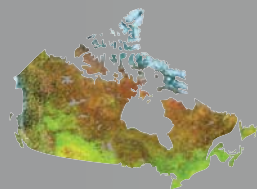




Natural Resources
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CANADIAN MINERALS YEARBOOK

2006 Review and Outlook



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Preface

Each year, the Minerals and Metals Sector of Natural Resources Canada undertakes a comprehensive review of developments in the mineral industry and publishes the results as the *Canadian Minerals Yearbook*. This publication forms a continuing record from year to year, with this edition reporting on the activities of the industry during 2006 (some events in 2007 may be referenced).

The main focus of this publication is the non-fuel mineral industry, together with uranium and coal, although all mineral fuels are normally included when the total value of Canada's mineral production and other comprehensive statistics are reported. The Yearbook includes chapters devoted to each major mineral commodity produced in Canada. The subject matter spans all stages of mineral industry activity from geoscience and exploration, through mining and processing, to markets and use. Although domestic issues receive the greatest attention in each chapter, international developments may also be reviewed because of the global nature of the mineral industry and the significant impact that such developments could have on the Canadian industry.

The Yearbook's first chapter, entitled "General Review," highlights the importance of the industry in the context of the Canadian economy. The General Review is followed by chapters that focus on the Canadian scene with reviews on mine reserves and recent production decisions; mineral exploration; and mine openings and closings. A chapter that details Canada's international mining presence is also included.

The 28 commodity reviews in this year's edition feature economic and policy developments and data specific to each commodity in respect of markets, prices, production, trade and use. These commodity chapters also provide an outlook on the industry's future position. Also included in this group this year is a chapter on Recycled Metals.

The Statistical Report at the end of the Yearbook is a comprehensive set of tables that provide a detailed statistical overview of the mineral industry. These tables are grouped according to the following topics: production; trade; use; prices; principal statistics; employment, salaries and wages; mining and exploration; transportation; and investment and finance. Although the tables focus on the most recent data available, many of the tables also include historical statistics.

The statistics on Canada's mineral and metal production, trade and use were collected by the Minerals and Mining Statistics Division of Natural Resources Canada, or by Statistics Canada, unless otherwise noted. Market quotations were taken mainly from published marketing reports. Corporate data presented in the various chapters of this Yearbook were obtained by the authors directly from company officials through surveys or correspondence, or were taken from web sites and annual reports. Natural Resources Canada is grateful to everyone who has contributed information used in the preparation of this publication.

Additional copies of the 2006 Yearbook may be purchased from the Geological Survey of Canada Bookstore (telephone 613-995-4342 or 1-888-252-4301 [toll free], or e-mail gsbookstore@nrcan.gc.ca) and local booksellers. Previous editions of the *Canadian*

Minerals Yearbook have been deposited in various libraries across Canada. Older editions dating back to 1944 have also been scanned and made available on our web site at www.nrcan.gc.ca/mms/cmy/info-hist_e.htm.

For more information on the products and services available from the Minerals and Metals Sector, visit our web site at www.nrcan.gc.ca/mms, or contact us at:

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Note: Previous and current commodity reviews prepared by the Minerals and Metals Sector since 1994 are also available on our web site at:

www.nrcan.gc.ca/mms/cmy/com_e.html

Updated reviews will be posted as they become available.

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* The 2006 nickel review contains some textual information and statistical tables on cobalt.

Note: Commodities shown in **bold** type are covered in this issue. The other commodities listed have appeared in previous editions for which the most recent year is indicated in parentheses.

Canadian Minerals Yearbook

2006 Review and Outlook

NOTE TO READERS

The intent of this publication is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The authors and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this publication.

ABBREVIATIONS

A number of abbreviations for common units of measurement may appear in the text:

A\$	Australian dollars
C\$	Canadian dollars
US\$	U.S. dollars
cm	centimetres
ct	carats
dmt	dry metric tonnes
€	euro, European currency
f/cm ³	fibres per cubic centimetre
ft	feet
g	grams
GJ	gigajoules
GWe	gigawatts electric
h	hour
ha	hectares
hp	horsepower
ht	hundred tonnes
in	inches
kg	kilograms
km	kilometres
km ²	square kilometres
kVA	kilovolts ampere
kW	kilowatts
kWe	kilowatts electric
kWh	kilowatt hours
L	litres
lb	pounds
m	metres
M	million
m ²	square metres
m ³	cubic metres
mg	milligrams
mm	millimetres
Mt	million tonnes or megatonnes
mtu	metric tonne unit
MW	megawatts
oz	ounces
ppm	parts per million
sq. ft.	square feet
st	short tons
t	tonnes
y	year
µg	micrograms
µm	micrometres

Note: All dollar figures in the text are Canadian unless specified otherwise.

General Review

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OVERVIEW

Global economic activity continued to be buoyant in 2006 and was again led by impressive activity in China and India. Global Gross Domestic Product (GDP) growth was estimated at 5.3%, up from the 4.9% experienced in 2005. Business investment was stronger and consumer spending continued to be firm in most countries, notwithstanding geopolitical uncertainties around the world, particularly in the Middle East. However, continuing higher energy prices, although down from the peaks of late 2005, continued to affect global market dynamics. Again, as in 2005, the global minerals industry experienced strong demand for mineral commodities, including scrap and recycled materials, which led to higher prices during the year.

Canada's real GDP, measured at market value in chained 2002 dollars, increased by 2.8% in 2006 to \$1.28 trillion, although growth was slowing throughout the year. Both interest rates and inflation remained relatively low. The average annual unemployment rate declined to 6.3% in 2006 from 6.8% in 2005 and the value of the Canadian dollar in terms of the U.S. dollar appreciated by 6.8%, averaging \$0.8818 compared to \$0.8253 in 2005. This currency performance continued to erode cost advantages in some sectors and posed trade challenges for many Canadian producers. Industrial capacity utilization declined from 84.2% in the first quarter of 2006 to 81.7% in the fourth quarter. The balance of trade fell by 21.3% to \$43.6 billion. The value of both exports and imports increased. Canadian merchandise exports (Customs basis) rose 0.9% to \$440.2 billion in 2006, compared to \$436.2 billion in 2005. Imports (Customs basis) totaled \$396.5 billion, up from \$380.8 billion in 2005, a 4.1% increase.

Preliminary estimates for the value of production¹ for all sectors of the Canadian mining industry rose substantially

by 22.7% to a record \$33.6 billion in 2006, up from the previous record of \$27.4 billion set in 2005. Of this, metal production increased by a staggering 45.4% to \$21.2 billion, while nonmetallic production fell by 2.7% to \$10.2 billion. Coal also declined, falling by 5.3% to \$2.2 billion after experiencing a substantial increase in 2005.

The value of total Canadian exports for non-fuel mining and mineral processing products (including coal)² increased by 16.2% to \$74.7 billion from \$64.3 billion in 2005. The 2006 export figure represents 17.0% of Canada's total exports. Canadian imports of non-fuel mining and mineral processing products (including coal) totaled \$62.0 billion, up 9.3%. As a result, the balance of trade (total exports minus imports of these commodities) showed a surplus of \$12.7 billion, up 68.1%.

There were sharp price increases in global markets for many of the major mineral commodities in 2006. Indeed, copper, nickel, zinc, uranium and platinum hit record highs. Ongoing favourable supply/demand conditions, coupled with increasingly active investor demand, provided upward pressures on prices during the year. Activities of large investment funds and other large speculators had a noticeable impact on price fluctuations, especially for certain precious and major metals. The major base metals (nickel, copper, zinc, lead, and aluminum) were all higher at year-end compared to the start of the year. The precious metals (gold, platinum, palladium, and particularly silver) were up strongly as 2006 came to a close.

Significant developments affecting the Canadian mining industry in 2006 included:

- continuing higher prices for most mineral commodities produced in Canada;

¹ Throughout this article, the volume and value of production are based on estimates using shipments from domestic sources as the measure of mine production, as published in *Canada's Mineral Production, Preliminary Estimates*, Statistics Canada catalogue no. 26-202-XIB. Foreign ores, for example, bauxite, are therefore not included.

² Throughout this article, unless otherwise noted, the mineral industry does not include crude oil or natural gas.

- corporate operating profits up for the fifth straight year;
- production declines in Canada again for several major mineral commodities;
- the acquisition of Canadian mining icons Inco Limited and Falconbridge Limited by foreign-based mining companies;
- continuing consolidation in the gold mining sector;
- the opening of Canada's third diamond mine in Nunavut;
- an increase in mining employment; and
- more mine openings than closings.

Global economic growth is expected to decline in 2007 to about 4.9%, with most economies experiencing growth rates lower than 2006 levels. China and India are again expected to be world leaders in global economic growth. Canada's GDP growth is expected to be slightly lower in 2007 at about 2.5%. Notably, the sustained robust global growth comes at a time of relatively high energy prices, ongoing global geopolitical tensions, and concerns about inflation. Although softness in certain mineral commodity prices is expected, overall, prices should remain buoyant in 2007. These robust commodity prices and the improved financial climate experienced in the past several years by Canadian companies should sustain higher exploration spending and development opportunities in the Canadian minerals industry in 2007.

CANADIAN ECONOMY

The Canadian economy expanded in 2006 as GDP grew by 2.8% to \$1.28 trillion, which was lower than the 3.1% rate experienced in 2005 (these figures are expressed in chained 2002 dollars). Quarter-over-quarter changes in 2006 declined from 0.8% in the first quarter to 0.4% in the second and 0.3% in the third. The rate increased slightly in the fourth quarter to 0.4%. Consumer spending and non-residential investment accounted for most of the growth in 2006. However, the stronger Canadian dollar, higher input costs (particularly energy), and international competition exerted continuing pressures on economic activity during the year.

Total private and public investment grew by 4.6% to \$311.1 billion in 2006 and the value of Canadian manufacturing shipments declined to \$587.6 billion, down 0.8% from 2005. Statistics Canada's Composite Leading Indicator index (1992=100) increased from 210.2 in December 2005 to 220.7 in December 2006, a gain of 5.0%. Industrial capacity utilization averaged 85.3% in 2006, the same as in 2005, although capacity utilization in the manufacturing sector declined throughout 2006 from 84.6% in the first quarter to 81.4% in the fourth.

Total Canadian merchandise exports (Customs basis) increased to \$440.2 billion in 2006, compared to \$436.2 billion in 2005 and \$412.3 billion in 2004. Imports

(Customs basis) totaled \$396.5 billion, up from \$380.8 billion in 2005 and \$355.8 billion in 2004. The trade surplus was \$43.1 billion in 2006, down from \$55.4 billion in 2005 and \$56.5 billion in 2004.

The Bank of Canada, which announces its key interest rate on eight pre-set dates per year, began the year with its target overnight rate at 3.25%, then had four consecutive rate increases of 0.25% to reach 4.25% in May. It remained at that level for the remainder of the year. In the United States, the federal funds rate increased steadily from 4.25% at the beginning of the year to 5.25% in June, and then remained unchanged for the balance of the year. Consequently, there was a spread of 1.00% between the key U.S. and Canadian rates as 2006 came to a close.

The annual inflation rate (Consumer Price Index [CPI]) averaged 2.0% in 2006 (the rate excluding food and energy averaged 1.5%) compared to 2.2% in 2005 and 1.9% in 2004. In November, the Bank of Canada renewed its five-year agreement with the Government of Canada to continue to conduct monetary policy aimed at keeping inflation, as measured by the CPI, at 2%, with a control range of 1-3% around this target, until 2011. However, the Bank announced that it will consider whether to cut its inflation target below the current level of 2% and will take the next three years to study whether to reduce its inflation target. The bank has invited outside researchers to submit their ideas.

Even though inflation and interest rates remained at low levels during 2006, pressures were coming from higher energy and commodity prices, particularly for oil and base metals. The value of the Canadian dollar in terms of the U.S. dollar averaged \$0.8818, up from \$0.8253 in 2005. This represents a 6.8% increase. On June 12, the Canadian dollar closed at \$0.9105, a 28-year high.

Consumer spending remained strong in 2006 with continuing low interest rates and a buoyant economy. According to Statistics Canada, retailers posted their highest annual sales gain of the last nine years in 2006 as retail sales advanced 6.4% to \$391.3 billion. This included new motor vehicle sales, which increased by 2.3% to 1.67 million vehicles in 2006, the second highest annual sales level on record, only exceeded by the 1.7 million recorded in 2002. Again, strong buyer incentives and rebates were put in place, particularly by North American-based manufacturers. However, higher prices for motor gasoline were having a negative effect on sales of large vehicles and sport utility vehicles throughout the year. On the production side, automotive manufacturers in Canada produced 1.4 million passenger cars in 2006, up 3.2% from 1.3 million in 2005.

The Canadian Real Estate Association reported that existing house sales across Canada on the Multiple Listing Service (MLS) reached the second highest level on record

in 2006 at 483 609 units, a decline of just 0.04% from the level recorded in 2005. The national MLS residential average price reached \$276 974 in 2006, representing an annual increase of 11.1%. This was the eighth consecutive annual record for the average residential price and the largest annual increase recorded by the MLS since 1989. New housing starts in Canada, as tabulated by Canada Mortgage and Housing Corporation, increased by 0.8% to 227 395 units, which is the second highest total in 18 years, only surpassed by the 233 431 units reached in 2004. Overall, building construction remained robust as Statistics Canada announced that the value of building permits issued by municipalities reached a new annual record of \$66.3 billion in 2006, up 9.1% from the previous record of \$60.8 billion in 2005. Of this total, residential permits accounted for \$41.1 billion, an increase of 6.0% over 2005, while the value of non-residential permits jumped by 14.5% to \$25.2 billion. These building permit values in both the residential and non-residential sectors reached new highs in 2006.

The average annual unemployment rate declined to 6.3% in 2006 from 6.8% in 2005 and 7.2 % in 2004, with the December 2006 rate being 6.1%, a 30-year low. Employment rose by 2.1%, or 346 000 net jobs. In December, employment in Canada stood at 16.6 million, of which 13.6 million jobs were full-time. Declines in manufacturing employment continued.

Global economic growth (real GDP) increased in 2006 to 5.3%, compared to 4.9% in 2005, 5.3% in 2004, and 3.9% in 2003. Growth rates among individual countries or regions varied considerably in 2006. China again led the way with a growth rate of 10.7%, followed by India with

a rate of 9.2%. Both of these rates were higher than those of 2005. The ASEAN-4 nations (Indonesia, Malaysia, the Philippines, and Thailand) had a combined growth rate of 5.4%, up from 5.2% in 2005. The economies of Hong Kong and Singapore expanded by 6.8% (down from 2005) and 7.9% (up from 2005), respectively. The Euro area rebounded in 2006, expanding by 2.9%, compared to only 1.5% the previous year. The United Kingdom's expansion also rebounded in 2006 to 2.8%, up from 1.9% in 2005. The Japanese economy accelerated by 2.2% in 2006 from 1.9% the previous year. The U.S. economy expanded in 2006 to 3.3%, up slightly from 3.2% in 2005.

CANADIAN MINERAL INDUSTRY

The Canadian mineral industry can be characterized by the following four stages of processing activity:

- Stage 1: Mineral extraction and concentrating industry (for example, gold mining, and sand and gravel quarrying);
- Stage 2: Smelting and refining industry (for example, nonferrous smelting and refining, alloying, and the production of primary steel);
- Stage 3: Nonmetals- and metals-based semi-fabricating industries (for example, copper rolling, casting and extruding, and concrete products); and
- Stage 4: Metals fabricating industries (for example, manufacturing of ornamental metal products and machine parts).

CANADIAN MINERAL INDUSTRY IN 2006

CANADIAN ECONOMIC CONDITIONS

Leading Indicators	2005	2006	% Change
Real GDP (\$ billions, 1997 chained dollars)	1 247.8	1 282.2	+2.8
Consumer prices (% annual change)	+2.2	+2.0	n.a.
Operating profits (\$ billions)	215.9	231.7	+7.3
Unemployment rate (% annual average)	6.8	6.3	-7.4
Merchandise trade balance (balance of payments basis) (\$ billions)	64.9	53.6	-17.3
Housing starts (000)	225.5	227.4	+0.8
Canada/U.S. exchange rate (annual average)	0.8253	0.8818	+6.8
International current account balance (\$ millions)	31 802.0	24 342.0	-23.5
Global economic output (% change)	+4.9	+5.3	n.a.

Sources: Statistics Canada; Bank of Canada; Canada Mortgage and Housing Corporation; International Monetary Fund.
n.a. Not applicable.

Leading Mining Indicators	2005	2006	% Change
Value of non-fuel mineral production (excluding oil and gas) (\$ millions)	27 397	33 603	+22.7
Exploration expenditures (\$ millions)	1 305	1 728	+32.4
Metal Price Index (1997=100)			
Precious metals	137.2	190.8	n.a.
Base metals	162.4	298.7	n.a.
Direct mining employment (000)	46.0	49.2	-6.8
Value of minerals and mineral products exports (\$ billions)	64.3	74.7	+16.2
Mining company operating profits (\$ billions)	4.0	4.6	+15.1
Worldwide mine equity financing (\$ billions)	12.1	5.0	+141.2

Sources: Natural Resources Canada; Statistics Canada; Gamah International.

n.a. Not applicable.

Note: All the indicators above, with the exception of the Metal Price Index and mining company operating profits, include the coal mining industry.

In 2006, the overall value of production of the Canadian mining, mineral processing and metal-producing industries totaled approximately \$77 billion. This amount includes the value of production from Canadian mined ores, concentrates, and aggregates (\$33.6 billion). The remainder (approximately \$43.4 billion) represents the value of production realized from the smelting and refining of domestic and imported ores, concentrates and recyclables, as well as from steel and aluminum production and oil sands mining.

The emphasis of this article, however, focuses on the activities of the mining industry (Stage 1), although a description of the mineral industry from Stages 1 to 4 provides a more comprehensive picture of its importance to Canada. Unless otherwise noted, in the context of this article, the mineral industry should be taken to exclude the extraction and processing of crude petroleum from conventional and non-conventional sources and natural gas, but to include both the coal and uranium mining industries.

GDP OF THE MINERAL INDUSTRY

The mineral industry for GDP is described statistically by Statistics Canada by the following industry groupings: mining, nonmetallic mineral product manufacturing, primary metal manufacturing, and fabricated metal product manufacturing. On this basis, in 2006, the mineral industry contributed \$39.9 billion to Canada's total GDP, a very slight decrease compared to the 2005 level of \$40.0 billion, and it represented 3.7% of Canada's total GDP of \$1091.7 billion. (In this section, all figures are based on GDP at basic prices in chained 1997 dollars.) Mining (coal mining, metal mining, and nonmetal mining) contributed 24.5% to the mineral industry's GDP in 2006, while nonmetallic mineral product manufacturing contributed a further 12.9%. Primary metal manufacturing accounted for 30.0% and fabricated metal product manufacturing accounted for the remaining 32.6%.

For mining in 2006, GDP declined by 1.1% to \$9.8 billion as coal mining fell by 10.5% to \$817 million and non-metallic mining fell by 1.1% to \$4.1 billion. Metal mining increased by 0.9% to \$4.6 billion. (Due to the nature of the chaining process, components of a larger whole are not additive.) GDP for services related to mining and oil and gas extraction was off by 2.7% at \$5.9 billion in 2006.

CANADIAN MINERAL PRODUCTION

Production From Canadian Mines and Quarries

The value of production of the mineral industry (metallic minerals + nonmetallic minerals + coal) in 2006 increased substantially by 22.7% to a new record of \$33.6 billion, up from \$27.4 billion in 2005, the previous record. Interest-

ingly, both nonmetals and coal declined in value; however, the unprecedented increase in the value of metal production led to the sizeable overall increase. Nickel was Canada's leading mineral commodity, accounting for 18.4% of the Canadian total. Again, as in 2005, the value of production of most mineral commodities benefitted greatly from higher prices. In almost all cases, the increase in the value of production for specific metals exceeded that of the change in volume for that metal.

The value of metal production rose 45.4% to a record \$21.2 billion in 2006, from \$14.6 billion in 2005, as significant increases occurred in the values for zinc (+101.5%), copper (+78.8%), nickel (+75.9%) and uranium (+26.4%). Six metals had a value of production in excess of \$1 billion with five over \$2 billion. Nickel was Canada's leading metal with a value of \$6.2 billion followed by copper at \$4.6 billion, iron ore at \$2.6 billion, gold at \$2.2 billion, and zinc at \$2.1 billion. Uranium was at \$1.4 billion. However, of these six commodities, only nickel, copper and iron ore experienced increases in the volume of production during 2006.

The table below shows the value and volume movements of the major mineral commodities produced in Canada for the years 2005 and 2006.

VALUE OF CANADIAN MINERAL PRODUCTION (1)

	2005 (r)	2006 (p)	Change
	(\$ millions)		(%)
Metallic minerals	14 582.6	21 199.3	45.4
Nonmetallic minerals	10 485.5	10 199.0	-2.7
Total	25 068.1	31 398.2	25.3
Coal	2 329.0	2 205.1	-5.3
Total minerals	27 397.1	33 603.3	22.7

Sources: Natural Resources Canada; Statistics Canada, *Canada's Mineral Production, Preliminary Estimates, 2006*, catalogue no. 26-202-XIB.

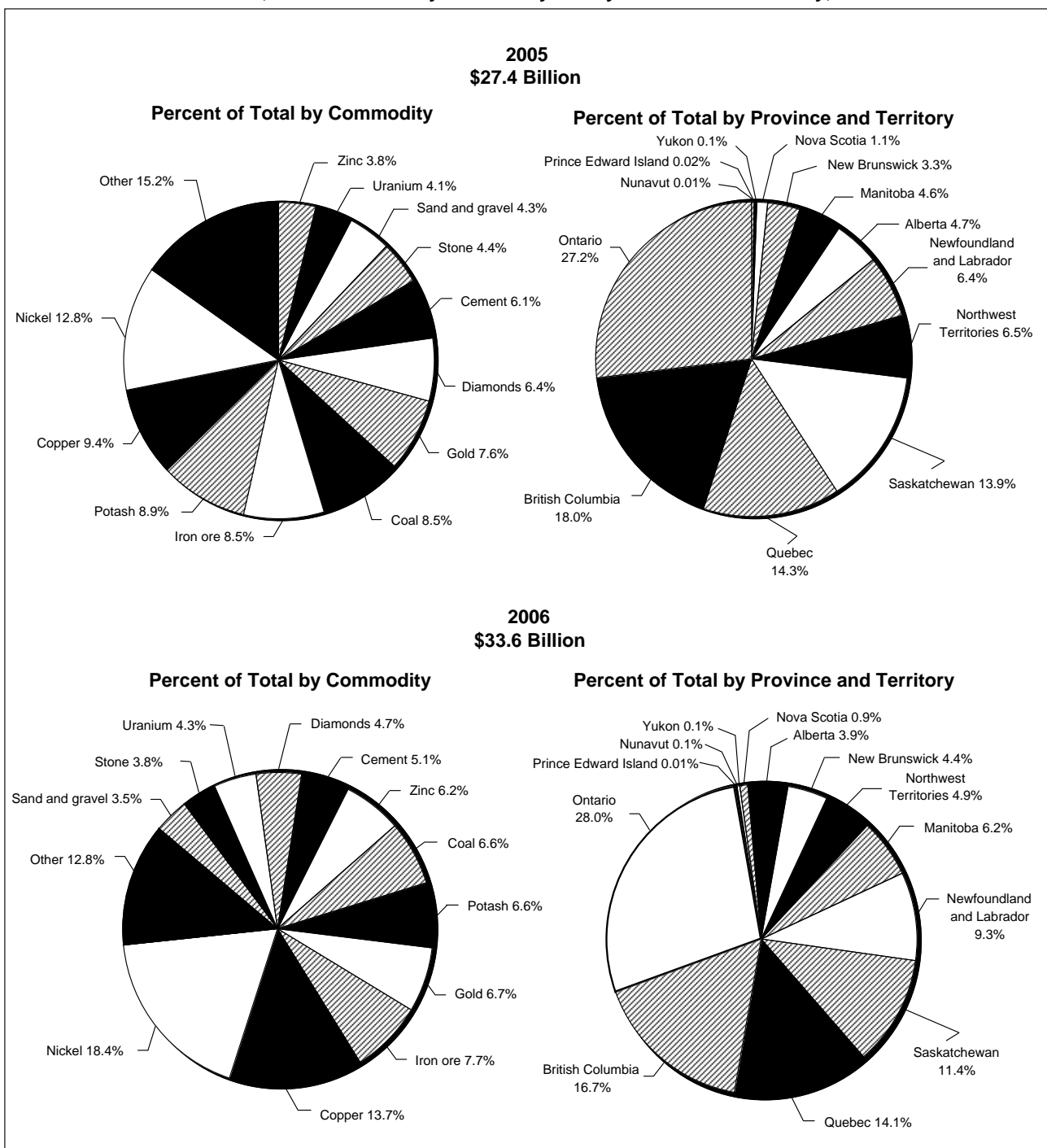
(p) Preliminary; (r) Revised.

(1) The value of production is based on shipments.

Note: Numbers may not add to totals due to rounding.

The value of nonmetals production in 2006 fell by 2.7% to \$10.2 billion from the record high of \$10.5 billion reached in 2005. Declines in the value of production for potash (-9.2%) and diamonds (-9.7%) were the main reason for the fall. Production values in excess of \$1 billion were recorded by five nonmetal commodities. Potash at \$2.2 billion was Canada's leading nonmetal, and the only nonmetal with a value of production in excess of \$2 billion. Potash was followed by cement at \$1.7 billion, diamonds at \$1.6 billion, stone at \$1.3 billion, and sand and gravel at \$1.2 billion. For these five leading nonmetals, only diamonds had a production increase in 2006.

Figure 1
Value of Mineral Production, Percent Shares by Commodity and by Province and Territory, 2005 and 2006



Sources: Natural Resources Canada; Statistics Canada.

Notes: The provincial/territorial shares may not add to 100% due to rounding.

The value of production for coal totaled \$2.2 billion in 2006, down 5.3% from 2005. Production fell by 3.6% to 63.0 Mt.

Based on the value of production for 2006, the top commodities were nickel (\$6.2 billion), copper (\$4.6 billion), iron ore (\$2.6 billion), gold (\$2.2 billion), potash (\$2.2 billion), coal (\$2.2 billion), zinc (\$2.1 billion), cement (\$1.7 billion), diamonds (\$1.6 billion), uranium (\$1.4 billion), stone (\$1.3 billion), and sand and gravel (\$1.2 billion).

In terms of production of Canada's leading minerals, increases in shipments of 5% or greater were recorded by cobalt, iron ore, lead, nickel, diamonds, gypsum, and sulphur (both elemental and in sulphur gas), whereas declines of 5% or more were experienced by gold, molybdenum, silver, uranium, and potash.

Geographically, the importance of the industry may be more significant on a regional and community basis as, in many parts of Canada, particularly in the North, it provides a major economic stimulus. About 100 communities across Canada with a total population of approximately 600 000 depend on the mineral industry.

Regionally, four provinces continued to dominate the value of Canada's mineral output, accounting for 70.2% of the total in 2006. Ontario contributed the largest share of this output at 27.9% of the total value while British Columbia accounted for 16.7%, Quebec for 14.1%, and Saskatchewan for 11.4%. For the other provinces and territories, Newfoundland and Labrador was at 9.3%, Manitoba was at 6.2%, the Northwest Territories was at 4.8%, New Brunswick was at 4.4%, Alberta was at 3.9%, Nova Scotia was at 0.9%, the Yukon was at 0.1%, Nunavut was at 0.1%, and Prince Edward Island was at less than 0.1%.

For the four leading provinces, the value of mine output in Ontario increased by 26.3% to \$9.4 billion, British Columbia was up by 14.1% to \$5.6 billion, Quebec was up by 20.8% to \$4.7 billion, and Saskatchewan was up by 1.1% to \$3.8 billion.

Strong metal and industrial mineral prices since 2003 have encouraged companies to develop new mines and to redevelop previously closed mines that still have unmined reserves and/or resources. Preliminary estimates, based on 2005 and the first half of 2006 (the latest data available), indicate that about 11 mines, including 4 new mines, were scheduled to open in 2006. The expected new mines are a copper-zinc mine in Newfoundland and Labrador, a gold mine in Ontario, a coal mine in British Columbia, and a diamond mine (Jericho) in Nunavut. Three gold mines in Quebec, two nickel-copper mines in Ontario, a gold mine in Manitoba, and another gold mine in British Columbia were expected to be redeveloped. For 2007, based on the continuing strength of world demand and mineral and metal prices, some 20 mines are expected to open or re-open.

MINERAL COMMODITY PRICES

Most mineral and metal commodity prices continued to rise in 2006, with many showing significant gains during the year as the commodity boom cycle continued. China and India again dominated the markets for many of these commodities, while increased investor activity also had a significant impact on the prices of many of the major commodities. With the exception of copper, which peaked in mid-year, the major metals finished 2006 at or near their highs for the year and up significantly from the beginning of the year. Indeed, record high price levels were observed for copper, nickel and zinc in 2006. Precious metals traded higher with silver showing the most impressive gain over the year. Gold and silver traded at their highest levels since 1980 and 1990, respectively, while platinum also traded at record levels. Prices for metallurgical coals, thermal coals, and iron ore pellets declined after significant gains in 2005, while other iron ore products went up in price.

Based on trading on the London Metal Exchange (LME) (daily spot closings), nickel opened 2006 at US\$6.13/lb, its low for the year, and finished 2006 strongly at US\$15.52/lb, an increase of 153.2% during the year. The high for the year was reached in mid-December at US\$16.08/lb. LME nickel inventories began the year at 35 994 t, moved to their high for the year in early February at 37 218 t, and declined significantly for the rest of the year to close 2006 at 6594 t. The low for the year was reached in early October at 3930 t. Strong demand growth for stainless steel, particularly in China, coupled with concerns about global nickel supplies, fueled ongoing upward pressures on prices in 2006.

Copper opened the year at US\$2.10/lb, the low for the year, and finished 2006 at US\$2.85/lb, a gain of 35.7%. The high was reached in mid-July at US\$3.73/lb. Prices were driven higher in response to supply disruptions, strong demand growth, and low inventories, particularly in the first half of the year. Copper stocks began the year at 96 175 t, fell to a year low of 89 600 t in early July, and then moved up markedly in the last quarter to end the year at 190 575 t, the high for 2006. Aluminum began the year at US\$1.03/lb, declined slightly to US\$1.028/lb in early January, and increased thereafter to finish the year at US\$1.29/lb, an increase of 25.5%. The high for the year was in mid-December at US\$1.31/lb. Continuing supply shortfalls coupled with strong market fundamentals led to higher prices. Inventories increased from 646 200 t at the beginning of the year to 793 350 t in early March, and then remained in a relatively tight range, falling to a low of 661 550 t in mid-December and ending the year at 698 425 t.

The price of zinc increased substantially in 2006, ending the year at US\$1.96/lb, compared to US\$6.7¢/lb at the beginning (its low for the year), an increase of 126.5%. The high for the year was US\$2.10/lb set in late November. Demand was strong throughout the year and with falling inventories, particularly in the second half of the year,

prices were subject to strong upward pressures. Inventories began the year at 393 300 t, their high for the year, and steadily decreased to reach 84 825 t, their low for the year in early December, before recovering to finish the year at 90 475 t. Lead began 2006 at US\$49.9¢/lb, declined to its low of US\$41.6¢/lb in mid-June, and then moved up to close out the year at 80.5¢/lb, up 61.3% for 2006. The high of the year was set in mid-December at 82.1¢/lb. Increased global consumption, led by China, and a tight supply chain resulted in higher prices. Stocks began the year at 42 000 t, increased to 117 900 t in mid-June, declined to their low of 39 225 t in early December, and then climbed slightly to close the year at 41 050 t.

For precious metals (LME daily spot closings), gold closed out the year at US\$635.70/oz, up by 19.9% from US\$530.00/oz at the beginning of 2006. Gold reached 26-year highs in mid-May, due in large part to the activities of hedge funds and other large speculators, reaching \$725.00/oz. As well, Exchange Traded Funds (ETFs) were an attractive method through which both retail and institutional investors chose to access gold. The low for the year was US\$524.75/oz set in early January. Against the ongoing backdrop of geopolitical factors, particularly conflicts in the Middle East and the increasing weakness in the U.S. dollar, especially versus major international currencies such as the Euro, gold continued to be viewed as a place to put funds in 2006. Silver was robust in 2006, benefitting from increasing use in electronics and medicine, and particularly from ongoing strong investment demand activity. Indeed, when Barclays Capital began offering a silver-backed ETF in April, the metal had its biggest gain in 11 years. Silver prices traded at their highest levels since the early 1980s in May, closing at an LME high of US\$14.94/oz, which was up from its low of US\$8.83/oz in early January. Silver started the year at US\$9.04/oz and closed out 2006 at US\$12.90/oz, an increase of 42.7% for the year.

The price of platinum rose in 2006 from US\$982.00/oz at the beginning of the year, its low for the year, to US\$1117.00/oz at year-end, an increase of 13.7%. The high was achieved in mid-May at US\$1335.00/oz. Strong industrial demand and investor activity continued to exert upward price pressures on platinum. Palladium began the year at US\$265.00/oz, also its low for the year, reached its peak in mid-May at US\$404.00/oz, and ended the year at US\$323.50/oz. The end-of-year price was up 22.1% from the beginning of the year. Palladium benefitted in 2006 at the expense of platinum by being a cheaper alternative in jewellery and, to some extent, in autocatalyst markets.

For other mineral commodities, the average spot price for uranium (U_3O_8) was quoted at US\$72.00/lb at the end of 2006, a stunning 97.9% increase over US\$36.38/lb a year earlier. Similarly, the long-term contract price for uranium almost doubled to US\$72.00/lb from US\$36.13/lb in the same time period. At year-end, high-grade cobalt was selling at US\$24.50-\$26.00/lb, up substantially from US\$14.00-\$15.50/lb a year earlier, while molybdenum

oxide was down from US\$28.50-\$30.00 to US\$25.00-\$26.00/lb in the same period. Potash was quoted at US\$170-\$173/t for standard grade f.o.b. Vancouver, up from US\$145-\$148/t at the end of 2005. The price for sulphur, f.o.b. Vancouver, at the end of 2006 was US\$39-\$56/t, compared to roughly US\$60-\$65/t a year earlier.

International coal and iron ore prices are largely determined by annual Japanese reference or benchmark contract pricing set as of April 1 of each year. On this basis, the price in 2006 for metallurgical coal (premium hard coking grade) fell by 10.2% to US\$114.00/t f.o.b., while thermal coal (steaming coal) dropped slightly by 0.9% to US\$52.50/t f.o.b. Reference prices for iron ore fines and lump ore into the Japanese market (Hamersley benchmark pricing) increased by 19.0% to US\$73.45¢/natural metric tonne unit f.o.b. and US\$93.74¢/natural metric tonne unit f.o.b., respectively. Iron ore pellet prices for European markets (CVRD benchmark pricing), on the other hand, were set 3.0% lower at US\$112.04¢/natural metric tonne unit f.o.b.

Specific Canadian experience in 2006 showed that for Canadian export coal, the Elk Valley Coal Partnership, owned by Fording Canadian Coal Trust (60%) and Teck Cominco Limited (40%), reached agreement with its major customers for its hard coking coal at an average price of US\$107.00/t f.o.b., down 12.3% from US\$122.00/t in 2005. For Canadian iron ore, the Iron Ore Company of Canada (IOC) announced a price agreement for 2006 deliveries with European steelmaker ThyssenKrupp Stahl AG for IOC Carol Lake Acid Limestone iron ore pellets (US\$115.86¢/natural metric tonne unit f.o.b. Sept-Îles, Quebec, a decrease of 3.5% over 2005) and IOC Carol Lake iron ore concentrate (US\$78.25¢/natural metric tonne unit f.o.b. Sept-Îles, Quebec, an increase of 17.3% over 2005). Pellet products account for about 80% of IOC's production with concentrates accounting for the remaining 20%.

RESERVES

Canadian reserves are estimated from information contained in annual and other corporate reports, and from the responses of mining companies to the annual Federal-Provincial/Territorial Survey of Mines and Concentrators.

In 2005, while Canadian reserves of lead, zinc and silver continued to decline, reserves of copper, nickel, molybdenum and gold increased by factors of 19%, 3%, 19% and 21%, respectively.

The continuation of strong metal prices through 2006, together with industry optimism and its determination to bring new deposits into production, make it probable that Canadian reserves of copper, nickel, molybdenum, silver and gold increased significantly in 2006. Canadian reserves of zinc likely rose slightly in 2006, while reserves of lead continued to decline.

EMPLOYMENT IN THE MINERAL INDUSTRY

Combined employment in the four stages of the mineral industry is estimated to have risen to 368 753 in 2006, up 3.4% from 2005. The minerals industry thus accounted for approximately 2.7% of the national employment level of 13.5 million full-time workers in 2006 (2.2% of 16.5 million total employment).

Employment in Stage 1 increased to an estimated 49 181, compared to 46 046 in 2005. The 2006 level was the highest since 2000. Employment in metal mining increased by 5.2% to 24 791. Employment in the nonmetal mining sector also increased, from 18 024 in 2005 to 19 671 in 2006, as did employment in the coal mining sector, where employment levels rose to 4719, a 6.0% increase over the 4519 recorded in 2005. The 19 671 recorded in the non-metal mining sector was the highest since 1981.

Employment in the primary metal manufacturing industry rose by 1.8% to an estimated 79 740, while employment in the nonmetal manufacturing industry increased to 55 521 in 2006 compared to 53 066 the previous year. The primary metal and nonmetallic mineral manufacturing industries together comprise Stages 2 and 3. In the primary metals industry, the main contributor to job growth was the non-ferrous (excluding aluminum) production and processing industry, while cement and concrete product manufacturing was the primary factor in the rise of the nonmetallic mineral processing industry.

Employment levels in the fabricated metal manufacturing industry (Stage 4) increased, rising from 178 727 in 2005 to 184 311 in 2006, an increase of 3.1%. Most industries within the fabricated metal sector experienced gains in employment levels.

(The employment numbers above differ fairly significantly from those published in previous years. In addition to regular annual revisions, Statistics Canada improved its collection methodology. This improved methodology resulted in the changes seen here.)

MINERAL INDUSTRY TRADE

Canada is one of the world's largest exporters of minerals and metals. The export of these commodities and more refined mineral products has a significant impact on Canada's overall merchandise balance of trade, and hence on the national standard of living. In 2006, the value of total exports of minerals and mineral product exports for the four stages of production (non-fuel, but including coal) increased by 16.2% to \$74.7 billion from \$64.3 billion in 2005 (Table 2). The United States was again by far the leading destination for Canada's total minerals and mineral product exports with \$49.1 billion in 2006. This repre-

sented 65.7% of total exports with the European Union at 15.2%, Japan (Canada's third largest export customer) at 4.3%, China (Canada's fourth largest customer) at 3.3%, Mexico (Canada's 10th largest customer) at 0.8%, and all other countries at 10.7%. Exports to the top 20 countries accounted for 96.2% of total Canadian exports. For Stage 1 (mining only), the United States accounted for 31.5% of exports.

The value of total exports of metallic minerals and mineral products (four stages of production) rose by 22.5% to \$59.7 billion, compared to \$48.7 billion in 2005. On a commodity basis, significant increases in the value of exports were exhibited by tungsten (+217.8%), zinc (+85.5%), copper (+60.9%), nickel (+42.2%), titanium metal (+35.9%), gold (+28.9%), and uranium and thorium (+24.0%). Notable decreases were shown by molybdenum (-28.6%), magnesium and magnesium compounds (-21.8%), chromium (-15.4%), and cobalt (-10.8%). Two commodities, aluminum and iron and steel, accounted for 45.0% of these total exports in 2006.

For Stage 1 metallic commodities only, total exports increased by 28.1% to \$8.0 billion in 2006. For individual metallic commodities in Stage 1, exports were up for most metals with sizeable increases exhibited by tungsten (+421.6%), platinum group metals (+128.9%), copper (+68.3%), silver (+48.0%), zinc (+44.6%), aluminum (+36.8%), lead (+31.5%), and iron and steel (+29.5%), while declining exports were noted for gold (-26.4%) and molybdenum (-26.2%). Note, however, that when Stage 2 exports of gold are included, the value of gold exports increased by 29.4% to \$5.4 billion. By far the largest proportion of gold exports are counted in Stage 2. Three commodities (copper, iron ore, and iron and steel) represented 67.0% of all Stage 1 metallic exports in 2006.

The value of total nonmetals exports decreased by 4.3% to \$11.5 billion from \$12.1 billion in 2005. Notable decreases were experienced by sulphur and sulphur compounds (-16.5%), potash and potassium compounds (-12.0%), chrysotile (asbestos) (-10.4%), nitrogen (-6.2%), and diamonds (-3.2%). Increases of note occurred for gypsum (+12.9%), mineral pigments (+8.3%), peat (+4.3%), and glass and glassware products (+3.0%). Four commodities (potash and potassium compounds, diamonds, nitrogen, and glass and glassware products) accounted for 58.3% of total nonmetallic exports.

For Stage 1 only, total exports of nonmetallic commodities fell by 8.2% to \$5.3 billion from \$5.8 billion in 2005. Exports of note that decreased were sulphur and sulphur compounds (-17.3%), potash and potassium compounds (-12.0%), chrysotile (asbestos) (-10.5%), diamonds (-5.5%), and gypsum (-4.8%). Increases were experienced by sand and gravel (+12.7%), salt and sodium compounds (+7.4%), and peat (+3.4%). Potash and potassium compounds and diamonds accounted for 75.4% of all Stage 1 nonmetallic exports in 2006.

In 2006, total exports of coal increased by 1.1% to \$3.4 billion, while coke declined from \$108 million to \$25 million. Stage 1 coal exports were unchanged at \$3.2 billion.

The value of total imports of minerals and mineral products (four stages) increased by 9.2% to \$62.0 billion from \$56.7 billion in 2005. Of this amount in 2006, shipments from the United States accounted for 57.9% of the total with the European Union at 9.0%, China at 7.5%, Mexico at 3.3%, Japan at 1.8%, and all other countries at 20.6%. The top 20 countries accounted for 90.9% of total imports. For the four stages of production, total imports from the United States accounted for 75.0% of Stage 1, 23.4% of Stage 2, 62.2% of Stage 3, and 60.1% of Stage 4 imports.

The total value of metal imports rose to \$52.1 billion in 2006 from \$47.2 billion in 2005, an increase of 10.5%. Major increases took place for zinc (+151.1%), silver (+55.7%), copper (+44.0%), gold (+36.7%), and platinum group metals (+16.4%), whereas large declines occurred for molybdenum (-19.8%) and nickel (-18.3%). Two commodities (iron and steel, and aluminum) accounted for 53.2% of all metal imports in 2006.

For nonmetals, import values rose from \$8.0 billion in 2005 to \$8.3 billion in 2006, an increase of 4.4%. Commodities of note included increases for diamonds (+40.4%), graphite (+15.0%), salt and salt compounds (+9.0%), and glass and glassware products (+4.4%), and decreases for nitrogen (-11.3%), titanium oxides (-7.5%), and phosphate and phosphate compounds (-7.0%). Two commodities (glass and glassware products, and clay and clay products) accounted for 41.0% of total imports of nonmetals in 2006.

Coal imports increased by 1.9% to \$1.4 billion while coke imports fell by 25.4% to \$111.9 million in 2006.

The balance of trade generated (total mining and mineral processing exports minus total mining and mineral processing imports) rose by 68.1% in 2006 to \$12.7 billion. This trade surplus compares to \$7.5 billion in 2005, \$4.2 billion in 2004, and \$3.0 billion in 2003. For the total Canadian economy, the trade surplus was \$43.6 billion in 2006, down from \$55.4 billion in 2005 and \$56.5 billion in 2004.

China has become an increasingly important customer for Canada's mining and mineral processing industry, ranking as the fourth largest customer in 2006 behind the United States, the United Kingdom, and Japan. In 2006, Canada exported \$2.5 billion in minerals and mineral products to China, up from \$2.1 billion in 2005 and \$1.4 billion in 2004.

Imports of these products from China have also increased significantly. In 2006, the value of imports of minerals and mineral products reached \$4.7 billion, compared to \$3.9 billion in 2005 and \$3.3 billion in 2004, making China Canada's second largest importing country after the United States for that year.

FINANCIAL INVESTMENT BY THE MINERAL INDUSTRY

Canada's financial markets play a strong role in providing equity financing to Canadian and foreign mining companies. At the end of 2006, there were some 291 companies listed on the Toronto Stock Exchange (TSX) with a total quoted market value of approximately \$287.7 billion. Over 35 of these companies had a market capitalization in excess of \$1 billion. In addition, there were 983 companies listed on the TSX Venture Exchange with a total quoted market value of some \$35.1 billion at the end of 2006. Taken together, the two exchanges list some 60% of the world's public mining companies.

During 2006, 38.8% of the equity capital raised worldwide to finance mining activity was raised on Canadian exchanges. These funds were spent on mineral exploration and to finance capital spending on mining projects in Canada and around the world.

Exploration Expenditures

Final exploration data for 2005 show that exploration and deposit appraisal expenditures amounted to \$1304.8 million, an increase of 10.8% over \$1177.8 million in 2004. Preliminary figures for 2006 indicate an impressive increase of 32.4% to \$1727.8 million, with spending intentions for 2007 showing a further 9.3% increase to \$1888.0 million.

In 2006, increases in exploration and deposit appraisal expenditures were experienced in all jurisdictions with the exception of Manitoba. Ontario (\$341.6 million), British Columbia (\$304.0 million), Quebec (\$260.2 million), Saskatchewan (\$236.3 million), Nunavut (\$199.7 million), and the Northwest Territories (\$129.8 million) accounted for 85.2% of total Canadian expenditures.

The level of mineral exploration activity is closely linked to mineral commodity prices. As commodity prices have been very robust for the past several years, the mineral exploration industry has responded with increased activity. In 2006, increases were experienced in each of the five commodity groupings: precious metals, base metals, diamonds, uranium, and other metal commodities. Other important factors that can influence exploration activities are economic conditions and tax incentive measures.

In 2006, precious metals (mainly gold) accounted for 38.6% of total exploration and deposit appraisal expenditures, followed by base metals at 22.0%, diamonds at 17.5%, uranium at 11.0%, and other mineral commodities at 10.9%.

Capital Investment

Mine complex development expenditures (including capital expenditures for construction and machinery and equipment) were estimated at \$3.6 billion in 2005, up 30.9%

from \$2.7 billion in 2004. Large increases were recorded in Quebec (precious metals), the Northwest Territories (diamonds), Saskatchewan (uranium and potash), Alberta (coal), British Columbia (precious metals), and Nunavut (diamonds). These regions accounted for 64.2% of the total expenditures. While mine complex development expenditures (including capital expenditures) in Ontario declined from \$735 million in 2004 to \$659 million in 2005, it remained the leading region in terms of mine complex development expenditures. Spending intentions for 2006 indicate a further increase of 16.5% to \$4.1 billion. Repair expenditures for structures, machinery and equipment fell to \$1.4 billion from \$1.6 billion in 2004, a drop of 13.9%. Ontario and Manitoba accounted for most of this decline.

According to Statistics Canada, actual expenditures for capital for construction and for materials and equipment in the mining and mineral processing industries were \$7.3 billion in 2005. Preliminary actual figures for 2006 indicate a slight decrease to \$7.2 billion, while intentions for 2007 indicate a rebound to \$8.0 billion.

For the total economy in 2005, capital investment (construction, materials and equipment) reached \$273.2 billion. Estimates for 2006 show an increase to \$297.3 billion, with intentions for 2007 reaching \$311.1 billion.

Technology Investment

Preliminary figures for 2005 indicate total intramural R&D expenditures in the mining and mineral processing industries were \$531 million (about 3.6% of total R&D spending by all industries), compared to \$542 million in 2004. Intentions for 2006 indicate expenditures of \$538 million.

HIGHLIGHTS IN THE CANADIAN MINING INDUSTRY

Corporate Developments

Corporate operating profits in the Canadian mining industry were \$4.6 billion in 2006, compared to \$4.0 billion in 2005 and \$3.3 billion in 2004. Profits in 2006, as in the two previous years, continued to benefit greatly from strong commodity prices.

The average annual capacity utilization rate for mining in 2006 stood at 83.9%, a decline of 8.8% from 92.0% for 2005. For the last quarter of 2006, the annualized rate was 81.5%, compared to 82.1% in the third quarter of the year. The rate for primary metals declined through the year, from 94.2% in the first quarter to 89.2% in the fourth. Capacity utilization in the nonmetallic mineral products industries declined during the year by 11.6% to 78.7%, while utilization in the fabricated metals industry also declined by 7.8% to 78.0% in the fourth quarter.

Major mergers and acquisitions continued at significant levels in the Canadian mining sector during 2006. According to Crosbie and Company, Inc., who produce data on Canadian mergers and acquisitions, the value of activity for metals and minerals reached \$54.0 billion (247 deals), a record level and a fivefold increase over \$9.5 billion (87 deals) in 2005. Well-known Canadian corporate icons, such as steelmaker Dofasco Inc. and base-metal mining giants Inco Limited and Falconbridge Ltd., became targets and were taken over. Significant consolidation also continued in the gold sector.

Following bidding by ThyssenKrupp AG of Germany and Arcelor SA of Luxembourg that began in late 2005, Dofasco was purchased by Arcelor in February 2006 for \$5.5 billion. Subsequently, Arcelor, as a defence against a hostile takeover, put the Dofasco shares into a Foundation in the Netherlands called Strategic Steel Stichting. Later in November following the US\$33.5 billion amalgamation of Mittal Steel Company NV and Arcelor, the new company (Arcelor Mittal) requested that the Foundation be dissolved so that Dofasco shares could be sold to ThyssenKrupp to satisfy anti-trust requirements of the amalgamation, but the Directors of the Foundation refused. In January 2007, a court in the Netherlands ruled that the Trust could not be forced into releasing the Dofasco shares. Therefore, Dofasco remains an operating unit of Mittal Arcelor.

In late 2005, Inco made a friendly \$12.8 billion offer for Falconbridge involving shares and cash that, mainly due to delays in getting regulatory approval from the U.S. Department of Justice and the European Commission, had not been completed by May 2006 when rival bids started. Teck Cominco Limited made a \$17.8 billion hostile share-cash offer for Inco only, and Xstrata Plc of Switzerland, a major global diversified mining group who already owned about 20% of Falconbridge, made an all-cash bid of \$16.1 billion for the rest of the Falconbridge shares that it did not already own. Subsequently, in an effort to thwart Xstrata and Teck Cominco, Inco-Falconbridge agreed to be taken over by Phelps Dodge Corp. in a share-cash deal that valued the merger at about US\$40 billion. In August, Companhia Vale do Rio Doce (CVRD) of Brazil, the world's largest iron ore producer, entered the bidding for Inco with an all-cash deal worth over \$19 billion (\$86.00 a share). Also in August, Xstrata was successful in obtaining Falconbridge in exchange for \$62.50 in cash for each common share of Falconbridge. With the redemption of Falconbridge's preferred shares, the total consideration of the transaction was estimated at approximately \$19.2 billion. Xstrata, which is organized along commodity lines, has renamed the Falconbridge nickel operations Xstrata Nickel. In October, CVRD's cash offer of \$86.00 per Inco common share was successful and, in early January 2007, it announced that it had completed the amalgamation of Inco Limited and a wholly owned subsidiary of CVRD that will continue as CVRD Inco Limited.

Merger and acquisition activity was quite buoyant in the Canadian gold sector in 2006 as consolidation continued.

Barrick Gold Corporation completed its US\$10.4 billion takeover of Placer Dome Inc. in mid-March, making it the number one global gold producer. As part of this deal, Barrick sold four Placer Dome mines and other interests to Goldcorp Inc. for US\$1.6 billion. This transaction was completed in May. Chief among these assets was the Campbell Red Lake mine, which is located adjacent to Goldcorp's Red Lake mine in Ontario.

In September, Pioneer Metals Corporation announced that over 80% of its shares had been tendered to Barrick Gold Corporation in Barrick's friendly all-cash takeover of Pioneer at \$1.00 a common share. When officially completed, expected in early 2007, the value of the total transaction would be approximately \$65 million on a fully diluted basis. Barrick made the bid in July following the rejection by Pioneer of a hostile bid from NovaGold Resources Inc. at \$0.57 a common share. Pioneer owns 100% of the Grace claims located immediately north of the Galore Creek gold-silver-copper deposit in northwestern British Columbia, approximately 150 km north of Stewart. The Galore Creek deposit, owned by NovaGold, is currently in the permitting and feasibility stages. A final feasibility study for this deposit completed in late October estimated proven and probable reserves at 540.7 Mt containing 5.3 million oz of gold, 92.6 million oz of silver, and 6.6 billion lb of copper.

In early November, Goldcorp Inc. completed the acquisition of Glamis Gold Ltd. with Glamis shareholders receiving 1.69 Goldcorp shares and \$0.0001 for each share of Glamis. Based on the share exchange, Goldcorp shareholders own approximately 60% and Glamis shareholders own approximately 40% of the new Goldcorp. The friendly transaction was valued at US\$8.9 billion and made the company the world's fifth largest gold producer based on estimated 2007 production. Completion of the deal came shortly after the Divisional Court of the Ontario Superior Court of Justice dismissed an appeal by former Goldcorp Chairman and its largest individual shareholder, Robert McEwen, that Goldcorp was not obligated to hold a shareholder vote on the proposed transaction. With the acquisition of Glamis, Goldcorp estimated that it had doubled its reserves and resources and expected to see production increases of 50% for gold over the next four years. For 2006, on an annualized basis, the new Goldcorp expected production of 1.75 million oz of gold, 13.5 million oz of silver, and 160 million lb of copper.

Also, in early November, IAMGOLD Corporation completed its US\$3 billion all-share friendly acquisition of Cambior Inc. on the basis of 0.42 of a common share of IAMGOLD for each issued share of Cambior. As a result, IAMGOLD shareholders own approximately 57% and Cambior shareholders own approximately 43% of the new IAMGOLD Corporation. Annual gold production is estimated at about 1.1 million oz. The new company announced that it now had total gold reserves of 9.7 million oz, total measured and indicated resources of close to 21 million oz, and inferred resources of 8 million oz.

In mid-November, Kinross Gold Corporation launched a friendly takeover bid for Bema Gold Corporation estimated at US\$3.1 billion. The all-share transaction involves a shareholder-approved plan of arrangement whereby each Bema common share is exchanged for 0.441 of a Kinross common share (later adjusted in late December to 0.4447) and \$0.01 in cash. Upon completion of the deal in early 2007, 61% of the new company would be owned by existing Kinross shareholders and 39% by existing Bema shareholders. The merged company is estimated to have mineral reserves and resources of 50 million oz of gold, 80 million oz of silver, and 2.9 billion lb of copper. On a pro-forma basis for 2006, the new Kinross would have estimated production of 1.8 million oz of gold equivalent, growing 56% to approximately 2.8 million oz in 2009.

In early December, Barrick Gold Corporation said it had ended its five-month-old hostile takeover bid for NovaGold Resources Inc. after picking up just 14.8% of the company's shares. In November, Barrick said its offer to acquire NovaGold stock was no longer conditional on it getting a majority of the company's shares. NovaGold called Barrick's bid of US\$16.00 per share for the company a "low-ball" offer, even though Barrick had boosted it from the US\$14.50 a share it had originally offered in July. NovaGold owns 70% and Barrick owns 30% of the Donlin Creek gold deposit in western Alaska. If Barrick spends US\$32 million, completes a bankable feasibility study, and makes a decision to begin mine construction by November 12, 2007, it will earn an additional 40% of this property to hold 70%. In late September, an independent Preliminary Economic Assessment of the Donlin Creek gold project indicated an average life-of-mine production of 1.4 million oz/y of gold for 22 years at a cash cost of \$276.00/oz.

The Canadian diamond sector expanded in 2006 with the opening of Canada's third diamond mine. As well, progress continued on the development of two other mines, and advanced exploration and development were under way at several other diamond projects.

In mid-August, Tahera Diamond Corporation held the official opening ceremony of its Jericho diamond mine, which represented Canada's third, and Nunavut's first, diamond mine. Construction of the mine was substantially completed during 2005, the first diamonds were produced in January 2006, and Tahera declared commercial production on July 1, 2006. Under the terms of an offtake and financing deal, Tiffany and Co. takes the entire run-of-mine production. From this, it purchases a significant amount for its own manufacturing and design needs, and then sells the remainder for Tahera on the international market for a fee. In mid-November, the company announced that it had entered into an agreement with Teck Cominco Limited whereby Teck Cominco will purchase, on a private placement basis, 30 million units of Tahera at a price of \$1.00 per unit for gross proceeds of \$30 million. Units will be comprised of a total of 30 million common shares and common share purchase warrants. Teck Cominco's initial

investment will represent approximately 16% of Tahera's issued and outstanding common shares, and its ownership could potentially go up to approximately 24.9% on a fully diluted basis if all warrants issued to Teck Cominco are exercised.

De Beers Canada Inc. is currently constructing two mines in Canada: Snap Lake in the Northwest Territories (N.W.T.) and Victor in Ontario. The Snap Lake project is located approximately 220 km northeast of Yellowknife and will be De Beers' first mine outside of Africa and Canada's first fully underground diamond mine. Construction began with the opening of the winter road in February 2005. By mid-August 2006, a total of nearly \$432 million had been spent on contracts and purchase orders for construction of the mine with a total investment to mid-2007 of \$878 million. The mine will produce 1.5 million ct/y when in full production and is scheduled to commence operation in the last quarter of 2007. De Beers' Victor project, located near Attawapiskat in the James Bay region of Northern Ontario, began its construction phase in 2006 and is scheduled to begin production in the last part of 2008. It is estimated that the \$1 billion mine will produce approximately 600 000 ct/y during its estimated production life of 12-13 years. There are a number of other diamondiferous kimberlites on the Victor property and De Beers is conducting further exploration work on the Tango Extension, Delta and India kimberlite within this group of kimberlites. A third De Beers project, Gahcho Kue, a joint venture of De Beers (51%), Mountain Province Diamonds Inc. (44.1%), and Camphor Ventures Inc. (4.9%), is located at Kennady Lake, approximately 300 km northeast of Yellowknife in the N.W.T. The project, with De Beers as the operator, is currently in the permitting and advanced exploration stage of development and is on target for production in 2012. The Gahcho Kue diamond mine is projected to have a life in excess of 20 years, with full production of more than 3 million ct/y over 15 years.

In late September, following a lengthy legal dispute during 2006 brought on by De Beers Canada Inc. over control of the exploration program and spending at the Fort-à-la-Corne diamond joint venture project (FALC JV), Shore Gold Inc., through its wholly owned subsidiary Kensington Resources Ltd., acquired 100% of the project. Shore purchased De Beers' 42.245% interest for \$180 million, Cameco Corporation's 5.51% interest for \$23.5 million, and UEM Inc.'s 10% interest for \$42.6 million. Kensington then sold 40% of the project to Newmont Mining Corporation of Canada Limited for \$170.4 million and retained the remaining 60% and will act as operator. Notwithstanding these events, significant advanced exploration activity continued during 2006 on the FALC JV kimberlite deposits where over 60 kimberlites have been identified.

During the year, Shore continued with its \$60 million pre-feasibility program for its wholly owned Star kimberlite located adjacent to the FALC JV, which is scheduled for completion by the end of 2007. This is the largest work

program outlined for any of the Fort-à-la-Corne kimberlites to date. The aim of the pre-feasibility study is to define a National Instrument 43-101 compliant mineral reserve for the Star project.

In early December, Peregrine Diamonds Ltd. began a third bulk sampling program on the 9-ha DO-27 kimberlite body of the WO (Tli Kwi Cho) Diamond Project Joint Venture (WOJV), which is located approximately 23 km southeast of the Diavik diamond mine in the Lac de Gras area of the N.W.T. The DO-27 kimberlite was discovered in 1993 by Kennecott Canada Exploration Inc. and partners, and was subject to advanced drilling and sampling. Peregrine obtained a 38.5% interest in the WO block in 2004. In the past two years, work by Peregrine has been under way to further assess the potential of the DO-27 pipe through more drilling and bulk sampling. Following decisions about financial participation by the partners of WOJV in December, WOJV ownership now consists of Peregrine, the operator (71.74%), Archon Minerals Limited (17.48%), and DHK Diamonds Inc. (10.78%).

In mid-December, Ashton Mining of Canada Inc. reported that it was making progress toward completion of the 2006 program at the Foxtrot property in north-central Quebec. Ashton and its 50:50 joint-venture partner, SOQUEM INC., were continuing to complete the collection of a 10 000-t bulk sample from Renard 2, 3 and 4, three significantly diamondiferous kimberlites that form part of the Renard cluster of nine bodies. Diamond results from the bulk sample of the three kimberlites are expected during the first and second quarters of 2007. In late July, Stornoway Diamond Corporation announced its intention to acquire Ashton, as well as Contact Diamond Corporation, for shares and cash. For Ashton, it is one common share of Stornoway plus \$0.01 in cash, and the cash consideration is equal to \$1.25 in cash but is subject to pro-ration of the approximately \$13.6 million that will be allocated among all Ashton shareholders who elect to receive the cash consideration. For Contact, it is on the basis of 0.36 common shares of Stornoway for each common share of Contact. Both transactions were finalized in early 2007. Stornoway has exposure to approximately 18 million acres of prospective diamond properties spanning 40 properties in Canada and Botswana. These include several advanced-stage properties such as Aviat, Qilalugaq, and Churchill in northern Canada, where a total of 77 kimberlites have been discovered since 2002, of which 40 so far have proven to be diamondiferous. The three-way combination is expected to create a company with a market capitalization in excess of \$200 million and will become one of the leading, pure diamond exploration and development companies in Canada.

Other important corporate news in 2006 included, in mid-August, Westdome Gold Mines Ltd. having the official re-opening of the Kiena underground gold mine, which is located some 10 km from Val-d'Or, Quebec, at Lac de Montigny. The mine, with a long history dating back to the 1930s, had been closed since 2002 when it was then owned

by McWatters Mining Inc. The mine/milling complex began commercial production in early August and is forecast to produce about 20 000 oz of gold in 2006, rising to approximately 50 000 oz in 2007.

In late August, Ascot Resources Ltd. received a *Mines Act* permit from the Government of British Columbia to allow it to begin development of an aggregate quarry and ship-loading facility at Swamp Point on the Portland Canal. The project site is located 50 km south of Stewart. The project's lifespan is anticipated to be a minimum of 18 years with a maximum production capacity of 3.3 Mt/y of aggregate. Initial capital investment is estimated at \$27.5 million. The company indicated that it intends to maximize local employment and contracting activities, primarily from Nisga'a communities and the communities of Stewart and Prince Rupert.

Also in late August, San Gold Corporation officially re-opened an underground gold mine at Bissett, Manitoba, which is about 250 km northeast of Winnipeg, with the pouring of its first two gold dore bars. The new Rice Lake mine, which is the only primary gold mine in Manitoba, was originally the San Antonio mine, a successful gold mine that operated for more than 35 years before shutting down in 1968. It re-opened briefly several times, the last being in 1998. Also called the Bissett mine, it last ceased production in 2001. New commercial operations began in the spring of 2006 at a mining rate of 400 short tons per day (st/d), which is expected to double in 2007. The mill is rated at 1250 st/d. The company expects to produce about 60 000 oz in 2007.

In early September, the Iron Ore Company of Canada (IOC) announced that it had reached an agreement with the Labrador Iron Ore Royalty Income Fund for exclusive mining rights to Wabush #3, a mining deposit located in Labrador West. The deposit is positioned adjacent to IOC's existing mining, processing and rail infrastructure. Estimates from previous drilling programs (1940s-1960s) indicated that Wabush #3 had resources in excess of 400 Mt with an iron content of 38%. IOC will commence a new drilling program during the fourth quarter of 2006 to confirm this work.

In early October, Western Canadian Coal Corp. officially opened its \$325 million Wolverine metallurgical coal mine complex located near Tumbler Ridge in northeastern British Columbia. The mine began production in late July and is expected to produce 1.35 Mt of hard coking coal in the company's fiscal year ending March 31, 2007, and in excess of 2.5 Mt in the next fiscal year. The state-of-the-art preparation plant and facilities at Wolverine are the first of their kind built in Canada in more than 20 years. The plant is designed to handle 3 Mt/y of high-quality coking coal. The company uses the existing rail and port facilities already in place for the northeast B.C. coalfields. The first shipments of Wolverine coal destined for customers in the

Indian Sub-Continent and Europe were shipped from Prince Rupert's Ridley Terminals earlier in October.

In mid-October, Hillsborough Resources Limited announced that it had signed a definitive asset transfer agreement with NEMI Northern Energy and Mining Inc. and Anglo Coal Canada Limited whereby the northeastern British Columbia metallurgical coal assets of Hillsborough, NEMI, and Anglo Coal Canada will be consolidated into a limited partnership. This consolidation (into Peace River Coal LP) took place in November 2006 with Anglo Gold receiving 60% of the partnership and Hillsborough and NEMI each receiving 20%. Anglo Gold will be the operator.

In late October, the Cigar Lake joint-venture uranium project (Cameco Corporation, 50%; Areva Resources Canada Inc., 37%; Idemitsu Uranium Exploration Canada, 8%; and TEPCO Resources Inc., 5%) suffered a major setback when significant flooding filled the underground workings. The mine had been on schedule to start production in early 2008. The deposit is the world's largest undeveloped uranium deposit with proven and probable reserves of 551 000 t with a grade of 19.06% U₃O₈. By year-end, Cameco, who is the operator, had begun a phased remedial action plan to restore the underground workings by drilling holes to the source of the water inflow. This was to be followed by pumping in concrete, the removal of water from underground areas, ground freezing in the area of the inflow, restoring other underground areas, and resumption of mine development.

Also in late October, EuroZinc Mining Corporation officially merged with Lundin Mining Corporation on the basis of one EuroZinc share for 0.0952 Lundin shares. This followed the announcement in August that the two Vancouver, British Columbia-based companies had entered into an agreement to merge through a Plan of Arrangement. The new company, to be called Lundin Mining Corporation, will operate four mines in Portugal (Neves-Corvo), Sweden (Zinkgruvan and Storliden), and Ireland (Galmoy), and in 2007 a fifth mine (Aljustrel) is planned to start production in Portugal. Production for 2006, on a combined basis, is estimated to be approximately 180 000 t (400 million lb) of contained zinc, 90 000 t (205 million lb) of contained copper, 45 000 t (100 million lb) of contained lead, and 6 million oz of contained silver.

In late October, Norsk Hydro announced that it was closing its magnesium facility at Bécancour, Quebec, during the first half of 2007. The facility closed in April 2007. The company indicated that it was primarily the extensive export of very low-priced metal from China that is preventing continued production at the world's largest and most environmentally friendly magnesium plant. Norsk opened the plant in 1989 as part of its drive to target the U.S. auto industry. The closure will be timed with the wind-up of a 10-year supply contract with General Motors.

In late November, Inco Limited (now CVRD Inco Limited) and Sud-Chemie AG announced the formation of a new joint-venture company called Alantum (50:50 ownership between Sud-Chemie and Inco ECM GmbH, a wholly owned indirect subsidiary of Inco), which will provide the automotive industry with materials to control catalytic diesel emissions. Alantum will initially focus on making diesel oxidation catalysts and diesel particulate filters for European-built passenger cars and light trucks. Initial production is expected in 2008 from a new plant to be built in Heufeld, Germany.

In early December, Aurizon Mines Ltd. announced the pouring of its first gold dore bars at its 100%-owned Casa Berardi mine situated in the Abitibi region of northwestern Quebec. Aurizon expects to achieve commercial production at Casa Berardi in the first quarter of 2007, with production gradually increasing from the initial planned rate of 1600 t/d to 2200 t/d by the end of 2007. It is estimated that Casa Berardi will produce approximately 185 000 oz of gold in 2007 at an estimated total cash cost of US\$250/oz. Casa Berardi is currently forecast to produce 1 092 000 oz of gold from 4.8 Mt of ore over the initial 6.2-year operating plan, based on current mineral reserves. Additional mineral resources comprise 2.7 Mt of indicated resources with an average grade of 5.1 g/t gold and 5.6 Mt of inferred resources averaging 6.5 g/t gold.

Also in early December, Teck Cominco Limited announced that it had been selected by the Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games (VANOC) to supply gold, silver, and bronze for the medals at the Vancouver 2010 Olympic and Paralympic Winter Games. As well, it will work with VANOC and the Royal Canadian Mint on the development and production of Olympic and Paralympic medals for 2010.

Government and Industry Initiatives

The Government of Canada, provincial and territorial governments, the mineral industry, and others undertook a number of activities to promote and support Canada's minerals and metals industry and mining-related equipment and services sectors in 2006.

During 2006, the Minerals and Metals Sector of Natural Resources Canada (NRCan), and more generally NRCan, participated in several national and international activities, programs, and trade and investment conferences and forums. This participation allowed the Sector to demonstrate the innovation, technology and leadership of Canada's minerals and metals sector on a global scale. Some of these activities are highlighted below.

Dr. Bill Price of the CANMET Mining and Mineral Sciences Laboratories gave five presentations in Brussels on the standards for the characterization of mine wastes,

focusing on "acid generation behaviour." The workshop was organized by the Comité Européen de Normalisation (CEN), the European standardization committee. CEN is responding to the new European Directive on the management of waste from the extractive industries, which requires proper waste characterization as a basis for the development of waste management plans. There is a concern that whatever Europe adopts may be adopted by other parts of the world, and there is therefore a need to ensure that what they adopt is practical and effective.

The Concrete Group of the CANMET Materials Technology Laboratory (CANMET-MTL) successfully executed the international development/technology transfer project "Implementation of High-Volume Fly Ash Technology in India" funded by the Canadian Climate Change Development Fund and administered by the Canadian International Development Agency.

The project's goals were to strengthen India's ability to reduce greenhouse gas emissions and promote sustainable development through high-volume fly ash concrete (HVFAC) technology in India that was developed by CANMET-MTL. The production of each tonne of portland cement, an essential component of concrete, results in about one tonne of CO₂. Fly ash, a by-product of coal combustion in thermal power generation that accounts for over 70% of India's power, causes environmental problems. HVFAC addresses both of these problems by reducing its portland cement content and incorporating more fly ash content. The project team, in cooperation with several Indian partners, achieved significant results, including many full-scale HVFAC constructions.

The research contributions of CANMET-MTL to the five-year, \$10 million Structural Cast Magnesium Development (SCMD) project was acknowledged by the U.S. Department of Energy (USDOE). The project, which involved 34 participants from industry, academia, and government research organizations, developed technologies and manufacturing processes that led to the redesign of an aluminum engine cradle into a magnesium cradle. The cradle met required vehicle specifications with a 35% weight savings. A special certificate from the USDOE was also awarded to CANMET-MTL for its overall contribution to the success of the SCMD project.

Dr. Dogan Paktunc of CANMET-MMSL was elected chairman of the International Mineralogical Association's Commission on Applied Mineralogy. The Association was established in 1958 as a non-profit organization with the mission to further international cooperation in the mineralogical sciences and to promote wider awareness among international groups that it is the sole international organization promoting mineralogy.

CANMET-MMSL has developed a methodology to detect well failures and fluid leakage using seismic monitoring

techniques in collaboration with Imperial Oil Ltd. scientists. The success of this methodology led the company to adopt seismic monitoring for the detection of such failures, promoting the environmentally friendly extraction of oil.

In 2006, Géologie Québec (MRNF) carried out a number of geological projects in various areas of Quebec, including nine geoscientific inventories, ten geological studies and analyses, and several compilations and evaluations of mineral potential. Several geological inventories and studies were carried out under the Copper Plan, the aim of which is to foster the identification of new exploration targets and new mineral discoveries, and to supply the Horne smelter with copper concentrate. The results from these studies were released in November at the 2006 Québec Exploration conference, which was attended by some 1500 representatives of the exploration sector from all regions of Canada and other parts of the world.

Also during 2006, Québec replaced the electronic register of mining titles with a new interactive, transactional, Web-based mining title management interface called GESTIM Plus. GESTIM Plus provides free, instant access 24 hours a day to the public register of real and immovable mining rights in Quebec, and allows users to consult the register and to download maps and data.

In mid-January, the Yukon government approved a Mine Site Reclamation and Closure Policy for hard rock mines that became effective immediately. The policy lays out the Yukon government's requirements for mining companies to plan for and finance the costs of restoring land to its former state or other productive uses. As well, it provides guidance to government agencies for implementing their regulatory responsibilities. Key components of the policy include:

- Mine operators are responsible for reclamation, care, maintenance, and abandonment of the site;
- Every mine is required to have an approved reclamation and closure plan that has been approved by the Yukon government before development proceeds;
- The reclamation and closure plan will be adjusted at regular intervals as new information is collected;
- A Certificate of Closure will be issued when mine development or production is terminated and the Yukon government is satisfied that the mine operator has complied with all licence conditions; and
- The Yukon government will determine the form and amount of security, to be provided by the mine operator, to cover the full amount of outstanding mine reclamation and closure liability. The amount will be periodically adjusted in accordance with decreased or increased site liability. The government indicated that extensive consultation with First Nations, mining industry repre-

sentatives, environmental groups, and government agencies took place to help guide development of the policy, which is consistent with policies in other jurisdictions in Canada.

In late January, the Government of British Columbia announced plans to invest an additional \$2.3 million to expand training for youth from rural and Aboriginal communities so they can pursue careers in the province's mining and mineral exploration industry. The new and expanded programs promote partnerships among First Nations, communities, industry, and educational institutions. The new funding includes: \$300 000 from the Ministry of Energy, Mines and Petroleum Resources' 2005/06 budget to continue the Northwest School of Exploration and Mining pilot program; \$1 million to expand the pilot program into a new province-wide Mining Education and Skills Development Program; and \$1 million to create Prospector and Environmental Teams to provide hands-on experience for youth in prospecting and environmental reclamation.

Between February and April 2006, the Government of British Columbia carried out a series of job and career fairs in communities in resource industry areas around the province. More than 20 of these fairs brought together exploration and mining companies, educational institutions, and employment agencies, together with prospective employees and people interested in learning more about mining in their region. The fairs provided information on job opportunities and career options in the mineral exploration and mining industries, and promoted the participation of First Nations and rural communities. The fairs also promoted awareness of the resource industry's skills and training requirements and of how mining benefits communities.

In early February, the Boreal Prospectors Association was founded in Thunder Bay, Ontario. It was established to provide a forum in which members can identify and address the many geographical, governmental and cultural challenges facing the mineral industry in Ontario's Far North. It is a member of the Ontario Prospectors Association and is made up of independent prospectors, regional First Nations representatives, and industry representatives active in Northern Ontario. When the Association was founded, there were 36 members, half of whom reside in northern communities.

In early March, the Honourable Gary Lunn, Minister of Natural Resources, gave the keynote address to open the annual Prospectors and Developers Association of Canada (PDAC) International Convention and Trade Show in Toronto. The event attracts more than 12 000 delegates from Canada and nearly 100 other countries.

Also in early March, NRCan and the Ontario Ministry of Northern Development and Mines (MNDM) released a new video designed to provide Aboriginal communities with a better understanding of the mining industry in

Northern Ontario. The video, entitled *Our Community . . . Our Future: Mining and Aboriginal Communities*, describes the mining sequence from government geological surveying and mapping, through the entire exploration and mining process, to mine closure and site rehabilitation. Filmed in Northern Ontario, the video was produced by NRCan and MNDM with support from a number of First Nations communities and exploration and mining companies that are active in Ontario. The video is available in both official languages and in three Aboriginal languages: Cree, Ojibwa, and Ojibwa.

Also in early March, the Government of Ontario announced its new Mineral Development Strategy to enhance the mineral sector's global competitiveness. The strategy builds on the provincial government's current initiatives, programs and services as it strives to ensure that the mineral sector continues to contribute at a high level to Ontario's regional and provincial economies. It outlines a series of key strategic objectives and action items that the government will address in the implementation stage. The strategy proposes an engagement process that aims to promote positive mineral sector relations with Aboriginal communities and supports the aspirations of Aboriginal communities by encouraging their enhanced participation in the benefits of resource development and ensuring that communities are appropriately consulted. While a mineral development strategy would apply to the entire province, the mineral sector is particularly important to the Northern Ontario economy. The strategy is part of the government's Northern Prosperity Plan for building stronger northern communities. The plan has four pillars: Strengthening the North and its Communities, Listening to and Serving Northerners Better, Competing Globally, and Providing Opportunities for All.

In the mid-March Quebec Budget Speech, the Minister of Finance announced that the head office of SOQUEM (Société québécoise d'exploration minière) would be relocating from Québec City to Val-d'Or. The move is intended to put the corporation closer to where the bulk of exploration activity takes place. The government also allocated \$3 million a year over three years for SOQUEM's exploration projects.

In late March, the Government of Ontario announced funding of \$10 million to Laurentian University to launch the Centre for Excellence in Mining Innovation. In 2004, Laurentian adopted a mining vision to become a national centre of excellence in mining innovation, which was followed in December 2005 by the university's decision to create such a centre at its Sudbury campus. The Centre's research priorities, developed with industry input, will focus on mining exploration, deep mining research, integrated mine process engineering, telerobotics and automation, and environment and reclamation. Subsequently, additional funding has come from Inco Limited (now CVRD Inco Limited), \$5 million in-cash and in-kind; the City of Greater Sudbury, \$50 000 over three years; and Xstrata Nickel (for-

merly Falconbridge Limited), \$5 million. The Government of Ontario has agreed to match any private contributions.

In early May, the Government of Canada in its 2006 Budget extended the federal Investment Tax Credit for Exploration (ITCE) from May 2, 2006, to March 31, 2007. The six-year-old program allows investors a 15% credit on their flow-through-share investments in grassroots exploration in Canada. The ITCE includes a provision that will allow funds raised in 2007 to be spent on eligible exploration activity up to the end of 2008.

As a result of this extension, continued eligibility for the Manitoba Mineral Exploration Tax Credit was made effective by the Government of Manitoba. Originally introduced in the 2002 provincial budget, this 10% non-refundable personal income tax credit would be in addition to the ITCE in Manitoba.

Also in early May, British Columbia's only mining engineering program at the University of British Columbia received a \$7.5 million donation from Teck Cominco Limited, plus contributions from the company's partners, to create the Norman B. Keevil Institute of Mining Engineering in honour of the company's former President and CEO. The gift will provide support for infrastructure upgrades, faculty recruitment, and an enriched student experience for an expanded number of students, thereby enhancing the quality of education and leading-edge research. The Institute will provide innovative solutions to real-world problems and ensure environmental stewardship, sustainability, community enhancement, and positive First Nations relations. Teck Cominco secured contributions from a number of its partners, including The Hallbauer Family Foundation, AMEC Inc., Silver Standard Resources Inc., Robert Quartermain, Steven G. Dean, and Dr. Klaus M. Zeitler.

In early June, the Government of British Columbia and the Blueberry River First Nations signed the first-of-its-kind Economic Benefits Agreement aimed at strengthening land use certainty in the province's northeast region with respect to the continued growth of the energy, mineral, and petroleum resource sectors in the area. The agreement provides for an initial payment of \$2.37 million, followed by payments totaling not more than \$3.214 million per year for 15 years. After the initial payment, subsequent payments will be linked to the level of activity and revenue from resource development in the northeast region. The funds provided to the Blueberry River First Nations will be paid into a trust whose sole beneficiary is the Blueberry River First Nations. This benefits agreement will be in effect until March 31, 2020, pending the successful negotiation of other corresponding matters such as the role for the Blueberry River First Nations in land and resource management.

In mid-June, the Honourable Gary Lunn announced a five-year, \$2.4 million project to provide access to new, high-quality satellite images of Canada. These improved and

standardized images will be available to all Canadians for free over the Internet. The images will support government decision- and policy-makers in the fields of public safety, health, and the environment, as well as northern and Aboriginal communities. As well, the investment will deliver more up-to-date and higher-resolution images for our energy, mining, and forestry industries.

In late June, the World Gold Council (WGC) announced that Agnico-Eagle Mines Limited, Cambior Inc., Coeur D'Alene Mines Corporation, Eldorado Gold Corporation, Goldcorp Inc., IAMGOLD Corporation, and Kinross Gold Corporation had joined the WGC. As a result, the WGC represents 24 companies and about 38% of total world gold production. Founded in 1987, the aim of the WGC is to stimulate and maximize the demand for and holding of gold by consumers, investors, industry, and the official sector.

In late July, the Government of British Columbia and the Upper Similkameen Indian Band (USIB) signed a consultation agreement which ensures that consultations are held before any mining activity is done in the band's traditional territory. The Mining and Minerals Protocol Agreement establishes an effective means for communication and information-sharing between the Province and the band, and ensures that mining development will be done in an environmentally and culturally sustainable manner. It also provides effective regulation of mineral resource development and allows the Province to assist the band in developing the capacity to participate in, and benefit from, mining activities within its territory. The USIB has about 100 members and has worked closely with government, industry, and other First Nations to develop capacity in the areas of mining, geographic information systems, forestry, tourism, and archaeological knowledge. The band has a long history extracting, utilizing, and trading rocks and minerals in the Similkameen area and is a leader in the interpretation of the cultural and contemporary use of minerals.

In mid-August, the Government of the Northwest Territories (GNWT) announced a new retailers club that would provide key North American retailers with exclusive tools, tips and techniques to promote their sales of GOVERNMENT CERTIFIED CANADIAN DIAMONDS™. The RARE IN NATURE™ Diamond Retailers Club is the second phase of the RARE IN NATURE™ campaign launched in 2005 to raise consumer awareness and interest in GOVERNMENT CERTIFIED CANADIAN DIAMONDS™ and to support the growth of the N.W.T.'s secondary diamond industry. Features of the new club will include an interactive on-line news service covering events and developments in the N.W.T. diamond industry, access to an exclusive gallery of northern images, point-of-sale display materials, and the inside track to the background and knowledgeable insight of diamond-marketing professionals. Designation as club members will be recognized with a certificate signed by the Premier of the Northwest

Territories. The GNWT has joined forces with Arslanian Cutting Works, Polar Diamond Group, Aurora College, the City of Yellowknife, Northwest Territories Tourism, and other partners to establish the club.

In late August, mines ministers from the Government of Canada, the provinces, and the territories met for the 63rd annual Mines Ministers' Conference and agreed to a renewed mining Action Plan for Canada. The federal-provincial-territorial Action Plan will guide intergovernmental initiatives that are critical to the long-term future of the industry. The goals of the agreement are to strengthen the competitiveness of the minerals and metals industry and to deliver benefits to mining communities across the country. The ministers pointed to the importance of focussing on clear priorities such as advancing the Cooperative Geological Mapping Strategies and improving the regulatory process. The ministers also agreed that work be undertaken to improve the efficiency of the regulatory process and to add specific timelines for project approvals, while recognizing that environmental protection must continue to be pursued in a rigorous manner. The annual Mines Ministers' Conference allows industry representatives, stakeholders, and governments to continue dialogue about the minerals and metals industry in Canada.

Also at the Mines Ministers' Conference in Whitehorse, Yukon, a new information kit was released to help Aboriginal people make more-informed decisions about mining and take advantage of the opportunities it offers for their communities. The information kit was the product of a partnership among the Prospectors and Developers Association of Canada, The Mining Association of Canada, the Canadian Aboriginal Minerals Association, and the Government of Canada (Natural Resources Canada, and Indian and Northern Affairs Canada). This project reaffirms the commitment of the partners to work with Aboriginal communities to increase the contribution of the minerals and metals industry to the well-being of Aboriginal people. The information kit is available in both English and French, and will be distributed to interested Aboriginal communities across Canada. It is also available on each of the partners' web sites.

In late September, the Government of Manitoba announced that the Province had established a \$70 million provincial account for orphaned and abandoned mines. This included a new agreement between the province and Viridian Inc. to share the rehabilitation cost of the East Tailings Management Area near the town of Lynn Lake. Under the agreement, the parties will complete a plan for rehabilitation of the area by May 2007. In 2006, the province was spending \$4 million for rehabilitation projects at Lynn Lake, Ruttan, Sherridon, and Snow Lake, including environmental monitoring, dike repair, demolition and clean-up, site revegetation, and preparation of long-term rehabilitation plans. The aim of the mine-site rehabilitation is to meaningfully address environmental, health and safety risks and return the site as closely as possible to its original condition. By

the end of the year, all orphaned and abandoned mine sites were to be inspected and sites requiring further rehabilitation were to be identified.

In late October, a workshop of the National Orphaned/Abandoned Mines Initiative (NOAMI) was held in Winnipeg, Manitoba, to share best practices on managing orphaned and abandoned mines. Representatives included provincial, territorial and federal government officials, non-governmental organizations, Aboriginal communities, mining industry officials, and others. Orphaned or abandoned mines are mines for which the owner either cannot be found or is financially unable or unwilling to carry out site rehabilitation. Many of these sites were developed decades ago, before environmental impacts were fully understood and modern operating standards were developed. Some of the sites pose environmental, health, safety, and economic risks. Orphaned and abandoned mines exist within all mining jurisdictions in Canada. The two-day workshop addressed key priorities, including best practices for mine-site assessment, monitoring and rehabilitation, community and Aboriginal consultation, partnership approaches, and funding options.

In early November, the formation of the International Plant Nutrition Institute (IPNI) was announced and it integrates the operations of the Potash & Phosphate Institute and the Potash & Phosphate Institute of Canada into its organization. IPNI is a new, not-for-profit, scientific organization dedicated to the responsible management of plant nutrients. IPNI founding members include Agrium Inc., PotashCorp, Mosaic, Saskferco, Simplot, Groupe OCP, Arab Potash Company, Belarusian Potash Company, Bunge Fertilizantes S.A., CF Industries Holdings Inc., Intrepid Mining, LLC, KK+S KALI GmbH, Sinochem Hong Kong Ltd., Spur Ventures Inc., SQM, Terra Industries Inc., and Uralkali. The companies involved in the new organization are basic producers of nitrogen, phosphate, potash, and sulphur for agricultural use.

PROFILES OF THE LEADING MINERALS PRODUCED IN CANADA

Gold

Canada has a long history of being one of the world's leading producers of gold. In 2006, Canada was the seventh largest global gold producer, trailing South Africa, China, Australia, the United States, Peru, and Russia. Canada-based Barrick Inc. and Goldcorp Inc. are two of the top global gold-producing companies. In 2006, gold mining was carried out in all provinces and territories with the exception of Newfoundland and Labrador, Prince Edward Island, Nova Scotia, the Northwest Territories, and Nunavut. Gold refineries are located in Quebec and Ontario. The main use for gold is in jewellery manufacturing, with other important uses including electronics, dentistry, and

coinage. Gold bullion is also important as a global investment/demand product.

In 2006, gold was Canada's fourth leading metallic mineral as the value of gold production increased by 8.4% to \$2.2 billion. However, mine production decreased by 13.5% to 103 402 kg. Exports rose by 28.9% to \$5.6 billion.

Copper

In global terms in 2006, Canada was ranked as the eighth leading producer of copper behind Chile, the United States, Peru, China, Australia, Indonesia, and Russia. Canada-based Falconbridge Limited (which was acquired by Xstrata plc in 2006), Hudson Bay Mining and Smelting Co. Limited, and Inco Limited (which was taken over by CVRD in 2006), are major world producers of copper. Copper is mined in Newfoundland and Labrador, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, and British Columbia, while primary smelters are located in Quebec, Ontario and Manitoba, with refineries in Quebec, Ontario, and British Columbia. Copper's properties, especially its high electrical and thermal conductivity, good tensile strength, relatively high melting point, and resistance to corrosion make it and its alloys attractive for electrical transmission, water tubing, castings, and heat exchangers.

In 2006, the value of copper production in Canada increased by 78.8% to \$4.6 billion, with production up by 3.1% to 595 100 t. Based on the value of production, copper was Canada's second leading metal in 2006. Exports increased by 60.9% to \$6.3 billion.

Zinc

Canada was the world's fifth largest producer of zinc in 2006, trailing China, Australia, Peru, and the United States. Canada-based Teck Cominco Ltd. and Falconbridge Limited, now Xstrata Nickel, are two of the largest zinc producers in the world. In 2006, zinc was mined in New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, and British Columbia, with metallurgical plants located in Quebec, Ontario, Manitoba, and British Columbia. The main uses of zinc are as a coating (galvanizing) for steel to protect it from corrosion, the manufacture of brass and bronze, and die-casting.

In 2006, the value of zinc production rose by 101.5% to \$2.1 billion, even though production fell by 4.0% to 594 200 t. Zinc was Canada's fifth leading metal based on value of production in 2006. Exports rose by a dramatic 85.5% to \$2.3 billion.

Nickel

Canada is the world's second leading nickel producer behind Russia. In 2006, the next leading producers were

Australia, Indonesia, and New Caledonia. Globally, the industry is relatively small and is dominated by several large producers, including Canada-based Inco Limited (now CVRD Inco Limited) and Falconbridge Limited (now Xstrata Nickel). In 2006, nickel was mined in the provinces of Newfoundland and Labrador, Quebec, Ontario, and Manitoba, with smelters in Ontario and Manitoba, and refineries in Ontario and Alberta. Nickel's resistance to corrosion, high strength, pleasing appearance, and suitability make it useful in many applications. Major markets include stainless steels (which use about 65% of nickel production), nickel and copper-based alloys, electroplating, alloy steels, and foundry products.

In 2006, the value of Canadian nickel production rose by 75.9% to \$6.2 billion with production increasing by 17.0% to 225 700 t. Based on its value of production, nickel was Canada's leading metal in 2006, as well as Canada's number one mineral commodity. Exports rose by 42.2% to \$5.9 billion.

Iron Ore

Canada is a major producer of iron ore, with North American steel producers being the major users of Canadian-mined iron ore. In global terms, Canada ranked ninth in production in 2006 behind China, Brazil, Australia, India, Russia, Ukraine, the United States, and South Africa. The major Canada-based producers of iron ore are the Iron Ore Company of Canada, Quebec Cartier Mining Company, and Wabash Mines. Production takes place in Newfoundland and Labrador, Quebec, and British Columbia. Iron ore is upgraded in Canada for steelmaking use as pellets and concentrates.

In 2006, the value of Canadian production rose by 10.5% to \$2.6 billion as production rose by 12.2% to 34.1 Mt. Iron ore was Canada's third leading metallic mineral in terms of value in 2006. Exports increased by 17.4% to \$1.9 billion.

Uranium

Canada is the world's largest producer and exporter of uranium, typically delivering over 85% of its annual production to customers around the world. In 2005, Canada accounted for 27.8% of global uranium production, followed by Australia, Kazakhstan, Russia, and Namibia. All Canadian uranium production takes place in Saskatchewan, and Saskatoon-based Cameco Corporation is the world's largest producer. Cameco also operates Canada's only refinery and conversion facilities in Ontario, and is a partner in the Bruce nuclear power station in Ontario. Canadian uranium is used almost exclusively as fuel for generating electricity in nuclear power plants, although a very small amount may be used to produce isotopes for applications in nuclear medicine.

In 2006, the value of production from mines in Canada increased by 26.4% to \$1.4 billion, with production falling

by 22.4% to 9781 t. Exports increased by 23.9% to reach \$2.2 billion.

Potash

Potash refers to a group of potassium-bearing minerals and chemicals. The dominant potash product is potassium chloride, a naturally occurring pink, salty mineral for which Canada is the world's leading producer and exporter. Internationally in 2005, Canadian output accounted for 33% of world production, followed by Germany, Russia, Belarus, and Israel. In Canada in 2006, potash was produced in Saskatchewan and New Brunswick, with the Potash Corporation of Saskatchewan Inc. being the largest potash producer and exporter in the world. Fertilizer use consumes over 90% of the output. Other uses include detergents, ceramics, chemicals, and pharmaceuticals.

The value of Canadian production declined by 9.2% in 2006 to \$2.2 billion as production fell by 15.9% to 8 528 000 t. Potash was again Canada's leading nonmetallic mineral in 2006 by value. Exports fell by 12.0% to \$2.4 billion.

Diamonds

Canada became a diamond producer in 1998 with the start-up of the Ekati mine (now owned 80% by BHP Billiton Plc) in the Northwest Territories. In 2003, Canada's second diamond mine began production. The Diavik mine, which is a joint venture of Diavik Diamond Mines Inc. (DDMI) (60%) and Aber Diamond Mines Ltd. (40%), is also located in the Northwest Territories. In 2006, Canada's third diamond mine, Tahera Diamond Corporation's Jericho mine, began operations in Nunavut. Diamond cutting and polishing facilities operate in Canada, processing a portion of Canadian production. Besides jewellery manufacturing, tools and equipment manufacturing are important markets for diamonds. On a global scale, it is estimated that Canada ranked third in 2006 in terms of the value of diamond production behind Botswana and Russia.

In 2006, the value of diamond production in Canada fell by 9.7% to \$1.6 billion as production improved by 7.2% to 13.2 million ct. Based on value, diamonds were Canada's third leading nonmetallic mineral in 2006 after potash and cement. Exports declined to \$1.8 billion, a decrease of 3.2%.

Aluminum

Canada has been a leading producer of aluminum for some three-quarters of a century with smelter production based on hydro-electric power. Aluminum is produced in two provinces, Quebec (90%) and British Columbia (10%), from imported alumina, alumina extracted from imported bauxite, and recycled materials. Because of its light and rust-resistant properties, aluminum is used extensively in

transportation, packaging, and building and construction applications. Globally, Canada was the third leading producer of primary aluminum in 2005, trailing China and Russia and ahead of the United States and Australia. The large Canadian company, Alcan Inc., is the world's second largest producer.

Production of Canadian primary aluminum increased 5.2% to 3040 Mt in 2006, compared with 2890 Mt in 2005. The value of Canadian primary aluminum production in 2006 was estimated at \$8.8 billion, up from \$6.65 billion in 2005. Exports increased by 27.2% to \$12.4 billion.

Because aluminum in Canada is initially produced entirely from imported materials, its value is not reflected in the statistics on "mineral production" that appear elsewhere in this chapter. Its value is, however, reflected in the GDP of the mineral industry, where its production and processing are major components of Stages 2 and 3.

OUTLOOK AND TRENDS FOR THE CANADIAN MINERALS INDUSTRY

Global economic growth is expected to decline in 2007 to around 5% from the estimated 5.3% rate recorded in 2006. This is partly the result of an anticipated slowdown in the U.S. economy, coupled with rising interest rates in the industrial world. For 2008, a slight decline to just under 5% can be expected.

Although real GDP growth in the United States got off to a slow start in the first quarter of 2007 (0.6%), consumer spending continued to rise, surpassing 4% for the second quarter in a row. Among other factors, declining residential investment put a damper on first-quarter growth. Solid wage growth has supported consumer spending up to now, but the decline in housing wealth is expected to have a negative impact on near-term spending. Despite a strong rebound in the second quarter to an annualized estimated growth rate of 4.0%, the expected decline in consumer spending will likely produce an annual increase in real GDP of about 2%.

The acceleration in real GDP growth in the second quarter primarily reflected a downturn in imports, upturns in federal government spending and in private inventory investment, accelerations in exports and in non-residential structures, and a smaller decrease in residential fixed investment that were partly offset by a notable deceleration in personal consumption expenditures. In September, the U.S. Federal Reserve cut its key interest rate to 4.75% from 5.25% in an attempt to offset the negative effects of the sub-prime mortgage lending situation. Further reductions are expected in the near future.

Business investment and strength in exports will likely help offset the decline in consumer spending, resulting in a 2%

growth rate in 2007 and a slight improvement to 2-2.4% in 2008.

The Canadian economy, as measured by real GDP at market prices in chained (2002) dollars, rose at an annualized rate of 3.4% in the second quarter of 2007, following a 3.9% increase in the first. The strength was widespread as consumer and investment expenditures accelerated from the first quarter. Despite a substantial appreciation of the Canadian dollar relative to the U.S. dollar, exports also increased. Conversely, spurred by the jump in the Canadian dollar and strong domestic demand, the value of imports rose by 1.6% compared to the first quarter. For the year 2007, growth may be expected to decline to about 2.5% as the strong Canadian dollar and lower U.S. demand could cut into Canada's export market. Strong domestic consumer demand will partially offset the somewhat weaker trade picture, but export-sensitive sectors will remain vulnerable, resulting in growth slowing in 2008 to about 2.2%.

In spite of core inflation running near 2.5%, above the Bank of Canada's target overnight rate, the Bank remained on hold at its September Fixed Announcement Date, primarily to provide a safety net related to financial market volatility caused by concern about exposure to U.S. sub-prime mortgages. An increase later in the year to 4.75% from 4.50% is possible as the Canadian economy seems well placed to weather the effects of the sub-prime situation and also to help provide some inflation relief. However, with the Canadian dollar reaching and surpassing par with the U.S. dollar in September 2007, and with the 0.5% cut in U.S. interest rates, interest rates in Canada are likely to remain steady, at least in the short term. The Canadian dollar should remain at about par with the U.S. dollar for the rest of 2007 and into 2008, but settle back to perhaps the mid-90s as resource prices moderate and the U.S. dollar strengthens as the U.S. economy picks up.

Growth in the Chinese economy is expected to maintain its hot pace of at least 10.0% in both 2007 and 2008, despite measures aimed at bringing the growth rate down. The rapid growth expected in China (and also India, where growth is likely to reach 8% or higher in both 2007 and 2008) will provide a solid base for prices for metals and other commodities. Conversely, as a result of fiscal tightening, gradually rising interest rates, and the spillover effects of U.S. and Western Europe economic cooling, the Japanese economy is expected to slow to under 2% in both 2007 and 2008.

The outlook for other Asia-Pacific regions is generally favourable with some interest rate relief, evident after a period of tightening, designed to stimulate a more domestically oriented economy.

In Western Europe, currency appreciation, rising interest rates, and more restrictive fiscal policies are likely to lead to a decline in the economic growth of the region from just

under 3% in 2006 to about 2.5% in 2007 and 2% in 2008. However, inflation is expected to be relatively tame through 2008 as domestic spending growth slows and commodity prices possibly ease. This should allow some reduction in key interest rates. Lower rates would also have the effect of taking some pressure off the euro, which has been appreciating strongly against the U.S. dollar.

The major Latin American economies' fiscal, monetary and banking sectors have improved markedly, which will help them weather the fallout from the sub-prime mortgage crisis in the United States. Some impact is likely from the U.S. slowdown; however, strong domestic demand and a shifting of some exports to other foreign markets should allow the core group of Latin American countries to maintain growth rates above those of 2006.

Global minerals and metals demand will be very much affected by the ongoing strong economic activity in China and, increasingly, India, and also by the expected slowdown in the growth of the U.S. economy.

Nickel prices rose steadily through 2006 and the first half of 2007, reaching a monthly average high of US\$23.67/lb in May. The price eased during the third quarter to about US\$12.50/lb in September. For 2007, the price of nickel should still average well above US\$17/lb, higher than the 2006 average of US\$11.00/lb. A Standard & Poors Rating Services report stated that "fundamental supply constraints remain positive for nickel and will limit downward price pressure" and "... the nickel market will not likely risk oversupply until 2010." With that in mind, although the average will very likely be below the record high of 2007, the price could still average in the US\$13-\$14/lb range, well above the long-term average of about US\$3.50/lb.

Copper, which has been trading at over US\$2/lb since December 2005, reached a monthly high record of US\$3.65/lb in May 2006. The price then eased until the beginning of 2007. An upward trend brought the price to a monthly average of US\$3.62/lb in July 2007 as the market reacted to several supply disruptions. As some of these disruptions were resolved, the price eased during the remainder of the third quarter to US\$3.40-\$3.50/lb. For 2007, the copper price could average about US\$3.20-\$3.25/lb, compared to US\$3.05/lb in 2006. With fundamentals expected to remain favourable over the medium term, prices should remain strong, although at lower levels than those seen in 2007.

The rise in the price of lead has been the most spectacular of the base metals. Starting the year at US\$0.76/lb, the price rose steadily to a September average of US\$1.46/lb. Supply interruptions and low stock levels contributed to this rise. The nine-month average price was US\$1.07/lb. For the year, the average will likely be about the same.

As new zinc supply starts to replenish zinc stocks, the price of zinc is expected to moderate from an expected 2007

average of about US\$1.50/lb. As lead is often produced in conjunction with zinc, the increased zinc production will result in an increase in the supply of lead, thereby likely producing a lead surplus in 2008 and an average price of less than US\$1.00/lb.

As for gold, it has traded above US\$600/oz throughout the first nine months of 2007, broached the US\$700/oz mark in September, and was over US\$700/oz at the end of the third quarter. Most analysts expect the price to remain above US\$700/oz. Investor interest is driving the gold market. Gold tends to move in the opposite direction with respect to the U.S. dollar, so the current weakness, and expectations of further dollar weakness, have supported the price. The September move by the U.S. Federal Reserve to lower interest rates put additional pressure on the dollar. Gold is also viewed as a "safe haven" in periods of global tensions and financial turmoil, both of which were in evidence as the year progressed. In addition, jewellery demand is strong, helping to further underpin the price.

Of the nonmetals, potash prices at the Port of Vancouver reached a record high US\$209/t in August 2007. As supply is tight and demand is robust due to solid global farm income growth, higher prices may be expected.

In general, 2007 was a very good year for the Canadian mining industry, as many mineral and metal product prices reached record or near-record levels. While some moderation in prices in 2008 may be expected, prices in most cases are likely to remain above historical averages. The prices experienced in 2007 (and that have generally been increasing for several years) have spurred investment in exploration and deposit appraisal to levels not seen since 1987-88. This level of activity is expected to be maintained.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review for 2006 statistics was current as of June 2007; outlook material was current as of September 2007. (3) Sources for outlook material include the Bank of Canada, Conference Board of Canada, various issues of Platts Metals Week; Royal Bank of Canada (RBC); Scotiabank; Statistics Canada; and TD Bank. (4) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/2006CMY_e.htm.

NOTE TO READERS

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TABLE 1. CANADA, PRODUCTION OF LEADING MINERALS, 2005 AND 2006

TABLE 1. CANADA, PRODUCTION OF MINERAL PRODUCTS, 1995 AND 1996							
		Volume		Change	Value		Change
		2005 (r)	2006 (p)	2006/2005	2005 (r)	2006 (p)	2006/2005
		(000 tonnes except where noted)		(%)	(\$ millions)		(%)
METALS							
Nickel		193	226	17.0	3510.3	6176.4	75.9
Copper		577	595	3.1	2572.5	4600.1	78.8
Iron ore		30387	34094	12.2	2339.5	2584.2	10.5
Gold	kg	119549	103402	-13.5	2071.8	2246.8	8.4
Zinc		619	594	-4.0	1035.9	2087.3	101.5
Uranium	tU	12597	9781	-22.4	1131.6	1430.5	26.4
Platinum group	kg	22709	22878	0.7	405.4	492.3	21.4
Silver	t	1063	968	-8.9	304.0	398.8	31.2
Lead		73	82	11.9	86.1	116.6	35.4
Cobalt	t	2391	2793	16.8	102.0	113.2	11.0
Molybdenum	t	7667	7042	-8.2	x	x	x
NONMETALS							
Potash (K ₂ O)		10140	8528	-15.9	2437.5	2212.1	-9.2
Cement		14656	14571	-0.6	1661.3	1702.9	2.5
Diamonds	000 carats	12314	13206	7.2	1762.1	1590.7	-9.7
Stone		141275	140840	-0.3	1215.0	1267.1	4.3
Sand and gravel		243440	236505	-2.8	1180.3	1189.2	0.8
Salt		13463	13338	-0.9	432.0	439.1	1.6
Lime		2289	2211	-3.4	261.8	271.7	3.8
Clay products		..	..	..	232.7	230.9	-0.8
Peat		1304	1245	-4.5	219.1	211.2	-3.6
Sulphur, elemental		7757	8296	6.9	234.2	158.4	-32.4
Gypsum		8570	9072	5.9	113.9	123.9	8.8
Nepheline syenite		745	719	-3.5	63.3	66.5	5.1
Quartz (silica)		1807	1893	4.8	59.7	64.8	8.6
Sulphur, in smelter gas		653	693	6.1	36.0	38.3	6.3
Soapstone, talc, pyrophyllite		70	68	-2.9	26.2	22.3	-15.0
Chrysotile (asbestos)		x	x	x	x	x	x
Coal		65345	62987	-3.6	2329.0	2205.1	-5.3

Sources: Natural Resources Canada; Statistics Canada, *Canada's Mineral Production, Preliminary Estimates*, catalogue no. 26-202-XIB.

.. Not available; (p) Preliminary; (r) Revised; (x) Confidential.

Notes: Numbers have been rounded. Percent changes are based on unrounded data.

TABLE 2. CANADA, VALUE OF DOMESTIC EXPORTS, TOTAL EXPORTS (INCLUDING RE-EXPORTS), IMPORTS, AND BALANCE OF TRADE OF MINERALS AND MINERAL PRODUCTS, STAGES 1-4 (CUSTOMS BASIS), 2002-06

	2002	2003	2004	2005	2006
	(\$ millions)				
TOTAL MINING, INCLUDING FUELS					
Domestic exports	96 368.6	105 479.2	121 753.2	145 483.5	156 136.2
Total exports	98 626.5	107 688.4	123 831.0	148 290.0	159 806.2
Imports	65 182.1	65 373.8	77 035.7	90 924.4	97 752.6
Balance of trade	33 444.5	42 314.7	46 795.3	57 365.6	62 053.6
NON-FUEL MINING					
Domestic exports	47 227.4	44 802.8	52 856.0	58 646.3	68 480.4
Total exports	48 583.7	46 211.0	54 611.2	60 774.9	71 228.5
Imports	47 140.7	43 805.1	51 028.0	55 178.6	60 461.6
Balance of trade	1 443.0	2 406.0	3 583.2	5 596.4	10 766.9
TOTAL NON-FUEL MINING, INCLUDING COAL					
Domestic exports	49 069.2	46 489.7	54 765.4	62 079.9	71 911.9
Total exports	50 443.8	47 901.4	56 552.4	64 257.4	74 665.7
Imports	48 428.9	44 940.5	52 337.9	56 714.4	61 986.2
Balance of trade	2 014.9	2 961.0	4 214.5	7 543.0	12 679.6
TOTAL ECONOMY					
Domestic exports	365 294.4	354 302.8	385 522.6	408 420.6	411 282.5
Total exports	396 381.3	381 071.4	412 294.4	436 225.9	440 156.6
Imports	348 956.8	336 141.3	355 799.1	380 809.6	396 530.7
Balance of trade	47 424.6	44 930.1	56 495.3	55 416.2	43 625.9

Sources: Natural Resources Canada; Statistics Canada.

Canadian Reserves of Selected Major Metals, and Recent Production Decisions

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RESERVES OF SELECTED MAJOR METALS

During the 25-year period from 1980 to 2005, Canada's reserves of base metals declined continuously at annual average rates varying from -2.1% for nickel to -3.8% for lead. This long period of decline caused ore reserves at the end of 2005 to be less than half of the known ore reserves at the end of 1980. Reserves in 2005 were 39% of 1980 reserves for copper, 47% for nickel, 6% for lead, 18% for zinc, and 17% for molybdenum.

The current period of prosperity in the mining industry has almost arrested, or even reversed, the declining trend of base-metal reserves. During 2006, nickel reserves declined by 1%, but lead reserves increased by 34% year over year, zinc reserves increased by 20% year over year, copper reserves increased by 5% year over year, and molybdenum reserves increased by 6% year over year. Silver reserves increased by 3% and gold reserves increased by 8%.

The dramatic increase in lead reserves is primarily due to the re-opening of the Caribou and Restigouche mines in New Brunswick and the Scotia mine (formerly Gays River mine) in Nova Scotia. This increase may be somewhat fragile, given that the Caribou and Restigouche mines have a history of metallurgical problems, and the Brunswick mine, Canada's largest lead-zinc mine, is scheduled for closure due to depletion of the orebody in 2010. The increase in zinc reserves is primarily due to the production decision announced for the Perseverance mine in Quebec, while the increase in copper reserves is primarily due to the development of additional reserves at the Gibraltar mine in British Columbia. The increase in molybdenum reserves is primarily due to the decision by Roca Mines Inc. to open the Max mine near Revelstoke in British Columbia. The increase in silver reserves is primarily due to the re-opening

of the Caribou and Restigouche mines in New Brunswick, while the increase in gold reserves is primarily due to the production decision announced for the Meadowbank mine in Nunavut. Despite these recent increases from the low base of 2005, reserves for most metals remain at considerably less than half of what they were 25 years ago.

Reserves Policy

Canadian reserves are estimated from information contained in annual and other corporate reports, and from the responses of mining companies to the annual Federal-Provincial/Territorial Survey of Mines and Concentrators.

Reserves reported here include only metal contained in material that is classified by companies as "proven reserves" or "probable reserves" at producing mines and in deposits that are firmly committed to production (Table 2). Metal contained in mineral resources classified by companies as "measured resources," "indicated resources" or "inferred resources" is not included in national totals, nor is metal contained in deposits that have not advanced beyond the deposit appraisal phase (Figure 1). When available, only metal contained in mineable ore is included in Canadian totals in order to exclude losses inherent in the mining process. Every effort is made to achieve, from year to year, consistency in the reserves reported here; however, consistency ultimately depends on industry practice, which has evolved over the years. Imperial units reported by companies have been converted to metric units and the results have been rounded to the appropriate number of significant digits.

Reserves by Commodity

Gold

There were 1032 t of gold contained in Canadian mine reserves in December 2006. This represents an increase of 7% (67 t) compared to December 2005. The greatest increase came from the decision to place into production the Meadowbank deposit (90 t) near Baker Lake in Nunavut. The second largest increase was at CVRD Inco Limited's Ontario Division, where a 7% increase in the copper-nickel reserves created an increase of 10 t in the reserves of by-product gold. The third largest increase was at the re-opened QR mine (5 t) near Quesnel in British

FIGURE 1
GENERALIZED MODEL OF MINERAL RESOURCE DEVELOPMENT

PHASE	MINERAL RESOURCE ASSESSMENT	MINERAL EXPLORATION					MINERAL DEPOSIT APPRAISAL				MINE COMPLEX DEVELOPMENT	MINE PRODUCTION	ENVIRONMENTAL RESTORATION
		GRASS-ROOTS EXPLORATION											
	MRA	EX-1	EX-2	EX-3	EX-4	EX-5	DA-1	DA-2	DA-3	DA-4	MCD	MP	ER
STAGE	Various surveys, research and synthesis.	Exploration planning.	Regional reconnaissance and surveys.	Prospecting and ground surveys of anomalies.	Verification of anomalies and showings.	Discovery and delimitation of a mineral deposit.	Mineral deposit definition.	Project engineering.	Project economics.	Feasibility study, production decision.	Mine development, construction of processing plant and infrastructure.	Production, marketing and renewal of reserves.	Mine complex closure and decommissioning, site restoration.
OBJECTIVES	Supply information and tools required to develop the mineral potential of the nation for economic benefit, in the perspective of sustainable development.	Select target commodities. Establish exploration objectives and strategies. Select target areas and sites. Acquire claims or permits if appropriate.	Seek anomalies of interest over wide areas by various survey methods. Select the more promising targets. Acquire claims or permits.	Confirm the presence, exact location and characteristics of anomalies. Acquire claims, leases and properties.	Investigate the cause of anomalies. Find mineral showings. Acquire additional claims, leases and properties.	Discover, delimit and interpret grade, quality and tonnage of a new mineral deposit. Determine if it constitutes a mineral resource of "potential economic interest" to justify more intensive and detailed work.	Define the limits, controls and internal distribution of grades, mineralogy and mineral processing characteristics of the deposit. Acquire all data required for project engineering and cost estimation.	Determine, in an iterative fashion, the design, plans, schedules, capital cost and operating cost estimates for all aspects of the project. Establish technical feasibility and costs thoroughly and realistically.	Obtain all the information required and determine, based on corporate objectives, parameters for the economic, financial and social-political evaluation of the project.	Diligently validate and integrate project data, interpretations, estimations, plans and evaluations to achieve MCD and production objectives. Decide on whether to undertake the mining project. Obtain permits and financing.	Complete mine development and construction on schedule and within budgets and specifications. Ensure efficient and timely mine complex start-up according to schedule, specifications and cash flow forecasts.	Achieve commercial production on schedule and meet cash flow forecasts and quality specifications. Achieve mine profitability and company survival in the perspective of sustainable development.	Restore mine site, outside plant and infrastructure to environmentally acceptable condition. Ensure the future quality of the environment.
EVALUATION METHODS	Geoscientific, mineral and economic surveys, research, compilations and synthesis by governments, research institutes, universities and industry.	Metal and mineral market research. Review of geological and ore deposit information and of the legal, fiscal and socio-political context in various areas.	Remote sensing, aerial photography and airborne geophysics. Prospecting, geology and geochemistry. Appraisal, rating and selection of anomalies.	Ground, geological, geochemical and geophysical prospecting and surveys. Compilation, appraisal and selection of significant anomalies.	Geological mapping and other surveys. Trenching, drilling and sampling. Appraisal of results, recommendations for further work, and selection of new targets.	Stripping, trenching, mapping, sampling, drilling and down-hole geophysics. Initial mineral processing tests. Environmental and site surveys. Mineral resource estimation and inventory.	Detailed mapping, sampling and drilling on surface or from underground. Systematic mineralogy and mineral processing tests. Detailed environmental and site surveys. Pre-feasibility studies.	Pilot tests, engineering design and planning. Capital and operating costs for mining, mineral processing, infrastructure, environmental protection and restoration. Technical risk analysis. Prefeasibility studies.	Market, prices, product development and financial studies. Environmental, economic, financial, and socio-political risk analysis. Pre-feasibility studies.	Exhaustive due diligence review of all data, interpretations, plans and estimates. Evaluation of profitability, given the geological, technical, financial and qualitative risks, and the up-side factors.	Project management methods in a quality assurance perspective. Training program for personnel and detailed start-up plan to meet the requirements of this demanding period.	Production management methods to ensure continuous quality and efficiency improvements. Exploration appraisal and development of new zones or deposits on-mine-site and off-mine-site.	Mine closure and decommissioning. Environmental restoration and monitoring.
RESULTS	Maps, data bases, tools and models.	Exploration projects.	Regional anomalies.	Local anomalies.	Mineral showings.	Mineral deposit.	Deposit appraisal project.			Mining project.	Mining complex.	Mineral production.	Restored site.
MINERAL INVENTORY	UNDISCOVERED MINERAL POTENTIAL					INFERRED RESOURCE	DELIMITED MINERAL RESOURCE				MINERAL RESERVE		
	SPECULATIVE		HYPOTHETICAL				INDICATED	INDICATED AND MEASURED			PROVEN AND PROBABLE		
ESTIMATION ERROR (targeted margin of error of tonnage/grade estimates at the 90% confidence level)						± 100%	± 50% to ± 30%	Indicated: ± 50 to ± 30% Measured: ± 20 to ± 10% (often several sample grid dimensions are used in each category)			Proven (feasibility: ± 10%; mining: ± 5%)		Full compliance
INVESTMENTS	Moderate	Low, but increasing multiple investments.					Larger and increasing multiple investments.				Very large industrial investment.		
RISK LEVEL	Low	Very high, but decreasing risk of failure and financial loss.					High, but decreasing risk of failure.				Moderate to low industrial risk.		

Sources: Modified by D.A. Cranstone, A. Lemieux and M. Vallée, February 25, 1994, from M. Vallée, 1992, *Guide to the Evaluation of Gold Deposits*, CIM Special Volume 45, p. 4, and *SOQUEM Annual Report*, 1976-77, pp. 4 and 5. Revised by M. Vallée and G. Bouchard, January 2001.

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Columbia. The greatest reductions in ore reserves were reported at the Red Lake mine (-90 t) in Ontario, at the Kemess South mine (-14 t) near Smithers in British Columbia, and at the Williams mine (-10 t) near Marathon in Ontario.

Silver

There were 6873 t of silver contained in Canadian mine reserves in December 2006. This represents an increase of 3% (189 t) compared to December 2005. The greatest increase was at the re-opened Caribou mine (304 t) near Bathurst in New Brunswick, and significant increases were reported from the re-opening of the Restigouche mine (133 t), also near Bathurst, and at the new Perseverance mine (130 t) at Matagami in Quebec. The greatest reductions in silver reserves were reported at the Brunswick mine (-276 t) near Bathurst in New Brunswick, at the LaRonde mine (-233 t) at Cadillac in Quebec, and at the Eskay Creek mine (-152 t) in British Columbia.

Zinc

During 2006, Canadian reserves of zinc increased by about 992 000 t (20%) to a year-end total of approximately 6.0 Mt. The greatest increases in zinc reserves occurred at the new Perseverance mine (689 000 t) at Matagami in Quebec, at the re-opened Caribou mine (228 000 t) near Bathurst in New Brunswick, and at the re-opened Scotia mine (165 000 t) (previously named Gays River mine) in Nova Scotia. The greatest reductions in reserves occurred at the Brunswick mine (-232 000 t) at Bathurst in New Brunswick, at the LaRonde mine (-82 000 t) at Cadillac in Quebec, and at the Myra Falls mine (-34 000 t) near Campbell River in British Columbia.

Lead

Canadian reserves of lead increased by approximately 34% during 2006 to 737 000 t. This increase is primarily due to the re-opening of the Caribou (101 000 t) and Restigouche (67 000 t) mines in New Brunswick, and the Scotia mine (78 000 t) (formerly Gays River mine) in Nova Scotia. The Brunswick mine at Bathurst in New Brunswick has reserves sufficient to continue production only until 2010. Reserves at the Kidd Creek mine at Timmins in Ontario increased by approximately 5% to 35 000 t.

Copper

In December 2006, Canadian reserves of copper were estimated at around 6.92 Mt, an increase of about 5% (334 000 t) from a year earlier. Copper reserves were reduced by depletion at the Highland Valley mine (-211 000 t) near Kamloops in British Columbia, at Kemess South (-42 000 t) near Smithers in British Columbia, and at the Voisey's Bay mine (-38 500 t) in Newfoundland and Labrador. This was more than replaced by the addition of 214 000 t at the Gibraltar mine near Williams Lake in

British Columbia, 129 000 t at the Minto mine in the Yukon, and 80 000 t at CVRD Inco's Ontario Division at Sudbury.

Molybdenum

Canadian reserves of molybdenum stood at 101 000 t in December 2006, or about 6% higher than in the previous year. The increase was due principally to the opening of the Max mine (3043 t) by Roca Mines Inc. near Revelstoke in British Columbia. Reserves increased slightly at the Gibraltar mine (215 t) at Williams Lake, but decreased slightly at the Endako mine (-291 t) at Fraser Lake, at the Highland Valley mine (-521 t) at Kamloops, and at the Huckleberry mine (-304 t) at Houston. All of the molybdenum mines are in British Columbia.

Nickel

In December 2006, there were some 3.94 Mt of nickel contained in Canadian mine reserves, a decrease of approximately 1% from 2005 levels. Reserves increased by 76 000 t at CVRD Inco's Ontario Division at Sudbury, but decreased by 25 000 t at CVRD Inco's Manitoba Division and by 18 000 t at Xstrata Nickel's Sudbury operations.

CVRD Inco had some 3.38 Mt of nickel in Canadian reserves at the end of 2006, or about 86% of the national total.

Canadian Reserves by Province and Territory

Four provinces (Ontario, British Columbia, New Brunswick, and Quebec) held dominant positions in terms of Canada's proven and probable mineable reserves of major metals in December 2006 (Table 4).

Ontario had 57% of the nickel, 45% of the gold, and 41% of the copper, plus 24% of the silver, 19% of the zinc, and 5% of the lead.

British Columbia had 100% of the molybdenum, 36% of the copper, 13% of the silver, 6% of the zinc, 6% of the gold, and 4% of the lead.

New Brunswick had 81% of the lead, 25% of the silver, 23% of the zinc, and 1% of the copper.

Quebec had 34% of the gold, 26% of the silver, 30% of the zinc, 11% of the nickel, and 5% of the copper.

Manitoba had 17% of the zinc, 11% of the nickel, 5% of the gold, 7% of the copper, and 8% of the silver.

Newfoundland and Labrador had 21% of the nickel, 9% of the copper, 4% of the zinc, and 4% of the silver.

Nunavut had 9% of the gold.

Nova Scotia had 11% of the lead and 3% of the zinc.

The Yukon had 2% of the copper, 1% of the silver, and 1% of the gold.

Canadian Reserves by Industry Classification

Canadian mines are, to a large extent, polymetallic, a complexity that the North American Industry Classification System (NAICS) tends to oversimplify (Table 5).

In 2006, mine reserves of gold in Canada were distributed through the various NAICS classes as follows: Gold and Silver Ore Mining, 84%; Copper and Zinc Ore Mining, 11%; and Nickel-Copper Ore Mining, 5%.

In 2006, mine reserves of silver in Canada were distributed through the various NAICS classes as follows: Gold and Silver Ore Mining, 25%; Copper-Zinc Ore Mining, 43%; Nickel-Copper Ore Mining, 8%; and Lead-Zinc Ore Mining, 25%.

Mine reserves of copper in Canada in 2006 were distributed through the various NAICS classes as follows: Gold and Silver Ore Mining, 2%; Copper-Zinc Ore Mining, 54%; Nickel-Copper Ore Mining, 43%; and Lead-Zinc Ore Mining, 1%.

Mine reserves of molybdenum in Canada were contained in the NAICS classes as follows: Copper-Zinc Ore Mining, 51%; and Other Metal Ore Mining, 49%.

Mine reserves of nickel in Canada were contained 100% in the NAICS class of Nickel-Copper Ore Mining.

Mine reserves of lead in Canada were contained in the NAICS classes as follows: Copper-Zinc Ore Mining, 9%; and Lead-Zinc Ore Mining, 91%.

Mine reserves of zinc in Canada were contained in the NAICS classes as follows: Gold and Silver Ore Mining, 12%; Copper-Zinc Ore Mining, 63%; and Lead-Zinc Ore Mining, 25%.

Apparent Life of Canadian Reserves

The apparent life (life index) of mine reserves is usually calculated by dividing the total amount of metals remaining in mine reserves at the end of a given year by the corresponding amount of metals contained in the ores produced during that year. Similar calculations are often applied at the national level.

At the national level, life indices are but a very rough measure of the expected life of aggregate mine reserves

and they are often misleading unless abnormal situations are recognized. Life indices based on proven and probable reserves do not make allowances for inferred extensions to reserves at current mines, gross additions that will accrue to current reserves from the likely development, in the foreseeable future, of known orebodies for which a production decision has yet to be made, or expected changes in production rates. Furthermore, life indices tend to overstate the apparent life of reserves when, for example, annual production is abnormally low due to strikes, cutbacks or suspensions at large establishments, or when significant increases in capacity resulting from new production decisions will be coming on stream, but only several years hence.

The apparent life indices for the major metals in Canada at the end of 2006 were 17 years for nickel, 10 years for copper, 10 years for molybdenum, 9 years for gold, 8 years for zinc, 6 years for silver, and 6 years for lead.

Reserve Trends

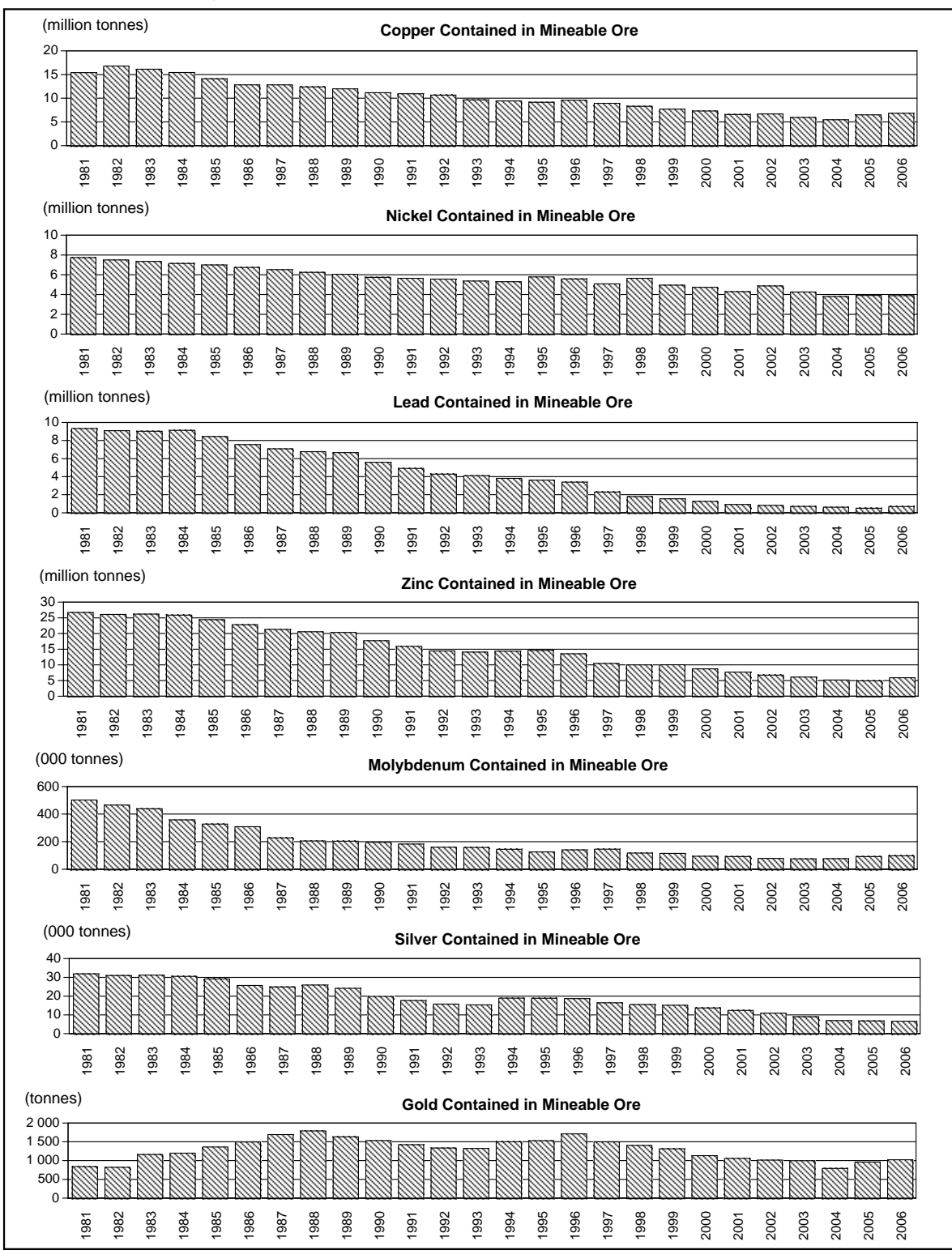
Figure 2 and Table 6 show how Canadian reserves of copper, nickel, lead, zinc, molybdenum and silver have declined since the early 1980s. In contrast, gold reserves increased substantially until 1988 before beginning to decline.

The current period of prosperity in the mining industry has almost arrested, or even reversed, the declining trend of base and precious metal reserves. During 2006, nickel reserves declined by 1%, but lead reserves increased by 34%, zinc reserves increased by 20%, copper reserves increased by 5%, molybdenum reserves increased by 6%, silver reserves increased by 3%, and gold reserves increased by 8%.

The annual aggregate change in Canadian reserves is the net result of three main factors affecting individual mines (Figure 3): additions to reserves, deletions to reserves, and production. Additions to reserves are the result of new discoveries; of new geological, metallurgical, production or other information; of a decrease in production costs; or of a rise in commodity prices, all of which increase the quantity of mineral resources that is profitable to mine. Deletions to reserves are the result of new geological, metallurgical, production or other information; of increases in costs; or of decreases in commodity prices, all of which reduce the quantity of mineral resources previously counted in mine reserves that are now expected to be mined at a profit.

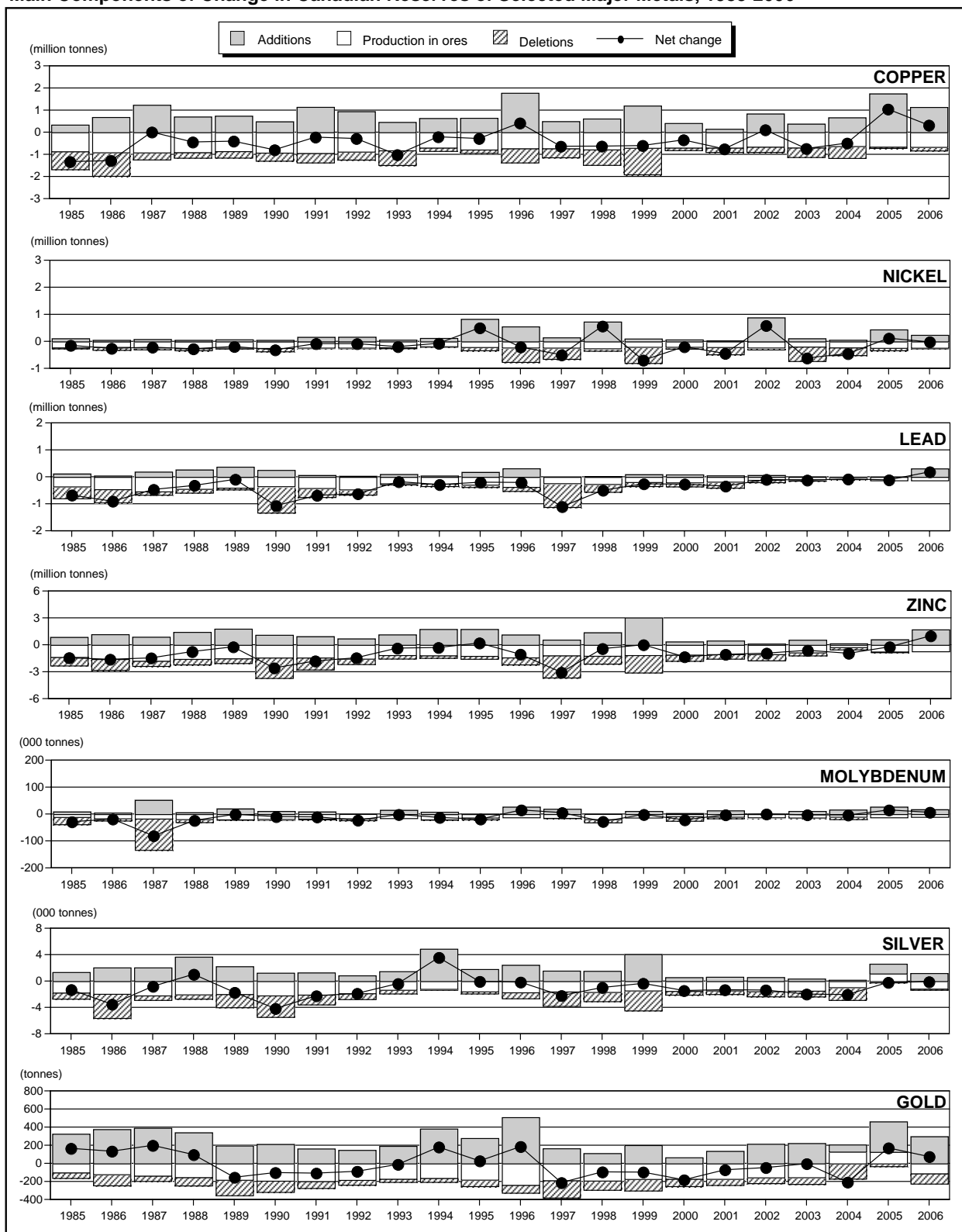
The dramatic increase in lead reserves is primarily due to the re-opening of the Caribou and Restigouche mines in New Brunswick and the Scotia mine (formerly Gays River mine) in Nova Scotia. This increase may be somewhat fragile, given that the Caribou and Restigouche mines have a history of metallurgical problems, and that the Brunswick mine, Canada's largest lead-zinc mine, is scheduled to close due to depletion of the orebody in 2010. The increase

Figure 2
Canadian Reserves of Selected Major Metals, 1981-2006
 Metal Contained in Proven and Probable Mineable Ore in Operating Mines and Deposits
 Committed to Production, as at December 31 of Each Year



Source: Natural Resources Canada, based on company reports and the federal-provincial/territorial survey of mines and concentrators.
 Note: This series was revised during 1996.

Figure 3
Main Components of Change in Canadian Reserves of Selected Major Metals, 1985-2006



Source: Natural Resources Canada.

in zinc reserves is primarily due to the production decision announced for the Perseverance mine in Quebec while the increase in copper reserves is primarily due to the development of additional reserves at the Gibraltar mine in British Columbia. The increase in molybdenum reserves is primarily due to the decision by Roca Mines Inc. to open the Max mine near Revelstoke in British Columbia. The increase in silver reserves is due to the re-opened Caribou and Restigouche mines near Bathurst in New Brunswick, and the new Perseverance mine at Matagami in Quebec. The increase in gold reserves is primarily to the decision to place into production the Meadowbank deposit near Baker Lake in Nunavut. Despite these recent increases from the low base of 2005, reserves for most metals remain at considerably less than half of what they were 25 years ago.

RECENT PRODUCTION DECISIONS

Several criteria need to be met for a project to be considered here to have reached the production decision stage. In general, there needs to have been a positive production feasibility study, all of the necessary permits must have been obtained, financing must have been arranged, and directors must have approved construction.

Table 3 shows the production decisions added to Canadian reserve totals in 2006.

In 2006, there were five new mine openings (Lapa, Max, Meadowbank, Minto, and Perseverance), and nine re-openings of old mines (Caribou, Gibraltar SX-EW, Kiena, Levack, Lockerby, QR, Restigouche, Scotia, and Table Mountain).

OUTLOOK

Strong metal prices continuing through 2007, together with industry optimism and determination to bring new deposits into production, make it probable that Canadian reserves of copper, nickel, molybdenum, silver, and gold will increase significantly in 2007. Canadian reserves of lead are expected to decline while Canadian reserves of zinc will probably show a slight increase during 2007.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of September 21, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/2006CMY_e.htm.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TABLE 1. MAIN COMPONENTS OF CHANGE DURING 2006 IN CANADIAN RESERVES OF SELECTED MAJOR METALS

Metal	Units	Revised Opening Metal Balance, January 2006	Metal in Ore Mined During 2006	Metal Apparently Written Off During 2006	Metal in New Reserves Found During 2006	Net Change During 2006	Closing Metal Balance, December 2006	% Change During 2006
Copper	000 t	6 589	662	159	1 138	334	6 923	5
Nickel	000 t	3 960	235	24	238	-20	3 940	-1
Lead	000 t	552	126		311	185	737	34
Zinc	000 t	5 063	722		1 714	992	6 055	20
Molybdenum	000 t	95	10		17	6	101	6
Silver	t	6 992	1 151	169	1 200	-119	6 873	-2
Gold	t	958	110	31	298	114	1 032	8

Source: Natural Resources Canada, based on company reports and the Federal-Provincial/Territorial Survey of Mines and Concentrators.

TABLE 2. TONNAGES AND GRADES OF OPERATIONS INCLUDED IN CANADIAN RESERVES OF SELECTED MAJOR METALS, AS AT DECEMBER 31, 2006

Tonnages classified by companies as "resources" are not included, nor are tonnages for which there is not a firm production decision. Confidential data have been suppressed from the details of this report.

	Tonnes	Grade						
		Cu	Ni	Pb	Zn	Mo	Ag	Au
		(%)	(%)	(%)	(%)	(%)	(g/t)	(g/t)
NEWFOUNDLAND AND LABRADOR								
Duck Pond								
Aur Resources Inc.								
Proven	1 190 000	3.37			5.27		53.00	0.75
Probable	2 888 000	3.26			5.85		61.9	0.90
Voisey's Bay								
CVRD Inco Limited								
Proven (open pit)	31 000 000	1.53	2.67					
NEW BRUNSWICK								
Brunswick No. 12 Underground								
Xstrata Canada Inc.								
Proven	11 300 000	0.4		3.50	8.70		104.00	..
Probable	900 000	0.4		3.3	8.2		88.00	..
Caribou								
Blue Note Metals Inc.								
Proven	2 455 000			3.04	6.5		90.00	
Probable	1 095 000			2.44	6.29		75.40	
Restigouche								
Blue Note Metals Inc.								
Proven	838 108			4.98	6.48		113	
Probable	495 000			5.17	6.61		77	
NOVA SCOTIA								
Scotia								
Acadian Gold Corporation								
Probable	4 590 000			1.7	3.6			
QUEBEC								
Beaufor								
Richmont Mines Inc.								
Louvem Mines Inc.								
Proven	184 870						..	8.33
Bousquet								
Agnico-Eagle Mines Limited								
Proven	86 035							6.30
Casa Berardi Ouest								
Aurizon Mines Ltd.								
Proven and probable	4 713 000							7.72
Copper Rand								
MSV Resources Inc.								
Proven	348 000	2.23					..	2.01
Probable	863 000	1.54					..	3.12
Doyon								
Barrick Gold Corporation								
Cambior inc.								
Proven	720 000						..	7.70
Probable	706 000						..	7.60
East Amphi								
Richmont Mines Inc.								
Proven	99 909							3.67
Goldex								
Agnico-Eagle Mines Limited								
Proven	97 270							2.25
Probable	22 813 391							2.29
Joe Mann								
Campbell Resources Inc.								
Proven	29 030	0.20					..	6.89
Probable	5 443	0.20					..	7.23
Kiena								
Wesdome Gold Mines Ltd.								
Proven	216 600							4.49
Probable	578 400							4.45
Langlois								
Breakwater Resources Ltd.								
Proven and probable	3 658 000	0.80			10.10		49.00	0.10

TABLE 2 (cont'd)

	Tonnes	Grade						
		Cu	Ni	Pb	Zn	Mo	Ag	Au
		(%)	(%)	(%)	(%)	(%)	(g/t)	(g/t)
QUEBEC (cont'd)								
Lapa								
Agnico-Eagle Mines Limited								
Probable	3 944 000							9.08
LaRonde								
Agnico-Eagle Mines Limited								
Proven and probable	29 200 000	0.40			2.50		50.00	5.28
Perseverance								
Xstrata Canada Inc.								
Proven	4 200 000	1.10			13.70		26.00	0.30
Probable	800 000	1.00			14.20		26.00	0.30
Raglan								
Xstrata Canada Inc.								
Proven	5 800 000	0.71	2.56					
Probable	8 900 000	0.82	2.96					
Sigma								
Century Mining Corporation								
Proven	8 781 000							1.53
Probable	7 540 500							1.25
Sleeping Giant								
Cambior Inc.								
Proven	198 000						..	11.70
Probable	90 000						..	11.00
Troilus								
Inmet Mining Corporation								
Proven	5 950 000	0.10					1.10	0.60
Probable	15 210 000	0.10					1.10	0.90
ONTARIO								
David Bell								
Barrick Gold Inc.								
Teck Cominco Limited								
Proven	549 000						..	11.72
Probable	164 000						..	10.98
Eagle River								
Wesdome Gold Mines Ltd.								
Probable	253 000						1.20	12.9
Sudbury Integrated Nickel Operations								
Xstrata Canada Inc.								
Proven	3 100 000	1.73	1.18					
Probable	3 900 000	1.25	1.04					
Ontario Division								
CVRD Inco Limited								
Probable	175 000 000	1.27	1.18				..	..
Kidd Creek								
Xstrata Canada Inc.								
Proven	19 600 000	2.00		0.17	5.29		53.00	
Probable	1 400 000	1.61		0.11	5.97		33.00	
Lac des Iles								
North American Palladium Ltd.								
Proven (open pit)	10 073 000	0.07	0.085					0.18
Probable (underground)	2 701 000	0.07	0.09					0.33
Levack								
FNX Mining Corporation Inc.								
Proven	36 287	0.40	1.57					
Probable	1 242 837	0.57	1.54					
Macassa								
Kirkland Lake Gold Inc.								
Proven	1 055 958						..	15.10
Probable	1 285 663						..	17.90
McCreedy West								
FNX Mining Corporation Inc.								
Proven	444 518	0.21	1.85					
Probable	1 451 496	0.87	0.77					0.38
Montcalm								
Xstrata Canada Inc.								
Proven	4 100 000	0.64	1.38					
Musselwhite								
Goldcorp Inc.								
Proven	3 971 000							5.88
Probable	4 721 000							6.73

TABLE 2 (cont'd)

	Tonnes	Grade						
		Cu	Ni	Pb	Zn	Mo	Ag	Au
		(%)	(%)	(%)	(%)	(%)	(g/t)	(g/t)
ONTARIO (cont'd)								
Porcupine Joint Venture								
Goldcorp Inc.								
Proven	26 490 000						..	1.40
Probable	35 078 000						..	2.03
Red Lake								
Goldcorp Inc.								
Proven	1 160 000						..	41.48
Probable	6 090 000						..	18.57
Williams								
Barrick Gold Corporation								
Teck Cominco Limited								
Proven (underground)	1 471 000						..	5.78
Probable (underground)	995 000						..	5.16
Proven (open pit)	7 810 000						..	1.71
Probable (open pit)	5 424 000						..	1.74
MANITOBA								
777								
Hudbay Minerals Inc.								
Proven	5 041 000	2.80			4.50		25.61	2.30
Probable	11 813 000	2.30			4.81		26.90	2.10
Chisel Lake North								
Hudbay Minerals Inc.								
Proven	605 000	0.1			8.20		20.0	0.5
Probable	1 054 000	0.1			8.80		20.0	0.5
Manitoba Division								
CVRD Inco Limited								
Proven	24 000 000	0.12	1.88				..	..
Rice Lake								
San Gold Corporation								
Proven and probable	895 000							9.60
Trout Lake								
Hudbay Minerals Inc.								
Proven	1 301 000	2.20			4.70		19.10	1.60
Probable	896 000	3.00			4.10		18.10	1.80
SASKATCHEWAN								
Seabee								
Claude Resources Inc.								
Proven	520 900						..	6.44
Probable	171 600						..	7.03
BRITISH COLUMBIA								
Endako								
Nissho Iwai Corp.								
Thompson Creek Mining Limited								
Proven	22 200 000					0.046		
Probable	51 800 000					0.070		
Eskay Creek								
Barrick Gold Corporation								
Proven	94 347						1 325	25
Probable	29 030						1 378	28.9
Gibraltar Open Pit								
Gibraltar Mines Limited								
Proven (sulphide ore)	217 800 000	0.320				0.01		
Probable (sulphide ore)	38 600 000	0.305				0.011		
Probable (oxide ore)	16 100 000	0.147						
Highland Valley								
Teck Cominco Ltd.								
Highmont Mining Company								
Proven	271 000 000	0.43				0.009	..	..
Huckleberry								
Imperial Metals Corporation								
Marubishi Materials Corporation/								
Marubeni Corporation/Dowa Mining Co.,								
Ltd./Furukawa Co., Ltd.								
Probable	21 913 000	0.400				0.007	..	..
Kemess South								
Northgate Minerals Corporation								
Proven	49 280 000	0.21						0.61

TABLE 2 (cont'd)

	Tonnes	Grade						
		Cu	Ni	Pb	Zn	Mo	Ag	Au
		(%)	(%)	(%)	(%)	(%)	(g/t)	(g/t)
BRITISH COLUMBIA (cont'd)								
Max								
Roca Mines Inc.								
Probable	260 000					1.17		
Mount Polley								
Imperial Metals Corporation								
Sumitomo Metal and Mining Co., Ltd.								
Proven and probable	59 870 000	0.36					0.73	0.27
Myra Falls								
Breakwater Resources Ltd.								
Proven	6 134 000	1.00		0.50	5.70		41.00	1.20
QR								
Cross Lake Minerals Ltd								
Probable	932 632							5.22
Table Mountain								
Cusac Gold Mines Ltd.								
Probable	39 900							16.60
YUKON								
Minto								
Sherwood Copper Corporation								
Proven	5 574 200	2.24					9.20	0.81
Probable	295 200	1.49					7.20	0.71
NUNAVUT								
Meadowbank								
Agnico-Eagle Mines Limited								
Proven	3 020 000							4.8
Probable	18 300 000							4.1

Source: Natural Resources Canada, based on published company reports.

.. Not available in published reports or estimated by author.

Notes: One tonne (t) = 1.1023113 short tons. One gram per tonne (g/t) = 0.02916668 troy oz per short ton.

**TABLE 3. PRODUCTION DECISIONS ADDED TO CANADIAN RESERVE TOTALS
AS AT DECEMBER 31, 2006**

Project	Operators and Major Partners	Province	Metals
Scotia	Acadian Gold Corporation	N.S.	Lead, zinc
Caribou	Blue Note Metals Inc.	N.B.	Lead, zinc, silver
Restigouche	Blue Note Metals Inc.	N.B.	Lead, zinc, silver
Kiena	Wesdome Gold Mines Ltd.	Que.	Gold
Lapa	Agnico-Eagle Mines Limited	Que.	Gold
Perseverance	Xstrata Canada Inc	Que.	Zinc, copper, silver, gold
Levack	FNX Mining Company Inc.	Ont.	Nickel, copper
Lockerby	First Nickel Inc.	Ont.	Nickel, copper
Gibraltar Oxides	Taseko Mines Limited	B.C.	Copper
Max	Roca Mines Inc.	B.C.	Molybdenum
QR	Cross Lake Minerals Ltd.	B.C.	Gold
Table Mountain	Cusac Gold Mines Ltd.	B.C.	Gold
Minto	Sherwood Copper Corporation	Y.T.	Copper, gold, silver
Meadowbank	Agnico-Eagle Mines Limited	Nun.	Gold

Source: Natural Resources Canada, based on company reports.

TABLE 4. CANADIAN RESERVES OF SELECTED MAJOR METALS BY PROVINCE AND TERRITORY, AS AT DECEMBER 31, 2006

Metal Contained in Proven and Probable Mineable Ore (1) in Operating Mines (2) and Deposits Committed to Production

Metal	Units (3)	N.L.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	B.C.	Yukon	N.W.T.	Nunavut	Canada (5)
Copper	000 t	609	—	47	357	2810	499	—	2 472	129	—	—	6 923
Nickel	000 t	828	—	—	412	2249	451	—	—	—	—	—	3 940
Lead	000 t	—	78	594	—	35	—	—	31	—	—	—	737
Zinc	000 t	232	165	1 372	1788	1 120	1027	—	350	—	—	—	6 055
Molybdenum	000 t	—	—	—	—	—	—	—	101	—	—	—	101
Silver	t	242	—	1 691	1807	1 647	530	—	903	53	—	—	6 873
Gold (4)	t	3	—	1	345	467	50	5	66	5	—	90	1 032

Source: Natural Resources Canada, based on company reports and the federal-provincial/territorial survey of mines and concentrators.

— Nil or less than one unit.

(1) No allowance is made for losses in milling, smelting and refining. Excludes material classified as "resources." (2) Includes metal in mines where production has been suspended temporarily. (3) One tonne (t) = 1.1023113 short tons = 32 150.746 troy oz. (4) Excludes metal in placer deposits because reserves data are generally unavailable. (5) May not balance due to rounding at the provincial/territorial level.

TABLE 5. CANADIAN RESERVES OF SELECTED MAJOR METALS BY INDUSTRY, AS AT DECEMBER 31, 2006

Metal Contained in Proven and Probable, Mineable Ore (1) in Operating Mines (2), and Deposits Committed to Production

	SIC no. (5)	Copper, Copper-Zinc, Nickel-Copper, Zinc-Lead-Silver, Molybdenum, Miscellaneous						Canada (6)
		Gold Mines	Copper-Zinc Mines	Nickel-Copper Mines	Zinc-Lead-Silver Mines	Molybdenum Mines	Miscellaneous Metal Mines	
		611	612	613	614	615	619	
	(Units (3))							
Copper	000 t	138	3 725	3 004	47	—	9	6 923
Nickel	000 t	—	—	3 929	—	—	11	3 940
Lead	000 t	—	66	—	672	—	—	737
Zinc	000 t	730	3 787	—	1 538	—	—	6 055
Molybdenum	000 t	—	52	—	—	50	—	101
Silver	t	1 692	2 955	535	1 691	—	—	6 873
Gold (4)	t	862	112	54	1	—	—	1 029

Source: Natural Resources Canada, based on company reports and the federal-provincial/territorial survey of mines and concentrators.

— Nil or less than one unit.

(1) No allowance is made for losses in milling, smelting and refining. Excludes material classified as "resources." (2) Includes metal in mines where production has been suspended temporarily. (3) One tonne (t) = 1.1023113 short tons = 32 150.746 troy oz. (4) Excludes metal in placer deposits because reserves data are generally unavailable. (5) SIC = Standard Industrial Classification. (6) May not balance due to rounding at the SIC level.

TABLE 6. CANADIAN RESERVES OF SELECTED MAJOR METALS AS AT DECEMBER 31 OF EACH YEAR, 1977-2006

Metal Contained in Proven and Probable Mineable Ore (1) in Operating Mines (2) and Deposits Committed to Production

Year	Copper	Nickel	Lead	Zinc	Molybdenum	Silver	Gold (3)
	(000 t)	(000 t)	(000 t)	(000 t)	(000 t)	(t)	(t)
1977	16 914	7 749	8 954	26 953	369	30 991	493
1978	16 184	7 843	8 930	26 721	464	30 995	505
1979	16 721	7 947	8 992	26 581	549	32 124	575
1980	16 714	8 348	9 637	27 742	551	33 804	826
1981	15 511	7 781	9 380	26 833	505	32 092	851
1982	16 889	7 546	9 139	26 216	469	31 204	833
1983	16 214	7 393	9 081	26 313	442	31 425	1 172
1984	15 530	7 191	9 180	26 000	361	30 757	1 208
1985	14 201	7 041	8 503	24 553	331	29 442	1 373
1986	12 918	6 780	7 599	22 936	312	25 914	1 507
1987	12 927	6 562	7 129	21 471	231	25 103	1 705
1988	12 485	6 286	6 811	20 710	208	26 122	1 801
1989	12 082	6 092	6 717	20 479	207	24 393	1 645
1990	11 261	5 776	5 643	17 847	198	20 102	1 542
1991	11 040	5 691	4 957	16 038	186	17 859	1 433
1992	10 755	5 605	4 328	14 584	163	15 974	1 345
1993	9 740	5 409	4 149	14 206	161	15 576	1 333
1994	9 533	5 334	3 861	14 514	148	19 146	1 513
1995	9 250	5 832	3 660	14 712	129	19 073	1 540
1996	9 667	5 623	3 450	13 660	144	18 911	1 724
1997	9 032	5 122	2 344	10 588	149	16 697	1 510
1998	8 402	5 683	1 845	10 159	121	15 738	1 415
1999	7 761	4 983	1 586	10 210	119	15 368	1 326
2000	7 419	4 782	1 315	8 876	97	13 919	1 142
2001	6 666	4 335	970	7 808	95	12 593	1 070
2002	6 774	4 920	872	6 871	82	11 230	1 023
2003	6 037	4 303	749	6 251	78	9 245	1 009
2004	5 546	3 846	667	5 299	80	6 568	787
2005	6 589	3 960	552	5 063	95	6 684	965
2006	6 923	3 940	737	6 055	101	6 873	1 032

Source: Natural Resources Canada, based on company reports and the federal-provincial/territorial survey of mines and concentrators.

(1) No allowance is made for losses in milling, smelting and refining. Excludes material classified as "resources."

(2) Includes metal in mines where production has been suspended temporarily. (3) Excludes metal in placer deposits because reserves data are generally unavailable.

Note: One tonne (t) = 1.1023113 short tons = 32 150.746 troy oz.

Mineral Exploration, Deposit Appraisal, and Mine Complex Development Activity in Canada

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INTRODUCTION

Overview

This review provides analytical highlights and describes mineral resource development activities from grassroots exploration up to, but not including, production for 2006 (final) and 2007 (revised spending intentions). The full spectrum of data covers three work phases—exploration, deposit appraisal, and mine complex development expenditures—including field work, overhead, engineering, economic and pre- or production feasibility studies, environment, and land access costs, along with the associated capital and repair and maintenance costs for construction, machinery and equipment. To better understand the major trends of the mineral exploration industry, two work phases—exploration and deposit appraisal—will be examined at the level of activity occurring either off-mine-site or on-mine-site. The regional context, including projects with a major impact on the 2006 and 2007 activity trends, is discussed where appropriate. To protect confidentiality, only project details publicly available were included in the analysis. Results are also presented from the perspective of factors contributing to success and associated with survey results, mainly the metal price context and expenditures by commodity group, the Canadian tax incentive, financing mechanism, and junior company spending. Supplementary results and other exploration indicators not discussed in this review can be found in the tables and graphs that follow the analysis.

Methodology

Statistics for 2006 and 2007 were collected by means of the annual federal-provincial/territorial Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures. This survey took place mainly between March and June 2007 and the data can be con-

sidered current as of November 2007. The definitions in use for this survey are based upon the Generalized Model of Mineral Resource Development described in Table 18. The survey response rate in terms of all questionnaires sent out (roughly 1700), inclusive of the three work phases, reached 90%. The estimates for the 10% of the questionnaires not received were based on reports from the preliminary estimates 2006 and spending intentions 2007 survey results and on different sources of public information. The amount estimated represented 4% of the total expenditures. However, when considering only the two work phases of exploration and deposit appraisal, non-respondents accounted for 7% of the total companies surveyed. This represented an estimated 11% of the total exploration and deposit appraisal expenditures only. Additional information about the survey history and methodology can be found on the Internet at http://mmsd1.mms.nrcan.gc.ca/mmsd/exploration/default_e.asp.

Project Operators

In 2006, statistics were compiled from the reports of 815 active company project operators and some 12 individual prospectors or groups of prospectors. A large portion (754) of these 815 companies, (compared to 723 in 2005), reported that they were active in mineral exploration at more than 2600 properties. Of these 754 companies, 641 were junior project operators (compared to 631 in 2005). Seventy companies were active in deposit appraisal (35 of them were junior project operators) at 89 properties, and 95 were active in mine complex development (MCD) at 162 (19 mills and plants were excluded for a fair comparison) of the estimated 194 principal mines in operation in 2006 (a principal mine as defined for the Map 900A). These 162 MCD projects represented 77 metal mines, including 4 uranium mines; 62 nonmetal mines, including 5 diamond mines and 15 stone quarries; and 23 coal mines.

(Note: Some companies are involved in more than one work phase and property at the same time.)

OVERVIEW OF RESULTS

In the following sections, major projects that have contributed to the main expenditure fluctuations between survey years will be discussed. In this period of major consolidation (mergers and acquisitions) in the industry, properties

and projects have been changing hands. Therefore, some project operators may have changed since the data for this review were collected.

Total Mineral Resource Development Expenditures

The Canadian mineral resource development sector (excluding petroleum, sand and gravel, and quarries, except 15 stone quarries) continued to be quite active in 2006. Total development expenditures of \$7.9 billion were recorded, compared to \$6.5 billion in 2005, an impressive increase of \$1.5 billion, or 22% over 2005 (Table 1). This amount is the difference between the total increase of about \$1.7 billion for nine jurisdictions (no activity was recorded in Prince Edward Island) less decreases of \$303 million for Newfoundland and Labrador, Alberta, and Nunavut. Once 2007 total development expenditures are confirmed, it would not be surprising to see total expenditures approach the \$10 billion level.

Altogether, the capital investment portion of the three work phases, namely mineral exploration, deposit appraisal, and mine complex development, as illustrated in Figure 1a, was the most important contributor to the \$1.5 billion increase in 2006, accounting for \$728 million or 50%. Total capital investment has climbed successively from \$1.0 billion in 2003 to \$2.0 billion in 2004, \$2.6 billion in 2005, and \$3.3 billion in 2006. Although capital cost budgets for 2007 were not finalized at the time of the survey, revised spending intentions results indicate a level surpassing \$4 billion. Therefore, the capital cost component will continue to be the main driver for the total development expenditures increase in 2007.

An increase in exploration expenditures of \$384 million (less capital) was the second most important contributor in 2006 after total capital investment, and the same ranking is expected for 2007 with an anticipated \$500 million increase over 2006. The off-mine-site exploration portion alone accounted for 99% (a \$380 million increase) of the total exploration increase in 2006. Deposit appraisal, with an increase of \$223 million (less capital), was the third most important contributor with the off-mine-site portion accounting for 92%. The repair and maintenance component increased by \$101 million in 2006 and ranked fourth in importance. Finally, the mine complex development increase of only \$17 million (less capital) ranked fifth in importance, down from its second place ranking in the previous year.

For each of 2006 and 2007 (Figures 1a and 1b), the ranking of total development expenditures (excluding repair and maintenance) by leading province and territory varied greatly although, in both years, Ontario was the leading jurisdiction. In 2006, however, Saskatchewan moved up to second place (fourth in 2005), followed closely by the Northwest Territories (up from fifth in 2005) and then Quebec (down two places from second in 2005). However, in 2007, Quebec should regain second place to rank ahead

of British Columbia, Saskatchewan, and the Northwest Territories. In 2006, when repair and maintenance expenditures are included, Ontario, and then Saskatchewan, were followed by Quebec and British Columbia. For capital investment only, the Northwest Territories was first, followed by Ontario, Saskatchewan, and British Columbia.

The most important component, capital costs, will be discussed in this section, while the exploration and deposit appraisal specifics will be covered in following sections. No analysis will be done in this review for the repair and maintenance cost category.

In 2006, although increases were recorded in all commodity groups (except for coal and other metals), due largely to the continuing favourable mineral investment climate, the diamond category was by far the most important contributor to the capital cost increase of this year. At De Beers Canada Inc.'s two major diamond mining projects, Snap Lake in the Northwest Territories and Victor in Ontario, intense construction activity took place. The non-metals (mainly potash), iron ore, and uranium were the next most important contributors. In comparison, for the total mineral resource development, this ranking was somewhat different as uranium occupied second place ahead of precious metals and iron ore. Potash mines, with increases in excess of \$50 million in capital costs, are all located in Saskatchewan where new tax incentives to stimulate expansion in the potash industry were established in April 2005. The Allan and Lanigan mines, owned by PCS Inc., continued to receive important capital investment (mainly in machinery and equipment). The expansion program at the Lanigan mine is scheduled to be completed during the second quarter of 2009. Agrium Ltd.'s Vanscoy mine was the third most important recipient of capital investment (mainly machinery and equipment) in Saskatchewan in 2006. In Newfoundland and Labrador and in Quebec, the iron ore companies made important investments at their existing operations as strong demand for this commodity continued. Again in Saskatchewan, some construction activity was under way at Cameco Corporation's Cigar Lake uranium mining project when the severe water inflow of October 2006 paralyzed the mine's construction. Consequently, the company concentrated its efforts on restoring the underground workings near the end of 2006 and during 2007. The Jeb mill expansion of Areva Resources Canada Inc. continued at a stronger pace in order to eventually process the ore slurry that will come from the Cigar Lake operation.

Despite the fact that 14 new mines (including 9 re-openings) were committed to production in 2006, they were not capital-intensive projects. Most of the increase described above was the result of ongoing construction at mining projects announced in previous years and at existing operations where expansions are under way.

In addition to the projects just described, very significant projects of more than \$100 million each in 2006 continued

to play an important role in the level of capital investment in Canada. In the Northwest Territories, the Diavik and Ekati diamond mines by Diavik Diamond Mines Inc. and BHP Billiton Diamond Inc., respectively, continued with important underground development. At Diavik, there was construction activity for underground access to the A154 and A158 pipes (in order to finalize a production feasibility study) and for the dike completion around the A418 open pit. At Ekati, the Panda project, and especially the Koala underground mining project (budget was approved in June 2006 after the completion of surface mining in April 2006), received substantial investment. In British Columbia, plant construction at the new Wolverine open-pit coal project, owned by Western Canadian Coal Corp., was completed in 2006. Also in that province, Highland Valley Copper had an expansion program under way at its copper-molybdenum mine. The company committed, at the beginning of 2007, a further US\$300 million aimed at extending the mine life to 2019.

About one quarter of total development expenditures in 2006 continued to be dedicated to exploration and deposit appraisal activity (including capital, and repair and maintenance expenditures). In 2007, this percentage may be closer to 30%. In 2006 and 2007, total exploration and deposit appraisal expenditures, including capital and repair costs, reached \$2.1 billion and an estimated \$2.8 billion, respectively. The exploration phase alone accounted for 19% of the total investment in 2006, while roughly 20% is estimated for 2007. In 2005, the percentage was 18%.

Exploration and Deposit Appraisal Expenditures

The analysis in this section focuses on exploration and deposit appraisal expenditures, excluding capital, repair and maintenance costs. Although not fully comparable to the annual federal-provincial/territorial survey results, the findings of the Metals Economics Group (MEG) annual survey on exploration (includes grassroots and late-stage/feasibility studies for companies with expenditures larger than US\$100 000) show a similar upward trend in expenditures. Furthermore, the MEG survey in its international comparison between mining countries revealed again in 2007, for the sixth year in a row, that Canada was the top global destination for exploration activity (21% of the worldwide exploration budgets totaling US\$12.4 billion, compared to 19% of US\$7.1 billion in 2006). Other results revealed that, for larger companies only (with budgets exceeding US\$3 million), Canadian companies were responsible for 45% of worldwide exploration expenditures in 2007 (40% in 2006). A more detailed analysis of MEG's data can be found in the chapter entitled "Canadian Mineral Exploration Highlights and Discovery Analysis."

The total exploration and deposit appraisal share of total mineral resource development expenditures continued to rise, up by 4% in 2006 to reach \$1912 million (up 20% in 2005 and 24% in 2006) (Table 1). This amount represents

about one quarter of the total \$7.9 billion spent in total mineral resource development for the year. After a low of \$573 million recorded in 2000 (similar to the low also recorded in 1992, Figures 2a and 2b), expenditures increased steadily up to 2003 and by a remarkable 66% in 2004 to reach above \$1 billion for the first time since 1997 (Table 3b, in constant dollars). In 2005, a healthy 7% increase was followed again by expenditure surges of 43% in 2006 and 31% in 2007. In 2007, the expected \$2.5 billion in expenditures should surpass, for the first time, the record expenditure levels of the 1987-88 period when more than \$2 billion per year was recorded. This upward trend of seven successive years reflects the improved and sustained overall favourable investment climate that has been experienced by the mining industry. Note that, for this discussion, data collected before 1997 were adjusted to reflect the content of the new activities introduced in the 1997 survey.

In 2004, increases were recorded in all surveyed jurisdictions across Canada while, in 2005, increases were recorded in just half of the jurisdictions. In 2006, increases were recorded again in all jurisdictions (Table 8). As for 2007 to date, only Alberta shows a decrease in its total level of expenditures. In 2006, major increases were recorded in Alberta, where expenditures almost tripled; in Newfoundland and Labrador, where they more than doubled; and in the Yukon, where they almost doubled. In dollar terms, British Columbia, Saskatchewan, Quebec, and the Northwest Territories accounted for 66% of the total \$607 million increase. Together, Ontario (\$347 million), British Columbia (\$344 million), Quebec (\$295 million), and Saskatchewan (\$236 million) accounted for 64% of the \$1.9 billion recorded in 2006. For 2007, it is expected that, for the third year in a row, the order of the top three jurisdictions will not change. Since 2000, Ontario has been the leading jurisdiction. Ontario, Quebec, British Columbia, and Nunavut are expected to account for 63% of the anticipated \$636 million increase in 2007. Major increases are also anticipated for Nova Scotia and New Brunswick of 143% and 128%, respectively.

Off-Mine-Site Expenditure Trend

EXPLORATION

The exploration work phase is defined as covering the activity up to and including the discovery and first delimitation of a mineral resource of potential economic interest (i.e., sufficient indicated National Instrument (NI) 43-101-compliant resources included in a positive scoping study). The definitions used in the survey are based on the Generalized Model on Mineral Resource Development (Table 18).

Close to 79% (\$1504 million) of the total on- and off-mine-site exploration and deposit appraisal expenditures were dedicated to exploration in 2006 and roughly the same percentage, representing \$2004 million, is expected to be dedicated in 2007. In 2006, the increase in exploration and

deposit appraisal expenditures resulted from continued growth in the off-mine-site exploration work phase (a 37% increase over 2005, accounting for 63% of the total on- and off-mine-site-exploration and deposit appraisal increase). Adding to this increase was the contribution from an expenditure upturn in the off-mine-site deposit appraisal work phase (a 125% increase, accounting for 34% of the total increase). In 2007, about 79% of the total increase will be attributable to the off-mine-site exploration work phase. In 2006, the share of off-mine-site exploration represented 73% (compared to 78% in 2005) of the total exploration and deposit appraisal expenditures (\$1400 million in 2006 and \$1020 million in 2005) while, for 2007, this amount is expected to reach close to 75% representing \$1904 million. Since 1997, the average for this sub-work phase has been about 75%.

The provincial/territorial ranking shows that in 2006, when considering leading jurisdictions for off-mine-site exploration only, Saskatchewan moved up from being fifth in 2005 to first place, followed by Quebec, up two places; British Columbia, remaining third as in 2005; Ontario, down three positions; and Nunavut, down three places to fifth. In 2007, it is expected that British Columbia will move to first place, up two positions, followed by Quebec keeping the same ranking as in 2006; Ontario, up one place; Saskatchewan, down three places; and then Nunavut with the same rank as 2006 (Tables 7a and 7b). In 2006, a decrease in expenditures (13%) was only recorded in Manitoba, while in 2007 only Alberta is anticipated to experience a decrease (15%).

IMPACT OF MAJOR PROJECTS

The highest percentage increases in total off-mine-site exploration spending in 2006 belonged to traditionally smaller jurisdictions such as Alberta, a quadruple increase over 2005; the Yukon, almost triple; and Newfoundland and Labrador and New Brunswick, more than double in each case. In 2007, major increases are expected for Nova Scotia with an almost threefold increase, and for New Brunswick again and Manitoba, with more than a doubling of expenditures for each. In 2006, around 70% of the \$380 million increase in off-mine-site exploration, in decreasing order of importance, came from four provinces: Saskatchewan (up \$100 million), Quebec (up \$72 million), the Yukon (up \$55 million), and British Columbia (up \$48 million).

In Saskatchewan, the Star Diamond and the Fort-à-la-Corne Joint Venture (FALC JV) diamond projects operated by Shore Gold Inc. and De Beers Canada Inc., respectively (Shore Gold Inc. became the new operator of the FALC JV in September of 2006), represented the core of the diamond activity in the province despite the presence of many other projects. Alone, those two projects accounted for most of the expenditure increase in this province. Phase 3 of the underground bulk sampling program conducted at the Star Diamond project was aimed at the Pense and Cantuar kim-

berlites. On the FALC JV project, the Orion Cluster received more exploration drilling during 2006, as did other targets in the area. Also increasingly important in the province was the buoyant activity taking place for uranium in the Athabasca Basin, which was reflected by increases in expenditures and by the number of projects. Indeed, more than 15 companies increased their spending by more than \$1 million each. About 180 active uranium projects (among at least 450 projects in Canada) totaling \$114 million were recorded in 2006 in Saskatchewan, compared to about 150 projects totaling \$66 million in 2005. This represented about 40% of all uranium projects accounting for 54% of all uranium spending in off-mine-site exploration in Canada. Some of the multi-million-dollar uranium projects under way in the province included Hidden River and the Black Lake JV by UEX Corporation, Moore Lake and Wheeler River by Denison Mines Inc., Shea Creek by Areva Resources, and the Cree extension by Cameco Corporation. In 2007, a further important expenditure increase, although at a slower pace, is expected for uranium, with the total approaching \$150 million.

Quebec represented the second largest expenditure increase in off-mine-site exploration. This resurgence from \$156 million in 2005 to \$228 million in 2006 was the result of an increase in the number of projects (about 100), mainly related to the intense uranium activity (about 83 projects compared to 34 in the previous year). Uranium expenditures increased from \$4 million in 2005 to \$22 million in 2006 and to an expected \$34 million in 2007. However, this uranium activity represented only 25% of the total increase in the province during 2006. Half of the increase came from the Foxtrot (Renard) diamond project of Ashton Mining of Canada (now owned by Stornaway Diamond Corporation); the Eleonore gold project now operated by Opinaca Mines Ltd., a subsidiary of Goldcorp Inc.; the Canadian Malarctic gold project of Osisko Exploration Ltd.; and the Raglan (outside mining lease) nickel exploration project of Xstrata Nickel.

In the Yukon, the Selwyn zinc-lead project being carried out by Selwyn Resources Ltd. and the former Keno Hill zinc mine property being explored by Alexco Resources Corp. were the main contributors to the important increase in off-mine-site exploration in that territory. The former was under a preliminary economic assessment while the latter was being re-evaluated through newly collected base-line information also necessary for the calculation of a NI-43-101-compliant resource estimate. Drilling took place at different targeted areas at the Keno Hill project, including Bellekeno, Lucky Queen, etc. In 2006, Cash Minerals had a significant budget to perform grassroots uranium exploration at several properties. Multi-million-dollar increases were also reported by six other companies, including Ketza River Holdings at the former Ketza River gold-silver mine. This last project and the Selwyn project were expected to enter into the deposit appraisal work phase in 2007. Despite this coming change of work phase, increases from Alexco Resources Corp. (Keno Hill zinc

mine), Tagish Lake Gold Corp (Skukum Creek gold project), and Southampton Ventures (new option for a nickel-molybdenum project) are expected to partly offset the void left by these two projects moving to a more advanced stage in 2007. In 2006, the Yukon's contribution in the precious-metal and base-metal categories was one of the most important of all jurisdictions, along with that of Quebec and British Columbia.

British Columbia was fourth in importance in terms of expenditure increase in 2006. There were an important number of companies with budget increases that more than offset the important Galore Creek copper-gold project by NovaGold Canada Inc. That project was mainly characterized by deposit appraisal activities (pre-feasibility/feasibility study) in 2006. For example, 20 companies reported increases above \$2 million while a further 19 companies had expenditure increases in the \$1 million-\$2 million range. Among the companies in the higher spending range, three were gold projects, three were coal, and the rest were mainly copper-gold projects. Among the gold projects were the former New Polaris gold mine operated by Canarc Resources Corp., the Spanish Mountain gold project by Skygold Ventures Ltd., and the former QR gold mine by Cross Lake Minerals Ltd. Important budget increases were also recorded at copper or copper-gold projects such as the Kerr Sulphurets property by Seabridge Gold Inc., the Anyox and Corey properties by Kenrich-Eskay Mining Corp., and the Tulsequah Chief project by Redcorp Ventures Ltd. In 2007, similar budget increases are indicated as 25 companies are reporting more than \$1 million increases targeted mainly for base-metal projects. Considering the geological characteristics of this province, most of the deposits and occurrences fall in the base-metal category (especially copper-gold). The increases recorded at these main projects in 2006 and likely for 2007 have a major impact on the level of expenditures for precious metals and base metals in that province, as stated above.

There were close to 320 projects each with more than \$1 million in spending that were recorded in the category of off-mine-site exploration during 2006. Among them, 13 projects were above the \$10 million level. Saskatchewan (highest in terms of spending in that category), Nunavut, Quebec (highest in terms of number of projects), the Yukon, the Northwest Territories, Ontario, and Newfoundland and Labrador were the recipients of these large budgets in 2006.

DEPOSIT APPRAISAL

The off-mine-site deposit appraisal work phase contributed 19% (\$369 million) of total exploration and deposit appraisal on- and off-mine-site expenditures of \$1912 million in 2006. Through the years, expenditures for this sub-work phase have represented an average of 21% of all the costs (low of 13% in 2005 and a high of 29% in 1999). Only in 2004 and 2006 did these amounts surpass the

\$200 million level and, in 2007, a record high of \$411 million is expected. The expenditure level in 2006 represented a major jump from the \$164 million recorded in 2005.

As illustrated above, important expenditure fluctuations are to be expected in this work phase. For example, major projects can become committed to production, as in 2005 (i.e., the Snap Lake and Victor diamond projects of De Beers Canada Inc. in the Northwest Territories and Ontario, respectively, and the Cigar Lake uranium project of Cameco Corporation in Saskatchewan), suddenly creating an expenditure void in off-mine-site deposit appraisal that is difficult to fill. However, in 2006, 29 new or revived projects that have entered off-mine-site deposit appraisal more than offset the void created by 14 projects (including 9 mine-re-openings) that have entered mine complex development the same year. In this buoyant period of high commodity prices, former mines or deposits are being fast tracked and can quickly migrate into the deposit appraisal stage with minimal appraisal work and, subsequently, into the mine complex development work phases. On the other hand, in this same year, about 10 projects moved back into the off-mine-site exploration phase. Their impact was small in terms of level of expenditures but they signify that, at times, some advanced projects may be the recipient of more exploration rather than deposit appraisal work in order to increase the level of mineral resources and the project's economic potential.

IMPACT OF MAJOR PROJECTS

The number of off-mine-site deposit appraisal projects totaled 64 in 2006, compared to 56 in 2005. The leading jurisdictions for the number of advanced projects remained British Columbia with 25 projects, followed by Ontario and Quebec with 9 and 8 projects, respectively.

Off-mine-site deposit appraisal expenditure increases totaling \$217 million were experienced across the country, except for New Brunswick, Alberta, and the Yukon, which together represented a decrease of \$12 million (in Alberta, the Muskeg Valley limestone quarry was committed to production while, in the Yukon, less activity was reported at the Wolverine base-metal deposit). Important increases in off-mine-site expenditures were recorded in British Columbia (\$79 million), the Northwest Territories (\$58 million), Ontario (\$38 million), and Nunavut (\$18 million). Altogether, these four jurisdictions accounted for 89% of the \$217 million increase. In 2006, British Columbia, the Northwest Territories, and Ontario were the top three jurisdictions for off-mine-site deposit appraisal expenditures, representing 74% of the total expenditures for this phase. In 2007, Ontario, British Columbia, and Quebec are expected to lead (Tables 7a and 7b).

British Columbia led the jurisdictions in 2006 with the most significant increase in that work phase. In particular, there was the Galore Creek copper-gold project of

NovaGold Canada Inc., which included a large pre-feasibility/feasibility study that year, and the former QR gold mine by Cross Lake Minerals Ltd. However, in November 2007, NovaGold Inc. and its new partner Teck Cominco suspended construction of the Galore Creek project due to higher capital costs and a projected longer development schedule. Evaluation of other development strategies are envisioned for this project. The Mount Milligan and Kemess North copper-gold projects of Terrane Metals Corp. and Northgate Minerals Corporation, respectively, continued with intense activity. Concerning Kemess North, a Joint Federal-Provincial Environmental Review Panel in September 2007 concluded that the project, in its present form, presented long-term risks to the environment and consequently did not receive a permit.

Second among the jurisdictions in 2006 was the Northwest Territories, where the A21 diamond pipe project at the Diavik diamond mine, owned by Diavik Diamond Mines Inc., received major expenditures. The company completed the tunnel that would allow for the underground bulk sampling activity necessary to better define the resource. Although considered important in the original Diavik mine plan, this pipe later proved to have insufficient reserves and was discarded for consideration at a future date. The work at A21 was performed simultaneously with the underground access of the A154 and A418 pipes, which are currently being evaluated under a feasibility study to determine the best underground mining method. Also in the N.W.T., the Gacho Kue project of De Beers Canada Inc. received an important budget increase. This project includes three pipes with calculated indicated mineral resources for the 5034, Hearne, and Tuzo kimberlite pipes. The work that took place in 2006 was to further define Tuzo, upgrade the resource of 5034, and continue to collect information to support the final feasibility study.

Third was Ontario, where Xstrata Nickel, at its Nickel Rim South project in Sudbury, continued the sinking of its main production shaft in order to start lateral development and definition drilling of the deposit during 2007. Underground development is scheduled for completion by the end of 2009. Increased spending at this project and also at Levack by FNX Mining Company Inc., who committed the project to production at the end of the calendar year, sustained the high level of activity in this work phase for Ontario. In addition, the Island Gold and Hollinger gold projects being carried out by Richmond Mines Inc. and Goldcorp Inc., respectively, and the Marathon copper-gold projects of Marathon PGM Corporation, included new and significant deposit appraisal expenditures in 2006.

Finally in Quebec, three of the seven projects newly recorded under deposit appraisal in 2006 have more than offset the void left by the East Amphi gold project of Richmond Mines, which moved into the mine complex development phase in 2006. This project was an advanced project that was a major contributor to the 2005 deposit appraisal work phase. Among the seven projects responsible for the

deposit appraisal expenditure increase, the most notable were the Fire Lake iron ore project of Quebec Cartier Mining, the Raglan Sud nickel project of Canadian Royalties Inc., and the Lac Bloom iron ore project of Consolidated Thompson-Lundmark Mines Limited.

The contribution of the major projects described above explains the increases recorded by the main commodity groups for the off-mine-site deposit appraisal work phase. Listed in decreasing order of significance were precious metals (up \$74 million), diamonds (up \$53 million), base metals (up \$41 million), iron ore (up \$27 million), and other metals (up \$13 million). For iron ore, the Lab Mag project in Newfoundland and Labrador being carried out by New Millenium Capital Corp. had an important impact, as did Consolidated Thompson-Lundmark Gold Mines Limited at its Lac Bloom project in Quebec. The important copper-gold projects in British Columbia contributed to significant increases in each of the base-metals and precious-metals categories in the province. The other metals category showed important increases, due in large part to the Nico bismuth-cobalt-gold project of Fortune Minerals Limited and Blue Pearl Mining's Davidson molybdenum project in the Northwest Territories and British Columbia, respectively.

In 2007, expenditures will continue to increase, not only because existing projects such as Nickel Rim South intensify underground activities, but also because new projects with large expenditures are entering or re-entering this work phase. Among them are Selwyn Resources Ltd.'s Selwyn zinc project in the Yukon, Opinaca Mines Ltd.'s Eleonore gold project in Quebec (pre-feasibility study), Northgate Minerals Corporation's Young-Davidson gold project in Ontario, and the Mary River iron ore project of Baffinland Iron Mines Corporation (pre-feasibility study) in Nunavut.

On-Mine-Site Expenditure Trend

EXPLORATION AND DEPOSIT APPRAISAL

The number of on-mine-site exploration projects increased slightly to 36 in 2006 from 33 in 2005 as expenditures increased to \$104 million from \$100 million. Despite a change of work phase location (from on-mine-site to off-mine-site) in Quebec that contributed to a slowing down of the upward national trend that started in 2001, total on-mine-site exploration expenditure increases were recorded in Manitoba, Ontario, the Yukon, and British Columbia. Since 2001, the level of on-mine-site expenditures has increased and, in 2005, for the first time in eight years, surpassed the \$100 million level in current dollars (a low of \$31 million was recorded in 2000). Despite the fact that expenditures have been higher in recent years compared to 2000, the number of projects has declined (from 47 to 36). This can indicate that on-mine-site activity in general is controlled by only a few important projects with fluctuating budgets. Projects that were newly committed to

production and that had mine-site exploration activity to report, such as the Casa Berardi gold project of Aurizon Mines in Quebec (committed in 2005), the Redstone nickel project of Liberty Mines Inc. in Ontario, and the Minto copper-gold project of Sherwood Copper Corporation in the Yukon (both committed in 2006), partly offset the decrease recorded in Quebec. Goldcorp Inc.'s Red Lake gold mine in Ontario and CVRD Inco Limited's Thompson nickel mine in Manitoba also contributed to the increase in 2006. Ontario remained the leading jurisdiction in total on-mine-site exploration expenditures.

The number of on-mine-site deposit appraisal projects increased significantly to 24 in 2006 from 14 in 2005, and the associated expenditures increased to \$39 million from \$21 million the previous year (Table 7a). In Quebec alone, a \$14 million increase resulted from more activity at the Bousquet and Troilus gold mines of Agnico-Eagle Mines Limited and Inmet Mining Corporation, respectively, and at the Westwood deposit, adjacent to the Doyon gold mine, by Cambior Inc. (IAMGOLD Corp. in September 2006). Consequently, Quebec was the leading jurisdiction in total on-mine-site deposit appraisal expenditures, ahead of Ontario, which was the leading jurisdiction in 2005.

Total on-mine-site exploration expenditures represented a meager 7% of total exploration spending in 2006 (9% in 2005), with close to 50% of it associated with 11 gold mines (6 in Quebec). In comparison, on-mine-site deposit appraisal represented 10% (compared to 11% in 2005) of total deposit appraisal with 78% of the spending realized at 8 gold mines (7 in Quebec).

The number of mines (excluding stone quarries) reporting either on-mine-site exploration and/or deposit appraisal was 43. This represented about 22% of the estimated number of principal mines in operation in Canada (estimated at 194) in 2006. In comparison, about 76% of the total principal mines received mine complex development expenditures (Figure 10). A total of 14 gold mines, representing about one third of on-mine-site exploration and deposit appraisal projects, accounted for 52% of total on-mine-site expenditures and for 86% of total on-mine-site expenditures in the precious metals category.

In 2007, on-mine-site exploration is expected to remain about the same, while deposit appraisal is expected to increase by \$93 million, most of it from Ontario. The Northwest Territories and British Columbia should also receive significant expenditure increases. However, those figures are quite uncertain at this time as some of these expenditures may also include mine complex development expenditures, which are difficult to separate in the context of a revised spending intentions survey.

Total on-mine-site exploration and deposit appraisal expenditures, including only field work and overhead costs, can be traced back to 1969 (Figure 3c). The 2006 level of on-mine-site expenditures of \$137 million was quite low

when compared to the record peak year of 1981 when \$323 million (in constant 2006 dollars) was spent.

Factors of Success

Metal Prices

The recent enhanced commitment to the development of mineral resources in Canada, for which the country has a rich mining history (gold, nickel, copper, zinc, lead, uranium, metallurgical coal, iron ore), is, to a large degree, a result of the current cycle of strong commodity prices. Figure 2c shows the many correlations between metal price cycles and exploration plus deposit appraisal expenditure levels, especially for the expenditure years of 1972, 1983 and 1992 when low metal prices were experienced. In 1999, and in 2001, field work and overhead expenditures, excluding diamonds, were low again, showing a strong correlation to the metals price indexes of those years. At \$386 million (in 2006 constant dollars), expenditures in 2001, excluding diamonds, were at the lowest level ever recorded in the historical series. Since then, both expenditures and the metals price index have recovered significantly (with a major jump in 2004) and are still climbing. Commodity prices rose at a slower pace in 2005 and then surged by 78% in 2006. In 2006, the annual average price for the commodities listed in Appendix 1 increased for all commodities except molybdenum, coal, and iron ore. An impressive 137% increase was experienced by zinc. More than 50% increases were recorded for copper, uranium, nickel, palladium, and silver. When comparing 2006 and 2007 over the same 11-month period, the increase in average commodity prices remained quite strong, with lead showing more than a 100% increase, uranium up 93%, and nickel up 64%. Coal prices encountered some slight downward pressures.

Again, the rapidly expanding economies of China and India were the main impetus for strong commodity demand and resulting higher prices, with investment demand also an important factor in 2006 and 2007. The U.S. economy has also continued to grow, but at a much slower pace than the emerging economies. On the other hand, the U.S. economy has been affected by the major credit crunch of August 2007 (precipitated by the sub-prime housing market crisis in the United States) and the resulting fall-out; therefore, measures, including a major reduction in interest rates, have been adopted to sustain the economy. Job creation remained strong in the United States, which partly alleviated the negative impact of the housing market crisis during 2007. This affected many investors, some of whom were active in the exploration and mining industry in Canada. However, so far, there does not seem to be any noticeable impact on spending levels on major projects.

The outlook for mineral commodities for 2008 remains favourable, especially for gold and platinum (driven by investment and fabrication demand, the uncertain U.S. economy, and inflationary concerns). China is expected to

grow by a further 8% (slower than the 12% recorded in 2007), which will continue to put upward pressures on the demand for and prices of the principal mineral and metal commodities. For individual commodities, a surplus is expected for zinc as production in 2008 is forecast to increase from new and re-opened mines. Although the U.S. demand will likely be more modest, demand from European steelmakers for nickel should strengthen. Copper demand may decline if the need for residential construction, especially in the United States, slows down, and this seems to be the case; however, this has not yet happened for commercial construction. Uranium prices should remain high in the near term as a consequence of production delays and disruptions, but some foresee a surplus in uranium inventories, which would put downward pressures on the price. China is showing signs of exhaustion in its ability to increase domestic iron ore production and may become more reliant on imported ore. The demand for potash should continue to grow with accompanying price increases. For example, potash is needed to grow crops for biofuels, which are becoming more popular as a means of reducing carbon emissions. Prices for hard coking coal are expected to strengthen in 2008 in response to recent supply disruptions.

Exploration and Deposit Appraisal Expenditures by Commodity Group

This section presents a brief analysis of commodity trends for exploration and deposit appraisal combined. The specifics have already been discussed by work phase and should be referred to for a better understanding of the main fluctuations described below.

In 2006, mineral resource development activity continued to be reflected across a wide range of commodities. Unlike the unique 1987-88 peak expenditures period, when gold contributed 80% of total exploration expenditures and base metals contributed less than 15%, an array of commodities of importance were recorded in 2006. Precious metals (38% of total expenditures) ranked first, followed by base metals (22%), diamonds (18%), uranium (11%), other metals (4%), coal (3%), iron ore (3%), and nonmetals (1%) (Table 12). Since 1993, at the beginning of the northern diamond rush, diamonds have continually sustained close to 20%, and at times up to 25%, of total mineral exploration and deposit appraisal spending. The order of importance of mineral commodity expenditures remained the same in 2006 as in 2005, and is not expected to change in 2007.

In 2006, all commodity groups except nonmetals experienced increases in the level of expenditures due to the exceptional circumstances discussed previously. In 2006, coal expenditures increased by 22% (reaching \$51 million), precious metals were up 35% (reaching \$725 million), base metals were up 36% (reaching \$412 million), diamonds were up 43% (reaching \$342 million), other metals were up 72% (reaching \$85 million), uranium was up 134% (reaching \$214 million), and iron ore was up 157% (reaching

\$65 million). In dollar terms, and in decreasing order of importance, precious metals, uranium, base metals, and diamonds, each with more than a \$100 million increase, contributed 86% of the total \$607 million increase recorded in 2006.

In 2007, all commodity groups are expected to show increases in their level of expenditures. Base metals are indicated to rise by a further 57%, reaching \$647 million (25% of total expenditures). Indeed, this level of expenditures for base metals could be a record high in both current and constant 2006 dollars (Figures 5a and 5b). The level of expenditures for diamonds will be close to the 2006 level and uranium could again hit a record high. Unfortunately, long historical trends for coal, iron ore, and other mineral commodities have not yet been compiled. In 2007, the increases in base metals, precious metals, and uranium could represent 81% of the anticipated \$636 million increase. The other metals category (mainly molybdenum and cobalt, a by-product of base-metal deposits) is also expected to increase significantly.

PROVINCIAL/TERRITORIAL TRENDS

In 2006, most of the expenditures for base-metal and precious-metal exploration and deposit appraisal, in decreasing order of importance, took place in Ontario, British Columbia, and Quebec (Table 13c). Quebec ranked second after Ontario in precious-metal exploration and deposit appraisal expenditures and ahead of British Columbia in 2005. For precious metals, Nunavut has occupied fourth place since 2004 (it was third in 2003). Precious metals was the leading commodity group for all of the above jurisdictions, as well as for the Yukon and Nova Scotia.

The Northwest Territories remains first for total diamond expenditures and, consequently, diamonds remain the leading commodity in that territory. Diamonds were also the leading commodity in Alberta. Saskatchewan was second in terms of importance for total spending for diamonds in 2006, followed by Nunavut, Ontario, and Quebec. Uranium continued to be the primary commodity in Saskatchewan in 2006, although not too far ahead of diamond expenditures in the province. Uranium became the leading commodity in Newfoundland and Labrador during 2006. Traditionally, base metals has been the leading commodity group in that province, as it continued to be in New Brunswick and Manitoba as well.

As for other commodities, coal has been active mainly in British Columbia since 2004, as has iron ore in Nunavut since 2005. Quebec and Newfoundland and Labrador ranked behind Nunavut in terms of the level of expenditures for iron ore in 2006. In 2007, the provincial trend in leading commodities is not expected to change much, except for Newfoundland and Labrador where base metals could regain first place due to intense work anticipated at the Voisey's Bay deposits by Voisey's Bay Nickel Company Limited. As well, base metals could also occupy first

place in the Yukon as a result of anticipated higher budgets at many base-metal projects.

Tax Incentive Measures

The availability of generous tax and non-tax incentives has also been singled out as a successful contributor to the breadth of activity in the exploration industry. Tax incentives, such as the already existing flow-through-share (FTS) mechanism tied in with the federal 15% Mineral Exploration Tax Credit introduced in 2000, and similar tax measures in different jurisdictions across Canada (some of which are harmonized with the federal tax credit), are aimed primarily at supporting the junior exploration sector. To date, four federal extensions of the tax credit have taken place since its inception (in 2003, 2004, 2006, and 2007). This measure is now scheduled to lapse at the end of March 2008, but companies will have until the end of 2009 to incur eligible expenses. It has been estimated by Gamah International Ltd. that, from the beginning of the tax credit measure in October 2000 to the end of December 2006, a total of \$2.2 billion has been raised via the FTS mechanism to finance mineral exploration in Canada. A further \$307 million was raised in the first half of 2007.

A similar situation existed during the astonishing peak expenditure period of 1987 and 1988. A combination of strong metal prices and tax incentives resulting from the enhancement of flow-through shares by a super deduction, the Mining Exploration Depletion Allowance (MEDA), was mostly responsible for the anomalous levels of spending recorded during that period (Figures 2a and 2c). However, some differences in the expenditure pattern by juniors are noticeable between the two periods of 1987-88 and 2005-07.

Expenditures by Junior and Senior Companies

In the actual context of the FTS and the various tax credits favourable to raising money by the junior companies, the seniors seem to have devolved themselves from the risky business of discovering new deposits and left it to the juniors. However, if the exploration results of a project become appealing, the seniors can then decide to take over the project and bring it through the deposit appraisal work phase and eventually into the mine complex development work phase. The seniors have the significant capital investment and expertise required to successfully complete such projects. The Eleonore gold project in northern Quebec, which was discovered by Virginia Gold Mines Inc. and was sold to Goldcorp Inc. in 2006, is an example of this strategy. This was the case in 2007 for the High Lake base-metal project in Nunavut of Wofliden Resources Inc., now controlled by Zinifex, and the Meadowbank gold project in Nunavut of Cumberland Resources, now operated by Agnico-Eagle Mines Limited. However, the seniors can still have aggressive exploration programs at their producing site or in the surrounding areas as usually much land has already been secured (e.g., Raglan, Voisey's Bay, and the Red Lake district).

Another senior strategy is to enter into an agreement with juniors to work at a former mine or mining camp. The juniors can also acquire such facilities from seniors. The juniors would then plan to explore using up-front financing to find sufficient mineral resources to justify the re-opening of a former mine (as the commodity price allows). This production activity, in turn, would bring adequate cash flow for the juniors to further explore and discover new resources to extend the mine life. The success of FNX Mining Company Inc. in re-opening some of the former Inco Limited mines in the Sudbury Basin area (McCreedy West and Levack) was an example of this strategy. This was also the case for First Nickel Inc. with the re-opening of Falconbridge Limited's former Lockerby nickel mine.

The increasing importance of the junior mining sector is evident from the junior exploration and deposit appraisal expenditure trend. Since the last junior expenditures downturn in the 1999-2000 period, expenditures, expressed in constant 2006 dollars, increased slightly up to 2002, and then successively by 44% (\$310 million) in 2003, 105% (\$635 million) in 2004, 29% (\$820 million) in 2005, 51% (\$1.2 billion) in 2006, and possibly another 24% in 2007 to \$1.5 billion. The \$1.2 billion level attained in 2006 surpassed for the first time the previous record high of the 1987-88 period of intense activity (Tables 3a and 3b). The junior share of total expenditures, after surpassing 50% in 2004 for the first time since 1987, continued to climb and reached successively 61% and 65% in 2005 and 2006. As stated earlier, the junior operators are now bearing more and more of the risk, and also the responsibility, for Canadian discovery successes. However, the senior companies, with the more recent strategy of acquiring major projects operated by the juniors and a few of them also increasing exploration and deposit appraisal budgets at or near existing operations, have spurred the level of expenditures for these activities during 2007. In fact, the senior level of expenditures is expected to reach close to \$1 billion in 2007, compared to \$674 million the year before. To date, this level has only been recorded in the 1987-88 and 1980-82 periods of strong commodity prices.

In 2006 and 2007, respectively, 55% and 51% of the spending by seniors was dedicated to off-mine-site exploration, while about 20% was directed to on-mine-site activities (exploration and deposit appraisal) and the rest went to off-mine-site deposit appraisal activities. Generally, the historical data for seniors have been in a similar proportion. However, in 2005, the seniors reported more in off-mine-site exploration (60%) and less in off-mine-site deposit appraisal (16%). That year was exceptionally low in off-mine-site deposit appraisal for the seniors as major projects migrated to the mine complex development phase (see earlier discussion). The senior off-mine-site exploration spending is not increasing as fast as the junior spending. However, for 2007, junior and senior expenditure increases are expected to be the same (36% in each case). The juniors have surpassed the seniors in this area since 2003 (Table 3c). In fact, the junior share of off-mine-site exploration expenditures reached 54% in 2003, 64% in 2004,

70% in 2005, 74% in 2006, and a possible 74% again in 2007. While the off-mine-site exploration spending by juniors increased by 43% (to \$1 billion) and by 36% (to \$1.4 billion) in 2006 and 2007, respectively, the off-mine-site deposit appraisal component jumped 152% in 2006, but is indicated to decrease by 24% in 2007. In 2007, two major projects (Galore Creek and Meadowbank) operated by junior companies were expected to be committed to production. This is not likely to happen as now, under the umbrella of senior companies, the first project has been cancelled and the second one has been postponed until further exploration is completed to increase the level of resources. This will translate into more expenditures either in off-mine-site exploration or deposit appraisal for the seniors in 2007 as the Meadowbank takeover took place in July 2007 after the survey results were collected. Consequently, the change of company classification will occur during the preliminary 2007 survey with results to be released in early 2008. The High Lake base-metal project (as well as Izok [base metals], and Ulu and Lupin [gold]) will likely have a similar impact as a result of the takeover by the senior Zinifex in June 2007. In 2006, these projects were reported under the junior off-mine-site deposit appraisal work phase, thus contributing to the record high of \$208 million reported that year. For all these reasons, the juniors (\$208 million) significantly surpassed the seniors (\$161 million) in off-mine-site deposit appraisal expenditures in 2006. This contrasts with 2005 when the juniors had a slightly higher amount than the seniors.

The number of off-mine-site deposit appraisal projects operated by juniors exceeded those operated by seniors in 2006 and 2005 (37 junior projects compared to 26 senior projects in 2006, and 34 compared to 22 in 2005). However, generally, seniors spend more per project because they happen to manage larger projects, with the exception of 2006 as discussed above. Since 2005, the total number of junior companies has not fluctuated much (only a 1% increase in 2006 with an average of 643 companies per year), but the number of companies spending above \$1 million strongly increased. Their higher budgets, resulting from easier access to different financing mechanisms, were the key factor in the increased amount of money available to be spent on more exploration projects (Table 4). For example, in 2005, 28% (179 companies were recorded) of the juniors spent more than \$1 million and accounted for 84% of total junior spending whereas, in 2006, 40% (258 companies) of the juniors accounted for 89% of total junior spending; in 2007, this is expected to reach 47% (297 companies), which would account for about 91% of total junior spending. Since 2005, the dominant range of expenditures for juniors has remained in the \$1 million-\$5 million category, but more juniors are now spending above \$10 million. For comparison, in 2002 and 2003, none were recorded in this category, compared to 6, 13, 20 and 25 for the juniors in the following four years, respectively.

The total number of seniors increased by 19% (119 companies were recorded) and their expenditures increased by

34% (\$673 million were recorded) in 2006, and this is expected to increase by 11% in 2007 (132 companies) and their expenditures are expected to increase by 47% (\$988 million indicated) (Table 14a). In 2006 and 2007, the senior company project operators spending above \$1 million represented about 50% of the total of senior companies and were responsible for close to 99% of their total expenditures. In 2006, 20 companies spending above \$10 million covered 71% of the total senior expenditures while, in 2007, 26 companies are expected to cover 76% of the senior expenditures.

In 2006, total spending by juniors exceeded total spending by seniors in all jurisdictions except Nova Scotia, Manitoba, Ontario, and the Northwest Territories (Table 15a). Indeed, in the Yukon, British Columbia, Nunavut, and Newfoundland and Labrador, the spending proportion by juniors compared to seniors exceeded 75%. In 2007, it is likely that total spending by seniors will exceed spending by juniors only in Ontario and Manitoba (Table 15b). When considering exploration expenditures only, spending by juniors dominated in all jurisdictions in 2006 except Nova Scotia and Manitoba while, in 2007, Manitoba is the only exception. On the other hand, when considering only deposit appraisal expenditures, the seniors were dominant in all jurisdictions except the Yukon and Nunavut while, in 2007, British Columbia, the Yukon, and Nunavut were the exceptions.

In 2006, juniors and seniors continued to be attracted primarily to precious metals for their exploration and deposit appraisal activity rather than to base metals and diamonds (Table 14). For each commodity group, juniors led the seniors in expenditures. The most important increase in junior expenditures by commodity group, in terms of percentage, belonged to uranium (194% increase with all under off-mine-site exploration) and, in dollar terms, belonged to precious metals (\$133 million with more than half of the increase under off-mine-site deposit appraisal). For the seniors, the most important percentage increase was for diamonds (51%, mainly under off-mine-site deposit appraisal) and the most important dollar increase was for precious metals (\$56 million, mainly from off-mine-site exploration and on-mine-site deposit appraisal).

SUMMARY AND CONCLUSION

Total mineral resource development activity continued to be buoyant in 2006 as total expenditures rose by 22% to \$7.9 billion; they are expected to rise toward the \$10 billion level in 2007. In 2006, 14 new projects entered the mine complex development work phase with 9 of them being mine re-openings. However, they were not the main reason for the significant increase as these projects were not capital-intensive. The large level of investment was fueled by the Snap Lake (Northwest Territories) and Victor (Ontario) diamond projects that are progressing with their

construction phase. Both of these projects were committed to production in 2005. Also important were the expansion activities under way at different operating potash mines in Saskatchewan, due in part to the tax incentive program introduced by the provincial government in April 2005. However, the leading commodity in terms of total investment in Canada in 2006 was diamonds, and it is likely to also lead in 2007. The existing operations of the Ekati and Diavik diamond mines in the Northwest Territories were, and still are, the recipients of massive capital investment. Both mines are doing underground development with production to take place in the near future.

Prices for many mineral and metal commodities continued to rise in 2006, some to record highs, due in large part to strong global demand, again led by the growing economies of China and India. Prices continued to increase in 2007 and are expected to remain firm into 2008, although a recession or a slowdown is possible in some countries and can alter economic conditions. It is also not clear yet what the impact will be on the mining industry of the credit market crunch that began to manifest in mid-2007. The favourable investment climate in 2006 that carried on into 2007 has had a positive impact not only on Canadian operating mines, but also on total exploration and deposit appraisal activity across Canada, as represented by impressive expenditure levels of \$1.9 billion and \$2.5 billion in 2006 and 2007, respectively. These amounts accounted for 24% in 2006, and likely 28% in 2007, of total mineral resource development expenditures. The 2007 level of expenditures should surpass the all-time record high of 1987-88 when more than \$2 billion per year was reached in exploration expenditures (constant 2006 dollars). It is not surprising that, with such a high level of commitment to the exploration sector (generally speaking) for the sixth year in a row in 2007, Canada was the leading destination for global exploration funding, accounting for 21% of the worldwide exploration budgets (MEG study).

All jurisdictions across Canada experienced exploration and deposit appraisal increases in 2006, with British Columbia, Saskatchewan, and Quebec being the major contributors to this increase. In 2007, Ontario, British Columbia, and Quebec will likely be responsible for most of the increase. However, smaller jurisdictions such as Nova Scotia and New Brunswick also greatly benefited from this intense activity. The sustained high commodity prices have encouraged companies to revive dormant deposits or former mines.

In 2006, spending was spread broadly among the commodity groups with precious metals and base metals at around 38% and 22%, respectively, diamonds at 18%, uranium at 11%, coal and iron ore at 3% each, and the remaining 5% was for other metals and nonmetals. In dollar terms, precious metals and uranium have received the biggest increases. Uranium continued to hit record highs in 2006 with \$214 million recorded for at least 450 exploration projects in Canada. Not only Saskatchewan, but also Quebec and Newfoundland and Labrador were major recipients of

this exploration activity. This contrasts with the previous peak period in 1987-88 when exploration activity was concentrated on gold (about 80% of all expenditures) and base metals (around 15%). In 2007, a record high is expected for base-metals spending.

Spending by the junior sector reached an all-time high in 2006 of \$1.2 billion, surpassing the \$1 billion attained in 1987-88. In 2007, \$1.5 billion is expected. In 2004, the junior share of total expenditures surpassed the seniors for the first time since 1987. Further highs of 61% and 65% were reported in 2005 and 2006, respectively. However, this trend may slow down as seniors are expected to reach \$1 billion in 2007. Although the juniors have become the driving force for the exploration activity in Canada over the past several years, the seniors, with recent takeovers of advanced projects (such as the Eleonore gold project in Quebec, the Meadowbank gold project in Nunavut, and the High Lake base metals project in Nunavut), are re-emerging with significant expenditures to bring such projects toward a production commitment.

Despite the favourable conditions affecting the mineral industry over the past several years, there remains future uncertainties. These include: how long will the current mineral and metal commodity boom last; will the growing, specialized labour shortage affect the companies' capacity to deliver; what will be the impact on the junior sector when the ITCE is allowed to expire in March 2008; will seniors increase their exploration budgets at their producing mines and for grassroots programs; and will the discovery rate increase as a result of the recent ongoing intensified exploration efforts? Furthermore, in Canada, factors such as a stronger Canadian dollar and higher energy costs are certain to affect the capital and operational cost parameters of many projects and to reduce the profit margins at producing sites.

Overall, the major challenge continues to be the replenishment of depleting ore reserves, especially base metals, in Canada. It is hoped that the Canadian mineral industry will meet this challenge.

Notes: Information in this review was current as of November 2007. (2) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/2006CMY_e.htm.

NOTE TO READERS

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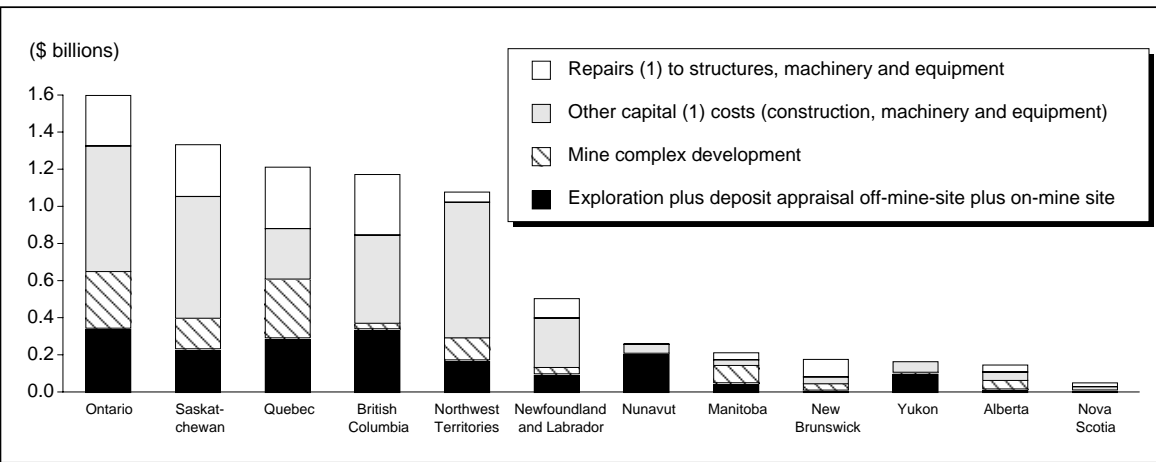
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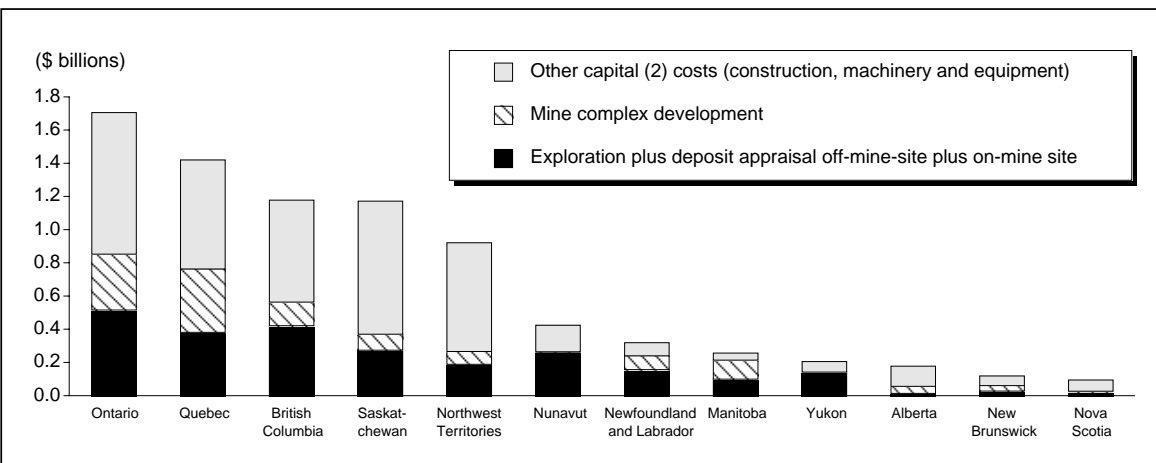
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15b	Exploration and Deposit Appraisal Expenditures, by Province and Territory, by Junior and Senior Companies, 2007	3.45
16	Exploration Plus Deposit Appraisal Expenditures, by Province and Territory, by Type of Company, 2006	3.46
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Figure 1a
Total Mineral Resource Development Expenditures in Canada, by Province and Territory, 2006
\$7.9 Billion



Source: Natural Resources Canada, from a federal-provincial territorial survey of mining and exploration companies.
 (1) Includes expenditures related to exploration (1.0%), deposit appraisal (2.6%), and mine complex development (96.4%).

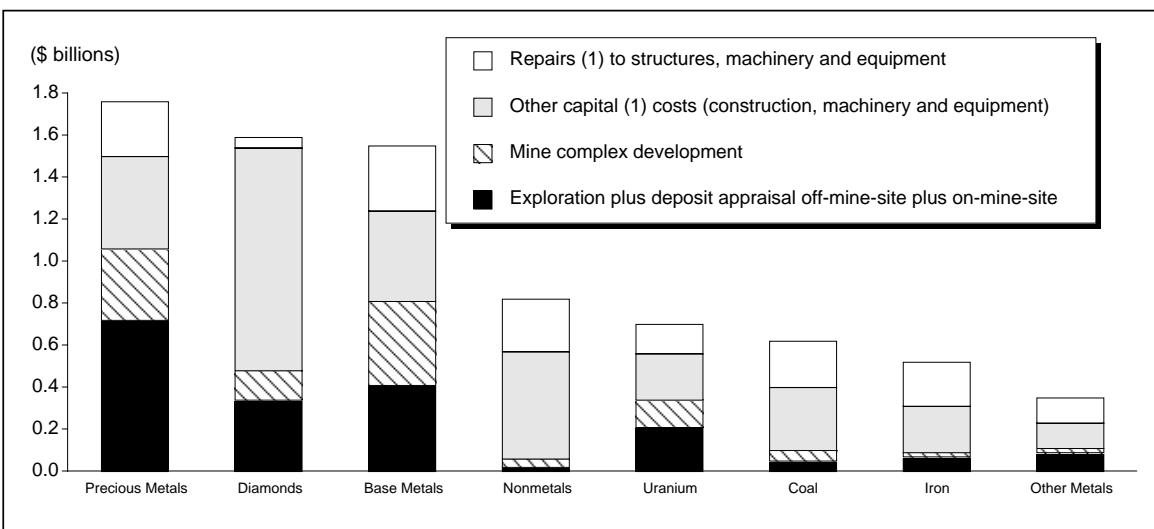
Figure 1b
Total Mineral Resource Development Expenditures (1) in Canada, by Province and Territory, 2007
\$8.0 Billion



Source: Natural Resources Canada, from a federal-provincial territorial survey of mining and exploration companies.
 (1) Repair and maintenance expenditures are not available. (2) Includes expenditures related to exploration (0.8%), deposit appraisal (4.4%), and mine complex development (94.8%).
 Note: Data for 2007 are revised spending intentions.

Figure 1c

Total Mineral Resource Development Expenditures in Canada, by Mineral Commodity, 2006
\$7.9 Billion

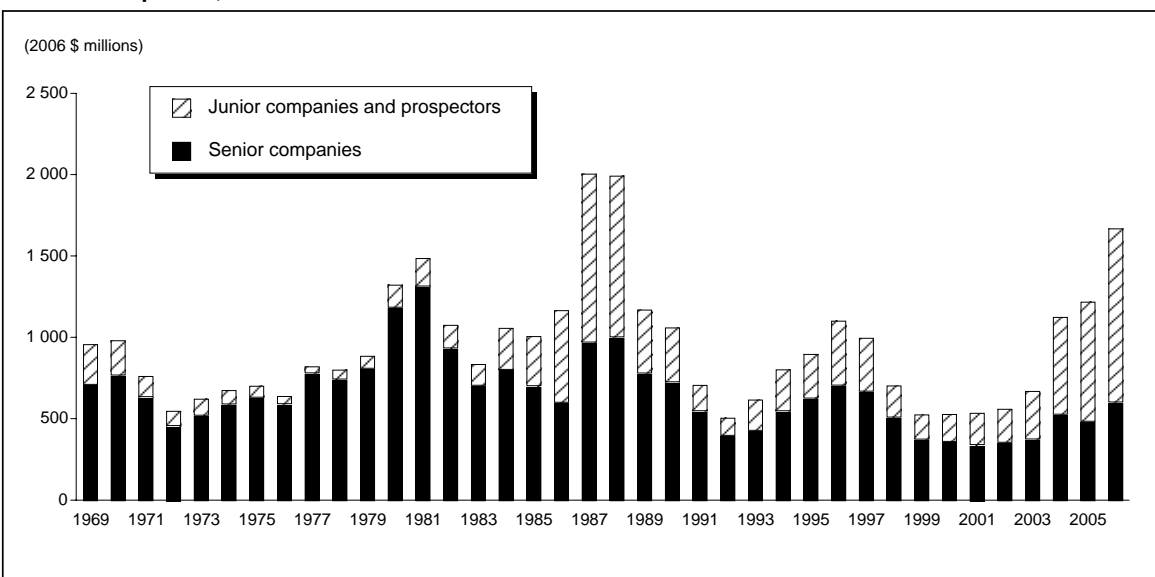


Source: Natural Resources Canada, from a federal-provincial territorial survey of mining and exploration companies.

(1) Includes expenditures related to exploration (1.0%), deposit appraisal (2.6%), and mine complex development (96.4%).

Figure 2a

Exploration Plus Deposit Appraisal Expenditures, (1) Field and Overhead (2) Costs, by Junior and Senior Companies, 1969-2006

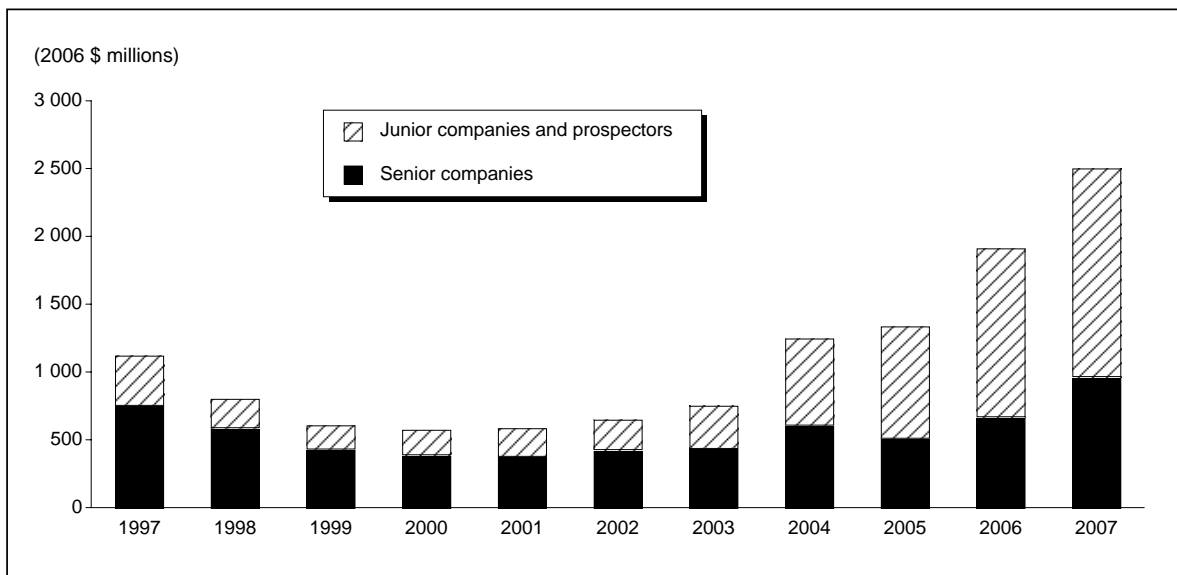


Sources: Natural Resources Canada and Statistics Canada, from a federal/provincial-territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. (2) Overhead costs include mineral leases, claims and property taxes, and project-related head office expenditures.

Notes: Total exploration expenditures for 1975-81 are overstated by an average of about 17% relative to earlier and later years because of changes to the methodology used by Statistics Canada over the years. Expenditures for 1997-2006 include both exploration plus deposit appraisal as per the new definitions; up to and including 1996, most of the expenditures now included in the deposit appraisal work phase were reported under exploration (broadly speaking).

Figure 2b
Exploration Plus Deposit Appraisal Expenditures, (1) by Junior and Senior Companies, 1997-2007

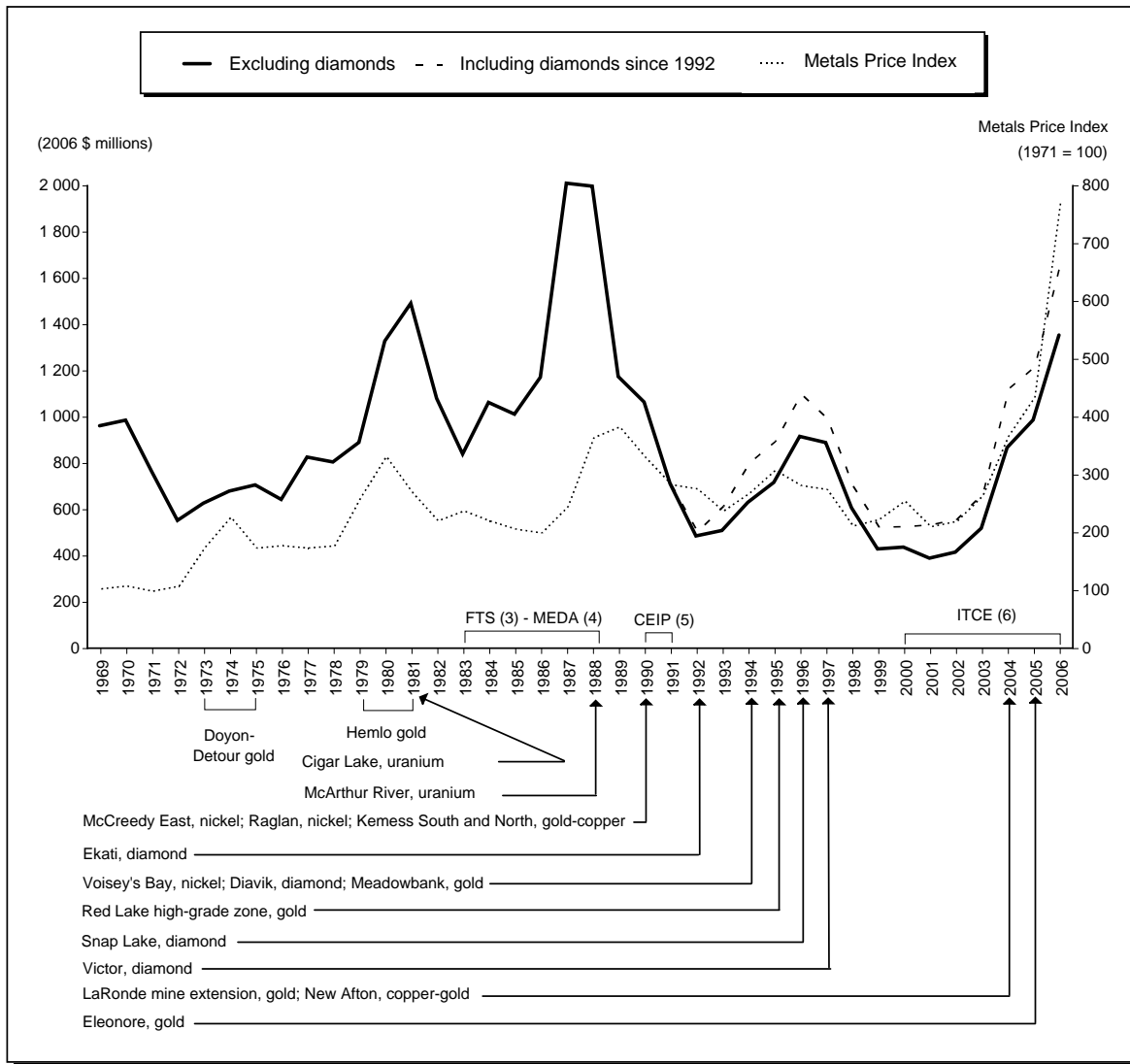


Source: Natural Resources Canada, from a federal-provincial territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Note: Data for 2007 are revised spending intentions.

Figure 2c
Exploration Plus Deposit Appraisal Expenditures, (1) Field and Overhead (2) Costs, Comparing
Metals Price Index, Some Major Discoveries, and Federal Incentive Measures, 1969-2006



Sources: Natural Resources Canada and Statistics Canada, from a federal-provincial/territorial survey of mining and exploration companies.

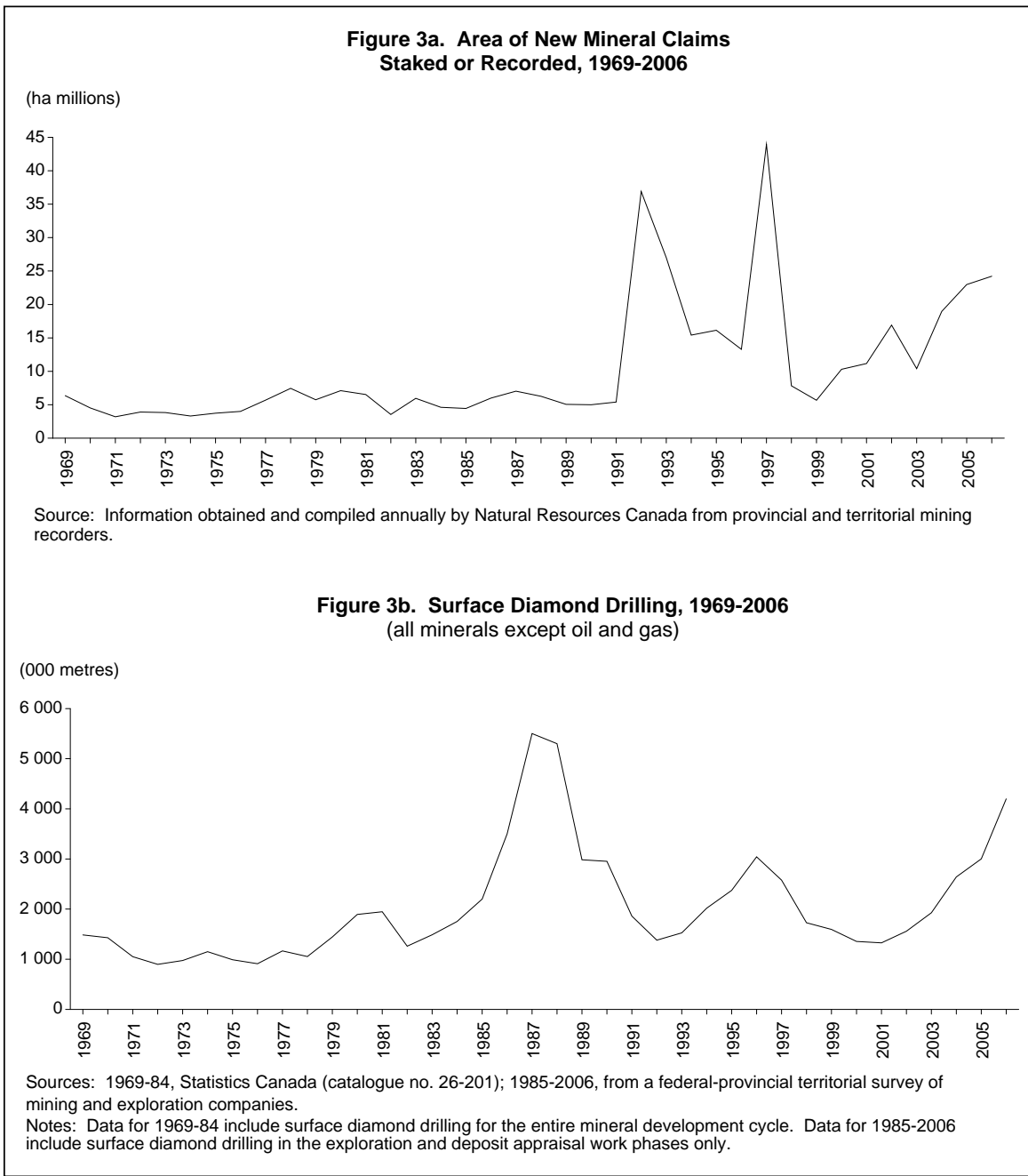
(1) Includes on-mine-site plus off-mine-site activities. (2) Overhead costs include mineral leases, claims and property taxes, and project-related head office expenditures. (3) FTS: Flow-through shares. (4) MEDA: Mining Exploration Depletion Allowance.

(5) CEIP: Canadian Exploration Incentive Program. (6) ITCE: Investment Tax Credit for Exploration.

Notes: The FTS program is continuous since 1983. Total exploration expenditures for 1975-81 are overstated by an average of about 17% relative to earlier and later years because of changes to the methodology used by Statistics Canada over the years.

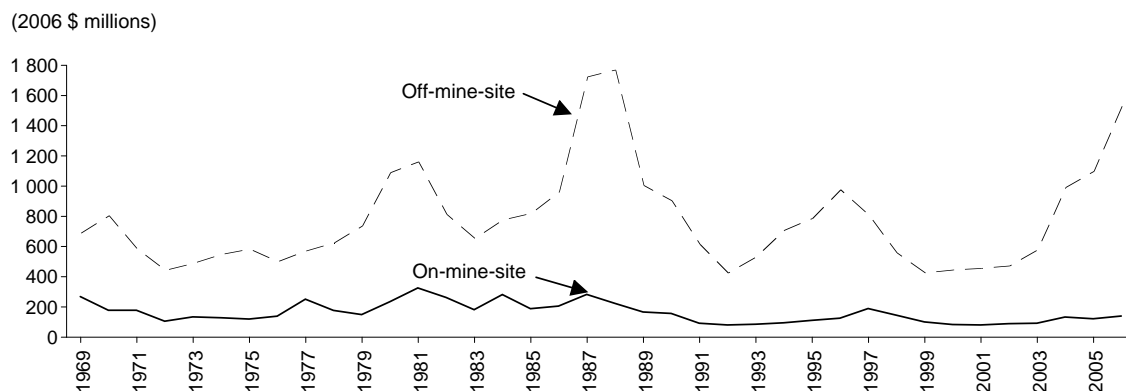
Up to and including 1996, most of the expenditures now included in the deposit appraisal work phase were reported under exploration (broadly speaking).

Figures 3a and 3b
Selected Measures of Exploration Activity



Figures 3c and 3d
Selected Measures of Exploration Activity

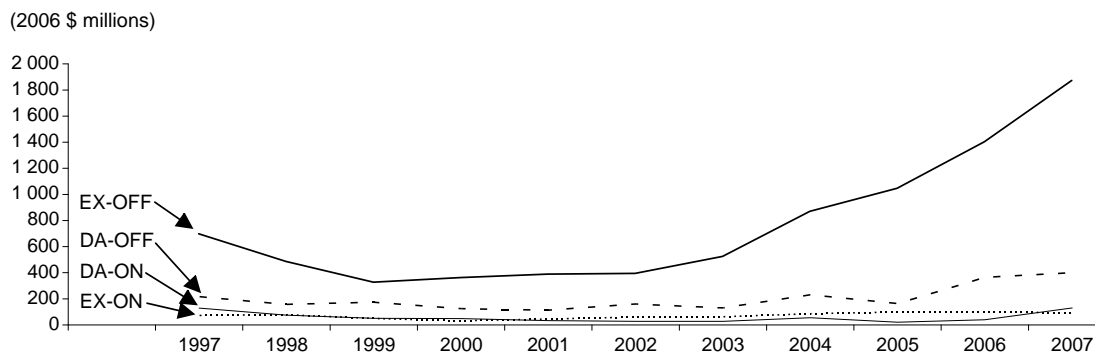
**Figure 3c. Exploration Plus Deposit Appraisal,
 Field Work Plus Overhead Expenditures, On- and Off-Mine-Site, 1969-2006**
 (all minerals except oil and gas)



Sources: 1969-84, Statistics Canada, Exploration, Development and Capital Expenditures for Petroleum and Natural Gas Wells, Intentions (catalogue no. 61-216); 1985-2006, from a federal-provincial/territorial survey of mining and exploration companies.

Notes: Adjusted to 2006 dollars using Gross Domestic Product deflator series. These expenditures do not include expenditures for oil and gas exploration. Expenditures for 1997-2006 include exploration plus deposit appraisal as per the new definitions; up to and including 1996, most of the expenditures now included in the deposit appraisal work phase were under exploration (broadly speaking). Off-mine-site and on-mine-site overhead expenditures for 1969-88 were estimated based on an average of the overhead/total ratio from the years 1989-96.

**Figure 3d. Exploration and Deposit Appraisal
 Expenditures, (1) On- and Off-Mine-Site, 1997-2007**



Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

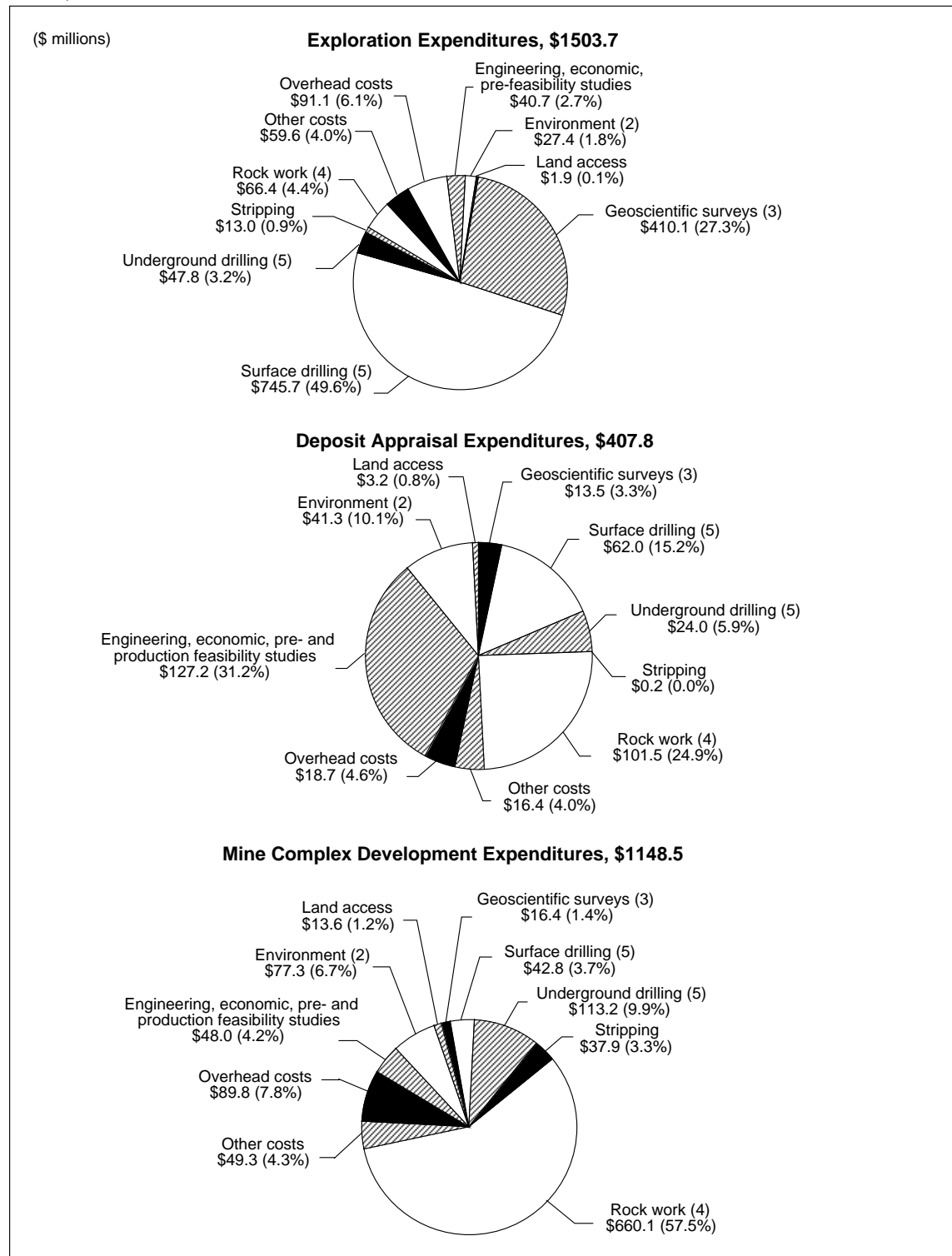
EX-OFF: Exploration off-mine-site. DA-OFF: Deposit appraisal off-mine-site.

EX-ON: Exploration on-mine-site. DA-ON: Deposit appraisal on-mine-site.

(1) Includes field work, overhead, engineering, economic, pre- or production feasibility studies, environment and land access costs.

Note: Data for 2007 are revised spending intentions.

Figure 4
Exploration, Deposit Appraisal and Mine Complex Development Expenditures, (1) by Type of Work, 2006



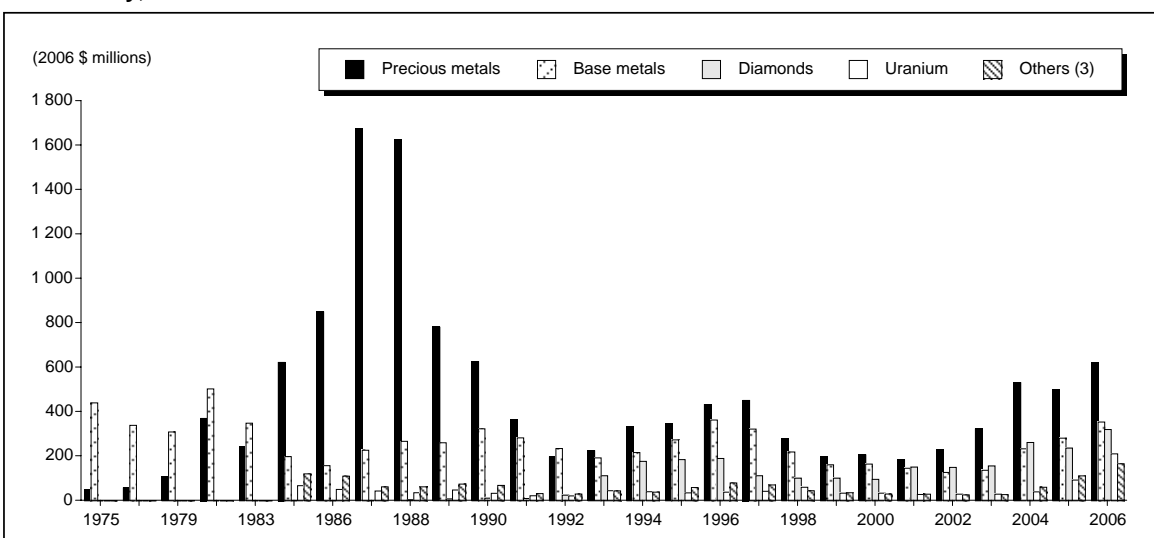
Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. (2) Environment includes characterization, permitting, protection, monitoring, and restoration.

(3) Geoscientific surveys include geology, geochemistry, ground geophysics, and airborne geophysics. (4) Rock work activity includes shaft work, drifts, cross-cuts, raises, declines, and dewatering costs. (5) Drilling includes diamond and other types of drilling.

Figure 5a

Exploration Plus Deposit Appraisal Expenditures, (1) Field and Overhead (2) Costs, by Mineral Commodity, 1975-2006



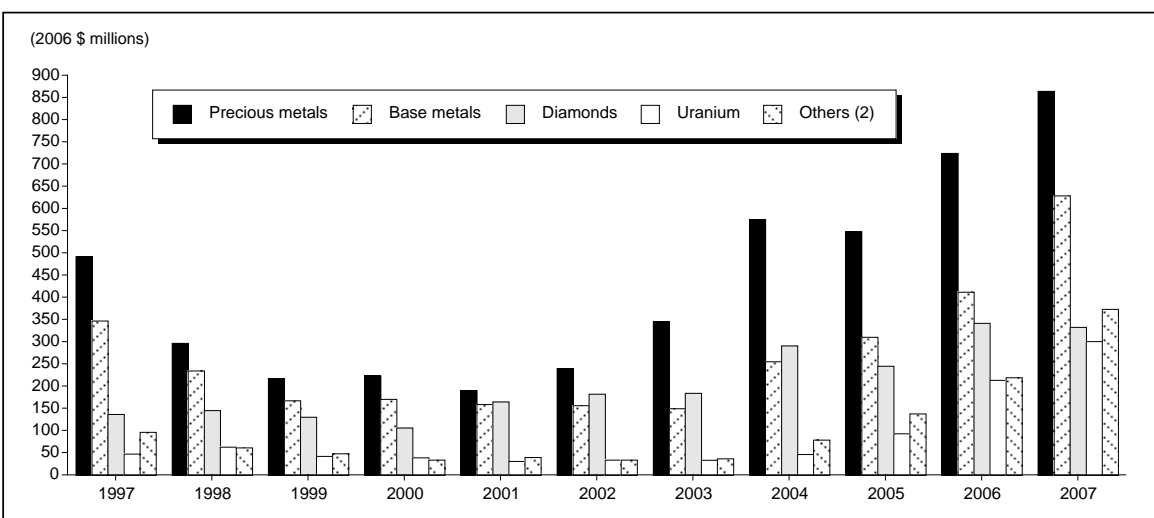
Sources: Natural Resources Canada and Statistics Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities; up to and including 1996, most of the expenditures now included in the deposit appraisal work phase were under exploration (broadly speaking). (2) Overhead includes mineral leases, claims, and project-related head-office expenditures. (3) Others include coal, iron, other metals, nonmetals, and unspecified mineral commodities where applicable.

Note: Data have not been compiled for 1976, 1978, 1980, 1982 and 1984.

Figure 5b

Exploration Plus Deposit Appraisal Expenditures, (1) by Mineral Commodity, 1997-2007

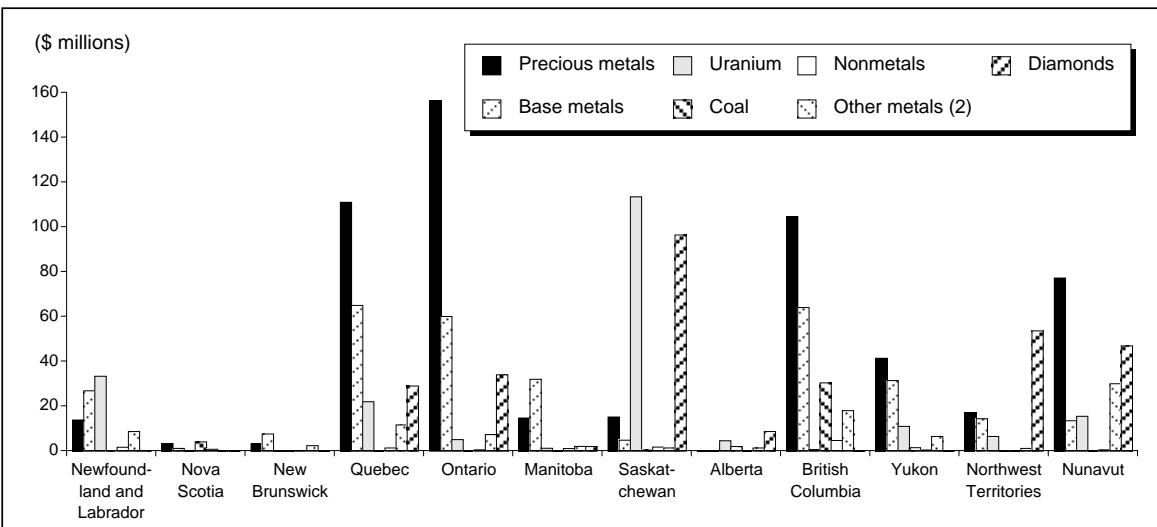


Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities for field work, overhead, engineering, economic pre- or production feasibility studies, environment and land access costs. (2) Others include coal, iron, other metals, and nonmetals.

Note: Data for 2007 are revised spending intentions.

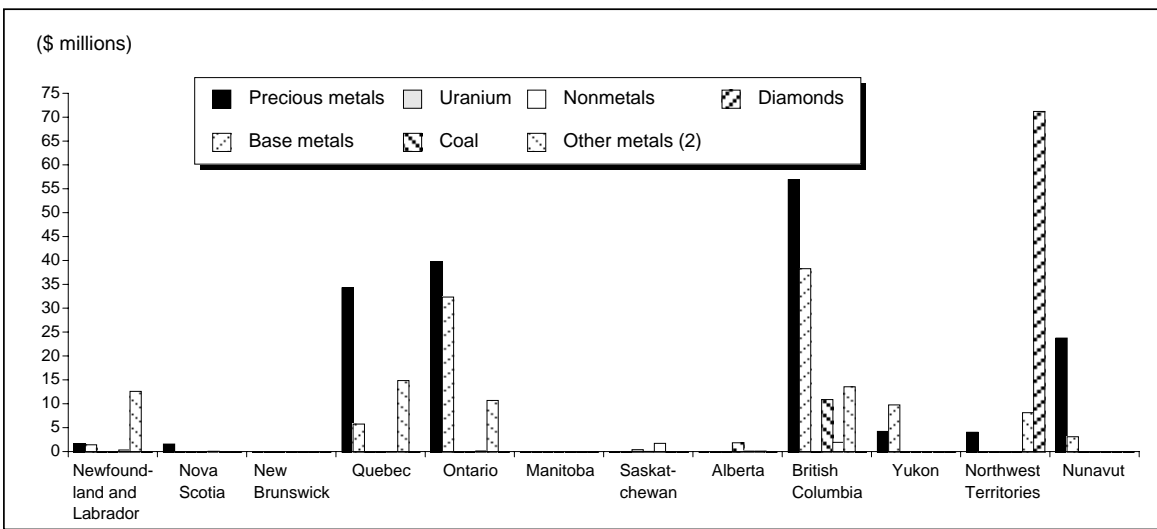
Figure 6a
Exploration Expenditures (1) by Province and Territory, by Mineral Commodity, 2006



Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre-feasibility studies, environment and land access costs. (2) Includes ferrous metals.

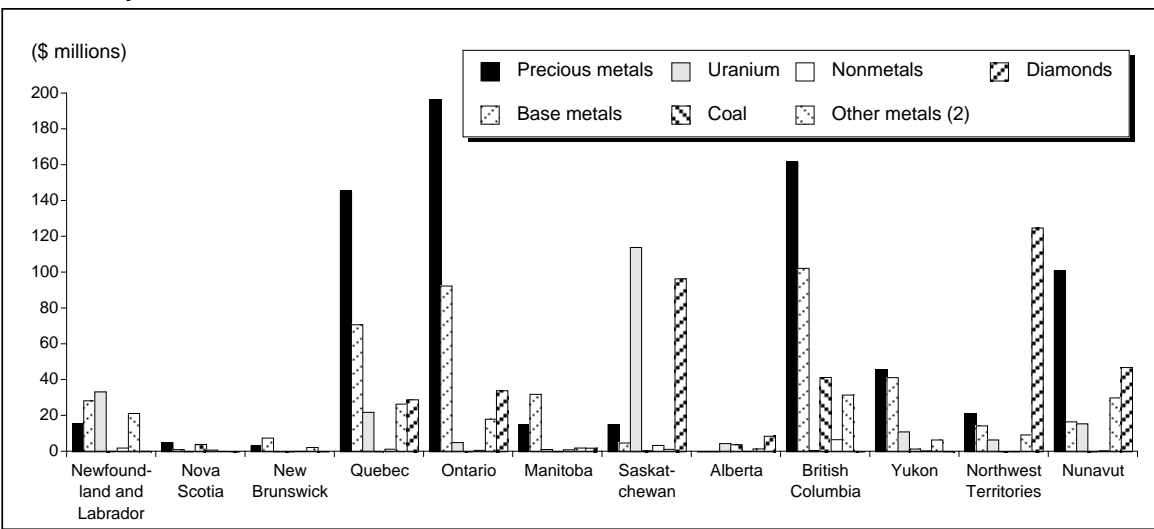
Figure 6b
Deposit Appraisal Expenditures (1) by Province and Territory, by Mineral Commodity, 2006



Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs. (2) Includes ferrous metals.

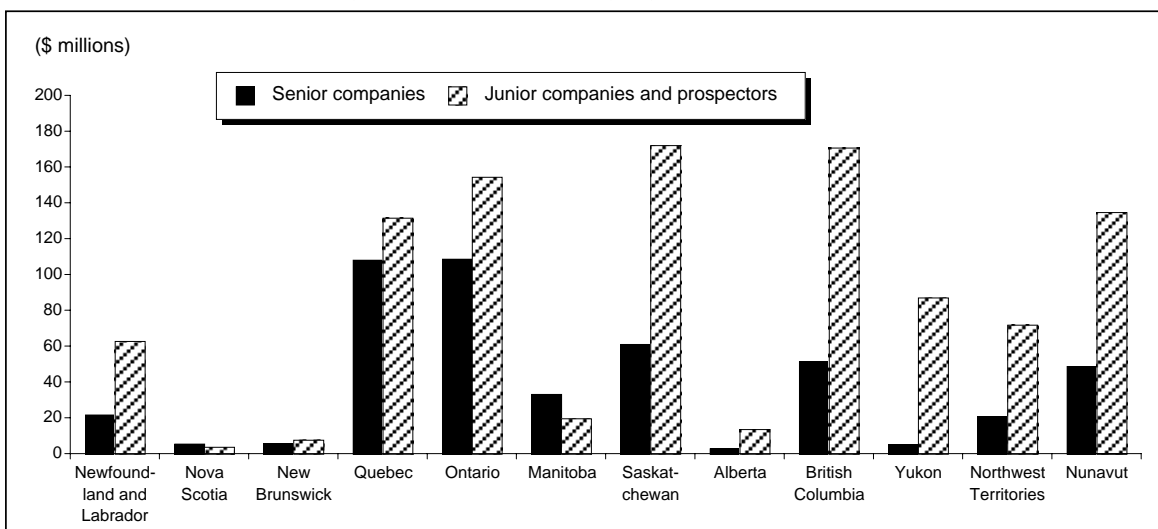
Figure 6c
Exploration Plus Deposit Appraisal Expenditures (1) by Province and Territory, by Mineral Commodity, 2006



Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs. (2) Includes ferrous metals.

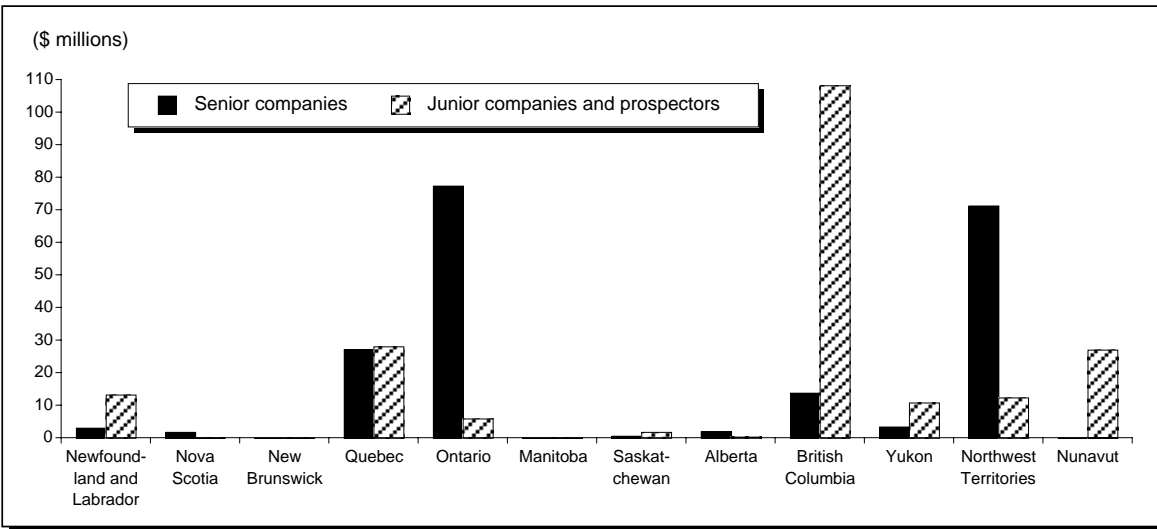
Figure 7a
Exploration Expenditures (1) by Province and Territory, by Junior and Senior Companies, 2006



Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

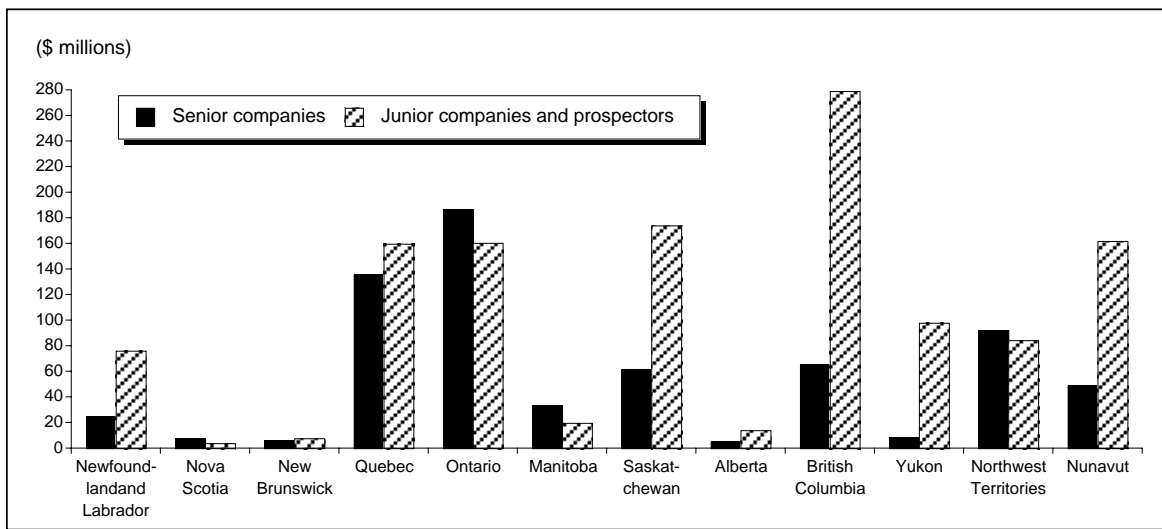
(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Figure 7b
Deposit Appraisal Expenditures (1) by Province and Territory, by Junior and Senior Companies, 2006



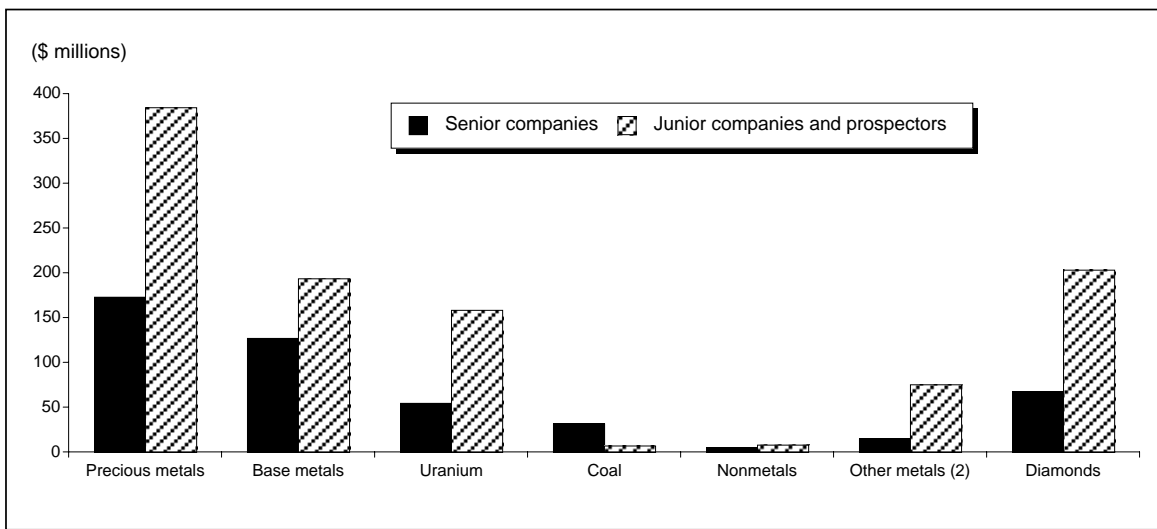
Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.
 (1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Figure 7c
Exploration and Deposit Appraisal Expenditures (1) by Province and Territory, by Junior and Senior Companies, 2006



Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.
 (1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

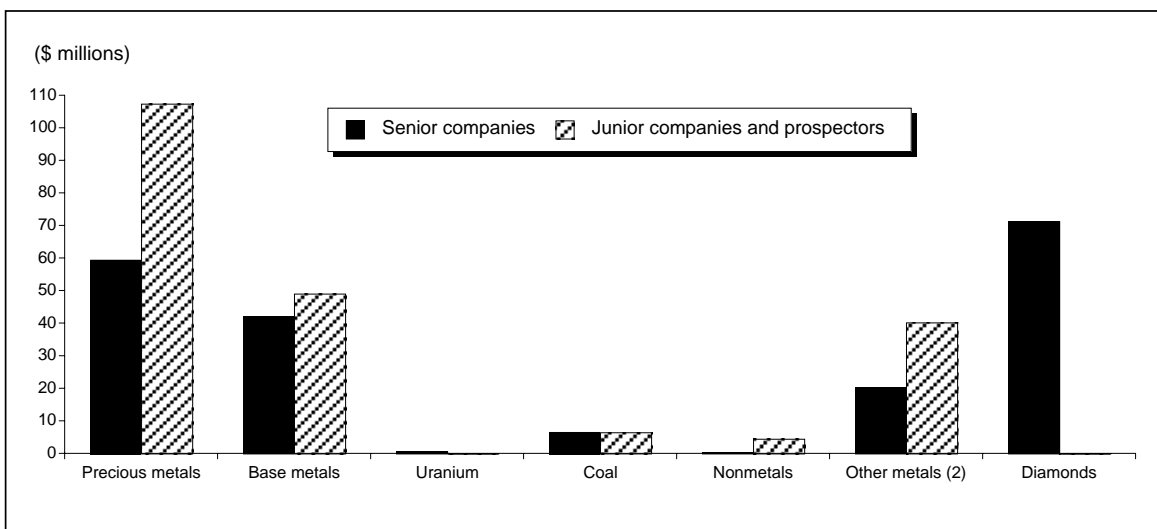
Figure 8a
Exploration Expenditures, (1) by Junior and Senior Companies, and by Mineral Commodity, 2006



Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre-feasibility studies, environment and land access costs. (2) Includes ferrous metals.

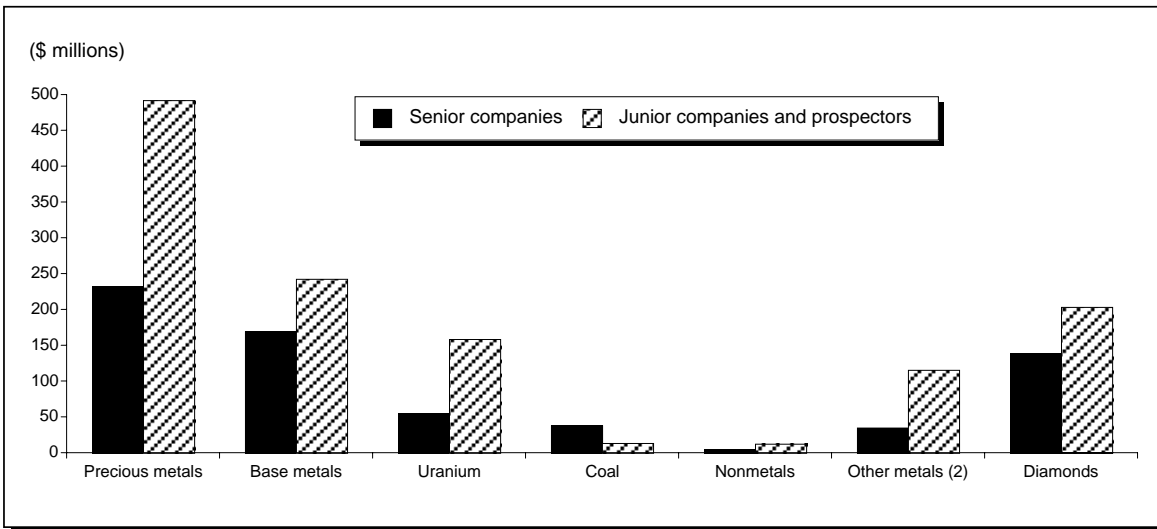
Figure 8b
Deposit Appraisal Expenditures, (1) by Junior and Senior Companies and by Mineral Commodity, 2006



Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs. (2) Includes ferrous metals.

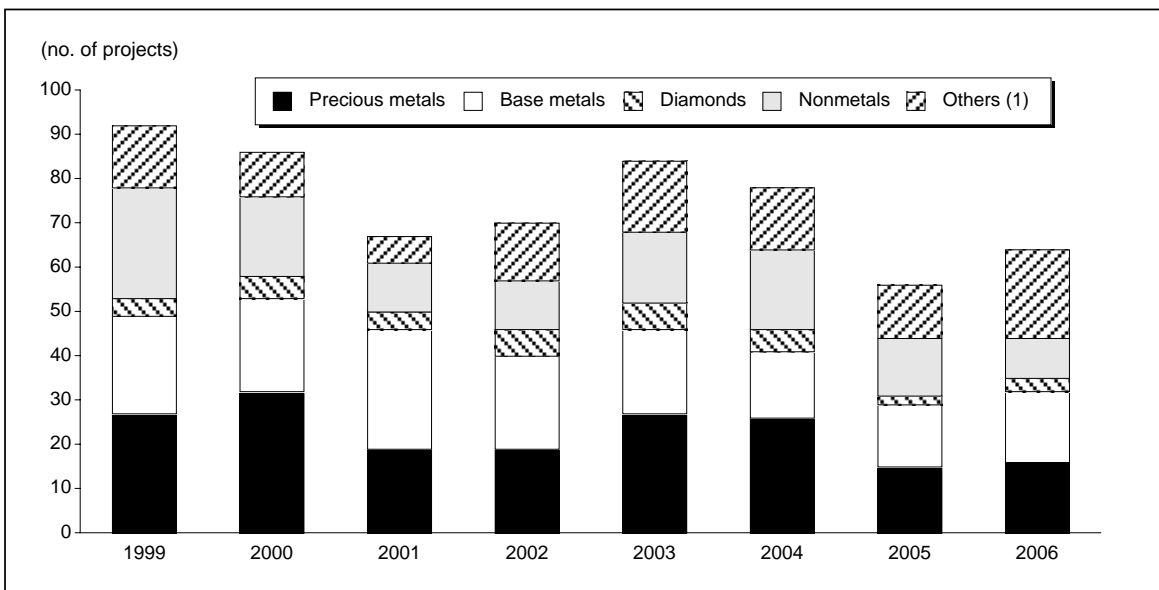
Figure 8c
Exploration Plus Deposit Appraisal Expenditures, (1) by Junior and Senior Companies, and by Mineral Commodity, 2006



Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs. (2) Includes ferrous metals.

Figure 9
Deposit Appraisal Off-Mine-Site, Number of Projects by Mineral Commodity, 1999-2006

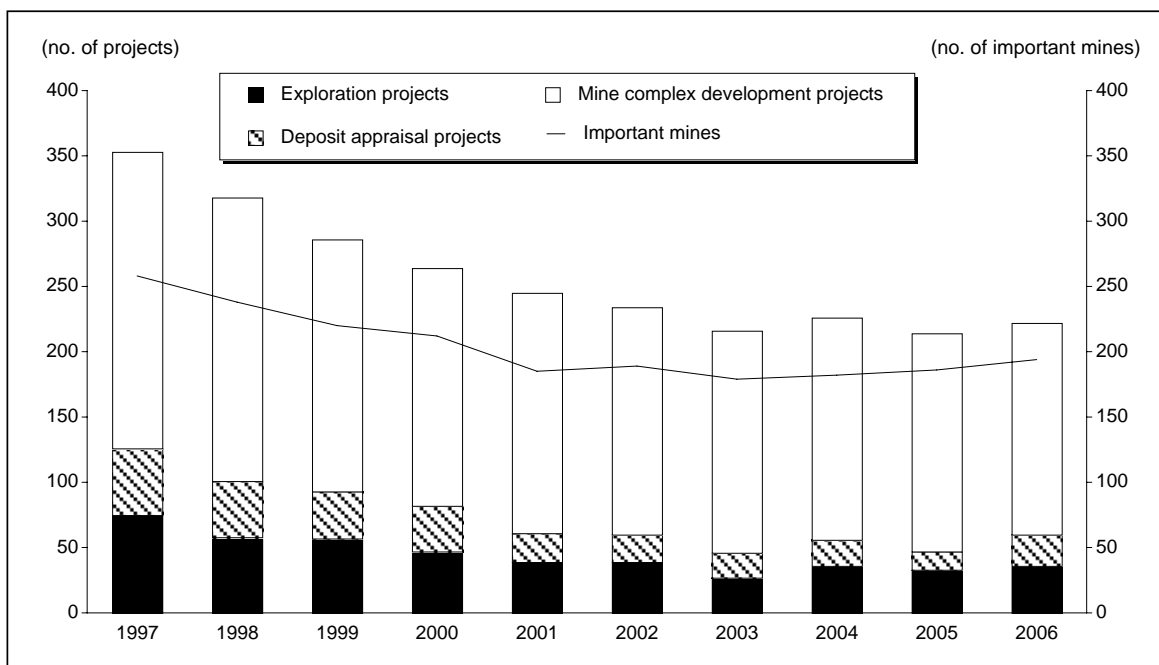


Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes iron, uranium, other metals, and coal.

Notes: In 2002 and 2003, the number of diamond projects includes two separate projects at Ekati. In 2004, classification criteria were strengthened making comparisons with previous years difficult.

Figure 10
Number of On-Mine-Site Projects by Work Phase, and Important Mines, 1997-2006



Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies and Map 900A.
 Notes: Projects exclude mills and plants. The number of important mines for 2006 is estimated due to changes in the methodology for compiling Map 900A.

TABLE 1. EXPLORATION, DEPOSIT APPRAISAL, AND MINE COMPLEX DEVELOPMENT ACTIVITY, ON- AND OFF-MINE-SITE, 2005-07

Expenditure Category by Work Phase	2005					2006					2007				
	Off-Mine-Site		On-Mine-Site		Total	Off-Mine-Site		On-Mine-Site		Total	Off-Mine-Site		On-Mine-Site		Total
	(\$ millions)	(%)	(\$ millions)	(%)	(\$ millions)	(\$ millions)	(%)	(\$ millions)	(%)	(\$ millions)	(\$ millions)	(%)	(\$ millions)	(%)	(\$ millions)
EXPLORATION															
Field work and overhead (1)	951.7	90.6	98.9	9.4	1 050.7	1 333.2	93.0	100.4	7.0	1 433.7	..	..	..	..	..
Engineering studies	37.5	98.9	0.4	1.1	37.9	22.6	99.8	0.1	0.2	22.7	..	..	..	..	..
Economic studies	1.1	100.0	—	—	1.1	1.0	100.0	—	—	1.0	..	..	..	..	..
Pre-feasibility studies	12.3	100.0	—	—	12.3	17.1	100.0	—	—	17.1	..	..	..	..	..
Environment	15.9	95.8	0.7	4.2	16.6	24.3	88.8	3.1	11.2	27.4	..	..	..	..	..
Land access	1.2	100.0	...	...	1.2	1.9	100.0	—	—	1.9	..	..	..	..	..
Subtotal	1 019.8	91.1	100.1	8.9	1 119.9	1 400.1	93.1	103.6	6.9	1 503.7	1 904.4	95.0	99.6	5.0	2 004.1
Capital (2)	29.5	99.7	0.1	0.3	29.6	33.0	100.0	—	—	33.0	33.1	99.1	0.3	0.9	33.4
Repair and maintenance (2)	3.2	93.6	0.2	6.4	3.4	6.0	99.4	...	0.6	6.0	..	..	..	..	..
Total	1 052.6	91.3	100.4	8.7	1 153.0	1 439.1	93.3	103.6	6.7	1 542.7	1 937.5	95.1	99.9	4.9	2 037.5
DEPOSIT APPRAISAL															
Field work and overhead	123.7	88.2	16.6	11.8	140.3	200.1	84.7	36.1	15.3	236.2	..	..	..	..	..
Engineering studies	7.3	98.2	0.1	1.8	7.4	56.5	97.4	1.5	2.6	58.0	..	..	..	..	..
Economic studies	0.6	91.9	0.1	8.1	0.7	0.5	100.0	—	—	0.5	..	..	..	..	..
Pre- or production feasibility studies	14.5	78.4	4.0	21.6	18.5	68.2	99.3	0.5	0.7	68.6	..	..	..	..	..
Environment	17.2	100.0	...	...	17.3	40.2	97.4	1.1	2.6	41.3	..	..	..	..	..
Land access	0.8	100.0	—	—	0.8	3.2	100.0	—	—	3.2	..	..	..	..	..
Subtotal	164.1	88.8	20.8	11.2	184.9	368.7	90.4	39.2	9.6	407.8	411.1	75.7	132.0	24.3	543.1
Capital (2)	118.4	96.5	4.3	3.5	122.7	78.9	92.3	6.6	7.7	85.5	169.4	92.7	13.2	7.3	182.7
Repair and maintenance (2)	1.2	3.3	36.0	96.7	37.2	4.4	22.0	15.8	78.0	20.2	..	..	..	..	..
Total	283.7	82.3	61.1	17.7	344.8	452.0	88.0	61.5	12.0	513.5	580.6	80.0	145.2	20.0	725.8
EXPLORATION PLUS DEPOSIT APPRAISAL															
Field work and overhead	1 075.4	90.3	115.5	9.7	1 191.0	1 533.3	91.8	136.6	8.2	1 669.8	..	..	..	..	..
Engineering studies	44.8	98.8	0.6	1.2	45.4	79.1	98.1	1.5	1.9	80.7	..	..	..	..	..
Economic studies	1.8	96.9	0.1	3.1	1.8	1.5	100.0	—	—	1.5	..	..	..	..	..
Pre- or production feasibility studies	26.8	87.0	4.0	13.0	30.8	85.2	99.5	0.5	0.5	85.7	..	..	..	..	..
Environment	33.1	97.9	0.7	2.1	33.8	64.6	93.9	4.2	6.1	68.7	..	..	..	..	..
Land access	2.0	100.0	...	...	2.0	5.1	100.0	—	—	5.1	..	..	..	..	..
Subtotal	1 183.9	90.7	120.9	9.1	1 304.8	1 768.8	92.5	142.7	7.5	1 911.5	2 315.5	90.9	231.6	9.1	2 547.1
Capital (2)	147.9	97.1	4.4	2.9	152.4	111.8	94.4	6.6	5.6	118.4	202.6	93.7	13.5	6.3	216.1
Repair and maintenance (2)	4.4	10.9	36.2	89.1	40.7	10.4	39.7	15.8	60.3	26.2	..	..	..	..	..
Total	1 336.3	89.2	161.5	10.8	1 497.8	1 891.1	92.0	165.1	8.0	2 056.2	2 518.1	91.1	245.1	8.9	2 763.3
MINE COMPLEX DEVELOPMENT															
Field work and overhead	n.a.	n.a.	983.3	100.0	983.3	n.a.	n.a.	1 009.6	100.0	1 009.6	n.a.	n.a.	..	..	..
Engineering studies	n.a.	n.a.	50.5	100.0	50.5	n.a.	n.a.	35.8	100.0	35.8	n.a.	n.a.	..	..	..
Economic studies	n.a.	n.a.	0.2	100.0	0.2	n.a.	n.a.	0.4	100.0	0.4	n.a.	n.a.	..	..	..
Pre- or production feasibility studies	n.a.	n.a.	14.2	100.0	14.2	n.a.	n.a.	11.8	100.0	11.8	n.a.	n.a.	..	..	..
Environment	n.a.	n.a.	72.3	100.0	72.3	n.a.	n.a.	77.3	100.0	77.3	n.a.	n.a.	..	..	..
Land access	n.a.	n.a.	10.8	100.0	10.8	n.a.	n.a.	13.6	100.0	13.6	n.a.	n.a.	..	..	..
Subtotal	n.a.	n.a.	1 131.4	100.0	1 131.4	n.a.	n.a.	1 148.5	100.0	1 148.5	n.a.	n.a.	1 309.0	100.0	1 309.0
Capital (2)	n.a.	n.a.	2 426.5	100.0	2 426.5	n.a.	n.a.	3 188.5	100.0	3 188.5	n.a.	n.a.	3 946.0	100.0	3 946.0
Repair and maintenance (2)	n.a.	n.a.	1 412.4	100.0	1 412.4	n.a.	n.a.	1 527.7	100.0	1 527.7	n.a.	n.a.	..	..	..
Total	n.a.	n.a.	4 970.3	100.0	4 970.3	n.a.	n.a.	5 864.7	100.0	5 864.7	n.a.	n.a.	5 255.0	100.0	5 255.0
Grand total	1 336.3	20.7	5 131.8	79.3	6 468.1	1 891.1	23.9	6 029.8	76.1	7 920.9	2 518.1	31.4	5 500.2	68.6	8 018.3

Sources: Natural Resources Canada and Statistics Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil; .. Not available; ... Amount too small to be expressed; n.a. Not applicable.

(1) Includes mineral leases, claims staking, and project-related head office expenditures. (2) Includes construction, and machinery and equipment expenditures, as well as related environmental protection and restoration expenditures.

Notes: Data for 2007 are revised spending intentions. Totals for 2007 exclude repair and maintenance expenditures. Numbers may not add to totals due to rounding.

TABLE 2. SUMMARY OF ENVIRONMENT EXPENDITURES FOR EXPLORATION, DEPOSIT APPRAISAL, AND MINE COMPLEX DEVELOPMENT, 2005 AND 2006

Expenditure Category	Exploration				Deposit Appraisal				Exploration Plus Deposit Appraisal				Mine Complex Development				Total			
	2005		2006		2005		2006		2005		2006		2005		2006		2005		2006	
	(\$000)	(%)	(\$000)	(%)	(\$000)	(%)	(\$000)	(%)	(\$000)	(%)	(\$000)	(%)	(\$000)	(%)	(\$000)	(%)	(\$000)	(%)	(\$000)	(%)
Environment																				
Characterization	9 246	55.3	11 793	40.5	9 995	57.9	25 713	62.1	19 240	56.6	37 506	53.2	3 458	2.0	5 707	4.8	22 698	10.8	43 213	22.7
Permits	4 382	26.2	8 210	28.2	5 131	29.7	13 565	32.8	9 513	28.0	21 774	30.9	7 886	4.5	8 404	7.0	17 399	8.3	30 178	15.9
Protection (1)	1 798	10.8	992	3.4	1 964	11.4	1 569	3.8	3 762	11.1	2 561	3.6	34 527	19.7	39 792	33.2	38 289	18.3	42 353	22.2
Restoration (2)	1 154	6.9	6 403	22.0	164	1.0	475	1.2	1 318	3.9	6 877	9.8	26 474	15.1	23 410	19.5	27 792	13.3	30 288	15.9
Subtotal	16 580		27 397		17 253		41 322		33 833		68 718		72 345		77 314		106 178		146 032	
Capital, share of environment	147	0.9	502	1.7	—	—	—	—	147	0.4	502	0.7	47 523	27.1	24 973	20.8	47 670	22.8	25 475	13.4
Repair and maintenance, share of environment	2	...	1 204	4.1	7	...	95	0.2	9	...	1 299	1.8	55 523	31.7	17 634	14.7	55 532	26.5	18 933	9.9
Total environment	16 729	100.0	29 103	100.0	17 260	100.0	41 417	100.0	33 988	100.0	70 519	100.0	175 391	100.0	119 920	100.0	209 379	100.0	190 440	100.0
Total environment as a percentage of work phase total (3)		1.5		1.9		5.0		8.1		2.3		3.4		3.5		2.0		3.2		2.4

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil.

(1) Additional to normal practice. (2) Excludes reclamation of permanently closed mine sites. (3) Work phase total refers to Table 1.

Notes: Numbers may not add to totals due to rounding. Data may be overlooked at times by some companies.

**TABLE 3a. EXPLORATION PLUS DEPOSIT APPRAISAL EXPENDITURES, (1)
FIELD WORK PLUS OVERHEAD, (2) BY JUNIOR AND SENIOR COMPANIES,
1969-2006**

Year	Current Dollars				Constant 2006 Dollars			
	Share of Total		Total	% of Total Junior	Share of Total		Total	% of Total Junior
	Junior	Senior			Junior	Senior		
	(\$ millions)			(%)	(\$ millions)			(%)
1969	44.4	130.5	174.9	25.4	243.1	714.6	957.7	25.4
1970	39.9	147.2	187.1	21.3	209.3	772.3	981.6	21.3
1971	24.5	127.5	152.0	16.1	122.8	639.2	762.0	16.1
1972	18.3	97.4	115.7	15.8	86.7	461.6	548.4	15.8
1973	22.5	121.6	144.1	15.6	97.2	525.5	622.8	15.6
1974	21.8	158.5	180.3	12.1	81.7	594.0	675.7	12.1
1975	19.5	187.8	207.3	9.4	66.1	636.2	702.2	9.4
1976	13.9	192.9	206.8	6.7	43.0	596.1	639.1	6.7
1977	12.5	271.0	283.5	4.4	36.2	785.8	822.1	4.4
1978	19.8	275.0	294.8	6.7	53.8	747.5	801.3	6.7
1979	29.4	329.5	358.9	8.2	72.6	813.3	885.9	8.2
1980	60.2	530.0	590.2	10.2	135.0	1 188.5	1 323.5	10.2
1981	83.0	651.2	734.2	11.3	168.1	1 318.8	1 486.9	11.3
1982	73.8	502.5	576.3	12.8	137.8	938.4	1 076.3	12.8
1983	71.2	400.6	471.8	15.1	126.1	709.4	835.5	15.1
1984	146.9	470.4	617.3	23.8	251.8	806.4	1 058.2	23.8
1985	181.1	424.7	605.8	29.9	301.4	706.5	1 007.9	29.9
1986	348.6	374.7	723.3	48.2	562.6	604.6	1 167.2	48.2
1987	668.2	631.8	1 300.0	51.4	1 031.1	974.9	2 006.0	51.4
1988	668.3	681.8	1 350.0	49.5	986.7	1 006.6	1 993.2	49.5
1989	272.6	555.3	827.9	32.9	385.3	784.9	1 170.3	32.9
1990	241.0	533.7	774.7	31.1	329.9	730.6	1 060.5	31.1
1991	116.1	415.6	532.0	21.8	154.5	552.9	707.7	21.8
1992	79.9	305.4	385.3	20.7	104.9	401.0	506.0	20.7
1993	142.7	334.5	477.3	29.9	184.6	432.7	617.4	29.9
1994	195.8	432.3	628.1	31.2	250.4	552.9	803.3	31.2
1995	213.4	504.2	717.6	29.7	266.9	630.5	897.4	29.7
1996	318.1	576.7	894.8	35.6	391.7	710.1	1 101.8	35.6
1997	266.7	553.4	820.2	32.5	324.2	672.8	997.0	32.5
1998	155.9	420.0	575.9	27.1	190.5	513.3	703.8	27.1
1999	123.3	314.6	437.9	28.2	148.1	377.9	526.0	28.2
2000	142.3	315.8	458.1	31.1	164.1	364.3	528.3	31.1
2001	167.7	302.4	470.1	35.7	191.3	344.9	536.1	35.7
2002	179.0	318.2	497.2	36.0	201.9	358.9	560.9	36.0
2003	267.2	347.0	614.2	43.5	291.7	378.9	670.6	43.5
2004	560.4	502.6	1 063.0	52.7	593.0	531.8	1 124.8	52.7
2005	714.2	476.8	1 191.0	60.0	731.1	488.0	1 219.1	60.0
2006	1 063.4	606.4	1 669.8	63.7	1 063.4	606.4	1 669.8	63.7

Sources: Natural Resources Canada and Statistics Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. (2) Includes mineral leases, claims, property taxes, and project-related head office expenditures.

Notes: Up to and including 1996, most of the expenditures now included in the deposit appraisal work phase were reported under exploration (broadly speaking). For 1987 and 1988, totals with overhead were calculated by multiplying the field expenditures by the ratio total/field from Statistics Canada.

**TABLE 3b. EXPLORATION PLUS DEPOSIT APPRAISAL EXPENDITURES, (1)
BY JUNIOR AND SENIOR COMPANIES, 1997-2007**

Year	Current Dollars				Constant 2006 Dollars			
	Share of Total		Total	% of Total Junior	Share of Total		Total	% of Total Junior
	Junior	Senior			Junior	Senior		
	(\$ millions)			(%)	(\$ millions)			(%)
1997	298.0	623.0	921.0	32.4	362.2	757.3	1 119.5	32.4
1998	170.5	485.4	655.9	26.0	208.4	593.2	801.6	26.0
1999	141.4	362.9	504.3	28.0	169.9	436.0	605.9	28.0
2000	156.0	340.7	496.7	31.4	179.9	392.9	572.8	31.4
2001	177.7	335.1	512.9	34.7	202.7	382.2	585.0	34.7
2002	190.8	382.6	573.4	33.3	215.2	431.6	646.8	33.3
2003	283.7	403.0	686.7	41.3	309.8	440.1	749.9	41.3
2004	599.7	578.1	1 177.8	50.9	634.6	611.7	1 246.3	50.9
2005	801.3	503.5	1 304.8	61.4	820.2	515.4	1 335.6	61.4
2006	1 238.0	673.5	1 911.5	64.8	1 238.0	673.5	1 911.5	64.8
2007	1 558.8	988.4	2 547.1	61.2	1 530.3	970.3	2 500.6	61.2

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Note: Data for 2007 are revised spending intentions.

TABLE 3c. EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES, (1) ON- AND OFF-MINE-SITE, BY JUNIOR AND SENIOR COMPANIES, 1997-2007

	Exploration		Deposit Appraisal		Exploration Plus Deposit Appraisal		Exploration Plus Deposit Appraisal
	On-Mine-Site	Off-Mine-Site	On-Mine-Site	Off-Mine-Site	On-Mine-Site	Off-Mine-Site	On- and Off-Mine-Site
(\$000)							
1997							
Junior	n.a.	233 231	n.a.	64 730	n.a.	297 961	297 961
Senior	62 383	338 796	105 608	116 222	167 991	455 018	623 009
Total	62 383	572 027	105 608	180 951	167 991	752 979	920 970
1998							
Junior	n.a.	144 970	n.a.	25 573	n.a.	170 544	170 544
Senior	67 875	249 959	61 535	106 018	129 411	355 977	485 387
Total	67 875	394 929	61 535	131 591	129 411	526 520	655 931
1999							
Junior	n.a.	92 926	n.a.	48 498	n.a.	141 424	141 424
Senior	44 471	177 262	42 302	98 889	86 773	276 151	362 924
Total	44 471	270 188	42 302	147 386	86 773	417 575	504 348
2000							
Junior	n.a.	127 901	n.a.	28 109	n.a.	156 010	156 010
Senior	30 743	183 881	42 273	83 744	73 016	267 625	340 641
Total	30 743	311 782	42 273	111 853	73 016	423 635	496 651
2001							
Junior	n.a.	157 913	n.a.	19 820	n.a.	177 733	177 733
Senior	42 297	180 963	29 173	82 704	71 469	263 667	335 136
Total	42 297	338 876	29 173	102 524	71 469	441 400	512 869
2002							
Junior	n.a.	172 402	n.a.	18 391	n.a.	190 793	190 793
Senior	56 408	174 735	23 863	127 621	80 272	302 356	382 628
Total	56 408	347 137	23 863	146 012	80 272	493 149	573 421
2003							
Junior	n.a.	256 578	n.a.	27 110	n.a.	283 688	283 688
Senior	60 203	221 272	25 370	96 203	85 572	317 475	403 047
Total	60 203	477 850	25 370	123 313	85 572	601 163	686 735
2004							
Junior	n.a.	523 104	n.a.	76 614	n.a.	599 718	599 718
Senior	84 431	295 943	52 095	145 598	136 526	441 541	578 067
Total	84 431	819 047	52 095	222 212	136 526	1 041 259	1 177 785
2005							
Junior	n.a.	718 838	n.a.	82 449	n.a.	801 287	801 287
Senior	100 073	301 002	20 780	81 648	120 853	382 650	503 504
Total	100 073	1 019 840	20 780	164 097	120 853	1 183 937	1 304 790
2006							
Junior	n.a.	1 030 516	n.a.	207 514	n.a.	1 238 031	1 238 031
Senior	103 562	369 602	39 157	161 176	142 719	530 777	673 496
Total	103 562	1 400 118	39 157	368 690	142 719	1 768 808	1 911 527
2007							
Junior	n.a.	1 400 666	n.a.	158 093	n.a.	1 558 759	1 558 759
Senior	99 643	503 743	131 956	253 035	231 599	756 779	988 378
Total	99 643	1 904 409	131 956	411 128	231 599	2 315 538	2 547 136

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

n.a. Not applicable.

(1) Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Notes: Data for 2007 are revised spending intentions. Numbers may not add to totals due to rounding.

TABLE 4. EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES IN CANADA, (1) BY RANGE OF EXPENDITURES AND BY TYPE OF COMPANY, 2004-07

Range of Expenditures	Junior			Senior			Total		
	Companies	Expenditures	Percentage of Total Expenditures	Companies	Expenditures	Percentage of Total Expenditures	Companies	Expenditures	Percentage of Total Expenditures
(\$)	(number)	(\$000)	(%)	(number)	(\$000)	(%)	(number)	(\$000)	(%)
2004									
>10 million	6	80 773	13.5	16	420 603	72.8	22	501 376	42.6
5 million-10 million	22	155 683	26.0	10	80 607	13.9	32	236 292	20.1
1 million-5 million	111	243 179	40.5	22	61 691	10.7	133	304 870	25.9
500 000-1 million	88	63 673	10.6	12	8 782	1.5	100	72 456	6.2
200 000-500 000	110	36 254	6.0	13	4 154	0.7	123	40 408	3.4
100 000-200 000	74	10 403	1.7	9	1 188	0.2	83	11 591	1.0
50 000-100 000	59	4 225	0.7	9	617	0.1	68	4 842	0.4
1-50 000	119	2 129	0.4	21	424	0.1	140	2 553	0.2
Subtotal	589	596 319	99.4	112	578 067	100.0	701	1 174 386	99.7
Prospectors (2)	13	3 399	0.6	—	—	—	13	3 399	0.3
Total 2004	602	599 718	100.0	112	578 067	100.0	714	1 177 785	100.0
2005									
>10 million	13	238 275	29.7	15	338 015	67.1	28	576 290	44.2
5 million-10 million	18	124 974	15.6	15	93 467	18.6	33	218 441	16.7
1 million-5 million	148	311 358	38.9	22	60 955	12.1	170	372 314	28.5
500 000-1 million	99	71 285	8.9	10	7 095	1.4	109	78 381	6.0
200 000-500 000	111	36 125	4.5	7	2 495	0.5	118	38 621	2.9
100 000-200 000	70	9 973	1.2	6	722	0.1	76	10 696	0.8
50 000-100 000	59	4 075	0.5	5	369	0.1	64	4 444	0.3
1-50 000	124	2 399	0.3	20	384	0.1	144	2 783	0.2
Subtotal	642	798 466	99.6	100	503 503	100.0	742	1 301 969	99.8
Prospectors (2)	11	2 821	0.4	—	—	—	11	2 821	0.2
Total 2005	653	801 287	100.0	100	503 503	100.0	753	1 304 790	100.0
2006									
>10 million	20	428 611	34.6	20	477 257	70.9	40	905 868	47.4
5 million-10 million	36	247 745	20.0	15	114 204	17.0	51	361 949	18.9
1 million-5 million	202	438 012	35.4	25	71 308	10.6	227	509 320	26.6
500 000-1 million	96	69 404	5.6	5	4 066	0.6	101	73 470	3.8
200 000-500 000	99	34 444	2.8	11	3 813	0.6	110	38 257	2.0
100 000-200 000	63	9 532	0.8	14	1 884	0.3	77	11 417	0.6
50 000-100 000	44	3 331	0.3	7	541	0.1	51	3 871	0.2
1-50 000	89	1 517	0.1	22	424	0.1	111	1 941	0.1
Subtotal	649	1 232 596	99.6	119	673 073	100.0	768	1 906 093	99.7
Prospectors (2)	13	5 434	0.4	—	—	—	13	5 434	0.3
Total 2006	662	1 238 031	100.0	119	673 073	100.0	781	1 911 527	100.0
2007									
>10 million	25	500 943	32.1	26	752 248	76.1	51	1 253 191	49.2
5 million-10 million	55	398 380	25.6	20	146 986	14.9	75	545 365	21.4
1 million-5 million	217	525 651	33.7	25	72 674	7.4	242	598 325	23.5
500 000-1 million	97	79 408	5.1	13	10 771	1.1	110	90 179	3.5
200 000-500 000	115	42 989	2.8	9	2 934	0.3	124	45 924	1.8
100 000-200 000	35	5 755	0.4	11	1 716	0.2	46	7 470	0.3
50 000-100 000	26	2 218	0.1	8	740	0.1	34	2 958	0.1
1-50 000	68	1 398	0.1	20	310	...	88	1 707	0.1
Subtotal	638	1 556 742	99.9	132	988 378	100.0	770	2 545 119	99.9
Prospectors (2)	10	2 017	0.1	—	—	—	10	2 017	0.1
Total 2007 (rsi)	648	1 558 759	100.0	132	988 378	100.0	780	2 547 136	100.0

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil; ... Amount too small to be expressed; (rsi) Revised spending intentions.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs. (2) The number of prospectors is underestimated because it contains groups of prospectors.

Notes: Data for 2007 are revised spending intentions. Numbers may not add to totals due to rounding.

TABLE 5. SUMMARY OF TOTAL DIAMOND EXPLORATION, DEPOSIT APPRAISAL, AND MINE COMPLEX DEVELOPMENT EXPENDITURES, (1) 1997-2006

Expenditure Category	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	(\$ millions)									
Field work and overhead (2)	116.2	148.9	83.9	95.0	240.2	188.3	188.9	339.9	334.4	440.2
Engineering, economic and pre- or production feasibility studies, environment and land access	20.2	36.7	25.0	55.2	27.5	34.4	41.3	45.8	28.5	38.4
Capital (3)	251.7	155.9	13.3	226.3	531.4	459.7	53.9	203.8	477.2	1 064.3
Repair (3)	0.1	5.4	62.7	55.5	88.4	63.3	43.3	126.8	142.8	54.2
Total	388.1	347.1	185.0	432.1	887.4	745.7	327.4	716.3	982.9	1 597.1

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. (2) Includes mineral leases, claims staking, and project-related head office expenditures. (3) Includes construction, and machinery and equipment expenditures.

Note: Numbers may not add to totals due to rounding.

TABLE 6a. AREA (1) OF NEW MINERAL CLAIMS STAKED OR RECORDED IN CANADA AS A PERCENTAGE OF PREVIOUS YEAR, 2002-06

Province/Territory	2002		2003		2004		2005		2006	
	(hectares)	(%)	(hectares)	(%)	(hectares)	(%)	(hectares)	(%)	(hectares)	(%)
Newfoundland and Labrador	828 150	211.5	338 675	40.9	482 875	142.6	1 051 675	217.8	1 437 800	136.7
Nova Scotia	147 713	168.4	202 784	137.3	63 764	31.4	226 920	355.9	313 590	138.2
New Brunswick	33 888	94.9	46 976	138.6	102 816	218.9	49 536	48.2	65 872	133.0
Quebec	3 290 446	155.5	1 204 523	36.6	1 546 640	128.4	2 543 508	164.5	2 294 635	90.2
Ontario	813 424	82.8	951 488	117.0	931 072	97.9	879 824	94.5	1 070 816	121.7
Manitoba	1 287 997	122.2	879 155	68.3	1 620 449	184.3	458 633	28.3	822 074	179.2
Saskatchewan	339 490	60.8	438 819	129.3	1 854 008	422.5	4 464 628	240.8	4 579 521	102.6
Alberta	4 670 028	111.4	2 904 300	62.2	4 727 344	162.8	5 234 000	110.7	3 789 296	72.4
British Columbia	688 500	108.1	912 575	132.5	1 169 050	128.1	4 864 000	416.1	5 976 649	122.9
Yukon	81 872	201.4	75 038	91.7	169 997	226.5	115 630	68.0	259 056	224.0
Northwest Territories (2)	1 099 888	175.7	391 371	35.6	2 095 979	535.5	1 234 930	58.9	1 861 163	150.7
Nunavut (2)	3 623 559	821.2	2 054 000	56.7	4 188 834	203.9	1 852 112	44.2	1 757 506	94.9
Total	16 904 955	151.5	10 399 704	61.5	18 952 828	182.2	22 975 396	121.2	24 227 978	105.5

Source: Provincial and territorial mining recorders.

(1) Excludes coal, potash, salt, and industrial minerals, except for Alberta where industrial minerals are included. (2) Excludes prospecting permits.

Note: Numbers may not add to totals due to rounding.

TABLE 6b. AREA (1) OF NEW MINERAL CLAIMS STAKED OR RECORDED BY PROVINCE AND TERRITORY AS A PERCENTAGE OF TOTAL CANADA, 2001-06

Province/Territory	2001		2002		2003		2004		2005		2006	
	(hectares)	(%)	(hectares)	(%)	(hectares)	(%)	(hectares)	(%)	(hectares)	(%)	(hectares)	(%)
Newfoundland and Labrador	391 625	3.5	828 150	4.9	338 675	3.3	482 875	2.5	1 051 675	4.6	1 437 800	5.9
Nova Scotia	87 722	0.8	147 713	0.9	202 784	1.9	63 764	0.3	226 920	1.0	313 590	1.3
New Brunswick	35 712	0.3	33 888	0.2	46 976	0.5	102 816	0.5	49 536	0.2	65 872	0.3
Quebec	2 115 424	19.0	3 290 446	19.5	1 204 523	11.6	1 546 640	8.2	2 543 508	11.1	2 294 635	9.5
Ontario	981 904	8.8	813 424	4.8	951 488	9.1	931 072	4.9	879 824	3.8	1 070 816	4.4
Manitoba	1 054 106	9.4	1 287 997	7.6	879 155	8.5	1 620 449	8.5	458 633	2.0	822 074	3.4
Saskatchewan	558 131	5.0	339 490	2.0	438 819	4.2	1 854 008	9.8	4 464 628	19.4	4 579 521	18.9
Alberta	4 192 055	37.6	4 670 028	27.6	2 904 300	27.9	4 727 344	24.9	5 234 000	22.8	3 789 296	15.6
British Columbia	636 800	5.7	688 500	4.1	912 575	8.8	1 169 050	6.2	4 864 000	21.2	5 976 649	24.7
Yukon	40 644	0.4	81 872	0.5	75 038	0.7	169 997	0.9	115 630	0.5	259 056	1.1
Northwest Territories (2)	626 177	5.6	1 099 888	6.5	391 371	3.8	2 095 979	11.1	1 234 930	5.4	1 861 163	7.7
Nunavut (2)	441 270	4.0	3 623 559	21.4	2 054 000	19.8	4 188 834	22.1	1 852 112	8.1	1 757 506	7.3
Total	11 161 570	100.0	16 904 955	100.0	10 399 704	100.0	18 952 828	100.0	22 975 396	100.0	24 227 978	100.0

Source: Provincial and territorial mining recorders.

(1) Excludes coal, potash, salt, and industrial minerals, except for Alberta where industrial minerals are included. (2) Excludes prospecting permits.

Note: Numbers may not add to totals due to rounding.

TABLE 7a. EXPLORATION AND DEPOSIT APPRAISAL, OFF-MINE-SITE AND ON-MINE-SITE EXPENDITURES, (1) BY PROVINCE AND TERRITORY, 2006

Province/Territory	Exploration		Deposit Appraisal		Exploration Plus Deposit Appraisal	
	Off-Mine-Site	On-Mine-Site	Off-Mine-Site	On-Mine-Site	Off-Mine-Site	On-Mine-Site
(\$000)						
Newfoundland and Labrador	83 916	651	13 273	2 996	97 189	3 648
Nova Scotia	9 272	—	1 644	130	10 916	130
New Brunswick	13 375	—	—	—	13 375	—
Quebec	228 368	11 505	37 121	18 078	265 489	29 583
Ontario	199 139	64 112	71 500	11 751	270 639	75 864
Manitoba	40 791	12 137	—	—	40 791	12 137
Saskatchewan	232 679	600	2 362	—	235 041	600
Alberta	16 443	—	325	1 912	16 768	1 912
British Columbia	212 235	10 046	117 672	4 290	329 907	14 335
Yukon	87 686	4 510	14 155	—	101 841	4 510
Northwest Territories	92 584	—	83 628	—	176 211	—
Nunavut	183 631	—	27 009	—	210 640	—
Total	1 400 118	103 562	368 690	39 157	1 768 808	142 719
Total (on- plus off-mine-site)	1 503 680		407 847		1 911 527	

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil.

(1) Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Note: Numbers may not add to totals due to rounding.

TABLE 7b. EXPLORATION AND DEPOSIT APPRAISAL, OFF-MINE-SITE AND ON-MINE-SITE EXPENDITURES, (1) BY PROVINCE AND TERRITORY, 2007

Province/Territory	Exploration		Deposit Appraisal		Exploration Plus Deposit Appraisal	
	Off-Mine-Site	On-Mine-Site	Off-Mine-Site	On-Mine-Site	Off-Mine-Site	On-Mine-Site
(\$000)						
Newfoundland and Labrador	110 678	356	44 192	4 785	154 870	5 141
Nova Scotia	25 116	100	1 500	140	26 616	240
New Brunswick	28 057	1 925	—	550	28 057	2 475
Quebec	295 482	19 201	61 500	9 070	356 982	28 271
Ontario	279 838	48 247	109 074	82 009	388 912	130 256
Manitoba	82 146	11 000	9 965	—	92 111	11 000
Saskatchewan	277 405	—	—	—	277 405	—
Alberta	14 036	—	828	2 500	14 864	2 500
British Columbia	333 886	13 915	62 258	15 181	396 144	29 096
Yukon	104 281	4 000	35 641	—	139 922	4 000
Northwest Territories	123 843	898	49 160	17 721	173 003	18 619
Nunavut	229 640	—	37 011	—	266 651	—
Total	1 904 409	99 643	411 128	131 956	2 315 538	231 599
Total (on- plus off-mine-site)	2 004 052		543 084		2 547 136	

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil.

(1) Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Notes: Data for 2007 are revised spending intentions. Numbers may not add to totals due to rounding.

TABLE 8. EXPLORATION PLUS DEPOSIT APPRAISAL EXPENDITURES, (1) BY PROVINCE AND TERRITORY, AS A PERCENTAGE OF TOTAL AND AS A PERCENTAGE OF THE PREVIOUS YEAR, 2004-07

Province/Territory	2004			2005			2006			2007		
			2004 as a % of 2003 Expenditures			2005 as a % of 2004 Expenditures			2006 as a % of 2005 Expenditures			2007 as a % of 2006 Expenditures
	(\$ millions)	(%)	(%)	(\$ millions)	(%)	(%)	(\$ millions)	(%)	(%)	(\$ millions)	(%)	(%)
Newfoundland and Labrador	33.2	2.8	143.9	48.7	3.7	146.6	100.8	5.3	207.2	160.0	6.3	158.7
Nova Scotia	9.1	0.8	143.0	6.5	0.5	71.2	11.1	0.6	169.7	26.9	1.1	243.1
New Brunswick	13.4	1.1	524.2	10.1	0.8	75.3	13.4	0.7	132.9	30.5	1.2	228.3
Quebec	227.2	19.3	169.5	205.1	15.4	90.3	295.1	15.4	143.9	385.3	15.1	130.6
Ontario	306.9	26.1	139.9	294.0	22.5	95.8	346.5	18.1	117.8	519.2	20.4	149.8
Manitoba	36.0	3.1	132.7	52.9	4.0	146.7	52.9	2.8	100.1	103.1	4.1	194.8
Saskatchewan	71.8	6.1	150.4	133.9	10.1	186.5	235.6	12.3	176.0	277.4	10.9	117.7
Alberta	6.3	0.5	129.1	6.6	0.5	104.7	18.7	1.0	281.7	17.4	0.7	93.0
British Columbia	151.9	12.9	243.0	218.1	16.4	143.5	344.2	18.0	157.9	425.2	16.7	123.5
Yukon	22.0	1.9	173.3	54.0	4.1	245.7	106.4	5.6	197.0	143.9	5.7	135.3
Northwest Territories	112.4	9.5	209.8	96.3	7.3	85.7	176.2	9.2	182.9	191.6	7.5	108.8
Nunavut	187.5	15.9	202.3	178.7	13.5	95.3	210.6	11.0	117.9	266.7	10.5	126.6
Total	1 177.8	100	171.5	1 304.8	100	110.8	1 911.5	100.0	146.5	2 547.1	100.0	133.3
Exploration	903.5	76.7	167.9	1 119.9	84.3	124.0	1 503.7	78.7	134.3	2 004.1	78.7	133.3
Deposit appraisal	274.3	23.3	184.5	184.9	15.7	67.4	407.9	21.3	220.6	543.1	21.3	133.2

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Notes: Data for 2007 are revised spending intentions. Numbers may not add to totals due to rounding.

TABLE 9a. EXPLORATION ACTIVITY, (1) BY PROVINCE AND TERRITORY, 2006

Province/Territory	Drilling (Surface and Underground)				Geochemistry	Geology	Geophysics		Rock Work (2)	Other Field Costs	Engineering Studies	Economic Studies	Pre- Feasibility Studies	Mineral Lease and Head Office	Environment	Land Access	Grand Total
	Diamond		Other				Ground	Airborne									
	Metres	Cost	Metres	Cost													
	(000)	(\$000)	(000)	(\$000)													
Newfoundland and Labrador	245	42 395	—	—	2 087	13 585	4 249	6 647	245	5 938	961	20	2 697	5 253	251	239	84 567
Nova Scotia	24	2 338	9	449	752	1 263	319	40	1 500	50	213	12	1 500	225	610	—	9 272
New Brunswick	52	7 090	—	—	262	2 019	2 509	202	53	769	83	—	—	366	7	15	13 375
Quebec	879	93 465	21	7 953	10 856	33 906	12 701	11 414	21 476	14 048	1 832	529	1 762	22 746	6 474	713	239 874
Ontario	1 229	139 461	73	20 370	9 008	41 929	8 108	4 937	21 377	2 890	1 582	30	1 638	8 065	3 664	192	263 252
Manitoba	197	35 058	1	160	717	2 364	4 195	2 408	2 443	1 583	712	160	250	2 708	111	61	52 928
Saskatchewan	411	89 346	94	40 557	6 387	6 706	22 829	17 702	18 778	6 117	2 135	165	1 308	19 974	1 265	10	233 279
Alberta	12	1 935	16	1 140	139	2 293	1 506	8 129	—	346	25	—	—	453	476	—	16 443
British Columbia	710	112 249	190	20 705	11 081	28 295	5 658	6 618	4 751	9 866	6 257	80	1 974	7 347	7 159	241	222 281
Yukon	197	43 604	26	4 502	6 115	12 717	1 654	6 191	2 994	9 682	1 207	—	204	1 947	1 378	—	92 196
Northwest Territories	167	24 458	1	1 417	16 371	6 635	11 228	15 312	4 090	1 372	3 228	6	241	5 917	2 069	240	92 584
Nunavut	216	98 558	5	6 228	15 641	11 557	6 115	6 751	1 752	6 927	4 429	—	5 503	16 083	3 932	155	183 631
Total	4 339	689 956	435	103 480	79 415	163 268	81 070	86 351	79 459	59 587	22 665	1 002	17 078	91 083	27 397	1 867	1 503 680
Percentage of grand total	n.a.	45.9	n.a.	6.9	5.3	10.9	5.4	5.7	5.3	4.0	1.5	0.1	1.1	6.1	1.8	0.1	100.0

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil; . . . Amount too small to be expressed; n.a. Not applicable.

(1) Includes on-mine-site plus off-mine-site activities. (2) Includes stripping, trenching, shaft work, drifts, cross-cuts, raises, declines, rock sampling, and de-watering costs.

Note: Numbers may not add to totals due to rounding.

TABLE 9b. DEPOSIT APPRAISAL ACTIVITY, (1) BY PROVINCE AND TERRITORY, 2006

Province/Territory	Drilling (Surface and Underground)				Geochemistry	Geology	Geophysics		Rock Work (2)	Other Field Costs	Engineering Studies	Economic Studies	Pre- or Production Feasibility Studies	Mineral Lease and Head Office	Environment	Land Access	Grand Total
	Diamond		Other				Ground	Airborne									
	Metres	Cost	Metres	Cost													
	(000)	(\$000)	(000)	(\$000)							(\$000)						
Newfoundland and Labrador	32	3 919	2	530	100	788	—	—	—	7	2 679	—	1 278	1 723	5 245	—	16 269
Nova Scotia	1	122	1	90	2	52	—	—	13	—	707	313	39	61	294	83	1 775
New Brunswick	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Quebec	133	10 553	1	2 752	174	695	454	200	21 766	4 098	8 783	22	858	3 439	1 388	15	55 198
Ontario	227	26 140	—	—	809	6 378	583	—	34 009	5 580	7 269	—	978	669	827	10	83 252
Manitoba	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Saskatchewan	—	—	—	—	—	—	—	—	—	243	395	137	458	649	480	—	2 362
Alberta	1	200	20	1 000	—	137	—	—	—	—	—	50	—	—	850	—	2 237
British Columbia	92	19 472	11	1 985	962	875	76	201	1 640	1 214	22 602	—	56 860	3 250	11 425	1 401	121 962
Yukon	7	1 011	1	63	119	742	—	—	3 855	2 659	1 069	—	1 137	1 500	1 393	610	14 155
Northwest Territories	17	14 010	3	3 687	—	114	—	—	38 790	2 615	8 150	—	690	7 039	8 534	—	83 628
Nunavut	...	377	—	—	—	—	—	—	1 585	—	6 348	—	6 332	403	10 886	1 079	27 009
Total	510	75 803	39	10 107	2 165	9 781	1 113	401	101 657	16 415	58 002	521	68 629	18 733	41 322	3 198	407 847
Percentage of grand total	n.a.	18.6	n.a.	2.5	0.5	2.4	0.3	0.1	24.9	4.0	14.2	0.1	16.8	4.6	10.1	0.8	100.0

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil; ... Amount too small to be expressed; n.a. Not applicable.

(1) Includes on-mine-site plus off-mine-site activities. (2) Includes stripping, trenching, shaft work, drifts, cross-cuts, raises, declines, rock sampling, and de-watering costs.

Note: Numbers may not add to totals due to rounding.

TABLE 9c. EXPLORATION PLUS DEPOSIT APPRAISAL ACTIVITY, (1) BY PROVINCE AND TERRITORY, 2006

Province/Territory	Drilling (Surface and Underground)										Pre- or Production Feasibility Studies	Mineral Lease and Head Office	Environment	Land Access	Grand Total		
	Diamond		Other		Geochemistry	Geology	Geophysics		Rock Work (2)	Other Field Costs						Engineering Studies	Economic Studies
	Metres	Cost	Metres	Cost			Ground	Airborne									
(000)	(\$000)	(000)	(\$000)								(\$000)						
Newfoundland and Labrador	277	46 314	2	530	2 187	14 373	4 249	6 647	245	5 945	3 640	20	3 975	6 976	5 496	239	100 836
Nova Scotia	25	2 460	10	538	754	1 315	319	40	1 513	50	920	325	1 539	286	905	83	11 046
New Brunswick	52	7 090	—	—	262	2 019	2 509	202	53	769	83	—	—	366	7	15	13 375
Quebec	1 012	104 018	22	10 705	11 030	34 601	13 155	11 614	43 243	18 145	10 616	551	2 621	26 186	7 862	728	295 072
Ontario	1 456	165 601	73	20 370	9 817	48 307	8 691	4 937	55 387	8 470	8 851	30	2 616	8 735	4 490	202	346 503
Manitoba	197	35 058	1	160	717	2 364	4 195	2 408	2 443	1 583	712	160	250	2 708	111	61	52 928
Saskatchewan	411	89 346	94	40 557	6 387	6 706	22 829	17 702	18 778	6 360	2 531	302	1 767	20 623	1 745	10	235 641
Alberta	13	2 135	36	2 140	139	2 430	1 506	8 129	—	346	25	50	—	453	1 326	—	18 680
British Columbia	802	131 721	201	22 691	12 043	29 170	5 734	6 818	6 391	11 079	28 859	80	58 833	10 597	18 584	1 642	344 243
Yukon	204	44 615	27	4 565	6 234	13 460	1 654	6 191	6 848	12 341	2 275	—	1 340	3 447	2 771	610	106 351
Northwest Territories	184	38 469	4	5 104	16 371	6 749	11 228	15 312	42 879	3 987	11 378	6	931	12 955	10 603	240	176 211
Nunavut	216	98 935	5	6 228	15 641	11 557	6 115	6 751	3 337	6 927	10 777	—	11 835	16 486	14 818	1 234	210 640
Total	4 849	765 760	474	113 587	81 580	173 049	82 183	86 752	181 117	76 002	80 667	1 524	85 707	109 817	68 718	5 065	1 911 527
Percentage of grand total	n.a.	40.1	n.a.	5.9	4.3	9.1	4.3	4.5	9.5	4.0	4.2	0.1	4.5	5.7	3.6	0.3	100.0

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil; ... Amount too small to be expressed; n.a. Not applicable.

(1) Includes on-mine-site plus off-mine-site activities. (2) Includes stripping, trenching, shaft work, drifts, cross-cuts, raises, declines, rock sampling and de-watering costs.

Note: Numbers may not add to totals due to rounding.

TABLE 9d. MINE COMPLEX DEVELOPMENT ACTIVITY, (1) BY PROVINCE AND TERRITORY, 2006

Province/Territory	Drilling (Surface and Underground)				Geochemistry	Geology	Geophysics		Rock Work (2)	Other Field Costs	Engineering Studies	Economic Studies	Pre- or Production Feasibility Studies	Mineral Lease and Head Office	Environment	Land Access	Grand Total
	Diamond		Other				Ground	Airborne									
	Metres	Cost	Metres	Cost													
	(000)	(\$000)	(000)	(\$000)													
Newfoundland and Labrador	2	209	163	2 361	211	—	—	—	26 011	—	400	—	15	3 699	1 591	—	34 496
Nova Scotia	—	—	165	315	—	50	—	—	822	—	80	—	—	311	1 527	13	3 117
New Brunswick	10	657	24	7 442	41	56	—	—	20 612	2	—	—	—	556	5 047	—	34 411
Quebec	124	8 606	32	2 356	332	6 972	10	—	234 313	6 700	10 677	—	133	16 674	22 231	6 650	315 655
Ontario	583	39 661	39	1 466	1	4 006	66	—	192 003	37 875	3 758	221	654	16 786	6 004	2 912	305 412
Manitoba	111	8 333	—	—	—	386	—	—	82 682	—	818	—	—	596	—	—	92 816
Saskatchewan	112	9 175	193	64 164	—	1 079	750	—	44 334	273	16 428	—	977	12 086	14 731	5	164 000
Alberta	10	4 551	16	1 841	35	640	34	—	15 756	4 222	1 228	68	694	4 167	13 026	51	46 313
British Columbia	—	—	34	3 143	730	970	68	2	13 872	228	1 479	130	736	325	6 516	458	28 657
Yukon	—	—	—	—	—	—	—	—	—	—	—	—	2 300	—	1 000	100	3 400
Northwest Territories	5	1 530	...	192	—	13	—	—	67 519	—	40	—	6 263	34 572	5 278	3 375	118 782
Nunavut	—	—	—	—	—	—	—	—	133	—	933	—	—	45	363	—	1 474
Total	956	72 721	668	83 280	1 349	14 171	927	2	698 056	49 299	35 841	418	11 772	89 817	77 314	13 565	1 148 532
Percentage of grand total	n.a.	6.3	n.a.	7.3	0.1	1.2	0.1	...	60.8	4.3	3.1	...	1	7.8	6.7	1.2	100

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil; ... Amount too small to be expressed; n.a. Not applicable.

(1) Includes on-mine-site plus off-mine-site activities. (2) Includes stripping, trenching, shaft work, drifts, cross-cuts, raises, declines, rock sampling and de-watering costs.

Note: Numbers may not add to totals due to rounding.

TABLE 10. SUMMARY OF DRILLING ACTIVITY IN CANADA, 2006

Drilling Activity	Exploration				Deposit Appraisal				Exploration Plus Deposit Appraisal
	Off-Mine-Site		On-Mine-Site		Off-Mine-Site		On-Mine-Site		On-Plus Off-Mine-Site
	(metres)	(% of subtotal)	(metres)	(% of subtotal)	(metres)	(% of subtotal)	(metres)	(% of subtotal)	(metres)
Diamond drilling									
Surface	3 699 987	99.4	165 666	26.9	265 565	81.0	67 573	37.1	4 198 791
Underground	21 564	0.6	451 315	73.2	62 316	19.0	114 632	62.9	649 827
Subtotal	3 721 551	100.0	616 981	100.0	327 881	100.0	182 205	100.0	4 848 618
Percentage of work phase total diamond drilling	85.8		14.2		64.3		35.7		
Other drilling									
Surface	373 435	99.7	53 922	89.7	16 358	100.0	22 076	95.8	465 791
Underground	1 000	0.3	6 209	10.3	—	—	976	4.2	8 185
Subtotal	374 435	100.0	60 131	100.0	16 358	100.0	23 052	100.0	473 976
Percentage of work phase total other drilling	86.2		13.8		41.5		58.5		n.a.
Total surface drilling	4 073 422		219 588		281 923		89 649		4 664 582
Total underground drilling	22 564		457 524		62 316		115 608		658 012
Grand total	4 095 986		677 112		344 239		205 257		5 322 594

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil; n.a. Not applicable.

Note: Numbers may not add to totals due to rounding.

TABLE 11a. EXPLORATION PLUS DEPOSIT APPRAISAL (SURFACE DRILLING), (1) BY PROVINCE AND TERRITORY, BY MINERAL COMMODITY, 2006

Province/Territory	Metals					Nonmetals	Diamonds	Coal	Total
	Base	Precious	Iron	Uranium	Other				
	(000 metres)								
Newfoundland and Labrador	88	49	14	74	22	4	1	1	251
Nova Scotia	6	25	...	—	—	3	—	1	35
New Brunswick	26	15	—	—	10	1	—	—	52
Quebec	235	573	20	30	10	4	15	—	886
Ontario	265	783	2	17	22	1	65	—	1155
Manitoba	74	60	—	...	6	...	1	—	143
Saskatchewan	13	60	—	264	2	1	151	1	492
Alberta	—	—	5	4	1	1	4	35	49
British Columbia	248	439	—	—	79	20	—	177	962
Yukon	89	108	—	23	9	—	—	2	231
Northwest Territories	9	128	—	4	3	—	44	—	188
Nunavut	25	151	7	8	5	1	24	—	221
Total	1 077	2 391	47	424	168	35	306	217	4 665

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil; ... Amount too small to be expressed.

(1) Includes on-mine-site plus off-mine-site drilling activity for diamond and other types of drilling.

Note: Numbers may not add to totals due to rounding.

TABLE 11b. EXPLORATION PLUS DEPOSIT APPRAISAL (UNDERGROUND DRILLING), (1) BY PROVINCE AND TERRITORY, BY MINERAL COMMODITY, 2006

Province/Territory	Metals					Nonmetals	Diamonds	Coal	Total
	Base	Precious	Iron	Uranium	Other				
(000 metres)									
Newfoundland and Labrador	14	14	—	—	—	—	—	—	28
Nova Scotia	—	—	—	—	—	—	—	—	—
New Brunswick	—	—	—	—	—	—	—	—	—
Quebec	11	137	—	—	—	—	—	—	148
Ontario	87	276	—	—	12	—	—	—	375
Manitoba	40	13	—	—	2	—	—	—	56
Saskatchewan	—	—	—	—	—	—	12	—	12
Alberta	—	—	—	—	—	—	—	—	—
British Columbia	13	17	—	—	10	—	—	—	40
Yukon	—	—	—	—	—	—	—	—	—
Northwest Territories	—	—	—	—	—	—	—	—	—
Nunavut	—	—	—	—	—	—	—	—	—
Total	165	457	—	—	24	—	12	—	658

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil; . . . Amount too small to be expressed.

(1) Includes on-mine-site plus off-mine-site drilling activity for diamond and other types of drilling.

Note: Numbers may not add to totals due to rounding.

TABLE 12. COMPARISON OF 2005 AND 2006 EXPLORATION PLUS DEPOSIT APPRAISAL EXPENDITURES, (1) BY MINERAL COMMODITY

Mineral Commodity	2005 Expenditures	2006 as % of 2005 Expenditures	2006 Total Expenditures			Percentage of Total
			On-Mine-Site	Off-Mine-Site	On-Mine-Site Plus Off-Mine-Site	
	(\$ millions)	(%)	(\$ millions)			(%)
Base metals (2)	303.5	135.7	44.5	367.5	411.9	21.6
Precious metals (3)	535.6	135.3	87.0	637.6	724.6	37.9
Gold	441.3	139.2	78.8	535.6	614.4	32.1
Platinum group elements	46.7	95.7	3.9	40.9	44.7	2.3
Iron ore	25.3	256.8	—	65.1	65.1	3.4
Uranium	91.2	234.2	—	213.6	213.6	11.2
Other metals	49.6	172.5	3.4	82.1	85.5	4.5
Nonmetals	18.0	96.8	0.2	17.2	17.5	0.9
Diamonds	239.6	142.8	—	342.0	342.0	17.9
Coal	41.9	122.5	7.7	43.6	51.3	2.7
Total	1 304.8	146.5	142.7	1 768.8	1 911.5	100.0

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil.

(1) Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

(2) Includes copper, nickel, lead and zinc. (3) Includes silver, gold, and platinum group metals.

Note: Numbers may not add to totals due to rounding.

TABLE 13a. EXPLORATION EXPENDITURES, (1) BY PROVINCE AND TERRITORY, BY MINERAL COMMODITY, 2006

Summary, 2006

Province/Territory	Metals					Nonmetals	Diamonds	Coal	Total
	Base	Precious	Iron	Uranium	Other				
	(\$000)								
Newfoundland and Labrador	26 878	13 799	2 332	33 331	6 285	1 642	150	150	84 567
Nova Scotia	1 148	3 291	28	—	15	752	—	4 038	9 272
New Brunswick	7 551	3 302	...	—	2 360	162	—	—	13 375
Quebec	64 969	111 042	6 685	21 982	4 916	1 315	28 964	—	239 874
Ontario	60 067	156 345	117	5 051	7 198	480	33 994	—	263 252
Manitoba	32 033	14 708	—	1 169	2 018	1 058	1 942	—	52 928
Saskatchewan	4 797	15 133	—	113 505	1 293	1 715	96 485	350	233 279
Alberta	8	1	1 343	4 516	—	—	8 631	1 944	16 443
British Columbia	64 002	104 562	78	634	17 916	4 662	5	30 423	222 281
Yukon	31 443	41 425	33	10 981	6 458	400	—	1 456	92 196
Northwest Territories	14 402	16 994	—	6 466	1 107	19	53 595	—	92 584
Nunavut	13 487	77 208	27 167	15 479	2 831	505	46 954	—	183 631
Total	320 786	557 810	37 783	213 114	52 397	12 709	270 721	38 360	1 503 680

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil; ... Amount too small to be expressed.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre-feasibility studies, environment and land access costs.

Note: Numbers may not add to totals due to rounding.

TABLE 13b. DEPOSIT APPRAISAL EXPENDITURES, (1) BY PROVINCE AND TERRITORY, BY MINERAL COMMODITY, 2006

Continued from page 10

Province/Territory	Metals					Nonmetals	Diamonds	Coal	Total
	Base	Precious	Iron	Uranium	Other				
	(\$000)								
Newfoundland and Labrador	1 498	1 698	12 378	—	300	395	—	—	16 269
Nova Scotia	—	1 644	—	—	—	130	—	—	1 775
New Brunswick	—	—	—	—	—	—	—	—	—
Quebec	5 834	34 362	14 927	—	—	75	—	—	55 198
Ontario	32 428	39 829	—	—	10 782	213	—	—	83 252
Manitoba	—	—	—	—	—	—	—	—	—
Saskatchewan	—	—	—	476	—	1 776	—	110	2 362
Alberta	—	—	—	—	163	163	—	1 912	2 237
British Columbia	38 366	57 011	—	—	13 629	2 010	—	10 946	121 962
Yukon	9 849	4 307	—	—	—	—	—	—	14 155
Northwest Territories	—	4 108	—	—	8 215	—	71 305	—	83 628
Nunavut	3 166	23 843	—	—	—	—	—	—	27 009
Total	91 141	166 801	27 305	476	33 090	4 761	71 305	12 968	407 847

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Note: Numbers may not add to totals due to rounding.

TABLE 13c. EXPLORATION PLUS DEPOSIT APPRAISAL EXPENDITURES, (1) BY PROVINCE AND TERRITORY, BY MINERAL COMMODITY, 2006

Province/Territory	Metals					Nonmetals	Diamonds	Coal	Total
	Base	Precious	Iron	Uranium	Other				
	(\$000)								
Newfoundland and Labrador	28 377	15 497	14 710	33 331	6 585	2 037	150	150	100 836
Nova Scotia	1 148	4 935	28	—	15	882	—	4 038	11 046
New Brunswick	7 551	3 302	...	—	2 360	162	—	—	13 375
Quebec	70 804	145 404	21 612	21 982	4 916	1 390	28 964	—	295 072
Ontario	92 495	196 174	117	5 051	17 981	692	33 994	—	346 503
Manitoba	32 033	14 708	—	1 168	2 018	1 058	1 942	—	52 928
Saskatchewan	4 797	15 133	—	113 982	1 293	3 491	96 485	460	235 641
Alberta	8	1	1 343	4 516	163	163	8 631	3 856	18 680
British Columbia	102 368	161 572	78	634	31 545	6 672	5	41 369	344 243
Yukon	41 291	45 731	33	10 981	6 458	400	—	1 456	106 351
Northwest Territories	14 402	21 102	—	6 466	9 323	19	124 900	—	176 211
Nunavut	16 653	101 052	27 167	15 479	2 831	505	46 954	—	210 640
Total	411 928	724 611	65 088	213 590	85 487	17 470	342 025	51 328	1 911 527

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil. ... Amount too small to be expressed.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Note: Numbers may not add to totals due to rounding.

TABLE 13d. MINE COMPLEX DEVELOPMENT EXPENDITURES, (1) BY PROVINCE AND TERRITORY, BY MINERAL COMMODITY, 2006

Province/Territory	Metals					Nonmetals	Diamonds	Coal	Total
	Base	Precious	Iron	Uranium	Other				
	(\$000)								
Newfoundland and Labrador	11 331	8 751	12 912	—	1 290	212	—	—	34 496
Nova Scotia	—	—	—	—	—	2 217	—	900	3 117
New Brunswick	19 614	12 285	—	—	—	2 512	—	—	34 411
Quebec	107 770	188 765	9 390	—	6 513	3 218	—	—	315 655
Ontario	175 846	100 976	—	—	9 093	3 006	16 490	—	305 412
Manitoba	81 616	11 200	—	—	—	—	—	—	92 816
Saskatchewan	—	8 625	—	133 504	—	18 826	—	3 045	164 000
Alberta	—	—	—	—	—	7 606	—	38 706	46 313
British Columbia	6 982	7 080	—	—	6 358	102	—	8 134	28 657
Yukon	1 133	2 267	—	—	—	—	—	—	3 400
Northwest Territories	—	—	—	—	148	—	118 635	—	118 782
Nunavut	—	—	—	—	—	—	1 474	—	1 474
Total	404 292	339 949	22 302	133 504	23 402	37 699	136 598	50 786	1 148 532

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Note: Numbers may not add to totals due to rounding.

TABLE 14. EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES, (1) BY JUNIOR AND SENIOR COMPANIES, OFF- AND ON-MINE-SITE, AND BY MINERAL COMMODITY, 2006

Work Phase/ Type of Company	Base Metals	Precious Metals	Uranium	Diamonds	Others (2)	Total
	(\$000)					
Exploration, off-mine-site						
Junior companies and prospectors	193 643	384 736	158 535	203 344	90 259	1 030 516
Senior companies	89 855	114 327	54 579	67 377	43 464	369 602
Total	283 498	499 063	213 114	270 721	133 723	1 400 118
Exploration, on-mine-site						
Junior companies and prospectors	—	—	—	—	—	—
Senior companies	37 288	58 747	—	—	7 527	103 562
Total	37 288	58 747	—	—	7 527	103 562
Exploration, off- plus on-mine-site						
Junior companies and prospectors	193 643	384 736	158 535	203 344	90 259	1 030 516
Senior companies	127 143	173 074	54 579	67 377	50 991	473 164
Total	320 786	557 810	213 114	270 721	141 249	1 503 680
Deposit appraisal, off-mine-site						
Junior companies and prospectors	49 055	107 378	—	—	51 081	207 514
Senior companies	34 920	31 187	476	71 305	23 287	161 176
Total	83 976	138 566	476	71 305	74 368	368 690
Deposit appraisal, on-mine-site						
Junior companies and prospectors	—	—	—	—	—	—
Senior companies	7 166	28 236	—	—	3 756	39 157
Total	7 166	28 236	—	—	3 756	39 157
Deposit appraisal, off- plus on-mine-site						
Junior companies and prospectors	49 055	107 378	—	—	51 081	207 514
Senior companies	42 086	59 423	476	71 305	27 043	200 333
Total	91 141	166 801	476	71 305	78 123	407 847
Exploration plus deposit appraisal, off- plus on-mine-site						
Junior companies and prospectors	242 699	492 114	158 535	203 344	141 339	1 238 031
Senior companies	169 229	232 497	55 055	138 681	78 033	673 496
Total	411 928	724 611	213 590	342 025	219 373	1 911 527

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil.

(1) Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

(2) Includes iron, other metals, coal, and nonmetals.

Note: Numbers may not add to totals due to rounding.

TABLE 15a. EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES, (1) BY PROVINCE AND TERRITORY, BY JUNIOR AND SENIOR COMPANIES, 2006

Province/Territory	Exploration			Deposit Appraisal			Exploration Plus Deposit Appraisal		
	Junior Companies and Prospectors	Senior Companies	Total	Junior Companies and Prospectors	Senior Companies	Total	Junior Companies and Prospectors	Senior Companies	Total
(\$000)									
Newfoundland and Labrador	62 848	21 719	84 567	13 233	3 036	16 269	76 081	24 755	100 836
Nova Scotia	3 752	5 520	9 272	—	1 775	1 775	3 752	7 295	11 046
New Brunswick	7 654	5 721	13 375	—	—	—	7 654	5 721	13 375
Quebec	131 669	108 205	239 874	28 030	27 169	55 198	159 698	135 374	295 072
Ontario	154 510	108 741	263 252	5 866	77 386	83 252	160 376	186 127	346 503
Manitoba	19 675	33 253	52 928	—	—	—	19 675	33 253	52 928
Saskatchewan	172 165	61 113	233 279	1 776	586	2 362	173 941	61 700	235 641
Alberta	13 627	2 816	16 443	325	1 912	2 237	13 952	4 728	18 680
British Columbia	170 800	51 481	222 281	108 186	13 776	121 962	278 986	65 257	344 243
Yukon	87 106	5 089	92 196	10 766	3 389	14 155	97 873	8 478	106 351
Northwest Territories	71 904	20 680	92 584	12 323	71 305	83 628	84 227	91 985	176 211
Nunavut	134 805	48 825	183 631	27 009	—	27 009	161 815	48 825	210 640
Total	1 030 516	473 164	1 503 680	207 514	200 333	407 847	1 238 031	673 496	1 911 527

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Note: Numbers may not add to totals due to rounding.

TABLE 15b. EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES, (1) BY PROVINCE AND TERRITORY, BY JUNIOR AND SENIOR COMPANIES, 2007

Province/Territory	Exploration			Deposit Appraisal			Exploration Plus Deposit Appraisal		
	Junior Companies and Prospectors	Senior Companies	Total	Junior Companies and Prospectors	Senior Companies	Total	Junior Companies and Prospectors	Senior Companies	Total
(\$000)									
Newfoundland and Labrador	86 679	24 355	111 035	1 799	47 177	48 976	88 478	71 533	160 011
Nova Scotia	13 466	11 750	25 216	—	1 640	1 640	13 466	13 390	26 856
New Brunswick	22 132	7 850	29 982	—	550	550	22 132	8 400	30 532
Quebec	217 680	97 004	314 684	29 000	41 570	70 570	246 680	138 574	385 254
Ontario	200 257	127 828	328 085	10 300	180 783	191 083	210 557	308 611	519 168
Manitoba	32 884	60 262	93 146	1 965	8 000	9 965	34 850	68 262	103 111
Saskatchewan	194 868	82 537	277 405	—	—	—	194 868	82 537	277 405
Alberta	11 768	2 267	14 036	—	3 328	3 328	11 768	5 596	17 364
British Columbia	272 794	75 007	347 801	47 758	29 681	77 439	320 552	104 688	425 240
Yukon	104 008	4 273	108 281	31 000	4 641	35 641	135 008	8 914	143 922
Northwest Territories	118 403	6 338	124 742	10 260	56 621	66 881	128 663	62 959	191 622
Nunavut	125 725	103 915	229 640	26 011	11 000	37 011	151 737	114 915	266 651
Total	1 400 666	603 387	2 004 052	158 093	384 991	543 084	1 558 759	988 378	2 547 136

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil.

(1) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Notes: Data for 2007 are revised spending intentions. Numbers may not add to totals due to rounding.

TABLE 16. EXPLORATION PLUS DEPOSIT APPRAISAL EXPENDITURES, (a) BY PROVINCE AND TERRITORY, BY TYPE OF COMPANY, 2006

Province/Territory	(1) Companies With a Producing Mine in Canada	(2) Affiliates of (1)	(3) Oil Companies	(4) Foreign Companies Excluding (1-3)	(5) Junior Companies and Prospectors	(6) Other Companies	(7) Total
(\$ 000)							
Newfoundland and Labrador	18 612	25	62	5 861	76 081	196	100 836
Nova Scotia	781	4 000	91	2 401	3 752	21	11 046
New Brunswick	5 721	—	—	—	7 654	—	13 375
Quebec	79 557	50 547	—	423	159 698	4 847	295 072
Ontario	182 826	42	259	2 895	160 376	105	346 503
Manitoba	22 150	10 330	—	105	19 675	668	52 928
Saskatchewan	45 037	1 821	—	14 622	173 941	221	235 641
Alberta	4 211	517	—	—	13 952	—	18 680
British Columbia	41 533	13 773	50	442	278 986	9 458	344 243
Yukon	5 083	—	—	3 395	97 873	—	106 351
Northwest Territories	89 336	2 543	—	106	84 227	—	176 211
Nunavut	22 867	440	6 747	—	161 815	18 772	210 640
Total	517 714	84 037	7 209	30 248	1 238 031	34 288	1 911 527

Source: Natural Resources Canada, from a federal-provincial/territorial survey of mining and exploration companies.

— Nil.

(a) Includes on-mine-site plus off-mine-site activities. Includes field work, overhead, engineering, economic and pre- or production feasibility studies, environment and land access costs.

Notes: Senior companies include categories 1, 2, 3, 4 and 6. Numbers may not add to totals due to rounding.

TABLE 17. GENERALIZED MODEL OF MINERAL RESOURCE DEVELOPMENT

PHASE	MINERAL RESOURCE ASSESSMENT	MINERAL EXPLORATION					MINERAL DEPOSIT APPRAISAL				MINE COMPLEX DEVELOPMENT	MINE PRODUCTION	ENVIRON- MENTAL RESTORATION
		GRASS-ROOTS EXPLORATION											
	MRA	EX-1	EX-2	EX-3	EX-4	EX-5	DA-1	DA-2	DA-3	DA-4	MCD	MP	ER
STAGE	Various surveys, research and synthesis.	Exploration planning.	Regional reconnaissance and surveys.	Prospecting and ground surveys of anomalies.	Verification of anomalies and showings.	Discovery and delimitation of a mineral deposit.	Mineral deposit definition.	Project engineering.	Project economics.	Feasibility study, production decision.	Mine development, construction of processing plant and infrastructure.	Production, marketing and renewal of reserves.	Mine complex closure and decommissioning, site restoration.
OBJECTIVES	Supply information and tools required to develop the mineral potential of the nation for economic benefit, in the perspective of sustainable development.	Select target commodities. Establish exploration objectives and strategies. Select target areas and sites. Acquire claims or permits if appropriate.	Seek anomalies of interest over wide areas by various survey methods. Select the more promising targets. Acquire claims or permits.	Confirm the presence, exact location and characteristics of anomalies. Acquire claims, leases and properties.	Investigate the cause of anomalies. Find mineral showings. Acquire additional claims, leases and properties.	Discover, delimit and interpret grade, quality and tonnage of a new mineral deposit. Determine if it constitutes a mineral resource of "potential economic interest" to justify more intensive and detailed work.	Define the limits, controls and internal distribution of grades, mineralogy and mineral processing characteristics of the deposit. Acquire all data required for project engineering and cost estimation.	Determine, in an iterative fashion, the design, plans, schedules, capital cost and operating cost estimates for all aspects of the project. Establish technical feasibility and costs thoroughly and realistically.	Obtain all the information required and determine, based on corporate objectives, parameters for the economic, financial and social-political evaluation of the project.	Diligently validate and integrate project data, interpretations, estimations, plans and evaluations to achieve MCD and production objectives. Decide on whether to undertake the mining project. Obtain permits and financing.	Complete mine development and construction on schedule and within budgets and specifications. Ensure efficient and timely mine complex start-up according to schedule, specifications and cash flow forecasts.	Achieve commercial production on schedule and meet cash flow forecasts and quantity and quality specifications. Achieve mine profitability and company survival in the perspective of sustainable development.	Restore mine site, outside plant and infrastructure to environmentally acceptable condition. Ensure the future quality of the environment.
EVALUATION METHODS	Geoscientific, mineral and economic surveys, research, compilations and synthesis by governments, research institutes, universities and industry.	Metal and mineral market research. Review of geological and ore deposit information and of the legal, fiscal and socio-political context in various areas.	Remote sensing, aerial photography and airborne geophysics. Prospecting, geology and geochemistry. Appraisal, rating and selection of anomalies.	Ground, geological, geochemical and geophysical prospecting and surveys. Compilation, appraisal and selection of significant anomalies.	Geological mapping and other surveys. Trenching, drilling and sampling. Appraisal of results, recommendations for further work, and selection of new targets.	Stripping, trenching, mapping, sampling, drilling and down-hole geophysics. Initial mineral processing tests. Environmental and site surveys. Mineral resource estimation and inventory.	Detailed mapping, sampling and drilling on surface or from underground. Systematic mineralogy and mineral processing tests. Detailed environmental and site surveys. Pre-feasibility studies.	Pilot tests, engineering design and planning. Capital and operating costs for mining, mineral processing, infrastructure, environmental protection and restoration. Technical risk analysis. Pre-feasibility studies.	Market, prices, product development and financial studies. Environmental, economic, financial, and socio-political risk analysis. Pre-feasibility studies.	Exhaustive due diligence review of all data, interpretations, plans and estimates. Evaluation of profitability, financial and qualitative risks, and the up-side factors.	Project management methods in a quality assurance perspective. Training program for personnel and detailed start-up plan to meet the requirements of this demanding period.	Production management methods to ensure continuous quality and efficiency improvements. Exploration, deposit appraisal and development of new zones or deposits on-mine-site and off-mine-site.	Mine closure and decommissioning. Environmental restoration and monitoring.
RESULTS	Maps, data bases, tools and models.	Exploration projects.	Regional anomalies.	Local anomalies.	Mineral showings.	Mineral deposit.	Deposit appraisal project.			Mining project.	Mining complex.	Mineral production.	Restored site.
MINERAL INVENTORY	UNDISCOVERED MINERAL POTENTIAL					INFERRED RESOURCE	DELIMITED MINERAL RESOURCE				MINERAL RESERVE		
	SPECULATIVE		HYPOTHETICAL				INDICATED	INDICATED AND MEASURED		PROVEN AND PROBABLE			
ESTIMATION ERROR (targeted margin of error of tonnage/grade estimates at the 90% confidence level)						± 100%	± 50% to ± 30%	Indicated: ± 50 to ± 30% Measured: ± 20 to ± 10% (often several sample grid dimensions are used in each category)			Proven (feasibility: ± 10%; mining: ± 5%)		Full compliance
INVESTMENTS	Moderate	Low, but increasing multiple investments.					Larger and increasing multiple investments.				Very large industrial investment.		
RISK LEVEL	Low	Very high, but decreasing risk of failure and financial loss.					High, but decreasing risk of failure.				Moderate to low industrial risk.		

Sources: Modified by D.A. Cranstone, A. Lemieux and M. Vallée, February 25, 1994, from M. Vallée, 1992, *Guide to the Evaluation of Gold Deposits*, CIM Special Volume 45, p. 4, and *SOQUEM Annual Report*, 1976-77, pp. 4 and 5. Revised by M. Vallée and G. Bouchard, January 2001.

For more information, please contact: Minerals and Mining Statistics Division, Programs Branch, Minerals and Metals Sector, Natural Resources Canada, 580 Booth Street, Ottawa, Ontario K1A 0E4; telephone (toll-free): 1-800-267-0452 or fax (toll-free): 1-877-336-3100.

APPENDIX 1. METAL PRICES OF SELECTED COMMODITIES, 2005-07

	U.S. Currency	2005 Annual Average	2006	% Change	2006 (see note below)	2007	% Change
Copper	¢/lb	166.87	304.91	82.72	305.11	325.08	6.55
Nickel	\$/lb	6.69	11.00	64.50	10.58	17.35	64.06
Zinc	¢/lb	62.68	148.54	137.00	143.88	150.74	4.77
Lead	¢/lb	44.29	58.50	32.07	56.70	116.97	106.27
Molybdenum	\$/lb	31.73	24.75	-22.02	25.32	30.04	18.64
Gold	\$/troy oz	444.88	604.43	35.86	602.13	686.98	14.09
Silver	\$/troy oz	7.31	11.57	58.28	11.41	13.31	16.68
Platinum	\$/troy oz	896.43	1 141.67	27.36	1 164.20	1 288.42	10.67
Palladium	\$/troy oz	201.21	320.43	59.25	323.65	355.03	9.70
Uranium (U ₃ O ₈)	\$/lb	28.67	49.61	73.04	47.57	91.73	92.83
Coal	\$/t f.o.b.	126.90	114.00	-10.17	114.00	96.00	-15.79
Iron ore	¢/Fe unit	115.51	112.00	-3.04	112.00	118.00	5.36

Sources: *Platts Metals Week*; Cameco Corporation; mining analysts.

Note: 2006/2007 comparisons are based on 11-month averages, except coal and iron ore, which are based on annual estimates.

Base metals - LME settlement

Molybdenum - MW mean

Precious metals - London Final or PM fix

Uranium - U.S. spot price - average of 12 months

Coal - Premium hard coking Japanese market

Iron ore - European CVRD benchmark - pellets

Canadian Mineral Discovery Analysis and Exploration Highlights

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INTRODUCTION

The year 2006 was forecast to be an even better year than 2005 for the exploration industry and, by all accounts, that has been true. Strong expenditure levels and an increasing number of projects at later stages of exploration, the completion of feasibility studies, and approaching or having made production decisions bode well for the future of mineral development projects in Canada.

This article highlights Canada's importance in global exploration activity, presents a broad overview of the exploration industry in Canada, reviews projects that could be of significance to this country's mining future, and presents an overview of Canada's recent mineral discovery record. This analysis is in keeping with Natural Resources Canada's (NRCan) ongoing research on exploration, deposit appraisal and mine complex development spending in Canada, and its analysis of exploration activity abroad, mine openings and closings in Canada, and mineral resources and ore reserve levels. It contributes to the overall understanding of the outlook for the Canadian exploration and mining industry.

SOURCES OF DATA

This chapter is based on data from a number of different sources. Unless stated otherwise, exploration expenditure statistics used in the analysis are from the Metals Economics Group's (MEG) annual Survey of Nonferrous Mineral Exploration Spending Intentions, published as *Corporate Exploration Strategies: A Worldwide Analysis*.¹ For 2006, this survey covered 1624 companies with spending of at least \$113 600 (US\$100 000).² MEG estimates that its survey covers approximately 95% of all worldwide exploration spending. All numbers in this report are expressed in

dollars of the day and have not been adjusted for inflation. Specific Canadian data are also available from the federal-provincial/territorial Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures, but confidentiality issues arise with the use of company-specific data. Project- and industry-specific information was obtained from published corporate sources (company annual reports, quarterly reports, press releases, etc.) and from other databases and specialized publications (InfoMine, MineSearch by Metals Economics Group, *The Northern Miner*, SEDAR, and Raw Materials Group).³

CANADA'S STANDING AS AN EXPLORATION TARGET

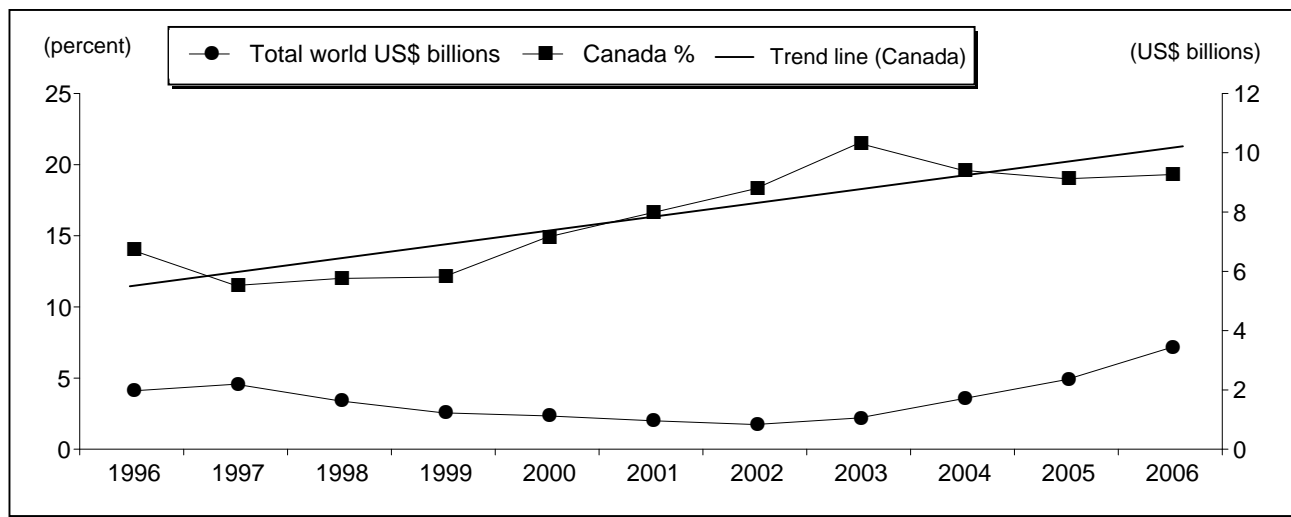
Since 2002, Canada has been the top country destination for mineral exploration expenditures (Figures 1 and 2), capturing 19.3% (\$1562 million [US\$1374.6 million]) of worldwide exploration budgets in 2006. Australia remained in second place and the United States continued

Figure 1
Top Three Country Destinations of Mineral Exploration Capital from Worldwide Sources, 1996-2006

Year	Rank		
	First	Second	Third
1996	Australia	Canada	United States
1997	Australia	Canada	United States
1998	Australia	Canada	United States
1999	Australia	Canada	United States
2000	Australia	Canada	United States
2001	Australia	Canada	United States
2002	Canada	Australia	United States
2003	Canada	Australia	United States
2004	Canada	Australia	United States
2005	Canada	Australia	United States
2006	Canada	Australia	United States

Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia.

Figure 2
Canada's Country Share of World Exploration Budgets, 1996-2006



Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia.

to hold third place with shares of 10.6% (\$856.3 million [US\$753.5 million]) and 7.7% (\$622.8 million [US\$548.1 million]), respectively.

In Canada, the exploration story is overwhelmingly about home-grown, junior mining companies riding on the wave of increased commodity prices and re-evaluating projects previously not considered economic. These junior companies are predominantly headquartered in Canada, as opposed to a declining number of major companies participating in grassroots and late-stage exploration. Surprisingly, the number of intermediate companies has remained relatively stable despite significant merger and acquisition activity in the industry.

DISCOVERY ANALYSIS

The analysis of Canada's mineral discovery record complements other currently ongoing statistical and analytical work on the state and future of Canadian exploration and mining. In particular, it is hoped that increased discovery knowledge will help identify future ore sources and deficiencies, determine the efficiency of the exploration effort, and better target government measures to support mineral exploration activity.

NRCan's Mineral Deposit Discovery List

NRCan resumed the collection of data for the Mineral Deposit Discovery List in 2005 after a three-year hiatus. This list is based on a database of mineral exploration discoveries dating back to 1946. Data are collected from a

number of sources: company press releases, annual reports, reports on the System for Electronic Document Analysis and Retrieval (SEDAR), *The Northern Miner*, corporate web sites, provincial and territorial exploration reports, the *Overview of Trends in Canadian Mineral Exploration* report, the *Canadian Minerals Yearbook*, and commercial databases (Raw Materials Group, InfoMine, and MineSearch by MEG).

Previous analysis by NRCan of historical discovery rates of significantly valuable deposits indicates that, from 1949 to 1979, an average of 2.3 deposits were found each year. It was found that the discovery rate declined to half that during the 1980s. The real highlight of Canadian exploration in the 1980s was the outstanding discovery record for uranium. More than 25 uranium deposits were found, many of them exceptionally high-grade, world-class deposits, such as Cigar Lake, Eagle Point, and McArthur River in Saskatchewan. But due to market conditions, these deposits were not immediately brought into production. During the 1990-99 period, 70 mineral deposits were discovered with the 1994-96 period the most successful years for discoveries in Canada by three-year period since the 1970s. Discoveries made during those three years that conform to NRCan's definitions include: Voisey's Bay in Newfoundland and Labrador, Onaping Depth and Kelly Lake in Sudbury, and diamond deposits in Canada's North (Ekati, Diavik, Jericho) and in Saskatchewan (Star, Orion).⁴

NRCan's Definition of a Discovery

A discovery is taken to be a deposit sufficiently attractive to have warranted the expenditure necessary to establish its

tonnage and grade. The date of discovery is taken to be the year when diamond drilling led to the recognition that the deposit was of economic interest. This level of knowledge requires that both the continuity of the controlling geological structures and the continuity of mineral content be supported by a systematic, but relatively widely spaced, drilling grid.

A new deposit found on a property where deposits were previously known is considered a *bona fide* new discovery, provided it is not an immediate or direct extension of known zones. There needs to be a “significant” distance separating it from known mineralization and no indication that it is part of the known mineralization.

The stringent guidelines of what constitutes an NRCan discovery mean that a deposit must be drilled, have some future economic potential, and not be an extension of known mineralization.

Base-Metal Discoveries in 2006

Base-metal exploration has picked up in recent years and, in 2006, the following deposits met the “discovery” criteria and were added to the Mineral Deposit Discovery List.

In the Yukon’s Selwyn Basin, Pacifica Resources Ltd.’s (renamed Selwyn Resources in January 2007) 2006 exploration resulted in five new zones, only three of which received sufficient work to calculate resource estimates. These were the HC West zone, the Don zone, and the Don East zone. As mentioned in the section on selected base-metal deposits, the Selwyn project is located in the eastern Yukon, straddling the border with the Northwest Territories approximately 350 km northeast of Whitehorse.

A new geological interpretation of the deposit, as a large sedimentary exhalative deposit covering a strike length of 38 km that has been disrupted by post-mineralization faulting, has opened up large areas for exploration. Drilling indicates that higher-grade mineralization occurs in the core axis of the regional synclinal structure. Intersections include Don Valley, grading 8.9% zinc and 3.10% lead over 22.3 m (core width); Anniv Area, grading 7.0% zinc and 3.63% lead over 8.70 m (core width); the OP 17 zone, grading 1.59% zinc and 0.47% lead over 20 m (core width); and Pelly North, grading 0.95% zinc and 0.23% lead over 40 m (core width). In April 2007, the mineral resource inventory for the three new zones was calculated and is shown in the table that follows.

The Minto mine is a copper-gold mine located in the Yukon, approximately 240 km northwest of the city of Whitehorse. In 2006, property owner Sherwood Copper Corporation concentrated on in-fill drilling in the northern half of the Minto deposit. Three exploration holes intersected new mineralization in Area 2, located 350 m south of the planned open pit in Minto’s Main zone. This was followed by 18 376 m in 79 drill holes to delineate and in-fill Area 2, which was outlined on 28-m centres and

RESOURCE ESTIMATE FOR PACIFICA RESOURCES LTD.’S SELWYN PROJECT’S THREE NEW ZONES

Zone	Category	Mt	% Zn	% Pb
HC West	Indicated	4.47	4.36	1.16
	Inferred	13.93	4.98	1.32
Don	Indicated	2.36	5.15	1.15
	Inferred	14.68	4.70	1.17
Don East	Inferred	24.71	5.54	1.43

Source: Pacifica Resources Ltd. press release of April 2, 2007.

measures approximately 350 m in a northwest-southeast direction and up to 260 m in a northeast-southwest direction. By comparison, the Minto Main zone is 450 m by 180 m. Mineralization at Area 2 contains more than 13 mineralized, stacked horizons with a 300-m to 350-m vertical extent and remains open. In 2006, Hatch Ltd. conducted a bankable feasibility on the Main Minto deposit and Lions Gate Geological Consulting Inc. was commissioned to estimate mineral resources in Area 2 that appear in the table below. The completed feasibility study includes plans for the development of the Minto project as an open pit, with production anticipated to begin in the third quarter of 2007. The company initiated a pre-feasibility study on Area 2 by SRK Consulting (Canada) Inc. In 2007, Sherwood Copper plans to drill 16 000 m in two phases. Phase 1 consists of four to six deep drill holes (2500 m) to test the “Gap” between the Area 2 deposit and the Main Minto deposit, and to extend Area 2 stacked mineralized zones beneath the proposed open pit in an area of very little previous work. Phase 2 consists of drilling 60 holes (13 500 m) to expand resources at Area 2, to target higher-grade resources and drill deeper holes to test mineralized horizons at depth, and to aggressively test several other highly prospective targets, including Area 118, Ridgetop, Airstrip, Copper Keel, and Area 112. A pre-feasibility study is under way to convert resources to reserves for the third quarter of 2007.

MINERAL RESOURCE ESTIMATE FOR SHERWOOD COPPER CORP.’S AREA 2 ZONE AND MINTO PROJECT, YUKON

Category	Mt	% Cu	g/t Au	g/t Ag
AREA 2 ZONE				
Measured	3.58	1.56	0.62	n.a.
Indicated	4.02	0.99	0.36	n.a.
Measured and indicated	7.60	1.26	0.48	n.a.
Inferred	1.38	1.01	0.33	n.a.
MINTO PROJECT				
Proven	5.57	2.24	0.81	9.2
Probable	0.30	1.49	0.71	7.2

Sources: For the Area 2 Zone, Sherwood Copper Corp.’s Annual Information Form for the year ended December 2006, reported on April 30, 2007, by Lions Gate Geological Consulting Inc; for the Minto project, Sherwood Copper Corp.’s 2006 Annual Report.

Notes: Area 2 resources are based on 92 drill holes with a 0.5% copper cut-off grade. Reserves are calculated from resources. Reserves have a 0.62% copper cut-off, and excludes oxide material.

The North Donnelly zone at the Kinaskan property was discovered by Canadian Gold Hunter Corporation (100% interest). The GJ/Kinaskan project is a copper-gold porphyry target, located in the Stikine region of northwestern British Columbia, about 90 km south of Dease Lake and 10 km west of the Stewart Cassiar highway. In 2006, exploration spending on the project amounted to \$3 million. Exploration work included 62 drill holes totaling 18 132 m, ground geophysics, reconnaissance geochemistry of the Donnelly and North Donnelly zones, with continued environmental baseline studies, in-fill drilling of the Donnelly zone (12 268 m), and exploration drilling at the newly discovered North Donnelly zone (3825 m). Deep drilling on the west end of the Donnelly zone returned intersections of 192.0 m grading 0.302% copper and 0.463 g/t gold, and 568.9 m grading 0.214% copper and 0.242 g/t gold. Donnelly has been the prime exploration target on the property and can be traced over a distance of 1500 m in an east and west direction, 315 m vertically and up to 300 m wide, and remains open to the west and at depth. The new North Donnelly zone lies northwest of the Donnelly zone and is a strong induced polarization anomaly extending over a 600-m by 600-m area containing variable amounts of copper and gold, pyrite, and local chalcopyrite. The zone has been drilled over a 200-m by 200-m area and remains open. Further drilling will establish continuity and geological control. North Donnelly drill intersections include 81.58 m (core width) grading 0.292% copper and 0.223 g/t gold, 138.14 m (core width) grading 0.161% copper and 0.110 g/t gold, 189 m grading 0.220% copper and 0.416 g/t gold, and 82.3 m grading 0.334% copper and 0.627 g/t gold. Plans for 2007 include 15 000 m of drilling at the Donnelly zone, as well as geophysics and geochemistry work. Drilling is also planned to expand and better define the North Donnelly zone with an updated resource estimate after completion of the 2007 program. In 2007, new resource estimates were made with a copper cut-off grade of 0.20% for the base-case scenario (see the table below).

RESOURCE ESTIMATE FOR CANADIAN GOLD HUNTER CORP.'S NORTH DONNELLY AND DONNELLY ZONES, AS OF APRIL 2007

Category	Mt	% Cu	g/t Au	g/t Ag
NORTH DONNELLY ZONE (1)				
Inferred	13.75	0.294	0.462	1.9
DONNELLY ZONE (2)				
Indicated	116.93	0.361	0.398	2.2
Inferred	9.87	0.336	0.365	1.8

Source: Canadian Gold Hunter Corp.'s 2007 Annual Information Form.

(1) Resource estimate based on 5770 m in 25 holes and on a 0.20% copper cut-off. (2) Resource estimate based on 24 300 m in 78 holes and on a 0.20% copper cut-off.

The 60-62 zone at the polymetallic Big Bull deposit was discovered by Redcorp Ventures Ltd. The Tulsequah project includes the past producing Tulsequah Chief and Big Bull deposits, located on the east side of the Tulsequah

River in northwestern British Columbia, approximately 100 km south of the town of Atlin and 65 km northeast of Juneau, Alaska. The 2006 exploration drill program was focused on upgrading resources for the feasibility study, exploration of geophysical anomalies near mine workings, and regional-scale studies. Combined drilling at Tulsequah Chief and Big Bull amounted to 23 350 m. At the Big Bull deposit, Redcorp completed 15 312 m of drilling in 37 holes, the first drilling since 1994, with the goal of confirming continuity and expanding resources along strike and down dip. The 60-62 discovery was announced in November 2006. A new lens of mineralization, southwest of the Main deposit, was encountered with a true width of 5 m grading 20 g/t gold, 253.42 g/t silver, 0.66% copper, 11.59% lead, and 26.63% zinc. The 60-62 zone is one of the highest-grade zones ever encountered on the deposit. Exploration near the Tulsequah mine workings also resulted in mineralization being intersected in the new A zone, which now has an NI 43-101-compliant resource estimate (see table below).

RESOURCE ESTIMATE FOR REDCORP VENTURES LTD.'S TULSEQUAH CHIEF AND BIG BULL PROJECTS, AS OF APRIL 2007

Category		tonnes	% Cu	% Pb	% Zn	g/t Au	g/t Ag
TULSEQUAH CHIEF (1)							
AND BIG BULL							
Indicated		6 139 800	1.4	1.24	6.41	2.67	98.93
Inferred		1 717 800	0.73	1.59	5.46	2.63	120.14
A-EXTENSION AT TULSEQUAH CHIEF (2)							
Indicated		108 900	2.12	0.55	3.29	1.58	72.7
Inferred		98 300	1.02	0.35	4.22	0.75	27.46
BIG BULL (3)							
Big Bull Main zone	Indicated	211 000	0.40	1.25	3.33	3.04	161.67
Big Bull Main zone	Inferred	482 000	0.37	1.50	3.42	2.89	212.89
60-62	Inferred	187 000	0.31	5.41	12.57	7.39	148.23

Sources: Redcorp press release, April 3, 2007; Redcorp's Annual Information Form for year ended December 2006, filed April 2007.

(1) Calculated by Wardrop Engineering Ltd., net smelter return cut-off at \$86/t. Includes A-extension mineralization at Tulsequah Chief. (2) Net smelter return cut-off at \$86/t, resource estimate is based on 30 drill holes. (3) Net smelter return cut-off at \$86/t, resource estimate is based on 205 historic holes and 64 recent holes.

Gold Discoveries for 2006

The South zones at the Macassa mine in Kirkland Lake were discovered by Kirkland Lake Gold Inc. Sixteen new mineralized gold structures called the "New South Mine Complex" lie 520-2140 ft south of historically mined mineralization and trend at angles to the structural "Breaks." The new zones are located south of the Macassa mine workings. Starting in 2003, the company planned to spend \$21 million over three years exploring the Kirkland Lake properties. In July 2003, a zone of 2.3 oz/ton gold over 90.4 ft was intersected south of the '04 Break and Main Break system followed by multiple high-grade drill-hole intersections. Zones intersected include the Lower D North zone grading 5.57 oz/ton (uncut) gold over a core length of 50 ft and the New South zone grading 2.08 oz/ton gold (uncut) over a true width of 22.1 ft. In 2006, the company discovered the White zone between the Lower D North and New South zones, which returned intersections grading 9.60 oz/ton (uncut) gold over a core length of 10.7 ft and

11.65 oz/ton (uncut) gold over a core length of 9 ft. The area of new mineralization is centred around 700-2000 ft south of the Macassa mine workings and between the 4600-ft and 5500-ft elevations. Recent (October 2006) reserves and resources are outlined in the table below. In 2006, a 2500-ft-long exploration drift was driven from Macassa's 5300 level and completed in April 2007, providing access for drill platforms and mining. Initial drifting on some of the mineralized zones confirm continuity and grade encountered during drilling. In 2007, the company plans to focus on exploration, underground drilling, drifting, and delineation on the new zones to the south.

RESOURCE ESTIMATE FOR KIRKLAND LAKE GOLD INC.'S NEW SOUTH MINE COMPLEX, ONTARIO, AS OF OCTOBER 2006

Category	tons	oz/ton
Proven reserves	1 200	0.84
Probable reserves	269 000	0.62
Indicated resources	184 000	0.74
Inferred resources	563 000	0.71

Source: Management's discussion and analysis, second quarter of fiscal year 2007, as of November 30, 2006, covering results up to October 31, 2006.

Note: Cut to 3.50 oz/ton.

The Cartwright zone at the Rice Lake mine (formerly Bissett mine and San Antonio mine) in Manitoba was discovered by San Gold Corporation Inc. The Cartwright zone was first intersected by the company in March 2006 and is located 1 km west of the Rice Lake gold mine. The Rice Lake project is located in the town of Bissett on the north shore of Rice Lake in southeastern Manitoba. This new mineralization lies within currently permitted mineral leases and is accessible from the 450-ft level of the Rice Lake mine. The discovery intersection graded 21 g/t (0.61oz/ton) gold over 3.4 m (11 ft). The Cartwright deposit contains multiple veins and is geologically similar to the Rice Lake mine. By July, over 50 000 ft (15 000 m) of surface drilling in 105 drill holes had tested the Cartwright zone along a strike length of 2000 ft to a maximum depth of 1300 ft below surface. A.C.A. Howe International was contracted to calculate a mineral resource and a feasibility study to develop the deposit. The consultants concluded that no additional drilling was necessary to justify beginning a program of underground delineation to establish proven and probable reserves. A.C.A. Howe recommended that the Cartwright zone be developed along the 2000-ft strike length down to 400 or 500 ft below surface with development headings within the San Antonio Mine Unit, allowing for enough detailed drilling to establish reserves. Development costs were estimated at \$4 million over a two-year period with a 3400-ft ramp opening that would be within 500 ft of the Rice Lake mill. Results from

A.C.A. Howe's mineral resource report, as of December 2006, are shown in the table below.

RESERVES AND RESOURCE ESTIMATE FOR SAN GOLD CORP.'S CARTWRIGHT ZONE AT THE RICE LAKE MINE, MANITOBA, AS OF DECEMBER 2006

Category	tons	oz/ton
Indicated	136 200	0.22
inferred	1 761 200	0.22
probable	54 700	0.27

Source: A.C.A. Howe International Limited, mineral resource and reserve estimates as of December 2006.

Notes: Measured and indicated resources include reserves. The Cartwright zone has a cut-off grade of 0.15 oz/ton over 4 ft.

Future Work on Discoveries

It is intended that future articles on discovery analysis will include diamonds, uranium, and possibly other commodities. As more data become available, analyses of exploration trends, including mineral discovery record, exploration efficiency and costs, and future production needs and sources, will be presented.

SIGNIFICANT SELECTED CANADIAN PROJECTS

This section highlights some of Canada's most active projects in 2006 by commodity. Project selection is based on the MEG listing of companies according to exploration spending intentions and other criteria. Some of these companies are listed in the next table, which outlines the companies with the largest exploration budgets in Canada. The survey is a snapshot of spending intentions when they were first announced; however, project analysis and descriptions are taken from annual reports after year-end. Therefore, the project descriptions and highlights are heavily dependent on corporate reporting, which can be of variable quality and transparency, as well as on the various publications and databases mentioned previously. Hence, only projects that have been announced or reported on publicly and in sufficient detail are included in this article. These projects were deemed to be representative of exploration activity in Canada for 2006. In addition, there is no guarantee that the projects highlighted below are the same projects that companies submitted to MEG for the corporate exploration survey. It should also be noted that, although only gold, base metals, and diamonds are considered in detail in this report, other commodities such as uranium, molybdenum, and iron ore saw significant exploration in Canada in 2006.

MEG-SURVEYED COMPANIES WITH THE LARGEST EXPLORATION BUDGETS FOR CANADA

Company	US\$ millions
De Beers Group	62.4
Shore Gold Inc.	60.9
Inco Limited	46.1
Falconbridge Ltd.	30.3
NovaGold Resources Inc.	27.6
Miramar Mining Corp.	26.4
BHP Billiton	22.0
St. Andrews Goldfields Ltd.	17.6
FNX Mining Company Inc.	15.0
Wolfden Resources Inc.	13.9

Furthermore, MEG exploration spending data are presented under the headings of company, location, commodity, and work stage. As this article covers exploration and discoveries, only expenditures at the grassroots, late-stage, and feasibility levels are considered; mine-stage exploration is excluded. MEG defines grassroots as "exploration from the earliest stage through perimeter drilling; also includes reconnaissance and evaluation forays." MEG defines late stage and feasibility as "exploration to further quantify and define a previously identified orebody once the target outline stage has been completed. Also includes all feasibility work up to the point of a production decision."

Gold

In Canada and in the rest of the world, gold exploration currently attracts the most attention in terms of exploration spending. In Canada, it is mainly focused on the Abitibi Greenstone belt of Ontario and Quebec, the Slave Province of the Northwest Territories, the Hope Bay and Meadowbank areas of Nunavut, and British Columbia's cordillera. A number of mines are in the development stage, including Meadowbank in Nunavut and Lapa, Goldex, and Lac Herbin, all in Quebec.

Selected Grassroots and Late-Stage and Feasibility Gold Exploration Projects

With planned spending of \$9.0 million (US\$7.9 million), Skygold Ventures Ltd. was the company with the largest grassroots gold exploration budget in Canada in 2006. The company is focused on the Spanish Mountain gold project, located in the Cariboo Region of south-central British Columbia about 180 km north of Kamloops and 15 km east of the Mount Polley mine. As joint-venture operator, Skygold had a 70% interest in the project and Wildrose Resources Ltd. held the remaining 30%. Exploration work in 2006 followed up positive results from the previous three years with the objective of a better definition of grades in known zones and the expansion of known mineralization at the Main zone, as well as targeting soil or geophysical anomalies. The drill campaign totaled 138 diamond drill

holes and reverse circulation drill holes (total of 27 000 m), and gold mineralization was expanded to 1200 m north-south, 300 m east-west, and to a depth of 200 m and remains open in all directions. One hole returned 38.75 m grading 1.36 g/t gold in the upper zone and 109.5 m grading 1.02 g/t in the lower zone. Plans for the Spanish Mountain project in 2007 included 60 000 m of drilling at 400-m centres.

With a budget of \$30.0 million (US\$26.4 million), Miramar Mining Corporation was the largest late-stage and feasibility gold exploration spender in 2006. Miramar's major project is the Hope Bay gold project in Nunavut (65 km east of Bathurst Inlet and 685 km northeast of Yellowknife). The three deposits of interest are Boston, Doris North, and Madrid, which lie in a north-south-oriented greenstone belt measuring 80 km long and 7-20 km wide. In 2006, a total of 65 975 m of drilling were completed. The drilling focused on the Madrid deposit area and was aimed at expanding the deposit size and increasing the confidence level of known mineralization. Resources were upgraded to the indicated category and continuity was tested at the Boston, Doris Central, and Naartok deposits. The company reported numerous highlights in 2006, including the identification of the new BN zone in the fold area of the Boston deposit, the issuance of a project certificate by the Nunavut Impact Review Board (NIRB), the raising of over \$100 million in equity financing, and the signing of an Inuit Impact and Benefits Agreement (IIBA) with the Kitikmeot Inuit Association (KIA). The company plans 2007 exploration spending totaling \$31 million, including \$11.8 million for resource/reserve drilling (50 000 m) on the Madrid group of deposits, \$2.9 million for resource expansion and definition drilling (10 000 m) on the new BN discovery at Boston, and \$3.8 million for exploration drilling (12 000 m) at other targets in the Hope Bay Belt, as well as \$8.1 million on camp and transportation costs and \$4.1 million on indirect expenditures. Resource levels for the Hope Bay gold project are shown in the table below.

RESOURCES FOR MIRAMAR CORPORATION'S HOPE BAY GOLD PROJECT

Category	Deposit	Mt	g/t Au
Indicated	Madrid	32.5	3.5
	Doris	1.2	19.3
	Boston	2.3	10.7
Inferred	Madrid	42.5	2.9
	Doris	1.6	14.5
	Boston	2.4	9.5

Source: Miramar Mining Corporation press release of April 4, 2007, resources as of December 31, 2006.

Note: Cut-off grades: Boston, 4 g/t; Doris, 5-8 g/t; Madrid, 1.5 g/t gold.

Alexis Minerals Corporation planned to spend \$7.7 million (US\$6.8 million) on gold and base-metals exploration focusing on properties in the Rouyn-Noranda and Val-d'Or areas of northwestern Quebec. In 2006, the company drilled a total of 64 915 m in 350 holes focused on two gold projects (Lac Herbin and Lac Pelletier) and three base-metal properties (West Ansil, Louvex, and the Metco Option). The total budget for 2006 was increased to \$18.8 million due to positive drill results. The Lac Herbin property is 10 km east of Val-d'Or near two past-producing mines: the Ferderber and Dumont mines. In 2005 and 2006, Alexis Minerals completed a scoping study at Lac Herbin and embarked on underground and lateral development, culminating with a 15 000-t bulk sample that produced 2322 oz of gold. The drilling program (33 890 m underground and 2778 m from surface) further defined and extended known zones and intersected new mineralization. The discovery of a set of multiple stacked, flat-dipping veins called the "Flat Swarm" was announced in January 2006 with intersections of 5.82 g/t gold over 32.5 m (core width assumed). An additional new zone parallel to the principal orebodies was intersected in the S3 shear zone and returned 35.42 g/t gold over 4.2 m (true width). In January 2007, InnovExplo inc. completed an update of the Lac Herbin mineral resources (see the table below). The Lac Herbin deposit has been defined for 500 m along strike and to a depth of 350 m, and remains open to the west and at depth. In August 2006, Alexis bought the 1400-t/d Aurbel mill from Aur Resources Inc. and the remaining 50% of the Aurbel property for \$3 million. The mill is located 3 km north of Lac Herbin. The Lac Pelletier deposit is located 4 km southwest of Rouyn-Noranda in the Abitibi Greenstone belt. The company has the option to earn a 100% interest in the property from Thundermin Resources Incorporated. In July 2006, the company drilled 15 holes totaling 4517 m, confirming the continuity and extensions with a new structural model for zones 3 and 4. A new resource estimate was made in October 2006 and appears in the table opposite. In September 2006, Alexis initiated a scoping study, which was completed in April 2007 by Golder Associates Ltd., with a mining capacity of 700 t/d for an initial three-year mine life. A more detailed pre-feasibility study was recommended to move the project closer to production. In 2007, the company plans to complete additional engineering studies, drill to add resources, and dewater the ramp and drifts for underground exploration.

**RESOURCE ESTIMATE FOR ALEXIS
MINERALS CORP.'S LAC HERBIN
PROJECT, AS OF JANUARY 2007**

Category	tonnes	g/t Au
Measured and indicated	494 900	7.83
Inferred	678 000	7.69

Source: Lac Herbin project, technical feasibility study, Golder Associates Ltd., August 2007.
Note: Cut-off grade of 34.28 g/t gold.

**RESOURCE ESTIMATE FOR ALEXIS
MINERALS CORP.'S LAC PELLETIER
PROJECT, AS OF OCTOBER 2006**

Category	tonnes	g/t Au
Measured	61 000	6.19
Indicated	1 179 800	5.39
Inferred	491 100	4.94

Source: Preliminary Assessment Review of the scope and potential of the Lac Pelletier Gold project, Rouyn-Noranda, Quebec, by Golder Associates Ltd., February 2007.
Note: Cut-off grade of 3 g/t gold.

San Gold Corporation budgeted \$7.0 million (US\$6.2 million) for grassroots gold exploration in 2006. The company acquired the underground Rice Lake gold mine (formerly known as the Bissett mine or San Antonio mine) in 2004 and brought it back into production in 2006. It also initiated the development of a satellite mine called the San Gold #1 mine. The Rice Lake gold mine is located in the town of Bissett in the Rice Lake greenstone belt, approximately 230 km north-northeast of Winnipeg in southeastern Manitoba. San Gold #1 is located 3 km east of the mine site along the mine horizon and the San Gold #2 and San Gold #3 deposits are located 6 km east along the same trend. In 2006, the company drilled 105 exploration holes west of the Rice Lake mine into the newly discovered Cartwright zone (strike length of 2000 ft and a maximum depth of 1300 ft below surface). A December 2006 study by A.C.A. Howe recommended that the Cartwright zone was drilled sufficiently to be developed. At San Gold #2 and San Gold #3, A.C.A. Howe recommended additional drilling to in-fill sparsely explored areas from surface to 700 ft below surface before development proceeds. The company currently has five years of proven and probable reserves with planned production of 800 tons per day. With the addition of the Cartwright, San Gold #2, and San Gold #3 zones, the company anticipates ramping up to full capacity of 1250 tons per day by January 2009 and hopes to extend the mine life to 10 years. Rice Lake resources are found in the table on the next page.

Agnico-Eagle Mines Ltd. budgeted \$5.7 million (US\$5 million) for gold exploration in 2006. Its exploration programs focused on identifying new mineral reserves in the Abitibi region of northwestern Quebec. The three main projects include the LaRonde mine and the Goldex and Lapa gold development-stage projects, which are both expected to start production in 2008. These projects are within 50 km of each other and the LaRonde mine infrastructure. At the Goldex project, construction started in 2005, underground development is under way, and construction is expected to be completed in late 2007. The mine life is expected to be 10 years. Probable reserves are 22.8 Mt grading 2.29 g/t gold with a capacity of 7000 t/d. Construction at Lapa started in 2004 and development was accelerated in 2006 with underground lateral development

**MINERAL RESOURCE AND MINERAL RESERVE ESTIMATES
FOR SAN GOLD CORP.'S RICE LAKE MINE, AS OF
DECEMBER 2006**

	Category	tons	oz/ton
RESERVES			
Rice Lake	Proven and probable	986 700	0.28
San Gold #1	Proven and probable	256 100	0.22
Cartwright	Probable	54 700	0.27
Total reserves		1 297 500	0.26
RESOURCES			
Rice Lake	Measured and indicated	964 100	0.29
	Inferred	1 879 500	0.29
San Gold #1	Measured and indicated	283 200	0.22
	Inferred	936 500	0.22
Cartwright	Indicated	136 200	0.22
	Inferred	1 761 200	0.22
San Gold #2 and #3	Indicated	173 100	0.2
	Inferred	195 600	0.26
Total measured and indicated resources		1 556 600	0.26
Total inferred resources		4 772 800	0.26

Source: A.C.A. Howe International Limited, Technical Report, December 2006.

Notes: Cut-off grade 0.15 oz/t over 4 ft. Measured and indicated resources include proven and probable reserves.

and shaft sinking nearing completion. Capacity is planned to be 1500 t/d with a seven-year mine life. In 2006, drilling at Lapa was aimed at confirming and expanding the known orebodies. Lapa contains probable reserves of 3.9 Mt grading 9.08 g/t gold. In 2007, the company expects to spend the following in Canada: capital expenditures of \$91 million on construction and development at Goldex, \$91 million at the LaRonde mine on new infrastructure, \$37 million on shaft sinking and development at Lapa, and approximately \$13 million for grassroots exploration.

In 2006, Cumberland Resources Ltd. planned to spend \$3.9 million (US\$3.4 million) on exploration at its 100%-owned, advanced Meadowbank gold project located in the Kivalliq District of Nunavut 70 km north of Baker Lake. Three of the four known deposits (Goose Island, Portage, and Vault) are planned to be mined by open pit. In 2006, the company continued to focus on defining, expanding, and in-fill drilling known mineralization; drilling 2270 m in 12 holes at the Goose South zone, a new discovery made in 2006; and drilling 5940 m in 46 holes at the Cannu zone, a 2005 discovery. In January 2007, SRK Consulting Limited completed an updated mineral resource estimate for the Portage deposit, which incorporated the Cannu zone (see table opposite). In September 2006, the board of directors approved a plan to bring the mine into production. In December 2006, the company received a project certificate from the Nunavut Impact Review Board (NIRB); land access and quarry permits followed, as well as additional licences to commence road construction from Baker Lake to the project. In February 2007, the company announced the acceptance of a take-over offer from Agnico-Eagle valued at approximately \$710 million. Agnico-Eagle plans to spend approximately \$375 million over a three-year period to bring Meadowbank into production.

**MINERAL RESOURCES FOR MIRAMAR MINING CORP.'S
MEADOWBANK GOLD PROJECT, AS OF JANUARY 2007**

Deposit	Category	tonnes	g/t Au
Portage (including Cannu zone)	Measured	2 800 000	5.4
1.5 g/t cut-off	Indicated	9 000 000	5.1
	Inferred	700 000	4.7
Goose Island	Indicated	2 240 000	6.5
1.5 g/t	Inferred	1 370 000	4.2
Vault	Indicated	8 610 000	3.9
2.0 g/t	Inferred	870 000	5.4
PDF	Inferred	507 000	4.5
OPEN-PIT MINERAL RESERVE			
Portage	Proven and probable	11 010 000	4.5
Vault	Proven and probable	8 010 000	3.4
Goose	Proven and probable	2 310 000	5.7
Total	Proven and probable	21 320 000	4.2

Sources: Cumberland Resources Ltd.'s Annual Information Form for the year ended December 2006, dated as of March 28, 2007, prepared by SRK Consulting (UK) Limited.

Notes: PDF inferred mineral resource estimate prepared by Cumberland Resources Ltd. Tonnes rounded to nearest 10 000 and grade rounded to nearest 0.1 g/t. Numbers may not add due to rounding. The PDF and Cannu zones were not used to derive the mineral reserve estimate; 95% mining recoveries and contact dilution applied for reserves.

Dundee Precious Metals Inc. planned to spend \$15.6 million (US\$13.7 million) on late-stage and feasibility gold exploration in 2006. The company's focus is on the Back River project in Nunavut, located 520 km northeast of Yellowknife, which comprises six main properties (George Lake, Goose Lake, Boot Lake, Boulder Pond, Needle Lake, and Bathurst Inlet). In July 2006, the company bought the remaining portion of the project from Kinross Gold Corporation to increase its interest to 100%. Exploration in 2006 consisted of regional exploration, mapping, prospecting, and grab sampling of new exploration targets at George Lake, Boot Lake, and Boulder Pond. At Goose Lake and George Lake, a total of 24 040 m were drilled in 79 holes to expand resources along strike and at depth. For 2007, a budget of \$18.4 million is proposed for the Back River project, which involves expanding resources at George Lake to test the strike and depth extensions of the Lone Cow Pond mineralization zone. A large geochemical survey is also planned. An update of Back River resources is expected in the second quarter of 2007.

In 2006, Tyhee Development Corp. planned to spend \$12.0 million (US\$10.6 million) on extending known zones at the advanced-stage Yellowknife gold project and re-evaluating a number of newly acquired past-producing properties. The Yellowknife project is located 90 km north of the city of Yellowknife, Northwest Territories. Exploration in 2006 was focused on step-out diamond drilling to expand known mineralization at the Ormsby North Extension, Ormsby South Extension, West zone, Bruce Lake zone, and Typhoon zone. The company expanded its work-

ing area by acquiring gold showings and deposits such as the Clan Lake property, the Big Sky property, and the Goodwin Lake property. At the Yellowknife project, the company discovered a new zone, the Discovery North zone, located 20 km north of the historic Discovery Main zone. The company reports completing 10 drill holes, 2 of which returned intersections of over 5 g/t gold over 1.5 m. As well, the Typhoon zone was discovered 500 m north of the Discovery Main zone. The Nicholas Lake mine zone was re-sampled in 2006 with the aim of outlining a larger but lower-grade deposit. Further re-sampling is planned for 2007. In total, the company drilled 30 000 m of surface diamond drill holes. In 2007, the company plans to complete a preliminary economic assessment, continue expansion drilling, upgrade resources to measured and indicated from inferred, and advance mine permitting. Resources for the project, as of December 2006, are shown in the table below.

RESOURCE SUMMARY OF TYHEE DEVELOPMENT CORP.'S YELLOWKNIFE GOLD PROJECT, (1) AS OF DECEMBER 2006

Category	tonnes	g/t Au
Measured and indicated	7 258 000	3.99
Inferred	4 489 000	3.42

Source: Tyhee Development Corp. press release, December 21, 2006.

(1) Includes the Ormsby, Nicholas Main, Bruce, and West zones.

Notes: The Ormsby, Bruce and West zones used a 1.25-g/t cut-off. The Nicholas Lake Main zone used a 2.5-g/t cut-off and 1.5-m minimum mining width.

NovaGold Resources Inc. planned to spend \$31.4 million (US\$27.6 million) on late-stage and feasibility study gold and base-metal exploration in 2006. The focus of NovaGold's Canadian activities is the advanced-stage Galore Creek gold-copper-silver porphyry-related deposit located 150 km northeast of Stewart in northwestern B.C. In 2006, the company drilled over 36 000 m aimed at expanding known mineralization and upgrading resources to the measured and indicated categories. Resources were expanded significantly on further definition of the deep Bountiful zone where new mineralization was intersected at the high wall of the Central zone and down dip in the West Fork deposit. Condemnation drilling for the tailings pond was completed. The company exercised its option to purchase a 100% interest in the project. A 2006 feasibility study by Hatch Ltd. calculated proven and probable reserves for Galore Creek, confirmed the economic viability, and outlined a mine plan for the project. Capacity is planned at 65 000 t/d for the first five years with a total mine life of 22 years. Total capital costs to bring Galore Creek into production were estimated at \$2.2 billion (US\$1.8 billion). Production was anticipated to start in 2012. Resources and

reserves at Galore Creek are shown in the table below. (Note: Although not covered during this period, a decision was made in November 2007 to suspend the development of a mine on the project.)

RESOURCES AND RESERVES OF NOVAGOLD RESOURCES INC.'S GALORE CREEK DEPOSIT, AS OF MARCH 2007

Category	Mt	g/t Au	g/t Ag	% Cu
Proven and probable	540.7	0.30	5.32	0.56
Measured and indicated	928.4	0.28	4.70	0.50
Inferred	401.6	0.19	3.70	0.37

Source: Novagold Annual Report 2006, as of March 31, 2007.

Notes: Mineral resources are inclusive of mineral reserves. Reserves were calculated using a \$3.82/t net smelter return as a cut-off.

Base Metals

Base-metal exploration took place in most provinces and territories with the focus on known base-metal producing areas and locations with known occurrences (the Sudbury Basin and Timmins area in Ontario, the Raglan area in northern Quebec, northwestern Manitoba, northwestern and southeastern British Columbia, the Wernecke mountains and Selwyn Basin of the Yukon, and the Northwest Territories). Mines nearing the development stage include: Ruby Creek (molybdenum), Galore Creek (copper-gold-silver), New Afton (copper-gold), all in British Columbia; Minto (copper-gold) in the Yukon; Bur (copper-zinc) in Manitoba; Podolsky (copper-nickel-PGM) in Ontario; and LaRonde II (gold-silver-zinc-copper) in Quebec.

Selected Grassroots and Late-Stage and Feasibility Base-Metals Exploration Projects

Falconbridge Ltd. (acquired by Xstrata plc in September 2006) planned to spend \$26.3 million (US\$23.1 million) on grassroots base-metals exploration in 2006. Falconbridge placed more emphasis on grassroots exploration in 2006 by pursuing its own exploration programs and joint ventures with junior and senior companies. The company's grassroots budget was focused on the search for copper-zinc in the Abitibi region, nickel-copper-PGM in the Sudbury Basin in Ontario and in Nunavik in northern Quebec, and zinc-lead in the Bathurst mining camp of New Brunswick. In August 2006, Falconbridge Ltd. announced a major investment of \$240 million over six years at its Raglan nickel mine to develop new ore reserves and \$250 million on expanding nickel ore production from 1 Mt/y to 1.3 Mt/y by 2009. In 2006, two new lenses at zone 5-8 (4 km east of the concentrator) contributed to the overall 2.67-Mt increase of resources grading 3.0% nickel and 0.8% copper. As of March 2007, Raglan's total resources stood at 25.7 Mt grading 3.0% nickel and 0.9% copper. Falconbridge also announced, in August 2006, the development of

its Perseverance zinc mine in the Matagami region of northwestern Quebec at a cost of \$145 million. A zinc concentrate will be produced at the Lac Matagami mine site. Construction is expected to take two years with a project mine life of five years. As of August 2006, resources at Perseverance stood at 5.1 Mt grading 15.8% zinc, 1.24% copper, 29 g/t silver, and 0.38 g/t gold.

Acadian Resources budgeted \$13.5 million (US\$11.9 million) on late-stage and feasibility base-metal exploration. The company has a portfolio of gold and base-metal projects. In July 2006, the company completed the \$7.5 million acquisition of ScoZinc Limited from HudBay Minerals Inc. The principal asset in this transaction was the Scotia mine, located 60 km northeast of Halifax, Nova Scotia. Acadian Resources completed a feasibility study, and the company plans to bring the mine into production in the second quarter of 2007. The proposed capacity is 2000 t/d for the first five years from an open pit and then a rate of 1350 t/d for a further two and a half years from an underground operation. Acadian also has four gold exploration projects in Nova Scotia: Beaver Dam, Forest Hill, Goldenville, and Tangier. At the Beaver Dam deposit, the company completed 133 drill holes totaling 17 840 m and started metallurgical testing with hopes of developing a potential bulk tonnage open-pit gold project. Current work is limited to diamond drilling, metallurgical testing, and a new resource estimate based on 238 historic drill holes plus 18 drilled by Acadian. Measured and indicated resources as of December 2006 stood at 2.918 Mt grading 2.97 g/t gold, mostly from the Main zone.

In October 2006, Inco Limited was taken over by Companhia Vale do Rio Doce (CVRD) and became CVRD Inco Limited. Before the takeover, Inco had allocated a total of US\$46.1 million for exploration in Canada and US\$36.6 million for reserves improvement and exploration near existing operations in Ontario and Manitoba. In 2006, Inco focused on exploration and extending known mineralization at its existing operations in Sudbury, Ontario; Voisey's Bay, Labrador; and Thompson, Manitoba.

In 2006, Anglo American budgeted \$9.0 million (US\$7.9 million) on grassroots base-metal exploration in Canada, including the West Raglan nickel-PGM project in northern Quebec, a joint venture with Knight Resources (earning a 49% interest) that reported encouraging results in 2005.⁵ Anglo is also earning in for 51% of Goldbrook Ventures Inc.'s Belanger and Nuvilik nickel-copper-PGM project in the Raglan district.

Pacifica Resources Ltd. budgeted \$8 million (US\$7 million) for its Selwyn project located in the eastern Yukon, straddling the border with the Northwest Territories. In total, Pacifica spent approximately \$21.1 million on exploration and acquisition costs in 2006, completing an option to purchase the Howard's Pass Joint Venture properties from Placer Dome (CLA) Ltd. and Cygnus Mines Ltd. Exploration in 2006 included 191 drill holes totaling

41 658 m. This drilling confirmed near-surface mineralization in the Don Valley. Five new zones were discovered (OP 17, Pelly North, Don East, HC, and HC West), and high-grade mineralization was discovered at depth in the XY, HC West, Don, and Anniv Central zones. Drilling of the XY zone upgraded resources and extended potential open-pit mineralization. Deeper drilling confirmed high-grade mineralization down dip toward the axis of the syncline. The company also began collecting baseline environmental data, conducted preliminary engineering surveys, and added more infrastructure. A preliminary economic evaluation was started in 2006 and completed in January 2007. A project development plan was compiled using existing indicated mineral resources that appear in the table below (based on 464 drill holes totaling 86 334 m drilled from 1973 to 2006 with a 2% zinc cut-off). Consultants (Merit International Development) envisaged four open pits with a strip ratio of 5.5:1, with deeper areas using bulk underground mining methods. An initial capacity of 20 000 t/d is planned for a mine life of 13 years. In March 2006, mineral resource estimates were updated to include three of the new discoveries. In January 2007, Pacifica transferred all of its exploration properties to a new exploration company called Savant Explorations Ltd. with Pacifica taking a 33.5% interest. Pacifica retained the Selwyn project and changed its name to Selwyn Resources Ltd. to reflect the sole focus of the company.

**MINERAL RESOURCE INVENTORY OF
PACIFICA RESOURCES LTD.'S
SELWYN BASIN PROJECT AS OF
APRIL 2007**

Category	Mt	% Zn	% Pb
Indicated	86.6	4.93	1.73
Inferred	215.46	4.71	1.48

Source: Pacifica Resources Ltd. press release, April 2, 2007.

Note: Cut-off of 2% zinc, resources based on 464 holes totaling 86 334.6 m.

Starfield Resources Inc. planned to spend \$9.0 million (US\$7.9 million) on late-stage and feasibility base-metal exploration, focusing on advancing existing resources at the Ferguson Lake (100%-owned) nickel-copper-cobalt-PGE property towards a feasibility study. The Ferguson Lake property is located in the Kivalliq region of southern Nunavut, some 240 km west of Rankin Inlet. The property has three principal mineral zones (East, West, and 119) stretching over an east-west strike length of 12 km. In 2006, exploration was directed at detailed in-fill drilling of the West zone pit, the West zone, the Mid and Pit extension, the West zone main, and East zone II. A total of 116 drill holes (24 951 m) led to the identification of a near-surface resource and low-sulphide PGM mineralization in the footwall gabbros. Mineral resources are shown

in the table below. For 2007, the company plans 3000 m of drilling at a cost of \$6.3 million to include definition drilling of the West zone pit and the low-sulphide platinum-palladium mineralization, as well as ongoing metallurgical studies. A scoping study is expected to be completed in late 2007 by Scott Wilson Roscoe Postle Associates Inc. to evaluate the economic potential of the deposit and plan the next stage of project advancement.

RESOURCES ESTIMATE OF STARFIELD RESOURCES INC.'S FERGUSON LAKE DEPOSIT, NUNAVUT, AS OF JULY 2007

Category	Mt	% Ni	% Cu	% Co	g/t Pt	g/t Pd
Inferred	28.9	0.67	1.01	n.a.	n.a.	n.a.
Indicated	15.3	0.71	1.04	0.08	0.28	1.64

Source: Technical review and report on revised estimates of mineral resources at Ferguson Lake nickel-copper-cobalt-PGE property.
n.a. Not applicable.

Canadian Royalties Inc. budgeted \$7.2 million (US\$6.3 million) on late-stage and feasibility base-metal exploration at the Raglan South nickel-copper-platinum-palladium deposit located at the northern tip of Quebec, near Xstrata Nickel's Raglan mine in Nunavik. The initial budget was significantly expanded due to positive drilling results with exploration expenses for the year totaling \$12.8 million. Drilling expanded the Ivakkak deposit, extended the Mequillon deposit, and explored the Tootoo zone and deep targets near the Mesamax deposit. The Mequillon deposit has now been traced for over 1.4 km and is a possible underground bulk mining operation. The company has delineated resources for five deposits within 50 km of the central area of the property and several additional areas of mineralization have been intersected. The company received a positive preliminary economic assessment report (scoping study) indicating the Raglan South project could be economic at a mining rate of 2500 t/d over a 10-year mine life with capital costs of \$225 million. This mining rate was increased to 3500 t/d after an encouraging 2006 exploration campaign. The company has proceeded to commission a bankable feasibility study with SNC-Lavalin Group Inc. Metallurgical tests were completed, including a pilot test plant of a small bulk sample from the Mesamax deposit, and an Environmental and Social Impact Assessment Study was initiated. In October 2006, a Memorandum of Understanding with Makivik Corporation to move towards a comprehensive impact and benefits agreement was signed. As it focuses on moving the Raglan South project towards production, the company's plans for 2007 include a deep penetrating airborne geophysical survey, completion of an environmental and social impact assessment, completion of a bankable feasibility study, the signing of offtake agreements for concentrates, and advancing the permitting process. Resources at Raglan South appear in the following table.

MINERAL RESOURCE ESTIMATE OF CANADIAN ROYALTIES INC.'S RAGLAN SOUTH PROJECT, (1) AS OF FEBRUARY 2007

Category	tonnes	% Ni	% Cu	% Co	g/t Pt	g/t Pd	g/t Au	g/t PGE
Indicated	16 180 000	0.91	1.1	0.04	0.53	2.07	0.13	2.73
Inferred	723 000	0.87	0.94	0.04	0.44	1.76	0.1	2.31

Source: Canadian Royalties Inc. 2006 Annual Report.
(1) Includes the Mesamax, Expo, Ivakkak, Mequillon and TK zones.

NewGold Inc. planned to spend \$7.0 million (US\$6.2 million) for late-stage and feasibility base-metal exploration focused on the New Afton copper-gold porphyry project, located 10 km west of Kamloops in the south-central interior of British Columbia. The property includes the two exhausted Afton open pits where resources at depth were investigated subsequent to NewGold's acquisition in 2000. In 2006, NewGold completed underground drilling totaling 16 800 m in 34 holes to in-fill the Main zone and explored the C zone. There are three main zones of mineralization: the Main zone, the Hanging Wall zone, and the C zone (defined in 2006 and located vertically beneath the Main zone), which sits between 300 m and 900 m below surface. A feasibility study coordinated by Hatch Ltd. envisioned developing the New Afton project as a bulk underground mining operation. The mill plan is designed to process 11 000 t/d with a lower daily rate for the first two years at 4400 t/d, with full production after completion of underground-to-surface conveyor facilities. A concentrate containing copper, gold and silver would be produced at the mine site over a 12-year mine life. Exploration in 2007 will be focused on drilling the Hanging Wall zone and on drilling to increase resources of known mineralization, including in-fill drilling around the Hanging Wall zone and beneath the C zone, and testing beneath intersections drilled in 2006. Reserves and resources appear in the table below.

MINERAL RESOURCE ESTIMATE OF NEW GOLD INC.'S NEW AFTON PROJECT, AS OF SEPTEMBER 2006

Category	Mt	%Cu	g/t Au	g/tAg
Measured	43.25	1.12	0.83	2.68
Indicated	22.41	0.84	0.66	2.42
Inferred	7.94	0.96	0.88	1.55
	(tonnes)	(% Cu)	(g/t Au)	(g/tAg)
RESERVES				
Probable	44 400	0.98	0.72	2.27

Sources: For mineral resources, New Afton project NI 43-101 Independent Technical Report, prepared by Hatch, April 2007; for reserves, prepared by Scott Wilson RPA, with net smelter return value cut-off of \$31.13/t.
Note: Inferred resources based on 12 holes in C zone with a \$10/t cut-off.

Sabina Silver Corporation budgeted \$7.0 million (US\$6.2 million) on late-stage and feasibility base-metal exploration focused on its 100%-owned Hackett River silver-zinc project in Nunavut, located 75 km south of Bathurst Inlet on the Arctic Ocean. The property contains five volcanic massive sulfide (VMS) deposits over a 5-km strike length. The most significant of these deposits are the Main, East Cleaver, and Boot Lake zones. In 2006, the company drilled 53 holes for a total of 17 293 m, with 27 holes drilled into the Boot Lake zone, investigating the new Boot Lake Deep trough. The Boot Lake Deep trough is described as a thick keel of massive sulphides that starts at 205 m in depth and remains open below 600 m, with true width intersections of up to 50 m grading 12% zinc and 300 g/t silver. A March 2007 preliminary economic assessment by Wardrop Engineering Inc. outlined a bulk mining plan for open pits at the Main and East Cleaver deposits, and a large underground mine on the Boot Lake deposit. The table below outlines Wardrop's estimated mineable mineral resources. Plans for 2007 are focused on more definition drilling to expand resources and known zones, as well as exploration and geotechnical drilling, further metallurgical testing, and geophysical surveys. In May 2007, the company signed on AMEC Americas Limited for a pre-feasibility assessment.

MINERAL RESOURCE ESTIMATE OF SABINA SILVER CORP.'S HACKETT RIVER PROPERTY, NUNAVUT, AS OF SEPTEMBER 2006

Category	tons	oz/t Ag	% Zn	% Cu	% Pb	oz/t Au
Indicated	47 073 000	4.37	4.67	0.32	0.68	0.009
Inferred	12 408 000	4.15	3.77	0.27	0.52	0.009

Source: Sabina Silver Corp. Management's discussion and analysis for the year ended September 2006.

Note: Cut-off of 5 oz/t silver equivalent.

Diamonds

Diamond exploration continues to be a significant recipient of exploration spending across Canada, with the focus remaining on the Northwest Territories, Nunavut, Saskatchewan, Ontario, and Quebec. A number of projects are at an advanced stage: Snap Lake, Victor, Star, and Gahcho Kue.

Selected Grassroots and Late-Stage and Feasibility Diamond Exploration Projects

De Beers Group budgeted \$28.4 million (US\$25 million) on grassroots diamond exploration in 2006. The company is involved in exploration projects in Quebec, Ontario, the Northwest Territories, Saskatchewan, Manitoba, and Nunavut. De Beers also increased late-stage spending with a budget of \$42.5 million (US\$37.4 million) for its three advanced Canadian projects. In early 2006, De Beers divested its 42.25% interest in the Fort-à-la-Corne diamond

project in Saskatchewan. The company focus in Canada is on three advanced-stage diamond projects: Snap Lake (Northwest Territories), Gahcho Kue (Northwest Territories), and Victor (Ontario). The Snap Lake project is planned as an underground mine. The company reports resources of 26.4 Mt grading 1.2 ct/t with an average diamond value of US\$144/ct. Full production (3150 t/d) is expected in 2008. The Gahcho Kue diamond project is located 300 km northeast of Yellowknife, Northwest Territories, and only 90 km southeast of the Snap Lake diamond project. The project is a joint venture with De Beers Canada Inc. holding a 51% interest and Mountain Province Diamonds Inc. holding the remaining 49% (after Mountain Province bought Camphor Ventures Inc.'s 4.9% share in June 2007). Three kimberlites have been identified as potentially mineable (the 5034, Hearne, and Tuzo pipes) with indicated and inferred resources of 31.4 Mt with a grade of 1.48 ct/t and diamond values of US\$74/ct. Open-pit production capacity is planned at 2.1 Mt/y over a 15-year mine life with estimated capital costs of \$825 million. The large-diameter drilling planned for 2006 was not completed, but will be restarted in 2007 as a program of seven holes over 1500 m to recover a 60-t sample, or approximately 100 ct of diamonds, for further analysis. The Victor project is located 90 km west of Attawapiskat in the James Bay Lowlands of northeastern Ontario. Construction at Victor was started in 2006 with a target of June 2008 for start-up. The mine is planned as an open pit with a 12-year mine life; however, numerous other diamondiferous kimberlites on the property may extend the mine life. The company reports resources of 28.1 Mt grading 0.23 ct/t with values of US\$419/ct.

Shore Gold Inc. planned to spend \$68.2 million (US\$60 million) on late-stage and feasibility diamond exploration in Canada in 2006. This is the largest budget for any project in Canada. Shore Gold Inc. owns the advanced-stage Star Kimberlite diamond project and a 60% interest in the less advanced Fort-à-la-Corne joint venture (FALC JV). Both properties are located in the Fort-à-la-Corne forest approximately 60 km east of the city of Prince Albert in central Saskatchewan. The Star Kimberlite diamond project has undergone a three-step evaluation process consisting of core drilling to delineate the size and map the internal structure of the kimberlite, underground bulk sampling to recover large parcels (3000 ct or more) of macro-diamonds for grade and price estimates, and large-diameter drilling (LDD) for the recovery of mini-bulk samples of kimberlite used for grade and value modeling for the calculation of a final National Instrument 43-101-compliant mineral resource. Plans for 2007 include completing the LDD program for final grade estimates so that economic models can be constructed and a mineable resource can be calculated by early to mid-2008. The company anticipates a mineral resource estimate and that the work required to upgrade resources to mineral reserves will be achieved by mid-2008. If the mineral reserve is sufficient, the company plans to complete a full bankable feasibility study by the end of 2008. Shore Gold's Fort-à-la-Corne property con-

tains 69 drill-confirmed kimberlites and the joint venture is aggressively exploring the Orion kimberlite cluster (North: 147, 148, 220 and 120; Centre: 145; and South: 133, 140, and 141), which is a 7-km-long contiguous belt of kimberlite. In 2006, the company increased its ownership and control of the property from 42.245% to 60% when De Beers sold its 42.3% interest. This brought in a new partner, Newmont Mining Corporation of Canada Limited, who purchased the remaining 40% for a cash price of \$170.4 million. Shore has control of the FALC JV through its wholly owned subsidiary, Kensington Resources Ltd. The same program of evaluation used for the Star Kimberlite is under way on Orion, including patterned core drilling and LDD, with plans for underground bulk sampling. In 2007, with \$46.2 million in expenditures planned, exploration will continue with ongoing in-fill core drilling and an LDD mini-bulk sample program focused on Orion North and South to delineate and define the kimberlite cluster and establish geological continuity. Drilling will be completed to help define the best location for a shaft to enable bulk sampling. Upon completion of the 20 LDD holes, the drill will return to Star to complete the remaining 25 LDD in the second quarter of 2007. Shore anticipates that a mineral resource estimate on the FALC JV will be available near 2010. The company has enough cash to continue with exploration until the end of 2008, at which point alternative sources of financing will be required to continue exploration and development efforts.

BHP Billiton budgeted \$15.9 million (US\$14 million) on grassroots diamond exploration in Canada in 2006. The majority of BHP Billiton projects are at an early stage of exploration involving drill testing of geophysical targets and following up on prospective locations identified in previous years' work. Another \$6 million went towards work at the Ekati diamond mine. BHP Billiton participated with joint-venture partners in a number of generative diamond exploration projects, including the Aviat project (joint venture with Stornoway Diamond Corporation and Hunter Exploration Group), the Amaruk project (joint venture with Diamonds North Resources Ltd.), and the Churchill project (joint venture with Shear Minerals Ltd. and Stornoway Diamonds Corp.), all in Nunavut, as well as the Seal River project in Manitoba (joint venture with Canstar Resources Inc.).

Stornoway Diamond Corporation budgeted \$15 million (US\$13.2 million) on grassroots diamond exploration in many regions of Canada in 2006. In terms of more advanced projects, Stornoway focused on the following properties: Aviat, Qilalugaq, and Churchill in Nunavut; Timiskaming in Ontario; and the late-stage Renard diamond project in north-central Quebec. In August 2006, Stornoway made takeover offers for Ashton Mining of Canada Inc. and Contact Diamond Corporation. As a result of these transactions, which were confirmed and finalized in January 2007, Stornoway added the development-stage Renard project and the Timiskaming prospect to its property portfolio. The Renard project's Foxtrot property is

located in the Otish Mountains, 820 km north of Montréal, and is the subject of a 50:50 joint venture between Stornoway (via its Ashton acquisition) and SOQUEM Inc. Stornoway, through Ashton, commenced a major bulk sampling program at the Renard kimberlite cluster in the Foxtrot property. The joint venture collected approximately 2400 t of kimberlite during 2006 from Renard 4 and 4000 t from each of Renard 2 and 3. The joint venture expected to announce results by the third quarter of 2007, as well as a valuation of the cumulative diamond parcel. Two new kimberlite dykes were intersected at Foxtrot: the "southeast" and "new" dykes. Exploration also included till sampling, ground geophysics, boulder prospecting, target drilling, and dyke trenching. The company has engaged consultants to prepare a comprehensive pre-feasibility study of potential mining scenarios. Summer work on the Aviat properties (on Nunavut's Melville Peninsula), for which Stornoway is the operator, included kimberlite boulder prospecting and the collection of 2100 till samples to better identify sources of indicator mineral trains. Spring drilling at Aviat totaled 2136 m in 15 drill holes while summer drilling totaled 1833 m in 22 holes. Exploration focused on testing the source of indicator minerals and resulted in 11 kimberlite intercepts and all bodies tested proved to be diamondiferous. A 2007 field program is planned with the focus on discovering the source of the "northern" mineral anomaly and testing the continuity of other known Aviat bodies that were intersected in 2006. The Churchill diamond project is located near Rankin Inlet in the Kivalliq region of Nunavut. Three kimberlites are known on the property: Kahuna, Notch, and Jigsaw. The project was a joint venture with BHP Billiton Diamonds, Shear Minerals Ltd. (58.14%), and Stornoway (41.86%). In July 2007, Shear and Stornoway each acquired 50% of BHP Billiton's (12.5%) interest for \$4 million each. The company was sufficiently encouraged by the diamond counts of these three kimberlites, plus the PST kimberlite, to plan a staged exploration program for 2007 worth \$8.5 million. The Timiskaming diamond project is located in northeastern Ontario and northwestern Quebec, and Stornoway, through Contact Diamond Corp., holds a 100% interest. To date, nine kimberlites have been discovered in the region, including MR8, KL01, and KL22. Six of the pipes are diamondiferous, including the 95-2 pipe, which was mini-bulk sampled in 2003 and 2004, yielding a significant number of commercial diamonds at marginally sub-economic grades. The most recent discovery was the Baby kimberlite found in Quebec in 2006. By mid-2007, Stornoway had re-started exploration, including a detailed airborne survey and till sampling. Analysis of the Baby kimberlite did not return any diamonds. More drilling is planned for 2007 to explore a second potentially diamondiferous kimberlite phase.

Sanatana Diamonds Inc. planned to spend \$9.3 million (US\$8.2 million) on grassroots diamond exploration. The company's focus is on the Mackenzie diamond project located north of Great Bear Lake, approximately 700 km northwest of Yellowknife, Northwest Territories. The

project is a joint venture with Rio Tinto's subsidiary, Kennecott Canada Exploration Inc. Kennecott earned a 15% interest in the project by subscribing to Sanatanas's Initial Public Offering (IPO) for \$2.5 million in equity shares and two additional payments of the same amount to earn its current interest of 15% in the Mackenzie project. Exploration in 2006 focused on the Kilekale Lake and Coville Lake areas, where four airborne magnetic targets were drilled by eight holes for a total of 1226 m. No kimberlite was intersected. Other exploration included helicopter borne magnetic surveys, as well as ground magnetic surveys, glacial till sampling, and drilling on other target areas in the Mackenzie Diamond project area. The company's budget for 2007 stood at \$6.1 million with plans to continue airborne and ground geophysical surveys, drilling, till sampling, and community consultations.

Other Commodities Sought

Continued high commodity prices encouraged the exploration and advancement of projects in uranium, potash, coal, and molybdenum in Canada in 2006. Projects highlighted here were previously mentioned in the 2006 *Overview of Trends in Canadian Mineral Exploration* report.⁶

Uranium

Uranium exploration took place in Saskatchewan's Athabasca Basin, in Labrador's Central Mineral Belt, in the northwest corner of Manitoba, in the Wernecke Mountains in northeastern Yukon, and in the Hornby and Thelon/Baker Basins of the Northwest Territories and Nunavut. In Saskatchewan alone, \$100.2 million was spent on uranium exploration and deposit appraisal, mostly in the Athabasca Basin.⁷

The Shea Creek uranium project is a joint venture with AREVA Resources Canada Inc. as operator and UEX Corporation with a 24.5% interest (with an option to earn up to 49%). The project is located in the western Athabasca area of northern Saskatchewan, immediately south of the depleted Cluff Lake uranium mine that operated from 1980 to 2002. Shea Creek has three zones: Anne, Colette, and Kianna (discovered in 2005⁵). Significant 2006 intersections from three zones in the Kianna deposit include: 1.81% U_3O_8 over 5.6 m (core width assumed) located approximately 20 m above the unconformity, 2.08% U_3O_8 over 3.7 m at the unconformity, and 1.37% U_3O_8 over 6.8 m about 20 m below the unconformity. Other holes returned 12.57% U_3O_8 over 11.9 m at the unconformity and 0.53% U_3O_8 over 100 m below the unconformity, as well as an additional 1.04% U_3O_8 over 4.9 m at 150 m below the unconformity. In January 2007, a drill program of 24 holes consisting of 4 pilot holes and 20 directional holes was proposed at a cost of \$4.3 million. In April 2007, AREVA and UEX announced plans to commence the regulatory process for sinking an exploration shaft between the Kianna and Anne deposits. The proposed shaft would reach 950 m in depth at an estimated capital cost of

\$100 million. The Anne deposit has been outlined for a strike length of 250 m and a width of 100 m and remains open.

Coronation Mines Ltd. (2%) and UEM Inc. (49% AREVA Resources Canada Inc. and 49% Cameco Corp.) continued to follow up on mineralization on the Virgin River project's new Centennial zone (first intersected in 2004). The project is located in the south-central part of the Athabasca Basin in northern Saskatchewan. The \$2.0 million exploration budget in 2006 was spent on four wedge holes and three pilot holes totaling 4636 m along the Dufferin/Virgin River trend. The Centennial zone has been traced for about a 450-m strike length along a northeast/southwest trend and a minimum across strike width of 12 m. Significant intersections include: 5.35% U_3O_8 over 5.3 m (true thickness) and 2.63% U_3O_8 over 7.2 m (true thickness). To help define drill targets, a ground geophysical survey was conducted. The company proposed a budget of \$3.3 million for 2007 for more drilling and follow-up work.

The Millennium deposit is located 35 km north of the former Key Lake mine in the southeastern Athabasca Basin and is a joint venture between Cameco (42%), JCU Canada Exploration Ltd. (Japan Canada Uranium Co. Ltd.) (30%), and AREVA Resources Canada Inc. (28%). In 2006, Cameco initiated feasibility work and proceeded with more expansion drilling along strike and in-fill drilling. Two shaft pilot holes were completed and a 3-D seismic survey was initiated. Indicated and inferred resources stand at 683 000 t grading 3.75% U_3O_8 .

In Newfoundland and Labrador, most uranium exploration takes place in Labrador's Central Mineral Belt in central and east-central Labrador, an area that has seen very little uranium exploration since the 1970s. The most advanced project is Aurora Energy Resources Inc.'s Michelin deposit. This project is located near the northeast coast of Labrador close to the town of Postville. With a 2006 budget of \$14.5 million, the company was able to complete 120 drill holes totaling 46 078 m, a ground gravity survey, a resource estimate, and metallurgical, environmental and engineering studies. Drilling was carried out at a number of deposits and prospects, including the Michelin Main, Jacques Lake, White Bear, Rainbow, Inda, and Nash targets. New mineralization was intersected at Jacques Lake and White Bear. A baseline environmental program was initiated to support a pre-feasibility study at the Michelin and satellite exploration sites. A January 2007 resource review updated the NI 43-101-compliant resource for the Michelin and Jacques Lake deposits with measured resources of 3.4 Mt grading 0.07% U_3O_8 , indicated resources of 25.06 Mt grading 0.10% U_3O_8 , and inferred resources of 17.88 Mt grading 0.10% U_3O_8 . The ore grade cut-off is 0.03% U_3O_8 for open-pittable resources and 0.05% U_3O_8 for underground resources. In 2007, the company budgeted \$21.25 million for continued evaluation of the Central Mineral Belt uranium property. The main focus is to con-

vert inferred resources to indicated at Michelin and to establish new resources at the Jacques Lake deposit and other target areas with 75 000 m of drilling.

Potash

Saskatchewan has the largest potash industry in the world, accounting for about 35% of world production. Global demand for potash increased to support crop development and biofuels, resulting in mine expansions, record earnings, and significant growth by the industry. A dozen new permits were issued in Saskatchewan for potash exploration in 2006 with another dozen pending, the most significant new exploration for potash in over two decades.⁷

In 2006, Potash Corporation of Saskatchewan planned to spend \$480 million on capital expenditures. In May 2007, the company announced development plans for the Cory operation in Saskatchewan at a cost of US\$775 million, as well as the re-opening of areas at the Allan and Lanigan operations, also in Saskatchewan. In July 2007, the company revealed plans to build a new potash mine in New Brunswick, adjacent to its Picadilly deposit, and to expand milling operations. A four-year construction schedule for the new New Brunswick mine is planned at a cost of US\$1.6 billion, and the company will keep costs down by using some of the existing facilities. This location has the increased benefits of being close to the port of St. John and a short shipping time to key Latin American markets such as Brazil. The company projects its annual potash capacity will reach 13.7 Mt by 2010 and 14.9 Mt by 2011.

Prairie Potash Corp. (a wholly owned subsidiary of Anglo Minerals Ltd. with an 85% interest) and its partner, Statebanke Potash Corp. (with a 15% interest), continued with early-stage exploration of the Jansen Lake potash project located 135 km east of Saskatoon and 20 km east of Potash Corporation of Saskatchewan's Lanigan potash mine. In January, Anglo retained Wardrop Engineering Inc. for a scoping study to be completed in March 2006 for the proposed development of the Jansen Lake project. Exploration in 2006 consisted of a 3-D seismic program. In June 2006, Anglo, through Prairie Potash Corp., entered into a joint-venture agreement with BHP Billiton Diamonds Inc. where BHP Billiton became the operator with 75% of the project. Further geological, engineering and mechanical work was recommended in a November 2006 technical report.

Coal

Major attention is being directed at the coal basins of the north mainland and Cape Breton Island of Nova Scotia with exploration interest in potential coal bed methane production and several existing mines considering expansions. In British Columbia, coal exploration decreased from \$40 million in 2005 to \$28 million,⁸ a decline attributed to more projects moving into the mine development and construction stages.

The Donkin coal resource block in Cape Breton, Nova Scotia, was being explored by the Xstrata Donkin Mine Development Alliance. During the year, two tunnels that access the underground coal resources were dewatered. A pre-feasibility study is under way along with resource and mining assessments, and environmental studies. Xstrata Coal's share of the capital costs is US\$4 million. Feasibility studies are planned to continue through 2007.

In British Columbia, a large number of projects are at the pre-feasibility or better stage and have some level of resources calculated. The province reports four coal projects that have opened or re-started within the last three years, about six coal projects proposed for mine development (or that have completed or are in the mine permitting process), and six coal exploration projects at the pre-feasibility stage or better.

Iron Ore

Nunavut recorded significant exploration expenditures for iron ore in 2005 (\$15 million) and 2006 (\$27.2 million).⁸

Baffinland Iron Mines Corporation's Mary River iron ore deposit is located on Baffin Island, approximately 1000 km northwest of Iqaluit. In 2006, the company drilled 78 holes for a total of 7067 m of in-filling and geotechnical drilling on Deposit No. 1. The satellite Deposit No. 2 was drilled sufficiently for an inferred resource calculation and one hole was drilled on Deposit No. 3. A hole drilled into the fold of Deposit No. 1 returned 176.3 m grading 68.9% iron. In May 2006, a scoping study on Deposit No. 1, based on indicated resources of 309 Mt grading 66.1% iron and inferred resources of 28 Mt grading 65.9% iron, proposed developing an open-pit mining operation with a 34-year mine life capable of shipping 10 million dry metric tonnes of high-grade lump ore (66% Fe) per year to the European market. In 2007, the company plans to develop and expand the existing resource base, complete a feasibility study, and seek out one or more strategic investors. A 9300-m drill program is planned to focus on in-filling Deposit No. 1 and exploring Deposit Nos. 2 and 3. A definitive feasibility study is scheduled to be finished in December 2007 and planning is under way for a 250 000-t bulk sample.

Molybdenum

Molybdenum exploration is confined to British Columbia and the Yukon. In British Columbia, a total of \$135 million⁸ was spent on exploration expenditures, of which a significant amount was on porphyry deposits. In the Yukon, exploration expenditures increased to almost \$80 million.⁸

Blue Pearl Mining Ltd. continued to advance its underground Davidson (formerly Yorke-Hardy) project. The Davidson property is located on the east flank of Hudson Bay Mountain, 9 km northwest of Smithers in west-central

British Columbia. The deposit is a molybdenite-scheelite porphyry, 2.5 km across and extending up to 2 km in depth, with moderately to steeply dipping stockwork veins. Exploration in 2006 focused on drilling the Lower zone situated about 250 m below the main deposit and on in-filling the central portion of the Main deposit. A mineral resource update is expected in 2007. A feasibility study by Hatch Ltd. was in progress, examining the viability of mining the Main zone at a rate of 2000 t/d using bulk underground methods and transporting the material 200 km for processing at the company's Endako molybdenum mine located 160 km west of Prince George, British Columbia. The study should be completed in the second quarter of 2007. Significant intersections from the 2006 drilling program into the Lower zone include 48.8 m (core width assumed) grading 0.46% MoS₂ and 0.37% MoS₂ over 39.6 m (core width assumed). The drill program also intersected mineralization in a zone between the Main deposit and the Lower zone. An in-fill program of 16 holes on the Main deposit intersected 122 m of 0.67% MoS₂. The company submitted draft terms of reference to the British Columbia Environmental Assessment Office.

Adanac Molybdenum Corporation advanced its Ruby Creek project located 50 km northeast of Atlin, British Columbia. This project is a molybdenum porphyry deposit located at the headwaters of Ruby Creek at about a 1500-m elevation underneath an alpine cirque, east of the Coast Range Mountains. In April 2006, a final bankable feasibility study by Wardrop Engineering Inc. indicated that the molybdenum resource could support a viable open-pit mine for at least a 24-year mine life. In December 2006, AMEC America Limited was contracted for detailed engineering and procurement services with construction anticipated to commence by the summer of 2007. In 2006, 16 holes totaling 3921 m were drilled for exploration and metallurgical studies. A new zone was intercepted to the southwest. Plans for 2007 include 14 holes totaling 7000 m around the periphery of the deposit to add to resources and collect information for future development planning. Current measured and indicated resources stand at 206.4 Mt grading 0.063% Mo, and inferred resources amount to 33.1 Mt grading 0.06% Mo with a cut-off of 0.04% Mo.

ENDNOTES

¹ Statistical data are based on numbers in *Corporate Exploration Strategies: A Worldwide Analysis*, published annually by Metals Economics Group, Halifax, Nova Scotia. MEG covers gold, base metals, polymetallics, platinum group metals, silver, and other hardrock metals and diamonds. It also includes exploration programs aimed at the discovery of industrial minerals from the exploration programs of large diversified companies. However, industrial minerals are not covered in this paper. MEG excludes exploration expenditures for iron ore, aluminum, uranium, coal, and oil and gas.

² Unless otherwise noted, all currency is expressed as current Canadian dollars. MEG numbers, which are reported in U.S. dollars, have been converted to Canadian dollars using an exchange rate of C1\$ = US\$0.88, a conversion factor provided by MEG in the 2006 *Corporate Exploration Strategies: A Worldwide Analysis*.

³ Databases and specific publications used in this article include: Infomine, infomine.com, for summaries of projects and companies; Metals Economics Group, metalseconomics.com, for exploration expenditures of companies in Canada, and MineSearch for specific property information; *The Northern Miner*, www.northernminer.com, news and press releases; SEDAR, Sedar.com, for annual reports, press releases, and technical reports; and Raw Materials Group, www.rmg.se, for project and corporate ownership information.

⁴ "Canadian Mineral Exploration" by Donald Cranstone, published in *Canadian Minerals Yearbook* 1990, Natural Resources Canada.

⁵ Arlene Drake, "Canadian Mineral Exploration Highlights and Discovery Analysis," in the 2005 edition of the *Canadian Minerals Yearbook*, Natural Resources Canada, Ottawa, pp 4.0-4.16, www.nrcan.gc.ca/mms/cmy/2005CMY_e.htm.

⁶ *Overview of Trends in Canadian Mineral Exploration*, Canadian Intergovernmental Working Group on the Mineral Industry (IGWG), 2006. Exploration and deposit appraisal spending statistics presented in this report are based on a federal/provincial/territorial survey that uses a different set of definitions than the MEG survey, available at www.nrcan.gc.ca/mms/pubs/explor_e.htm.

⁷ *Saskatchewan Exploration and Development Highlights 2006*, A. Costa, C. Harper, C. Card, C. Hughes, P. Schwann, and G. Delaney, Saskatchewan Industry and Resources, 2006.

⁸ Federal-provincial/territorial Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures for 2006, source of exploration spending for other commodities such as coal, iron ore, and molybdenum.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of October 31, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

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Canadian Mine Openings, Closings, Expansions, Extensions, and New Mine Developments

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INTRODUCTION

In 2006, 14 mines opened and 1 mine closed in Canada, continuing an upward trend for mine openings since 2003 that marked the end of a seven-year mining downturn that started in 1997. The 14 mines that opened consisted of 6 new mines (3 gold, 1 base-metal, 1 coal, and 1 diamond) and 8 re-openings (4 gold, and 4 base-metal). The single mine closing was a coal mine that had depleted its reserves.

NEW MINES AND RE-OPENINGS

The six new mines that opened in 2006 were the 1800-t/d Duck Pond open-pit and underground copper-zinc-silver-gold mine in Newfoundland and Labrador, the 800-t/d San Gold #1 underground gold mine in Manitoba, the 600-t/d Clavos underground gold mine in Ontario, the 550-t/d East Amphi underground gold mine in Quebec, the 6600-t/d Wolverine open-pit coal mine in British Columbia, and the 2000-t/d Jericho open-pit diamond mine in Nunavut.

In addition, eight mines, at which operations were previously suspended, re-opened for production. These were the 2200-t/d Casa Berardi underground gold mine and the 2000-t/d Kiena underground gold mine, both in Quebec; the 1000-t/d Rice Lake underground gold mine in Manitoba; the 300-t/d Table Mountain underground gold mine in British Columbia; the 1500-t/d Levack underground nickel mine, the 300-t/d Lockerby underground nickel mine, and the 200-t/d Redstone underground nickel mine, all in Ontario; and the 1500-t/d Langlois underground zinc-copper-gold-silver mine in Quebec. The addition of these relatively significant new and re-opened mines has boosted the number of principal producing mines in Canada to 203 in 2006 from 191 in 2005.

MINE CLOSURES AND PRODUCTION SUSPENSIONS

During 2006, the only mine closure in Canada was the 2700-t/d Dillon open-pit bituminous coal mine in British Columbia. The Dillon mine closed because its coal reserves were depleted; however, the Dillon coal processing facilities are continuing to operate and are treating coal from the nearby Brule mine, which began production in January 2007.

NEW DEVELOPMENTS EXPECTED TO BECOME NEW MINES IN 2007

Preliminary estimates indicate that about 12 mines, including 5 new mines, came on stream in 2007.

For 2007, expected new mines are Max (molybdenum) in British Columbia, Minto (copper-gold-silver) in the Yukon, Snap Lake (diamond) in the Northwest Territories, and Brule and Trend (coal) in British Columbia. In addition, seven mines were redeveloped for production in 2007. These are Lamaque (gold) and Fabie Bay (copper-zinc-gold-silver) in Quebec, Caribou and Restigouche (both lead-zinc) in New Brunswick, Scotia (lead-zinc) in Nova Scotia, and QR (gold) and Gibraltar (solvent-extraction electro-winning copper) in British Columbia.

Notes: (1) Information in this review, based on company reports and communications with companies, was current as of January 25, 2008. (2) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/2006cmy_e.htm.

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TABLE 1. MINE OPENINGS, RE-OPENINGS, SUSPENSIONS AND CLOSURES IN CANADA IN 2006

Mine Project	Location	Province/ Territory	Capacity (t/d)	Employment (no.)	Date of Opening or Closing	Mine or Plant Type	Main Commodities	Company
NEW MINE OPENINGS								
Precious Metals								
East Amphi	Malartic	Que.	550	30	February	U/G	Gold	Richmont Mines Inc.
Clavos	Timmins	Ont.	600		January	U/G	Gold	St. Andrew Goldfields Ltd.
San Gold #1	Bissett	Man.	800	220	August	U/G	Gold	San Gold Corporation
Base Metals								
Duck Pond	100 km SW of Grand Falls	N.L.	1 800	170	December	O/P and U/G	Copper, zinc, silver, gold	Aur Resources Inc.
Other Minerals/Metals								
Jericho	400 km NE of Yellowknife	Nun.	2 000	130	April	O/P	Diamond	Tahera Diamond Corporation
Wolverine	Tumbler Ridge	B.C.	6 600	200	July	O/P	Metallurgical coal	Western Canadian Coal Corp.
RE-OPENINGS								
Precious Metals								
Casa Berardi	La Sarre	Que.	2 200	300	November	U/G	Gold	Aurizon Mines Ltd.
Kiena	Val-d'Or	Que.	2 000	99	August	U/G	Gold	Wesdome Gold Mines Ltd.
Rice Lake	Bissett	Man.	1 000	180	April	U/G	Gold	San Gold Corporation
Table Mountain	Watson Lake	B.C.	300	..	December	U/G	Gold	Cusac Gold Mines Ltd.
Base Metals								
Langlois	Val-d'Or	Que.	1 500	50	October	U/G	Zinc, copper, silver, gold	Breakwater Resources Ltd.
Levack	Sudbury	Ont.	1 500	154	December	U/G	Nickel, copper	FNX Mining Company Inc.
Lockerby	Sudbury	Ont.	300	105	January	U/G	Nickel, copper	First Nickel Inc.
Redstone	Timmins	Ont.	85	200	May	U/G	Nickel	Liberty Mines Inc.
MINE CLOSINGS								
Dillon	Chetwynd	B.C.	2 700		December	O/P	Metallurgical coal	Western Canadian Coal Corp.

Source: Natural Resources Canada, based on company reports and communications with the provinces/territories, information current as of January 2008.

.. Not available; O/P Open pit; U/G Underground.

Canada's International Mining Presence

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INTRODUCTION

The 2006 edition of this chapter is one of change. First, the previous author, André Lemieux, took a well-deserved retirement after writing this chapter for many years. The second change is related to the type of data that are used and published in this chapter. These data are different from those used by any other organization: they are neither based on surveys nor on planned exploration spending but, rather, on an asset-based approach. This approach refers to fixed assets, also known as property, plant and equipment (PP&E), a term used to denote assets that cannot easily be converted into cash. In most cases, only tangible assets are referred to as fixed.

There are growing concerns related to investment protection, corporate social responsibility, and the reality that Canadian companies may now have ownership interest in more mines and/or facilities outside of Canada than inside the country due to recent foreign acquisitions of some large Canadian mining companies. These worries have increased the policy demand for more detailed data on the international presence of Canadian exploration and mining companies based on identifiable assets. Natural Resources Canada (NRCan) believes that this new analytical approach will contribute to a more precise assessment of the presence of Canadian companies abroad.

In order to maintain some continuity with previous editions, four key graphs have been updated and are discussed in the following four sections. These four figures are based on planned exploration spending extracted from Metals Economics Group's *Corporate Exploration Strategies*.

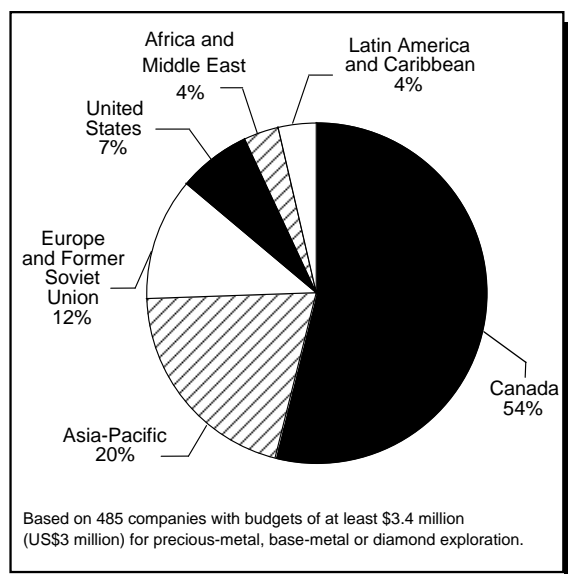
Distribution of the World's Larger Mining Companies

Mining companies whose exploration budgets are at least \$3.4 million (US\$3 million) are defined as "larger." The number of such companies with stated plans to spend in excess of \$3.4 million in 2006 rose to 485, a 59% increase from the 310 companies in this group in 2005. Figure 1 shows the distribution of the headquarters of these companies.

As can be seen, more than half of the world's mining companies are based in Canada. These 262 Canadian companies account for 54% of the total number of companies, up from 50% in 2005. The exact reason for this increase is unknown. Is it because of an increase in the number of new companies, an increase in the number of existing companies that have raised their exploration budgets to above \$3.4 million, an increase in the number of existing companies that moved their headquarters to Canada, an increase in metal prices, or a combination of all these answers? One fact is certain, however – more companies are based in Canada than anywhere else on the planet.

The number of mining companies whose headquarters are located in the United States rose from 21 in 2005 to 34 in 2006. In percentage terms, however, this figure represents only a 1% increase and 7% of the world's larger mining companies in 2006. In Latin America and the Caribbean, the percentage remained unchanged; the number of companies rose from 13 to 17 in 2006. In 2006, 99 companies were headquartered in the Asia-Pacific region (comprising primarily Australia), representing a 2% decrease from 67 companies in 2005. Europe and countries of the former Soviet Union are home to the headquarters of 56 mining companies, or 12%, compared with 40 companies, or 13%, in 2005. However, De Beers Group, with an exploration budget in excess of \$300 million, moved its headquarters from South Africa to Luxembourg, increasing the exploration budget for that part of the world. The percentage of mining companies with headquarters in Africa and the Middle East remained the same in both 2005 and 2006, i.e., 4%, although the number of companies rose from 13 in 2005 to 17 in 2006.

Figure 1
Distribution of the World's Larger Exploration Companies, by Domicile, 2006



Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia.

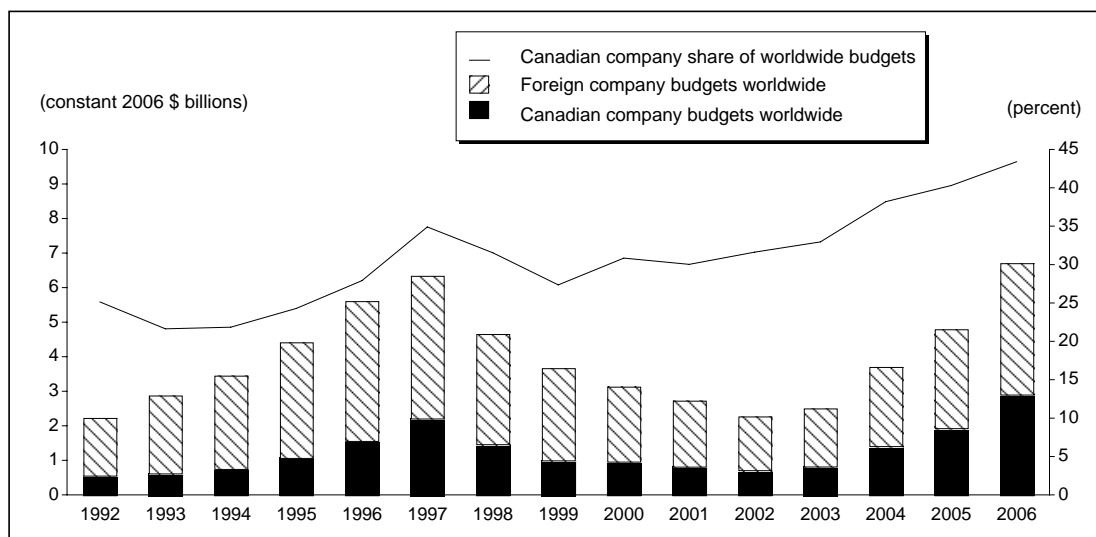
Exploration Budgets of the World's Larger Mining Companies

Figure 2 shows the value of the exploration programs that larger Canadian mining companies plan to undertake in Canada and throughout the world, as well as the proportion these programs represent of the budgets of all mining companies with headquarters outside Canada.

In 2006, Canadian mining companies anticipated exploration expenditures in the order of \$2.9 billion, a 53% increase from 2005 expenditures of \$1.9 billion. This means that the exploration budgets of Canadian companies represented 43.4% of the total budgets of mining companies in all countries combined (note here that Inco and Falconbridge are included in this percentage), or a total in excess of \$6.7 billion.

Of the \$2.9 billion in exploration expenditures that Canadian mining companies expected to spend in 2006, close to half (47%) was to go toward gold exploration, representing a substantial decrease compared with 2005 when gold exploration accounted for 54% of the amount budgeted. Base metals received \$1.1 billion of the budget earmarked for exploration (or 36%), whereas in 2005 this figure was 31%. A total of \$269 million, or 9.2% of the budgets set aside for exploration, went to diamonds, an increase over 2005 when the figure leveled off at 8%. Finally, 1.6% of budgets was earmarked for platinum group elements, which had garnered 2% in 2005.

Figure 2
Exploration Budgets of the World's Larger Companies, by Origin, 1992-2006
 Companies With Worldwide Budgets of at Least \$3.4 Million in 2006 for Precious-Metal, Base-Metal or Diamond Exploration



Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia.

Notes: The worldwide exploration budgets of companies that intended to spend less than \$3.4 million (US\$3 million) in 2006 and an equivalent amount in previous years are excluded. The worldwide exploration budgets for other commodities such as uranium or industrial minerals are also excluded.

Mineral Properties Held by Canadian Mining Companies Worldwide

In 2006, Canadian mining companies held about 7200 mineral properties throughout the world, a 1% decrease in the figure for 2005, which was slightly over 7900 properties (number taken from InfoMine, January 12, 2007; includes public companies traded on the Toronto Stock Exchange and TSX Venture Exchange whose properties are at the raw prospect stage, exploration and development status) (Figure 3). Over half of these properties (52%) were concentrated in Canada, with Latin America in second place at 17%. The proportion of mineral properties held by Canadian mining companies in the United States was 10%.

Exploration Budgets of the Larger Mining Companies, by Region

Among the larger foreign-based companies, Canada is in last place in terms of planned exploration expenditures (Figure 4). In 2006, at least 14 larger foreign-based mining companies planned in excess of \$143 million in exploration expenditures in Canada, an increase of 11% over 2005. Close to half of this amount, i.e., \$62.4 million, is budgeted by a single company, the De Beers Group, whose headquarters has moved from South Africa to Luxembourg.

With over \$1.02 billion in exploration spending planned by the larger foreign-based companies, Africa and the Middle East were in first place in 2006, followed closely by the Asia-Pacific region and Latin America with \$1 billion each.

For the larger Canadian companies, Canada remained the first choice with exploration spending for 2006 projected at over \$1 billion. Second place was held by Latin America with over \$700 million, followed by the Asia-Pacific region with \$546 million and then Africa and the United States with close to \$250 million each.

ASSET-BASED APPROACH

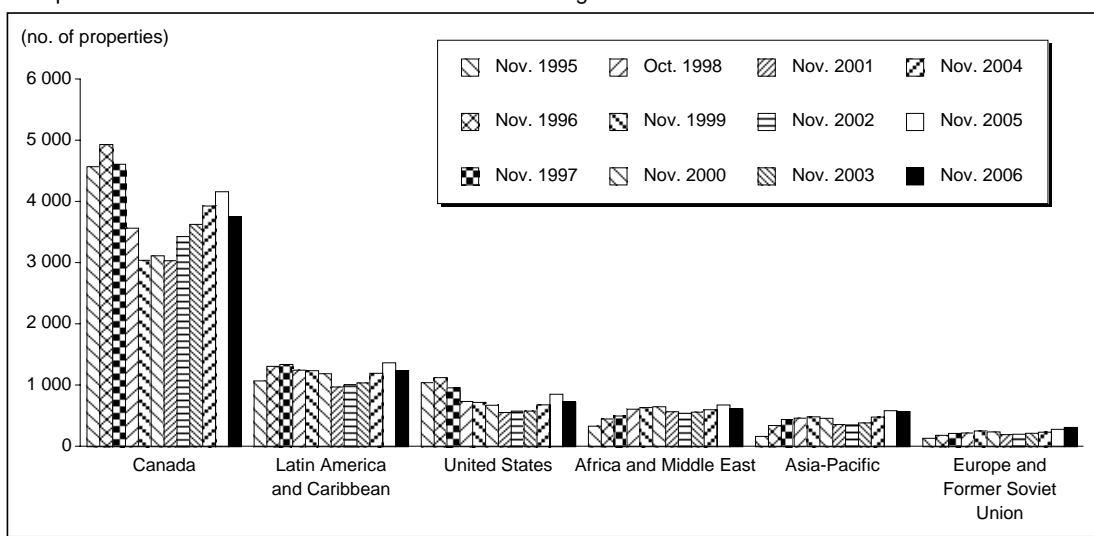
As mentioned in the Introduction, the remainder of this chapter will be based on a compilation of cumulative capitalized exploration expenses and mining assets, hereafter referred to as “mining assets”: property, plant and equipment, and deferred exploration expenditures at cost (book value) less accumulated amortization and write-downs or write-offs.

Three different databases were used in an attempt to capture every Canadian exploration and mining company with assets outside Canada since 2001. The numbers (in Canadian dollars) were extracted from audited annual financial reports/statements. This information has been gathered by company and by country.

Fixed Assets Included in This Analysis

Property, Plant and Equipment: Upon commencement of production, construction and development costs are capitalized and amortized over the estimated useful life of the asset.

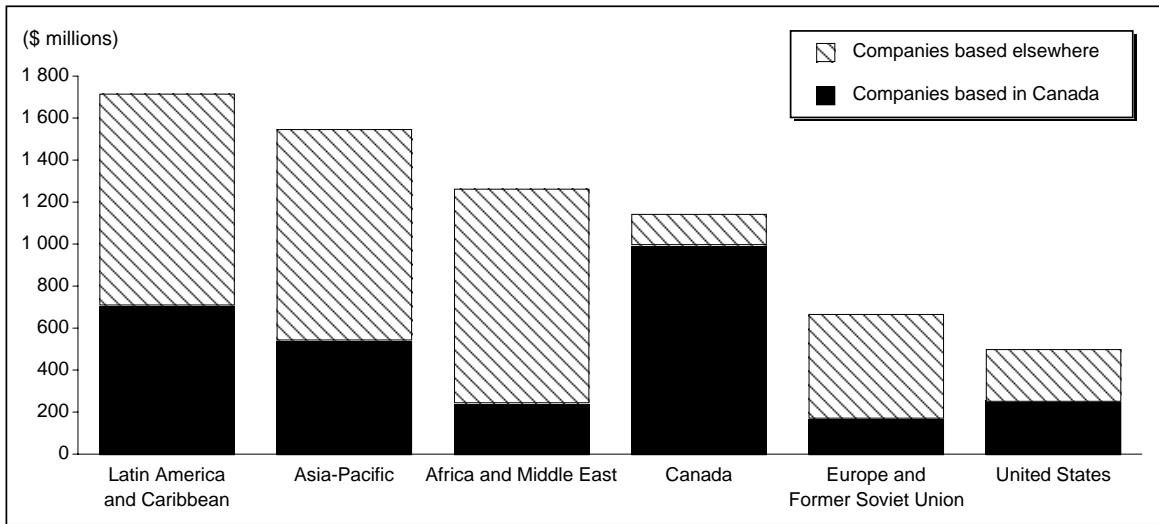
Figure 3
Canadian Mineral Property Portfolio Worldwide, by Region, 1995-2006
Companies of All Sizes Listed on Canadian Stock Exchanges



Source: Natural Resources Canada, based on *MIN-MET CANADA* for 1995-97 and InfoMine db for 1998-2006, Robertson Info-Data Inc., Vancouver, British Columbia, and used under licence.

Note: The decrease in properties in Canada after 1997 is due, in part, to the implementation of database features that make it possible to exclude many inactive properties.

Figure 4
Exploration Budgets of the World's Larger Companies for Selected Regions of the World, 2006
 Companies With Worldwide Budgets of at Least \$3.4 Million for Precious-Metal, Base-Metal or Diamond Exploration



Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia.

Notes: The worldwide exploration budgets of companies that intended to spend less than \$3.4 million (US\$3 million) in 2006 are excluded. The worldwide exploration budgets for other commodities such as uranium or industrial minerals are also excluded.

Mineral Properties and Deferred Exploration Expenses:

Costs relating to the acquisition, exploration, and development of mineral properties are usually capitalized by a company. Non-producing mineral properties in which a company abandons its interest are written off in that year.

In certain cases, a company follows the practice of expensing all exploration costs until mineral reserves have been firmly established and a mining permit has been issued. In that event, the company's decision has been respected and these costs were not included as assets.

Royalty Interests: A company records its royalty interests at cost. The cost is defined as the consideration given to acquire the royalty interests plus associated external professional fees and travel expenses. Amortization of producing royalty interests is calculated on a unit-of-production basis.

Investments on a Cost Basis: If one can track the investment to a mineral property or to a specific country, it has been included as an investment in this study.

Assets Not Included in This Study

The following assets were not included in this analysis:

- Cash or cash equivalents;
- Restricted cash;
- Accounts receivable;

- Prepaid expenses and deposits;
- Inventory and/or ore stockpiles;
- Short-term/long-term deposits and/or receivables;
- Gold bullion; and
- Goodwill: In a few instances, in the information provided by some companies, goodwill is associated with property, plant and equipment, and intangible assets. In these cases, the number recorded in the study includes goodwill and intangible assets. Again, this situation is unusual.

Book Value Versus Market Value

All assets compiled are recorded as book value or net asset value. An asset's initial book value is its actual cash value or its acquisition cost. Assets such as buildings, land, and equipment are valued based on their acquisition cost, which includes the actual cash cost of the asset plus certain costs tied to the purchase of the asset, such as brokerage fees. Monthly or annual depreciation, amortization, and depletion are used to reduce the book value of assets over time as they are "consumed" or used up in the process of obtaining revenue.

The International Valuation Standards Committee (IVSC) defines market value as:

"The estimated amount for which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arm's-length trans-

action after proper marketing wherein the parties had each acted knowledgeably, prudently, and without compulsion.”

What is important here is that, in response to an almost universal increase in metal prices, the market value of assets has increased significantly, creating a significant gap between the book value and the market value of assets. In a market downturn, the reverse would occur and the market value of assets would equal the book value. According to generally accepted accounting principles (GAAP), the value of assets cannot be lower than the book value.

The following two examples include the purchase of Canadian company Adastra Minerals Inc. by another Canadian company, First Quantum Minerals Ltd. Before it was sold, the book value of the assets of Adastra Minerals was approximately \$33.5 million. At the time of the sale, First Quantum registered the book value of the assets of Adastra Mining at \$380 million. The market value of the assets of Adastra therefore rose by over 1000%! Hence, it is this new book value that will be registered in the assets of First Quantum.

The book value of the assets of Placer Dome Inc. in South Africa was approximately \$648 million in 2006. Barrick Gold Corporation purchased Placer Dome, including its assets in South Africa. Although the selling price was not made public, it is known that Placer Dome's assets were re-sold to South African company Gold Fields Limited for approximately \$1.5 billion. These examples demonstrate the significant gap that can exist between the book value and the market value of mining assets, particularly in the context of very high commodity prices.

Definition of a Canadian Company

Only publicly traded Canadian companies are covered in this study. For the purpose of this exercise, a publicly traded Canadian company was considered to be a company with its headquarters in Canada or with an operating office in Canada.

Although most of the companies in this study are traded on the Toronto Stock Exchange or the TSX Venture Exchange, a number of them are either traded on foreign stock exchanges or on other financial markets such as over-the-counter trading. It is important to mention that the first criterion for a company to be included in this study is the location of its headquarters or its operating office, and not the exchange on which it is listed.

SOURCES OF DATA

The first goal was to try to capture all Canadian publicly traded companies according to the criterion described above. Three databases were used to generate the list of

companies: InfoMine, Metals Economics Group, and MineSCAN. Despite the fact that precaution was taken to avoid missing a company, NRCan apologizes for any and all omissions.

Audited annual financial reports/statements were mainly found on the System for Electronic Document Analysis and Retrieval (SEDAR). Others were found either on the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system, InfoMine, or the company's web site.

All numbers in this report are expressed in Canadian dollars and have not been adjusted for inflation. The Canada-U.S. exchange rates used were:

Year 2001:	1.50
Year 2002:	1.45
Year 2003:	1.35
Year 2004:	1.25
Year 2005:	1.20
Year 2006:	1.15

WORLDWIDE CANADIAN MINING ASSETS, BY REGION, 2001-06

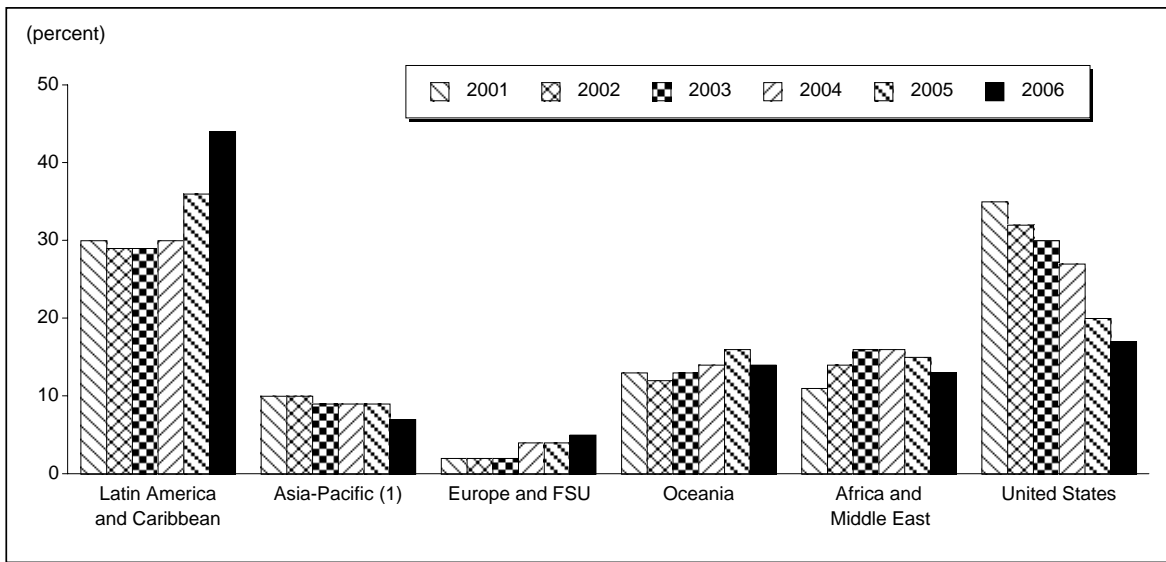
Figure 5 shows the regional distribution of the \$64.4 billion in assets held by Canadian companies in 2006, and a five-year comparison of the regional allocations as a percentage of each year's worldwide assets.

According to the 2006 Metals Economic Group study,¹ Latin America, which comprises the countries in the Americas where Latin-based languages are spoken, is favoured not only by Canadian mining companies, but also by mining companies of all origins. The asymptotic curve shows that in 2001, 2002, 2003 and 2004, approximately 30% of Canada's mining assets were in Latin America, representing cumulative values ranging from \$7.8 billion in 2001 to \$10.1 billion in 2004 (Table 1). In 2005, a 45% increase brought the value of cumulative assets to \$14.7 billion and the proportion of total assets to 36%. In 2006, this proportion rose to 44%, bringing the cumulative assets value to \$28.2 billion. In other words, nearly half of the assets of Canadian mining companies were in Latin America. Although Mexico played a major role in this dramatic increase, Argentina, Brazil, Chile and Peru (South America's leading countries), also contributed. A more detailed account is provided in the analysis for this continent.

In 2006, 17% of the assets of Canadian mining companies were in the United States, with cumulative values ranging from \$8.9 billion in 2001 to \$11.0 billion in 2006. Even

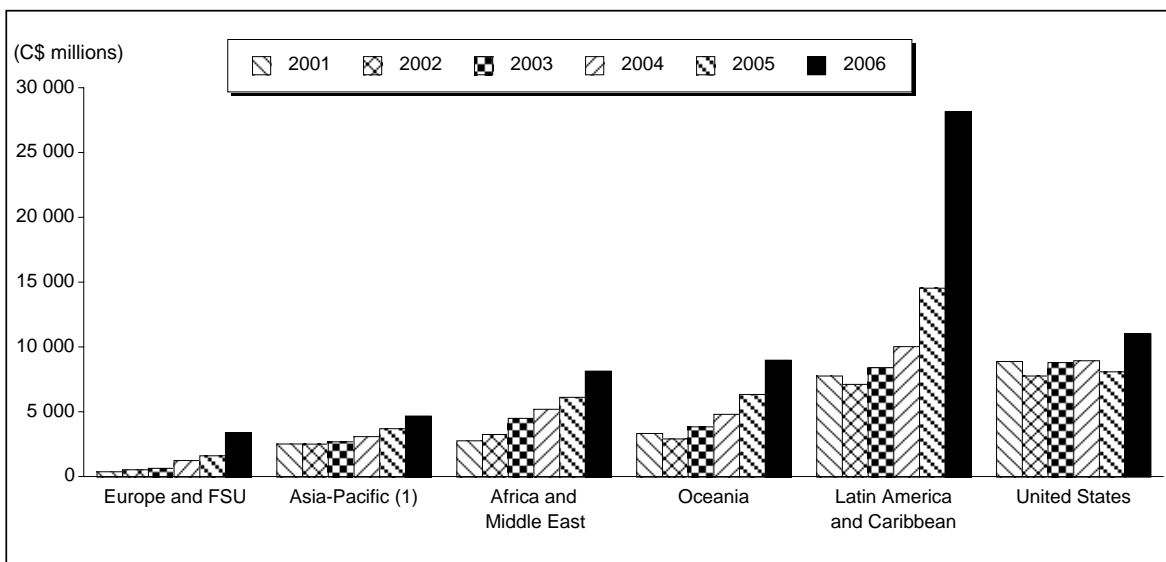
¹ *Corporate Exploration Strategies: A Worldwide Analysis, 2006.*

Figure 5
Worldwide Canadian Mining Assets, in Percentages, by Region, 2001-06



Source: Natural Resources Canada, based on companies' audited annual reports.
 FSU Former Soviet Union.
 (1) Includes Russia.

Figure 6
Worldwide Canadian Mining Assets, in Dollars, by Region, 2001-06



Source: Natural Resources Canada, based on companies' audited annual reports.
 FSU Former Soviet Union.
 (1) Includes Russia.

more interesting is an analysis of the curves that represent the percentage of these assets since 2001 and the cumulative dollar value since 2001. Figure 5 clearly shows a negative slope for the United States: in 2001, 35% of Canada's mining assets were in the United States, but by 2006, this percentage had dwindled to just 17%. Although Table 1 shows an increase in cumulative assets between 2002 and 2003 (from \$7.8 billion to \$8.8 billion) and between 2005 and 2006 (from \$8.1 billion to \$11.0 billion), when these values are examined in relation to the total value of Canada's worldwide mining assets for a given year, it is clear that the value of assets on U.S. soil as a percentage has been decreasing every year since at least 2001.

In 2006, Canadian mining companies held 14% of their mining assets (with cumulative values ranging from \$3.4 billion in 2001 to \$9.0 billion in 2006) in Oceania, which includes Australia, New Zealand, Papua New Guinea, and the Solomon Islands. In percentages terms, however, the value fell to a low of 12% in 2002, but rose to 16% in 2005.

In 2006, 12% of Canada's mining assets were in Africa, revealing a Gaussian profile with a peak of 16% in 2003 and 2004. Canadian assets totaled \$2.8 billion in 2001 and reached \$8 billion in 2006. Figure 6 shows that, as in Oceania, Asia, and Europe, values in terms of billions of dollars in cumulative assets have been on the rise since 2001.

In 2006, 7% of Canada's mining assets were in Central Asia, the Middle East, Southeast Asia, and Russia (collectively referred to here as Asia), representing a value of

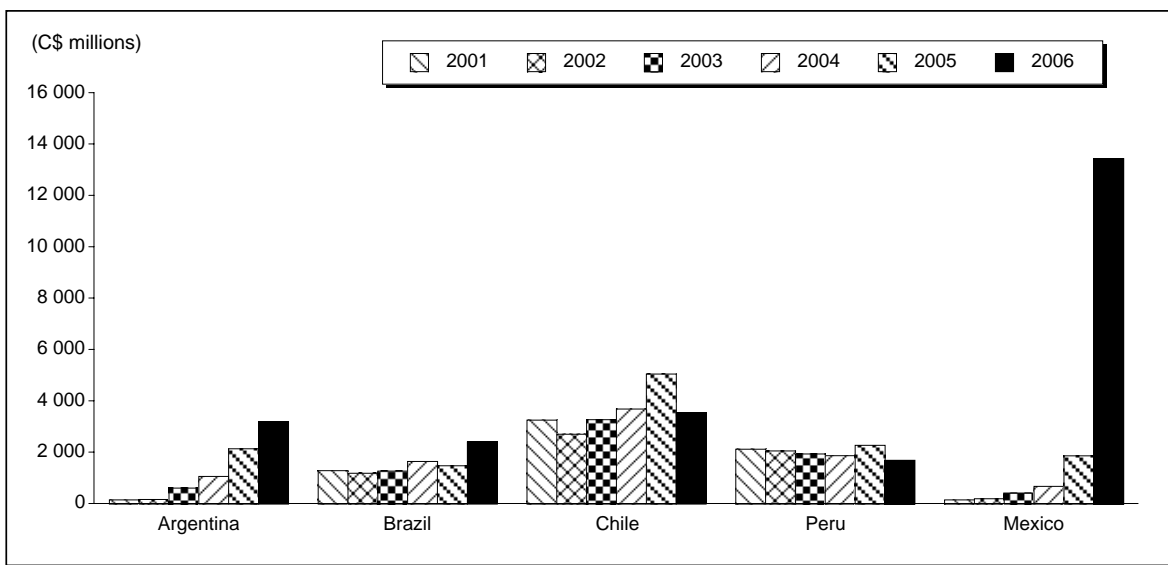
\$4.7 billion. Figure 5 shows that, with the exception of 2002 (10.4%), the percentage of Canadian assets in this area remained at just under 10% from 2001 to 2006.

In 2006, 5% of Canada's mining assets were in Europe. From 2001 to 2003, Canadian mining assets ranged from \$398 million to \$660 million. A positive turning point was reached in 2004 when accumulated assets rose to \$1.4 billion; by the end of 2006 they had reached \$3.5 billion. It was Portugal that sparked this dramatic 104% increase from 2005 with Lundin Mining Corporation playing an active role. A more detailed account is provided in the analysis for this continent.

CUMULATIVE CANADIAN MINING ASSETS IN LATIN AMERICA, BY COUNTRY, FROM 2001 TO 2006

Table 2 lists the countries for which Canadian mining assets were compiled from 2001 to 2006, along with the total for each year. It should be noted that these amounts are cumulative from year to year. Figure 7 focuses on the "Big Five," which consists here of Argentina, Brazil, Chile, Peru, and Mexico. In 2006, Canadian mining assets in these five countries totaled \$24.3 billion, representing 86.2% of all Canadian mining assets in Latin America. By 2009, more than \$7.5 billion will be invested by Canadian mining companies in these five countries and more than 15 Canadian mining companies, with as many development projects, are expected to bring mining operations into production. More information on these projects is provided under the headings for each country.

Figure 7
The "Big Five" in Latin America, 2001-06



Source: Natural Resources Canada, based on companies' audited annual reports.

Argentina

Since 2001, at least 60 Canadian companies have invested money and effort in exploration in Argentina. From 2003 to 2004, assets rose by 74%, increasing from \$615 million to \$1.1 billion. The following companies more than doubled the value of their cumulative assets in Argentina over this period: Amera Resources, Aquiline Resources, Barrick Gold, Exeter Resource, Intrepid Minerals, Palladon Ventures, and Silver Standard Resources.

From 2004 to 2005, a 101% increase drove assets to \$2.2 billion. The following companies played a major role in this increase, doubling the value of their cumulative assets: Antares Minerals, Cardero Resources, Chapleau Resources, Committee Bay Resources, Consolidated Pacific Bay, Exeter Resource, Far West Mining, Global Copper, Goldcorp, Golden Peaks Resources, IMA Exploration, Mansfield Minerals, Marifil Mines, Mega Uranium, Lundin Mining, Vangold Resources, and Viceroy Exploration.

In 2006, with mining assets of \$3.2 billion, at least two Canadian mining companies held interests in Argentine mining operations: Goldcorp and Northern Orion Resources held shares in the Alumbreira copper-gold mine and Barrick Gold owned the Veladero gold mine.

The outlook for Canadian mining companies in Argentina appears promising. Nearly \$2.5 billion will be invested in the following development projects:

- **Agua Rica (Mi Vida)** is a copper-gold-molybdenum-silver deposit owned by Northern Orion Resources (this company was purchased by Yamana Gold, another Canadian company, in September 2007). The project requires estimated capital expenditures of \$2.1 billion. The environmental assessment has been submitted to the appropriate Argentine authorities and a response on whether it will be approved is expected within the next year.
- **Casposo** comprises two gold-silver deposits (Kamila and Mercado) owned by Intrepid Minerals. Capital expenditures of \$45.5 million are required in order to proceed with the project. The environmental assessment was submitted to Argentine authorities in June 2007.
- **Manantial Espejo** is a gold-silver deposit for which a third of the surface development has been completed. The operation is owned by Pan American Silver and involves capital expenditures of \$170 million.
- **Pirquitas** is a silver-tin-zinc deposit owned by Silver Standard Resources. Construction at the mine site has just begun and the mine should begin production by the end of 2008. This project requires capital expenditures of \$146 million.

Brazil

Forty-eight Canadian companies were active in Brazil between 2001 and 2006. Their mining assets increased from \$1.3 billion to \$2.4 billion during this period. Between 2005 and 2006, Canadian mining assets in Brazil rose 62%, from \$1.5 billion to \$2.4 billion, which was the most significant increase since 2001.

The following companies contributed to the increase and more than doubled their respective assets: Amarillo Gold, Aura Gold, Chapleau Resources, Crescent Resources, International Nickel Ventures, Majescor Resources, Monster Copper, Oromin Explorations, Randsburg International Gold, Talon Metals Corp. (formerly BrazMin Corp.), Vaal-diam Resources, Verena Minerals, and Yamana Gold.

In 2006, with cumulative mining assets of \$2.4 billion, Canadian mining companies with interests in mining operations included:

- Yamana Gold: the Chapada, Fazenda Brasileiro, Fazenda Nova, Sao Francisco, and Jacobina mines;
- Kinross Gold: the Paracatu mine;
- Eldorado Gold: the Sao Bento mine;
- Goldcorp: the Amapari mine; and
- Alcan: the São Luís alumina refinery and the Porto Trombeta and Ouro Preto mines.

In July 2007, Eldorado Gold announced its intention to proceed with the Vila Nova iron ore project in which it holds a 75% interest. Construction of the open-pit mine is scheduled to begin in fall 2007 and to be completed the following year. Capital expenditures of \$32 million are required to complete the project.

Chile

At least 61 Canadian mining companies have been in Chile since 2001. Canadian mining assets in the country are approximately \$3.4 billion, having dropped to a low of \$2.7 billion in 2002 and peaked at \$5.1 billion in 2005, generating an increase of 37% from 2004.

The following Canadian companies contributed to the 37% increase from 2004 to 2005 by doubling their respective assets: Andina Minerals, Atacama Minerals, Falconbridge, Global Copper, Global Hunter, Quadra Mining, Samba Gold, Lundin, and Valencia Ventures.

In 2006, mining assets were in excess of \$3.5 billion, and Canadian mining companies with interests in mining operations included:

- Kinross: the Refugio mine;
- Goldcorp: the La Coipa mine;
- Barrick: the Zaldivar mine;
- Aur Resources: the Andacollo and Quebrada Blanca mines;
- South American Gold and Copper Company: the Pimenton mine;
- Americo Resources: extraction of copper from Minera Valle Central's mining tailings; and
- Breakwater Resources: the El Toqui and Concordia mines.

At least two mine development projects are under way for Canadian mining companies in Chile. One of these is the Andacollo Hypogene copper-gold project, 90% of which is held by Teck Cominco (following the acquisition of Aur Resources in September 2007). The open-pit mine is expected to go into production in late 2009 with capital costs of \$341 million.

In addition, Barrick Gold's gold-silver Pascua-Lama project is well under way. The mine straddles the border between Chile and Argentina, and has received the necessary environmental approval from the governments of both countries. The next step will be to obtain a construction permit. It should be noted that Pascua-Lama is a world-class gold and silver deposit requiring capital expenditures of \$2.3 billion.

Peru

Some 76 Canadian mining companies have operated in the country since 2001. Unfortunately, Canadian mining assets in Peru have continued to lose ground since 2001, dropping from \$2.1 billion in 2001 to \$1.7 billion in 2006, with the only exception being a 22% increase between 2004 and 2005.

What caused the 22% increase in Canadian mining assets in Peru in 2005? The following is a non-exhaustive list of companies that contributed to the increase, doubling their respective assets during the process: Absolut Resources, Acero-Martin Exploration, Alturas Minerals, Antares Minerals, Bear Creek Mining, Canadian Shield Resources, Cardero Resources, Duran Ventures, Esperanza Silver, Falconbridge, Fortuna Silver Mines, Frontier Pacific Mining, Cambior, New Dimension Resources, Northern Peru Copper, Peru Copper, Plexmar Resources, Sienna Gold, Silver Standard Resources, Strathmore Minerals, Tiomin Resources, Vena Resources, and Zincore Metals.

In 2006, mining assets were \$1.7 billion, and Canadian mining companies with interests in mining operations included:

- Teck Cominco: the Antamina and Colquijirca mines;
- Barrick Gold: the Lagunas Norte (Alto Chicama) and Pierina mines;
- Fortuna Silver Mines Inc.: the Caylloma mine;
- Andean American Mining: the Santa Rosa mine; and
- Dynacor Gold Mines: the Acari mine.

Through its 70% interest in the Peruvian company Marcobre S.A.C., Chariot Resources is expected to complete its feasibility study on the Mina Justa/Marcona copper-gold deposit in 2008. To date, the project has required capital expenditures of \$126 million.

Mexico

More than 159 Canadian companies are currently active in this country. In fact, since 2001, Mexico has attracted the largest number of Canadian mining companies of all the Latin American countries. Canadian mining assets soared from \$157.8 million in 2001 to \$13.5 billion in 2006, a 611% increase from 2005. It should be noted that this increase began in 2005 when Canadian mining assets rose to \$1.9 billion from \$628.7 million the previous year, an increase of 174%.

Goldcorp's arrival in Mexico in 2005 was related to its acquisition of Wheaton River in December 2004 and its purchase of Glamis Gold in 2006. With no mining assets in Mexico from 2001 to 2004, Goldcorp emerged on the Mexican scene with mining assets of \$814 million in 2005 and \$11.3 billion in 2006.

Goldcorp's contribution to Canadian mining assets in Mexico is truly undeniable. However, the following Canadian companies also played a role, doubling their respective mining assets from 2005 to 2006: Agnico-Eagle Mines, Aurcana, Aurea Mining, Avino Silver & Gold, Bandera Gold, Canasil Resources, Capstone Mining, Colibri Resource, Columbia Metals, Continuum Resources, Cream Minerals, Endeavour Silver, Esperanza Silver, Exmin Resources, First Majestic Silver, Fortuna Silver Mines, Frontera Copper, Gammon Gold, Geologix Explorations, Golden Tag Resources, Impact Silver, Kimber Resources, Lateegra Gold, Linear Metals, Mexivada Mining, Milner Consolidated Silver Mines, Minefinders, Nayarit Gold, Normabec Mining Resources, Noront Resources, Orko Silver, Oro Gold Resources, Palmarejo Silver and Gold, Pediment Exploration, Pershimco Resources, Premium Exploration, Quaterra Resources, Rochester Resources, ROMARCO Minerals, Seabridge Gold, Seafield Resources, Sierra Minerals, Silver Dragon Resources, Silver Eagle Mines, Silver Standard Resources, SilverCrest Mines, Silvermex Resources, Silverstone Resources, Soho Resources, Solid Resources, Soltoro, Southern Silver Exploration,

Sparton Resources, Stroud Resources, Sunrise Minerals, Timmins Gold, Tumi Resources, Twenty-Seven Capital, Tyler Resources, UC Resources, Valdez Gold, West Timmins Mining, and Zinco Mining Corp.

In 2006, mining assets stood at close to \$13.5 million, and Canadian mining companies with interests in mining operations included:

- Teck Cominco: the Maria Copper mine;
- Goldcorp: the EL Sauzal, Tayoltita (Luismin), Nukay (Luismin), San Antonio/Central Block (Luismin), and Santa Rita (Luismin) mines;
- Alamos Gold: the Mulatos mine (Salamandra);
- Aurcana: the La Negra mine;
- Capstone Mining: the Cozamin mine;
- Dia Bras Exploration: the Bolivar mine;
- Ecu Silver Mining: the Velardena mine (Santa Juana);
- Endeavour Silver Corp.: the Guanacevi mine;
- Exmin Resources: the Moris mine;
- First Majestic Silver: the La Parrilla Silver and San Martin mines;
- Frontera Copper: the Piedras Verdes mine;
- Gammon Gold: the El Cubo and Ocampo mines;
- Genco Resources: the La Guitarra mine (Temascaltepec);
- Great Panther Resources: the Guanajuato-Valenciana and Topia mines;
- Impact Silver: the Zacualpan mine;
- Pan American Silver: the Alamo Dorado and La Colorado mines; and
- Roxwell Gold Mines: the Los Pajaros mine.

At least nine Canadian mining companies with as many projects under development should begin production by 2009. More than \$2.2 billion in capital investment will go toward getting the following projects off the ground:

- **Dolores** is a gold-silver deposit held by Minefinder. The project requires capital expenditures of \$132 million and should go into production in mid-2008.

- **El Boleo** is a copper-cobalt-zinc-manganese deposit held by Baja Mining that is expected to go into production in mid-2009 with capital expenditures of \$475 million.
- **La Yesca** is a silver-gold mining property owned by UC Resources.
- **Los Filos-Bermejil** is held by Goldcorp. This gold deposit, which contains measured and indicated resources of 1.8 million oz at 0.62 g/t, is expected to go into production in 2008 and requires capital expenditure costs of \$98 million.
- **Penasquito**, also held by Goldcorp, is a silver-gold-zinc-lead orebody. Construction is scheduled to begin in 2008 and will require capital expenditures of \$882 million. This deposit has measured gold reserves of 9 million oz at 0.49 g/t.
- **Mina Real (Rochester)**, held by Rochester Resources, is a gold-silver deposit set to go into production in late 2007.
- **Palmarejo/Trogan**, owned by Palmarejo Silver and Gold, is a gold-silver deposit with measured gold reserves of 382 000 oz at 2.2 g/t that is expected to go into production in late 2008. The project involves capital costs of \$200 million.
- **Pinos Altos**, held by Agnico-Eagle, is a project with indicated gold reserves of 158 000 oz at 1.92 g/t, for which production is expected to begin in early 2009. Capital costs for the project are estimated at \$190 million.
- **Platosa/Saltillera** is a silver-lead-zinc deposit, 51% of which is held by Excellon Resources. The project involves capital costs of \$211 million.
- **San Antonio/Luz del Cobre** is a copper property held by Zaruma. Construction at the site is scheduled to start in November 2007 with production set to begin in early 2009. The project involves capital costs of \$25 million.

In addition to the future projects in the South American countries mentioned above, it is also important to note the following projects that may come on stream in 2009 and which will substantially increase the assets of Canadian mining companies in Latin America:

- **Cerro Crucitas** is a low-grade gold deposit (1.22 g/t) in Costa Rica, held by Vanessa Ventures, involving capital costs of \$47 million.
- **Cerro de Maimon**, owned by GlobeStar Mining, is a copper-zinc-gold-silver-nickel deposit in the Dominican Republic. Production is scheduled for early 2008 and involves costs of \$45 million.

- **Pueblo Viejo**, owned by Barrick Gold and Goldcorp, is a gold-silver deposit also located in the Dominican Republic that involves capital costs of \$2.2 billion. The companies are expected to notify the Government of the Dominican Republic by February 2008 as to whether they intend to proceed with construction of the project.
- **Fenix (Exmibal)**, 92% of which is owned by Canadian company Skye Resources, is a nickel-cobalt deposit in Guatemala that requires capital expenditures of \$640 million (for Phase 1). Construction is scheduled to begin in early 2008.
- **Mirador**, owned by Corriente Resources, is a copper-gold deposit in Ecuador that requires capital expenditures of \$204 million. Production is scheduled to begin in mid-2009.

CUMULATIVE CANADIAN MINING ASSETS IN ASIA, BY COUNTRY, FROM 2001 TO 2006

Table 3 shows the countries for which Canadian mining assets were compiled from 2001 to 2006, with the total for each year. Note that these totals are cumulative from one year to the next. Figure 8 focuses on the countries of the "Persian Empire" group, represented by China, Kazakhstan, Kyrgyzstan, Mongolia, Myanmar, Russia, Turkey, and Indonesia, which together accounted for 80.5% of all Canadian assets in Asia in 2006.

China

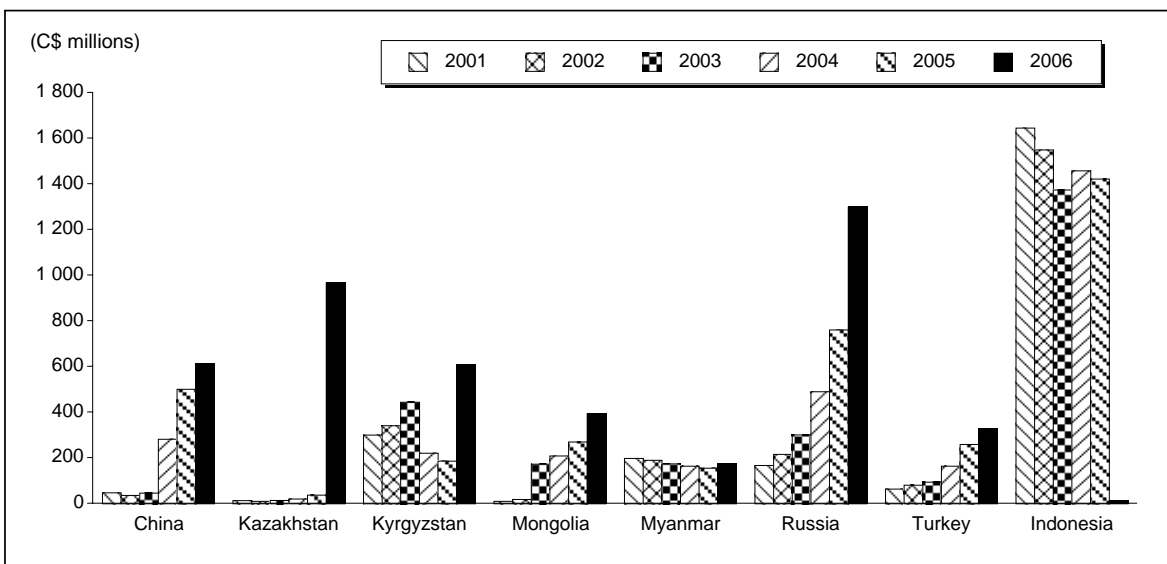
At least 52 Canadian mining companies are active in China. Cumulative Canadian mining assets in China sat at \$46.8 million in 2001, but had climbed to \$613.6 million by 2006.

After an astonishing 507% increase from 2003 to 2004, the pace slowed to 78% from 2004 to 2005, and to 22% from 2005 to 2006. A closer examination indicates that the following Canadian companies contributed to this growth between 2003 and 2004 by doubling their respective assets: Alcan, Asia Now Resources, Dynasty Gold, Garrison International, GobiMin, Golden China Resources, Inter-Citic Minerals, Ivanhoe Mines, Jinshan Gold Mines, Majestic Gold, Maxy Gold, McVicar Resources, Neo Material Technologies, Noront Resources, Orsa Ventures, Pinnacle Mines, Red Dragon Resources, Silk Road Resources, Southwestern Resources, Sparton Resources, Spur Ventures, Sterling Group Ventures, TVI Pacific, and VVC Exploration.

In 2006, with mining assets of close to \$614 million, the Canadian mining companies with interests in mining operations included:

- Eldorado Gold: the Tanjianshan mine;
- Silvercorp Metals: the Hou-Ping-Gou mine;
- GobiMin: the Huangshan (Yellow Mountain), Huangshan (Ylo Mountain East), and Xianshan mines; and

Figure 8
The "Persian Empire" Group, 2001-06



Source: Natural Resources Canada, based on companies' audited annual reports.

- Jinshan Gold Mines: the Chang Shan Hao mine.

Golden China Resources' Beyinhar project, a low-grade gold deposit (475 000 oz at 0.3 g/t measured and indicated) with a capital cost of approximately \$55 million, could be in production by 2008.

Kazakhstan

At least nine Canadian mining companies are operating in Kazakhstan. Eurasia Gold is the only Canadian mining company that has had mining assets on the Kazakh landscape each year since 2001 (although Ivanhoe Mines declared \$1 million in assets in 2001).

Over the years, other Canadian mining companies joined Eurasia, increasing Canadian mining assets in the country. From \$12.6 million in assets in 2001, the figure reached almost \$966 million in 2006. No Canadian interests associated with a mining operation were found in the country in 2006.

The following Canadian mining companies have assets in Kazakhstan: Alhambra Resources, Barrick Gold, Cameco, Eurasia Gold, Ivanhoe Mines, Lero Gold, Uranium One, UrAsia Energy, and World Wide Minerals.

The South Inkai and Kharasan uranium projects of Canadian-based Uranium One are among those scheduled to begin production in late 2007 or in 2008.

Kyrgyzstan

In 2001, Canadian mining assets in Kyrgyzstan totaled close to \$300 million. In 2004, assets decreased by half from the \$444 million they had reached in 2003 to \$221 million. The following year, a 19% decrease brought the value of cumulative assets to \$186 million, their lowest level since 2001.

The following nine Canadian mining companies had cumulative mining assets of \$606 million in 2006: Barrick Kyrgyzstan, Cameco, Centerra Gold, Centrasia Mining, Conquest Resources, Eurasian Minerals, Lero Gold, Uranium One, and UrAsia Energy. Only one Canadian mining company, Centerra Gold, has interests in a mining operation in Kyrgyzstan (the Kumtor mine).

Mongolia

More than 25 Canadian mining companies have undertaken exploration activities in Mongolia since 2001. From \$4 million that year, Canadian mining assets in Mongolia reached nearly \$393 million in 2006. In 2003, Canadian assets ballooned to \$173 million from only \$18 million the previous year. By doubling their respective assets, the fol-

lowing mining companies made a significant contribution to this 861% increase: Centerra Gold, Denison Mines, Erdene Gold, Ivanhoe Mines, Maximum Ventures, Planet Exploration, QGX, Red Hill Energy, Samba Gold, and SouthGobi Energy Resources. Only one Canadian mining company, Centerra Gold, has interests in a mining operation in Mongolia (the Boroo mine).

Construction has already begun on the copper-gold-molybdenum Oyu Tolgoi project, owned by Canadian company Ivanhoe Mines. The project requires capital expenditures estimated at \$7.3 billion and is scheduled to go into production in 2010. It is the largest project in Mongolian history in terms of foreign capital. However, Ivanhoe Mines will not be alone. On October 18, 2006, Britain's Rio Tinto Group announced that it was acquiring a strategic 19.9% holding in Ivanhoe Mines at a cost of \$691 million in order to jointly develop the Tolgoi gold and copper deposit in Mongolia.

Myanmar

Four Canadian mining companies (Ivanhoe Mines, Jet Gold, Leeward Capital, and Sterlite Gold) built up cumulative mining assets of close to \$172 million in 2006. It should be noted, however, that Canadian policy on Burma discourages businesses from concluding further investment agreements or initiating business ventures in Burma until the political situation there has improved substantially.²

Russia

Since 2001, 16 Canadian mining companies have been searching to uncover the secrets that lie beneath the surface of the Russian landscape.

Canadian mining assets in Russia totaled almost \$167 million in 2001 and ended 2006 at nearly \$1.3 billion. Although cumulative mining assets have risen every year since 2001, 2006 saw the largest increase since that time – a 71% jump over 2005. During this period, the following Canadian mining companies doubled their respective assets: Fortress Minerals, Golden Reign Resources, Lundin Mining, and Sutcliffe Resources.

In 2006, Canadian mining companies with interests in mining operations included:

- Bema Gold: the Julietta mine (note that Kinross Gold acquired Bema Gold in February 2007); and
- High River Gold Mines: the Mnogovershinnoye and Buryatzoloto mines.

² Foreign Affairs and International Trade Canada's policy on Burma.

The future Berezitovy mine, a High River Gold Mines gold-silver-zinc-lead project, will go into production in August 2007 with indicated gold resources of 1.13 million oz at 2.12 g/t. The project requires \$76 million in capital before going into production.

Kinross Gold's Kupol gold-silver project (75% interest), requiring \$352 million in capital, should begin operations in mid-2008. Production capacity is estimated at 3000 t/d. This very high-grade deposit has indicated gold reserves of 4.8 million oz at 20.20 g/t.

Turkey

Eleven Canadian mining companies have been active in Turkey: Aldridge Minerals, Cloudbreak Resources, Eldorado Gold, Eurasian Minerals, Fronteer Development Group, Inmet Mining, Mediterranean Resources, Nuinsco Resource, Odyssey Resources, Silvermet, and Teck Cominco.

In 2001, the cumulative mining assets of these companies stood at over \$63 million and, by the end of 2006, this figure had reached \$327 million. Although assets have increased continuously since 2001, the largest jump was seen in 2005 when cumulative assets increased 58% over 2004. Between 2004 and 2005, the following Canadian mining companies doubled their respective assets: Aldridge Minerals, Cloudbreak Resources, Mediterranean Resources, Nuinsco Resources, and Silvermet.

Eldorado Gold and Inmet Mining have interests in the Kisladag and Cayeli mines, respectively. Eldorado is currently developing another property, the Efemcukuru mine, with a capital investment of \$104 million; production is to begin in 2009. For its part, Inmet Mining is developing a copper-zinc-gold-silver deposit, the Cerattepe project, for which the capital costs are \$87 million. This mine is expected to go into production in early 2009.

Indonesia

Only 13 Canadian mining companies are conducting exploration activities in the world's largest archipelagic state. In 2001, Canadian mining assets totaled over \$1.6 billion. In 2006, this figure was under \$6 million. Why? In 2006, Canadian mining company Inco Limited ceased to exist under Canadian ownership (it was purchased by Brazilian company Companhia Vale do Rio Doce [CVRD] in October 2006). For the purposes of this compilation of Canadian mining assets, Inco's mining assets were therefore reduced to zero for the year 2006.

Finally, it is noted that IAMGOLD is receiving royalties on the Rawas mining operation.

CUMULATIVE CANADIAN MINING ASSETS IN EUROPE, BY COUNTRY, FROM 2001 TO 2006

Table 4 shows the countries for which Canadian mining assets were compiled from 2001 to 2006, with the total for each year. Note that these totals are cumulative from one year to the next. Figure 9 focuses on the European group, represented here by Ireland, Finland, Spain, Romania, Norway, Portugal, and Sweden, which together account for 97.5% of all Canadian assets in Europe in 2006.

Ireland

Five Canadian mining companies have been active in Ireland since 2001. Bayswater Uranium, Galantas Gold, Lundin Mining, Strongbow Exploration, and Tournigan Gold held cumulative mining assets of almost \$150 million in 2006.

While there were no Canadian mining assets in Ireland in 2001, Canadian assets totaled \$10 million by 2004 and, with the purchase of ARCON International Resources (an Irish company) by Lundin Mining in 2005, the figure skyrocketed to \$177 million. Through this purchase, Lundin acquired control of the Galmoy mine. Galantas Gold also holds interests in the Omagh mine.

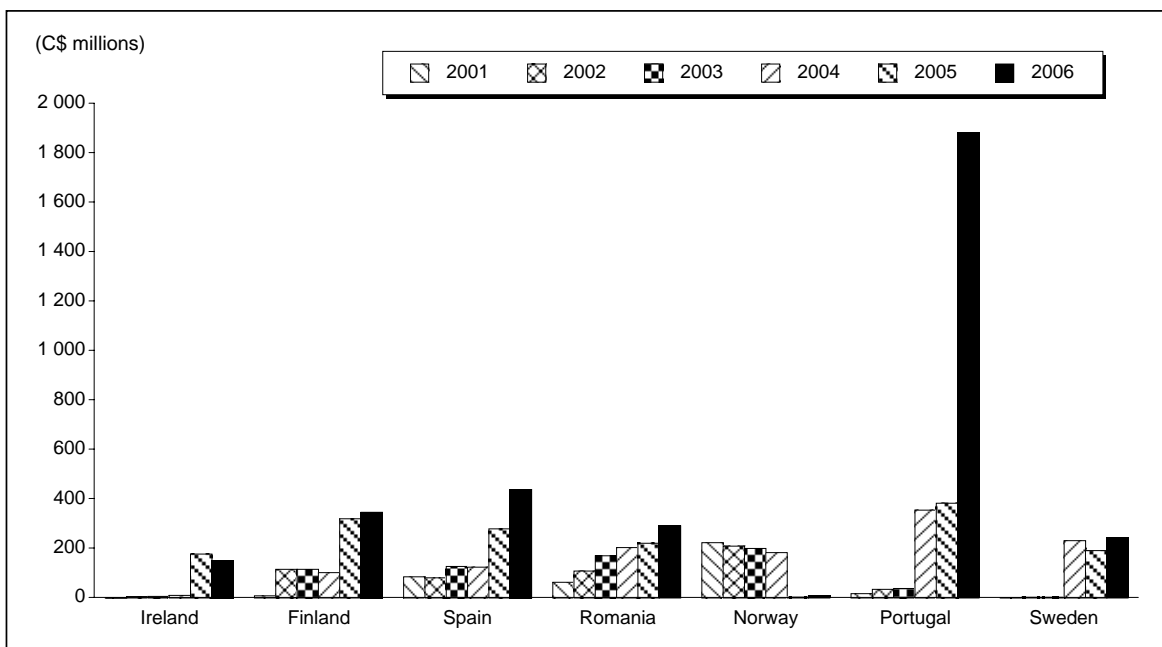
Finland

The 15 Canadian mining companies with a presence in Finland held mining assets of \$8 million in 2001. In 2002, Canadian mining company Inmet Mining concluded an agreement with the Finnish company Outokumpu for the purchase of the Pyhäsalmi copper-zinc mine, driving Canadian mining assets up to \$115 million that year. The figure changed little in 2003 and 2004 but, with the arrival of Agnico-Eagle in Finland in 2005, Canadian mining assets increased by 214% to close the year at a cumulative total of almost \$320 million. Adriana Resources, Northern Lion Gold, and Northland Resources contributed to this percentage increase by doubling their respective assets.

In 2006, Canadian mining assets in Finland totaled close to \$346 million, and Inmet Mining was the only Canadian mining company with interests in a mining operation there (the Pyhäsalmi mine).

However, two major projects are under way. The first is the Kevitsa nickel-copper-cobalt-platinum-palladium project being developed by Scandinavian Minerals at a cost of \$110 million. This mine is expected to go into production in 2010. The second project, the Kittila gold mine held by

Figure 9
Where Nordic Meets "Iberic," 2001-06



Source: Natural Resources Canada, based on companies' audited annual reports.

Agnico-Eagle Mines, has indicated reserves of 2.6 million oz grading 4.23 g/t. A total of \$135 million in capital is required and the project should go into production in mid-2008.

Spain

With the exception of 2004, every year since 2001 has seen an increase in cumulative Canadian mining assets from slightly over \$85 million in 2001 to almost \$438 million in 2006. Rio Narcea Gold Mines and Solid Resources have been part of the Spanish landscape since at least 2001, but the arrival of Iberian Minerals, Inmet Mining, and Kinbauri Gold in 2005 more than doubled cumulative assets to \$278.5 million that year. It should be mentioned, however, that Inmet Mining's Las Cruces project was most likely the trigger for the sudden increase in assets from 2004 to 2005 and from 2005 to 2006.

In 2006, Rio Narcea Gold Mines was the only Canadian mining company with interests in mining operations in Spain (the Aguablanca, Le Valle, and Carles mines).

Las Cruces, the future copper mine owned by Inmet Mining (70%), requires capital of \$380 million and should go into production in 2008. The other mining project planned for 2008 is the Aguas Tenidas project held by Canadian company Iberian Minerals. The zinc-lead-copper-silver-gold deposit requires capital expenditures of \$12 million.

Romania

Four Canadian mining companies are currently in Romania: Carpathian Gold, Cloudbreak Resources, European Goldfields, and Gabriel Resources. Over 80% of Romania's cumulative mining assets are associated with Gabriel Resources' Rosia Montana project.

Norway

After Iceland, Norway has Canada's smallest mining presence. From 2001 to 2004, Falconbridge was active in Norway, with interests in the Nikkelverk refinery and sulphuric acid plant. Because Falconbridge was purchased by Swiss mining company Xstrata, its assets were therefore reduced to zero for the year 2005 for purposes of this compilation of Canadian mining assets.

Ivanhoe also had interests in the Bjornevatn iron mine in 2001, but completely divested itself of the property in 2002. This leaves only one Canadian mining company in Norway, Blackstone Ventures, with three active projects and assets totaling close to \$8 million in 2006.

Portugal

In 2001, its cumulative Canadian mining assets totaled almost \$17 million but, by 2006, the figure was almost \$2 billion. The largest increases occurred from 2003 to

2004 when assets increased from \$38 million to almost \$355 million, and from 2005 to 2006 when the assets of the nine Canadian mining companies operating in Portugal rose from \$384 million to \$1.9 billion.

The increase in 2004 was related to the purchase by EuroZinc Mining of a 100% interest in Sociedade Mineira de Neves Corvo S.A. (Somincor), which held the rights to the Neves-Corvo mine. The 2006 increase was related to the merger of EuroZinc with Lundin Mining. The merged company, Lundin Mining, holds the operating rights to the Neves-Corvo mine and all other properties previously held by EuroZinc Mining.

In addition to the Neves-Corvo copper-zinc-lead deposit, another Canadian mining company, Primary Metals, has interests in the Panasqueira mine (a tungsten-copper-tin deposit).

Lundin Mining is working to bring the Aljustrel zinc-lead-copper-silver-gold mine into operation. The project requires capital expenditures of \$88.3 million. Production is slated to begin in mid-2007.

Sweden

In 2006, at least 16 Canadian mining companies were active in Sweden searching for commodities such as lead, zinc, copper, silver, and uranium.

Nordic Diamonds was the only Canadian mining company to declare mining assets (\$844 000) in Sweden in 2001. In subsequent years, Nordic Diamonds was joined in the country by Lundin Mining, Mawson Resources, and Northland Resources, but it is unquestionably Lundin Mining's 2004 acquisitions (the Zinkgruvan mine, the Norrbotten property, and a 74% interest in North Atlantic Resources, which operates the Storliden mine) that raised cumulative Canadian mining company assets in Sweden from \$1.9 million in 2003 to \$230 million in 2004.

In 2006, the cumulative assets of Canadian mining companies in Sweden increased to almost \$242 million, and Lundin Mining is the only Canadian mining company to hold interests in the Zinkgruvan and Storliden mines.

CUMULATIVE CANADIAN MINING ASSETS IN OCEANIA, BY COUNTRY, FROM 2001 TO 2006

Table 5 shows the countries for which Canadian mining assets were compiled from 2001 to 2006, with the total for each year. Note that these totals are cumulative from one year to the next. Figure 10 focuses on the countries of Oceania, represented here by Australia and Papua New Guinea; these two countries accounted for 99.6% of all Canadian assets in Oceania in 2006.

Australia

At least 53 Canadian mining companies have been present in Australia since 2001 and are involved in over 30 mining operations.

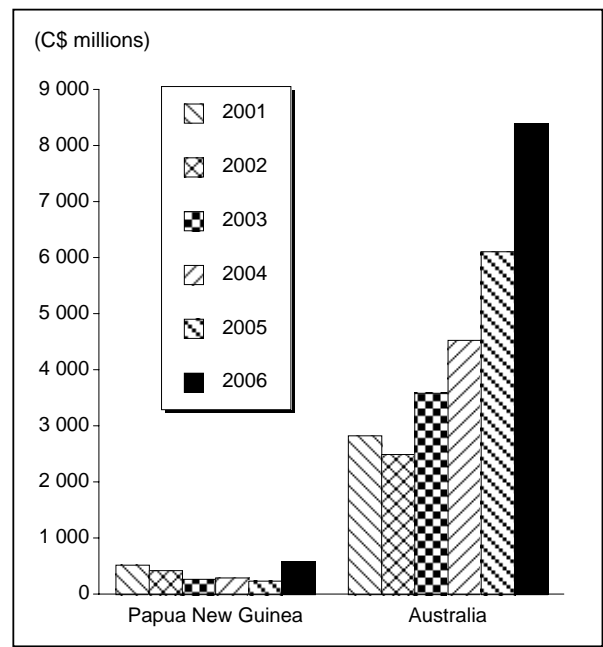
Cumulative Canadian mining assets in Australia in 2001 were \$2.8 billion. A 44% increase was seen in 2003, increasing cumulative assets by \$2.5 billion to almost \$3.6 billion. Subsequent annual increases varied from 26% to 37%, resulting in cumulative assets of almost \$8.4 billion by 2006.

There are a number of explanations for the 44% increase in cumulative assets in 2003, including the arrival of new Canadian mining companies in Australia—Aldershot Resources, Equinox Minerals, Goldcrest Resources, Oriental Minerals, Queensland Minerals, and Teck Cominco—and/or their first declaration of assets on Australian soil. Two Canadian mining companies, Goldminco and LionOre Mining, also contributed to the 44% increase in 2003 by doubling their respective cumulative assets.

In 2006, Canadian mining companies with interests in mining operations in Australia included:

- Teck Cominco: the Lennard Shelf mine;

Figure 10
Under the Austral Sun, 2001-06



Source: Natural Resources Canada, based on companies' audited annual reports.

- Goldcorp: the Peak mine (Note: In February 2007, Goldcorp sold the Peak mine to Peak Gold, another Canadian mining company);
- LionOre Mining: the Emily Ann, Thunderbox and Maggie Hays mines; the Lake Johnston processing facility; the Mt. Mcclure mine (royalties); the Black Swan Operations; and the Silver Swan, Waterloo, Bounty, Cosmos and Stawell mines (Note: In August 2007, Russian company OJSC MMC Norilsk Nickel acquired LionOre Mining; therefore, the mining assets of LionOre for 2007 will be reduced to zero);
- Barrick Gold: the Yilgarn Darlot, East Kundana JV, Granny Smith, Henty, Kalgoorlie, Kanowna Belle (Red Hill), Kundana, Yilgarn Lawlers, Osborne, and Yilgarn Plutonic (Freshwater) mining properties;
- GBS Gold International: the Brocks Creek (Union Reef), Fountain Head (Union Reef), Frances Creek, Rising Tide (Union Reef), and Union Reefs (Pine Creek) mining properties; and
- Ivern Inc.: the Magellan mine.

Major projects in subsequent years include the Maud Creek (Union Reefs) project by Canadian company GBS Gold International. This deposit contains 935 000 oz of gold at an average grade of 3.10 g/t measured and indicated, and is expected to go into production in late 2008/early 2009.

In addition, the Honeymoon uranium project owned by Canadian company Uranium One is expected to go into production before the end of 2008.

Finally, the Coolgardie-Redemption project is a joint venture in which Canadian company Committee Bay Resources holds a 50% interest. This is a gold-nickel project with reserves of 78 000 oz at 2.50 g/t indicated.

Papua New Guinea

Twelve Canadian mining companies have had a presence in Papua New Guinea since 2001.

In 2001, cumulative Canadian mining assets in Papua New Guinea stood at almost \$524 million. After declining year after year, assets in 2006 returned to (and slightly exceeded) their 2001 level (reaching close to \$576 million). The over \$500 million increase in assets can be explained, in part, by the purchase of Placer Dome by Barrick Gold in December 2005. Placer Dome held a 75% interest in the Porgera mine, while an Australian company, Emperor Mines, held 20% and the Papua New Guinea government held 5%. Barrick became the owner of Placer Dome's 75% interest in Porgera, increasing its stake to 95% by purchasing Emperor Mines' 20% interest, which explains the increase in cumulative assets for 2006.

In addition to Barrick Gold, other Canadian mining companies that doubled their respective assets from 2005 to 2006 include Buffalo Gold, Nautilus Minerals, and New Guinea Gold.

In 2006, Canadian mining companies with interests in mining operations in Papua New Guinea included:

- Barrick Gold: the Porgera mine;
- New Guinea Gold: the Sinivit mine; and
- Inmet Mining: the Ok Tedi mine.

CUMULATIVE CANADIAN MINING ASSETS IN AFRICA, BY COUNTRY, FROM 2001 TO 2006

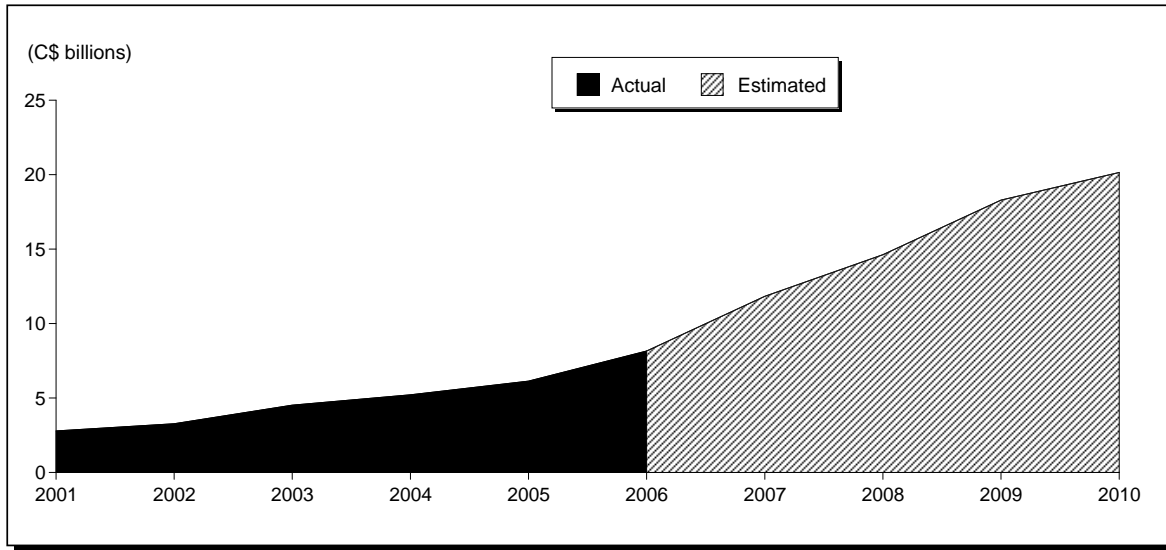
Table 6 shows the countries for which Canadian mining assets were compiled from 2001 to 2006, with the total for each year. Note that these totals are cumulative from one year to the next. Figure 11 shows actual Canadian mining assets from 2001 to 2006 and an estimate for the years 2007 to 2010.

(Note: This section on the African content was written by Michel Miron, Senior Policy Advisor for Africa, Minerals and Metals Sector.)

Of the 53 countries in Africa, over half have a known mineral potential. Because of the difficult social, political, and economic context, development of the continent's mineral resources is significantly delayed compared with mining regions elsewhere in the world. Inadequate mining legislation, an unstable political climate, weak infrastructure—due in part to problems related to decolonization—have helped relegate the African continent to the role of a secondary supplier of mining products. According to the U.S. Bureau of Mines, in the case of many metals and minerals, mining production in Africa in 2003 was down from 1990. Only South Africa and, to a lesser degree, Botswana, Ghana and Namibia managed to maintain levels of production equal to their mineral potential.

Since the early 1990s, several African countries have modernized their mining policies with the support of the World Bank. African countries have also been inspired by the great success of the Latin America countries, which succeeded in attracting major investment to the mining sector after implementing similar reforms. With the exception of a number of African countries embroiled in internal political conflicts, this change in mining policies and codes has created a favourable economic climate that has led to a significant increase in investments in exploration and in the development of mining projects.

Figure 11
Actual and Estimated Canadian Mining Assets, 2001-10



Source: Natural Resources Canada, based on companies' audited annual reports.

Canadian mining companies have played a central role in the renewal of mining activities in Africa, particularly with regard to mineral exploration, where Canadian companies have been very successful. A number of discoveries have already led to the development of mining operations in Tanzania, Zambia, the Democratic Republic of Congo (DRC), Mali, Mauritania, Guinea, Ghana, South Africa, and Kenya. The renewal of activities is in its infancy, and the African continent can be expected to once again become an important world source of minerals and metals in the next 10 to 15 years.

Since 2001, Canadian companies have been particularly active on the African continent, increasing the cumulative value of their mining assets from \$2.8 billion in 2001 to close to \$8.2 billion at the end of 2006. New projects announced by the companies should raise the value of Canadian mining assets to over \$20 billion by the end of 2010 (see Figure 11). Mining development projects in Africa involving Canadian companies, in some cases as partners with foreign companies and African governments, will result in investments totaling close to \$27 billion. The Canadian share of these new investments will amount to over \$12 billion.

In 2006, Canadian mining companies were most active in countries where the geology is favourable, but also where the political climate is conducive to foreign investment. The presence of Canadian companies was therefore concentrated in six countries that account for 77% of all mining assets: South Africa, Tanzania, Ghana, Zambia, the DRC, and Botswana. The return of peace to the DRC

explains the jump in the value of Canadian mining assets in that country, which are expected to exceed \$3 billion by 2010.

Canadian companies operate 39 mines or processing facilities, directly or in partnership, in 15 African countries. This figure is expected to increase rapidly, reaching 70 by 2010 if all announced projects go ahead. South Africa, the DRC, Botswana, Burkina Faso, Zambia, Tanzania, Madagascar, and Eritrea are the countries that will benefit the most from new Canadian investment projects within their borders.

The past 10 years have seen an increasing trend in terms of the value and percentage of mineral exploration in Africa. For example, according to the most recent survey by the Metals Economics Group (MEG), the proportion of exploration expenditures by mining companies (junior companies, producers, Crown corporations) budgeted for Africa relative to the worldwide total has risen from close to 12% in 1996 to almost 17% (estimate for 2006). By comparison, over the same period, the proportion of worldwide expenditures budgeted for Canada rose from 14% to 19.6%.

The MEG survey also reported planned exploration expenditures of US\$1.2 billion for all of Africa in 2006, a strong increase over levels in previous years. According to MEG data for Africa, of 222 mining companies active in 2006, 88 were from Canada, 51 from Australia, 35 from South Africa, 35 from Europe, 7 from the United States, and the remainder from other countries.

In 2006, Canadian mining companies headquartered in Canada that took part in the MEG survey are believed to have spent close to US\$280 million in Africa, which represents 24% of all exploration expenditures on the continent. Only companies from South Africa spent a larger part of their budget on the African continent – US\$510 million, or 43% of total spending in Africa (including the budget of the De Beers Group). Of the South African total, the largest part will be spent domestically and the balance will be spent in the remainder of Africa.

The strong presence of Canadian mining companies in Africa is unequaled in other industrial sectors in Canada. Canada is disadvantaged by geography relative to European countries and, to a lesser degree, to Australia when it comes to activities in Africa. Despite this handicap, Canada has been able to play a key role in the rebirth of the African mining sector. Because Canada's presence is particularly important in the area of exploration, an activity that extends over several years and that can lead to the discovery of deposits and potentially to major investments, mining will certainly continue to figure prominently in business relations between Canada and the countries of Africa.

CUMULATIVE CANADIAN MINING ASSETS IN THE UNITED STATES FROM 2001 TO 2006

At least 318 Canadian mining companies are active within the United States with mining assets totaling over \$8.9 billion in 2001 and reaching over \$11.0 billion in 2006 (Table 7). Since 2001, Canadian mining assets in the United States have fluctuated by a factor of roughly 10, with the exception of 2006 when cumulative mining assets rose by 36%.

Many Canadian mining companies contributed to this 36% increase. In the same way that sponsors are ranked according to the level of their contribution to an event, the following breakdown categorizes Canadian mining companies that doubled (or more than doubled) their mining assets in the United States in 2006.

Category: Bronze

This category comprises Canadian mining companies that at least doubled their assets in 2006 and for which the total assets of each company were less than \$3 million. The following companies are ranked in this category: Anglo-Canadian Uranium, Astral Mining Corporation, Atomic Minerals, Aurogin Resources, Bell Resources, Big Bar Gold Corporation, Black Pearl Minerals, Bluerock Resources, Bonaventure Enterprises, Brett Resources, Celtic Minerals, Cloudbreak Resources, Columbus Gold, Consolidated Gold Win Ventures, Constantine Metal Resources, Coronado Resources, Energy Fuels, Excalibur Resources,

Fury Explorations, Galway Resources, Global Uranium, Goldstake Explorations, Grayd Resource, Great Western Minerals Group, International Enenco, Kenai Resources, Kent Exploration, Landmark Minerals, Lebon Gold Mines, Maestro Ventures, Magnum Uranium, Maximus Ventures, Medallion Resources, Mesa Uranium, Mexivada Mining, Mill Bay Ventures, Molycor Gold, New World Resources, Northern Canadian Uranium, Phoenix Matachewan Mines, Rainy River Resources, Regent Ventures, Salmon River Resources, Sheffield Resources, Silver Fields Resources, Silver Quest Resources, Southern Silver Exploration, Sparton Resources, Starcore International Ventures, Stina Resources, Sutter Gold Mining, Target Exploration and Mining, Telkwa Gold, Teras Resources, Thelon Ventures, Tournigan Gold, Trans America Industries, Triex Minerals, Trigon Uranium, and Zappa Resources.

Category: Silver

This category comprises Canadian mining companies that at least doubled their assets in 2006 and for which the total assets of each company were between \$3 million and \$9.9 million. The following companies are ranked in this category: Aquila Resources, Bolero Resources, Carlin Gold, Chesapeake Gold, Erdene Gold, Grandview Gold, International Tower Hill Mines, Journey Resources, Laramide Resources, Nevada Geothermal Power, Niblack Mining, Quaterra Resources, Rodinia Minerals, Strathmore Minerals Corp., Universal Uranium, and Uranium Power.

Category: Gold

This category comprises Canadian mining companies that at least doubled their assets in 2006 and for which the total assets of each company were between \$10 million and \$49.9 million. The following companies are ranked in this category: Andover Ventures, Augusta Resources Corporation, Denison Mines, Energy Metals, HudBay Minerals, Klondex Mines, Polymet Mining Corp., Powertech Uranium Corp., St. Andrew Goldfields, and U.S. Silver Corporation.

Category: Diamond

This category comprises Canadian mining companies that at least doubled their assets in 2006 and for which the total assets of each company were over \$50 million. The following companies are ranked in this category: Goldcorp, Kinross Gold, Northern Dynasty Minerals, Novagold Resources, Stelco, and Thompson Creek Metals Company.

Category: Platinum

This category comprises all Canadian mining companies with total mining assets of over \$1 billion each in 2006. The following companies are ranked in this category: Alcan, Barrick Gold, and Teck Cominco.

Canadian Ownership in U.S. Mining Operations in 2006

In 2006, Canadian mining companies with interests in U.S. mining operations included:

- Teck Cominco: the Pend d'Oreille, Pogo (Stoneboy JV), and Red Dog mines;
- Kinross Gold: the Fort Knox, Kettle River (Emanuel Creek), and Denton-Rawhide mines;
- Goldcorp: the Marigold and Wharf mines;
- Barrick Gold: the Bald Mountain Project, and the Cortez (Cortez JV), Golden Sunlight, Goldstrike (Betze-Post), Goldstrike (Meikle), Goldstrike (SJ Claims), Marigold, Ruby Hill, Pipeline (Cortez JV), South Pipeline (Cortez JV), and Turquoise Ridge (Getchell) mines;
- Denison Mines: the Sunday (Colorado Plateau) mine and White Mesa mill;
- Cameco: the Crow Butte, Highland-Cameco, and Smith Ranch mines;
- HudBay Minerals: the Balmat mine;
- Pacific Rim Mining: the Denton-Rawhide mine;
- Polymet Mining: the Mesabi Range-LTV Steel Mining mine;
- Quadra Mining: the Robinson mine;
- Thompson Creek Metals: the Thompson Creek mine;
- U.S. Silver Corporation: the Galena (Silver Valley) mine;
- Western Goldfields: the Mesquite mine;
- Yukon-Nevada Gold: the Jerritt Canyon mine;
- Agrium: the Rasmussen Ridge mine; and
- Silverado Gold Mines: the Nolan Gold mine.

Numerous future projects are planned for our neighbouring country to the south. Among those found in literature, the following would require a total of almost \$3 billion in capital expenditures to become mining operations:

- **Ashdown** is a former molybdenum mine, 40% of which is held by Canadian company Win-Eldrich Mines; it plans to re-open in 2007 after a \$2.5 million infusion of capital.

- **Carlota** is a copper deposit held by Canadian company Quadra Mining for which the capital costs are \$189 million; it should go into production in mid-2008.
- **Donlin Creek** is a gold project by Canadian companies Barrick and Novagold with indicated reserves of 5.6 million oz at 2.5 g/t; it involves capital investment of \$2.6 billion and is scheduled to go into operation in 2013.
- **Bullfrog-Tony** is a uranium-vanadium project held by Denison Mines that is scheduled to go into production in late 2007.
- **Idaho-Sunshine Cobalt** is a cobalt-copper-gold deposit held by Canadian company Formation Capital Corp; it involves capital investment of \$46 million.
- **Iron Springs-Comstock Mountain** is an iron deposit in which Canadian company Palladon Ventures holds a 50% interest; it involves capital investment of \$55 million.
- **Hollister** is a very high-grade gold deposit held by Canadian company Great Basin Gold with measured and indicated reserves of 929 000 oz grading 35.32 g/t; it should go into production in 2008-09 and requires a capital investment of \$44 million.
- **Rock Creek/Big Hurrah** is a low-grade gold deposit held by Novagold Resources with measured and indicated reserves of 454 000 oz grading 1.28 g/t; capital investment of \$120 million should enable the mine to open in early 2008.

CONCLUSION

The data used in this chapter are of an entirely different nature than those collected by every other organization. There is a simple reason for this: these data are based on the assets (or more specifically the fixed assets) of Canadian mining companies rather than on the forecast exploration budgets of the mining companies surveyed. These assets consist of mining properties, development costs, land, buildings, and equipment used in mines and mineral projects. The data were compiled by company and by country.

Although every effort has been made to capture all Canadian mining companies active in each of the world's mining countries, a number will undoubtedly have been missed. Nevertheless, we believe that these data paint a very representative picture of Canada's mining presence abroad. The \$64.4 billion in cumulative assets compiled for 2006 represent the GAAP book value. The book value

is a minimum value that, judging from the value of mining acquisitions made, is likely to be significantly below market value in a context of very high metal prices.

Given the steady increase in demand for minerals and metals on world markets, mining companies are looking more than ever toward new resources, many of which are located in developing countries. With interests in more than 230 mining operations worldwide in 2006 (excluding mining operations involving Canadian mining companies in Canada), Canadian mining companies are certainly faced with specific social and environmental issues. Accordingly, a number of Canadian mining companies have implemented initiatives to strengthen their corporate social responsibility as they manage the social and environmental risks associated with their activities abroad.

The Canadian mining sector is not limited to corporations that take minerals from the ground. As noted in an Export Development Canada article,³ it is really a cluster of industries, with the extraction firms at the centre and other companies feeding into them. Among these are engineering and construction firms, equipment suppliers and manufacturers, exploration and consulting companies, drilling companies, legal firms specializing in resource extraction, and a whole range of peripheral businesses such as instrument

producers and surveying companies. Therefore, these companies are likely to invest in countries where Canadian mining companies are already active, and hence it is safe to say that the \$64.4 billion figure is very conservative because it does not take into account investments by businesses peripheral to mining operations.

Canada's natural resources are one of the foundations upon which the country is built, and the mining sector continues to make an active contribution to its prosperity. Building on this heritage, Canadian mining companies have become leading players on the international stage. With ongoing projects valued at over \$3 billion over the coming years, it goes without saying that the know-how of Canadian mining companies will continue to be appreciated worldwide.

Notes: (1) Information in this review was current as of December 31, 2006. (2) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/2006CMY_e.htm.

NOTE TO READERS

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TABLE 1. WORLDWIDE CANADIAN MINING ASSETS, BY REGION, 2001-06

	2001	2002	2003	2004	2005	2006
(%)						
IN PERCENTAGES						
Latin America	30	29	29	30	36	44
Asia-Pacific (1)	10	10	9	9	9	7
Europe	2	2	2	4	4	5
Oceania	13	12	13	14	16	14
Africa	11	14	16	16	15	13
United States	35	32	30	27	20	17
(\$ millions)						
IN DOLLARS						
Latin America	7 783	7 136	8 430	10 046	14 565	28 183
Asia-Pacific (1)	2 536	2 524	2 703	3 102	3 714	4 699
Europe	398	555	660	1 258	1 626	3 419
Oceania	3 353	2 924	3 860	4 831	6 357	9 007
Africa	2 786	3 272	4 521	5 220	6 139	8 157
United States	8 908	7 785	8 812	8 962	8 103	11 027
Total	25 764	24 195	28 986	33 419	40 504	64 492

Source: Natural Resources Canada, based on companies' audited annual reports.

(1) Includes Russia.

³ ExportWise, Spring 2007, *Canada and the World's Mining Industry*, by Dennis and Sandi Jones.

TABLE 2. CANADIAN MINING ASSETS IN LATIN AMERICA, 2001-06

	2001	2002	2003	2004	2005	2006
(\$ millions)						
Argentina	157	174	615	1 069	2 146	3 192
Bolivia	34	33	39	65	73	88
Brazil	1 293	1 193	1 276	1 655	1 487	2 411
Chile	3 265	2 715	3 282	3 694	5 058	3 541
Colombia	7	7	7	8	9	65
Costa Rica	5	5	14	40	59	64
Cuba	220	218	220	194	217	261
Dominican Republic	133	146	136	163	524	346
Ecuador	12	16	21	44	70	131
Guatemala	0.02	1	9	23	23	1 390
Guyana	115	81	56	60	98	123
Honduras	28	24	19	57	58	122
Mexico	158	201	412	683	1 870	13 447
Nicaragua	–	1	12	16	17	84
Panama	17	17	17	17	21	53
Peru	2 133	2 064	1 945	1 876	2 283	1 700
Salvador	10	10	8	10	12	9
Suriname	11	53	174	182	184	747
Uruguay	28	23	20	31	41	49
Venezuela	157	155	151	160	315	360
Total	7 783	7 136	8 430	10 046	14 565	28 183

Source: Natural Resources Canada, based on companies' audited annual reports.

– Nil.

TABLE 3. CANADIAN MINING ASSETS IN ASIA-PACIFIC, 2001-06

	2001	2002	2003	2004	2005	2006
(\$ millions)						
Armenia	53	31	28	11	14	62
China	47	36	46	282	501	614
India	–	–	–	–	–	–
Indonesia	1 645	1 549	1 374	1 458	1 422	6
Iran	–	–	–	–	4	9
Kazakhstan	13	10	14	20	37	966
Kyrgyzstan	300	341	444	221	186	606
Mongolia	4	18	173	209	270	393
Myanmar	198	190	174	164	155	172
Pakistan	–	–	–	–	–	93
Philippines	28	30	30	36	44	45
Russia	167	216	301	490	761	1 298
South Korea	1	3	2	–	–	23
Turkey	64	81	94	164	259	327
Vietnam	16	19	23	47	60	84
Yemen	–	–	–	–	–	–
Total	2 536	2 524	2 703	3 102	3 714	4 699

Source: Natural Resources Canada, based on companies' audited annual reports.

– Nil.

TABLE 4. CANADIAN MINING ASSETS IN EUROPE, 2001-06

	2001	2002	2003	2004	2005	2006
	(\$ millions)					
Finland	8	115	115	102	320	346
Greece	—	—	1	17	16	16
Hungary	—	1	1	1	1	—
Ireland	—	5	6	10	177	150
Italy	—	—	—	30	31	32
Norway	223	209	200	183	3	8
Portugal	17	34	38	355	383	1 882
Romania	63	108	170	203	221	291
Serbia	—	—	—	—	—	7
Slovakia	—	—	1	2	3	8
Spain	85	81	127	124	279	438
Sweden	1	2	2	231	191	242
Total	398	555	660	1 258	1 626	3 419

Source: Natural Resources Canada, based on companies' audited annual reports.

— Nil.

TABLE 5. CANADIAN MINING ASSETS IN OCEANIA, 2001-06

	2001	2002	2003	2004	2005	2006
	(\$ millions)					
Australia	2 830	2 497	3 588	4 533	6 112	8 397
New Zealand	—	—	1	2	6	18
Papua New Guinea	524	427	271	295	240	576
Solomon Islands	—	—	—	—	—	16
Total	3 353	2 924	3 860	4 831	6 357	9 007

Source: Natural Resources Canada, based on companies' audited annual reports.

— Nil.

TABLE 6. CANADIAN MINING ASSETS IN AFRICA, 2001-06

	2001	2002	2003	2004	2005	2006
	(\$ millions)					
Angola	38	37	33	34	26	29
Botswana	30	230	273	277	247	516
Burkina Faso	17	32	41	82	193	321
Cameroon	—	—	105	112	118	107
Central African Republic	29	29	29	33	41	49
Congo Brazzaville	7	8	7	9	13	24
Congo, D.R.	321	159	167	178	226	864
Eritrea	3	10	13	5	8	21
Gabon	2	4	7	11	11	1
Ghana	159	199	437	477	905	1 038
Guinea	205	203	201	221	322	491
Guinea-Bissau	—	—	—	5	5	—
Ivory Coast	—	—	2	1	5	6
Kenya	13	16	18	22	28	36
Liberia	8	8	8	9	13	13
Madagascar	—	—	8	38	73	99
Mali	250	230	192	222	274	179
Mauritania	—	—	—	71	152	261
Morocco	—	—	—	1	2	3
Mozambique	—	—	—	—	—	—
Namibia	23	25	26	22	23	29
Niger	52	54	64	78	74	79
Senegal	—	—	1	2	6	15
Sierra Leone	20	20	27	27	32	37
South Africa	658	862	1 192	1 375	1 425	1 819
Tanzania	658	1 008	1 519	1 480	1 412	1 283
Tunisia	30	24	13	5	3	2
Uganda	2	2	2	3	5	3
Zambia	162	110	132	418	496	827
Zimbabwe	6	5	2	1	2	5
Total	2 786	3 272	4 521	5 220	6 139	8 157

Source: Natural Resources Canada, based on companies' audited annual reports.

— Nil.

TABLE 7. CANADIAN MINING ASSETS IN THE UNITED STATES, 2001-06

	2001	2002	2003	2004	2005	2006
	(\$ millions)					
United States	8 908	7 785	8 812	8 962	8 103	11 027

Source: Natural Resources Canada, based on companies' audited annual reports.

Aluminum

Prepared by the Minerals and Metals
Sector, Natural Resources Canada.
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(Notes: General information on aluminum is included in the 2003 edition. It is also available on the Internet at www.nrcan.gc.ca/mms/scho-ecol/main_e.htm#aluminum. Abbreviations of company names used in this paper are listed in Table 9 along with known Internet addresses of those companies.)

Canada's rank in world production
of primary aluminum: Third
Installed capacity (December 2006): 3.1 Mt/y

2006	Amount	Value (p)
Primary aluminum production	3.05 Mt	\$8.9 billion
Imports (unwrought)	0.15 Mt	\$0.4 billion
Imports (HS Chapter 76) (a)	n.a.	\$4.3 billion
Exports (unwrought)	2.4 Mt	\$7.2 billion
Exports (HS Chapter 76) (a)	n.a.	\$12.1 billion

n.a. Not applicable; (p) Preliminary.

(a) In the classification of export statistics, Harmonized System Chapter 76 includes codes for identifiable aluminum products, including primary metal, semi-fabricated products, and products made of aluminum. See Table 1 for a listing of the main codes. Export data can be obtained at http://strategis.gc.ca/sc_mrkti/tdst/engdoc/tr_homep.html or from Statistics Canada at www.statcan.ca/trade/scripts/trade_search.cgi.

PRIMARY ALUMINUM CASH PRICE, LME, 2004-06

	2004	2005	2006
	(US\$/t)		
Year average	1 716 (78¢/lb)	1 898 (86¢/lb)	2 568 (118¢/lb)
Start of year	1 601 (73¢/lb)	1 835 (83¢/lb)	2 271 (103¢/lb)
End of year	1 964 (89¢/lb)	2 285 (104¢/lb)	2 850 (129¢/lb)
Year high	1 964 (89¢/lb)	2 289 (104¢/lb)	3 275 (149¢/lb)
Year low	1 575 (71¢/lb)	1 675 (76¢/lb)	2 267 (103¢/lb)

World production of primary and recycled aluminum increased in 2006 to an estimated 44.1 Mt, compared to the past record of 41.5 Mt in 2005. Of this total, 33.9 Mt was primary metal, compared to 31.9 Mt in 2005.

Prices in the spot alumina market declined in 2006 as refinery expansions, particularly in China, increased supplies of alumina. *Metal Bulletin* has reported that spot prices for metallurgical-grade alumina started the year at US\$580-\$590/t and subsequently rose to US\$620-\$635/t in March 2006, but declined to end the year at US\$200-\$210/t. Prices then strengthened in early 2007 to US\$350-\$370/t. Antaike has reported that, within China, the spot price of imported alumina started the year at 6300 yuan/t (US\$780/t) and ended the year at 2500 yuan/t (US\$318/t).

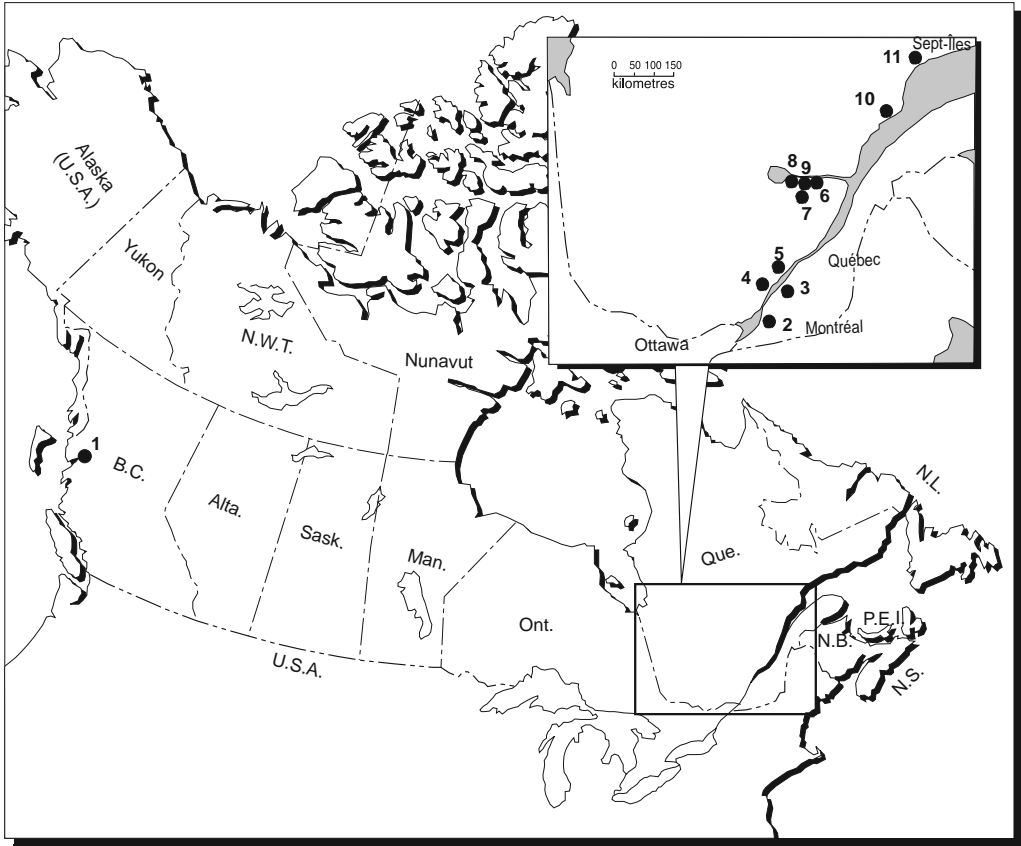
CANADIAN DEVELOPMENTS

The production of primary aluminum in Canada increased by 5% to 3.05 Mt in 2006, compared with 2.89 Mt in 2005, ranking Canada third after China (9.3 Mt) and Russia (3.7 Mt) in terms of world primary production. The increase was due to capacity creep and a full year of production from the Alouette smelter expansion. Monthly Canadian production statistics can be obtained on Natural Resources Canada's Internet site at http://mmsd1.mms.nrcan.gc.ca/mmsd/data/default_e.asp.

The value of Canadian primary aluminum production in 2006 is estimated at \$8.9 billion (US\$7.8 billion), up 34% from \$6.6 billion in 2005. This increase in value resulted from the increase in metal prices during the year and an increase in production, which countered an increase in the value of the Canadian dollar relative to the U.S. dollar.

Canada is the second largest aluminum-exporting country in the world after Russia. Canadian exports of primary ingot in 2006 increased in quantity to 2.4 Mt valued at \$7.16 billion (US\$6.3 billion), compared to a revised 2.32 Mt valued at \$5.38 billion (US\$4.4 billion) in 2005. Of this amount, unwrought exports to the United States totaled 1.98 Mt valued at \$6.05 billion (US\$5.3 billion) (see summary above and Table 1).

Figure 1
Aluminum Smelters, 2006



SMELTER	COMPANY	CAPACITY (t/y)
1. Kitimat	Alcan	277 000
2. Beauharnois	Alcan	52 000
3. Bécancour	A.B.I.	409 000
4. Shawinigan	Alcan	99 000
5. Luralco Deschambault	Alcoa-Aluminerie Luralco Inc.	255 000
6. Grande-Baie	Alcan	207 000
7. Laterrière	Alcan	228 000
8. Alma	Alcan	415 000
9. Arvida, Jonquière	Alcan	166 000
10. Baie-Comeau	Canadian Reynolds Metals (Alcoa)	438 000
11. Sept-Îles	Alouette	572 000
		3 118 000

Reported Canadian use¹ of aluminum metal at the first processing stage, including the use of recycled aluminum, was 1 099 519 t in 2005, up about 4% from a revised 1 059 038 t in 2004 (Table 3a).

Alcoa Inc. issued a hostile takeover bid for Alcan Inc. Subsequently, discussions between Alcan and Rio Tinto resulted in an agreement that Rio Tinto would purchase Alcan, and Alcoa withdrew its takeover bid. The merger was expected to be completed in the third quarter of 2007. The resulting company would be the largest bauxite and

aluminum producer with projects in place for it to become the largest alumina producer.

Alcan announced plans for a US\$550 million, 60 000-t/y pilot plant for its new AP50 smelting technology in Jonquière, Quebec. Construction was expected to begin in 2008 with first metal coming on stream in late 2010. This initial phase could be followed by up to an additional 390 000 t/y of new capacity in the Saguenay–Lac-Saint-Jean region by 2015.

Alcan and employees in Quebec, represented by the Canadian Auto Workers Union (CAW) and the United Steel Workers (USW), ratified new collective labour agreements for an initial term of five years with possible four-year extensions if Alcan decides to make major investments in the Jonquière Complex (CAW) and Alma (USW) during the first term. The collective agreement applies to members of the CAW in the Arvida, Beauharnois, Laterrière, Shawinigan, and Vaudreuil plants, as well as in other operations servicing the smelters.

Alcan announced its intention to modernize its Kitimat Works, B.C. primary aluminum smelter through a US\$1.8 billion investment. The project would replace existing Söderberg cells with AP35 technology and expand the smelter from its current 277 000-t/y capacity to 400 000 t/y over an extended period. The modernization is subject to conditions, including receipt of environmental permits and the successful conclusion of agreements with B.C. Hydro and the CAW, as well as Board approval. Alcan had a preliminary agreement with B.C. Hydro in late 2006; however, the B.C. Utilities Commission ruled in February 2007 against the agreement (www.bcuc.com). Submissions and hearings were scheduled for late 2007.

Alcan is constructing a US\$180 million spent pot lining recycling plant in the Saguenay–Lac-Saint-Jean region of Quebec. This unique industrial-scale pilot plant is expected to have a capacity of 80 000 t/y and will use Alcan's proprietary technology developed at its Arvida Research and Development Centre. The plant is expected to begin operations in the second quarter of 2008.

Aluminerie Alouette Inc., after completion of its expansion in early 2005, operated at full capacity during all of 2006. The expansion created 340 permanent new jobs at the smelter and 1500 indirect jobs in other areas of the province. This smelter is now the largest in North America and the company reports it is producing 1559 t/d (569 000 t/y). Partners in this smelter are Alcan (40%), Aluminium Austria Metall Québec (20%), Hydro Aluminum a.s. (20%), Société générale de financement du Québec (SGF) (13.33%), and Marubeni Québec Inc. (6.66%). Further details are available on the company's web site at www.alouette.qc.ca.

Alcoa and the Quebec government held talks on renewals of energy agreements for its three smelters. No announcements have yet been made on the results of these talks.

The Bécancour smelter, with a capacity of 409 000 t/y (owned by Alcoa 75% and Alcan 25%), operated at full capacity all year. Alcoa and Alcan had previously announced that billet production at the Bécancour smelter will be expanded to 234 000 t/y in 2007.

Alcoa previously established a project office in Montréal for the Alcoa-Fjaröal aluminum smelter in Iceland, and a number of Quebec companies are involved in the construction of the aluminum smelter. A team of 250 engineers,

specialists and technicians, responsible for the engineering, supply, and project management, have been on the job since the spring of 2004. Anodes were also shipped from Deschambault for the smelter's start-up.

Alcoa's Baie Comeau smelter will celebrate its 50th anniversary in 2007. The smelter began operating in 1957 and has been upgraded and expanded during its lifetime.

Both Alcan and Alcoa are included in the Dow Jones Sustainability Index. Individually, they and their regional operations organize and participate in various social, community, and environmental initiatives in Canada and around the world.

Alcan continues its efforts in the social and sustainability areas, including its 2006 Alcan Prize for Sustainability, a Global Indigenous Peoples Policy that will apply to Alcan's more than 440 sites, and its work on HIV/AIDS in Africa. Alcan received a 2007 Gold Medal Award from the World Environment Center for its comprehensive integration of sustainability. Further details on its work are available on the company's web site at www.alcan.com.

Alcoa also participates in a broad range of social and sustainability areas. It signed an agreement with the Musée de la civilisation de Québec for a three-year sponsorship of the museum through which Alcoa becomes a partner in the museum's entire annual program for three years, as well as one of the major partners involved in an exhibition the museum is preparing as part of Québec City's 400th anniversary in 2008.

Aluminerie Alouette announced a contribution of \$1 million in venture capital in the North Shore Regional Economic Intervention Fund (FIER), which supports aluminum-processing initiatives and regional economic diversification.

The Aluminium Association of Canada links the Canadian aluminum industry, aluminum users, the public, and government. Its activities during 2006 included a public awareness campaign to improve awareness of issues surrounding aluminum production in Quebec and an economic study outlining the contribution the industry makes to the economy. The report indicated that the primary aluminum industry in Quebec is the third largest industrial sector in the province and that it spends over \$2.5 billion in Quebec each year. Further information and links to web sites of Canadian primary aluminum producers can be found on the Association's web site at www.aac.aluminium.qc.ca.

Exploration

Exploration Orbite V.S.P.A. inc. has been conducting exploration and research into the production of alumina from a high-alumina clay found in the region of Murdochville on the Gaspé Peninsula in Quebec. The property is located 32 km northeast of Murdochville where surficial deposits of clay contain up to 24% Al_2O_3 .

The company contracted the Centre d'études des procédés chimiques du Québec (CÉPROCQ), a technology centre located in Montréal, to conduct laboratory work on a preliminary alumina extraction process. Preliminary results, received in early 2007, showed alumina extraction rates of about 20% from the clay and the possibility of production of high-purity alumina and by-products. The company is focusing on chemical or specialty alumina applications (www.explorationorbite.com).

CANADIAN OUTLOOK

Canadian installed capacity for the production of primary aluminum is now 3.12 Mt/y with the completion and ramp-up in production from the expanded Alouette smelter at Sept-Îles. Canada is expected to produce approximately 3.15 Mt of primary aluminum in 2007 and is expected to maintain its rank as the third largest primary producer after China and Russia. Canada is also expected to produce slightly higher amounts in 2008 and 2009 due to capacity creep in existing smelters.

Production growth will flatten over the next few years, depending on expected closures of Söderberg capacity in the next decade (not included in Figure 3), which will lower Canadian installed capacity should modernizations not occur at these facilities. Alcan's 60 000-t/y AP50 pilot smelter is expected to come on stream in late 2010. Other smelter expansion projects in Quebec are dependent on the construction of new power projects and/or the negotiation of additional long-term power supply contracts. A number of new power projects have been recently announced by

Quebec for the longer term; however, the Régie de l'énergie authorized Hydro-Québec to increase rates by 5.3% as of April 1, 2006, and this may affect the longer-term plans of industrial users (www.hydroquebec.com).

Canada's reported use of all forms of aluminum increased approximately 4% to an estimated 1.1 Mt in 2005, up from 1.09 Mt in 2004. Use is expected to increase at approximately the same rate in 2006.

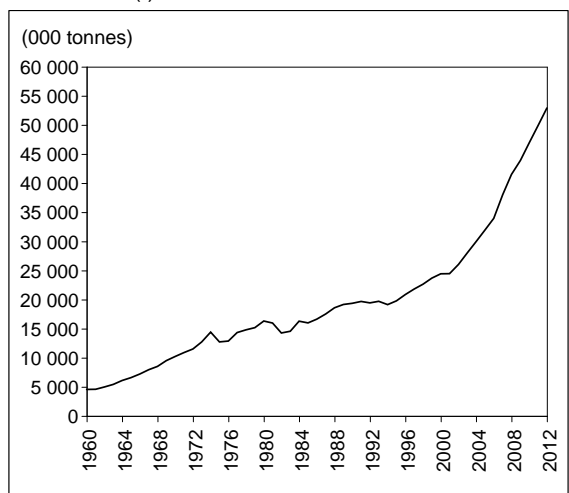
On a longer-term basis, potential expansions at Alcan's AP50 pilot plant and Alma smelter, and modernization and expansion of Alcan's Kitimat smelter and Alcoa's Deschambault smelters, may counter the expected closures of Canadian Söderberg technology that are expected to occur in the next decade. However, should these expansions/modernizations not occur, it is likely that Canadian production will fall over the next 5-10 years.

PRODUCTION, USE AND INVENTORY

On a longer-term basis, global primary aluminum production has been growing at about 4% per year (Figure 2); however, growth rates prior to 1980 and those since 2001 have been much higher.

World production of primary aluminum increased 6.7% to 31.9 Mt in 2005 from a revised 29.9 Mt in 2004 (Table 8, Figure 2). World production is estimated to have risen by a further 6% to 33.9 Mt in 2006 and is expected to rise by a further 10% to 37.6 Mt in 2007.

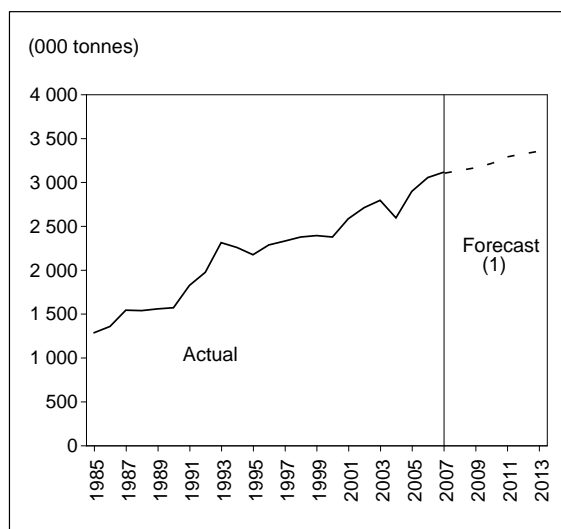
Figure 2
World Total Primary Aluminum Production,
1960-2012 (f)



Source: International Consultative Group on Nonferrous Metals Statistics.

(f) Author forecast for 2007-12.

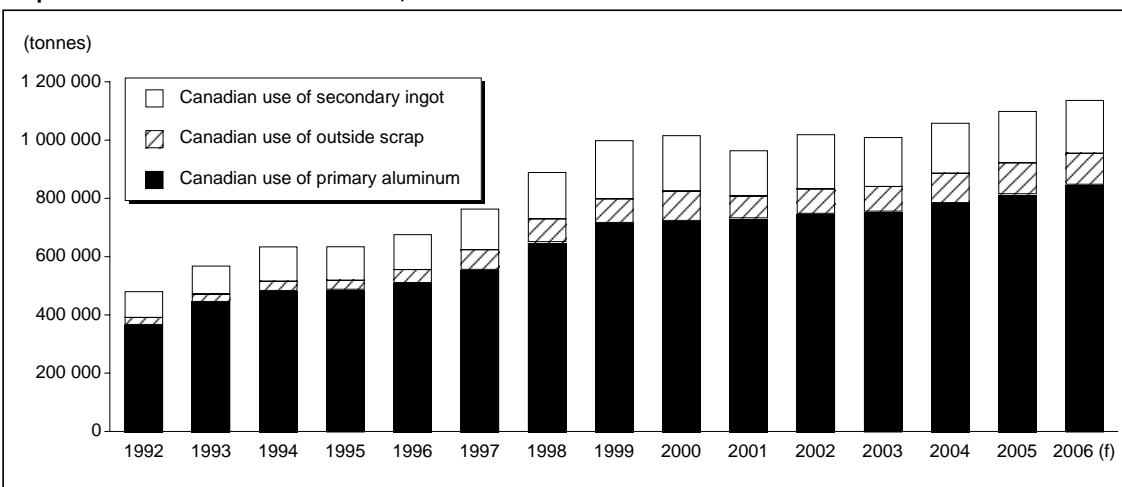
Figure 3
Canadian Primary Aluminum Production,
1985-2013



Source: Natural Resources Canada.

(1) No Söderberg closures included.

Figure 4
Reported Canadian Use of Aluminum, 1992-2006

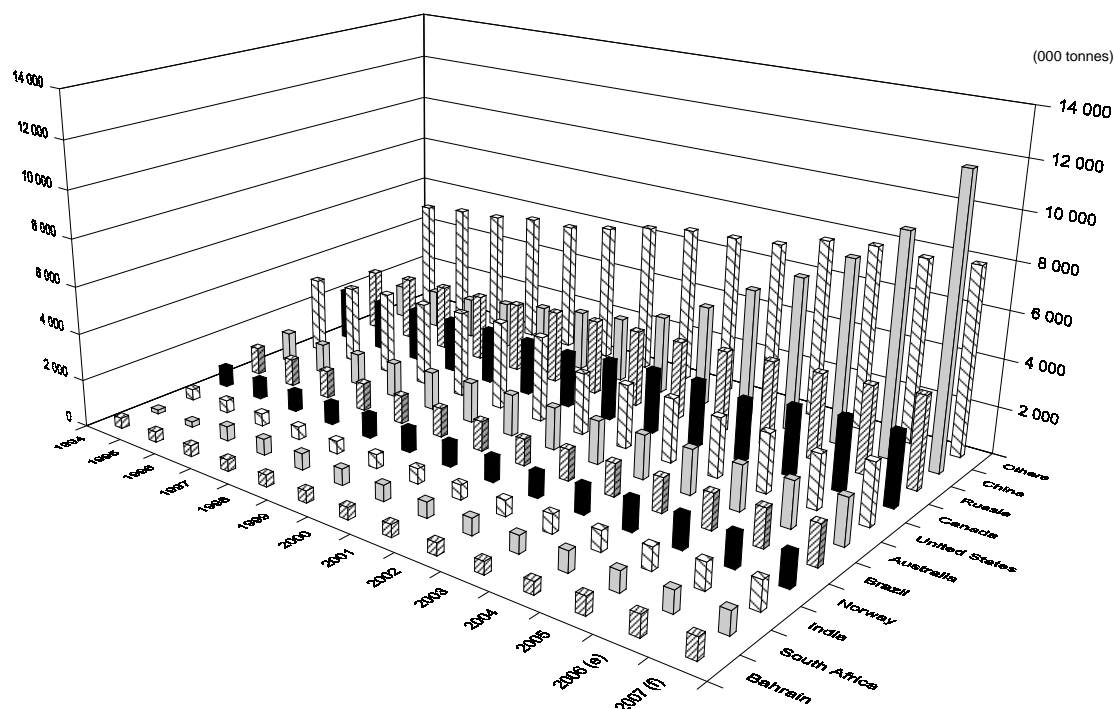


Source: Natural Resources Canada Annual Survey of Aluminum Metal Use in Canadian Establishments (170 aluminum-using companies in 2005).

(f) Author forecast.

Notes: Export figures are obtained from Canadian government trade data. Data on metal use are obtained from responses to questionnaires sent to aluminum-using companies. Companies surveyed include primary metal producing, recycling, casting, rolling, extruding, and foundry operations.

Figure 5
Primary Aluminum Production, Top Ten Producers, 1994-2007
 Total Estimated Production in 2006 = 33.9 Mt; 2007 forecast = 37.6 Mt



Source: International Consultative Group on Nonferrous Metals Statistics.

(e) Estimated; (f) Author's estimates and forecast based on published reports, company reports, journals, and Internet sources.

The International Aluminium Institute (IAI) indicates that members' world daily average of primary aluminum production for the year to March 2007 was 67 000 t, up 1600 t/d from March 2006. It also reports the average rate of consolidated production (IAI members plus China) was 91 000 t/d for 2006, an increase of 5300 t/d, although the average for the month of March 2007 was 98 200 t/d. Additional information can be obtained from the IAI's web site at www.world-aluminium.org.

IAI total inventories started the year at 3.2 Mt and remained relatively constant to end it at 2.9 Mt. LME high-grade inventories started the year at approximately 645 000 t and remained relatively constant to end it at 699 000 t. Aluminum alloy stocks in London Metal Exchange (LME) warehouses in early January 2006 were approximately 53 000 t, declined to 33 000 t in April, and then steadily increased during the year to 99 000 t at the end of December.

Combined IAI members' and LME aluminum inventories totaled approximately 3.9 Mt at the end of 2006. This represented about 37 days of global supply.

The IAI also reported that members' refined alumina production capacity increased from 59.4 Mt/y in December 2005 to 61.5 Mt/y in December 2006, while alumina production also rose from 56.2 Mt in 2005 to 58.3 Mt in 2006.

Chinese alumina production rose from 8.5 Mt in 2005 to 13.7 Mt in 2006.

WORLD DEVELOPMENTS

China

In China, metal production growth continued to be strong and increased by about 20% in 2006. Metal production is expected to increase by a further 25% in 2007 due to increased availability and lower cost for alumina. In addition, domestic alumina production rapidly increased by about 60% in 2006 based in part on imports of bauxite. Within China, the consolidation of smaller primary aluminum companies and the rapid expansion of processing facilities are accelerating.

Tax and other policy changes within China, including a cancellation of value-added tax (VAT) refunds and the imposition of an export tax on ingot (15%), as well as higher power rates, along with other government policy initiatives, continue to affect the longer-term plans for new smelters and manufacturing activity. However, increased profits resulting from a reduction in domestic alumina prices to US\$305/t from prices above US\$700/t in early 2006 have countered that influence.

The Chinese government continues to place pressure on older and smaller smelters to close or modernize and has taken measures to restrain phenomenal growth rates in vari-

ous industries, including aluminum. Measures taken to curb growth rates include: policies to close older Söderberg smelters, increased charges for power, cutbacks on alumina supplies to smelters that do not follow government policy, changes in the VAT rebate on primary aluminum exports from 15% to 8% in 2004, and a replacement of the rebate with a 5% export tax in January 2005. Subsequently in July, however, the export tax was removed from aluminum alloy exports. In 2006, the government also reduced tariffs on imports of scrap (from 2% to 0%) and alumina imports (from 8% to 5.5% to 3%) and imposed a 15% tax on exports of aluminum scrap.

The Federation of Aluminium Consumers in Europe (FACE) continued its efforts to stimulate aluminum demand by promoting the use of aluminum, assessing the impact of new technologies, and reducing the costs of primary metal through tariff reductions. FACE was formed in 1999 and has approximately 40 members from European aluminum-using companies from 11 countries. As the EU uses more than double the amount of primary aluminum it produces, FACE estimated that the EU's 6% duty on unwrought aluminum imports costs European consumers US\$475 million per year. (FACE has an Internet site at www.facealuminium.com.)

Expansions, proposals and studies for new mines, refineries and smelters have been announced in many countries. Global primary aluminum production is expected to grow by about 5% in 2006 and 2007. A partial listing of expected and potential changes follows.

Australia

Alcan Inc. received approval from the Government of Queensland to mine the Ely bauxite deposit in the northeast of the country. Mining subsequently started in January 2007. At the Gove refinery, work on expansion and upgrading the refinery capacity from 2.0 to 3.8 Mt/y continued.

The Worsley refinery in Western Australia, jointly owned by BHP Billiton/Japan Alumina/Sojitz Alumina Western Australia, completed an expansion from 3.25 to 3.50 Mt/y. However, BHP delayed a planned additional 1.1-Mt/y expansion for further study due to cost pressures.

Alcoa completed a 657 000-t/y expansion of the Pinjarra refinery to a capacity of 4.2 Mt/y and ramped up production during the year.

Alcoa also received government approval for the construction of a third line at the Wagerup refinery to increase alumina capacity from 2.6 to 4.7 Mt/y.

Chalco started a feasibility study for the Aurukun bauxite mine and refinery with a capacity of 2 Mt/y located in Queensland. The study is expected to be completed in two years.

Argentina

Aluar continued work on expansion and modernization of the Puerto Madryn smelter from 275 000 t/y to 400 000 t/y. Start-up of a new pot line was expected in mid-2007.

Brazil

Alunorte completed a capacity expansion at the Barcarena refinery to 4.4 Mt/y of alumina from 2.5 Mt/y.

Cia Brasileira de Alumínio planned to open additional mines in 2007, including a new 3-Mt/y operation at Mirai, and planned a new mining and refinery complex to be set up in Pará State in northern Brazil.

Cameroon

Alcan conducted studies on a potential US\$900 million project to upgrade and expand the Alucam smelter to a capacity of 260 000 t/y and to construct a new hydro-electric power station.

Europe

The European Commission adopted a proposal to reduce the EU's duty on unwrought aluminum in a two-step reduction from 6% to 3% in January 2007 and from 3% to 0% in 2009.

France

Alcan announced the start of the closure of the Lanne-mezan smelter in France due to high costs and expiry of an energy contract in June 2006. The smelter operated at near capacity all of 2006, but the closure was expected to be completed in 2008.

Germany

Trimet Aluminium AG purchased the closed 130 000-t/y Hamburger Aluminium-Werk smelter and obtained a new power supply agreement. It expected to re-open the smelter in 2007.

Guinea

Alcan, Alcoa, and the Government of Guinea signed an agreement on the development of a new alumina refinery in Guinea. The first phase was expected to have a capacity of 1.5 Mt/y. If feasibility studies were positive, construction would take three years.

Toronto-based Global Alumina Corporation (Global Alumina) continued work to finance and construct a 2.8-Mt/y alumina refinery in the Boké region of Guinea. The company worked toward a joint venture to develop and operate its alumina refinery project with BHP Billiton, Dubai Aluminium Company Limited (Dubal), and

Mubadala Development Company PJSC. Completion of the joint-venture agreement was expected in early 2007 (www.globalalumina.com).

Navasota Resources Ltd. obtained an option agreement from La Société AMIG Mining International S.A.R.L. to acquire up to 100% of this Guinean corporation with a bauxite exploration project in the Republic of Guinea, West Africa. AMIG holds a mineral exploration permit covering two contiguous areas aggregating 1064 km², located in the prefectures of Telemele and Gaoual in northwestern Guinea (www.navasota.com).

Guyana

IAMGOLD Corporation sold Omai Bauxite Mining Inc. (owned by Cambior Inc., 70%, and the Government of Guyana, 30%) and Omai Services Inc. to Bosai Minerals Group Co., Ltd. The company is a producer of high-alumina refractory bauxite, mainly for non-metallurgical applications (www.iamgold.com).

Iceland

Alcoa's new 320 000-t/y Fjardaal smelter in Iceland was expected to produce its first metal in mid-2007 and to reach full capacity by the end of the year. In addition, Alcoa and the Government of Iceland agreed to begin detailed feasibility studies for the development of a new 250 000-t/y aluminum smelter, based on geothermal energy, at Bakki near Husavik in northern Iceland. If positive results were obtained, construction would not start before 2010.

Century Aluminum Company completed an expansion of the Nordural smelter to a capacity of 220 000 t/y and expected a further 40 000-t/y expansion to be on stream in late 2007.

Alcan continued work towards a 280 000-t/y expansion of its ISAL smelter in Straumsvik, Iceland. The company obtained power for the expansion starting in 2010; however, residents narrowly voted against the project in a plebiscite. A power outage resulted in the loss of a pot line and about 10 000 t of production.

India

Bharat Aluminium Company Ltd. (Balco) completed a new 245 000-t/y smelter at Korba in the state of Chattisgarh, and expected that full capacity would be reached in early 2007.

Hindalco is ramping up the Hirakud smelter from 65 000 t/y to 143 000 t/y and is expecting full capacity production by the end of 2007.

Nalco is expected to complete an expansion at the Angul smelter from 360 000 t/y to 460 000 t/y in 2008.

Vedanta Resources expected the 1.0- to 1.4-Mt/y alumina refinery at Lanjigarh to be completed in 2007.

A number of other new mines, refineries and smelters are being considered in India. Vedanta expected the Phase 1 Jharsuguda smelter, with a 250 000-t/y capacity, to be ready in mid-2008. It expected it would reach its full 500 000-t/y capacity in 2010. Hindalco also has three greenfield project proposals (Aditya, Mahan, and Lathehar), each with a capacity of over 300 000 t/y.

Indonesia

National Aluminium Co. Ltd. (Nalco), based in India, held discussions on a new 500 000-t/y smelter and power plant in Indonesia.

Iran

IRALCO shut down 20% of the 120 000-t/y Arak smelter due to its high levels of emissions. China Aluminium International Engineering Corp., a subsidiary of Chalco, is building a 270 000-t/y aluminum smelter. The first phase of the new Arak smelter will be 110 000 t/y and start-up is expected in 2007. The older part of the smelter will be closed (www.iralco.net).

Madagascar

Alcan signed a Memorandum of Understanding with Access Madagascar Sarl, a Malagasy company holding exploration rights in Madagascar's southeastern Manantenina District, to study the development of a bauxite mine and alumina refinery with an initial capacity of up to 1.5 Mt/y.

Malaysia

A number of companies, including Rio Tinto, conducted studies for several new smelters in Malaysia that would be able to use power from the new 2400-MW Bakun dam that was expected to be completed in 2007.

Oman

Alcan Inc. and partners Oman Oil Company S.A.D.C. and the Abu Dhabi Water and Electricity Authority are constructing a US\$1.7 billion primary aluminum smelter in Sohar, Oman. Alcan has a 20% stake in the 350 000-t/y smelter, which was expected to produce metal in 2008. Sohar Aluminium has a dedicated 1000-MW power plant. It expected that eventually the smelter would be doubled in size.

Russia

RUSAL, SUAL, and Glencore completed a merger of their assets and created United Company RUSAL with

4 bauxite mines, 10 alumina refineries, 14 aluminum smelters, and 3 foil mills. The company's assets and over 100 000 employees are located in 17 countries on 5 continents.

Construction started on a new 150 000-t/y pre-baked cell pot line (line 5) in the Irkutsk smelter in 2005. It was expected to produce metal in 2007 and to reach full capacity in 2008. Upon completion, the smelter's capacity will be 450 000 t/y. It was planned that another similar new pot line would be operational in 2009. RUSAL also began work in 2006 on a new 750 000-t/y aluminum smelter in Taishet in the Irkutsk region. Construction is expected to be completed in 2011.

The new 300 000-t/y Khakas aluminum smelter at the Sayanogorsk smelter site started operation in late 2006 and was expected to reach full capacity in late 2007.

Work has continued on the Komi aluminum, bauxite and alumina complex with an expansion of bauxite production at the Timan bauxite mine of up to 6 Mt/y by 2009 and construction of a refinery with a capacity of 1.4 Mt/y. The first alumina is expected in 2008 and operation at full capacity is expected in 2009. Studies and permitting work for a new smelter at this location are also under way.

The Boguchanskoye Energy and Metals Complex is a joint venture with Rao United Energy Systems of Russia's subsidiary, Hydro OGK, with a 3000-MW hydro facility and a 600 000-t/y smelter. The first phase of 300 000 t/y was expected to be completed in 2009 and the second phase is scheduled for 2012.

Other projects include incremental improvements and expansions at the Bratsk, Krasnoyarsk, Sayanogorsk, Irkutsk, and Kubal smelters.

Saudi Arabia

Alcan and Ma'aden signed an agreement for a proposed US\$7 billion "mine-to-metal" project with a bauxite mine, alumina refinery, power plant, and aluminum smelter in Saudi Arabia. The project would have a refinery with a capacity of 1.6 Mt/y, a 720 000-t/y aluminum smelter, and a 1400-MW power plant. There is potential to expand the smelter to 2.1 Mt/y.

Sierra Leone

Toronto-based Moydow Mines International Inc. has a 50% interest with Gondwana Investments Limited in a bauxite deposit located in the Port Loko District of Sierra Leone's Northern Province. The property had been previously explored by SIEROMOCO, a Sierra Leone subsidiary of Alu-suisse. In late 2006, Gondwana and Moydow optioned a one-third interest in the project to Titanium Resource Group, Ltd. for the latter to conduct a bankable feasibility study in 2007.

South Africa

Alcan continued work on its proposed 720 000-t/y Coega aluminum smelter project at Port Elizabeth, South Africa, including finalizing a long-term energy supply agreement with South African energy firm ESKOM Holdings Limited.

Switzerland

Alcan closed the 44 000-t/y Steg primary aluminum smelter and facility for anode production in mid-2006.

United Arab Emirates

Rio Tinto signed an agreement with General Holding Corporation (GHC), an entity of the Emirate of Abu Dhabi, to undertake a pre-feasibility study on the construction of an aluminum smelter in Abu Dhabi. Stage 1 capacity could be as much as 700 000 t/y.

United States

Alcoa announced plans to restart one 90 000-t/y line at its 280 000-t/y Intalco smelter in Washington State in early 2007. This will lift production to around 185 000 t/y.

Ormet Corporation resumed production at the 265 000-t/y smelter in Hannibal, Ohio, after obtaining a new power supply contract.

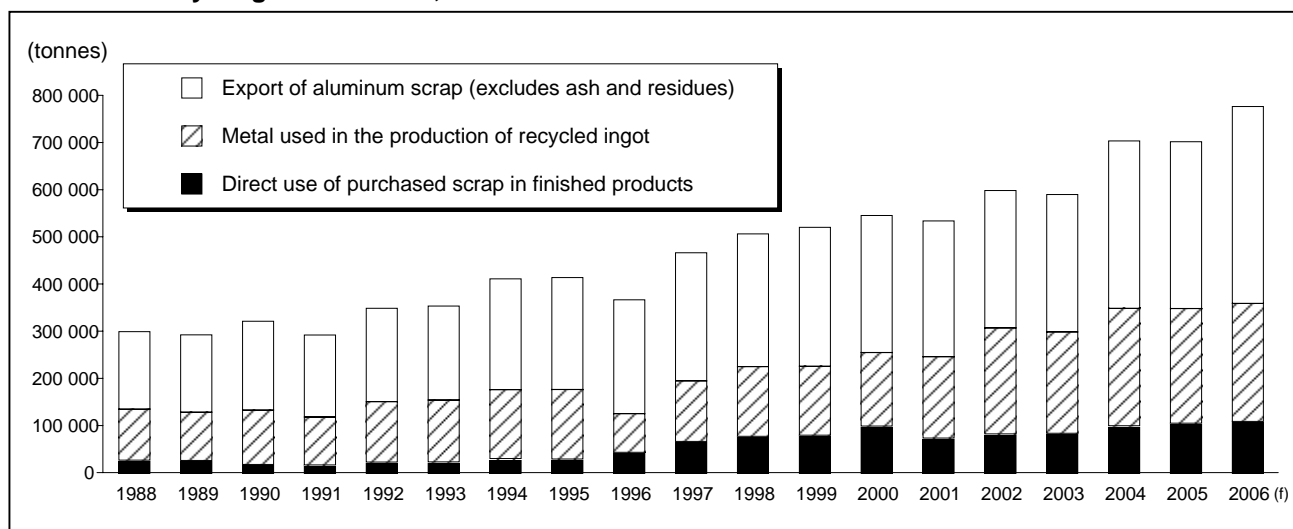
RECYCLING

The World Bureau of Metal Statistics (WBMS) reports that Western World production² of recycled aluminum metal remained steady at 7.8 Mt in 2006. U.S. production, at just under 3.0 Mt, was the largest amount in any one country and represented almost 40% of this recycled aluminum production. (The WBMS has an Internet site at www.world-bureau.com. The U.S. Geological Survey has an Internet site with further information on aluminum production, recycling and use at <http://minerals.usgs.gov>.)

Chinese production of recycled aluminum was reported at 2.4 Mt by the China Nonferrous Metals Industry Association.

Reported Canadian use of outside scrap (scrap aluminum obtained from other companies) for direct use in the production of semi-finished or finished products was 106 127 t in 2005, up from the previous record of 100 697 t in 2004. The reported use of aluminum metal, including scrap used in the production of recycled aluminum ingot, was 243 206 t in 2005, down slightly from 248 778 t in 2004. The reported use of purchased recycled aluminum ingot was 175 672 t in 2005, up slightly from a revised 170 997 t in 2004 (Table 3b, Figures 4 and 8).

Figure 6
Canadian Recycling of Aluminum, 1988-2006



Source: Natural Resources Canada Annual Survey of Aluminum Metal Use in Canadian Establishments.

(f) Author forecast.

Notes: Export figures are obtained from Canadian government trade data. Data on metal use are obtained from responses to questionnaires sent to aluminum-using companies. In 2005, 170 Canadian companies reported the use of primary, recycled and scrap aluminum. Companies surveyed include primary metal producing, recycling, casting, rolling, extruding, and foundry operations.

PRICES AND OUTLOOK

U.S. dollar-denominated prices were very strong and volatile in 2006. Given the continued strength in alumina prices and the current demand for the metal, this strength and volatility are expected to continue. Sales of aluminum, alumina, and bauxite are generally valued in U.S. currency. The rapid changes in the relative value of other currencies to the U.S. dollar seen in the last several years have resulted in the potential for diverging views on prices dependent on the currency considered (Figure 9).

Cash prices for primary-grade aluminum on the LME started 2006 at approximately US\$2270/t (103¢/lb) and peaked sharply at US\$3275/t (149¢/lb) in mid-May 2006. Subsequently, prices weakened to approximately US\$2385/t (108¢/lb) in mid-September; however, prices have since increased to US\$2800/t (131¢/lb) at the end of the year, for an increase of about 27% for the year. The Canadian currency equivalents for the start of the year were \$2625/t (121¢/lb) and in mid-December were \$3200/t (145¢/lb), representing an increase of about 22% for the year.

Prices in the spot alumina market, although historically high in the early part of the year, were relatively weak later in 2006 as refinery expansions, mainly in China, Australia and Brazil, provided increased supply. *Metal Bulletin* has reported that spot prices for metallurgical-grade alumina started the year at US\$590-\$610/t and declined throughout the year to end it at US\$200-\$210/t; however, prices strengthened in early 2007 to US\$350-\$370/t in March.

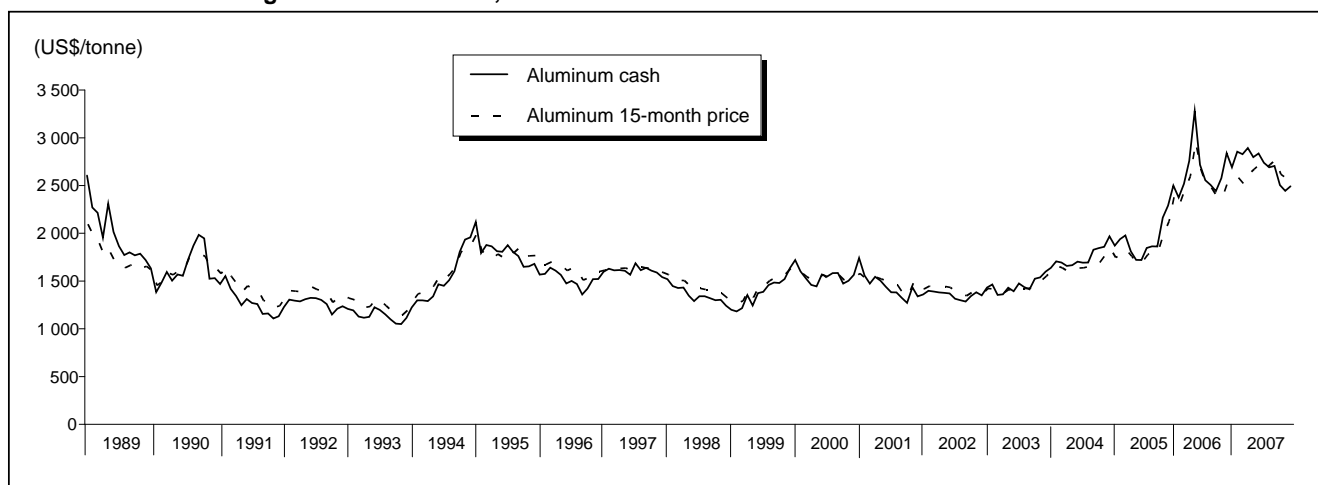
Antaika reported that alumina spot prices within China for imported alumina started the year at about 6100 yuan/t (approximately US\$770/t) and peaked at 6500 yuan/t in March. Prices then fell throughout the year to approximately 2400 yuan/t (approximately US\$300/t) at year-end. Prices rebounded in early 2007 to above 3900 yuan/t.

Alumina prices in Australia were reported to have increased by about 9% in Australian dollar terms over 2005-06 values to average A\$408/t at the end of December (approximately US\$310/t) with prices continuing to be strong in early 2007 (www.doir.wa.gov.au). The Australian Bureau of Agricultural and Resource Economics reports that the average price of exported alumina from Australia in 2006 was A\$413.41/t (www.abareconomics.com).

Additional production of approximately 3.6 Mt (11%) of metal from new and restarted production capacity located around the world (focused in China) is expected in 2007 (Table 8).

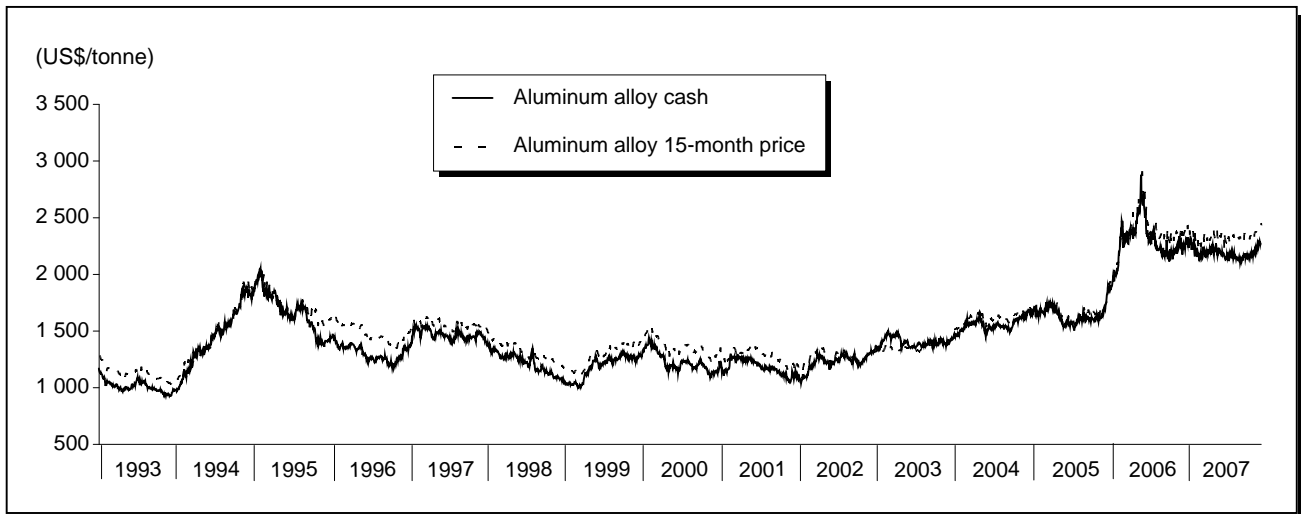
With the expansion at Alouette, Canadian installed capacity for the production of primary aluminum rose above 3 Mt/y in 2005. Alcan has proposed a 60 000-t/y AP50 pilot plant that may start production in 2010; however, other than that, project capacity will increase only as a result of expected capacity creep.³ Other expansions and modernizations remain on hold pending board approvals and power supplies. On a slightly longer-term basis, given the expected closures of other Canadian Söderberg capacity in the next decade and the absence of plans for new power projects, it is likely that Canadian production capacity may level off above 3 Mt/y and that production will fall thereafter unless brownfield expansions are undertaken using power from closed smelters.

Figure 7
London Metal Exchange Aluminum Prices, 1989-2007



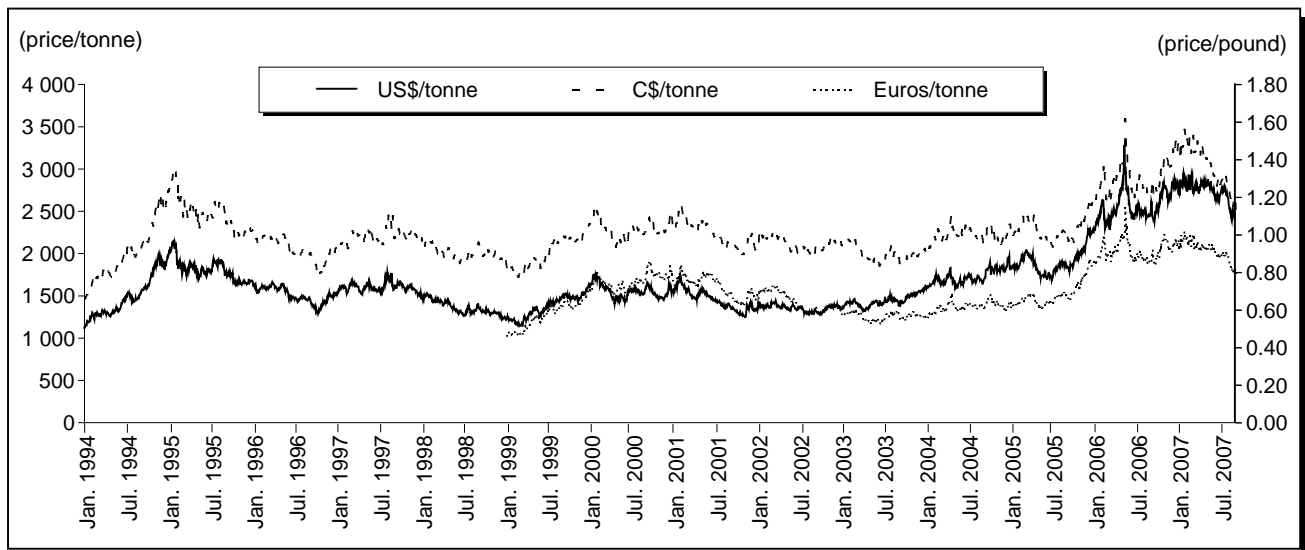
Sources: Natural Resources Canada; London Metals Exchange; Reuters; Metalprices.com.

Figure 8
London Metal Exchange Aluminum Alloy Prices, 1993-2007



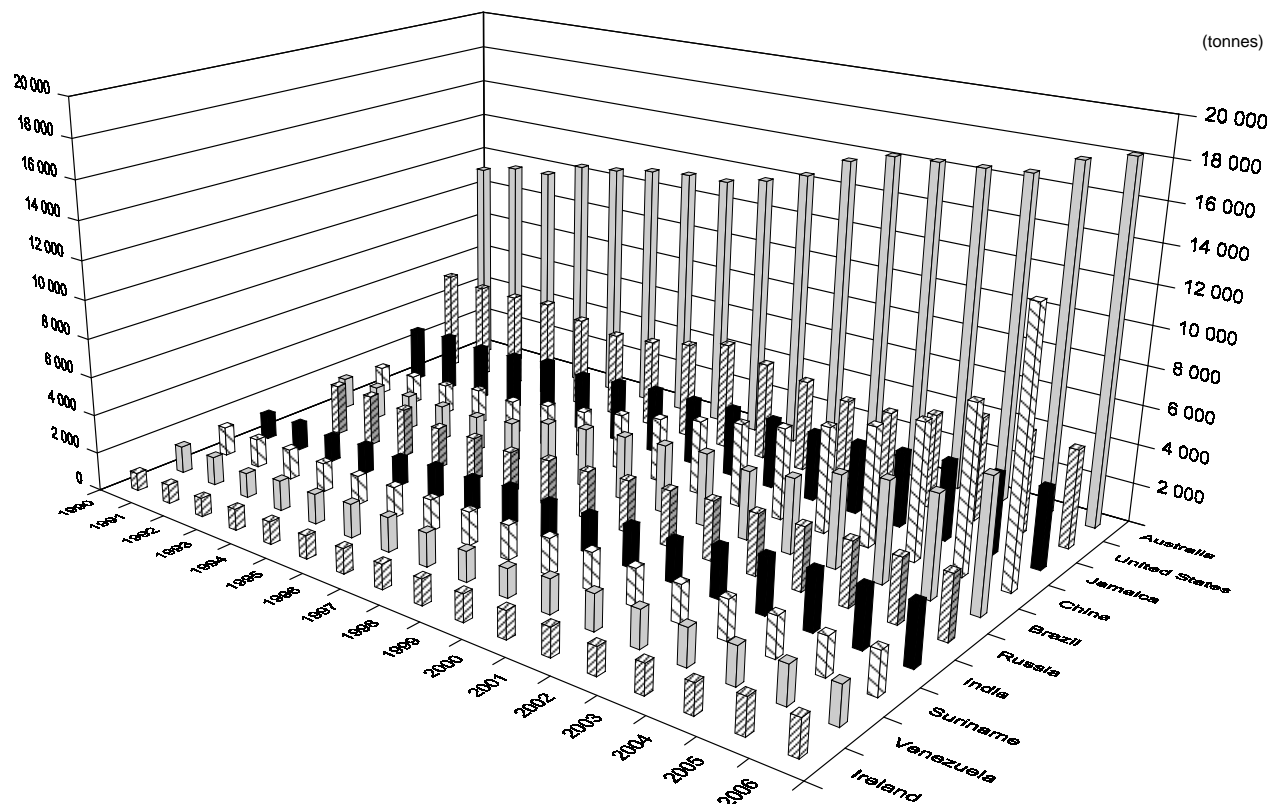
Sources: Natural Resources Canada; London Metal Exchange, Reuters, MetalPrices.com.

Figure 9
Aluminum Prices, 1994-2007



Sources: Natural Resources Canada; data from www.metalprices.com and www.bankofcanada.ca.

Figure 10
Top 10 Alumina Producers, 1990-2006
 (80% of Total Production of 72.6 Mt in 2006)



Sources: Natural Resources Canada; International Consultative Group on Nonferrous Metals Statistics; The International Aluminum Institute; media reports.

ENDNOTES

¹ NRCan Canadian aluminum use data for 2005 are from survey-based responses from 170 Canadian companies using primary and recycled aluminum in scrap, ingot or liquid metal form. Scrap used in the production of recycled ingot is not included in “use” (contact Julie Simon, tel. 613-947-6777).

² It should be noted that this “production of recycled aluminum” is that which generally results in ingot for resale or re-use. This figure does not generally include the direct use of scrap to produce semi-finished or finished products. It is noted that WBMS reports Canadian recycled production as 185 000 t, while the use of aluminum to produce recycled ingot by the above-mentioned 170 companies was reported as 243 206 t in 2005. In addition, companies in Canada used another 106 127 t of scrap directly in the production of finished products.

³ Capacity creep results from incremental expansion from removing bottlenecks in existing plants.

Notes: (1) Most information in this review was current as of March 30, 2007. (2) Julie Simon of the Minerals and Mining Statistics Division prepared Tables 3a and 3b, and she and others in that Division have provided other assistance, including with trade data. (3) Various Internet sites have been identified in this article. Please note that Natural Resources Canada has no control over the content of the web sites of other organizations, which may be modified, updated or deleted at any time. (4) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

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TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2606.00	Aluminum ores and concentrates	Free	Free	Free	Free	Free	Free
2620.40	Ash and residues, containing arsenic, metals or their compounds: containing mainly aluminum	Free	Free	Free	Free	Free	Free
28.18	Artificial corundum, whether or not chemically defined; aluminum oxide; aluminum hydroxide						
2818.20	Aluminum oxide, other than artificial corundum	Free	Free	Free	Free	4%	Free
2818.30	Aluminum hydroxide	Free	Free	Free	Free	5.5%	3.3%
7601.10	Unwrought aluminum: not alloyed	Free	Free	Free	Free	6%	Free
7601.20	Unwrought aluminum: alloys	Free	Free	Free	Free	6%	Free
7602.00	Aluminum waste and scrap	Free	Free	Free	Free	Free	Free
76.03	Aluminum powders and flakes	3.5%-5%	Free	Free	Free	5%	3%
76.04	Aluminum bars, rods and profiles						
7604.10	Of aluminum: not alloyed	Free-3.5%	Free	Free	Free	7.5%	7.5%
7604.21	Of aluminum: alloys: hollow profiles	5%	Free	Free	Free	7.5%	7.5%
7604.29	Of aluminum: alloys: other	Free-3%	Free	Free	Free	7.5%	7.5%
76.05	Aluminum wire	Free-4%	Free	Free	Free	7.5%	7.5%
76.06	Aluminum plates, sheets and strip; of a thickness exceeding 0.2 mm	Free-6.5%	Free-5%	Free	Free	7.5%	Free-2%
76.07	Aluminum foil of a thickness not exceeding 0.2 mm	Free-6.5%	Free-5%	Free	Free	7.5%-10%	7.5%
76.08	Aluminum tubes and pipes	Free-5%	Free	Free	Free	7.5%	7.5%
7609.00	Aluminum tube or pipe fittings	5.5%	3%	Free	Free	5.9%	3%
76.10	Aluminum structures (excluding prefabricated buildings of heading 94.06) and parts of structures; aluminum plates, rods, profiles, tubes and the like, prepared for use in structures	6.5%	5%	Free	Free	6%-7%	Free-3%
7611.00	Aluminum reservoirs, tanks, vats and similar containers, for any material (other than compressed or liquefied gas), of a capacity exceeding 300 litres, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment	Free-6.5%	Free-5%	Free	Free	6%	3%
76.12	Aluminum casks, drums, cans, boxes and similar containers for any material (other than compressed or liquefied gas), of a capacity not exceeding 300 litres, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment	6.5%	2.5%-5%	Free	Free	6%	3%
7613.00	Aluminum containers for compressed or liquefied gas	6.5%	5%	Free	Free	6%	3%
76.14	Stranded wire, cables, plaited bands and the like, of aluminum, not electrically insulated	4.5%	3%	Free	Free	6%	3%
76.15	Table, kitchen or other household articles and parts thereof, of aluminum; pot scourers and scouring or polishing pads, gloves and the like, of aluminum; sanitary ware and parts thereof, of aluminum	6.5%	Free-5%	Free	Free	6%	Free
76.16	Other articles of aluminum	Free-6.5%	Free-5%	Free	Free	6%	3%

Sources: Canadian *Customs Tariff*, effective January 2006, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2006; *Official Journal of the European Union* (October 27, 2005 Edition); *Customs Tariff Schedules of Japan*, 2006.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, ALUMINUM TRADE, 2004-06

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS							
2606.00	Aluminum ores and concentrates						
	United States	300	6	100	11	112	9
	Peru	—	—	44	21	—	—
	Total	300	6	144	32	112	9
2620.40	Ash and residues containing mainly aluminum						
	United States	35 965	17 640	40 296	22 711	31 515	14 491
	India	—	—	—	—	20	21
	Total	35 965	17 640	40 296	22 711	31 535	14 512
2818.20	Aluminum oxide (excluding artificial corundum)						
	United States	54 910	47 128	52 060	48 050	50 123	58 199
	Germany	57	144	2 150	1 866	1 171	1 755
	Brazil	—	—	1	1	201	268
	Israel	40	67	9	16	38	56
	South Korea	24	23	37	35	23	36
	Iceland	—	—	—	—	85	34
	Argentina	—	—	24	23	9	22
	Dominican Republic	—	—	9	8	22	16
	Indonesia	—	—	—	—	9	14
	China	7	7	393	374	9	10
	France	7	7	—	—	5	10
	South Africa	—	—	—	—	6	9
	Greece	2	3	4	4	6	8
	Colombia	49	16	1	...	43	5
	Others	253	417	472	357	10	18
	Total	55 349	47 812	55 160	50 734	51 760	60 460
7601.10	Unwrought aluminum, not alloyed						
	United States	763 736	1 768 925	927 358	2 070 094	933 256	2 768 750
	Netherlands	9 871	19 992	77 705	161 227	130 906	340 081
	Japan	40 935	100 390	50 826	125 908	53 637	165 896
	South Korea	29 936	72 870	24 808	61 042	40 013	121 610
	Mexico	1 668	3 448	—	—	6 866	16 457
	Switzerland	—	—	—	—	998	2 243
	China	166	444	99	260	130	401
	United Kingdom	211	542	127	328	113	357
	Israel	383	978	—	—	94	297
	Germany	5 000	9 955	4 997	10 420	—	—
	Hong Kong	7 185	17 582	6 766	18 211	—	—
	Nepal	3 728	9 103	—	—	—	—
	Belgium	—	—	1 558	4 256	—	—
	Norway	—	—	2 498	5 196	—	—
	Others	601	1 413	126	274	6	35
	Total	863 420	2 005 642	1 096 868	2 457 216	1 166 019	3 416 127
7601.20	Unwrought aluminum alloyed						
	United States	917 487	2 313 639	981 843	2 527 963	1 047 660	3 283 730
	Japan	128 975	322 156	107 420	274 357	97 838	306 608
	Mexico	44 790	115 097	18 380	47 729	18 274	57 753
	South Korea	26 446	68 198	13 283	33 969	15 000	49 081
	United Kingdom	4 295	11 368	4 914	13 326	5 922	19 473
	France	166	437	3 768	8 790	2 420	8 472
	Netherlands	212	560	—	—	1 988	6 854
	China	4 047	10 315	3 476	9 034	1 935	6 030
	Israel	1 849	4 569	867	2 303	667	2 270
	Turkey	3 059	8 062	1 039	2 647	550	1 859
	South Africa	58	171	100	260	480	1 683
	Hungary	—	—	—	—	202	686
	Ireland	1 240	3 407	—	—	161	558
	Germany	18	81	—	—	98	441
	India	—	—	23	59	111	376
	New Zealand	—	—	—	—	77	295

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)						
Dominican Republic	—	—	—	—	64	208
Thailand	27	91	25	53	67	191
Others	395	1 022	273	594	76	285
Total	1 133 064	2 859 173	1 135 411	2 921 084	1 193 590	3 746 853
Total unwrought aluminum exports	1 996 484	4 864 815	2 232 279	5 378 300	2 359 609	7 162 980
7602.00 Aluminum waste and scrap						
United States	324 837	498 168	293 695	488 417	330 548	632 304
China	21 852	29 613	39 824	55 539	64 027	115 759
South Korea	647	940	4 833	7 229	12 449	27 778
Japan	932	1 738	1 599	2 739	2 702	6 245
Taiwan	3 153	5 134	5 543	8 452	2 086	3 868
United Kingdom	258	472	1 000	1 876	849	2 194
Italy	785	1 386	493	899	899	2 039
Indonesia	392	559	1 490	2 059	937	2 018
India	290	303	707	819	748	1 526
Brazil	119	198	632	1 219	398	1 040
Pakistan	1 202	1 392	2 059	2 291	644	885
Hong Kong	108	152	538	721	381	802
Thailand	—	—	94	146	289	662
Spain	—	—	—	—	81	265
Chile	—	—	20	47	67	115
Mexico	19	31	45	83	39	88
Others	151	216	639	645	129	220
Total	354 745	540 302	353 211	573 181	417 273	797 808
76.03 Aluminum powders and flakes						
United States	73	669	22	212	58	538
Germany	—	—	—	—	106	398
France	—	—	—	—	37	91
Others	78	278	8	51	4	21
Total	151	947	30	263	205	1 048
76.04 Aluminum bars, rods and profiles						
United States	92 542	402 235	96 940	428 325	98 576	487 098
Iceland	1	4	2 088	9 518	10 104	43 926
Norway	5	56	171	731	2 131	9 127
Oman	—	—	—	—	2 614	8 693
Bahrain	45	256	...	...	2 002	6 995
United Arab Emirates	37	109	4	26	1 480	5 495
China	439	1 964	1 086	4 635	999	4 790
Poland	17	31	5	23	881	3 236
Switzerland	285	1 122	599	1 985	774	3 010
Mexico	16	119	72	312	196	1 350
Australia	80	468	160	770	210	1 056
Italy	86	260	34	112	130	512
Germany	185	1 211	243	1 402	47	377
Kuwait	...	...	—	—	44	310
Slovenia	4	42	2	6	72	307
Bahamas	...	1	...	1	30	240
Barbados	3	19	9	52	24	235
Spain	24	135	37	113	56	219
Peru	7	102	7	97	45	200
Ireland	12	104	4	30	26	180
Denmark	18	149	11	84	15	125
United Kingdom	52	363	23	98	15	119
France	21	58	46	145	27	111
Netherlands	16	100	21	109	12	105
Turkey	—	—	108	671	12	72
Taiwan	300	1 356	9	44	1	7
New Zealand	22	122	3	14	1	6
Others	321	1 871	317	1 415	121	500
Total	94 538	412 257	101 999	450 718	120 645	578 401

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
76.05	Aluminum wire						
	United States	158 741	426 227	171 324	458 656	174 377	569 273
	Mexico	468	1 542	5 896	14 794	3 126	9 181
	South Korea	478	1 521	630	2 129	745	3 185
	New Zealand	1 264	3 565	303	900	687	2 319
	China	132	496	319	928	443	1 750
	Australia	208	890	156	621	207	1 177
	Ecuador	81	212	295	827	374	1 144
	Germany	—	—	76	442	128	831
	Poland	14	80	48	267	217	772
	Colombia	154	468	137	424	174	640
	Spain	—	—	48	265	50	295
	Netherlands	20	127	58	334	46	282
	Thailand	8	57	3	19	50	222
	Comoros	—	—	—	—	78	197
	Oman	—	—	—	—	20	129
	United Kingdom	3	23	—	—	10	85
	South Africa	98	336	—	—	19	70
	Brazil	39	129	—	—	19	69
	Others	54	265	147	603	74	374
	Total	161 762	435 938	179 440	481 209	180 844	591 995
76.06	Aluminum plates, sheets and strip, of a thickness exceeding 0.2 mm						
	United States	388 749	1 272 208	410 827	1 339 030	411 564	1 577 497
	Australia	1 125	4 902	932	3 592	813	2 702
	Israel	717	2 762	511	1 942	285	1 290
	Iceland	—	—	—	—	208	1 246
	India	...	1	31	148	173	872
	China	302	1 022	1 084	1 869	147	707
	Ireland	100	384	264	1 053	170	694
	Germany	104	389	119	312	71	593
	United Kingdom	79	286	171	531	79	520
	Venezuela	71	377	112	527	75	372
	Iran	97	429	220	1 019	55	249
	Brazil	—	—	149	421	48	229
	Taiwan	5	10	55	71	48	215
	Japan	4	36	198	584	17	140
	Switzerland	20	74	9	27	32	125
	Mexico	14	43	165	440	41	102
	New Zealand	...	1	4	10	55	100
	Spain	203	763	91	366	1	3
	Others	272	997	309	861	149	684
	Total	391 862	1 284 684	415 251	1 352 803	414 031	1 588 340
76.07	Aluminum foil not exceeding 0.2 mm						
	United States	44 686	228 003	48 241	238 779	52 195	274 618
	Mexico	53	260	24	123	1 224	8 238
	Australia	742	3 698	878	4 457	520	3 797
	United Kingdom	725	4 231	1 469	9 090	382	3 140
	China	607	2 592	454	1 886	512	2 533
	Thailand	183	896	552	2 813	377	2 108
	Venezuela	217	947	422	2 018	317	1 891
	Brazil	295	1 379	212	1 055	391	1 860
	India	18	37	102	575	295	1 728
	Japan	64	332	168	727	291	1 557
	Taiwan	30	113	263	1 253	484	1 252
	Indonesia	76	278	191	806	134	579
	Argentina	23	216	112	521	57	558
	Germany	124	1 025	125	637	60	428
	New Zealand	8	56	62	303	41	403
	Malaysia	142	698	132	676	106	357
	Spain	4	21	145	1 115	28	335
	Colombia	—	—	72	264	59	286
	Hong Kong	13	53	32	170	22	181
	Peru	7	45	27	147	16	170
	Iran	70	357	69	339	35	164
	Jamaica	3	13	2	14	21	154

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)						
Chile	42	166	20	89	18	118
Denmark	30	70	18	130	24	117
Costa Rica	9	51	16	90	20	108
Netherlands	—	—	...	2	23	105
Others	323	1 519	363	1 999	99	744
Total	48 494	247 056	54 171	270 078	57 751	307 529
76.08 Aluminum tubes and pipes						
United States	5 622	33 111	3 612	20 210	3 819	19 708
China	162	1 296	106	841	132	1 112
Hong Kong	—	—	1	12	50	446
Cuba	11	120	3	26	8	120
Brazil	90	587	109	815	8	108
Ireland	147	728	23	208	10	82
United Kingdom	31	439	8	81	7	72
Others	119	720	78	554	155	733
Total	6 182	37 001	3 940	22 747	4 189	22 381
76.09 Aluminum tube or pipe fittings						
United States	947	11 431	990	12 587	1 039	12 257
Trinidad and Tobago	—	—	2	12	19	167
Czech Republic	26	169	28	139	19	164
France	1	5	13	96	11	83
Greece	—	—	13	90	11	77
Venezuela	16	137	51	357	10	74
Russia	—	—	2	13	6	63
Netherlands	2	23	...	3	5	59
China	8	61	12	110	6	49
Singapore	2	16	3	26	4	42
Bangladesh	—	—	—	—	4	32
Croatia	—	—	2	12	4	32
Barbados	5	46	7	52	5	31
Cuba	18	82	22	182	5	29
Japan	3	19	...	2	3	28
Mexico	2	24	3	29	5	27
Others	55	565	112	729	35	279
Total	1 085	12 578	1 260	14 439	1 191	13 493
	(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
76.10 Aluminum structures and parts of structures, aluminum plates, rods, profiles, tubes and the like, prepared for use in structures						
United States	..	397 913	..	392 295	..	447 988
Mexico	..	433	..	688	..	3 952
Bahamas	..	405	..	353	..	2 967
United Kingdom	..	1 715	..	3 287	..	1 908
Iceland	..	121	..	68	..	1 520
Bermuda	..	342	..	984	..	1 364
France	..	1 115	..	1 362	..	1 011
Cuba	..	115	..	600	..	753
United Arab Emirates	..	537	..	547	..	705
Sweden	..	1 478	..	1 306	..	696
Australia	..	212	..	104	..	653
Vietnam	..	1	..	—	..	627
Trinidad and Tobago	..	582	..	1 073	..	580
South Korea	..	239	..	728	..	573
China	..	400	..	354	..	510
Cyprus	..	224	..	186	..	467
Ireland	..	351	..	880	..	422
Hong Kong	..	555	..	241	..	418
Greece	..	356	..	605	..	366
Panama	..	57	..	71	..	361
Spain	..	58	..	50	..	299
Suriname	..	40	..	72	..	249
Barbados	..	233	..	641	..	243

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
EXPORTS (cont'd)						
Turks and Caicos Islands	..	160	..	142	..	240
Qatar	..	61	..	171	..	207
Jamaica	..	273	..	387	..	206
Turkey	..	10	..	810	..	198
Estonia	..	66	..	101	..	196
Netherlands	..	624	..	105	..	186
Cayman Islands	..	57	..	435	..	185
Russia	..	33	..	52	..	184
Argentina	..	79	..	37	..	171
Japan	..	526	..	364	..	168
Singapore	..	69	..	1 456	..	156
Peru	—	—	—	—	..	150
Antigua and Barbuda	..	69	..	76	..	150
Guatemala	..	33	..	38	..	149
Taiwan	..	10	..	114	..	143
Malaysia	..	27	..	114	..	132
Israel	..	70	..	76	..	131
Costa Rica	..	36	..	36	..	114
Grenada	..	4	..	139	..	104
Dominican Republic	..	45	..	5	..	102
Chile	..	60	..	119	..	97
Hungary	..	14	..	272	..	91
Denmark	..	138	..	36	..	88
Bahrain	..	897	..	304	..	83
Saudi Arabia	..	195	..	174	..	81
Nicaragua	..	83	..	25	..	73
Poland	..	408	..	444	..	61
New Zealand	..	120	..	217	..	40
Kazakhstan	..	582	..	17	..	38
Finland	..	529	..	103	..	17
Brazil	..	560	..	7	..	10
Algeria	..	1 137	..	84	..	3
Uruguay	..	843	..	15	—	—
Others	..	1 740	..	1 690	..	1 062
Total	..	417 040	..	414 660	..	473 648
	(number)	(\$000)	(number)	(\$000)	(number)	(\$000)
76.11	Aluminum reservoirs, tanks, vats, and similar containers, for any material					
United States	360	223	403	728	321	1 587
Taiwan	3	3	6	8	3	2
Others	3	70	8	27	55	67
Total	366	296	417	763	379	1 656
76.12	Aluminum casks, drums, cans, boxes and similar containers, for any material					
United States	589 088 118	103 412	804 843 296	120 409	714 977 354	138 089
Germany	1 367 032	306	2 397 575	507	76 008	299
United Kingdom	1 195 874	245	596 250	176	356 802	235
Australia	12 043	3	338 631	78	34 510	204
Peru	40 980	11	—	—	54 761	138
Jamaica	22 985 595	2 065	6 266 753	558	1 212 960	109
Ireland	385 561	84	172 883	40	115 405	103
Singapore	—	—	—	—	373	73
Lebanon	—	—	—	—	225 216	39
Chile	44 877	11	115 444	31	110	38
Costa Rica	—	—	—	—	211	34
France	731 055	189	470 022	42	134	27
Italy	21 993	5	2 623	1	818	23
Spain	10	1	2 899	1	85	21
Israel	921	...	1 677	...	164	13
Russia	1 306	...	15 133	3	80	13
India	231 887	21	50 690	12	12 938	11
Romania	—	—	483	...	44	9
Taiwan	3	2	210	...	14	9
United Arab Emirates	—	—	2 408	1	24	8
Iceland	2 425	1	—	—	2	7

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(number)	(\$000)	(number)	(\$000)	(number)	(\$000)
EXPORTS (cont'd)						
Mexico	31 880	5	15 776	6	21	5
Portugal	—	—	6 875	1	18 480	4
Poland	—	—	—	—	48 000	3
Czech Republic	776	...	35 893	8	44	3
Cuba	5 842	2	1 620	5	10	1
Sweden	25 811	6	7 178	2	6	...
Hong Kong	1 838	31	—	—	3	...
Philippines	3 810	1	—	—	2	...
Panama	—	—	2 464	1	1	...
Trinidad and Tobago	470 022	42	—	—	1	...
New Zealand	—	—	72 212	17	—	—
Malaysia	—	—	27 173	6	—	—
Lithuania	—	—	4 446	7	—	—
Libya	—	—	10 683	2	—	—
Indonesia	—	—	3 886	1	—	—
Venezuela	—	—	28 537	7	—	—
Brazil	—	—	25 843	6	—	—
Bolivia	—	—	236 936	15	—	—
China	79	...	54 679	13	—	—
Denmark	5 552	2	—	—	—	—
Dominican Republic	3 499	1	—	—	—	—
Azerbaijan	—	—	7 739	2	—	—
Bulgaria	6 406	1	—	—	—	—
Bermuda	666	...	—	—	—	—
Belgium	2 715	1	108 696	25	—	—
Equatorial Guinea	28 823	9	620	...	—	—
Japan	102 000	10	—	—	—	—
Nigeria	3 110 742	261	—	—	—	—
Barbados	242 624	65	—	—	—	—
Others	1 007	13	—	—	348	45
Total	620 153 772	106 806	815 928 233	121 983	717 134 929	139 563
76.13 Aluminum containers for compressed or liquefied gas						
Germany	3 862	317	29 816	661	3 687	2 787
United States	1 113 842	2 293	551 896	1 750	949 737	2 230
Japan	667	15	29 916	88	15 533	639
South Korea	—	—	—	—	583	279
Mexico	168 593	381	243 289	568	34 263	167
Ireland	—	—	—	—	94 500	35
Belgium	—	—	40 000	58	10 500	18
United Kingdom	10 800	198	9 777	154	2	...
Italy	5 463	125	—	—	—	—
Others	1 334	31	3 153	71	1 045	368
Total	1 304 561	3 360	907 847	3 350	1 109 850	6 523
76.14 Stranded wire, cables, plaited bands and the like, of aluminum, not electrically insulated						
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
United States	20 110	65 306	20 408	69 903	19 710	69 171
Libya	—	—	—	—	...	424
China	183	234	450	626	224	387
Pakistan	—	—	—	—	105	169
France	8	11	...	...	24	112
Others	297	455	254	390	97	388
Total	20 598	66 006	21 112	70 919	20 160	70 651
	(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
76.15 Table, kitchen or other household articles and parts thereof, of aluminum						
United States	..	66 871	..	86 845	..	103 832
Mexico	..	552	..	535	..	2 753
United Kingdom	..	301	..	300	..	1 461
Germany	..	375	..	484	..	1 275
Cuba	..	32	..	109	..	924

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
EXPORTS (cont'd)							
	Spain	..	357	..	81	..	434
	Finland	—	—	..	88	..	105
	Others	..	292	..	693	..	378
	Total	..	68 780	..	89 135	..	111 162
76.16	Other articles of aluminum						
	United States	..	192 094	..	192 667	..	210 344
	Austria	..	2 299	..	1 616	..	3 457
	United Kingdom	..	2 865	..	3 154	..	3 136
	Japan	..	1 545	..	1 542	..	2 351
	Germany	..	1 170	..	2 424	..	2 348
	Indonesia	..	159	..	378	..	1 916
	China	..	607	..	1 040	..	1 529
	France	..	649	..	1 010	..	1 481
	Australia	..	707	..	671	..	1 222
	Mexico	..	1 609	..	1 392	..	1 191
	Chile	..	2 566	..	3 162	..	1 101
	Malaysia	..	378	..	472	..	885
	Poland	..	546	..	397	..	738
	Turkey	..	615	..	193	..	586
	Turks and Caicos Islands	..	19	..	138	..	483
	New Zealand	..	493	..	483	..	409
	Argentina	..	15	..	11	..	391
	Saint Lucia	..	...	—	—	..	363
	Netherlands	..	89	..	152	..	334
	Portugal	..	2	..	6	..	317
	Cuba	..	718	..	132	..	313
	Israel	..	366	..	651	..	311
	Brazil	..	1 299	..	253	..	295
	Iceland	..	14	..	4	..	292
	Sweden	..	69	..	203	..	278
	Russia	..	42	..	14	..	273
	Spain	..	137	..	239	..	265
	Kuwait	..	14	..	5	..	243
	India	..	7	..	25	..	239
	Italy	..	3 640	..	427	..	189
	Singapore	..	141	..	1 166	..	186
	Ireland	..	596	..	112	..	173
	Bermuda	..	63	..	52	..	172
	Norway	..	325	..	260	..	156
	Peru	..	34	..	1	..	154
	Greece	..	46	..	70	..	135
	Denmark	..	27	..	98	..	132
	Panama	..	3	..	...	..	130
	Thailand	..	107	..	184	..	119
	Hong Kong	..	151	..	191	..	117
	Romania	..	363	..	208	..	117
	Ghana	..	3	—	—	..	100
	Others	..	2 165	..	3 482	..	1 092
	Total	..	218 757	..	218 685	..	240 063
	Total exports	..	8 716 623	..	9 463 233	..	12 107 241
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS							
2606.00	Aluminum ores and concentrates						
	Brazil	1 925 770	58 286	2 054 529	65 953	1 617 811	50 505
	Guinea	690 622	20 775	672 821	22 121	901 193	30 709
	Ghana	292 468	8 781	403 905	12 361	390 156	11 967
	Bermuda	—	—	59 381	1 966	291 181	9 565
	United States	31 523	3 606	87 423	5 638	20 158	3 283
	Guyana	19 536	787	94	11	27 337	1 538
	China	11 942	1 445	55	16	13 606	940
	Greece	—	—	...	...	6 979	728
	United Kingdom	—	—	—	—	23 521	537
	South Africa	—	—	—	—	451	52
	India	4 085	123	69 306	3 088	...	...

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)						
Australia	18 577	2 051	1 055	153	—	—
New Zealand	—	—	2 500	258	—	—
Saudi Arabia	—	—	31 603	1 539	—	—
Others	334	23	10	...	1	...
Total	2 994 857	95 877	3 382 682	113 104	3 292 394	109 824
2620.40 Ash and residues containing mainly aluminum						
United States	18 252	18 036	18 534	13 776	6 819	2 916
Greece	—	—	—	—	...	...
Total	18 252	18 036	18 534	13 776	6 819	2 916
2818.20 Aluminum oxide (excluding artificial corundum)						
Australia	1 820 283	487 326	1 555 339	455 832	1 058 567	385 918
Jamaica	1 168 751	318 178	1 264 704	363 412	1 039 065	375 713
Brazil	378 759	110 817	462 108	144 418	932 870	345 415
United States	199 131	74 740	763 364	259 268	732 875	287 821
Venezuela	128 155	36 142	307 033	97 914	656 359	226 145
Germany	1 229	6 952	1 650	8 670	1 728	8 664
Japan	449	284	500	380	24 270	8 037
China	4 771	1 880	5 511	2 666	4 290	3 464
France	1 025	1 666	3 832	3 881	2 628	2 771
Austria	426	976	359	888	302	680
Suriname	15 035	4 129	—	—	—	—
Others	144	248	98	790	152	305
Total	3 718 158	1 043 338	4 364 498	1 338 119	4 453 106	1 644 933
2818.30 Aluminum hydroxide						
United States	8 735	6 886	5 578	5 535	7 460	6 686
Germany	863	871	388	396	337	324
Netherlands	373	332	416	376	245	220
Others	114	84	13	24	42	40
Total	10 085	8 173	6 395	6 331	8 084	7 270
7601.10 Unwrought aluminum, not alloyed						
United States	23 856	54 905	18 308	42 091	13 627	40 975
New Zealand	247	592	350	931	286	930
Canada	1	3	158	364	60	187
China	445	946	33	67	37	114
Russia	1 062	2 302	—	—	8	26
Australia	369	891	123	320	...	...
Ghana	961	1 981	—	—	—	—
Others	213	556	120	377	40	133
Total	27 154	62 176	19 092	44 150	14 058	42 365
7601.20 Unwrought aluminum, alloyed						
United States	125 844	299 148	127 109	285 718	117 919	338 479
Bahrain	—	—	427	1 072	8 505	26 976
Brazil	221	661	298	754	2 626	8 658
Canada	3 792	1 840	5 595	1 969	6 172	5 796
Netherlands	743	2 318	919	3 430	960	3 972
United Arab Emirates	—	—	—	—	1 110	3 484
Argentina	348	115	361	881	1 118	3 348
Russia	2 872	7 025	534	1 322	891	2 674
Germany	153	322	1 768	4 055	877	2 363
United Kingdom	1 135	3 188	6 810	18 405	367	1 494
Saudi Arabia	—	—	41	103	202	633
China	122	324	269	493	164	443
France	22	66	17	52	99	344
Spain	—	—	—	—	57	262
Australia	6	24	2	11	44	167
Others	2 969	7 425	29	135	96	343
Total	138 227	322 456	144 179	318 400	141 207	399 436
Total unwrought aluminum imports	165 381	384 632	163 271	362 550	155 265	441 801

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
7602.00	Aluminum waste and scrap						
	United States	143 413	206 437	151 758	217 596	138 632	237 565
	Cuba	714	1 104	845	1 028	590	1 030
	Canada	79	160	174	341	234	294
	Mexico	246	302	94	155	121	240
	United Kingdom	5 087	7 698	244	392	22	61
	Others	63	99	39	85	40	101
	Total	149 602	215 800	153 154	219 597	139 639	239 291
76.03	Aluminum powders and flakes						
	United States	1 927	6 886	1 943	6 581	1 932	7 399
	Germany	149	703	86	879	55	673
	France	87	382	94	346	54	233
	Others	36	216	9	54	5	61
	Total	2 199	8 187	2 132	7 860	2 046	8 366
7604.10	Aluminum bars, rods and profiles: of aluminum, not alloyed						
	United States	2 807	17 253	2 265	15 203	2 676	18 106
	China	1 203	4 194	1 843	6 074	2 340	8 915
	Belgium	1 208	5 500	1 200	5 221	1 074	5 479
	Malaysia	220	773	390	1 374	568	1 927
	Russia	295	1 037	222	877	133	596
	Germany	130	723	69	381	17	204
	Canada	10	49	12	56	23	178
	France	7	40	23	108	26	134
	Others	89	512	123	532	52	390
	Total	5 969	30 081	6 147	29 826	6 909	35 929
7604.21 to 7604.29	Aluminum bars, rods and profiles: of aluminum alloys						
	United States	31 943	155 958	34 820	171 012	36 590	190 797
	China	16 022	52 914	25 196	85 514	30 485	115 477
	Hong Kong	1	3	156	501	1 073	4 167
	Canada	286	2 533	312	2 875	325	3 653
	South Korea	1 336	4 532	1 197	4 173	812	3 296
	Germany	300	2 399	300	2 530	238	2 622
	India	89	292	78	310	561	2 060
	Brazil	469	1 646	550	1 733	410	1 679
	Egypt	...	9	843	2 646	411	1 444
	Italy	282	2 440	166	1 637	133	1 425
	Netherlands	35	229	43	329	221	1 295
	British Virgin Islands	—	—	—	—	276	1 042
	Russia	341	1 416	208	1 024	207	1 041
	Austria	33	217	156	757	169	1 013
	Belgium	154	702	254	1 194	180	974
	Israel	270	1 124	164	752	152	572
	Sweden	14	116	54	717	38	516
	United Kingdom	67	410	33	292	39	513
	France	92	501	62	591	59	470
	Vietnam	...	...	62	274	78	352
	Finland	—	—	17	103	25	331
	Taiwan	47	231	13	137	11	245
	Japan	7	44	2	53	27	243
	Slovenia	12	69	36	219	40	234
	Others	266	2 007	188	1 443	111	838
	Total	52 066	229 792	64 910	280 816	72 671	336 299
76.05	Aluminum wire						
	United States	9 641	36 130	10 706	41 411	11 680	51 090
	Bahrain	163	523	130	419	545	1 858
	Brazil	104	423	204	883	323	1 559
	China	16	54	16	50	349	1 155
	Belgium	89	396	232	956	136	615
	United Kingdom	436	1 693	377	1 536	108	444
	Spain	...	...	79	376	62	317
	Netherlands	84	299	91	358	42	177

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)						
Japan	94	424	54	255	24	124
Canada	22	68	39	130	31	123
Others	625	2 148	236	932	42	256
Total	11 274	42 158	12 164	47 306	13 342	57 718
76.06	Aluminum plates, sheets and strip, of a thickness exceeding 0.2 mm					
United States	471 938	1 582 491	428 759	1 498 079	412 161	1 593 147
China	4 340	13 071	15 334	48 864	15 552	54 191
Germany	6 815	28 760	7 639	33 963	7 606	34 726
Greece	4 734	17 449	5 120	20 478	5 682	24 252
Russia	997	4 124	1 380	6 057	4 635	18 845
France	4 740	19 785	3 662	14 551	3 777	16 725
United Kingdom	1 635	7 883	2 190	11 024	2 519	13 974
Brazil	1 910	6 068	2 820	10 392	3 491	13 517
Canada	1 878	7 200	1 971	7 751	3 035	13 343
South Africa	2 004	6 907	2 003	7 527	3 021	12 306
South Korea	3 614	11 500	2 237	7 256	2 693	10 025
Indonesia	1 318	4 302	1 705	5 471	2 507	9 132
Belgium	4 478	14 339	8 318	27 958	2 755	6 097
Hungary	1 767	6 682	2 501	9 205	1 446	5 898
Romania	286	1 250	731	3 058	962	4 527
Switzerland	777	3 097	1 477	7 543	675	4 122
Turkey	192	594	399	1 155	1 089	3 910
Sweden	928	3 467	657	2 360	879	3 312
Austria	389	1 805	467	2 794	530	2 982
Thailand	—	—	1	5	752	2 870
India	234	816	630	2 201	691	2 718
Hong Kong	647	2 480	856	3 409	670	2 656
Venezuela	599	1 964	230	805	619	2 421
Japan	603	1 912	399	2 003	341	1 919
Egypt	885	2 848	325	1 053	370	1 530
Netherlands	276	1 077	295	1 491	223	1 291
Italy	159	769	458	2 454	209	1 161
Australia	55	284	46	244	90	918
Mexico	166	626	139	534	181	787
Norway	183	913	65	281	105	506
Singapore	102	339	68	292	119	500
Taiwan	16	131	15	180	81	440
Slovenia	12	53	9	43	57	299
Bulgaria	—	—	...	...	84	282
Malaysia	48	308	25	164	34	200
Poland	43	149	88	326	54	197
Denmark	9	69	46	273	38	190
Others	54	267	293	1 171	138	549
Total	518 831	1 755 779	493 358	1 742 415	479 871	1 866 465
76.07	Aluminum foil not exceeding 0.2 mm					
United States	50 716	215 090	50 908	219 735	54 001	250 305
China	2 205	8 588	8 577	28 915	5 906	23 695
Luxembourg	2 583	9 039	3 742	13 108	2 571	11 291
Germany	876	7 826	1 355	10 874	1 241	10 120
South Korea	1 102	4 185	1 403	6 362	1 258	6 341
France	680	3 359	1 382	5 841	1 045	5 021
Taiwan	1 162	4 749	860	3 704	1 263	4 498
Switzerland	298	3 002	369	3 947	351	3 604
Greece	119	393	179	635	758	3 599
United Kingdom	49	457	130	1 440	556	2 765
Brazil	19	66	101	313	380	1 457
Japan	112	863	123	857	203	1 358
Netherlands	155	1 432	137	1 329	216	1 108
Israel	91	930	34	758	50	1 037
Turkey	10	62	21	90	216	980
South Africa	610	2 606	280	1 577	199	942
Italy	100	950	145	1 150	122	777
Australia	57	279	133	602	105	586
Austria	31	287	23	233	42	424
Russia	9	33	1	4	94	411

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)						
Mexico	1	12	104	557	67	411
Belgium	856	2 951	278	1 068	64	271
Canada	12	80	17	62	40	261
New Zealand	11	167	16	315	12	232
Costa Rica	63	326	29	162	43	210
India	1	12	26	111	39	206
Others	128	568	44	215	52	314
Total	62 056	268 312	70 417	303 964	70 894	332 224
76.08 Aluminum tubes and pipes						
United States	10 699	67 164	9 809	60 571	10 104	64 319
China	1 735	5 688	1 100	3 858	3 908	15 173
Mexico	234	2 611	665	2 738	445	2 999
South Korea	724	2 549	570	2 146	449	1 894
Taiwan	48	334	103	1 546	76	1 155
Germany	26	281	30	448	49	812
France	45	526	33	480	31	715
United Kingdom	60	496	52	465	32	583
Italy	19	231	40	453	33	418
Japan	9	81	52	326	227	364
Bahrain	—	—	38	99	91	278
Brazil	160	562	177	482	66	234
Canada	9	84	13	122	16	181
Russia	26	162	22	177	24	178
Others	45	305	89	601	69	452
Total	13 839	81 074	12 793	74 512	15 620	89 755
76.09 Aluminum tube or pipe fittings						
United States	2 073	29 639	1 227	31 100	1 246	29 180
Taiwan	208	1 037	174	973	282	1 603
China	274	1 219	273	1 346	294	1 597
United Kingdom	79	1 123	31	1 077	35	854
India	7	64	22	178	102	557
Canada	30	207	24	421	47	523
France	14	263	4	226	6	387
Japan	1	44	1	46	1	237
Mexico	161	1 203	81	579	13	196
Germany	16	227	14	374	9	121
Others	25	255	33	475	34	487
Total	2 888	35 281	1 884	36 795	2 069	35 742
	(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
76.10 Aluminum structures and parts of structures, aluminum plates, rods, profiles, tubes and the like, prepared for use in structures						
United States	..	113 374	..	126 829	..	143 176
China	..	5 322	..	6 807	..	13 952
Germany	..	723	..	3 317	..	4 263
United Kingdom	..	1 921	..	1 599	..	3 556
Italy	..	920	..	1 082	..	1 330
Canada	..	407	..	240	..	915
Mexico	..	739	..	484	..	842
Netherlands	..	891	..	436	..	789
Japan	..	288	..	1 193	..	773
France	..	764	..	448	..	771
Sweden	..	1 508	..	1 014	..	695
Taiwan	..	283	..	164	..	454
Spain	..	22	..	92	..	382
Ireland	..	72	..	212	..	270
India	..	...	..	7	..	269
Denmark	..	104	..	107	..	214
South Korea	..	690	..	576	..	162

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
IMPORTS (cont'd)						
Australia	..	66	..	55	..	134
Hong Kong	..	568	..	25	..	106
Others	..	396	..	788	..	397
Total	..	129 058	..	145 475	..	173 450
	(number)	(\$000)	(number)	(\$000)	(number)	(\$000)
76.11 Aluminum reservoirs, tanks, vats and similar containers, for any material, etc.						
United States	273	1 193	6 501	1 453	7 913	1 934
Others	16	29	447	94	172	25
Total	289	1 222	6 948	1 547	8 085	1 959
76.12 Aluminum casks, drums, cans, boxes and similar containers, for any material						
United States	1 231 915 425	145 503	1 193 457 180	118 012	2 114 498 709	180 956
France	54 335 490	8 106	59 541 534	7 843	52 643 423	7 004
Germany	473 555	280	1 815 818	829	2 262 713	1 994
Brazil	195 427	39	9 805 471	976	14 685 852	1 395
Finland	37 965	2 037	2 786 809	1 561	5 540 869	1 163
Costa Rica	26 334	6	1 809 088	329	8 399 594	1 046
United Kingdom	156 810	127	380 783	391	2 019 791	948
Switzerland	1 920 319	478	2 119 803	456	2 799 275	931
China	229 788	742	604 317	545	1 148 101	517
Taiwan	643 012	193	163 719	154	210 517	262
India	829 574	185	513 127	266	464 268	216
Thailand	195 725	1 457	2 103 122	1 244	1 563 060	212
Chile	—	—	657 805	226	534 736	165
Venezuela	1 797 979	240	1 197 799	268	1 019 424	148
Canada	784 619	233	181 149	146	75 730	141
Spain	434 132	113	1 635 050	463	420 282	140
Japan	167 668	34	13 998	95	436 571	138
Hungary	—	—	94 913	36	260 142	113
Italy	466 352	426	149 743	141	46 992	42
Israel	—	—	5	1	113 926	26
Hong Kong	79 861	5	5 021	1	18 660	23
Czech Republic	—	—	—	—	29 130	14
South Korea	10 342	29	31 905	63	4 985	5
Netherlands	11 195	421	215	4	177	5
Mexico	4 189 064	425	32 324	8	3	4
Denmark	—	—	—	—	680	1
Bulgaria	—	—	11 305	2	3 009	1
Greece	21 163	3	63 643	5	182	...
Honduras	—	—	2 800	...	—	—
Austria	—	—	9 740	13	—	—
Others	1 102	11	200	...	468	8
Total	1 298 922 901	161 093	1 279 188 386	134 078	2 209 201 269	197 618
76.13 Aluminum containers for compressed or liquefied gas						
United States	239 967	14 023	137 213	16 569	141 309	14 483
Canada	128 000	385	16 956	176	16 627	159
Taiwan	17	3	2 693	57	2 490	44
Others	920	73	1 573	99	2 135	100
Total	368 904	14 484	158 435	16 901	162 561	14 786
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
76.14 Stranded wire, cables, plaited bands and the like, of aluminum, not electrically insulated						
United States	396	1 742	1 175	4 165	231	1 430
United Kingdom	—	—	41	120	167	996
Others	23	121	28	111	28	136
Total	419	1 863	1 244	4 396	426	2 562

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
IMPORTS (cont'd)						
76.15	Table, kitchen or other household articles and parts thereof, of aluminum					
	China	.. 24 483	.. 36 095	.. 37 843		
	United States	.. 21 331	.. 24 358	.. 28 443		
	Italy	.. 7 438	.. 8 084	.. 12 221		
	France	.. 14 380	.. 14 516	.. 10 950		
	Thailand	.. 7 925	.. 6 964	.. 10 632		
	India	.. 2 089	.. 1 736	.. 1 747		
	Indonesia	.. 4 874	.. 1 851	.. 1 455		
	Turkey	.. 46	.. 406	.. 1 429		
	South Korea	.. 3 035	.. 2 732	.. 1 276		
	Taiwan	.. 1 496	.. 1 329	.. 1 258		
	Germany	.. 1 709	.. 1 706	.. 732		
	Brazil	.. 675	.. 459	.. 499		
	Hong Kong	.. 520	.. 948	.. 266		
	Denmark	.. 169	.. 418	.. 236		
	Switzerland	.. 160	.. 217	.. 176		
	United Kingdom	.. 72	.. 73	.. 128		
	Colombia	.. 65	.. 75	.. 122		
	Spain	.. 218	.. 169	.. 121		
	Mexico	.. 185	.. 305	.. 118		
	Others	.. 1 223	.. 705	.. 574		
	Total	.. 92 093	.. 103 146	.. 110 226		
76.16	Other articles of aluminum					
	United States	.. 194 440	.. 220 636	.. 244 663		
	China	.. 19 300	.. 24 961	.. 41 138		
	Mexico	.. 8 583	.. 10 497	.. 9 644		
	Germany	.. 6 967	.. 8 443	.. 8 493		
	Canada	.. 7 160	.. 6 133	.. 5 734		
	Taiwan	.. 3 685	.. 3 261	.. 3 867		
	France	.. 2 153	.. 2 158	.. 2 871		
	United Kingdom	.. 2 599	.. 2 373	.. 2 710		
	Malaysia	.. 2 989	.. 3 331	.. 2 248		
	South Korea	.. 2 482	.. 1 719	.. 2 191		
	Italy	.. 2 605	.. 1 629	.. 2 126		
	Brazil	.. 881	.. 675	.. 1 634		
	Sweden	.. 1 172	.. 990	.. 1 483		
	India	.. 626	.. 904	.. 1 477		
	Poland	.. 1 557	.. 1 722	.. 1 258		
	Vietnam	.. 27	.. 72	.. 1 220		
	Japan	.. 1 673	.. 657	.. 1 039		
	Spain	.. 1 068	.. 809	.. 994		
	Netherlands	.. 182	.. 263	.. 916		
	Thailand	.. 140	.. 339	.. 669		
	Denmark	.. 643	.. 412	.. 415		
	Israel	.. 465	.. 379	.. 323		
	Australia	.. 725	.. 730	.. 245		
	Austria	.. 165	.. 870	.. 211		
	Switzerland	.. 357	.. 225	.. 190		
	Singapore	.. 117	.. 110	.. 160		
	Portugal	.. 7	.. 161	.. 144		
	New Zealand	.. 930	.. 227	.. 122		
	Hong Kong	.. 703	.. 455	.. 108		
	Others	.. 721	.. 1 077	.. 904		
	Total	.. 265 122	.. 296 218	.. 339 197		
Total imports		3 716 031	3 807 402	4 283 388		

Sources: Natural Resources Canada; Statistics Canada.

– Nil; .. Not available; ... Amount too small to be expressed; n.a. Not applicable; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, ALUMINUM SMELTER CAPACITY

Company	As of December 31, 2006
	(t/y)
Alcan Aluminium Inc.	
Quebec	
Grand-Baie	207 000
Arvida, Jonquière	166 000
Alma	415 000
Shawinigan	99 000
Beauharnois	52 000
Laterrière	228 000
British Columbia	
Kitimat	277 000
Alcoa Inc.	
Quebec	
Aluminerie de Baie-Comeau	438 000
Aluminerie Lauralco Inc., Deschambault	255 000
Aluminerie de Bécancour Inc.	
Quebec	
Bécancour	409 000
Alcoa, 74.95%	
Alcan (Pechiney) 25.05%	
Aluminerie Alouette Inc.	
Quebec	
Sept-Îles	572 000
Alcan, 40%	
Aluminium Austria Metall Québec, 20%	
Hydro Aluminium, 20%	
Société générale de financement du Québec, 13.33%	
Marubeni Québec Inc., 6.66%	
Total Canadian capacity	3 118 000
Total Alcan, 56.94%	1 775 255
Total Alcoa, 32.06%	999 546
Total other, 11.01%	343 200

Source: Natural Resources Canada.

TABLE 3a. USE (1) OF ALUMINUM METAL (4) IN CANADA AT FIRST PROCESSING STAGE, 2002-05

2002 (a)

Use	2002 (a)	2003	2004 (r,a)	2005 (p,a,5)
(tonnes)				
METAL USED IN CASTINGS				
Permanent mould	87 294	60 649	81 469	85 828
Sand	4 487	4 000	4 113	4 273
Die and other	220 587	240 280	206 027	213 186
Total	312 368	304 929	291 609	303 287
METAL USED IN WROUGHT PRODUCTS				
Sheet, plate, coil and foil	240 155	259 027	275 285	267 756
Extrusions, including tubing	240 311	223 586	265 872	272 309
Other wrought products (including rods, forgings and slugs)	187 359	196 372	200 857	231 564
Total	667 825	678 985	742 014	771 629
METAL USED IN OTHER PRODUCTS				
Destructive uses (deoxidizer), non-aluminum base alloys, powder and paste and other uses	39 519	26 176	25 417	24 603
Total used	1 019 712	1 010 090	1 059 040	1 099 519
Aluminum metal used for the production of recycled aluminum (2)	224 613	214 844	248 778	243 206
METAL ENTERING PLANT				
Primary aluminum and alloys	762 779	765 071	812 353	835 780
Recycled aluminum (6)	186 097	165 263	174 588	174 897
Aluminum scrap and aluminum content of drosses and skimmings	307 721	299 221	339 919	330 435
Total	1 256 597	1 229 555	1 326 860	1 341 112
ON HAND DECEMBER 31				
Primary aluminum and alloys	17 671	16 505	23 751	19 798
Recycled aluminum (6)	8 558	4 605	8 138	4 926
Aluminum scrap and aluminum content of drosses and skimmings	9 441	10 484	11 135	12 161
Total	35 670	31 594	43 024	36 885
Aluminum shipments (3)	288 456	292 567	348 400	377 146
Production of recycled aluminum, scrap and aluminum content of dross and skimmings (3)	280 063	283 868	339 815	372 651

Source: Natural Resources Canada.

(p) Preliminary; (r) Revised.

(a) Increase in number of companies being surveyed; therefore, the closing inventory of the previous year does not equal the opening inventory of the current year.

(1) Available data as reported by users. (2) Aluminum metal used in the production of recycled aluminum is not included in usage totals. (3) Aluminum shipments include shipments of recycled aluminum, aluminum scrap, and aluminum content of dross and skimmings of own manufacture. (4) Aluminum metal refers to primary aluminum and alloys, recycled aluminum, aluminum scrap, and aluminum content of dross and skimmings. (5) For 2005, this table is compiled from Natural Resources Canada's annual survey, "Aluminum Metal Used," from data for 170 Canadian users. (6) Recycled aluminum entering plant contains tolling returns.

Note: Numbers may not add to totals due to rounding.

TABLE 3b. USE (1) OF ALUMINUM METAL (2) IN CANADA, BY TYPE AT FIRST PROCESSING STAGE, 1993-2005

Use	1993 (a)	1994 (a)	1995	1996 (a)	1997 (a)	1998 (a)	1999 (a)	2000 (a)	2001(a,5)	2002 (a)	2003	2004 (r,a)	2005 (p,a,4)
TYPE OF ALUMINUM METAL USED IN PRODUCTS													
Primary aluminum and alloys	447 997	485 845	490 000	512 865	558 139	653 320	719 124	726 187	735 011	750 728	757 945	787 344	817 720
Purchased recycled aluminum (7)	95 774	117 710	114 961	119 515	138 852	158 355	199 429	190 026	154 730	185 420	167 384	170 997	175 672
Outside aluminum scrap	25 084	31 469	30 441	44 555	67 447	78 298	80 689	100 294	74 869	83 565	84 760	100 697	106 127
Total used in products other than in recycled aluminum	568 855	635 024	635 402	676 935	764 438	889 973	999 242	1 016 507	964 610	1 019 713	1 010 089	1 059 038	1 099 519
TYPE OF ALUMINUM METAL USED IN RECYCLED ALUMINUM (3)													
Primary aluminum and alloys	x	x	x	x	14 650	x	10 879	10 074	x	x	x	x	x
Outside aluminum scrap, dross, skimmings and recycled aluminum (6)	x	x	x	x	113 865	x	135 081	145 654	x	x	x	x	x
Total used in recycled aluminum (3)	131 174	145 661	146 987	81 630	128 515	147 847	145 960	155 728	172 222	224 612	214 844	248 778	243 206

Source: Natural Resources Canada.

(p) Preliminary; x Confidential.

(a) Increase in number of companies being surveyed.

(1) Available data as reported by users. (2) Aluminum metal refers to primary aluminum and alloys, purchased recycled aluminum, and outside aluminum scrap and aluminum content of dross and skimmings. (3) Aluminum metal used in recycled aluminum is not included in "Total used in products other than in recycled aluminum" above. (4) For 2005, this table is compiled from Natural Resources Canada's annual survey, "Aluminum Metal Used", from data for 170 Canadian users. (5) Some totals prior to 2001 contained runaround aluminum scrap. In 2001, runaround scrap was removed where known from totals. (6) Aluminum content of drosses and skimmings is not included for years prior to 2001. (7) Recycled aluminum entering plant contains tolling returns.

Note: Numbers may not add to totals due to rounding.

TABLE 4. AVERAGE ALUMINUM PRICES, 1995-2006

Year	Month	<i>Metals Week</i>		
		LME Cash Settlement (1)	U.S. Markets (1)	
		(US\$/t)	(US\$/lb)	(US\$/lb)
ANNUAL AVERAGES (2)				
1995		1 806	0.82	0.86
1996		1 506	0.68	0.71
1997		1 600	0.73	0.77
1998		1 358	0.62	0.66
1999		1 361	0.62	0.66
2000		1 549	0.70	0.75
2001		1 444	0.65	0.69
2002		1 350	0.61	0.65
2003		1 431	0.65	0.68
2004		1 716	0.78	0.84
2005		1 899	0.86	0.91
2006		2 570	1.17	1.21
MONTHLY AVERAGES				
2005	January	1 834	0.83	0.90
	February	1 883	0.85	0.92
	March	1 982	0.90	0.97
	April	1 894	0.86	0.93
	May	1 744	0.79	0.85
	June	1 731	0.79	0.83
	July	1 779	0.81	0.85
	August	1 868	0.85	0.88
	September	1 840	0.83	0.86
	October	1 929	0.87	0.91
	November	2 051	0.93	0.96
	December	2 247	1.02	1.06
2006	January	2 378	1.08	1.12
	February	2 455	1.11	1.17
	March	2 429	1.10	1.15
	April	2 622	1.19	1.24
	May	2 861	1.30	1.36
	June	2 477	1.12	1.19
	July	2 513	1.14	1.20
	August	2 460	1.12	1.17
	September	2 473	1.12	1.17
	October	2 655	1.20	1.24
	November	2 703	1.23	1.27
	December	2 814	1.28	1.30

Sources: Natural Resources Canada; *Metals Week*.

(1) Highest grade sold. (2) Primary ingots, minimum 99.7% purity.

**TABLE 5. AVERAGE ALUMINUM ALLOY
(RECYCLED) PRICES, 1995-2006**

Year	Month	LME Alloy (1) Cash Settlement	
		(US\$/t)	(US\$/lb)
ANNUAL AVERAGES			
1995		1 656	0.75
1996		1 303	0.59
1997		1 461	0.66
1998		1 204	0.55
1999		1 191	0.54
2000		1 217	0.55
2001		1 172	0.53
2002		1 234	0.56
2003		1 400	0.63
2004		1 559	0.71
2005		1 646	0.75
2006		2 290	1.04
MONTHLY AVERAGES			
2004	January	1 648	0.75
	February	1 675	0.76
	March	1 716	0.78
	April	1 661	0.75
	May	1 559	0.71
	June	1 560	0.71
	July	1 565	0.71
	August	1 610	0.73
	September	1 601	0.73
	October	1 608	0.73
	November	1 674	0.76
	December	1 881	0.85
2005	January	2 031	0.92
	February	2 331	1.06
	March	2 347	1.06
	April	2 424	1.10
	May	2 631	1.19
	June	2 343	1.06
	July	2 283	1.04
	August	2 193	0.99
	September	2 176	0.99
	October	2 203	1.00
	November	2 240	1.02
	December	2 283	1.04

Sources: Natural Resources Canada; *Metals Week*.

(1) Alloy ingots, meeting LME specifications.

TABLE 6. WORLD MINE PRODUCTION OF BAUXITE, 2001-06

	World Rank in 2005	World Rank in 2006	2001	2002	2003	2004	2005	2006 (e)
(000 tonnes)								
Australia	1	1	53 799.0	54 134.0	55 602.0	56 593.0	59 959.0	62 595
Bosnia and Herzegovina	14	16	90.0	(r) 113.0	573.0	(r) 916.9	1 031.6	817
Brazil	2	2	13 388.1	13 147.9	18 456.8	20 948.8	(r) 20 307.4	22 836
China	4	3	8 650.0	12 958.7	14 567.0	17 518.0	(r) 17 408.2	21 000
France	21	22	174.0	(r) 150.0	(r) 170.0	(r) 170.0	(r) 170.0	160
Ghana	15	15	715.5	795.8	646.6	585.6	(r) 726.6	886
Greece	11	11	1 986.0	2 491.9	2 418.0	2 444.0	2 495.1	2 163
Guinea	3	4	17 191.7	17 480.5	17 072.2	18 799.8	19 236.9	18 184
Guyana	12	13	2 011.3	1 639.3	1 712.2	1 503.4	1 473.5	1 474
Hungary	17	19	1 000.0	720.0	665.9	646.7	510.9	507
India	6	6	7 863.9	9 647.3	10 413.7	11 284.9	12 385.4	13 940
Indonesia (1)	13	12	1 275.6	1 283.5	1 262.7	1 330.8	(r) 1 081.7	1 502
Iran	18	20	273.7	323.6	365.8	420.0	500.0	500
Jamaica	5	5	12 370.4	13 119.5	13 444.4	13 296.5	(r) 14 116.4	14 865
Kazakhstan	9	10	3 685.1	4 376.6	4 737.1	4 705.4	4 815.4	4 860
Malaysia (2)	25	23	64.2	40.0	5.7	2.0	4.7	92
Mozambique	23	25	8.6	9.1	11.8	6.7	9.5	12
Pakistan	24	26	3.7	12.2	4.1	4.8	6.5	8
Russia	7	7	4 805.0	4 585.7	5 441.8	6 017.6	6 409.3	6 399
Serbia and Montenegro	16	18	610.0	611.5	540.1	486.0	(r) 610.0	657
Sierra Leone		14	—	—	—	—	—	1 071
Suriname	10	9	4 393.7	4 001.6	4 215.1	4 051.7	4 757.0	4 945
Tanzania	26	27	—	—	—	—	1.6	5
Turkey	19	17	242.0	287.4	364.3	365.8	(r) 356.5	771
United States	20	21	200.0	200.0	200.0	200.0	200.0	200
Venezuela	8	8	4 584.9	5 190.8	5 445.5	5 842.0	5 900.0	5 500
Vietnam	22	24	20.0	20.0	20.0	20.0	20.0	20
Total world			139 406.4	(r) 147 339.9	(r) 158 355.8	(r) 168 160.4	(r) 174 493.2	185 970
% change from previous year			0.2%	5.7%	7.5%	6.2%	3.8%	6.6%

Source: International Consultative Group on Nonferrous Metals Statistics.

— Nil; (e) Estimated; (r) Revised.

(1) It is noted that trade data from Indonesia show the export of 2.5 Mt of bauxite in 2005 and 7.2 Mt in 2006. Trade data from China indicate imports of 8.3 Mt of bauxite from Indonesia in 2006. (2) Trade data from China indicate imports of 150 000 t of bauxite from Malaysia in 2006.

TABLE 7. PRODUCTION OF ALUMINA (HYDRATE), 2001-06

	World Rank in 2005	World Rank in 2006	2001	2002	2003	2004	2005	2006
(000 tonnes)								
Australia	1	1	16 313.0	(r) 16 429.0	16 529.0	(r) 16 700.0	17 704.0	18 280
Azerbaijan (1)	22	22	87.5	91.0	180.0	232.3	314.8	363
Bosnia and Herzegovina (1)			30.9	—	35.0	30.0	—	—
Brazil	4	3	3 519.7	3 855.4	4 713.8	5 126.5	5 201.1	6 720
Canada (2)	13	13	1 196.5	1 283.0	1 269.6	1 328.8	1 400.3	1 477
China	2	2	4 746.5	(r) 5 449.6	(r) 6 112.1	(r) 6 980.0	(r) 8 535.7	13 696
France	21	19	(r) 620.0	(r) 610.0	600.0	600.0	600.0	636
Germany (1)	16	16	836.0	(r) 825.0	830.0	835.0	830.0	830
Greece	17	17	709.0	750.0	758.8	786.0	(r) 805.0	800
Guinea	19	21	680.7	(r) 698.0	(r) 731.9	(r) 778.0	729.6	555
Hungary (1)	23	23	330.0	293.7	300.0	304.0	300.0	300
India	7	7	2 120.0	2 556.0	2 856.0	2 974.0	3 005.0	3 080
Iran	25	25	—	101.3	102.8	137.0	150.0	150
Ireland (1)	10	10	1 448.7	1 400.0	1 500.0	1 500.0	(r) 1 800.0	1 800
Italy (1)	15	15	993.0	(r) 1 010.0	1 021.0	1 064.0	1 070.0	1 090
Jamaica	5	5	3 542.4	3 630.6	3 843.6	4 022.7	4 085.6	4 100
Japan	18	18	739.0	723.9	725.0	780.0	780.0	780
Kazakhstan	12	12	1 231.1	1 386.5	1 419.3	1 467.8	1 505.4	1 515
Romania (1)	20	20	319.4	361.0	332.9	560.2	689.3	622
Russia	6	6	3 046.4	3 130.9	3 230.5	3 269.4	3 259.2	3 265
Serbia and Montenegro	24	24	200.7	237.4	239.7	245.0	(r) 235.2	237
South Korea			25.0	25.0	125.0	—	—	—
Spain	14	14	1 199.0	1 350.0	1 380.0	1 400.0	1 400.0	1 400
Suriname	8	8	1 893.3	1 902.7	2 004.0	2 038.9	1 939.6	2 151
Turkey (1)	26	26	146.0	152.9	(r) 160.7	170.0	112.6	140
United States (2)	3	4	4 340.0	4 338.0	4 861.0	5 354.0	5 215.0	5 012
Ukraine	11	11	1 343.4	1 350.9	1 434.1	1 563.0	1 632.0	1 672
United Kingdom (1)			83.9	73.8	—	—	—	—
Venezuela	9	9	1 833.1	1 901.0	1 882.0	1 900.0	(r) 1 931.0	1 920
Total world			(r) 53 574.2	(r) 55 916.6	(r) 59 177.8	(r) 62 146.6	(r) 65 230.4	72 589
% change from previous year			0.9%	4.4%	5.8%	5.0%	5.0%	11.3%

Sources: Natural Resources Canada; International Consultative Group on Nonferrous Metals Statistics.

— Nil; (r) Revised.

(1) Calcined. (2) Calcined alumina equivalent.

TABLE 8. WORLD PRODUCTION OF PRIMARY ALUMINUM, 2002-07

	World Rank in 2005	World Rank in 2006	2002	2003	2004	2005	2006 (e)	2007 (f)
(000 tonnes)								
China	1	1	4 321.3	5 546.9	(r) 6 688.8	7 806.0	9 349	12 100
Russia	2	2	3 348.2	(r) 3 478.1	(r) 3 594.7	3 647.1	3 718	3 900
Canada	3	3	2 708.9	2 791.9	2 592.2	2 894.2	3 051	3 085
United States	4	4	2 706.6	2 703.3	2 516.4	2 481.0	2 283	2 600
Australia	5	5	1 836.0	1 857.5	1 895.0	1 903.0	1 932	1 950
Brazil	6	6	1 318.4	1 380.6	1 457.4	1 497.6	1 604	1 690
Norway	7	7	(r) 1 044.0	(r) 1 178.0	(r) 1 318.0	(r) 1 390.0	1 381	1 375
India	8	8	671.2	798.8	860.9	942.4	1 105	1 200
South Africa	9	9	706.9	738.0	863.6	851.0	895	930
Bahrain	10	10	517.0	525.8	(r) 528.7	744.1	872	880
Dubai	11	11	538.0	560.0	683.0	722.0	789	860
Venezuela	13	12	(r) 604.0	601.3	631.1	624.0	617	590
Mozambique	14	13	273.2	407.4	547.1	553.7	563	565
Germany	12	14	652.8	660.8	667.8	647.9	516	575
France	15	15	463.2	444.1	(r) 446.9	437.9	442	420
Tajikistan	17	16	307.6	319.4	358.1	379.6	414	400
Spain	16	17	380.1	389.1	397.5	394.2	367	390
United Kingdom	18	18	344.3	342.7	359.6	368.5	360	365
New Zealand	19	19	333.9	334.4	350.4	351.4	337	340
Iceland	21	20	263.7	265.9	271.3	272.4	325	450
Netherlands	20	21	284.4	282.8	(r) 327.0	(r) 333.8	294	320
Argentina	22	22	268.8	(r) 272.4	272.1	270.7	273	325
Romania	25	23	187.1	(r) 196.8	(r) 222.3	243.6	258	255
Egypt	24	24	195.0	194.6	216.0	243.8	252	255
Indonesia	23	25	162.8	197.3	240.8	252.3	250	255
Iran	27	26	165.8	171.9	203.2	232.0	240	225
Italy	26	27	(r) 190.4	(r) 191.4	195.4	192.9	194	195
Greece	28	28	(r) 165.3	(r) 167.8	166.6	165.3	165	165
Slovakia	29	29	111.6	(r) 132.1	156.9	158.4	157	158
Slovenia (1)	30	30	87.6	109.8	120.7	138.5	140	100
Bosnia and Herzegovina	31	31	(r) 102.3	(r) 112.5	(r) 121.3	131.2	135	135
Serbia and Montenegro	32	32	(r) 111.9	(r) 116.7	120.8	120.4	122	120
Ukraine	33	33	112.5	113.6	113.2	114.2	113	115
Sweden	34	34	100.1	100.7	100.6	102.1	102	100
Cameroon	35	35	67.0	77.2	85.9	90.4	87	90
Ghana	39	36	132.4	15.9	—	13.4	76	15
Turkey	36	37	62.5	62.9	62.4	59.0	60	60
Poland	37	38	(r) 58.8	57.2	58.9	53.6	56	58
Azerbaijan	41	39	0.1	18.6	(r) 29.5	31.8	32	32
Switzerland	38	40	40.0	43.9	44.9	44.8	12	—
Japan	42	41	6.4	6.5	6.4	6.4	6	6
Hungary	40		35.3	35.0	34.4	31.0	—	—
Mexico			(r) 39.0	17.6	—	—	—	—
Total world			(r) 23 710.7	(r) 22 173.4	(r) 16 650.6	(r) 30 213.8	33 944	37 649
% change from previous year			6.5%	-6.5%	-24.9%	81.5%	12%	11%

Sources: International Consultative Group on Nonferrous Metals Statistics; media reports; author's forecast.

— Nil; (e) Estimated; (f) Forecast; (r) Revised.

(1) Talum reports production of 120 642 t in 2005 and 118 682 t in 2006.

TABLE 9. COMPANY WEB SITES FOR FURTHER INFORMATION

Company	Abbreviation	Web Site Address
Alcan Inc.	Alcan	www.alcan.com
Alcoa Inc.	Alcoa	www.alcoa.com
Alcoa World Alumina and Chemicals	AWAC	www.alcoa.com
ALRO Slatina (Vimetco N.V.)	ALRO Slatina	www.marcogroup.ch, www.vimetco.ch
Aluar Aluminio Argentino S.A.I.C.	Aluar	www.aluar.com.ar
Alum SA Tulcea	Alum SA Tulcea	www.alumtulcea.com
Alumina do Norte do Brasil S.A.	Alunorte	www.cvrd.com.br
Alumina Limited	Alumina Limited	www.aluminalimited.com
Alumina Partners of Jamaica	Alpart	www.kaiseral.com
Aluminerie Alouette Inc.	Alouette	www.alouette.qc.ca
Aluminerie de Bécancour Inc.	A.B.I.	www.alcoa.com
Aluminij d.d. Mostar	Aluminij Mostar	www.aluminij.ba
Aluminium Association of Canada	the Association	www.aia.aluminium.qc.ca
Aluminium Bahrain B.S.C.	Alba	www.albasmelter.com
Aluminium Company of Egypt, The	Egyptalum	www.egyptalum.com.eg
Aluminium Delfzijl	Aluminium Delfzijl	www.aldel.nl
Aluminium Konin - Impexmetal S.A.	Konin	www.aluminium-konin.com.pl
Aluminum Association, Inc. (U.S.A.), The	Aluminum Association	www.aluminum.org
Aluminum Corporation of China Ltd.	Chalco	www.chinalco.com.cn
Bharat Aluminium Company Limited	Balco	www.balcoindia.com
BHP Billiton	BHP	www.bhpbilliton.com
Brunei Economic Development Board	Brunei Economic Development Board	www.bedb.com.bn
Cambior Inc.	Cambior	www.cambior.com
Century Aluminum Company	Century Aluminum	http://centuryca.com
Coega Smelter	Coega	www.smelter.csir.co.za
Columbia Ventures Corporation	Columbia Ventures	www.nordural.is
Comalco Limited	Comalco	www.comalco.com, www.riotinto.com
Companhia Brasileira de Alumínio	CBA	www.aluminiocba.com.br, www.votorantim.com
Companhia Vale do Rio Doce S.A.	CVRD	www.cvrd.com.br
Corporación Venezolana de Guayana	CVG	www.cvg.com
CVG Alcasa	Alcasa	www.aluminio.com.ve
CVG Bauxilum	Bauxilum	www.bauxilum.com
CVG Venalum	Venalum	www.venalum.com.ve
Dubai Aluminium Company Limited	Dubal	www.dubal.ae
East Hope Group	East Hope Group	www.easthope.com.cn
Elkem ASA	Elkem	www.elkem.com
Exploration Orbite V.S.P.A. inc.	Exploration Orbite	www.explorationorbite.com
Federation of Aluminium Consumers in Europe	FACE	www.facealuminium.com
Glencore International AG	Glencore	www.glencore.com
Global Alumina Corporation	Global Alumina	www.globalalumina.com
Grupo Votorantim	Votorantim	www.votorantim.com.br
Hindalco Industries Limited	Hindalco	www.adityabirla.com
Indian Aluminium Limited	Indal	www.indal.com
International Aluminium Institute, The	IAI	www.world-aluminium.org
Iranian Aluminium Company	IRALCO	www.iralco.net
Kombinat Aluminijuma Podgorica	Kombinat Aluminijuma Podgorica	www.kap.cg.yu
Magyar Aluminium Rt.	Magyar Aluminium	www.mal.hu
Marubeni Corporation	Marubeni	www.marubeni.com
Metallica Minerals Limited	Metallica	www.metallicaminerals.com.au, www.capealumina.com.au
Minmetals Nonferrous Metals Co., Ltd.	Minmetals	www.minmetals.com
Moydow Mines International Inc.	Moydow Mines	www.moydow.com
Mubadala Development Company PJSC	Mubadala	www.mubadala.ae
Navasota Resources Ltd.	Navasota	www.navasota.com
National Aluminium Company Limited	Nalco	www.nalcoindia.com
Norsk Hydro ASA/Hydro Aluminium a.s.	Norsk Hydro or Hydro Aluminium	www.hydro.com
Nova Pb inc.	Nova Pb	www.novapb.com
Novelis Inc.	Novelis	www.novelis.com
Ormet Corporation	Ormet	www.ormet.com
PT Antam Tbk	Antam	www.antam.com/News/news.htm
Queensland Alumina Limited	QAL	www.qal.com.au
Russian Aluminium	RUSAL	www.rusal.com
Saudi Arabian Mining Company	Ma'aden	www.maaden.com.sa
Sherwin Alumina Company	Sherwin Alumina	www.sherwinalumina.com
Siberian-Urals Aluminium Company	SUAL	www.sual.com
Sibirsky Aluminium	Sibirsky (Russian Aluminium)	www.sibirskyaluminum.com
Slovalco A.S.	Slovalco	www.slovalco.sk
Sierra Leone Ore & Metal Company Ltd.	SIEROMOCO	..
Société générale de financement du Québec	SGF	www.sgfqc.com
Sterlite Industries (India) Ltd.	Sterlite	www.balcoindia.com
Sural Group	SURAL	www.sural.com
Talum D.D. Kidricevo	Talum	www.talum.si
Titanium Resources Group	Titanium Resources	www.titaniumresources.com
Tomago Aluminium Company Pty Limited	Tomago	www.tomago.com.au
Trimet Aluminium AG	Trimet	www.trimet.de
Vietnam National Mineral Corp.	Vimico	Unknown
Worsley Alumina Pty. Ltd.	Worsley Alumina	http://worsley.geo.net.au

Barite and Witherite

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Mineralogically, barite (barium sulphate, BaSO_4) resembles celestite (strontium sulphate mineral, SrSO_4), not only in crystal habit, hardness and colour, but also chemically to some degree. Barium can substitute for strontium since the atoms have a similar ionic radius. Barite is also referred to as barytes or baryte.

The only other commercially available barium mineral is witherite (barium carbonate, BaCO_3). Witherite is a rare mineral, primarily since it easily alters to barite. It alters when sulphuric acid from sulphide minerals dissolves the witherite and the sulphur combines with the barium and forms barite. However, in some localities, such as Illinois in the United States, it occurs in relative abundance as new specimens are formed from calcite that lose calcium to barium, thus forming witherite.

Barite is most commonly coarse grained; it also occurs as platy crystals or fine-grained compact masses that may be white, light yellow, light grey, brown, pink, or blue. When pure, barite contains up to 58.8% barium, the balance being mainly sulphate, or carbonate. A commercially important characteristic of barite is its specific gravity of 4.5 g/cm^3 . Although heavy, it is soft with a hardness of 2.5 to 3.5 on the Mohs scale (i.e., a fingernail cannot scratch it, a copper penny may or may not, but a knife blade will). Some barite deposits may be classified as hard or soft depending on the ease with which the mineral may be ground. Although barite contains a heavy metal (barium), it is not a toxic chemical since it is relatively insoluble in water and acid, and therefore can be used as a chemically inert material.

Inclusions of other minerals may reduce the specific gravity of barite, but a high density, chemical inertness, and widespread occurrences are the properties that are valued for barite's most important application as a weighting agent in drilling fluids. Colour and chemical purity are important properties when considering the suitability of barite for

small non-drilling, higher-value applications such as fillers in marine and industrial paints, in brake lining/friction materials, and in plastics. It is also important in the manufacture of paper, glass and rubber, and is used in radiology for X-rays of the digestive system.

BARITE DEPOSITS IN CANADA

Barite deposits have been found in all provinces except Alberta, Saskatchewan, and Prince Edward Island. More than 150 deposits have been identified in Canada, and many of these are small and of limited commercial interest; however, some have been developed as producing mines.

Barite deposits can be classified into three groups: vein, replacement, and residual. There are no known residual deposits in Canada. Residual deposits are formed by the weathering of barite-bearing rocks and consist of barite fragments in a layer of soil or clay. The barite is derived from vein or replacement bodies in soft sedimentary host rocks. Barite fragments from sand size to boulder size are usually concentrated in a zone overlying the source of barite.

Most of the known Canadian barite occurrences are of the vein type. The vein deposits in the Atlantic provinces contain barite that is mostly coarse grained with a platy texture. The barite-fluorite veins that comprise the Lake Ainslie system (Nova Scotia) are developed along strong fault cavities and subsidiary tension fractures. The majority of the veins are concentrated in three specific areas east of Lake Ainslie. The barite vein deposits of Ontario are compact, coarsely granular, and massive. Barite from the Kootenay district of British Columbia varies from friable and finely granular to compact and platy, to fine grained and compact. Most domestic production has come from replacement deposits, which are similar in many respects to vein deposits, but which replace in whole or in part certain beds of sedimentary formation. Limestone is often the host rock and these deposits are usually more extensive than vein types, although the BaSO_4 content may not be as uniform or high. There are four main replacement orebodies in Canada: the Walton orebody in Nova Scotia, the Giant Mascot and Mineral King orebodies in British Columbia, and the Buchans orebody in Newfoundland and Labrador.

With respect to witherite, there are not many localities for this mineral, but a small deposit exists at Thunder Bay, Ontario.

CANADIAN SUPPLIERS

Newfoundland and Labrador

Barite has been produced intermittently in this province, most recently by Phoenix Minerals in 1998-99 (from small open-pit operations at Collier Point, Trinity Bay, and by Pennecon Ltd.), who in 1999 produced 35 000 t of barite and celestite from a quarry at Boswarlos in the western part of the province. Barite production was mostly sold as a weighting agent for the drilling mud used in petroleum exploration.

Atlantic Barite Ltd. (ABL) was incorporated in 2004 by Pennecon Limited and Swallow Services Ltd. ABL saw an opportunity to develop a flotation process that would extract barite from mine tailings at Buchans. The flotation process employed by ABL involves the use of novel, water-based "designer reagents" of the alkyl sulphate family to separate barite from quartz and sulphide-based minerals to produce a high-quality product for oil and gas field use for the Newfoundland and Labrador offshore industry. The company produced a 500-t trial product batch in 2005 and was subsequently awarded a contract to supply 10 000-12 000 t/y to begin production in 2006. The tailings are estimated to contain 400 000 t of barite. The plant has a capacity to produce 15 000-25 000 t/y of barite with a mine life of 15-20 years. Although four oil wells were drilled in 2005, the present decrease due to lower demand from the local oil and gas sector has temporarily rendered the plant idle.

Nova Scotia

E-Z-EM Canada, Inc. (Nystone Division) is the only barite producer in Nova Scotia. Nystone has a barite-siderite deposit in Early Carboniferous sediments located 1.6 km northeast of Brookfield at Upper Brookfield, Colchester County. During 1997, the surface mine was dewatered and approximately 1497 t of ore were mined from the pit that were crushed and screened. All of the material that had previously been mined and stockpiled at the mine was trucked to the company's plant at Debert. The mill circuit at the plant consists of gravity separation, magnetic separation, acid leaching, and ultra-fine grinding in a paddle mill to produce USP pharmaceutical-grade barium sulphate with a minimum purity of 97.7% that sells for over \$1200/t. During 2002, there was no production from the surface mine; however, 2369 t were processed at the company's plant. This product was shipped to the parent company, E-Z-EM, Inc., in Westbury, New York, until 2004, where it was prepared and packaged into barium kits that were sold to hospitals and medical clinics. Therapex in Montréal,

Quebec, now replaces the Westbury plant for the global market. Nystone production is currently ongoing, although less than in previous years, since formulations for medical barium kits require a lot less barium.

Lynx Minerals Inc. of Trenton had acquired the mineral rights and purchased the surface rights for the Lake Ainslie barite-fluorite deposit on Cape Breton Island from Conwest Exploration Company Ltd. In 1998, Lynx produced 5000 t (reserves of 200 000 t) of mud-grade barite and sold this production in 1999 for the offshore drilling market before suspending operations. In 2002, Atlantic Industrial Minerals Inc. (AIM) of Halifax had entered into a memorandum of understanding to acquire the assets of Lynx but, in 2004, decided not to proceed with its previously announced purchase of Lynx.

Quebec

A deposit up for sale, located in Saint-Fabien, Quebec, within 10 km of the Rimouski port located on the shores of the St. Lawrence River, contains estimated reserves of 870 000 t of barium sulphate (barytes) and 13 Mt of calcium carbonate. The analysis, from Les minéraux Industriels St-Fabien Inc., reports the potential for pharmaceutical-grade barite production from the deposit.

Although not a producing barite mine, Therapex (Division and trademark of E-Z-EM Canada Inc., a global leader in the manufacture of barium products) is a provider of turnkey outsourced drug development and manufacturing services that produces high-purity barite for pharmaceutical use (main medical use is barium meals for X-rays of the intestinal tract); the company obtains its natural barite from Nystone, Nova Scotia, and also precipitated barite from Germany. Supply negotiations are in process with a third potential source in the United States. In 2004, E-Z-EM, Inc. closed its Westbury, New York, operations where it prepared and packaged barium kits sold to hospitals and medical clinics around the world and transferred all of its activity to Therapex in Montréal.

Ontario

Extender Minerals of Canada Ltd. produces approximately 12 000 t of barite annually from the North Williams underground mine (snow-white barite vein deposit-type) located in Shining Tree, and from processing operations close to Matachewan near Kirkland Lake. The company produces barite powder and aggregate (grades 93-97%) for the friction, plastic, rubber, paint, adhesives, casting, and other specialized industries.

In 2006, Cimbar Performance Minerals of Cartersville, Georgia, acquired the barite business of Dynatec Corporation of Richmond Hill, Ontario. The deal included the customer list and the Sparwite trade names, but no physical assets. Both companies process barite imported from

China. Dynatec will continue to process talc and dolomite at Marmora, Ontario. The Richmond Hill facility produced all of its high-end barite (barium sulphate) filler products for the high-end manufacturing industries in the United States and South America that were previously produced by Mountain Minerals Division (i.e., paints and plastics grades). It is expected that in early 2007 Dynatec will stop its involvement in the processing of barite.

Alberta

Heemskirk Canada Limited of Calgary (previously Dynatec's western Canadian industrial minerals assets) operates a barite processing plant at Lethbridge. The product is used mainly in drilling muds. All of the barite comes from the U.S. state of Nevada. The company has announced plans to expand capacity at its processing plant in Lethbridge where an added mill will process primary barite to meet the accumulated demand from western Canada's oil and gas industry.

British Columbia

Fireside Minerals Inc. of Red Deer, Alberta, operates a high-grade white barite mine near the Yukon border in a poorly exposed area in the Liard Plain and a processing plant at Watson Lake (125 km west of the mine), located in the Yukon near the Alaska Highway. In 2006, Fireside mined 12 000 t of barite from the Bear vein at the Fireside mine; 15 000 t was also mined from the West Bear pit. The company expects substantially higher production in 2007. The barite produced is suitable for filler applications or for use in drilling mud.

Rock Creek Minerals Ltd. (a subsidiary of Zena Capital Corp.), took a 40-t test sample of high-grade barite with a low metal content from the Lapin deposit located near Bridesville.

MINING AND PROCESSING

Commercial barite is mined from surface or near-surface deposits by open-pit or underground mining methods. The broken ore is trucked to the processing plant where it may be washed by log washer or trommel screen to remove adhering clay and low-grade fines before reduction by jaw or impact crusher to 25 cm or finer for further processing. The degree of further processing and concentration depends on the grade of ore, identified end use, and liberation size (i.e., the size at which the barite is essentially free of contaminating impurities). If a further size reduction is required, this can be accomplished by jaw, impact, cone, or roll crushers.

The concentrated barite may be ground to final size specifications by roller mill, paddle mill, or other suitable unit. A 45-micrometre (μm) product is normally specified for drill-

mud barite; however, a much finer product may be required for other applications such as chemical and pharmaceutical preparations.

Barite used for drilling (source: U.S. Geological Survey) petroleum wells must be finely ground so that at least 97% of the material, by weight, can pass through a 200-mesh (75- μm) screen, and no more than 30%, by weight, can be less than 6 μm effective diameter, which is measured using sedimentation techniques. The ground barite must also be dense enough so that its specific gravity is 4.2 or greater, soft enough to not damage the bearings of a tricone drill bit, chemically inert, and containing no more than 250 mg/kg of soluble alkaline salts. A small percentage of iron oxide is allowable.

CANADIAN SHIPMENTS, CONSUMPTION AND TRADE

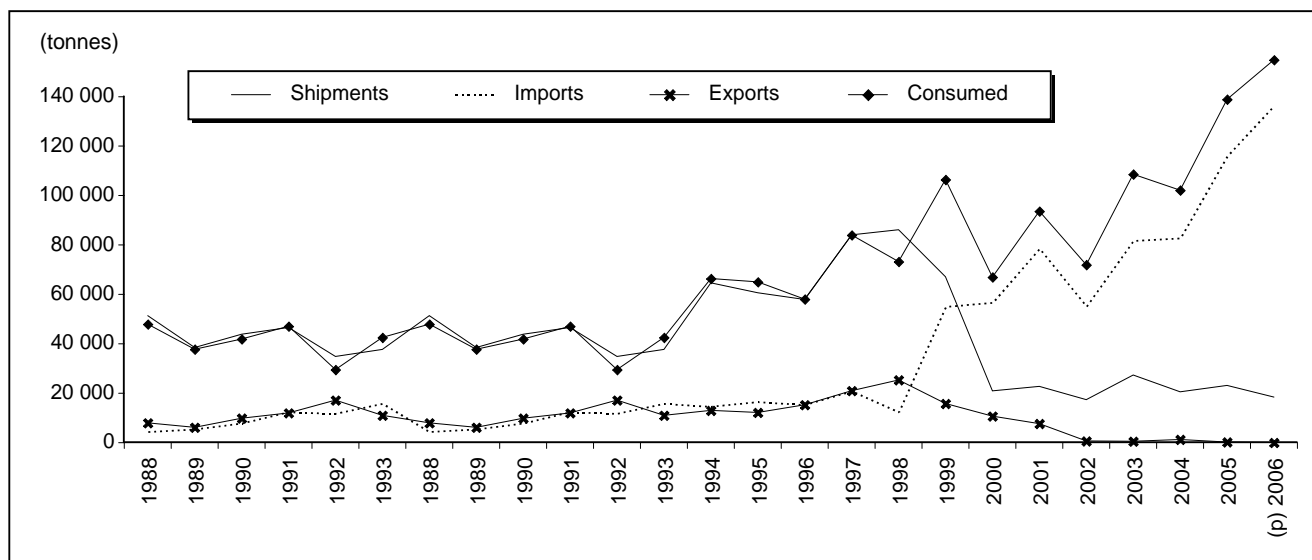
Preliminary data (Table 1) reported by Canadian producers for 2006 indicate shipments were valued at \$4.6 million, almost a \$0.2 million decrease from the revised 2005 value of \$4.8 million, for a quantity of 18 474 t (a decrease of 4705 t from 2005). Table 3 demonstrates that shipments from 1998 have declined dramatically (from 86 159 t in 1998 to 20 992 t in 2000) and stabilized in the 20 000-t range. The U.S. Geological Survey's 2005 review on barite (Table 4) shows that Canada moved to 21st place in 2005 with 21 000 t of barite production, compared to 22nd in 2004, but not as good a global position as its previous 8th place ranking in 1999. Global production (Table 4) for 2005 was estimated at over 7.9 Mt, led by China with 4.2 Mt followed by India with 1.0 Mt and the United States with 489 000 t.

Preliminary imports (Tables 1 and 3, "HS 2511.10 - natural barium sulphate - barite only") were valued at \$18.1 million for 2006, an increase of almost \$5.8 million from 2005, with an increase in the quantity of imports from 116 053 t in 2005 to 136 506 t in 2006. The bulk of imports for 2006 was supplied, for the first time, by China with 68 252 t (113% import increase from 2005) valued at \$10.5 million, surpassing the United States' previous historic leading ranking, showing for the first recent time a noticeable decrease in imports into Canada from the United States with 67 582 t (72.1%) valued at \$7.4 million (71.9%). Total barite imports for 2006 increased by 20 453 t (17.6%).

Preliminary imports (Tables 1 and 3, "HS 2511.20 - natural barium carbonate - witherite only") were valued at \$0.6 million for 2006, a decrease of \$1.3 million from 2005, although the quantity imported increased from 4129 t in 2005 to 8701 t in 2006.

As for the balance of imports (barium/strontium compounds), quantities decreased to 21 753 t in 2006 from

Figure 1
Barite Statistics and Trends, 1988-2006



Source: Natural Resources Canada.

(p) Preliminary.

23 607 t in 2005, with values of \$14.6 million and \$14.8 million, respectively.

Preliminary exports (Tables 1 and 3, “HS 2511.10 - natural barium sulphate - barite only”) were valued at almost \$26 000 for 2006, a major decrease of almost \$100 000 from the revised 2005 value of \$126 000; the quantity exported also decreased from 281 t in 2005 to 55 t in 2006. The bulk of the exports was delivered to the United States, amounting to 30 t (54.5%) valued at \$12 000 (46.2%). As can be seen in Table 3, exports of barite decreased continuously since the 1998 peak of 25 395 t to a low of 572 t in 2003, then rebounded slightly in the preliminary reported figure of 1310 t for 2004, but then declined again in 2006 to 55 t.

Canada has no production of natural barium carbonate (witherite); therefore, it does not export any. Nevertheless, the balance of export quantities (barium/strontium compounds) decreased to 276 t for 2006 from 296 t in 2005, with values of \$6.0 million and \$5.0 million, respectively.

The apparent use of barite and witherite in Canada (Table 3) has increased from 138 951 t in 2005 to 154 925 t in 2006 (an 11.5% increase). However, the reported use (Table 2) of both barite and witherite by industry sector differs in this trend, since a decrease in consumption from 55 531 t in 2004 to 23 751 t in 2005 is reported via the voluntary yearly survey conducted by Natural Resources Canada.

PRODUCTION AND MARKET CONSIDERATIONS

Barite originates in many countries. Various grades of barite are suitable for use in chemical markets, pigment applications, industrial fillers, and drilling muds. There is a direct relationship between barite demand and oil/gas exploration and production drilling activity, which in turn depends on the present and projected price of oil and, to a lesser extent, on demand for gas. Reports of world drill rig counts are the main criteria for evaluating the potential demand for barite. Drilling activity is highly volatile.

Barite is used for both its physical attributes, such as relatively high specific gravity and/or chemical inertness (drilling mud additive, construction, functional filler), and for its chemical properties (source of BaO and chemical feedstock).

The principal worldwide uses of barite (source: *Industrial Minerals*, World Metals & Minerals Review 2005) are estimated as: 88% as an additive in drilling fluids; 6% for chemicals, fillers, extenders and aggregates; and 6% for ceramic and glass.

Most barite is ground to a small uniform size before it is used as a filler, extender, or additive in industrial products, or as a weighting agent in petroleum well drilling mud based on specifications set by the American Petroleum Institute (API).

Barite that can satisfy the specification of the oil and gas industry without flotation may be in short supply in five years, despite extensive world reserves (source: U.S. Geological Survey 2006 *Barite Review*). The challenges to find clean, high-density barite are reflected by the lobby efforts of U.S. barite producers, especially those based in Nevada, to have oil and gas drilling-grade specifications modified from 4.2 to 4.1 g/cm³ to extend the ore reserve. It is projected that economic 4.2 grade reserves in Nevada will be depleted by 2011. If the 4.1 grade gains acceptance and becomes the norm, then the Nevada reserves could be extended and would allow production to continue at current levels to about 2016.

PRICES

According to *Industrial Minerals*, mid-year international barite prices were as follows: paint grade micronized, ex-works USA, min. 95%, US\$275-\$325/t; and drilling grade API, lump, c.i.f. U.S. Gulf Coast, US\$77-\$85/t.

OUTLOOK

Oil and gas price levels are linked to factors like the state of the world economy, international politics, and changes in technology related to fuel burning. North America's energy demand has been driving up demand for drilling-grade barite as oil and gas exploration has increased. Drilling for oil and gas both onshore and offshore is booming.

With China being the principal source of barite for U.S. drillers, demand for barite from China is so great that lower-grade reserves are being mined. While there is a large number of small Chinese mining companies, only a few key traders and direct exporters supply the main consumers in Europe and North America. Chinese production (source: February 2004 *Industrial Minerals* magazine) of drilling-grade barite is centred in Guangxi Province while much of the non-drilling-grade ore is mined in Guizhou in the Guiyang City area. Exports are still almost all lump barite with grinding conducted in the countries of consumption. The leading North American consumer of Chinese non-drilling barite is Cimbar Performance Minerals in the United States. The best Chinese white barite is unequalled in terms of quality and available volume worldwide, so to fill any significant gap in the tonnages currently exported to Europe and North America would be a challenge.

Nevertheless, rising prices for Chinese drilling-grade barite as a result of high ocean freight rates, port congestion, hampered overland logistics, and the lowering of the value-added tax rebate on barite exports from China have made some North American suppliers competitive again in the drilling mud market.

Canada does not produce barite chemicals such as barium carbonate, barium oxide, barium chloride, and barium nitrate. Specialized applications for barite offer little scope for significantly increased use. In these markets, barite tends to be chosen in preference to other minerals because it is cheap and readily available. Barite has the ability to block X-rays (second only to lead) and is the only X-ray-opaque material that is safe to use in the human body.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information data in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

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TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
25.11	Natural barium sulphate (barytes); natural barium carbonate (witherite), whether or not calcined, other than barium oxide of heading no. 28.16						
2511.10	Natural barium sulphate (barytes)	4.5%	Free	Free	Free	Free	Free
2511.20	Natural barium carbonate (witherite)	Free	Free	Free	Free	Free	Free
2816.40	Hydroxide and peroxide of magnesium; oxides, hydroxides and peroxides, of strontium or barium; oxides, hydroxides and peroxides, of strontium or barium	Free	Free	Free	Free	5.5%	3.3%-3.9%
28.27	Chlorides, chloride oxides and chloride hydroxides; bromides and bromide oxides; iodides and iodide oxides						
2827.39	Other	Free-4%	Free-3%	Free	Free	2.1%-5.5%	3.3%-3.9%
2833.27	Sulphate; alums; peroxosulphates (persulphates); other sulphates: of barium	Free	Free	Free	Free	5.5%	3.9%
2834.29	Nitrites; nitrates: nitrates: other	Free-5.5%	Free-3%	Free	Free	3%-5.5%	Free-3.9%
2836.60	Carbonates; peroxocarbonates (percarbonates); commercial ammonium carbonate containing ammonium carbonate: barium carbonate	Free	Free	Free	Free	5.5%	3.9%

Sources: Canadian *Customs Tariff*, effective January 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2007; *Official Journal of the European Union* (October 17, 2006 Edition); *Customs Tariff Schedules of Japan*, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, BARITE PRODUCTION AND TRADE, 2004-06

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION (Shipments)							
	Nova Scotia	x	755	x	225	x	596
	Ontario	x	2 000	x	2 000	x	1 500
	British Columbia	x	1 750	x	2 600	x	2 500
	Total	20 601	4 505	23 179	4 825	18 474	4 596
EXPORTS							
2511.10	Natural barium sulphate (barytes)						
	Ecuador	119	58	60	37	20	12
	United States	920	959	106	46	30	12
	Brazil	4	1	9	3	5	2
	Argentina	28	10	28	10	—	—
	Chile	80	47	66	27	—	—
	China	6	2	12	3	—	—
	Cuba	120	73	—	—	—	—
	Russia	33	14	—	—	—	—
	Total	1 310	1 164	281	126	55	26
2511.20	Natural barium carbonate (witherite)						
	United States	—	—	—	—	1	5
2816.40	Oxide, hydroxide and peroxide of strontium or barium						
	Greece	—	—	—	—	..	23
	Japan	—	—	—	—	..	11
	Turkey	—	—	..	2	—	—
	Total	—	—	..	2	..	34
2827.39	Other chlorides: other						
	Philippines	..	1 711	..	2 831	..	5 060
	United States	..	23	..	731	..	357
	Japan	..	85	..	267	..	219
	China	—	—	..	54	..	64
	Hungary	—	—	—	—	..	23
	Mexico	..	1	..	1	..	2
	Belgium	..	6	..	14	—	—
	Dominican Republic	..	...	..	...	—	—

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)						
2827.39 (cont'd)						
France	..	9	—	—	—	—
Germany	..	36	..	664	—	—
Malaysia	..	3	—	—	—	—
Norway	..	136	—	—	—	—
Suriname	..	...	—	—	—	—
United Arab Emirates	..	...	—	—	—	—
India	—	—	..	4	—	—
Indonesia	—	—	..	1	—	—
Israel	—	—	..	5	—	—
Taiwan	—	—	..	7	—	—
United Kingdom	—	—	..	5	—	—
Venezuela	—	—	..	6	—	—
Total	..	2 010	..	4 590	..	5 725
2833.27						
Other sulphates: of barium						
United States	—	—	—	—	2	3
Switzerland	—	—	17	11	—	—
Total	—	—	17	11	2	3
2834.29						
Nitrates: other						
United States	198	224	125	142	256	182
China	—	—	—	—	17	30
Mexico	...	1	...	1	1	2
Japan	4	10	—	—	—	—
Russia	1	2	—	—	—	—
Suriname	...	...	—	—	—	—
Kuwait	—	—	154	283	—	—
Taiwan	—	—	...	...	—	—
Total	203	237	279	426	274	214
Total exports	1 513	3 411	577	5 155	332	6 007
IMPORTS						
2511.10						
Natural barium sulphate (barytes)						
China	18 575	1 242	32 049	3 360	68 252	10 498
United States	63 555	6 218	83 741	8 875	67 582	7 429
Netherlands	670	169	262	105	333	152
India	—	—	—	—	262	48
Germany	—	—	—	—	31	13
Canada	—	—	—	—	10	3
Australia	—	—	—	—	9	2
Brazil	—	—	—	—	15	2
Peru	—	—	—	—	4	1
United Kingdom	—	—	—	—	6	1
Austria	133	10	—	—	1	...
Italy	—	—	—	—	..	...
Romania	—	—	—	—	1	...
Russia	—	—	—	—	..	...
Sweden	—	—	—	—	...	...
Algeria	2	...	1	...	—	—
South Africa	..	...	—	—	—	—
Total	82 935	7 639	116 053	12 340	136 506	18 149
2511.20						
Natural barium carbonate (witherite)						
Morocco	1 819	818	3 918	1 806	8 700	641
Hong Kong	...	...	...	...	1	...
United States	2	1	—	—	—	—
Brazil	—	—	107	48	—	—
China	—	—	...	...	—	—
India	—	—	104	47	—	—
Italy	—	—	..	...	—	—
Taiwan	—	—	...	...	—	—
Total	1 821	819	4 129	1 901	8 701	641
2816.40						
Oxide, hydroxide and peroxide of strontium or barium						
Germany	296	287	284	280	431	322
Italy	184	131	247	168	283	202
China	40	36	83	60	139	108
United States	148	84	143	96	181	101
Japan	4	3	19	16	37	31
Switzerland	—	—	—	—	21	10
India	...	...	—	—	...	...
Belgium	...	...	—	—	—	—
Denmark	—	—	...	...	—	—
Total	672	541	776	620	1 092	774

TABLE 1 (cont'd)

TABLE 1 (cont'd)		2004		2005		2006 (p)	
Item No.		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2827.39.20.10	Barium chloride, to reduce level of radium in liquid from uranium production						
	Mexico	...	...	...	...	...	...
	United States	...	...	...	...	...	...
	India	...	...	—	—	—	—
	Total	...	...	...	...	...	...
2827.39.20.90	Other barium chlorides						
	China	218	303	827	408	962	377
	United States	90	158	109	149	66	133
	Japan	1	3	1	5	1	8
	India	2	9	...	1	1	3
	Germany	1	4	1	4	...	...
	Mexico	...	...	...	...	...	...
	Canada	2	8	—	—	—	—
	Sweden	...	...	—	—	—	—
	Denmark	—	—	...	1	—	—
	Total	314	485	938	568	1 030	521
2833.27	Other sulphates: of barium						
	Germany	2 508	2 498	3 538	3 712	3 878	4 140
	United States	622	480	169	159	253	221
	Japan	44	44	41	52	179	195
	Italy	93	64	98	82	120	98
	China	—	—	4	5	69	62
	Canada	—	—	—	—	3	4
	France	—	—	—	—	1	1
	United Kingdom	...	...	—	—	...	...
	Switzerland	...	...	...	...	—	—
	Ireland	—	—	1	1	—	—
	Total	3 267	3 086	3 851	4 011	4 503	4 721
2834.29	Nitrates: other						
	United States	4 612	3 936	6 355	3 435	6 223	3 480
	China	1 977	1 903	1 991	2 455	1 688	2 339
	Norway	2 625	1 017	3 013	992	2 976	941
	Mexico	5	90	4	101	4	112
	Chile	462	226	228	121	203	111
	Israel	227	110	128	55	232	111
	France	27	64	57	105	1	60
	Germany	17	35	12	28	17	37
	Netherlands	46	22	108	50	49	23
	Japan	34	44	33	52	9	21
	Portugal	10	17	—	—	42	18
	India	2	8	1	5	1	12
	Poland	319	194	63	48	13	11
	United Kingdom	1	1	...	3	...	2
	Switzerland	1	2	...	1	...	1
	Spain	—	—	—	—	...	1
	Hungary	...	...	...	...	...	...
	Singapore	—	—	...	...	...	...
	Canada	—	—	—	—	...	...
	Russia	—	—	—	—	...	...
	Ukraine	—	—	—	—	...	...
	Azerbaijan	...	...	—	—	—	—
	Belgium	19	18	—	—	—	—
	Macedonia	...	...	...	...	—	—
	Sweden	44	137	58	54	—	—
	Brazil	—	—	1	4	—	—
	Indonesia	—	—	1	1	—	—
	Total	10 428	7 824	12 053	7 510	11 458	7 280
2836.60	Barium carbonate						
	China	2 958	736	3 694	1 027	2 244	658
	United States	1 762	822	2 244	1 057	1 392	656
	United Kingdom	—	—	—	—	22	10
	Japan	12	6	31	15	11	5
	India	—	—	20	14	1	...
	Germany	41	16	—	—	—	—
	Italy	3	1	—	—	—	—
	Total	4 776	1 581	5 989	2 113	3 670	1 329
Total imports		104 213	21 975	143 789	29 063	166 960	33 415

Sources: Natural Resources Canada; Statistics Canada.

— Nil; . . Not available; ... Amount too small to be expressed; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, REPORTED USE OF BARITE, 2000-2005

Reported Use (1)	2000	2001	2002	2003	2004	2005
(tonnes)						
Well drilling	x	x	x	x	x	x
Paint and varnish	x	x	x	x	x	x
Other products (2)	8 577	6 295	5 751	4 198	4 309	3 921
Total	16 062	27 517	14 840	28 820	55 531	23 751

Source: Natural Resources Canada.

x Confidential.

(1) Available data reported by consumers. (2) "Other products" include plastics, bearings and brake linings, nonferrous smelting and refining, etc.

Note: Numbers may not add to totals due to rounding.

TABLE 3. CANADA, BARITE AND WITHERITE, PRODUCTION, TRADE, AND APPARENT USE, 1988-2006

Year	Production (1)	Imports (3)	Exports (3)	Apparent Use (2)
(tonnes)				
1988	51 450	4 529	8 022	47 957
1989	38 511	5 539	6 214	37 836
1990	43 906	7 966	9 928	41 944
1991	46 614	12 572	12 052	47 134
1992	34 870	11 905	17 221	29 554
1993	37 712	15 920	11 065	42 567
1994	64 701	14 776	13 054	66 423
1995	60 662	16 616	12 229	65 049
1996	57 967	15 472	15 352	58 087
1997	84 091	20 958	21 038	84 011
1998	86 159	12 506	25 395	73 270
1999	67 161	55 149	15 838	106 472
2000	20 992	56 797	10 751	67 038
2001	22 780	78 639	7 727	93 692
2002	17 417	55 273	682	72 008
2003	27 369	81 853	572	108 650
2004	20 601	82 935	1 310	102 226
2005	23 179	116 053	281	138 951
2006 (p)	18 474	136 506	55	154 925

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

(1) Mine shipments. (2) Production plus imports less exports. (3) Includes HS code 2511.10.

Note: Numbers may not add to totals due to rounding.

TABLE 4. BARITE AND WITHERITE, WORLD PRODUCTION BY COUNTRY, 2004 AND 2005

Country	2004	2005 (e)	Change	Global Rank
	(tonnes)		(%)	
China	3 900 000	4 200 000	8	1
India	723 000	1 000 000	38	2
United States	532 000	489 000	-8	3
Morocco	355 800	360 000	1	4
Iran	275 607	280 000	2	5
Mexico	306 668	274 700	-10	6
Turkey	134 504	155 000	15	7
Thailand	211 278	120 000	-43	8
Kazakhstan	120 000	120 000	0	9
Vietnam	101 040	116 000	15	10
Germany	93 624	95 000	1	11
Bulgaria	95 000	95 000	0	12
France	82 000	82 000	0	13
Russia	63 000	63 000	0	14
Brazil	59 612	60 500	1	15
United Kingdom	60 000	60 000	0	16
Algeria	47 945	52 813	10	17
Spain	45 000	45 000	0	18
Pakistan	44 200	44 000	0	19
Belgium	30 000	30 000	0	20
Canada	20 601	21 000	2	21
Australia	20 000	20 000	0	22
Georgia	15 000	15 000	0	23
Laos	10 470	15 000	43	24
Italy	25 000	12 000	-52	25
Slovakia	14 000	10 000	-29	26
Bolivia	5 774	5 800	0	27
Romania	8 000	5 000	-38	28
Nigeria	5 000	5 000	0	29
Peru	3 606	3 700	3	30
Argentina	2 276	3 000	32	31
Burma	2 224	3 000	35	32
Poland	3 000	2 500	-17	33
Ecuador	2 350	2 400	2	34
Bosnia and Herzegovina	1 900	1 900	0	35
Afghanistan	2 000	1 500	-25	36
Greece	800	800	0	37
Colombia	600	600	0	38
Egypt	500	500	0	39
South Korea	50	100	100	40
Guatemala	70	70	0	41
Chile	31	30	-3	42
Total	7 423 530	7 870 913	6	

Source: U.S. Geological Survey, 2005 Review on Barite.

(e) Estimated.

Cadmium

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Cadmium (Cd), is a naturally occurring, soft, ductile, silvery white metal that melts at 320.9°C. First discovered by Friedrich Stromeyer in Germany in 1817, cadmium owes its name to the Latin word *cadmia*, meaning “calamine” (zinc carbonate, ZnCO_3) and from the Greek word *kadmeia* with the same meaning. The most common cadmium mineral, greenockite (CdS), is generally found in zinc-bearing ores and is recovered as a by-product during processing. Cadmium is present in the Earth’s crust in varying concentrations from 0.1 to 0.5 parts per million.

Cadmium is used principally in the production of rechargeable nickel-cadmium (Ni-Cd) and silver-cadmium batteries (81%), in yellow and red pigments (10%), and as a protective coating for other metals such as electroplating iron and steel products (6%) to improve appearance and to protect against corrosion. Cadmium is also used as a stabilizer in polyvinylchloride plastic where it helps to retard the degradation process (Figure 1). More information on cadmium properties, uses, and cadmium in the environment can be retrieved from www.cadmium.org.

In 2006, Canada produced 2094 t of refined cadmium, a 21% increase from the previous year. By-product cadmium is mined in New Brunswick, Quebec, and Ontario. According to the U.S. Geological Survey, Canada is the world’s fifth largest producer of refined cadmium, after South Korea, China, Japan, and Kazakhstan (Figure 2). Total world production of refined cadmium was 19 263 t in 2006. Cadmium is produced as a by-product of zinc refining at Canadian zinc plants. About 90% of Canadian production is exported, mostly to the United States and Japan.

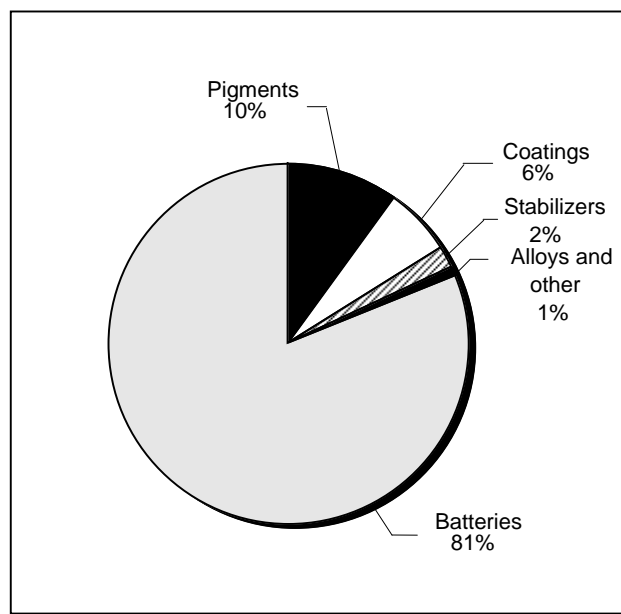
Table 2 shows exports and imports of cadmium metal and ores and concentrates. Most metal produced in Canada is exported to Belgium, Japan, China, and the Netherlands.

Because cadmium is produced as a by-product of zinc mining and refining, the supply of cadmium is more

dependent on zinc production than on cadmium demand. Cadmium is also produced from recycled materials such as Ni-Cd batteries and some residues or intermediate products. Some 10-15% of total Western World production is from recycled materials. In Ellwood City, Pennsylvania, INMETCO operates a cadmium recycling facility where cadmium is recovered from used Ni-Cd batteries. The Rechargeable Battery Recycling Corporation (RBRC) operates depots in the United States and Canada for the collection of used batteries, including Ni-Cd batteries.

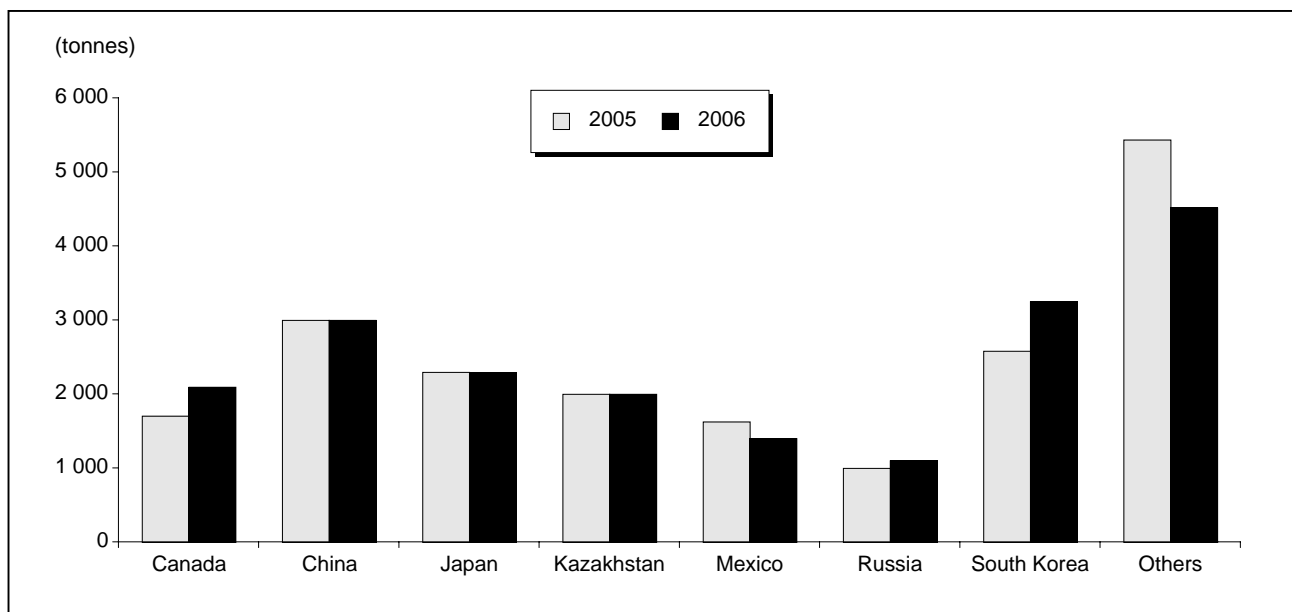
In 2006, cadmium prices ranged from just under US\$3229/t to over US\$4288/t in July and again at the end of the year (Figure 3). Cadmium prices averaged US\$3867/t in 2006, a 4.5% increase from 2005. Strong demand in the Asian battery market, combined with tight supplies, continues to keep prices at high levels.

**Figure 1
Cadmium Uses, 2005**



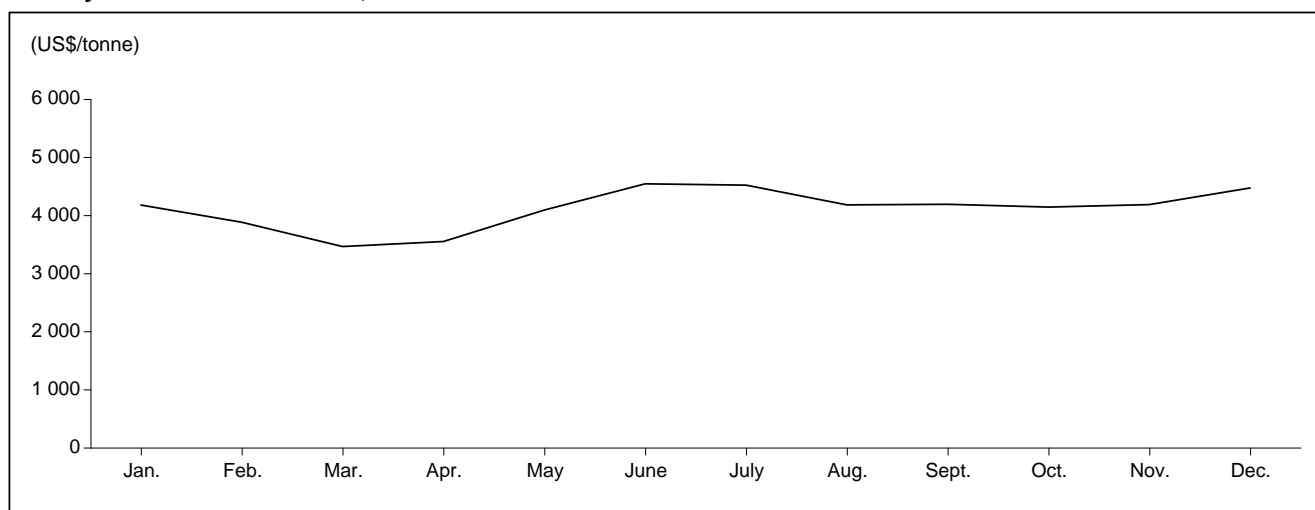
Source: International Cadmium Association.

Figure 2
Refined Cadmium, World Production, 2005 and 2006



Source: U.S. Geological Survey.

Figure 3
Weekly Mean Cadmium Prices, 2006



Source: metalprices.com

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

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TARIFFS

Item No.	Description	Canada			United States Canada	EU Conventional Rate (1)	Japan WTO (2)
		MFN	GPT	USA			
2617.90.00.10	Other ores and concentrates: other: cadmium	Free	Free	Free	Free	Free	Free
2825.90.90.10	Hydrazine and hydroxylamine and their inorganic salt; other inorganic bases; other metal oxides, hydroxides and peroxides: other: cadmium oxide	Free	Free	Free	Free	Free-5.5%	Free
2830.30.00	Sulphides; polysulphides, whether or not chemically defined: cadmium sulphide	Free	Free	Free	Free	5.5%	Free
81.07	Cadmium and articles thereof, including waste and scrap						
8107.20.00.10	Unwrought cadmium; powders: not alloyed	Free	Free	Free	Free	3%	3%
8107.20.00.20	Unwrought cadmium; powders: alloyed	Free	Free	Free	Free	3%	3%
8107.30	Waste and scrap	Free	Free	Free	Free	Free	3%
8107.90	Other	3%	Free	Free	4.4%	4%	3%

Sources: Canadian *Customs Tariff*, effective January 2006 and 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2006 and 2007; *Official Journal of the European Union* (October 17, 2006 Edition); *Customs Tariff Schedules of Japan, 2006 and 2007*.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties.

(2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, CADMIUM PRODUCTION, 2004-06

	2004		2005		2006 (p)	
	(kg)	(\$000)	(kg)	(\$000)	(kg)	(\$000)
PRODUCTION (All Forms) (1)						
New Brunswick	101 464	159	236 946	947	93 233	295
Quebec	401 769	630	191 640	766	132 904	420
Ontario	236 400	370	205 000	820	249 200	787
Total	739 633	1 159	633 586	2 533	475 337	1 502
Refined (2)	1 880 147	...	1 727 210	...	2 093 976	...

Sources: Natural Resources Canada; Statistics Canada.

... Amount too small to be expressed; (p) Preliminary.

(1) Production includes recoverable content of cadmium in the zinc-lead concentrates shipped. (2) Refined metal produced from domestic and foreign ores and recycled materials.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, CADMIUM TRADE, 2004-06

Item No.	2004		2005		2006 (p)	
	(kg)	(\$000)	(kg)	(\$000)	(kg)	(\$000)
EXPORTS						
2830.30	Cadmium sulphide					
	United States	—	—	—	51	15
	Germany	—	—	—	6 006	3
	Japan	12 000	7	—	—	—
	Total	12 000	7	—	6 057	18
8107.20	Unwrought cadmium; waste and scrap; powders					
	Belgium	477 502	930	602 599	1 339	845 282
	Japan	619 751	932	528 416	1 133	381 565
	China	—	—	34 721	188	413 822
	Netherlands	—	—	—	—	183 704
	United States	16 862	396	37 312	286	33 631
	Israel	4 019	38	42 191	76	92 664
	Hong Kong	—	—	19 980	69	61 222
	France	32 755	69	12 165	93	41 979
	Germany	—	—	3 693	28	71 618
	United Kingdom	121 144	185	19 000	21	19 980
	India	39 960	76	—	—	—
	Philippines	59 940	112	733 661	367	—
	Sweden	240 775	436	—	—	—
	Switzerland	39 960	67	—	—	—
	South Korea	—	—	68 467	74	—
	Malaysia	—	—	104 407	139	—
	Total	1 652 668	3 241	2 206 612	3 813	2 145 467
8107.90	Cadmium and articles thereof, n.e.s.					
	China	19 616	22	91 205	216	174 297
	United States	74	37	4 056	917	584
	Belgium	299 387	339	122 713	128	—
	Australia	—	—	27 503	83	—
	Total	319 077	398	245 477	1 344	174 881
	Total exports	1 983 745	3 646	2 452 089	5 157	2 326 405
IMPORTS						
2617.90.00.10	Cadmium ores and concentrates					
	United States	19	...	—	—	19
	Taiwan	—	—	—	—	7
	Total	19	...	—	—	26
2825.90.90.10	Cadmium oxide					
	United States	2 045	44	1 153	25	1 565
	Belgium	442	9	728	16	1 430
	Total	2 487	53	1 881	41	2 995
2830.30	Cadmium sulphide					
	United States	1 512	1	96 944	48	1 958
	China	—	—	3 590	2	—
	Germany	—	—	52	...	—
	Total	1 512	1	100 586	50	1 958
8107.20.00.10	Unwrought cadmium, not alloyed; powders, not alloyed					
	United States	448	12	439	12	2 669
	Peru	357	10	—	—	398
	Japan	3	...	2	...	3
	Canada	—	—	392	11	—
	South Korea	—	—	706	19	—
	Macedonia	—	—	766	21	—
	Mexico	—	—	54	1	—
	United Kingdom	—	—	...	...	—
	Total	808	22	2 359	64	3 070

TABLE 2 (cont'd)

Item No.	2004		2005		2006 (p)	
	(kg)	(\$000)	(kg)	(\$000)	(kg)	(\$000)
IMPORTS (cont'd)						
8107.20.00.20	Unwrought cadmium, alloyed; powders, alloyed					
	Belgium	—	—	—	36	1
	United States	1	...	153	4	...
	Germany	—	—	8	...	12
	Total	1	...	161	4	49
8107.30	Cadmium waste and scrap					
	United States	192	5	22	1	13
8107.90	Cadmium and articles thereof, n.e.s.					
	Brazil	—	—	3 019	96	52 810
	Belgium	408	3	12 199	332	40 797
	United States	20 343	580	8 365	254	24 078
	Peru	—	—	—	—	15 704
	Mexico	294	5	612	5	583
	Canada	874	6	—	—	21
	Germany	6	...	13	...	1
	Sweden	—	—	—	—	96
	Total	21 925	594	24 208	687	134 090
	Total imports	26 944	675	129 217	847	142 201

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Amount too small to be expressed; n.e.s. Not elsewhere specified; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 3. CANADA, CADMIUM USE, 2001-06

	2001	2002	2003	2004	2005	2006 (p)
	(kilograms)					
Cadmium metal (used) (1)						
Plating	x	x	x	x	x	x
Solders, other alloys and uses (2)	x	x	x	x	x	x
Total	212 969	209 434	209 925	210 101	203 413	207 863

Source: Natural Resources Canada.

(p) Preliminary; x Confidential.

(1) Available data reported by users. (2) Includes chemicals.

Note: Numbers may not add to totals due to rounding.

TABLE 4. CANADA, CADMIUM PRODUCTION AND EXPORTS, 1988-2006

Year	Production All Forms (1)	Production Refined (2)	Exports of Cadmium Metal
(kilograms)			
1988	1 663 978	1 693 708	1 144 994
1989	1 710 527	1 619 798	1 433 144
1990	1 333 664	1 470 229	1 282 603
1991	1 549 087	1 829 059	1 452 630
1992	1 393 099	1 962 813	1 579 823
1993	1 161 173	1 888 255	1 856 940
1994	1 499 996	2 173 018	1 903 371
1995	1 686 439	2 349 256	2 462 798
1996	1 540 072	2 432 681	1 693 120
1997	1 272 172	2 260 172	2 538 816
1998	1 179 427	2 090 052	2 049 517
1999	1 114 921	1 910 527	2 169 553
2000	934 084	1 940 917	2 059 898
2001	978 564	1 492 683	1 399 039
2002	898 895	1 706 223	1 612 338
2003	715 791	1 759 263	1 709 515
2004	739 633	1 880 147	1 983 745
2005	633 586	1 727 210	2 452 089
2006 (p)	475 337	2 093 976	2 326 405

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

(1) Production includes recoverable content of cadmium in the zinc-lead concentrates shipped. (2) Refined metal produced from domestic and foreign ores and recycled materials.

Note: Numbers may not add to totals due to rounding.

TABLE 5. WORLD PRODUCTION OF CADMIUM, 2001-06

Country	2001	2002	2003	2004	2005	2006 (p)
(tonnes)						
Argentina	34.0	—	25.0	39.0	3.0	10.0
Australia	416.0	524.0	673.0	469.0	429.0	400.0
Belgium	1 235.9	116.8	—	—	—	—
Brazil	140.0	170.0	180.0	187.0	200.0	200.0
Bulgaria	333.0	345.0	307.0	356.0	319.0	319.0
Canada	1 492.7	1 706.2	1 759.0	1 880.0	1 727.0	2 094.0
China	2 467.0	2 426.0	2 705.0	2 800.0	3 000.0	3 000.0
Finland	604.0	4.0	—	—	—	—
France	175.8	153.7	120.0	120.0	100.0	100.0
Germany	538.9	422.1	640.0	640.0	640.0	640.0
India	437.0	466.0	477.0	489.0	409.0	453.0
Italy	312.7	390.6	22.0	—	—	—
Japan	2 460.0	2 444.0	2 497.0	2 233.0	2 297.0	2 287.0
Kazakhstan	1 250.0	1 300.0	1 351.0	1 900.0	2 000.0	2 000.0
Macedonia	73.0	111.2	75.0	—	—	—
Mexico	1 421.0	1 382.0	1 638.0	1 594.0	1 627.0	1 400.0
Netherlands	455.0	485.0	495.0	572.0	575.0	570.0
North Korea	200.0	200.0	200.0	200.0	200.0	200.0
Norway	372.0	208.6	331.0	260.0	260.0	153.0
Peru	473.0	422.0	529.0	532.0	481.0	416.0
Poland	330.0	440.0	375.0	356.0	350.0	356.0
Russia	620.0	650.0	650.0	950.0	1 000.0	1 100.0
Serbia and Montenegro	—	—	—	—	—	—
South Korea	1 879.0	1 825.0	2 175.0	2 362.0	2 582.0	3 249.0
United Kingdom	425.0	292.3	22.0	—	—	—
United States	1 450.0	1 280.0	1 450.0	1 480.0	1 470.0	700.0
Uzbekistan	—	—	—	—	—	—
Total world	19 595.0	17 764.5	18 696.0	19 419.0	19 669.0	19 647.0

Sources: Natural Resources Canada; U.S. Geological Survey.

— Nil.

Note: Numbers may not add to totals due to rounding.

Cement

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INTRODUCTION

Portland cement was first made by bricklayer Joseph Aspdin in England in 1824 and is the primary ingredient of concrete. Raw materials for cement manufacture include: limestone that is usually quarried locally; alumina sourced from shale or clay or from by-products such as coal fly ash; silica (sand); and iron oxide. Approximately 1.6 t of raw materials are required to produce a tonne of cement (85% limestone, 15% silica, alumina and iron combined). This raw mix is burned in a long rotary kiln at temperatures of 1500°C to produce an intermediate product called clinker (a complex of calcium-aluminum silicates). Fuels used to fire the kiln include pulverized coal, petroleum coke, natural gas, waste oils, and tires. Clinker is then ground to a fine powder with about 3-4% gypsum (as a set retarder) and other additives, such as slag or limestone, to produce portland cement. Cement is shipped in powdered form to ready-mix concrete plants where it is combined with coarse and fine aggregates and water to form concrete for use in numerous construction applications.

CANADIAN INDUSTRY

Portland cement is produced at 16 plants in five provinces (Nova Scotia, Quebec, Ontario, Alberta, and British Columbia) by seven companies (Figure 1). Cement manufacturers in Canada shipped an estimated 14.02 Mt of portland cement valued at \$1.67 billion in 2006, based on preliminary data, compared to shipments of 13.93 Mt valued at \$1.62 billion in 2005, based on revised data (Table 1). Cement shipments have remained relatively steady for the past three years in the 14-Mt range.

According to the Portland Cement Association (PCA), portland cement consumption in Canada increased 1.7% in 2006 to 9.348 Mt. Demand was strongest in British

Columbia (13.8% increase compared to 2005) followed by Alberta with a 7.3% increase. Consumption in Ontario and Quebec declined by 2% and 7.9%, respectively.

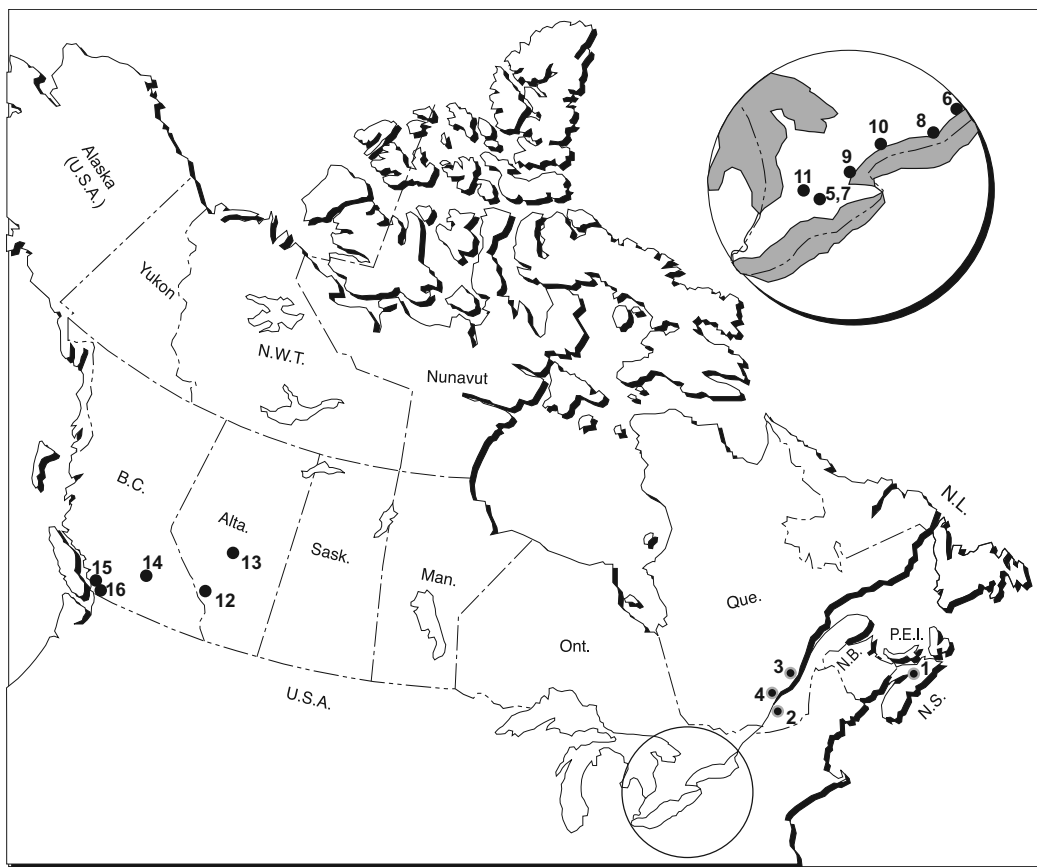
Cement production and shipments are directly related to levels of construction activity in Canada and parts of the United States. Statistics Canada also reports on the value of building permits (www.statcan.ca/start.html). In 2006, issued building permits increased from \$60.75 billion to \$66.22 billion, a rise of 9%. Construction activity continues to be highest in western Canada. Permits increased by 36.3% in Alberta, 25.0% in Saskatchewan, and 13.2% in B.C. over 2005 levels. In eastern Canada, mixed activity is evidenced by a 3.6% decline in Ontario and a 5.1% increase in Quebec.

Table 5 shows the value of construction in Canada by type, according to data provided by Statistics Canada. When comparing activity in 2006 with 2005 activity, there was an overall increase of 14.2% to \$185.0 billion for all types of construction. Building construction increased 10.2% while engineering construction jumped 21.3%. The trend in these data can be seen in Figure 6. The graph illustrates that engineering construction has taken up a larger percentage of total construction since 2002.

Portland cement production had been on a steady upward trend until 2004. Production in 2006 is off slightly from the 2004 peak, as shown in Figure 2. Clinker exports declined 18% over the previous year to 608 467 t. Plant capacity utilization in 2006 (Figure 2, Table 3) was calculated at 75%.

Most cement companies are integrated companies in the building products sector and have interests that include cement, concrete, and aggregates. Lafarge SA of France operates seven cement plants located across Canada. In addition to cement manufacturing, Lafarge operates slag pelletizers at the Dofasco and Stelco steel plants in Hamilton and a slag-grinding facility in Stoney Creek, Ontario. St. Lawrence Cement Inc. of Montréal, Quebec, operates plants in Quebec and Ontario and is 64% owned by Swiss-based Holcim AG. St. Marys Cement (Canada) Inc., of Toronto, produces cement from two plants in Ontario. The company is a subsidiary of Votorantim Cimentos of Sao Paulo, Brazil. It also operates slag granulators at Algoma Steel in Sault Ste. Marie, Ontario, and at Stelco Lake Erie

Figure 1
Cement Producers in Canada, 2006

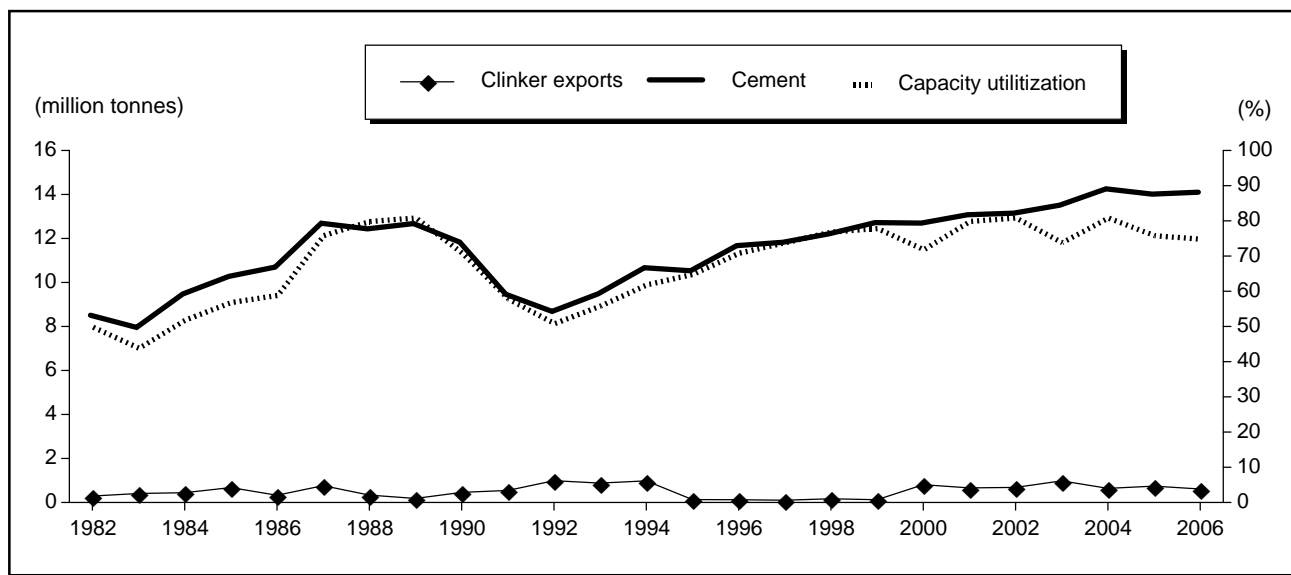


1. Lafarge Canada Inc., Brookfield, N.S.
2. Lafarge Canada Inc., Saint-Constant, Que.
3. Ciment Québec Inc., Saint-Basile, Que.
4. St. Lawrence Cement Inc., Joliette, Que.
5. Lafarge Canada Inc., Woodstock, Ont.
6. Lafarge Canada Inc., Bath, Ont.
7. Federal White Cement Ltd., Woodstock, Ont.
8. Essroc Canada Inc., Picton, Ont.
9. St. Lawrence Cement Inc., Mississauga, Ont.
10. St. Marys Cement (Canada) Inc., Bowmanville, Ont.
11. St. Marys Cement (Canada) Inc., St. Marys, Ont.
12. Lafarge Canada Inc., Exshaw, Alta.
13. Lehigh Inland Cement Limited, Edmonton, Alta.
14. Lafarge Canada Inc., Kamloops, B.C.
15. Lafarge Canada Inc., Richmond, B.C.
16. Lehigh Northwest Cement Limited, Delta, B.C.

Works in Nanticoke, Ontario. Essroc Canada Inc., owned by Italcementi Group of Italy, has a cement plant in Picton, Ontario. Lehigh Inland and Lehigh Northwest, owned by Heidelberg Cement Group of Germany, have plants in Edmonton, Alberta, and Delta, British Columbia, respectively. Other cement plants are owned by Ciment Quebec at St. Basile, Quebec, and by Federal White Cement at Woodstock, Ontario. The Ciment Quebec plant is owned 50% by Ciment Quebec (a private company) and 50% by Essroc.

Table 2 shows cement plants that were in operation as of December 31, 2006, as well as clinker and finish-grinding capacities, according to data supplied by the PCA. Compared with the previous report, there has been a 2.6% increase in total grinding capacity and a 1.8% increase in clinker capacity, considering both grey and white cement plants comprising 25 active kilns. Of note, grinding capacity at the Lafarge plant in Richmond, B.C., increased 42% to 1.871 Mt. There was a 27% increase in grinding

Figure 2
Canadian Cement Production, 1982-2006



Source: Natural Resources Canada.

capacity at the Lafarge St. Constant, Quebec, plant. Total clinker capacities in Ontario and Quebec increased 1.9% and 6.9%, respectively.

Primary-stage clinker production is used to measure ultimate cement production capacity, rather than grinding capacity, because clinker production is the most capital- and energy-intensive stage and clinker can be stockpiled for later use or shipped off-site to grinding-only plants. Total grey and white cement clinker capacity in Canada is estimated at 16.375 Mt. Total estimated grinding capacity is 18.760 Mt.

Atlantic Canada has one operating cement plant located at Brookfield, Nova Scotia, owned by Lafarge Canada Inc. In Quebec, total clinker capacity at three plants increased 6.9% to 2.989 Mt. The three cement plants, two in the Montréal area and one near Québec City, account for about 21% of Canada's total output. There are six plants in southern Ontario, between Kingston and St. Marys, that account for 46% of Canada's total portland cement production. Federal White Cement in Woodstock, Ontario, manufactures white architectural cement. Ontario clinker capacity increased 2.3% to 7.964 Mt (includes both grey and white forms). There are five cement plants in western Canada (Alberta and B.C.) with a reported clinker capacity of 4.971 Mt.

INDUSTRY NEWS

In May 2006, Lafarge SA of France completed its purchase of the 46.8% minority stake of Lafarge North America that it did not already own. The offer was for US\$85.50 per share for a total cost of US\$3.5 billion. The transaction gives Lafarge the flexibility to pursue growth opportunities without operating through a partially owned subsidiary.

U.S. and Mexican government authorities have settled the longstanding anti-dumping duty dispute on Mexican cement exports to the United States. The anti-dumping duties had been in effect since August 1990 with recent exports being subject to a duty of \$26/t on approximately 1.7 Mt exported in 2005. Mexican cement companies will be allowed to export 3.0 Mt annually over the next three years upon paying a duty of \$3/t.

The Lafarge plant located in Bath, Ontario, near Kingston has been awarded the Energy and Environment award for land stewardship by the PCA. The facility was recognized for a tree planting program conducted on plant lands and for its work with ecologists to improve land near the Lake Ontario waterfront. The plant is ISO 14001 designated for its environmental management system.

St. Lawrence Cement is installing a vertical roller mill at its Mississauga, Ontario, plant. The mill will be able to grind

500 000 t of granulated blast furnace slag per year. The slag can be used as a replacement for portland cement in special concrete mixes, or to manufacture blended cements, thus reducing the overall greenhouse gas emissions intensity of cement products.

Lafarge Canada has announced plans to expand its Exshaw, Alberta, cement plant. The plant currently comprises one long dry kiln with a clinker capacity of 399 000 t and a dry pre-calciner kiln with a capacity of 870 000 t (PCA, 2006 Canadian Plant Summary). One option that the company is considering would be to convert the long kiln into a short kiln with a preheater tower. A second option would involve the installation of a new kiln. It is expected that the modifications would increase overall capacity by 60%. These capacity changes would help the company supply a healthy and growing market for cement in western Canada.

WORLD OVERVIEW

World cement production in 2006 is estimated at 2500 Mt, up from 2310 Mt in 2005, according to the U.S. Geological Survey (Table 6, Figure 3). Global clinker capacity is estimated at 2300 Mt, an increase of 4.5% over the previous year. The top five cement-producing countries are: China (1100 Mt, 44% of total), India (155 Mt, 6.2%), the United States (101 Mt, 4.0%), Japan (68 Mt, 2.7%), and Russia (54 Mt, 2.1%).

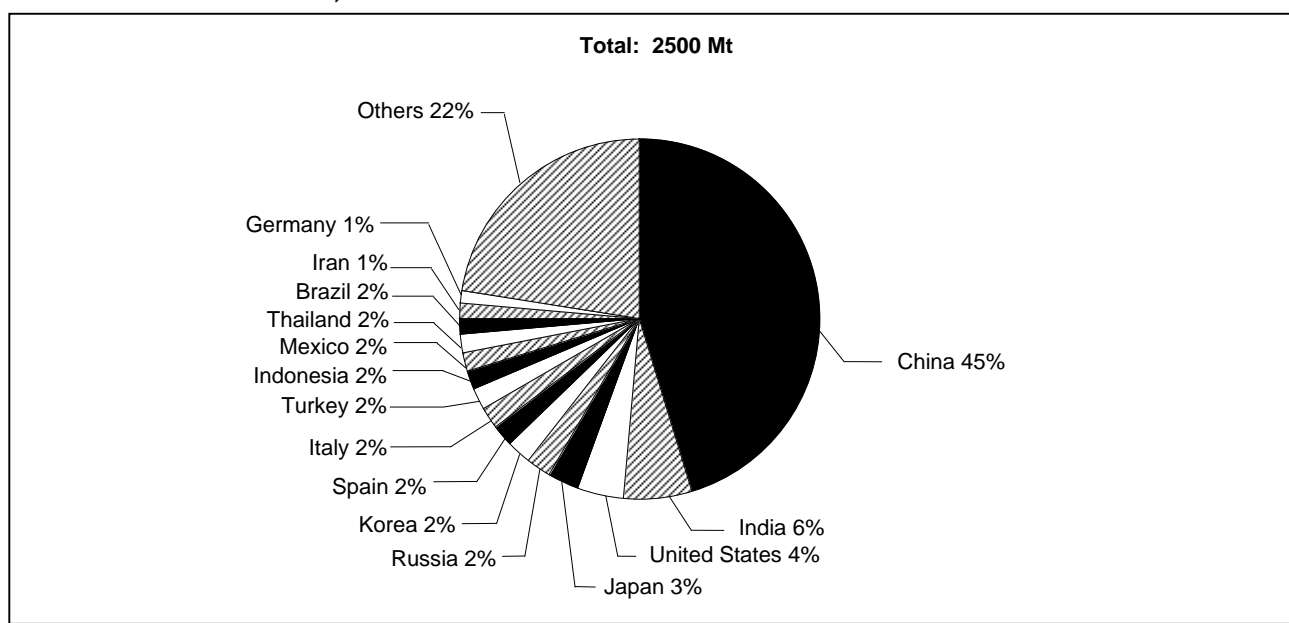
Lafarge SA of Paris produced 131.8 Mt of cement and clinker in 43 countries in 2006, an increase of 7% from the previous year. Switzerland-based Holcim AG produced 140.7 Mt of cement/clinker in 41 countries. This 27% increase is largely due to a consolidation of recent acquisitions in India. Heidelberg Cement Group of Germany produced 79.7 Mt of cement/clinker in 42 countries, an increase of 13.7% over 2005 figures.

According to the U.S. Geological Survey, the United States produced 94 Mt of portland cement and 6 Mt of masonry cement from 113 plants in 2006. As of December 31, 2006, clinker capacity in the continental United States was 94.693 Mt and total finish grinding capacity was 122.855 Mt (PCA, 2006 Plant Summary). According to the U.S. Geological Survey, the United States consumed 121.8 Mt of cement in 2006, a decrease of 0.3% over 2005 figures.

Cemex S.A de C.V. has announced an offer to acquire all outstanding shares of the Australian cement and aggregates company Rinker Group Limited for a total value, including debt, of US\$13 billion. Rinker has two cement operations in Florida.

Construction began in March 2006 at the site of the Holcim (US) Inc. greenfields plant at Ste. Genevieve, Missouri. The plant, to be commissioned in 2009, will have a capacity of 4 Mt/y of cement and will have the largest single kiln in the world. It is strategically located on the Mississippi River about 70 km south of St. Louis.

Figure 3
World Cement Production, 2006



Source: U.S. Geological Survey.

Lehigh Northwest Cement Co. is planning to upgrade cement-handling facilities at the port of Everett in Washington State just north of Seattle. The new terminal will include a 60 000-ton storage dome, as well as docking facilities and rail and truck load-out areas. The company expects throughput to average 500 000 tons, serving markets in Washington, Oregon, and British Columbia. Lehigh Northwest operates a cement plant in Delta, B.C.

Lafarge North America announced the expansion of its Joppa plant located in Grand Chain, Illinois. The expansion would include the installation of two new pre-calciner kilns, the shut-down of one of two existing kilns, and the installation of two new finish mills. The new plant would have a capacity of 3.25 million tons per year. Lafarge also announced that it intends to invest US\$500 million to expand its capacity in India by 6 Mt and an undisclosed amount to double production capacity in China to 40 Mt.

Essroc Cement Corp. plans to expand and modernize its facility at Martinsburg, West Virginia, to about 6000 t/d from the current 2279 t/d at a cost of US\$320 million. The expansion is expected to be complete in 2008.

USE

Portland cement is a key ingredient in the manufacture of ready-mix concrete. A typical mix design for a concrete

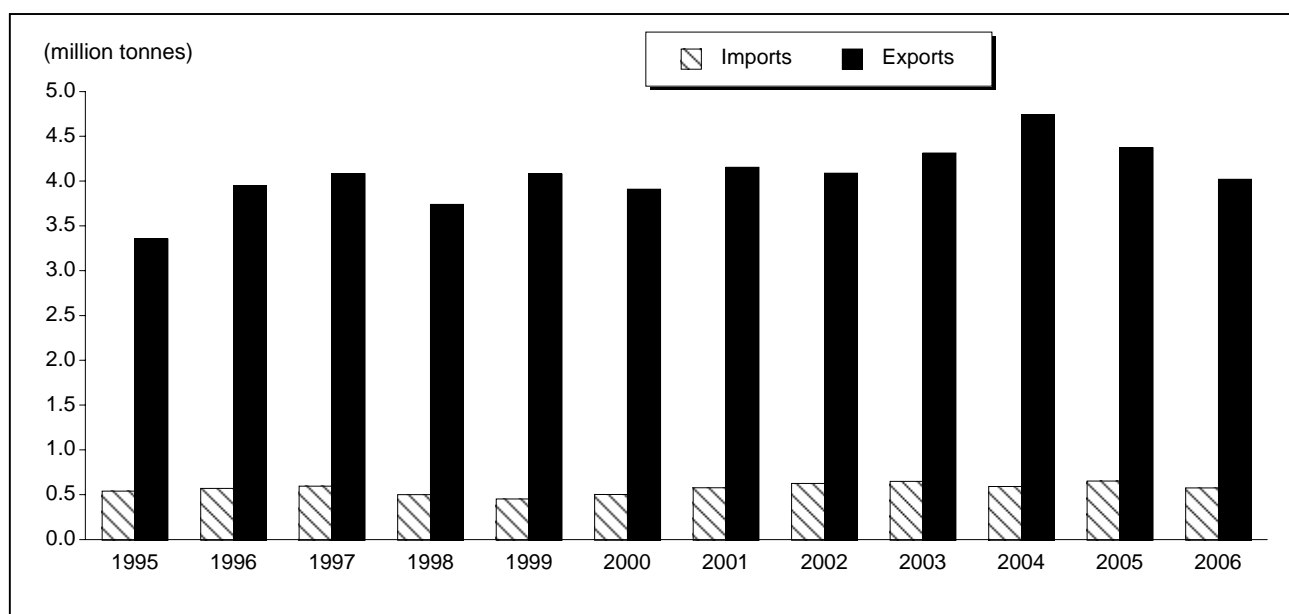
highway would contain about 360 kg of cementitious materials and about 1700 kg of coarse and fine aggregates per cubic metre of concrete. Concrete comprises the basic raw material for building and engineering construction applications, including buildings, roads and bridges, and airport infrastructure. The average consumption rate for cement in Canada is approximately 280 kg per person. This compares to an average per capita rate in the United States of 410 kg.

TRADE

Canadian cement producers exported 608 467 t of clinker in 2006, a decrease of 17.8% over the previous year. In addition, 4.026 Mt of portland cement were exported, primarily to the United States, a decrease of 8% from the previous year. Exports of white cement increased 6.7% to 353 922 t. Companies also imported 580 820 t of portland cement in 2006, compared to 657 096 t imported in 2005.

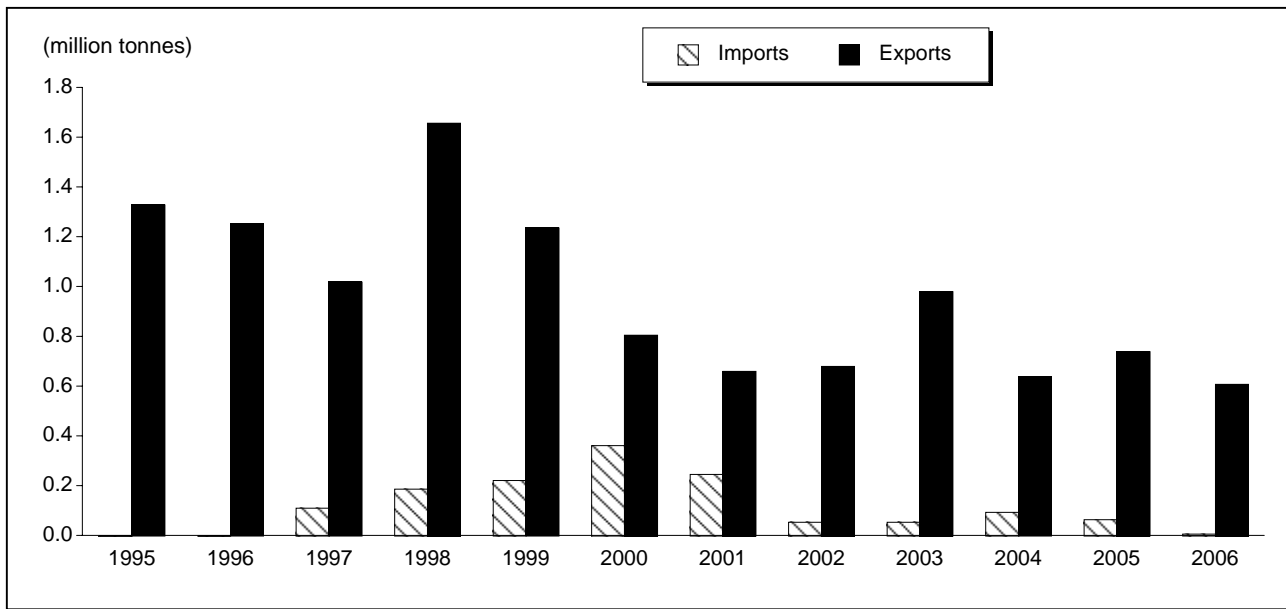
According to the PCA, the United States imported a record 35.89 Mt of cement in 2006, an increase of 6.7% from the previous year. Cement and clinker imports into the United States come primarily from China, Canada, Thailand, South Korea, Mexico, Greece, and Colombia, in decreasing order of volume. Imports of cement and clinker from China continue to dramatically increase, a sign of the increasing importance of China in world cement supply.

Figure 4
Canadian Portland Cement Trade, 1995-2006



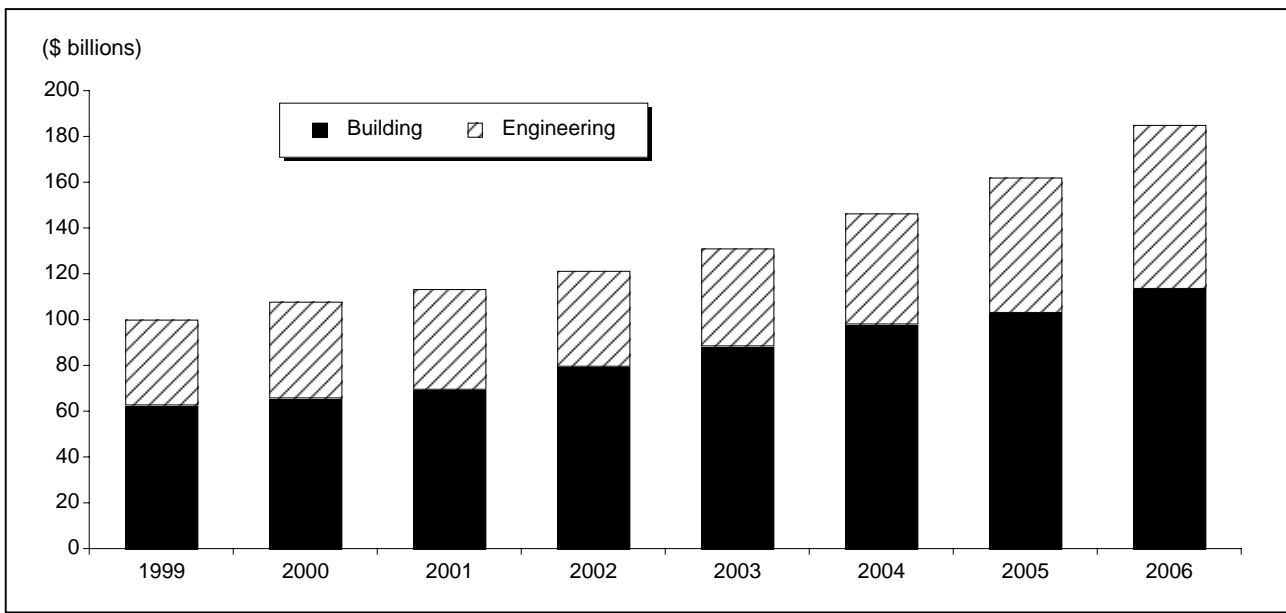
Source: Natural Resources Canada.

Figure 5
Canadian Cement Clinker Trade, 1995-2006



Source: Natural Resources Canada.

Figure 6
Canada, Value of Construction by Type, 1999-2006



Source: Statistics Canada.

Year-over-year increases in Chinese exports to the United States have been in the 95-105% range since 2004. For the same period, Canadian exports declined 6% on a yearly basis.

Trade data for portland cement, clinker and cement products can be found in Table 1. Figure 4 shows the trend for finished cement imports and exports for 1995-2006. Figure 5 shows clinker imports and exports for the same period. Clinker exports declined by 18% in 2006. The level of clinker imports declined dramatically in 2006 to 7012 t from 65 119 t the previous year.

TECHNOLOGY NEWS

The Ontario Ministry of the Environment has granted certificates of approval to Lafarge Canada to burn scrap tires and other municipal waste at its plant in Bath, Ontario, west of Kingston. The Bath facility consists of a dry process preheater kiln with a capacity of 980 000 t of clinker. As part of a pilot project, the plant will burn alternative fuels in gradually increasing amounts over a period of two years. Over time, the plant will be allowed to replace about 30% of conventional fuel with waste tires, bone meal, and other wastes. Lafarge will ensure that the wastes used will be surplus to the capacity of Ontario's recycling markets.

Lafarge Canada is being considered by the Nova Scotia Resource Recovery Fund Board as a location to burn up to 900 000 tires per year at its cement plant in Brookfield, Nova Scotia, and at a plant in St. Constant, Quebec. The company must now seek approval from the Nova Scotia environment ministry.

Lafarge has received approval from New York State for the company to burn up to 4.8 million scrap tires per year at its Ravena, New York, plant beginning in 2007. The tires will replace about 20% of the conventional fuel (coal and pet coke) used to heat the kiln.

Coal combustion products (CCP) are produced during the generation of electricity at coal-fired power plants. These products include fly ash, bottom ash, and flue gas desulphurization (FGD) gypsum, also known as synthetic gypsum. Fly ash characteristics depend on coal sources and the combustion or conditioning processes used, and different fly ashes are suitable for different applications. Coal fly ash is used as a supplementary cementing material (SCM) in concrete and other cementitious applications, such as hydraulic mine backfill, grout, and controlled low-strength material. SCM also includes ground granulated blast furnace slag and silica fume. These additives act to improve the workability of concrete, reduce water requirements, and impart enhanced strength, durability and chemical-resistance properties. Fly ash is also used in road subbase and as a mineral filler in paints and plastics. Not all fly ashes are suitable for all applications and some may require processing to meet specific technical requirements.

Table 4 contains averaged data on the production and use of CCP, including fly ash and synthetic gypsum, for the period 2004-06. During the period, coal-fired generating plants in Canada produced an average of 4.198 Mt of fly ash and 385 000 t of synthetic gypsum per year. Including bottom ash and synthetic gypsum, there was an annual average of 6.424 Mt of CCP produced. The average total use percentage for the period was 30%, up from 27% for the previous period. Overall, 31% of fly ash and 95% of synthetic gypsum were re-used. Synthetic gypsum is used for wallboard manufacture and as a cement additive. According to statistics published by the American Coal Ash Association (ACAA), 41% of fly ash produced in 2005 was re-used in a variety of applications. The overall utilization rate for CCP in the United States was 40.3% in 2005.

PRICES

The average value for portland cement produced in Canada in 2006 was \$117/t, based on total production figures, an increase of 3.5% from the previous year. The actual realized price for cement f.o.b. plant varies from region to region and depends on the type of cement produced. These prices are negotiated between the cement companies and their customers and are not published. The U.S. Geological Survey reports that the average mill net value of portland cement in 2006 was an estimated US\$98/ton. Cement prices in the United States averaged 7.7% higher than in 2005.

OUTLOOK

As a measure of construction growth potential, the key driver of the cement industry, housing starts, increased by 0.8% overall in 2006 to 227 395 units, compared to 225 481 units in 2005 (Statistics Canada CANSIM table 027-0008). Housing starts were up significantly in Alberta and B.C. (19.8% and 5.1%, respectively) and showed declines in Ontario (-6.8%) and Quebec (-5.9%). Canada Mortgage and Housing Corporation expects housing starts in 2007 to come in around 210 000 units, representing a decline of about 10%. Growth will be focussed in Alberta, and to a lesser extent British Columbia, whereas declines will be observed in Ontario and Quebec. Cement production is expected to maintain current levels in 2007. Consumption trends should be positive in the western provinces and negative in central and eastern Canada. Total consumption should be about 9.53 Mt, according to analysis by the PCA.

According to the PCA, the U.S. construction industry will continue to show weak performance in 2007. The residential housing market is not expected to recover in 2007. This trend is due in part to higher-than-expected inventories of existing homes caused by higher rates of foreclosure. As long as existing home inventories remain high, the trend

in new housing starts will not rebound and demand for cement will remain weak. The non-residential and public construction sectors are expected to generate moderate demand. Cement consumption is expected to decline by 10% overall.

Cement consumption in the United States should be in the range of 110-115 Mt in 2007 while production should be about 100 Mt, leaving a 10-15 Mt shortfall. Canadian exports of cement and clinker are forecast to decline in 2007 as the result of an expected continued weakness in the residential housing market south of the border.

RELEVANT CEMENT INDUSTRY WEB SITES

Cement Association of Canada
www.cement.ca
Essroc Canada Inc.
www.essroc.com
Federal White Cement Ltd.
www.federalwhitecement.com
Lafarge North America
www.lafarge-na.com
Lehigh Inland Cement Limited
www.lehighinland.com
Lehigh Northwest Cement Limited
www.lehighnw.com

Portland Cement Association
www.cement.org
St. Marys Cement (Canada) Inc.
www.stmaryscement.com
St. Lawrence Cement Inc.
www.stlawrencecement.com
Association of Canadian Industries Recycling Coal Ash
www.circainfo.ca
American Coal Ash Association
www.acaa-usa.org

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 1, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

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TARIFFS

Item No.	Description	Canada			United States Canada	EU Conventional Rate (1)	Japan WTO (2)
		MFN	GPT	USA			
25.23	Portland cement, aluminous cement, slag cement, supersulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers						
2523.10	Cement clinkers	Free	Free	Free	Free	1.7%	2.2%
2523.21	Portland cement: white cement, whether or not artificially coloured	Free	Free	Free	Free	1.7%	2.2%
2523.29	Portland cement: other	Free	Free	Free	Free	1.7%	2.2%
2523.30	Portland cement: aluminous cement	Free	Free	Free	Free	1.7%	2.2%
2523.90	Portland cement: other hydraulic cements	Free	Free	Free	Free	1.7%	2.2%
68.10	Articles of cement, of concrete or of artificial stone, whether or not reinforced						
6810.11	Tiles, flagstones bricks and similar articles: building blocks and bricks	3%	Free	Free	Free	1.7%	Free
6810.19	Tiles, flagstones bricks and similar articles: other	5%	Free	Free	Free	1.7%	Free
6810.91	Other articles: prefabricated structural components for building or civil engineering	5%	Free	Free	Free	1.7%	Free
6810.99	Other articles: other	5%	Free	Free	Free	1.7%	Free

Sources: Canadian Customs Tariff, effective January 2007, Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2007; Official Journal of the European Union (October 17, 2006 Edition); Customs Tariff Schedules of Japan, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, CEMENT PRODUCTION AND TRADE, 2004-06

TABLE 1. CANADA, CEMENT PRODUCTION AND TRADE, 2004-05							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION (1) (all forms)							
	Nova Scotia	x	x	x	x	x	x
	Quebec	3 176 222	355 615	2 881 082	344 370	2 824 995	328 980
	Ontario	6 044 483	616 530	5 801 759	608 238	5 833 087	629 686
	Alberta	x	x	x	x	x	x
	British Columbia	2 385 354	276 148	2 402 191	285 636	2 531 783	310 720
	Total	14 170 484	1 586 992	13 928 063	1 622 709	14 017 872	1 665 688
EXPORTS							
2523.10	Cement clinker						
	United States	638 611	40 436	740 128	41 052	608 301	40 832
	Bermuda	—	—	—	—	144	9
	Saint Kitts and Nevis	27	2	—	—	20	2
	Other countries	51	3	46	6	2	—
	Total	638 689	40 441	740 174	41 058	608 467	40 843
2523.21	Portland cement, white, whether or not artificially coloured						
	United States	307 683	47 440	328 843	48 583	347 043	49 832
	Jamaica	—	—	2 280	231	5 934	618
	United Arab Emirates	—	—	—	—	462	47
	Ukraine	—	—	269	27	218	22
	Other countries	502	51	176	18	265	27
	Total	308 185	47 491	331 568	48 859	353 922	50 546
2523.29	Portland cement, n.e.s.						
	United States	4 739 062	327 638	4 308 703	300 213	3 993 147	279 063
	Denmark	—	—	25 016	336	23 301	402
	Saint Pierre and Miquelon	1 085	165	1 617	219	1 942	230
	Bermuda	11	1	2 678	299	3 811	214
	China	1 207	123	1 360	102	2 188	164
	Iceland	—	—	1 430	115	855	64
	United Arab Emirates	4 304	411	7 455	559	673	50
	Japan	—	—	527	44	520	40
	Other countries	1 441	81	27989	440	234	18
	Total	4 747 110	328 419	4 376 775	302 327	4 026 671	280 245
2523.30	Aluminous cement						
	United States	—	—	—	—	5	25
	India	—	—	—	—	400	15
	Argentina	—	—	—	—	221	5
	Bermuda	—	—	—	—	55	1
	Other countries	89	5	66	1	—	—
	Total	89	5	66	1	681	46
2523.90	Hydraulic cement, n.e.s.						
	United States	61 705	8 040	34 447	4 407	15 281	3 572
	Barbados	—	—	316	125	628	256
	Russia	104	47	291	98	202	80
	Bermuda	559	18	65	21	182	75
	Czech Republic	105	47	120	44	189	70
	China	95	41	94	34	107	40
	Slovakia	12	5	191	70	66	24
	Iran	—	—	54	20	23	17
	Cuba	4	8	147	56	45	17
	Poland	12	4	106	39	43	16
	Japan	46	22	89	29	37	14
	Other countries	1 384	585	882	276	247	84
	Total	64 026	8 817	36 802	5 219	17 050	4 265
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6810.11	Building blocks and bricks of cement, concrete or artificial stone						
	United States	..	102 235	..	79 895	..	82 235
	Russia	—	—	—	—	..	314
	South Africa	..	780	..	1 004	..	243
	Japan	..	648	..	292	..	181
	Iceland	—	—	..	20	..	56
	Bermuda	..	513	..	76	..	38
	Other countries	..	60	..	307	..	73
	Total	..	104 236	..	81 594	..	83 140

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
EXPORTS (cont'd)						
6810.19	Tiles, flagstones and similar articles of cement/concrete or artificial stone					
	United States	.. 25 795	.. 30 437	.. 24 571		
	Bermuda	.. 187	.. 35	.. 196		
	Japan	.. 988	.. 400	.. 119		
	Other countries	116	157	202		
	Total	.. 27 086	.. 31 029	.. 25 088		
6810.91	Prefabricated structural components of buildings, etc., of cement/concrete, etc.					
	United States	.. 75 334	.. 85 352	.. 113 096		
	Japan	.. 307	.. 523	.. 355		
	Bermuda	.. 21	.. 145	.. 130		
	Spain	—	—	.. 81		
	United Kingdom	.. 79	.. 29	.. 78		
	Latvia	—	—	.. 50		
	Portugal	—	.. 27	.. 18		
	Turks and Caicos Islands	—	.. 6	.. 15		
	Saint Kitts and Nevis	—	—	.. 12		
	Other countries	468	4 114	8		
	Total	.. 76 209	.. 90 196	.. 113 843		
6810.99	Articles of cement, of concrete or of artificial stone, n.e.s.					
	United States	.. 93 772	.. 90 989	.. 80 946		
	Dominican Republic	—	.. 17 745	.. 16 830		
	Italy	.. 695	.. 1 011	.. 1 106		
	Greece	.. 649	.. 841	.. 1 034		
	Israel	—	.. 223	.. 421		
	Ireland	.. 248	.. 301	.. 276		
	Bahamas	—	.. 12	.. 196		
	Cuba	—	.. 1	.. 170		
	Trinidad and Tobago	—	—	.. 108		
	United Kingdom	.. 60	.. 15	.. 95		
	Belgium	—	.. 19	.. 76		
	Australia	.. 7	.. 60	.. 59		
	Denmark	.. 75	.. 41	.. 58		
	Other countries	1 053	938	276		
	Total	.. 96 559	.. 112 196	.. 101 651		
	Total exports	.. 729 263	.. 712 479	.. 699 667		
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (2)						
2523.10	Cement clinker					
	China	—	—	—	3 346	180
	United States	1 705	76	1 794	81	3 666
	Mexico	—	—	—	—	...
	Brazil	2 200	43	—	—	—
	Turkey	90 507	5 112	22 977	2 062	—
	United Kingdom	1	...	—	—	—
	Germany	—	—	16 651	1 577	—
	Netherlands	—	—	149	7	—
	United Arab Emirates	—	—	23 548	1 437	—
	Total	94 413	5 231	65 119	5 164	7 012
2523.21	Portland cement, white, whether or not artificially coloured					
	United States	8 828	1 455	11 168	1 852	16 269
	China	1	...	—	—	731
	Denmark	48	14	70	20	104
	Mexico	210	27	30	9	66
	Germany	222	51	44	32	34
	Other countries	408	76	104	71	29
	Total	9 717	1 623	11 416	1 984	17 233
2523.29	Portland cement, n.e.s.					
	United States	558 565	43 338	558 782	41 696	465 365
	Thailand	36 739	4 075	94 448	6 370	107 360
	China	...	...	66	7	6 852
	South Korea	—	—	—	—	786
	Croatia	146	48	255	88	76
	Taiwan	—	—	3 332	413	263
	Mexico	24	8	23	8	94
	United Kingdom	303	23	3	8	6
	Other countries	9 760	1 641	187	135	18
	Total	605 537	49 133	657 096	48 725	580 820
						45 328

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2523.30	Aluminous cement						
	United States	12 860	7 482	13 541	8 037	10 841	6 431
	Croatia	2 662	1 455	3 681	1 600	2 776	1 283
	United Kingdom	171	91	65	37	132	76
	Netherlands	306	251	63	73	55	62
	South Africa	18	21	81	55	45	45
	Other countries	—	—	..	...	2	3
	Total	16 017	9 300	17 431	9 802	13 851	7 900
2523.90	Hydraulic cement, n.e.s.						
	United States	53 889	8 334	27 499	8 475	25 723	9 665
	United Kingdom	1 892	572	379	448	515	382
	Croatia	1 031	429	626	322	612	312
	France	451	147	410	127	382	310
	Denmark	474	204	228	140	284	234
	Japan	123	96	629	230	309	206
	Germany	472	144	499	143	328	171
	Mexico	33	10	53	17	160	55
	China	209	4	372	34	7	7
	Other countries	51	29	93	21	1	3
	Total	58 625	9 969	30 788	9 957	28 321	11 345
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6810.11	Building blocks and bricks of cement, concrete or artificial stone						
	United States	..	6 858	..	11 212	..	16 341
	China	..	...	..	71	..	159
	Netherlands	—	—	—	—	..	51
	Other countries	—	31	..	37	—	54
	Total	..	6 889	..	11 320	..	16 605
6810.19	Tiles, flagstones and similar articles of cement/concrete or artificial stone						
	United States	..	27 172	..	30 419	..	29 830
	Israel	..	111	..	951	..	2 456
	Italy	..	1 122	..	1 475	..	1 242
	Belgium	..	67	..	192	..	651
	China	..	771	..	695	..	493
	Spain	..	92	..	15	..	207
	Other countries	—	454	..	1318	—	1130
	Total	..	29 789	..	35 065	..	36 009
6810.91	Prefabricated structural components of buildings, etc., of cement/concrete, etc.						
	United States	..	3 517	..	5 988	..	7 379
	Malaysia	..	428	..	388	..	474
	China	..	53	..	290	..	119
	Other countries	—	892	..	60	—	154
	Total	..	4 890	..	6 726	..	8 126
6810.99	Articles of cement, of concrete or of artificial stone, n.e.s.						
	United States	..	20 542	..	16 979	..	22 785
	China	..	9 935	..	10 518	..	12 628
	Mexico	..	2 247	..	2 837	..	2 748
	Spain	..	1 615	..	2 715	..	2 574
	South Korea	..	54	..	1 039	..	2 265
	Belgium	..	1 258	..	797	..	728
	Germany	..	981	..	758	..	391
	Philippines	..	90	..	69	..	306
	Italy	..	3 789	..	10 921	..	188
	Other countries	..	594	..	469	..	676
	Total	..	41 105	..	47 102	..	45 289
	Total imports	..	157 929	..	175 845	..	173 496

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; ... Amount too small to be expressed; n.e.s. Not elsewhere specified; (p) Preliminary; x Confidential.

(1) Producers' shipments plus quantities used by producers. (2) Includes re-imports.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CEMENT PLANTS, GRINDING AND CLINKER CAPACITIES, 2006

Company	Plant	Kiln Type	Fuel	No. of Kilns	Grinding Capacity	Clinker Capacity
ATLANTIC REGION						
Lafarge Canada Inc.	Brookfield, N.S.	D	C,A	2	500	451
Subtotal, Atlantic region				2	500	451
QUEBEC						
Lafarge Canada Inc.	Saint-Constant	D	KA,GA	2	1 479	948
Ciment Québec Inc. (50% Essroc Group; 50% private)	Saint-Basile	Dc	C,OGA	1	1 571	1085
St. Lawrence Cement Inc. (Holcim AG)	Joliette	D	CK,A	4	1 393	956
Subtotal, Quebec region				7	4 443	2 989
ONTARIO						
Lafarge Canada Inc.	Woodstock	W	CGK	2	1 090	504
	Bath	Dx	CK,G	1	939	980
Federal White Cement Ltd.	Woodstock	Dx	OG, K	2	477	998
ESSROC Canada Inc. (Italcementi Group)	Picton	D,Dx	CK,G	2	835	1 325
St. Lawrence Cement Inc. (Holcim AG)	Mississauga	Dc	C,KA	1	2 210	1 384
St. Marys Cement (Canada) Inc.	Bowmanville	Dc	K	1	1 269	2 001
(Votorantim Cimentos)	St. Marys	Dx	K	1	800	772
Subtotal, Ontario region				10	7 620	7 964
PRAIRIE REGION						
Lafarge Canada Inc.	Exshaw, Alta.	D,Dc	CG	2	1 330	1 269
Lehigh Inland Cement Limited (Heidelberg Cement Group)	Edmonton, Alta.	Dc	CG	1	1 380	1 082
Subtotal, Prairie region				3	2 710	2 351
BRITISH COLUMBIA						
Lafarge Canada Inc.	Kamloops	D	K,CGA	1	410	212
	Richmond	Dc	C,A	1	1 871	1 201
Lehigh Northwest Cement Limited (Heidelberg Cement Group)	Delta	Dx	C,GA	1	1 206	1 207
Subtotal, B.C. region				3	3 487	2 620
Total Canada (7 companies, based on ownership)				25	18 760	16 375

Source: Portland Cement Association.

Fuel: C Coal; O Oil; G Gas; K Coke, A Waste.

Kiln type: W Wet; D Dry; X Preheater; C Precalciner.

TABLE 3. CANADA, CEMENT PLANTS, KILNS AND CAPACITY UTILIZATION, 1980-2006

	Clinker- Producing Plants	Kilns (a)	Approximate Cement Grinding Capacity	Portland and Masonry Cement Production (1)	Clinker Exports (2)	Approximate Total Pro- duction (3)	Capacity Utilization
	(no.)	(no.)	(t/y)	(tonnes)	(tonnes)	(tonnes)	(%)
1980	23	47	16 363 000	10 274 000	726 087	11 000 087	63
1981	23	48	16 771 000	10 145 000	524 006	10 669 006	60
1982	23	48	16 771 000	8 418 000	290 329	8 708 329	50
1983	23	49	17 900 000	7 870 878	404 793	8 275 671	44
1984	23	49	17 900 000	9 387 466	440 297	9 827 763	52
1985	23	49	17 900 000	10 192 442	676 596	10 869 038	57
1986	23	49	17 900 000	10 611 223	324 000	10 935 223	59
1987	20	40	16 600 000	12 603 164	767 338	13 370 502	76
1988	20	40	15 506 000	12 349 873	331 796	12 681 669	80
1989	20	38	15 546 000	12 590 637	178 491	12 769 128	81
1990	20	38	16 439 000	11 745 152	460 075	12 205 227	71
1991	20	34	16 262 000	9 372 219	544 870	9 917 089	58
1992	18	34	16 800 000	8 593 399	988 348	9 581 747	51
1993	18	34	16 800 000	9 393 581	882 935	10 276 516	56
1994	18	34	17 021 000	10 584 414	981 022	11 565 436	62
1995	18	34	16 157 000	10 440 329	1 329 548	11 769 877	65
1996	18	32	16 252 000	11 587 365	1 252 863	12 840 228	71
1997	17	30	15 856 000	11 736 272	1 019 308	12 755 580	74
1998	17	28	15 837 000	12 124 058	1 657 808	13 781 866	77
1999	17	27	16 269 000	12 624 924	1 236 860	13 861 784	78
2000	16	27	17 605 000	12 611 954	805 870	13 417 824	72
2001	16	27	16 190 000	12 985 521	660 913	13 646 434	80
2002	16	27	16 190 000	13 059 527	680 547	13 740 074	81
2003	16	27	18 022 000	13 424 786	980 763	14 405 549	74
2004 (r)	16	27	17 550 000	14 170 484	638 689	14 809 173	81
2005 (r)	16	27	18 289 000	13 928 063	740 174	14 668 237	76
2006 (e)	16	25	18 760 000	14 017 872	608 467	14 626 359	75

Sources: Statistics Canada; Portland Cement Association.

(e) Estimated; (r) Revised.

(a) Includes two inactive kilns (1980-2005).

(1) Producers' shipments and amounts used by producers, including cement ground from imported clinker. (2) Based on Trade of Canada harmonized system code HS 2523.10. (3) Producers' shipments plus clinker exports.

Notes: Production figures for 2004 and 2005 have been revised. The utilization rate for 2004 has been revised.

TABLE 4. CANADA, PRODUCTION (1) AND USE (2) OF COAL COMBUSTION PRODUCTS (CCPs), 2004-06 AVERAGE

	Fly Ash	Bottom Ash	FGD Gypsum	Other (3)	Total CCPs
(000 tonnes)					
PRODUCTION					
Produced	4 198	1 658	385	184	6 424
Disposed/stored	3 285	1 390	—	184	4 859
Removed from disposal	2	37	1	—	39
USE (DOMESTIC)					
Cement	638	147	10	—	795
Concrete/grout	472	—	—	—	472
Mining applications	89	—	—	—	89
Roadbase/subbase	17	94	—	—	111
Wallboard	—	—	313	—	313
Other (4)	84	6	43	—	133
Total use	1 300	247	366	—	1 913
Individual use percentage	31	15	95	—	30

Source: Natural Resources Canada.

— Nil.

(1) Reported production of coal combustion products (CCPs) may include both dry and ponded categories. (2) Use (domestic), as reported, includes amounts imported (assumed HS codes 2621.00 relating to fly ash and HS 2520.10 relating to gypsum). (3) Cfb (circulating fluidized bed) fly ash and bottom ash. (4) Includes waste stabilization and specialty uses such as mineral filler and flowable fill.

Note: Numbers may not add to totals due to rounding.

TABLE 5. CANADA, VALUE OF CONSTRUCTION BY TYPE, 1999-2006

	1999	2000	2001	2002	2003	2004	2005	2006
(\$ billions)								
BUILDING CONSTRUCTION								
Residential investment	38.8	40.8	43.6	55.1	61.4	70.4	74.0	79.8
Non-residential building investment	24.2	25.3	26.3	24.8	27.4	28.0	29.4	34.1
Total building construction	63.0	66.1	69.9	79.9	88.8	98.4	103.4	113.9
ENGINEERING CONSTRUCTION								
Mining and oil and gas extraction	15.4	19.3	21.1	19.1	19.4	23.6	30.3	39.9
Transportation and warehousing	5.0	4.1	3.4	3.2	2.7	2.4	2.1	3.5
Other engineering	16.6	18.3	18.9	19.1	20.2	22.0	26.2	27.7
Total engineering construction	37.0	41.7	43.4	41.4	42.3	48.0	58.6	71.1
Total all components	100.0	107.8	113.3	121.3	131.1	146.4	162.0	185.0

Sources: Natural Resources Canada; Statistics Canada, CANSIM II (Table 026-0013 – Residential Values, by Type of Investment and Related Table 031-0002 – Flows and Stocks of Fixed Non-Residential Capital, by North American Industry Classification System). (More information can be obtained on the Internet at the CANSIM II site at <http://cansim2.statcan.ca>.)

Notes: Numbers may not add to totals due to rounding. Residential construction includes value of new construction, renovations and acquisition costs.

TABLE 6. WORLD PRODUCTION OF CEMENT, 2002-06

	2002	2003	2004	2005 (r)	2006 (e)
	(000 tonnes)				
Canada	13 059	13 424	14 016	13 928	14 017
Brazil	39 500	38 000	38 000	36 700	37 000
China	705 000	813 000	934 000	1 040 000	1 100 000
Egypt	23 000	29 100	28 000	29 000	29 000
France	20 000	20 000	21 000	21 300	21 000
Germany	30 000	30 000	32 000	30 600	30 000
India	100 000	110 000	125 000	145 000	155 000
Indonesia	33 000	35 000	36 000	37 000	40 000
Iran	30 000	30 000	30 000	32 700	33 000
Italy	40 000	38 000	38 000	46 400	46 000
Japan	71 800	71 000	67 400	69 600	68 000
Mexico	31 100	32 000	35 000	36 000	40 000
Russia	37 700	41 000	43 000	48 700	54 000
South Korea	55 500	59 200	54 000	51 400	52 000
Spain	42 500	42 000	47 000	50 300	50 000
Thailand	31 700	32 500	35 600	37 900	40 000
Turkey	32 600	33 000	38 000	42 800	45 000
United States	91 300	94 300	99 000	101 000	101 000
Other countries	372 241	388 476	414 984	439 672	544 983
Total world	1 800 000	1 950 000	2 130 000	2 310 000	2 500 000

Sources: Natural Resources Canada; U.S. Geological Survey.

(e) Estimated; (r) Revised.

Chrysotile

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SUMMARY

Canadian chrysotile production is concentrated in Quebec's Eastern Townships and is derived from three mining operations: the Bell and Lac d'amiante mines owned by LAB Chrysotile, Inc. in the Thetford Mines area, and the Jeffrey mine operated by Jeffrey Mine Inc. in the town of Asbestos. Jeffrey Mine Inc. is mining residual ore reserves from the open pit at a reduced rate until the new underground mine is ready to produce.

After years of downsizing and the resulting impact on its suppliers and service providers, the chrysotile industry is currently estimated to provide approximately 900 direct seasonal jobs and at least 1000 indirect jobs in the industrial and service sectors in the immediate area of Thetford Mines (regional county municipality of Amiante) and across the administrative region of Chaudière-Appalaches.

The restructuring of Lab Chrysotile, Inc., now known as Lab Chrysotile, did not directly affect employment in the sector. At the time of writing this review, operations were alternating among the three Canadian chrysotile mines in Quebec to ensure major users had a continuous supply of chrysotile fibres for the production of chryo-cement construction materials and friction products.

Quebec has proven chrysotile reserves of upwards of 200 Mt with an average fibre content of 6%. The plants in Canada in which this ore is processed are the most productive in the world. They are also the safest in the world with concentrations of between 0.1 and 0.2 fibres per cubic centimetre of air in the direct working environment. It is also important to note that Canadian commercial chrysotile fibres are certified "zero tremolite."

Although this review is for 2006, it is nevertheless important to mention that on November 14, 2007, Jeffrey Mine Inc. and Lab Chrysotile created Chrysotile Canada Inc. (CCI) to jointly market approximately 10% of global

chrysotile consumption. An estimated 200 000 t of Canadian fibres will be produced annually and used on domestic and international markets.

It is assumed that world production and consumption of chrysotile in 2006 remained essentially the same as in 2005. It should be noted, however, that the rising trend observed since 2003 was expected to continue in 2006. However, for various reasons, a significant number of chrysotile production and use data are estimates and this apparent trend could not be confirmed in 2006. Canadian chrysotile production in 2006 is estimated at 175 000 t. The strength of the Canadian dollar, increased energy costs, and particularly rising transportation costs and other barriers to the delivery of chrysotile, are seriously harming the capability of the Canadian chrysotile industry to compete internationally with other producers.

The tremendous efforts that have been, and are still being, exerted by various countries and organizations to promote a ban on all forms of "asbestos" are having a serious impact on the capability of producer countries to respond to the legitimate needs of user countries, which have major infrastructure needs and, consequently, chryo-cement needs.

DIFFERENTIATION BETWEEN CHRYSOTILE AND AMPHIBOLE ASBESTOS FIBRES

Chrysotile represents nearly 100% of the "asbestos" produced and used worldwide. It does not have the same physical and chemical properties as amphibole asbestos, a silicate mineral commercially identified as "asbestos," but considered far more harmful than chrysotile by the international scientific community. Consequently, amphibole use has declined to little or none.

A recent expert review panel convened by the U.S. Environmental Protection Agency (EPA) concluded that "the available epidemiology studies provide compelling evidence that the carcinogenic potency [for mesothelioma] of amphibole fibers is two orders of magnitude [over one hundred times] greater than that for chrysotile fibers" and possibly five to seven times more potent for lung cancer. These conclusions reinforced the scientific findings of numerous studies and reviews conducted over the last

30 years, most notably the findings of the 1984 *Report of the Royal Commission on Matters of Health and Safety Arising From the Use of Asbestos in Ontario* (ORCA Report). According to the most recent and most thorough meta-analysis (Hodgson *et al.*, 2000), the danger of cancer from chrysotile is 10 to 500 times less than from amphiboles.

A recent World Health Organization (WHO) publication (Concha-Barrientos *et al.*, 2004) acknowledges that there is a difference in risk between chrysotile and the amphibole asbestos varieties. Based on historical data from 20 studies of at least 100 000 “asbestos” workers, it is estimated that “little excess lung cancer is expected from low exposure levels.”

Recently, a multi-centre case-control study in Europe (R. Carel *et al.*, 2006) has shown that occupational exposure to asbestos does not appear to contribute to the lung cancer burden in men in Central and Eastern Europe, whereas the lung cancer risk in the United Kingdom is higher following exposure to asbestos. The authors suggest that differences in fibre types (i.e., workers in Eastern Europe were mostly exposed to chrysotile, while amphibole fibres were widely used in Western Europe) and circumstances of exposure may explain their results.

EVALUATION OF CHRYSOTILE FIBRE SUBSTITUTES

While there are substantial efforts being made to identify and use acceptable chrysotile substitutes, there is no certainty at the moment that these synthetic or natural substitute fibres would be any safer than chrysotile. Substitutes that tend to be technically equivalent to chrysotile also tend to have similar properties. This means that, generally speaking, they are also fibrous and may pose similar threats to health as chrysotile and even amphibole asbestos in some cases. There is a serious gap in knowledge regarding the dangers of substitutes compared with the risks of chrysotile fibres, which poses an ever-increasing danger for workers and the public.

The International Agency for Research on Cancer (IARC) classifies certain substitutes as “possible carcinogens.” The IARC held a Workshop on Mechanisms of Fibre Carcinogenesis and Assessment of Chrysotile Asbestos Substitutes in Lyon, France, from November 8 to 12, 2005. A summary consensus report was made available for general distribution on January 23, 2006, but the scientific community interested in this matter is still awaiting the release of the final report.

It should be noted that several fibres presently used as chrysotile substitutes in the manufacture of corrugated fibre-cement sheets cannot even be categorized in terms of “hazard assessment.” In the Consensus Report, the hazard

from these fibres is categorized as “indeterminate.” This is the case for the polyvinyl alcohol (PVA) fibres, polypropylene, and even respirable cellulose fibres that are used by themselves or in combination with other products. Wollastonite, for which the hazard was identified as “likely to be low” in the report, was found to be active in different studies for genotoxicity. Wollastonite, mixed with other fibres, is used as a substitute for chrysotile in the production of flat sheets of fibre-cement.

International experts, decision-makers, and international organizations must address the issue and provide a scientifically sound answer to the above-noted legitimate concerns.

CHRYSOTILE-BASED ENCAPSULATED PRODUCTS, SAFETY IN THEIR USE, AND RESPONSE TO PRESSING NEEDS

“Asbestos” has been the focus of extensive scientific and medical scrutiny. Findings have resulted in the elimination of substances harmful for human health, such as amphibole asbestos, and of methods and products that could allow fibres to be readily released into the air, such as spray insulation, which was discontinued in Canada in the 1970s.

In Canada, products likely to release free fibres into the environment under normal conditions of use, i.e., the “non-encapsulated” products, are regulated or prohibited under the *Hazardous Products Act*. In addition, all products containing “asbestos” used by children as either learning tools or games are prohibited from being imported, mentioned in advertising, or sold in Canada. A regulation of this kind has existed in Canada for 30 years.

Today’s chrysotile-based manufactured products, such as building materials, brake linings, water and sewer pipes, and other specialty products, can be used safely because the fibres they contain are encapsulated in a matrix such as cement or resin that cannot, under normal conditions, disperse into the environment. In the major chrysotile-based product manufacturing and consumer countries, more than 93% of chrysotile is used by the chryso-cement industry, while the remaining 7% is split roughly one-third into specialty products and two-thirds into friction products. Some chrysotile-based composite products and application techniques are also now available to consumers. These are more appealing from an architectural standpoint as they are structurally stronger, non-friable, and meet the highest construction standards.

Countless people in developing and developed countries benefit from the use of chrysotile each day because it is used in durable and affordable building products and essential public infrastructure for irrigation, public drinking water supply, and sewage treatment. Chrysotile is also used in brakes and clutches that enhance transportation safety and reliability.

INTERNATIONAL INSTRUMENTS SUPPORTING THE CONTROLLED-USE APPROACH TO CHRYSOTILE

It is necessary to address in this review the controlled and safe-use approach promoted by numerous producing and user countries, and to say a few words about the international and national instruments and practices supporting the controlled-use approach to chrysotile.

Canada was one of the key driving forces behind the development of the International Labour Organization (ILO) Convention 162 Concerning Safety in the Use of Asbestos. Among the more salient provisions of the Convention are Article 11 (requires the use of crocidolite and products containing that fibre to be prohibited) and Article 12 (requires spraying of all forms of asbestos to be prohibited). Articles 14, 15 and 17 are particularly important in implementing the safe and controlled use of chrysotile and its manufactured products.

Canada encourages and supports efforts by countries to ratify and/or implement Convention 162, while recognizing the need for countries to act in accordance with national circumstances and priorities. Convention 162 (1986) is supplemented by another formal ILO instrument, ILO Recommendation 172, which is intended to guide government action in implementing the Convention.

Legal, financial, political, or other barriers may preclude ratification of an ILO convention by a country. It is appropriate to look beyond whether or not a country has ratified Convention 162 and to consider national policies and practices before reaching any conclusion about its ability to manage risks associated with chrysotile. An example is India, which produces close to 2 Mt of chrysotile cement products annually. Recognizing the difference between various "asbestos" fibres, India banned the use of crocidolite in the early 1990s and finalized a policy on the manufacturing of chrysotile-based products in March 2003. Manual handling and opening of chrysotile fibre bags will be eliminated and replaced by fully automatic debagging systems. The policy limits airborne fibre concentrations in plants to 0.5 fibres per cubic centimetre, while atmospheric fibre emissions are limited to 0.2 fibres per cubic centimetre. In short, although India has not ratified Convention 162, its national policy recognizes the value of chrysotile products and it is implementing best practices to control risks.

The controlled and safe-use approach, implemented and advocated by Canada, is aimed at reducing the risks associated with chrysotile mining, milling, product manufacturing, transportation, handling, and disposal activities to safe levels, i.e., this means below levels where it is possible to detect the incidence of chrysotile-related diseases.

The controlled and safe-use approach is implemented through the enforcement of regulations to rigorously keep exposure levels low, compliance with ILO Convention 162,

the implementation of ILO Recommendation 172 (1986), and the voluntary actions of all major exporters and importers.

Crystalline silica is a good example to demonstrate that even substances classified as Group 1 carcinogens by the IARC can be managed, and are effectively managed, to societally acceptable risk levels. Standard industrial working-environment technology controls have allowed European Union (EU) members to successfully address the challenge of protecting the health and safety of more than two million workers from exposure to respirable crystalline silica. The Agreement on Workers' Health Protection Through the Good Handling and Use of Crystalline Silica and Products Containing It came into force on October 25, 2006. This first multi-sectoral "European social dialogue agreement" is aimed at improving the protection of EU workers from exposure to respirable crystalline silica and enhancing compliance with the European Union and EU member states' existing workers' health and safety legislation. The initiative was supported by the European Commission.

WORLD PRODUCTION

Global Trends

It is assumed that world production and consumption of chrysotile in 2006 remained essentially the same as in 2005. It should be noted, however, that the rising trend observed since 2003 was expected to continue in 2006. However, for various reasons, a good number of chrysotile production and use data are estimates and this apparent trend could not be confirmed in 2006. In Canada, production decreased by an estimated 5% from 2005. The table below provides production data recorded over the last three years for which information was available.

**CHRYSTILE, WORLD PRODUCTION
BY COUNTRY, 2004-06**

Country (1)	2004	2005	2006
	(tonnes)		
Brazil	243 000	220 000	(e) 230 000
Canada	220 000	(e) 185 000	(e) 175 000
China	400 000	400 000	(e) 350 000
Colombia (2)	(r) 5 000	10 000	10 000
India	(r) 5 000	—	—
Kazakhstan	202 000	225 000	(e) 241 000
Russia	(r) 912 000	1 045 000	(e) 1 120 000
South Africa	6 000	—	—
Zimbabwe	(e,3) 107 000	115 000	(e) 110 000
Total	2 100 000	2 200 000	(e) 2 236 000

Sources: Natural Resources Canada; U.S. Geological Survey.

— Nil; (e) Estimated; (r) Revised.

(1) In addition to the countries listed, five other countries also produce chrysotile, but output is either not reported or the tonnage is below 5000 t. (2) Previous data reported in terms of crude ore. For 2005, data are reported in tonnes of fibres. (3) Production problems have reduced the planned output of 150 000 t by about 29%.

Brazil

In 2006, Brazilian production was estimated to be essentially unchanged from 2005. Brazil has become the fourth largest chrysotile producer after Russia, China, and Kazakhstan. It ranked third in 2004. It is estimated that Brazil exported close to 90 000 t of chrysotile in 2006, representing nearly 41% of its total production.

Canada

Canada's chrysotile production is estimated since there are only two producers and data are kept confidential. Production for 2006 is estimated at 175 000 t, a slight decrease from 2005. Total chrysotile fibre exports were 161 000 t, or 92% of total estimated production. Exports of manufactured goods containing chrysotile totaled \$30 million, of which 83% went to the United States. The total export value (fibres and manufactured products) was \$112 million. The total value of imported manufactured goods containing chrysotile was \$57 million and the value of manufactured goods containing chrysotile, cellulose, or other fibres was \$54 million, for a total of \$111 million.

Canadian chrysotile production is concentrated in Quebec's Eastern Townships and is derived from three mining operations: the Bell and Lac d'amiante mines owned by LAB Chrysotile and the Jeffrey mine operated by Jeffrey Mine Inc. LAB Chrysotile, Inc. continues to alternate between an underground mine and an open-pit operation. Canada was ranked the world's fifth largest producer of chrysotile, based on its estimated 2006 output, down one rank compared to 2004.

China

Chrysotile is produced in about 50 areas of China, mostly in the western part of the country. The most important chrysotile-producing areas are Qinghai, Sichuan, Shanxi, and Xinjiang, in decreasing order of importance. It is estimated that China produced 350 000 t in 2006 and that it will produce the same amount in 2007. While China can produce enough short fibres for its domestic market, it cannot produce enough long chrysotile fibres to meet its internal demand, which is increasing fairly rapidly; imports of these fibres are required and are predominantly from C.I.S. countries. An estimated 200 000 t were imported in 2006, which matches the 2005 level.

Commonwealth of Independent States (C.I.S.)

The C.I.S. produced 1.28 Mt of chrysotile in 2006, i.e., 1.05 Mt in Russia and 0.23 Mt in Kazakhstan. Russian production comes from JSC Uralasbest and JSC Orenburg-asbest. It is estimated that C.I.S. domestic use amounted to approximately 700 000 t in 2006, while exports were estimated at 580 000 t, or approximately 45% of total production.

Zimbabwe

In 2006, production in Zimbabwe was estimated at 115 000 t, which was unchanged from 2005 but represented a 7.5% increase over 2004 production (107 000 t). For 2006, it is estimated that approximately 20 000 t were for domestic consumption and the rest (95 000 t) was exported.

WORLD CONSUMPTION

In 2006, at least 22 countries were importing more than 1500 t from Canada, and Canada exported chrysotile fibres and/or manufactured products to at least 70 different countries. This represents about 40% of all the countries recognized by the United Nations. Even countries that have heavily legislated the use of chrysotile-based products and fibres still use specialty products for which no suitable substitutes exist. The three largest chrysotile-producing countries consume a relatively large percentage of their production domestically.

It is estimated that, in 2006, the C.I.S. consumed nearly 50% of its production.

Total demand for chrysotile fibres in China is estimated to have increased by at least 10% in 2006 compared to 2005 because of the tremendous economic development in this country. The manufacture of chrysotile-cement products accounts for 50% of China's consumption of chrysotile fibres, while friction materials and other specialty products account for the remainder. As mentioned above, China had to import about 200 000 t of long chrysotile fibres to meet its domestic needs in 2006. The demand for chrysotile is expected to increase at a conservative rate of 7% annually for the foreseeable future. However, this increase seems to be dependent on the safe use of the substance and on the population's understanding that chrysotile can and must be used safely.

In 2006, the Brazilian domestic market consumed an estimated 134 000 t, representing an increase of 7% over 2005. Brazil's consumption of chrysotile-based products is expected to continue to increase by 7% annually, a rate comparable with that of other emerging countries.

Canada exports about 92% of its total production of fibres. It has fewer immediate needs in terms of water, sewage, and building infrastructure than emerging countries, which is why most of its production is exported, primarily to emerging countries. However, as can be seen in the table on the next page, the per capita consumption of chrysotile fibres in Canada is the same as or higher than in India, Indonesia, and Mexico, and is comparable to per capita consumption in China, Vietnam, and South Korea. Canada's leading foreign markets are Asian countries, which account for more than 77% of its total exports. Notwithstanding the importance of the Asian market for Canada, the tonnage of Canadian chrysotile fibres exported to this market represents only about 10% of this market's total consumption.

PER CAPITA CONSUMPTION FOR MAJOR PRODUCERS AND USERS OF CHRYSTILE FIBRES AT A LEVEL OF 98%+ FOR CHRYSTILE-CEMENT AND FRICTION PRODUCTS, 2006

Country	2006	2006	Per Capita
	Production (1) (tonnes)	Apparent Use (2) (kilograms)	
China	350 000	(3) 650 000	0.5
Russia	1 120 000	(3) 540 000	4.0
India	..	(3) 205 000	0.2
Kazakhstan	241 000	(3) 182 000	12.6
Ukraine	..	160 000	3.2
Thailand	..	105 000	1.8
Iran	..	78 000	1.2
Brazil	230 000	(3) 125 000	0.7
Vietnam	..	40 000	0.5
Indonesia	..	31 000	0.1
South Korea	..	23 000	0.5
Mexico	..	20 000	0.2
Canada	175 000	60 000	0.2
Zimbabwe	110 000	..	..
South Africa	..	..	..
Colombia	10 000	..	..
Others	..	71 000	..
Total	2 236 000	2 236 000	..

.. Not available.

(1) Source: Natural Resources Canada (NRCAN). (2) Sources: U.S. Geological Survey plus NRCAN for 2005. (3) Use is estimated for 2006 based on actual production in 2006 and the increase or decrease planned for the identified countries.

Canada is a net exporter of chrysotile fibres, but is a net importer of manufactured products. In 2006, Canada imported manufactured products valued at \$111 million from more than 40 countries, unchanged from 2005. Aside from compressed chrysotile fibres, Canada imports mainly friction materials, tubes and pipes, corrugated sheets and panels, paper, millboard, clothing, and other chrysotile-based materials.

Because emerging countries in particular require new or modified infrastructure, they are the main consumers of chrysotile fibres, and chrysotile-cement products are the most efficient products for this purpose. While more than 93% of the chrysotile used in the world is for chrysotile-reinforced cement products, chrysotile fibres make up only a small percentage of the total content of the finished products (between 8% and 10%). Therefore, it is more cost-effective to manufacture these products near the end-user countries where such manufacturing also provides much needed employment.

ENVIRONMENTAL AND NATIONAL REGULATORY INITIATIVES FOR THE SAFE AND CONTROLLED USE OF CHRYSTILE

Canada follows a controlled-use approach to chrysotile, strictly controlling exposure through federal, provincial and territorial workplace exposure limits and regulating some

categories of consumer and workplace products and practices under the *Hazardous Products Act*. All federal, provincial and territorial regulations comply with ILO Convention 162 Concerning Safety in the Use of Asbestos. Since there have been numerous peer-reviewed scientific studies on “asbestos” and chrysotile since the publication of the *Report of the Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario* (ORCA Report) in 1984, Canada is considering updating its own risk assessment of “asbestos” and chrysotile in 2007. Among the most recent authoritative studies, the following are considered the most comprehensive: a) reviews done by the U.S. Environmental Protection Agency (EPA) and the United Kingdom’s Health and Safety Executive; b) the *Report on the Peer Consultation Workshop to Discuss a Proposed Protocol to Assess Asbestos-Related Risk*, U.S. EPA, 2003; c) *The Quantitative Risks of Mesothelioma and Lung Cancer in Relation to Asbestos Exposure*, Hodgson and Darnton, 2000; and d) *The Biopersistence of Canadian Chrysotile Asbestos Following Inhalation: Final Results Through One-Year After Cessation of Exposure*, D.M. Bernstein *et al.*, 2005.

At the time of writing, no regulations were pending in the United States regarding the manufacture or use of “asbestos” and products containing “asbestos.” However, as is the case in Canada, certain products containing asbestos are prohibited in the United States since the EPA so decided in 1989. These banned products are corrugated paper, roll-board, commercial paper, flooring felt, and specialty paper.

The U.S. EPA has regulated “asbestos” since the early 1970s without regard to fibre type. In 2001, the EPA started the process of reviewing the most recent science on “asbestos” as part of its Integrated Risk Information System. Three workshops and panels of experts were convened in the past two years. The EPA’s current assessment of “asbestos” toxicity is based primarily on an “asbestos” assessment completed in 1986. However, the EPA acknowledges that, since 1986, there have been substantial improvements in “asbestos” measurement techniques and in the understanding of how “asbestos” exposure contributes to disease. In August 2006, the EPA announced that its Science Advisory Board would set up an Asbestos Expert Panel to provide technical advice in updating the risk assessment for “asbestos” and called for nominations. The proposed EPA’s review exercise would incorporate the knowledge gained over the last 17 years into its toxicity assessment for “asbestos.” The results of this initiative should be available in late 2007 or early 2008.

About two months ago, the U.S. Senate unanimously approved Bill S. 742, *Ban Asbestos in America Act of 2007*, introduced by Senator Murray. Senator Murray had previously introduced two similar bills in 2002 and 2003 that were defeated in committee. The next stage in the U.S. legislative process is to pass the bill in the House of Representatives. Normally, bills such as S. 742 must be considered by an appropriate committee and then approved by that committee and the House of Representatives before

they can be submitted for the President's signature and become law.

In Brazil, the federal government has the exclusive responsibility and authority to legislate over "asbestos" and chrysotile issues, and the status quo continues to apply with respect to the legislative powers of state governments versus the federal government.

China is a major producer and consumer of chrysotile fibres and chrysotile-based manufactured products. It is one of the top three countries in the world in terms of chrysotile reserves and is continuing to put more emphasis on improving mining conditions. It is adopting effective dust control measures and promoting the safe and rational use of chrysotile resources. Since August 2006, the chrysotile industry has been implementing a comprehensive plan for the safe use of chrysotile. As part of this plan, detailed reports are being sent to government departments and ongoing collaborative dialogue has been instituted. Chinese scientists have conducted interesting studies on the use of chrysotile in China, and the study reports have been submitted to departments and ministries under the comprehensive plan to maintain measures for the safe and controlled use of chrysotile and chrysotile-based products. In partnership with Canadian industry, Chinese industry is importing Canadian knowledge to ensure the quality and safety of its chrysotile processing plants.

In India, a major consumer of chrysotile and producer of chrysotile-based products, many improvements have been achieved and are ongoing in work practices and new regulations since the Ministry of Environment and Forests' policy on the manufacture of chrysotile-based products was finalized in March 2003. Under the new policy, the chrysotile-cement industry, in collaboration with the regulatory agency, is working to improve working conditions by eliminating the manual handling and opening of chrysotile fibre bags; fully automatic debagging systems are currently being implemented throughout the manufacturing process.

In Indonesia, the Directorate of Occupational Safety and Health (OSH) Norm Supervision, the Directorate General of Manpower Supervision Development, and the Ministry of Manpower and Transmigration of the Republic of Indonesia, in collaboration with the Fibre Cement Manufacturers Association Ltd., have developed and just launched a technical guide on occupational safety and health in the use of materials containing asbestos.

The purpose of this guide is to ensure the implementation of occupational health and safety standards and to provide optimum protection to workers from raw material procurement and storage through to product manufacturing and waste management. The guide was developed following numerous consultations and discussions with experts, field observations, and a study based on the ILO code of good practice regarding occupational safety and health in "asbestos" use.

In Pakistan, the government, recognizing the important needs of its population and the value of chryso-based products, decided in 1999 to differentiate between amphibole asbestos and chrysotile fibres. As a result, only chrysotile fibres can be imported to Pakistan, effectively banning amphibole asbestos fibres. Many other countries have made the same decision. The Government of Pakistan also advocates the adoption of measures for the safe use of high-density chrysotile products.

In Latin America, Peru, Colombia and Venezuela also recognize that chrysotile can be used safely under controlled conditions, and they are working in close collaboration with Canada, Mexico, Brazil, and other countries to facilitate the implementation of the controlled-use approach inspired by ILO Convention 162 and Recommendation 172.

INTERNATIONAL CONVENTIONS AND ORGANIZATIONS – POSITIONING AND INITIATIVES REGARDING CHRYSOTILE USE

In October 2006, at the third Conference of the Parties to the Rotterdam Convention in Geneva, a proposal was put forward to add chrysotile to the list of substances subject to the Prior Informed Consent (PIC) procedure. During the debates concerning the proposal, Canada was the first country to register its views. Canada opposed the PIC procedure listing of chrysotile under the Convention. Other countries were also opposed to the listing. In the Conference of the Parties process, decisions are made on the basis of consensus. Notwithstanding its position, Canada participated in a working group tasked by the President of the Conference with reviewing key issues related to the proposed addition of chrysotile to the list of substances subject to the PIC procedure. Canada then joined all other Parties in agreeing to defer consideration of the listing of chrysotile until the fourth Conference of the Parties in October 2008.

India, a major consumer of chrysotile fibres, strongly opposed the addition of chrysotile to the list of substances subject to the PIC procedure at the third Conference of the Parties. India stated that the epidemiological studies cited by the European Union, Chile, and Australia in drafting the Decision Guidance Document in support of the submission for listing chrysotile all pertained to the use of mixed fibres consisting predominantly of amphibole varieties. India claimed that numerous other epidemiological studies concluded that chrysotile fibres alone, used in the manufacturing of chryso-cement products, did not substantially increase the incidence of lung cancer. It was further mentioned that in India, crocidolite, which caused most of the lung-related diseases in the western part of the country, has been banned since 1994.

At the 95th session of the International Labour Conference held in 2006, a resolution that was not part of the agenda was introduced by the workers' group. The resolution called for the prohibition and elimination of the use of all forms of "asbestos," including chrysotile. The Government of Canada did not support the resolution adopted by the International Labour Conference calling for elimination of the use of "asbestos." Canada did not agree with the process used to bring the resolution by the workers' group, but rather agreed with the views expressed by the employers' group and a number of other countries that the Conference Committee was not the appropriate forum to discuss this complex issue.

Canada did not support and does not consider itself bound by the International Labour Conference's decision because the process used to adopt the resolution was unacceptable. Canada stated that there are controlled and safe ways of producing and using chrysotile.

In July 2006, the Occupational and Environmental Health Division of the World Health Organization (WHO) issued an information paper on the elimination of asbestos-related diseases. Since then, the information paper has been posted on the WHO web site as an official WHO document.

It is unfortunate to note that the document is in total disagreement with the most recently published scientific evidence. One of the main gaps in the aforementioned information paper is the lack of recognition of the difference in potency between chrysotile fibres and amphibole fibres. Current international scientific literature shows that there is a vast difference in pathogenic potential between chrysotile fibres and amphibole fibres. Recently published evidence from epidemiological studies (Hogson and Darnton, 2000) and toxicological experimentation (Bernstein *et al.*, 2006) support this view, yet there is no mention of this fundamental point in the draft policy paper.

There are numerous peer-reviewed studies indicating that below some low exposure levels to chrysotile, there is no demonstrated increased risk to health in the general population and in the workplace. The aforementioned information paper does not refer to these studies and concludes that there is no safe threshold level of exposure to "asbestos."

Finally, there is no mention in that paper of the risk associated with the use of modern chrysotile-based products, such as chrysotile-cement, friction materials, and other specialty materials. Yet, recent analyses have been published on the absence of demonstrable risk from chrysotile use in controlled conditions (Paustenbach *et al.*, 2004).

Many international governments and scientists have expressed concerns about the WHO's information paper. While the elimination of asbestos-related diseases is an excellent objective, the recommendations proposed by the Occupational and Environmental Health Division of the WHO are not justifiable and do not have enough basis in

fact to pass the test of objectivity required from such a credible organization.

It is important to note that the WHO's *Environmental Health Criteria 203: Chrysotile Asbestos*, Geneva, 1998, is now outdated and needs to be revisited in the context of the most recent scientific literature, which has shed new and more realistic light on the modern uses of chrysotile.

Although this review focuses on the events of 2006, it is nevertheless important to mention the document entitled *Workers' Health: Global Plan of Action*, presented at the 60th World Health Assembly held May 23, 2007, which states that the "WHO will work with Member States to strengthen the capacities of the ministries of health to provide leadership for activities related to workers' health, to formulate and implement policies and action plans, and to stimulate intersectoral collaboration. Its activities will include global campaigns for elimination of asbestos-related diseases – **bearing in mind a differentiated approach to regulating its various forms** – in line with relevant international legal instruments and the latest evidence for effective interventions." Therefore, the WHO recognizes that not all forms of "asbestos" can be regulated in the same way.

Albeit tentative, this approach does recognize a difference in the hazard levels between chrysotile and amphibole fibres. It also recognizes the difference in the hazard levels between modern use of chrysotile fibre-based products and past use of products or practices that were either amphibole-based or mixes of amphibole and other fibres for which the risks are still being managed today.

It should be noted that Canada has always been one of the first countries to recognize and strive to eliminate occupational diseases, particularly those related to prior conditions and practices.

OUTLOOK

It is unfortunate that supporters of the movement to ban all forms of "asbestos," which include worker groups with vested interests and, unfortunately, some governments and global organizations, have decided to ignore the facts about chrysotile and refuse to recognize the differences, both physical and chemical, between amphibole asbestos and chrysotile, and the differences between past problems and modern realities.

Such campaigns will probably have some impact on the global use of chrysotile, but are unlikely to change the present trend toward increased production and use of chrysotile fibres and chrysotile-based products. Increases of at least 7% are not uncommon in many countries that use chrysotile and its derived products. In China where chrysotile fibres are both produced and exported, consumption is keeping pace with or exceeding the growth rate of the global Chinese economy.

On the strength of more than 100 years of experience in the chrysotile sector and following many struggles, including major labour strikes in 1949 and 1975, Canadian chrysotile workers benefit from working conditions that do not endanger their lives. Moreover, all the major producers and users of chrysotile have adopted similar working conditions and implemented regulations that comply with ILO Recommendation 172 and Convention 162 Concerning Safety in the Use of Asbestos.

While neither Canada nor any other chrysotile-producing country has the legal authority to monitor chrysotile exposure in other countries, Canadian chrysotile producers have agreed not to export to companies that do not use chrysotile in a manner that is consistent with Canada's safe and controlled-use approach. While such agreements have limitations, they are a valuable component of a comprehensive approach. Canada and many other countries use similar agreements to enlist the cooperation of industries in preventing misuse of many substances, including weapons precursors, explosives precursors, and drug precursors, within a broader framework that may include international agreements, domestic legislation, regulations, or other elements.

The Chrysotile Institute of Canada is helping to build capacity and expertise in chrysotile user countries to better ensure safe use. To that end, the Institute periodically collects data from industry on a range of workplace exposures in chrysotile-producing and using countries. As a result of all of these initiatives, other major exporters of chrysotile have joined Canada in efforts to encourage safe handling practices through the ILO, the Institute, and agreements with other governments and with industry. Very few other, if any, hazardous substances have received so much care and attention. This ongoing cooperative effort began well before the concept of Prior Informed Consent emerged.

The possible addition of chrysotile to the list of substances subject to the PIC procedure could change the future for chrysotile and chrysotile-based products. Several countries consider that such a listing would send a global signal that chrysotile must be severely regulated or banned outright if it is listed among substances for which there is little scope for safe use. Yet the fact remains that chrysotile can be used safely under controlled conditions.

Emerging countries that need to develop their housing, water supply, and sewage infrastructure rely on chrysotile-cement products since these are the most cost-effective and durable products available. Substitute products cannot achieve the same value for money in addressing particular physical conditions of use, as in the case of water supply and water sewage piping.

The main chrysotile producers are likely to remain the same. Canada, now the fifth world producer, is being confronted with relatively high production and transportation costs, as well as fierce competition that is keeping global

prices down. However, it is expected to remain an important player since the price structure of chrysotile and chrysotile-based products is progressively adjusting itself to demand and to production costs.

Asian countries, particularly India and China, will continue to increase their consumption of chrysotile in response to their pressing infrastructure needs and growing industrial development.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Data used are from December 2006. Other information such as on international events is more current. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States		EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)		WTO (2)
2524.00.10	Asbestos: crude	Free	Free	Free	Free	Free		Free
2524.00.90	Asbestos: other	Free	Free	Free	Free	Free		Free
68.11	Articles of asbestos-cement, of cellulose fibre-cement or the like							
6811.10	Corrugated sheets	5%	Free	Free	Free	1.7%		2.6%
6811.20	Other sheets, panels, tiles and similar articles	5%	Free	Free	Free	1.7%		2.6%
6811.30	Tubes, pipes, and tube or pipe fittings	5%	Free	Free	Free	1.7%		2.6%
6811.90	Other articles	5%	Free	Free	Free	1.7%		2.6%
68.12	Fabricated asbestos fibres; mixtures with a basis of asbestos or with a basis of asbestos and magnesium carbonate; articles of such mixtures or of asbestos							
6812.50	Clothing, clothing accessories, footwear and headgear	15.5%	Free	Free	Free-8.3%	3.7%		2.6%
6812.60	Paper, millboard and felt	Free	Free	Free	Free	3.7%		2.6%
6812.70	Compressed asbestos fibre jointing, in sheets or rolls	Free	Free	Free	Free	3.7%		2.6%
6812.90	Other	Free	Free	Free	Free	1.7-3.7%		2.6%
68.13	Friction material and articles thereof, not mounted, for brakes, for clutches of the like with a basis of asbestos, of other mineral substances or of cellulose, whether or not combined with textile or other materials							
6813.10	Brake linings and pads	5-7%	Free-5%	Free	Free	2.7%		Free-2.3%
6813.90.00	Other	Free	Free	Free	Free	2.7%		Free-2.3%

Sources: Canadian *Customs Tariff*, effective January 2006; Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2006; *Official Journal of the European Union* (October 27, 2005 Edition); *Customs Tariff Schedules of Japan*, 2006.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, CHRYSOTILE (ASBESTOS) PRODUCTION AND TRADE, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS							
2524.00.10	Crude asbestos						
	India	9 041	3 200	11 899	3 766	16 837	4 754
	United States	254	64	288	69	200	44
	Total	9 295	3 264	12 187	3 835	17 037	4 798
2524.00.21	Asbestos milled fibres, group 3 grades						
	Pakistan	2 424	1 550	3 711	2 373	3 563	2 366
	Mexico	1 102	1 431	933	1 209	1 709	1 611
	United Arab Emirates	1 743	2 265	726	943	471	612
	China	810	262	150	201	250	337
	India	3 435	2 834	206	268	204	266
	Peru	288	374	204	266	88	116
	Other countries	233	287	237	290	129	129
	Total	10 035	9 003	6 167	5 550	6 414	5 437
2524.00.22	Asbestos milled fibres, groups 4 and 5 grades						
	India	36 470	24 908	30 200	19 872	24 872	16 425
	Algeria	1 410	1 315	1 910	1 770	4 920	4 582
	Sri Lanka	5 142	4 459	5 162	4 562	4 502	3 749
	Indonesia	12 803	5 630	16 907	7 429	9 035	3 443
	Thailand	20 573	9 232	17 523	8 355	8 050	3 409
	Mexico	1 768	1 120	2 695	1 966	3 055	2 372
	Brazil	2 880	2 057	2 220	1 796	2 206	1 568
	United Arab Emirates	2 200	2 176	1 732	1 655	1 652	1 547

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
	Bangladesh	1 600	774	2 600	1 097	2 560	1 112
	Colombia	995	841	1 354	1 199	1 184	1 094
	El Salvador	720	601	714	594	1 250	1 002
	Malaysia	3 326	2 152	2 704	1 601	1 534	938
	Pakistan	4 360	3 246	1 740	1 544	1 344	864
	Philippines	2 558	1 393	1 080	585	1 620	790
	Senegal	467	448	638	612	648	621
	Turkey	575	403	550	522	500	614
	Ecuador	760	756	424	380	594	482
	Morocco	346	242	283	197	542	381
	Vietnam	272	295	1 018	421	800	367
	Angola	502	413	524	420	360	330
	Singapore	—	—	—	—	801	258
	Peru	380	219	372	200	386	199
	Tunisia	—	—	—	—	160	196
	Other countries	7 711	5 491	2 902	2 546	665	480
	Total	107 818	68 171	95 252	59 323	73 240	46 823
2524.00.29	Asbestos shorts, groups 6, 7, 8 and 9 grades						
	India	15 125	6 043	16 029	6 423	22 067	10 484
	Thailand	5 152	2 184	10 120	4 557	9 225	4 309
	Colombia	4 064	1 460	4 690	1 744	5 642	1 902
	Indonesia	4 544	1 429	3 954	1 160	3 811	1 404
	South Korea	12 197	4 646	5 783	1 634	4 059	1 138
	Taiwan	2 179	793	2 296	795	2 418	978
	Sri Lanka	1 860	930	918	473	1 448	728
	United States	1 968	594	1 927	860	1 776	655
	Mexico	2 399	648	2 064	711	2 462	630
	Algeria	410	193	270	127	1 080	508
	Malaysia	2 970	975	1 748	630	1 282	436
	Senegal	740	300	914	370	952	386
	Venezuela	2 012	667	1 816	623	1 197	372
	Philippines	452	194	400	151	738	331
	United Arab Emirates	508	218	1 428	686	546	261
	China	2 774	469	2 244	383	1 094	217
	El Salvador	240	125	232	121	400	208
	Iran	800	120	4 400	1 351	1 575	185
	Other countries	5 894	2 380	3 170	1 096	2 039	684
	Total	66 288	24 368	64 403	23 895	63 811	25 816
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6811.10	Corrugated sheets of asbestos-cement, of cellulose fibre-cement, or the like						
	United States	..	10	..	5	..	50
	Saint Pierre and Miquelon	..	3	—	—	—	—
	Total	..	13	..	5	..	50
6811.20	Sheets n.e.s., panels/tiles, etc., of abestos-cement, cellulose fibre-cement, etc.						
	United States	..	10 483	..	10 055	..	10 889
	Cuba	..	62	..	313	..	698
	Bermuda	—	—	..	34	..	127
	Other countries	..	102	..	183	..	51
	Total	..	10 647	..	10 585	..	11 765
6811.30	Tubes, pipes, and tube or pipe fittings of abestos-cement, of cellulose fibre-cement, etc.						
	Bahamas	—	—	—	—	..	273
	Cuba	—	—	—	—	..	1
	Other countries	..	...	..	17	—	—
	Total	..	...	..	17	..	274

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
EXPORTS (cont'd)							
6811.90	Articles n.e.s. of asbestos-cement, of cellulose fibre-cement, or the like						
	United States	..	91	..	115	..	105
	Fiji	—	—	—	—	..	16
	Costa Rica	—	—	—	—	..	1
	Other countries	..	28	..	10	—	—
	Total	..	119	..	125	..	122
6812.50	Asbestos clothing, clothing accessories, footwear and headgear						
	Dominican Republic	—	—	—	—	..	97
	Indonesia	—	—	—	—	..	13
	United Arab Emirates	—	—	..	10	..	10
	Cuba	—	—	—	—	..	4
	Other countries	..	113	..	119	..	...
	Total	..	113	..	129	..	124
6812.60	Asbestos paper, millboard and felt						
	Taiwan	—	—	—	—	..	26
	New Zealand	—	—	—	—	..	15
	Seychelles	—	—	—	—	..	10
	New Caledonia	..	1	—	—	..	8
	Bahamas	—	—	—	—	..	4
	Fiji	..	1	..	1	..	2
	Other countries	..	12	..	4	..	...
	Total	..	14	..	5	..	65
6812.70	Compressed asbestos fibre jointing, in sheets or rolls						
	United States	..	661	..	735	..	686
	Cuba	..	51	..	53	..	168
	Taiwan	—	—	—	—	..	12
	India	—	—	—	—	..	4
	Israel	—	—	—	—	..	4
	Other countries	..	16	..	...	..	...
	Total	..	728	..	788	..	874
6812.90.10	Asbestos building material, n.e.s.						
	Cuba	..	55	..	394	..	745
	Zimbabwe	—	—	—	—	..	330
	Qatar	—	—	..	56	..	263
	Russia	..	22	..	132	..	216
	Bermuda	..	101	..	817	..	143
	Japan	..	16	..	152	..	125
	Jamaica	..	1	—	—	..	79
	Other countries	..	779	..	1 721	..	227
	Total	..	974	..	3 272	..	2 128
6812.90.90	Other asbestos fabricated products, n.e.s.						
	Cuba	..	98	..	40	..	29
	United States	..	117	..	12	..	13
	Other countries	..	46	..	6	..	...
	Total	..	261	..	58	..	42
6813.10	Asbestos brake linings and pads						
	United States	..	48 244	..	14 731	..	12 717
	China	..	30	..	527	..	979
	New Zealand	..	189	..	163	..	104
	Italy	..	25	..	17	..	86

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
EXPORTS (cont'd)							
	Trinidad and Tobago	..	49	..	29	..	55
	Chile	..	19	—	—	..	22
	Jamaica	..	55	—	—	..	10
	Netherlands	..	4	..	9	..	9
	Other countries	..	305	..	204	..	31
	Total	..	48 920	..	15 680	..	14 013
6813.90	Asbestos friction material and articles, n.e.s.						
	United States	..	28	..	25	..	15
	Other countries	..	63	..	83	..	10
	Total	..	91	..	108	..	25
	Total exports	..	166 686	..	123 375	..	112 356
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS							
2524.00.00.10	Crude asbestos						
	Belgium	—	—	...	...	—	—
2524.00.00.90	Other asbestos						
	South Africa	—	—	—	—	37	36
	United States	3	3	—	—	7	7
	Other countries	114	81	121	116	—	—
	Total	117	84	121	116	44	43
6811.10	Corrugated sheets of asbestos-cement, of cellulose fibre-cement, or the like						
	United States	1	1	203	238	260	327
	France	—	—	2	2	—	—
	Total	1	1	205	240	260	327
6811.20	Sheets n.e.s., panels/tiles, etc., of asbestos-cement, cellulose-fibre cement, etc.						
	United States	44 082	30 954	58 555	40 880	64 634	48 733
	Mexico	1 905	1 000	1 473	634	2 300	1 263
	Japan	142	170	167	227	437	627
	Switzerland	8	95	153	130	177	313
	Other countries	2 007	2 192	1 978	1 336	213	238
	Total	48 144	34 411	62 326	43 207	67 761	51 174
6811.30	Tubes, pipes, and tube or pipe fittings of asbestos-cement, cellulose fibre-cement, etc.						
	Mexico	370	356	311	332	534	389
	Pakistan	1 067	462	317	147	482	209
	Other countries	2	4	1	2	1	3
	Total	1 439	822	629	481	1 017	601
6811.90	Articles n.e.s., of asbestos-cement, cellulose fibre-cement or the like						
	China	11	32	21	56	165	1 173
	United States	177	600	212	689	106	472
	Denmark	115	155	53	114	55	174
	Other countries	49	167	47	51	4	37
	Total	352	954	333	910	330	1 856
6812.50	Asbestos clothing, clothing accessories, footwear and headgear						
	China	6	150	5	121	6	138
	United States	...	6	...	8	1	39
	Denmark	—	—	...	7	...	6
	Other countries	4	59	...	11	...	...
	Total	10	215	5	147	7	183

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
IMPORTS (cont'd)							
6812.60	Asbestos paper, millboard and felt						
	United States	..	173	..	470	..	582
	United Kingdom	..	5	..	1	..	2
	Other countries	..	41	..	6	..	...
	Total	..	219	..	477	..	584
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
6812.70	Compressed asbestos fibre jointing, in sheets or rolls						
	Brazil	13	244	13	216	16	229
	Slovenia	...	5	...	2	1	36
	United States	21	454	1	10	2	20
	South Korea	1	19	1	30	1	19
	China	...	2	1	10	1	11
	Other countries	1	37	3	78	...	14
	Total	36	761	19	346	21	329
6812.90.00.10	Asbestos belting						
	United States	531	1 433	408	613	313	577
	Japan	186	237	115	224	77	205
	Germany	32	117	43	108	13	47
	Sweden	...	...	...	...	7	21
	United Kingdom	8	46	2	5	5	11
	Other countries	8	30	32	82	4	16
	Total	765	1 863	600	1 032	419	877
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6812.90.00.90	Other asbestos fabricated products, n.e.s.						
	United States	..	39	..	39	..	49
	China	..	10	..	38	..	37
	Brazil	..	2	..	...	..	9
	Germany	..	1	..	2	..	5
	Taiwan	..	14	..	3	..	4
	United Kingdom	..	...	..	2	..	2
	India	-	-	..	1	..	2
	Other countries	..	21	..	3	..	...
	Total	..	87	..	88	..	108
6813.10	Asbestos brake linings and pads						
	United States	..	43 000	..	33 007	..	28 745
	Brazil	..	15 711	..	14 514	..	6 713
	China	..	3 841	..	3 446	..	6 117
	Japan	..	3 566	..	3 437	..	3 691
	Germany	..	925	..	790	..	997
	South Korea	..	364	..	508	..	741
	Mexico	..	794	..	670	..	599
	Chile	..	331	..	328	..	438
	Colombia	..	612	..	642	..	411
	United Kingdom	..	705	..	657	..	380
	India	..	212	..	303	..	341
	Italy	..	40	..	63	..	214
	Hungary	..	179	..	336	..	124
	Other countries	..	2 003	..	860	..	465
	Total	..	72 283	..	59 561	..	49 976
6813.90	Asbestos friction material and articles, n.e.s.						
	United States	..	4 297	..	4 316	..	4 426
	China	..	140	..	154	..	160
	United Kingdom	..	54	..	73	..	101
	Germany	..	49	..	25	..	95
	Mexico	..	20	..	22	..	39

TABLE 1 (cont'd)

	2004		2005		2006 (p)	
	(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
IMPORTS (cont'd)						
Japan	..	31	..	39	..	37
France	..	4	..	12	..	36
Italy	..	50	..	49	..	29
Chile	..	2	..	31	..	25
Sweden	..	13	..	10	..	24
Taiwan	..	15	..	11	..	10
Other countries	..	95	..	91	..	40
Total	..	4 770	..	4 833	..	5 022
Total imports	..	116 470	..	111 438	..	111 080

Sources: Natural Resources Canada; Statistics Canada.

– Nil; .. Not available; ... Amount too small to be expressed; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADIAN CHRYSOTILE PRODUCERS, 2006

TABLE 2. CANADIAN CHRYSOTILE PRODUCERS, 2003				
Producer	Mine Location	Normal Mill Capacity		Remarks
		Ore/Day	Fibres/Year	
(tonnes)				
LAB CHRYSOTILE, INC. (1)		Hundred percent (100%) owned by LAQ.		
Lac d'Amiante du Québec, Ltée (LAQ)	Black Lake, Que.	9 000	185 000	Open-pit. Since September 1989, LAQ has been owned by Jean Dupéré and successors, and Connell Bros. Company, Ltd. of the United States.
Bell Asbestos Mines, Ltd.	Thetford Mines, Que.	2 700	100 000	Owned by Mazarin Mining Exploration Inc. since 1992. Operated in 2006 by Lab Chrysotile, Inc.
JEFFREY MINE INC.		Partnership owned 65% by Fibre Forte du Québec Inc. and 35% by Cooperative des Travailleurs JM Asbestos Inc.		
Jeffrey Mine	Asbestos, Que.	15 000	250 000	Open-pit (effective capacity reduced by 75% since 2002 until the projected underground mine is completed).
Total of three producers at year-end		26 700	535 000	

Sources: Natural Resources Canada; The Chrysotile Institute; U.S. Geological Survey; South Africa Department of Minerals and Energy.

(1) A partnership involving two operating companies. Lab Chrysotile, Inc. became Lab Chrysotile in 2007.

Note: For the purpose of this review and because of the time of writing it, it is assumed that, notwithstanding the fact that the split between LAQ and Mazarin occurred during the 2007 calendar year, LAB Chrysotile as such was an existing entity by itself in 2006 and was operating the Bell underground mine owned by Mazarin Mining Exploration Inc.

Clays

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The clays are a complex group that consists of several mineral commodities, each having different mineralogy, geological occurrence, mining/processing technology, and uses. They are fine-grained minerals of secondary origin and are composed of an alumina silicate structure with additional iron, alkalis and alkaline earth elements. Clay minerals are classified into two broad groups: **specialty clays**, which include attapulgite, bentonite, Fuller's earth, hectorite, montmorillonite, and sepiolite; and **kaolinitic clays**, which include ball clay, fire clay (refractory clay), stoneware clay, and kaolinite. These minerals rarely occur in a pure state and occur with gangue minerals (e.g., quartz, calcite, dolomite, feldspar, gypsum, and iron oxide), which may or may not be deleterious for ceramic applications. (Note: Palygorskite is the internationally recognized mineralogical term for attapulgite, the name more commonly used.)

Clay is an abundant raw material with a wide variety of uses and properties. The commercial value of a clay depends primarily on its physical properties, such as plasticity, strength, shrinkage, vitrification range, refractoriness, fired colour, porosity, and absorption. Many definitions state that a clay is plastic when wet. Most clay materials do have this property, but some clays are not plastic (e.g., halloysite and flint clay).

Also, it is the physical characteristics of clays, more so than the chemical and structural characteristics, that define this group:

- Clay minerals tend to form microscopic to sub-microscopic crystals.
- They can absorb or lose water from simple humidity changes.
- When mixed with limited amounts of water, clays become plastic and can be molded and formed, such as pottery.

- When water is absorbed, clays will often expand as the water fills the spaces between the stacked silicate layers.
- Due to the absorption of water, the specific gravity of clays is highly variable and is lowered with increased water content.
- The hardness of clays is difficult to determine due to the microscopic nature of the crystals, but actual hardness is usually between 2 and 3, and many clays give a hardness of 1 in field tests.
- Clays tend to form from weathering and secondary sedimentary processes with only a few examples of clays forming in primary igneous or metamorphic environments.
- Clays are rarely found separately and are usually mixed not only with other clays, but also with microscopic crystals of carbonates, feldspars, micas, and quartz.

Many changes have taken place in the clay industry in recent years as a result of technological advancements, changing economic conditions, new uses, shifts in demand, and increases in both domestic and export markets. The industry relies on various institutions for assistance in specific fields to meet those challenges. Mission Clay Products of San Antonio, Texas, provides laboratory analysis for fire clays in North America; the centre spécialisé en pâtes et papiers (CSPP) of Trois-Rivières, Quebec, provides clay analysis for paper-grade pulp clay minerals; the Clay Minerals Society of Aurora, Colorado, fosters research and disseminates information relating to all aspects of clay science and technology; and the Industrial Minerals Association – North America is a trade association created to advance the interests of North American companies that mine or process minerals used throughout the manufacturing and agricultural industries (e.g., ball clay, bentonite).

SUMMARY

The clay-based industries are of fundamental importance to all countries. The large-volume clay industries, besides the construction clays, are the kaolin and bentonite industries, although these large tonnages belie the variety of product specifications and special consumer-designed products that

are available as a result of research and development in close liaison with customer needs.

Overall world production (source: U.S. Geological Survey 2005 Review) of bentonite was approximately 11.7 Mt, Fuller's earth production was estimated to be 5.06 Mt, and kaolin production was 44.7 Mt in 2005. The United States continued to be the leading producer of all three varieties of clays. Canada, not being a world producer, is not represented in the USGS's world production review; only a brief reference appears about its imports of bentonite and kaolin from the United States.

Canada's preliminary 2006 figures indicate a shipment value of \$230.9 million (tonnage not available), exports of \$21.0 million (58 952 t), and imports of \$190.4 million (1.7 Mt).

Preliminary consumption for 2005 was 2.2 Mt for "other" clays, 752 247 t for kaolin, 293 219 t for bentonite, 27 055 t for fire clay, and 8215 t for ball clay, for a grand total of 3.3 Mt. Preliminary figures reported on the uses of clays by industry were only available up to 2005. Their specific markets (i.e., industry sectors) are identified in Table 3.

Although clays are present everywhere in Canada, not all types are evenly distributed. Clays are mined in all provinces with the exception of Prince Edward Island, New Brunswick, and Manitoba. No information on findings or exploration projects in the territories and/or Nunavut has yet been reported, although this should not be interpreted as a lack of existence.

The mining and processing of clays depend upon the type of clay. Kaolin production is a highly mechanized operation that requires conversion into clay-water slip or a slurry. The other clay types (e.g., bentonite, Fuller's earth, etc.) are stripped from the ground under controlled conditions to ensure quality control and are processed by simple milling techniques and de-watering to be dried and stockpiled.

U.S. prices on clays are provided in the text under the "Price" section. It should be understood that the prices provided serve only as a reference measure. Prices for actual transactions vary, not only according to the various types of clays, but also according to geographic region, and will take into account the quantity purchased, application, quality assurance, exact grade purchased, credit terms, and other parameters.

The short-term forecast from expert organizations (e.g., USGS 2005 Review; *Mineral Price Watch*, January 2007) seems to project that overall demand for both bentonite and Fuller's earth are destined to increase at a rate approximately equal to the growth in Gross Domestic Product (GDP). Similarly, demand for common clay is expected to keep pace with GDP and the demand for other clays is likely to fall short of this growth rate.

CONSUMPTION, PRODUCTION AND TRADE

The major uses/consumption of clays reported (Table 3) for Canada are: the "Other" clays at 2.2 Mt (with an estimated 51.5% used in the clay products and structural industry and 43.40% used by the cement [construction] industry); kaolin (China Clay) at 752 247 t (93.1% used in the pulp, paper and paper products industry); bentonite at 293 219 t (73.0% used in the iron ore pelletizing industry and 10.7% used by the foundry industry); fire clay at 27 055 t, of which the major uses are undisclosed; and ball clay at 8215 t (77.5% used by the clay products, ceramics and structural industries). Table 2 provides a representation of bentonite imports (tonnage and value) and consumption (tonnage only) from 1988 to 2006. With the exception of the "Other" clays category, which has sustained a slight decrease in demand, all other types of clays have seen their demand increase since the previous year (2004).

Canadian clay production in Table 1 provides a preliminary shipments value of almost \$230.9 million in 2006, down by 0.8% compared to the revised 2005 value of \$232.7 million.

In 2006, Canada exported 58 952 t of clay valued at almost \$21 million, an increase of 31 747 t (167%) from 2005. This increase is related to France and Germany having significantly increased their demand for the "Other" clays category from 2004. "Other" clays represent 92.4% of Canada's total exports while bentonite, kaolin, decolourizing earths and Fuller's earths, and fire clay represent 4.4%, 1.7%, 0.8% and 0.5% of total exports, respectively. Canada's major export destination has been the United States for kaolin, bentonite (Belgium in first position), and fire clay. Decolourizing earths and Fuller's earth were exported mainly to Belgium. With respect to the "Other" clays category, France, Germany, Belgium, and the United States are the core markets for exports.

Canada's overall 2006 imports of clays totaled over 1.7 Mt valued at \$190.4 million, a decrease of 29 041 t (1.6%) from 2005. The value of kaolin imports dominated in 2006 (55.4% of total imports valued at \$105.6 million), followed by bentonite (20.8%), activated clays (10.8%), "Other" clays (10.7%), decolourizing earths and Fuller's earth (1.4%), and fire clay (0.9%). Imports by tonnage provide a similar standing with kaolin leading (57.0% of total imports of almost 1.0 Mt), followed by bentonite (28.7%), "Other" clays (11.8%), activated clay (1.3%), fire clay (0.6%), and decolourizing earths and Fuller's earth (0.6%). The United States maintained its position as the major supplier of all clays imported into Canada, with the exception of Greece for activated clay (the United States was in second position).

CANADIAN CLAY DEPOSITS AND USES

Environmentally, certain types of clays are the materials of choice in protecting the local environment and ground in the construction and rehabilitation of landfill sites. Clay is used for the production of geosynthetic clay liners (GCLs), where it is sandwiched between two geosynthetic liners. In addition to acting as a containing barrier that protects aquifers, clay (especially bentonite) is used to clean contaminated water (the addition of bentonite in waste water results in the removal of suspended solids and adsorption of hazardous trace elements). The main purpose of a clay barrier is to retard the movement of fluids into the surrounding medium.

Common Clay and Shales

Common clay is sufficiently plastic to permit ready molding and vitrifies below 1100°C. Shale is a sedimentary rock composed chiefly of clay minerals that have been laminated and indurated while buried under other sediments. Suitable common clay and shales are used in the manufacture of structural clay products such as common brick, face brick, structural tile, partition tile, conduit tile, drain tile, lightweight aggregate, and portland cement.

Common clay and shale deposits are found in all parts of Canada: in Newfoundland and Labrador, shales occur near Corner Brook; in New Brunswick, shales occur at Havelock in Kings County and from a quarry at Chipman; in Nova Scotia, shales occur at Lantz in Hants County; in Quebec, shales occur near plants located in Laprairie, Beauport and Deschaillons; and in Ontario, glacial clays occur near Woodstock and St. Mary's, and shales occur near numerous plants located throughout the southeastern portion of the province. In western Canada, glacial shales and clays occur in each of the major provinces: in Manitoba, glacial clays and shales occur near Lake Agassiz; in Saskatchewan, glacial clays occur near Regina, Estevan, Rockglen, Flintoff, and Readlyn; and in British Columbia, there are several active deposits with the most important ones occurring at Sumas Mountain near Abbotsford.

Kaolin

Kaolin is a clay consisting of substantially pure kaolinite, or related clay minerals, that is naturally white or that can be beneficiated to be white. Kaolin has many industrial applications and new uses are still being developed. It is a unique industrial mineral because it is chemically inert over a relatively wide pH range, it is white and has good covering or hiding power when used as a pigment or extender, it is soft and non-abrasive and has a low conductivity of heat and electricity, and it costs less than most materials with which it competes. Kaolin is used primarily as a filler in the pulp and paper, plastic, paint, and rubber industries, and also in the manufacture of conventional ceramic products.

Kaolin is also used as a batch ingredient in the production of textile-type fibreglass and, to a lesser extent, in the preparation of medicinal products, food additives, bleaching agents, plaster, filter aids, cosmetics, detergents, paste, roofing granules, foundries, linoleum, and textiles.

Kaolin occurs in various provinces of eastern and central Canada, including Nova Scotia, New Brunswick, Quebec, and Ontario. Kaolin deposits are known in various areas of Quebec (in the counties of Papineau, Montmorency and Gatineau), but their small size and the presence of impurities have hindered their development. In Ontario, extensive deposits of a kaolinized sand mixture occur along the Missinaibi and Mattagami rivers southwest of James Bay in northern Ontario over an area of 10 000 km². An occurrence of Mesozoic clay also occurs at Limestone Rapids.

Kaolinitic clays occur at various locations in western Canada. In Manitoba, deposits are found on Deer Island, in the Cross Lake area to the north of Grand Rapids, in the Pine River area in the Swan River group, near Arborg, and in the Phanerozoic Sylvan strata; kaolinitic shales also occur in the Kergwenan area south of Sainte-Rose-du-Lac. The most important deposit is the quarry at Sainte-Rose-du-Lac. The kaolinitic clay resources of southern Saskatchewan occur as Whitemud deposits at Wood Mountain, Knollys, Cypress Hills, Moose Jaw, and as far east as Weyburn. The deposits of principal interest are the Wood Mountain area in south-central Saskatchewan and the Eastend-Shaunavon area along the Frenchman River in southwestern Saskatchewan. A low-grade kaolin and fire clay deposit occurs at Wabamun, Alberta, but further development is unlikely since previous mining of the fire clay has contaminated the kaolin. British Columbia hosts various kaolinitic deposits. The most important deposit occurs at Lang Bay in the southwestern portion of the province. Other deposits occur along the Fraser River near Prince George and, at Sumas Mountain, kaolinized basement rocks occur below the basal fire clay seam.

Ball Clay

Ball clay is a fine-grained mixture of 70% disordered kaolinite with illite, quartz, montmorillonite, chlorite, and minor amounts of carbonaceous material. In Canada, ball clay is mineralogically similar to high-grade, plastic fire clay and is composed principally of fine-sized kaolinite, quartz and mica. Ball clay is used mostly in the manufacture of pottery or whiteware, including domestic tableware, wall tiles, sanitaryware and electrical porcelain. Miscellaneous non-ceramic applications include uses as an animal feedstuff binder; a fertilizer anti-caking agent; a filler in rubber, plastics and adhesives; and in chemicals, petroleum refining, paint, and varnish.

Economic deposits of ball clay occur only in Saskatchewan in the Whitemud and Ravenscrag geological formations.

Fire Clay (Refractory Clay)

Refractory clay, also known as fire clay, is a detrital clay composed mainly of kaolinite with a high content of alumina and silica. These clays may range in plastic varieties such as flint clay. Fire clay is used in the manufacture of products requiring high resistance to heat such as fire brick, insulating brick, and refractory mortar.

A variety of good-quality fire clay grades occur in several provinces of Canada. Fire clay deposits occur in the Musquodoboit Valley and at Shubenacadie in Nova Scotia. Multi-coloured fire clay also occurs in the James Bay lowlands of northern Ontario along the Missinaibi, Abitibi, Moose and Mattagami rivers. Fire clay deposits occur in western Canada in Whitemud formations in southern Saskatchewan and on Sumas Mountain in British Columbia. A number of brown or dark-grey mud stone and clay-stone beds have also been reported in the Lang Bay area in British Columbia.

Stoneware Clays

Stoneware clays are intermediary between low-grade common clays and the high-grade kaolinitic clays. They are typically a mixture of kaolinitic and micaceous clay minerals. Stoneware clays are used exclusively in the manufacture of sewer pipe, flue liners, and face brick. They are also used widely by amateur and studio potters.

The principal source of stoneware clay in Canada is the Whitemud formation in southern Saskatchewan and south-eastern Alberta. Stoneware clays in British Columbia occur near Abbotsford on Sumas Mountain, at Chimmey Creek Bridge near Quesnel, and at Williams Lake. Deposits in Manitoba occur near Swan River and Sainte-Rose-du-Lac, and in Nova Scotia at Shubenacadie and Musquodoboit.

Bentonite

Bentonite is a clay consisting essentially of smectite minerals (montmorillonite group) and is formed from volcanic ash, tuff or glass, other igneous rocks, or rocks of sedimentary origin. There are two categories: swelling and non-swelling bentonite. Sodium bentonite has strong swelling properties and possesses a high dry-bonding strength, while calcium bentonite, or the non-swelling type, usually exhibits greater adsorptive characteristics.

The widest application of swelling bentonite is in well-drilling muds, followed by pelletizing iron ore concentrates. Other applications include use as a binder, a filler, an extender, an emulsifier, and as a suspending agent, as well as use for its adsorptive properties.

The principal Canadian bentonite deposits are confined to western Canada, particularly Manitoba, Saskatchewan and Alberta. Bentonite deposits have been located in Ontario and Quebec, but they are not considered to be of economic

significance. Calcium non-swelling bentonite in Manitoba occurs mainly near the base of the Pembina member of the Vermilion River formation and in the overlying Millwood member of the Riding Mountain formation. Saskatchewan has many bentonite occurrences: in eastern Saskatchewan near Pelly, in the south-central part near St. Victor, and in the southwestern part near Eastend. Bentonite in Alberta is found at Rosalind near the Battle River Valley. Deposits of bentonite in British Columbia occur along the Fraser River in the Lytton to Gang Ranch area, near coal seams in the Quilchena and Guichon valleys of the Merrit Basin, and in shale and coal-rich sections throughout the northern half of the Princeton Basin. Bentonite is also widespread in the Hat Creek beds of the Hat Creek Valley.

Fuller's Earth

Fuller's earth is a term related to bentonite, but it is derived from a particular application for clay. Fuller's earth is defined as a non-plastic clay or clay-like material, usually high in magnesia, that has adequate absorbing properties. It is formed by the alteration of volcanic ash or by direct chemical precipitation of montmorillonite in shallow marine basins. Fuller's earth is employed mainly for its adsorptive properties for use chiefly in bleaching and clarifying petroleum, and secondarily in refining edible oils. It is also being used in other applications as a carrier and as a filler-extender in fibre, as a filler retention aid in paper-making systems, and as a bonding agent for foundry sands. There are now more than 90 grades of Fuller's earth. The more important of these grades are used for pharmaceuticals designed to absorb toxins, bacteria and alkaloids; for the treatment of dysentery; for purifying water and dry-cleaning fluids; for the manufacture of wallpaper; and as an extender or filler for plastic, paint and putty. A special use of Fuller's earth is its use as a carrier of platinum catalysts.

CANADIAN CLAY-PRODUCING MINES

Newfoundland and Labrador

Trinity Brick Products (1972) Ltd. located in St. John's extracts shale for the production of bricks.

Prince Edward Island

There is no production of clay in the province.

Nova Scotia

Shaw Brick (a member of The Shaw Group Limited) extracts clay from pits at Lantz, Milford, and Shubenacadie, all in Hants County, and shale from quarries located in Hardwood Lands, Hants County, and New Glasgow, Pictou County. These materials are used in the company's plant in Lantz for the manufacture of bricks and other clay products.

New Brunswick

There is no production of clays in the province.

Quebec

Briques Hanson ltée, previously known as Briqueterie St-Laurent (a division of Hanson Building Materials America), is located in the city of La Prairie and mines shale from a quarry to produce bricks.

Exploration Orbite V.S.P.A. inc., which owns 100% of the mining rights of the Grande-Vallée property (an alumina clay deposit representing a surface area of approximately 2300 ha located 32 km northeast of Murdochville in the Gaspé Peninsula), is soon to be a fully integrated future producer from which ultra-pure and specialty alumina will be extracted and manufactured. An exclusive sole commercialization agreement was signed with Amalgamet Canada Limited, a subsidiary of Amalgamated Metal Corporation PLC of London, United Kingdom, for the sale of its high-purity alumina.

Ontario

The brick industry currently extracts most of its raw material from the Queenston Formation shale. The two major producers are Brampton Brick Limited and Hanson Brick Ltd. Other producers include Century Brick Limited, George Coultis & Sons Ltd., Norwich Brick and Tile, and Paisley Bricks and Tile Co.

Canada Brick Co. became, in 2003, part of Hanson Building Materials America, the largest brick manufacturer in Canada and one of the largest brick manufacturers in North America.

Manitoba

There is no production of clays in the province at this time.

Saskatchewan

The most important commercial clays mined in Saskatchewan include kaolinite, montmorillonite (i.e., bentonite) and illite clays.

Clays and clay products are produced by three major companies. Estavan Brick (1995) Ltd. has quarries at Estevan, Rockglen, Flintoft and Readlyn for the manufacture of face brick. Canadian Clay Products Inc. quarries sodium bentonite near Truax, 60 km southwest of Regina, and processes it at its plant at Wilcox to produce swelling bentonite products. Cindercrete Products Ltd. produces light-weight clay aggregates for its ready-mix concrete plant in Saskatoon.

Current production from these producers is mainly for face brick for Canadian and U.S. markets and stoneware clay

for the Canadian market. Saskatchewan's bentonite production is sold mainly in western Canada. The bentonite is produced by quarrying and is processed by drying, adding soda ash, grinding, and bagging. Much of the Saskatchewan bentonite production is used as fertilizer carrier, animal feed binding, reservoir sealing, and as a foundry sand binder. Future opportunities for swelling bentonite include its use as a pesticide carrier, as an agent in water and effluent purification, and in the production of pet litter.

At present, there is no kaolin production in the province.

Plainsman Clay Limited of Alberta mines its own pottery clay in Saskatchewan for processing at Medicine Hat, Alberta.

Clayburn Industries Ltd. (a subsidiary of I-XL Industries Ltd. of Alberta) of Abbotsford, British Columbia, mines clay seasonally in Saskatchewan and operates a manufacturing plant in Medicine Hat, Alberta.

Alberta

Plainsman Clay Limited mines clay specifically for pottery (i.e., Helmer kaolin) from sites in Manitoba, Saskatchewan, Alberta, Montana, and Idaho for plastic stoneware and processes the mined clay at Medicine Hat, Alberta.

I-XL Industries Ltd. of Medicine Hat is the largest producer of fired clay products in western Canada. Clays are quarried at modern open-pit mining sites (i.e., Cyprus Hills of Alberta and Saskatchewan) and are stockpiled at I-XL plants (e.g., Clayburn Industries Ltd.). Two different processes are used to form the clay into bricks.

British Columbia

Sumas Shale Ltd. is scheduled to produce 500 000 t of shale, clay, conglomerate, and sandstone from its Sumas shale quarries. The clay with the highest alumina content is sold to Clayburn Industries Ltd. Lower-grade clay, sandstone and conglomerate are used for feed at Clayburn, Lafarge Canada Inc., and Tilbury Cement Ltd.

Sumas Clay Products Ltd. produces small quantities of ornamental and specialty facing bricks at its historic plant near Abbotsford from fire clay.

Clayburn Industries Ltd. of Abbotsford processes fire clay from Sumas Mountain into a variety of refractory bricks and castable products that are exported worldwide. The company imports ball clay for the manufacture of some of its refractory products. Clayburn also produces residential clay (common bricks).

The Lang Bay site, which received lots of attention as a potential source of clay and construction materials, is expected to be the subject of a small drilling program in late 2006.

Pacific Bentonite Ltd. is extracting high-alumina material from its Decora deposit located in the Hat Creek area. Although the material is used mainly in cement production, the company is aggressively developing new markets.

Absorbent Products Ltd. purchased the business of Western Industrial Clay Products Ltd. on January 1, 2005. It produces domestic and industrial absorbents, principally from its Red Lake Fuller's earth deposit near Kamloops. In the Princeton area, the company is mining bentonite from the Bud property. The products are for agriculture, cat litter, industrial absorbents, carriers for herbicides and pesticides, and binders for feeds. The company also produces a Fuller's earth that is described by the B.C. Ministry of Energy, Mines and Petroleum Resources as a diatomaceous earth deposit since it is mainly diatomaceous earth. This material is sold as a non-swelling (conventional) cat litter throughout Canada and the United States. The company also produces a sodium bentonite (clumping) cat litter from its Princeton deposit that is sold throughout Canada and the United States. Its agricultural products are sold throughout Canada, the United States, and Europe.

Ironwood Clay Company Inc. is the largest producer of cosmetic/medical clay in British Columbia. It mines seasonally from the De Cosmos Lagoon on Hunter Island deposits. The market for cosmetic/medical clay is limited; therefore, there was no reported clay extraction during 2006.

Similar clay material for cosmetic/medical applications is extracted from Carrie Cove Clay of Comox Valley and marketed and sold by Carrie Cove Cosmetics.

Glacial Marine Clay Inc. is producing a clay for specialized hydroponics applications. The market for specialized hydroponics clays is large.

PRICES

Prices for actual transactions vary accordingly to geographic region and will take into account the quantity purchased, application, quality assurance, exact grade purchased, credit terms, and other parameters. Due to the unavailability of prices for Canada's clay industry, all of the following prices are provided as a comparative example in U.S. currency and reflect the U.S. industry (source: USGS 2005 Review).

Ball Clay

The average value for ball clay reported by U.S. producers was US\$43.67/t. The average values for exported and imported ball clay were US\$63.00 and US\$289.00/t, respectively.

Bentonite

The average value reported by U.S. producers for non-swelling bentonite was US\$47.94/t. The average value for swelling bentonite was US\$45.53/t. The average value for all bentonite was US\$45.68/t. The average value of imported bentonite by the United States was US\$355.00/t while the average value of exported bentonite by the United States was US\$116.00/t.

The price for ex-work, Wyoming and crude, bulk, rail cars, was US\$33-\$69/t; for foundry grade, bagged, rail cars, was US\$55-\$84/t; and for API-grade, bagged, rail cars, was US\$47-\$58/t. The price for bentonite, India, crushed, dried, loose in bulk, was US\$43-\$53/t for API grade, US\$32-\$40/t for cat litter grade, and US\$59-\$76/t for foundry grade (*Industrial Minerals*, 2005).

Common Clay and Shale

The average value of all common clay and shale produced in the United States and Puerto Rico was US\$7.21/t. The average value of clay and shale used in lightweight aggregate was US\$20.17/t. The value for lightweight aggregate is an estimate of the clay clause. Average prices for lightweight aggregate produced from clay and shale range from US\$30 to \$50/t for most applications. (Note: The so-called structural clays group for making bricks, pipes and tiles for the construction industry creates a conflict since the common clays and shales often used for these products may contain high proportions of non-clay minerals such as quartz and mica.)

Fire Clay

The average value for fire clay reported by U.S. producers was US\$30.22/t. The average value of imported fire clay into the United States was US\$310.00/t. The average value of exported fire clay out of the United States was US\$94.00/t.

Fuller's Earth

The average value of attapulgite-type Fuller's earth was not available for 2005 (US\$126.90/t in 2004 review). The average value of montmorillonite-type Fuller's earth was US\$101.22/t. The average value of all Fuller's earth was estimated to be US\$101.22/t. The average value of imported Fuller's earth was US\$143.00/t and the average value of exported Fuller's earth was US\$246.00/t.

Kaolin

The average value of kaolin was US\$110.25/t for all kaolin grades. The average value for airfloat was US\$64.53/t; for refractory-grade (high-temperature calcined), US\$31.31/t; for pigment-grade (low-temperature calcined), US\$299.20/t; for all types of calcined, US\$202.34/t; for

delaminated, US\$111.90/t; and for water washed, US\$97.66/t. The average value of imported kaolin was US\$153.00/t and the average value of exported kaolin was US\$168.00/t.

The kaolin price for ex-work, Georgia, filler, bulk, was US\$80-\$110/t; for coating, bulk, US\$94-\$204/t; for sanitaryware-grade, bagged, US\$72-\$83/t; for tableware-grade, bagged, US\$138/t; and for calcined, bulk, US\$353-\$413/t (*Industrial Minerals*, 2004).

NOTE TO READERS

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OUTLOOK

Overall demand for both bentonite and Fuller's earth is expected to increase at the same rate of growth as the Gross Domestic Product (GDP). Long-range demand for some products made from common clay can be expected to keep pace with GDP growth. Demand for clay and shale, which are required for portland cement and lightweight aggregates, is increasing and this trend is likely to continue. Growth in demand for structural clay products is also hampered by increasing production costs and by the heavy weight of these products, which limits their market range.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2507.00	Kaolin and other kaolinic clays, whether or not calcined	Free	Free	Free	Free	Free	Free
25.08	Other clays, andalusite, kyanite and sillimanite, whether or not calcined; mullite; chamotte or dinas earths						
2508.10	Bentonite	Free	Free	Free	Free	Free	Free
2508.20	Decolourizing earths and Fuller's earth	Free	Free	Free	Free	Free	Free
2508.30	Fire clay	Free	Free	Free	Free	Free	Free
2508.40	Other clays	Free	Free	Free	Free	Free	Free
3802.90.00.10	Activated carbon; activated natural mineral products; animal black, including spent animal black; other: activated clay	Free	Free	Free	Free	5.7%	2.5%

Sources: Canadian *Customs Tariff*, effective January 2006 and 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2006 and 2007; *Official Journal of the European Union* (October 17, 2006 Edition); *Customs Tariff Schedules of Japan*, 2006 and 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, CLAY PRODUCTION AND TRADE, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION (Shipments) (1)							
	Nova Scotia	x	x	x	x	x	x
	Quebec	x	x	x	x	x	x
	Ontario	x	183 807	x	187 278	x	184 935
	Saskatchewan	x	x	x	x	x	x
	Alberta	x	x	x	x	x	x
	British Columbia	x	x	x	x	x	x
	Total	x	230 059	x	232 691	x	230 924
EXPORTS							
2507.00	Kaolin and other kaolinic clays whether or not calcinated						
	United States	658	259	458	166	984	252
	France	—	—	—	—	10	4
	United Arab Emirates	—	—	...	...	1	1
	India	—	—	—	—	...	...
	Venezuela	—	—	—	—	...	...
	Brazil	22	19	—	—	—	—
	New Caledonia	1	...	—	—	—	—
	United Kingdom	9	9	—	—	—	—
	Malaysia	—	—	...	...	—	—
	Total	690	287	458	166	995	257
2508.10	Bentonite						
	Belgium	14	8	142	51	698	225
	United States	5 372	2 162	3 805	1 552	520	201
	France	21	12	—	—	356	187
	Cuba	28	6	33	19	197	143
	China	—	—	155	87	272	114
	Peru	—	—	41	24	121	88
	United Kingdom	—	—	27	12	44	58
	Finland	17	5	171	63	126	50
	Germany	—	—	84	28	66	39
	Denmark	—	—	77	23	101	26
	Argentina	—	—	—	—	27	20
	Dominican Republic	—	—	—	—	12	8
	Sweden	—	—	350	141	25	8
	French Polynesia	—	—	—	—	8	7
	Spain	—	—	—	—	7	6
	Mexico	3	3	7	5	8	6
	Jamaica	—	—	22	12	10	5
	Malaysia	—	—	25	12	5	3
	Senegal	—	—	—	—	2	2
	Iceland	—	—	—	—	4	1
	Iran	—	—	3	2	1	1
	Pakistan	—	—	—	—	1	1
	Philippines	—	—	—	—	1	...
	Mali	—	—	...	1	—	—
	Netherlands	—	—	49	19	—	—
	New Zealand	—	—	...	...	—	—
	Nicaragua	—	—	1	1	—	—
	Norway	—	—	25	8	—	—
	Guatemala	16	9	10	5	—	—
	Singapore	—	—	27	12	—	—
	Chile	—	—	66	38	—	—
	Turkey	—	—	19	4	—	—
	South Korea	5	3	—	—	—	—
	Italy	2	2	—	—	—	—
	Israel	57	20	89	25	—	—
	Ghana	68	50	...	2	—	—
	Eritrea	10	6	—	—	—	—
	Australia	...	...	—	—	—	—
	Brazil	15	13	41	18	—	—
	Barbados	1	1	—	—	—	—
	Total	5 629	2 300	5 269	2 164	2 612	1 199

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
2508.20	Decolourizing earths and Fuller's earth						
	Belgium	106	57	201	80	334	104
	Denmark	—	—	—	—	74	26
	France	—	—	—	—	25	10
	Mexico	—	—	—	—	26	7
	China	—	—	—	—	27	6
	Cuba	—	—	—	—	1	...
	Sweden	—	—	38	15	—	—
	Total	106	57	239	95	487	153
2508.30	Fire clay						
	United States	253	104	393	178	256	112
	Brazil	1	1	35	18	41	19
	Trinidad and Tobago	—	—	—	—	3	2
	Anguilla	—	—	—	—	1	1
	France	—	—	—	—	...	...
	Cuba	...	...	—	—	—	—
	Lebanon	—	—	3	2	—	—
	United Kingdom	—	—	6	3	—	—
	Total	254	105	437	201	301	134
2508.40	Other clays (excluding expanded clays of no. 68.06)						
	France	320	132	504	192	24 203	8 092
	Germany	7 426	2 643	12 348	4 613	20 520	7 997
	Belgium	2 113	1 039	1 585	533	1 529	534
	United States	1 657	433	1 901	394	2 407	465
	Denmark	742	348	1 135	448	1 296	362
	Netherlands	476	259	490	233	828	306
	Sweden	544	237	809	289	798	292
	Norway	336	333	186	169	585	250
	Switzerland	225	120	549	226	583	217
	Latvia	100	131	265	101	419	159
	United Kingdom	...	1	24	13	26	90
	Finland	25	7	219	71	248	87
	Israel	61	50	144	94	171	83
	Austria	48	17	196	60	221	76
	South Korea	48	15	74	25	99	38
	Portugal	31	19	60	23	87	32
	Chile	26	23	46	31	316	29
	Malaysia	28	14	18	11	39	15
	Saudi Arabia	13	6	3	2	24	15
	Venezuela	21	3	8	4	20	14
	Belize	5	10	45	17	25	10
	Romania	—	—	—	—	22	9
	United Arab Emirates	—	—	4	9	7	8
	Uruguay	25	5	13	2	34	7
	Hong Kong	—	—	1	2	4	7
	Panama	48	16	7	2	11	5
	Barbados	—	—	12	6	7	4
	Cuba	—	—	—	—	3	4
	Philippines	44	11	2	4	1	4
	Saint Lucia	—	—	—	—	2	3
	Jamaica	2	1	5	3	3	2
	Saint Pierre and Miquelon	3	3	5	2	2	1
	Greenland	—	—	—	—	...	1
	Bermuda	3	1	4	2	4	1
	Trinidad and Tobago	—	—	10	10	3	1
	Saint Vincent and the Grenadines	—	—	5	6	2	1
	Costa Rica	...	...	5	1	2	1
	Dominican Republic	—	—	3	1	3	1
	Spain	—	—	—	—	2	1
	India	—	—	—	—	1	...
	Slovenia	...	...	...	...	...	...
	Libya	—	—	—	—	...	...
	Colombia	1	...	...	...	...	...
	South Africa	...	1	...	...	...	...
	Czech Republic	...	1	—	—	—	—
	Cayman Islands	—	—	2	3	—	—
	Antigua and Barbuda	—	—	2	2	—	—
	Grenada	—	—	...	...	—	—
	El Salvador	1	...	—	—	—	—
	China	5	8	—	—	—	—

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
	Taiwan	12	16	25	11	—	—
	Lithuania	—	—	24	9	—	—
	Malta	—	—	2	...	—	—
	New Zealand	—	—	11	12	—	—
	Qatar	—	—	4	7	—	—
	Saint Kitts and Nevis	—	—	...	...	—	—
	Dominica	1	2	9	4	—	—
	Tanzania	—	—	...	...	—	—
	Greece	24	7	4	10	—	—
	Brazil	6	12	29	12	—	—
	Vietnam	—	—	3	5	—	—
	Italy	221	72	...	...	—	—
	Japan	17	7	—	—	—	—
	Guatemala	—	—	...	...	—	—
	Bahrain	...	...	—	—	—	—
	Lebanon	—	—	2	1	—	—
	Total	14 658	6 003	20 802	7 675	54 557	19 224
	Total exports	21 337	8 752	27 205	10 301	58 952	20 967
IMPORTS (2)							
2507.00	Kaolin and other kaolinic clays whether or not calcinated						
	United States	851 850	118 266	715 425	81 329	756 745	78 715
	Brazil	110 944	11 175	145 573	16 468	199 825	20 781
	United Kingdom	83 964	19 036	130 668	20 888	36 684	5 967
	Australia	90	21	149	20	197	29
	Spain	43	11	43	11	107	26
	Ivory Coast	—	—	—	—	163	19
	Czech Republic	—	—	—	—	39	17
	China	45	6	2	5	5	16
	France	5	6	8	12	16	7
	Germany	...	...	122	49	18	7
	Congo	—	—	—	—	...	...
	Senegal	—	—	—	—	...	...
	Argentina	...	...	—	—	...	...
	India	—	—	...	...	...	...
	Morocco	—	—	—	—	...	...
	Saudi Arabia	3	1	—	—	—	—
	Netherlands	12	5	—	—	—	—
	Taiwan	...	...	...	...	—	—
	Thailand	...	...	...	...	—	—
	South Korea	5	2	—	—	—	—
	Japan	...	...	1	1	—	—
	Canada	—	—	...	...	—	—
	Finland	—	—	3	1	—	—
	Ghana	1	...	1	...	—	—
	Indonesia	—	—	2	1	—	—
	Macedonia	—	—	...	...	—	—
	Greece	...	...	—	—	—	—
	Austria	...	...	1	3	—	—
	Switzerland	...	...	—	—	—	—
	Total	1 046 962	148 529	991 998	118 788	993 799	105 584
2508.10	Bentonite						
	United States	296 739	28 094	342 840	28 597	456 229	36 203
	Greece	44 300	4 694	46 215	3 508	43 034	3 033
	Germany	120	75	479	238	110	108
	Italy	156	146	58	90	98	103
	Egypt	108	34	234	70	176	49
	United Kingdom	997	500	174	80	112	39
	China	105	33	30	3	120	22
	Canada	—	—	182	18	143	10
	Bulgaria	—	—	—	—	47	6
	France	28	8	5	2	22	5
	Mexico	—	—	1	1	3	4
	Australia	—	—	—	—	7	1
	India	29 937	2 791	—	—	...	...
	Switzerland	37	12	—	—	6	...
	Netherlands	—	—	...	...	...	...
	Hong Kong	—	—	—	—	...	...
	Singapore	—	—	—	—	...	...
	South Africa	—	—	—	—	...	...

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
	Argentina	627	199	—	—	—	—
	Belgium	...	...	—	—	—	—
	Chile	4	4	—	—	—	—
	Japan	1	1	...	1	—	—
	Spain	1	...	—	—	—	—
	Uruguay	50	16	52	15	—	—
	Austria	—	—	...	...	—	—
	Cuba	—	—	...	...	—	—
	Philippines	—	—	...	...	—	—
	Total	373 210	36 607	390 270	32 623	500 107	39 583
2508.20	Decolourizing earths and Fuller's earth						
	United States	7 042	1 677	7 158	1 690	10 437	2 536
	Mexico	8	6	235	102	299	107
	United Kingdom	349	90	198	122	168	106
	Germany	41	12	55	15	7	8
	Sri Lanka	—	—	1	1	16	4
	China	—	—	—	—	1	...
	India	—	—	—	—	...	...
	Malaysia	—	—	—	—	...	...
	Australia	...	...	—	—	—	—
	Iran	—	—	4	1	—	—
	Total	7 440	1 785	7 651	1 931	10 928	2 761
2508.30	Fire clay						
	United States	10 439	1 713	10 823	1 637	10 105	1 622
	United Kingdom	127	72	202	99	97	44
	Japan	12	2	18	3	46	9
	Italy	51	15	80	15	20	6
	Guyana	—	—	—	—	18	6
	China	3	...	27	8	11	5
	France	7	1	—	—	...	...
	India	...	...	—	—	...	...
	Taiwan	...	...	—	—	1	...
	Mexico	—	—	...	...	...	...
	Vietnam	—	—	—	—	...	...
	Germany	6	1	—	—	—	—
	Canada	—	—	138	22	—	—
	Total	10 645	1 804	11 288	1 784	10 298	1 692
2508.40	Other clays (excluding expanded clays of no. 68.06)						
	United States	304 541	31 797	319 642	26 748	204 760	19 520
	France	431	304	476	355	479	358
	Japan	54	27	175	34	170	192
	Germany	105	71	49	78	49	60
	China	289	231	147	112	233	46
	United Kingdom	139	60	163	35	140	40
	Mexico	2	2	24	37	45	30
	Spain	42	70	27	72	12	30
	Switzerland	121	30	23	8	3	15
	Italy	6	5	7	24	1	3
	Canada	7	4	1	17	2	3
	Morocco	...	...	—	—	1	3
	South Korea	—	—	...	1	1	3
	Romania	—	—	—	—	...	2
	India	...	...	...	1	...	1
	Taiwan	6	5	4	3	1	1
	Austria	—	—	—	—	1	...
	Sweden	—	—	2	...	...	...
	Indonesia	—	—	—	—	...	...
	Peru	—	—	...	...	1	...
	Malaysia	...	...	—	—	...	...
	Philippines	...	...	1	...	...	...
	Thailand	...	1	—	—	...	...
	Pakistan	—	—	—	—	...	...
	Madagascar	—	—	...	1	...	...
	Hong Kong	...	...	19	4	3	...
	Cuba	—	—	...	...	...	...
	Israel	...	...	—	—	—	—
	Czech Republic	1	...	—	—	—	—
	Portugal	1	...	...	...	—	—

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
	Finland	—	—	...	...	—	—
	Guyana	—	—	26	1	—	—
	Iran	—	—	1	...	—	—
	Chile	—	—	...	...	—	—
	Brazil	—	—	7	11	—	—
	Netherlands	—	—	...	...	—	—
	Jordan	1	1	—	—	—	—
	South Africa	—	—	1	11	—	—
	Greece	..	...	...	...	—	—
	Egypt	2	1	—	—	—	—
	Argentina	1	...	—	—	—	—
	Belgium	...	...	—	—	—	—
	Australia	9	16	—	—	—	—
	Total	305 758	32 625	320 795	27 553	205 902	20 307
3802.90.00.10 Activated clay							
	Greece	7 316	4 814	30 006	11 237	8 862	10 988
	United States	18 249	7 942	20 380	9 622	12 576	9 158
	Germany	7	5	117	99	1 047	321
	China	—	—	2	5	5	15
	Spain	—	—	4	6	3	4
	Belgium	—	—	—	—	1	2
	Japan	...	...	...	...	...	...
	Taiwan	1	...	...	...	...	...
	Hong Kong	—	—	—	—	...	...
	France	1	...	...	...	—	—
	Sweden	...	...	...	...	—	—
	United Kingdom	13	167	—	—	—	—
	Austria	—	—	...	...	—	—
	Mexico	—	—	58	30	—	—
	Total	25 587	12 928	50 567	20 999	22 494	20 488
	Total imports	1 769 602	234 278	1 772 569	203 678	1 743 528	190 415

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; ... Amount too small to be expressed; (p) Preliminary; x Confidential.

(1) Production values for bentonite and diatomite have been included. (2) Imports from "other countries" may include re-imports from Canada.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, BENTONITE IMPORTS AND USE, (1) 1988-2006

Year	Imports	Imports	Use (2)
	(tonnes)	(\$000)	(tonnes)
1988	335 012	14 420	264 033
1989	294 280	15 070	274 987
1990	252 395	12 259	252 333
1991	268 609	11 712	248 725
1992	255 810	14 568	238 867
1993	295 356	20 684	230 006
1994	330 221	27 270	255 171
1995	343 826	25 983	263 294
1996	381 043	26 723	255 475
1997	372 103	29 760	279 602
1998	325 620	29 738	286 329
1999	336 909	28 990	256 566
2000	325 574	34 515	296 266
2001	254 242	29 021	267 449
2002	238 413	27 121	284 123
2003	273 389	34 681	276 630
2004	373 209	36 607	280 471
2005	390 269	32 624	293 219
2006 (p)	500 108	39 585	..

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; (p) Preliminary.

(1) As reported by consumers. (2) Does not include activated clays and earths or Fuller's earth.

TABLE 3. CANADA, REPORTED USE (1) OF CLAYS, BY INDUSTRY, 2003-05

	2003	2004	2005
	(tonnes)		
China clay (kaolin)			
Pulp and paper, and paper products	580 034	679 997	700 294
Rubber products	9 045	7 441	10 514
Ceramic products	6 412	6 158	6 225
Paint and varnish	9 107	8 430	8 356
Other products (2)	26 626	29 131	26 858
Total	631 224	731 157	752 247
Ball clay			
Clay products, ceramics and structural	6 554	5 767	6 368
Refractory brick, mixes	1 075	1 191	1 044
Other products (3)	761	857	803
Total	8 390	7 815	8 215
Fire clay			
Refractory brick, mixes	x	x	x
Foundries	515	477	259
Other products (4)	x	x	x
Total	25 296	26 772	27 055
Bentonite, quantity used (available data) (5)			
Iron ore pelletizing	196 594	192 916	213 977
Paper, pulp and paper products	9 090	7 674	7 511
Well drilling (6)	x	x	x
Refractory brick, mixes	x	x	x
Foundries	34 624	34 636	31 293
Other products (7)	12 041	17 956	17 186
Total	276 630	280 471	293 219
Other clays	2 245 136	2 247 811	2 234 036

Source: Natural Resources Canada.

x Confidential.

(1) Reported from NRCan survey on the use of nonmetallic minerals by Canadian manufacturing plants. (2) Includes chemicals, glass fibre wool, asphalt roofing products, gypsum products, packaging, and other miscellaneous products. (3) Includes gypsum products, fertilizers, and other miscellaneous products. (4) Includes structural clay products, nonferrous smelting and refining, and other miscellaneous products. (5) Does not include activated clays and earths or Fuller's earth.

(6) Well drilling is included in "other products" for 1999 to 2004 due to confidentiality. (7) Includes animal feeds, cat litter, structural clay products, fertilizers, paint and varnish, mortar mixes and other miscellaneous minor uses.

Note: Numbers may not add to totals due to rounding.

TABLE 4. MAJOR CANADIAN MANUFACTURERS OF STRUCTURAL CLAY PRODUCTS, BY PROVINCE

Company	Plant Location	Products	Raw Material	Size (1) and Remarks
NOVA SCOTIA				
The Shaw Group Ltd.	Lantz	Brick, block and pipe	Common clay, ball clay	(B)
QUEBEC				
Briques Hanson Itée (formerly St. Lawrence Brick Div.)	La Prairie	Building and facing brick	Shale	(C)
ONTARIO				
Brampton Brick Ltd.	Brampton	Building brick	Shale	(D)
Hanson Brick Ltd. (formerly Canada Brick Co.)				(E)
Burlington Division	Burlington	Building brick	Shale	
Streetsville Division	Streetsville	Building brick	Shale	
Ottawa Division	Ottawa	Building brick	Shale	
Century Brick Limited (formerly Hamilton Brick)	Etobicoke	Building brick	Shale	(B)
Paisley Bricks and Tile Co.	Paisley	Building brick and tile	Shale	(A)
SASKATCHEWAN				
Canadian Clay Products Inc.	Wilcox	Bentonite	Sodium bentonite	(A)
ALBERTA				
I-XL Industries Ltd.	Medicine Hat	Brick, block, flue liners	Common clay	(B)
Plainsman Clay Ltd.	Medicine Hat	Processed clay	Common clay	(A)
BRITISH COLUMBIA				
Sumas Clay Products Ltd.	Abbotsford	Clay bricks, pavers, flue liners, liner caps	Common clay	(A)
Absorbent Products Ltd. Calcium bentonite and diatomite operations	Kamloops and Red Lake	Absorbent products	Calcium and sodium bentonite	(B)

Sources: Natural Resources Canada; company web sites.

(1) Size keys: (A) up to 25 employees; (B) 25-49 employees; (C) 50-99 employees; (D) 100-199 employees; (E) 200-499 employees.

Coal

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Coal is an organically derived material. It is formed from the remains of decayed plant material compacted into a solid through millions of years of chemical changes under pressure and heat. As the organic maturity process continues, the buried plant material is transformed into different types of coal. In general, the longer coal is subjected to heat and pressure, the higher its grade and contained heat volume per unit weight. Bituminous coal and anthracite are high-rank coals, also known as hard coal. Bituminous coal is consumed for both metallurgical and thermal purposes. Anthracite, the highest rank coal, is often called smokeless and can be consumed by households as a fuel for heat and cooking, and by various industries such as steel-making. Lignite and subbituminous are low-rank coals, also known as brown coals, consumed only for the generation of electricity.

Coal is the world's most abundant and widely distributed fossil fuel. About 909 billion t of proven coal reserves spread over 70 countries have been identified as recoverable. Coal is currently mined in more than 50 countries. At the current rate of production, coal will offer more than 157 years of supply, significantly longer than known reserves of oil and gas. Coal is a cheaper energy source compared to oil and gas. Canada holds 6.6 billion t of proven recoverable coal reserves, which will offer more than 100 years of supply at the current production rate. In addition, about 193 billion t of coal resources have been identified.

Coal has been consumed as an energy source for hundreds of years. It provided the energy that boosted the industrial revolution of the 19th century and launched the electric era in the 20th century. Coal was the most important source of the world's primary energy until the late 1960s when it was overtaken by oil. Today, close to 90% of total world coal production is consumed as steam coal. The majority of steam coal is used to generate electricity and a small portion is used as a fuel for heat or steam, such as for residential building heating; cement, pulp and paper, and other

industries; and the agriculture and transportation sectors. Coal-fired power generation currently provides more than 40% of the world's total electricity. In Canada, 16% of the total electricity is provided by coal-fired power generation. About 10% of global coal production is used to produce coke, which is a key ingredient in steel-making. Almost all primary steel production worldwide is based on pig iron from blast furnaces fed with coke from coal and on iron ore.

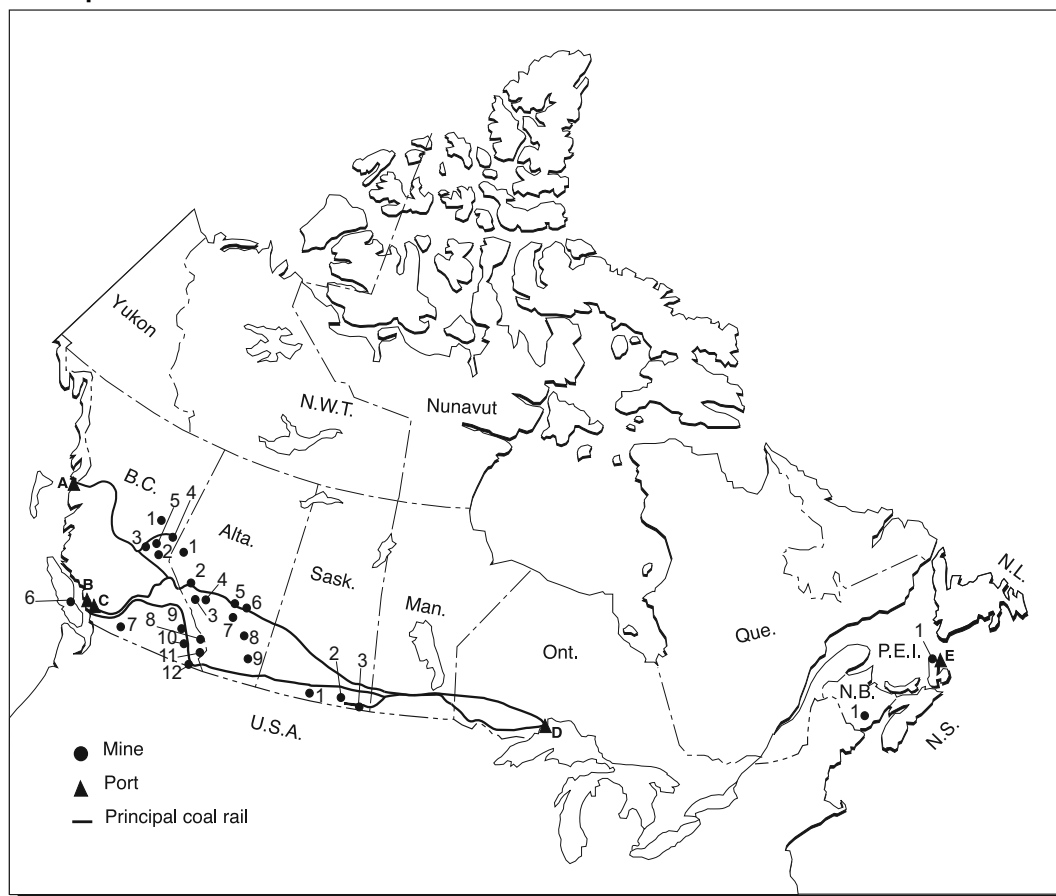
The International Energy Agency, which collects worldwide data on production, consumption and trade, publishes *IEA Coal Information* annually. The latest edition showed that the world's total coal output was 6195 Mt in 2006, including hard coal and brown coal (subbituminous and lignite).

TOP 15 COAL-PRODUCING COUNTRIES, 2006

Rank	Country	2006
		Production (Mt)
1	China	2 380
2	United States	1 054
3	India	447
4	Australia	374
5	Russia	309
6	South Africa	257
7	Germany	197
8	Indonesia	195
9	Poland	156
10	Kazakhstan	96
11	Ukraine	81
12	Greece	71
13	Canada	66
14	Colombia	66
15	Turkey	63

The Canadian coal industry plays an important role in the Canadian economy, both as a mining industry and as an energy provider. It currently employs more than 5000 people directly in the production of coal and creates more than 50 000 indirect jobs across the country. The coal industry contributes about \$5 billion to the national economy annually. Coal is the number one commodity in volume hauled by rail in Canada; 31 Mt of coal were hauled by rail in 2006. The majority was hauled to Vancouver ports for shipment overseas.

Figure 1
Principal Canadian Coal Mines and Ports



Numbers and letters refer to locations on map above.

MINES

BRITISH COLUMBIA

1. Willow Creek
2. Dillon
3. Wolverine
4. Brule
5. Trend
6. Quinsam
7. Basin
8. Fording River
9. Greenhills
10. Elkview
11. Line Creek
12. Coal Mountain

ALBERTA

1. Grande Cache
2. Obed Mountain
3. Cheviot Creek
4. Coal Valley
5. Highvale
6. Whitewood
7. Genesee
8. Paintearth
9. Sheerness

SASKATCHEWAN

1. Poplar River
2. Boundary Dam
3. Bienfait

NEW BRUNSWICK

1. Minto

NOVA SCOTIA

1. Stellarton

PORTS

BRITISH COLUMBIA

- A. Ridley
- B. Neptune
- C. Westshore

ONTARIO

- D. Thunder Bay

NOVA SCOTIA

- E. International Pier

CANADIAN DEVELOPMENTS

Three new mines came on stream in British Columbia (B.C.) in 2006. Northern Energy and Mining Inc.'s (NEMI) Trend mine started coal production in January 2006. The company has a mining permit to produce 2 Mt/y of metallurgical (coking) coal for exports. The Wolverine mine of Western Canadian Coal Corp. (WCC) began coal production in July 2006. The mine has a mining permit to produce 3 Mt/y of coking and Pulverized Coal Injection (PCI) coal for export. WCC's Brule mine received regulatory approval in July 2006 and production began in November 2006. The Brule mine is located 55 km south of Chetwynd in northeastern B.C. The mine is designed to produce 2 Mt/y of PCI coal for export. Production from the Brule mine will be trucked to the existing Bullmoose load-out, which is currently used by the Dillon mine. The Dillon mine is scheduled to close once the deposit is depleted at the mine site.

Twenty-five coal mines were in operations in Canada at the end of 2006. Most large-scale coal mines are located in western Canada. Five companies produce coking and PCI coal for export, two companies produce bituminous steam coal for export and for domestic use, and three companies produce subbituminous, lignite and bituminous coal exclusively for domestic coal-fired power generation. The mine details can be found in Table 6.

PRODUCTION

Preliminary figures indicate that Canada produced approximately 66 Mt¹ of coal in 2006, a decline of 3.4% from

68.3 Mt² in 2005. Canada's major coking coal producer, Elk Valley, recorded a production decrease of 4.1 Mt in 2006. The coal production of Elk Valley was 22.6 Mt, compared to 26.7 Mt in 2005. The company cited a lack of demand from China as the reason for the decline. Three companies reported production increases. Sherritt International Corp., WCC, and Grande Cache Coal Corp. recorded production of 3.6 Mt, 1.15 Mt, and 1.1 Mt, respectively, in 2006.

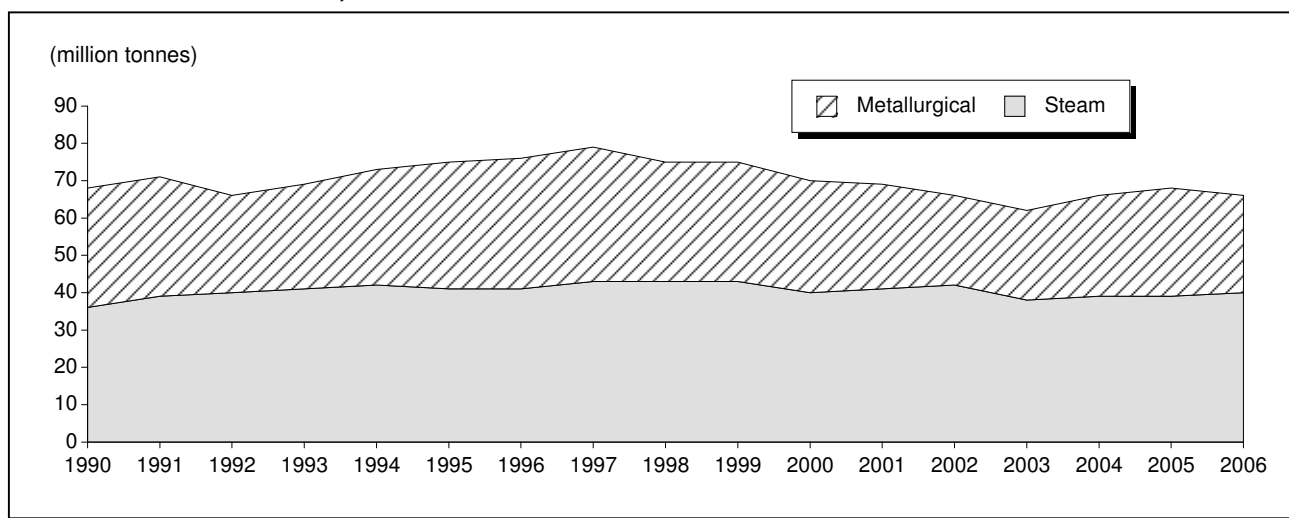
Alberta produced 32 Mt³ of coal, B.C. produced 23.4 Mt,⁴ Saskatchewan produced 10.4 Mt, and New Brunswick and Nova Scotia produced a limited amount of coal.

Of the total coal production in Canada, 26 Mt was coking coal, solely for exports, and 40 Mt was steam coal, mostly for domestic coal-fired power generation use. A small portion of steam coal was also exported. Most of the output in the coking coal category was hard coking coal and a small portion was PCI coal. The majority of the steam coal was subbituminous and lignite coal while about 10% was a bituminous-grade steam coal.

TRADE

Canada exports more than 40% of its coal production to global markets. In 2006, Canada exported 27.7 Mt of coal, a decline of 2% compared to 28.3 Mt in 2005. Canada is the world's second largest coking coal supplier and, in 2006, it exported 24.6 Mt of coking coal, lower than the 26.8 Mt exported in 2005. Steam coal exports increased to 3 Mt in 2006, doubling the 1.5 Mt exported in 2005. Exports to Japan, Canada's largest market, increased to

Figure 2
Canadian Coal Production, 1990-2006



Sources: Natural Resources Canada; Statistics Canada.

8.7 Mt, up 15% compared to the previous year's 7.5 Mt. Canada's exports to Asia increased 3% to 15.2 Mt in 2006, compared to 14.8 Mt in 2005. However, due to weaker demand, Canada's exports to Europe declined about 10% with volumes decreasing to 7.9 Mt in 2006 from 8.8 Mt in 2005. Exports to the Americas also declined 3%.

About 90% of Canada's coal exports were seaborne and shipped through coal terminals in Vancouver while the rest was shipped through the Ridley Terminals in Prince Rupert in northern B.C.

Canadian coal exporters continued to enjoy near-record prices in 2006, receiving US\$113/t, on average, for coking coal in the 2006 coal year.⁵ This was the result of continuous demand increases and tight supply of coking coal on global coal markets. However, global demand for coking coal started to slow down in the second half of 2006. Global coking coal supply seems to be catching up to the demand growth. Canadian coal exporters settled various coking coal contracts for the 2007 coal year at prices of US\$94-\$97/t, lower than the 2006 coal year prices of US\$107-\$110/t.

Canada imported 20.8 Mt of coal in 2006, similar to the volume imported in 2005. The United States supplied 17.9 Mt and the combined supply of Colombia, Venezuela and Russia was close to 3 Mt. Of the total imports, 16.5 Mt was steam coal, mainly for coal-fired power generation in Ontario, Nova Scotia, and New Brunswick. Coking coal imports were 4.2 Mt, mostly consumed by Canada's steel industry in Ontario.

CONSUMPTION

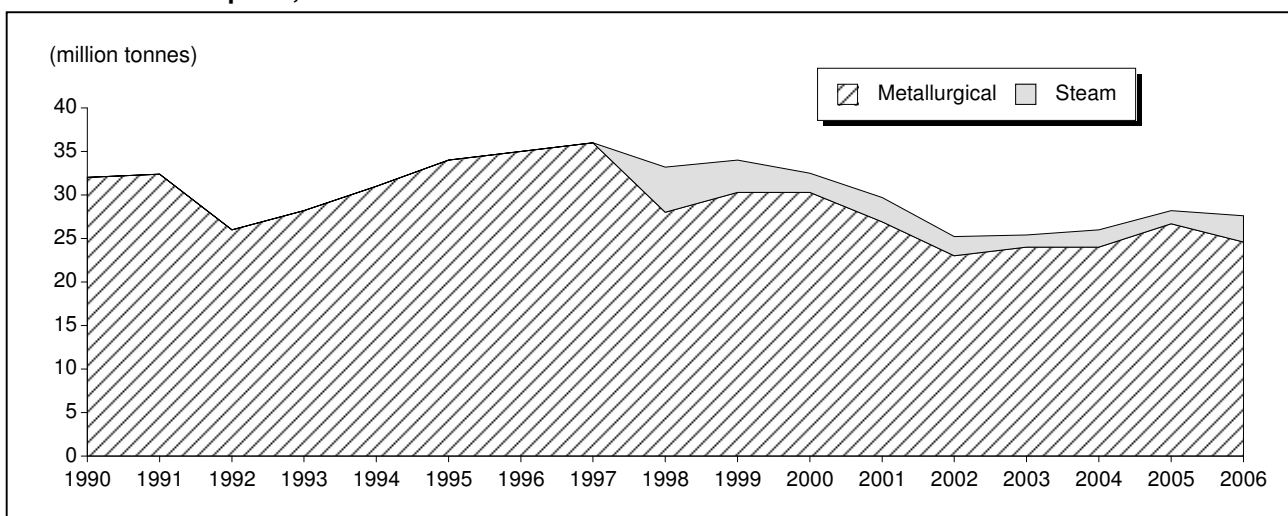
Canada's apparent coal consumption was estimated at 58 Mt in 2006. Of the total coal consumption, 37 Mt was sourced domestically and 21 Mt was imported. Canada's major coal consumption was as a fuel for coal-fired electric power generation. At the end of 2006, Canada had 21 coal-fired power generation plants and coal consumption was estimated at 51 Mt, accounting for more than 90% of Canada's total. Canada's steel industry consumed about 4 Mt of coking coal, accounting for 7% of the coal consumption. The cement and other industries consumed limited amounts of coal.

Alberta, the largest coal-consuming province, consumes about 26 Mt of coal annually for electric power generation, accounting for close to half of Canada's coal consumption for that purpose and for about 40% of Canada's total coal consumption. Alberta's coal-fired power generation provides about 74% of the electricity supply in the province.

Ontario is the second largest coal-consuming province. It was estimated that approximately 16 Mt of coal was consumed in Ontario in 2006. Coal-fired power generation consumption was estimated to be around 12 Mt and the steel industry consumed about 4 Mt. It is expected that Ontario's coal consumption will be stable for the short term as the province has postponed the closure of all coal-fired power generation plants due to electricity demand increases.

Saskatchewan consumes about 11 Mt of lignite annually for its coal-fired power generation and provides two thirds

Figure 3
Canadian Coal Exports, 1990-2006



Sources: Natural Resources Canada; Statistics Canada.

of the province's electricity supply. Coal consumption in Nova Scotia is solely for coal-fired electric power generation, which provides about 60% of the province's electricity supply. It was estimated that around 2.4 Mt was consumed in 2006. New Brunswick's coal consumption is also for coal-fired electric power generation and the coal consumption was estimated at around 1 Mt in 2006. Quebec's coal consumption remained at about 800 000 t for the past 10 years, all for industrial purposes.

COAL PROJECTS UNDER DEVELOPMENT

Coal developments in western Canada continued in full swing in 2006.

There are six coal projects currently waiting for environmental assessment approval from the B.C. government.

Dehua International Mines Group Inc. applied for an environmental assessment for its Gething coal mine project in November 2006. The project is located in northeastern B.C., 25 km northwest of Henderson's Hope. The company proposes to construct an underground mine and a coal preparation plant. The mine is projected to produce 2 Mt/y of coking coal with a 40-year mine life.

WCC applied for an environmental assessment for its Hermann mine project in July 2006. The project is located in Tumbler Ridge in northeastern B.C., adjacent to the company's Wolverine mine. WCC is applying for a certificate to allow the company to produce 0.8-1.1 Mt/y of coking coal with an expected mine life of 10 years.

Cline Mining Corp. submitted an application for an environmental assessment for its Lodgepole mine project in January 2006. The project is located in the Crowsnest Coalfield of southeastern B.C. and the company is planning to produce 2 Mt/y of coking coal for export.

The application for an environmental assessment for the Horizon mine project was originally submitted by Hillsborough Resources Limited in September 2005. The project is now under Peace River Coal Inc., a new partnership between Hillsborough (60%), Anglo Coal Canada Inc. (20%), and NEMI (20%). It is located near the closed Quintette and Bullmoose mines, but the Horizon area has never been mined before. Part of the project also includes some lands previously explored as the Quintette property. The project is planning to produce 1.6 Mt/y of coking coal.

Fortune Minerals Limited applied for an environmental assessment for its Mount Klappan mine project in October 2004. The project is located 160 km northeast of Stewart in northern B.C. It includes an open-pit mine and a preparation plant with an anticipated production of 1.5 Mt/y of anthracite coal.

In Alberta, Sherritt and the Ontario Teachers' Pension Plan applied for an environmental assessment for a coal gasification project in early January 2007. The Dodds-Roundhill Gasification Project is located 80 km southeast of Edmonton, Alberta. The \$1.5 billion project will be the first commercial application of coal gasification technology in Canada. The proposed project involves mining subbituminous coal and processing it into gas. Production will begin in 2011 and the project will reach its designed capacity of 320 million cubic feet of synthetic gas per day by 2012. Coal reserves and resources were estimated at 320 Mt in the project area and a 40-year mine lifespan is expected.

In Saskatchewan, a new 300-MW, \$1.5 billion clean coal-fired power generation plant is under feasibility study by SaskPower Inc. The SaskPower Clean Coal Project will develop and adopt carbon dioxide (CO₂) separation technology. The technology, called Oxyfuel, eliminates nearly all emissions of combustion and captures 8000 t of CO₂ per day. The project is to take advantage of low-cost and abundant lignite coal in Saskatchewan. The proposed location is the Shand Power Generation Station pending negotiations with stakeholders in the area. SaskPower is also considering two regions for the development of potential clean coal-fired generation units in the Estevan area and in the Coronach/Willow Bunch area.

In eastern Canada, the Xstrata Donkin Mine Development Alliance (Alliance), selected by the Nova Scotia government, continued its feasibility study to develop the Donkin mine offshore of Cape Breton Island. The Alliance consists of Xstrata Coal (Australia, 66%), Kaoclay Resources Inc. (Halifax, 20%), and Atlantic Green Energy Development (Savannah, Georgia, 14%). In December 2006, the study team pumped the water out of the two flooded tunnels and found them to be in surprisingly good condition after two decades. The Alliance will complete the study in 2007 and start coal production in 2008.

ENVIRONMENT

On October 19, 2006, the Government of Canada tabled Canada's *Clean Air Act* to help protect human health and the environment by taking an integrated approach to reducing emissions of both air pollutants and greenhouse gases.

In January 2007, the Government announced a \$230 million ecoENERGY Technology Initiative that focuses on research, development, and demonstration of clean energy technologies. The initiative will accelerate the development and market-readiness of technology solutions in clean energy and foster the next generation of clean technologies to break through emissions-free energy production and use. Projects such as clean coal and CO₂ storage and sequestration will be carried out by public/private partnerships.

The Canadian coal industry has continuously made progress with respect to environmental concerns such as the disturbance of land, acid mine drainage, greenhouse gas (GHG) emissions, and the production of particulate associated with the burning of coal. Some coal mining companies have already been recognized for their successful environmental management programs.

Two mining operations of Elk Valley Coal received mine reclamation awards in June 2006. Fording River operations was awarded the 2005 British Columbia Jake McDonald Mine Reclamation Award for outstanding reclamation achievements. This was the third time that the Fording River mine received this award; it was previously recognized in 1979 and 1992. The Elkview operations were awarded the 2005 Citation for Outstanding Achievement for Reclamation at a Coal Mine. Recent wildlife surveys indicate that the largest recorded populations of elk and mule deer were found on the Elkview property in more than 20 years.

The Coal Valley mine of Sherritt International Corp. received the 2005 Alberta Chamber of Resources Reclamation Award in April 2006. Reclamation of the Coal Valley mine involved the construction and development of Lovett and Silkstone lakes, and re-sloping and levelling of the shoreline and bottom configurations with additional topsoil replacement and vegetative seeding. A fisheries habitat was incorporated into the planning and rainbow trout have been stocked successfully at these lakes since 1995.

New coal mines and mine expansions are required to have environmental assessments under provincial legislation and, in some cases, also require a federal environmental review under the *Canadian Environmental Assessment Act*. Environmental assessments ensure that mining activities, such as the removal of vegetation, relocation of overburden, construction of roads, storage of waste rocks, reclamation of previously mined areas, and mining operations, are done in a way that manages the negative effect on the environment.

The development of Clean Coal Technologies (CCT) made coal use environmentally acceptable. In its newly proposed energy policies, the European Commission calls for security of energy supply and wider use of CCT, and plans to construct 12 large-scale demonstration plants with CO₂ capture and storage technologies. Coal has already been playing a vital role in Europe's energy mix as more than 30% of its electricity supply comes from coal-fired plants.

In addition to CCT, coal gasification and coal-to-liquid (CTL) will provide alternative ways to use coal efficiently and in an environmentally sound manner. Currently, there are 117 gasification plants in operation worldwide and more than half of these plants are coal-fed. Ten new coal-based gasification plants are expected to come on stream within the next three to four years in the United States, China, and Europe. Several coal resource-rich countries

such as Australia, China, the United States, and India have been actively pursuing the development of CTL. In South Africa, coal liquefaction currently provides 30% of the country's oil demand. CTL can be produced at US\$25-\$45 per barrel of oil equivalent, including the costs of carbon capture and storage. CTL fuels are ultra clean; they produce no sulphur and low NO_x, particulate matter, and carbon monoxide emissions.

In Alberta, the Genesee 3 coal-fired power generation unit, which commenced production in 2005, continued to perform well. The \$695 million, 455-MW unit is the most technologically advanced coal-fired power plant built in Canada. The Genesee 3 unit uses a supercritical pressure boiler in which higher temperature, higher steam pressure, and an efficient steam turbine combine to produce a more efficient process for converting thermal energy into electricity. As a result, less coal is burned to produce each megawatt of electricity. The cost of the clean air technology was \$90 million. It reduces nitrogen oxide (NO_x) emissions by 54%, sulphur dioxide (SO₂) emissions by 60%, and carbon dioxide (CO₂) emissions by 18%. In total, greenhouse gas emissions at the Genesee 3 unit have been reduced by 52% when compared to the emission levels of a standard coal-fired power plant. The unit also prevents 99.8% of particulates (fly ash) from being released into the atmosphere. The Genesee 3 unit uses subbituminous coal from the adjacent Genesee mine.

OUTLOOK

Global total coal production has increased, on average, about 7% each year from 2003 to 2006. It was well above the 10-year average growth rate of 2.6% between 1995 and 2005. Meanwhile, global consumption of coal increased at 8% per year from 2003 to 2006, 1% higher than production. The increases were largely driven by the continuous increasing demand for energy. Record high oil and gas prices and volatility have also contributed to increased coal use because of cheaper, plentiful, and readily available coal. Coal is a reliable, affordable and abundant resource, and continues to increase its share in the global energy supply mix. Current proven global reserves will provide 157 years of coal production at the current production rate.

Global coking coal trade declined 2.4% in 2006. Coking coal markets began to cool off in the second half of 2006, largely due to softened demand from major importing countries. Supply in 2007 is not expected to be as tight as in the previous years, but it is not in an oversupply situation and demand still exceeds supply. It is expected that global coking coal trade will increase 3.5% in 2007, which indicates that the global trade will not only recover to 2005's 225-Mt level, but also will grow an additional 1%. Canadian exporters settled various coking coal contracts for the 2007-08 coal year at a price of US\$97/t, lower than the 2006-07 coal year price of US\$107/t.

Global steam coal markets continue to look strong, not only in emerging countries like China and India, but also in the developed world such as the United States and Europe. Global steam coal trade increased 8.4% in 2006 and this trend is expected to continue in 2007. Most of the demand is for electricity generation, but also for heating and steam use.

The outlook for Canada in 2007 is positive. Canadian coal production is expected to reach 70 Mt in 2007 and exports are expected to increase to 30 Mt. Most production increases will be coking and PCI coal for export. Coking and PCI coal producers Elk Valley Coal Corp., WCC, Grande Cache Coal Corp., and NEMI will attempt to achieve a maximum volume of production. The steam coal producer, Sherritt, will maximize its production from Coal Valley as global demand for steam coal is very strong. Steam coal production destined for domestic coal-fired electricity generation will remain constant as the majority of production is under long-term contracts. Canada's coal consumption and imports are expected to remain stable in 2007.

CANADIAN COAL COMPANIES' WEB SITES

The Coal Association of Canada
www.coal.ca

Fording Canadian Coal Trust
www.fording.ca

Teck Cominco Ltd.
www.teckcominco.com

Elk Valley Coal Corp.
www.elkvalleycoal.ca

Sherritt International Corp.
www.sherritt.com

Royal Utilities Income Trust
www.royalutilities.com

Western Canadian Coal Corp.
www.westerncoal.com

Grande Cache Coal Corp.
www.gccoal.com

Hillsborough Resources Ltd.
www.hillsboroughresources.com

Pine Valley Mining Corp.
www.pinevalleycoal.com

Northern Energy and Mining Inc.
www.nemi-energy.com

ENDNOTES

¹ Production numbers were based on annual and quarterly reports published by coal-producing companies in Canada.

² Ibid.

³ Ibid.

⁴ Ibid.

⁵ The coal year starts on April 1 and ends on March 31 of the following year.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of March 31, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

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TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
27.01	Coal; briquettes, ovoids and similar solid fuels manufactured from coal						
2701.11	Coal, whether or not pulverized, but not agglomerated: anthracite	Free	Free	Free	Free	Free	Free
2701.12	Coal, whether or not pulverized, but not agglomerated: bituminous coal	Free	Free	Free	Free	Free	Free
2701.19	Coal, whether or not pulverized, but not agglomerated: other coal	Free	Free	Free	Free	Free	Free
2701.20	Briquettes, ovoids and similar solid fuels manufactured from coal	Free	Free	Free	Free	Free	3.9%
27.02	Lignite, whether or not agglomerated, excluding jet						
2702.10	Lignite, whether or not pulverized, but not agglomerated	Free	Free	Free	Free	Free	Free
2702.20	Agglomerated lignite	Free	Free	Free	Free	Free	Free
2704.00	Coke and semi-coke of coal, of lignite or of peat, whether or not agglomerated; retort carbon	Free	Free	Free	Free	Free	Free-3.2%

Sources: Canadian Customs Tariff, effective January 2007, Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2007; Official Journal of the European Union (October 17, 2006 Edition); Customs Tariff Schedules of Japan, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, COAL PRODUCTION AND TRADE, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
SHIPMENTS							
	Nova Scotia	x	x	x	x	x	x
	New Brunswick	x	x	x	x	x	x
	Saskatchewan	11 588 000	x	11 017 000	x	10 441 000	x
	Alberta	27 202 000	x	28 570 000	x	31 258 000	x
	British Columbia	27 084 000	1 125 420	25 572 000	1 840 307	21 180 000	1 649 947
	Total	65 997 000	1 596 459	65 345 000	2 329 021	62 986 500	2 205 105
EXPORTS							
2701.11	Anthracite	475	200	227	23	1 790	339
2701.12.10	Bituminous coal, metallurgical						
	Japan	4 883 987	300 796	6 792 111	781 342	7 224 305	906 079
	South Korea	3 625 115	230 191	4 770 365	544 589	4 441 137	500 992
	Germany	1 813 986	128 145	1 757 343	188 840	1 679 876	232 599
	United States	1 735 103	150 124	1 602 239	239 867	1 460 585	218 251
	Brazil	1 469 050	89 485	1 718 266	180 062	1 584 246	203 835
	Taiwan	990 020	62 620	1 274 345	156 297	1 220 155	158 019
	United Kingdom	1 063 763	65 680	1 677 264	178 961	1 417 776	138 957
	Italy	890 750	54 691	1 468 895	173 609	1 177 213	138 897
	Turkey	1 306 265	95 899	1 025 098	146 252	1 080 129	136 984
	Netherlands	1 139 166	84 484	807 144	91 752	993 656	132 474

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
	Finland	199 897	12 682	516 011	69 039	493 669	63 338
	France	387 968	33 191	493 735	70 958	371 839	49 752
	Chile	364 526	17 448	368 493	36 865	373 064	38 451
	Mexico	482 930	26 189	406 464	50 802	274 422	33 038
	China	1 762 860	116 132	955 736	74 877	211 219	27 350
	Egypt	381 008	32 825	426 237	54 067	220 073	24 994
	Spain	112 816	6 608	343 948	49 991	174 657	22 766
	Bulgaria	138 713	14 809	145 445	10 473	70 231	9 827
	India	49 143	6 353	—	—	69 140	7 725
	Pakistan	204 300	12 469	103 566	13 046	54 127	6 908
	Guatemala	—	—	—	—	48 415	2 568
	Belgium	292 931	22 797	57 651	4 557	—	—
	Greece	552 680	36 455	—	—	—	—
	Total	23 846 977	1 600 073	26 710 356	3 116 246	24 639 934	3 053 804
2701.12.90	Bituminous coal, other						
	Japan	499 719	25 490	728 453	43 035	1 373 511	71 268
	South Korea	—	—	169 287	10 537	533 695	24 884
	Chile	44 990	1 704	180 406	10 127	348 209	16 236
	United States	759 852	56 475	237 203	19 960	229 324	14 847
	Others	590 288	26 278	35 930	3 235	298 283	15 544
	Total	1 894 849	109 947	1 351 279	86 894	2 783 022	142 779
2701.19	Other coal						
	Japan	—	—	—	—	78 136	10 203
	United States	1 322	313	6 934	590	58 801	3 263
	Others	3 535	346	4 609	437	4 362	492
	Total	4 857	659	11 543	1 027	141 299	13 958
2701.20	Briquettes, ovoids and similar solid fuels manufactured from coal	5	1	513	40	1	...
2702.10	Lignite whether or not pulverized, but not agglomerated						
	United States	66 090	6 533	72 629	6 940	80 468	7 207
	Others	176	12	165	11	261	20
	Total	66 266	6 545	72 794	6 951	80 729	7 227
2702.20	Agglomerated lignite						
	United States	46 242	3 926	55 063	4 286	28 863	3 198
	Others	66	43	179	98	39	20
	Total	46 308	3 969	55 242	4 384	28 902	3 218
Total exports		25 859 737	1 721 394	28 201 954	3 215 565	27 675 677	3 221 325
IMPORTS							
2701.11	Anthracite						
	Russia	34 594	2 724	113 709	11 531	263 701	22 217
	United States	264 393	11 160	112 646	10 479	136 179	12 163
	China	462	137	50 697	5 367	16 113	1 755
	Others	169 536	13 592	61 538	5 420	121	13
	Total	468 985	27 613	338 590	32 797	416 114	36 148
2701.12.00.11, 2701.12.00.12	Bituminous coal, metallurgical						
	United States	3 429 444	242 848	4 160 036	360 840	4 131 966	390 296
	Colombia	—	—	8 983	1 554	7 376	982
	Others	..	...	59 032	6 008	113 391	16 156
	Total	3 429 444	242 848	4 228 051	368 402	4 252 733	407 434
2701.12.00.91	Bituminous coal, other, high volatile						
	United States	6 823 417	396 111	5 807 253	403 983	5 376 498	373 999
	Venezuela	—	—	—	—	27 502	1 174
	Colombia	145 449	5 849	—	—	7 703	329
	Total	6 968 866	401 960	5 807 253	403 983	5 411 703	375 502
2701.12.00.92	Bituminous coal, other, low volatile						
	United States	284 420	18 678	398 307	27 655	530 162	36 208
	Venezuela	734 150	38 008	625 330	52 211	415 739	30 908
	Colombia	743 724	36 105	1 306 536	73 758	269 658	16 743
	Others	9	—	1	...	7	2
	Total	1 762 303	92 791	2 330 174	153 624	1 215 566	83 861

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2701.19	Other coal						
	United States	5 778 681	184 166	7 164 705	228 653	7 695 005	266 960
	Colombia	614 747	31 810	1 250 106	67 918	1 633 356	111 237
	South Africa	—	—	17	...	72 575	4 420
	Russia	—	—	21 451	1 527	65 685	3 904
	United Kingdom	2 839	236	20 733	720	8 092	445
	Others	28 086	3 122	61 032	7 903	136	2
	Total	6 424 353	219 334	8 518 044	306 721	9 474 849	386 968
2701.20	Briquettes, ovoids and similar solid fuels manufactured from coal	9 387	874	2 041	191	599	91
2702.10	Lignite whether or not pulverized, but not agglomerated	1 332	136	967	98	296	32
2702.20	Agglomerated lignite	2	...	256	83	..	...
	Total imports	19 064 672	985 556	21 225 376	1 265 899	20 771 860	1 290 036

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; ... Amount too small to be expressed; (p) Preliminary; x Confidential.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADIAN COKE TRADE, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS							
2704.00	Coke and semi-coke of coal, of lignite or of peat, whether or not agglomerated; retort carbon						
	United States	132 551	42 117	239 030	66 376	78 540	20 402
	Others	871	141	668	95	84	19
	Total (1)	133 422	42 258	239 698	66 471	78 624	20 421
IMPORTS							
2704.00	Coke and semi-coke of coal, of lignite or of peat, whether or not agglomerated; retort carbon						
	United States	602 615	59 335	780 879	91 351	802 277	73 057
	China	317 292	115 419	211 835	57 974	133 012	24 143
	Colombia	—	—	...	...	60 201	13 887
	Germany	3 827	892	2 053	669	1 995	800
	Others	63 794	20 797	11	3	4	1
	Total (1)	987 528	196 443	994 778	149 997	997 489	111 888

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Amount too small to be expressed; (p) Preliminary.

(1) Total includes other countries.

Note: Numbers may not add to totals due to rounding.

TABLE 3. COAL PRODUCTION BY TYPE AND PROVINCE, 1990-2006

	Alberta			British Columbia	New Brunswick	Nova Scotia	Saskatchewan	Canada
	Bituminous	Subbituminous	Total	Bituminous	Bituminous	Bituminous	Lignite	Total
(000 tonnes)								
1990	9 153	21 252	30 405	24 556	548	3 415	9 407	68 331
1991	10 312	22 242	32 554	24 963	498	4 138	8 981	71 134
1992	10 508	23 020	33 528	17 174	399	4 486	10 027	65 614
1993	11 498	23 660	35 159	20 628	389	3 647	9 000	68 824
1994	10 195	25 489	35 684	22 604	331	3 509	10 684	72 815
1995	11 523	25 621	37 144	23 349	263	2 482	10 739	74 979
1996	11 164	24 985	36 150	25 420	272	3 171	10 838	75 853
1997	10 560	25 782	36 343	27 878	173	2 715	11 652	78 762
1998	10 871	25 285	36 156	24 866	272	2 118	11 790	75 204
1999	9 903	24 229	34 203	24 844	251	1 537	11 659	75 204
2000	6 728	24 168	30 896	25 681	229	1 165	11 190	69 163
2001	5 971	24 940	30 911	27 007	165	881	(a) 11 390	70 355
2002	4 957	25 528	30 485	24 398	175	x	(a) 11 365	66 608
2003	3 346	24 880	28 226	23 099	141	x	(a) 10 665	62 163
2004	2 055	25 147	27 202	27 084	x	x	(a) 11 588	66 019
2005	2 828	25 742	28 570	27 544	x	x	11 017	67 500
2006 (p)	6 400	26 100	32 500	23 400	x	x	10 440	66 440

Sources: Natural Resources Canada; Statistics Canada

(p) Preliminary; x Confidential.

(a) Saskatchewan Bureau of Statistics, *Monthly Statistical Review*.**TABLE 4. CANADIAN COAL CONSUMPTION, 1990-2006**

	Electricity	Steel	Industry	Producer Use	Non- Energy	Total
(000 tonnes)						
1990	42 136	4 996	1 730	144	349	49 354
1991	43 873	4 906	1 473	165	315	50 732
1992	45 808	4 885	1 504	88	311	52 596
1993	43 112	4 665	1 392	128	386	49 683
1994	45 273	4 780	1 513	129	370	52 065
1995	45 954	4 189	1 595	186	415	52 338
1996	46 607	4 446	1 641	166	442	53 302
1997	49 799	4 490	1 721	144	450	56 605
1998	52 455	4 119	1 713	105	430	58 821
1999	52 037	4 360	1 745	179	382	58 703
2000	55 824	4 265	1 959	160	469	62 676
2001	55 537	4 255	1 870	335	396	62 393
2002	55 612	4 201	1 810	216	413	62 252
2003	55 213	4 174	1 931	284	457	62 059
2004	51 241	4 370	2 109	264	474	58 458
2005 (e)	51 000	4 200	2 100	260	450	58 010
2006 (e)	51 000	4 300	2 000	250	450	58 000

Sources: Natural Resources Canada, Statistics Canada.

(e) Estimated.

TABLE 5. CANADIAN COAL TRADE, 1988-2006

	Metallurgical (1)		Steam (2)		Total Canada	
	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)
EXPORTS						
1988	29 354	1 931 031	118	7 036	29 472	1 938 067
1989	31 706	2 061 924	116	15 315	31 822	2 077 239
1990	31 986	2 109 070	72	9 474	32 058	2 118 544
1991	32 401	2 043 347	80	8 002	32 481	2 051 349
1992	25 910	1 666 905	224	17 110	26 134	1 684 015
1993	28 249	1 845 140	103	10 053	28 352	1 855 193
1994	31 243	2 039 875	68	7 325	31 311	2 047 200
1995	34 054	2 228 708	161	9 294	34 215	2 238 002
1996	34 593	2 494 781	102	8 414	34 695	2 503 195
1997	35 610	2 571 970	272	22 016	35 882	2 593 986
1998	27 972	2 060 927	5 213	301 083	33 185	2 362 010
1999	30 289	1 746 020	3 662	152 136	33 951	1 898 156
2000	30 305	1 632 441	2 196	89 358	32 501	1 721 799
2001	26 914	1 715 603	2 782	118 785	29 696	1 834 388
2002	22 964	1 582 580	2 222	108 642	25 186	1 691 222
2003	23 716	1 480 528	1 389	77 651	25 105	1 558 179
2004	23 847	1 600 072	2 013	121 322	25 860	1 721 394
2005	26 710	3 116 245	1 492	99 320	28 202	3 215 565
2006	24 640	3 053 802	3 036	167 520	27 676	3 221 322
IMPORTS						
1988	..	..	13 860	647 416	13 860	647 416
1989	..	..	13 901	615 332	13 901	615 332
1990	4 021	185 421	10 819	426 879	14 840	612 300
1991	4 170	189 627	7 665	288 520	11 835	478 147
1992	4 733	216 429	9 017	375 259	13 750	591 688
1993	4 721	227 404	4 002	183 819	8 723	411 223
1994	4 047	201 583	5 007	232 349	9 054	433 932
1995	4 183	211 235	5 566	264 198	9 749	475 433
1996	5 465	283 250	6 183	288 448	11 648	571 698
1997	4 616	238 944	10 202	453 898	14 818	692 842
1998	4 536	258 201	15 318	671 063	19 854	929 264
1999	3 857	204 018	16 103	717 592	19 960	921 610
2000	3 493	183 214	15 932	755 576	19 425	938 790
2001	3 987	229 475	15 443	799 304	19 430	1 028 779
2002	4 315	283 037	18 321	809 983	22 636	1 093 020
2003	3 294	180 633	19 422	718 240	22 716	898 873
2004	3 429	242 848	15 635	742 709	19 064	985 557
2005	4 228	368 401	16 997	897 499	21 225	1 265 900
2006	4 253	407 434	16 519	882 606	20 772	1 290 040

Sources: Natural Resources Canada; Statistics Canada.

.. Not available.

(1) Metallurgical includes 2701.12.00.11 and 2701.12.00.12 for imports and 2701.12 and 2701.12.10 for exports.

(2) Steam includes 2701.11, 2701.19, 2701.12.00.91, 2701.12.00.92, 2701.12.00.99, 2701.20, 2702.10 and 2702.20 for imports and 2701.11, 2701.12.90, 2701.19, 2701.20, 2702.10 and 2702.20 for exports.

Note: Includes domestic exports only.

TABLE 6. COAL MINES IN CANADA, 2006

Coal Mine	Owner	Operator	Location	Production Capacity (Mt/y)	Type of Coal
Basin	Compliance Energy Corp.	Compliance Energy Corp.	Princeton, B.C.	0.4	Bituminous steam
Bienfait	Royal Utilities Income Trust	Prairie Mines & Royalty Ltd.	Bienfait, Saskatchewan	2.8	Lignite
Boundary Dam	Royal Utilities Income Trust	Prairie Mines & Royalty Ltd.	Estevan, Saskatchewan	6.5	Lignite
Brule	WCC	WCC	Chetwynd, B.C.	2.0	Bituminous coking, PCI
Cardinal River (Cheviot)	Fording Canadian Coal Trust and Teck Cominco Ltd.	Elk Valley Coal Corp.	Hinton, Alberta	Mine 2.2 Plant 2.5	Bituminous coking
Coal Mountain	Fording Canadian Coal Trust and Teck Cominco Ltd.	Elk Valley Coal Corp.	Sparwood, B.C.	Mine 2.7 Plant 3.5	Bituminous coking
Coal Valley	Sherritt International Corp.	Sherritt International Corp.	Edson, Alberta	3.6	Bituminous steam
Dillon	WCC	WCC	Chetwynd, B.C.	..	PCI
Elkview	Fording Canadian Coal Trust and Teck Cominco Ltd.	Elk Valley Coal Corp.	Sparwood, B.C.	Mine 5.5 Plant 7.0	Bituminous coking
Fording River	Fording Canadian Coal Trust and Teck Cominco Ltd.	Elk Valley Coal Corp.	Elkford, B.C.	Mine 8.9 Plant 10.0	Bituminous coking
Genesee	Royal Utilities Income Trust and EPCOR	Prairie Mines & Royalty Ltd.	Warburg, Alberta	5.6	Subbituminous
Grande Cache	Grande Cache Coal Corp.	Grande Cache Coal Corp.	Grande Cache, Alberta	2.0	Bituminous coking
Greenhills	Fording Canadian Coal Trust and Teck Cominco Ltd.	Elk Valley Coal Corp.	Elkford, B.C.	Mine 5.1 Plant 5.0	Bituminous coking
Highvale	TransAlta Corp.	Prairie Mines & Royalty Ltd.	Seba Beach, Alberta	13	Subbituminous
Line Creek	Fording Canadian Coal Trust and Teck Cominco Ltd.	Elk Valley Coal Corp.	Sparwood, B.C.	Mine 2.7 Plant 3.5	Bituminous coking
Obed Mountain	Sherritt International Corp.	Sherritt International Corp.	Hinton, Alberta	..	Bituminous steam
Paintearth	Royal Utilities Income Trust	Prairie Mines & Royalty Ltd.	Forestburg, Alberta	3.5	Subbituminous
Poplar River	Royal Utilities Income Trust	Prairie Mines & Royalty Ltd.	Coronach, Saskatchewan	4.0	Lignite
Quinsam	Hillsborough Resources Ltd.	Hillsborough Resources Ltd.	Campbell River, B.C.	0.5	Bituminous steam
Salmon Harbour	NB Power	NB Power	Minto, New Brunswick	..	Bituminous steam
Sheerness	Royal Utilities Income Trust	Prairie Mines & Royalty Ltd.	Hanna, Alberta	4.0	Subbituminous
Stellarton	Pioneer Coal Ltd	Pioneer Coal Ltd	Stellarton, Nova Scotia	..	Bituminous steam
Trend	NEMI	NEMI	Tumbler Ridge, B.C.	2.0	Bituminous coking
Whitewood	TransAlta Corp.	Prairie Mines & Royalty Ltd.	Seba Beach, Alberta	1.4	Subbituminous
Willow Creek	Pine Valley Mining Corp.	Pine Valley Mining Corp.	Chetwynd, B.C.	..	PCI
Wolverine	WCC	WCC	Tumbler Ridge, B.C.	3.0	Bituminous coking, PCI

Source: Natural Resources Canada.

.. Not available.

TABLE 7. COAL PROJECTS UNDER DEVELOPMENT, 2006

Project Name	Proponent	Location	Production Capacity	Type of Coal
			(Mt/y)	
AESWapiti	Hillsborough Resources Ltd.	Tumbler Ridge, B.C.	..	Bituminous steam
Dodds-Roundhill	Sherritt and the Ontario	Edmonton, Alberta	..	Subbituminous
Gasification	Teachers Pension Plan			
Donkin	Xstrata Donkin Mine	Sydney, Nova Scotia	..	Bituminous steam
	Development Alliance			
Gething	Dehua International Mines	Henderson's Hope, B.C.	2	Bituminous coking
	Group Inc.			
Hermann	WCC	Tumbler Ridge, B.C.	1	Bituminous coking, PCI
Horizon	Peace River Coal Inc.	Tumbler Ridge, B.C.	1.6	Bituminous coking
Lodgepole	Cline Mining Corp.	Fernie, B.C.	2	Bituminous coking
Mount Klappan	Fortune Minerals Ltd.	Skeena, B.C.	1.5	Anthracite
Shand	SaskPower Inc.	Estevan, Saskatchewan	..	Lignite

Source: Natural Resources Canada.

.. Not available.

TABLE 8. WORLD AND SELECTED COUNTRIES' COAL PRODUCTION, 2005 (p)

Country	Steam Coal	Coking Coal	Total Production
	(million tonnes)		
China	1 968	258	2 226
United States	983	45	1 028
India	403	26	429
Australia	245	126	371
Russia	226	71	297
South Africa	239	1	240
Germany	191	15	206
Poland	146	14	160
Indonesia	120	20	140
Kazakhstan	82	..	82
Greece	71	..	71
Canada	39	27	67
Czech	55	7	62
Colombia	60	1	61
Ukraine	61	..	61
Turkey	59	1	60
Serbia and Montenegro	54	..	54
North Korea	53	..	33
Romania	31	..	31
Vietnam	28	..	28
Bulgaria	25	..	25
Thailand	21	..	21
United Kingdom	21	..	21
Spain	19	..	19
Estonia	15	..	15
Mexico	8	2	10
Hungary	10	..	10
Venezuela	9	..	9
Brazil	6	..	6
New Zealand	3	2	5
World total	5 244	633	5 878

Sources: Natural Resources Canada; *Coal Information*, International Energy Agency, 2006.

.. Not available or not applicable; (p) Preliminary.

Note: Statistics show countries with over 5 million tonnes of coal production.

**TABLE 9. WORLD AND SELECTED COUNTRIES'
COAL CONSUMPTION, 2005 (e)**

Country	Steam Coal	Coking Coal	Total Consumption
(million tonnes)			
China	1 920	259	2 179
United States	921	21	1 020
India	388	45	465
Japan	114	63	178
Russia	104	59	238
South Africa	167	2	169
Germany	221	22	243
Poland	130	11	141
Australia	136	2	139
South Korea	62	22	84
Turkey	70	6	72
Greece	72	..	72
Ukraine	60	6	66
Kazakhstan	66	..	66
United Kingdom	55	7	62
Chinese Taipei	55	6	61
Canada	55	4	58
Czech Republic	57	..	57
Serbia and Montenegro	56	..	56
Spain	41	4	45
Indonesia	34	..	34
Romania	31	3	34
North Korea	32	..	32
Thailand	30	..	30
Bulgaria	25	2	27
Italy	18	6	24
France	14	7	21
Brazil	6	15	21
Vietnam	16	..	16
Estonia	16	..	16
Mexico	13	1	14
Israel	13	..	13
Netherlands	8	5	13
Hungary	11	1	12
Hong Kong	11	..	11
Malaysia	10	..	10
Slovakia	6	3	9
Philippines	9	..	9
Belgium	4	4	8
Denmark	6	..	6
Portugal	6	..	6
Colombia	5	..	5
Pakistan	3	2	5
Austria	3	2	5
Finland	4	1	5
World total	5 269	633	5 902

Sources: Natural Resources Canada; *Coal Information*, International Energy Agency, 2006.

.. Not available or not applicable; (e) Estimated.

Note: Statistics show countries with over 5 million tonnes of coal consumption.

TABLE 10. WORLD AND SELECTED COUNTRIES' RECOVERABLE COAL RESERVES, END OF 2002

Country	Bituminous	Subbituminous	Lignite	Total
(million tonnes)				
United States	111 338	101 978	33 327	246 643
Russia	49 088	97 472	10 450	157 010
China	62 200	33 700	18 600	114 500
India	90 086	..	2 360	92 445
Australia	38 600	2 200	37 700	78 500
South Africa	48 751	..	..	48 751
Ukraine	16 274	15 946	1 933	34 153
Kazakhstan	28 151	..	3 128	31 279
Serbia and Montenegro	9	656	15 926	16 591
Poland	14 000	..	..	14 000
Brazil	..	10 113	..	10 113
Germany	183	..	6 556	6 739
Colombia	6 230	381	..	6 611
Canada	3 471	871	2 236	6 578
Czech Republic	2 094	3 242	216	5 552
Indonesia	740	1 322	2 906	4 968
Turkey	278	761	3 147	4 186
Uzbekistan	1 000	..	3 000	4 000
Greece	..	..	3 900	3 900
Hungary	198	199	2 960	3 357
Pakistan	..	60	2 990	3 050
Bulgaria	4	91	2 092	2 187
Thailand	..	..	1 354	1 354
Mexico	860	300	51	1 211
Chile	31	1 150	..	1 181
Peru	960	100	..	1 060
World total	478 771	272 326	157 967	909 064

Sources: Natural Resources Canada; Survey of Energy Resources, 2004, World Energy Council.

.. Not available or not applicable.

Note: Countries with recoverable coal reserves over 1000 Mt were selected.

Copper

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RECENT WORLD COPPER DATA

	2004	2005	2006	2005/04	2006/05
	(000 tonnes)		(% change)		
Mine production	14 607	14 922	15 026	2.2	0.7
Primary refined production	13 843	14 413	14 858	4.1	3.1
Secondary refined production	2 037	2 130	2 466	4.6	15.8
Total refined production	15 880	16 543	17 324	4.2	4.7
Usage (consumption)	16 786	16 664	16 994	-0.7	2.0
Refined balance (1)	-906	-121	330	n.a.	n.a.
Refined stocks at year-end (all)	928	855	1 093	-0.78	27.8

Source: International Copper Study Group (ICSG), Forecast, 29th Regular Meeting, May 16, 2007.

n.a. Not applicable.

(1) Surplus or deficit is calculated using total refined production minus refined usage.

LME COPPER PRICES

	2004	2005	2006
Cash US\$/lb	130	166.8	304.8
Cash US\$/t	2 865	3 678	6 721
3 months US\$/t	2 752	3 504	6 665
15 months US\$/t	2 436	2 982	6 038
27 months US\$/t	2 271	2 732	5 383

Source: Bloomsbury Minerals Economics Ltd.

RECENT CANADIAN COPPER DATA

	2004	2005	2006 (p)
	(tonnes)		
Mine output (1)	562 795	595 383	606 896
Primary production (2)	544 558	570 395	593 557
Reported mine production (3)	547 885	562 821	596 242
Copper refined production	526 955	515 223	500 208
Copper domestic shipments	243 848	225 083	241 851
Copper refined imports	53 300	64 400	60 200
Apparent copper usage (4)	297 148	289 483	302 051

Source: Natural Resources Canada.

(1) Metal content in concentrates produced based on NRCan surveys.

(2) Recoverable metal in concentrates shipped based on NRCan surveys.

(3) Reported copper mine production is taken from company reports and is a mixture of copper in concentrates produced and payable copper in concentrates, depending upon the company. (4) Usage = domestic shipments + refined imports.

Note: NRCan data are rounded to the nearest 100 t, except for reported copper mine production, which is rounded to the nearest 1000 t.

SUMMARY

Copper is the third-ranking metal produced and used in the world, behind aluminum and steel. Total refined copper production in 2006 was reported at 17.4 Mt. Of this 17.4 Mt, 15%, or 2.6 Mt, was produced from recycled sources (see also recent World Copper Data in the table opposite).

Copper prices climbed to fresh historical highs throughout 2006, driven by strong demand in Asia, continued low stocks, concerns about slow supply growth, and strong buying interest from investment funds. The average London Metal Exchange (LME) cash settlement price for copper in 2006 was US\$6721/t or US\$3.04/lb, 83% higher than the 2005 average of US\$1.67/lb. The spot price peaked in May 2006 at US\$3.99862/lb on the LME and at US\$4.08/lb on the New York Mercantile Exchange (NYME) Comex Division (Comex) (see Figure 1).

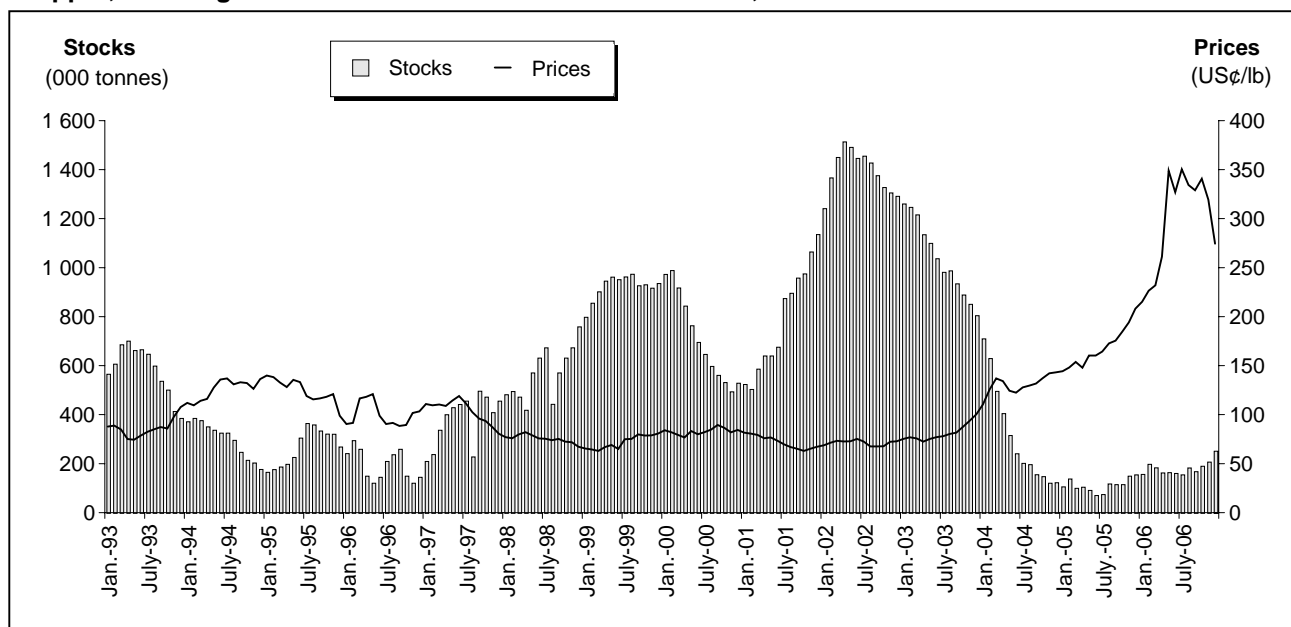
CANADIAN PRODUCTION SUMMARY AND OUTLOOK

The locations of Canadian mines and metallurgical operations that produced copper in 2006 are shown in Figure 2.

Mined copper production data for each mine in Canada that produced copper in 2004, 2005 and 2006 are detailed in the table on the next page.

Mined copper output for 2006 rose by 1.9% to 607 000 t from 2005 output of 595 400 t on the strength of full output from mines that re-opened in 2005 (Mount Polley and Gibraltar). A breakdown of mine production by province is shown in Table 2 at the end of this chapter. Mined output in 2007 is forecast at a level similar to 2006 on the expectation of increased copper concentrate output from Voisey's Bay and the start-up of the Duck Pond and Minto mines. A forecast of mine output to 2015 is plotted in Figure 3; it indicates that output may dip down below current levels by the end of 2008 when Kemess South reserves are expected to be depleted.

Figure 1
Copper, Exchange Stocks and LME Cash Settlement Prices, 1993-2006



Sources: London Metal Exchange; International Copper Study Group.

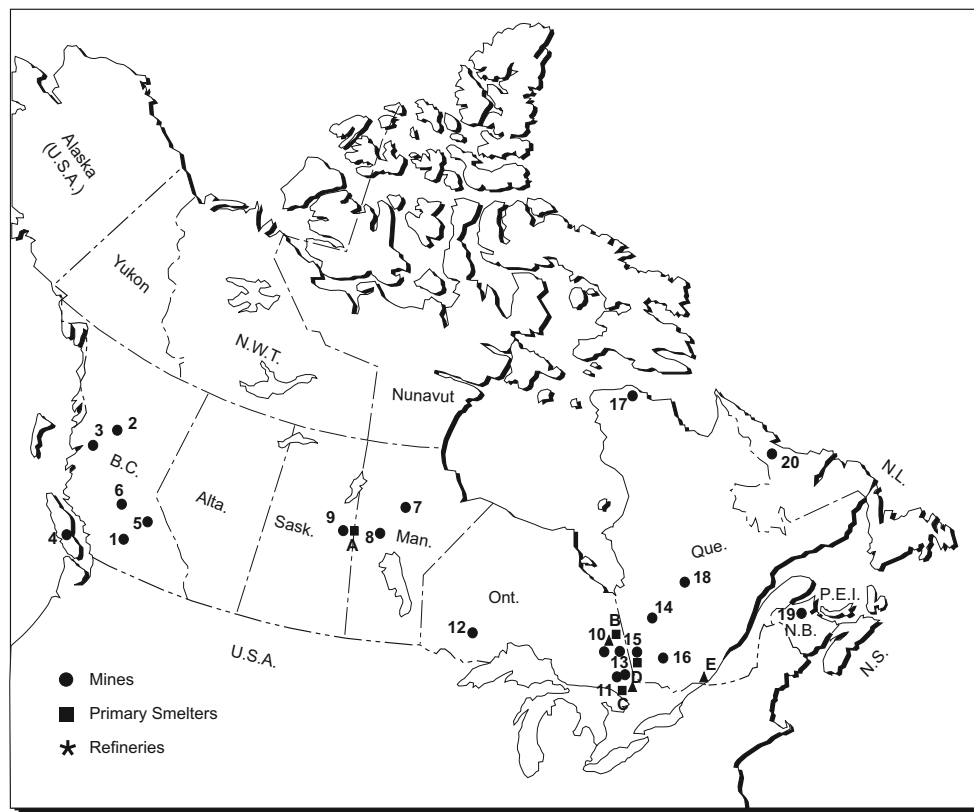
CANADIAN MINES PRODUCING COPPER IN CONCENTRATE, 2004-06

Name of Mine	Operator	2004	2005	2006
(tonnes)				
Bouchard-Hébert	Breakwater Resources Ltd.	8 600	1 000	—
Brunswick	Xstrata Plc	6 547	5 894	8 774
Copper Rand	Campbell Resources Inc.	—	407	200
Gibraltar	Ledcor Mining Ltd.	—	24 850	22 271
Highland Valley	Highland Valley Mine Partnership	170 300	179 000	171 300
Huckleberry	Imperial Metals Corp.	28 542	33 519	32 114
777 and Trout Lake	HudBay Minerals Inc.	45 871	41 756	56 698
Kemess South	Kemess Mines Limited	34 000	33 440	36 836
Kidd Creek	Xstrata Plc	41 029	42 738	50 405
Montcalm	Xstrata Plc	1 188	4 996	5 680
Lac des Iles	North American Palladium	3 554	2 501	2 339
LaRonde	Agnico-Eagle Mines Limited	10 251	7 378	7 300
Louvicourt	Aur Resources Inc.	33 112	17 237	—
Matagami/Bell Allard	Xstrata Plc	6 617	—	—
Mount Polley	Imperial Metals Corp.	—	13 757	24 948
Myra Falls	Breakwater Resources limited	16 800	7 620	8 482
Raglan	CVRD Inco Limited	6 867	5 842	6 281
Selbaie	Les Mines Selbaie	800	—	—
Sudbury	CVRD Inco Limited	104 312	108 712	109 000
Sudbury Division	Xstrata Plc	24 694	23 367	22 714
Troilus	Inmet Mining Corporation	4 800	4 400	2 900
Voisy's Bay	CVRD Inco Limited	—	4 406	28 000
Total		547 885	562 821	596 242

Source: Author's calculations based on company reports.

— Nil.

Figure 2
Copper Producers in Canada, 2006



Numbers and letters refer to locations on map above.

MINES

BRITISH COLUMBIA

1. Highland Valley Copper Partnership (1)
2. Northgate Minerals Corporation (Kemess mine)
3. Huckleberry Mines Ltd. (Huckleberry mine)
4. Breakwater Resources Ltd. (Myra Falls mine)
5. Imperial Metals Corporation (Mount Polley mine)
6. Taseko Mines Limited (Gibraltar mine)

MANITOBA

7. CVRD Inco Limited (Thompson mine)
8. HudBay Minerals Inc. (Chisel Lake North mine)
9. HudBay Minerals Inc. (Trout Lake mine, 777 project)

ONTARIO

10. Xstrata Plc (Kidd Creek Division)
11. Xstrata Plc (Sudbury Division)
12. North American Palladium Ltd. (Lac des Iles mine)
13. Xstrata Plc (Montcalm mine)

QUEBEC

14. MSV Resources (Copper Rand)
15. Campbell Resources Inc. (Joe Mann mine)
16. Agnico-Eagle Mines Limited (LaRonde mine)
17. Xstrata Plc (Raglan mine)
18. Inmet Mining Corporation (Troilus mine)

NEW BRUNSWICK

19. Xstrata Plc (Brunswick mine)

NEWFOUNDLAND AND LABRADOR

20. CVRD Inco Limited (Voisey's Bay mine)

PRIMARY SMELTERS

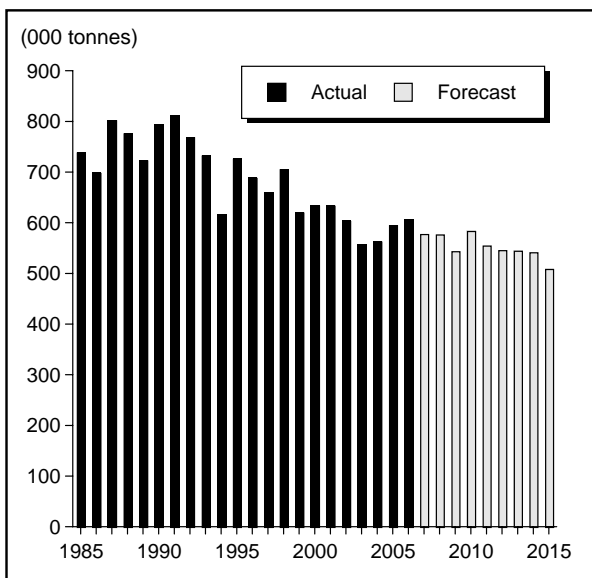
- A. HudBay Minerals Inc. (Flin Flon)
- B. Xstrata Plc (Kidd Creek)
- C. CVRD Inco Limited (Copper Cliff)
- Xstrata Plc (Falconbridge)
- D. Xstrata Plc (Horne)

REFINERIES

- B. Xstrata Plc (Kidd Creek)
- E. Xstrata Plc (CCR Division)

(1) Highland Valley Copper is a partnership of Teck Cominco Limited and Highmont Mining.

Figure 3
Canadian Mine Production of Copper,
1985-2015



Source: Natural Resources Canada.

Based on data reported to Natural Resources Canada (NRCAN) via monthly surveys, forecast refined copper output for 2006 is 500 000 t, down slightly from 2005 output of 515 000 t. Canadian cathode production from 2006 onwards is coming from two refineries: the CCR refinery in Montréal and the Kidd Creek refinery in Timmins, Ontario, both owned by Xstrata plc, following Inco Limited's decision in 2005 to close its Copper Cliff refinery by the end of 2006 and ship copper anode from its Sudbury nickel operation to CCR for further processing. Going forward, annual output is likely to range between 500 000 and 520 000 t/y based on the current operating capacities of the two plants.

Additional information regarding Canadian production developments can be found in the copper section of the 2006 *Nonferrous Metals Outlook* publication available on the Internet at www.nrcan.gc.ca/ms/pdf/nfo/nfo06/copp_e.pdf.

The web sites for Canadian copper producers and for companies that are prospective producers are shown in Table 4 at the end of this chapter.

MARKET REVIEW AND OUTLOOK

Smelter Treatment and Refining Charges

Spot market and long-term concentrate treatment and refining charges (TC/RCs¹) fell sharply from historical highs in 2005 in reaction to a deficit in the supply/demand balance

for concentrates that emerged in the second half of 2006 and persisted into 2007. Average spot TC/RCs c.i.f. Shanghai delivery basis were US\$68.5/t and 6.9¢/lb for 2006, compared with US\$150/t and 15¢/lb in 2005. The annual contract TC/RC for 2006 deliveries under long-term contracts c.i.f. Japan delivery basis averaged US\$95/t and 9.5¢/lb, up slightly from the 2005 average of US\$85/t and 8.5¢/lb, but 2007 terms seem to be settling at the US\$60/t and 6¢/lb level. Further evidence of the market tipping in favour of the miners is a much-quoted settlement between BHP Billiton and the Chinese for Escondida concentrates that was agreed at terms of US\$60/t and 6¢/lb, and the elimination of price participation.² The concentrates market is expected to remain in a deficit position until beyond 2008; consequently, TC/RCs are not likely to recover strongly in the near term.

Supply/Demand Outlook

Mine production growth of 0.7% in 2006 was sluggish for the second year in a row as disruptions from accidents, strikes, and production shortfalls affected some of the world's largest mines, including Chuquibambilla and Escondida in Chile and Grasberg and Batu Hijau in Indonesia. A forecast issued by the International Copper Study Group (ICSG) in May 2007 projected a 6.3% growth in mine supply in 2007 and this should help rebalance the concentrate market. Refined production grew at a stronger pace than 2005 (4.6% according to the ICSG), but this is just barely keeping pace with demand growth, which ranged from 2.0% to 4.9% in 2006, up substantially from 2005's 3-4%, depending on how analysts interpreted the change in China's State Reserve Bureau (SRB) stocks.³ The view for 2007 is mixed on whether refined production growth will outpace supply, but indications are that the supply/demand balance will swing from a deficit to a small surplus (less than 150 000 t).

Price Outlook

Beyond 2007, a consensus view is emerging among market watchers that the strong demand for copper in developing countries will remain for several years to come and that supply growth will not match demand growth, at least in the medium term. With fundamentals remaining strong until at least 2009, prices will likely remain above US\$2.50/lb over 2007/2008 and trend downward thereafter. Prices should start to decline below the US\$2.00/lb level beyond 2010 when supply from new projects will be sufficient to allow a rebuilding of global inventories.

OTHER COPPER INFORMATION

Applications

Copper is used in many applications. Due to its high electrical conductivity, a prime application of copper is wire and cable used to carry power and signals. The high

conductivity means good efficiency, and good corrosion resistance means that copper is a very good electrical conductor. High conductivity means a smaller cross-section for wires relative to other metals, which is important for small motors, hand tools, and crowded conduit spaces. However, in long-distance transmission lines, the heavier density of copper relative to conductivity means that aluminum is preferred to copper as the current-carrying metal for such lines.

Copper also has a high thermal conductivity that makes it a leading competitor for heat exchangers, such as automotive radiators, and for solar heating. More information about the applications of copper can be found on the web site of various copper development organizations. An extensive review of applications is available at www.copperinfo.com/cproducts/index.html.

Use

Canadian copper use is not surveyed on an annual basis. Apparent use can be calculated by adding the imports of refined copper to the reported domestic shipments of copper producers. For 2006, as noted in the data table on the first page of this chapter, these data were 60 200 t of refined imports plus 241 850 t of producers' domestic shipments.

Other Information Sources

The **Canadian Copper & Brass Development Association** (CCBDA) assists copper and copper alloy users on many matters, including technical information. Its web site contains technical information that can be ordered on-line for such topics as alloy castings, tubing, forgings, etc. Technical assistance and library services are also available. Its membership consists of both users and producers of copper. Companies making wire, tubes, rod, plumbing fixtures, castings and forgings are among those that are members of the CCBDA. The Association's web site can be found at www.ccbda.org.

The CCBDA web site also provides links to other copper development associations. There is information:

- in French at www.cuivre.org and at www.copperbenelux.org; and
- in English at www.copper.org (United States), www.copperinfo.com (international), www.copper.org.sg (Southeast Asia), www.procobreperu.org/home.htm (Peru), www.indiancopper.org (India), and www.jcda.or.jp (Japan).

Information is also available in other languages, including Finnish, Danish, Dutch, German, Greek, Italian, Japanese, Norwegian, Portuguese, Spanish, and Swedish through links shown at www.copperinfo.com/professionals/index.html.

The **Canadian Association of Recycling Industries** is the national organization of recycling industries, of which metal recycling, and copper recycling in particular, is an important component. The Association represents companies through the entire chain of recycling from scrap collection to processing and utilization (www.cari-acir.org).

The **Canadian Foundry Association** (CFA) is the national association of foundries in Canada, formed in 1975. Its members include brass and bronze foundries. Its site contains a membership list with links to the members' web sites (click on "Member Profiles"). The CFA web site is located at www.foundryassociation.ca.

The **Canadian Die Casters Association** represents companies in Canada engaged in pressure die casting. Its site contains information about members and links to web sites (click on "Member Profiles" in left frame). Companies seem to publicize their use of aluminum, zinc, and magnesium rather than that of copper. The CDCA web site is located at www.diecasters.ca.

Industry Canada maintains a web site that allows searches for companies engaged in the semi-fabrication of metals and fabrication metals, including copper and copper alloys. The Canadian Company Capabilities (CCC) data base can be searched using terms such as "copper," "brass," or "bronze." The site is located at <http://strategis.ic.gc.ca/cgi-bin/allsites/search/basicviewwhits?lang=e&file=R317907>.

Securities information is available from SEDAR, the System for Electronic Document Analysis and Retrieval (see www.sedar.com).

Production, trade, and capacity data are published by the International Copper Study Group (ICSG), a group consisting of 25 countries serviced by a secretariat in Lisbon, Portugal. Various publications are sold. The ICSG *Copper Bulletin* is a monthly publication. Yearly subscriptions are available. In addition, the Group sells a *Directory of Copper Mines and Plants* spanning a five-year period. Details of these and other publications are available at www.icsg.org in the "Publications" section.

Long-term data are available from the World Bureau of Metal Statistics (WBMS). The WBMS is a private company that holds the copyright for *METALLSTATISTIK*, the renowned data series formerly published by Metallgesellschaft AG. This publication series contains production data back to 1900, as well as trade and price data. The WBMS also publishes *World Metal Statistics* on a monthly, quarterly, and yearly basis. The WBMS web site is located at www.world-bureau.com.

The **International Copper Association** (ICA) maintains a web site with information about:

- **copper products** - building products, consumer and electronic items, transportation, agriculture, industrial applications, and machinery and future applications;

- **energy efficiency** - air conditioners and refrigerators, copper bus bars, motors, power cables, solar energy, transformers, and case studies;
- **health and nutrition** - aquatic life, biological importance, copper deficiency, copper research, information flow project, drinking water, good health with copper, how much do we need?, plant and animal health, pregnancy and infants, public health benefits, quick facts, ICA research;
- **environment** - climate change mitigation, copper research information flow project, energy conservation, natural presence, recycling, sustainability, ICA research; and
- **about copper** - copper alloys, copper exchanges, copper markets, copper mining, copper products.

The web site for the International Copper Association is located at www.copperinfo.com/index4.shtml.

One of the more interesting destinations from the ICA site is an on-line history of copper. This site provides material of interest to students and others seeking an overview of the history of copper. This can be found at <http://60centuries.copper.org>.

The **International Copper Study Group** based in Lisbon sells detailed statistics on world copper production, use, and trade. Details are available on its web site at www.icsg.org.

The **U.S. Geological Survey** (USGS) is another source of detailed information on the world copper industry. The copper information available includes yearly reviews, monthly articles, and an annual summary. The copper portal for the USGS is located at <http://minerals.usgs.gov/minerals/pubs/commodity/copper>.

Information about copper use is also available from the **International Wrought Copper Council** (IWCC). The site has links to member companies and organizations. The IWCC site is located at www.coppercouncil.org.

Please note that web sites other than those of Natural Resources Canada are maintained and owned by other parties who are responsible for the material displayed therein; questions about the suitability and accuracy of such information should be directed to the owners of the web sites. Reference to an external web site does not imply in any way that the material contained therein is accurate or will be maintained in the future; such external references are provided only for the convenience of the reader.

A NOTE ON STATISTICS BASED ON “PRODUCTION” VS. “SHIPMENTS”

Canadian statistics include a report of “mine production” (which is actually mill or concentrator production) and is the total amount of copper produced in concentrates by Canadian mines. However, Canadian statistics also include a “primary production” figure, which is actually the total amount of copper contained in concentrates that is shipped from the mine site in a year. This measure of production is less widely used and is not consistent with the definitions used by the International Copper Study Group (ICSG); Canadian “mine production” data are consistent with the ICSG definition.

The preliminary estimate for 2006 shipments of copper in concentrates (“primary production”) was 593 600 t, which is less than the over 606 900 t of copper in concentrates reported as being produced in 2006. The production data are usually higher than shipments as production relates to the total content of copper in concentrates produced, whereas the shipments data relate to the estimated recoverable copper in concentrates shipped. In certain instances, material produced at the end of one year may not be shipped until the next year, causing a further difference between the data series.

Companies may show production data that report the total amount of copper contained in the concentrates produced in a year or the “payable production” may be shown. The latter reflects the amount of copper for which the mine is paid by the custom smelter. The deduction reflects the inability of the smelters to achieve 100% recoverability of the copper in the feed material. For some operations that report payable production, it is possible to calculate the production of copper contained if one knows the tonnage of ore processed, the copper grade of the material processed, and the recovery factor at the mill.

ENDNOTES

¹ TC/RCs are the amounts charged by smelters to miners to smelt copper concentrates and to produce refined copper. Treatment charges are expressed as a dollar amount per tonne of concentrate received. Refining charges are expressed as a dollar amount per pound of copper contained in the concentrate received. TC/RCs are deducted from the value of the metal in concentrates paid by the smelter to the miner.

² Price participation (PP) is a feature of long-term contracts between smelters and miners of concentrate. For example, if a contract includes price participation above 90¢/lb of copper, it means that miners pay smelters 1¢/lb for every 10¢/lb the copper price is above an agreed threshold price.

³ Note that the ICSG does not take into account changes in SRB stocks.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of December 2007. Some information on developments related to Canadian projects that occurred in 2007 has been included. (3) Various Internet sites have been identified in this article. Please note that Natural Resources Canada has no control over the content of the web sites of other organizations, which may be modified, updated or deleted at any time. (4) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States Canada	EU Conventional Rate (1)	Japan WTO (2)
		MFN	GPT	USA			
2603.00	Copper ores and concentrates	Free	Free	Free	Free	Free	Free
2604.00	Nickel ores and concentrates	Free	Free	Free	Free	Free	Free
2607.00	Lead ores and concentrates	Free	Free	Free	Free	Free	Free
2608.00	Zinc ores and concentrates	Free	Free	Free	Free	Free	Free
2616.10	Precious metal ores and concentrates: silver ores and concentrates	Free	Free	Free	Free	Free	Free
2620.30	Slag, ash and residues (other than from the manufacture of iron or steel) containing metals, arsenic or their compounds: containing mainly copper	Free	Free	Free	Free	Free	Free
2825.50	Hydrazine and hydroxylamine and their inorganic salts; other inorganic bases; other metal oxides, hydroxides and peroxides: copper oxides and hydroxides	Free	Free	Free	Free	3.2%	4.8%
2833.25	Sulphates; alums; peroxosulphates (persulphates); other sulphates: of copper	Free-5.5%	Free	Free	Free	3.2%	3.9%
2836.99	Carbonates; peroxocarbonates (percarbonates); commercial ammonium carbonate containing ammonium carbonate: other: other	Free-3.5%	Free-3%	Free	Free	3.7%-5.5%	3.3%
2837.19.00	Cyanides, cyanide oxides and complex cyanides: cyanides and cyanide oxides: other	Free	Free	Free	Free	5.5%	3.3%
3212.90	Pigments dispersed in non-aqueous media, in liquid or paste form, of a kind used in the manufacture of paints; stamping foils; dyes and other colouring matter put up in forms or packings for retail sale: other	Free-3%	Free	Free	Free	6.5%	2.1%-4.1%
7401.00	Copper mattes; cement copper (precipitated copper)	Free	Free	Free	Free	Free	Free
7402.00	Unrefined copper; copper anodes for electrolytic refining	Free	Free	Free	Free	Free	Free-3%
74.03 7403.11	Refined copper and copper alloys, unwrought Refined copper: cathodes and sections of cathodes	Free	Free	Free	Free	Free	Free-3%
7403.12	Refined copper: wire-bars	Free	Free	Free	Free	Free	Free-3%
7403.13	Refined copper: billets	Free	Free	Free	Free	Free	Free-3%
7403.19	Refined copper: other	Free	Free	Free	Free	Free	Free-3%
7403.21	Copper alloys: copper-zinc base alloys (brass)	Free	Free	Free	Free	Free	Free
7403.22	Copper alloys: copper-tin base alloys (bronze)	Free	Free	Free	Free	Free	Free-3%
7403.23	Copper alloys: copper-nickel base alloys (cupro-nickel) or copper-nickel-zinc base alloys (nickel-silver)	Free	Free	Free	Free	Free	Free-3%
7403.29	Copper alloys: other copper alloys (other than master alloys of heading 74.05)	Free	Free	Free	Free	Free	Free-3%
7404.00	Copper waste and scrap	Free	Free	Free	Free	Free	Free
7405.00	Master alloys of copper	Free	Free	Free	Free	Free	3%
7406.10	Copper powders and flakes: powders of non-lamellar structure	Free	Free	Free	Free	Free	3%
7406.20	Copper powders and flakes: powders of lamellar structure; flakes	Free	Free	Free	Free	Free	3%

TARIFFS (cont'd)

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
74.07	Copper bars, rods and profiles:						
7407.10	Of refined copper	2.5%-3%	Free	Free	Free	4.8%	3%
7407.21	Of copper alloys: of copper-zinc base alloys (brass)	Free-2%	Free	Free	Free	4.8%	3%
7407.22	Of copper alloys: of copper-nickel base alloys (cupro-nickel) or copper-nickel-zinc base alloys (nickel-silver)	2.5%-3%	Free	Free	Free	4.8%	3%
7407.29	Of copper alloys: other	2%-3%	Free	Free	Free	4.8%	3%
74.08	Copper wire:						
7408.11	Of refined copper: of which the maximum cross-sectional dimension exceeds 6 mm	Free-3%	Free	Free	Free	4.8%	3%
7408.19	Of refined copper: other	3%	Free	Free	Free	4.8%	3%
7408.21	Of copper alloys: of copper-zinc base alloys (brass)	Free-3%	Free	Free	Free	4.8%	3%
7408.22	Of copper alloys: of copper-nickel base alloys (cupro-nickel) or copper-nickel-zinc base alloys (nickel-silver)	2.5%-3%	Free	Free	Free	4.8%	3%
7408.29	Of copper alloys: other	2.5%-3%	Free	Free	Free	4.8%	3%
74.09	Copper plates, sheets and strip, of a thickness exceeding 0.15 mm:						
7409.11	Of refined copper: in coils	Free	Free	Free	Free	4.8%	3%
7409.19	Of refined copper: other	Free	Free	Free	Free	4.8%	3%
7409.21	Of copper-zinc base alloys (brass): in coils	Free	Free	Free	Free	4.8%	3%
7409.29	Of copper-zinc base alloys (brass): other	Free	Free	Free	Free	4.8%	3%
7409.31	Of copper-tin base alloys (bronze): in coils	Free	Free	Free	Free	4.8%	3%
7409.39	Of copper-tin base alloys (bronze): other	Free	Free	Free	Free	4.8%	3%
7409.40	Of copper-nickel base alloys (cupro-nickel) or copper-nickel-zinc base alloys (nickel-silver)	Free	Free	Free	Free	4.8%	3%
7409.90	Of other copper alloys	Free	Free	Free	Free	4.8%	3%
74.10	Copper foil, of a thickness not exceeding 0.15 mm						
7410.11	Not backed: of refined copper	Free	Free	Free	Free	5.2%	3%
7410.12	Not backed: of copper alloys	Free	Free	Free	Free	5.2%	3%
7410.21	Backed: of refined copper	Free	Free	Free	Free	5.2%	3%
7410.22	Backed: of copper alloys	Free	Free	Free	Free	5.2%	3%
74.11	Copper tubes and pipes:						
7411.10	Of refined copper	2.5%	Free	Free	Free	4.8%	3%
7411.21	Of copper alloys: of copper-zinc base alloys (brass)	2%	Free	Free	Free	4.8%	3%
7411.22	Of copper alloys: of copper-nickel base alloys (cupro-nickel) or copper-nickel-zinc base alloys (nickel-silver)	2.5%	Free	Free	Free	4.8%	3%
7411.29	Of copper alloys: other	2.5%	Free	Free	Free	4.8%	3%
74.12	Copper tube or pipe fittings:						
7412.10	Of refined copper	3%	Free	Free	Free	5.2%	Free
7412.20	Of copper alloys	3%	Free	Free	Free	5.2%	Free
7413.00	Stranded wire, cable, plaited bands and the like, of copper, not electrically insulated	3%	Free	Free	Free	5.2%	3%
7414.20	Cloth, grill and netting, of copper wire; expanded metal of copper: cloth	3%	Free	Free	Free	4.3%	Free
7414.90	Cloth, grill and netting, of copper wire; expanded metal of copper: other	3%	Free	Free	Free	4.3%	Free
74.15	Nails, tacks, drawing pins, staples and similar articles, of copper or of iron or steel with heads of copper; screws, bolts, nuts, screw hooks, rivets, cotters, cotter-pins, washers and similar articles, of copper						
7415.10	Nails, tacks, drawing pins, staples, and similar articles	2.5%	Free	Free	Free	4%	Free
7415.21	Other articles, not threaded: washers	3%	Free	Free	Free	3%	Free
7415.29	Other articles, not threaded: other	3%	Free	Free	Free	3%	Free
7415.33	Other threaded articles: screws; bolts and nuts	Free-3%	Free	Free	Free	3%	Free
7415.39	Other threaded articles: other	3%	Free	Free	Free	3%	Free
7416.00	Copper springs	3%	Free	Free	Free	4%	Free
74.19	Other articles of copper						
7419.10	Chain and parts thereof	3%	Free	Free	Free	3%	Free
7419.91	Other: cast, moulded, stamped or forged, but not further worked	Free-3%	Free	Free	Free	3%	Free
7419.99	Other: other	Free-9.5%	Free-5%	Free	Free	3%-4.3%	Free

Sources: Canadian *Customs Tariff*, effective January 2006 and January 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2006 and 2007; *Official Journal of the European Union* (October 27, 2005 and October 17, 2006 editions); *Customs Tariff Schedules of Japan*, 2006 and 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, COPPER TRADE, 2004-06

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS							
2603.00.10	Copper ores and concentrates						
	Copper content						
	Japan	93 478	341 997	117 585	470 976	115 787	856 077
	China	15 407	51 580	44 210	180 046	34 384	234 393
	South Korea	32 364	108 949	44 984	146 997	27 843	211 353
	India	4 057	13 790	11 328	46 098	18 157	143 584
	Philippines	13 117	48 798	15 346	65 584	14 493	107 415
	Sweden	—	—	12 112	39 033	14 762	33 303
	Spain	—	—	—	—	2 940	23 494
	Finland	—	—	—	—	1 885	16 025
	United States	516	1 135	2	3	191	216
	Indonesia	—	—	3 753	16 701	—	—
	Poland	—	—	2 878	14 161	—	—
	Thailand	—	—	3 418	13 106	—	—
	Other countries	—	—	56	205	11	50
	Total	158 939	566 249	255 672	992 910	230 453	1 625 910
2604.00.00.10,	Other ores and concentrates						
2607.00.00.10,	Copper content						
2608.00.00.10,	China	—	—	218	458	286	1 229
2616.10.00.10	Other countries	...	...	20	18	1	2
	Total	...	...	238	476	287	1 231
2620.30	Copper ash and residues						
	United States	96	430	120	723	318	1 838
	Other countries	3	4	...	...	—	—
	Total	99	434	120	723	318	1 838
2825.50	Copper oxides and hydroxides						
	Dominican Republic	—	—	...	...	—	—
	United States	—	—	...	3	—	—
	Total	—	—	...	3	—	—
2833.25	Copper sulphates						
	United States	8 604	11 308	8 323	11 241	10 708	13 967
	Luxembourg	—	—	—	—	140	206
	Other countries	1	4	—	—	103	189
	Total	8 605	11 312	8 323	11 241	10 951	14 362
7401.10	Copper mattes						
	Norway	21 839	73 850	19 370	78 599	19 840	127 939
	United States	3	19	37	87	267	733
	Other countries	130	689	—	—	—	—
	Total	21 972	74 558	19 407	78 686	20 107	128 672
7402.00	Copper anodes						
	United States	75 951	289 516	87 035	308 649	88 259	424 500
	Other countries	2	8	23	29	34	86
	Total	75 953	289 524	87 058	308 678	88 293	424 586
7403.11 to 7403.19	Refined copper and copper alloys, unwrought; refined copper						
	United States	277 647	861 698	295 698	1 066 979	256 684	1 501 833
	Switzerland	—	—	—	—	9 896	79 385
	Netherlands	—	—	491	1 970	8 643	72 649
	Italy	1 275	5 021	492	1 981	2 019	17 374
	United Kingdom	498	1 944	...	1	988	8 850
	Colombia	260	1 043	—	—	—	—
	Other countries	60	223	276	625	15	128
	Total	279 740	869 929	296 957	1 071 556	278 245	1 680 219

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
7403.21 to 7403.29	Refined copper and copper alloys, unwrought; other copper alloys						
	United States	3 397	12 524	3 403	15 382	7 271	31 115
	Saudi Arabia	—	—	—	—	22	393
	France	99	905	—	—	—	—
	Other countries	3	24	33	189	34	216
	Total	3 499	13 453	3 436	15 571	7 327	31 724
7404.00	Copper waste and scrap						
	United States	50 981	135 189	56 844	176 143	51 632	257 465
	China	25 894	33 536	44 712	72 983	78 471	211 914
	Belgium	400	479	3 588	3 954	6 810	9 542
	South Korea	833	2 216	2 168	4 129	21 588	7 114
	India	589	1 010	8 411	5 476	1 012	4 809
	Taiwan	376	1 096	293	811	982	4 453
	Hong Kong	277	266	576	1 048	2 478	4 310
	Thailand	20	47	26	50	451	3 285
	Spain	98	65	185	88	701	920
	Japan	121	334	599	1 004	191	662
	Netherlands	—	—	—	—	62	258
	Italy	298	1 028	71	175	26	166
	Philippines	—	—	—	—	20	162
	Germany	510	1 306	1 449	3 454	77	111
	Other countries	388	752	275	725	174	304
	Total	80 785	177 324	119 197	270 040	164 675	505 475
7405.00	Master alloys of copper						
	United States	—	—	...	3	98	486
	Other countries	3	16	—	—	5	26
	Total	3	16	...	3	103	512
7406.10 to 7406.20	Copper powders and flakes						
	Taiwan	5	52	7	143	47	368
	United States	33	194	29	194	38	313
	Other countries	29	243	12	153	9	59
	Total	67	489	48	490	94	740
7407.10 to 7407.29	Copper bars, rods and profiles of refined copper and copper alloys						
	United States	8 524	43 277	6 464	39 714	7 072	60 382
	Chile	687	3 957	360	1 961	311	1 259
	Thailand	66	216	52	186	37	183
	Trinidad and Tobago	15	73	8	47	39	146
	Other countries	226	901	74	266	105	546
	Total	9 518	48 424	6 958	42 174	7 564	62 516
7408.11 to 7408.29	Copper wire of refined copper and of copper alloys						
	United States	142 925	549 298	155 678	719 817	168 633	1 313 860
	Cuba	...	1	3 224	14 956	4 520	35 048
	Brazil	20	79	1 790	8 640	4 759	34 373
	Colombia	3 367	13 381	3 749	16 925	3 410	25 994
	Trinidad and Tobago	1 579	6 214	2 674	11 681	1 779	13 554
	Dominican Republic	514	1 943	1 343	5 913	1 369	10 163
	Hong Kong	118	492	1 135	5 138	1 156	7 788
	China	14 088	53 591	8 021	36 225	1 634	7 437
	Philippines	20	80	4 073	18 548	786	4 325
	Jamaica	99	404	515	2 247	256	1 561
	Barbados	91	451	109	392	111	764
	Bangladesh	—	—	196	952	59	555
	Bermuda	70	316	81	353	94	453
	Indonesia	925	3 670	—	—	33	350
	Jordan	—	—	—	—	39	223
	Saudi Arabia	—	—	—	—	20	119
	Other countries	457	1 831	148	607	33	132
	Total	164 273	631 751	182 736	842 394	188 691	1 456 699

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
7409.11 to 7410.22	Copper and copper alloy plates, sheets, strip and foil						
	United States	1 856	11 662	896	6 541	395	2 671
	France	17	93	7	42	39	177
	Barbados	...	4	—	—	34	134
	Other countries	822	4 060	120	576	135	434
	Total	2 695	15 819	1 023	7 159	603	3 416
7411.10 to 7411.29	Copper and copper alloy tubes and pipes						
	United States	20 229	131 208	17 042	115 698	17 521	165 855
	China	64	133	1 284	4 010	2 065	8 972
	United Kingdom	2	9	26	205	238	2 377
	Portugal	—	—	18	133	139	1 714
	Australia	89	497	380	1 293	154	1 329
	Singapore	109	878	59	482	202	1 168
	Italy	41	177	134	424	171	848
	Netherlands	157	1 229	152	1 077	38	320
	Russia	3	27	4	18	24	307
	Saudi Arabia	17	125	23	178	24	215
	Chile	15	182	—	—	20	138
	Other countries	216	998	89	599	101	511
	Total	20 942	135 463	19 211	124 117	20 697	183 754
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
7412.10 to 7412.20	Copper and copper alloy tubes and pipe fittings (e.g., couplings, elbows, sleeves)						
	United States	..	33 563	..	34 556	..	38 857
	China	..	14	..	328	..	481
	Japan	..	...	..	...	..	355
	South Africa	..	122	..	85	..	267
	Spain	..	1	..	...	..	135
	Other countries	..	1 049	..	872	..	744
	Total	..	34 749	..	35 841	..	40 839
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
7413.00	Stranded wire, cables, plaited bands and the like, of copper, not electrically insulated						
	United States	1 247	5 336	398	3 206	240	3 572
	Germany	21	63	1	5	13	134
	Other countries	181	608	58	295	23	131
	Total	1 449	6 007	457	3 506	276	3 837
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
7414, 7415, 7416, 7419	Other items of copper						
	United States	..	33 178	..	33 571	..	35 275
	Germany	..	252	..	1 064	..	883
	Denmark	..	...	—	—	..	196
	Australia	..	191	..	73	..	189
	China	..	336	..	73	..	181
	Cuba	..	91	..	20	..	154
	Japan	..	37	..	6	..	141
	United Kingdom	..	101	..	167	..	119
	France	..	81	..	62	..	109
	Peru	..	80	..	47	..	100
	Chile	..	53	..	21	..	92
	United Arab Emirates	..	55	..	104	..	88
	Other countries	..	734	..	2 343	..	882
	Total	..	35 189	..	37 551	..	38 409
	Total exports	..	2 910 690	..	3 843 119	..	6 204 739

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (1)							
2603.00.00.10	Copper ores and concentrates						
	Copper content						
	Peru	9 160	27 491	31 532	104 191	37 281	216 979
	United States	13 690	43 831	11 124	38 301	23 785	172 862
	Chile	36 408	121 385	29 926	113 225	25 101	171 442
	Argentina	—	—	3 648	14 246	6 737	34 711
	Spain	871	2 774	1 192	4 129	3 499	21 103
	Bulgaria	2 383	7 273	3 583	10 604	3 074	16 280
	Australia	...	...	...	1	2 294	11 341
	Mexico	2 488	6 578	...	...	1 939	10 252
	Germany	355	1 000	304	1 019	345	2 149
	Romania	—	—	244	975	310	2 075
	Canada	—	—	—	—	99	837
	Philippines	—	—	—	—	41	319
	Saudi Arabia	550	1 921	76	275	—	—
	Other countries	17	64	2	8	20	158
	Total	65 922	212 317	81 631	286 974	104 525	660 508
2604.00.00.10,	Other ores and concentrates						
2607.00.00.10,	Copper content						
2608.00.00.10,	South Africa	1 399	4 861	2 328	8 403	2 175	16 723
2616.10.00.10	United States	325	744	274	655	141	557
	Other countries	...	...	1	2	...	1
	Total	1 724	5 605	2 603	9 060	2 316	17 281
2620.30	Copper ash and residues						
	United States	31 480	28 163	30 666	26 434	59 007	90 579
	Thailand	—	—	—	—	15 648	25 250
	Chile	—	—	—	—	3 150	8 565
	Sweden	2 804	5 643	1 395	6 119	653	3 818
	United Kingdom	15	24	5 705	700	120	315
	Spain	7 700	504	167	375	—	—
	Other countries	40	57	474	124	376	216
	Total	42 039	34 391	38 407	33 752	78 954	128 743
2825.50	Copper oxides and hydroxides						
	United States	706	2 856	1 947	9 534	4 233	18 173
	Other countries	40	165	1	4	1	4
	Total	746	3 021	1 948	9 538	4 234	18 177
2833.25	Copper sulphates						
	China	3 689	3 545	2 263	2 984	6 060	11 700
	Russia	2 722	2 633	1 742	2 384	2 461	5 835
	Chile	1 020	983	2 129	4 423	2 168	5 342
	Taiwan	7 168	6 321	2 970	4 090	2 497	5 150
	France	1 285	1 455	929	1 447	803	1 862
	United States	854	1 222	1 528	2 495	687	1 589
	Netherlands	495	500	140	184	470	1 097
	Finland	63	56	105	131	314	699
	Peru	360	462	369	573	261	671
	Other countries	487	466	199	277	121	240
	Total	18 143	17 643	12 374	18 988	15 842	34 185
2836.99.10.20	Copper carbonates						
	United States	—	—	..	...	..	10
	United Kingdom	..	5	—	—	—	—
	Total	..	5	..	...	..	10
2836.99.90.10	Other copper carbonates						
	United States	4	9	4	8	8	17
	Other countries	2	5	...	...	...	1
	Total	6	14	4	8	8	18

TABLE 1 (cont'd)

TABLE 1 (cont'd)							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2837.19.00.10	Copper cyanides						
	United States	24	144	22	147	25	191
	Other countries	9	48	10	60	12	80
	Total	33	192	32	207	37	271
3212.90.90.12	Pigments based on copper or copper alloy powders and flakes						
	United States	20	219	21	164	16	172
	Other countries	5	98	5	89	3	53
	Total	25	317	26	253	19	225
7401.10	Copper mattes						
	United States	...	...	3 643	4 754	18 601	22 929
	China	—	—	80	104	359	455
	Botswana	389	1 500	—	—	—	—
	Other countries	...	...	4	6	—	—
	Total	389	1 500	3 727	4 864	18 960	23 384
7401.20	Copper mattes; cement copper (precipitated copper)						
	Peru	—	—	—	—	1 635	4 860
	United States	87	259	11 336	10 873	3 577	3 942
	Bolivia	—	—	—	—	146	159
	Germany	422	872	514	600	—	—
	Other countries	2	7	...	...	1	1
	Total	511	1 138	11 850	11 473	5 359	8 962
7402.00	Copper anodes						
	Chile	123 820	447 943	142 076	599 416	88 753	637 913
	Peru	—	—	—	—	1 000	8 127
	United States	19 530	51 080	16 287	35 973	3 459	7 928
	Finland	—	—	2	13	110	285
	Germany	—	—	630	1 454	54	72
	Spain	5 031	25 121	—	—	—	—
	Other countries	...	...	12	16	5	32
	Total	148 381	524 144	159 007	636 872	93 381	654 357
7403.11 to 7403.19	Refined copper and copper alloys, unwrought; refined copper						
	United States (1)	2 261	7 738	2 065	8 019	25 097	178 607
	Peru	5 994	23 238	25 605	117 769	20 712	161 178
	Chile	41 817	161 230	25 682	120 587	8 489	65 545
	Japan	858	3 627	2 878	11 592	3 714	14 913
	Switzerland	—	—	...	...	1 510	11 308
	Germany	2 367	9 037	888	2 792	102	933
	Austria	37	165	86	379	32	121
	Finland	1	4	3 007	15 496	—	—
	Poland	—	—	1 413	6 525	—	—
	Sweden	—	—	3 002	14 134	—	—
	Other countries	...	3	11	47	12	48
	Total	53 335	205 042	64 637	297 340	59 668	432 653
7403.21 to 7403.29	Refined copper and copper alloys, unwrought; copper alloys						
	United States (2)	14 196	53 889	13 952	56 232	11 671	80 277
	United Kingdom	5	19	4	20	182	774
	China	51	272	55	309	58	328
	India	8	39	6	30	29	231
	Germany	19	76	2	77	2	106
	Other countries	90	492	64	573	21	145
	Total	14 369	54 787	14 083	57 241	11 963	81 861

TABLE 1 (cont'd)

TABLE 1 (cont'd)							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
7404.00	Copper waste and scrap						
	United States	53 162	87 640	46 214	71 866	54 783	178 916
	Cuba	1 032	1 904	1 292	2 021	958	2 041
	China	3	8	...	...	193	731
	Canada	72	161	36	107	50	328
	United Kingdom	222	825	55	194	51	237
	Trinidad and Tobago	36	120	38	140	37	237
	Japan	313	643	17	43	34	137
	Other countries	387	792	209	632	101	378
	Total	55 227	92 093	47 861	75 003	56 207	183 005
7405.00	Master alloys of copper						
	United States	460	1 991	263	1 218	339	1 677
	China	109	431	107	485	52	228
	Other countries	5	28	3	15	27	123
	Total	574	2 450	373	1 718	418	2 028
7406.10 to 7406.20	Copper powders and flakes						
	United States	2 091	11 257	2 823	13 760	3 668	17 615
	China	155	978	115	612	264	1 311
	France	61	323	120	676	130	670
	United Kingdom	81	535	67	420	153	592
	Germany	45	346	10	148	11	122
	Other countries	19	90	26	117	35	192
	Total	2 452	13 529	3 161	15 733	4 261	20 502
7407.10 to 7407.29	Copper bars, rods and profiles of refined copper and copper alloys						
	United States	35 076	139 125	38 350	178 433	43 740	300 049
	Germany	230	1 292	562	3 372	365	2 745
	South Korea	515	1 661	733	2 656	293	1 668
	Poland	446	1 640	551	2 491	312	1 578
	France	470	2 507	268	1 730	173	1 546
	China	95	566	145	877	147	1 367
	United Kingdom	68	446	70	527	111	1 097
	New Zealand	163	864	124	700	73	630
	India	27	130	90	438	104	606
	Mexico	48	307	15	119	50	477
	Canada	32	218	36	250	36	380
	Serbia and Montenegro	9	35	92	365	59	348
	Russia	152	658	473	2 016	36	344
	Italy	119	586	81	423	42	294
	Finland	51	301	46	251	36	259
	Israel	—	—	177	809	47	234
	Brazil	6 541	27 655	12	88	18	189
	Australia	166	651	86	370	14	85
	Turkey	454	1 402	69	231	...	1
	Other countries	197	1 010	117	665	48	453
	Total	44 859	181 054	42 097	196 811	45 704	314 350
7408.11 to 7408.29	Copper wire of refined copper and of copper alloys						
	United States	18 461	61 342	18 744	82 805	19 884	137 974
	Brazil	1 542	5 259	13 881	63 424	8 832	67 287
	Russia	1	6	8 204	41 323	4 727	39 568
	Germany	754	2 902	255	2 479	268	2 954
	South Korea	265	1 434	253	1 402	233	1 672
	Canada	794	3 440	255	1 339	184	1 368
	France	94	652	46	627	43	780
	Japan	110	875	61	523	56	574
	China	106	473	158	846	74	528
	Malaysia	...	...	23	164	44	360
	Mexico	18	108	23	68	37	327
	United Kingdom	69	512	39	228	12	195
	Taiwan	99	465	83	410	27	183
	Austria	22	170	23	230	15	175
	Other countries	345	1 806	201	979	35	225
	Total	22 680	79 444	42 249	196 847	34 471	254 170

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
7409.11 to	Copper and copper alloy plates, sheets,						
7410.22	strip and foil						
	United States	17 256	123 595	16 400	121 391	19 086	154 145
	Germany	5 036	24 638	4 911	24 921	2 633	21 127
	Netherlands	2 278	11 306	2 848	15 554	3 232	20 377
	Sweden	1 062	6 047	1 046	6 570	1 561	8 544
	Taiwan	456	3 327	452	3 088	636	7 366
	Luxembourg	351	2 555	387	3 064	945	5 155
	China	918	6 208	803	5 439	667	4 808
	Japan	229	2 804	214	2 858	308	4 673
	Greece	714	4 047	625	4 003	314	2 625
	India	220	931	46	239	182	1 372
	New Zealand	29	153	26	290	158	1 222
	Chile	59	268	28	155	138	1 028
	South Korea	27	134	39	221	81	479
	Mexico	62	279	90	449	48	457
	Sri Lanka	—	—	—	—	82	423
	Belgium	..	...	—	—	55	346
	Bulgaria	3	13	4	20	31	276
	Serbia	—	—	—	—	25	230
	Serbia and Montenegro	45	212	122	600	21	186
	Italy	152	761	56	362	12	134
	Finland	11	77	8	66	9	107
	Poland	311	1 315	18	95	14	87
	Other countries	413	2 482	180	1 149	50	489
	Total	29 632	191 152	28 303	190 534	30 288	235 656
7411.10	Pipes and tubes, refined copper						
	United States	8 512	48 034	6 381	38 347	5 559	52 773
	Chile	948	4 205	718	3 622	1 713	12 642
	China	2 018	9 574	1 179	6 817	1 380	11 882
	South Korea	1 022	5 036	1 102	5 851	1 335	9 090
	Malaysia	2	31	130	802	320	2 822
	Germany	25	199	108	690	26	431
	Mexico	2	11	117	804	34	373
	Seychelles	—	—	—	—	21	212
	France	29	133	82	382	36	163
	Other countries	202	990	39	253	40	352
	Total	12 760	68 213	9 856	57 568	10 464	90 740
7411.21	Pipes and tubes, copper-zinc base alloys						
	China	1 076	7 059	1 438	8 982	980	8 711
	United States	823	6 486	581	5 228	504	5 578
	Germany	736	4 210	752	4 366	507	4 141
	Mexico	136	1 107	142	1 075	112	912
	Japan	4	182	41	308	5	271
	Serbia and Montenegro	41	184	28	148	27	245
	Serbia	—	—	—	—	19	168
	Chile	554	2 167	20	108	18	159
	Taiwan	24	161	10	102	11	126
	Other countries	110	889	165	881	38	464
	Total	3 504	22 445	3 177	21 198	2 221	20 775
7411.22	Pipes and tubes, copper-nickel base alloys or copper-nickel-zinc base alloys						
	United States	317	2 151	219	1 769	245	1 794
	United Kingdom	45	279	9	59	79	531
	Mexico	23	176	31	284	53	414
	Canada	7	45	14	102	32	235
	Other countries	25	183	36	163	27	173
	Total	417	2 834	309	2 377	436	3 147

TABLE 1 (cont'd)

TABLE 1 (cont'd)							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
7411.29	Plates and tubes, copper alloys, n.e.s.						
	United States	790	4 924	705	5 891	829	9 089
	China	146	705	233	1 181	41	507
	South Korea	5	26	78	421	46	394
	Italy	13	115	25	220	24	333
	Other countries	113	571	24	193	18	214
	Total	1 067	6 341	1 065	7 906	958	10 537
7412.10	Fittings, pipe or tube, of refined copper						
	United States	1 171	10 541	892	10 845	1 089	12 410
	China	276	2 081	293	2 006	484	4 883
	South Korea	1 417	8 403	997	6 100	512	4 806
	Germany	27	651	30	629	23	616
	Italy	35	350	37	470	41	287
	Thailand	...	3	9	45	16	168
	Other countries	48	354	62	421	29	287
	Total	2 974	22 383	2 320	20 516	2 194	23 457
7412.20	Fittings, pipe or tube, copper alloys						
	United States	7 246	49 883	6 590	50 648	8 647	60 480
	China	2 493	12 530	3 512	14 739	3 334	18 697
	South Korea	677	3 541	1 069	6 456	1 503	12 039
	Taiwan	1 251	6 953	1 105	6 381	954	6 762
	Italy	62	1 214	98	1 522	190	2 186
	Germany	120	1 548	185	1 917	216	2 160
	Thailand	286	1 021	197	881	680	1 661
	Mexico	61	439	107	612	148	864
	Japan	13	255	49	571	166	625
	India	99	524	87	574	497	425
	United Kingdom	32	430	31	459	41	380
	Netherlands	1	9	6	168	9	339
	Canada	29	344	37	292	30	316
	Israel	18	312	15	296	8	255
	France	14	140	16	263	24	244
	Sweden	11	145	5	65	9	207
	Indonesia	63	264	84	246	61	159
	Other countries	19	339	23	369	50	592
	Total	12 495	79 891	13 216	86 459	16 567	108 391
7413.00	Stranded wire, cables, plaited bands and the like, of copper, not electrically insulated						
	United States	7 352	34 209	7 475	39 051	8 875	45 797
	Canada	1 081	5 176	1 194	6 398	1 844	14 058
	Germany	55	352	48	323	70	645
	Mexico	19	130	55	433	42	433
	Israel	7	46	—	—	34	341
	Other countries	103	607	71	458	67	438
	Total	8 617	40 520	8 843	46 663	10 932	61 712
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
7414.20	Endless bands of copper wire for machinery						
	United States	..	120	..	171	..	108
	United Kingdom	..	79	..	56	..	30
	Other countries	..	65	..	70	..	54
	Total	..	264	..	297	..	192
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
7414.90	Cloth, grill and netting of copper wire and expanded metal of copper						
	United States	90	750	75	598	33	495
	Other countries	8	55	3	61	2	74
	Total	98	805	78	659	35	569

TABLE 1 (cont'd)

TABLE 1 (cont'd)							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
7415.10	Nails, tacks, drawing pins, staples and similar articles of copper or of iron or steel with copper heads						
	United States	40	308	48	301	34	309
	China	15	182	45	457	31	288
	Taiwan	31	190	15	102	17	102
	Other countries	33	220	33	175	33	153
	Total	119	900	141	1 035	115	852
7415.21	Copper washers, including springs						
	United States	300	1 413	365	1 789	503	1 989
	Mexico	65	567	98	679	105	763
	United Kingdom	48	423	51	429	52	466
	China	51	306	127	458	53	398
	South Korea	...	2	...	1	814	125
	Other countries	326	1 124	318	350	211	321
	Total	790	3 835	959	3 706	1 738	4 062
7415.29	Articles of copper, not threaded, n.e.s., similar to those of headings 7415.10 and 7415.21						
	United States	494	2 801	1 290	2 841	932	3 314
	China	235	239	311	359	91	484
	New Zealand	17	140	23	255	23	283
	Germany	12	118	41	173	42	186
	Other countries	63	430	92	410	116	468
	Total	821	3 728	1 757	4 038	1 204	4 735
7415.33	Screws, bolts and nuts of copper, excluding wood screws						
	United States	491	3 059	593	3 266	760	3 570
	China	277	1 238	298	1 320	222	1 529
	Taiwan	262	1 291	239	1 306	173	1 317
	Germany	57	311	205	357	360	632
	Brazil	5	80	137	92	167	114
	Other countries	62	426	69	321	90	492
	Total	1 154	6 405	1 541	6 662	1 772	7 654
7415.39	Articles of copper, threaded, n.e.s., similar to bolts, nuts and screws						
	United States	620	3 605	947	3 567	698	2 704
	China	47	414	156	583	202	1 220
	Taiwan	34	308	34	340	54	456
	Germany	25	240	14	160	18	111
	Japan	4	28	147	114	103	94
	Other countries	96	386	229	449	90	298
	Total	826	4 981	1 527	5 213	1 165	4 883
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
7416.00	Copper springs						
	Germany	..	451	..	468	..	784
	United States	..	240	..	180	..	158
	Other countries	..	75	..	22	..	14
	Total	..	766	..	670	..	956
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
7419.10	Chain and parts thereof of copper						
	United States	79	1 738	28	559	17	183
	China	2	18	7	30	26	90
	Other countries	13	85	10	97	4	73
	Total	94	1 841	45	686	47	344

TABLE 1 (cont'd)

TABLE 7 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
7419.91	Articles of copper, not further worked than cast, moulded, stamped or forged						
	United States	2 557	21 229	3 024	24 027	2 971	24 032
	China	73	425	51	480	99	725
	Italy	5	59	29	154	61	430
	Taiwan	58	352	57	527	20	273
	Indonesia	55	373	17	118	18	160
	Germany	4	150	4	114	7	136
	Other countries	37	246	22	229	31	376
	Total	2 789	22 834	3 204	25 649	3 207	26 132
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
7419.99	Articles of copper, n.e.s.						
	United States	..	22 566	..	23 151	..	27 221
	China	..	6 019	..	7 321	..	10 838
	India	..	2 420	..	2 924	..	6 610
	Germany	..	3 848	..	2 730	..	4 988
	Taiwan	..	3 394	..	3 705	..	4 210
	Italy	..	864	..	1 143	..	1 245
	Thailand	..	218	..	313	..	565
	Finland	..	537	..	250	..	504
	United Kingdom	..	599	..	513	..	419
	Japan	..	450	..	530	..	385
	Indonesia	..	423	..	408	..	347
	France	..	580	..	305	..	328
	Canada	..	146	..	446	..	243
	Mexico	..	624	..	522	..	166
	Hong Kong	..	49	..	116	..	150
	Other countries	..	1 064	..	978	..	765
	Total	..	43 801	..	45 355	..	58 984
	Total Imports	..	1 952 625	..	2 379 873	..	3 498 470

Sources: Natural Resources Canada; Statistics Canada.

– Nil; .. Not available; ... Amount too small to be expressed; n.a. Not applicable; n.e.s. Not elsewhere specified; (p) Preliminary.

(1) A discrepancy between U.S. export data and data reported by Statistics Canada for this HS code for 2005 and 2006 is being investigated as of December 2007.

Therefore, the data reported above may be revised. (2) A discrepancy between U.S. export data and data reported by Statistics Canada for this HS code for 2006 is being investigated as of December 2007. Therefore, the data reported above may be revised.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, COPPER PRODUCTION BY PROVINCE, 2004-06

	2004		2005		2006 (p)	
	(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
MINE PRODUCTION (1)	562 794 980	..	595 383 354	..	608 285 860	..
SHIPMENTS (2)						
Newfoundland and Labrador	—	—	5 813 760	25 906	30 582 867	236 406
New Brunswick	8 216 567	30 640	7 019 661	31 280	9 576 979	74 030
Quebec	67 505 596	251 728	39 170 910	174 546	18 706 290	144 600
Ontario	173 496 561	646 969	188 994 138	842 158	187 973 397	1 453 034
Manitoba	39 446 507	147 096	35 468 454	158 047	54 734 905	423 101
Saskatchewan	11 757 800	43 845	11 486 893	51 186	1 242 065	9 601
British Columbia	244 134 848	910 379	289 350 332	1 289 345	292 275 925	2 259 293
Total	544 557 879	2 030 656	577 304 148	2 572 467	595 092 428	4 600 064

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; (p) Preliminary.

(1) Copper contained in concentrates produced. (2) Anode copper recovered in Canada from domestic concentrates plus exports of payable copper in concentrate and matte.

TABLE 3. CANADA, COPPER PRODUCTION, TRADE (1) AND USE, 1988-2006

	Production		Exports			Imports	Use (3)
	Shipments (2)	Refinery Output	Concentrates and Matte (4)	Refined (5)	Total	Refined (6)	Refined
	(tonnes)						
1988	758 478	528 723	348 404	268 680	617 084	4 660	236 281
1989	704 432	515 216	348 811	321 690	670 501	4 408	213 046
1990	771 433	515 835	374 875	335 941	710 816	2 611	180 605
1991	780 362	538 339	348 080	377 985	726 065	2 321	159 170
1992	761 694	539 302	346 842	385 761	732 603	8 916	156 132
1993	709 650	561 580	319 840	408 364	728 204	21 155	185 565
1994	590 784	549 869	237 553	388 568	626 121	19 594	199 350
1995	700 843	572 616	274 492	434 691	709 183	24 176	189 550
1996	652 499	559 200	409 578	384 337	793 915	28 700	218 280
1997	647 779	560 582	515 547	381 475	897 023	22 602	224 776
1998	690 762	562 261	433 685	355 826	789 511	18 685	246 212
1999	581 583	548 563	355 839	294 107	649 946	16 475	266 504
2000	621 889	551 393	426 007	288 334	714 341	11 875	272 076
2001	614 312	567 720	359 634	308 898	668 531	7 994	265 210
2002	584 195	494 522	311 920	238 117	550 036	11 692	274 133
2003	540 998	454 866	196 538	218 810	415 349	21 712	257 338
2004	544 558	526 955	180 910	279 741	460 651	53 336	297 184
2005	577 304	515 223	275 317	296 958	572 275	64 638	289 721
2006 (p)	595 092	499 768	250 847	278 244	529 090	59 668	301 519

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

(1) Beginning in 1988, exports and imports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. (2) From 1975 to 1988, anode copper recovered in Canada from domestic concentrate plus exports of payable copper in concentrates and matte. Starting in 1989 to date, recoverable copper in concentrate shipped. (3) Producers' domestic shipments of refined copper plus imports of refined shapes. (4) Data include HS Codes 2603.00.10, 2604.00.00.10, 2607.00.00.10, 2608.00.00.10, 2616.10.00.10, 7401.10 and 7401.20. (5) Data include HS Codes 7403.11 to 7403.19. (6) Data include HS Codes 7403.11 to 7403.19.

TABLE 4. COPPER PRODUCERS

Country	Company	Web Site Address
Canada	Agnico Eagles Mines Limited	www.agnico-eagle.com
	Aur Resources Inc.	www.auresources.com
	Barrick Gold Corporation	www.barrick.com
	BHP Billiton Plc	www.bhpbilliton.com/bb/home.jsp
	bcMetals Corporation	www.bcmetalcorp.com
	Breakwater Resources Ltd.	www.breakwater.ca
	Campbell Resources Inc.	www.ressourcescampbell.com/en/index.html
	CVRD Inco Limited	www.inco.com
	Expatriate Resources Ltd.	www.expatriateresources.com/start.htm
	First Quantum Minerals Limited	www.first-quantum.com/s/Home.asp
	Highland Valley Copper (see Teck Cominco Limited)	www.teckcominco.com
	HudBay Minerals Inc.	www.hudbayminerals.com
	Imperial Metals Corporation	www.imperialmetals.com/s/Home.asp
	Inmet Mining Corporation	www.inmetmining.com
	New Gold Inc.	www.newgoldinc.com/index.html
	North America Palladium Ltd.	www.napalladium.com
	Northgate Exploration Ltd.	www.northgateexploration.ca
	Redcorp Ventures Ltd.	www.redcorp-ventures.com
	Sherwood Copper Corporation	www.sherwoodcopper.com/index.php
	Taseko Mines Limited	www.tasekomines.com/tko/Home.asp
	Teck Cominco Limited	www.teckcominco.com
Australia	Xstrata Plc	www.xstrata.com
	WMC Resources Ltd.	www.wmc.com
	BHP Billiton	www.bhpbilliton.com
	Anglo American plc	www.angloamerican.co.uk
Belgium	Rio Tinto plc	www.riotinto.com
	Cumero	www.umicore.com/en/
Brazil	Caraiba Metals S.A.	www.paranapanema.com.br
Chile	Companhia Vale do Rio Doce	www.cvrld.com.br
	Antofagasta Holdings	www.aminerals.cl
	Corporación Nacional del Cobre de Chile	www.codelco.com
	Compañía Minera Doña Inés de Collahuasi	www.collahuasi.cl
China	Empresa Nacional de Minería (ENAMI)	www.enami.cl
	Minera Escondida Limitada	www.escondida.cl
	Jiangxi Copper Company Limited	www.jxcc.com/english/engfsg/enindex.htm
	Yunnan Copper Industrial Corp. Ltd.	www.yunnan-copper.com/ehml/copper.html
India	Jinchuan Group Limited (JNMC)	www.jnmc.com.cn/default.asp
	Hindalco Industries Limited	www.hindalco.com
Indonesia	Hindustan Copper Ltd. (HCL)	www.hindustancopper.com/home.asp
	Freeport-McMoRan Copper & Gold Inc.	www.fcx.com
Japan	Dowa Mining Co., Ltd.	www.dowa.co.jp/index_e.html
	Furukawa Electric Co., Ltd.	www.furukawa.co.jp/english/index.htm
	Mitsubishi Materials Corporation	www.mmc.co.jp/english/top_e.html
	Mitsubishi Group	www.mitsubishi.com/mpac/e/index.html
	Mitsui & Co., Ltd.	www.mitsui.co.jp/tkabz/english/index.html
	Nippon Mining & Metals Co., Ltd.	www.nikko-metal.co.jp/e/index.html
	Nittetsu Mining Co., Ltd.	www.nittetsukou.co.jp
	Onahama Smelting and Refining Co., Ltd.	www.group.mmc.co.jp/osr/eng
	Sumitomo Metal Mining Co., Ltd.	www.smm.co.jp/index_E.html
	Grupo México S.A. de C.V.	www.gmexico.com
Mexico	Erdenet Mining Corporation	www.emc.erdnet.mn
Mongolia	Ok Tedi Mining Limited	www.oktedi.com
Papua New Guinea	Centromin Peru S.A.	www.centromin.com.pe
Peru	Southern Peru Copper Corporation	www.southernperu.com/pages/home.htm
	The Doe Run Company	www.doerun.com
Philippines	Philippine Associated Smelting & Refining Corp.	www.pasar.net.ph
Poland	KGHM Polska Miedz S.A.	www.kghm.pl
Russia	MMC Norilsk Nickel	www.nornik.ru/en
Switzerland	Xstrata Plc	www.xstrata.com
Thailand	Thai Copper Industries	www.thaicopperind.com/en/
United States	ASARCO LLC	www.asarco.com
	Kennecott Utah Copper Corporation	www.kennecott.com
	Phelps Dodge Corporation	www.phelpsdodge.com
	Konkola Copper Mines plc	www.kcm.co.zm
Zambia	Zambian Copper Investments Limited	www.zci.lu

Source: Natural Resources Canada.

Diamonds

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SUMMARY

Challenged by the short ice-road season, which crippled the supply of mine sites with operational needs such as fuel, explosives, equipment, and food, the Canadian diamond industry nonetheless performed well in 2006. It achieved a rough diamond production estimated at 13.2 million carats (Mct) for a value of close to \$1.59 billion. These preliminary figures indicate that Canadian diamond production in 2006 registered a 7.2% increase in quantity and a 9.7% decrease in value (in Canadian dollars) compared to 2005. The increase in quantity resulted from the processing of higher-grade ore at Diavik's A154 South pipe and new production from Tahera Diamond Corporation's Jericho mine. As for the drop in value, it is largely attributed to the 6.4% appreciation of the Canadian dollar versus the U.S. dollar in 2006 (sales are made in U.S. dollars), the slightly lower diamond values at Ekati, and the overall lower diamond prices in 2006.

On a value basis, Canada's production currently accounts for approximately 11.7% of world diamond production, which is estimated at 175.5 Mct valued at about US\$12.0 billion in 2006. This makes Canada the world's third largest producer by value after Botswana and Russia. However, with the scheduled opening of the Snap Lake mine in 2007, the Victor mine in 2008, and the Gahcho Kué mine in 2011, Canada's share of the world's diamond production is expected to hover between 12 and 15% in the coming years (Figure 1).

Canada's current diamond production comes from three mines: the Ekati™ and Diavik mines located about 300 km northeast of Yellowknife in the Northwest Territories (N.W.T.), and the Jericho mine in Nunavut, which achieved commercial production on July 1, 2006 (Figure 2).

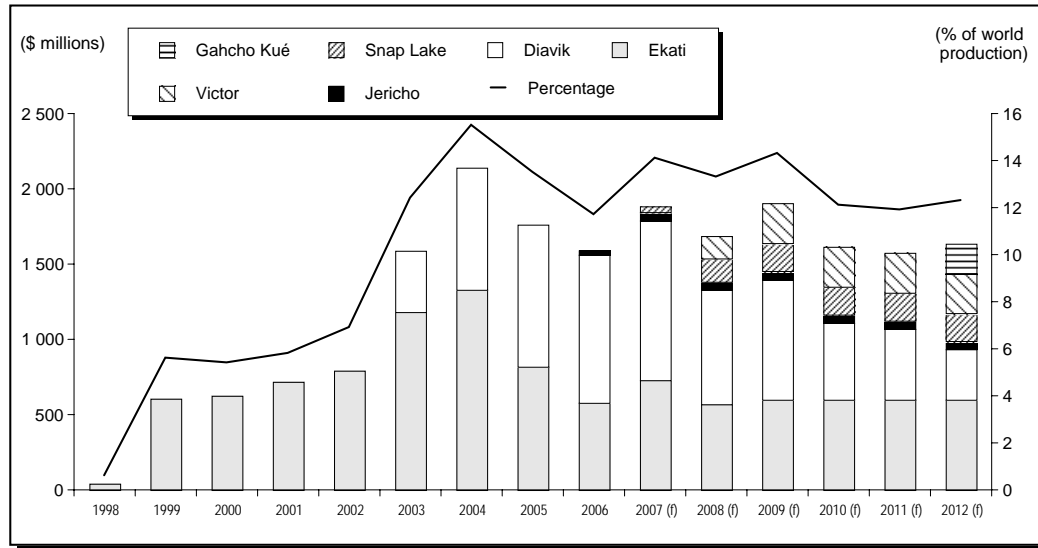
Combined, the Ekati and Diavik mines are the largest private employers in the Northwest Territories. The opening of diamond mines has resulted in the creation of about 7000 direct and indirect jobs (including contractors working on projects under construction) in Canada and the formation of several hundred companies by Aboriginals. On this account, the diamond industry is the largest contributor to the N.W.T.'s Gross Domestic Product, providing more than 50% of the amount.

Canada also has a small diamond cutting and polishing industry comprising five factories operating in Yellowknife (N.W.T.), Vancouver (British Columbia), and Matane (Quebec).

Major events in the Canadian diamond industry during 2006 included:

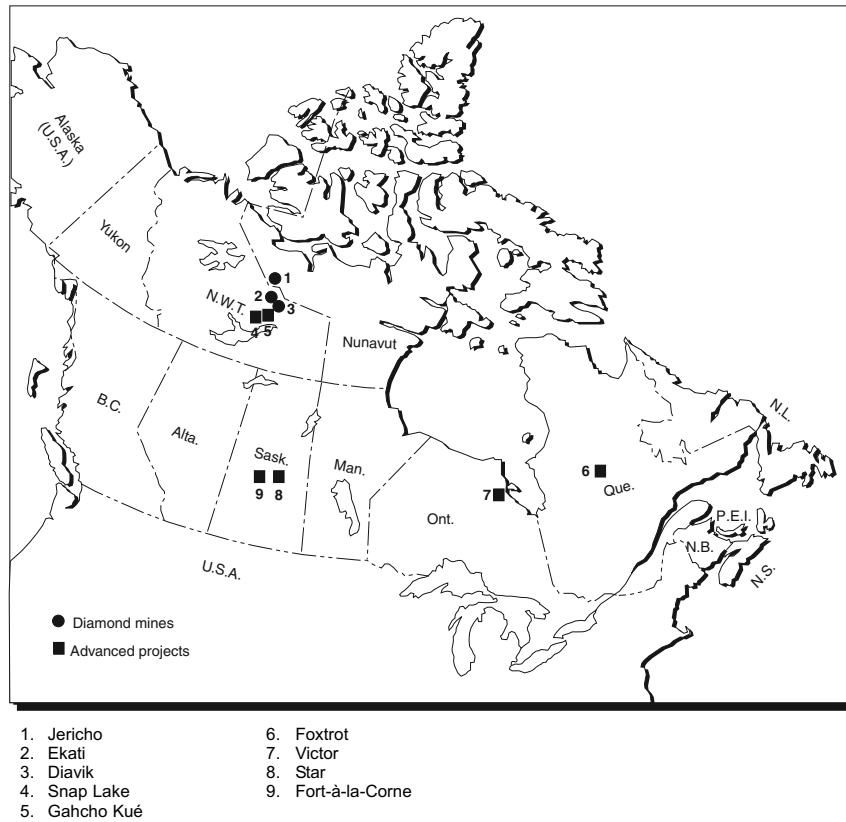
- The elimination on May 2 of the 10% excise tax on diamonds and jewellery, a recent development that will result in lowering the cost of jewellery in Canada and foster increased activity;
- the BHP Billiton approval of the Koala underground project at the Ekati mine on June 28;
- Completion of the construction of a dyke to allow open-pit mining of Diavik's A418 orebody;
- The initiation of procedures by Diavik to renew its water licence under the new Wek'eezhii Land and Water Board, and participation in public hearings to review its application;
- The purchase by Aber Diamond Corporation of the minority shareholder's interest in Harry Winston in early October for approximately US\$157 million;
- The commissioning on April 4 of Tahera Diamond Corporation's Jericho mine open pit, located in Nunavut, and the achievement of commercial production on July 1;
- The signing in August of the Snap Lake Impact and Benefits Agreement. In January, construction of the Victor open-pit mine began;

Figure 1
Canada's Diamond Production, Estimated Gross Revenues, 1998-2012



Sources: Natural Resources Canada; BHP Billiton Diamonds Inc.; De Beers Canada Inc.; Diavik Diamond Mines Inc.; Tahera Diamond Corporation.
(f) Forecast.

Figure 2
Diamond Mines and Advanced Projects in Canada, 2006



- The ordering of the Gahcho Kué project in June to undergo an Environmental Impact Review by the Mackenzie Valley Land and Water Board (MVEIRB), which may delay the project's development schedule; and
- Diamond exploration expenditures across Canada reaching \$303 million and involving 82 companies acting as project managers.

CANADIAN DEVELOPMENTS

Mine Developments

Ekati™ Mine

Canada's first diamond-producing mine, Ekati™, came into production in 1998. The mine is owned 80% by BHP Billiton Ltd. Chuck Fipke and Stuart Blusson, who discovered the diamond deposit in 1991, each hold a 10% interest in the mine. It achieved a production level of 3.1 Mct in 2006, mostly from the Panda underground mine and from the Koala, Misery, Fox and Beartooth open-pit mines, registering a drop of 22.1% compared with 2005. The lower production is said to result from the mining of lower-grade material. However, an 11-week strike by part of Ekati's work force in the second quarter of 2006 may have affected mining activities, although the mine continued to operate. Development of the Koala underground project was approved on June 28, 2006, and is estimated to cost US\$250 million. The project is expected to deliver approximately 9.8 Mct of high-value Koala diamonds over an 11-year production life starting in December 2007. It is reported that it will supply 25% of the mine feed and 40% of the diamond output by value in the coming years. As of June 30, 2006, Ekati ore reserves were estimated at 44 Mt grading 0.59 ct/t, for a total of about 26 Mct.

BHP Billiton continues to meet its commitments to purchase goods and services from northern companies and to hire northern Aboriginals and Northerners on a priority basis. BHP Billiton directly employed about 850 people in 2006. Some 80% of the Ekati mine's staff are Northerners, of which over 50% are Aboriginals. Additional information is available on the Internet at <http://ekati.bhpbilliton.com>.

Diavik Mine

Canada's second diamond mine, Diavik, began production in early 2003. It is an unincorporated joint venture between Diavik Diamond Mines Inc. (DDMI), which owns 60%, and Aber Diamond Mines Ltd. (ADML), which owns 40%. DDMI is a wholly owned subsidiary of Rio Tinto plc, and ADML is a wholly owned subsidiary of Aber Diamond Corp. of Toronto, Ontario. The two joint-venture participants retain the right to market, independently, their

respective share of the diamonds produced from the Diavik diamond mine. DDMI is the manager of the mine.

Production at Diavik in 2006 from the A154 South and North kimberlites reached 9.8 Mct, an 18.1% increase compared with 2005. Construction of the A418 dyke, which started during the summer of 2005 to allow open-pit mining of Diavik's A418 orebody, was completed by year-end, allowing de-watering of the pool to be carried out on schedule. The company will proceed with pre-stripping work during 2007 and expects first production from the A418 pit to occur as scheduled in late 2007. Diavik also pursued driving two declines to conduct the underground mining feasibility study of the A154 and A418 pipes and to better estimate the value of the A21 pipe. The first decline, designed to access the A154 and A418 kimberlite pipes, reached the A418 pipe during the fourth quarter of the year, enabling underground test mining on the latter to start. At about the same time, the second decline intersected the A21 pipe. Work was under way at the end of 2006 to collect a bulk sample from the A21 pipe for diamond valuation purposes. At the end of 2006, Diavik's ore reserves in the A154 North, A154 South, and A418 pipes were estimated at 24.5 Mt averaging 3.3 ct/t, for a total of 81.7 Mct.

For 2006, the operations work force at the Diavik diamond mine averaged 735 employees. Of this number, 497 (68%) were Northerners, of which 247 were Aboriginal Northerners (34% of the total work force). For 2006, Diavik's construction work force averaged 347 people, with an average of 72 Northerners (21%) and 29 Aboriginals (8%). Additional information on the project can be found on the Internet at www.diavik.ca and www.aber.ca.

Jericho Project

The Jericho mine, Canada's third diamond mine and its first outside the Northwest Territories, is located in Nunavut about 420 km northeast of Yellowknife and about 170 km north of the Diavik mine at Lac de Gras in the N.W.T. It is owned by Tahera Diamond Corp., a Toronto-based firm. Mobilization and construction of the mine's open pit started in February 2005 and was completed in March 2006. The company experienced start-up problems related to ore mining and processing that were compounded by a shorter-than-expected 2006 winter road access, which limited the transport of supplies to the mine site, including fuel and explosives, thereby restricting the mine plan. Despite these difficulties persisting until year-end, the company was able to produce about 296 000 ct valued at about US\$93/ct, for an average recovered grade of 0.55 ct/t. Nonetheless, Tahera sought a partner and entered into a strategic alliance in December 2006 with Teck Cominco Ltd., who invested \$30 million in a private placement. This agreement gives Teck Cominco 24.9% of the shares of Tahera on a fully diluted basis. Tahera also has a diamond-purchasing and marketing agreement with a wholly owned subsidiary of Tiffany & Co. Under this agreement, the

latter purchases a portion of the diamond production from Jericho for its own manufacturing requirements and sells the balance of the production on behalf of Tahera into the international market for a fee. Despite initial difficulties, Tahera is confident with its initial reserve assessment for the deposit and believes it will ramp up production to about 500 000 ct/y over the projected nine-year mine life. Additional information is available on the Internet at www.tahera.com.

Snap Lake Project

The Snap Lake diamond deposit, 100% owned by De Beers Canada, part of the De Beers Group, is located approximately 220 km northeast of Yellowknife in the N.W.T. The deposit is unique in that the diamondiferous kimberlite is in the form of a dyke, as opposed to the more common carrot-shaped pipe. The dyke is a tabular-shaped structure about 2.7 m thick that dips at a shallow angle of 15 degrees. Because of its shape, the company will use a modified room and pillar underground mining method to mine the deposit. The kimberlite to be mined over the project life is estimated at 18.3 Mt grading 1.46 ct/t.

Construction of De Beers Canada's Snap Lake underground mine went on at full pace during the year. Capital costs for the project are evaluated at C\$975 million. The mine is expected to begin production in early autumn 2007 and to produce about 1.5 Mct/y (average value of about US\$144/ct) when it reaches full production in early 2008. The mine is expected to have a life of just over 20 years and to create about 500 full-time jobs. De Beers Canada has a commitment to distribute to the local cutting industry 10% by value of the diamonds extracted at the mine that can be cut economically in Canada.

De Beers is dedicated to hiring and developing Aboriginal and northern workers. Employment practices have been put in place to ensure that 40% of employees are hired from the N.W.T. during construction and 60% during operations. More detailed information is available on the Internet at www.debeerscanada.com.

Victor Project

In northern Ontario, about 90 km west of the coastal community of Attawapiskat on the James Bay coast, the 100%-owned De Beers Victor project will be the first diamond mine in Ontario. Development of the C\$982 million mine started in January 2006, which should allow production to start during the spring of 2008. The Victor pipe has mineable reserves estimated at 27.4 Mt averaging 0.23 ct/t, with a value of US\$440/ct. At full capacity, the mine is expected to produce about 600 000 ct/y over a 12-year open-pit mine life. Victor is one of 18 kimberlite pipes discovered on the property, 16 of which are diamondiferous. Employment on site is expected to reach 600 people during construction and 400 during production. Additional information can be found at the De Beers web site noted above.

Gahcho Kué

De Beers Canada Inc. (51%) and its partners, Mountain Province Diamonds Inc. (44.1%) and Camphor Ventures (4.9%), pursued work on the Gahcho Kué project despite disruptions in the environmental assessment process after the project was ordered to Environmental Impact Review by the Mackenzie Valley Land and Water Board (MVEIRB) in June 2006. A court action by De Beers, asking for a judicial review of the MVEIRB order, was still ongoing at year-end. The Gahcho Kué project is located south of Lac de Gras, 90 km southeast of the Snap Lake project and approximately 300 km northeast of Yellowknife. Eight diamondiferous kimberlites, along with several sills and dykes, have been found to date on the Gahcho Kué property. The larger 5034, Hearne and Tuzo kimberlite bodies are currently considered to be potentially economically viable. As of August 2004, the weighted average modeled values per carat for the three pipes were US\$74.20 for 5034, US\$61.00 for Hearne, and US\$49.00 for Tuzo. The technical study completed in 2005 indicated that 30 Mt with an average grade of 1.48 ct/t could be mined out to produce 3 Mct/y over 15 years of mining.

Exploration Developments

Across Canada, diamond exploration involving 82 companies acting as project managers was under way in the Northwest Territories, Nunavut, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Newfoundland and Labrador, with a preliminary estimate of expenditures reaching \$303 million in 2006. Projects at an advanced stage of exploration are located in the N.W.T., Saskatchewan, and Quebec.

The **Northwest Territories** remains a focal point for diamond exploration. Exploration on BHP's **Ekati property** is returning encouraging results in the Lac du Sauvage area. A total of 154 kimberlite occurrences have now been confirmed on the property. However, few of these kimberlites currently meet the grade and diamond values required to be economic to mine. BHP Billiton, in a joint venture with Archon Minerals Ltd. and Charles Fipke (10%), explored the Ekati leases and the Buffer zone, and completed bulk samples on the Jay and Pigeon pipes. Delineation drilling was also completed on the Sable, Jay, and other known pipes.

Peregrine Diamonds Ltd. (54.47%) and partners DHK Diamonds Inc. (13.27%), Archon Minerals Limited (13.27%), Aber Diamonds Corporation (7.35%), and SouthernEra Diamonds Inc. (4.9%) collected a 548 dry tonnes bulk sample from the DO-27 kimberlite pipe on their **WO diamond project**, 23 km southeast of the Diavik diamond mine. DO-27 is one of two pipes and intervening kimberlite dykes or sills that comprise the Tli Kwi Cho kimberlite complex; DO-18 is the other pipe. The portion of the sample collected from the main lobe (340.33 t) returned an

average grade of 0.88 ct/t and tripled the known area of higher-grade kimberlite. A modeled valuation report by WWW International Diamond Consultants Ltd. on the combined 2005 and 2006 diamond parcels, comprising 508.9 ct from the Main Lobe and Northeast Lobe pyroclastic kimberlite of DO-27, revealed an average value ranging between US\$41 and \$62/ct. A third, large-diameter, bulk sample drilling program on the DO-27 kimberlite pipe was ongoing at the end of the year to increase the size of the diamond parcel recovered on the property and to improve the degree of confidence of the modeled valuation. The budget for the Fall 2006/Winter 2007 large-diameter drilling bulk sampling programs totals approximately \$26.6 million.

New Nadina Explorations Limited (57%), SouthernEra Resources (22%), and Archon Minerals (21%) carried out a 1034-m diamond drilling program on their **Monument property** south of Ekati. The drilling intersected three new kimberlites (the Rip, Nic and Sonja kimberlites) and further delineated the known DD17-11 kimberlite. The three new kimberlites, in addition to the previously discovered kimberlites, coincide with a 1.2-km linear magnetic low.

In **Nunavut**, joint-venture partners Stornoway Diamond Corporation (70%), BHP Billiton (20%), and Hunter Exploration Group (10%) pursued exploration of the **Aviat project** located on the Melville Peninsula north of Hudson Bay. The property has been Stornoway's main project since 2003 and was the principal focus for 2006. Eleven kimberlite bodies have been discovered to date. These range from small pipe-like intrusions to layered sheet or dyke-like intrusions. All bodies have proven to be significantly diamondiferous with sample grades ranging from 0.26 to 0.97 ct/t. In 2006, Stornoway drilled a total of 1833 m (22 holes) and intercepted kimberlite with true thicknesses up to 5.25 m; these are tentatively interpreted to represent shallowly dipping (8-20°) stacked sheets. Eight distinct kimberlite bodies were intersected in an area measuring 1.5 km by 3.5 km. Stornoway's 2007 \$2.75 million exploration program on Aviat will include further prospecting to discover the source of the "northern" mineral anomaly, drill testing the continuity/surface projection of the Aviat bodies, and sampling (both till and rock). More information is available on the Internet at www.stornowaydiamonds.com.

Tahera and De Beers Canada Inc. have a joint-venture agreement on the **Polar project**, neighbouring the Jericho property, where the Muskox kimberlite is located. In 2006, Tahera conducted a \$13 million evaluation program to increase reserves in the Jericho area. A total of 5730 m (21 holes) of core drilling were carried out to further interpret the kimberlite body while large-diameter reverse circulation drilling enabled bulk samples to be taken in the MKU-A and MKU-B units of the kimberlite. The 865 dry tonnes sample from MKU-A yielded 13 890 stones representing 455.3 ct for a recovered sample grade of 0.53 ct/t. The 63 dry tonnes sample from MKU-B yielded 692 stones

representing 21.8 ct for a recovered grade of 0.35 ct/t. Updated estimates of the tonnage of the body are 10-11 Mt to a depth of 200 m and 15-16.5 Mt to a depth of 300 m.

Stornoway Diamonds Corp. is earning a 50% interest in BHP Billiton's **Qilalugaq property** located near Repulse Bay, on the Melville Peninsula, by spending \$9 million before the end of 2011. So far, work has identified 11 diamondiferous kimberlites, including the Naujaat 1 and 2 hypabyssal kimberlite dykes discovered in 2006. Work during the year included the extraction of a 4.2-t sample from the previously drilled A28 kimberlite, which returned a grade of 0.328 ct/t. A total of 1.38 ct of diamonds were recovered in the sample, including a 0.587-ct stone. A mini-bulk sampling (1 t) was also done on the Naujaat 1 dyke, but it revealed a minor diamond content. Further sampling and prospecting are to be carried out in 2007 to better define the potential of the dykes.

Also attracting attention following the results of its 2006 exploration program, the **Churchill diamond project** (Shear Minerals Ltd. [51%], Stornoway Diamonds Corp. [35%], BHP Billiton [14%]) is located between the communities of Rankin Inlet and Chesterfield Inlet on the west coast of Hudson's Bay. To date, Shear and its partners have discovered over 50 kimberlites on the Churchill and Churchill West projects, mostly confined in the Sedna and Josephine corridors. As operator, Shear conducted a multi-season program in 2006 consisting of drilling, ground geophysics, prospecting, and till sampling. This work enabled the discovery of four vertical kimberlite dykes: the Notch, Jigsaw, PST003, and Kahuna dykes. The latter, a 3.5- to 4.0-m-thick dyke, traceable by geophysics for over 5.5 km, and the Notch dyke appear to contain the highest tonnage potential. Mini-bulk samples of these four diamondiferous dykes yielded respectively: 0.69 ct/t (4.93-t sample), 0.39 ct/t (5.15-t sample), 2.04 ct/t (3.55-t sample), and 1.09 ct/t (3.13-t sample). In each case, diamond populations are dominated by clear white (colourless) stones with high value characteristics that indicate the potential for high average diamond values. The follow-up 2007, \$8.5 million exploration program will include the collection of mini-bulk samples of up to 500 t from the Kahuna and Notch kimberlites with the goal of recovering approximately 200 ct of diamonds from each to better estimate the grade and provide a preliminary assessment of diamond value. Core drilling, commencing at Kahuna, will also be undertaken to help delineate the known kimberlites and to provide an initial assessment of size and tonnage.

Other **Nunavut** projects showing promise include Diamond Resources Ltd.'s **Brodeur Peninsula project** and Twin Mining Corporation's **Jackson Inlet property**, both on Baffin Island; Diamonds North Resources Limited's **Amaruk project** near the Gulf of Boothia and **Victoria Island project** on Victoria Island; and Indicator Minerals Inc.'s **Darby project** near the Gulf of Boothia.

In the Fort-à-la-Corne region of northern **Saskatchewan**, Shore Gold Inc. recently completed the mining of a

cumulative 45 000-t bulk sample at its **Star diamond project** from a 250-m-deep exploration shaft and lateral drifts on the 235-m level as part of the advanced evaluation study. Processing of this sample enabled the recovery of about 7500 ct for an average grade of 0.16 ct/t. Estimated modeled values are US\$135/ct. The company is proceeding with the completion by the end of 2007 of its C\$60 million evaluation program to define a National Instrument 43-101 compliant mineral resource followed by a mineral reserve for the Star kimberlite. This program includes the extraction and analysis of an additional 10 000- to 15 000-t bulk sample, delineation drilling, and engineering studies. All underground sampling on the Star project is scheduled to be completed in the first part of 2007. Assuming the company completes the feasibility study for the project in 2008 and the environmental assessment and permitting stage run smoothly, the deposit could be brought into production in 2011.

Nearby is the **Fort-à-la-Corne diamond project** owned by Shore Gold's wholly owned subsidiary, Kensington Resources Ltd. (60%) and Newmont Mining Corp. of Canada Ltd. (40%). With over 60 kimberlite bodies identified on the property, the Fort-à-la-Corne field forms one of the largest diamondiferous clusters in the world. Work carried out on the property, as part of the C\$43 million exploration budget for 2006, included the completion of 260 core drill holes and 5 large-diameter drill holes. This work enabled the company to estimate 360-400 Mt of kimberlite (non-NI 43-101 compliant) in the Orion South deposit (140 and 141) and 800-870 Mt of kimberlite (non-NI 43-101 compliant) in the Orion North deposit. Models established so far predict grades ranging from 7 to 16 ct/100 t. A C\$66.5 million exploration budget was approved by the joint venture for 2007. It will include the sinking of a shaft on Orion North kimberlite bodies to carry out underground bulk sampling. Additional core and large-diameter reverse circulation drilling will also be done and will help position the shaft location. The joint venture is anticipating completion of a bankable feasibility study by the end of 2010.

In **Ontario**, exploration for diamonds is focused in the James Bay-Hudson Bay Lowlands, and in the Wawa and Timiskaming regions. Metalex Ventures Ltd. (91.5%) and Arctic Star Diamond Corp. (8.5%) continue to bulk sample the **T1 kimberlite project**, located approximately 80 km west of the Victor diamond project. A total of 896 diamonds were recovered from 1992 kg of kimberlite. To date, 88 t of a planned 16-hole, 200-t mini-bulk sample have been collected by reverse circulation drilling. The partners also announced the discovery of a new kimberlite on their T1 project. Located between the T1 kimberlite and the Victor diamond project, the new kimberlite (named U2) was intersected by drilling at a depth of approximately 10 m. Approximately 100 kg of kimberlite were collected in the drill hole and will be submitted for diamond extraction and analysis of indicator minerals (www.metalexventures.com and www.arcticstardiamond.com).

In the Timiskaming region, **Contact Diamond Corporation** (acquired 100% by Stornoway in 2006) has discovered nine kimberlite pipes since 1995, six of which were found to be diamondiferous, including the 95-2 pipe. The last pipe discovered in late 2006, the Baby pipe, is located on the Quebec side of the property. A 652-t reverse circulation drilling mini-bulk sampling program conducted on this pipe between 2003 and 2004 returned 66.15 ct for an overall recovered grade of 0.10 ct/t and an average value of US\$48.50/ct. In 2007, the company plans to conduct an airborne geophysical survey, till sampling, and ground geophysics to better define the Baby kimberlite. Drilling of the Baby kimberlite and of other targets may be undertaken later in the year.

In the Wawa region, Dianor Resources Inc. pursued the evaluation of a diamondiferous conglomerate on its **Lead-better diamond property** by completing a 40 000-m diamond drilling program. Drilling results indicate diamond continuity through the Archean conglomerate both laterally and at depth. A 600-t mini-bulk sampling program (105 6-t samples) carried out during Fall 2005 to test the diamond distribution and size variation revealed an average grade of 0.2995 ct/t in the North sector (42 samples). The largest stone recovered from outcrop samples weighed 0.667 ct (www.dianor.com).

In north-central **Quebec**, Ashton Mining of Canada Inc. (now a wholly owned subsidiary of Stornoway Diamond Corp.), in a 50:50 joint venture with Soquem Inc., explored the **Foxtrot property** where 14 kimberlite bodies had been identified by year-end. This number includes a dyke discovered in August 2006 in an outcrop located about 8 km from the Renard cluster. The joint venture proceeded with an extensive exploration program that included bulk sampling to recover at least 6000 ct from Renard 2, 3 and 4. It expects to complete the collection of this sample of over 10 000 t of kimberlite material in early 2007 and to have the processing of the sample, through the on-site dense media separation facility, completed within the third quarter of 2007. Full market valuation of the diamonds recovered will follow. A rough diamond valuation estimate in April 2005 returned a modeled value of US\$88/ct from a 459-ct parcel extracted from a bulk sample of 664 t collected at Renard 2, 3, 4, and 65. A preliminary model prepared by the joint venture indicated that Renard bodies 2, 3, 4 and 9 contained 17.6-20.9 Mct of diamonds in 23.2-27.5 Mt of kimberlitic material. During 2007, the joint venture plans to conduct an underground delineation drilling program on Renard 2 and 3 to define a resource compliant with National Instrument 43-101 standards as part of the prefeasibility study. It will also collect a 500-t bulk sample from the Lynx dyke system for valuation purposes. Additional information is available on the Internet at www.stornowaydiamonds.com.

A more comprehensive report of all exploration projects in Canada can be found on the Internet at www.nrcan.gc.ca/mms/pdf/explor/2006/toc06-e.pdf. Also, additional web

sites of some companies active in diamond exploration in Canada can be found at www.diamondplay.com and www.thediamondhunter.com.

CANADIAN GOVERNMENT DIAMOND VALUATOR

In the Northwest Territories and Nunavut, the Canada Mining Regulations require that all diamonds produced in the territories be examined by a government valuator in order to establish a value for the diamonds for the purposes of calculating royalties owed to the Crown. The valuation must be done before the diamonds are sold or exported out of the territories. The Canadian government, represented by Indian and Northern Affairs Canada, renewed its contract with Diamonds International Canada (DICAN) Ltd. for a three-year period starting January 1, 2006, for the valuation of N.W.T. diamond production. DICAN is a Canadian incorporated company with headquarters in Yellowknife, N.W.T. The company is a partnership between Aboriginal Diamonds Group Ltd. (51%) and WWW International Diamond Consultants Ltd. (49%).

DICAN has a team of nine individuals with expertise in the valuation of rough diamonds and in the statistical analysis of rough diamond production. As required by regulation, DICAN provides the government with a value of diamond production from both the Ekati and Diavik mines for use in the calculation of royalties that will be paid to the Crown.

In addition to providing its valuation services, DICAN is also committed to providing valuation training to Canadians. Northern Aboriginals have priority for the training program.

USES¹

Diamond is best known as a gemstone, but only 20% of the world's production by weight is used in jewellery. The other 80%, known as bort, is destined for industrial uses and research applications where diamonds' unique properties are put to great use. About 180 Mct, or 36 000 kg, of diamonds are mined annually worldwide. In addition to mined diamonds, there are close to 600 Mct (120 000 kg) of synthetic diamonds that are produced annually for industrial use.

Diamond is the hardest known material and has the highest thermal conductivity of any material at room temperature.

Diamond is more than twice as hard as its nearest competitors: cubic boron nitride and silicon nitride. Because it is the hardest substance known, diamond has been used for centuries as an abrasive in cutting, drilling, grinding, and polishing. This currently represents the dominant industrial use of diamond. Even though it has a higher unit cost, diamond has proven to be more cost-effective in many industrial processes because it cuts faster and lasts longer than alternative abrasive materials. Diamond also has chemical, electrical, optical, and thermal characteristics that make it the best material available to industry for wear- and corrosion-resistant coatings, special lenses for laser radiation equipment, heat sinks in electrical circuits, wire drawing, polishing silicon wafers and disk drives in the computer industry, and other advanced technologies.

Most uses of diamonds in these technologies do not require large diamonds; in fact, most diamonds that are gem-quality except for their small size can find an industrial use. Diamonds are embedded in drill tips or saw blades, or ground into a powder for use in grinding and polishing applications. Synthetic industrial diamond is superior to its natural diamond counterpart because its properties can be tailored to specific applications and it can be produced in large quantities. It is for these reasons that synthetic diamond accounts for about 87% of the industrial diamond used in the world.

Diamond tools have numerous industrial functions. Diamond drilling bits and reaming shells are used principally for gas, mineral, and oil exploration. Other applications of diamond bits and reaming shells include foundation testing, masonry drilling, and inspecting concrete. The primary uses of point diamond tools are for dressing and truing grinding wheels, and for boring, cutting, finishing, and machining applications. Beveling glass for automobile windows is another application. Cutting dimension stone and cutting/grooving concrete in highway reconditioning are the main uses of diamond saws; other applications include cutting composites and forming refractory shapes for furnace linings. Very fine diamond saws are used to slice brittle metals and crystals into thin wafers for electronic and electrical devices. Diamond wire dies are essential for high-speed drawing of fine wire, especially from hard, high-strength metals and alloys. The primary uses of diamond grinding wheels include edging plate glass, grinding dies, grinding parts for optical instruments, and sharpening and shaping carbide machine tool tips.

Synthetic diamond grit and powder are used in diamond grinding wheels, saws, impregnated bits and tools, and as a loose abrasive for polishing. Loose powders made with synthetic diamond for polishing are used primarily to finish cutting tools, gemstones, jewel bearings, optical surfaces, silicon wafers, and wire-drawing dies for computer chips. Hundreds of other products made from ceramics, glass, metals, and plastics also are finished with diamond powders.

¹ The sources for some information in this section were the U.S. Geological Survey's 2005 Minerals Yearbook article on Industrial Diamonds (<http://minerals.usgs.gov/minerals/pubs/commodity/diamond/diamombyb05.pdf>) and Wikipedia, the free encyclopedia (<http://en.wikipedia.org/wiki/Diamond>).

The use of polycrystalline diamond shapes (PDSs) and polycrystalline diamond compacts (PDCs) continues to increase for many of the applications cited above, including some of those that employ natural diamond. The use of PDSs, PDCs, and matrix-set synthetic diamond grit for drilling bits and reaming shells has increased in recent years. PDSs and PDCs are used in the manufacture of single- and multiple-point tools, and PDCs are used in a majority of the diamond wire-drawing dies.

CANADIAN DIAMOND MANUFACTURING

Diamond Cutting and Polishing

Canada has a small diamond-manufacturing industry. At the end of 2006 there were five diamond manufacturers operating across Canada located in Yellowknife (N.W.T.), Vancouver (British Columbia), and Matane (Quebec). These cutting and polishing factories provide work for about 150 workers. In comparison to other countries with cutting and polishing industries, the Canadian industry is still quite small. With the expansion of mine production in Canada, there is interest in establishing new facilities in this country. In order to have their interests represented in Canada's decision-making process, Canada's major diamond manufacturers established the Diamond Manufacturers Association of Canada (DMAC) during 2005. DMAC is expected to lobby governments, exchange information, and uphold best practices with other associations. Founding members of the association include: Arslanian Cutting Works (NWT) Ltd., Beit Zimmerman Diamantaires Inc., Diarough Canada, Diamond Finishers of Canada Ltd., HRA Investments Ltd., Polar Diamonds Inc., and Jimmy Diamonds.

Yellowknife, N.W.T.

There are three factories operating in Yellowknife, N.W.T., where, under territorial government policy, the diamond-mining companies have made a commitment to provide 10% by value of their production to the northern factories at market price. The success of diamond cutting and polishing in the N.W.T. has been mixed, forcing some factories to alter their business models or close.

The first facility to open in Yellowknife was established by Sirius Diamonds Ltd. in June 1999. The company currently employs about 15 people, most of whom are Northerners. Sirius diamonds are marketed as Polar Bear diamonds. Sirius went into receivership in August 2004 when the Government of the N.W.T. (GNWT) called in the company's \$8 million loan guarantee as a result of the company's viability being questioned. The factory was eventually forced to close in 2005. However, its assets were purchased by the Arslanian Cutting Works (NWT) Ltd.

factory, which neighbours Sirius and who operates the latter independently under the Polar Diamonds name.

The second factory was constructed by Deton'cho Diamonds, majority owned by the Yellowknives Dene; it began production in March 2000. The factory is located in Ndilo, a Yellowknives community adjoining Yellowknife. It had about 30 employees, most of whom were Aboriginal trainees. The company suffered a setback in 2002 when it was forced to close its doors, leaving the territorial government to cover its \$2 million loan guarantee. The operation re-emerged as Canada Dene Diamonds in January 2003 with the backing of Schacter and Namdar, based in Israel, but was forced to close in April 2006.

Arslanian Cutting (NWT) Works, Yellowknife's largest plant with about 40 employees, began production in December 2000. As in the case of Sirius Diamonds Ltd., the company was forced into interim receivership in August 2004 when the GNWT called in the company's \$9.2 million loan guarantee. Basal Diamonds later acquired a 25% stake in the Arslanian plant by repaying the loan. In order to maximize production, Arslanian uses experienced polishers from its factories in Armenia. The company also established a one-on-one training program to train Northerners. The factory markets its diamonds under the Polar Ice brand name.

Laurelton Diamonds, 100% owned by Tiffany & Co. New York, is the most recent addition to the diamond manufacturing scene in Yellowknife. The company has rough diamond supply agreements with Aber and with Tahera, and employs approximately 55 people in its Yellowknife factory. Its polished diamond production is marketed through Tiffany's retail outlets.

BHP Billiton Diamonds Inc. has contracts to supply three of the facilities with up to 2500 ct each five-week period. The factories require a specific assortment of diamonds, which BHP Billiton prepares at its sales offices in Antwerp, Belgium. The assortments are then shipped back to the company's sorting and valuation facility in Yellowknife where sales to the factories take place.

Diavik, through its parent company Rio Tinto, also fulfills its obligation to the GNWT of supplying up to 10% by value of its rough diamond production for manufacture in the N.W.T. by selling specially selected rough diamonds from its offices in Antwerp, Belgium, to be cut and polished in the North.

Matane, Quebec

In Matane, Diamants du St-Laurent started a diamond cutting and polishing operation in October 2000 and employed about 20 workers. The plant had to reduce its operations to short-term contracts in 2004 following the bankruptcy of its principal distributor. However, it has kept links with Group

Collegia, a continuous learning agency offering training in diamond cutting and polishing that is associated with the Cegep de Matane and the Cegep de la Gaspésie et des Îles. Efforts were made during 2006 to find an interested party to restart the operation.

In February 2005, Diarough Canada, a subsidiary of Diarough N.V., an Indian company with headquarters in Antwerp, Belgium, opened up a cutting and polishing factory in Matane, Quebec. Operations at this plant provide work for about 40 workers. The plant is expected to have a production capacity of about 10 000 ct and to specialize in the production of cut diamonds ranging in size from 0.3 to 2 ct destined for the North American and Asian markets. A Quebec government training program with a \$1.6 million budget was established to train about 30 people in diamond cutting and polishing. Matane's location in the Lower St. Lawrence region also allows Diarough to benefit from a Quebec government program fostering job creation. Under the program managed by Investissement Québec, a reimbursable income tax credit amounting to 30% of the salaries of workers involved in the transformation industry is provided to enterprises located in "région-ressources." This program is in place until December 31, 2009.

Vancouver, British Columbia

In operation since 2001, the Vancouver diamond cutting and polishing factory is owned by Hyperion Industries (Hyperion), a private company partly owned by HRA Investments Ltd. (HRA). HRA is a core client of Rio Tinto Diamonds NV. The factory is fully automated and currently employs about 12 workers. The plant is essentially a robotic operation equipped with about 20 robots and an additional 8 schaiwes (polishing wheels) where the plant's production workers do the final polishing on some stones to finish the work done by the robots, such as to get rid of inclusions that are close to the surface. Each stone is placed in a computer (Sarin machine) where the operator chooses the parameters of the cut. It is then placed in an automated "brutting" machine that makes the stone round. The stone is placed in one of the robots that polishes it in about 22 minutes. The whole process, however, takes about two hours per stone. Hyperion Industries concentrates on cutting and polishing Canadian diamonds in order to add value to its product through the various branding programs it designs for its clients, such as the Ikuma brand designed for the Ben Bridge Jewellery chain. The size of rough favoured at the factory is around 1 ct. The plant is said to be producing at an average of 1500-1700 ct per month.

Other Cutting and Polishing Plants

Limited cutting and polishing work is also performed at other locations in Canada, including in Winnipeg, Manitoba; Toronto, Ontario; and Montréal, Quebec.

Diamond Jewellery Manufacturing

The largest mark-up in the pipeline for diamonds is at the jewellery stage. There are approximately 20 major plants located mainly in the Toronto region with a few in Montréal. There are also several smaller plants in Montréal. The elimination on May 2 of the 10% excise tax on diamonds and jewellery is a recent development that will lower the cost of jewellery in Canada and foster increased activity. A recent Diamond Trading Company study identified Canada as the world's sixth leading diamond-buying culture on account of its diamond value market share (1.8%), despite its relatively small population. Tiffany recently created a jewellery design company in partnership with an Aboriginal group in the North, although manufacturing is done elsewhere.

Diamond Tools and Equipment Manufacturing

These products include drill bits, segments for circular blades, grinding wheels, and specialty tools. The major manufacturing plants are: (in Quebec) Fordia and K&Y Diamond Limited at Ville St-Laurent, Diamond Production at Montréal, North Star Abrasives at Montréal, Diacan at Québec City, and Diamond Systems at Dorval; (in Ontario) Tru-Form Diamond Tool Company at Georgetown, JKS Boyle, Longyear, JKS Lamage, and Pilot Diamond Tools, all in North Bay; Diatech Diamond Tools in Toronto; Hammond Diamond Tooling Ltd in Collingwood; and Northern Super Abrasives at Oakville; Dimatec at Winnipeg, Manitoba; Diaset Products Ltd. at Delta, British Columbia; and Hobic Bit Industry at Richmond, British Columbia.

Synthetic Diamond Production

Crystalline Manufacturing Ltd. of Calgary, Alberta, produces synthetic diamond films using the Carbon Vapour Deposition (CVD) method.

KIMBERLEY PROCESS CERTIFICATION SCHEME

Background

The Kimberley Process (KP) derives its name from the city in South Africa that is synonymous with diamonds and was the location of the first meeting of countries whose ultimate goal was to develop a scheme to prevent conflict diamonds from entering into legitimate diamond trade. Conflict diamonds are those diamonds sold by rebel forces to purchase arms for use in conflict against legitimate governments.

Throughout 2001 and early 2002, there was a series of meetings attended by governments of diamond-producing

and trading countries, non-governmental organizations, and industry. The meetings focussed on the negotiation of a working document that, when finalized in 2002, became the Kimberley Process Certification Scheme. Under the Scheme, all government participants agreed that exports of rough diamonds would be accompanied by a certificate (issued by the government or an agency authorized by the government of the exporting country) and that trade would only occur between participants. In order to be a participant, governments are required to have appropriate legislation in place that allows for adequate enforcement of the terms and conditions of the Scheme. At a plenary meeting in Ottawa in March 2002, all participants agreed that the Scheme would come into force on January 1, 2003. Botswana chaired the KP in 2006 and was replaced by the European Community in 2007. More information is available on the Internet at www.kimberleyprocess.com.

The Kimberley Process was based on a consensus agreement between some 35 countries, numerous representatives of civil society, and industry. On December 31, 2006, there were 45 Participants in the Kimberley Process, including the European Community, which has 25 member countries. These Participants are believed to represent 99% of the world trade in diamonds. In addition to the above-noted site, there are several other sites with information on the Kimberley Process: Partnership Africa Canada at www.pacweb.org, The World Diamond Council at www.worlddiamondcouncil.com, and Global Witness at www.globalwitness.org.

Third-Year Review

A Third-Year Review of the KPCS, chaired by Canada, was carried out in 2006 to strengthen the Kimberley Process. The plenary endorsed the conclusions of this review and adopted 46 recommendations. It agreed to: publish production statistics gathered through the KPCS and publish the names of participants that habitually fail to submit statistics or reports; highlight requirements related to illegal shipments; develop proposals related to interim measures, including possible suspension in cases of significant non-compliance; and create the Working Group on Artisanal-Alluvial Production. The plenary also agreed that four other issues would receive priority attention in the year ahead: funding and resource requirements, improving statistical data gathering and analysis, effective and credible government oversight of industry, and the treatment of illegal shipments.

Implementation of the Kimberley Process Certification Scheme in Canada

In order for Canada to meet its obligations as a Participant in the Kimberley Process Certification Scheme, new legislation and regulations needed to be created. On October 12, 2002, Bill C-14, *The Export and Import of Rough Diamonds Act*, was passed into law and permitted Canada to begin implementation of the certification scheme on

January 1, 2003. As a result of modifications brought forward at the Kimberley Process Plenary meeting in Fall 2004, amendments to the Act were made during 2005 for Canada to remain compliant. The amendments required were to:

- introduce a provision to enable the publication of Kimberley Process Certificate-based import and export statistics collected through the KPCS; and
- change the definition of the term “rough diamond” as defined in the Act and provide ministerial powers to facilitate future changes to the term as required by the KP.

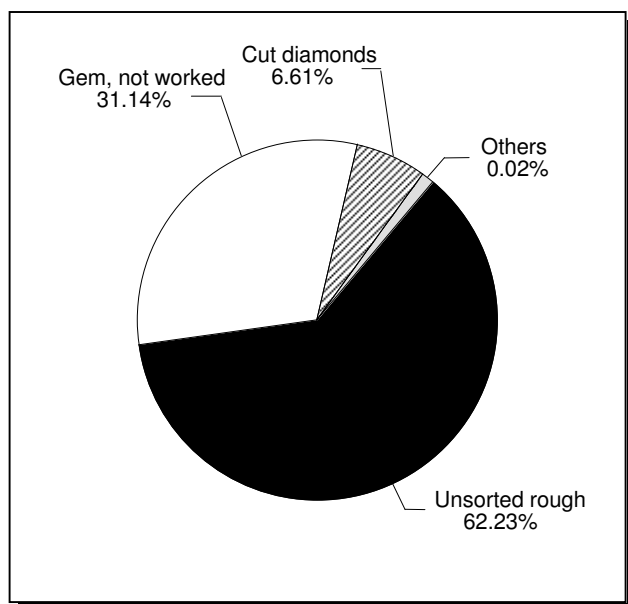
Bill S-36, which was designed to amend the *Export and Import of Rough Diamonds Act*, received Royal Assent on November 25, 2005. Publication in the *Canada Gazette* fixed June 16, 2006, as the day of coming into force of the changes in the provisions of the Act.

More information on the Kimberley Process in Canada is available on the Internet at http://mmsd1.mms.nrcan.gc.ca/kimberleyprocess/note_e.asp.

TRADE

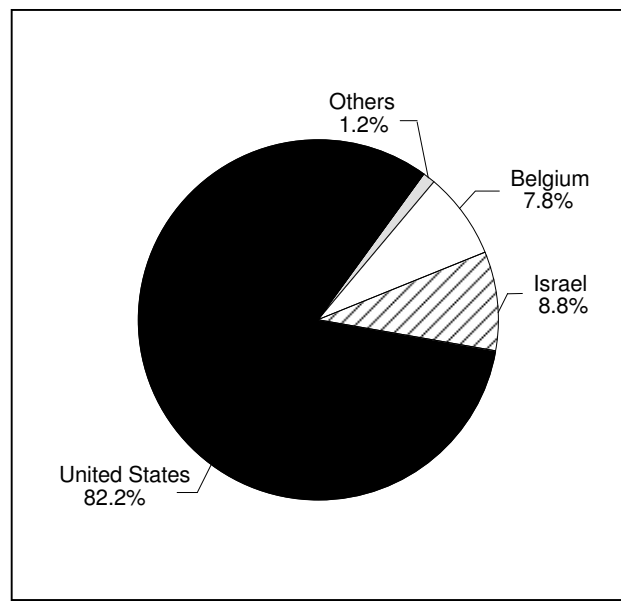
Canada's total primary exports of diamonds in 2006 are estimated to be valued at \$1.48 billion, a decrease of 16% relative to 2005. The lower exports are directly related to the lower value of the rough diamond production during the year, as Canada's most important diamond export item is classified under Harmonized System (HS) code 7102.10, representing unsorted diamonds (Figure 3). However, the lower exports for 2006 appear to have been partly caused by variations in the timing of exports during the year with lower exports having occurred in the first few months of 2006. Exports under this code, on a value basis (\$922 million), were in most part directed towards Belgium (54%) and the United Kingdom (46%). The second most important trade item, on a value basis (\$461 million, 14% more than in 2005), is classified under HS code 7102.31, diamonds, non-industrial, unworked or simply sawn, cleaved or bruted, and represents diamonds that were sorted and are specifically destined for the jewellery business. Diamonds in this category were destined for Antwerp, Belgium (84%), the United Kingdom (11%), and India (5%), the latter increasing its share at the expense of the United States. The third most important export, on a value basis (\$98 million, 8% more than in 2005), falls under HS code 7102.39, which represents cut diamonds. These exports (Figure 4), sent mostly to the United States (82%), Israel (9%), and Belgium (8%) in 2006, have significantly increased over the past decade (Figure 5) and reflect the increase in cutting and polishing capacity and branding efforts in Canada. The rest of Canada's exports (industrial and synthetic diamonds), amounted to over 27 000 ct valued at \$61 000. These were mostly exported to the United States.

Figure 3
Canadian Diamond Exports, by Product Type, 2006



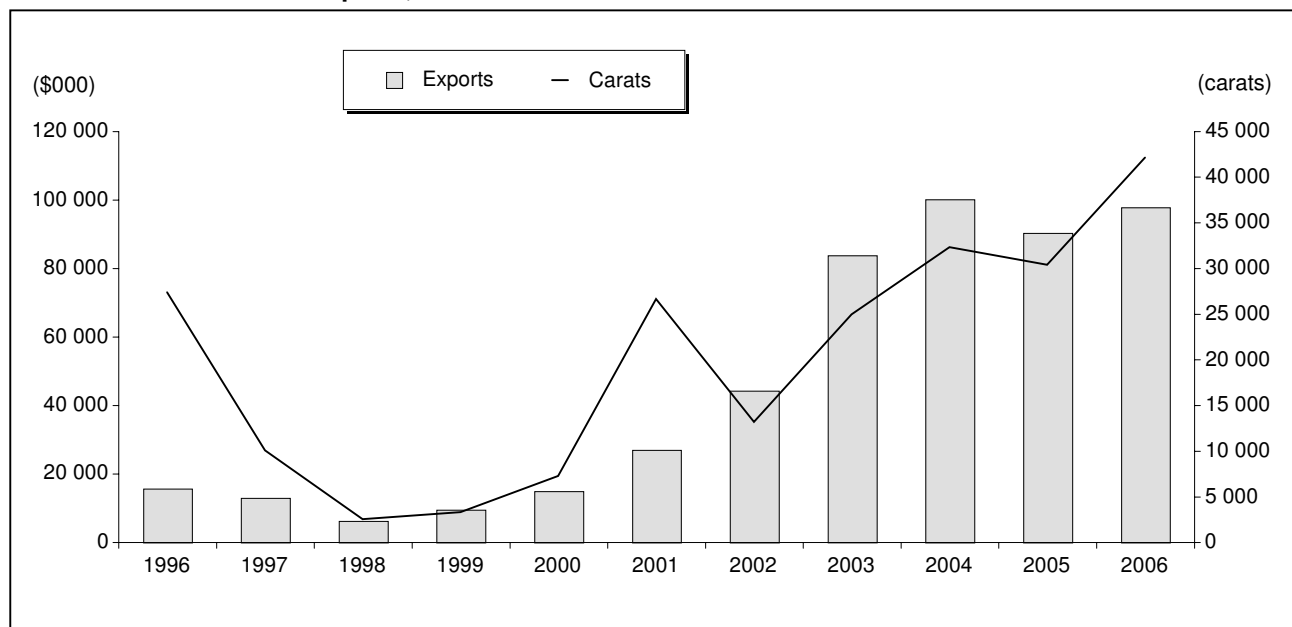
Source: Statistics Canada.

Figure 4
Canadian Cut Diamond Exports, by Country, 2006



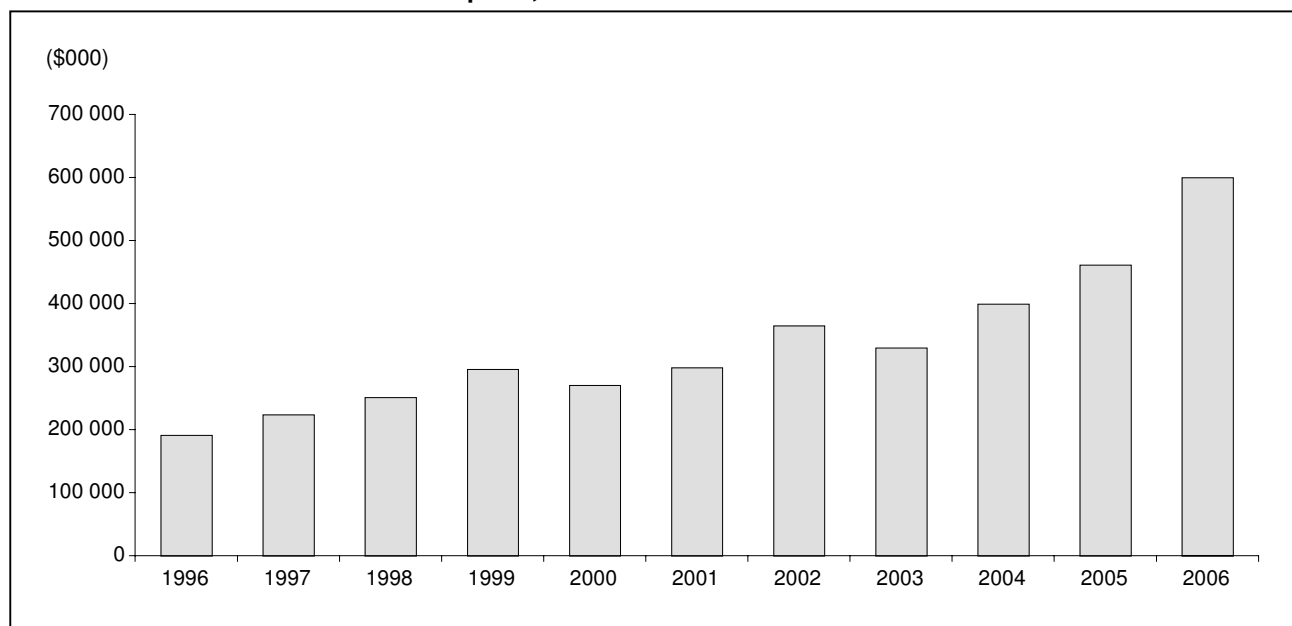
Source: Statistics Canada.

Figure 5
Canadian Cut Diamond Exports, 1996-2006



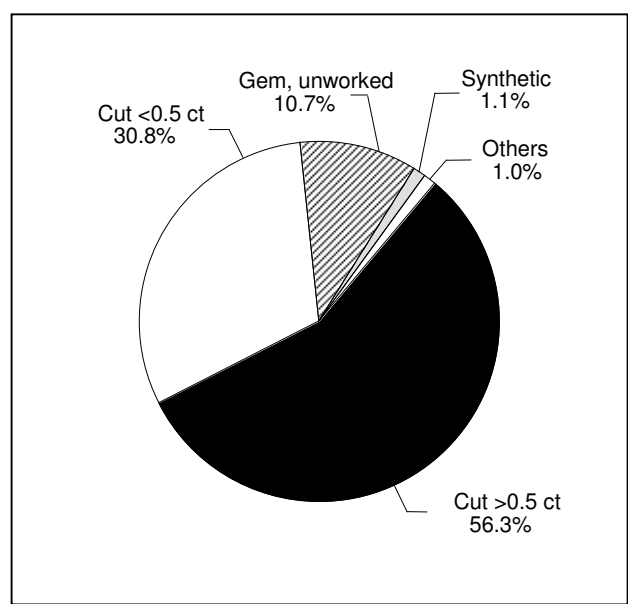
Source: Statistics Canada.

Figure 6
Total Value of Canadian Diamond Imports, 1996-2006



Source: Statistics Canada.

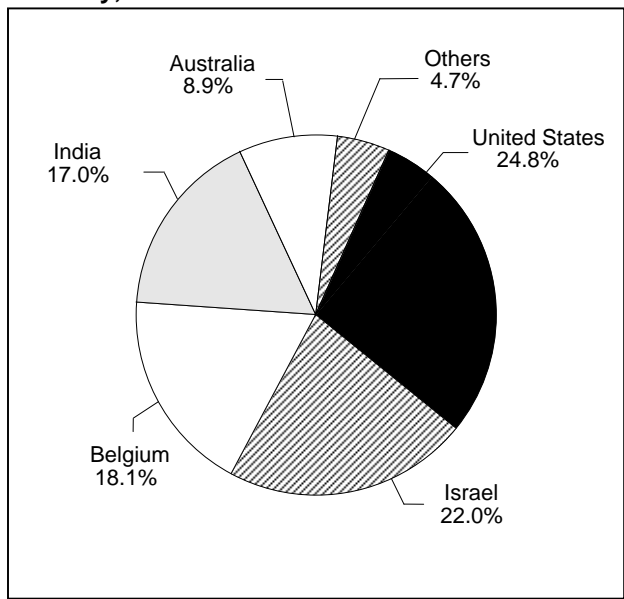
Figure 7
Canadian Diamond Imports, by Product Type, 2006



Source: Statistics Canada.

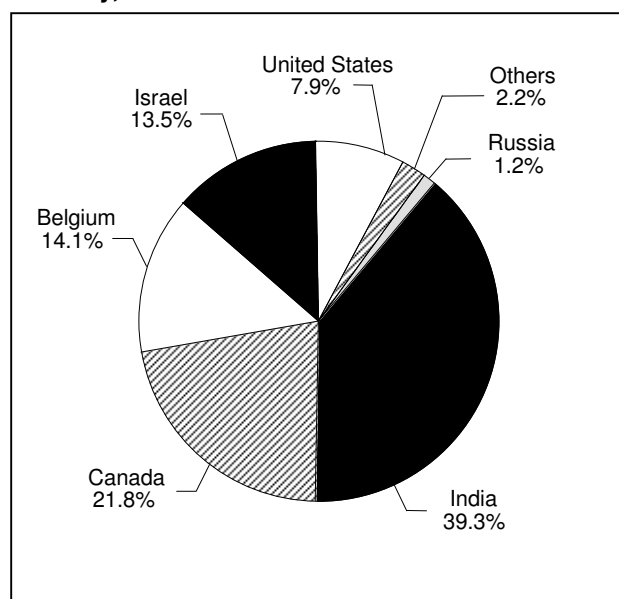
On the import side, Canada's total primary imports of diamonds in 2006 (Figure 6) are estimated to be valued at \$600.3 million, a 30% increase over 2005. This drastic increase in imports probably results from the combined effect of the appreciation of the Canadian dollar and the elimination of the excise tax on jewellery. Canada's number one import item (Figure 7) is cut diamonds exceeding 0.5 ct in weight destined for jewellery manufacturing. Imports in 2006 reached \$338 million, a 13.0% increase over 2005. Shipments (Figure 8) were from the United States (24.8%), Israel (22.0%), Belgium (18.1%), and India (17.0%). The second item of importance, again on a value basis (\$185 million, an increase of 47% over 2005), was cut diamonds not exceeding 0.5 ct in weight that are also intended for jewellery manufacturing. Shipments in this case (Figure 9) came from India (39.3%), Canada (re-imports 21.8%), Belgium (14.1%), Israel (13.5%), and the United States (7.9%). It is interesting to note, as shown in Figures 10 and 11, that imports of cut diamonds of both size categories have steadily increased over the past 10 years, indicating either an increase in jewellery manufacturing in Canada and/or branding/marketing activities. The third item of importance, uncut gem diamonds partly intended for the Canadian cutting industry, amounted to \$64 million in 2006, compared to \$27 million in 2005 (Figure 12). The increase in imports observed over the past few years reflects an increase in cutting capacity such as provided by the commissioning of the Diarough facility in

Figure 8
Canadian Cut Diamond Imports (>0.5 ct), by Country, 2006



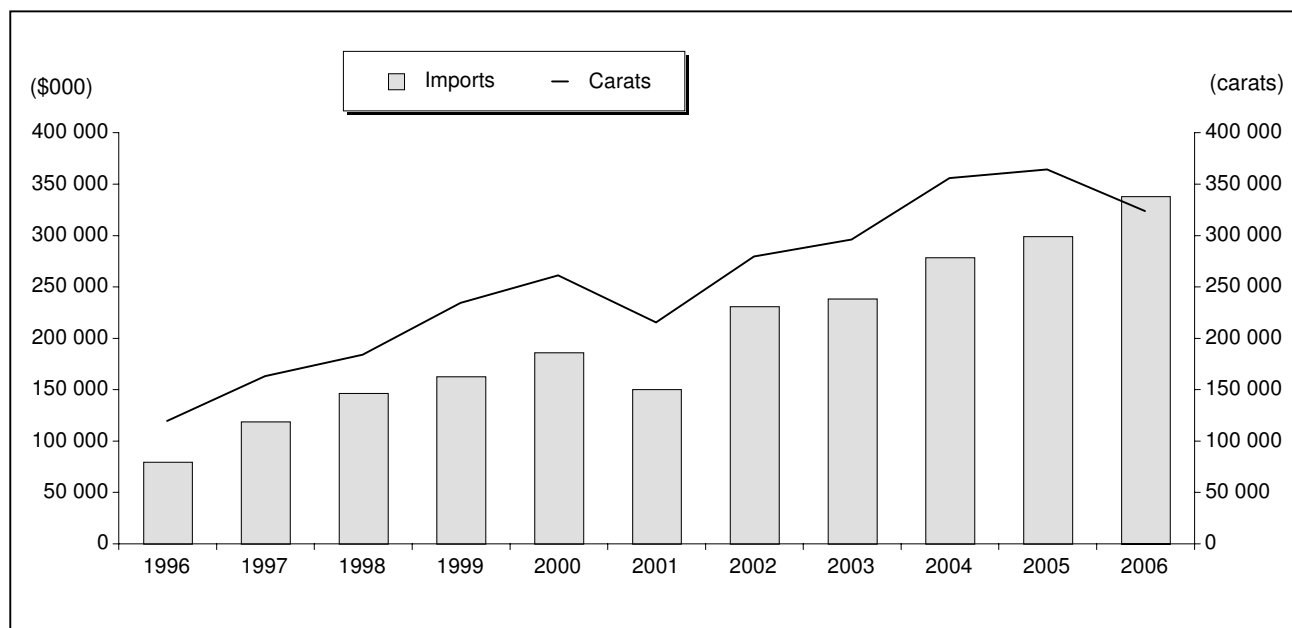
Source: Statistics Canada.

Figure 9
Canadian Cut Diamond Imports (<0.5 ct), by Country, 2006



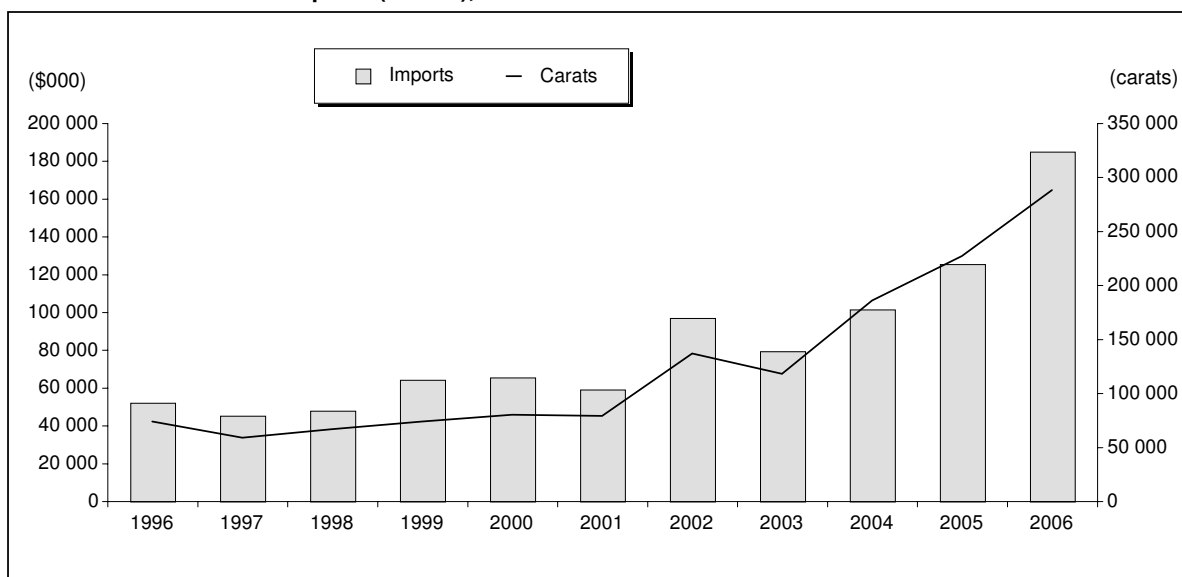
Source: Statistics Canada.

Figure 10
Canadian Cut Diamond Imports (>0.5 ct), 1996-2006



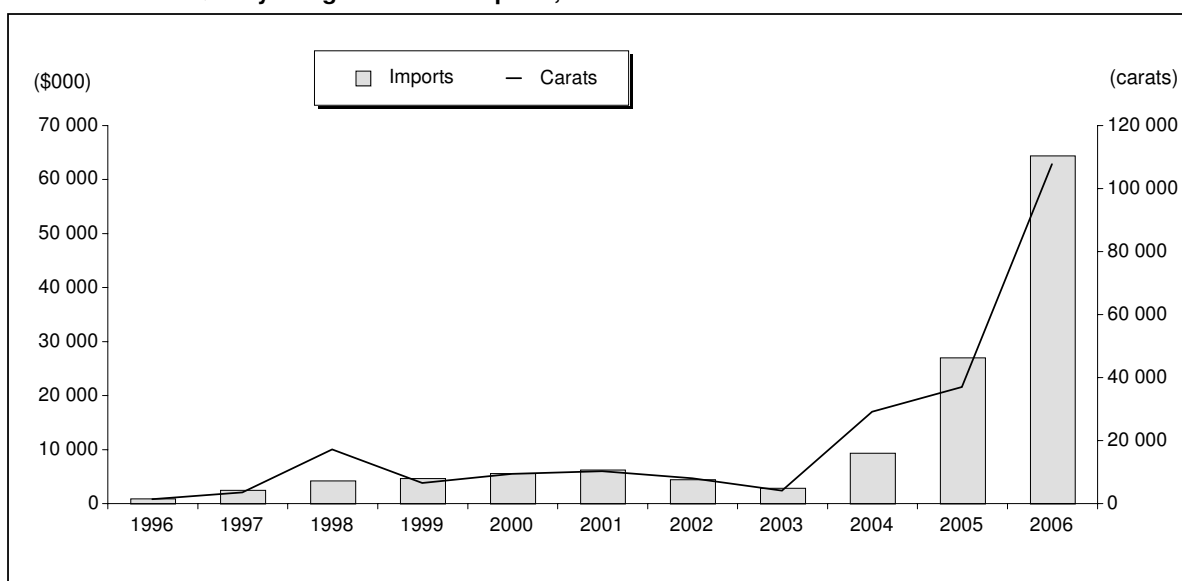
Source: Statistics Canada.

Figure 11
Canadian Cut Diamond Imports (<0.5 ct), 1996-2006



Source: Statistics Canada.

Figure 12
Canadian Gem-Quality Rough Diamond Imports, 1996-2006

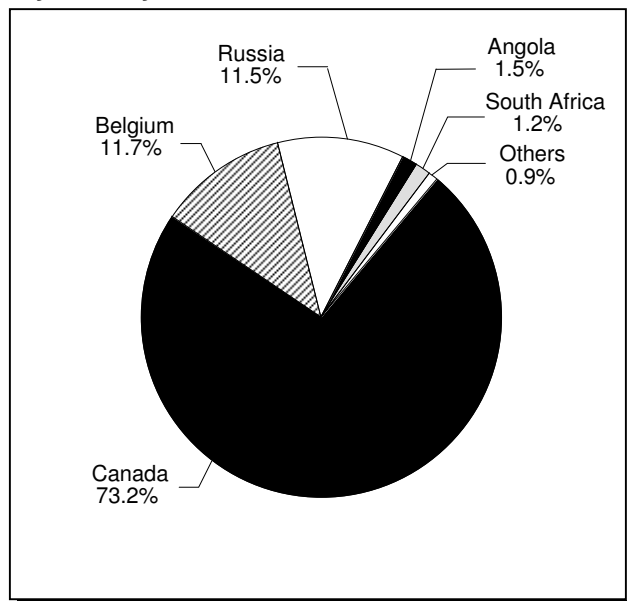


Source: Statistics Canada.

early 2005 and/or a change in marketing approach. These diamonds were imported (Figure 13) from Canada (re-imports 73.2%), Belgium (11.7%), and Russia (11.5%). The rest of Canada's diamond imports (various industrial

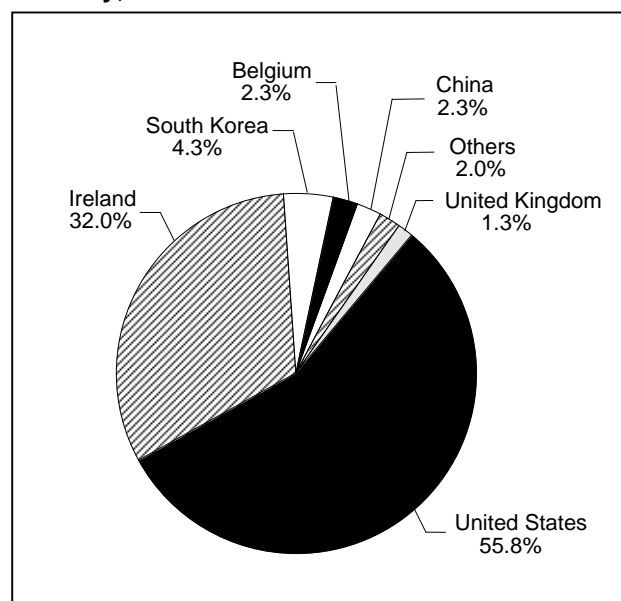
grades, natural dust, and synthetic diamonds [Figure 14]) were valued at \$12.6 million. These were mostly imported from the United States, Ireland, Belgium, Ghana, and South Africa.

Figure 13
Canadian Gem-Quality Rough Diamond Imports,
by Country, 2006



Source: Statistics Canada.

Figure 14
Canadian Synthetic Diamond Imports, by
Country, 2006



Source: Statistics Canada.

WORLD NATURAL ROUGH DIAMOND PRODUCTION AND DEMAND

Production

World production of natural rough diamonds in 2006, as publicly reported for the first time by the Kimberley Process (see table on the next page), is estimated at 175.5 Mct valued at US\$12.0 billion, for an average price of US\$68.23/ct. This represents a 0.7% decrease in production on a carat basis and an increase of 3.7% on a value basis over that of 2005. The lower carat production is due to drops in production in South Africa (4.0%), Australia (9.1%), The Democratic Republic of Congo (12.3%), and Sierra Leone (53.3%). These drops were partly offset by production hikes in Botswana (7.5%), Canada (7.2%), Angola (29.6%), and Namibia (28.7%). The increase in value stems from higher values reported in Botswana (11.8%), South Africa (3.2%), Angola (4.0%), and Namibia (29.3%), while significant drops occurred in The Democratic Republic of Congo (-29.8%) and Sierra Leone (-52.7%). Refer to the table on the next page for production estimates from the main producing countries and to Figures 3 and 4 for the relative share of the world rough diamond production of each of the main producers.

More details on world rough diamond production are available on the Internet at www.iti.gov.nt.ca/diamond/industry.htm.

Demand

According to the Diamond Intelligence Briefs, worldwide retail sales of diamond jewellery in 2006 are estimated at US\$68.5 billion, an increase of 9.7% compared to 2005. The value of the diamond jewellery content for its part is estimated at US\$18.5 billion, or 26.9% of the retail sales. Retail markets are also reported to have been dominated by the Americas (50%) while Japan accounted for 15%, Europe for 12%, Asia-Arabia for 7%, Asia-Pacific for 6%, and others for 11%. Note that demand in emerging markets, such as China and India, is growing strongly.

Demand for rough diamonds is reported to be in overall balance with supplies. However, a closer analysis indicates that, as reflected by price movements, smaller and lower-quality diamonds are in oversupply, while demand for larger, better-quality diamonds is reported as having exceeded supply.

GLOBAL ROUGH DIAMOND PRODUCTION STATISTICS, 2005 AND 2006

Country	Production 2005			Production 2006				
	Volume	Value	Average Value	Volume	Variation vs. 2005	Value	Variation vs. 2005	Average Value
	(ct)	(US\$)	(US\$/ct)	(ct)	(%)	(US\$)	(%)	(US\$/ct)
Botswana	31 889 771	2 870 079 390	90	34 293 401	8	3 207 570 684	12	94
Russia	38 000 990	2 531 308 600	67	38 360 810	1	2 574 280 850	2	67
Canada	12 314 031	1 454 279 789	113	13 206 357	7	1 397 443 872	-4	106
South Africa	15 559 531	1 319 087 980	85	14 934 706	-4	1 361 816 225	3	91
Angola	7 079 121	1 089 170 956	154	9 175 061	30	1 132 514 826	4	123
Namibia	1 866 320	696 702 746	373	2 402 477	29	900 977 934	29	375
Australia	32 941 063	547 087 503	17	29 940 451	-9	559 573 075	2	19
Congo, Democratic Republic of	33 054 998	615 430 901	19	28 990 241	-12	431 931 171	-30	15
Lesotho	52 036	64 300 000	1 236	112 408	116	83 545 876	30	743
Sierra Leone	668 710	141 940 244	212	312 342	-53	67 121 707	-53	215
Central African Republic	382 756	60 572 405	158	419 528	10	59 066 866	-3	141
Guyana	337 798	32 001 343	95	350 518	4	44 387 773	39	127
Guinea	548 522	47 459 555	87	473 862	-14	39 884 880	-16	84
Zimbabwe	248 262	36 018 236	145	1 046 025	321	33 853 838	-6	32
Ghana	1 013 616	33 878 145	33	972 648	-4	30 910 703	-9	32
Tanzania	221 286	25 469 806	115	272 161	23	25 553 133	0	94
Indonesia	17 557	4 928 569	281	51 603	194	10 643 235	116	206
Brazil	300 000	21 850 500	73	94 010	-69	6 279 020	-71	67
Togo	17 670	1 992 920	113	28 176	60	3 221 570	62	114
India	60 124	9 785 751	163	10 279	-83	1 763 359	-82	172
China	71 764	1 000 000	14	74 080	3	1 240 000	24	17
Venezuela	55 154	3 173 022	58	16 981	-69	1 181 020	-63	70
Total	176 686 781	11 542 190 126	65	175 538 127	-1	11 974 761 618	4	68

Source: Kimberley Process Certification Scheme.

FACTORS AFFECTING DIAMOND MINING

Grade

Grade is the weight of diamonds expressed as carats per tonne (ct/t) of ore. It varies widely from one mine to another, but generally falls somewhere between 0.3 and 1.3 ct/t. The value of the ore per tonne equals the grade times the average value per carat of all the individual diamonds in the deposit.

Size (Weight) of Rough Diamonds in the Deposit

Individually, rough diamonds can range in size from micro-sized to stones weighing in excess of 1000 ct. A much more telling measure of a mine's production is the average size of its rough diamonds. Depending on the mine, the average size of rough diamonds recovered can vary from 0.01 ct (about 1 mm in size) to more than 0.7 ct. Many mines in the world average about 0.4-0.5 ct per stone. It is interesting to note that the number of stones larger than 1 ct (0.2 g) produced at mines is very small (about 400 000 stones per year) and, in terms of total carats produced, represents only about 0.5% of world production.

Mine Production Costs

According to different sources, production costs (excluding depreciation and interest) for kimberlites and lamproites can be as low as US\$5-\$6/t for large and easy-to-access diamond mines operating in good climatic conditions and are up to about US\$35-\$38/t for small mines located in remote areas and operating under harsh climatic conditions. The total production costs for these mines are around US\$15/t and US\$40-\$45/t, respectively.

PRICES

There are no internationally set prices for rough diamonds, such as there are for precious metals like gold, silver and platinum, and for base metals such as copper, lead and zinc. The market prices for rough natural diamonds are almost constantly in a state of flux.

Natural Diamonds

Gem-quality rough diamonds: While there are no internationally set prices for rough gem-quality diamonds, De Beers SA's marketing agency, the Diamond Trading Company (DTC), which controls nearly half of the world's rough diamond supply, is reported as having decreased its prices for smaller stones (0.5 ct) by about 1% over the

course of the year, while prices for 1-ct stones remained unchanged and prices for larger stones (3 ct and up) are reported to have increased by about 5%. On average, prices are reported to have followed the tendency observed in the second half of 2005. A 2% price increase by the DTC in February was reversed in July due to the financial difficulties faced by the diamond manufacturing and jewellery industries, and the fragile nature of the U.S. economy. This correction is expected to continue in early 2007. However, prices are expected to increase in the short to medium term as demand outpaces supply, especially for rough diamonds 3 ct and above. The price of a rough stone depends on its carat weight, shape, clarity, and colour. The prices vary widely, but the following is an indication of the prices paid at cutting and polishing factories for gem-quality rough stones: a 1-ct stone that sells for around US\$20 is very low quality, US\$200 is medium quality, US\$400 is good quality, and US\$1000+ is top quality. Figure 15 provides an historical perspective of rough diamond prices during the period 1960-2004.

Natural industrial diamonds: Crushing bort sells for about US\$30¢/ct, casting sells for US\$1-\$2/ct, industrial stones sell for US\$7-\$10/ct, flets (e.g., a high-quality thin macle) sell for US\$50/ct, and dies (larger diamonds of high quality but with poor [often yellow] colour that makes them unsuitable as gems) sell for up to US\$200/ct.

Synthetic Diamonds

Synthetic diamond prices depend on their particle strength, size and shape, and whether or not the diamonds are coated with a metal, etc. For this reason, there are several hundred

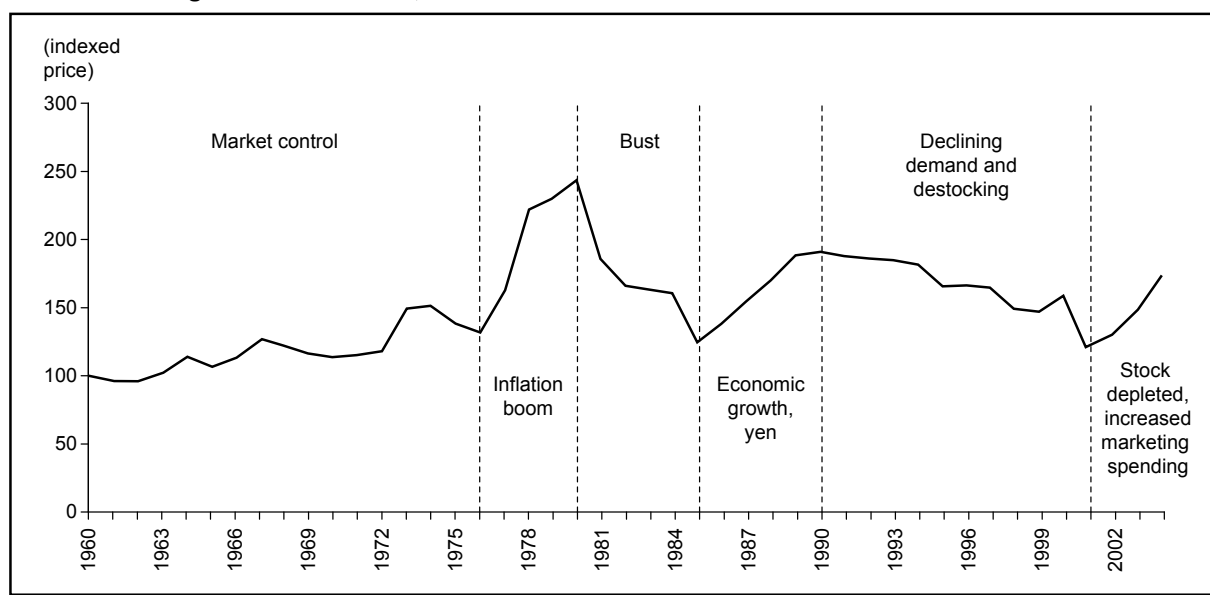
prices for synthetic industrial diamonds. Generally speaking, synthetic diamonds used in grinding and polishing vary in price from US\$30¢/ct to US\$1/ct. Strong and blocky material for use in sawing and drilling, and known in the trade as SDA and MBS (Saw Diamond Abrasive and Metal Bond Sawing), produced respectively by De Beers and General Electric, sells for up to US\$3/ct. Large single crystals with excellent structure for use in specific applications sell for several hundred dollars per carat.

OUTLOOK

Although Canada's status as an important diamond-producing country is recent, this industry already generates mining revenues estimated in 2006 at \$1.6 billion. The diamond industry is, therefore, the largest contributor to the Northwest Territories' Gross Domestic Product, providing more than 50% of the amount. This industry provides an estimated 3500 direct Canadian jobs (including workers on construction projects) and an equivalent number of indirect jobs in the service industries. This only marks the start of Canada's diamond history as the mines that are scheduled to come into production in the coming years could increase Canada's share of the world's diamond production to about 14%. These and other advanced exploration projects ensure prosperous times to come for the economy of many Canadian regions, including Aboriginal communities and major Canadian cities as hubs for the financial markets, equipment manufacturing companies, and allied industries.

The arrival of Canada on the diamond industry scene has contributed to change the way business is done, the effects

Figure 15
Historical Rough Diamond Prices, 1960-2004



Source: Rio Tinto Diamonds (2005).

of which will continue for the short to medium term. For example, De Beers' control on supplies of rough diamonds has declined from about 95% in the mid-1900s to less than 45% by value currently. As a result, a number of industry players are positioning themselves to be present at various levels of the diamond pipeline from "mines to market" either to ensure their supply of rough diamonds or to maximize their profits. At the same time, mining-based countries, such as South Africa, Botswana and Namibia, aim to encourage the development of a domestic downstream industry to maximize the benefits accruing from the mining of their resources.

While rough diamond supplies are currently believed to be in equilibrium relative to demand, market observers estimate that world production may have peaked as no new world-class-sized deposits are scheduled to come into production shortly, whereas a number of currently mined deposits have passed their peak production and others are becoming uneconomic to operate, such as in South Africa. This is expected to result in a reduction in production until 2010, after which a resumption in the volume of production should occur for a while. Given that demand for rough diamonds is forecast to increase yearly by nearly 5% over the same period, market insiders believe that rough diamond prices will increase between 2 and 5% annually for the next five years. However, because of the scarcity of larger stones of high quality (rough diamonds 2 ct and more represent about 7% of world production on a carat basis, but 45% on a value basis), some goods may experience price increases of around 10% annually.

In the polished diamond industry, there has been a movement towards branding and associating the product with purity or high quality of colour, clarity and cut, or with other known brand names, as seen with the Canadian Arctic

Diamond certificate of the GNWT; the Aurias and Canada Mark diamonds from BHP Billiton, which guarantee the source as Canada and the quality of cut to be up to triple excellent; and the joint marketing agreement between De Beers and LVMH, the European marketer associated with luxury goods. However, the success these brands gain with customers will require significant long-term marketing efforts.

After four years of operation, the implementation of the KPCS has demonstrated significant benefits in curbing illicit trade in rough diamonds. However, much more could be done to better implement the KPCS in developing countries, such as increasing their capacity to compile and publish accurate trade statistics and improving their internal controls on the industry.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of January 15, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States		EU	Japan
		MFN	GPT	USA	Canada		Conventional Rate (1)	WTO (2)
7102.10	Diamonds, whether or not worked, but not mounted or set: unsorted	Free	Free	Free	Free		Free	Free
7102.21	Diamonds, whether or not worked, but not mounted or set: industrial: unworked or simply sawn, cleaved or bruted	Free	Free	Free	Free		Free	Free
7102.29	Diamonds, whether or not worked, but not mounted or set: industrial: other	Free	Free	Free	Free		Free	Free
7102.31	Diamonds, whether or not worked, but not mounted or set: non-industrial: unworked or simply sawn, cleaved or bruted	Free	Free	Free	Free		Free	Free
7102.39	Diamonds, whether or not worked, but not mounted or set: non-industrial: other	Free	Free	Free	Free		Free	Free
7105.10	Dust and powder of natural or synthetic precious or semi-precious stones: of diamond	Free	Free	Free	Free		Free	Free

Sources: Canadian *Customs Tariff*, effective January 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2007; *Official Journal of the European Union* (October 17, 2006 Edition); *Customs Tariff Schedules of Japan*, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties.

(2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, DIAMOND PRODUCTION AND TRADE, 2004-06

TABLE A. CANADA: DIAMOND PRODUCTION AND TRADE, 1991-99						
Item No.	2004		2005		2006 (p)	
	(carats)	(\$000)	(carats)	(\$000)	(carats)	(\$000)
PRODUCTION (all forms)						
Northwest Territories	12 679 910	2 096 718	12 314 031	1 762 053	12 938 234	1 561 536
Nunavut	—	—	—	—	268 123	29 201
Total	12 679 910	2 096 718	12 314 031	1 762 053	13 206 357	1 590 737
EXPORTS						
7102.10	Diamonds, unsorted, whether or not worked, but not mounted or set					
Belgium	4 487 879	477 662	4 933 215	525 739	5 143 340	497 131
United Kingdom	5 098 790	1 089 320	3 575 915	737 550	1 711 904	424 456
United States	—	—	—	—	4	34
Australia	—	—	94	2	118	22
Hong Kong	12	1	27	8	6	4
Germany	—	—	—	—	68	2
South Africa	5	1	1	1	2	1
Total	9 586 686	1 566 984	8 509 252	1 263 300	6 855 442	921 650
7102.21	Diamonds, industrial, unworked or simply sawn, cleaved or bruted					
United States	65	7	1 098	63	733	33
Belgium	1 220	20	—	—	—	—
Bulgaria	3 684	71	—	—	—	—
United Kingdom	1 695	25	899	10	—	—
Total	6 664	123	1 997	73	733	33
7102.29	Diamonds, industrial, other					
United States	4 527	81	2 825	109	296	237
United Arab Emirates	6 842	64	—	—	—	—
Total	11 369	145	2 825	109	296	237
7102.31	Diamonds, non-industrial, unworked or simply sawn, cleaved or bruted					
Belgium	3 093 493	342 293	2 442 486	328 544	2 416 968	387 005
United Kingdom	3 016	2 468	564 112	48 843	746 528	52 770
India	—	—	686 041	13 433	1 176 767	21 481
Israel	1 957	3 090	113	37	18	6
United States	2 976	6 919	4 740	14 808	15	5
Australia	3 957	906	—	—	—	—
China	424	54	—	—	—	—
Total	3 105 823	355 730	3 697 492	405 665	4 340 296	461 267
7102.39	Diamonds, non-industrial, other					
United States	26 958	87 991	22 746	69 455	26 228	80 483
Israel	1 023	2 043	3 608	10 038	11 304	8 622
Belgium	2 686	7 509	3 336	9 705	4 271	7 621
Australia	521	1 269	205	591	175	722
United Kingdom	263	608	17	38	69	181
Hong Kong	373	113	162	147	15	132
Netherlands	18	28	31	66	7	43
Singapore	14	20	2	11	5	30
France	—	—	—	—	3	23
Germany	—	—	—	—	..	6
Japan	124	380	2	5	3	5
Guatemala	—	—	—	—	1	4
Chile	6	7	7	8	..	3
New Zealand	—	—	—	—	..	2
South Africa	9	17	2	4	1	1
Bermuda	3	4	—	—	—	—
Denmark	2	7	—	—	—	—
India	5	6	14	16	—	—
Ireland	1	7	—	—	—	—

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(carats)	(\$000)	(carats)	(\$000)	(carats)	(\$000)
EXPORTS (cont'd)						
	Thailand	140	76	—	—	—
	United Arab Emirates	135	80	—	—	—
	Belarus	—	—	198	220	—
	Italy	—	—	4	5	—
	Switzerland	—	—	6	8	—
	Total	32 281	100 165	30 340	90 317	42 082
7105.10	Natural or synthetic diamond dust and powder					
	Australia	—	—	—	—	6 983
	South Africa	—	—	—	—	6 445
	United States	8 524	12	445 473	31	12 664
	United Kingdom	—	—	—	—	1 173
	Total	8 524	12	445 473	31	27 265
	Total exports	12 751 347	2 023 159	12 687 379	1 759 495	11 266 114
						1 481 126
IMPORTS						
7102.21.00.10	Diamonds, industrial, bort and black, diamonds for borers, unworked or simply sawn, cleaved or bruted, but not mounted or set					
	South Africa	489	67	3 614	244	35 986
	Belgium	1 617	13	2 400	14	70 800
	Ghana	28 310	178	68 267	393	30 650
	United States	3 957	45	10 175	56	13 911
	Mexico	—	—	8 800	48	11 350
	Australia	719	23	785	28	1 586
	Botswana	16 750	100	19 250	101	7 700
	United Kingdom	1 738	41	416	26	3 212
	Canada	—	—	—	—	19
	Russia	405	17	31	2	35
	Guinea	—	—	1 500	7	—
	Total	53 985	484	115 238	919	175 249
7102.21.00.90	Diamonds, industrial, other, unworked or simply sawn, cleaved or bruted, but not mounted or set					
	Canada	—	—	—	—	1 919
	South Africa	48	2	13 491	333	1 998
	Australia	1 141	17	5 570	172	3 584
	Ghana	5 567	150	7 444	232	8 108
	United States	3 058	99	7 541	156	8 542
	Belgium	602	27	7 501	48	697
	Russia	685	76	—	—	289
	United Kingdom	919	38	87	10	158
	Guinea	—	—	—	—	223
	Saudi Arabia	—	—	—	—	118
	Botswana	1 000	9	2 183	12	1 000
	Mexico	189	11	239	4	300
	India	156	3	—	—	—
	Japan	5 954	22	—	—	—
	Sierra Leone	318	3	—	—	—
	South Korea	—	—	203	16	—
	Total	19 637	457	44 259	983	26 936
7102.29.00.10	Diamonds, industrial, other, bort and black diamonds, for borers, but not mounted or set					
	Ghana	145 874	390	121 381	299	52 700
	Ireland	—	—	—	—	394
	United States	148 936	300	54 436	92	140
	Sierra Leone	—	—	—	—	45
	China	—	—	—	—	19
	United Kingdom	—	—	—	—	10

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(carats)	(\$000)	(carats)	(\$000)	(carats)	(\$000)
IMPORTS (cont'd)						
France	1	...	—	—	1	...
Germany	2	...	4	1	1	...
Taiwan	—	—	—	—	...	...
Australia	181	11	—	—	—	—
Belgium	3 000	15	—	—	—	—
Hong Kong	3	1	—	—	—	—
India	8	2	14	4	—	—
South Africa	2 608	5	5 000	10	—	—
Japan	—	—	3	1	—	—
Total	300 613	724	180 838	407	53 310	279
7102.29.00.90	Diamonds, industrial, other, other than bort and black, for borers, worked but not mounted or set					
Belgium	521	163	—	—	2 018	1 017
United States	2 781	184	3 949	316	10 520	119
Ghana	4 060	98	154	53	144	49
India	231	15	..	...	76	26
Israel	3	...	7	2	45	16
Russia	—	—	—	—	74	13
South Africa	192	36	131	32	51	12
South Korea	—	—	—	—	623	4
United Kingdom	530	69	42	14	6	2
Sweden	—	—	—	—	7	2
Switzerland	1	1	33	5	2	1
Australia	493	73	310	5	—	—
China	4	2	—	—	—	—
Italy	2 178	19	2 300	34	—	—
Taiwan	12	...	—	—	—	—
Albania	—	—	4	2	—	—
Guyana	—	—	640	64	—	—
Hong Kong	—	—	1	...	—	—
Mexico	—	—	500	3	—	—
Netherlands	—	—	5	2	—	—
Total	11 006	660	8 076	532	13 566	1 261
7102.31	Diamonds, non-industrial, unworked or simply sawn, cleaved or bruted, not mounted or set					
Canada	3 770	3 745	10 022	11 858	49 839	47 139
Belgium	19 032	1 092	15 580	10 869	7 955	7 517
Russia	—	—	2 729	1 300	40 537	7 410
Angola	—	—	—	—	436	996
South Africa	3 328	1 271	363	372	7 992	781
Congo, Democratic Republic of	70	56	139	94	530	339
China	—	—	—	—	79	115
Israel	1 265	1 560	392	965	187	105
Guinea	—	—	—	—	7	14
United States	..	...	11	239	1	...
Botswana	368	251	335	442	—	—
Brazil	953	1 195	—	—	—	—
Central African Republic	109	26	39	45	—	—
Sierra Leone	6	8	98	59	—	—
Ghana	—	—	6 000	33	—	—
Namibia	—	—	3	3	—	—
Netherlands	—	—	1 115	599	—	—
Sweden	—	—	1	1	—	—
Tanzania	—	—	3	3	—	—
Total	28 901	9 204	36 830	26 882	107 563	64 416
7102.39.00.10	Diamonds, non-industrial, other, of a weight not exceeding 0.5 carats each					
India	86 600	36 182	100 558	40 013	153 098	72 774
Canada	11 118	17 418	9 315	23 683	20 737	40 418
Belgium	38 027	15 134	53 057	20 117	40 290	26 008
Israel	32 389	23 039	39 854	26 269	45 960	24 907

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(carats)	(\$000)	(carats)	(\$000)	(carats)	(\$000)
IMPORTS (cont'd)						
United States	13 494	6 949	17 205	10 870	20 656	14 580
Russia	23	29	3 474	2 900	2 899	2 261
Brazil	87	19	132	71	480	1 283
Australia	1 393	1 611	821	900	1 329	964
Namibia	—	—	372	335	531	529
Ireland	—	—	90	122	108	231
Hong Kong	428	114	622	272	214	147
Armenia	—	—	—	—	85	124
China	384	137	130	113	276	122
Thailand	904	410	678	239	213	111
Sri Lanka	—	—	3	1	142	101
Congo, Democratic Republic of	—	—	—	—	225	89
Guinea	—	—	—	—	70	65
Indonesia	—	—	—	—	76	60
South Africa	11	11	110	116	104	58
Germany	157	72	10	12	81	54
Niger	—	—	—	—	35	52
Taiwan	—	—	—	—	57	24
United Arab Emirates	75	70	79	36	102	19
Sierra Leone	—	—	108	62	11	17
Ukraine	—	—	2	10	23	13
Austria	—	—	6	4	11	11
Tunisia	—	—	—	—	19	11
Guyana	—	—	—	—	27	10
Japan	2	1	17	9	4	6
Switzerland	2	1	—	—	6	4
Italy	...	...	43	27	12	1
United Kingdom	164	152	2	1	1	...
Sweden	—	—	...	...	...	...
Saudi Arabia	13	11	..	...	..	...
Iran	—	—	6	2	—	—
Ghana	2	7	6	4	—	—
France	6	3	1	...	—	—
U.S. Minor Outlying Islands	—	—	34	5	—	—
Botswana	146	223	—	—	—	—
South Korea	20	2	—	—	—	—
Mexico	8	9	—	—	—	—
Lebanon	130	6	—	—	—	—
Peru	2	...	1	2	—	—
Netherlands	36	117	—	—	—	—
Spain	12	6	—	—	—	—
Total	185 633	101 733	226 736	126 195	287 882	185 054
7102.39.00.20 Diamonds, non-industrial, other, of a weight exceeding 0.5 carats each						
United States	51 392	54 248	59 066	56 734	47 745	83 992
Israel	70 517	72 248	64 015	67 489	72 234	74 467
Belgium	71 669	60 678	58 578	61 175	43 364	61 226
India	134 543	52 140	146 001	58 792	124 008	57 469
Australia	14 085	24 594	18 807	33 953	16 638	30 199
South Africa	2 277	4 452	5 506	6 813	5 184	15 118
Canada	1 544	3 773	2 388	6 649	4 464	8 758
Myanmar	—	—	—	—	702	1 489
Russia	447	1 776	1 728	2 683	884	1 357
Hong Kong	1 202	950	824	887	1 082	1 103
Thailand	3 454	1 054	2 589	754	2 346	736
China	301	284	484	417	713	526
Botswana	83	157	64	206	568	322
United Arab Emirates	2 592	1 293	2 163	870	1 880	300
Austria	—	—	273	395	149	282
Ukraine	2	4	—	—	360	198
Guyana	40	48	103	130	202	158
Taiwan	17	2	2	3	77	119
Germany	49	133	295	115	274	94
Ireland	—	—	20	30	23	73
Iceland	16	17	63	53	17	61
Iran	—	—	—	—	10	61

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(carats)	(\$000)	(carats)	(\$000)	(carats)	(\$000)
IMPORTS (cont'd)						
Indonesia	—	—	43	42	92	31
Japan	404	322	..	...	17	28
Brazil	25	14	92	101	2	23
Singapore	360	167	369	95	102	21
United Kingdom	32	55	10	17	32	15
Italy	—	—	57	15	86	13
American Samoa	—	—	—	—	43	12
Swaziland	—	—	—	—	5	9
Bulgaria	4	3	—	—	1	4
Saudi Arabia	273	248	42	30	4	3
Netherlands Antilles	—	—	—	—	5	3
Colombia	—	—	—	—	8	3
Peru	—	—	—	—	1	3
Switzerland	..	...	3	25	1	2
Nicaragua	—	—	—	—	1	2
Poland	2	3	—	—	—	—
Mexico	10	7	133	56	—	—
Lebanon	35	43	2	2	—	—
South Korea	2	2	—	—	—	—
Armenia	—	—	49	131	—	—
Ecuador	—	—	1	2	—	—
Guatemala	—	—	23	41	—	—
Ghana	11	17	—	—	—	—
Lesotho	—	—	25	489	—	—
Tanzania	—	—	4	1	—	—
France	—	—	2	3	—	—
Total	355 388	278 732	363 824	299 198	323 324	338 280
7105.10.00.10 Diamond dust for borers; dust mixed with a carrier in cartridges or in tubes						
United States	423 308	895	478 396	918	413 042	656
Ireland	—	—	22 344	38	25 082	20
United Kingdom	2 081	7	3 928	14	4 539	17
Brazil	—	—	—	—	3 159	12
Ghana	2 100	1	10 928	10	11 500	7
South Korea	—	—	91 343	89	1 023	4
China	1 897	6	3 590	13	937	3
Belgium	—	—	—	—	604	2
New Caledonia	—	—	—	—	3	...
India	—	—	6 878	25	—	—
Total	429 386	909	617 407	1 107	459 889	721
7105.10.00.91 Natural diamond dust and powder						
United States	90 454	227	235 851	527	255 820	657
Ireland	990 121	1 139	137 577	363	24 420	99
Ghana	14 008	56	11 717	43	21 813	68
South Korea	—	—	6 245	26	36 408	48
United Kingdom	3 910	16	7 322	30	10 530	43
China	43 510	177	7 397	30	8 321	34
Belgium	27 229	29	33 024	32	14 696	18
South Africa	—	—	2 377	10	1 904	8
India	—	—	—	—	2 071	8
Israel	748	4	—	—	1 664	7
Namibia	—	—	—	—	1 800	6
Taiwan	—	—	—	—	96	...
Germany	471	1	—	—	—	—
Iran	12 913	53	7 970	31	—	—
Sweden	210	1	—	—	—	—
Australia	—	—	660	3	—	—
Austria	—	—	61	...	—	—
France	—	—	39	...	—	—
Hong Kong	—	—	20	...	—	—
Spain	—	—	2 866	12	—	—
Total	1 183 574	1 703	453 126	1 107	379 543	996

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(carats)	(\$000)	(carats)	(\$000)	(carats)	(\$000)
IMPORTS (cont'd)						
7105.10.00.92 Synthetic diamond dust or powder						
United States	2 080 990	2 366	2 733 738	2 789	4 708 340	3 638
Ireland	1 462 922	1 997	1 337 000	1 209	2 445 673	2 087
South Korea	60 024	58	72 551	78	416 994	283
China	152 287	110	617 958	339	65 886	152
Belgium	240 818	247	128 987	141	154 838	148
United Kingdom	127 728	47	149 265	33	350 592	86
Israel	—	—	2	2	11 330	31
Ghana	—	—	21 200	12	26 319	22
Iran	—	—	2 140	7	30 000	19
France	—	—	90	12	16 964	18
South Africa	—	—	3 035	4	199	17
Russia	63 196	61	—	—	101 518	14
India	—	—	15 000	3	140	3
Botswana	—	—	—	—	3 000	3
Australia	10 002	2	155	6	52	2
Ukraine	—	—	—	—	5 001	2
Germany	4 346	6	387	6	—	—
Switzerland	10 009	14	50	39	—	—
Taiwan	11 000	6	16 976	11	—	—
Thailand	6	...	—	—	—	—
Brazil	—	—	5 044	4	—	—
Italy	—	—	237	...	—	—
Total	4 223 328	4 914	5 103 815	4 695	8 336 846	6 525
Total imports	6 791 451	399 520	7 150 149	462 025	10 164 108	600 330

Sources: Natural Resources Canada; Statistics Canada.

— Nil; . . Not available; . . . Amount too small to be expressed; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

Gold

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Gold has long been valued for its rarity, lustrous beauty, ductility, high resistance to corrosion, and conductivity. It has been treasured for its decorative and monetary value for at least 8000 years. The origin of the chemical symbol for gold, Au, is from the Latin word *aurum* meaning literally “glowing dawn.” Gold has a high density, its weight being equal to 19.3 times an equivalent volume of water. It is found as the free element in nature and is commonly associated with quartz, pyrite, and other metallic minerals. The main industrial uses for gold are in jewellery (83%) and electronics (8%). Gold bullion coins, such as the Maple Leaf coin, are also important products.

Gold prices continued to rise in 2006 and rallied to a 26-year high of US\$725/oz in mid-May. On average, gold was up 35.8% in U.S. dollar terms over 2005, reaching an annual average of US\$603.77/oz on the London Bullion Market Association. While the price rise in U.S. dollar terms was strong, the net effect of the stronger Canadian dollar against the U.S. dollar resulted in gold prices in Canadian dollar terms not rising quite as sharply. Gold started the year in the \$612/oz range and peaked at \$801.71/oz in mid-May, followed by a sharp correction to the \$635/oz range in June. Prices rallied to end the year at \$733.78/oz. Overall, gold averaged \$684.58/oz in Canadian dollar terms, up just over 21% from an average \$538.51/oz in 2005.

CANADIAN DEVELOPMENTS

2006 mine production: \$2.25 billion
World rank: Eighth (mine production)
Exports: \$5.46 billion

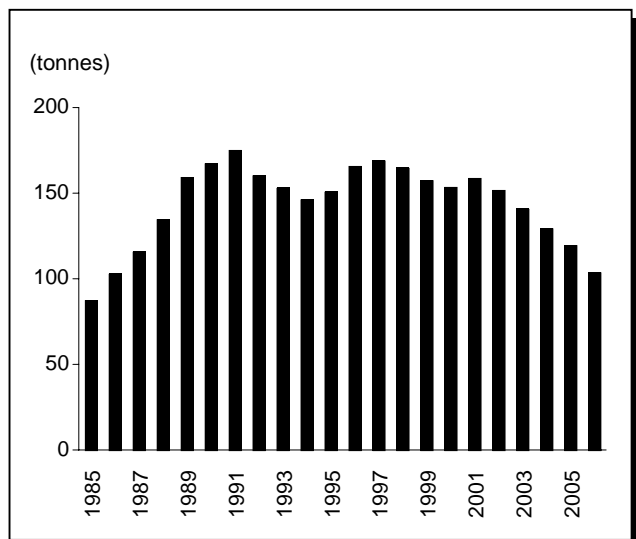
In 2006, Canadian gold production continued to decline to a total of 103.4 t, a decrease of just over 13% compared to the 2005 total of 119.5 t. The reduction in production resulted primarily from a number of mine closures in Ontario (the Holloway and Golden Giant mines) and

Saskatchewan (the Konuto Lake mine), combined with lower outputs as a result of lower-grade ore. Several small-scale operations and mine re-openings are expected to help offset some of these closures in 2007.

About 90% of Canada’s gold production comes from hard-rock underground and open-pit gold mines. The remainder is from base-metal mines and placer mining operations. Ontario accounted for 55% of Canada’s total gold production in 2006, followed by Quebec (23%) and British Columbia (15%). The other provinces and territories combined contributed the remaining 7%. The value of gold exports increased in 2006 with the preliminary value (including gold contained in scrap and base-metal concentrates) at about \$5.46 billion, up from \$4.2 billion in 2005. The preliminary value of imports was \$2.6 billion, up from \$2.2 billion in 2005.

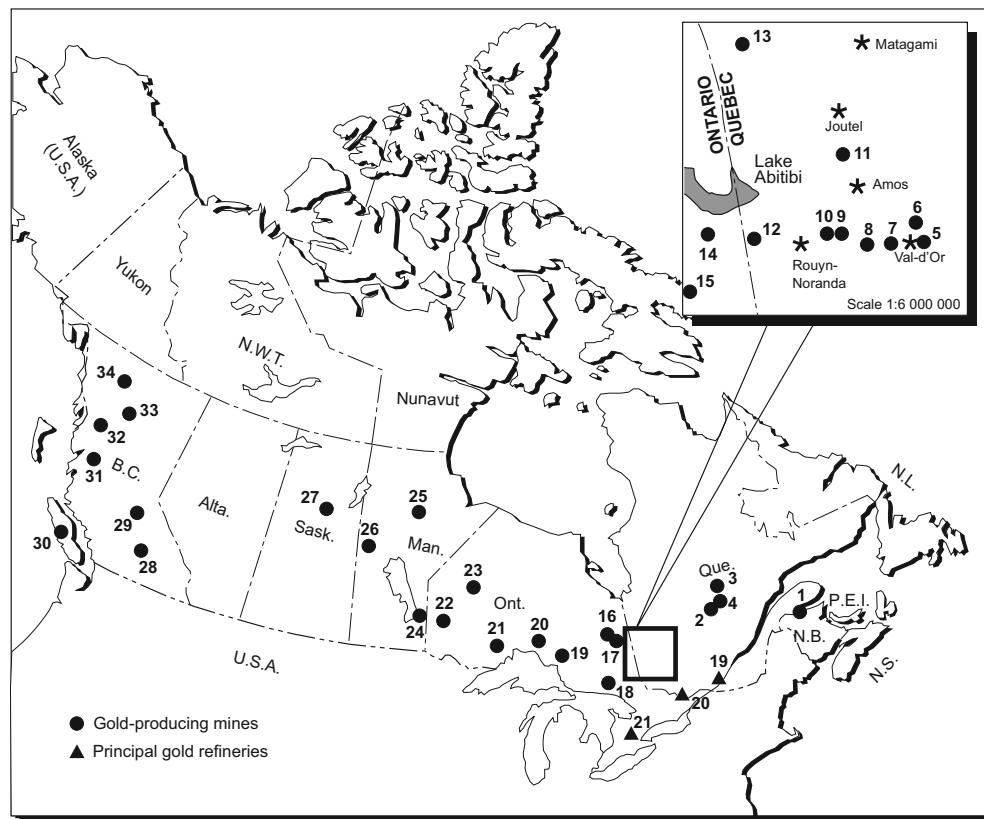
As companies around the world positioned themselves in 2006 to increase their reserve base and overall market share, a number of Canadian companies were involved in

Figure 1
Mine Production of Gold in Canada,
1985-2006



Source: Natural Resources Canada.

Figure 2
Gold-Producing Mines and Principal Gold Refineries in Canada, 2006



Numbers refer to locations on map above.

GOLD-PRODUCING MINES

1. Brunswick
2. Joe Mann
3. Troilus
4. Copper Rand
5. Beaufor
- Sigma
6. Lac Herbin
7. Kiena
8. East Amphi
9. LaRonde
10. Doyon
- Mouska
11. Sleeping Giant
12. Russian Kid
13. Casa Berardi
14. Holloway
15. Macassa
16. Porcupine Joint Venture
- Golden Giant
- Kidd Creek
17. Clavos
18. Sudbury Division
- Ontario Division

Xstrata Plc
 Meston Resources Inc.
 Inmet Mining Corporation
 Campbell Resources Inc.
 Richmont Mines Inc. (50%) and
 Louvem Mines Inc. (50%)
 Century Mining Corporation
 Alexis Minerals Corporation
 Wesdome Gold Mines Ltd.
 Richmont Mines Inc.
 Agnico-Eagle Mines Limited
 IAMGOLD Corporation
 IAMGOLD Corporation
 IAMGOLD Corporation
 Rocmec Mining Inc.
 Aurizon Mines Ltd.
 Newmont Canada Ltd. (84.65%) and
 Teddy Bear Valley Mines,
 Limited (15.35%)
 Kirkland Lake Gold Inc.
 Goldcorp inc. (51%) and
 Kinross Gold Corporation (49%)
 Newmont Canada Limited
 Xstrata plc
 St Andrew Goldfields Ltd.
 Xstrata Plc
 Vale Inco (CVRD Inco Limited)

WEB SITE

www.xstrata.com
www.ressourcescampbell.com
www.inmet-mining.com
www.ressourcescampbell.com
www.richmont-mines.com
www.centurymining.com
www.alexisminerals.com
www.wesdome.com
www.richmont-mines.com
www.agnico-eagle.com
www.iamgold.com
www.iamgold.com
www.iamgold.com
www.iamgold.com
www.rocmeccmines.com
www.aurizon.com
www.newmont.com
www.klgold.com
www.goldcorp.com
www.kinross.com
www.newmont.com
www.xstrata.com
www.standrewgoldfields.com
www.xstrata.com
www.inco.com

GOLD-PRODUCING MINES (CONT'D)

19. Eagle River	River Gold Mines Ltd.	www.rivergoldmine.com
20. Hemlo	Barrick Gold Inc. (50%) and Teck Cominco Limited (50%)	www.barrick.com www.teckcominco.com
21. Lac des Iles	North American Palladium Ltd.	www.napalladium.com
22. Campbell Red Lake	Placer Dome (CLA) Limited	www.placerdome.com
23. Musselwhite	Goldcorp Inc.	www.goldcorp.com
24. Rice Lake	Goldcorp Inc.	www.goldcorp.com
25. Manitoba Division	San Gold Corporation	www.sangoldcorp.com
26. Flin Flon	Vale Inco Limited	www.inco.com
	Hudson Bay Mining and Smelting Co. Ltd.	www.hudbayminerals.com
27. Seabee	Claude Resources Inc.	www.clauderessources.com
28. Highland Valley	Teck Cominco Limited	www.teckcominco.com
29. Mount Polley	Imperial Metals Corporation	www.imperialmetals.com
30. Myra Falls	Breakwater Resources Ltd.	www.breakwater.ca
31. Huckleberry	Huckleberry Mines Ltd. (50%) and Japan Group (50%)	www.imperialmetals.com
32. Kemess South	Northgate Minerals Corporation	www.northgateminerals.ca
33. Eskay Creek	Barrick Gold Inc.	www.barrick.com
34. Table Mountain	Cusac Gold Mines Ltd.	www.cusac.com

PRINCIPAL GOLD REFINERIES

19. Canadian Copper Refinery (CCR)	Xstrata Plc	www.xstrata.com
20. Royal Canadian Mint		www.mint.ca
21. Johnson Matthey Limited		www.matthey.com

large-scale mergers and acquisitions that saw the emergence of several new Canadian-based, large-scale global gold producers. Toronto-based **Barrick Gold Corporation** acquired all of the outstanding shares of Vancouver-based Placer Dome Inc. in 2006. Included in the deal to acquire Placer Dome, Toronto-based **Goldcorp Inc.** agreed to acquire Placer's Campbell, Porcupine, and Musselwhite gold mines in Ontario and the La Coipa silver mine in Chile, as well as Placer's Canadian exploration and reclamation properties. Barrick also completed a friendly all-cash takeover of Pioneer Metals Corporation.

In addition to picking up some of Placer's assets, Goldcorp also pursued separate deals that led to the acquisition of Virginia Gold Mines Inc. and its Éléonore gold project in northern Quebec and of Nevada-based Glamis Gold Ltd., along with its low-cost mines and development projects in Nevada, Mexico, and Central America.

In February, **Wesdome Gold Mines Inc.** merged with River Gold Mine Ltd. to create Wesdome Gold Mines Ltd. In September, Toronto-based **IAMGOLD Corporation** and Montréal-based **Cambior Inc.** agreed to a US\$3 billion deal to create a new merged company under the name IAMGOLD Corporation with operations in Canada, South America, and West Africa. In December, Toronto-based **Kinross Gold Corporation** signed an agreement to acquire Vancouver-based **Bema Gold Corporation**. The acquisition of Bema will expand Kinross's operations in Canada, the United States, and South America to include operations in Russia and South Africa.

Yukon

An estimated \$50 million was spent on **Sherwood Copper Corporation's** Minto copper-gold-silver mine in 2006, which is scheduled to start commercial production in the third quarter of 2007. The deposit has measured and indicated reserves of 9.06 Mt grading 1.78% copper, 0.62 g/t gold, and 7.3 g/t silver at a 0.5% copper cut-off grade and, at a 1.5% copper cut-off, the deposit contains a high-grade core of 4.03 Mt grading 2.82% copper, 1.02 g/t gold, and 11.6 g/t silver. Total development costs at Minto, including a 50% mill expansion in year one, are estimated to be \$107 million. The Minto mine is an open-pit operation with conventional crushing, grinding, and flotation to produce copper concentrates with significant gold and silver credits. Concentrates are exported via the Port of Skagway, Alaska, to smelters in Asia for treatment and sale.

Placer gold mining continues to play a significant role in the Yukon economy more than 100 years after the first discovery of gold in the region. Some 350 people were directly employed at 115 placer mines in 2006. Most of the placer operations were small and family-run with an average of three or four employees. The majority of active placer mining operations were in the Dawson mining district, followed by the Whitehorse and Mayo mining districts.

British Columbia

Cusac Gold Mines Ltd. restarted gold production at the Table Mountain gold mine in northern British Columbia in

December. The Table Mountain mine produced some 11 t of gold before it was closed in 1997 due to weak gold prices.

Cross Lake Minerals Ltd. received an operating permit from the B.C. government in December 2006 and planned to restart and develop the QR mine 58 km southeast of Quesnel, British Columbia.

Manitoba

In August, **San Gold Corporation** poured its first gold bars at the rejuvenated Rice Lake mine in Bissett in southeastern Manitoba. The mine and 1100-t/d mill, purchased from Harmony Gold (Canada) Inc. in 2004, started commercial production in April. The Rice Lake mine contains measured and indicated reserves totaling 874 535 t of 9.9 g/t gold. The company also brought the San Gold #1 deposit into production this year. Located just east of Bissett and accessed by a new decline, San Gold #1 contains 256 890 t of 7.5 g/t gold and will supply additional feed to the Rice Lake mill. There are two other gold zones along strike of the San Gold #1 deposit that could supply future mill feed. In the spring, San Gold discovered the Cartwright zone located 1 km west of the mill property; it is returning grades and thicknesses similar to the Rice Lake mine.

Newfoundland and Labrador

Richmont Mines Inc. sold its interests in the Nugget Pond property and gold mill located on the Baie Verte Peninsula in Newfoundland to **New Island Resources Inc.** New Island subsequently sold the gold mill to Crew Gold Corporation, but retained the mineral claim blocks adjacent to and near the Nugget Pond mill.

Anaconda Mining Inc. continued to explore gold zones on its Pine Cove property and nearby Dorset property on the Baie Verte Peninsula. The Pine Cove gold deposit is scheduled to start production sometime before the end of 2007 and Anaconda Gold was proceeding with purchasing the plant for the mine. Pine Cove hosts probable reserves of 2.3 Mt grading 2.76 g/t gold. Inferred resources total 66 700 t grading 2.43 g/t gold.

Nunavut

Exploration work continued at **Cumberland Resources Ltd.**'s Meadowbank project on which the company had completed a feasibility study in 2005. The project is located 70 km north of Baker Lake in the Kivalliq region of the territory. Open-pit production is forecast at 330 000 oz/y with total cash costs estimated at US\$201/oz over an 8.1-year mine life.

In early 2007, Cumberland Resources Ltd. and **Agnico-Eagle Mines Limited** entered into a definitive agreement in which Agnico-Eagle would make an all-share exchange offer for all outstanding and fully diluted common shares of Cumberland.

Miramar Mining Corporation continued exploration at its Hope Bay project in western Nunavut, which comprises several gold deposits, including the Doris, Boston, and Madrid deposits within the Hope Bay volcanic belt. Miramar is following a phased approach towards developing potential gold mines from the Hope Bay belt. The first phase includes a short-term objective to develop a small-scale, high-grade gold mine at Doris North. Doris North is projected to produce 155 000 oz/y of gold for two years. The second phase include a medium-term objective to extend and expand production levels by developing the higher-grade, more accessible areas of the Boston, Doris, and Madrid deposits with a target production level of approximately 200 000 oz/y of gold followed by a longer-term objective to access the Madrid deposit and the remainder of the Boston and Doris deposits to generate sustained production in the range of 350 000-400 000 oz/y of gold.

Comaplex Minerals Corp. continued exploration at the Meliadine project located 25 km northwest of Rankin Inlet. The company issued a resource report indicating measured and indicated resources for the Tiriganiaq deposit above the 9900-m elevation of 3.5 Mt at a grade of 8.4 g/t gold (cut-off grade of 3.5 g/t). Measured and indicated resources below the 9900-m elevation were almost 0.9 Mt at a grade of 11.7 g/t (with a cut-off grade of 7.5 g/t). Additional inferred resources are present.

Ontario

Richmont Mines Inc. continued work on an advanced exploration project at the Island Gold property in northeastern Ontario. Richmont started milling operations at Island Gold in September and the first gold pour was announced in November. A decision on whether to proceed to commercial production was expected in 2007 once the current technical and metallurgical program is completed.

In May 2006, **Goldcorp** acquired the former Placer Dome Inc.'s Canadian operations, which saw the combination of two major Canadian gold mining operations near Red Lake in northwestern Ontario. The new Red Lake gold mines now consist of the Red Lake Complex and the Campbell Complex. Goldcorp is spending \$196 million on a new 1924-m-deep shaft that is currently under construction. The new shaft, scheduled for completion in 2007, will increase hoisting capacity, reduce time to access the workplaces, and provide significant cost savings.

Kirkland Lake Gold Inc. owns the operating Macassa mine and mill and four contiguous former gold-producing properties located in Kirkland Lake, Ontario. Past production at Macassa since 1933 has been over 8.2 Mt of ore averaging 0.47 oz/t. Exploration under way has located a new ore system that is different from the historical mining and is contained within sulphide rather than in quartz. Ore reserves, which are generally higher grade, were expanded in late 2006 to over 269 000 t of probable reserves grading 1.02 oz/t and inferred resources of 563 000 t grading 1.29 oz/t.

Lake Shore Gold Corp. has been exploring its Timmins West property and has reported new indicated resources of 3.2 Mt of 8.2 g/t based on cut assay results. Mineral resource estimates total 1.3 million oz in the indicated category and 200 000 oz in the inferred category. In early 2007, the company filed an application under the Ontario *Mining Act* for an advanced exploration permit for continued underground work at its Timmins West gold project in Timmins, Ontario. A pre-feasibility study of Timmins West was expected to be completed in mid-2007.

Northgate Minerals Corporation completed the acquisition of Young-Davidson Mines, Limited, a former producer in the Kirkland Lake-Larder Lake Gold Belt near Matachewan in northeastern Ontario. An extensive underground exploration program to expand the reserves was planned for 2007.

Quebec

Richmont Mines Inc. brought the East Amphi mine project in northwestern Quebec into production in February. The company reported that 179 194 t of ore were processed at an average recovered grade of 3.47 g/t yielding 622 kg of gold. Over 2000 m of exploration drilling were completed in 2006 in several zones, which yielded results that were below expectations. As a result, the company has decided not to complete additional development and announced its intention to cease operations at the East Amphi mine in the second quarter of 2007.

Agnico-Eagle Mines Limited is completing construction of its Lapa gold mine project in northwestern Quebec. The first phase of construction at the mine, located 11 km east of the LaRonde mine, began in July 2004. In April 2006, 2800 t of development ore were extracted at Lapa and sorted through a sampling tower to form a representative sample. Together with the results of a diamond drilling program, the ore was estimated to contain, on average, 10.65 g/t gold. The Lapa mine is expected to start production in the fourth quarter of 2008.

Shaft sinking at Agnico-Eagle's Goldex project west of Val-d'Or, Quebec, began in late 2006 and is scheduled to reach a final depth of close to 900 m by late 2007. Underground development and construction have also started with access provided by existing underground workings. The capital cost of the project is estimated to be \$135 million. Gold production is expected in 2008, averaging 5.3 t/y. The Goldex mine is expected to have a 10-year mine life with mineralization still open to the east and at depth.

Agnico-Eagle approved the LaRonde Extension for construction in May 2006. The extension will access deeper ore at the current LaRonde operation. The orebody is a continuation of gold-copper and zinc-silver mineralization situated on the LaRonde property, but is not accessible by the current Penna shaft. The extension contains probable

reserves of 19.9 Mt of 5.99 g/t gold, 21.73 g/t silver, 0.31% copper, and 0.79% zinc.

Rocmec Mining Inc. poured its first doré bar in December from development ore at its Rocmec 1 (Russian Kid) project in northwestern Quebec. Rocmec completed three drifts on three separate levels of the mine and plans on milling 10 000 t of development ore before the end of the second quarter of 2007.

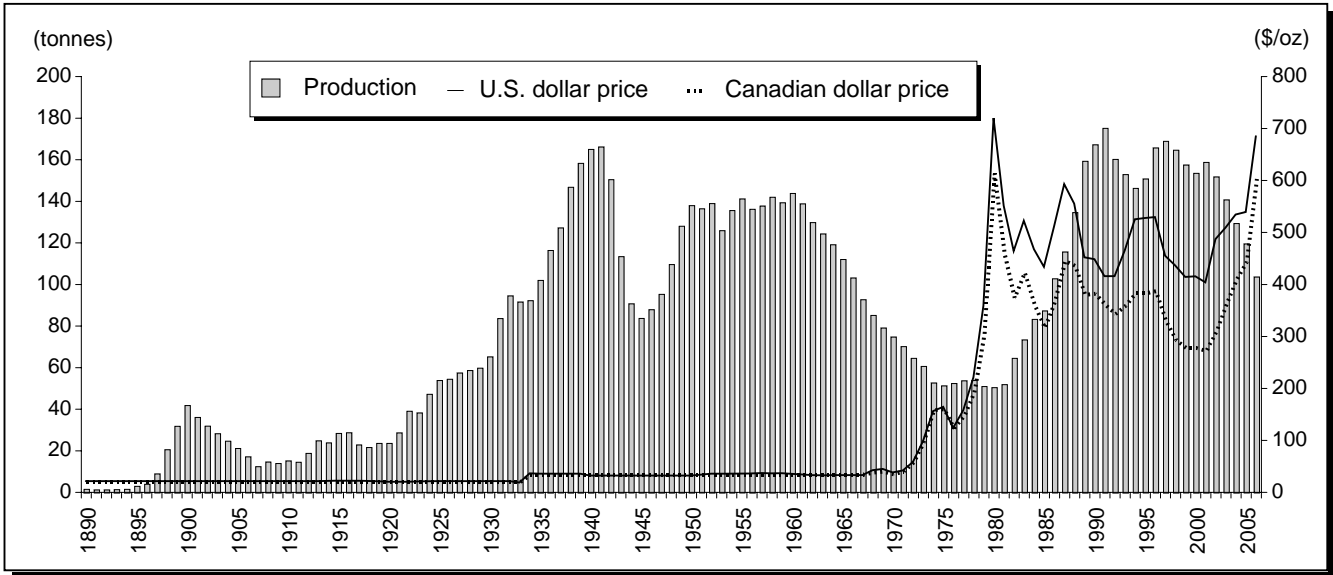
Wesdome Gold Mines Ltd. started milling operations at its wholly owned Kiena mine in Val-d'Or, Quebec, in July. The Kiena mill started treating stockpiled development ore totaling 12 000 t at 4.0 g/t gold. The milling rate was expected to ramp up to the targeted 1250 t/d on a five-day-per-week basis over the third quarter of the year as stope development was completed. The Kiena Complex is a fully integrated mining-milling complex with a capacity to more than double targeted milling rates. The year 2007 will be the first full year of production, forecast at approximately 1.6 t.

Aurizon Mines Ltd. produced some 551 kg of gold in 2006 at its 100%-owned Casa Berardi mine in northwestern Quebec since start-up of production in early November 2006. Mine operations at Casa Berardi are expected to achieve commercial production in the first quarter of 2007, with production gradually increasing from an initial rate of 1600 t/d to 2200 t/d by the end of the year.

IAMGOLD's Doyon Division comprises the adjacent Doyon and Mouska underground mines located near Cadillac, Quebec. The Doyon property produced its five millionth ounce (155.5 t) of gold in January 2006. The Mouska property lies immediately west of the Doyon property. Access to the mine is by a 485-m-deep shaft and a 560-m internal shaft located 1.2 km east of the main shaft. Production from the entire Doyon Division in 2006 totaled some 4.7 t of gold. Production for 2007 is forecast to be 140 000 oz at a cash cost of approximately \$460/oz. IAMGOLD continues with exploration in the area between the two properties known as the Westwood deposit. The exploration program was accelerated in November 2006 with the addition of a third and fourth drill following promising results reported by the company. Three gold-bearing horizons have been identified to date and the two additional drills are testing the continuity of the new zones and determining the mineral potential at depth.

Osisko Exploration Ltd. is acquiring and delineating mineralization on a number of former mines in the Malartic area of northwestern Quebec, focusing on its Canadian Malartic project. This area has seen significant gold production in the past, often from very high-grade deposits. However, Osisko is focused on production from large volumes of mineralization with a low grade. A resource estimate using a cut-off grade of 1 g/t gold showed inferred resources at about 85 Mt containing about 6.5 million oz of gold.

Figure 3
Historical Mine Production of Gold in Canada, 1890-2006



Source: Natural Resources Canada.

Saskatchewan

At **Claude Resources Inc.**'s Seabee gold mine, mill expansion was under way and bulk sampling continued at the nearby Santoy Lake and Porky Lake projects. Ore from these projects was expected to contribute to production by year-end.

WORLD DEVELOPMENTS

World	2001	2002	2003	2004	2005
	(tonnes)				
Mine production	2 544	2 538	2 538	2 411	2 442
Gold fabrication	3 475	3 134	2 990	3 163	3 280

Gold is produced from mines on every continent with the exception of Antarctica (where mining is not permitted) in operations ranging from small enterprises employing just a few individuals to very large-scale industrial complexes with hundreds of employees.

A wave of investment demand helped push the annual gold price to a level in U.S. dollar terms not seen since 1987. Fabricated demand for gold jewellery increased by about 3.8% in 2005. The third quarter of 2006 saw the value of gold jewellery demand reach another quarterly record at US\$11.8 billion although, in volume terms, demand

declined by 4% year-on-year in response to high price volatility early in the quarter. Industrial demand was the fastest-growing source of demand in 2006. The global hedge book declined by a further 62 t in the third quarter of 2006. While only accounting for 8% of the total fabricated demand for gold, the electronics industry is the second largest market for gold after jewellery. Gold's high electrical conductivity, its malleability, and its resistance to corrosion have made it an important component in the manufacture of a wide range of electronic products and equipment, including computers, telephones, cellular telephones, and home appliances. Some 357 t will be used in 2006, with Japan expected to lead the way in the market, accounting for 135 t, or 61%, of the demand.

On the investment side, the rise in oil prices and the risk of inflation have provided added incentives for investors to put their money into gold. The introduction of gold exchange traded funds (ETFs) in recent years has made it easier for investors to invest in gold. By the end of 2006, the relatively new form of gold investment was worth US\$12.8 billion worldwide.

For most of the past 100 years, South Africa has been the dominant gold producer worldwide. This position is now being challenged as production in South Africa declines and new players in the marketplace expand their production. According to information from the World Gold Council, South Africa remained the world's largest producing nation in 2006 with just under 292 t, or just under 12% of the world total. Other major producers include the United States at 260 t (10%) and Australia at 244 t (10%).

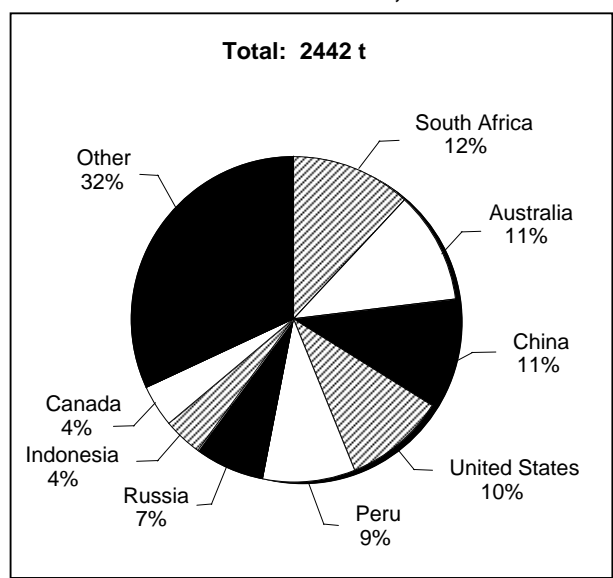
The past decade has also witnessed the emergence of two important new gold mining countries: Indonesia and Peru. Gold production in Indonesia has risen from some 2 t in 1992 to almost 114 t in 2006, primarily from the Grasberg mine (the world's largest gold-producing mine) and from a joint-venture copper-gold deposit held by Rio Tinto plc and Freeport-McMoRan Copper & Gold Inc. In Peru, production has risen from 18 t in 1992 to 203 t in 2006, of which almost half came from the Yanacocha mine, the second largest gold mine in the world. Canada was the eighth largest producer in the world in 2006 (Figure 4).

In terms of global gold-producing companies, four of the top fifteen gold producers are based in Canada. **Barrick Gold Corporation** is the world leader, at 269 t, followed by Newmont Mining Corporation of the United States (185 t) and AngloGold Ashanti Limited of South Africa (175 t). **Goldcorp** has risen to eighth place with 52 t. **Kinross Gold Corporation** dropped to eleventh place with 43 t in 2006 while **IAMGOLD** rose to fifteenth place with 20 t following the merger with Cambior (Figure 5).

United States

According to information provided by the U.S. Geological Survey, U.S. domestic gold production in 2006 increased an estimated 2% over 2005 production. The increase in gold production came from newly opened mines in Alaska and Nevada and was partially offset by the closure of the Kettle Creek mine and reduced output from other mines in the country. Mine output continues to be located primarily in Nevada, where production accounts for about 82% of the U.S. total.

Figure 4
World Mine Production of Gold, 2006



Sources: Natural Resources Canada; GFMS Limited.

Northern Dynasty Minerals Ltd. is working on its Pebble project in the Bristol Bay region of the Alaska Peninsula. A new resource estimate was made in 2006. At a 0.60% copper equivalent cut-off, the estimated inferred mineral resources in the Pebble East deposit are 3.4 billion t grading 1% copper equivalent, containing 42.6 billion lb of copper, 39.6 million oz of gold, and 2.7 billion lb of molybdenum. The Pebble West deposit has additional resources of lower-grade material.

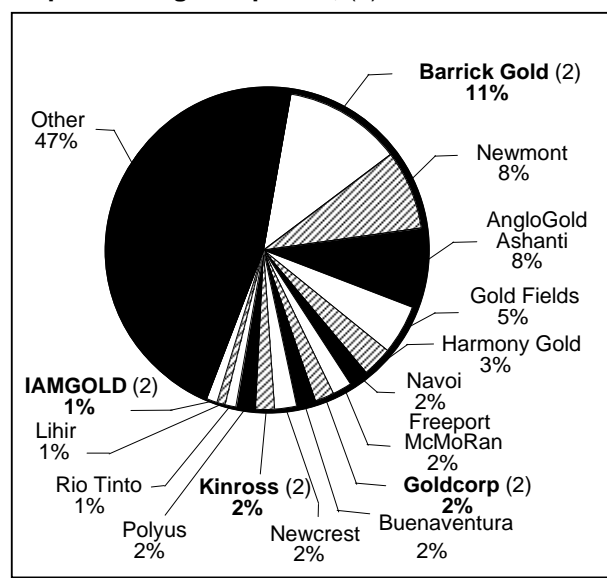
Teck Pogo, Inc. completed construction of the US\$350 million Pogo mine in Alaska in 2006 and operations commenced in January with the first gold bar poured on February 12, 2006. Commercial production was expected to be reached in the second quarter of 2007. Annual gold production of 350 000-450 000 oz is expected over the 10-year life of the mine.

Central and South America

Taken together, Peru, Brazil, Chile, and Argentina now account for some 13% of the total world production of gold. Peru is the largest producer and has seen some of the highest growth rates in the region. Most of the increase in Peruvian gold production is the result of developments at the Yanacocha mine, now ranked as the second largest mine in the world after the Grasberg mine in Indonesia.

Toronto-based **Yamana Gold Inc.** expected to boost its gold output from its Brazilian mines fourfold in 2006 to 12.4 t, up from 3.1 t in 2005. The increase is due mainly to Yamana's purchase in April of **Desert Sun Mining Corp.**, which operated the Jacobina gold mine in Brazil's Bahia

Figure 5
Top 15 Mining Companies, (1) 2006



Sources: Natural Resources Canada; GFMS Limited.
(1) Excludes Chinese companies. (2) Canadian company.

Gold Belt. In addition, Yamana started two new mines in 2006: the Sao Francisco mine in Mato Grosso State and the Chapada mine in Goias State, Brazil.

Gold Fields Limited acquired Toronto-based **Bolivar Gold Corp.** in February. Gold Fields will increase its output by 47 t by 2009 with the acquisition of Bolivar, which operated the Choco 10 open-pit gold mine in Venezuela.

Barrick sold its 51% interest in the Cerro Casale gold project in Chile that it had acquired as a result of the takeover of Placer Dome. Barrick also sold its stake in the property to Bema Gold (now owned by Kinross) and Arizona Star Resource, which own the rest of the property.

Barrick's Pascua Lama gold project received approval by Chilean environmental authorities in February 2006 and from the Argentinian authorities in December 2006. Construction at the Pascua Lama open-pit gold project, which straddles the border between Chile and Argentina, is expected to begin soon with production scheduled for 2010. Pascua Lama has reserves of 569 t of gold.

Crystallex International Corporation operates mines in Venezuela's Bolivar State near the historic gold mining centre of El Callao. The Venezuelan Ministry of Basic Industry and Mining formally approved the technical, economic, and financial feasibility study for the Las Cristinas gold project. Crystallex expected to commence gold production at Las Cristinas in the second half of 2009 at 20 000 t/d. In the first five years of full operation, Las Cristinas' average production was expected to be approximately 256 000 oz/y.

Africa

Gold production declined in South Africa for the fourth consecutive year in 2006. Some 25% of the drop in production can be attributed to the accident at the South Deep mine in May. Hoisting capacity was severely affected when a skip fell down the Twin Shaft during routine maintenance. The mine is expected to return to full production in the second quarter of 2007. Lower-than-expected production at a number of other mines combined for the drop in overall gold production for 2006.

Gold Fields Limited acquired Barrick Gold's stake in the South Deep gold mine and Barrick's rights under the joint venture with Western Areas. Barrick Gold held a 50% stake in the South Deep mine as a result of its merger with Placer Dome earlier in the year. The South Deep mine has an indicated total resource of over 1835 t of gold.

New mine production in the second half of 2006 raised Ghana's total gold production to a four-year high. The Ahafo project represents Newmont Mining Corporation's first Ghanaian project. The Ahafo mine poured its first gold in July and started commercial production in August 2006.

Increases in gold production in Mali in 2006 can be attributed to the recently commissioned Loulo mine (Randgold Resources Limited, 80%, and Republic of Mali, 20%) and Tabakoto mine (Vancouver-based Nevsun Resources Ltd.). Higher production at the Yatela mine also contributed to the higher output. IAMGOLD Corporation of Toronto has a 40% indirect interest in Yatela, as does AngloGold Ashanti Limited, the operator. The Republic of Mali owns 20%.

Asia

Gold Fields increased its stake in Australia's Sino Gold Mining Limited to 14% from 8%. In June 2005, Sino Gold received approval from the Chinese government to build a mine at the Jinfeng deposit in southwestern Guizhou Province, one of China's largest undeveloped gold mines.

Centerra Gold Inc. lowered 2006 production forecasts for its Kumtor mine in Kyrgyzstan and is assessing forecasts for 2007 after a pit wall ground movement at the mine in July. Output at the Kumtor mine was expected to be 9.3 t in 2006, down from previous projections of about 13 t of gold.

Xstrata Copper Canada acquired 62.5% of the Tampakan copper-gold deposit in the Philippines from Indophil Resources NL after a pre-feasibility study confirmed a 2 billion t resource containing 11.6 Mt of copper and 14.6 million oz of gold at a 0.3% copper cut-off grade.

Ivanhoe Mines Ltd. continued working on its Oyu Tolgoi copper and gold project and other mineral exploration properties in southern Mongolia. Rio Tinto agreed to invest up to US\$1.5 billion for a 40% interest in the company. Ivanhoe has had an independent study completed that indicates that the Oyu Tolgoi mine will be capable of average annual production in excess of 1 billion lb of copper and 330 000 oz of gold for at least 35 years.

Pt Nusa Halmahera Minerals, a joint-venture company owned 82.5% by Newcrest Mining Limited and PT Aneka Tambang, completed construction and moved the focus of operations to the Kencana underground mine in Indonesia as the remaining ore in the Toguraci open pit was mined. Production by the joint venture at the Gosowong mine was reported at 180 000 oz.

Europe

Toronto-based **Agnico-Eagle** started construction of the Kittila gold mine in northern Finland. The Kittila project is expected to produce an average of 5 t/y of gold. Production is expected to begin by mid-2008.

Russia

Highland Gold Mining Ltd. missed its full-year gold production target due to a fire at its Darasun mine in Russia in

September. Highland Gold said its full-year production would reach around 5.6 t for 2006, 124 kg under its original expectation. **Barrick Gold** now has a 34% interest in Highland Gold and a 50% interest in the Belaya Gora, Sovinoe, and Malo Fedorovskoye exploration projects with Highland.

Peter Hambro Mining PLC announced that it planned to increase production from the Pokrovskiy, Pioneer, and Malomir deposits to increase gold production to 1 million oz in 2009. The company planned to expand the pits at the Pokrovskiy deposit. At Pioneer, which is expected to contain 4 million oz of gold, heap leach operations were expected to start in 2007. At Malomir, the company was planning to install a 5-Mt/y concentrator by 2009 that would be expanded to 7 Mt/y by 2011.

The Republic of Uzbekistan and the Zarafshan-Newmont Joint Venture (Newmont, 50%, and Government of Uzbekistan agencies, 50%) had a dispute over taxes resulting in the seizure of assets and the expropriation of Newmont's 50% interest in the joint venture.

Australia

Lihir Gold Limited and Ballarat Goldfields NL completed their merger in March 2007, creating a major Asia-Pacific gold producer. The combined company plans to be producing in excess of 1.25 million oz/y from 2010 from mines in Australia (Lihir's Minifie and Lienetz pits in Papua New Guinea) and in the Ballarat Goldfield in Victoria, Australia.

Newcrest Mining Limited, Australia's largest producer, completed the first full year of production from the Telfer open pit in Western Australia, which produced 639 607 oz of gold in 2006, and started underground production at the mine, which was expected to reach a production level of 4 Mt/y of ore by year-end. Its 70% joint venture with Sediimentary Holdings' Cracow mine in Central Queensland also completed its first full year of operation.

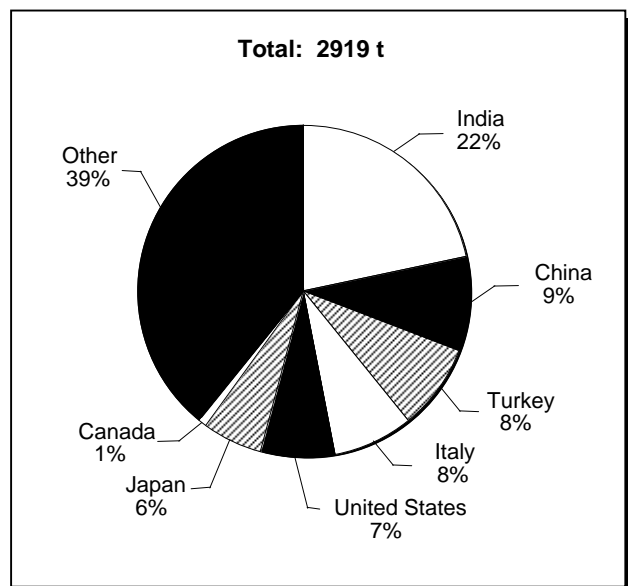
GOLD FABRICATION DEMAND

Overall, a 16% decline in jewellery demand, due to the increased price for gold, was not countered by increases in use in electronics, medals and coins, resulting in an overall 11% decrease in total fabrication demand from 2005 to 2006.

PRICES AND STOCKS

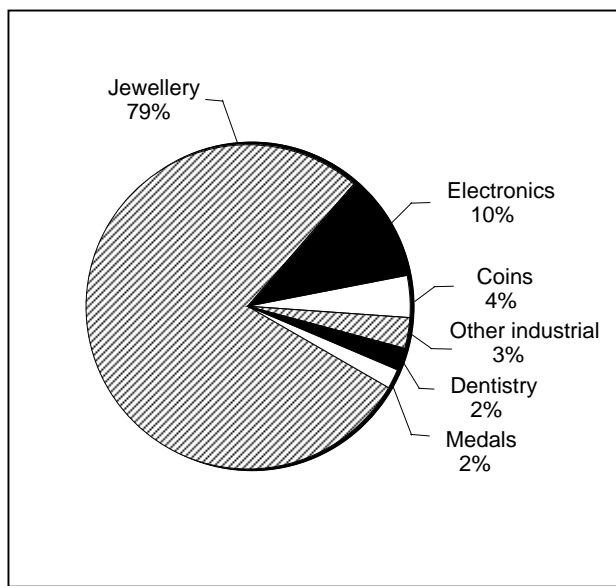
Gold prices continued to rise in 2006 and rallied to a 26-year high of US\$725/oz in mid-May. On average, gold was up 35.8% in U.S. dollar terms over 2005, reaching an annual average of US\$603.77/oz on the London Bullion Market Association. While the price rise in U.S. dollar terms was strong, the net effect of the stronger Canadian dollar against the U.S. dollar resulted in gold prices in Canadian dollar terms not rising quite as sharply. Gold started the year in the \$612/oz range and peaked at \$801.71/oz in mid-May, followed by a sharp correction to

Figure 6
World Gold Fabrication, 2006



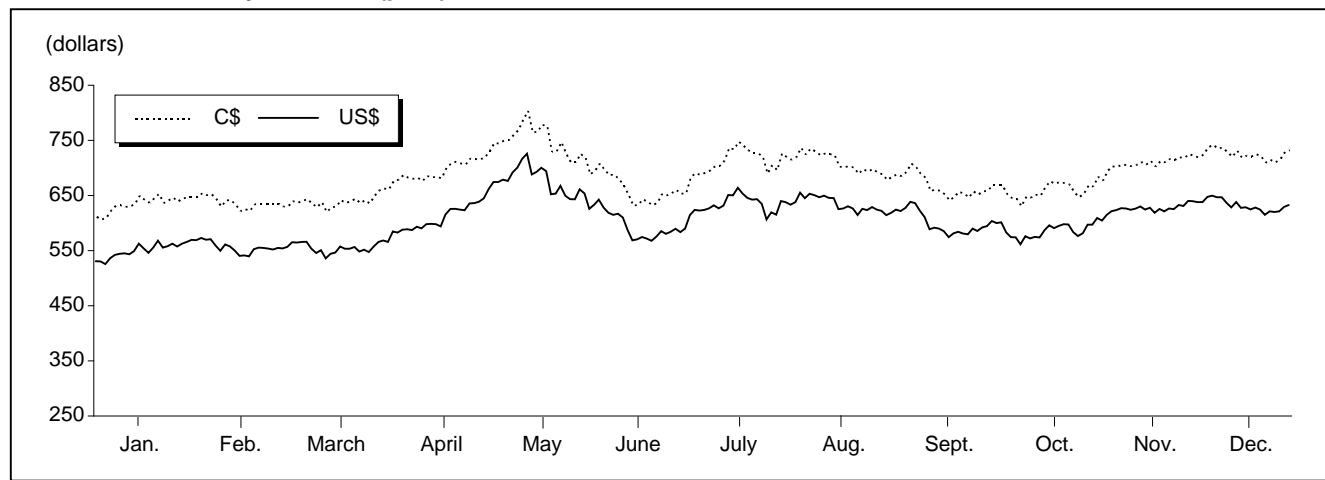
Source: GFMS Limited.

Figure 7
World Gold Markets, 2006



Source: GFMS Limited.

Figure 8
Price, London Daily Gold Fix (p.m.), 2006



Sources: Natural Resources Canada; London Bullion Market Association; Bank of Canada.

the \$635/oz range in June. Prices rallied to end the year at \$733.78/oz. Overall, gold averaged \$684.58/oz in Canadian dollar terms, up just over 21% from an average \$538.51/oz in 2005.

While mining of new gold resources is an important contributor to the overall supply of gold, the recycling and remobilization of existing stocks play an important role as well. According to information provided by GFMS Limited, the total above-ground stock of gold increased by about 1.6% in 2006 to reach some 158 000 t. Total supply to the market of above-ground stocks amounted to 1435 t in 2006 and provided 37% of the global supply of gold.

OUTLOOK

Gold prices continued to make an impressive recovery in U.S. dollar terms throughout 2006, rising above the US\$700/oz barrier in May before falling back somewhat to trade between \$600 and \$650/oz. On average, the price of gold was up 26% over the 2005 average to reach an annual average of US\$603/oz. While the price rise in U.S. dollar terms is welcome news for producers, the net effect of the stronger Canadian dollar against the U.S. dollar, coupled with higher energy costs and rises in other operating costs at some Canadian mines, muted the good news. The annual average gold price in Canadian dollar terms was \$684/oz in 2006, up 21% from \$538/oz in 2005. The rise in prices saw a number of projects, particularly previously closed operations, coming back on stream in Canada in 2006.

Low interest rates and the record current account deficit in the United States continued to put downward pressure on

the U.S. dollar in 2006. This in turn gave upward support for gold prices. The agreement by central banks to limit sales, de-hedging by producers, the risk of inflation, higher energy prices, and lower mine output all combined with strong physical demand to support higher gold prices in 2006. The liberalization of gold markets in China and India is expected to increase investor demand in both of these important markets. Merger and acquisition activity will also likely continue in 2007 as large producers continue efforts to increase their market share.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of December 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

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TARIFFS

Item No.	Description	Canada			United States Canada	EU Conventional Rate (1)	Japan WTO (2)
		MFN	GPT	USA			
2603.00.00.82	Copper ores and concentrates: gold content	Free	Free	Free	Free	Free	Free
2604.00.00.82	Nickel ores and concentrates: gold content	Free	Free	Free	Free	Free	Free
2607.00.00.82	Lead ores and concentrates: gold content	Free	Free	Free	Free	Free	Free
2608.00.00.82	Zinc ores and concentrates: gold content	Free	Free	Free	Free	Free	Free
2616.10.00.82	Precious metal ores and concentrates: silver ores and concentrates: gold content	Free	Free	Free	Free	Free	Free
2616.90.00.20	Precious metal ores and concentrates: other: gold content	Free	Free	Free	Free	Free	Free
71.08	Gold (including gold plated with platinum) unwrought or in semi-manufactured forms, or in powder form						
7108.11	Non-monetary: powder	Free	Free	Free	Free	Free	Free
7108.12	Non-monetary: other unwrought forms	Free	Free	Free	Free	Free	Free
7108.13	Non-monetary: other semi-manufactured forms	Free	Free	Free	Free	Free	Free

Sources: Canadian *Customs Tariff*, effective January 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2007; *Official Journal of the European Union* (October 17, 2006 Edition); *Customs Tariff Schedules of Japan*, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, GOLD PRODUCTION BY PROVINCE AND TERRITORY, 2004-06

	2004		2005		2006 (p)	
	(grams)	(\$000)	(grams)	(\$000)	(grams)	(\$000)
PRODUCTION						
Newfoundland and Labrador	477 650	8 179	—	—	—	—
Nova Scotia	37 044	634	—	—	—	—
New Brunswick	227 022	3 887	219 583	3 805	254 918	5 539
Quebec	24 102 841	412 713	23 903 303	414 244	23 392 733	508 301
Ontario	72 150 983	1 235 441	71 836 661	1 244 929	57 368 494	1 246 560
Manitoba	4 438 574	76 002	2 909 544	50 422	3 501 955	76 094
Saskatchewan	1 813 828	31 058	1 811 503	31 393	1 505 188	32 706
Alberta	73 299	1 255	55 350	959	60 000	1 304
British Columbia	20 408 114	349 448	16 656 112	288 650	15 594 001	338 842
Yukon	3 166 647	54 222	1 939 385	33 610	1 725 116	37 485
Northwest Territories	511 098	8 752	—	—	—	—
Nunavut	2 070 776	35 458	217 724	3 773	—	—
Total	129 477 876	2 217 050	119 549 165	2 071 787	103 402 405	2 246 831
Mine output	130 727 146	..	120 541 111	..	103 807 139	..

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, GOLD TRADE, 2004-06

		2004		2005		2006 (p)	
		(grams)	(\$000)	(grams)	(\$000)	(grams)	(\$000)
EXPORTS							
2600.00 (1)	Gold in ores and concentrates						
	Japan	3 465 165	39 454	3 697 363	54 342	2 294 488	42 541
	Sweden	—	—	2 444 879	42 231	985 265	18 989
	United States	1 830 582	25 005	1 589 543	22 443	1 016 922	13 041
	South Korea	142 403	1 155	464 528	6 408	297 407	5 411
	India	7 416	87	13 542	176	148 976	3 378
	China	190 434	2 950	63 480	1 038	129 833	2 622
	Belgium	139 178	2 414	53 291	799	30 603	679
	Mexico	—	—	—	—	32 400	673
	Philippines	16 162	199	1 347 028	710	28 800	496
	Germany	—	—	82 924	1 193	—	—
	Indonesia	—	—	6 720	80	—	—
	Other countries	—	—	224	3	—	—
	Total	5 791 340	71 264	9 763 522	129 423	4 964 694	87 830
7108.11	Gold powder						
	United States	420 583	7 495	50 658	620	396 194	4 281
	Japan	—	—	154	2	—	—
	Taiwan	—	—	11 464	35	—	—
	Total	420 583	7 495	62 276	657	396 194	4 281
7108.12	Other unwrought forms						
	United Kingdom	72 659 321	1 233 329	109 280 097	1 888 461	139 149 025	3 067 977
	United States	118 223 846	2 063 714	98 816 523	1 714 096	93 092 390	2 044 698
	Switzerland	554 990	8 730	17 461 855	298 184	8 189 855	173 489
	United Arab Emirates	2 814 868	43 100	4 679 458	79 873	1 656 013	38 056
	Hong Kong	1 273	17	1 044 200	16 161	497 656	10 368
	India	10 000	172	970 490	18 169	109 800	2 624
	Pakistan	4 000	68	—	—	11 895	275
	Japan	12 343	197	1 019 028	16 928	4 000	91
	Trinidad and Tobago	—	—	10 501	96	6 053	76
	France	—	—	1 001	21	1 001	27
	Armenia	2 000	35	2 000	34	—	—
	Germany	1 321	18	498 088	8 237	—	—
	Italy	4 400	47	—	—	—	—
	South Korea	—	—	1 382 758	22 366	—	—
	Other countries	—	—	9 381	199	8121	144
	Total	194 288 362	3 349 427	235 175 380	4 062 825	242 725 809	5 337 825
7108.13	Other semi-manufactured forms						
	United States	1 980 034	21 073	1 840 772	20 083	2 033 953	27 934
	Thailand	772	13	1 365	23	170 382	1 515
	Spain	—	—	—	—	6 299	64
	Trinidad and Tobago	1 960	15	4 798	67	2 524	45
	Other countries	849	19	3 507	69	3 862	47
	Total	1 983 615	21 120	1 850 442	20 242	2 217 020	29 605
	Total exports	202 483 900	3 449 306	246 851 620	4 213 147	250 303 717	5 459 541
IMPORTS (2)							
2600.00 (3)	Gold in ores and concentrates						
	Spain	1 120 495	15 949	756 765	10 832	1 372 367	24 851
	United States	1 582 812	21 498	1 556 212	24 322	1 329 158	23 967
	Australia	134	2	847	13	662 637	11 630
	Argentina	2	...	360 883	5 537	642 240	9 837
	Bulgaria	550 362	7 411	497 670	6 291	469 018	7 340
	Mexico	1 613 277	2 163	197 256	2 816	336 302	6 274
	Peru	652 519	10 756	198 034	3 227	185 970	3 567
	Germany	105 823	1 371	71 379	969	92 760	1 771
	Chile	9	...	16	...	88 086	1 762
	South Africa	27 475	482	168 065	2 614	34 744	770
	Philippines	—	—	—	—	37 673	767
	Azerbaijan	—	—	—	—	6 653	133
	Canada	—	—	—	—	4 425	95
	Saudi Arabia	654 209	9 593	84 456	1 383	—	—
	Other countries	393	6	265	3	50	1
	Total	6 307 510	69 231	3 891 848	58 007	5 262 083	92 765

TABLE 2 (cont'd)

		2004		2005		2006 (p)	
		(grams)	(\$000)	(grams)	(\$000)	(grams)	(\$000)
IMPORTS (cont'd)							
7108.11	Gold powder						
	United States	3 862	56	15 602	213	18 020	267
	Sierra Leone	387	6	—	—	2 000	35
	Other countries	4 720	65	1 192	16	1 428	19
	Total	8 969	127	16 794	229	21 448	321
7108.12	Other unwrought forms						
	Peru	9 646 956	126 669	103 380 626	889 210	156 694 607	1 118 888
	Suriname	7 371 814	137 641	9 846 896	183 448	17 835 974	212 939
	Chile	204 371	3 403	51 385 601	168 966	121 044 002	208 751
	Mongolia	2 378 073	36 714	10 844 404	154 791	15 344 943	193 230
	United States	23 975 632	405 133	4 929 140	73 726	6 871 884	143 066
	Guyana	10 982 378	190 467	8 030 670	138 911	5 225 039	116 893
	Brazil	4 824 880	89 657	1 235 332	21 797	4 254 766	82 659
	South Africa	1 238 892	17 209	2 871 008	45 183	4 145 362	78 426
	Sudan	1 225 453	14 812	7 582 331	80 165	6 607 210	71 240
	Mexico	—	—	695 201	5 663	3 327 118	60 839
	Georgia	496 303	3 547	4 939 371	42 078	6 967 969	54 289
	Argentina	361 374	4 572	2 919 138	30 923	7 507 454	54 148
	Tanzania	878 741	10 946	12 561 359	157 817	3 017 000	42 238
	Nicaragua	2 231 817	23 419	2 418 459	21 660	2 597 737	31 892
	Costa Rica	—	—	696 720	7 454	3 512 850	26 461
	Canada	23 490	397	2 419	96	575 636	14 170
	Hong Kong	73	1	328 000	4 301	274 945	7 027
	Germany	46 929	649	40 713	454	131 472	2 278
	Switzerland	65 161	1 146	3 980	76	8 131	417
	Colombia	—	—	—	—	21 969	322
	Bolivia	24 070	203	708 059	718	8 771	206
	Netherlands	—	—	—	—	8 391	136
	Australia	5 397	70	1 888	33	10 103	129
	Other countries	3 248 999	38 006	7 839 026	72 991	65 596	93
	Total	69 230 803	1 104 661	233 260 341	2 100 461	366 058 929	2 520 737
7108.13	Other semi-manufactured forms						
	United States	698 026	11 630	814 520	12 606	1 466 079	12 827
	Thailand	9 354	166	—	—	140 724	1 870
	Switzerland	27 222	366	49 338	603	80 190	1 558
	Singapore	78 237	1 493	108 859	1 906	35 604	796
	Croatia	—	—	—	—	38 703	727
	Armenia	2 726	8	5 196	30	9 220	374
	Brazil	1	...	—	—	7 643	144
	Italy	12 537	60	8 850	90	19 983	144
	Germany	18 429	180	20 484	267	28 024	129
	Canada	13 892	173	2 769	59	4 857	93
	Other countries	18 232	283	64 646	509	33 222	253
	Total	878 656	14 359	1 074 662	16 070	1 864 249	18 915
	Total imports	76 425 938	1 188 378	238 243 645	2 174 767	373 206 709	2 632 738

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Amount too small to be expressed; (p) Preliminary.

(1) Includes HS classes 2603.00.00.82, 2607.00.00.82, 2608.00.00.82, 2616.10.00.82 and 2616.90.00.82. (2) Imports from "Other countries" may include re-imports from Canada. (3) Includes HS classes 2603.00.00.82, 2604.00.00.82, 2607.00.00.82, 2608.00.00.82, 2616.10.00.82 and 2616.90.00.20.

Note: Numbers may not add to totals due to rounding.

TABLE 3. CANADA, GOLD PRODUCTION BY SOURCE, HISTORICAL, 1988-2006

	Auriferous Quartz Mines		Placer Operations		Base-Metal Ores		Total	
	(kg)	(%)	(kg)	(%)	(kg)	(%)	(kg)	(%)
1988	112 404	83.40	4 879	3.6	17 530	13.00	134 813	100
1989	138 211	86.70	5 354	3.4	15 930	10.00	159 494	100
1990	147 355	88.00	3 993	2.4	16 025	9.6	167 373	100
1991	153 859	87.80	3 834	2.2	17 589	10.00	175 282	100
1992	141 965	88.50	3 469	2.2	14 917	9.3	160 351	100
1993	137 346	89.70	3 787	2.5	11 997	7.8	153 129	100
1994	133 018	90.80	3 714	2.5	9 696	6.6	146 428	100
1995	132 834	88.00	5 303	3.5	12 730	8.4	150 867	100
1996	147 052	89.30	3 971	2.4	13 636	8.3	164 660	100
1997	155 543	90.70	3 987	2.3	11 949	7.0	171 479	100
1998	147 574	89.60	3 098	1.9	14 102	8.6	164 773	100
1999	141 467	89.80	3 081	2.0	13 068	8.3	157 617	100
2000	139 145	90.50	2 695	1.8	11 874	7.7	153 715	100
2001	144 815	91.20	2 461	1.5	11 598	7.3	158 875	100
2002	140 839	92.70	2 347	1.5	8 719	5.7	151 904	100
2003	130 549	92.70	1 841	1.3	8 471	6.0	140 861	100
2004	116 993	90.40	3 557	2.7	8 928	6.9	129 478	100
2005	107 879	90.20	2 189	1.8	9 482	7.9	119 549	100
2006 (p)	92 671	89.60	1 958	1.9	8 774	8.5	103 402	100

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

TABLE 4. CANADA, GOLD PRODUCTION, AVERAGE VALUE AND PERCENT OF TOTAL MINERAL PRODUCTION, HISTORICAL, 1988-2006

	Total Production	Total Value	Average Value (1)	Gold as a Percent of Total Mineral Production (2)
	(kg)	(\$000)	(\$/g)	(%)
1988	134 813	2 331 989	17	6
1989	159 494	2 315 860	15	6
1990	167 373	2 407 654	14	6
1991	175 282	2 338 614	13	7
1992	160 351	2 141 161	13	6
1993	153 129	2 284 991	15	6
1994	146 428	2 468 926	17	6
1995	150 867	2 557 502	17	6
1996	164 660	2 799 547	17	6
1997	171 479	2 527 429	15	5
1998	164 773	2 312 593	14	5
1999	157 617	2 099 302	13	4
2000	153 715	2 044 869	13	2
2001	158 875	2 135 275	13	3
2002	151 904	2 377 303	16	12
2003	140 861	2 307 157	16	11
2004	129 478	2 217 050	17	9
2005	119 549	2 071 787	17	8
2006 (p)	103 402	2 246 831	22	8

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

(1) Value is based on average London p.m. fix price for gold. (2) Beginning in 2002, "Total Mineral Production" excludes oil and gas.

TABLE 5. WORLD MINE PRODUCTION OF GOLD, 2002-06

Country	2002	2003	2004	2005	2006
(tonnes)					
NORTH AMERICA					
Canada (1)	152	142	131	121	104
United States	298	277	258	256	242
Total North America	450	418	389	376	346
AFRICA					
South Africa	398	373	337	295	272
Ghana	69	71	63	67	66
Tanzania	43	48	48	47	40
Mali	56	46	38	44	51
Zimbabwe	16	12	21	13	11
Guinea	17	17	15	17	16
Other Africa	30	26	24	32	33
Total Africa	629	591	547	516	489
LATIN AMERICA					
Peru	157	173	173	208	203
Brazil	42	40	48	41	37
Chile	39	39	40	40	42
Mexico	21	20	22	30	38
Argentina	33	30	29	28	44
Colombia	21	47	38	36	35
Venezuela	10	8	10	10	12
Suriname	-	-	9	11	10
Ecuador	3	5	5	5	5
Guyana	14	12	11	8	6
Bolivia	11	9	6	9	10
Other	20	18	15	13	23
Total Latin America	370	401	404	440	467
ASIA					
China	202	210	212	230	247
Indonesia	142	141	94	143	86
Uzbekistan	86	85	88	84	84
Papua New Guinea	61	68	73	69	58
Philippines	36	38	36	38	36
Mongolia	12	11	18	24	23
Kyrgyzstan	16	23	21	17	11
Kazakhstan	22	19	19	18	22
Japan	9	8	8	8	9
Saudi Arabia	4	9	8	8	5
Other	19	23	22	24	20
Total Asia	610	634	600	661	601
EUROPE					
Russia	168	170	169	163	159
Sweden	6	6	7	5	7
Spain	6	5	5	2	2
Other	20	18	13	10	13
Total Europe	200	199	194	181	181
OCEANIA					
Australia	266	282	259	263	247
Other	13	13	14	13	11.98
Total Oceania	280	295	273	276	259
Total world production	2 538	2 538	2 407	2 450	2 344

Source: International Consultative Group on Nonferrous Metals Statistics.

– Nil.

(1) Production figures for Canada were obtained from Natural Resources Canada.

Note: Numbers may not add to totals due to rounding.

TABLE 6. WORLD GOLD FABRICATION, (1) 2002-06

Fabricated Gold	2002	2003	2004	2005	2006
(tonnes)					
Carat jewellery	2 660	2 482	2 614	2 707	2 280
Electronics	206	233	260	279	304
Dentistry	69	67	68	62	61
Other industrial uses	83	80	83	85	86
Medals and fake coins	27	26	26	37	59
Official coins	97	107	115	111	129
Total gold fabrication	3 140	2 995	3 166	3 282	2 919

Source: GFMS Limited, "Gold Survey 2007."

(1) Including the use of scrap.

Note: Numbers may not add to totals due to rounding.

TABLE 7. ANNUAL AVERAGE GOLD PRICES, 1934-2005, AND MONTHLY, 2002-06

Year	US\$/oz		C\$/oz		Year	US\$/oz		C\$/oz	
1934-67	35.00		..		1987	446.66		592.18	
1968	38.82		41.82		1988	436.45		554.76	
1969	41.13		44.29		1989	381.27		451.33	
1970	35.97		37.54		1990	383.72		447.79	
1971	40.87		41.27		1991	362.34		415.09	
1972	58.22		57.66		1992	343.86		415.23	
1973	97.22		97.24		1993	360.06		464.35	
1974	158.80		155.36		1994	384.15		524.60	
1975	160.96		163.76		1995	384.07		526.94	
1976	124.78		123.01		1996	387.69		528.62	
1977	147.80		157.10		1997	328.41		454.52	
1978	193.51		220.74		1998	294.11		435.77	
1979	305.69		358.12		1999	278.86		413.57	
1980	614.38		719.08		2000	279.11		414.70	
1981	459.22		550.57		2001	271.40		403.08	
1982	375.52		463.51		2002	309.73		486.40	
1983	423.52		521.82		2003	363.32		509.18	
1984	360.63		466.99		2004	409.17		531.72	
1985	317.35		433.21		2005	444.45		538.51	
1986	367.58		510.73						

Month	2002		2003		2004		2005		2006	
	(US\$/oz)	(C\$/oz)	(US\$/oz)	(C\$/oz)	(US\$/oz)	(C\$/oz)	(US\$/oz)	(C\$/oz)	(US\$/oz)	(C\$/oz)
January	281.65	450.73	356.86	549.92	413.79	530.18	424.03	519.58	549.86	636.35
February	295.50	471.56	358.97	542.89	404.88	531.21	423.35	524.81	555.00	637.63
March	294.05	466.66	340.55	502.62	406.67	536.32	434.32	528.18	557.09	644.78
April	302.68	478.66	328.18	478.65	403.26	534.29	429.23	530.54	610.65	698.45
May	314.49	487.37	355.68	492.44	383.78	522.96	421.87	529.66	675.39	749.32
June	321.18	491.95	356.35	481.89	392.37	526.98	430.66	534.11	596.15	664.01
July	313.29	484.31	351.02	484.90	398.09	520.79	424.48	519.03	633.71	715.61
August	310.25	486.44	359.77	502.11	400.51	520.93	437.93	527.28	632.59	707.41
September	319.16	502.93	378.95	516.59	405.28	518.16	456.05	537.04	598.19	667.68
October	316.56	499.47	378.92	500.87	420.46	519.82	469.90	553.34	585.78	661.11
November	319.15	501.51	389.91	511.79	439.38	523.13	476.67	562.98	627.83	713.33
December	332.43	518.36	406.95	535.14	442.08	533.76	510.10	592.23	629.79	726.15

Sources: London Bullion Market Association, p.m. fix; Bank of Canada.

.. Not available.

TABLE 8. COMPANY WEB SITES FOR FURTHER INFORMATION

Company	Web Site Address
Afcan Mining Corporation	www.afcan-mining.com
Agnico-Eagle Mines Limited	www.agnico-eagle.com
Anaconda Mining Inc.	www.anacondamining.com
Aur Resources Inc.	www.auresources.com
Aurizon Mines Ltd.	www.aurizon.com
Barrick Gold Corporation	www.barrick.com
Bema Gold Corporation	www.bema.com
Bralone Gold Mines Ltd.	www.bralorne.com
Breakwater Resources Ltd.	www.breakwater.ca
Callinan Mines Limited	www.callinan.com
Campbell Resources Inc.	www.ressourcescampbell.com
Centerra Gold Inc.	www.centerragold.com
Claude Resources Inc.	www.clauderresources.com
Comaplex Minerals Corp.	www.comaplex.com
Cross Lake Minerals Ltd.	www.crosslakeminerals.com
Crystallex International Corporation	www.crystallex.com
Cusac Gold Mines Ltd.	www.cusac.com
Eldorado Gold Corp.	www.eldoradogold.com
Etruscan Resources Inc.	www.etruscan.com
Goldcorp Inc.	www.goldcorp.com
Handy & Harman of Canada, Limited	www.handyharmancanada.com
High River Gold Mines Ltd.	www.hrg.ca
Highland Gold Mining Ltd.	www.highlandgold.com
Hudbay Minerals Inc.	www.hudbayminerals.com
IAMGOLD Corporation	www.iamgold.com
Imperial Metals Corporation	www.imperialmetals.com
Inmet Mining Corporation	www.inmet-mining.com
International Tower Hill Mines Ltd.	www.ithmines.com
Ivanhoe Mines Ltd.	www.ivanhoe-mines.com
Johnson Matthey Plc	www.matthey.com
Kinross Gold Corporation	www.kinross.com
Kirkland Lake Gold Inc.	www.klgold.com
Lihir Gold Limited	www.lihir.com.pg
Miramar Mining Corporation	www.miramarmining.com
Newcrest Mining Limited	www.newcrest.com.au
Newmont Mining Corporation	www.newmont.com
North American Palladium Ltd.	www.napalladium.com
Northern Dynasty Minerals Ltd.	www.northerndynastyminerals.com
Northgate Minerals Corporation	www.northgateminerals.ca
Orvana Minerals Corp.	www.orvana.com
Osisko Exploration Ltd.	www.osisko.com
Peter Hambro Mining PLC	www.peterhambro.com
Richmont Mines Inc.	www.richmont-mines.com
River Gold Mines Ltd.	www.rivergoldmine.com
Rocmec Mining Inc.	www.rocmeccmines.com
Royal Canadian Mint	www.mint.ca
San Gold Corporation	www.sangoldcorp.com
Semafo Inc.	www.semafo.com
Teck Cominco Limited	www.teckcominco.com
TVI Pacific Inc.	www.tvipacific.com
Vale Inco (CVRD Inco Limited)	www.inco.com
Xstrata Plc	www.xstrata.com
Yamana Gold Inc.	www.yamana.com

Graphite

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Graphite is a raw material with a unique blend of physical and chemical properties. There are quite a number of minerals similar in appearance to graphite; however, graphite's intrinsic properties make it easy to distinguish.

A useful classification of graphite depends on the mode of formation that leads to three physically distinct common varieties: amorphous (micro-crystalline) graphite, which has a carbon content of 70-85%; high crystalline graphite (lump, vein or crystalline vein), which has a carbon content of 90-99%; and flake graphite, which has a carbon range of 80-98%.

Flake graphite (i.e., flat plate-like grains from <1 mm to 2.5 cm in size) is sold in two particle size distributions: coarse flake (-20 to +100 mesh) and fine flake (-100 to +325 mesh). Crystalline graphite ranges from chip or dust to fine or amorphous lump, to coarse or crystalline lump.

The term "flake" is self-explanatory; flake forms occur disseminated in rock. Lump graphite occurs in fissure-filled veins in pegmatite dykes, also associated with chips and the rarer needle forms. Amorphous graphite occurs in beds that were once coal, but fine-grained, easily ground vein graphite is also classified as amorphous.

All graphite has a crystalline structure, but only certain kinds and sizes of natural graphite are commercially classified as "crystalline," a term used for import duty purposes. Natural graphite, the mineral form of graphitic carbon, occurs worldwide. It differs from the carbon of coal and of diamond in its predominantly lamellar hexagonal crystal structure. The ore usually contains associated silicate minerals that vary in kind and amount with the source.

Synthetic graphite has a higher purity but lower crystallinity than natural graphite and is divided into: primary or electrographite, with a carbon content of 99.9%, which is

manufactured on a large scale in electric furnaces using calcined petroleum coke and coal tar pitch (used to produce electrodes and carbon brushes); secondary synthetic graphite in the form of powder or scrap, which is produced by heating calcined petroleum pitch (used in the refractories industry); and graphite fibres, which are produced from organic precursors such as rayon or polyacrylonitrile and tar pitch (used as reinforcing agents in polymer composites in aerospace and sporting goods).

There are significant differences between naturally and synthetically produced graphite as, while natural graphite is generally less pure than its synthetic equivalent due to a more defective crystal structure, synthetic graphite is less conductive. While natural graphite usually has to be purified and upgraded, synthetic graphite can be engineered that has 99.9% and higher carbon. Technology now allows natural graphite material to be upgraded to more than 99.5% carbon. Purification techniques have improved to the point that even low-quality graphite can be used in high-tech applications that were once the domain of synthetic material.

Natural graphite is a lustrous black carbon mineral, crystallized in the hexagonal system with rhombohedral symmetry. Flake graphite is opaque, flexible and sectile, and exhibits perfect basal cleavage. Natural graphite is unctuous and relatively soft with a hardness of 1-2 on the Mohs scale. It has a black streak on glaze porcelain. Its specific gravity is 2.26 g/cm³. Molybdenite, commonly confused with graphite, is heavier and not smudgy, and it is also metallic bluish silver in colour. Graphite is one of those "tip of the iceberg" materials. For example, large amounts of graphite are used to make "lead" pencils, so-called because graphite resembles lead in colour, but in reality is graphite mixed with clay.

Graphite has properties of both metals and nonmetals, which make it suitable for many industrial applications. The metallic properties include electrical and thermal conductivity. The nonmetallic properties include high thermal resistance, inertness, and lubricity.

The many useful properties of graphite give rise to a wide variety of products (30 different applications with hundreds of formulations): unctuous – dry lubricant; marks readily – writing and drafting pencils; combination of lubricity and

electrical conductivity – motor and generator brushes; excellent weathering properties and inertness – industrial paint pigment; solubility in molten iron – carbonraiser for steel; poorly wet by most metals and alloys – foundry mold facings; and burns slowly, conducts heat, and retains strength over a large temperature range – refractories such as crucibles, carbon-magnesite brick, continuously casting ware, and stopper heads for steel ladles. Some additional properties of interest include hydrophobicity, forms water-in-oil emulsions, carries a negative charge, has low photoelectric sensitivity, is strongly diamagnetic, and is an infrared absorber. Therefore, graphite is an excellent conductor of heat and electricity and has a high melting temperature of 3500°C. It is extremely resistant to acid, chemically inert, and highly refractory.

GRAPHITE DEPOSITS IN CANADA

Graphite deposits of potentially commercial interest in Canada occur principally in rocks of the Grenville series of eastern Canada. The mineral is found in disseminated crystalline flake and vein forms. Most Canadian graphite deposits are associated with graphite gneiss and crystalline limestones that have been subjected to contact metamorphism associated with tectonic features such as folding, compression and fracturing, and with pegmatitic intrusions. The richest ore zones occur as a succession of veins or lenticular bodies that gradually merge into the adjacent non-graphitic host rock and that are bordered by lenses of lower-grade ore.

Fine-to-coarse flake graphite deposits have been reported mainly in Quebec and Ontario, but also in New Brunswick, Nova Scotia, Saskatchewan, Labrador, and British Columbia. The more important occurrences are those found in metasomatic-hydrothermal deposits and in sedimentary rocks that have been subjected to regional or thermal metamorphism. Marble, gneiss and schist are the more common rock types in which economic graphite deposits occur.

In Quebec, graphite deposits are located mainly along the Grenville series in several townships of western Quebec: Buckingham, Argenteuil, and Pontiac. The disseminated flake graphite variety is dominant in biotite gneiss and crystalline limestone associated with biotite quartzite, but the vein variety is also reported along the contact of intrusive rocks and crystalline limestone. Occurrences of graphite are associated with metasedimentary rocks that have been subjected to several deformations and where metamorphism has reached amphibolitic or granulitic phases.

Graphite also occurs in Esmantown Township, south of Fermont. Several graphite-rich schist zones, measuring 1-25 m in thickness, are found interlayered with quartz-feldspar gneiss. Some graphite zones locally contain more than 15% graphite in the form of fine and well-crystallized flakes.

In Ontario, graphite deposits are found in several townships of eastern Ontario in rocks of the Grenville series. Flake graphite occurs disseminated in marble and gneiss. The occurrences of major interest are in semipelitic and pelitic gneiss units within paragneiss sequences. Graphite is present in amounts up to 10%. Accessory minerals consist of biotite, garnet and pyrite; trace elements in these graphitic rocks include nickel, cobalt, boron and vanadium.

In southeastern British Columbia, the Hoder Creek and Little Slokan River Valley's graphite deposits, located in the Regolith zone, host rocks were metamorphosed primarily from limestone to marble of other limey metasediments. The granites within the batholith were metamorphosed to hybrid or mixed gneisses. This calc-silicate metasediment is regional (typical of crystal graphite deposits) with numerous occurrences of graphite. In the west-central coast Bentinck Arm area, the graphite showing occurs as small thin graphite flakes widely dispersed in a quartz-rich gneiss, an area that is underlain by metavolcanic rocks that have been intruded by a now foliated granodiorite.

CANADIAN PRODUCTION

There is presently one graphite deposit being exploited in Canada; therefore, production values and quantities (Table 1) cannot be released by Natural Resources Canada due to a confidentiality agreement with the Canadian producer.

Quebec

Timcal Canada Inc. (part of the graphite business unit "Timcal Graphite" of Imerys SA of France) operates the Lac-des-Îles graphite mine near Mont-Laurier. To diversify production, it invested US\$10 million in a new processing plant in Terrebonne, near Montréal, to produce exfoliated graphite. Mechanical concentration of the graphite, which raises the carbon content to 98.8%, and packaging, mainly for refractory grades, is performed at Lac-des-Îles. The Terrebonne plant processes natural graphite (expanded graphite) from its mining and processing operation in Lac des-Îles, Quebec, and from offshore sources.

In the developmental stage, Quinto Technology Inc. of Delta, British Columbia, is in the phase of completing a feasibility study for its graphite deposit in the province of Quebec called the Lac Gueret property. The property lies in eastern Quebec, 300 km north-northwest of Baie-Comeau, along the southwestern shore of Reservoir Manicouagan.

Ontario

Industrial Minerals Inc. (IMI) of Mississauga developed a graphite mill and processing plant in Bissett Creek, located in Maria Township northwest of Deep River (i.e., 240 km

west of Ottawa and 100 km east of North Bay). The deposit has approximately 640 000 t of proven graphite resources and is claimed as one of the largest and purest natural graphite deposits in the world. It contains coarse flakes ranging in size from 180 micrometres to 1.7 millimetres. Designed to produce 20 000 t/y via a dry process to offer two grades of 85% and 94% graphitic carbon, the company discovered shortly after start-up of the plant in 2005 that valuable large flakes (high-grade Graf-X jumbo) were being destroyed during processing. IMI does not expect to generate any production until a proposed feasibility study is completed and the necessary equipment to commence production is acquired.

British Columbia

Crystal Graphite Corp. (CGC) of Vancouver, which had started its own graphite beneficiation plant for the mining of its high-purity graphite Black Crystal deposit near Slo-can Lake, northwest of Nelson, went into receivership and was recently sold to a private company that has renamed the operation Eagle Graphite Corp. The purchase was limited to Crystal Graphite's graphite business only, but Eagle Graphite does not intend to pursue Crystal Graphite's plan to invest in Chinese graphite production. As for Crystal Graphite's black pumice and basalt mines (in Nazko, B.C.) and processing plant (near Quesnel, B.C.), they were purchased by Lightweight Advanced Volcanic Aggregates Inc. (LAVA). Eagle Graphite plans to reactivate production and produce both fuel cell-grade and conventional graphite.

WORLD PRODUCTION

World production (source: U.S. Geological Survey's 2005 review on graphite) of natural graphite increased slightly in 2005 to an estimated 1.05 Mt. China maintained its position as the world's leading graphite producer with 720 000 t (68.6% of world production). India was the second largest graphite producer with 130 000 t, followed by Brazil, North Korea, and Canada (estimated 30 000 t) in decreasing order of tonnage produced. In 2005, there was no reported production of natural graphite in the United States (but production of synthetic graphite was estimated to be 209 000 t).

MINING

Graphite deposits are usually located at or near the surface and are typically mined by open-pit methods. Underground mining methods are only employed when warranted by grade and structure. The present Canadian graphite producers operate open-pit deposits. Underground mining of graphite was relatively common in eastern Ontario and in the Buckingham area of Quebec during the early 1900s with shafts extending to depths of 80 m or more.

PROCESSING

Flake graphite in Canada is too finely disseminated for hand sorting and cobbing methods, which are used in some countries to recover massive flake graphite. Production of Canadian graphite is usually only possible by a combination of careful grinding and screening to recover coarse flakes and by flotation to recover fine graphite. Flotation concentrates are sometimes further beneficiated by tabling to remove associated gangue minerals such as quartz, mica, hornblende, feldspar, calcite, and sulphides.

Impurities tend to float with graphite since, being soft, graphite tends to smear and coat impurity minerals during grinding so that they behave like graphite. This is especially true when processing finely divided ores that require extensive grinding.

Size reduction is usually accomplished by jaw, cone, or hammer mill-type crushers; screening to recover coarse flakes or to reject coarse hard impurities is accomplished by trommel or vibratory screens. The recovery of intermediate and fine flake graphite is possible by roll crushing, ball, rod milling or jet milling, followed by additional screening, air classification, wet tabling, or flotation.

Graphite is naturally floatable and particles as coarse as 1 mm may be floated in a slightly alkaline pH medium. Pine oil and kerosene are the standard reagents and are usually employed together. Pine oil acts as a frother. The function of kerosene or fuel oil is as a promoter to recover unliberated graphite middlings. Flotation is fairly fast and multiple cleaning is necessary for recoveries of 80-85%; recovery can be improved by regrinding and refloatation, but careful regrinding is necessary to avoid smearing of gangue minerals and the production of slime graphite.

Modifiers and depressants to improve selectivity include sodium silicate, which acts as a quartz depressant and slime dispersant, and lactic acid, $C_3H_6O_3$, which is used to depress mica.

Graphite may be further purified to 99% carbon by chemical treatment, chloridization or fluoridization.

Synthetic graphite, mainly produced in the United States, is made from a mixture of petroleum coke or anthracite filler, coal tar or petroleum pitch binder, and various impregnating or additive materials. The coke or anthracite, which should contain 95% carbon and have a low sulphur content, is calcined to remove volatiles, ground, mixed with binder and other materials, and molded to the required shape. The product, known in the trade as "green bar" or "green stock," is then baked at 800-1000°C to convert the pitch binder to coke and to solidify the shape. The resulting product is then "graphitized" by heating in an electric furnace at 2600-3000°C over an extended period. The product is then cooled and machined to final size specifications.

(e.g., production of electrodes = turned on lathes to the desired diameter for use in steel mini-mills).

USE AND TRADE

NRCan's 2006 voluntary survey on the use of nonmetallic minerals by Canadian manufacturing plants indicated that the use of graphite in Canada for 2005 increased slightly by 1% to 15 982 t from 15 877 t in 2004. Of these figures (Table 2), natural graphite represented 3727 t (23.3%) and synthetic graphite represented 12 255 t (76.7%). Natural graphite consumption was mainly in the foundry facing (64.2%) industry, while the balance (35.8%) reported was for refractories and other uses (i.e., brake linings, chemicals, abrasives, primary steel, and other uses).

As for Canadian trade (Table 1), Statistic Canada reported that the total value of Canadian exports of graphite decreased by 2.8% to \$29.7 million in 2006 from \$30.6 million in 2005. Of these exports, \$16.0 million (15 328 t) was natural graphite, the balance being refractory products and carbon/graphite brushes. The United States was the main destination of Canadian natural graphite, valued at \$11.2 million (9680 t). Imports into Canada totaled \$36.3 million in 2006, a decrease of 2.1% from \$37.0 million in 2005. Of these imports, \$4.7 million (3751 t) was natural graphite and the balance was refractory products and carbon/graphite brushes. The United States exported into Canada \$1.8 million worth (1686 t) of natural graphite in 2006, a negligible decrease in value from 2004, but a 24.3% (540 t) decrease from 2005. As for China, 2006 exports to Canada of natural graphite, imports were valued at \$2.6 million (1773 t), an increase of 5.8% in value and an increase of 45.8% in quantity from 2005.

PRODUCTION AND MARKET CONSIDERATIONS

The major producing countries, by type of graphite and in decreasing order of importance, are as follows:

- Flakes: China, Ukraine, Brazil, Canada, Madagascar, Zimbabwe, and Norway;
- Microcrystalline (amorphous): China, South Korea, Mexico, the Czech Republic, Austria, North Korea, Russia, and Zimbabwe; and
- Lump: Sri Lanka.

Refractories, foundries, friction products and lubricants are the highest volume applications for graphite (Source: *Industrial Minerals* magazine, October 2003). New applications for graphite producers to keep tabs on include the use of natural graphite in heat sinks, which could be used for electronics cooling applications, e.g., in computers, servers, and power devices. There is also an increasing

new interest in graphite as a flame retardant and as an additive in polymers used in applications such as sealing and piping.

Currently, the market for large-flake, high-carbon graphite is experiencing a cycle of high growth. This is due in large measure to the new demand created by the fuel cell industry and its need for electrodes and conductive separators being developed for the automotive industry sector. There is additional new growth in demand in magnesia and alumina refractories and for the use of graphite in lithium ion batteries.

The ability to purify and modify graphite and carbon products is the key to future growth in the graphite industry. Along with consistency in specifications and source of supply, as well as just-in-time (JIT) service and joint cooperation/development programs with industry users, consistency is the number one request made in the market today.

PRICES

Prices for actual transactions vary according to geographic region and will take into account the quantity purchased, application, quality assurance, exact grade purchased, credit terms, and other parameters. Due to the unavailability of Canadian prices, the following price examples from the U.S. Geological Survey's 2005 review on graphite are provided to facilitate an understanding.

Natural graphite prices remained unchanged during 2005. Prices for crystalline and crystalline flake graphite concentrates ranged from US\$410 to US\$795/short ton (st); prices for amorphous powder ranged from US\$240 to US\$260/st. Ash and carbon content, crystal and flake size, and flake distribution affect the price of graphite.

Flake graphite has the advantage of being sold into a wider range of markets and enjoys higher prices than amorphous from Mexico or lump from Sri Lanka. As a general rule, the larger flake sizes sell at the highest prices amongst the natural graphite products.

MAJOR USES

Graphite usage, stable for some years, appears to be about to undergo a renaissance. Advantage is being taken of the electrical conductivity of graphite and its light weight. There is renewed interest in making plastics conductive. Graphite has advantages over the carbon blacks of producing lower-viscosity compounds and being cleaner to use. New end uses include fuel cell components, energy cell components, graphite reactor fuel elements, and intercalation compounds. Further off the horizon are uses in magnetic levitation and lower-cost synthesis of diamonds.

The largest consumers (i.e., Russia, Japan, the United States, China, Germany, the United Kingdom, Italy, France, and Brazil) of graphite are the biggest producers of steel, base metals, and precious metals. Together it is estimated that they consume about 50% of all graphite and are the largest users of flake graphite.

Graphite crucibles are used in steel-making and in the production of nonferrous and precious metals. Here, flake graphite is preferred to microcrystalline graphite because it burns more slowly, has a high attrition resistance, and imparts structural strength through the orientation of the flakes. The average carbon content is 80-90% and the average flake size is 0.15 mm.

Although graphite is used in metallurgy, it is also consumed by the chemical, mechanical, glass, and ceramic industries. Its role is also important in a range of medical, environmental, transportation, and energy management technologies.

Growing markets include: (a) exfoliated “expanded” flake graphite rolled into sheet (grafoil, also called flexible graphite foil) for the manufacture of gaskets and seals used in the automotive industry, heat exchangers, and other products; (b) high-alumina and magnesia-graphite bricks for the refractory industry; (c) zirconia-graphite coatings; (d) flake graphite-silicon carbide refractories; and (e) friction materials. Other growing markets are very high-purity graphite for specialty applications, metal powders, and motor brushes.

New and developing applications are providing demand growth for graphite. In particular, there is considerable potential for high-purity, high-carbon graphite in the batteries sector, and in the fuel cells, which could offer good longer-term growth.

As an example, a research group associated with the University of New South Wales in Sydney developed a new form of very-high-density graphite (VHD graphite) that provides advantages over conventional graphite in four key areas: porosity, composition, and electrical and thermal conductivity. VHD graphite is manufactured at lower temperatures than conventional graphite and the processing time is an order of magnitude shorter.

The nuclear industry uses VHD graphite since the denser the carbon is, the better it serves as a neutron moderator. It is not as strong as cast iron, but milling the graphite is about as hard as milling iron. A block of VHD graphite 10 x 10 x 122 cm (4 x 4 x 48 inches in size) weighed about 23-27 kg (50-60 lb).

VHD provides a range of other possible applications in the following sectors: low friction uses, fuel cells, batteries, corrosion-resistant electrodes, high-density heat storage devices, and carbon-reinforced graphite and other related materials.

Nanocomposites: When intercalated and expanded, graphite nano-flakes are produced with a thickness to 20-50 nanometres. The potential end use of graphite nano-flakes would be in the aerospace, automobile, and conductive plastics sectors.

OUTLOOK

Refractory use trends (Source: U.S. Geological Survey 2005 review on graphite) for graphite closely follow events in the steel industry because graphite is mostly used in the manufacture of refractory brick, which is used in iron and steel furnace linings. Brake linings and other friction materials will steadily use more natural graphite as new automobile production continues to increase and more replacement parts are required for the growing number of vehicles. Flexible graphite products, such as grafoil (a thin graphite cloth), will probably be the fastest growing market, but will use small amounts of natural graphite compared with major end-use markets such as brake linings and refractories.

Hybrid and electric vehicles are expected to increase demand for high-purity graphite in fuel cell and battery applications. Global demand (source: USGS 2005 review on graphite) may increase to more than 25 000 t/y in the next four to five years. The demand is expected to be spread between two main consuming sectors: alkaline batteries and lithium-metal ion batteries. Synthetic and natural graphite are used in these batteries. The markets for graphite used in rubber and plastics (including Styrofoam coatings) are growing, and continued growth is expected.

Canadian deposits are of the flake type and are relatively easy to upgrade to +90% carbon; many contain graphite that is expandable. Products made from expandable graphite command higher prices and the outlook for growth in these products is good.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

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TARIFFS

Item No.	Description	Canada			United States		EU	Japan
		MFN	GPT	USA	Canada		Conventional Rate (1)	WTO (2)
25.04	Natural graphite							
2504.10	In powder or in flakes	Free	Free	Free	Free		Free	Free
2504.90	Other	Free	Free	Free	Free		Free	Free
6902.90	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths: other	Free	Free	Free	Free		2%	1.5%
6903.10	Other refractory ceramic goods, other than those of siliceous fossil meals or of similar siliceous earths: containing by weight more than 50% of graphite or other carbon or of a mixture of these products	Free	Free	Free	Free		5%	3.5%
85.45	Carbon electrodes, carbon brushes, lamp carbons, battery carbons and other articles of graphite or other carbon, with or without metal, of a kind used for electrical purposes							
8545.20	Brushes	Free	Free	Free	Free		2.7%	3.3%

Sources: Canadian *Customs Tariff*, effective January 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2007; *Official Journal of the European Union* (October 17, 2006 Edition); *Customs Tariff Schedules of Japan*, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, GRAPHITE PRODUCTION, SHIPMENTS AND TRADE, 2004-06

		2004		2005 (r)		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION (all forms)							
	Quebec	x	x	x	x	x	x
	British Columbia	x	x	—	—	—	—
	Total	x	x	x	x	x	x
EXPORTS							
2504.10	Natural graphite in powder or flake						
	United States	14 219	11 705	9 917	12 169	9 603	11 197
	United Kingdom	2 192	1 416	1 765	1 380	1 795	1 362
	Switzerland	252	288	1 324	1 455	888	1 007
	Italy	2 016	1 319	1 128	899	1 020	724
	Belgium	—	—	418	599	507	694
	Spain	1 558	896	395	258	497	319
	Macedonia	—	—	140	65	580	258
	China	—	—	—	—	154	204
	France	—	—	18	17	74	69
	Turkey	3 710	1 637	140	93	60	31
	Netherlands	85	59	8	11	39	29
	Japan	40	41	20	21	20	21
	Austria	500	262	—	—	—	—
	Cuba	1	2	—	—	—	—
	Czech Republic	60	19	—	—	—	—
	New Caledonia	1	1	—	—	—	—
	Israel	—	—	..	...	—	—
	Romania	—	—	8	2	—	—
	Total	24 634	17 645	15 281	16 969	15 237	15 915
2504.90	Natural graphite, n.e.s.						
	United States	38	152	12	61	77	32
	Japan	—	—	17	8	9	4
	Iceland	—	—	—	—	5	2
	Germany	8	4	—	—	—	—
	Trinidad and Tobago	27	16	46	22	—	—
	Thailand	—	—	11	5	—	—
	United Arab Emirates	—	—	61	29	—	—
	Total	73	172	147	125	91	38

TABLE 1 (cont'd)

		2004		2005 (r)		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
6902.90	Refractory bricks, blocks, tiles; other						
	United States	3 953	4 368	2 598	2 401	1 347	2 263
	Australia	174	161	198	115	182	255
	Japan	158	171	71	104	84	124
	Indonesia	—	—	273	376	85	91
	Brazil	—	—	—	—	4	7
	Cuba	—	—	—	—	1	7
	United Kingdom	8	10	1	3	7	4
	Belgium	11	20	—	—	2	3
	South Africa	759	693	—	—	2	3
	Finland	—	—	—	—	1	3
	India	—	—	—	—	1	2
	Niger	—	—	—	—	..	...
	Chile	20	13	—	—	—	—
	China	35	28	—	—	—	—
	Croatia	3	5	2	2	—	—
	El Salvador	16	25	—	—	—	—
	Kazakhstan	30	180	—	—	—	—
	Mali	7	10	—	—	—	—
	New Zealand	49	23	18	23	—	—
	Qatar	15	22	—	—	—	—
	France	—	—	1	...	—	—
	Honduras	—	—	..	...	—	—
	Israel	—	—	53	65	—	—
	Italy	—	—	3	4	—	—
	Mexico	—	—	2	2	—	—
	Singapore	—	—	13	18	—	—
	Total	5 238	5 729	3 233	3 113	1 716	2 762
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6903.10	Other refractory ceramic goods, containing by weight more than 50% of graphite or other carbon or of a mixture of these products						
	Venezuela	—	—	..	...	..	146
	United States	..	58	..	76	..	37
	Iceland	—	—	—	—	..	34
	Australia	..	10	—	—	—	—
	Austria	..	7	—	—	—	—
	Brazil	..	12	—	—	—	—
	Finland	..	21	..	6	—	—
	Germany	..	7	—	—	—	—
	Netherlands	..	5	—	—	—	—
	New Zealand	..	14	—	—	—	—
	Spain	..	3	—	—	—	—
	Sweden	..	66	..	2	—	—
	Cuba	—	—	..	17	—	—
	Jordan	—	—	..	9	—	—
	Total	..	203	..	110	..	217
		(kg)	(\$000)	(kg)	(\$000)	(kg)	(\$000)
8545.20	Carbon or graphite brushes						
	United States	73 869	8 651	70 850	8 542	107 457	9 561
	Germany	7 289	33	181	1	7 047	228
	United Kingdom	21 791	133	61 741	435	4 390	183
	Peru	11 801	69	10 763	97	10 886	97
	France	5 724	27	140 381	450	5 388	80
	Netherlands	16 151	92	13 388	76	11 190	69
	Trinidad and Tobago	—	—	1 177	5	267	65
	Chile	13 259	130	10 709	77	9 064	54
	Taiwan	—	—	6 510	43	6 600	47
	United Arab Emirates	78	...	130	...	1 400	47
	Spain	9 273	64	8 533	68	6 516	47
	Cuba	365	2	4	...	75	43
	Belgium	—	—	239	...	5 156	39
	Australia	6 566	32	5 392	14	16 870	38
	Colombia	6 864	43	6 283	37	3 638	30
	South Africa	17 115	152	7 284	150	2 125	27
	Mexico	—	—	—	—	2 570	23
	China	25 163	118	31 258	116	2 000	17
	Israel	4 000	32	5 710	39	2 500	17
	Botswana	—	—	—	—	1 952	11
	Hong Kong	3 256	36	3 316	16	1 580	9
	Egypt	—	—	—	—	1 809	8
	Cameroon	—	—	—	—	1 160	8

TABLE 1 (cont'd)

		2003		2004 (r)		2005 (p)	
		(kg)	(\$000)	(kg)	(\$000)	(kg)	(\$000)
EXPORTS (cont'd)							
	Italy	87	...	720	5	344	8
	Kazakhstan	—	—	880	4	200	8
	Vietnam	10 346	47	3 171	20	1 213	8
	Ivory Coast	—	—	—	—	1 000	6
	Dominican Republic	—	—	—	—	734	6
	Indonesia	104	...	—	—	111	6
	Guinea	870	5	1 560	10	876	5
	Brazil	—	—	100	1	20	4
	Iceland	—	—	80	2	264	4
	Mauritania	—	—	—	—	13	3
	New Zealand	481	2	639	2	777	2
	Slovenia	—	—	—	—	992	2
	Argentina	—	—	—	—	1 600	1
	Oman	98	...	—	—	102	1
	Venezuela	—	—	—	—	2 500	1
	Japan	100	1	..	...	15	...
	Jamaica	—	—	18	...	4	...
	Switzerland	26	...	5	...	10	...
	Philippines	—	—	159	1	100	...
	Saudi Arabia	512	2	5 136	17	172	...
	Barbados	—	—	—	—	5	...
	Greece	7	...	19	...	64	...
	Finland	71	...	241	1	110	...
	Malaysia	—	—	—	—	19	...
	Norway	—	—	—	—	10	...
	South Korea	290	18	428	2	—	—
	Uruguay	850	6	—	—	—	—
	Austria	—	—	65	...	—	—
	Iran	1 503	7	—	—	—	—
	Kyrgyzstan	4	...	—	—	—	—
	Turkey	4	...	5 000	34	—	—
	Iraq	—	—	10	...	—	—
	India	628	3	104	2	—	—
	Poland	31	...	—	—	—	—
	Singapore	30	...	1 963	9	—	—
	Senegal	1 000	6	—	—	—	—
	Turks and Caicos Islands	12	...	—	—	—	—
	Denmark	2 676	13	2 336	7	—	—
	Sweden	806	4	—	—	—	—
	Total	243 100	9 728	406 483	10 283	222 895	10 813
	Total exports	..	33 477	..	30 600	..	29 745
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS							
2504.10	Natural graphite in powder or flake						
	United States	1 789	1 426	1 894	1 457	1 239	1 380
	China	458	366	276	300	334	334
	Germany	5	7	4	8	111	139
	Japan	103	114	10	109	67	61
	Mexico	226	128	122	68	50	25
	Belgium	5	13	4	12	2	4
	Brazil	—	—	—	—	..	1
	Italy	...	...	—	—	...	...
	Switzerland	16	35	5	14	..	...
	India	—	—	—	—	1	...
	United Kingdom	—	—	—	—	..	...
	Austria	...	...	...	...	—	—
	Canada	2	3	—	—	—	—
	Spain	1	1	29	2	—	—
	Swaziland	..	...	—	—	—	—
	Taiwan	1	...	—	—	—	—
	Sweden	—	—	21	36	—	—
	Total	2 606	2 093	2 365	2 006	1 804	1 944
2504.90	Natural graphite, n.e.s.						
	China	746	1 800	940	2 192	1 439	2 303
	United States	383	378	332	312	447	386
	Germany	46	75	14	30	29	27
	Japan	..	1	—	—	7	7
	Austria	—	—	..	1	25	3
	Finland	7	1	—	—	..	...
	Guyana	2	...	—	—	...	...
	Switzerland	—	—	...	...	...	...

TABLE 1 (cont'd)

		2004		2005 (r)		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
	Guam	—	—	—	—	..	...
	Nicaragua	—	—	—	—	...	...
	Spain	—	—	—	—	...	...
	Sweden	—	—	—	—	...	...
	Belgium	1	...	—	—	—	—
	Dominican Republic	3	1	—	—	—	—
	Tanzania	...	...	—	—	—	—
	United Kingdom	12	26	...	...	—	—
	Eritrea	—	—	...	...	—	—
	Italy	—	—	1	3	—	—
	Russia	—	—	63	28	—	—
	Total	1 200	2 282	1 350	2 566	1 947	2 726
6902.90	Refractory bricks, etc., n.e.s. (containing by weight more than 50% carbon or graphite)						
	United States	16 777	10 527	37 241	10 117	17 308	11 099
	China	1 542	3 296	14 512	3 929	2 416	4 327
	United Kingdom	1 512	2 921	1 982	3 584	436	1 902
	Germany	7 071	5 918	139	412	247	799
	Italy	2 268	133	7 624	796	222	474
	France	7 639	6 635	42	128	24	341
	Mexico	182	113	21	42	1 295	213
	Brazil	576	37	85	137	85	117
	Belgium	31	124	378	97	26	114
	Denmark	1 979	1 890	218	275	49	69
	India	3	3	—	—	39	23
	Austria	...	...	95	123	2	13
	Spain	37	30	103	85	6	11
	Japan	55	98	2	4	29	10
	Morocco	—	—	—	—	1	8
	Canada	2	...	15	8	1	7
	Australia	2	1	8	4	3	5
	Portugal	—	—	—	—	1	2
	Norway	4	21	3	22	1	1
	Israel	—	—	—	—	..	...
	Mozambique	—	—	—	—	..	...
	Vietnam	—	—	—	—	..	...
	Netherlands	1 176	959	137	616	—	—
	Czech Republic	...	...	—	—	—	—
	Poland	1	2	—	—	—	—
	Switzerland	380	219	3	16	—	—
	Taiwan	...	...	—	—	—	—
	Thailand	5	44	—	—	—	—
	Turkey	..	...	—	—	—	—
	Ukraine	...	...	—	—	—	—
	Zimbabwe	2	6	—	—	—	—
	Ethiopia	—	—	...	...	—	—
	Hong Kong	—	—	1 306	28	—	—
	Sri Lanka	—	—	4	4	—	—
	Sweden	—	—	...	2	—	—
	Argentina	..	1	—	—	—	—
	Total	41 244	32 978	63 918	20 429	22 191	19 535
		(kg)	(\$000)	(kg)	(\$000)	(kg)	(\$000)
6903.10	Refractory ceramic goods, n.e.s., containing more than 50% or graphite or other forms of carbon, etc. (including crucibles)						
	United States	67 767	1 467	48 349	1 600	93 429	1 594
	United Kingdom	16 020	468	25 172	586	33 839	750
	Germany	452	223	917	393	772	291
	France	239	44	317	97	498	122
	Canada	—	—	—	—	163	47
	Brazil	1	8	170	35	53	26
	Australia	3	4	2	5	15	19
	Morocco	—	—	—	—	1	8
	Mexico	—	—	1 619	3	692	5
	Finland	3	1	9	1	26	4

TABLE 1 (cont'd)

		2004		2005 (r)		2006 (p)	
		(kg)	(\$000)	(kg)	(\$000)	(kg)	(\$000)
IMPORTS (cont'd)							
	Japan	—	—	1	...	37	4
	Italy	36	3	6	1	6	2
	China	1 753	46	—	—	3	1
	Taiwan	27	3	..	2	80	1
	Ghana	1	...	—	—	—	—
	India	2	2	—	—	—	—
	South Korea	5	2	—	—	—	—
	Netherlands	1	...	—	—	—	—
	Sweden	14	10	2	...	—	—
	Total	86 324	2 281	76 564	2 723	129 614	2 874
8545.20	Carbon or graphite brushes						
	United States	377 693	7 298	947 835	6 330	285 131	6 262
	Japan	37 929	433	53 534	447	38 346	797
	Germany	18 893	551	19 233	848	16 088	658
	China	3 618	280	49 051	444	33 448	459
	United Kingdom	20 762	535	16 487	291	10 017	327
	Brazil	3 622	127	4 058	161	6 550	155
	Canada	3 350	54	3 307	83	2 777	105
	France	6 911	452	9 887	278	3 383	103
	Sweden	847	55	5 165	62	3 082	102
	Austria	2 647	36	3 094	40	1 594	37
	India	124	7	474	30	893	36
	Thailand	1 316	22	996	22	23 294	27
	Italy	671	23	1 420	24	1 031	19
	Taiwan	9 956	34	8 829	31	1 175	18
	Mexico	667	21	1 428	41	868	17
	Switzerland	517	15	758	17	402	15
	Denmark	28	1	105	2	496	12
	South Korea	642	18	706	15	274	12
	Netherlands	2 828	179	3 176	119	213	7
	Belgium	59	1	178	4	161	6
	Ireland	33	1	168	7	136	5
	Slovenia	61	7	617	8	461	5
	Australia	737	4	209	3	158	4
	Czech Republic	101	1	57	1	62	3
	Spain	180	1	512	1	250	3
	Hungary	97	1	44	...	42	1
	Slovakia	271	13	248	8	22	1
	Hong Kong	6	...	110	1	4	...
	Argentina	1	...	—	—	43	...
	Gabon	—	—	—	—	7	...
	Norway	38	1	215	1	2	...
	Finland	—	—	31	1	2	...
	Romania	4	...	19	...	2	...
	Bulgaria	—	—	1	...	3	...
	Cameroon	—	—	—	—	5	...
	Malaysia	—	—	29	...	10	...
	Kenya	—	—	—	—	26	...
	U.S. Minor Outlying Islands	—	—	—	—	3	...
	South Africa	2	...	—	—	—	—
	Vietnam	..	...	..	...	—	—
	Costa Rica	—	—	100	1	—	—
	Croatia	—	—	...	...	—	—
	Poland	15	...	—	—	—	—
	Israel	—	—	10	...	—	—
	Philippines	—	—	8	...	—	—
	Singapore	—	—	96	2	—	—
	Sri Lanka	—	—	9	1	—	—
	Suriname	—	—	24	1	—	—
	Tunisia	—	—	1	...	—	—
	Turkey	—	—	...	...	—	—
	Sierra Leone	7	...	13	...	—	—
	Indonesia	..	...	1	...	—	—
	Total	494 633	10 171	1 132 243	9 325	430 461	9 196
	Total imports	..	49 805	..	37 049	..	36 275

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; ... Amount too small to be expressed; n.e.s. Not elsewhere specified; (p) Preliminary; (r) Revised; x Confidential.

Note: Numbers may not add to totals due to rounding.

TABLE 2. REPORTED USE (1) OF GRAPHITE IN CANADA, 2000-2005

	2000	2001	2002	2003	2004	2005 (p)
	(tonnes)					
Natural graphite						
Foundry facing	2 496	2 170	2 217	2 387	2 312	2 394
Refractories	x	x	x	—	x	x
Other uses (2)	x	x	x	1 294	x	x
Synthetic graphite						
Foundry facing	2 597	1 992	1 943	1 650	1 954	1 759
Other uses (3)	7 152	7 331	8 515	9 343	10 324	10 496
Total	14 955	13 297	14 137	14 674	15 877	15 982

Source: Natural Resources Canada.

— Nil; (p) Preliminary; x Confidential.

Notes: (1) Reported from NRCan survey on the use of nonmetallic minerals by Canadian manufacturing plants. (2) Includes brake linings, chemicals, abrasives, primary steel, and other end uses. (3) Includes abrasives, batteries, bearings and brake linings, cement, chemicals, primary steel, and other uses.

Note: Numbers may not add to totals due to rounding.

Gypsum and Anhydrite

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INTRODUCTION

Pure gypsum, calcium sulphate dihydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), is a fine-grained white mineral that occasionally is grey or brown in its impure state. It forms in large marine basins where, by processes of evaporation and precipitation, substantial thicknesses of primary gypsum can form. When buried, it converts to anhydrite (CaSO_4), which subsequently reconverts to gypsum when exposed to surface weathering. Most deposits consist of layers of gypsum, often intercalated with shale and usually underlain by anhydrite. Gypsum has a specific gravity of 2.32 and a hardness of 2.

Gypsum is one of the oldest building materials known, having first been used around 6000 B.C. in Anatolia (modern-day Turkey). The Egyptians used gypsum plaster as a jointing material during construction of the Pyramids. In the 1700s, France started to make extensive use of "Plaster of Paris" in the interior walls of wooden homes as protection against fire. Uncalcined gypsum is used in cement manufacturing and as a fertilizer and soil conditioner.

When gypsum is processed, it is ground to a fine powder called "landplaster" and then heated in a calcining kettle at 280°-320°C to drive off 75% of the contained water, forming calcium sulphate hemihydrate ($\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O}$), commonly called stucco. When stucco is recombined with water, it dries and hardens into a variety of shapes. The most common form of gypsum, β -gypsum (beta-gypsum), is calcined under atmospheric pressure. A more refined product, α -gypsum (alpha-gypsum), is produced in a reactor under elevated pressures. It is used for specialized applications such as dental molds. Wallboard, or drywall, is manufactured by applying a stucco paste between two sheets of backing paper. It has unique fire-resistance and insulation properties.

Synthetic gypsum is produced as a by-product of several industrial processes, most commonly from flue gas scrubbers at coal-fired power generation stations (commonly called flue-gas desulphurization, or FGD gypsum). With increased availability due to stricter environmental controls on emissions, synthetic gypsum is becoming a more common substitute for natural mined gypsum in wallboard manufacture. It can also be produced from sulphate-route titanium production and other acid neutralization processes.

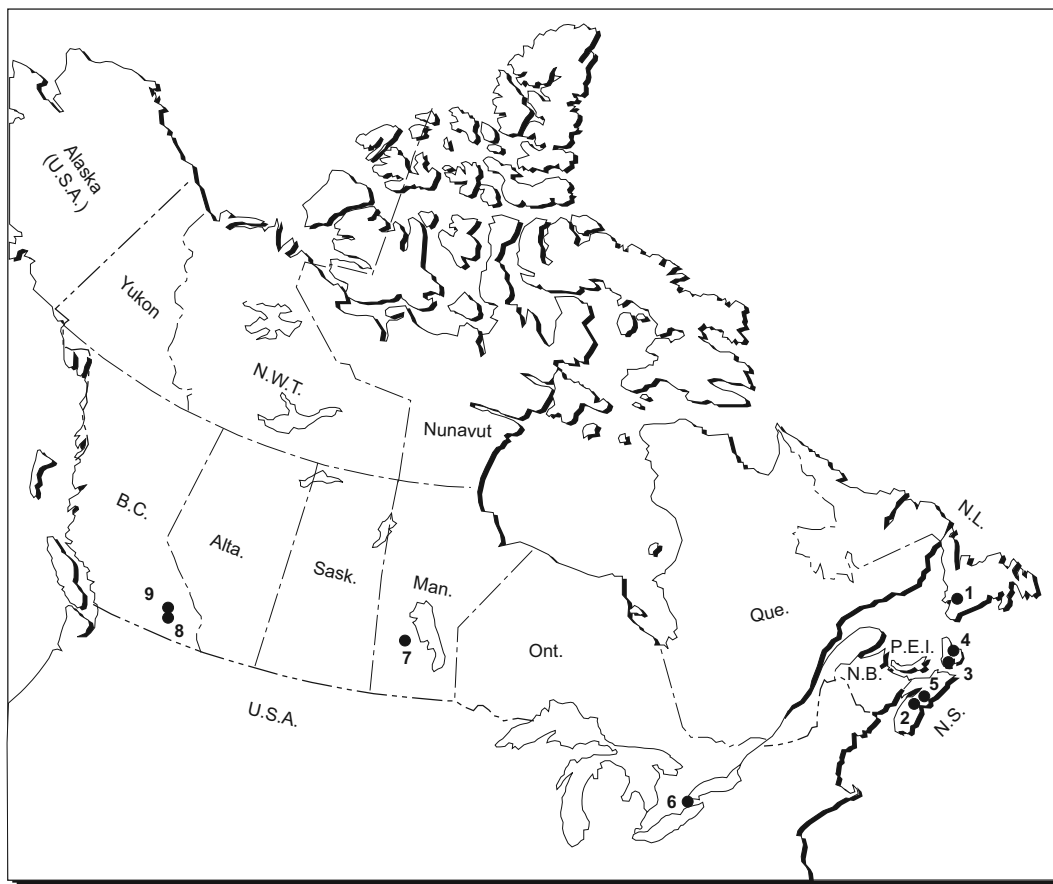
CANADIAN INDUSTRY

Shipments of natural gypsum from Canadian mines in 2006 totaled an estimated 9.07 Mt valued at \$123.9 million (Table 1). This amount compares to 8.56 Mt valued at \$113.9 million in 2005, representing a 5.8% increase in the volume of shipments. The volume of gypsum shipped from Nova Scotia mines increased by 6.7%. Figure 2 shows the trend in production since 1994. The Canadian gypsum industry employs about 1900 workers. The gypsum mines and related wallboard production plants are listed in Table 2.

Natural gypsum is mined in five provinces in Canada, as shown in Figure 1. Nova Scotia is the leading producer with an estimated 7.73 Mt produced in 2006, compared to 7.24 Mt in 2005. National Gypsum Co. operates a large open-pit mine at Milford Station, Nova Scotia. CGC Inc., based in Mississauga, Ontario, is a subsidiary of USG Corporation. It operates an underground mine in Hagersville, Ontario, and wallboard manufacturing plants in Montréal, Quebec, and in Hagersville. It also operates joint compound plants in Hagersville and in Calgary, Alberta.

Little Narrows Gypsum Co. and Fundy Gypsum Co. are both subsidiaries of USG Canadian Mining Ltd. Little Narrows operates a gypsum mine at Little Narrows on Cape Breton Island, Nova Scotia, while Fundy Gypsum operates mines at Wentworth and Miller Creek in Nova Scotia. Georgia-Pacific Canada Inc., now a wholly owned subsidiary of Koch Forest Products Inc. of Wichita, Kansas, mines gypsum at Melford, Inverness County, Nova Scotia, and at Canal Flats, British Columbia. Compagnie de Saint-Gobain SA of France, with its purchase of BPB Canada Inc., mines gypsum in Manitoba and British Columbia and manufactures wallboard in six provinces. It operates under

Figure 1
Gypsum Producers in Canada, 2006



1. Galen Gypsum Mines Limited, Coal Brook, N.L.
2. Fundy Gypsum Company, Wentworth and Miller Creek, N.S.
3. Georgia-Pacific Canada Inc., Melford, N.S.
4. Little Narrows Gypsum Company, Little Narrows, N.S.
5. National Gypsum (Canada) Ltd., Milford Station, N.S.
6. CGC Inc., Hagersville, Ont.
7. Certainteed Gypsum Canada Inc., Amaranth, Man.
8. Georgia-Pacific Canada Inc., Canal Flats, B.C.
9. Certainteed Gypsum Canada Inc., Windermere, B.C.

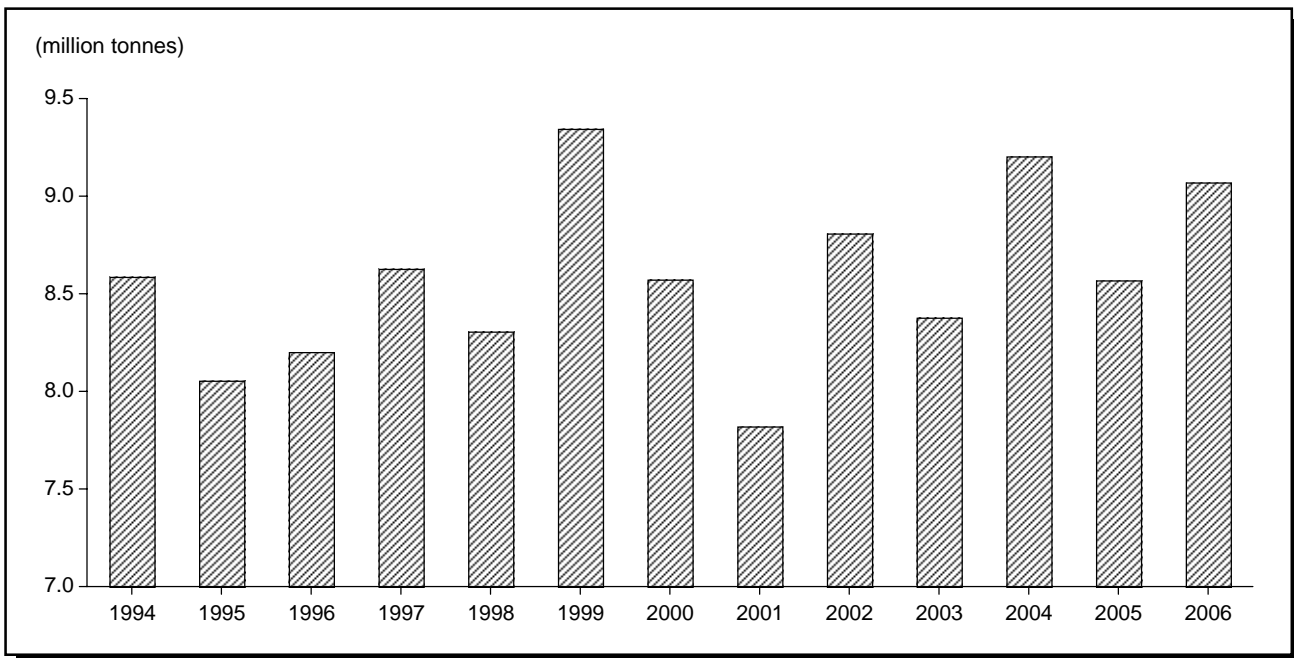
the name Certainteed Gypsum Canada Inc. Galen Gypsum Mines Limited produces gypsum at Coal Brook and Lafarge Gypsum Canada Inc. manufactures wallboard at Corner Brook, both in Newfoundland and Labrador.

Nova Scotia accounts for about 85% of Canada's natural gypsum production and for nearly all of the country's gypsum exports. The gypsum mines in Nova Scotia are open-pit mines that provide high-quality, low-cost raw material. The majority of Nova Scotia production is shipped by ocean freighter to wallboard plants along the U.S. eastern seaboard.

Construction continued at the 350 million-sq.-ft./y gypsum wallboard plant owned by J.D. Irving Ltd. of Saint John, New Brunswick, located on the site of a former shipyard in Saint John. The plant will use synthetic gypsum produced at NB Power's Coleson Cove oil-fired generating station, which has recently been refurbished with a wet limestone scrubber system. Wallboard production is scheduled to start in the fall of 2007.

Nova Scotia Power is planning to install wet flue gas desulphurization equipment at its Lingan generating station in Cape Breton, Nova Scotia. The plan involves the installation of scrubbers at two 150-MW units in order to

Figure 2
Canadian Gypsum Production, 1994-2006



Source: Natural Resources Canada.

reduce sulphur emissions by 95%. The modifications are estimated to cost \$170 million. Synthetic gypsum from this process could be used to make wallboard in eastern Canada.

In October 2006, Eagle Plains Resources Ltd. completed an option-to-purchase agreement with CGC Inc. whereby CGC has the right to acquire a 100% interest in the Coyote Creek gypsum project, located 50 km northeast of Cranbrook, British Columbia. The property covers gypsum occurrences hosted within the Burnais Formation. A recent drilling program returned an average gypsum thickness of 31 m, with gypsum purity reportedly at up to 87%.

Federal Gypsum Company has commenced production at its 275 million-sq.-ft./y wallboard plant at Port Hawkesbury, Nova Scotia. The site was a former fibre-board panel plant, once owned by USG Corporation, that closed in 2002. Federal Gypsum plans to market its products in eastern Canada and New England.

National Gypsum Co. has announced plans to expand by 50% the capacity of its PermaBase cement backerboard plant in Bromont, Quebec. The plant was purchased by National Gypsum from Unifix Inc. in 1998. Cement backerboard is used as an underlay for floor tiles, walls, and countertops.

USG Corporation reported that its Canadian subsidiary, CGC Inc., posted a 6% increase in net sales while operating profits dropped 13% due to lower volume and higher manufacturing costs.

According to the Gypsum Association, Canadian wallboard manufacturers shipped 3.371 billion sq. ft. of wallboard during 2006.

USE

The main uses for calcined gypsum are wallboard (also known as drywall or plasterboard), joint compounds, and in art and dental plasters. The average 2000-sq.-ft. home uses about 7.3 t of gypsum in 570 m² of wallboard. Gypsum can also be used for industrial mold making and as a cementing agent in oil well drilling muds. Uncalcined gypsum is used as a set retarder in the manufacture of portland cement and as a soil conditioner and fertilizer additive in agricultural applications. It also acts as a binder in food processing, as an animal feed carrier, and as an inert extender in pharmaceutical applications.

The consumption of natural and synthetic gypsum in wallboard is largely driven by residential and commercial construction activity in Canada and the United States. In North America, wallboard manufacturing accounts for

an estimated 75% of gypsum use, cement manufacture accounts for 10-15%, and agriculture and industrial processes account for the remainder of uses.

TRADE

Canadian gypsum producers exported 7.38 Mt of uncalcined gypsum to the United States in 2006, compared with 7.63 Mt in 2005, a 3.4% decrease. According to U.S. Geological Survey figures, the United States gets approximately 68% of its imported gypsum from Canada. The trend in Canadian gypsum exports for the period 1994-2006 can be seen in Figure 3. Exports increased steadily during the 2002-05 period before declining in 2006. Canadian wallboard manufacturers exported 49.8 million m² of wallboard in 2006, compared with 82.2 million m² the previous year (Table 1). This dramatic decline in wallboard exports is partly due to the deterioration of the U.S. housing market during the second half of 2006. Wallboard exports for the 1994-2006 period are shown in Figure 4. The total export value for gypsum products was \$252.6 million, an increase of 13.3% over the previous year.

Imports of both raw gypsum and wallboard from the United States are small in relation to exports (Figure 3 and Table 1). The total value of gypsum product imports was \$94.1 million. The apparent use of gypsum in Canada increased by 771 000 t in 2006, as shown in Table 2.

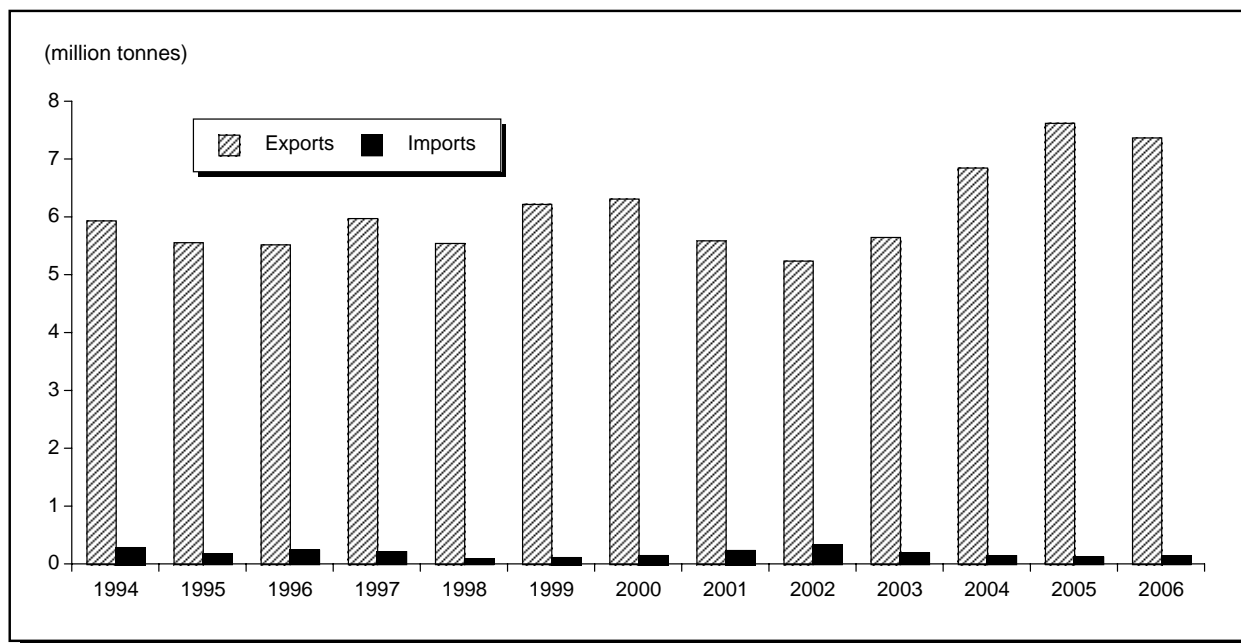
WORLD OVERVIEW

World production of gypsum in 2006 is an estimated 119 Mt (Table 5, from U.S. Geological Survey data). The United States was ranked number one with production of 21.2 Mt, followed by Iran, 13.0 Mt; Spain, 11.5 Mt; Canada, 9.1 Mt; and China and Mexico, each producing 7.4 Mt. Figure 5 shows world gypsum production for 2004-06. U.S. wallboard plants shipped 35.028 billion sq. ft. of wallboard products in 2006, a 3% decrease from the previous year.

USG Corporation emerged from Chapter 11 bankruptcy protection, effective June 20, and created an asbestos trust that will be responsible for compensating asbestos personal injury claimants. The trust is funded by \$900 million in cash and a contingent note for a further \$3.05 billion. The company shipped 10.8 billion sq. ft. (bsf) of wallboard in 2006, down 4% from the previous year (USG Corporation 2006 annual report). The company reports that capacity utilization rates for the fourth quarter of 2006 declined to 79% versus 98% for the same period in 2005, as the industry was affected by the downturn in housing in the United States that commenced during the second half of 2006.

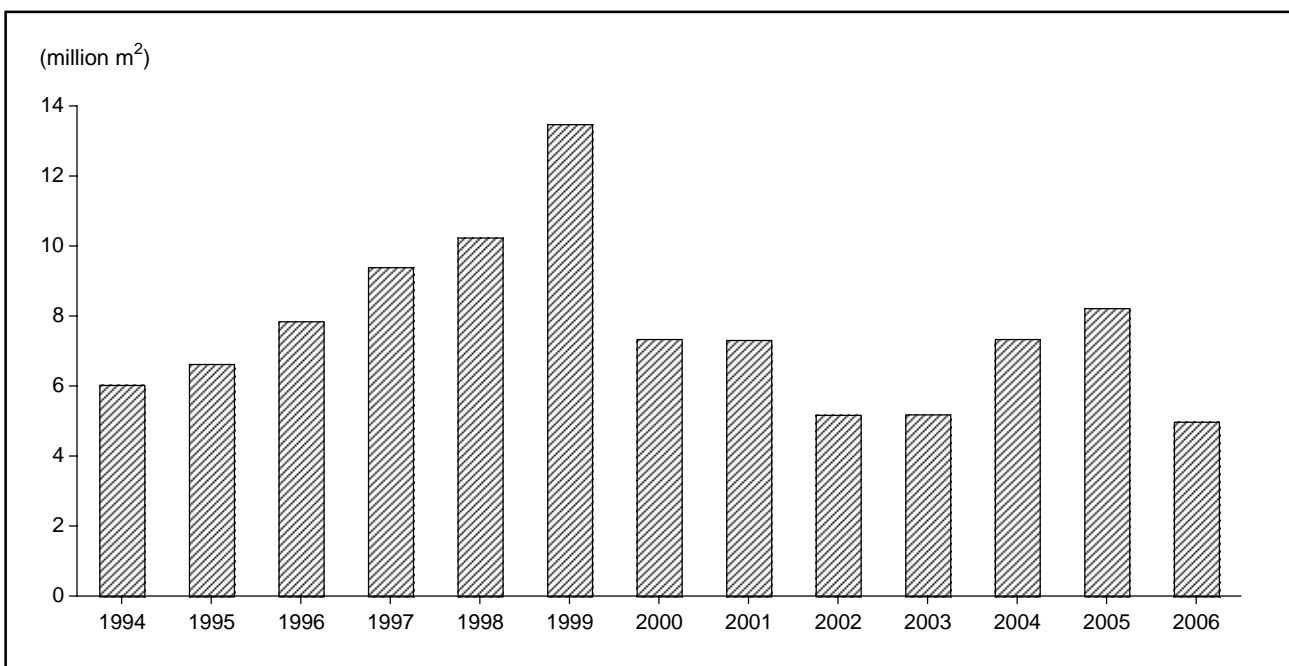
BPB Inc. was fully consolidated into Compagnie de Saint-Gobain SA of France, as of December 1, 2005.

Figure 3
Canadian Gypsum Trade, 1994-2006



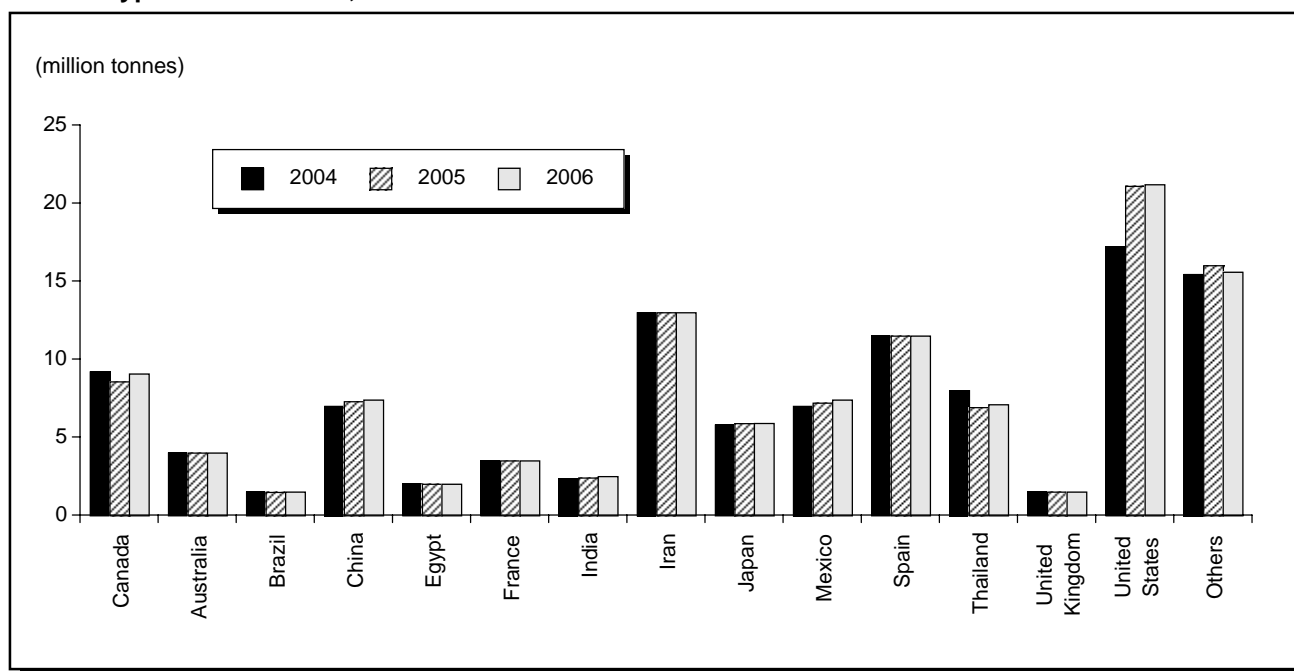
Source: Natural Resources Canada.

Figure 4
Gypsum Wallboard Exports, 1994-2006



Source: Natural Resources Canada.

Figure 5
World Gypsum Production, 2004-06



Source: U.S. Geological Survey.

SYNTHETIC GYPSUM AND RECYCLING

In the gypsum industry, the use of synthetic gypsum and recycled gypsum products continued the growth trend of previous years. Synthetic gypsum, also known as FGD (flue gas desulphurization) gypsum, continues to be used in the manufacture of wallboard in many U.S. plants. FGD gypsum is produced by coal-fired power generating stations through the scrubbing of exhaust gases. Sulphur is contained in the coal and is oxidized into SO_2 when the fuel is burned. As a result of increasingly strict environmental regulations, such as the Clean Air Interstate Rule, U.S. utility companies continue to add scrubbers to existing generating units. These scrubbers use either limestone or lime to produce calcium sulphite or synthetic calcium sulphate.

According to the American Coal Ash Association, synthetic gypsum production in the United States in 2005 was 11.975 Mt from 18 coal-fired power plants. This figure is up slightly from 2004. In terms of overall use percentage, 77.4% of synthetic gypsum produced in 2005 was used, up from 75.7% in 2004. A total of 8.178 Mt of synthetic gypsum was used to make wallboard in 2005. Synthetic gypsum is also produced at sulphate-route titanium dioxide plants in Canada at Varennes, Quebec, and in the United States.

In Canada, synthetic gypsum is produced, via the wet limestone process, at two coal-fired power stations. Ontario Power Generation Inc. produces by-product gypsum at its Lambton generating station south of Sarnia, Ontario, and sells the product to the Certainteed Gypsum Canada Inc. wallboard plant at Mississauga, Ontario. NB Power produces synthetic gypsum at its Belledune generating station near Bathurst, New Brunswick, and ships to the CGC Inc. wallboard plant in Montréal, Quebec. All the by-product gypsum produced is used in the cement and wallboard industries, as shown in Table 4.

In 2006, electric power utilities in the United States continued to announce plans to add scrubbers that will produce by-product gypsum. The companies include Mirant Corp. of Atlanta, Georgia; Ohio Valley Electric Corp. of Piketon, Ohio; Minnesota Power of Duluth, Minnesota; Ameren Corp. of St Louis, Missouri; Allegheny Energy of Greensburg, Pennsylvania; and Reliant Energy Inc. of Houston, Texas. For example, Allegheny Energy will invest US\$550 million to install flue gas desulphurization scrubber equipment on three 576-MW units at its Hatfield's Ferry generating station near Masontown, Pennsylvania. Approximately 1.5 million tons per year of by-product gypsum will be produced.

PRICES

Prices for gypsum in the merchant market are negotiated between supplier and user and are not generally published.

From Table 1, the value of gypsum production is equivalent to C\$13.65/t, up slightly from the previous year. According to the U.S. Geological Survey, crude gypsum f.o.b. mine averaged US\$7.50 per short ton (st) in 2006, up slightly from 2005, while calcined gypsum averaged US\$20.50/st.

U.S. Gypsum, the largest manufacturer of gypsum products in the United States, reported that the nationwide average realized selling price for SHEETROCK(R) brand gypsum wallboard was \$180.59/1000 sq. ft. in 2006, up 25% from the previous year.

Industry wallboard selling prices began to decline in the second half of 2006 in response to weakening demand in the residential housing sector. Further declines in prices are expected for 2007.

OUTLOOK

As a measure of construction growth potential, the key driver of the gypsum wallboard industry, Statistics Canada reported that housing starts increased to 227 395 units in 2006, compared to 225 481 units in 2005 (Statistics Canada CANSIM table 027-0008). Decreases in the 6-7% range were posted in Ontario and Quebec. Growth continued in the western provinces with increases in Alberta (19.8%) and British Columbia (5.1%).

Following a downturn in housing starts that commenced in mid-2006, Canada Mortgage and Housing Corporation is predicting a further decline in 2007 in the order of 10%, bringing total estimated starts to 210 000.

Canadian shipments of gypsum in 2007 are expected to maintain current levels or decline slightly, while exports to the U.S. market are expected to decline due to a continuing soft residential housing sector. Wallboard production levels should decline by 10-15% in both the Canadian and U.S. markets. Exports of wallboard south of the border may also be negatively affected due to new wallboard capacity along the eastern seaboard that will utilize synthetic gypsum and due to overcapacity at other U.S. plants.

Production of synthetic gypsum, mainly in the northeastern United States, is expected to continue to increase as electric utility companies add SO_2 scrubber systems to existing power plants. This will offset the use of natural gypsum in wallboard, which over the long term may reduce exports of Canadian natural gypsum south of the border.

ANHYDRITE

Anhydrite (CaSO_4) is the anhydrous form of gypsum. It has a grey to blue-grey colour, a hardness of about 3.5 (compared to gypsum at 2), and is more dense than gypsum with a specific gravity of 2.98. It typically occurs

below gypsum beds with the overlying gypsum having been formed by the weathering of a thicker anhydrite layer and is generally excluded from gypsum mining. Production and trade data for anhydrite are included with gypsum (Table 1). Anhydrite is produced by Fundy Gypsum Company at Wentworth, Nova Scotia, and by Little Narrows Gypsum Company at Little Narrows, Nova Scotia.

Shipments of anhydrite, mainly to the United States, are used as a soil conditioner and fertilizer, and in portland cement manufacture. The mineral has also been used for roof support in underground mining applications, where it sets up like cement and can be blown into mining cavities that need to be sealed.

RELEVANT GYPSUM INDUSTRY WEB SITES

Certainteed Gypsum Canada Inc.
www.bpb-na.com
CGC Inc.
www.cgcinc.com
Georgia-Pacific Canada Inc.
www.gp.com
Lafarge Gypsum Canada Inc.
www.lafarge-na.com

National Gypsum (Canada) Ltd.
www.nationalgypsum.com
New West Gypsum Recycling Ltd.
www.nwgysum.com
The Gypsum Association
www.gypsum.org
USG Corporation
www.usg.com

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
25.20	Gypsum; anhydrite; plasters whether or not coloured, with or without small quantities of accelerators or retarders						
2520.10	Gypsum; anhydrite	Free	Free	Free	Free	Free	Free
2520.20	Plasters	Free	Free	Free	Free	Free	Free
6809.11.10	Articles of plaster or of compositions based on plaster: boards, sheets, panels, tiles and similar articles, not ornamented: faced or reinforced with paper or paperboard only: gypsum wallboard	6%	Free	Free	Free	1.7%	Free
6809.19	Articles of plaster or of compositions based on plaster: boards, sheets, panels, tiles and similar articles, not ornamented: other	6.5%	3%	Free	Free	1.7%	Free
6809.90	Articles of plaster or of compositions based on plaster: other articles	Free-6.5%	Free-3%	Free	Free	1.7%	Free

Sources: Canadian Customs Tariff, effective January 2007, Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2007; Official Journal of the European Union (October 17, 2006 Edition); Customs Tariff Schedules of Japan, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, GYPSUM PRODUCTION AND TRADE, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION (Shipments)							
Crude gypsum							
Newfoundland and Labrador	x	x	x	x	x	x	x
Nova Scotia	7 710	110	93 102	7 244	990	7 732	590
Ontario	x	x	x	x	x	x	x
Manitoba	x	x	x	x	x	x	x
British Columbia	x	x	x	x	x	x	x
Total (1)	9 204	636	112 499	8 569	526	113 928	9 071 939
EXPORTS							
2520.10 Gypsum, anhydrite, uncalcined							
United States	6 844	264	87 038	7 626	422	96 280	7 374 626
United Kingdom	966	76	3 711	167	1 560	70	1 560
Israel	629	38	718	33	1 414	64	1 414
Brazil	—	—	—	—	294	20	294
Hong Kong	197	10	1 300	59	418	19	418
France	521	28	1 113	50	230	17	230
Russia	39	2	28	1	241	11	241
Malaysia	205	10	92	4	178	8	178
Japan	—	—	27	1	115	7	115
Singapore	301	18	135	6	144	6	144
Kuwait	—	—	—	—	102	5	102
Mexico	133	8	29	1	107	5	107
North Korea	—	—	—	—	...	4	...
Germany	477	23	628	28	40	2	40
Chile	—	—	71	3	53	2	53
South Korea	66	4	104	5	...	1	...
Colombia	14	1	—	—	24	1	24
Other countries	7 471	348	1006	45	—	—	—
Total	6 855	283	87 604	7 635	384	96 683	7 379 546
2520.20 Gypsum, anhydrite, plasters							
Latvia	127	68	630	232	1 135	449	1 135
United States	1 263	713	1 829	1 179	489	403	489
Bermuda	104	50	119	63	147	71	147
Italy	—	—	—	—	47	55	47
Sweden	—	—	—	—	36	33	36
Japan	19	15	19	11	44	29	44
Pakistan	16	13	—	—	37	27	37
Taiwan	—	—	29	21	34	26	34
Czech Republic	46	26	90	43	48	17	48
Chile	—	—	—	—	16	14	16
Cayman Islands	—	—	—	—	7	5	7
Germany	20	17	7	4	6	3	6
China	13	2	—	—	4	2	4
Cuba	130	82	74	42	4	2	42
Croatia	—	—	—	—	4	2	4
Saint Vincent and the Grenadines	1	1	2	1	3	2	3
United Arab Emirates	—	—	—	—	1	1	1
Antigua and Barbuda	5	2	—	—	2	1	2
Grenada	3	2	8	5	2	1	5
Other countries	800	427	385	213	2	—	213
Total	2 547	1 418	3 192	1 814	2 068	1 143	2 068
		(m ²)	(\$000)	(m ²)	(\$000)	(m ²)	(\$000)
6809.11 Plasterboards, etc., not ornamental, faced or reinforced with paper or paperboard							
United States	73 279	149	71 986	81 434	123	81 471	49 476 766
Denmark	—	—	—	—	—	—	210 800
Cuba	67 789	286	34 116	107	55 749	186	55 749
Jamaica	6 628	21	18 319	46	21 988	106	21 988
Saint Pierre and Miquelon	14 967	47	13 082	40	8 478	39	8 478
Bermuda	9 928	30	16 486	46	9 141	32	9 141
Turks and Caicos Islands	—	—	—	—	5 743	22	5 743
Saint Kitts and Nevis	951	2	1 883	5	5 327	19	5 327
Croatia	2 386	7	3 418	9	2 348	9	2 348
Barbados	—	—	—	—	1 783	7	1 783
Romania	—	—	—	—	1 091	4	1 091
Japan	8 636	31	7 234	25	1 017	4	1 017
Bosnia-Herzegovina	—	—	—	—	624	2	624
Colombia	—	—	11 524	29	41	1	41
Other countries	45 563	181	742 402	1 341	190	—	1 341
Total	73 435	997	72 591	82 282	587	83 119	49 801 086

Item No.		2004		2005		2006 (p)	
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
EXPORTS (cont'd)							
6809.19	Plasterboards, etc., not ornamental, faced or reinforced, n.e.s.						
	United States	n.a.	6 556	n.a.	8 960	n.a.	15 504
	Chile	n.a.	108	n.a.	218	n.a.	273
	Sweden	—	—	—	—	n.a.	194
	Germany	—	—	—	—	n.a.	122
	China	—	—	n.a.	23	n.a.	67
	Switzerland	—	—	—	—	n.a.	42
	Cayman Islands	—	—	—	—	n.a.	42
	Saint Kitts and Nevis	—	—	—	—	n.a.	40
	France	n.a.	31	n.a.	109	n.a.	37
	Finland	—	—	n.a.	15	n.a.	28
	Venezuela	—	—	—	—	n.a.	16
	Hong Kong	—	—	n.a.	6	n.a.	12
	Other countries	—	173	—	166	—	15
	Total	n.a.	6 868	n.a.	9 497	n.a.	16 392
6809.90	Articles of plaster or compositions based on plaster						
	United States	n.a.	31 998	n.a.	30 201	n.a.	31 577
	Peru	—	—	—	—	n.a.	503
	United Arab Emirates	n.a.	117	n.a.	32	n.a.	443
	Italy	n.a.	24	n.a.	97	n.a.	367
	New Zealand	n.a.	219	n.a.	192	n.a.	359
	Switzerland	—	—	—	—	n.a.	353
	Bermuda	n.a.	87	n.a.	143	n.a.	281
	Netherlands	n.a.	165	n.a.	223	n.a.	220
	Australia	n.a.	125	n.a.	125	n.a.	184
	Brazil	—	—	—	—	n.a.	136
	Egypt	—	—	n.a.	3	n.a.	113
	United Kingdom	n.a.	122	n.a.	53	n.a.	98
	Finland	n.a.	122	—	—	n.a.	93
	Bahamas	—	—	n.a.	55	n.a.	91
	Chile	—	—	—	—	n.a.	67
	France	n.a.	7	n.a.	77	n.a.	61
	Turkey	—	—	—	—	n.a.	54
	Indonesia	—	—	—	—	n.a.	35
	Barbados	—	—	—	—	n.a.	33
	Russia	—	—	n.a.	24	n.a.	29
	Germany	n.a.	3	n.a.	12	n.a.	22
	Israel	n.a.	77	n.a.	10	n.a.	20
	Japan	n.a.	45	n.a.	88	n.a.	15
	Saint Kitts and Nevis	—	—	—	—	n.a.	14
	Malaysia	—	—	—	—	n.a.	14
	Ireland	—	—	n.a.	33	n.a.	14
	Hong Kong	—	—	—	—	n.a.	12
	Saudi Arabia	—	—	n.a.	10	n.a.	12
	Singapore	—	—	n.a.	17	n.a.	12
	Other countries	n.a.	1617	—	472	—	54
	Total	n.a.	34 728	n.a.	31 867	n.a.	35 286
Total exports		n.a.	203 209	n.a.	222 980	n.a.	252 680
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS							
2520.10	Gypsum, anhydrite, uncalcined						
	United States	125 920	13 093	113 397	12 168	123 156	13 239
	Mexico	26 390	1 296	13 786	1 732	15 801	2 140
	Italy	—	—	5	114	925	330
	United Kingdom	24	6	715	186	567	148
	China	28	9	3	2	252	52
	France	1	...	—	—	4	6
	Brazil	—	—	—	—	46	6
	Other countries	9	9	39	11	20	11
	Total	152 372	14 413	127 945	14 213	140 771	15 932
2520.20	Gypsum, anhydrite, plasters						
	United States	58 953	10 664	62 430	11 470	84 986	11 533
	Italy	570	239	35	71	103	409
	China	346	28	42	44	3	45
	France	247	3	2	1	9	34
	Germany	150	49	17	41	81	31
	Israel	8	6	n.a.	1	2	10
	United Kingdom	11	10	9	24	28	5
	Japan	50	6	3	4	1	4
	Other countries	206	66	6	35	2	2
	Total	60 541	11 071	62 544	11 691	85 215	12 073

TABLE 1 (cont'd)

TABLE 1 (cont'd)						
Item No.		2004		2005		2006 (p)
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.) (\$000)
IMPORTS (cont'd)						
6809.11	Plasterboards, etc., not ornamental, faced or reinforced with paper or paperboard					
	United States	n.a.	41 883	n.a.	42 892	n.a. 44 648
	United Kingdom	n.a.	3	n.a.	32	n.a. 81
	China	n.a.	...	n.a.	1	n.a. 21
	Denmark	n.a.	11	n.a.	10	n.a. 8
	Italy	—	—	n.a.	2	n.a. 4
	Thailand	—	—	n.a.	5	n.a. 4
	Other countries	—	2	—	116	— 5
	Total	n.a.	41 899	n.a.	43 058	n.a. 44 771
6809.19	Plasterboards, etc., not ornamental, faced or reinforced, n.e.s.					
	United States	n.a.	18 300	n.a.	18 677	n.a. 20 183
	Hungary	—	—	—	—	n.a. 45
	China	n.a.	16	n.a.	40	n.a. 34
	Hong Kong	—	—	—	—	n.a. 10
	France	—	—	n.a.	228	n.a. 3
	Other countries	—	1	—	31	— 4
	Total	n.a.	18 317	n.a.	18 976	n.a. 20 279
6809.90	Articles of plaster or compositions based on plaster					
	United States	n.a.	2 023	n.a.	1 230	n.a. 469
	China	n.a.	807	n.a.	311	n.a. 367
	Mexico	n.a.	515	n.a.	160	n.a. 69
	Thailand	n.a.	321	n.a.	219	n.a. 65
	United Kingdom	n.a.	248	n.a.	139	n.a. 63
	Italy	n.a.	120	n.a.	8	n.a. 19
	Philippines	n.a.	1	n.a.	2	n.a. 19
	Morocco	n.a.	1	n.a.	10	n.a. 8
	Other countries	—	148	—	81	— 32
	Total	n.a.	4 184	n.a.	2 160	n.a. 1 111
	Total imports	n.a.	89 884	n.a.	90 098	n.a. 94 166

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Amount too small to be expressed; n.a. Not applicable; n.e.s. Not elsewhere specified; (p) Preliminary; x Confidential.

(1) Totals do not include gypsum produced or shipped for use by Canadian portland cement producers.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, GYPSUM PRODUCTION, TRADE AND USE, 1988-2006

	Production (1)	Imports (2)	Exports	Apparent Use (3)
	(tonnes)			
1988 (a)	8 813 760	274 917	5 651 286	3 437 391
1989	8 179 588	291 374	5 357 055	3 113 907
1990	7 977 685	318 114	5 757 327	2 538 472
1991	6 727 221	259 863	4 940 193	2 046 891
1992	7 294 700	260 505	5 010 649	2 544 556
1993	7 563 369	280 581	5 315 618	2 528 332
1994	8 587 303	292 156	5 942 572	2 936 887
1995	8 054 741	177 326	5 565 427	2 666 640
1996	8 201 774	247 207	5 526 010	2 922 971
1997	8 627 772	220 915	5 981 974	2 866 713
1998	8 306 534	96 591	5 552 146	2 850 979
1999	9 345 342	121 049	6 224 829	3 241 562
2000	8 572 464	154 604	6 318 686	2 408 382
2001	7 821 013	243 143	5 596 557	2 467 599
2002	8 809 102	332 509	5 245 662	3 895 949
2003	8 378 326	196 212	5 654 341	2 920 197
2004	9 204 636	152 372	6 855 281	2 501 727
2005	8 569 526	127 946	7 635 384	1 062 088
2006 (p)	9 071 939	140 771	7 379 549	1 833 161

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

(a) Beginning in 1988, imports and exports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. Imports and exports include H.S. class 2520.10.00 (gypsum, anhydrite).

(1) Producers' shipments of crude gypsum. (2) Includes crude and ground, but not calcined.

(3) Production plus imports minus exports.

TABLE 3. CANADA, GYPSUM MINES AND GYPSUM PRODUCTS MANUFACTURING OPERATIONS, 2006

Company	Location	Operation
NEWFOUNDLAND AND LABRADOR		
Galen Gypsum Mines Limited	Coal Brook	Open-pit mining
Lafarge Gypsum Canada Inc.	Corner Brook	Wallboard manufacture
NOVA SCOTIA		
Fundy Gypsum Company	Wentworth and Miller Creek	Open-pit mining of gypsum and anhydrite
Georgia-Pacific Canada, Inc.	Melford	Open-pit mining
Little Narrows Gypsum Company	Little Narrows	Open-pit mining of gypsum and anhydrite
National Gypsum (Canada) Ltd.	Milford Station	Open-pit mining
NEW BRUNSWICK		
Certainteed Gypsum Canada Inc.	McAdam	Wallboard manufacture
QUEBEC		
CGC Inc.	Montréal	Wallboard manufacture
Georgia-Pacific Canada, Inc.	Montréal	Distribution terminal only
Certainteed Gypsum Canada Inc.	Montréal	Wallboard manufacture
ONTARIO		
CGC Inc.	Hagersville	Underground mining and wallboard manufacture
Georgia-Pacific Canada, Inc.	Caledonia	Wallboard manufacture
Certainteed Gypsum Canada Inc.	Mississauga	Wallboard manufacture
MANITOBA		
Certainteed Gypsum Canada Inc.	Amaranth	Open-pit mining
	Winnipeg	Wallboard manufacture
ALBERTA		
Georgia-Pacific Canada, Inc.	Edmonton	Wallboard manufacture
Certainteed Gypsum Canada Inc.	Calgary	Wallboard manufacture
BRITISH COLUMBIA		
Georgia-Pacific Canada, Inc.	Canal Flats	Open-pit mining
	Vancouver	Gypsum products manufacture
Certainteed Gypsum Canada Inc.	Vancouver	Gypsum products manufacture
	Windermere	Open-pit mining

Source: Natural Resources Canada.

TABLE 4. CANADA, PRODUCTION (1) AND USE (2) OF COAL COMBUSTION PRODUCTS (CCPs), 2004-06 AVERAGE

	Fly Ash	Bottom Ash	FGD Gypsum	Other (3)	Total CCPs
(000 tonnes)					
PRODUCTION					
Produced	4 198	1 658	385	184	6 424
Disposed/stored	3 285	1 390	—	184	4 859
Removed from disposal	2	37	1	—	39
USE (DOMESTIC)					
Cement	638	147	10	—	795
Concrete/grout	472	—	—	—	472
Mining applications	89	—	—	—	89
Roadbase/subbase	17	94	—	—	111
Wallboard	—	—	313	—	313
Other (4)	84	6	43	—	133
Total use	1 300	247	366	—	1 913
Individual use percentage	31	15	95	—	30

Source: Natural Resources Canada.

— Nil.

(1) Reported production of coal combustion products (CCPs) may include both dry and ponded categories. (2) Use (domestic), as reported, includes amounts imported (assumed HS codes 2621.00 relating to fly ash and HS 2520.10 relating to gypsum). (3) Cfb (circulating fluidized bed) fly ash and bottom ash. (4) Includes waste stabilization and specialty uses such as mineral filler and flowable fill.

Note: Numbers may not add to totals due to rounding.

TABLE 5. WORLD PRODUCTION OF GYPSUM, 2003-06

	2003	2004	2005	2006 (e)
	(000 tonnes)			
Canada	8 378	9 204	8 570	9 072
Algeria	—	—	1 460	1 460
Australia	4 000	4 000	4 000	4 000
Austria	1 000	1 000	1 000	1 000
Brazil	1 650	1 500	1 480	1 500
China	6 900	7 000	7 300	7 400
Egypt	2 000	2 000	2 000	2 000
France	3 500	3 500	3 500	3 500
Germany	. .	1 750	1 580	1 580
India	2 300	2 350	2 400	2 500
Iran	11 500	13 000	13 000	13 000
Italy	1 200	1 200	1 210	1 220
Japan	5 700	5 800	5 890	5 900
Mexico	6 800	7 000	7 200	7 400
Poland	1 100	1 300	1 300	1 300
Russia	1 000	700	2 200	2 400
Spain	7 500	11 500	11 500	11 500
Thailand	6 500	8 000	6 920	7 100
United Kingdom	1 500	1 500	1 500	1 500
United States	16 700	17 200	21 100	21 200
Uruguay	1 130	1 130	1 130	1 130
Other countries	12 452	11 316	11 760	11 338
Total world	102 000	109 000	118 000	119 000

Sources: Natural Resources Canada; U.S. Geological Survey.

— Nil; . . Not available; (e) Estimated.

Lead

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Canada is an important producer and supplier of refined lead, ranking seventh in the world in 2006 after China, the United States, Germany, the United Kingdom, Japan, and Mexico. In Canada, primary lead is produced mainly as a co-product of zinc mining. The recycling of lead, mainly from scrapped car batteries, is an important source of refined lead in Canada, representing about 40% of total refined production.

According to figures from the International Lead and Zinc Study Group (ILZSG), world refined lead usage was 8.031 Mt in 2006, up from 7.8 Mt in 2005, an increase of 3%. World mine production of lead rose to 3.492 Mt from 3.415 Mt the previous year, while lead metal production increased to 8.024 Mt from 7.637 Mt in 2005. Demand in the Western World exceeded supply by 638 000 t. This deficit was made up for by exports from Eastern countries, leading to an overall balance at year-end. Lead inventories held in London Metal Exchange (LME) warehouses stood at 41 000 t at year-end. Stocks reported by producers were 137 000 t.

HISTORY

Lead has been known since ancient times and is one of several metals that were discovered during the early periods of human history. Some experts believe that lead was used as early as 5000 B.C. The oldest archaeological evidence of lead use by humans is a figurine found in the Dardanelles area of Asia Minor dating from 3800 B.C.

Lead was used in coinage in China about 2000 B.C. and was mined by the Greeks from about 1200 B.C. to make coins, ornaments, weights, and many other articles. One of lead's most enduring uses has been as pipe for the transportation of water. The Romans manufactured lead pipes in one standard length and in several diameters, and used it

extensively in municipal water systems. The Latin word for lead is *plumbum*, which forms the root of modern English words such as "plumber" and "plumbing," as well as the chemical symbol for lead, Pb.

Almost all lead is obtained from sulphide ores in which the most common lead mineral is galena (PbS). It is usually found in combination with other sulphide ores, most frequently those of zinc, and also those of copper. Other lead-containing minerals include cerrusite (PbCO₃) and anglesite (PbSO₄).

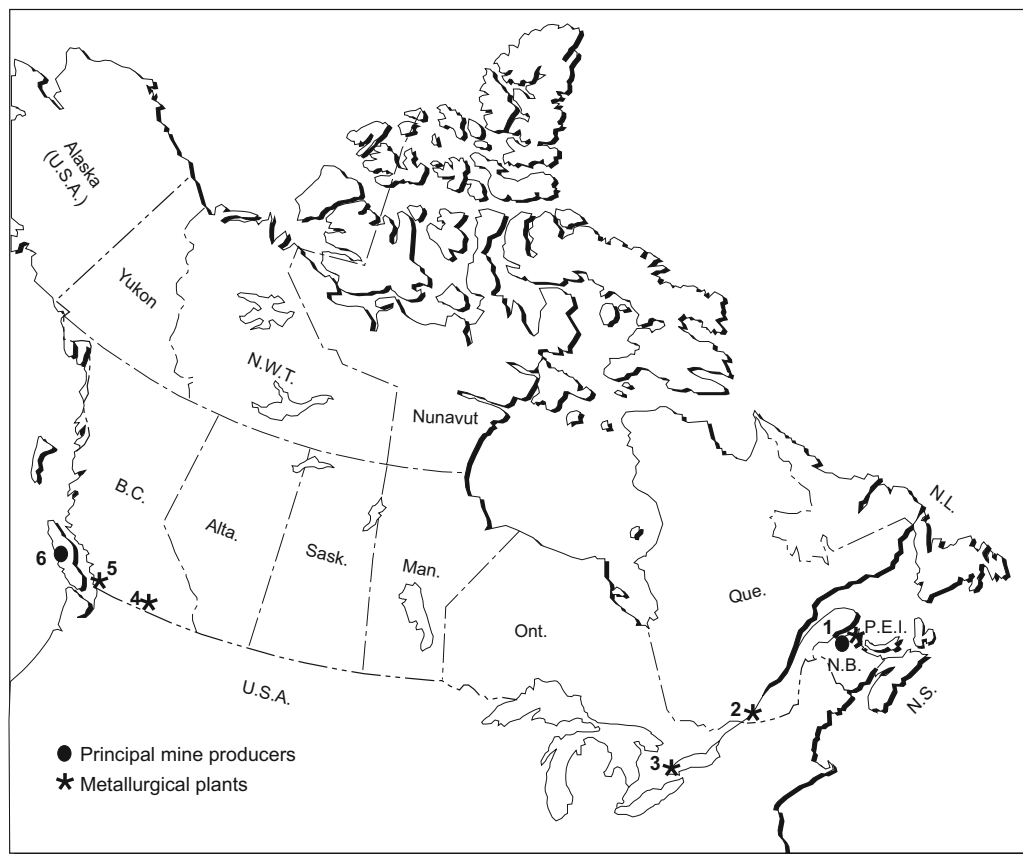
LEAD IN CANADA

Lead-zinc ores were originally discovered in the Kootenay region of British Columbia in the 1820s. Active prospecting in the area dates from 1865 and mining commenced shortly thereafter. In the early years, the ores from British Columbia were sent to the United States for smelting and refining.

The now-famous Sullivan mine started operation near Kimberley, British Columbia, in the early 1900s and continued to produce lead until its closure in December 2001. By 1914, the Sullivan mine was the largest lead producer in Canada – a position it held for 50 years until the Pine Point mine in the Northwest Territories completed its first year of operation in 1966. Pine Point closed in 1988. The Kingdon mine at Galetta, on the Ottawa River near Arnprior, Ontario, was discovered in 1884, operated briefly in the 1880s, and was reactivated in 1914, producing lead and zinc ore until the early 1930s. The discovery of lead and zinc ores by the Geological Survey of Canada on Baffin Island in the mid-1950s led to the development of the Nanisivik mine in the mid-1970s. The mine closed in September 2002. The discovery of lead-zinc on Little Cornwallis Island in 1971 led to the development of the Polaris mine. Operated by Teck Cominco, the mine had the distinction of being the most northerly base-metal mine until its closure at the end of August 2002 after 20 years of operation.

Today, Xstrata Zinc Canada produces lead, along with zinc, at the Brunswick mine near Bathurst, New Brunswick, and is Canada's largest producer. A small amount of lead is contained in concentrates from the Myra Falls, B.C., operation of Breakwater Resources Ltd.

Figure 1
Lead Producers in Canada, 2006



Numbers refer to locations on map above.

LEAD-PRODUCING MINES

1. Brunswick, Xstrata Zinc Canada
6. Myra Falls, Breakwater Resources Ltd.

WEB SITE

www.xstrata.com
www.breakwater.ca

LEAD METALLURGICAL PLANTS

1. Belledune, Xstrata Zinc Canada
2. Nova Pb Inc.
General Smelting Company of Canada
3. Tonolli, Tonolli Canada Ltd.
4. Trail, Teck Cominco Limited
5. Metalex Products Ltd.

www.xstrata.com
www.novapb.com
www.archive.xstrata.com

www.teckcominco.com
www.metalexleadrecycling.com

Canadian Operations

In 2006, Canadian mines produced 82 393 t of lead in concentrate, compared to 79 254 t in 2005, a 4% increase in production (Table 1). Refined metal production for 2006 was 250 464 t, compared to 229 407 t for 2005, an increase of 9.2%. Table 4 shows lead production, trade, and use for the period 1988-2006.

Lead was produced at two mines in New Brunswick and British Columbia (Figure 1). Primary refined lead metal is produced from domestic and foreign concentrates at two smelters located in New Brunswick and British Columbia. Secondary lead metal is produced at four sites in Quebec, Ontario, and British Columbia (Figure 1). Statistics on exports and imports of lead concentrates, metal, and semi-fabricated products are given in Table 2.

USES FOR LEAD

The largest single use of lead today is in the manufacture of the lead-acid storage battery, a vital part of every automobile. The average car battery contains about 10 kg of lead. Lead-acid batteries for automotive, industrial, and consumer purposes account for 77% of world lead usage. In the communications industry, lead is still used extensively as protective sheathing for underground and underwater cables, including transoceanic cable systems. Certain lead compounds are used as paint pigments. Red lead (lead oxide) is the basic paint primer for iron and steel. Lead compounds are used as stabilizers in plastic (PVC) piping and in decorative glass. Lead's corrosion-resistant nature also makes it suitable for applications in sheeting for roofing purposes, while its high density imparts radiation attenuation properties that prevent the emission of harmful radiation from television, video, and computer screens. Lead alloys, such as lead-antimony, are used in batteries and in the chemicals industry for pumps and valves. Lead-tin solders are used for welding metal parts together. Figure 2 shows the breakdown of lead uses worldwide for 2006.

INTERNATIONAL LEAD AND ZINC STUDY GROUP

The International Lead and Zinc Study Group (ILZSG, www.ilzsg.org) is an intergovernmental organization that

regularly brings together 28 member countries in an international forum to exchange information on lead and zinc. Particular attention is given to providing regular and frequent information on supply, demand, and the outlook for lead and zinc prices and markets.

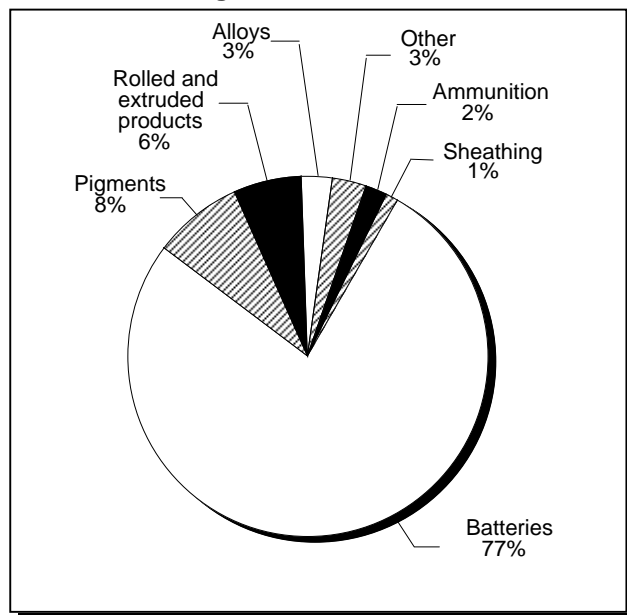
The Study Group, headquartered in Lisbon, Portugal, represents most of the world's major lead- and zinc-producing and using nations. The Group has an extensive information-gathering and dissemination role and acts as an effective mechanism for increasing market transparency related to the production, use, and trade of lead and zinc. The Group is also an important forum for communication among governments, among industry, and between governments and industry. It holds a general session each year in October.

PRICE OUTLOOK

The average annual LME settlement price for lead in 2006 was US\$1285.28/t, an increase of 32% over the previous year's average. Weekly LME cash settlement prices for 2006 are shown in Figure 3. In December 2006, the settlement price averaged US\$1730/t. At the end of 2006, total reported lead metal stocks were 293 000 t, of which 41 000 t were in LME warehouses, down slightly from 2005 stocks.

Stocks should decrease further in 2007 due to increasing demand in China for both automobile batteries and batteries for electric bicycles, which are seeing increased use. Reduced stocks and increasing demand will move prices higher in 2007 beyond the US\$2000/t level. Lead concentrate markets should remain tight as new mine production will not come on stream until 2007 or beyond.

Figure 2
World Lead Usage, 2006



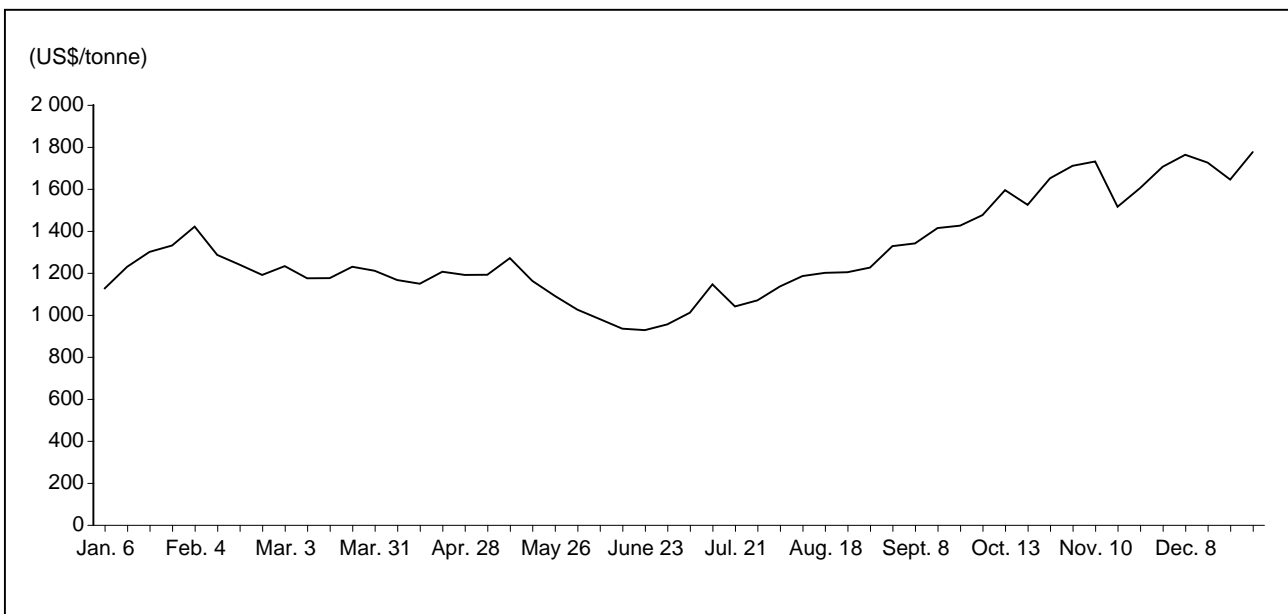
Source: International Lead and Zinc Study Group.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

Figure 3
Lead LME Cash Settlement Prices, 2006



Source: metalprices.com.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada (1)	Conventional Rate (1)	WTO (2)
2603.00	Copper ores and concentrates	Free	Free	Free	Free	Free	Free
2607.00	Lead ores and concentrates	Free	Free	Free	Free	Free	Free
2608.00	Zinc ores and concentrates	Free	Free	Free	Free	Free	Free
2616.10.00.20	Precious metal ores and concentrates: silver ores and concentrates: lead content	Free	Free	Free	Free	Free	Free
78.01	Unwrought lead						
7801.10	Refined lead	Free-2.5%	Free	Free	Free	2.5%	Free
7801.91	Other: containing by weight antimony as the principal other element	Free	Free	Free	Free	2.5%	Free-2.8%
7801.99	Other: other	2.5%	Free	Free	Free	Free-2.5%	Free-2.8%
7802.00	Lead waste and scrap	Free	Free	Free	Free	Free	2.1%
7803.00	Lead bars, rods, profiles and wire	2.5%-3%	Free	Free	Free	5%	3%
7804.00	Lead plates, sheets, strip and foil; lead powders and flakes						
7804.11	Plates, sheets, strip and foil: sheets, strip and foil of a thickness (excluding any backing) not exceeding 0.2 mm	Free-3%	Free	Free	Free	5%	3%
7804.19	Plates, sheets, strip and foil: other	2.5%	Free	Free	Free	5%	3%
7804.20	Powders and flakes	2.5%	Free	Free	Free	Free	3%
7805.00	Lead tubes, pipes, and tube or pipe fittings	3%	Free	Free	Free	5%	3%
7806.00	Other articles of lead	2.5%-3%	Free	Free	Free	Free-5%	3%
8548.10	Waste and scrap of primary cells, primary batteries and electric accumulators; spent primary cells, spent primary batteries and spent electric accumulators	Free	Free	Free	Free	Free-4.7%	Free

Sources: Canadian Customs Tariff, effective January 2006 and 2007; Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2006 and 2007; Official Journal of the European Union (October 27, 2005 and October 17, 2006 editions); Customs Tariff Schedules of Japan, 2006 and 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, LEAD PRODUCTION, (1) BY PROVINCE, 2004-06

	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
SHIPMENTS						
New Brunswick	70 215	80 958	69 166	81 754	78 923	112 860
British Columbia	2 558	2 949	3 663	4 329	2 605	3 725
Total	72 773	83 907	72 828	86 083	81 528	116 585
Mine output (2)	76 730	..	79 254	..	82 393	..
Refined production						
Primary	131 717	..	109 795	..	115 989	..
Recycled	109 453	..	119 613	..	134 475	..
Total	241 169	..	229 407	..	250 464	..

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; (p) Preliminary.

(1) Production includes recoverable lead in ores and concentrates shipped valued at the Montréal Exchange average price for the year. (2) Lead content of domestic ores and concentrates exported.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, LEAD TRADE, 2004-06

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS						
2603.00.20	Lead content of copper ores and concentrates					
	Belgium	867	989	1 276	1 152	—
	Romania	1 660	1 046	—	—	—
	Poland	—	—	5 186	3 230	—
	Total	2 527	2 035	6 462	4 382	—
2607.00	Lead ores and concentrates					
	Kazakhstan	—	—	—	—	1
	Venezuela	596	270	2	1	—
	Romania	—	—	94	44	—
	Total	596	270	96	45	1
2608.00.20	Lead content of zinc ores and concentrates					
	Poland	3 534	2 171	5 048	4 298	11 501
	Romania	—	—	2 333	2 297	5 562
	Belgium	4 523	2 640	679	599	—
	Total	8 057	4 811	8 060	7 194	17 063
7801.10	Refined lead, unwrought					
	United States	118 325	136 097	135 748	171 315	162 619
	Netherlands	4 498	4 740	1 620	1 932	1 022
	Other countries	5 965	6 191	1 971	2 396	271
	Total	128 788	147 028	139 339	175 643	163 912
7801.91	Lead, unwrought, containing by weight antimony as the principal other element					
	United States	20 102	23 132	20 976	25 556	19 175
	China	—	—	—	—	598
	United Kingdom	—	—	229	210	95
	Belgium	633	563	—	—	—
	Netherlands	60	51	174	156	—
	Total	20 795	23 746	21 379	25 922	19 868
7801.99	Lead, unwrought, n.e.s.					
	United States	28 625	35 305	33 172	45 886	42 183
	Mexico	410	483	2 535	3 217	3 600
	Belgium	4 963	5 530	875	1 021	1 912
	Other countries	13 446	15 792	2 961	3 619	2 202
	Total	47 444	57 110	39 543	53 743	49 897

TABLE 2 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
7802.00	Lead waste and scrap						
	United States	928	646	2 614	1 722	1 435	867
	China	75	54	116	75	123	54
	India	105	92	180	81	45	48
	Total	1 108	792	2 910	1 878	1 603	969
7803.00	Lead bars, rods, profiles and wire						
	United States	587	1 460	659	1 624	515	1 700
	United Arab Emirates	32	35	64	65	54	67
	Saudi Arabia	14	16	23	26	40	43
	Other countries	14	19	28	29	76	101
	Total	647	1 530	774	1 744	685	1 911
7804.11	Lead sheets, strip and foil of a thickness (excluding any backing) <0.2 mm						
	Poland	3	5	...	1	—	—
	Venezuela	...	1	—	—	—	—
	Denmark	—	—	...	...	—	—
	Total	3	6	...	1	—	—
7804.19	Lead plates, sheet, strip and foil, n.e.s.						
	United States	1 122	1 987	915	1 690	554	1 317
	Other countries	35	53	61	56	35	51
	Total	1 157	2 040	976	1 746	589	1 368
7804.20	Lead powders and flakes						
	Germany	—	—	—	—	3	4
	France	—	—	—	—	1	2
	United States	1	16	—	—	—	—
	India	—	—	1	2	—	—
	Total	1	16	1	2	4	6
7805.00	Lead tubes, pipes, and tube or pipe fittings (i.e., couplings, elbows, sleeves)						
	United States	49	118	45	168	77	92
	Other countries	13	43	—	—	4	16
	Total	62	161	45	168	81	108
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
7806.00	Other articles of lead						
	United States	..	7 165	..	10 281	..	9 183
	Other countries	..	378	..	699	..	990
	Total	..	7 543	..	10 980	..	10 173
8548.10	Waste and scrap of primary cells, primary batteries and electric accumulators; spent primary cells, spent primary batteries and spent electric accumulators						
	United States	..	2 825	..	3 005	..	7 747
	Other countries	..	38	..	73	..	56
	Total	..	2 863	..	3 078	..	7 803
	Total exports	..	249 951	..	286 526	..	379 100
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (1)							
2607.00	Lead ores and concentrates						
	United States	34 516	78 316	52 510	102 248	34 899	93 467
	Peru	42 082	38 195	9 805	7 721	2 026	16 818
	Bolivia	55	1 774	48	1 362	175	8 977
	Netherlands	—	—	—	—	3 921	4 313
	Brazil	3	640	6	1 091	7	1 968
	Australia	19 125	15 074	—	—	241	157
	Other countries	2	211	214	297	—	—
	Total	95 783	134 210	62 583	112 719	41 269	125 700

TABLE 2 (cont'd)

TABLE 2 (cont'd)							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2608.00.00.20	Lead content of zinc ores and concentrates						
	United States	1 188	760	2 519	2 140	1 289	914
2616.10.00.20	Lead content of silver ores and concentrates						
	Bolivia	199	193	9	7	29	23
	Chile	2	1	—	—	—	—
	Total	201	194	9	7	29	23
7801.10.10	Refined lead, unwrought, pig and block						
	United States	2 131	2 458	1 502	1 733	2 588	3 411
	Other countries	—	—	2	3	149	194
	Total	2 131	2 458	1 504	1 736	2 737	3 605
7801.10.90	Refined lead, unwrought, other						
	United States	248	288	295	342	508	589
	Other countries	75	88	...	...	73	85
	Total	323	376	295	342	581	674
7801.91	Lead, unwrought, containing by weight antimony as the principal other element						
	Cuba	304	331	90	100	294	262
	United States	5	6	12	14	22	24
	Other countries	...	...	207	252	...	...
	Total	309	337	309	366	316	286
7801.99	Lead, unwrought, other						
	United States	112	116	26	27	53	54
	Other countries	382	402	8	9	40	44
	Total	494	518	34	36	93	98
7802.00	Lead waste and scrap						
	United States	44 869	10 844	53 726	14 364	79 787	24 052
	Other countries	640	337	1 281	512	420	125
	Total	45 509	11 181	55 007	14 876	80 207	24 177
7803.00	Lead bars, rods, profiles and wire						
	Japan	69	440	17	691	22	670
	United States	675	2 595	113	668	79	309
	Other countries	35	76	730	934	15	284
	Total	779	3 111	860	2 293	116	1 263
7804.11	Lead sheets, strip and foil of a thickness (excluding any backing) <0.2 mm						
	United States	1 654	2 086	221	369	1 529	2 564
	Other countries	116	249	62	211	59	226
	Total	1 770	2 335	283	580	1 588	2 790
7804.19	Lead plates, sheet, strip and foil, n.e.s.						
	United States	357	511	128	185	396	667
	Other countries	49	73	63	84	58	83
	Total	406	584	191	269	454	750
7804.20	Lead powders and flakes						
	United States	405	515	344	473	390	532
	Other countries	7	8	...	...	3	5
	Total	412	523	344	473	393	537
7805.00	Lead tubes, pipes, and tube or pipe fittings (i.e., couplings, elbows, sleeves)						
	United States	13	27	28	55	168	408
	Other countries	1	1	—	—	3	6
	Total	14	28	28	55	171	414

TABLE 2 (cont'd)

TABLE 2 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
7806.00	Other articles of lead						
	United States	2 406	3 800	1 210	3 574	1 494	4 613
	China	24	55	41	236	107	929
	Other countries	209	268	188	420	114	786
	Total	2 639	4 123	1 439	4 230	1 715	6 328
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
8548.10	Waste and scrap of primary cells, primary batteries and electric accumulators; spent primary cells, spent primary batteries and spent electric accumulators						
	United States	..	1 561	..	1 588	..	4 744
	Japan	..	10	..	48	..	378
	Other countries	..	200	..	903	..	30
	Total	..	1 771	..	2 539	..	5 152
	Total imports	151 958	162 509	125 405	142 661	130 958	172 711

Sources: Natural Resources Canada; Statistics Canada.

– Nil; .. Not available; ... Amount too small to be expressed; n.a. Not applicable; (p) Preliminary; x Confidential.

(1) Imports from "other countries" may include re-imports from Canada.

Note: Numbers may not add to totals due to rounding.

TABLE 3. CANADA, (1) LEAD USE, 2003-05

	2003			2004			2005		
	Primary	Recycled (2)	Total	Primary	Recycled (2)	Total	Primary (p)	Recycled (2, p)	Total (p)
Lead used for or in the production of:									
Antimonial lead	x	x	30 299	x	x	31 895	x	x	34 241
Batteries and battery oxides	x	x	x	x	x	x	x	x	x
Chemical uses; white lead, red lead, litharge, tetraethyl lead, etc.	x	—	x	x	—	x	x	—	x
Copper alloys; brass, bronze, etc.	x	x	19	x	x	12	x	x	12
Lead alloys:									
Solders	x	x	x	x	x	x	x	x	x
Others (including babbitt, type metals, etc.)	x	x	x	x	x	x	x	x	x
Semi-finished products:									
Pipe, sheet, traps, bends, blocks for caulking, ammunition, etc.	x	x	x	x	x	x	x	x	x
Other lead products	2 202	1 485	3 687	3 412	1 827	5 238	2 498	2 119	4 618
Total, all categories	32 519	35 840	68 359	34 077	37 661	71 738	28 651	39 440	68 091

Source: Natural Resources Canada.

(p) Preliminary; x Confidential.

(1) Available data, as reported by users. (2) Includes all remelt scrap lead used to make antimonial lead.

Note: Numbers may not add to totals due to rounding.

TABLE 4. CANADA, LEAD PRODUCTION, TRADE AND USE, HISTORICAL, 1988-2006

	Production				Domestic Exports (1)			Imports Refined	Quantity Used (3)	
	All Forms (2)	Primary	Secondary	Total	In Ores and Concentrates	Refined	Total			
										Refined
(tonnes)										
1988	351 148	179 461	88 615	268 076	200 822	179 946	380 769	15 133	88 728	
1989	268 887	157 330	85 515	242 845	170 582	121 444	292 027	11 734	88 408	
1990	233 372	87 180	96 465	183 645	221 566	84 007	305 573	11 781	72 203	
1991	248 102	106 420	105 946	212 366	175 150	86 631	261 781	7 553	80 253	
1992	339 626	151 252	101 633	252 885	190 822	131 546	322 368	8 289	92 420	
1993	183 105	147 907	69 107	217 014	96 428	124 610	221 039	11 611	91 915	
1994	167 584	153 035	98 605	251 640	55 923	133 203	189 127	5 119	95 764	
1995	204 227	178 019	103 372	281 390	90 254	140 478	230 732	3 969	91 171	
1996	241 751	192 877	117 914	310 791	154 696	159 859	314 555	4 180	93 373	
1997	170 847	139 736	131 659	271 395	112 694	155 639	268 333	5 841	92 997	
1998	150 019	129 750	135 737	265 487	52 249	145 358	197 607	6 460	87 466	
1999	155 369	148 526	117 889	266 414	58 831	139 622	198 453	7 662	92 557	
2000	143 303	159 192	125 141	284 333	50 524	148 427	198 952	7 029	81 365	
2001	150 389	127 007	103 921	230 928	69 093	126 651	195 743	5 111	56 905	
2002	101 330	136 896	114 664	251 560	53 183	144 178	197 360	3 619	66 575	
2003	92 934	118 506	104 927	223 434	22 068	129 737	151 805	4 064	68 359	
2004	72 773	131 717	109 453	241 169	11 179	130 598	141 778	5 822	71 738	
2005	72 828	109 795	119 613	229 407	14 524	141 088	155 612	3 477	68 091	
2006 (p)	81 528	115 989	134 475	250 464	17 063	165 187	182 250	5 868	..	

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; (p) Preliminary.

(1) Beginning in 1988, exports and imports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. Exports in ores and concentrates include HS classes 2603.00.20, 2607.00.20, 2608.00.20 and 2616.10.20. Refined exports include HS classes 7801.10, 7803.00, 7804.11, 7804.19 and 7804.20. Refined imports include HS classes 7801.10.10, 7801.10.90, 7803.00, 7804.11, 7804.19 and 7804.20. (2) Recoverable lead in ores and concentrates shipped. (3) Consumption of lead, primary and secondary in origin, as measured by a survey of consumers.

**TABLE 5. ANNUAL AVERAGE LEAD PRICES,
LONDON METAL EXCHANGE, 1980-2006**

	London Metal Exchange			
	Settlement		Three Months	
	(US\$/t)	(US\$/lb)	(US\$/t)	(US\$/lb)
1980	909.12	41.24	911.46	41.34
1981	734.73	33.33	750.12	34.03
1982	544.08	24.68	562.53	25.52
1983	425.27	19.29	440.55	19.98
1984	444.36	20.16	445.25	20.20
1985	394.10	17.88	394.12	17.88
1986	406.89	18.46	407.26	18.47
1987	597.41	27.10	567.38	25.74
1988	655.83	29.75	635.68	28.83
1989	676.14	30.67	659.36	29.91
1990	817.85	37.10	790.82	35.87
1991	557.84	25.30	568.90	25.81
1992	540.04	24.50	553.56	25.11
1993	406.38	18.43	420.36	19.07
1994	549.01	24.90	564.10	25.59
1995	630.51	28.60	638.88	28.98
1996	773.96	35.11	771.22	34.98
1997	624.08	28.31	633.01	28.71
1998	528.42	23.97	533.29	24.19
1999	502.24	22.78	508.89	23.08
2000	454.22	20.60	468.07	21.23
2001	476.04	21.59	483.24	21.92
2002	452.52	20.53	461.65	20.94
2003	515.66	23.39	517.53	23.48
2004	888.41	40.30	850.63	38.58
2005	975.65	44.26	941.41	42.70
2006	1 285.28	58.30	1 280.47	58.08

Source: International Lead and Zinc Study Group.

TABLE 6. MINE PRODUCTION OF LEAD, BY COUNTRY, 2002-06

	2002	2003	2004	2005	2006 (p)
	(000 tonnes)				
EUROPE					
Bulgaria	24	17	13	13	10
Greece	29	2	—	3	11
Ireland	32	50	64	72	62
Italy	4	5	6	6	6
Macedonia	15	5	—	—	10
Poland	57	42	53	51	51
Romania	18	16	15	12	12
Russia	19	24	23	36	34
Spain	6	2	—	—	—
Sweden	44	51	55	61	56
Serbia and Montenegro	—	—	1	2	7
Total Europe	248	216	229	256	259
AFRICA					
Morocco	62	41	59	64	60
Namibia	12	16	14	14	12
South Africa	50	40	37	42	48
Other Africa	7	6	6	10	1
Total Africa	130	102	117	130	121
AMERICAS					
Canada	97	81	77	79	82
Mexico	139	144	118	134	120
Peru	297	308	306	319	313
United States	449	458	439	432	435
Other Americas	40	42	45	43	51
Total Americas	1 022	1 033	985	1 007	1 001
ASIA					
China	641	955	997	1142	1251
India	34	44	51	58	66
Iran	17	16	16	20	24
Japan	6	6	6	3	1
Kazakhstan	43	44	44	45	62
North Korea	10	20	20	20	20
Turkey	17	14	19	19	18
Other Asia	4	1	2	3	2
Total Asia	772	1100	1154	1309	1444
OCEANIA					
Australia	658	648	642	715	621
Total world	2 831	3 099	3 128	3 423	3 446

Sources: Natural Resources Canada; International Lead and Zinc Study Group.

— Nil; (p) Preliminary.

TABLE 7. REFINED LEAD PRODUCTION, BY COUNTRY, 2002-06

	2002	2003	2004	2005	2006 (p)
	(000 tonnes)				
EUROPE					
Belgium	88	65	62	97	82
Bulgaria	66	69	66	81	76
Czech Republic	29	26	25	26	26
France	203	101	104	90	88
Germany	378	357	411	418	379
Italy	196	214	202	211	191
Poland	66	60	74	88	78
Russia	63	66	70	66	80
Spain	116	102	105	110	131
Sweden	65	76	72	73	75
United Kingdom	368	320	243	304	298
Other Europe	124	117	135	135	139
Total Europe	1 762	1 573	1 569	1 702	1 643
AFRICA					
Morocco	72	61	25	54	45
South Africa	61	65	64	65	67
Other Africa	11	12	11	11	10
Total Africa	144	138	100	130	122
AMERICAS					
Argentina	44	41	49	45	45
Brazil	37	35	38	42	44
Canada	252	223	241	230	250
Mexico	232	239	242	256	255
Peru	120	112	119	122	120
United States	1 364	1 392	1 262	1 293	1 297
Other Americas	46	51	48	55	57
Total Americas	2 095	2 093	2 005	2 043	2 068
ASIA					
China	1 325	1 564	1 934	2 391	2 680
India	78	71	49	59	104
Japan	286	295	283	275	280
Kazakhstan	152	141	144	142	160
Malaysia	40	57	54	42	44
South Korea	243	230	243	256	240
Thailand	43	47	58	61	61
Other Asia	194	225	237	248	264
Total Asia	2 361	2 630	3 002	3 486	3 833
OCEANIA					
Australia	302	307	273	268	241
New Zealand	9	8	8	7	7
Total Oceania	311	315	281	276	248
Total world	6 670	6 748	6 957	7 636	7 914

Sources: Natural Resources Canada; International Lead and Zinc Study Group.

(p) Preliminary.

TABLE 8. REFINED LEAD USE BY COUNTRY, (1) 2002-06

	2002	2003	2004	2005	2006 (p)
(000 tonnes)					
EUROPE					
Austria	60	54	48	28	29
Czech Republic	80	72	91	103	84
France	230	220	215	215	200
Germany	385	384	395	407	378
Ireland	42	37	44	53	49
Italy	286	258	272	269	285
Netherlands	29	34	31	30	30
Poland	70	58	81	94	89
Russia	111	112	84	80	80
Spain	238	216	246	270	265
United Kingdom	311	302	295	271	271
Other Europe	185	178	179	185	170
Total Europe	2 027	1 925	1 984	2 002	1 930
AFRICA					
Algeria	8	11	13	15	14
Egypt	2	6	2	7	5
South Africa	71	80	80	74	75
Other Africa	17	19	17	18	17
Total Africa	98	116	112	113	111
AMERICAS					
Brazil	112	112	102	119	114
Canada	58	51	52	42	41
Mexico	267	259	262	267	273
United States	1 536	1 513	1 502	1 586	1 608
Other Americas	93	95	121	127	124
Total Americas	2 066	2 030	2 041	2 132	2 160
ASIA					
China	950	1 183	1 510	1 973	2 179
India	130	142	150	160	170
Indonesia	61	71	85	72	80
Iran	68	72	65	61	65
Japan	303	311	292	291	303
Malaysia	86	90	90	85	90
South Korea	343	349	376	384	337
Taiwan	154	137	162	132	135
Thailand	111	131	134	129	141
Other Asia	202	226	232	215	246
Total Asia	2 408	2 712	3 105	3 533	3 746
OCEANIA					
Australia	39	38	39	28	27
New Zealand	3	4	2	1	2
Total Oceania	42	42	40	29	29
Total Western World	6 642	6 826	7 282	7 809	7 976

Sources: Natural Resources Canada; International Lead and Zinc Study Group.

(p) Preliminary.

(1) Refined lead and lead alloys (lead content) produced from scraps, wastes and residues.

Lime

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INTRODUCTION

Lime is a versatile chemical that is derived from the burning of high-purity calcitic or dolomitic limestone. High-calcium quicklime contains less than 5% MgO and is the most common type of lime produced. Magnesium quicklime contains 5-35% MgO and dolomitic quicklime (also referred to as do-lime) contains 35-45% MgO. Hydrated lime (calcium hydroxide, $\text{Ca}(\text{OH})_2$), also known as slaked lime, is a dry powder manufactured by adding water to quicklime, converting the oxide to hydroxide. To produce lime, crushed limestone is burned in a kiln at temperatures ranging from 890° to 1340°C. A dissociation reaction, termed calcination, takes place when the limestone is broken down, releasing CO_2 and producing high-calcium quicklime (CaO) or dolomitic quicklime ($\text{CaO}\cdot\text{MgO}$). Type N lime is made up of $\text{Ca}(\text{OH})_2$ and MgO, whereas type S lime consists of $\text{Ca}(\text{OH})_2$ and $\text{Mg}(\text{OH})_2$. Approximately two tonnes of limestone are required to produce one tonne of quicklime.

CANADIAN INDUSTRY

In Canada, the lime industry is divided into merchant producers and captive producers. Merchant lime production is destined for a variety of customers and industrial processes whereas captive production is a specific process requirement at one industrial plant. Lime for the merchant market is produced at 11 plants in six provinces (New Brunswick, Quebec, Ontario, Manitoba, Alberta, and British Columbia). Captive production is confined to two plants in Ontario and one in Alberta. Figure 1 shows the location of all lime plants in Canada as of December 31, 2006.

In 2006, Canadian captive and merchant lime producers shipped 2.211 Mt of quicklime and hydrated lime valued at \$271.7 million, based on preliminary data. Shipments

in 2005 were 2.288 Mt, based on final data. This represents a 3.4% decrease in shipments, which is similar to the decrease between 2004 and 2005. Table 1 provides statistics on Canadian production and trade while Table 2 shows apparent lime use in Canada for the period 1988-2006. Based on calculations in Table 2, apparent lime use has decreased 3.1% in the past year. Canada maintained its tenth-place ranking among major lime-producing countries in 2006, according to global production estimates by the U.S. Geological Survey. Quicklime accounted for 92.5% of the total volume and for 90.5% of the value of shipments in 2005 (does not include some captive production from pulp and paper plants). The capacity utilization rate in 2006 was 63.1% (based on merchant and captive production and published plant capacities). In terms of production trends, Figure 2 shows quicklime and hydrated lime production for the period 1994-2006. Total published calcining capacity for active plants stands at 3.571 Mt/y, as shown in Table 3. The industry employed about 700 people in 2006.

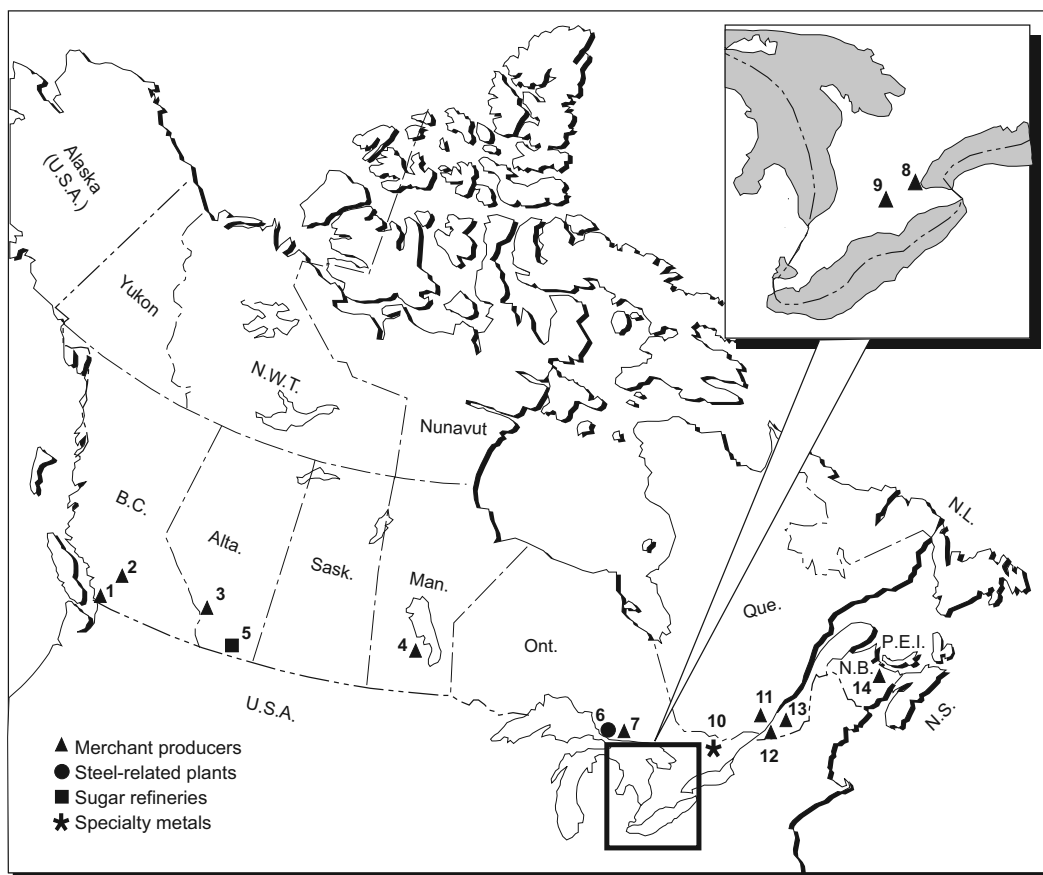
The main lime-producing companies in Canada are Graymont Limited, Carmeuse North America, and Chemical Lime Company of Canada Inc. Graymont operates seven lime plants across Canada, as well as plants and quarries in Ohio and Pennsylvania. It is the largest producer of lime products in Canada and the third largest in North America.

Graymont Western Canada Inc. has signed an agreement with Syncrude Canada Ltd. for the supply of high-calcium quicklime for a future flue gas desulphurization plant to be located at Syncrude's Mildred Lake site near Fort McMurray, Alberta. The plant is scheduled for completion in 2009. The company concluded a supply agreement with Nexen Inc., owner of the Long Lake bitumen production facility near Fort McMurray. It also announced that it had finalized an agreement with Athabasca Northern Railway that would see the construction of a new product transfer terminal located immediately south of Fort McMurray.

Carmeuse North America operates three plants in Canada and is owned by Carmeuse SA of Belgium. It also produces lime in Pennsylvania, Ohio, Alabama, Michigan, Indiana, Illinois, Kentucky, and Louisiana.

Chemical Lime Company of Canada Inc., owned by Lhoist Group of Belgium, is the second largest lime producer in

Figure 1
Lime Producers in Canada, 2006



MERCHANT PRODUCERS

1. Chemical Lime Company of Canada Inc., Fort Langley
2. Graymont Western Canada Inc., Pavilion Lake
3. Graymont Western Canada Inc., Exshaw
4. Graymont Western Canada Inc., Faulkner
7. Carmeuse North America, Spragge
8. Lafarge Lime (Canada) Inc., Dundas Division
9. Carmeuse North America, Ingersoll
11. Graymont (QC) Inc., Joliette
12. Graymont (QC) Inc., Bedford
13. Graymont (QC) Inc., Marbleton
14. Graymont (NB) Inc., Havelock

STEEL-RELATED PRODUCERS

6. Algoma Steel Inc., Sault Ste. Marie

SUGAR REFINERIES

5. Rogers Sugar Ltd., Taber

SPECIALTY METALS

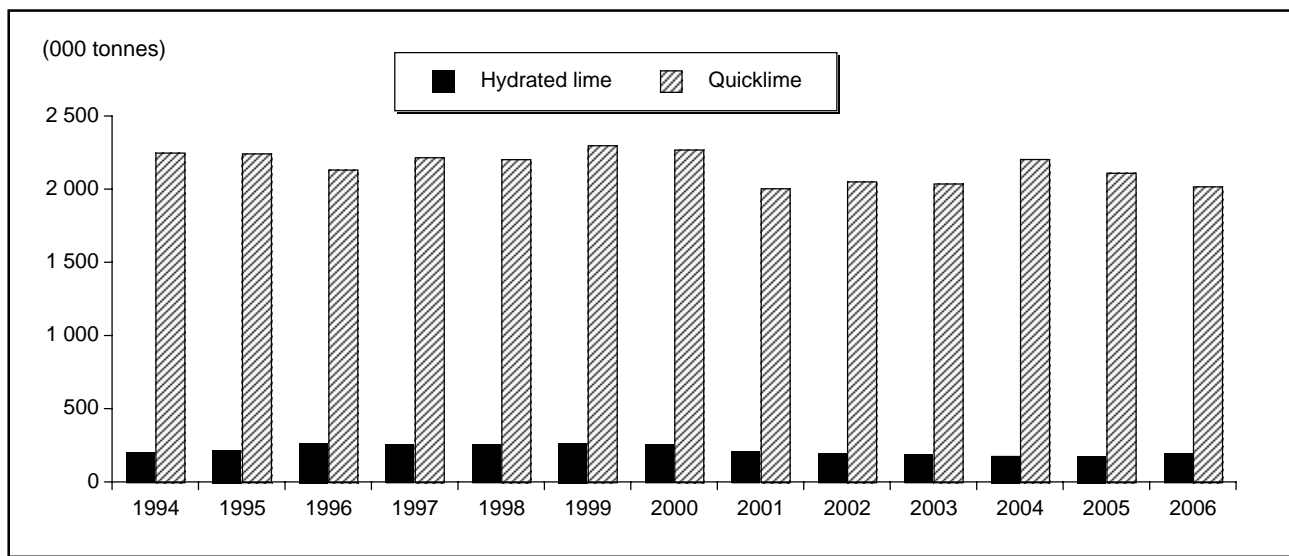
10. Timminco Limited, Haley Station

North America. It operates a lime plant at Fort Langley, British Columbia.

Birch Mountain Resources Ltd. is developing the Hammerstone project adjacent to its operating Muskeg Valley aggregate quarry operation near Fort McMurray, Alberta. The company submitted a revised prefeasibility report that includes plans to construct a 200 000-t/y quicklime

plant to be commissioned in 2009. In addition, it would install a limestone activation plant designed to remove bitumen from calcinable limestone, a process step that would allow the lime kilns to be equipped with preheaters. The company has submitted a revised Application and Environmental Impact Assessment to the provincial government. It has already purchased three rotary kilns, preheaters and other equipment from Northwest Alloys, Inc.

Figure 2
Canadian Lime Production, 1994-2006



Source: Natural Resources Canada.

in Addy, Washington. The equipment will be stored in Fort McMurray pending regulatory approval for construction of its lime plant.

USE

The use of quicklime, based on reported shipments for the merchant market, amounted to an estimated 1.883 Mt in 2006, compared to 1.970 Mt in 2005, a decrease of 4.4%. Hydrated lime shipments in the merchant market amounted to an estimated 178 505 t in 2006, compared to 163 255 t in 2005, an increase of 9.3%. Hydrated lime is used for environmental control, road construction and soil stabilization, and other industrial uses.

Table 4 shows a breakdown of uses for quicklime and hydrated lime in Canada for the period 1999-2006. Major uses for lime in Canada continue to be steel-making (43.4%), pulp and paper manufacturing (12.7%), water and sewage treatment (14.3%), and nonferrous metallurgy (7.9%). Figure 3 compares lime use data for 2004-06 in different industrial applications. The trend in recent years has seen an increase in demand for lime in the steel-making and pulp and paper industries and a slight decrease in the water treatment and nonferrous metallurgy sectors.

Data from the U.S. Geological Survey show lime consumption by major industries in the United States is: metallurgical (36.5%), flue-gas desulphurization (14.4%), water and sludge treatment (9.4%), chemical/industrial (22.3%), construction (14.4%), and refractory (1.5%).

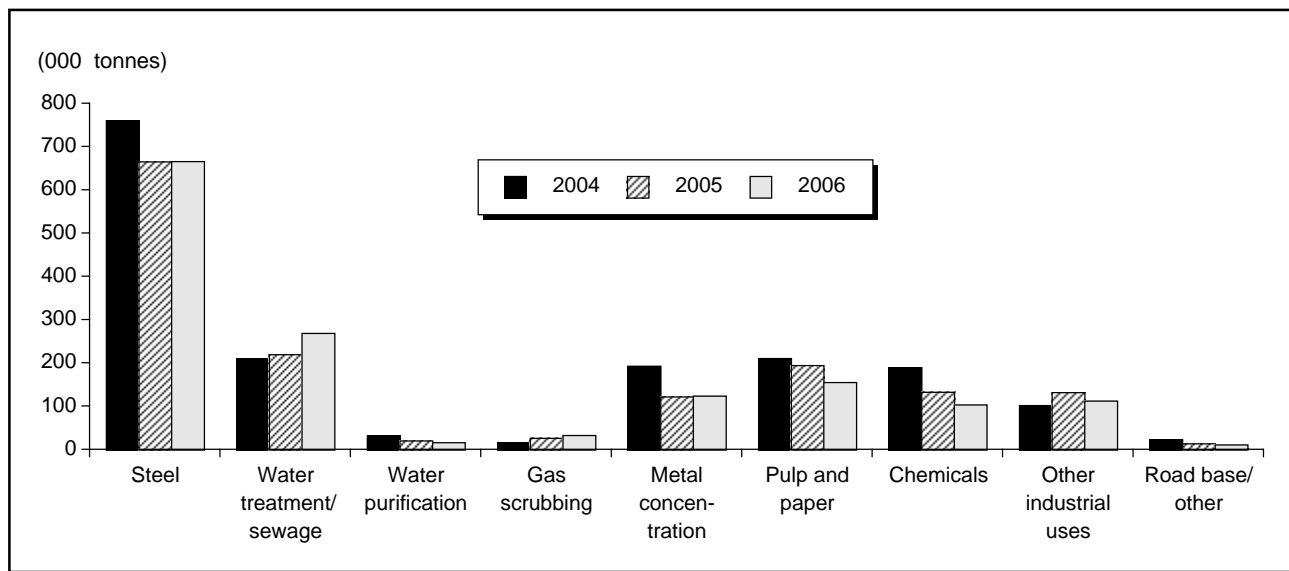
Lime is used in both ferrous and nonferrous metallurgical processes. In ferrous metallurgy applications (steel-making), high-calcium quicklime is used as a flux to remove impurities such as phosphorus and sulphur. Dolomitic quicklime, or do-lime, is of particular use in steel-making as it has the additional benefit of prolonging refractory brick life. In the basic oxygen furnace, up to 70 kg of lime is used per tonne of steel ingot produced. Often a blend of high-calcium and dolomitic quicklime is used as a flux and the total flux amount varies from 25 kg to 60 kg per tonne of steel produced in the electric arc process.

For nonferrous ores, lime is used in copper beneficiation to maintain the proper pH in the flotation process. It is also used in metallurgical processes that extract uranium, gold, nickel, aluminum, and silver. In the production of metallic magnesium, lime is used as the magnesium oxide is reduced using ferrosilicon.

In the pulp and paper industry, lime is used in sulphate process paper plants to reconvert sodium carbonate into sodium hydroxide (caustic soda) in the kraft pulping process. The by-product calcium carbonate is calcined in a kiln to recover lime for re-use. Most plants operate their own kilns and the merchant producers, therefore, only supply make-up lime. Lime is also used to produce calcium bisulphite, an acid cooking liquor used to digest wood fibres, although this process is used less than the sulphate process due to environmental issues.

In the environmental sector, lime is used to control acid mine drainage in the vicinity of metal mines. Lime is

Figure 3
Lime Use (Quick and Hydrated) by Canadian Industry, 2004-06



Source: Natural Resources Canada.

important for the treatment of municipal sewage and potable water. Lime is consumed in the flue gas desulphurization (FGD) process at coal-fired generating stations for the control of SO₂ emissions. It is consumed in dry and wet lime scrubbers and produces either calcium sulphite or calcium sulphate (gypsum). It is also added as a stabilizer to waste sludges before disposal. Other uses for lime include: sugar refining, where lime acts to precipitate out colloidal impurities (essentially captive production within the specific industrial plant), the production of precipitated calcium carbonate (PCC), and as an additive in hot-mix asphalt pavements.

In the road-paving industry, new high-performance asphalt mixtures, such as Superpave, use hydrated lime as an anti-stripping agent. Hydrated lime acts to reduce the incompatibility between the bitumen used as a cementing agent and the coarse aggregates. The lime improves the mechanical and chemical bonding properties between the bitumen and aggregate, reducing rutting and mechanical abrasion. Studies have shown that hydrated lime added to hot-mix asphalt adds 12% to the cost of construction, but increases the lifespan of the highway by 38%. The use of hydrated lime also allows for less asphalt cement in the paving mix.

High-calcium quicklime is commercially available in a variety of sizes, including lump (>6.3 cm), crushed or pebble (0.63-5.8 cm), ground (<2.4 mm), and pulverized (<0.84 mm). Slaked lime, also known as hydrated lime (Ca(OH)₂), is produced by mixing quicklime with water, and it can be purchased as a putty, dry powder, or slurry.

Aglime, or agricultural lime, is pulverized limestone that is used for acid neutralization in soils.

TRADE

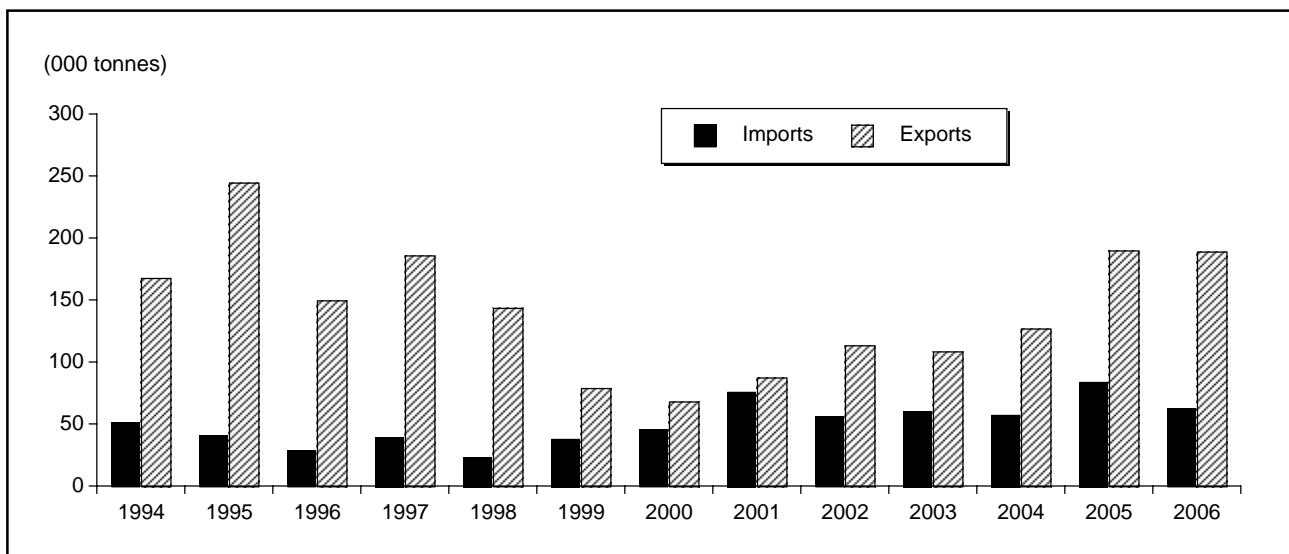
Total lime exports to the United States in 2006 were 201 346 t valued at \$28.5 million, up from 199 928 t valued at \$26.9 million in 2005 (Table 1). This represents about 73% of total lime imports into the United States. Canada imported 106 125 t of lime from the United States in 2006, compared to 95 053 t in 2005, an increase of 11.6%. Figure 4 shows imports and exports of quicklime for the period 1994-2006. Figure 5 shows hydrated lime trade data for the same period. Imports and exports of quicklime and hydrated lime with the United States vary from year to year depending upon local market demands in the industrial sectors that consume lime.

INTERNATIONAL OVERVIEW

World lime production, based on figures from the U.S. Geological Survey, is estimated at 130 Mt in 2006, compared to 127 Mt in 2005 (Table 5, Figure 6). Production was led by China (25 Mt), followed by the United States (21.2 Mt). Other leading countries included Japan, Russia and Germany with 8.9 Mt, 8.5 Mt and 6.8 Mt, respectively.

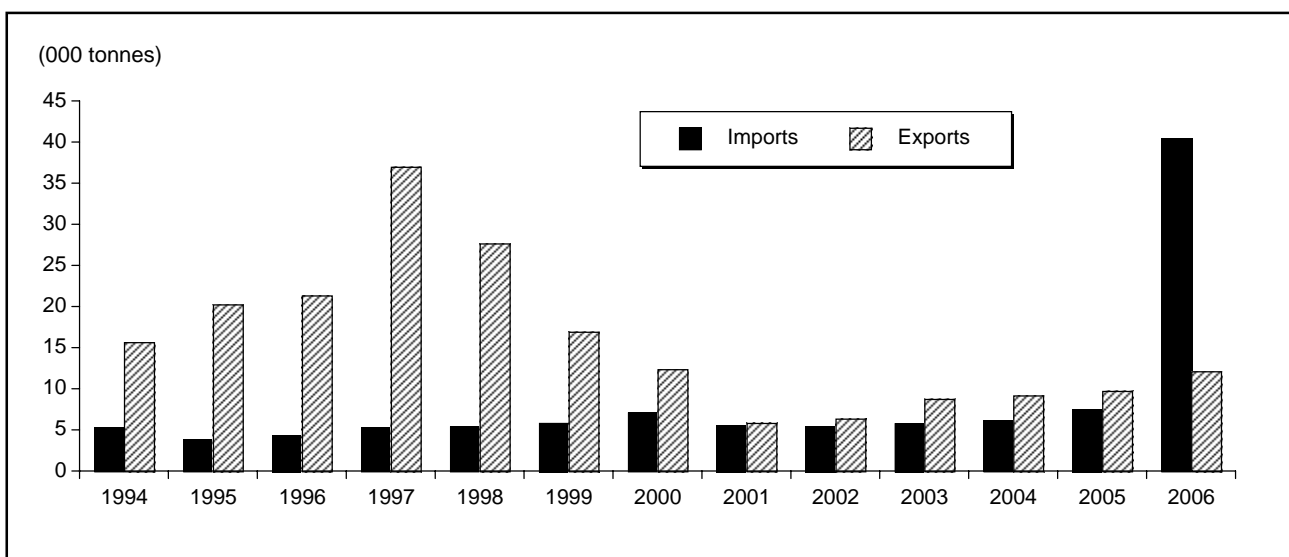
The United States produced 21.2 Mt of quicklime and hydrated lime in 2006, up 6% over 2005 production, from 95 plants, based on data from the U.S. Geological Survey.

Figure 4
Canadian Quicklime Trade, 1994-2006



Source: Natural Resources Canada.

Figure 5
Canadian Hydrated Lime Trade, 1994-2006



Source: Natural Resources Canada.

This increase is in part due to strong steel production. The top five lime producers in the United States were Carmeuse Lime Co., Chemical Lime Company, Graymont Inc., Mississippi Lime Company, and O-N Minerals.

Graymont Western US Inc. has concluded a deal with Ash Grove Cement Company to lease a lime hydration plant in Portland, Oregon. Graymont plans to supply the hydrator with quicklime from existing plants in Washington, Montana, Utah, and Nevada.

Chemical Lime Company announced plans to construct a lime hydration facility in Louisville, Kentucky, to serve a growing market for calcium hydroxide emission control reagents in the Ohio River area. It is also going ahead with construction of a new rotary preheater kiln and air emission controls at its New Braunfels, Texas, facility to be commissioned in 2008.

Carmeuse North America completed the acquisition of Rockwell Lime, of Manitowac, Wisconsin. The former company operated two rotary kilns with a combined annual capacity of 135 000 t that produced dolomitic lime and hydrated lime products.

PRICES

Prices for lime produced in Canada vary according to region, company marketing strategies, and supply and demand forces in effect. The average reported values (f.o.b. plant) for 2006, based on producers' shipments

as listed in Table 1, were \$119.60/t for quicklime and \$157.32/t for hydrated lime. This represents an increase of 6.8% for quicklime and 8.9% for hydrated lime. Price increases have reflected increases in energy, raw materials, and labour costs. The U.S. Geological Survey reported an average value of US\$80.50/t for quicklime (an 11.7% increase) and US\$93.00/t for hydrated lime (a 2.1% increase) f.o.b. plant for 2006. Price increases in the 8-12% range were reported by most companies during 2006.

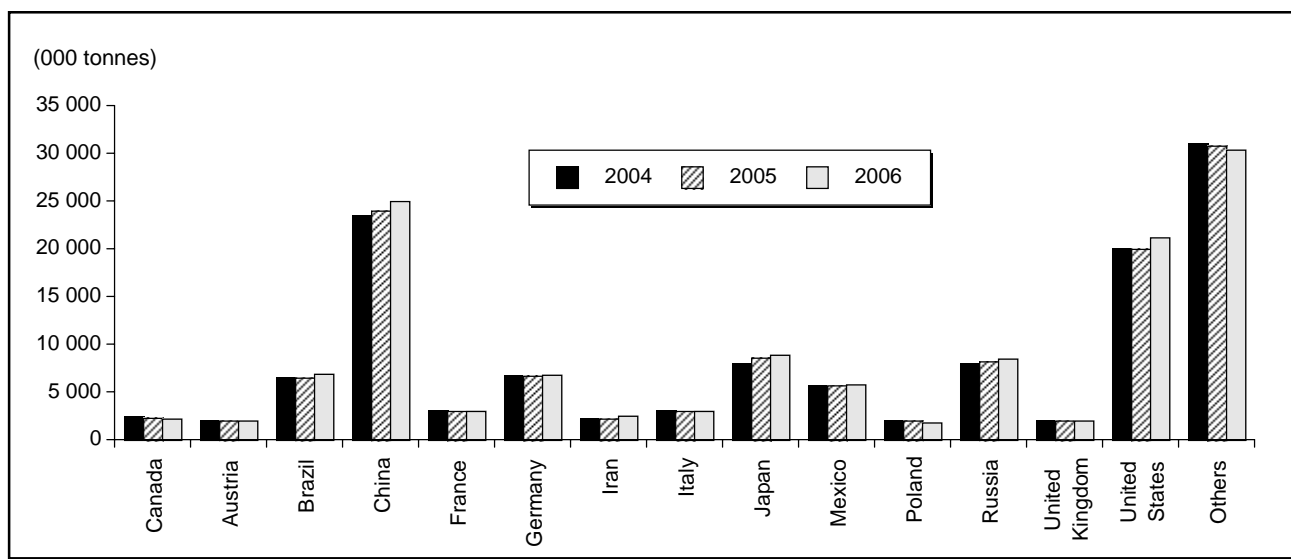
ENERGY AND TECHNOLOGY

Table 3 lists the 14 lime plants in Canada along with kiln capacities and types. Most plants burn a combination of coal and petroleum coke and consume about 6-7 gigajoules of energy per tonne of lime produced.

About 60% of CO₂ emissions from lime kilns are related to the calcination process, but this figure varies somewhat depending upon the chemical composition of the limestone used. Reductions in CO₂ emissions will be achieved through advancements in kiln efficiencies that reduce the fuel requirements per tonne of lime produced and the implementation of CO₂ sequestration processes.

The U.S. Department of Energy is supporting a project to explore the viability of using direct causticizing in a circulating fluidized bed reactor instead of using lime to regenerate caustic soda in the pulp-making process. If this process change was made, pulp mills would no longer

Figure 6
World Lime Production, 2004-06



Source: U.S. Geological Survey.

have to operate an energy-intensive lime kiln. This would also reduce the demand for make-up lime from merchant producers.

Energy companies in the United States continue to make major investments in flue gas desulphurization equipment in order to comply with new emissions legislation, such as the Clean Air Interstate Rule (CAIR). It is reported that companies will spend US\$2 billion per year over the next five years on flue gas scrubber systems. A typical scrubber installation at a 1000-MW power plant is reported to cost in the US\$300 million range.

For example, Duke Energy of Charlotte, North Carolina, is constructing scrubber systems at the 1140-MW Allen Station in Belmont, North Carolina, at a cost of US\$425 million. The new scrubber systems will be designed to remove about 90% of the mercury from flue gases, helping utilities comply with the upcoming Clean Air Mercury Rule. Some of these installations use pebble lime as a reagent.

OUTLOOK

Lime production in Canada is expected to decrease slightly in 2007 due to continuing lacklustre growth in the steel sector and plant closures in the pulp and paper sector. Some steel producers had already experienced a downturn in demand in late 2006 and this is expected to continue into 2007, along with larger steel inventories. The mining and nonferrous metallurgy sector remains in a growth pattern globally with record high commodity prices, which will increase demand for lime in that sector as new mines come on stream. Demand for scrubber lime for the electricity sector will stay on a growth trend. Canadian producers may benefit from this trend by exporting more lime south of the border. High energy costs will continue to put

upward pressure on lime prices. Price increases in the 5-10% range can be expected for 2007, with quicklime prices around \$128/t and hydrated lime at \$168/t in 2007.

RELEVANT CANADIAN LIME INDUSTRY WEB SITES

Canadian Lime Institute
www.canadianlimeinstitute.ca
 Carmeuse North America
www.carmeusena.com
 Chemical Lime Company of Canada Inc.
www.chemicallime.com
 Graymont Limited
www.graymont.com
 National Lime Association
www.lime.org

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States		EU	Japan
		MFN	GPT	USA	Canada	Canada	Conventional Rate (1)	WTO (2)
2518.20	Dolomite, whether or not calcined or sintered, including dolomite roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape; dolomite ramming mix: calcined or sintered dolomite	3%	3%	Free	Free		Free	Free
25.22	Quicklime, slaked lime and hydraulic lime, other than calcium oxide and hydroxide of heading no. 28.25							
2522.10	Quicklime	Free	Free	Free	Free		1.7%	Free
2522.20	Slaked lime	Free	Free	Free	Free		1.7%	Free
2522.30	Hydraulic lime	Free	Free	Free	Free		1.7%	Free

Sources: Canadian *Customs Tariff*, effective January 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2007; *Official Journal of the European Union* (October 17, 2006 Edition); *Customs Tariff Schedules of Japan*, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, LIME PRODUCTION AND TRADE, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION (1)							
By type							
	Hydrated lime	178 371	24 192	175 564	25 355	191 895	30 190
	Quicklime	2 207 465	232 750	2 113 259	236 493	2 019 508	241 523
	Total	2 385 836	256 942	2 288 823	261 848	2 211 403	271 713
By province							
	New Brunswick	x	x	x	x	x	x
	Quebec	x	x	x	x	x	x
	Ontario	1 129 783	122 412	1 021 331	117 613	976 042	119 982
	Manitoba	x	x	x	x	x	x
	Alberta	x	x	x	x	x	x
	British Columbia	x	x	x	x	x	x
	Total	2 385 836	256 942	2 288 823	261 848	2 211 403	271 713
EXPORTS							
2518.20	Calcined or sintered dolomite						
	United States	21 590	2 743	43 682	5 247	45 950	5 368
2522.10	Quicklime						
	United States	127 085	20 760	189 987	25 569	189 017	26 905
	Malaysia	—	—	22	7	23	10
	Bermuda	—	—	...	...	—	—
	China	—	—	20	7	—	—
	Saint Pierre and Miquelon	—	—	7	2	—	—
	Total	127 085	20 760	190 036	25 585	189 040	26 915
2522.20	Slaked lime						
	United States	9 196	1 261	9 735	1 282	12 115	1 555
	Saint Pierre and Miquelon	2	1	5	3	7	4
	Cuba	—	—	—	—	4	3
	Thailand	—	—	—	—	4	1
	Israel	—	—	—	—	...	...
	Total	9 198	1 262	9 740	1 285	12 130	1 563
2522.30	Hydraulic lime						
	China	82	29	82	29	134	45
	United States	4	3	30	3	...	10
	Bermuda	—	—	39	9	43	8
	Jamaica	332	85	—	—	—	—
	Singapore	4	1	—	—	—	—
	Total	422	118	151	41	177	63
	Total exports	158 295	24 883	243 609	32 158	247 297	33 909
IMPORTS (2)							
2518.20	Calcined or sintered dolomite						
	United States	52 739	6 733	60 507	7 250	60 923	7 415
	Australia	—	—	—	—	15	2
	Denmark	—	—	—	—	9	1
	Germany	—	—	—	—	...	...
	Bhutan	...	...	—	—	—	—
	China	...	...	1	...	—	—
	Total	52 739	6 733	60 508	7 250	60 947	7 418
2522.10	Quicklime						
	United States	57 083	6 349	83 618	8 546	62 002	7 926
	France	3	...	—	—	345	244
	Switzerland	98	16	141	25	45	34
	China	—	—	1	...	5	4
	Germany	—	—	—	—	2	3
	Canada	106	29	137	32	3	1
	India	1	...	1	...	—	—
	Total	57 291	6 394	83 898	8 603	62 402	8 212
2522.20	Slaked lime						
	United States	6 113	1 198	7 500	1 340	40 438	2 066
	Germany	9	3	—	—	—	—
	Israel	30	5	—	—	—	—
	Taiwan	...	...	—	—	—	—
	Canada	—	—	...	...	—	—
	Italy	—	—	...	10	—	—
	Total	6 152	1 206	7 500	1 350	40 438	2 066

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2522.30	Hydraulic lime						
	United States	6 796	1 254	3 360	737	3 286	571
	France	966	248	285	322	—	—
	Italy	1	...	—	—	—	—
	United Kingdom	—	—	9	393	—	—
	Total	7 763	1 502	3 654	1 452	3 286	571
	Total imports	123 945	15 835	155 560	18 655	167 073	18 267

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Amount too small to be expressed; (p) Preliminary; x Confidential.

(1) Producers shipments and quantities used by producers. (2) Includes re-imports. HS code 2522.30, as interpreted, applies mainly to hydrated lime.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, LIME PRODUCTION, TRADE AND APPARENT USE, 1988-2006

	Production (1)			Imports	Exports	Apparent Use (2)
	Quick	Hydrated	Total			
(tonnes)						
1988 (a)	2 306 831	211 151	2 517 982	32 543	122 899	2 427 626
1989	2 349 312	202 622	2 551 934	39 096	83 607	2 507 423
1990	2 137 996	202 741	2 340 737	43 715	138 410	2 246 042
1991	2 184 836	190 424	2 375 260	45 011	134 405	2 285 866
1992	2 193 752	190 592	2 384 344	55 706	173 249	2 266 801
1993	2 186 749	192 247	2 378 996	52 690	190 068	2 241 618
1994	2 250 205	198 818	2 449 023	66 885	193 902	2 322 006
1995	2 244 800	216 916	2 461 716	52 883	266 476	2 248 123
1996	2 134 437	267 595	2 402 032	36 640	216 849	2 221 823
1997	2 219 385	257 186	2 476 571	47 382	224 233	2 299 720
1998	2 204 957	256 086	2 461 043	34 031	171 447	2 323 627
1999	2 299 705	265 746	2 565 451	54 535	96 058	2 523 928
2000	2 271 277	254 092	2 525 369	62 296	80 630	2 507 035
2001	2 007 078	205 568	2 212 646	94 150	93 516	2 213 280
2002	2 054 443	193 089	2 247 532	70 324	120 062	2 197 794
2003	2 035 611	185 387	2 220 998	78 277	117 505	2 181 770
2004	2 207 465	178 371	2 385 836	71 206	136 705	2 320 337
2005	2 113 259	175 564	2 288 823	95 053	199 928	2 183 948
2006 (p)	2 019 508	191 895	2 211 403	106 125	201 347	2 116 181

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

(a) Beginning in 1988, exports and imports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. Imports and exports include HS classes 2522.10, 2522.20 and 2522.30.

(1) Producers' shipments and quantities used by producers. (2) Production plus imports, less exports.

TABLE 3. CANADIAN LIME INDUSTRY, 2006

Company	Plant Location	Calcining Capacity	Kiln Type	Market	Type of Quicklime and Other Products
(000 t/y)					
NEW BRUNSWICK					
Graymont (NB) Inc.	Havelock	175	V	Merchant	High-calcium (1)
QUEBEC					
Graymont (QC) Inc.	Marbleton	330	V, R	Merchant	High-calcium (1)
Graymont (QC) Inc.	Joliette	220	R	Merchant/captive	High-calcium (1)
Graymont (QC) Inc.	Bedford	400	R	Merchant	High-calcium
ONTARIO					
Algoma Steel Inc.	Sault Ste. Marie	200	..	Captive	High-calcium and dolomitic
Beachville Lime Limited	Ingersoll	900	R	Merchant	High-calcium (1) and dolomitic
Northern Lime Limited	Spragge	160	R	Merchant	High-calcium and dolomitic
Lafarge Lime (Canada) Inc., Dundas Division	Dundas	400	R	Merchant	High-calcium and dolomitic
Timminco Limited	Haley Station	53	..	Captive	Dolomitic
MANITOBA					
Graymont Western Canada Inc.	Faulkner	117	R	Merchant	High-calcium and dolomitic
ALBERTA					
Rogers Sugar Ltd.	Taber	66	..	Captive	High-calcium
Graymont Western Canada Inc.	Exshaw	180	R	Merchant	High-calcium (1)
BRITISH COLUMBIA					
Graymont Western Canada Inc.	Pavilion Lake	235	R	Merchant	High-calcium
Chemical Lime Company of Canada Inc.	Fort Langley	135	C	Merchant	High-calcium (1)

Source: Natural Resources Canada.

.. Not available.

Kiln type: V = vertical; R = rotary; C = calcimatic.

(1) Production of hydrated lime.

TABLE 4. CANADA, USE (1) OF DOMESTIC LIME, QUICK AND HYDRATED, 1999-2006

End Uses	1999	2000	2001	2002	2003	2004 (r)	2005	2006 (p)
(tonnes)								
CHEMICAL AND INDUSTRIAL								
Steel-making	780 877	632 284	530 605	730 180	664 225	761 208	665 642	666 384
ENVIRONMENTAL								
Water and sewage treatment	296 053	224 074	197 817	233 036	213 391	210 869	219 792	269 125
Water purification	51 323	37 445	48 420	38 590	34 320	31 472	20 623	16 577
Gas scrubbing	16 309	7 629	6 742	22 803	30 229	16 001	26 430	33 268
Total environment	363 686	269 148	252 979	294 429	277 940	258 342	266 845	318 970
Metal concentration	138 431	153 469	176 213	141 434	152 563	193 247	122 359	124 043
Pulp and paper mills	213 627	218 878	253 287	240 646	267 072	211 214	194 902	155 629
Chemicals	194 362	161 408	163 070	167 952	156 005	189 500	133 164	103 841
Other industrial uses	101 102	109 645	44 765	88 500	108 344	102 337	132 227	112 688
CONSTRUCTION								
Road and soil stabilization	15 810	x	x	x	x	x	5 552	3 918
Mason and finishing lime	x	x	x	x	x	x	1 950	x
Other	22 126	11 259	x	3 754	7 351	8 683	x	6 096
Total constructions	x	21 762	x	x	x	x	x	x
AGRICULTURE								
	x	4 699	x	x	x	x	x	x
Total use	1 834 124	1 571 293	1 447 722	1 688 145	1 651 014	1 742 031	1 533 841	1 498 954

Source: Natural Resources Canada.

(p) Preliminary; x Confidential.

(1) Includes merchant market only; excludes companies that are completely captive producers/users.

Note: Numbers may not add to totals due to rounding.

TABLE 5. WORLD PRODUCTION OF QUICKLIME AND HYDRATED LIME, INCLUDING DEAD-BURNED DOLOMITE SOLD AND USED, 2000-2006

	2000	2001	2002	2003	2004	2005	2006 (p)
	(000 tonnes)						
Canada	2 500	2 210	2 248	2 221	2 385	2 288	2 211
Austria	..	..	..	2 000	2 000	2 000	2 000
Belgium	..	..	..	..	..	2 000	2 000
Brazil	5 700	6 300	6 300	6 500	6 500	6 500	6 900
Bulgaria	..	..	..	..	..	2 500	2 500
China	21 500	22 000	22 500	23 000	23 500	24 000	25 000
France	2 400	2 400	2 500	2 500	3 000	3 000	3 000
Germany	7 600	7 000	7 000	7 000	6 700	6 700	6 800
Iran	..	..	..	2 200	2 200	2 500	2 500
Italy (1)	3 500	3 500	3 000	3 000	3 000	3 000	3 000
Japan (2)	7 700	8 100	8 050	7 800	7 950	8 600	8 900
Mexico	6 600	6 500	6 500	6 500	5 700	5 700	5 800
Poland	2 500	2 200	2 000	1 900	2 000	2 000	1 800
Russia	(3)	8 000	8 000	8 000	8 000	8 200	8 500
United Kingdom	2 500	2 500	2 000	2 000	2 000	2 000	2 000
United States	19 600	18 900	17 900	19 200	20 000	20 000	21 200
Other countries	33 995	28 056	28 002	26 179	31 065	26 012	25 889
Total	116 095	117 666	116 000	120 000	126 000	127 000	130 000

Sources: Natural Resources Canada; Statistics Canada; U.S. Geological Survey.

.. Not available; (p) Preliminary.

(1) Includes hydraulic lime. (2) Quicklime only. (3) Included with other countries.

Magnesium

*Prepared by the Minerals and Metals
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Trade (HS-8104)	2002	2003	2004 (r)	2005 (r)	2006
(\$'000)					
VALUE					
Exports	266 717	188 053	164 182	169 459	133 831
Imports	114 385	110 292	152 048	114 031	107 844
(tonnes)					
QUANTITY					
Exports	71 244	58 629	47 860	48 094	44 766
Imports	34 895	37 934	53 254	38 811	41 178

(r) Revised.

CANADIAN DEVELOPMENTS

Producers

Norsk Hydro Canada Inc. (www.magnesium.hydro.com), a wholly owned subsidiary of Norsk Hydro ASA of Norway, has produced primary magnesium metal at its Bécancour, Quebec, plant using an electrolytic process since 1989. In October 2006, the company announced it was leaving the magnesium industry and its Bécancour smelter was closed in April 2007 after it was unable to find a buyer for the facility as an operating smelter.

Timminco Limited (www.timminco.com) produces and markets alloy magnesium, silicon metal, specialty ferro-silicon, calcium, and strontium alloys. The company's products are used in a broad range of specialized industrial applications and industries, such as engineered extruded products, and in chemical, pharmaceutical, electronics, automotive, and metallurgical applications. It operates a plant producing high-purity metal and alloyed magnesium for specialized markets at Haley Station, Ontario. The company also produces highly corrosion-resistant magnesium die-casting alloys and extruded anode rods for hot-water heaters. The casting facility at Haley Station

provides magnesium billets for Timminco's extrusion facilities.

Project Proposals

Canadian company projects include: Globex Mining Enterprises Inc.'s magnesite-talc project at Timmins, Ontario; Leader Mining International Inc.'s silicate-based project near Hope, British Columbia; and Gossan Resources Ltd.'s dolomite project at Inwood, Manitoba.

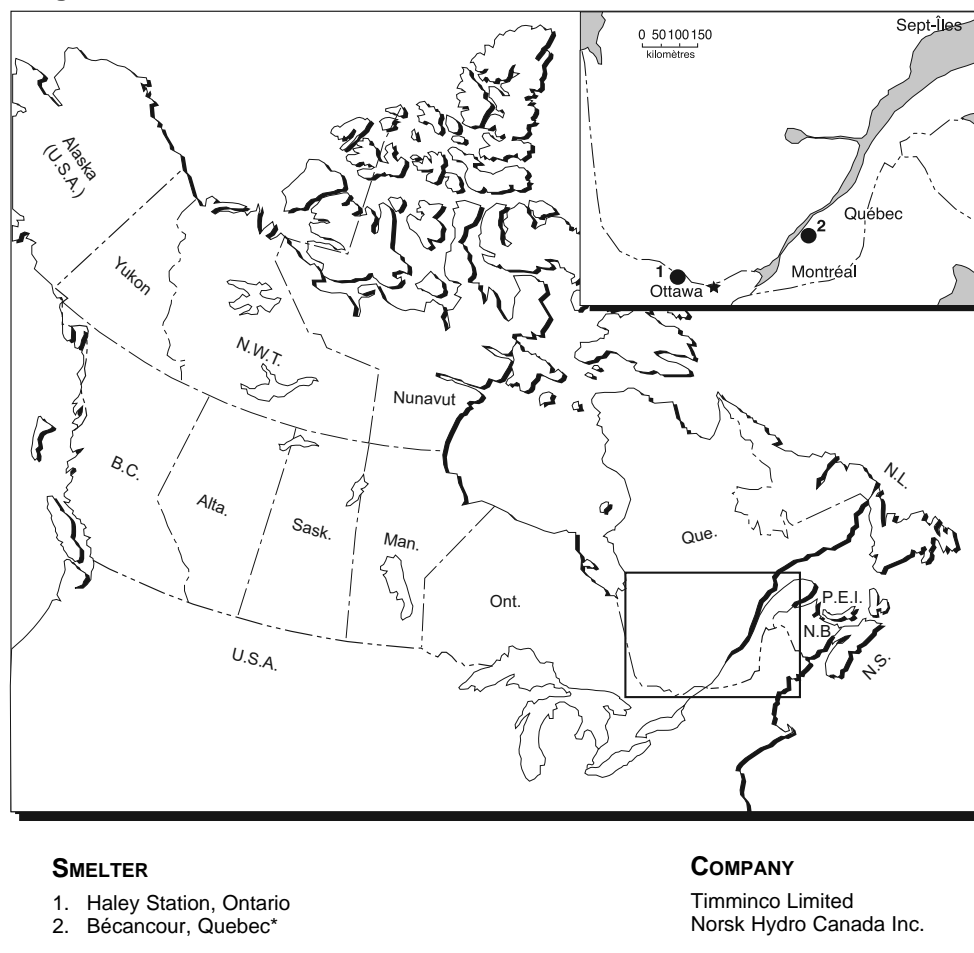
Globex continued to seek a financial or technical partner for its magnesium-talc deposit 13 km south of Timmins, Ontario. Previous work has indicated the potential for production of both magnesium metal and high-quality talc from the deposit. Results of a 2001 scoping study were positive and indicated a good economic potential using available technology. The project would include a mine-mill complex located near Timmins, Ontario, and a 95 000-t/y smelter located west of Rouyn-Noranda, Quebec, and has the advantages of ready access to competitive power prices; large consumer markets; a stable, high-calibre work force; excellent infrastructure, including highways and railways; and a high-quality talc by-product to provide additional revenue (www.globexmining.com).

Gossan Resources Ltd. holds a dolomite deposit at Inwood, Manitoba, on which the company is conducting studies towards a metal project. In 2006, Gossan completed a 27-hole drill program totaling 496.2 m and engaged consultants to undertake a resource calculation report based on the current and past drilling.

Gossan has examined the Mintek process for the production of magnesium and has evaluated the use of other production methods. In 2007, the company signed a Memorandum of Understanding to acquire an interest in a new technology for the production of magnesium metal from dolomite. The new process is based on an adaptation of the Magnatherm process for producing magnesium metal by silicothermic vacuum reduction of molten slag containing magnesia. Gossan is undertaking a three-phase evaluation process, including thermodynamic modelling, bench-scale testing, and pilot plant testing. (Additional information is available on the Internet at www.gossan.ca.)

North Pacific Alloys Limited, a wholly owned subsidiary of Leader Mining International Inc., has now obtained a

Figure 1
Magnesium Smelters, 2006



* Closed in 2007.

100% interest in the Cogburn ultramafic intrusive near Hope, British Columbia, which contains magnesium-bearing silicates. In late 2005, the company filed its draft Terms of Reference for the Cogburn magnesium project to the B.C. Environmental Assessment Office. The project was described as a US\$1.3 billion integrated quarry and magnesium reduction plant producing 131 000 t/y of high-purity magnesium alloys. The company is currently in the process of identifying possible joint-venture partners to develop the project (www.leadermining.com).

Canadian Production and Use

Canadian production is confidential due to the low number of producers.

In Canada, the reported use of magnesium decreased from a revised 50 045 t in 2005 to 47 765 t in 2006. In both years, 32 companies were surveyed on their use of magnesium (see Table 2).

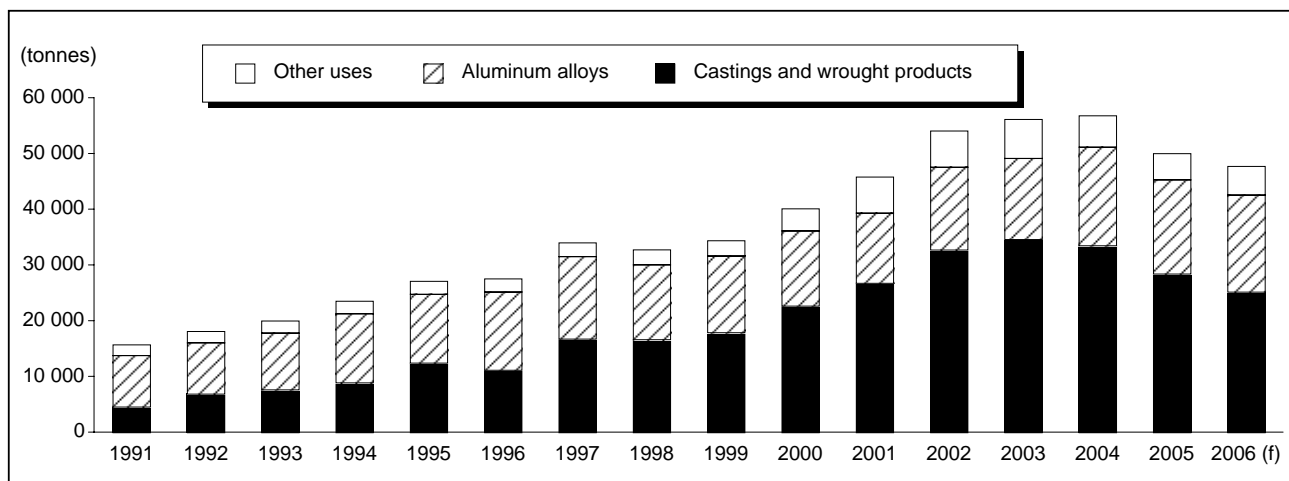
GLOBAL CONTEXT

World primary magnesium production was approximately 710 000 t in 2006. With recycled magnesium, the total reached approximately 805 000 t. This represents about an 85% increase in primary magnesium production over the past decade.

An increase in titanium production capacity and plants in the world will create a short-term increased demand for magnesium metal, which is used in the titanium production process. The magnesium is generally regenerated back to magnesium metal for re-use. Historically, this regeneration has often been done within the titanium production facility and this production of magnesium has not generally been counted as magnesium production or use.

The apparent use of magnesium ingot (recycled and primary) was approximately 761 000 t in 2006, an increase of 47 000 t (7%) (see Table 3).

Figure 2
Canadian Use of Magnesium, 1991-2006



Source: Natural Resources Canada, 2004 survey of 32 Canadian users of magnesium.

(f) Forecast.

China

China is by far the largest producer of primary magnesium in the world and it also has the world's fastest growth in magnesium use. The National Bureau of Statistics of China reported that magnesium production increased by about 12% in 2006 to 525 624 t. It is expected that this growth rate will increase in 2007 with increased metal prices, but not to the level of increase (50%) seen in 2003 (see Table 4).

In 2006, approximately 173 232 t of unwrought pure magnesium were reported exported from China (down 5%) and 85 681 t of alloy magnesium (down 8%), reflecting the tax changes for exports of unwrought magnesium. Exports of articles of magnesium rose to 9250 t in 2006 from 3599 t in 2005, an increase of 157%. Alloy production has grown in the past several years, and export growth in semi-fabricated forms of magnesium, and parts and finished products, is expected to continue in the coming years.

China continues to address concerns with rapidly expanding industries such as the magnesium industry and has focused on improvements to increase the size and efficiency of smaller operations and more value-added operations. In its continued efforts to reduce the production of energy-intensive products and reduce pollution, the Chinese government again cut the Value Added Tax (VAT) rebate on exports of metals, including magnesium, from 5% to 0% in September 2006. It had previously reduced this rebate from 13% to 5% in January 2006. Tax breaks for toll trading/processing of magnesium and magnesium scrap were also removed in November 2006.

Republic of Congo (Brazzaville)

MagIndustries Corp. continued activity across its business segments in The Republic of Congo (Brazzaville). It has focused on work by forestry and energy subsidiaries and has announced that it would move forward on a bankable feasibility study for its potash operation in 2007. A pre-feasibility study on developing its Kouilou magnesium smelter project from the by-product magnesium salt was expected to be completed in 2007 once successful start-up of the potash operation is completed (www.magindustries.com).

Australia

Latrobe Magnesium Limited, in Australia's Victoria State, continued studies on the production of magnesium from fly ash. During 2006, the company decided to expand its asset base to coal, gold, uranium, and the oil and gas sectors due to the depressed state of the magnesium market. It is currently working on a bankable feasibility study, including a pilot plant (<http://latrobemagnesium.com>).

Malaysia

Commerce Venture Manufacturing Sdn Bhd, a subsidiary of Ho Wah Genting Bhd, was reported by the government to be building South-East Asia's first magnesium smelter in Perak. Its capacity was to be 15 000 t/y in the first phase, which was to produce metal in 2008. An expected second phase would double capacity in 2009 (www.mida.gov.my).

Norway

As part of Norsk Hydro's exit from magnesium, the 20 000-t/y magnesium casthouse operation in Porsgrunn, Norway, was closed in June.

Russia

Interfax reported that the Government of the Sverdlovsk Region in Russia, JSC Uralasbest, and Minmet Financing Co., part owner of the Solikamsk magnesium plant in Russia, have continued working on a project to produce metal from asbestos mining residues. It was thought construction might start in 2007.

It was also reported that the Government of Ingushetia had presented an investment proposal for third parties to build a magnesium plant based on dolomitic resources in the region.

United States

Ongoing trade actions in the United States were again reported, including:

- pure magnesium ingot and butt ends from China that are remelted in France do not undergo a substantial trans-

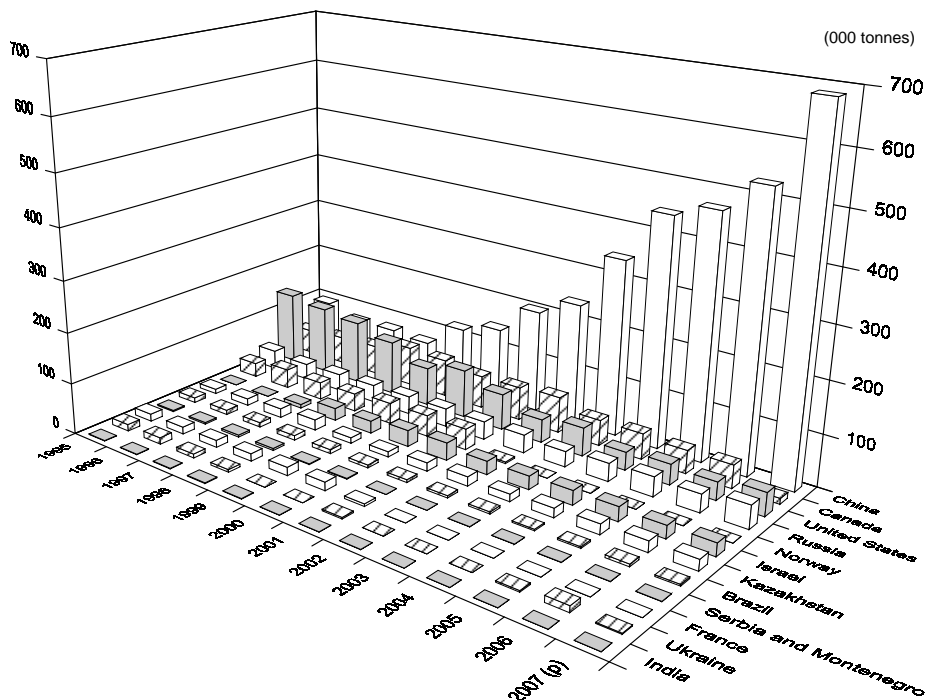
formation and are therefore subject to anti-dumping duties;

- revocation of the countervailing duties on pure and alloy magnesium from Canada would be unlikely to lead to continuation or recurrence of material injury to an industry in the United States;
- magnesium from China and Russia that was transformed into billet in Canada before it was shipped to the United States was not subject to anti-dumping duties;
- China Tianjin Magnesium International Co. Ltd. received a ruling that it was not subject to the 108% anti-dumping duties on pure magnesium that are applied to other Chinese producers;
- the administrative review of dumping margins on Russian magnesium was ongoing with a decision expected in April 2007; and
- anti-dumping duties on pure granular magnesium from China will be maintained at 305.56%.

Further information is available on the Internet at <http://minerals.usgs.gov>.

Figure 3
World Primary Magnesium Production, 1995-2007

Estimated total in 2006 = 710 000 t



Sources: International Consultative Group on Nonferrous Metals Statistics; reports in various journals (also see notes on the accompanying production table).
(p) Preliminary.

PRICES

Prices published by *Metals Week* for magnesium remained weak through the year, rising only in October. The U.S. Spot Western Mean started the year at about US\$1.22/lb, subsequently fell to US\$1.13/lb in June, and remained there until prices started to rise, ending December with an average of US\$1.40/lb. Prices continued to rise in 2007 and were at the US\$1.60/lb level in March. The mean U.S. dealer import prices reflected the same trend, starting the year at US\$1.19/lb and ending it at US\$1.39/lb.

Reported prices of Chinese magnesium on a spot basis f.o.b. China started the year at approximately US\$1530-\$1600/t and strengthened steadily through the year to end it at US\$1900-\$1920/t. Prices continued to increase in early 2007 and were reported as approximately US\$2150-\$2200/t at the end of March.

ANNUAL AVERAGE PRICES, METALS WEEK (U.S. SPOT WESTERN MEAN) (1)

2001	2002	2003	2004	2005	2006
(US\$/lb)					
1.25	1.21	1.09	1.48	1.46	1.18

(1) Calculated from data published in *Platts Metals Week*.

GENERAL INFORMATION

For recent statistics and events in the Canadian and global magnesium industry, see:

- Previous magnesium chapters in the *Canadian Minerals Yearbook* at www.nrcan.gc.ca/mms/cmy/com_e.html;
- the web site of the International Magnesium Association at www.intlmag.org;
- Magnesium.com on-line resource at www.magnesium.com/w3/; and
- the U.S. Geological Survey web site at <http://minerals.usgs.gov/minerals/pubs/commodity/magnesium>.

Canadian companies with magnesium metal interest have web sites located at:

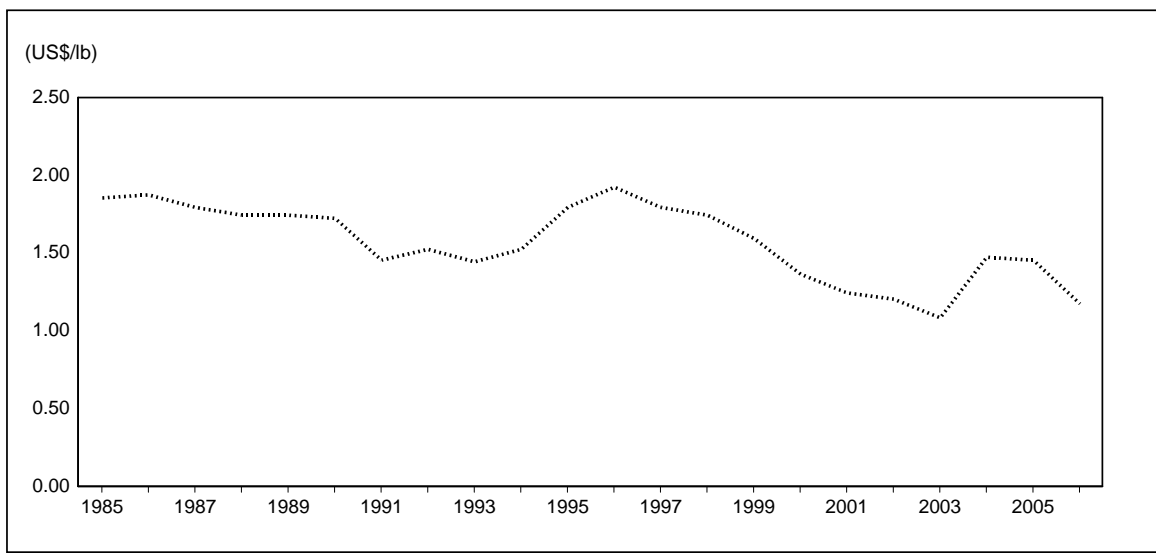
Timminco Limited
www.timminco.com

Globex Mining Enterprises Inc.
www.globexmining.com

Gossan Resources Ltd.
www.gossan.ca

Hatch Associates of Canada
www.hatch.ca

Figure 4
Annual Average Magnesium Prices, 1985-2006



Sources: Natural Resources Canada; *Metals Week* (U.S. Spot Western Mean).

Lakefield Research of Canada Limited
www.lakefield.com

Leader Mining International Inc.
www.leadermining.com

MagIndustries Corp.
www.magindustries.com

Occurrence

Magnesium is the eighth most abundant element, comprising over 2% of the earth's crust. It is the third most abundant element dissolved in seawater with a concentration averaging 0.14% by weight. Magnesium does not naturally occur in its native or metallic state, but is found in more than 60 different minerals. The principal magnesium minerals include carbonate forms in dolomite and magnesite, as silicate forms in olivine and brucite, as an oxide/silicate in serpentine, and as a chloride in seawater, natural brines, and evaporites. In the past, magnesium metal has been produced from dolomite, magnesite, brucite, seawater, brines, and residues from asbestos mines. Companies have also studied the production of magnesium from other magnesium-rich sources such as fly ash.

Technology

Magnesium metal is currently produced by several methods that can be classed into two general processes. These are: metallothermic, in which a reducing agent such as ferro-silicon or aluminum is mixed with magnesium oxide and heated in a furnace, generally in a vacuum, to produce magnesium metal vapour; and electrolytic, in which molten magnesium chloride salts are electrolyzed/reduced to produce liquid magnesium metal. Larger plants generally use electrolytic methods, which account for over one third of the world's production. Metallothermic methods require more labour and are more suitable for small batch operations; these have become more important with the increased production from China.

Research has taken place to refine, modernize, and replace existing production processes. Although production improvements have been made in existing operations, other options exist. The results of work to date have not been successfully adapted to large-scale production, although some changes in material supply and feedstock production and preparation have been implemented by existing producers.

Nichromet Extraction Inc. and LAB Chrysotile Inc. have proposed the production of magnesium compounds (chloride and oxide) from a magnetic fraction of asbestos tailings at the mine in Thetford. A hydrometallurgical process using a chloride leach would produce these compounds, along with nickel and cobalt (www.nichromet.com).

Use

Although magnesium is consumed in some applications (such as in flares or pyrotechnics, or when magnesium is used in chemical reactions in the production of other metals), most use in industrial and consumer products is generally non-destructive and the metal can be recycled and re-used. The energy inherent in the metal remains and the process of recycling the metal recovers that energy in a repeating and sustainable manner. Discussions on metals taking place in a number of fora indicate that the word "consumption" in reports should be modified to more appropriately reflect the actual use of the metal.

Magnesium metal is best known for its light weight and high strength-to-weight ratio, making it suitable for a wide range of applications. It is the lightest of all structural elements and is easily malleable and easily alloyed. Magnesium alloys are stiff and resist denting. When used as a structural material, magnesium is alloyed with other elements, including aluminum, manganese, rare earth metals, silver, thorium, zinc, and zirconium. When alloyed with one or more of these elements, the resulting alloys can have unusually high strength-to-weight ratios. Magnesium-aluminum alloys are the most common and are principally used in die-casting applications.

The use of magnesium in larger-scale structural applications is relatively new, and metal and alloy development for specific applications is not as advanced as for better-known metals such as iron or aluminum. In addition, ways to avoid potential problems with corrosion are not as well developed for magnesium. As a result, some magnesium alloys have limitations on their use due to this potential for corrosion in some environments. In addition, the use of some magnesium metal and magnesium alloys at higher temperatures is limited due to the creep that can occur in those environments. Work by metal producers such as former Noranda/Magnola and Hydro Magnesium has resulted in new creep-resistant alloys for use in higher-temperature environments. Engineering data on their physical properties are being generated to allow increased use in larger-component automotive applications such as transmission housings, oil pans, and engine blocks.

The use of die-cast magnesium parts can help automobile manufacturers reduce total vehicle weight while meeting the consumer demand for larger vehicles. The interest in magnesium metal in the automotive market is largely due to weight savings of more than 30% compared to aluminum and to a desire to increase fuel efficiency through weight reduction.

Magnesium has good vibration-dampening characteristics. Its lower heat of solidification, which increases die-casting production capacity by 25%, results in major process energy savings. Its characteristics also allow the casting of thinner and more complex shapes, which can replace a number of parts made with other materials, which in turn

can also reduce the cost of assembly. Dies for magnesium castings are reported to have more than twice the life of aluminum dies and, at a magnesium-to-aluminum price ratio of about 1.7:1.0 or less, many magnesium metal parts can be fabricated at a lower cost than those made from aluminum. In this regard, over the last few years, the increased price of aluminum and the decreased price of magnesium have made the use of magnesium relatively more economical.

The primary use of magnesium metal is as an alloying agent for aluminum where it imparts strength and rigidity to alloys used in various applications, including aluminum sheet, such as that used in the manufacture of aluminum beverage containers. These alloys allow the use of less material, producing thinner walls and lighter containers than would normally otherwise be possible.

The next most important use for magnesium metal is for die-cast products. These castings can be used in structural applications such as instrument panel beams of automobiles or as equipment cases for electronic equipment such as cameras, cell phones, computers, portable tools, and sporting goods. Magnesium's advantages for these applications are its good strength-to-weight ratio, heat dissipation, electromagnetic field containment, and radio frequency interference dissipation.

The third largest use of magnesium is as a deoxidizing and desulphurizing agent in the ferrous industry where it is consumed in the production of steel and cast iron. Magnesium is introduced into the melt during the production of nodular iron, which is used primarily for the production of ductile iron pipes and die-cast parts for use in automobiles and farm equipment.

Other uses are much smaller in comparison to those above. These include:

- Chemical uses: in pharmaceutical and chemical products, perfumes, and pyrotechnics;
- Electrochemical applications: in batteries and in anodes for the cathodic protection of gas pipelines and water heaters;
- Wrought products: in extruded products, sheets, and plates; and
- Magnesium metal is also used to produce other metals such as titanium, beryllium, zirconium, hafnium, and uranium.

The biggest potential for growth in the use of magnesium lies in the aluminum alloy and automotive market sectors. However, growth will be dependent upon prices and price stability as magnesium continues to face stiff competition from other materials, including aluminum, steel, and plastics.

Recycling

The production of recycled magnesium from metallic scrap requires about 5% of the energy required to produce primary magnesium. The recycling of old or post-consumer magnesium scrap is expected to increase with the anticipated growth in the use of magnesium die-cast automobile parts and electronics. In addition, casting operations produce a high proportion of new or process scrap in their operations that is recycled either on site or at another location. Producers collect new magnesium scrap from their clients and recondition and recast the metal into a usable form and shape. This source of scrap is expected to increase with time as magnesium metal further penetrates the automotive and electronics markets and the vehicles and electrical equipment are scrapped. However, as technology and methods for recycling magnesium improve, it is likely that more recycling of this and other clean new scrap will take place in facilities using the original metal. As figures are not collected on this runaround or new scrap, statistics on recycling magnesium may eventually show a decrease, although recycling itself would not decrease.

Major North American auto manufacturers, including Daimler-Chrysler Canada Inc., Ford Motor Company, and General Motors Corporation, use magnesium alloy parts containing recycled magnesium. The recovery and use of this recycled magnesium reduce the cost of die-cast components and contribute to sustainable practices in metal use.

Prices

Magnesium metal does not trade on the London Metal Exchange or the New York Mercantile Exchange Inc. Producers and metal traders deal directly with users as the volumes of metal are not large enough for inclusion in an organized market. Producer and dealer pure and alloy magnesium metal price quotes can be found in various metal publications such as *Metal Bulletin* and *American Metal Markets*, or other similar papers and journals with metals news. It should be noted that duties and other taxes can significantly change prices within regional areas and published data may not apply to all markets.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of March 30, 2007. (3) Some differences are noted in some production data from independent sources. Readers are cautioned to confirm data from all sources. (4) Julie Simon and others in the Minerals and Metals Statistics Division created Tables 1 and 2 and provided input into other tables and figures (contact Julie Simon, tel.: 613-947-6777). (5) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmty/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading,

investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS (1)

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (2)	WTO (3)
25.19	Natural magnesium carbonate; fused magnesia; dead-burned magnesia, whether or not containing small quantities of other oxides added before sintering; other magnesium oxide, whether or not pure						
2519.10	Natural magnesium carbonate	Free	Free	Free	Free	Free	Free
2519.90	Other	Free	Free	Free	Free	Free-1.7%	Free
2816.10	Hydroxide and peroxide of magnesium; oxides, hydroxides and peroxides, of strontium or barium: hydroxide and peroxide of magnesium	Free	Free	Free	Free	4.1%	3.3%
2827.31	Chlorides, chloride oxides and chloride hydroxides; bromides and bromide oxides; iodides and iodide oxides: other chlorides: of magnesium	Free	Free	Free	Free	4.6%	3.3%
2833.21	Sulphates; alums; peroxosulphates: other sulphates: of magnesium	Free-3.5%	Free-3%	Free	Free	5.5%	Free
2836.99.10.40	Carbonates; peroxocarbonates; commercial ammonium carbonate containing ammonium carbonate: commercial ammonium carbonate and other ammonium carbonates; lead carbonates; other: other: bismuth carbonate: other carbonates and peroxocarbonates, for use in the manufacture of animal or poultry feeds, glues or adhesives, optical fibres or optical fibre bundles or cables, typewriter or similar ribbons, polymers in primary forms or profile shapes or sheets of plastics; other carbonates and peroxocarbonates, to be employed as drilling mud or additives thereof in drilling for minerals, natural gas, oil or water: magnesium carbonates	Free	Free	Free	Free	3.7%	3.3%
2836.99.90.30	Carbonates; peroxocarbonates; commercial ammonium carbonate containing ammonium carbonate: other: other: magnesium carbonates	3.5%	3%	Free	Free	5.5%	3.3%
38.24	Prepared binders for foundry moulds or cores; chemical products and preparations of the chemical or allied industries, not elsewhere specified or included						
3824.90.90.42	Other: granular metallic magnesium coated with inorganic salt, mixed with lime	6.5%	3%	Free	Free	Free-6.5%	Free-3.9%
3824.90.90.43	Other: other granular metallic magnesium coated with inorganic salts	6.5%	3%	Free	Free	Free-6.5%	Free-3.9%
81.04	Magnesium and articles thereof, including waste and scrap:						
8104.11	Unwrought magnesium: containing at least 99.8% by weight of magnesium	2.5%	Free	Free	Free	5.3%	Free-3%
8104.19	Unwrought magnesium: other	Free-2.5%	Free	Free	Free	4%	Free-3%
8104.20	Waste and scrap	Free	Free	Free	Free	Free	2.1%
8104.30	Raspings, turnings and granules, graded according to size; powders	2.5%	Free	Free	Free	4%	3%
8104.90	Other	2.5%	Free	Free	Free	4%	3%

Sources: Canadian Customs Tariff, effective January 2006, Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2006; Official Journal of the European Union (October 27, 2005 Edition); Customs Tariff Schedules of Japan, 2006.

(1) Does not include countervail or anti-dumping duties, which may be applied to material of certain origin. (2) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (3) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, MAGNESIUM TRADE, 2004-06

TABLE 1. CANADA, MAGNESIUM TRADE, 2004-05							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS							
2519.10	Natural magnesium carbonate (magnesite)						
	Japan	...	...	—	—	43	18
	United States	6 176	575	238	21	—	—
	Others	...	...	8	3	1	...
	Total	6 176	575	246	24	44	18
2519.90	Other magnesium oxide						
	United States	57 691	14 045	42 300	10 165	19 748	5 497
	Taiwan	470	211	286	145	637	326
	Hungary	1 105	289	1 303	374	—	—
	Singapore	1 560	732	1 669	785	—	—
	Others	1 619	893	1 016	478	439	195
	Total	62 445	16 170	46 574	11 947	20 824	6 018
2816.10	Hydroxide and peroxide of magnesium						
	Chile	3	2	—	—	—	—
	United Kingdom	1	1	—	—	—	—
	United States	255	509	27	56	—	—
	Total	259	512	27	56	—	—
2827.31	Other chlorides: of magnesium						
	United States	323	59	55	68	261	252
	Others	15	15	...	...	30	17
	Total	338	74	55	68	291	269
2833.21	Other sulphates: of magnesium						
	United States	9 976	2 566	7 042	1 740	4 562	1 259
	Others	3	7	2	7	...	1
	Total	9 979	2 573	7 044	1 747	4 562	1 260
	Total exports of magnesium compounds	79 197	19 904	53 946	13 842	25 721	7 565
8104.11	Magnesium unwrought, containing by weight at least 99.8% magnesium						
	United States	1 853	8 355	4 806	18 382	8 782	24 839
	Japan	1 750	4 373	1 382	4 068	1 460	4 322
	Netherlands	1 389	3 470	290	819	562	1 516
	Austria	686	1 716	538	1 555	316	884
	Belgium	679	1 677	450	1 314	247	678
	Germany	1 320	3 237	775	2 237	189	513
	United Kingdom	692	4 100	54	292	44	119
	Brazil	533	1 423	1 776	5 382	—	—
	United Arab Emirates	1 214	2 962	470	1 354	—	—
	Others	123	580	344	1 038	17	78
	Total	10 239	31 893	10 885	36 441	11 617	32 949
8104.19	Magnesium unwrought, other						
	United States	23 591	88 181	25 439	98 912	19 355	71 593
	Netherlands	728	3 518	579	2 976	326	1 627
	Sweden	19	98	39	201	38	187
	Germany	...	...	58	297	19	109
	Chile	12	86	8	53	17	108
	Others	900	2 905	29	136	40	190
	Total	25 250	94 788	26 152	102 575	19 795	73 814
8104.20	Magnesium waste and scrap						
	United States	10 046	20 510	8 902	15 034	11 527	16 733
	Others	1	2	22	24	—	—
	Total	10 047	20 512	8 924	15 058	11 527	16 733

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
8104.30	Magnesium raspings, turnings or granules, graded according to size and powders						
	United States	827	3 185	758	3 025	970	2 620
	Ireland	270	1 828	193	1 253	103	627
	Netherlands	205	1 295	187	1 158	77	414
	Germany	65	542	95	832	35	270
	Others	11	75	3	10	20	111
	Total	1 378	6 925	1 236	6 278	1 205	4 042
8104.90	Magnesium and articles thereof: other						
	United States	933	9 913	891	9 021	615	6 194
	Others	13	151	6	86	7	99
	Total	946	10 064	897	9 107	622	6 293
	Total exports of magnesium metal	47 860	164 182	48 094	169 459	44 766	133 831
IMPORTS							
2519.10	Natural magnesium carbonate (magnesite)						
	China	78 994	4 105	74 636	3 183	36 018	1 634
	Australia	113 078	4 606	65 700	2 852	31 588	1 374
	Spain	6 818	1 295	—	—	19 297	847
	United States	3 601	659	3 653	698	2 121	406
	Others	33	6	29	5	38	7
	Total	202 524	10 671	144 018	6 738	89 062	4 268
2519.90	Other magnesium oxide						
	United States	30 076	14 010	25 822	12 384	22 106	11 955
	China	16 907	6 484	30 633	12 287	25 645	8 496
	Australia	7 182	2 935	12 013	11 190	13 985	6 858
	Austria	11 554	7 331	3 138	1 895	8 214	4 523
	Japan	1 591	1 199	1 087	1 313	1 182	1 163
	Spain	—	—	23	7	1 331	451
	Netherlands	7 157	3 074	10 710	4 966	499	395
	Israel	641	432	438	345	325	333
	Brazil	119	144	24	63	162	207
	Mexico	1 021	554	956	515	157	131
	Germany	33	31	5	5	139	107
	Italy	149	73	216	93	124	64
	Slovakia	1 362	591	1 228	373	188	43
	Others	22	18	15	11	3	12
	Total	77 814	36 876	86 308	45 447	74 060	34 738
2816.10	Hydroxide and peroxide of magnesium						
	United States	8 432	4 790	6 950	3 857	7 174	3 673
	Others	12	29	14	31	17	35
	Total	8 444	4 819	6 964	3 888	7 191	3 708
2827.31	Other chlorides: of magnesium						
	United States	24 070	2 653	35 405	3 580	45 279	3 705
	Netherlands	372	135	31 008	2 153	46 625	2 137
	Israel	4 645	1 439	4 323	1 454	3 575	1 161
	Germany	234	339	251	921	142	163
	China	97	20	99	35	508	131
	Others	257	357	307	317	134	150
	Total	29 675	4 943	71 393	8 460	96 263	7 447

TABLE 1 (cont'd)

TABLE 1 (cont'd)							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2833.21	Other sulphates: of magnesium						
	United States	14 368	2 968	14 897	3 351	10 655	3 143
	Germany	5 401	1 309	5 872	1 229	4 096	915
	China	403	99	1 132	325	1 611	521
	Japan	125	45	41	43	233	490
	Others	311	85	215	74	306	99
	Total	20 608	4 506	22 157	5 022	16 901	5 168
2836.99.10.40	Magnesium carbonates						
	Germany	7	16	6	15	3	6
	Others	15	28	5	10	1	1
	Total	22	44	11	25	4	7
2836.99.90.30	Other: magnesium carbonates						
	France	7	13	2	3	16	33
	Germany	11	22	6	12	13	26
	Italy	19	36	19	38	11	21
	United States	8	18	22	44	10	19
	Others	18	35	19	41	15	32
	Total	63	124	68	138	65	131
	Total imports of magnesium compounds	339 150	61 983	330 919	69 718	283 546	55 467
3824.90.90.42	Granular metallic magnesium coated with inorganic salts, mixed with lime						
	United States	32	27	73	59	92	70
	Germany	—	—	14	12	—	—
	Total	32	27	87	71	92	70
3824.90.90.43	Other granular metallic magnesium coated with inorganic salts						
	United Kingdom	—	—	—	—	...	...
	China	...	...	—	—	—	—
	Total	...	...	—	—	...	...
8104.11	Magnesium unwrought, containing by weight at least 99.8% magnesium						
	China	31 979	81 603	11 555	25 592	16 334	35 436
	Russia	2 346	6 192	2 376	6 597	4 288	9 268
	United States	1 729	4 737	743	2 900	3 487	8 534
	Israel	118	534	—	—	99	289
	Others	42	125	1	6	23	48
	Total	36 214	93 191	14 675	35 095	24 231	53 575
8104.19	Magnesium unwrought, other						
	Russia	3 166	11 545	729	2 401	4 801	11 627
	China	4 076	12 835	7 421	22 048	2 205	7 478
	United Kingdom	190	2 233	161	2 097	221	1 863
	United States	821	3 755	104	1 584	691	1 428
	Canada	...	2	16	304	17	322
	Norway	1 145	3 407	2 003	6 789	25	71
	Germany	—	—	986	3 331	...	...
	Others	19	50	...	1	11	61
	Total	9 417	33 827	11 420	38 555	7 971	22 850
8104.20	Magnesium waste and scrap						
	United States	5 273	13 564	5 206	13 035	3 414	8 144
	Mexico	246	660	247	601	973	2 360
	China	186	564	783	1 718	481	1 024
	Canada	50	101	40	84	116	213
	Others	4	12	10	25	—	—
	Total	5 759	14 901	6 286	15 463	4 984	11 741

TABLE 1 (cont'd)

TABLE 1 (Cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
8104.30	Magnesium raspings, turnings or granules, graded according to size and powders						
	China	446	1 608	1 514	5 369	466	1 894
	United States	346	1 423	104	437	110	457
	Others	11	67	14	78	17	78
	Total	804	3 098	1 632	5 884	593	2 429
8104.90	Magnesium and articles thereof, other						
	China	179	763	4 421	14 439	2 899	11 758
	United States	836	5 812	367	4 492	482	5 312
	Others	45	456	10	103	18	179
	Total	1 060	7 031	4 798	19 034	3 399	17 249
	Total imports of magnesium metal	53 254	152 048	38 811	114 031	41 178	107 844

Sources: Natural Resources Canada; Statistics Canada.

– Nil; . . . Amount too small to be expressed; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, MAGNESIUM USE, (1) 1988-2005

	1988 (a)	1989 (a)	1990	1991 (a)	1992 (a)	1993 (a)	1994	1995 (a)	1996
	(tonnes)								
Castings and wrought products (2)	5 067	5 661	5 849	4 604	6 915	7 678	8 940	12 488	11 197
Aluminum alloys	7 810	7 761	7 672	9 215	9 203	10 174	12 389	12 323	14 022
Other uses (3)	1 190	1 985	1 603	1 926	2 005	2 162	2 234	2 329	2 357
Total	14 066	15 407	15 125	15 745	18 123	20 014	23 563	27 140	27 576
	1997	1998 (a)	1999 (a)	2000 (a)	2001 (a)	2002	2003	2004	2005 (p)
	(tonnes)								
Castings and wrought products (2)	16 795	16 687	17 951	22 728	26 818	32 770	34 655	33 538	28 485
Aluminum alloys	14 793	13 417	13 741	13 466	12 562	14 857	14 537	17 671	16 858
Other uses (3)	2 438	2 685	2 727	3 960	6 460	6 472	6 983	5 635	4 472
Total	34 026	32 790	34 419	40 154	45 840	54 100	56 175	56 843	49 815

Source: Natural Resources Canada.

(p) Preliminary.

(a) Increase in number of companies being surveyed.

(1) Available data as reported by users. A total of 32 companies are included in the 2004 data. (2) Die, permanent mould and sand castings, structural shapes, tubings, forgings, sheet and plate. (3) Cathodic protection, reducing agents, deoxidizers and other alloys.

Note: Numbers may not add to totals due to rounding.

TABLE 3. APPARENT USE OF MAGNESIUM INGOT, 2004-06

Country	2004	2005	2006
	(tonnes)		
Argentina	2 408	2 380	2 319
Australia	8 045	7 426	8 242
Austria (Customs)	4 918	1 397	-3 384
Belgium	2 260	4 560	6 111
Brazil	8 770	7 981	11 287
Canada	78 642	54 013	65 293
Chile	16	14	86
China	137 659	195 216	268 665
Czech Republic	-8 673	-8 159	-7 936
Denmark	126	-13	2
Estonia	68	—	—
Finland	8	-21	12
France	10 348	14 032	10 295
Germany	40 178	35 983	33 474
Greece	3 077	3 087	2 757
Hong Kong	112	-94	20
Hungary	2 099	2 339	1 832
India	4 043	4 788	5 158
Indonesia	809	-11	1 302
Ireland	132	1	3
Israel	28 000	27 900	24 600
Italy (Customs)	11 615	13 103	11 520
Japan	41 818	35 132	38 230
Kazakhstan	18 000	20 000	21 000
Latvia	1	—	—
Lithuania	-2	—	-1
Luxembourg	86	—	—
Malta	520	76	1
Mexico	5 789	4 453	5 854
Netherlands	10 251	10 838	6 195
Norway	29 667	30 057	16 302
Peru	24	35	16
Philippines	154	23	17
Poland	1 338	1 529	2 638
Portugal	37	31	131
Romania	2 732	3 947	4 916
Russia	-77	17 455	9 748
Serbia & Montenegro	500	500	500
Slovakia	675	787	875
Slovenia	6 120	4 694	5 436
South Africa	3 891	5 611	4 089
South Korea	7 680	11 627	14 624
Spain	1 531	1 301	1 778
Sweden	1 785	3 019	2 359
Ukraine	839	2 016	11 763
United Kingdom	4 052	7 998	9 384
United States	182 836	184 841	162 441
Venezuela	1 346	1 619	1 259
Total	656 258	713 512	761 214

Source: Natural Resources Canada.

— Nil.

Notes: Apparent use is production of magnesium plus imports of unwrought alloy and pure magnesium less exports of unwrought alloy and pure magnesium. Raw country data obtained from Global Trade Atlas, Global Trade Information Services, Inc. (www.gtis.com) in September 2007; data consolidated from data on trade with: Algeria - CNIS - Algerian Customs Office; Argentina - INDEC - National Institute of Statistics and Census; Australia - Australian Bureau of Statistics; Brazil - SECEX - Foreign Trade Secretariat; Canada - Statistics Canada; Chile - Chile Customs - Servicio Nacional de Aduana; China - China Customs; Colombia - DANE - National Administrative Department of Statistics; Costa Rica - INEC - National Institute of Statistics & Census; Croatia - CBS - Croatia Bureau of Statistics; Ecuador - Ecuadorian Central Bank; EU25 - EuroStat; Guatemala - INE - National Statistics Institute; Hong Kong - Hong Kong Census & Statistics Department; Iceland - Statistics Iceland; India - Ministry of Commerce; Indonesia - Statistics Indonesia; Japan - Japan Customs; Malaysia - Malaysia Department of Statistics; Mexico - Secretary of Economy; Morocco - Office des Changes; New Zealand - Statistics New Zealand; Norway - Statistics Norway; Panama - The Republic of Panama General Control Statistics Office; Peru - Peru Customs - Super Intendencia Nacional de Aduanas; Philippines - Philippines National Statistics Office; Poland - EuroStat; Romania - National Institute of Statistics; Russia - Customs Committee of Russia; Serbia and Montenegro - Serbia Statistics; Singapore - Singapore Customs; South Africa - South African Revenue Service; South Korea - Korea Customs Service; Sri Lanka - Sri Lanka Customs; Switzerland - Swiss Customs; Taiwan - Taiwan Directorate General of Customs; Thailand - Thai Customs Department; Turkey - State Institute of Statistics; Ukraine - State Customs Committee of the Ukraine; United States - U.S. Department of Commerce, Census Bureau; Uruguay - Central Bank; and Venezuela - SENIAT - National Customs and Tax Administration Service

TABLE 4. PRODUCTION OF MAGNESIUM, (1) 2001-07

	Rank in 2006	2001	2002	2003	2004	2005	2006	2007 (e)
(000 tonnes)								
PRIMARY								
Brazil (4)	8	5.5	4.5	4.0	3.0	3.0	5.0	3.0
Canada (2)	2	65.0	70.0	50.0	50.0	45.0	45.0	11.3
China	1	199.7	235.0 (r)	341.8	442.4	467.6	525.6	685.0
France		4.8	—	—	—	—	—	—
India	10	0.5	0.5	0.2	0.2	0.2	0.2	0.2
Israel	5	34.0	26.0 (r)	26.0	28.0	27.9 (r)	24.6	25.0
Kazakhstan	6	16.5	17.9	14.2	18.0 (r)	20.0 (r)	21.0	21.0
Norway		40.7	3.1	—	—	—	—	—
Russia	4	35.0	35.0	30.0	35.0	38.0	35.0	28.0
Serbia and Montenegro	9	—	—	0.5	0.5	0.5	0.5	1.0
United States	3	70.0	45.0	55.0	35.0	40.0 (r)	40.0	45.0
Ukraine (5)	7	3.0	— (r)	— (r)	— (r)	2.9 (r)	12.0	0.0
World total		474.7	437.0	521.7	612.1	645.1	708.9	819.5
RECYCLED								
Canada (1)		20.0	20.0	20.0	20.0	20.0	20.0	5.0
United States		65.8	73.6	70.1	72.0	72.8	73.0	75.0
United Kingdom		0.5	0.7	0.7	0.7	0.7	0.7	0.7
World total (3)		86.3	94.3	90.8	92.7	93.5	93.7	80.7
PRIMARY AND RECYCLED								
World total		561.0	(r) 531.3	(r) 612.5	704.8	(r) 738.6	802.6	900.2

Sources: International Consultative Group on Nonferrous Metals Statistics; China Magnesium Association, as reported in various journals.

— Nil; (e) Estimated; (r) Revised.

(1) Numbers used in table are from the International Consultative Group on Nonferrous Metals Statistics. As reported in various journals, the China Magnesium Association reported higher numbers for Chinese production: 2002 - 268 000 t; 2003 - 356 000 t; 2004 - 450 000 t; and 2005 - 468 000 t. For Canada in 2003, estimate is noted to be lower than Canadian reported capacity; however, no company-issued reports have indicated Canadian plants ran below production capacity. For Canada in 2007, forecast based on 2006 data prorated to months plant was in production in 2007. (2) Canadian data are confidential; prior to 2000, estimate per U.S. Geological Survey provided to the International Consultative Group on Nonferrous Metals Statistics; after 2000, estimated using published capacity. (3) Recycled magnesium facilities exist in other locations including Canada, China, and Germany that have not reported separate production figures for recycled magnesium due to confidentiality reasons and other considerations. (4) Brazil's production estimated as 6000 t for 2002 and beyond by D. Kramer (<http://minerals.usgs.gov/minerals/pubs/commodity/magnesium/magnemyb05.pdf>). R. Brown estimated Brazil's production at 9000 t in 2001, 7000 t in 2002, 6000 t in 2003, and 11 000 t in 2004 (*Mining Journal*, June 2006). (5) *Metal Bulletin* reported September 14, 2006, that Kalush Magniy produced 6000-6500 t in 2005, but did not produce magnesium in 2006.

Mercury

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Named after the Roman god of commerce, travel and thievery, mercury has been used for more than 3000 years. Its chemical symbol, Hg, comes from the Latin word *hydrargyrum* meaning “liquid silver.” Also known to many as quicksilver, mercury was known to the ancient Chinese and Hindus before 2000 B.C. It has also been found in tubes in Egyptian tombs dating from about 1500 B.C. The first recorded mention of the metal was by Aristotle in the fourth century B.C., when the heavy, silvery white metal was used to form amalgams with other metals. It was also used in ointments and cosmetics.

Mercury is a naturally occurring element that is unique amongst the metals in that it is liquid at ambient temperature. At room temperature, mercury is a silvery white colour. It is solid white below its melting point of -38.9°C and is a colourless gas above its boiling point of 356.9°C . Mercury exists in nature in some 25 different minerals but is most commonly recovered from the red sulphide mineral known as cinnabar (HgS). Other common mercury ores include corderoite and livingstonite. Native mercury metal exists in nature but is rare. Mercury deposits are generally formed at relatively low temperatures in the world’s major orogenic belts.

Mercury’s unique physical and chemical properties have led to its widespread use in art, science, medicine, agriculture, and many industrial processes since ancient times. Since it is a naturally occurring element, mercury can be released into the environment as a result of human activities, e.g., coal combustion, as well as by natural sources and processes, e.g., volcano eruptions and wild fires. When mercury from natural and anthropogenic sources is released into the atmosphere, it can undergo long-range atmospheric transport in a cycle of depositing onto land and re-emitting into the atmosphere. Mercury exists in several forms or species depending on the surrounding conditions. As methylmercury, it can bioaccumulate in fish and may pose a potential health threat to fish-eating animals and humans.

WORLD DEVELOPMENTS

Uses

Mercury is used in a broad range of products and processes that can be grouped into the following major categories:

- artisanal/small-scale mining (ASM);
- chlor-alkali production;
- vinyl chloride monomer (VCM) production;
- dental amalgams;
- measuring and control devices (mainly fever and other thermometers);
- electrical electronic devices (thermostats);
- batteries; and
- fluorescent tubes, compact fluorescent and other energy-efficient lamps.

Up until the 1970s, the chlor-alkali sector used mercury in the form of mercury cathode for the electrolysis of an aqueous sodium chloride solution to yield chlorine and caustic soda. Process losses to the environment became a concern and many chlor-alkali plants were either closed or converted to diaphragm cell or ion exchange technologies. Worldwide demand is declining as older facilities are being closed and replaced with mercury-free technology.

Vinyl chloride monomer (VCM) production has been growing in China as a result of its booming economy. According to data reported by the United Nations Environment Programme,¹ in 2004 there were 62 plants in China using mercuric chloride on carbon pellets as a catalyst in the VCM production process. Other than a few plants in Russia, VCM production in other areas of the world uses a mercury-free process based on oxychlorination of ethylene.

Although large-scale gold mining operations have phased out mercury by adopting alternative technologies, mercury

¹ “Summary of Supply, Trade and Demand Information on Mercury,” United Nations Environment Programme, Chemicals Branch, Division of Technology, Industry, and Economics, Geneva, November 2006 (program sponsored jointly by the United Nations Industrial Development Project, the United Nations Development Programme, and the Global Environment Fund).

continues to be used by the artisanal and small-scale gold mining (ASM) sector. According to the Global Mercury Project, at least 100 million people depend on ASM for their livelihood in over 55 countries, mainly in Africa, Asia, and South America. Mercury amalgamation is still practised by these informal miners as it is an inexpensive, quick and simple way to extract gold from ore. There are many initiatives under way in countries where ASM is practised to build awareness and education among miners and their families about mercury-free alternatives in gold extraction and about best practices in the use of mercury to minimize health and environmental risks.

Batteries are another major market for mercury that is experiencing a decline as manufacturers switch to alternative metals. Another shrinking market for mercury is in electrical applications. Uses range from metallic mercury switches in thermostats to mercury-vapour discharge lamps. Other uses include dental amalgams, temperature- and pressure-measuring devices, detonators, pigments, and pharmaceuticals. Increased concerns related to the risks of exposure to human health and the environment have led to increased restrictions on the uses of mercury; however, its unique properties will likely guarantee its use in some key sectors, such as energy-efficient fluorescent lamps, for the foreseeable future.

MINE PRODUCTION

World production of mercury from primary mercury mines and as a by-product of other metal mining is presented in Figures 1 and 2.

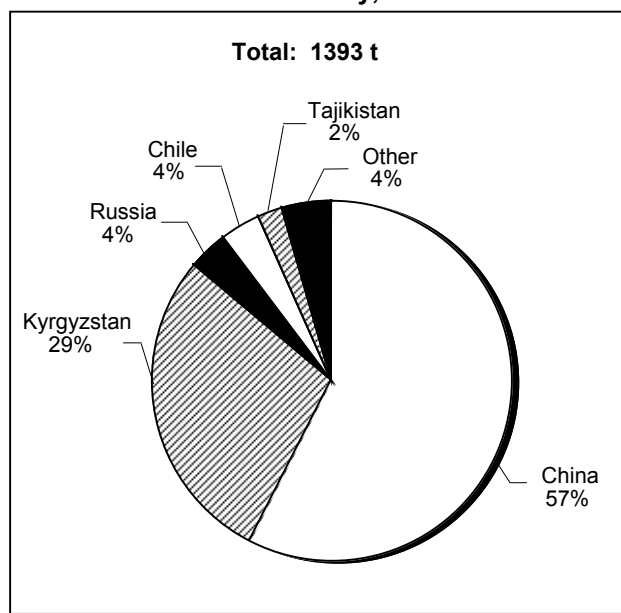
World mine production of mercury was 1393 t in 2006, compared to 1699 t in 2005. China and Kyrgyzstan are the only two countries in the world still producing mercury from primary mines. These two countries accounted for just over 86% of the world's total production of mercury in 2006.

In the United States, an estimated 118 t of mercury were recovered as a by-product of gold mining in 2006, while mercury recovered from product recycling and waste recovery was estimated at 80 t.² The principal sources of recycled mercury are from automobile convenience switches, dental amalgams, mercury vapour and fluorescent lamps, and medical equipment. However, this supply of mercury is declining as fewer and fewer products that contain mercury are made available to the marketplace.

Elsewhere in the world, mines in Slovenia, Turkey, and the Ukraine remained closed. By-product production from

² Presentation "Update Supply Data and Sources of U.S. Mercury," Meeting of Commodity-Grade Mercury Stakeholder Panel, September 20, 2007, available on the Internet at www.epa.gov/mercury/stocks/20070920.htm.

Figure 1
World Production of Mercury, 2006



Source: International Consultative Group on Nonferrous Metals Statistics.

mining continues in Finland, Tajikistan, Mexico, the United States, and Chile (Figure 1). Overall, mine production in 2006 declined to a level not seen since 2000 (Figure 2).

MERCURY IN CANADA

Since the closure of the Pinchi Lake mine in 1975, Canada no longer produces primary mercury metal. Mercury has been primarily an imported commodity in Canada. With the increase in concerns related to environmental releases of mercury, the use of mercury in Canada continues to decline. Canada uses primary mercury for the manufacture of fluorescent lamps and for the electrolytic preparation of chlorine at the one remaining chlor-alkali plant for use in the pulp and paper industry in New Brunswick. The use of mercury for applications such as gold recovery, industrial chemicals, and paints and pigments has been phased out.

PRICES

The commercial unit for handling mercury is the "flask," which weighs 34.47 kg (76 lb).

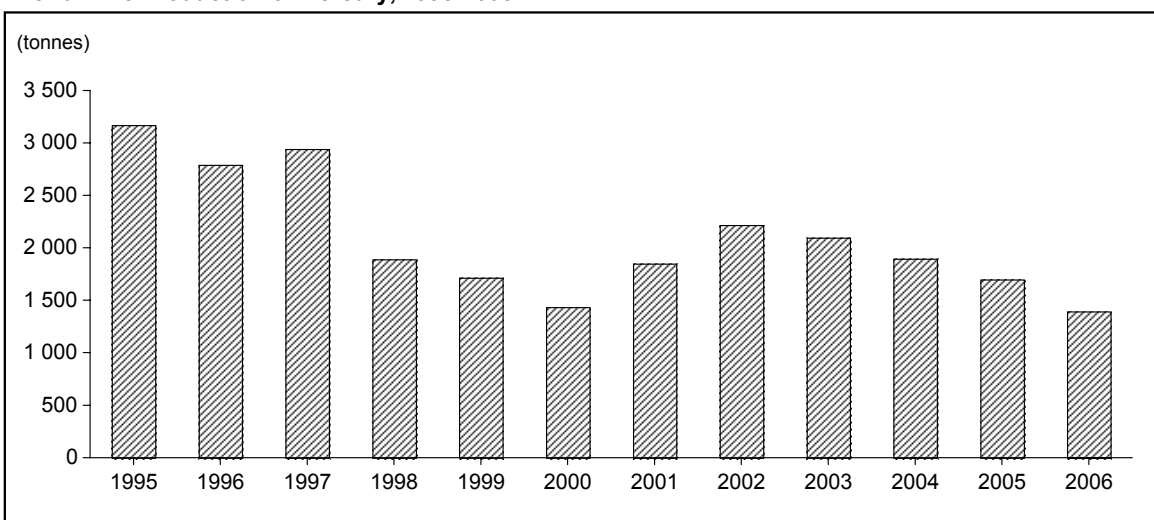
The average price of a flask of mercury in 2006 was US\$612, compared to an average of \$775 in 2005. Prices at the start of 2006 ranged from US\$650 to \$750 per flask and then declined steadily to the US\$450-\$550/flask range by December. A 10-year price trend is shown in Figure 3.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of January 2, 2008. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

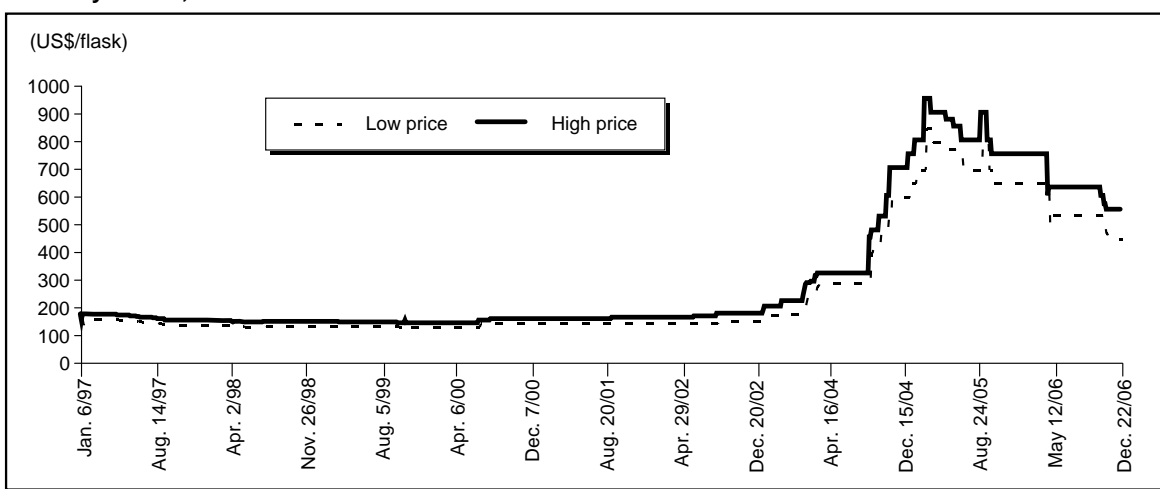
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Figure 2
World Mine Production of Mercury, 1995-2006



Source: International Consultative Group on Nonferrous Metals Statistics.

Figure 3
Mercury Prices, 1997-2006



Source: Metal Bulletin.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
28.05	Alkali or alkaline-earth metals; rare-earth metals, scandium and yttrium, whether or not intermixed or interalloyed; mercury						
2805.40	Mercury	Free	Free	Free	Free	Free-3%	5.4%
28.25	Hydrozine and hydroxalamine and their inorganic salt; other inorganic bases; other metal oxides, hydroxides and peroxides						
2825.90	Other: mercury oxides	Free-4%	Free	Free	Free	Free-5.5%	Free-3.3%

Sources: Canadian Customs Tariff, effective January 2007, Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2007; Official Journal of the European Union (October 17, 2006 Edition); Customs Tariff Schedules of Japan, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, MERCURY TRADE, 2004-06

TABLE A. SUMMARY OF EXPORTS AND IMPORTS OF MERCURY, 2004-05							
Item No.		2004		2005		2006 (p)	
		(kg)	(\$000)	(kg)	(\$000)	(kg)	(\$000)
EXPORTS							
2805.40	Mercury						
	United States	2 335	19	12 859	77	7 892	76
	Saint Pierre and Miquelon	9	...	—	—	—	—
	Mali	—	—	16	...	—	—
	Total exports	2 344	19	12 875	77	7 892	76
IMPORTS							
2805.40	Mercury						
	United States	7 239	61	9 892	115	11 067	133
	Austria	—	—	34	...	5	...
	Canada	—	—	15	...	24	...
	France	—	—	—	—	1	...
	Switzerland	—	—	—	—	4	...
	Italy	21	...	10	...	—	—
	United Kingdom	25	...	42	...	—	—
	Israel	—	—	35	...	—	—
	Total	7 285	61	10 028	115	11 101	133
2825.90.10.20	Mercury oxides						
	United States	89	2	158	3	192	3
	Spain	10	...	41	1	49	1
	India	—	—	—	—	29	1
	Switzerland	—	—	—	—	3	...
	Germany	22	...	—	—	—	—
	Mexico	—	—	2	...	—	—
	United Kingdom	—	—	1	...	—	—
	Total	121	2	202	4	273	5
	Total imports	7 406	63	10 230	119	11 374	138

Sources: Natural Resources Canada; Statistics Canada.
 — Nil; ... Amount too small to be expressed; (p) Preliminary.
 Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, MERCURY USE, 1991-2006

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 (p)
	(kilograms)															
USE (METAL) (1)																
Electrical apparatus, industrial and control instruments	3 948	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Electrolytic preparation of chlorine and caustic soda, and other uses	5 351	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Total	9 299	4 515	8 020	6 376	2 985	6 327	x	2 803	x	x	5 605	2 131	4 865	x	4 180	5 590

Source: Natural Resources Canada.

(p) Preliminary; x Confidential.

(1) Available data reported by users.

Note: Numbers may not add to totals due to rounding.

Mineral Aggregates

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INTRODUCTION

Mineral aggregate production in Canada consists of natural sand, gravel, and crushed stone products. These products are used in the construction, manufacturing, chemical, and metallurgical industries. Production of construction aggregates is a very important part of the Canadian economy with operations near most communities. These urban mining activities are largely invisible to the general public when in operation; however, public interest increases when new or expanded quarries are proposed. Total volumes of sand, gravel, and crushed stone extracted in Canada each year make this commodity the largest by volume of any mineral mined in Canada.

Natural sands and gravels are unconsolidated deposits that are extracted from glacially derived materials and river channels. Limestone, granite, and shale are also mined and crushed to provide aggregates for the construction, chemical, and metallurgical industries.

This report also includes data on the production and use of lightweight aggregates, comprising vermiculite, perlite, pumice, and expanded clays and shale.

CANADIAN INDUSTRY

In Canada, total production of sand and gravel in 2006 was 236.5 Mt valued at \$1.189 billion. This compares to 2005 production of 243.4 Mt, a decrease of 2.8%. Production of crushed stone in 2005 used for aggregate, road metal, ballast, and miscellaneous uses totaled 130.4 Mt, a 4.5% increase from the previous year (Table 1, by use). Table 2 shows the production of sand and gravel by province. Use of crushed limestone in cement plants was unchanged in 2005, while crushed limestone production for Canadian lime plants decreased 9.7%. Figure 1 shows the

sand and gravel production trend for the largest producing provinces for the period 1996-2006. Figure 2 shows the relative percentage of chemical stone and crushed stone produced in Canada since 1994.

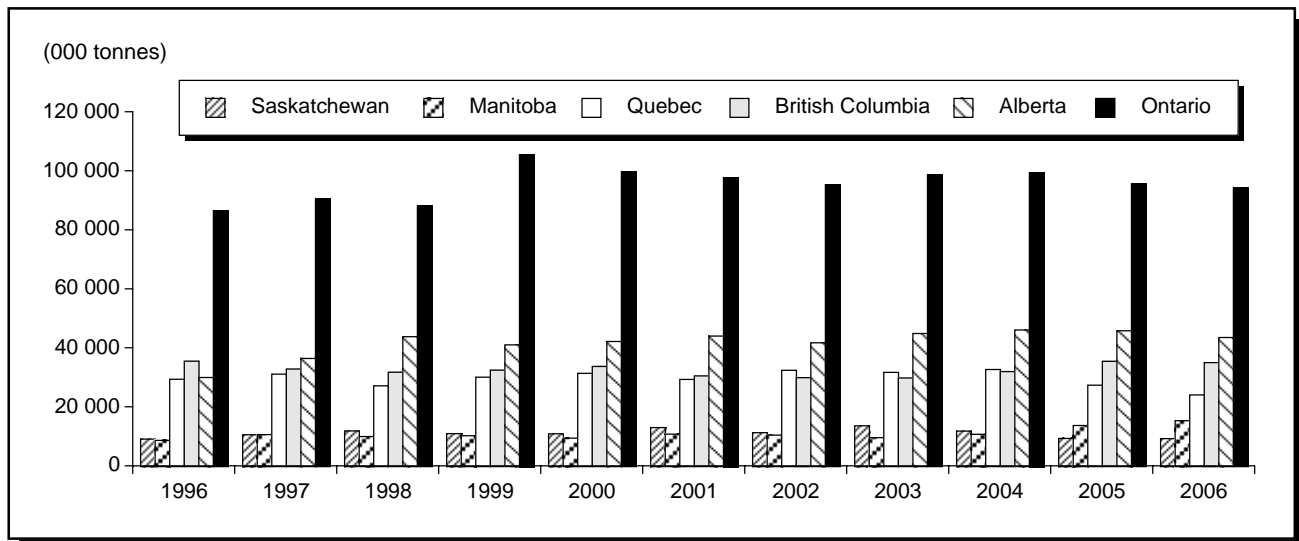
According to *Aggregates and Roadbuilding Magazine*, the top five construction aggregate operations in Canada in 2006 were unchanged from 2005: the Texada Island quarry, in British Columbia (Texada Quarrying) - 5.7 Mt; the Sechelt Pit in British Columbia (Construction Aggregates) - 5.0 Mt; the Manitoulin quarry in Ontario (Lafarge Canada) - 5.0 Mt; the Dundas quarry in Ontario (Lafarge Canada) - 4.3 Mt; and the Porcupine Mountain quarry in Nova Scotia (Martin Marietta Materials) - 4.0 Mt. Other large producers included the Villeneuve Pit of Inland Aggregates near Edmonton, Alberta, and the Milton Quarry, owned by Dufferin Aggregates, northwest of Toronto, Ontario. As reported by *Aggregates and Roadbuilding Magazine*, total production of sand, gravel, and crushed stone from the top 25 Canadian producers was 63.3 Mt in 2006.

INDUSTRY DEVELOPMENTS

The Ontario Cabinet approved the expansion of Dufferin Aggregates' Milton quarry located northwest of Toronto, Ontario. The quarry, which has been in production since 1962, provides 3-4 Mt of crushed limestone aggregates to the Toronto area construction market. Dufferin, a business unit of St. Lawrence Cement, began the expansion permitting process in 1996. The expansion will add 15 years of reserves to the operation. The company will hand over 1000 acres of rehabilitated quarry and adjacent lands to public ownership.

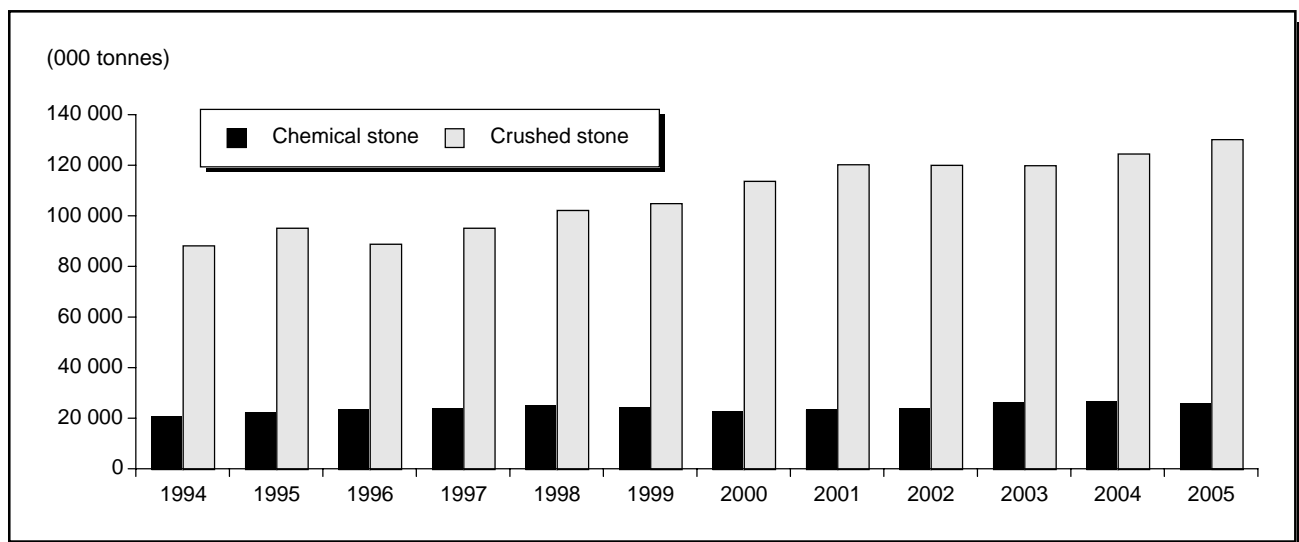
The Muskeg Valley quarry of Birch Mountain Resources Ltd. of Calgary, Alberta, is now producing about 900 000 t/y of construction aggregates for the local market near Fort McMurray, Alberta. The company has filed an environmental impact assessment for the adjacent Hammerstone project located about 60 km north of Fort McMurray. This project will be integrated into the Muskeg Valley quarry operation. The plan is to construct a quicklime plant with a potential capacity of 1 Mt/y and a cement plant with a 500 000-t/y capacity, both designed to service expanding oil sands developments in the region.

Figure 1
Canadian Sand and Gravel Production, 1996-2006



Source: Natural Resources Canada.

Figure 2
Canadian Crushed Stone Production, 1994-2005



Source: Natural Resources Canada.

Polaris Minerals Corp. of Vancouver, B.C., is developing the Orca sand and gravel project located near the community of Port McNeill on northern Vancouver Island. The company plans to mine and process up to 6 Mt of high-quality aggregates over a period of 25 years to supply a growing California market. Polaris is working in partnership with 'Namgis First Nation and has entered into agreements with other Aboriginal communities for development of the site. It is part owner of an off-loading facility in the Port of Richmond, near San Francisco. The Government of California recently announced US\$200 billion in spending over the next 10 years for public infrastructure construction in the state. The company has quoted an expected selling price of US\$6.69/t for gravel in 2007.

Bilcon of Nova Scotia, a wholly owned subsidiary of Clayton Group of New Jersey, has proposed construction of a new quarry on the Bay of Fundy near Digby, Nova Scotia. The Whites Point quarry would produce 2 Mt of basalt per year to be sold as concrete aggregates in the New Jersey market. The company has submitted an environmental impact statement to federal and provincial authorities.

Pan Pacific Aggregates Ltd. of Vancouver, B.C., plans to build a limestone quarry on the Sechelt Peninsula about 15 km north of Sechelt, B.C. The quarry would have a capacity of 6 Mt/y and cost \$100 million to build. The quarry would be located near the centre of the peninsula and the product would be conveyed about 10 km to a ship-loader located on Wood Bay. Product from the quarry would mainly be exported to U.S. markets on the west coast, principally California. The proponent has signed a

memorandum of understanding with the Sechelt Indian Band with the goal of developing a business relationship surrounding the development of the deposit.

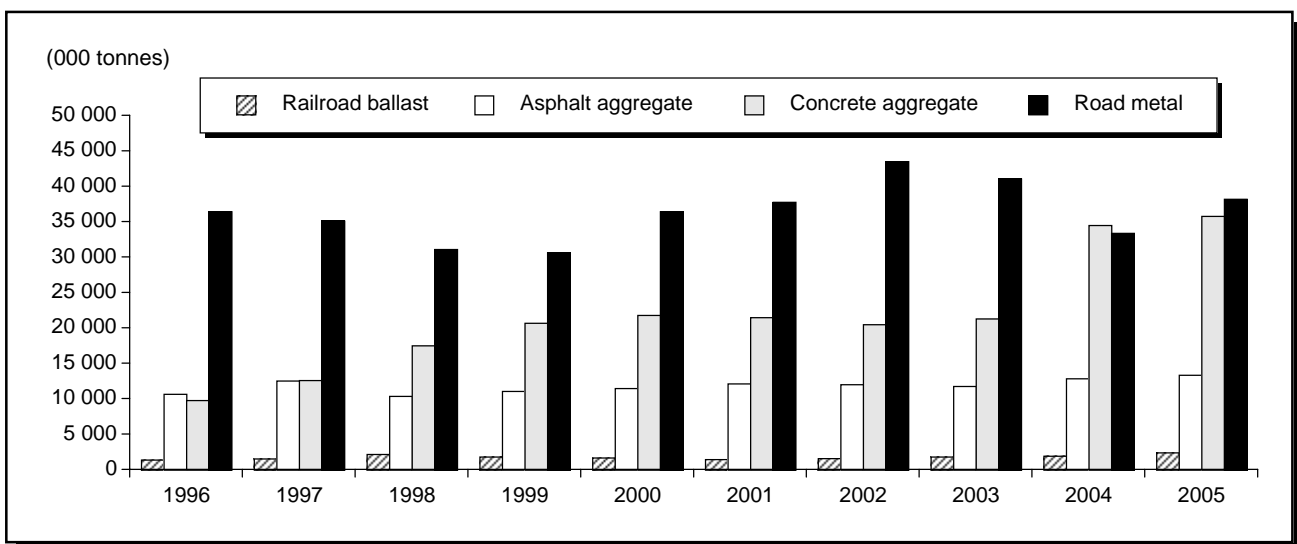
Doublestar Resources Ltd. is evaluating the Century limestone deposit on Nootka Sound, western Vancouver Island, B.C. The company sees a potential market in limestone for flue gas desulphurization at a proposed biomass-powered thermal power plant being developed by Green Island Energy Ltd. at nearby Gold Rover, B.C.

USE

High-quality aggregates, including sand, gravel, and crushed stone, are key ingredients in ready-mix concrete, precast concrete products, asphalt pavements, and sub-surface fill. Aggregate is usually described as either coarse aggregate (greater than 4.75 mm) or fine aggregate (passing 4.75 mm). Aggregates generally make up about 95% of the total mass of hot-mix asphalt and 90% by mass of concrete. Hot-mix asphalt contains about equal amounts of coarse and fine aggregates, whereas concrete contains more coarse than fine aggregate. Construction aggregate specifications deal with such parameters as particle shape and size distribution, strength and hardness, durability, and porosity, as well as chemical reactivity.

Statistics on the use of crushed stone for 2004 and 2005 are provided in Table 1. The production trend for the period 1996-2005 is shown in Figure 3. A breakdown of sand and gravel use by region for 2004 and 2005 can be found in

Figure 3
Canadian Crushed Stone Production by Use, 1996-2005



Source: Natural Resources Canada.

Table 3. In a typical concrete mixture, one cubic metre (m^3) of concrete contains about 800 kg of sand and 1300 kg of crushed stone. One kilometre of six-lane expressway requires about 52 000 t of aggregate, while a new home typically uses 440 t (Ontario Stone, Sand and Gravel Association).

TRADE

Most Canadian aggregate exports are shipped by bulk freighter from quarries along the British Columbia and Nova Scotia coasts to markets in Washington, California, New England, and Florida. Exports are also shipped via the Great Lakes into New York, Ohio, and Michigan.

Export and import data for sand, gravel, and crushed stone products are given in Table 4. Included are natural sands and gravel, granules and chippings, uncalcined and calcined dolomite, and crushed limestone. In 2006, Canada exported 6.82 Mt of gravel and crushed stone valued at \$64.1 million, of which 95% went to the United States. This represents an increase of 3.6% over the previous year. In addition, exports of crushed, uncalcined dolomite amounted to 3.87 Mt valued at \$36.3 million, up 30% from 2005 levels. Exports of crushed limestone for the cement and lime industries totaled 2.45 Mt valued at \$15.3 million, down 12.2%.

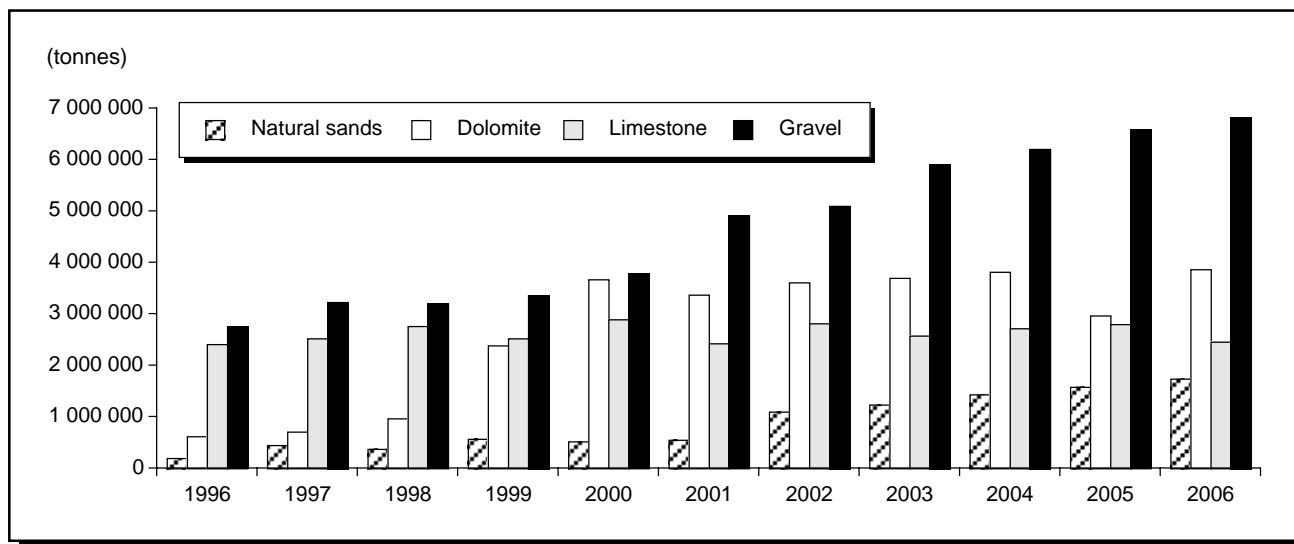
Trends in aggregate exports and imports for the period 1996-2006 are shown in Figures 4 and 5, respectively.

Imports of limestone for use in lime or cement were down 23% to 503 000 t. Imports of gravel and construction stone increased 5.5% to 2.29 Mt.

LIGHTWEIGHT AGGREGATES

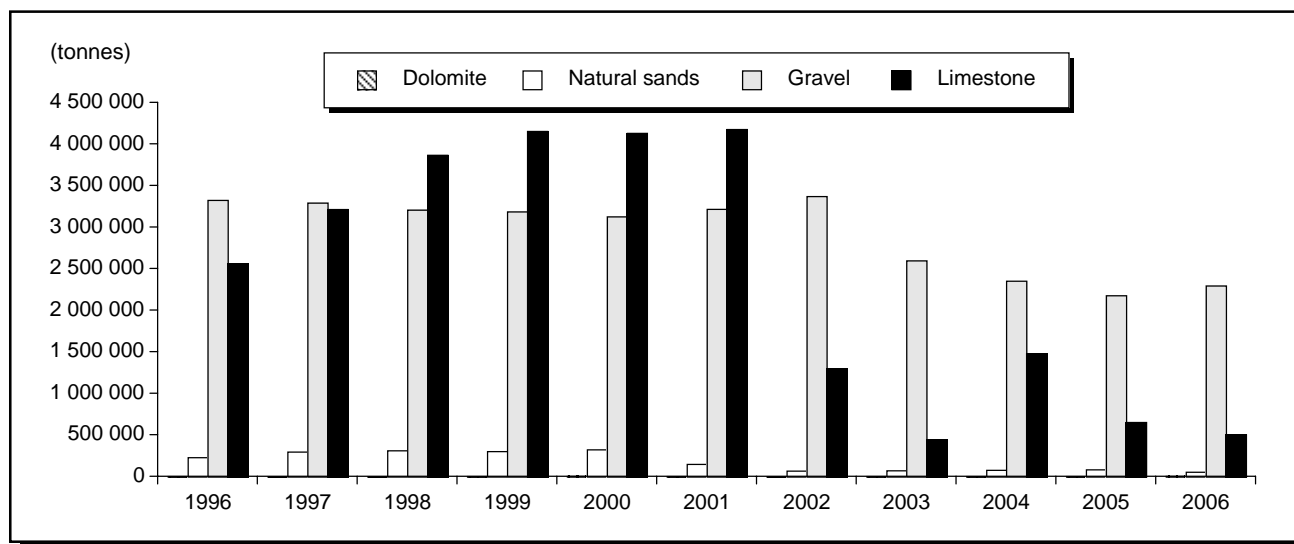
Most lightweight aggregate products are produced by rapidly heating clay or shale to high temperatures, causing the rock to expand and become less dense. These expanded products are then used in the manufacture of lightweight concrete products, such as pre-cast blocks, that are less costly to produce and transport. Low-compressive-strength concrete can be made using perlite or vermiculite as an aggregate, while expanded clays, shale, pumice, and slag are used for lightweight structural concretes and concrete block. A list of lightweight aggregate producers is given in Table 5. Trade data are found in Table 6. Table 7 shows production and shipments of expanded clay and shale, as well as expanded perlite and exfoliated vermiculite. Use data for various lightweight aggregates can be found in Tables 8-11. Figure 6 gives the trend in lightweight aggregate production for the period 1996-2005. Canada is a net importer of lightweight aggregates, mainly perlite and vermiculite, which are processed at expansion plants in Canada. Vermiculite ore is imported from South Africa, the United States, and Uganda. Unexpanded perlite is imported from the United States and Greece. Smaller amounts of expanded perlite and vermiculite are imported into Canada from U.S. expansion plants.

Figure 4
Canadian Aggregate Exports, 1996-2006



Source: Natural Resources Canada.

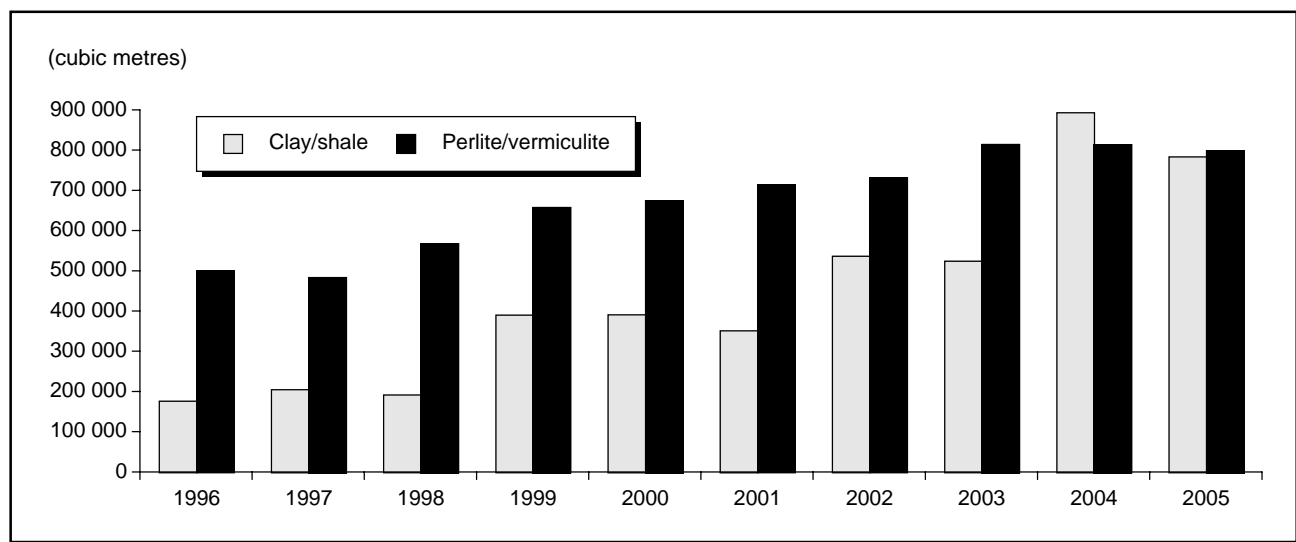
Figure 5
Canadian Aggregate Imports, 1996-2006



Source: Natural Resources Canada.

Note: Dolomite imports are less than 5200 t/y.

Figure 6
Canadian Lightweight Aggregates Produced, 1996-2005



Source: Natural Resources Canada.

Pumice

Pumice is a light, porous, glassy volcanic rock that forms during explosive eruptions. When used as an aggregate in the manufacture of lightweight concrete products, it provides a lower thermal conductivity and a higher fire rating than conventional concrete. It also has six times the flexural strength of normal concrete. It is used as a filler in paint and asphalt mixes, as an absorbent and chemical carrier, and for filtration purposes. In Canada, pumice is produced by Great Pacific Pumice Inc. from Mt. Meager in British Columbia and at the Nazko quarry near Quesnel, B.C. Pumice is also imported from the United States and Turkey. World mine production of pumice was 16.8 Mt in 2006, according to figures from the U.S. Geological Survey. Italy, Greece, the United States, Chile, and Turkey supplied about 65% of all pumice mined.

Perlite

Perlite is a natural volcanic glass that contains 2-5% chemically combined water. When quickly heated to above 1600°F, perlite expands its volume from 4 to 20 times. Under careful kiln retention times, the expanded product can weigh as little as 30-60 kg/m³. Perlite is widely used as a loose-fill masonry insulation and as an aggregate in concrete, where it imparts lightweight, fire-resistant and insulating properties. It is also a constituent of ceiling tiles. Perlite insulating concrete is one-third the weight of regular concrete and has 20 times the insulating value. Horticultural applications include use as an additive in soilless growing mixes and as a chemical carrier. Industrial uses include abrasives, fillers, and refractory brick manufacture. It is imported into Canada primarily from the island of Milos in Greece and from the United States. Total world production of perlite is 1.82 Mt (U.S. Geological Survey). The United States and Greece each mined about 500 000 t of raw perlite, with lesser quantities coming from Japan, Mexico and Turkey.

Vermiculite

Vermiculite is a general term applied to mica-like, platy minerals that contain up to 4% water, chemically trapped between the mica sheets. Upon rapid heating to temperatures in excess of 900°C, the trapped water changes to steam, forcing the mineral sheets to expand, forming an exfoliated vermiculite product. The expanded vermiculite is very lightweight and displays excellent fire-resistance and sound-insulating properties. Its uses in Canada are mainly for horticultural and other industrial applications. Crude vermiculite ore is imported into Canada for processing from mines owned by W.R. Grace and Co. in Enoree, South Carolina, and Virginia Vermiculite Ltd. in Woodruff, South Carolina, and Louisa County, Virginia, as well as from the Palabora region of South Africa and from Uganda (Table 6 - imports). Vermiculite processing plants are located in New Brunswick, Quebec, Ontario, Manitoba,

and Alberta (Table 5). World production was 520 000 t (U.S. Geological Survey), primarily from South Africa, China, and the United States.

Expanded Clays, Shale

Raw clay materials are dried and heated in a kiln to produce a lightweight aggregate suitable for use in concrete applications and in the manufacture of lightweight concrete blocks. Shale is mined, crushed, screened, and then heated. Concrete made from expanded clays and shale has special thermal and acoustical properties and can be used in special applications such as highway bridges with longer single spans.

INDUSTRY DEVELOPMENTS

Perlite Canada of St-Laurent, Quebec, has finalized supply agreements for raw perlite mined by Aegean Perlites of Greece. The company will distribute the material throughout Canada (except for Alberta and British Columbia) and along the U.S. eastern seaboard. The company has also announced a deal to supply expanded perlite to Tourbières Lambert Inc. (TLI) to be mixed with peat mined at Rivière-Ouelle, northeast of Québec City. This agreement will involve the construction of a perlite and vermiculite processing plant, to be opened in mid-2007, near the peat plant. Perlite Canada currently supplies TLI with product from its Baie-du-Fèbvre processing plant. The company has ceased production at its expansion facility in Lameque, New Brunswick.

Lightweight Advanced Volcanic Aggregates Inc. has purchased the assets of Canada Pumice Corp., previously owned by Crystal Graphite Corp., who went into receivership early in the year. The company intends to reactivate a black pumice and basalt quarry near Nazko, B.C.

Normiska Corp. of Guelph, Ontario, has completed the acquisition of Normiska USA, which itself was the owner of The Schundler Co., a supplier of vermiculite and perlite to the U.S. northeast and the operator of an expansion plant in Edison, New Jersey. The company also operates a vermiculite and perlite expansion facility in Lachine, Quebec.

IBI Corp. of Toronto, Ontario, agreed to sell its Namekara vermiculite mine in Uganda to Rio Tinto Uganda Ltd., a subsidiary of Rio Tinto plc. The mine contains an estimated reserve of 6 Mt of recoverable vermiculite. Rio Tinto owns 46.5% of Palabora Mining Co. Ltd., a South African producer of vermiculite.

PRICES

Prices for sand, gravel, and crushed stone aggregates are set by producers and customers and vary depending on

product specifications, region, and distance to markets. Prices for construction aggregates in Ontario ranged from \$3.60/t for sub-base material to \$11.50/t for quarry stone. The average value of sand and gravel, taken from Table 2, is \$5.02/t. The average value of concrete aggregate, taken from Table 1, for 2005 was \$7.78/t. Asphalt aggregate is valued at \$7.20/t.

Raw vermiculite ore is US\$95-\$190/t (ex-U.S. plant), depending on grade, according to the U.S. Geological Survey. The average selling price of exfoliated vermiculite was US\$410/t in 2005. Prices reported by *Mineral Price-watch* were US\$160-\$260/t f.o.b. Rotterdam for South African concentrate, as of December 2006.

Raw perlite was reported as US\$42.72/t f.o.b. U.S. mine. Coarse bulk perlite, suitable for the filter-aid market, sells for US\$54-\$68/t f.o.b. eastern Mediterranean, as reported by *Mineral Pricewatch*.

According to the U.S. Geological Survey, the price for pumice depends largely on end use. In 2006, pumice for abrasives was US\$209.69/t, for concrete admixture and aggregate was US\$28.19/t, and for horticultural use was US\$16.68/t.

OUTLOOK

Mineral aggregate demand in 2007 is expected to maintain current levels. Canada Mortgage and Housing Corporation is predicting housing starts will decline in 2007 to around 210 000 units. Declines in residential construction will be offset to some degree by activity in industrial, commercial and institutional construction. There will also be increased production, mainly in British Columbia, for the export market (California). Similar to last year, construction activity is expected to be strongest in the western provinces, mainly Alberta and British Columbia. Ontario and Quebec will see level activity or slight declines.

The reserve picture for mineral aggregates in most of the large urban centres continues to be one of shrinking permitted resources and active opposition to new quarries or extensions of existing operations. There are several examples of proposals for new crushed stone quarries that are being stalled by vigorous and organized opposition from local interest groups. If these new resources are not successfully permitted in the medium term, new construction projects, including residential housing and infrastructure, will have to source aggregate supplies from more distant quarries, adding costs both in terms of delivered price and increased emissions from transportation.

RELEVANT AGGREGATE INDUSTRY WEB SITES

Aggregate Producers Association of British Columbia

www.gravelbc.ca

Alberta Sand and Gravel Association

www.asga.ab.ca

Association des constructeurs de routes et grands travaux de Québec

www.acrgtq.qc.ca

Manitoba Heavy Construction Association

www.mhca.mb.ca

National Stone, Sand & Gravel Association

www.nssga.org

Ontario Stone, Sand & Gravel Association

www.ontariossga.com

Road Builders and Heavy Construction Association of Saskatchewan

www.rbhca.sk.ca

The Ontario Aggregate Resources Corporation

www.toarc.com/home.asp

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

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TABLE 1. CANADA, STONE PRODUCTION, 2004-06

Item No.	2004		2005		2006 (p)	
	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)
BY PROVINCE/TERRITORY (1)						
Newfoundland and Labrador	4 624	28 767	5 561	33 450	5 664	32 897
Nova Scotia	10 118	67 896	11 650	80 102	11 719	82 934
New Brunswick	5 256	32 762	5 452	37 049	4 994	37 348
Quebec	42 578	346 163	44 738	370 953	42 505	366 772
Ontario	59 584	585 117	58 086	578 284	59 362	626 525
Manitoba	3 583	18 604	3 964	20 753	4 118	23 905
Alberta	370	6 228	372	5 799	960	9 000
British Columbia	9 112	66 494	9 972	74 279	10 469	81 743
Northwest Territories	763	3 733	1 480	14 366	1 050	5 987
Total	135 988	1 155 765	141 275	1 215 036	140 840	1 267 110
BY USE (2)						
Stone (Dimension)						
Dimension stone						
Rough	535	62 442	566	76 896	..	..
Monumental and ornamental stone (n.f.)	77	6 492	105	8 884	..	..
Other (flagstone, curbstone, paving blocks, etc.)	118	18 158	117	17 380	..	..
Total dimension stone	730	87 091	789	103 160	..	..
Stone (Crushed)						
Crushed stone for						
Concrete aggregate	34 520	292 828	35 813	278 644	..	..
Asphalt aggregate	12 867	85 721	13 366	96 503	..	..
Road metal	33 421	207 698	38 228	243 761	..	..
Railroad ballast (includes traprock)	1 934	16 784	2 420	21 178	..	..
Other uses	41 978	269 301	40 591	282 183	..	..
Chemical and metallurgical						
Cement plants, Canada	17 750	56 185	17 298	56 587	..	..
Cement plants, foreign	1 773	9 341	1 750	8 953	..	..
Flux in iron and steel furnaces	209	813	216	702	..	..
Flux in nonferrous smelters	51	887	47	845	..	..
Glass factories	28	317	18	118	..	..
Lime plants, Canada	3 622	25 510	3 270	24 057	..	..
Lime plants, foreign	609	6 749	730	7 828	..	..
Pulp and paper mills	75	699	80	679	..	..
Sugar refineries	2	10	2	10	..	..
Other chemical uses	2 461	15 265	2 545	15 951	..	..
Miscellaneous stone						
Manufacture of artificial stone	12	652	10	897	..	..
Roofing granules	798	14 786	682	8 775	..	..
Poultry grit	145	978	145	1 065	..	..
Stucco dash	21	3 223	16	2 726	..	..
Terrazzo chips	9	740	8	704	..	..
Rock wool	45	541	89	1 174	..	..
Rubble and riprap	628	4 067	732	4 089	..	..
Other uses	2 493	16 869	1 891	14 670	..	..
Pulverized stone						
Whiting	49	4 920	50	5 202	..	..
Asphalt filler	185	1 176	172	1 928	..	..
Agricultural purposes and fertilizer plants	601	11 802	451	8 990	..	..
Other uses	1 695	106 879	1 803	108 966	..	..
Total crushed stone	157 982	1 154 741	162 423	1 197 182	..	..
Total all stone	158 712	1 241 832	163 212	1 300 341	..	..

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; n.f. Not finished or dressed; (p) Preliminary.

(1) Data exclude stone used in the Canadian cement, lime and clay industries. (2) Data include stone used in the Canadian cement, lime and clay industries.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, PRODUCTION OF SAND AND GRAVEL (1) AND CRUSHED STONE BY PROVINCE AND TERRITORY, 2004-06

	2004		2005		2006 (p)	
	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)
Newfoundland and Labrador	2 729	7 670	3 490	9 977	3 461	9 919
Prince Edward Island	x	x	140	x	146	x
Nova Scotia	x	x	4 435	x	4 276	x
New Brunswick	3 131	11 350	4 303	15 358	3 907	15 627
Quebec	32 854	116 014	27 515	97 689	24 233	89 855
Ontario	99 581	451 134	95 838	439 623	94 267	431 864
Manitoba	10 914	38 972	13 875	47 430	15 493	58 770
Saskatchewan	11 992	46 490	9 470	34 835	9 446	37 071
Alberta	46 273	283 265	45 975	295 346	43 689	306 807
British Columbia	32 158	172 027	35 624	203 839	35 189	203 720
Yukon	3 588	7 526	1 530	5 205	1 146	5 442
Northwest Territories	872	3 242	1 245	5 797	1 254	5 813
Total	250 067	1 167 648	243 440	1 180 266	236 505	1 189 185

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary; x Confidential.

(1) Production represents shipments of natural gravel, sand and crushed gravel. It does not include shipments to Canadian cement plants.

Production values for quartz are excluded from the sand and gravel production.

Note: Numbers may not add to totals due to rounding.

TABLE 3. AVAILABLE DATA ON USE (1) OF SAND AND GRAVEL, BY REGION, 2004 AND 2005

	Year	Atlantic Provinces	Quebec	Ontario	Western Provinces (2)	Canada
		(000 tonnes)				
Fill	2004	489	2 777	7 229	6 674	17 170
	2005	352	1 991	7 238	8 584	18 165
Road bed, surface	2004	5 462	18 685	33 938	49 898	107 983
	2005	4 759	13 143	29 854	47 933	95 688
Roads, ice control	2004	848	2 204	2 097	2 318	7 466
	2005	1 395	1 019	1 466	2 965	6 844
Concrete aggregate	2004	2 207	4 517	12 639	17 796	37 159
	2005	2 136	5 818	12 422	19 061	39 437
Asphalt aggregate	2004	784	2 599	5 391	11 848	20 621
	2005	460	2 701	3 319	12 240	18 720
Railroad ballast	2004	53	296	296	134	778
	2005	1	150	638	98	886
Backfill for mines	2004	870	23	1 396	—	2 289
	2005	1 110	11	761	207	2 089
Mortar sand	2004	42	337	2 931	143	3 453
	2005	54	304	1 794	207	2 359
Other purposes	2004	1 308	1 416	33 839	17 228	53 792
	2005	2 298	2 379	38 598	16 928	60 203
Total	2004	12 063	32 854	99 756	106 039	250 711
	2005	12 565	27 516	96 090	108 223	244 391

Sources: Natural Resources Canada; Statistics Canada.

— Nil.

(1) Data include shipments by producers regardless of industrial classification. Data include sand and gravel used in Canadian cement plants. Data exclude production of natural silica sand and of silica sand manufactured from quartz or silica rock. (2) The western provinces include the Yukon, the Northwest Territories and Nunavut.

Note: Numbers may not add to totals due to rounding.

TABLE 4. CANADA, SAND AND GRAVEL AND CRUSHED STONE TRADE, 2004-06

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS							
2505.90	Natural sands n.e.s., excluding metal-bearing sands						
	United States	1 431 687	9 117	1 578 667	9 899	1 735 485	10 610
	Bermuda	8	1	—	—	74	21
	Saint Pierre and Miquelon	25	5	587	12	54	10
	France	53	8	13	3	18	6
	Bahamas	—	—	—	—	319	5
	Dominican Republic	—	—	—	—	880	5
	Kuwait	—	—	248	1	960	3
	Belgium	—	—	762	2	292	2
	Slovenia	60	...	—	—	480	1
	Turks and Caicos Islands	—	—	110	5	22	1
	United Arab Emirates	—	—	—	—	128	1
	Other countries	559	3	1082	9	193	—
	Total	1 432 392	9 134	1 581 469	9 931	1 738 905	10 665
2517.10	Pebbles, gravel, broken or crushed stone used for aggregates, etc.						
	United States	5 795 879	56 862	6 302 073	56 787	6 138 961	59 099
	Trinidad and Tobago	53 451	988	—	—	377 627	2 695
	Bermuda	650	4	122 395	797	78 168	820
	Barbados	351 660	2 153	57 794	344	38 001	555
	Guyana	—	—	—	—	105 056	531
	Netherlands Antilles	—	—	—	—	64 433	325
	Hong Kong	25	19	13 912	82	16 752	99
	Bolivia	—	—	—	—	2 773	14
	Poland	—	—	—	—	109	2
	Belize	—	—	—	—	141	1
	Other countries	3 137	22	87 250	453	85	—
	Total	6 204 802	60 048	6 583 424	58 463	6 822 106	64 141
2517.41	Marble granules, chippings and powder of 25.15 or 25.16, heat-treated or not						
	United States	45 054	8 140	41 243	7 170	43 073	7 429
	Uganda	—	—	—	—	2	...
	Italy	30	4	—	—	—	—
	Total	45 084	8 144	41 243	7 170	43 075	7 429
2517.49	Granules, chippings and powder, n.e.s., of 25.15 or 25.16, heat-treated or not						
	United States	9 039	505	9 772	581	11 990	680
	Iceland	—	—	—	—	79	32
	Japan	—	—	—	—	22	19
	Trinidad and Tobago	—	—	—	—	1	5
	Antigua and Barbuda	25	2	236	5	19	3
	Italy	145	15	—	—	..	3
	Venezuela	—	—	—	—	40	3
	Belize	—	—	71	5	32	2
	Chile	7	1	—	—	16	1
	Portugal	—	—	—	—	15	1
	Other countries	9455	35	5 379	62	135	—
	Total	18 671	558	15 458	653	12 349	749
2518.10	Dolomite, not calcined						
	United States	3 428 194	28 488	2 393 680	20 809	3 324 067	30 339
	Venezuela	345 711	4 294	516 597	7 293	487 696	5 517
	Trinidad and Tobago	43 633	764	58 190	691	55 048	468
	Other countries	14	3	—	—	6	1
	Total	3 817 552	33 549	2 968 467	28 793	3 866 817	36 325
2518.20	Calcined dolomite						
	United States	21 590	2 743	43 682	5 247	45 950	5 368
2521.00	Limestone flux; limestone and other calcareous stone used for lime or cement						
	United States	2 717 654	17 184	2 773 498	16 891	2 378 316	14 481
	Brazil	—	—	20 000	644	75 670	811
	Bermuda	1 554	9	4 791	20	1 431	12
	France	23	...	76	...	95	...
	Jamaica	—	—	34	...	56	...
	Other countries	358	2	178	36	—	—
	Total	2 719 589	17 195	2 798 577	17 591	2 455 568	15 304
Total exports		14 259 680	131 371	14 032 320	127 848	14 984 770	139 981

TABLE 4 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS							
2505.90	Natural sands n.e.s., excluding metal-bearing sands						
	United States	73 926	6 612	65 830	5 434	53 859	4 228
	China	1 938	490	17 259	519	574	192
	Australia	1 478	99	197	66	189	64
	United Kingdom	164	44	19	58	15	43
	Other countries	667	63	644	61	475	79
	Total	78 173	7 308	83 949	6 138	55 112	4 606
2517.10	Pebbles, gravel, broken or crushed stone used for aggregates, etc.						
	United States	2 293 245	15 329	2 153 882	14 901	2 292 067	14 780
	China	41 388	336	11 346	396	2 207	277
	Philippines	3 784	24	3 467	135	254	62
	Brazil	2 115	29	2 374	30	395	27
	Mexico	398	11	289	28	225	22
	France	1 990	22	635	22	73	19
	Germany	18	1	5	30	21	16
	Belgium	489	4	88	8	328	13
	Canada	1	...	1	...	307	12
	Indonesia	738	7	20	6	927	10
	Czech Republic	—	—	—	—	23	9
	Sweden	5	...	1 386	13	422	4
	Kazakhstan	—	—	—	—	30	3
	Australia	5	1	5	4	3	2
	Taiwan	403	5	42	3	77	2
	United Kingdom	80	18	20	16	2	1
	Peru	2	...	—	—	10	1
	South Korea	45	...	—	—	2	1
	Ghana	..	...	...	...	...	1
	Italy	10	1	13	23	1	1
	Denmark	2	...	...	...	1	1
	Other countries	9416	79	5250	27	98	—
	Total	2 354 134	15 867	2 178 823	15 642	2 297 473	15 264
2517.20	Macadam of slag, dross or similar industrial waste, etc.						
	United States	2 748	24	11 879	99	11 124	145
	Other countries	—	—	359	3	277	2
	Total	2 748	24	12 238	102	11 401	147
2517.30	Tarred macadam						
	United States	620	29	828	38	859	43
	Ukraine	—	—	1	...	—	—
	Total	620	29	829	38	859	43
2517.41	Marble granules, chippings and powder of 25.15 or 25.16, heat-treated or not						
	United States	98 003	18 663	68 514	11 310	97 423	12 451
	France	—	—	—	—	579	101
	Germany	..	...	—	—	23	16
	Indonesia	1	...	...	...	7	14
	Italy	56	9	111	19	97	14
	Other countries	34	8	285	92	94	7
	Total	98 094	18 680	68 910	11 421	98 223	12 603
2517.49	Granules, chippings and powder, n.e.s., of 25.15 or 25.16, heat-treated or not						
	United States	15 972	1 487	103 321	1 844	23 166	2 514
	China	860	47	2 774	55	365	180
	South Korea	3	...	—	—	98	56
	Germany	82	1	12	1	446	26
	Indonesia	—	—	3	...	11	22
	France	922	44	129	29	59	17
	New Zealand	—	—	...	11	1	16
	Brazil	63	10	17	5	7	7
	Mexico	2	...	—	—	184	5
	Greenland	—	—	..	...	49	5
	Peru	8	1	1	1	3	4
	Italy	459	11	1 012	5	865	3
	Other countries	376	42	77	18	32	10
	Total	18 747	1 643	107 346	1 969	25 286	2 865

TABLE 4 (cont'd)

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2518.10	Dolomite, not calcined						
	United States	3 350	569	4 518	613	5 027	788
	Germany	99	31	75	11	99	14
	Other countries	118	31	4	—	1	—
	Total	3 567	631	4 597	624	5 127	802
2518.20	Calcined dolomite						
	United States	52 739	6 733	60 507	7 250	60 923	7 415
	Other countries	...	...	1	...	24	3
	Total	52 739	6 733	60 508	7 250	60 947	7 418
2518.30	Dolomite ramming mix						
	United States	893	337	799	302	1 073	409
	Austria	79	34	70	27	106	40
	Total	972	371	869	329	1 179	449
2521.00	Limestone flux; limestone and other calcareous stone used for lime or cement						
	United States	1 368 933	14 213	646 854	13 808	489 165	10 740
	France	4	...	986	34	8 609	616
	Italy	—	—	83	86	2 348	174
	Portugal	108 107	57	1 214	137	642	82
	China	5	1	249	47	343	70
	Netherlands	26	2	4	...	837	70
	Israel	871	24	444	18	868	30
	Spain	—	—	49	17	41	26
	United Kingdom	2	...	—	—	438	15
	Brazil	2	...	8	2	22	14
	Turkey	—	—	16	3	102	9
	Other countries	436	36	3 608	109	52	2
	Total	1 478 386	14 333	653 515	14 261	503 467	11 848
	Total imports	4 088 180	65 619	3 171 584	57 774	3 059 074	56 045

Sources: Natural Resources Canada; Statistics Canada.

— Nil; . . Not available; . . . Amount too small to be expressed; n.e.s. Not elsewhere specified; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 5. LIGHTWEIGHT AGGREGATE PRODUCERS IN CANADA, 2006

Company	Location	Commodity	Remarks
ATLANTIC PROVINCES			
Fafard Peat Moss Company Ltd.	Inkerman, N.B.	Perlite, vermiculite	Processed for use in horticulture.
Le Groupe Berger Ltée	Escuminac, N.B.	Vermiculite, perlite	Processed for use in horticulture.
Sun Gro Horticulture Canada Ltd.	Maisonnette, N.B.	Perlite	Processed for use in horticulture.
QUEBEC			
Le Groupe Berger Ltée Normiska Corp.	Saint-Modeste Lachine (plant)	Perlite, vermiculite Vermiculite, perlite	Processed for use in horticulture. Vermiculite processed for use in loose insulation, horticulture and concrete products; perlite processed for use in horticulture.
Premier Horticulture Perlite Canada Inc.	Rivière-du-Loup Baie-du-Febvre	Perlite, vermiculite Perlite, vermiculite	Processed for use in horticulture. Processed for use in horticulture.
ONTARIO			
Algoma Steel Inc.	Sault Ste. Marie	Slag	Used in cement.
Grace Canada, Inc.	Ajax	Vermiculite, perlite	Vermiculite processed for use in horticulture, as loose insulation, and in friction materials; perlite processed for use in gypsum, plaster, horticulture, refractories and as loose insulation.
Lafarge Canada Inc., Hamilton Slag Division	Hamilton	Slag	Used in concrete products industry.
PRAIRIE PROVINCES			
Cindercrete Products Ltd. Grace Canada, Inc.	Regina, Sask. Winnipeg, Man.	Expanded clay Vermiculite, perlite	Processed for concrete products industry. Perlite processed for use in gypsum plaster, loose insulation and horticulture.
	Edmonton, Alta.	Vermiculite, perlite	Vermiculite processed for use in horticulture friction material and loose insulation.
Inland Heidelberg Cement Group	Edmonton, Alta.	Expanded clay	Processed for concrete products industry, and for loose insulation.
Sun Gro Horticulture Canada Ltd.	Elma, Man. Seba Beach, Alta.	Perlite Perlite	Processed for use in horticulture. Processed for use in horticulture.
BRITISH COLUMBIA			
Basalite Concrete Products Vancouver, ULC	Surrey	Pumice	Purchased for concrete products industry.
Canada Pumice Corporation	Abbotsford	Pumice, shale	A range of pumice and shale products for construction, horticulture and landscaping material.
Great Pacific Pumice Inc.	Vancouver	Pumice	Used in horticulture, concrete products industry, and as loose insulation.
Teck Cominco Metals Ltd.	Trail	Slag	Used in concrete products industry.

Source: Natural Resources Canada, reported from NRCan 2005 preliminary survey questionnaire "Production of Lightweight Aggregates in Canada."

TABLE 6. CANADA, EXPORTS AND IMPORTS OF VERMICULITE, PERLITE AND PUMICE, 2004-06

TABLE 9. EXPORTS AND IMPORTS OF VERMICULITE, PERLITE AND CHLORITES, 2004-2006							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS							
2513.11	Pumice stone, crude or in irregular pieces, including crushed pumice						
	Finland	—	—	—	—	18	16
	France	...	...	...	...	...	...
	China	—	—	—	—	...	...
	Mexico	10	8	—	—	—	—
	Bermuda	—	—	11	10	—	—
	Total	10	8	11	10	18	16
2513.19	Pumice stone, other						
	Netherlands	—	—	—	—	...	1
	Germany	2	2	—	—	—	—
	Total	2	2	—	—	...	1
2530.10	Vermiculite, perlite and chlorites, unexpanded						
	United States	565	155	967	299	1 070	323
	Jamaica	—	—	—	—	29	8
	Chile	10	5	12	4	14	4
	India	—	—	20	6	—	—
	Total	575	160	999	309	1 113	335
6806.20	Exfoliated vermiculite, expanded clays, foamed slag and similar expanded mineral materials (including intermixtures thereof)						
	United States	10 502	7 718	1 098	845	895	794
	United Kingdom	1	3	—	—	97	356
	Guatemala	—	—	—	—	24	25
	China	24	29	—	—	20	24
	Cuba	4	106	—	—	2	6
	Other countries	16	35	13	32	5	9
	Total	10 547	7 891	1 111	877	1 043	1 214
	Total exports	11 134	8 061	2 121	1 196	2 174	1 566
IMPORTS							
2513.11	Pumice stone, crude or in irregular pieces, including crushed pumice						
	United States	6 630	635	6 688	933	12 110	755
	Taiwan	500	189	168	96	2 793	103
	China	46	11	319	76	694	68
	Turkey	1 659	156	760	66	571	49
	Italy	45	11	302	27	271	18
	Other countries	30	5	4	1	120	14
	Total	8 910	1 007	8 241	1 199	16 559	1 007
2513.19	Pumice stone, other						
	United States	3 861	776	4 183	592	6 116	558
	China	80	45	349	282	93	219
	South Korea	8	3	3	19	4	45
	Philippines	1	3	5	34	13	26
	Taiwan	59	44	10	48	5	24
	Greece	378	26	...	...	112	20
	Germany	10	7	13	9	2	15
	France	7	3	15	9	1	8
	Indonesia	11	2	—	—	2	7
	Other countries	26	50	20	46	7	15
	Total	4 441	959	4 598	1 039	6 355	937
2530.10.00.10	Vermiculite, unexpanded						
	United States	9 827	1 866	9 310	2 189	9 567	2 007
	South Africa	9 686	2 164	9 516	2 211	13 223	1 648
	Uganda	5 189	1 453	2 266	690	3 213	903
	Greece	1	...	—	—	327	124
	Other countries	46	14	5	1	186	51
	Total	24 749	5 497	21 097	5 091	26 516	4 733

TABLE 6 (cont'd)

TABLE 6 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2530.10.00.20	Perlite, unexpanded						
	Greece	30 741	3 211	36 653	4 129	37 153	3 638
	United States	24 210	3 636	22 895	3 199	20 770	3 004
	Netherlands	—	—	—	—	2	...
	Morocco	6	4	—	—	—	—
	Philippines	43	5	22	2	—	—
	Total	55 000	6 856	59 570	7 330	57 925	6 642
3802.90.00.20	Activated perlite, other than that to be employed in filtering						
	United States	256	144	214	112	273	128
	Germany	...	...	...	...	1	...
	Total	256	144	214	112	274	128
6806.20.00.10	Exfoliated (expanded) vermiculite						
	United States	2 738	2 336	4 370	2 561	4 203	2 681
	Austria	110	256	152	152	80	165
	United Kingdom	13	18	61	52	45	38
	Other countries	1	4	57	107	2	8
	Total	2 862	2 614	4 640	2 872	4 330	2 892
6806.20.00.20	Expanded perlite						
	United States	16 445	9 868	17 324	9 832	17 507	9 718
	Germany	39	13	23	13	21	6
	Mexico	12	7	12	9	4	2
	Japan	—	—	—	—	3	2
	South Africa	7	6	9	5	—	—
	Netherlands	—	—	55	17	—	—
	Total	16 503	9 894	17 423	9 876	17 535	9 728
	Total imports	112 721	26 971	115 783	27 519	129 494	26 067

Sources: Natural Resources Canada; Statistics Canada.
 — Nil; ... Amount too small to be expressed; (p) Preliminary.
 Note: Numbers may not add to totals due to rounding.

TABLE 7. CANADA, LIGHTWEIGHT AGGREGATES PRODUCED, SOLD AND USED, 2004 AND 2005

	2004 (r)				2005 (p)			
	Produced		Sold and Used		Produced		Sold and Used	
	(m ³)	(\$)	(m ³)	(\$)	(m ³)	(\$)	(m ³)	(\$)
FROM DOMESTIC AND/OR IMPORTED RAW MATERIALS								
Expanded clay, shale and slag (1)	894 613	20 815 167	616 529	14 967 079	784 744	19 249 046	674 660	17 237 312
FROM IMPORTED CRUDE MATERIALS								
Expanded perlite and exfoliated vermiculite (1)	814 816	57 087 033	814 185	57 043 471	799 569	55 180 924	792 530	54 659 909
Total	1 709 429	77 902 200	1 430 714	72 010 550	1 584 313	74 429 970	1 467 190	71 897 221

Source: Natural Resources Canada, reported from NRCAN survey questionnaire "Production of Lightweight Aggregates in Canada" (see Table 5 for list of establishments surveyed).
 (p) Preliminary; (r) Revised.
 (1) Combined to avoid disclosing confidential company data.

TABLE 8. CANADA, SALES OF EXPANDED SLAG, PERCENTAGE BY END USE, 2003-05

Use	2003	2004	2005 (p)
	(%)		
Concrete block manufacture	80.0	47.3	53.3
Ready-mix concrete	15.0	49.9	46.7
Miscellaneous uses	5.0	2.8	—

Source: Natural Resources Canada, reported from NRCan survey questionnaire "Production of Lightweight Aggregates in Canada."

— Nil; (p) Preliminary.

Notes: See Table 5 for list of establishments surveyed.

Sales also imply quantities consumed for own use.

Numbers may not add to totals due to rounding.

TABLE 9. CANADA, SALES OF EXPANDED CLAY AND SHALE, PERCENTAGE BY END USE, 2003-05

Use	2003	2004	2005 (p)
	(%)		
Concrete block manufacture	77.8	72.8	73.7
Loose insulation	7.8	17.3	15.1
Pre-cast concrete manufacture	4.7	2.3	1.9
Ready-mix concrete	4.7	5.4	7.6
Horticulture and miscellaneous uses	5.1	2.2	1.8

Source: Natural Resources Canada, reported from NRCan survey questionnaire "Production of Lightweight Aggregates in Canada."

(p) Preliminary.

Notes: See Table 5 for list of establishments surveyed.

Sales also imply quantities consumed for own use.

Numbers may not add to totals due to rounding.

TABLE 10. CANADA, SALES OF EXPANDED PERLITE, PERCENTAGE BY END USE, 2003-05

Use	2003	2004	2005 (p)
	(%)		
Horticulture and agriculture	96.6	96.3	96.8
Loose insulation and miscellaneous uses	2.9	2.7	2.8
Insulation			
in gypsum products	0.4	0.4	0.4
in other construction materials	0.1	0.7	—

Source: Natural Resources Canada, reported from NRCan survey questionnaire "Production of Lightweight Aggregates in Canada."

— Nil; (p) Preliminary.

Notes: See Table 5 for list of establishments surveyed.

Sales also imply quantities consumed for own use.

Numbers may not add to totals due to rounding.

TABLE 11. CANADA, SALES OF EXPANDED VERMICULITE, PERCENTAGE BY END USE, 2003-05

Use	2003	2004	2005 (p)
	(%)		
Horticulture	87.6	86.4	82.7
Loose insulation	1.7	8.0	3.0
Miscellaneous uses	10.7	5.6	14.3

Source: Natural Resources Canada, reported from NRCan survey questionnaire "Production of Lightweight Aggregates in Canada."

(p) Preliminary.

Notes: See Table 5 for list of establishments surveyed.

Sales also imply quantities consumed for own use.

Numbers may not add to totals due to rounding.

Nickel

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(Note: “Reserves” and “resources” have specific meanings in Canada.¹)

World primary nickel production of refined and other forms of finished nickel in 2006 was estimated by the International Nickel Study Group (INSG) at 1.36 Mt, compared to primary nickel usage of 1.40 Mt, up from production of 1.29 Mt and usage of 1.24 Mt in 2005. The cash settlement nickel price averaged US\$24 335/t, a record annual average and a sharp increase from the average of US\$14 732/t in 2005; the lowest price in 2006 was in early January at US\$13 505/t and the highest price was in mid-December at US\$34 555/t.

In 2006, Canadian mine production of nickel was 233 500 t, shipments of recoverable nickel in concentrates were 225 100 t, and the production of primary refined nickel (Class I and Class II) was 153 700 t. In 2006, mine production of cobalt in concentrates was 6976 t, shipments of recoverable cobalt in concentrates were 2793 t, and refined cobalt production was 4537 t. Canadian use of primary nickel was reported as 7500 t; reported cobalt usage was 86 t.

Nickel’s resistance to corrosion, high strength over a wide temperature range, pleasing appearance, and suitability as an alloying agent make it useful in a wide variety of applications. Markets for primary nickel include stainless steel (over 60%), nickel-based alloys, electroplating, alloy steels, foundry products, batteries, and copper-based alloys. Nickel is intensively recycled; between 45% and 48% of nickel used to make stainless steel is in the form of stainless steel scrap.

Nickel and cobalt are used in many specialized applications, including superalloys needed for gas turbine engines, rechargeable batteries, and catalysts; nickel’s main use is in the production of stainless steel, which accounts for over 60% of primary nickel used in the world. Nickel and cobalt are intensively recycled.

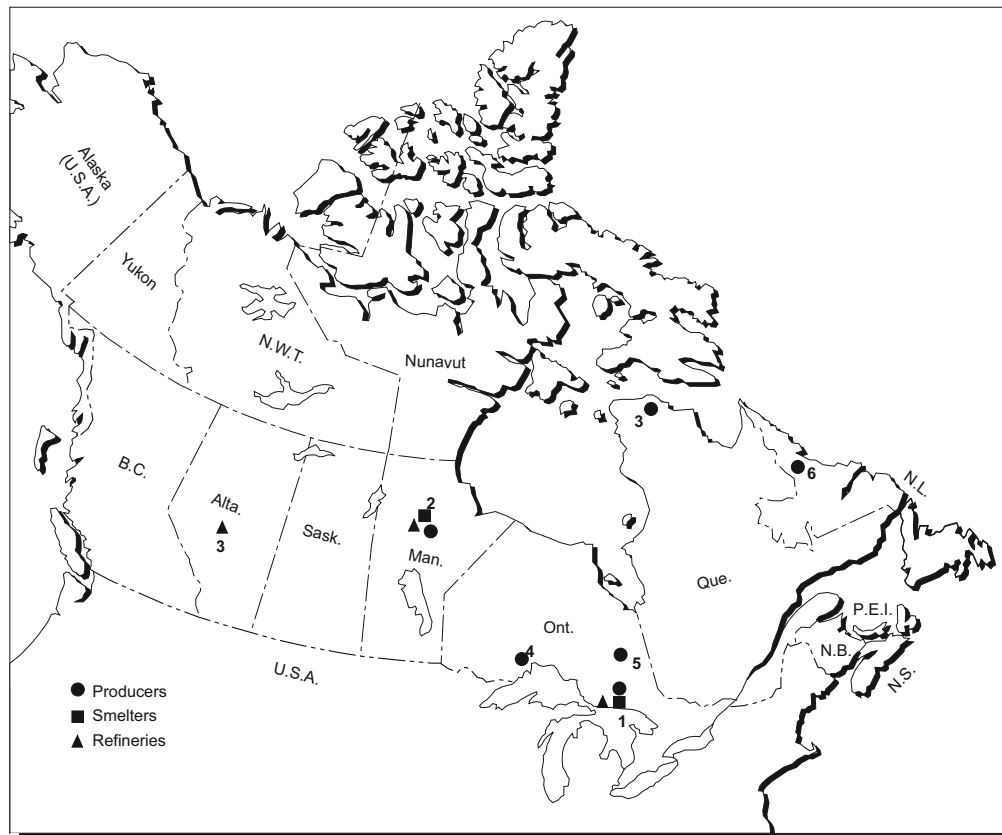
CANADIAN OVERVIEW

The majority of the Canadian nickel industry was purchased by foreign interests in 2006. **Inco** offered to purchase **Falconbridge** in October 2005 for cash and Inco shares, and the Canadian Competition Bureau cleared the proposed purchase in January 2006. The companies foresaw synergies in the Sudbury Basin. Concern about competition in the high-purity nickel market delayed regulatory approvals in Europe and the United States until July. In May, **Teck Cominco** offered cash and shares for Inco on the condition that Inco’s acquisition of Falconbridge did not proceed. In June, Inco and **Phelps Dodge** proposed a US\$56 billion transaction to merge Phelps Dodge, Inco, and Falconbridge. Inco’s offer of cash and shares was not as attractive to shareholders as **Xstrata**’s enhanced offer, and Inco’s offer lapsed in July. Xstrata bought 68% of Falconbridge in mid-August, took management control on August 22, and completed the acquisition by November. **CVRD** made an offer for Inco on August 11, received Canadian regulatory clearance on October 19, and purchased control in October, buying 76%, or 174 million shares at \$86/share. The purchase was completed at a special Inco meeting in January 2007 and a new company, **CVRD Inco Limited**, was created. (The Canadian dollar averaged US\$0.8818 in 2006.)

Canadian production (rounded to the nearest 100 t, with 2005 data in brackets following) of nickel in 2006 was 233 500 t (192 900 t) of nickel in concentrates, of which shipments were 225 100 t (192 900 t) of recoverable nickel. The production of finished Class I plus Class II nickel (refined, nickel in chemicals, and nickel in nickel oxide sinter) was 153 700 t (139 700 t). Ontario was the largest provincial producer of mined nickel, accounting for 53% of Canadian output of nickel in concentrates shipped in 2006; the vast majority of Ontario’s production was from the Sudbury Basin. Manitoba, Newfoundland and Labrador, and Quebec produced 16%, 21%, and 10%, respectively, of

¹ The reader should view the information concerning mineral “reserves” and “resources” such as that published by the Canadian Council of Professional Geoscientists at www.ccpge.ca/guidelines/index.html, as well as information from Canadian provincial securities commissions.

Figure 1
Nickel and Cobalt in Canada, 2006



Numbers refer to locations on map above

PRODUCERS

1. Xstrata Nickel Limited (Fraser, Lindsley, Craig)
1. First Nickel Inc. (Lockerby)
1. CVRD Inco Limited (Copper Cliff North, Copper Cliff South, Creighton, Garson, Gertrude, McCreedy East/Coleman, Stobie)
1. FNX Mining Company Inc. (McCreedy West)
2. CVRD Inco Limited (Thompson, Birchtree)
3. Xstrata Nickel Limited (Raglan)
4. North American Palladium Ltd. (Lac des Iles)
5. Xstrata Nickel Limited (Montcalm)
5. Liberty Mines Inc. (Redstone)
6. CVRD Inco Limited (Voisey's Bay)

SMELTERS

1. Xstrata Nickel Limited (Falconbridge)
1. CVRD Inco Limited (Copper Cliff)
2. CVRD Inco Limited (Thompson)

REFINERIES

1. CVRD Inco Limited (Sudbury)
2. CVRD Inco Limited (Thompson)
3. The Cobalt Refinery Company Inc. (Fort Saskatchewan)

Canada's output. Nickel was refined at CVRD Inco's Sudbury and Thompson refineries, as well as at The Cobalt Refining Company Inc. in Alberta, whose main feed source for nickel was in the form of an intermediate nickel residue, a nickel and cobalt sulphide produced in Cuba at Moa Bay by leaching nickel laterite ore in sulphuric acid. The Xstrata Nickel smelter in Sudbury processed nickel concentrates and nickel-cobalt recyclables, and sent the matte to the Xstrata refinery in Norway for refining into nickel, copper, cobalt, and precious metals.

Inco's Voisey's Bay operation was scheduled to produce 54 400 t of nickel in concentrate. It had produced 29 000 t by June, but the mine was subsequently shut for two months by a strike. CVRD reported that production of refined nickel from Voisey's Bay-sourced feed was 35 500 t in 2006. Nickel concentrates from Voisey's Bay were processed primarily at CVRD Inco's Sudbury and Thompson operations, although the company reported that a portion of the output in 2006 was toll smelted and refined in Europe. Copper concentrate was sold to third parties. Reported shipments of recoverable nickel in concentrates from Newfoundland and Labrador in 2006 were 46 500 t of recoverable nickel in concentrates. Inco chose Long Harbour for the commercial nickel plant site because Argentia posed potential environmental problems. Inco filed an application for a plant to produce 50 000 t/y of refined nickel; two alternative technologies will be examined. In October, **CVRD** said it would consider accelerating the Voisey's Bay project by 12-18 months.

In Sudbury, **Inco** started up a fluid bed roaster to reduce SO₂ emissions. Inco Sudbury targeted 117 000 t of finished nickel in 2007, but some production was lost in the July-September quarter. The production of nickel as refined nickel and as nickel oxide from the Sudbury-sourced material in 2006 was 93 000 t; of this, about 37 000 t was refined in the United Kingdom at CVRD Inco's Clydach carbonyl refinery. In addition, the Sudbury and Clydach refineries produced refined nickel from Voisey's Bay-sourced material that was smelted in Sudbury. Inco's Thompson operation in Manitoba produced 35 300 t of nickel from material sourced from Inco mines in Manitoba, down from 48 600 t in 2005. The Thompson smelter and refinery also processed a significant portion of the output from Voisey's Bay. Shipments of recoverable nickel in concentrates from CVRD Inco's mines in 2006 totaled about 36 900 t. A problem temporarily shut the Thompson smelter and converter in the July-September quarter. CVRD Inco also recovered copper from the Manitoba and Ontario operations, as well as platinum group metals, gold, and silver. The Ontario operations produced by-product sulphuric acid and liquid sulphur dioxide.

Falconbridge signed a new contract with workers at Raglan and committed US\$50 million to infrastructure upgrades. Xstrata reported that Raglan's concentrator processed 1.06 Mt of ore to produce about 23 700 t of nickel, about 6300 t of copper, and 486 t of cobalt in concentrates. The second phase of the Raglan concentrator expansion was due to be completed in 2008.

Xstrata reported the three mines in Sudbury produced 20 900 t of nickel in concentrates, which were processed at the company's Strathcona mill. In addition, Strathcona handled 0.365 Mt of custom material, including feed from the Lockerby mine. In total in 2006, Strathcona processed 1.89 Mt of ore, including 0.365 Mt of feed from third parties (such as the Lockerby mine output and recycled feeds), to produce 112 400 t of nickel-copper-cobalt matte that contained about 61 100 t of nickel, about 21 000 t of copper, and about 2350 t of cobalt, as well as precious metals such as gold, silver, and platinum group elements. In Sudbury, negotiations between Mine Mill Local 598 and **Xstrata** began in December for a new contract for Sudbury workers; the existing contract ends on February 1, 2007. **Xstrata** announced an expansion of nickel-cobalt recycling capacity at the Falconbridge smelter by mid-2007. The smelter feed consisted of concentrates produced from Raglan and Strathcona, Montcalm mine output that was concentrated at the Kidd metallurgical site in Timmins, and metals contained in recycled feeds. Xstrata's smelter produced by-product sulphuric acid.

FNX Mining delivered 281 000 t of ore to CVRD Inco's Clarabelle mill in Sudbury in 2006; the ore graded 1.6% nickel containing about 3675 t of payable nickel, and about 80% of the nickel in the ore was payable. In addition, significant quantities of copper and precious metals were also contained in the ore. The ore was almost entirely derived from production at the McCreedy West mine in Sudbury. FNX started production from the Levack mine in December. FNX's Podolsky shaft was sunk to depth and production was expected in 2008. The company planned to sell about 11 000 t/y of nickel to CVRD Inco by 2010.

Sherritt International revised its expansion plans at the Fort Saskatchewan refinery; incremental expansions will be 4000 t/y in 2007, 9000 t/y in 2009, and 3000-6000 t/y in 2011. Sherritt and the Cuban government have equal shares in the refinery operated by The Cobalt Refining Company Inc., which produced 3312 t of refined cobalt and about 30 200 t of refined nickel in 2006. The Fort Saskatchewan plant also produces about 250 000 t/y of by-product fertilizer. Feed for the expansion will come from the Moa Bay operation in Cuba, jointly owned by Sherritt and the Cuban government. The nickel laterite ore was leached to produce an intermediate nickel-cobalt sulphide that was shipped to Fort Saskatchewan for final recovery.

North American Palladium's new underground palladium mine entered commercial production in April. The company produced 1234 t of by-product nickel in concentrate in 2006 from both mines. In addition to the nickel, the company produced palladium, platinum, gold, and copper in concentrates. A contract with Xstrata for the smelting and refining of the concentrates from the operation will expire in April 2007. A review of the life-of-pit plan was under way at year-end.

First Nickel Inc. sent about 1435 t of nickel in 98 000 t of ore grading 1.51% nickel and 0.88% copper from its Lockerby mine near Sudbury to Xstrata's Strathcona mill in 2006, of which 1168 t was payable.

Liberty Mines started its Redstone mine in mid-May. A 1500-t/d mill was moved to the mine site and was to be operational by mid-2007 to take 360 t/d from Redstone and 1000 t/d of feed from the company's nearby McWatters deposit; until then, Redstone's ore will be custom milled. Liberty shipped concentrate to **Jilin Jien Nickel** in China, who provided financing to Liberty. Liberty also had other nickel and cobalt properties in the area. In 2006, Liberty sent 11 495 t of ore to be custom milled by SMC (Canada) Ltd. from which concentrate containing 129 t of nickel was sent to China.

Canadian exports and imports of nickel in various products are shown in Tables 1b and 1c and the cobalt export and import data are shown in Tables 2b and 2c. Canadian trade data for nickel in concentrates are under investigation; the United States and Germany do not produce nickel in concentrates from domestic mines, so either the classification or the country of origin is incorrect. Also, tonnages imported from Australia are being reviewed because of past inconsistencies with the reported exports from Australia. Trade data for nickel and cobalt from Cuba are not published by Statistics Canada; estimates of the tonnages imported are shown in the trade tables based upon the reported production of Moa Bay Nickel.

Canadian Arrow agreed to buy the Kenbridge property and planned more drilling, metallurgical testing, and resources evaluation in 2007. **Canadian Royalties** assessed its Raglan area deposits for the production of 9900 t/y of nickel in concentrates, plus copper and platinum group metals (PGM); the company signed an offtake Memorandum of Understanding (MOU) with **Jinchuan Group** and a feasibility study will be delivered in 2007. **Crowflight Minerals** bought a used concentrator, crusher, and surface plant for its Bucko deposit, began rehabilitating the shaft, and applied for permits for a 1000-t/d underground mine to produce 5600 t/y of nickel, expecting it to start in late 2007. Crowflight also had the TNB South and other projects in Manitoba, plus properties near Sudbury.

First Nickel planned to finish a pre-feasibility/feasibility study of Premier Ridge by February 2007. A study of **Independent Nickel's** Lynn Lake property looked at a \$192 million investment to produce 6300 t/y of nickel and about 3400 t/y of copper in concentrate. **Mustang Minerals'** scoping study of its Maskwa project was expected in early 2007; open-pit indicated resources were 5.2 Mt @ 0.68% Ni and 0.15% Cu. **Nuinsco Resources** released a scoping study of the Minago deposit; a 10 000-t/d open pit and 3000-t/d underground mine producing about 9700 t/y of nickel in high-grade concentrates were evaluated. The company drilled its Lac Rocher

deposit and estimated that measured and indicated resources were 1.2 Mt @ 0.91% Ni.

URSA Major applied for permits for an open-pit mine and a 4500-t/d mill that is expected to produce concentrates containing about 3700 t/y of nickel plus copper, cobalt, PGM, and gold at its Shakespeare operation. URSA may send concentrates to **Xstrata** for smelting and refining, and will send a 50 000-t bulk sample to **Xstrata's** Strathcona mill in 2007 for testing and to generate early cash flow.

Fortune Minerals undertook a \$10 million program to collect a 250-t bulk sample from its cobalt-gold-bismuth NICO project in the Northwest Territories. A bankable feasibility study was completed that considered producing 1474 t/y of cobalt in cathode with associated bismuth and gold production.

Nickel exploration continued to be stimulated by high nickel prices and the prospect that prices would not fall to historical levels in the near term. Increased Canadian costs due to the appreciating currency have been mitigated by the very high prices for nickel, cobalt, and by-product metals. The period of sustained high prices also allows producers in Canada to make capital expenditures that will ultimately reduce operating costs, such as sinking new shafts to service mining areas below the depth of present shafts. Future cost reduction measures are also possible in Sudbury where the new owners of Falconbridge and Inco could realize some of the synergies that were mapped out by the two nickel producers in late 2005 and during 2006.

Cobalt mine production in Canada was a by-product of nickel operations. Three facilities recovered cobalt in Canada in a marketable form: the CVRD Inco Port Colborne refinery in Ontario, which produced refined cobalt; the CVRD Inco Thompson operations; and The Cobalt Refining Company in Alberta, which produced refined cobalt. The cobalt from Voisey's Bay output was recovered at the CVRD Inco operations. Cobalt in concentrates and secondary forms was also processed at the Xstrata smelter in Sudbury and then sent to Norway for refining.

WORLD OVERVIEW

Oceania

Capital costs at **BHP Billiton's** 60 000-t/y Ravensthorpe mine/leach plant and Yabulu refinery expansion in Australia rose to US\$2.2 billion. The company sold 38 300 t of nickel in matte and 1200 t of nickel in concentrate, and produced 59 000 t of nickel metal in 2006 from its Ni West operations (former WMC Resources). Allegiance concluded a concentrate sales contract with **Jinchuan Group** and will start up its 7000-t/y nickel-in-concentrate operation in 2007. Minara produced 31 500 t of nickel and nearly 2100 t of cobalt.

The Lanfranchi Joint Venture delivered 4800 t of nickel ore to the Kambalda mill of BHP Billiton located in Western Australia; **Brilliant Mining Corp.** bought **Donegal Resources Pty. Ltd.**'s 25% share in the joint venture. **Independence Group NL** produced about 8700 t of nickel in ore that was sold to the Kambalda mill. **Consolidated Minerals Limited** purchased **Titan Resources** and started production at the East Alpha property; East Alpha and Beta Hunt produced about 4100 t of nickel in ore delivered to the Kambalda mill. The Armstrong mine did not produce during the year. **Fox Resources Limited** produced a nickel-copper concentrate at Radio Hill that was sold to Jinchuan Group; the mine closed in mid-year after producing about 550 t of nickel in concentrates.

Jubilee Mines N.L. concluded a new offtake agreement with Inco Limited for the period October 2006 to September 2007. Jubilee produced about 11 400 t of nickel in concentrates, compared to about 10 300 t in 2005. **LionOre Mining International Ltd.** owned the Lake Johnston operations (two mines and a concentrator), as well as a majority interest in the Black Swan operations. Lake Johnston concentrate was sent to CVRD Inco while the Black Swan concentrate was sent to Harjavalta, to the **Boliden AB** smelter, and then to the OMG nickel refinery. Payable nickel produced in 2006 at Lake Johnston was 9700 t of nickel, compared to 11 300 t in 2005. Black Swan produced 6400 t of payable nickel in concentrates. The Waterloo mine sold about 950 t of nickel in ore to the Kambalda mill. **Sally Malay Mining Limited** produced about 7400 t of nickel and 370 t of cobalt in concentrates at its Sally Malay mine; the concentrates were sold to Jinchuan Group of China. Sally Malay also owned 75% of the Lanfranchi Joint Venture (see above).

Minara Resources Limited produced 28 200 t of refined nickel and 1750 t of refined cobalt at the Murrin Murrin operation. Murrin Murrin mines nickel laterite ore that is fed into a hydrometallurgical plant. The Murrin Murrin Joint Venture was owned 60% by Minara and 40% by **Glencore International AG**; Glencore also owned 50.5% of Minara.

Western Areas NL announced a decision to build a 250 000-t/y concentrator at its Forrestania site to process output from the Flying Fox deposit. The first ore was extracted in October when development of a decline intersected one of the orebodies.

Many projects were under consideration in Australia, prompted by the high nickel prices. **Allegiance Mining NL** concluded an offtake agreement with Jinchuan Group of China; about 8500 t/y of nickel in concentrates was to be produced over a 10-year period by mining 1 Mt/y of ore. **Compass Resources NL** approved the Browns Oxide Project in the Northern Territories; environmental clearances were received in September. A mine producing 2 Mt/y would provide feed for a concentrator that would supply a hydrometallurgical project to produce about

78 000 t/y of lead, 18 000 t/y of copper, 3150 t/y of cobalt, and 2250 t/y of nickel. **Gladstone Pacific Nickel Limited** planned a staged hydrometallurgical nickel and cobalt refinery in Queensland. Feed from the Marlborough deposit would be supplemented with ore imported from New Caledonia. Initial production was to be 36 000 t/y of nickel and 1650 t/y of cobalt; thereafter, this would be doubled and then doubled again.

In Indonesia, **PT Antam Tbk's** FeNi III, 15 000-t/y nickel in ferronickel (Ni in FeNi) smelter started up in July, but a leak shut the plant. Antam produced 4.35 Mt (wet) of lateritic ore, of which 3.5 Mt was high grade. Most of Antam's ore was exported to Japanese smelters and Chinese pig iron producers; Antam produced 14 500 t of Ni in FeNi. A fire in May at **PT Inco**, owned 61% by CVRD Inco, reduced production by about 4000 t; low rainfall forced a 130-t/d nickel cutback in late December. PT Inco's output of nickel in matte was sent to two Japanese smelters for refining; output was reported as 70 000 t of finished nickel. PT Inco's expansion to 90 000 t/y of nickel in matte was suspended in January due to delays in securing a forestry permit. Eramet purchased Weda Bay in March for \$270 million and planned to build a 60 000-t/y nickel hydromet plant. A successful hydrometallurgical process for Weda Bay could be applied to Eramet's limonitic resources in New Caledonia.

In New Caledonia, CVRD Inco continued work on the mine and hydrometallurgical project that will produce 60 000 t/y of nickel in nickel oxide. The cost to complete the work was estimated to be US\$3212 million, of which 45% had been spent by the end of 2006. The operation was scheduled to start up in 2008; part of the output was expected to go to CVRD Inco's US\$63 million refinery at Dalian, China (announced in May), targeted to begin producing 32 000 t/y of UTILITY® nickel in the first half of 2008. Other destinations for the Goro output could be refineries in South Korea and Taiwan, in which CVRD Inco has interests, or as direct feed to stainless steel plants. **Xstrata** and **SMSP** said US\$100 million would be spent in a strategic renewal phase at the 60 000-t/y Ni in FeNi Koniambo project, targeted to start by 2010. SMSP owns 51% of **Koniambo Nickel SAS**, the company that will hold the mining leases and operate the mines and smelter. **SMSP** and **Posco** announced a 30 000-t/y Ni in FeNi joint-venture smelter in South Korea to start up in 2008. SMSP will provide the mineral properties and Posco will build the smelter. SMSP will own 51% of the combined operations. Labour actions reduced SLN's output by about 4000 t of Ni in FeNi and matte; for the year, SLN produced 41 700 t of nickel in both products. The matte was sent to Eramet's Sandouville refinery, which produced 13 500 t of refined nickel and nickel chemicals, and 256 t of cobalt. This refinery's capacity was being increased to 15 000 t/y of nickel and 300 t/y of cobalt.

China Metallurgical Construction will finance and build the US\$800 million Ramu project in Papua New Guinea to

produce 33 000 t/y of nickel and about 3300 t/y of cobalt in sulphide intermediates; **Jilin Jien** will participate in the project. Chinese pig iron producers were reported to have imported about 3.79 Mt of limonitic laterite nickel ore from Oceania, of which 3.35 Mt was from the Philippines and 0.16 Mt was from Indonesia.

Sumitomo will spend US\$285 million to double capacity at its Coral Bay operation in the **Philippines** to 20 000 t/y of nickel in sulphides by 2009. Philippine nickel production was 3.6 Mt of direct shipping laterite ore containing about 50 000 t of nickel, as well as about 8200 t of nickel in a mixed nickel-cobalt sulphide produced by **Coral Bay** grading 58% Ni.

Africa

In Botswana, the Department of Mines reported that 64 000 t of matte had been produced by the **BCL** smelter, containing 26 700 t of nickel, 24 300 t of copper, and 303 t of cobalt. The smelter feed came from BCL's underground mines and from LionOre's Tati operation, which produced 14 900 t of nickel in concentrates, of which 13 700 t was payable. LionOre will build an Activox refinery to produce 22 000 t/y of nickel metal by 2009; refinery and other costs will be US\$620 million.

Dynatec's 60 000-t/y nickel, 5600-t/y cobalt Ambatovy project in Madagascar received environmental approval. Partners were Sumitomo, Korea Resources, and SNC-Lavalin. Proven plus probable reserves were 125 Mt @ 1.04% Ni and 0.099% Co. Estimated capital costs were US\$2500 million.

In South Africa, LionOre and **African Rainbow Minerals** approved an interim project at Nkomati to bridge the production gap until the Main Expansion project starts producing 20 000 t/y of nickel with an Activox refinery. Platinum producers in South Africa produced by-product nickel primarily from underground mines. Further development of the platinum industry in South Africa was expected to be constricted by available smelting capacity; **Braemore Resources** agreed to purchase **Independence Platinum Limited**, which was planning a smelting and refining project in South Africa that could process about 0.36 Mt/y of concentrates that would produce up to 30 000 t/y of nickel metal plus copper and PGM.

Eurasia

In China, **Jinchuan** production was estimated at 100 000 t of refined nickel (up 9000 t), of which 60 000 t of nickel in concentrate came from its mines. Jinchuan signed offtake contracts for nickel in concentrate with **Allegiance** (7000 t/y), **Albidon** (9000 t/y), and **Canadian Royalties** (10 000 t/y). **Jilin Jien** began taking nickel concentrate from **Liberty Mine's** Redstone mine and agreed to take an equity participation in Ramu. Jilin's output was nickel sul-

phate, although it built a 2000-t/y nickel in carbonyl plant. Pig iron producers in China imported an estimated 30 000 t of nickel in laterite ore, representing an important new source of supply to China and to the world's nickel market. During 2006, an estimated 15.3 Mt were imported from the Philippines, Indonesia, and New Caledonia. The use of formerly obsolete blast furnaces to produce nickel containing pig iron was seen as a temporary measure that could be sustained during times of high prices for nickel, although other technologies may be employed to reduce production costs for the production of nickel pig iron. Nevertheless, because the limonitic nickel laterite ore contains about 35% moisture, transportation costs will remain a significant disadvantage for the production of nickel pig iron; in an era of much lower nickel prices, the nickel pig iron operations will not be economically viable.

Japanese nickel refineries source the majority of their feed from nickel lateritic sources. Three ferronickel smelters produced about 69 000 t of Ni in FeNi using the saprolitic fraction of nickel laterite ore mined in the Philippines, New Caledonia, and Indonesia. Sumitomo's nickel refinery recovered about 29 000 t of nickel from feeds, including nickel matte from **PT Inco**, mixed nickel-cobalt sulphide intermediates from the Coral Bay operation in the Philippines, and other sources. CVRD's TNC refinery in Japan produced about 50 000 t of nickel in nickel oxide in 2006.

Korean stainless steel producer Posco signed an agreement with SMSP in New Caledonia to create a joint venture to produce ferronickel in Korea at the Kwangyang Steel Works using laterite ore from New Caledonia. The 30 000-t/y nickel in ferronickel plant was to be completed at the end of 2008.

International Mineral Resources bought **NewCo Feronikeli L.L.C.** in Kosovo for €30.5 million in April, promising an investment of €20 million and employment for 1000; Feronikeli's three mines and a 12 000-t/y Ni in FeNi plant have been shut since the 1990s.

In Russia, **Norilsk Nickel** produced 244 000 t of nickel in 2006, up marginally from 2005. Of this, 37 000 t was sourced from the Kola Peninsula mines and the remainder was from the Polar Division located in the Taimyr Peninsula in Siberia. The Polar Division's output was smelted on site, but was refined both on site or shipped to the Kola Peninsula for refining. Almost all PGM produced were sourced from the Polar Division. Cobalt production in 2006 was about 4750 t. Norilsk also agreed to buy Finland's **OMG Harjavalta** refinery and Australian mine assets for US\$400 million; the sale had not been concluded as of year-end 2006. **Ufaleinikel's** plant produced 10 400 t of nickel and 1865 t of cobalt in the first nine months of 2006, and **Mechel's Yuzhuralnickel** produced 14 400 t of Ni in FeNi in 2006.

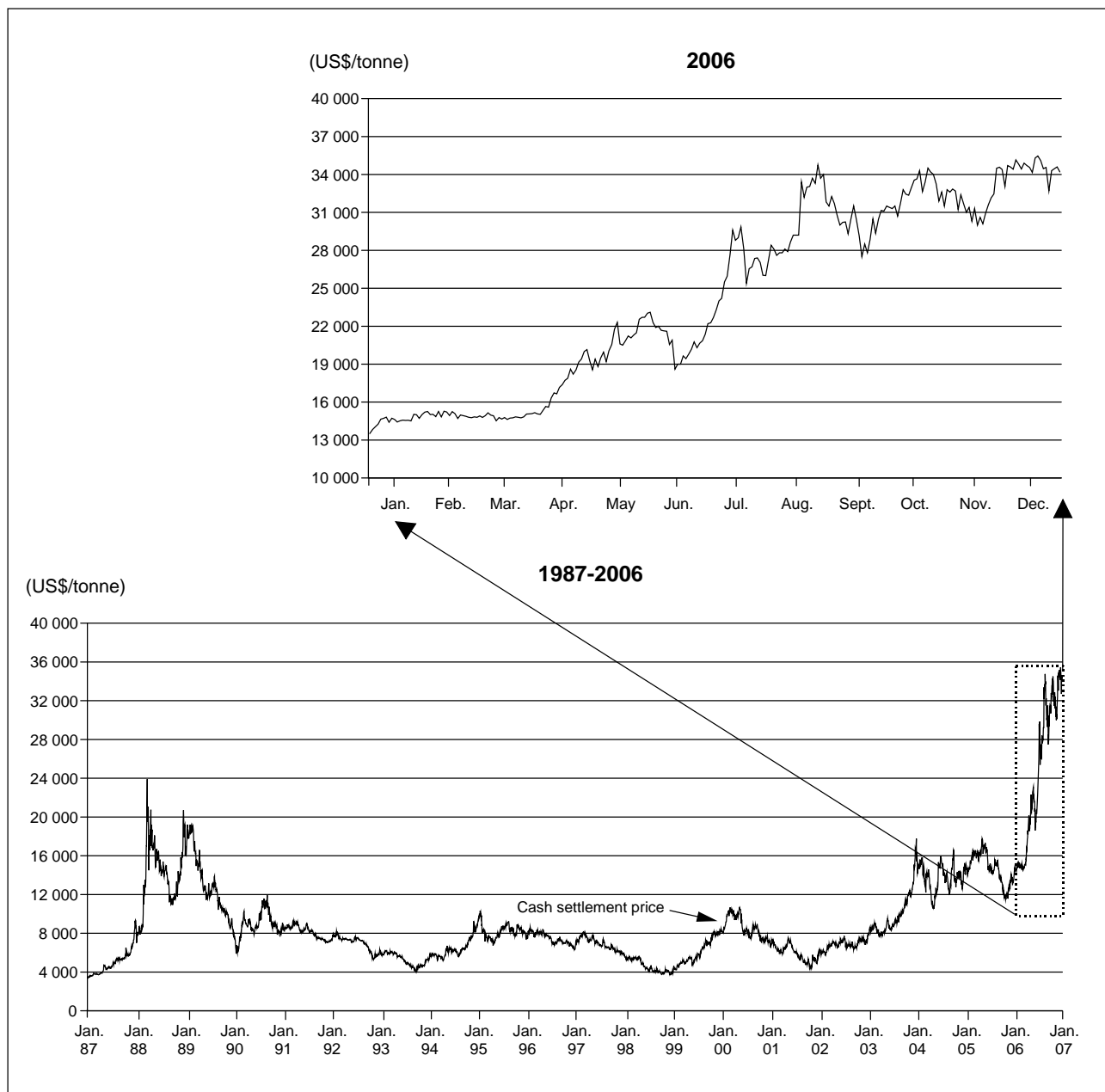
European Nickel will build a 21 000-t/y nickel mine heap leach operation in Turkey, selling nickel hydroxide to **BHP Billiton** and ore to **Larco**; lack of a forestry permit was delaying the project at year-end. Larco produced 17 700 t of Ni in FeNi in 2006. It planned upgrades to furnaces and transformers that, in conjunction with additional feed imported from Turkey and Indonesia, was to allow production to increase to over 20 000 t/y of Ni in FeNi. Larco

was also conducting a feasibility study of a heap leaching operation to further boost production and reduce costs.

Americas

In Brazil, **CVRD** completed the purchase of **Canico**; CVRD approved a US\$1437 million investment to produce 58 000 t/y of Ni in FeNi targetting start-up in early 2008.

Figure 2
LME Cash Settlement Nickel Prices, 1987-2006



Sources: International Nickel Study Group; *Metal Bulletin*.

Conversions: \$2.50/lb = \$5512/t; \$3.00/lb = \$6614/t; \$3.50/lb = \$7716/t; \$4.00/lb = \$8818/t.

CVRD's 46 000-t/y Vermelho hydrometallurgical project was delayed until 2010. **Votorantim Metals** announced that it will build a 10 600-t/y Ni in FeNi smelter to start in 2009 and obtained replacement feed for its Fortaleza smelter. Votorantim planned to produce 27 000 t of nickel in all forms in 2007. Its production in 2006 was 21 240 t of nickel and 900 t of cobalt, as well as 4775 t of nickel in matte produced at the Fortaleza smelter. The US\$1.2 billion, 33 000-t/y Ni in FeNi Barro Alto project was approved by **Anglo American** in December.

Subject to financing, **Skye Resources** planned to build a 20 000-t/y Ni in FeNi plant in Guatemala, at a cost of US\$754 million, with start-up planned for 2009. A US\$854 million hydromet operation producing 22 000 t/y of nickel and 1900 t/y of cobalt was also under consideration.

Moa Nickel, owned jointly by Sherritt International and the Cuban government, will expand production at the mine and leaching operation to supply feed to the Fort Saskatchewan refinery noted above. Work began on the expansion in April.

PolyMet Mining released a feasibility study in the second half of the year. The company planned to start up an open-pit mine in mid-2008. The ore would be processed in the Cleveland Cliffs crushing and grinding facilities, purchased earlier, with the concentrate fed to a hydrometallurgical process. Copper cathode, as well as nickel and cobalt in hydroxide (about 7000 t/y of nickel and 350 t/y of cobalt)

and a PGM-gold residue, would be produced. **Kennecott Minerals** continued evaluation of the Eagle project, an underground sulphide deposit in Michigan.

Cobalt production in 2006 was about 53 600 t, the same as in 2005. Cobalt production in China was mainly the result of processing imported intermediate products containing cobalt, such as nickel-copper-cobalt concentrates and heterogenite from the Congo.

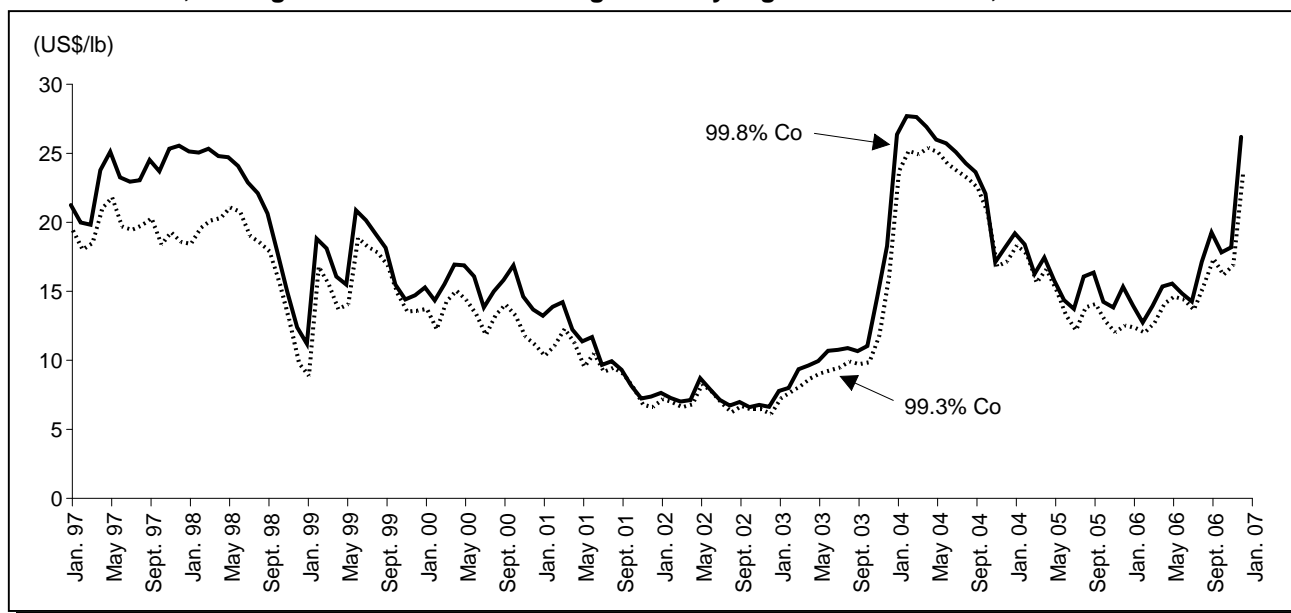
Cobalt prices as reported by the *Metal Bulletin* varied during the year, as shown in the graph below. While the average of the average monthly high and low prices was only up 4% and 5% for 99.8% and 99.3% cobalt, respectively, the weakening prices reached a floor in early 2006 and thereafter trended sharply upward. The average of the December high and low price for 99.8% cobalt was about 70% higher than the average in December 2005; for 99.3% cobalt, the December 2006 figure was nearly 90% higher.

BHP Billiton's recent and historical cobalt transaction prices and tonnages were reported on the company's web site at <http://cobalt/bhpbilliton.com>.

DEMAND FOR NICKEL

According to Eramet's Reference Document for 2006, the principal uses for primary nickel were stainless steel (63%), other metallurgical uses, including coinage (about 20%), and electroplating (9%).

Figure 3
Cobalt Prices, Average of Metal Bulletin Average Monthly High and Low Prices, 1997-2006



Source: *Metal Bulletin*.

Crude stainless steel production increased from 19.2 Mt in 2001 to 27.8 Mt in 2006, with most increases occurring in China. For the period 2001-06, the increases in production in tonnes and as a percentage increase on 2001 output were:

Western Europe plus Africa	1.762 Mt	+21%
Central + Eastern Europe	0.078 Mt	+27%
Americas	0.662 Mt	+29%
Asia	<u>6.771 Mt</u>	<u>+79%</u>
World total	9.172 Mt	+48%

BHP Billiton forecast that demand for stainless steel would average 4.9%/y over the period of approximately mid-2005 to 2011 inclusive, with China providing most of the growth, as it had since 2000. **CRU** expected that nickel use would increase by 4.3% between 2006 and 2011. Nickel growth will likely be constrained by availability until 2008. In late 2006, Chinese stainless users were reportedly planning to purchase stainless steel with lower nickel contents to reduce prices. **MEPS** reported that world prices for Cold Roll Grade 304 stainless in December 2006 were US\$4614/t, compared to about US\$2714/t a year earlier. In October 2006, the INSG forecast world primary nickel use as 1.37 Mt in 2006 and 1.45 Mt in 2007.

OUTLOOK

Sustained high nickel prices allowed many companies to advance projects. With **Inco** having reconfigured its Clarabelle mill to remove 30% of the copper from its Sudbury mine output, its nickel smelting capacity in Sudbury has increased. By 2012, **CVRD Inco** is to have additional refined nickel capacity at Long Harbour in Newfoundland and Labrador. Additional nickel production from properties in Manitoba could help secure the Thompson smelter's future, but a major challenge exists to reduce SO₂ emissions. As noted above, **Sheritt's** expansion will bring on an additional 12 000 t/y of nickel by the end of 2009.

World demand for nickel in 2006 was limited by supply. Past periods of low prices put a damper on producers' plans for expansion and new development to increase nickel production capacity. When the increase in demand overtook existing capacity, prices rose to ration demand. Chinese demand for nickel was fueled by a burgeoning stainless steel industry that added about 2 Mt of new capacity in 2006. Offsetting this somewhat was the output of nickel in pig iron produced in blast furnaces utilizing low-grade limonitic laterite nickel feed.

With the long lead times for new projects due to lengthening construction periods and environmental permitting timelines, producers have been unable to quickly increase production. The high prices have triggered moves to substitute low-nickel and no-nickel stainless steels for austenitic stainless steels. The degree to which the substitution

penetrates the existing stainless markets will in part be determined by the length of time that high nickel prices are sustained. Some market expectations seem to assume that supply must "meet" demand whatever the price; however, demand is also affected by prices. Sustained periods of high prices provide incentives to substitute away from nickel use and to economize nickel use when possible. Once the large new projects are on stream, their continued production in the medium term will be a function of their operating costs, not the "sunk" capital costs, and therefore they can sustain production when prices are much lower than the level that justified the original investment.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

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TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2604.00	Nickel ores and concentrates	Free	Free	Free	Free	Free	Free
2620.99.00	Slag, ash and residues (other than from the manufacture of iron or steel) containing metals, arsenic or their compounds, other: other	Free	Free	Free	Free	Free	Free
2825.40	Hydrazine and hydroxylamine and their inorganic salt; other inorganic bases; other metal oxides, hydroxides and peroxides: nickel oxides and hydroxides	Free	Free	Free	Free	Free	4.8%
2827.35	Chloride, chloride oxides and chloride hydroxides; bromides and bromide oxides; iodides and iodide oxides: other chlorides: of nickel	3.5%	3%	Free	Free	5.5%	3.3%
2833.24	Sulphates; alums; peroxosulphates (persulphates): other sulphates: of nickel	3%	Free	Free	Free	5%	3.9%
3815.11	Reaction initiators, reaction accelerators and catalytic preparations, not elsewhere specified or included: supported catalysts: with nickel or nickel compounds as the active substance	Free	Free	Free	Free	6.5%	2.2%
7202.60	Ferro-alloys: ferro-nickel	6.5%	Free	Free	Free	Free	3.3%
7204.21	Ferrous waste and scrap; remelting scrap ingots of iron or steel: waste and scrap of alloy steel: of stainless steel	Free	Free	Free	Free	Free	Free
75.01	Nickel mattes, nickel oxide sinters and other intermediate products of nickel metallurgy	Free	Free	Free	Free	Free	Free-3%
7502.10	Unwrought nickel: nickel: not alloyed	Free	Free	Free	Free	Free	44yen/kg
7502.20	Unwrought nickel: nickel: alloys	Free	Free	Free	Free	Free	Free-3%
7503.00	Nickel waste and scrap	Free	Free	Free	Free	Free	Free
7504.00	Nickel powders and flakes	Free	Free	Free	Free	Free	Free-3%
7505.11	Nickel bars, rods, profiles and wire: bars, rods and profiles: of nickel, not alloyed	Free	Free	Free	Free	Free	3%
7505.12	Nickel bars, rods, profiles and wire: bars, rods and profiles: of nickel, alloys	Free	Free	Free	Free	2.9%	3%
7505.21	Nickel bars, rods, profiles and wire: wire: of nickel, not alloyed	Free	Free	Free	Free	Free	3%
7505.22	Nickel bars, rods, profiles and wire: wire: of nickel, alloys	Free	Free	Free	Free	2.9%	3%
7506.00	Nickel plates, sheets, strip and foil	Free	Free	Free	Free	Free-3.3%	Free-3%
7507.00	Nickel tubes, pipes, and tube or pipe fittings	Free	Free	Free	Free	Free-2.5%	Free-3%
7508.00	Other articles of nickel	Free-3%	Free	Free	Free	Free	3%

Sources: Canadian *Customs Tariff*, effective January 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2007; *Official Journal of the European Union* (October 17, 2006 Edition); *Customs Tariff Schedules of Japan*, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially. (3) Free except for nickel oxide sinters containing by weight not less than 88% nickel, for which the tariff rate is 44 yen/kg, and nickel oxide containing by weight not more than 1.5% copper, for which the tariff rate is 3%. (4) The tariff rate of 3% applies to nickel alloys other than those containing by weight less than 50% nickel and not less than 10% cobalt.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2605.00	Cobalt ores and concentrates	Free	Free	Free	Free	Free	Free
2822.00	Cobalt oxides and hydroxides, commercial cobalt oxides	Free	Free	Free	Free	4.6%	Free
2827.34	Chlorides, chloride oxides and chloride hydroxides; bromides and bromide oxides; iodides and iodide oxides: other chlorides: of cobalt	4%	3%	Free	Free	5.5%	3.3%
2833.29.00.40	Sulphates; alums; peroxosulphates (persulphates); other sulphates: other: cobalt sulphate	Free	Free	Free	Free	5.3%	Free-3.9%
2836.99.10.30	Carbonates; peroxocarbonates (percarbonates); commercial ammonium carbonate containing ammonium carbonate: other: other: commercial ammonium carbonate and other ammonium carbonates; lead carbonates; other carbonates and peroxocarbonates (percarbonates), for use in the manufacture of animal or poultry feeds, glues or adhesives, optical fibres or optical fibre bundles or cables, typewriter or similar ribbons, polymers in primary forms or profile shapes or sheets of plastics; other carbonates and peroxocarbonates (percarbonates), to be employed as drilling mud or additives thereof in drilling for minerals, natural gas, oil or water; cobalt carbonates	Free	Free	Free	Free	3.7-5.5%	3.3%
2836.99.90.20	Carbonates; peroxocarbonates (percarbonates); commercial ammonium carbonate containing ammonium carbonate: other: other: other: cobalt carbonates	3.5%	3%	Free	Free	3.7-5.5%	3.3%
2915.23	Saturated acyclic monocarboxylic acids and their anhydrides, halides, peroxides and peroxyacids; their halogenated, sulphonated, nitrated or nitrosated derivatives: cobalt acetates	Free-5.5%	Free-3%	Free	Free	5.5%	3.9%
81.05	Cobalt mattes and other intermediate products of cobalt metallurgy; cobalt and articles thereof, including waste and scrap						
8105.20	Cobalt mattes and other intermediate products of cobalt metallurgy; unwrought cobalt; powders	Free-3%	Free	Free	Free	Free	Free
8105.30	Waste and scrap	Free	Free	Free	Free	Free	Free
8105.90	Other	3%	Free	Free	Free	3%	Free

Sources: Canadian *Customs Tariff*, effective January 2006 and 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2006 and 2007; *Official Journal of the European Union* (October 27, 2005 and October 17, 2006 editions); *Customs Tariff Schedules of Japan*, 2006 and 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1a. CANADA, NICKEL PRODUCTION BY PROVINCE, 2004-06

	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
MINE OUTPUT (1)						
Nickel content of concentrates produced	186 694	..	199 932	..	234 111	..
SHIPMENTS						
Recoverable content of nickel in concentrates shipped from Canadian mines						
Newfoundland and Labrador	—	—	10 032	182 602	46 437	1 270 786
Quebec	26 613	484 223	22 230	404 625	22 953	628 132
Ontario	113 672	2 068 260	123 744	2 252 383	119 454	3 268 970
Manitoba	36 996	673 136	36 849	670 728	36 854	1 008 546
Total	177 281	3 225 620	192 855	3 510 339	225 697	6 176 435
Finished nickel output = refined nickel in various shapes in Class I, plus Class II nickel (as defined by the International Nickel Study Group), which includes nickel oxide sinter						
	151 518	..	139 683	..	153 743	..

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; (p) Preliminary.

(1) Monthly mine production data, September 2007, at <http://mmsd1.mms.nrcan.gc.ca/mmsd/data/2007/07MTLY09.pdf>.

Note: Numbers may not add to totals due to rounding.

TABLE 1b. CANADA, NICKEL EXPORTS, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
2604.00.40	Nickel ores and concentrates (nickel content)						
	China	—	—	—	—	905	2 616
	Other	—	—	...	5	—	—
	Total	—	—	...	5	905	2 616
2825.40	Nickel oxides and hydroxides (weight of material, not nickel content)						
	Hong Kong	515	6 484	688	5 053	563	7 473
	China	295	3 885	423	3 083	411	5 211
	United States	22	332	38	405	300	4 106
	Germany	313	3 180	542	4 088	244	3 913
	South Korea	...	3	79	580	85	1 093
	Japan	278	3 117	135	999	59	856
	Singapore	75	803	85	617	15	280
	Other	306	3 344	16	123	13	154
	Total	1 804	21 148	2 006	14 948	1 690	23 086
2827.35	Nickel chlorides (weight of material, not nickel content)						
	United States	—	—	—	—	1	4
	Mexico	—	—	—	—	...	...
	Total	—	—	—	—	1	4
2833.24	Nickel sulphates (weight of material, not nickel content)						
	United Kingdom	471	926	699	1 240	193	527
	Other	1	5	5	47	—	—
	Total	472	931	704	1 287	193	527
3815.11	Catalysts and other reaction initiators, reaction accelerators and catalytic preparations with nickel or nickel compounds as the substance (weight of material, not nickel content)						
	United States	11	19	2	100	143	262
	United Kingdom	—	—	1	16	1	12
	Other	—	—	...	2	...	...
	Total	11	19	3	118	144	274
7204.21	Stainless steel waste and scrap (weight of material, not nickel content)						
	United States	97 768	151 395	73 089	107 997	134 363	178 511
	China	3 202	4 004	87 104	94 255	50 577	116 484
	Netherlands	14 144	25 722	18 153	31 074	22 357	38 015
	Italy	5 937	10 593	14 882	29 093	10 134	26 181
	India	7 677	15 025	10 618	23 583	5 259	14 226
	Japan	520	1 277	5 173	15 335	3 008	10 775
	South Korea	639	1 103	2 041	3 167	3 499	9 000
	Hong Kong	65	58	3 177	4 821	1 781	3 292
	Belgium	114	220	42	123	1 369	3 096
	United Kingdom	851	1 377	1 443	685	621	2 814
	Taiwan	26	24	2 020	2 854	1 397	2 049
	Other	1 142	2 572	10 119	14 112	3 669	8 623
	Total	132 085	213 370	227 861	327 099	238 034	413 066
7501.10	Nickel mattes (nickel content)						
	Norway	61 115	1 116 312	59 720	1 124 512	56 628	1 420 664
	Other	...	4	2	27	4	18
	Total	61 115	1 116 316	59 722	1 124 539	56 632	1 420 682

TABLE 1b (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
7501.20	Nickel oxide sinters and other intermediate products of nickel metallurgy (weight of material, not nickel content)						
	United Kingdom	39 612	551 827	37 383	499 356	38 545	731 690
	South Korea	7 337	92 000	82	1 035	5 619	143 817
	United States	1 524	21 461	1 972	29 465	1 590	29 540
	Taiwan	221	3 333	—	—	936	24 704
	China	113	1 390	424	4 148	4 541	8 159
	Other	602	8 538	400	5 499	78	998
	Total	49 409	678 549	40 261	539 503	51 309	938 908
7502.10	Nickel unwrought, not alloyed (nickel content)						
	United States	54 493	971 464	51 830	938 609	56 193	1 271 144
	China	11 281	209 628	11 866	211 562	20 792	597 523
	Hong Kong	10 506	196 406	8 160	156 004	9 164	235 800
	Netherlands	6 735	119 815	6 051	108 035	5 553	137 185
	Belgium	8 740	157 727	10 488	189 336	5 062	128 289
	Taiwan	5 599	105 482	4 784	87 015	4 619	109 401
	South Korea	3 225	59 214	3 641	67 193	3 704	92 713
	Japan	3 404	62 622	3 118	58 445	3 208	85 776
	Singapore	2 436	44 389	2 559	45 278	3 930	80 716
	United Kingdom	8 241	123 761	2 999	55 235	1 234	39 839
	Italy	1 491	25 389	1 916	35 433	1 590	38 310
	Spain	3 273	55 809	1 650	28 474	1 355	35 017
	India	962	16 066	701	13 227	1 511	33 228
	Australia	423	7 510	844	15 850	972	20 512
	Thailand	863	16 557	913	17 086	759	17 181
	South Africa	—	—	155	2 833	506	16 800
	Indonesia	410	7 782	640	12 268	495	13 359
	Germany	60	1 068	42	550	337	9 806
	France	790	12 820	448	7 705	367	9 250
	Vietnam	—	—	8	131	237	5 529
	Brazil	51	943	16	315	163	4 306
	Sweden	3	42	—	—	60	1 931
	Luxembourg	—	—	—	—	42	1 572
	Estonia	—	—	—	—	40	1 479
	Argentina	23	451	10	184	51	1 414
	Switzerland	156	2 733	120	1 886	21	776
	Chile	10	194	2	37	23	775
	Mexico	220	4 155	62	757	21	683
	Other	810	13 949	222	4 189	—	—
	Total	124 205	2 215 976	113 245	2 057 637	122 009	2 990 314
7502.20	Nickel unwrought, alloyed (weight of material, not nickel content)						
	United States	29	623	1	46	102	1 752
	Poland	1	5	1	10	1	6
	Total	30	628	2	56	103	1 758
7503.00	Nickel waste and scrap (weight of material, not nickel content)						
	United States	3 606	19 155	4 150	25 309	3 307	23 767
	Netherlands	213	1 896	42	364	515	6 845
	Italy	96	497	239	1 316	218	2 133
	Norway	32	228	46	693	21	436
	Other	163	657	184	724	—	—
	Total	4 110	22 433	4 661	28 406	4 061	33 181
7504.00	Nickel powders and flakes, alloyed and unalloyed (weight of material, not nickel content)						
	Japan	5 154	96 861	5 829	108 483	6 366	165 534
	United States	4 731	97 567	4 421	87 309	3 900	95 328
	China	1 130	20 824	1 577	28 882	1 670	32 258
	Brazil	255	4 862	1 232	24 470	703	18 215
	Belgium	621	10 852	687	12 028	640	16 951
	South Korea	492	11 925	470	8 828	557	15 511
	Germany	71	1 504	79	2 596	246	6 744
	Netherlands	213	4 074	253	4 819	147	3 702
	Taiwan	570	11 632	156	3 404	130	3 028
	Singapore	41	776	131	2 287	133	2 078

TABLE 1b (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
7504.00 (cont'd)	Luxembourg	21	240	63	1 034	42	1 572
	Thailand	22	463	12	233	55	902
	Other	511	5 704	176	3 640	891	4 304
	Total	13 832	267 284	15 086	288 013	15 480	366 127
7505.11	Bars, rods and profiles of nickel, not alloyed (nickel content)						
	Argentina	—	—	—	—	...	1
	United States	...	5	—	—	—	—
	United Arab Emirates	—	—	...	1	—	—
	Total	...	5	...	1	...	1
7505.12	Bars, rods and profiles of nickel alloy (weight of material, not nickel content)						
	United States	1	54	24	278	41	449
	Cuba	—	—	—	—	3	94
	Japan	3	34	1	17	3	29
	Other	6	76	6	73	1	33
	Total	10	164	31	368	48	605
7505.21	Nickel wire, not alloyed (weight of nickel wire plus coating if any, not nickel content)						
	United States	1	33	3	63	17	720
	United Kingdom	—	—	—	—	...	...
	Total	1	33	3	63	17	720
7505.22	Wire, nickel alloy (weight of alloy plus coating, if any; not nickel content)						
	United States	24	553	41	1 565	60	1 358
	Other	3	27	32	214	12	118
	Total	27	580	73	1 779	72	1 476
7506.00	Nickel plates, sheets, strip and foil						
	United States	1	57	40	673	103	333
	Japan	...	...	—	—	14	151
	Cuba	1	8	—	—	7	62
	Other	36	329	11	108	5	64
	Total	38	394	51	781	129	610
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
7507.00	Tubes, pipes, and tube or pipe fittings alloyed and unalloyed (weight of material, not nickel content)						
	Czech Republic	..	2 764	..	16 711	..	24 016
	United States	..	3 245	..	5 804	..	9 440
	Venezuela	..	64	..	695	..	869
	Sweden	..	283	..	601	..	544
	United Arab Emirates	..	223	..	211	..	487
	Taiwan	—	—	..	3	..	460
	United Kingdom	..	246	..	454	..	388
	Trinidad and Tobago	—	—	..	187	..	159
	China	..	304	—	—	..	137
	Other	..	2 167	..	3071	..	209
	Total	..	9 296	..	27 737	..	36 709
7508.00	Other articles of nickel (weight of material, not nickel content)						
	United States	..	7 403	..	6 947	..	3 432
	Germany	..	79	..	224	..	269
	Poland	..	90	..	156	..	255
	United Kingdom	..	64	..	43	..	97
	Other	..	303	..	397	..	547
	Total	..	7 939	..	7 767	..	4 600
	Total exports	..	4 555 065	..	4 420 107	..	6 235 264

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; ... Amount too small to be expressed; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 1c. CANADA, NICKEL IMPORTS, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
2604.00.00.20	Nickel ores and concentrates (nickel content)						
	South Africa	2 836	54 681	2 643	48 544	2 674	68 954
	Australia (1)	14 747	282 869	12 965	239 089	2 485	45 658
	United States	307	5 766	484	9 047	388	8 886
	Other	...	...	...	...	...	1
	Total	17 890	343 316	16 092	296 680	5 547	123 499
2620.99.00.90	Ash and residues, other (containing mainly nickel)						
	Germany	5 570	1 877	5 244	1 600	7 495	6 683
	Philippines	1 720	7 782	2 364	6 183	7 178	4 937
	United States	89 373	2 674	139 691	2 412	135 201	2 354
	Norway	694	2 671	7 612	4 999	6 999	2 329
	Suriname	—	—	—	—	11 345	649
	Guyana	126	13	—	—	120	231
	Mexico	—	—	2 661	107	35	113
	Other	76 582	336 786	152 439	72 583	1 376	55
	Total	174 065	351 803	310 011	87 884	169 749	17 351
2825.40	Nickel oxides and hydroxides (weight of material, not nickel content)						
	United States	893	254	763	1 079	1 503	5 402
	Finland	41	699	37	640	33	468
	Belgium	206	417	131	350	96	412
	Japan	1	7	3	34	15	174
	Other	268	488	497	524	—	—
	Total	1 409	1 865	1 431	2 627	1 647	6 456
2827.35	Nickel chlorides (weight of material, not nickel content)						
	France	142	797	154	849	68	465
	United States	292	1 913	34	229	46	275
	China	3	19	—	—	31	205
	Other	...	...	5	28	...	1
	Total	437	2 729	193	1 106	145	946
2833.24	Nickel sulphates (weight of material, not nickel content)						
	United States	10 504	24 762	7 232	14 131	8 738	22 532
	Belgium	313	1 397	507	2 330	407	2 167
	China	26	124	45	243	186	1 112
	Finland	37	213	54	246	37	174
	Other	18	87	25	121	26	162
	Total	10 898	26 583	7 863	17 071	9 394	26 147
3815.11	Catalysts and other reaction initiators, reaction accelerators and catalytic preparations with nickel or nickel compounds as the substance (weight of material, not nickel content)						
	United States	435	9 179	378	5 007	427	7 173
	Netherlands	16	179	...	1	261	4 070
	South Africa	—	—	—	—	270	3 543
	Germany	79	1 270	248	5 161	138	2 381
	Belgium	411	12 065	168	5 011	46	742
	United Kingdom	170	2 714	98	1 312	28	622
	India	70	510	18	206	42	313
	France	337	2 813	...	...	10	242
	Canada	—	—	6	85	10	122
	Denmark	80	1 798	70	1 425	3	71
	Japan	66	554	404	4 930	—	—
	Other	...	1	...	...	...	2
	Total	1 664	31 083	1 390	23 138	1 235	19 281
7202.60	Ferronickel (weight of material, not nickel content)						
	United States	47	245	16	86	22	162
	Other	—	—	—	—	...	4
	Total	47	245	16	86	22	166

TABLE 1c (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
7204.21	Stainless steel scrap (weight of material, not nickel content)						
	United States	32 886	29 034	30 049	30 746	36 666	47 138
	Sweden	—	—	—	—	20	27
	Canada	203	194	3	5	18	19
	Other	404	224	424	306	32	48
	Total	33 493	29 452	30 476	31 057	36 736	47 232
7501.10	Nickel mattes (nickel content)						
	Russia	—	—	199	465	177	495
	Other	518	8945	49	57	9	39
	Total	518	8 945	248	522	186	534
7501.20	Nickel oxide sinters and other intermediate products of nickel metallurgy (weight of material, not nickel content)						
	Germany	7 859	23 991	7 929	27 615	10 408	39 088
	United Kingdom	—	—	...	...	4	44
	United States	4	37	100	338	1	15
	Other	3 903	15 454	308	1 089	...	...
	Total	11 766	39 482	8 337	29 042	10 413	39 147
7502.10	Nickel unwrought, not alloyed (nickel content)						
	Finland	405	7 855	600	11 628	492	10 288
	Norway	540	7 571	727	13 423	373	7 247
	United Kingdom	541	6 183	335	4 806	209	4 972
	Brazil	—	—	—	—	163	1 450
	Zimbabwe	—	—	7	59	50	946
	Russia	111	2 124	82	1 584	51	843
	Canada	101	1 171	...	4	46	623
	United States	13	176	124	1 602	41	584
	China	—	—	—	—	31	380
	Other	174	3 033	29	421	...	2
	Total	1 885	28 113	1 904	33 527	1 456	27 335
7502.20	Nickel unwrought, alloyed (weight of material, not nickel content)						
	United States	848	3 246	126	2 393	170	2 859
	Russia	691	3 414	631	2 892	328	1 556
	United Kingdom	28	691	32	736	38	751
	Estonia	—	—	—	—	80	342
	Canada	1	23	10	139	6	113
	Germany	3	22	1	10	20	85
	Other	10	159	3	44	2	62
	Total	1 581	7 555	803	6 214	644	5 768
7503.00	Nickel waste and scrap (weight of material, not nickel content)						
	United States	20 451	51 099	19 089	47 147	18 463	70 971
	Norway	579	1 153	726	1 396	150	1 259
	Germany	100	752	18	101	362	1 095
	Japan	196	1 244	146	512	148	852
	Zimbabwe	15	42	42	179	210	551
	United Kingdom	180	1 163	148	849	199	544
	China	...	1	1	4	100	470
	Finland	269	1 386	103	347	11	389
	Netherlands	—	—	119	388	66	267
	South Africa	—	—	19	343	68	235
	Bermuda	111	555	18	79	50	221
	Estonia	—	—	—	—	46	194
	France	106	1 306	13	143	51	175
	Russia	320	709	5	94	40	170
	Other	158	806	24	132	19	107
	Total	22 485	60 216	20 471	51 714	19 983	77 500

TABLE 1c (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
7504.00	Nickel powders and flakes, alloyed and unalloyed (weight of material, not nickel content)						
	Australia	837	10 024	752	12 536	1 383	30 659
	United States	241	4 530	553	5 557	134	4 581
	Belgium	8	145	4	126	21	799
	United Kingdom	44	660	40	1 035	13	444
	Russia	126	2 324	9	166	16	371
	Ireland	6	124	4	100	9	344
	South Africa	5	47	6	71	4	100
	Other	83	1 045	30	631	5	189
	Total	1 350	18 899	1 398	20 222	1 585	37 487
7505.11	Bars, rods and profiles of nickel, not alloyed (nickel content)						
	United States	10	196	10	234	11	233
	United Kingdom	...	1	3	58	12	223
	Other	...	15	1	6	...	8
	Total	10	212	14	298	23	464
7505.12	Bars, rods and profiles of nickel alloy (weight of material, not nickel content)						
	United States	542	11 751	621	17 588	915	26 554
	Germany	52	920	79	2 095	94	2 858
	Italy	26	629	37	1 237	19	690
	United Kingdom	13	456	25	1 007	10	373
	Japan	10	79	19	227	15	286
	Other	3	121	23	401	10	196
	Total	646	13 956	804	22 555	1 063	30 957
7505.21	Nickel wire, not alloyed (weight of nickel wire plus coating if any, not nickel content)						
	United States	48	576	42	521	38	452
	Germany	45	479	6	60	8	109
	Other	2	22	...	3	5	70
	Total	95	1 077	48	584	51	631
7505.22	Wire, nickel alloy (weight of alloy plus coating, if any, not nickel content)						
	United States	175	4 672	246	7 443	236	6 734
	Germany	134	2 479	156	2 923	140	2 997
	Sweden	87	1 683	39	877	63	1 579
	Austria	34	651	26	460	52	1 224
	United Kingdom	38	666	5	132	25	998
	France	5	192	34	1 083	28	798
	Italy	1	12	15	281	13	243
	Other	1	39	1	24	1	18
	Total	475	10 394	522	13 223	558	14 591
7506.00	Nickel plates, sheets, strip and foil (weight of material, not nickel content)						
	United States	476	13 417	581	18 480	519	18 012
	Germany	115	2 763	1 869	36 534	789	15 071
	Austria	...	1	...	3	5	148
	Japan	14	482	3	172	2	108
	Sweden	1	35	6	159	3	87
	Other	95	1 413	9	246	13	276
	Total	701	18 111	2 468	55 594	1 331	33 702
7507.00	Tubes, pipes, and tube or pipe fittings alloyed and unalloyed (weight of material, not nickel content)						
	Canada	...	11	289	16 705	365	26 500
	United States	483	15 199	482	19 088	497	18 586
	Norway	490	9 152	437	7 690	678	18 249
	Sweden	18	386	21	467	46	1 027
	United Kingdom	15	391	23	1 055	19	791
	Germany	29	582	28	482	7	410
	Japan	10	444	209	19 937	7	320

TABLE 1c (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
7507.00	France	1	52	15	639	5	148
7507.00	Italy	4	140	22	1 029	7	118
	Spain	4	158	3	73	1	56
	Other	46	801	6	126	4	84
	Total	1 100	27 316	1 535	67 291	1 636	66 289
7508.00	Other articles of nickel (weight of material, not nickel content)						
	United States	433	12 695	254	11 042	646	12 145
	China	94	642	209	802	194	1 077
	United Kingdom	20	681	22	454	83	906
	Australia	...	3	—	—	13	377
	Switzerland	93	667	74	527	44	316
	Germany	12	207	19	463	14	301
	France	99	1 924	4	305	9	262
	India	11	116	5	73	6	109
	Other	63	925	41	526	9	234
	Total	825	17 860	628	14 192	1 018	15 727
	Total imports	283 340	1 039 212	406 652	774 627	264 422	591 210

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Not available; ... Amount too small to be expressed; (p) Preliminary.

(1) The United States does not produce nickel concentrates, so reported imports may come from other countries or be misclassified.

Notes: The total import value is less than actual as the imported nickel in residues has not been included in any of the years. Numbers may not add to totals due to rounding.

TABLE 1d. CANADA, HISTORICAL NICKEL PRODUCTION AND USE, 1990-2006

	Production (1)	Use (2)
	(tonnes)	
1990	196 225	7 454
1991	192 259	8 486
1992	186 384	10 676
1993	188 080	10 026
1994	149 886	12 335
1995	181 820	12 469
1996	192 649	14 194
1997	190 529	10 689
1998	208 302	12 053
1999	186 236	14 447
2000	190 793	14 861
2001	194 058	10 057
2002	189 297	10 618
2003	163 244	7 906
2004	186 694	7 441
2005	199 932	8 701
2006 (p,3)	233 461	7 506

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

(1) Refined nickel and nickel in oxides and salts produced, plus recoverable nickel in matte and concentrates exported. Data for 1990-2006 are nickel contained in concentrates produced.

(2) Use of metallic nickel, all forms (refined metal, nickel in ferronickel oxides and salts, and other forms of nickel including nickel in purchased scrap) as reported by users on the Natural Resources Canada survey "Nickel Use." (3) Preliminary data from *Production of Canada's Leading Minerals*, September 2007, Table 2 at <http://mmsd1.mms.nrcan.gc.ca/mmsd/data/2007/07MTLY09.pdf>.

Note: Metals are used in industrial and consumer applications; unlike fuel oil or agricultural commodities, metals are not "used up" or "consumed"; instead, they are recycled. Discussions taking place in international fora indicate that the term "consumption" should be changed to more appropriately reflect actual practice. For this reason, the word "use" has replaced "consumption" in this chapter, where appropriate.

TABLE 1e. CANADA, CUPRONICKEL, NICKEL-SILVER, STAINLESS STEELS, AND NICKEL-CADMIUM AND NICKEL-IRON BATTERIES, 2004-06

	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
STAINLESS STEEL SEMI-FABRICATED ITEMS (excludes scrap)						
Exports – Total For Each HS Class						
7204.29	224 264	65 910	338 999	75 024	470 578	120 864
7210.90	4 037	2 838	3 797	3 685	2 227	2 220
7220.20	4 490	17 204	1 465	6 589	1 194	4 759
7222.11	226	823	202	1 307	175	1 019
7222.19	334	1 782	102	570	120	643
7222.20	751	4 309	1 352	8 269	1 225	7 527
7222.30	936	1 985	441	1 014	239	1 594
Total exports	235 038	94 849	346 359	96 458	475 758	138 626
Imports – Total For Each HS Class						
7204.29	398 090	64 014	458 929	65 041	463 960	70 121
7210.90	7 238	20 499	9 910	30 907	6 735	16 952
7212.50.90.13	3 857	8 440	2 641	5 382	2 778	5 209
7222.11	2 974	15 070	3 613	20 726	3 349	22 189
7222.19	3 526	15 044	3 523	16 876	3 612	15 984
7222.20.10	114	740	248	1 486	108	642
7222.20.90	10 372	46 130	11 937	63 751	11 741	68 035
7222.30.00.11	227	1 144	1 183	5 977	945	5 120
7222.30.00.19	864	4 022	727	4 277	1 100	6 582
Total imports	427 263	175 103	492 712	214 423	494 328	210 834
Net exports of stainless steels	-192 225	-80 253	-146 354	-117 965	-18 569	-72 208
CUPRO-NICKEL AND NICKEL-SILVER SEMI-FABRICATED GOODS (nickel-silver is a copper-nickel-zinc alloy)						
Exports – Total For Each HS Class						
7403.23	101	927	37	323	20	180
7408.22	257	1 991	452	4 002	455	4 268
7408.22	10	224	12	182	37	495
7409.4	116	173	172	1 105	93	832
7411.22	4 996	45 184	3 151	29 379	4 005	49 394
Total exports	5 480	48 500	3 825	34 990	4 611	55 169
Imports – Total For Each HS Class						
7403.23.00.10 to 7403.23.00.40	18	67	14	58	180	706
7407.22.11 to 7407.22.29.10	425	2 642	580	3 537	1 180	6 654
7408.22.10 to 7408.22.90.30	270	856	297	964	297	907
7409.40.00.11 to 7409.40.00.40	89	548	116	743	74	411
7411.22.00.10 to 7411.22.00.30	418	2 834	310	2 378	436	3 147
Total imports	1 220	6 948	1 317	7 680	2 168	11 825
Net exports of cupronickel and nickel-silver	4 260	41 552	2 507	27 310	2 444	43 344
ELECTRIC ACCUMULATORS (nickel-cadmium and nickel-iron batteries)						
Exports – Total For Each HS Class						
8507.30 Ni-Cd batteries	121	3 631	65	1 617	56	2 698
8507.40 Ni-Fe batteries	26	81	36	145	8	81
Total exports	147	3 712	101	1 762	64	2 779
Imports – Total For Each HS Class						
8507.30 Ni-Cd batteries	5 133	36 791	4 970	35 281	4 171	38 030
8507.40 Ni-Fe batteries	137	754	300	2 180	238	1 682
Total imports	5 269	37 545	5 270	37 461	4 408	39 712
Net exports of Ni-Cd and Ni-Fe batteries	-5 122	-33 833	-5 169	-35 699	-4 344	-36 933

Source: Natural Resources Canada.

(p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 2a. CANADA, COBALT PRODUCTION BY PROVINCE, 2004-06

	2004		2005		2006 (p)	
	(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
MINE OUTPUT	5 060 061	..	5 767 250	..	6 976 003	..
SHIPMENTS						
Newfoundland and Labrador	—	—	198 000	8 441	619 548	25 105
Quebec	344 845	23 674	367 500	15 668	339 791	13 769
Ontario	1 313 673	90 186	1 404 727	59 888	1 364 864	55 307
Manitoba	426 377	29 272	421 161	17 955	469 015	19 005
Total	2 084 895	143 132	2 391 388	101 952	2 793 218	113 187
Refined (1)	4 673 075	..	4 617 866	..	4 537 264	..

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; (p) Preliminary.

(1) This total includes cobalt refined production sourced from both domestic and imported feed materials, including mixed nickel-cobalt sulphides from Cuba.

Note: Numbers may not add to totals due to rounding.

TABLE 2b. CANADA, COBALT EXPORTS, 2004-06

	2004		2005		2006 (p)	
	(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
2605.00 Cobalt ores and concentrates. (cobalt content)						
China	99 858	404	72 090	495	—	—
Germany	386	1	—	—	—	—
Taiwan	3 000	31	—	—	—	—
Total	103 244	436	72 090	495	—	—
2822.00 Oxides and hydroxides; commercial cobalt oxides (weight of material, not cobalt content)						
United Kingdom	127 085	2 725	—	—	—	—
United States	1 200	57	1	5	—	—
Total	128 285	2 782	1	5	—	—
2915.23 Cobalt acetates (weight of material not cobalt content)						
Mexico	—	—	—	—	5	...
8105.20 Cobalt mattes and other intermediate products; powders						
Japan	2 081 573	137 599	1 884 238	77 117	1 848 792	70 548
Norway	2 156 612	127 555	2 235 014	87 382	2 195 762	68 638
United States	1 124 158	47 919	818 121	36 725	968 040	33 608
Netherlands	815 750	53 232	755 000	31 506	795 075	30 961
Belgium	628 954	26 040	595 118	30 955	458 092	22 789
Singapore	410 840	27 904	554 000	22 847	558 000	21 643
China	149 000	5 387	105 000	3 686	153 000	6 936
United Kingdom	—	—	119 482	1 676	346 226	6 091
Taiwan	234 000	16 334	158 000	5 778	155 000	5 572
Australia	—	—	69 025	3 174	58 000	2 129
Jamaica	—	—	20 000	974	20 000	1 063
Slovenia	—	—	—	—	20 000	822
Indonesia	5 000	315	30 000	1 226	5 000	198
Other	41 500	1 706	11 066	449	1 680	63
Total	7 647 387	443 991	7 354 064	303 495	7 582 667	271 061

TABLE 2b (cont'd)

		2004		2005		2006 (p)	
		(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
8105.30	Cobalt waste and scrap						
	United States	73 453	1 203	136 281	730	57 832	648
8105.90	Cobalt and articles thereof, n.e.s.						
	United States	29 509	5 134	23 453	5 041	30 019	6 173
	Germany	13 865	2 203	8 215	1 860	10 381	1 762
	France	15	2	1 008	170	2 834	484
	United Kingdom	1 102	38	42	19	1 032	261
	Australia	36 301	75	1 664	251	1 281	212
	Other	2 423	501	1 308	220	1 464	395
	Total	83 215	7 953	35 690	7 561	47 011	9 287
	Total exports	8 035 584	456 365	7 598 126	312 286	7 687 515	280 996

Sources: Natural Resources Canada; Statistics Canada.

– Nil; . . . Amount too small to be expressed; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 2c. CANADA, COBALT IMPORTS, 2004-06

		2004		2005		2006 (p)	
		(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
2605.00	Cobalt ores and concentrates (cobalt content)						
	Finland	1 814	55	–	–	–	–
	France	895	24	–	–	–	–
	United States	5 870	146	–	–	–	–
	Total	8 579	225	–	–	–	–
2822.00.00.10	Cobalt hydroxides (weight of material, not cobalt content)						
	United States	36 608	1 818	37 630	2 336	41 018	2 598
	Other	2 500	128	–	–	–	–
	Total	39 108	1 946	37 630	2 336	41 018	2 598
2822.00.00.20	Cobalt oxides (weight of material, not cobalt content)						
	Belgium	548	32	2 376	91	2 695	119
	Finland	613	21	2 056	87	2 560	63
	United States	209	11	1 208	46	982	49
	Other	4 174	251	176	8	422	13
	Total	5 544	315	5 816	232	6 659	244
2822.00.00.30	Commercial cobalt oxides (weight of material, not cobalt content)						
	United Kingdom	1 091	21	1 075	21	1 621	32
	United States	325	6	63	1	140	3
	India	–	–	–	–	134	3
	Belgium	7 472	149	2 678	53	–	–
	Other	46	1	424	9	–	–
	Total	8 934	177	4 240	84	1 895	38
2827.34	Cobalt chlorides (weight of material, not cobalt content)						
	United Kingdom	74 358	939	2 097	36	34 570	584
	United States	3 179	63	3 196	60	3 535	67
	Other	50	1	34	...	44	1
	Total	77 587	1 003	5 327	96	38 149	652

TABLE 2c (cont'd)

		2004		2005		2006 (p)	
		(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
2833.29.00.40	Cobalt sulphate (weight of material, not cobalt content)						
	United States	313 033	2 475	481 010	2 458	362 908	2 698
	China	4 050	78	53 365	497	17 578	198
	Philippines	12 176	223	5 463	88	3 222	47
	Finland	418	9	8 427	181	904	13
	France	1 000	7	500	3	2 000	9
	United Kingdom	3 797	80	3 462	59	322	6
	Other	1 300	30	—	—	—	—
	Total	335 774	2 902	552 227	3 286	386 934	2 971
2836.99.10.30	Cobalt carbonates (weight of material, not cobalt content)						
	Philippines	..	224	..	242	..	281
	United States	..	76	..	83	..	130
	Other	..	144	..	3	—	—
	Total	..	444	..	328	..	411
2836.99.90.20	Other cobalt carbonates (weight of material, not cobalt content)						
	United States	30 511	891	8 301	247	32 419	915
	Finland	4 751	140	9 327	261	7 353	189
	China	23	1	568	13	1 225	24
	Other	113	5	400	9	—	—
	Total	35 398	1 037	18 596	530	40 997	1 128
2915.23	Cobalt acetates (weight of material not cobalt content)						
	United States	138 260	1 526	77 318	863	63 152	710
	United Kingdom	18 690	210	18 699	207	25 079	282
	Italy	—	—	—	—	244	3
	Total	156 950	1 736	96 017	1 070	88 475	995
8105.20.10.10	Cobalt powders						
	Australia	469 728	28 560	495 580	16 576	409 801	10 557
	United States	74 342	3 578	51 443	2 973	45 680	2 561
	Finland	4 357	205	37 711	1 731	19 564	738
	United Kingdom	9 580	351	13 302	604	9 825	533
	Germany	10 947	755	4 696	239	6 409	371
	Belgium	16 792	1 543	19 966	1 397	9 231	350
	France	511	33	551	47	1 605	103
	China	254	6	249	15	452	19
	Japan	586	35	20 211	910	219	12
	Other	10	1	1 360	66	137	6
	Total	587 107	35 067	645 069	24 558	502 923	15 250
8105.20.10.20	Unwrought cobalt, not alloyed						
	South Africa	—	—	60 656	2 237	49 200	1 793
	Zambia	—	—	5 542	188	1 500	45
	United States	8 859	518	2 544	123	716	38
	Brazil	—	—	4 000	137	999	37
	Other	43094	2580	2 250	159	402	34
	Total	51 953	3 098	74 992	2 844	52 817	1 947
8105.20.90	Other						
	United States	3 612	246	4 254	142	947	67
	Germany	—	—	430	27	1 380	38
	United Kingdom	1 399	51	806	42	396	22
	Other	16 608	535	200	14	131	7
	Total	21 619	832	5 690	225	2 854	134
8105.30	Cobalt waste and scrap						
	Japan	287 196	4 068	1 033 602	9 425	659 146	4 060
	United States	422 894	1 371	418 958	1 141	519 984	1 917
	United Kingdom	79 596	162	—	—	41 496	594
	Netherlands	182 177	372	39 718	98	118 758	269
	South Africa	—	—	211 856	1 488	71 441	256
	Colombia	—	—	—	—	60 553	214
	Germany	2 844	171	45 421	306	36 351	170
	France	9 090	101	—	—	19 113	140

TABLE 2c (cont'd)

		2004		2005		2006 (p)	
		(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
	Belgium	40 100	430	—	—	44 821	80
	Congo	272 679	3 204	—	—	21 083	76
	Other	40 097	245	128 105	465	3 714	19
	Total	1 336 673	10 124	1 877 660	12 923	1 596 460	7 795
8105.90.00.10	Cobalt bars and rods, not alloyed						
	United States	22 278	1 520	21 161	1 646	34 917	2 854
	Japan	51	4	103	8	213	16
	United Kingdom	90	8	118	12	328	13
	Canada	60	5	182	14	26	2
	Other	11	1	128	12	1	...
	Total	22 490	1 538	21 692	1 692	35 485	2 885
8105.90.00.90	Cobalt and articles thereof, n.e.s.						
	United States	40 861	4 804	29 852	3 665	38 638	4 849
	Germany	213	20	344	31	1 113	129
	Japan	1 264	107	1 984	113	1 875	101
	United Kingdom	731	60	2 102	147	717	49
	Other	2 245	135	839	24	242	13
	Total	45 314	5 126	35 121	3 980	42 585	5 141
Total imports (2)		2 733 030	65 570	3 380 077	54 184	2 837 251	42 189

Sources: Natural Resources Canada; Statistics Canada.

— Nil; . . Not available; . . . Amount too small to be expressed; (p) Preliminary.

(1) Estimated content of ash and residue based upon data from Sherritt International annual and quarterly reporting assuming that imports occurred approximately one month after production, and that Moa Nickel S.A. is sole exporter of cobalt-containing ash and residue to Canada from Cuba, rounded to nearest 25 000 kg.

(2) This total does NOT include estimated imports of cobalt in ashes and residues imported from Cuba.

TABLE 2d. CANADA, COBALT PRODUCTION, TRADE AND USE, 1988-2006

	Concentrate Shipments (1)	Processed Cobalt Exports (2)	Cobalt Oxide and Hydroxide Exports (6)	Cobalt Ore and Concentrate Exports (3)	Cobalt Oxide and Hydroxide Imports (4)	Use (5)
(tonnes)						
1988	2 398	3 062	953	98	37	159
1989	2 344	3 262	371	22	33	147
1990	2 184	3 039	391	—	72	194
1991	2 171	3 456	459	—	42	166
1992	2 223	2 963	489	—	64	205
1993	2 150	3 581	394	—	52	187
1994	1 846	3 922	204	—	81	193
1995	2 016	4 227	—	—	41	148
1996	2 150	4 488	632	—	33	147
1997	2 168	5 829	526	—	39	136
1998	2 262	6 592	457	—	45	146
1999	2 014	6 311	224	10	114	130
2000	2 022	4 987	335	—	103	127
2001	2 112	5 009	356	—	126	94
2002	2 065	6 386	287	—	24	92
2003	1 842	5 950	300	—	31	88
2004	2 085	7 804	128	103	54	95
2005	2 391	7 526	—	72	48	90
2006 (p)	2 793	7 688	—	—	50	86

Sources: Natural Resources Canada; Statistics Canada.

— Nil; (p) Preliminary.

(1) Production includes recoverable cobalt in concentrates shipped. Beginning in 1988, exports and imports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. (2) Processed cobalt includes all forms classified in HS code 8105.10 (intermediate forms such as cobalt in matte, unwrought cobalt, alloyed cobalt, waste or scrap of cobalt, cobalt powders) plus all forms classified in HS code 8105.90 (cobalt and articles thereof, not elsewhere specified). As of 2002, the codes changed to 8105.20, 8105.30 and 8105.90. (3) Cobalt content. From 1975 to 1988, cobalt recovered in Canada from domestic concentrate plus exports of payable cobalt in concentrate. Starting in 1989 to date, recoverable cobalt in concentrates shipped.

(4) Gross weight. Producers' domestic shipments of refined cobalt plus imports of refined shapes. (5) Use of cobalt in metal, oxides and salts; available data as reported by user. (6) Cobalt oxide and hydroxide exports include HS code 2822.00.

**TABLE 3. AVERAGE MONTHLY NICKEL PRICES,
SETTLEMENT PRICE, 2001-06**

	2001	2002	2003	2004	2005	2006
(US\$/t)						
January	6 999	6 047	8 030	15 337	14 505	14 555
February	6 528	6 033	8 627	15 153	15 350	14 797
March	6 138	6 541	8 382	13 723	16 190	14 897
April	6 334	6 962	7 914	12 853	16 142	17 942
May	7 064	6 764	8 334	11 123	16 932	21 077
June	6 645	7 123	8 858	13 540	16 160	20 755
July	5 940	7 146	8 866	15 032	14 581	26 586
August	5 525	6 720	9 355	13 686	14 893	30 744
September	5 030	6 644	9 969	13 277	14 228	31 100
October	4 828	6 808	11 052	14 411	12 403	32 703
November	5 082	7 317	12 091	14 053	12 116	32 114
December	5 268	7 197	14 170	13 776	13 429	34 570
(converted to US\$/lb)						
January	3.17	2.74	3.64	6.96	6.58	6.60
February	2.96	2.74	3.91	6.87	6.96	6.71
March	2.78	2.97	3.80	6.22	7.34	6.76
April	2.87	3.16	3.59	5.83	7.32	8.14
May	3.20	3.07	3.78	5.05	7.68	9.56
June	3.01	3.23	4.02	6.14	7.33	9.41
July	2.69	3.24	4.02	6.82	6.61	12.06
August	2.51	3.05	4.24	6.21	6.76	13.95
September	2.28	3.01	4.52	6.02	6.45	14.11
October	2.19	3.09	5.01	6.54	5.63	14.83
November	2.31	3.32	5.48	6.37	5.50	14.57
December	2.39	3.26	6.43	6.25	6.09	15.68

Source: International Nickel Study Group, *World Nickel Statistics*.

Note: Conversion to US\$/lb by dividing US\$/t price by 2204.62 lb/t.

**TABLE 4. LEADING PRIMARY NICKEL-PRODUCING COUNTRIES, (1)
2001-06**

	2001	2002	2003	2004	2005	2006
(000 tonnes)						
Russia	250	240	265	265	270	275
Canada	140	145	125	150	140	155
Japan	155	160	165	170	165	155
China	50	55	65	75	100	135
Australia	130	130	115	125	130	115
Norway	70	70	80	70	85	80
Colombia	40	45	50	50	55	50
New Caledonia	45	50	50	45	45	50
Finland	55	55	50	50	40	45
South Africa	35	35	40	40	40	40
United Kingdom	35	35	25	40	35	35
Others	155	160	160	170	195	215
World total	1 160	1 180	1190	1 250	1 300	1350
Top 11 as a % of total	87%	86%	87%	86%	85%	84%

Source: International Nickel Study Group, *World Nickel Statistics* (August 2007).

(1) Class I plus Class II nickel.

Notes: Numbers may not add to totals due to rounding. The INSG data are shown in their publication to the nearest 100 t, but the author has rounded data to the nearest 5000 t for this table.

TABLE 5. LEADING PRIMARY NICKEL-USING COUNTRIES, (1) 2001-06

	2001	2002	2003	2004	2005	2006
(000 tonnes)						
China	85	95	125	150	190	255
Japan	160	190	195	190	175	185
United States	130	120	120	130	135	145
Germany	110	105	100	100	95	105
South Korea	75	85	100	105	100	95
Taiwan, China	80	90	90	85	75	90
Italy	55	65	65	60	60	70
Finland	40	40	50	55	50	55
Spain	45	45	45	45	45	50
Belgium	30	30	40	40	45	55
Sweden	35	40	35	35	35	40
United Kingdom	40	35	30	35	35	30
France	50	55	45	35	30	35
South Africa	30	35	45	45	30	40
India	25	25	25	25	30	35
Others	220	235	225	215	210	220
World total	1 105	1 175	1 220	1 245	1 250	1 395
Top 15 as a % of total	90%	90%	91%	91%	90%	92%

Source: International Nickel Study Group, *World Nickel Statistics* (August 2007).

(1) Class I plus Class II nickel, including chemicals.

Notes: Numbers may not add to totals due to rounding. The INSG data are shown in their publication to the nearest 100 t, but the author has rounded data to the nearest 5000 t for this table.

TABLE 6. REFINED COBALT PRODUCTION AND STOCKPILE DELIVERIES, 2000-2006

Company	2000	2001	2002	2003	2004	2005	2006
(tonnes)							
PRODUCTION OF COMPANIES BELONGING TO THE COBALT DEVELOPMENT INSTITUTE							
China (a)	1 200	1 470	1 842	4 576	8 000	12 700	12 700
OMG (a)	7 700	8 100	8 200	7 990	7 893	8 170	8 580
Xstrata	3 433	3 314	3 993	4 556	4 670	5 021	4 927
Norilsk	4 100	4 600	4 200	4 654	4 524	4 748	4 759
ICCI	2 855	2 943	3 065	3 141	3 325	3 391	3 312
Chambishi	2 316	2 789	4 344	4 570	3 769	3 648	3 227
Umicore	1 110	1 090	1 135	1 704	2 947	3 298	2 840
Murrin Murrin	925	1 452	1 838	2 039	1 979	1 750	2 096
QNI (BHP Billiton)	1 520	1 818	1 863	1 800	1 900	1 400	1 900
CVRD Inco	1 470	1 450	1 480	1 000	1 562	1 563	1 711
Mopani Copper	1 026	1 876	1 800	2 050	2 022	1 774	1 438
CTT	1 200	1 200	1 354	1 431	1 593	1 613	1 405
India	206	250	270	255	300	1 220	1 184
Sumitomo	311	350	354	379	429	471	920
Brazil	792	889	960	1 097	1 155	1 136	902
Kasese	420	634	450	—	457	638	674
Gécamines	4 320	3 199	2 149	1 200	735	600	550
South Africa (estimates after 2002)	320	252	250	285	545	214	257
Eramet	204	199	176	181	199	280	256
Bulong	192	203	200	—	—	—	—
Subtotal	35 621	38 078	39 923	42 908	48 004	53 635	53 638
STOCKPILE DELIVERIES							
DLA	3 083	1 893	1 284	1 987	1 632	1 199	294
TOTAL COBALT AVAILABILITY							
Grand total	38 704	39 971	41 207	44 895	49 636	54 834	53 932

Source: Data reproduced with permission of The Cobalt Development Institute (www.thecdi.com) from *Cobalt News*, April 2007. Table rearranged in order of descending production for 2006.

"Refined cobalt" includes:

All cobalt units whether in metal or chemicals that are derived from feed requiring further refining.

Production from Likasi and lower-grade production from Moroccan mines are not counted as "feed" or as production.
— Nil.

(a) Chinese production excludes that produced by Umicore in China, which is included in their figure in the table.

ICCI = International Cobalt Company Inc. (marketed by Sherritt International Corporation)

OMG = OM Group, Inc.

CTT = La Compagnie de Tifnout Tiranimine

DLA = Defense Logistics Agency

Mopani Copper = Mopani Copper Mines plc

Potash

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Potash is a generic term used to describe a variety of mined minerals and manufactured chemicals that contain potassium. Potash includes potassium chloride (sylvite), potassium magnesium chloride (carnallite), potassium magnesium sulphate (langbeinite), potassium sulphate, and potassium nitrate. The dominant potash product is potassium chloride (KCl) or muriate of potash (MOP), a naturally occurring pink, salty mineral of which Canada is the leading producer and exporter.

Potash used as an agricultural fertilizer accounts for 95% of production worldwide. Potassium, nitrogen, and phosphorus are the three basic and important nutrients for plants. Potash supports plant growth and enhances the absorption of other nutrients. There is no substitute for potash. Smaller amounts are used for the manufacture of potassium-bearing chemicals, detergents, ceramics, and pharmaceuticals; as water conditioners; or as an alternative to de-icing salt.

Potash is a limited resource that is only found in a few places in the world. Canada has the world's largest known potash resource, conservatively estimated at 56 billion t, or sufficient to mine for several thousand years at the current production level. The second largest deposit is found in Russia. The brine of the Dead Sea in the Middle East is rich in potassium. Most of the potash is mined by conventional underground or solution mining. A portion of potash is also recovered from brine by solar evaporation.

Potash was discovered in Saskatchewan in the early 1940s. This deposit, the largest in the world, lies underneath the southern plains of Saskatchewan and western Manitoba, and extends into northeastern Montana and North Dakota.

Canada started the exploration of potash mining in the early 1950s with several attempts to produce it by solution mining. Construction of the first conventional underground

mining shaft began in Saskatchewan in 1956 and production started in late 1958. In the 1960s, more conventional mines and a solution mine came on stream in Saskatchewan. By the mid-1980s, New Brunswick had become a potash-producing province.

Currently, there are eleven potash mining and processing operations in Canada. Nine operations extract potassium ores by conventional underground mining and two by solution mining. There are ten mining/processing operations in Saskatchewan and one in New Brunswick. Canada's potash industry has a work force of approximately 4000.

CANADIAN DEVELOPMENTS

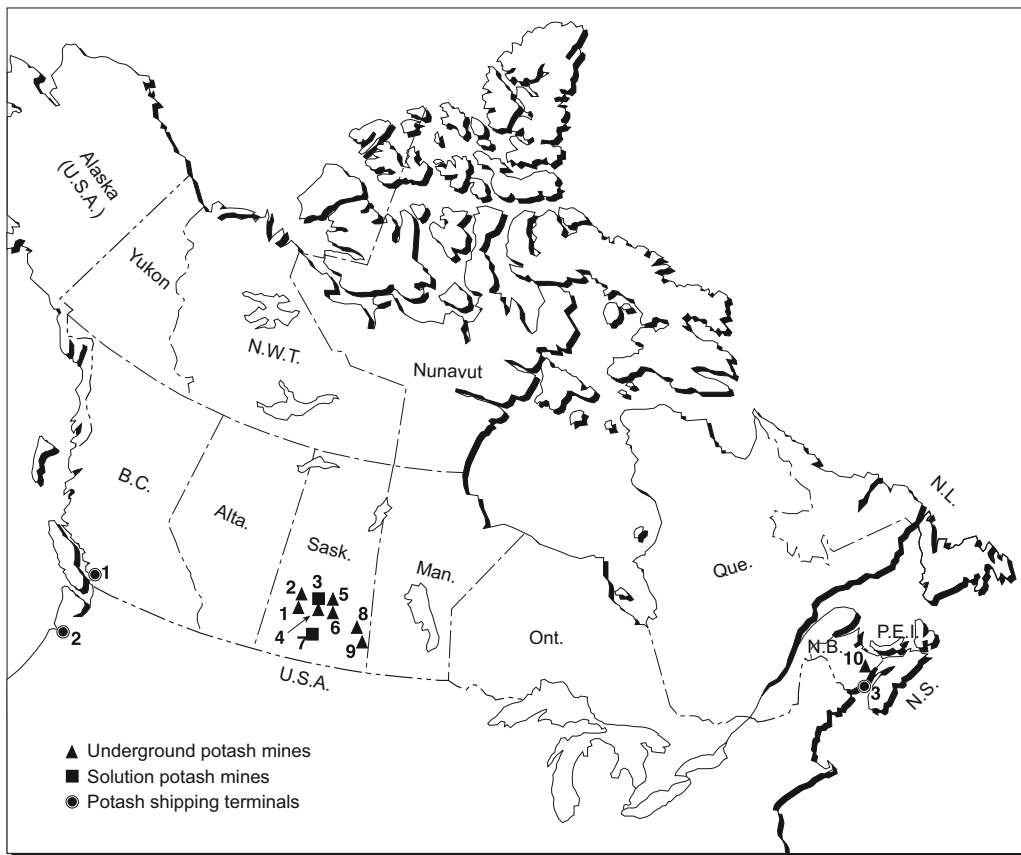
Preliminary figures indicate that Canada's potash production was 13.7 Mt KCl (8.4 Mt K₂O) in 2006, accounting for 28% of the global production of 48.8 Mt KCl (29.4 Mt K₂O). Production decreased 3.7 Mt KCl, a decline of 20% from 2005's 17.3 Mt KCl (10.6 Mt K₂O). Potash Corporation of Saskatchewan Inc. (PotashCorp) produced 7 Mt KCl, a decrease of 1.8 Mt from 2006's 8.8 Mt KCl. The four Canadian operations of the Mosaic Company (Mosaic) produced 5.4 Mt KCl, a decline of 1.4 Mt from 2005's 6.8 Mt KCl. Agrium Inc. (Agrium) produced 1.2 Mt KCl, a decline of 0.5 Mt from 2005's 1.7 Mt KCl.

Canada's potash sales were 14 Mt KCl in 2006, a decline of 16% from 2005's 16.6 Mt KCl. Exports were 13.6 Mt KCl in 2006, a decline of 14% from 2005's 15.8 Mt KCl. Exports to China dropped significantly, declining 45% to 1.3 Mt KCl in 2006, compared to 2.4 Mt KCl in 2005. The United States remained Canada's largest market, accounting for 45% of total exports.

Most Canadian potash exports were shipped out of ocean terminals in Vancouver, British Columbia, and Portland, Oregon, in the northwestern United States. PotashCorp's New Brunswick Division production was shipped from Saint John, New Brunswick.

Three Canadian potash producers completed production capacity expansions in 2006. Canada will have a potash production capacity of 23.9 Mt/y KCl from 2007 onward, an increase of 8% from 22.1 Mt KCl in 2006.

Figure 1
Location of Potash Mines in Canada and Shipping Terminals, 2006



Numbers refer to locations on map above.

UNDERGROUND POTASH MINES

1. Agrium Inc., Vanscoy, Saskatchewan
2. Potash Corporation of Saskatchewan Inc., Cory Division, Saskatoon, Saskatchewan
4. Potash Corporation of Saskatchewan Inc., Allan Division, Allan, Saskatchewan
5. Mosaic Potash Colonsay ULC, Colonsay, Saskatchewan
6. Potash Corporation of Saskatchewan Inc., Lanigan Division, Lanigan, Saskatchewan
8. Mosaic Potash Esterhazy Canada Limited Partnership (K1 and K2 mines), Esterhazy, Saskatchewan
9. Potash Corporation of Saskatchewan Inc., Rocanville Division, Rocanville, Saskatchewan
10. Potash Corporation of Saskatchewan Inc., New Brunswick Division, Sussex, New Brunswick

SOLUTION MINING OPERATIONS

3. Potash Corporation of Saskatchewan Inc., Patience Lake Division, Patience Lake, Saskatchewan
7. Mosaic Potash Canada Ltd., Belle-Plaine, Saskatchewan

POTASH SHIPPING TERMINALS

1. Neptune Bulk Terminals, Vancouver, British Columbia
2. Portland Bulk Terminals, Portland, Oregon
3. Barrack Point Terminal, Saint John, New Brunswick

PotashCorp, based in Saskatoon, Saskatchewan, is the world's largest publicly owned potash producer with six Canadian operations: Allan Division, Cory Division, Lanigan Division, Rocanville Division, New Brunswick Division, and Patience Lake Division (a solution mine). PotashCorp also has ownership in other potash producers: 32% of SQM in Chile, 28% of Arab Potash Company (APC) in Jordan, 10% of Israel Chemical Limited in Israel, and 20% of Sinochem Hong Kong Holdings Limited (Sinofert).

PotashCorp owns 25% of the reserves at Esterhazy, Saskatchewan, which are mined by Mosaic Potash Esterhazy Canada Limited Partnership under a long-term agreement. The share entitled PotashCorp to 953 000 t/y KCl. Thanks to the completion of the expansion project in Esterhazy in 2006, PotashCorp's share will increase to 1.23 Mt/y from 2007 onward. The expansion offered PotashCorp an additional 275 000 t/y KCl and the company paid US\$9 million for its share of the expansion cost.

The Penobscuis mine in Sussex, New Brunswick, owned by PotashCorp, experienced water inflow increases in September 2006. The water inflow has been a problem since 1998 with an inflow rate at about 1300 litres per minute. Since September, the inflow rate has increased to 5000 litres per minute. The company is trucking water around the clock (on average, about 200 loads per day), and uses grout made of cement, fly ash, and other components to fill the cracks in an attempt to intercept the water as it comes in. The company is also constructing a surface plant where grout is produced in large quantities. Despite the increased inflow rate, PotashCorp indicated that the situation is currently manageable.

PotashCorp's debottlenecking project at Allan will be completed in the second quarter of 2007 and will bring back idled production capacity of 400 000 t/y KCl. The debottlenecking at Lanigan is planned to be completed in 2008 and to bring back idled capacity of 1.5 Mt/y. PotashCorp also plans to bring back 360 000 t/y of idled capacity in Patience Lake by 2009 at a cost of US\$92 million. There is another debottlenecking and expansion project planned at Cory that will increase its production capacity to 2 Mt/y at a cost of US\$775 million by 2010.

The Mosaic Company, whose head office is located in Plymouth, Minnesota, has four potash operations in Saskatchewan. The four potash operations are Mosaic Potash Canada Ltd. for the mine at Belle-Plaine (a solution mine), Mosaic Potash Esterhazy Canada Limited Partnership for the two mines at Esterhazy (K1 and K2), and Mosaic Potash Colonsay ULC for the mine at Colonsay.

Mosaic completed its production capacity expansion project in Esterhazy in late 2006. The project started in mid-2005 following the Saskatchewan government's new mining tax initiative that provides a 10-year tax holiday for expansions exceeding 200 000 t/y KCl. The expansion cost

US\$35 million and added 1.1 Mt KCl of production capacity. Mosaic is currently considering plans to increase production capacity at its Belle Plaine operation by 120 000 t/y KCl by 2010 and 360 000 t/y KCl by 2012, and at Colonsay by 200 000 t/y KCl by 2010. The cost estimates for these projects have not been completed yet.

The Esterhazy potash mine, owned by Mosaic, also experienced water inflow increases. The company has been successfully managing brine inflow for more than two decades. The recent inflow began in December 2006 and the inflow rate reached 80 000-100 000 litres per minute. Mosaic has been aggressively pumping the water and grouting the cracks. By early March 2007, Mosaic had successfully controlled the inflow rate to below 20 000 litres per minute.

Agrium Inc., based in Calgary, Alberta, has one mine in Vanscoy, Saskatchewan. Agrium also completed its production capacity expansion project in 2006, which added 310 000 t/y at its Vanscoy operation at a cost of US\$87 million. Agrium now has a production capacity of 2.1 Mt/y KCl. The second expansion project is undergoing a detailed engineering study; it will add an additional 350 000 t/y of production capacity. The cost of the expansion will be determined upon completion of the engineering study. The decision is expected to be made in late 2007.

Canpotex Limited, owned by potash producers Agrium, Mosaic and PotashCorp, is an exclusive offshore marketing and distribution company to handle Canadian potash destined for overseas markets. Canpotex's sales are currently in the range of 8 Mt/y of potash. A corporate office in Singapore directs Canpotex's international marketing activities and ocean transportation function worldwide. Offices in Hong Kong and Tokyo maintain direct contact with Asian buyers. A corporate office in Saskatoon, Saskatchewan, maintains daily operations, including product supply, inland transportation, terminal services, corporate finance, and administration. Canpotex also offers comprehensive ocean freight services to customers through its in-house Ocean Transportation group and its exclusive chartering and brokerage networks. In order to meet potash demand in offshore markets, Canpotex started a \$15 million, 1-Mt capacity expansion project at its shipping terminal at Portland, Oregon, in 2006. Canpotex is considering an expansion at its terminals at Neptune, Vancouver.

Calgary-based Anglo Minerals Ltd. (25%) entered into a joint-venture agreement with BHP Billiton (75%) through its wholly owned subsidiary, Prairie Potash Corporation (PPC). The Anglo-BHP joint venture intends to explore a property approximately 135 km east of Saskatoon, adjacent to the Lanigan mine operated by PotashCorp, and to develop the Saturn Potash Project. The exploration will be carried out on roughly 283 279 ha (2832 km²) subsurface in the "potash belt" of central Saskatchewan. BHP Billiton will pay US\$3.8 million for a 75% interest in the project and spend another US\$40 million over a 66-month period to complete exploration and produce a feasibility study.

BHP Billiton will be the operator of the joint venture and Anglo will get another \$10 million from the company within 5.5 years of the closing.

ISX Resources Inc. acquired a potash exploration permit from the Saskatchewan government in May 2006 on 97 000 acres of subsurface land 60 km northwest of Regina, adjacent to Mosaic's Belle-Plaine operation. ISX Resources is a Vancouver-based resource acquisition, exploration and development company. The company has not decided on a timeline to carry out the exploration work under the permit.

The Manitoba government issued Agrium a five-year exploration permit to explore for potash in the St. Lazare area in October 2005. The permit allows Agrium to conduct seismic exploration work to determine whether there are sufficient reserves to warrant potash mining. If exploration results are successful, Agrium has the option to convert the exploration permit to a potash mineral lease within five years to facilitate mining. No updated information on the exploration program is currently available.

After many years of inactivity on the potash deposit in the Russell-Binscarth area, the Manitoba government announced in February 2007 that it will allow BHP Billiton to conduct exploration work on the potash deposit. The deposit is located about 40 km east of the Mosaic Esterhazy operations, adjacent to the Saskatchewan border. The Russell-Binscarth deposit is owned by the Province of Manitoba (49%) and Potamine Corporation of Canada (51%) as joint partners in Manitoba Potash Corporation (MPC), which was created in 1986 to hold the potash pro-

ject. BHP Billiton bought Potamine's share in MPC and will invest \$15 million to conduct exploration work on the deposit. The deposit, discovered in the 1980s, contains an estimated 120 Mt of potash grading 24.5% K_2O .

Production Capacity and Usage

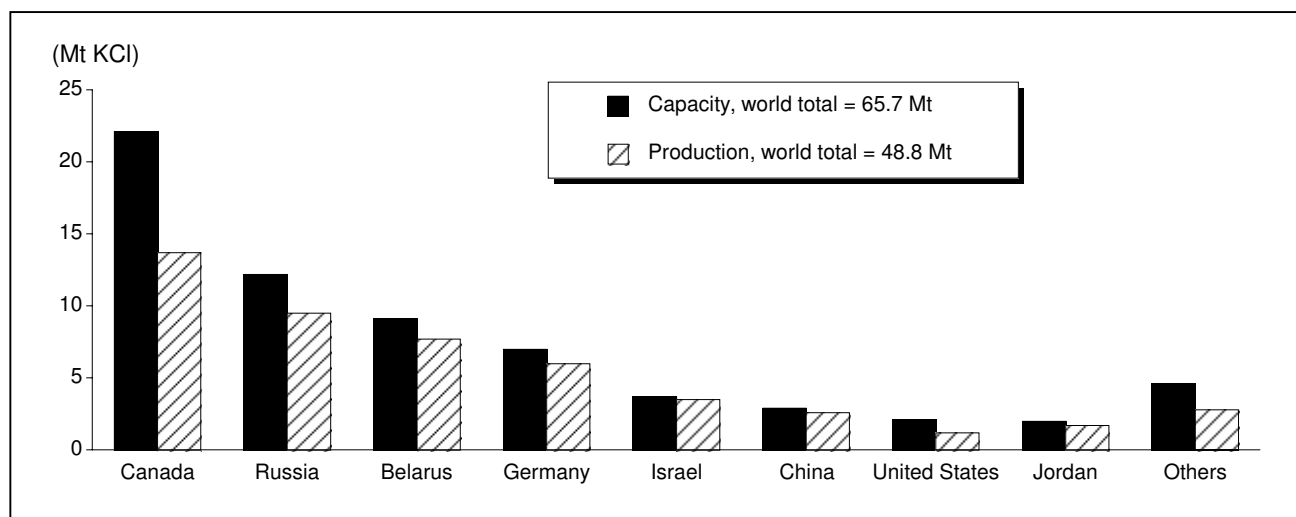
In 2006, Canada's production capacity was 22.1 Mt KCl, the world's largest, accounting for 35% of total world capacity of 63.2 Mt KCl. The average capacity usage rate was 62%, significantly lower than the 79% usage rate in 2005. As noted earlier, this was due to a temporary market depression and producers had to scale down their production. The annual production capacity of PotashCorp was 12.9 Mt KCl in 2006, but the utilization rate was only 54%. Mosaic's Canadian potash operations, with an annual capacity of 7.4 Mt KCl, operated at 73% of their capacity in 2006. Agrium operated at 67% in 2006 with an annual capacity of 1.8 Mt KCl.

From 2007, Canada's potash production capacity will increase to 23.9 Mt/y KCl thanks to the completion of capacity expansion projects started by potash producers in 2005.

WORLD REVIEW

There are 12 countries producing potash globally. The world's total potash output declined 10% to 48.8 Mt in 2006 from 54.4 Mt KCl in 2005. The decline resulted from a temporary market depression, largely due to the price negotiations between major buyers (China and India) and

Figure 2
Potash Capacity and Production, by Country, 2006



Sources: Natural Resources Canada; International Fertilizer Industry Association.

major suppliers that took more than nine months to reach the settlements. Ten of the twelve countries producing potash recorded production decreases. China and Brazil were the only two to record production increases. Three large potash-producing countries (Canada, Russia, and Belarus) suffered production losses.

Global potash production capacity was at 66 Mt KCl (39.9 Mt K₂O) in 2006. Capacity for the production of muriate of potash (MOP) was about 65 Mt (39 Mt K₂O) and capacity for the production of other forms of potash, such as SOP and KMgSOP, was about 1 Mt (0.6 Mt K₂O). The global potash industry operated at 76% of its production capacity in 2006, while the utilization rate declined 9% compared to the previous year's 85%.

The 2006 production decline was regarded as a temporary market depression. Global potash production is expected to return to normal or even higher levels in 2007 and the utilization rate is expected to return to 85% or higher.

North America

The United States produced 1.2 Mt KCl in 2006, a decline of 11% from the previous year's 1.4 Mt KCl. The U.S. potash production was from Michigan, New Mexico, and Utah. Most of the production was from Carlsbad in south-eastern New Mexico where two companies operated three mines. Intrepid Potash New Mexico has two operations and Mosaic Potash Carlsbad produces a variety of potash. In Michigan, Mosaic Potash Hersey operates a solution mine. In Utah, Intrepid Potash Moab and Wendover produce a variety of potash.

Intrepid Mining LLC of Denver, Colorado, is the major potash producer in the United States; it owns three subsidiaries: Intrepid Potash Moab, Intrepid Potash Wendover, and Intrepid Potash New Mexico. Intrepid produces potash from its two production facilities in Utah and three in New Mexico.

Europe

Russia and Belarus are the second and third leading potash producers in the world behind Canada. In the last decade, potash production in both countries has been increasing.

In 2006, Russia produced 9.5 Mt KCl, a 9% decline from 10.4 Mt KCl in 2005. Russia has been mining potash from the Verkhnekamskoye deposit in the Western Urals in the Perm Region since the 1940s. JSC Uralkali and JSC Silvinit combined have an annual production capacity of 12.2 Mt KCl and have been operating at high capacity rates in recent years.

In the last decade, both Russia and Belarus emerged from only supplying potash to East European countries to become major suppliers to the world market. Russia exported 8.3 Mt KCl in 2006, a decrease of 6% from the

previous year's 8.9 Mt. Belarus exported 6.6 Mt KCl in 2006, 4% lower than the 6.9 Mt exported in 2005.

In 2006, the newly emerged JSC Belarussian Potash Company (BPC) led the price negotiations with China and India and obtained a US\$25/t price increase after a nine-month-long negotiation. BPC is currently marketing potash for Uralkali and Belaruskali.

JSC International Potash Company (IPC) in Moscow has been marketing potash for Russia and Belarus producers since 1992 and currently markets production from Silvinit only.

Uralkali's Berezniki No. 1 potash mine was flooded in October 2006. Water started to flow into the mine on October 19 and the inflow speed increased significantly over the next 10 days. On October 28, Uralkali decided to stop fighting the water inflow and let the water flood the mine. It was an unfortunate loss. The mine was built in 1954 and had a production capacity of 1.2 Mt KCl. The potash reserves at the mine would have been depleted by 2019. Uralkali moved all workers to the Berezniki No. 4 mine and boosted its operation to full capacity. The mill of the No. 1 mine was still in operation, but was processing potash ore mined from the No. 4 mine. Uralkali will speed up its expansion plans at Berezniki No. 3 and No. 4 to compensate for the loss from the No. 1 mine. There is also a plan to develop a new No. 5 mine. Uralkali's production in 2006 was only slightly affected as the flood incident happened in late October and only two months' production was lost from mine No. 1. At the same time, Uralkali increased production from the No. 4 mine. However, its production will likely decrease by around 1.2 Mt KCl in 2007.

Silvinit produced 5.3 Mt KCl and operated at full capacity in 2006. Construction of a new shaft in the Solikamsk No 2 mine is ongoing. Shaft construction started in 1987 and stopped when the former Soviet Union fell apart. Construction resumed in 2005 and is scheduled to be completed by 2008. The new shaft will add 1 Mt of production capacity to Silvinit's existing capacity, and is expected to increase it further to 6 Mt KCl by 2009. The expansion project also includes a new granular compaction capacity.

Production in Belarus comes from the Starobinskoye deposit located near the city of Soligorsk. The country's only producer, PA Belaruskali, is state-owned and has an annual capacity of 9.1 Mt KCl. Belaruskali produced 7.7 Mt KCl in 2006 and operated at 86% of its capacity. The company is currently constructing two new underground mines, Krasnoslobodsky and Berezovsky, which are expected to be completed by 2009 and 2012, respectively. The new mines are to replace Soligorsk II and I where the potash ores are nearly depleted.

In Russia, EuroChem is planning to develop a potash mine in the Volgograd Region. EuroChem bought a licence

in 2005 to develop the Gremyachinsk potash deposit. Reserves were estimated at 1.2 billion t and inferred reserves were estimated at 4.8 billion t. The tentative plan is to construct a solution mine with a production capacity of 2 Mt/y KCl. The work is scheduled to start in 2007 and production is projected after 2012.

European Union

Germany produced 6 Mt KCl in 2006, a 1% decrease from 6.1 Mt in 2005. Germany's sole potash producer, K+S Kali GmbH, produces potash from six mines. The company not only produces standard potassium chloride (MOP), but also produces specialty potassium fertilizer such as potassium sulphate (SOP), potassium chloride with magnesium (Korn-Kali), Magnesia-Kainit, etc. After completion of the sylvinite project in 2004, Germany's production capacity increased to 7 Mt KCl in 2005. Germany operated at 86% of its capacity in 2006. K+S Kali GmbH Germany also exports the majority of its potash production globally. In 2006, the export volume remained unchanged at 5 Mt KCl.

Spain experienced another production decrease in 2006. Its production dropped 12% with an output volume of 728 000 t KCl, down from 824 000 t in 2005 and 922 000 t in 2004. The producer, Iberpotash S.A., is a wholly owned subsidiary of ICL Fertilizers, which is part of Israel Chemical Limited (ICL). Iberpotash supplies potash to European markets.

The United Kingdom's production remained steady in 2006. It produced 716 000 t KCl, which is slightly lower than the previous year's production of 732 000 t. The Boulby potash mine is owned by Cleveland Potash, a wholly owned subsidiary of ICL Fertilizers, which is part of ICL.

Middle East

Israel produced 3.5 Mt KCl in 2006, a decline of 5% from 3.7 Mt KCl in 2005. The Dead Sea Works (DSW), a production unit, belongs to ICL Fertilizer, which is a subsidiary of ICL. DSW produces potash from the Dead Sea by solar evaporation technology. DSW has a production capacity of 3.7 Mt KCl and operated at 96% in 2006. ICL Fertilizer also controls subsidiaries producing potash in Spain and the United Kingdom, in addition to its own potash production.

Jordan produced 1.7 Mt KCl in 2006, a decrease of 7% from 1.8 Mt KCl in 2005. Arab Potash Company (APC) is the country's only potash producer and also produces potash from the Dead Sea. APC operated at 85% of its capacity of 2 Mt/y KCl in 2006.

Asia

China continues to pursue the strategy to reduce reliance on potash imports and increase the domestic potash supply in

its total potash demand. In 2006, China's potash production increased 8% to 2.6 Mt KCl, compared to 2.4 Mt KCl in 2005. The largest share of production was from Qinghai Salt Lake Potash Company Limited, a subsidiary of Qinghai Salt Lake Group of Companies Limited. Qinghai Salt Lake Potash operated at full capacity in 2006 and produced 1.73 Mt KCl, according to the company's annual report.

The Qaidam Basin in Qinghai Province holds rich potash deposits estimated at 440 Mt. The Qaidam Basin is located between the Qilian and Kunlun Mountains in the Tibet-Qinghai Plateau, with an altitude averaging 3000 m above sea level. It has 33 salt lakes; the largest is Chaerhan Lake from which the Qinghai Salt Lake Potash Co. extracts potash. There are many mineral reserves and resources that have been identified in the Qaidam Basin. More than 90% of the known magnesium chloride, potassium chloride, and lithium chloride deposits in China rests in the Qaidam Basin. Of the total 440-Mt potash deposit, 130 Mt rests in the salt water and 310 Mt is in solid form resting underneath the salt water.

A pilot KMgSOP facility began production in 2006 in the Jinaier Lake in Qinghai Province. Back in 2003, China CITIC GUOAN Group obtained the rights to explore for minerals in Jinaier Lake, in the middle of the Qaidam Basin, Qinghai Province. Jinaier Lake is about 570 km² in size and rich in lithium, potassium, boron, and magnesium. It is estimated that the lake contains about 3 Mt of lithium chloride, 26.6 Mt of potassium chloride, and other minerals. CITIC GUOAN plans to build a complex to produce 1-Mt/y KMgSOP, 30 000 t/y lithium carbonate, and 75 000 t/y boron. By the end of 2005, CITIC GUOAN had completed a 57-km² solar evaporation pond and a pilot production facility that could produce 45 000 t/y KMgSOP. The 1-Mt KMgSOP facility is expected to be completed by 2010.

In Xingjian, China officially started construction of a 1.2-Mt potassium sulphate plant in Luopubo in April 2006. Between 1988 and 1995, a geological survey discovered a potash deposit in Luobupo. Detailed exploration work carried out between 1998 and 2000 identified that the deposit contains an estimated 250 Mt of potassium chloride. Later, an additional 76 Mt was added in 2005. Total reserves in the region are currently estimated to be 330 Mt. After the exploration was completed in 2000, a pilot project was carried out with the construction of a 20 000-t potassium sulphate plant and 22-km² evaporation ponds between October 25, 2001, and April 2002. The plant's processing capacity was expanded to 120 000 t of potassium sulphate by 2005. In June 2002, a proposal to build a large-scale, 1.2-Mt potassium sulphate plant was proposed by the China State Reform and Development Commission with the goal of increasing China's potash supply. The project's environmental assessment received approval from the China State Environmental Protection Agency on October 31, 2003. An agreement between

Xingjian and China State Development and Investment Corporation (SDIC) was reached in November 2004. The agreement specified that both sides would jointly develop the Luobupo potash project and SDIC would provide RMB¥2.6 billion to construct the 1.2-Mt potassium sulphate production facility. Construction is expected to be completed in three years and production will begin in 2009. China's potash production capacity, including its capacity of MOP, SOP and KMgSOP, is expected to rise to 4.8 Mt in 2010.

SRMT Holdings Limited, a wholly owned indirect subsidiary of Italian-Thai Development Public Company Limited (ITD), bought Asia Pacific Resources Ltd. (APR), a Canadian company that held 90% of a potash concession in Udon Thani, located in northeastern Thailand, on June 2, 2006.

APR discovered two deposits: Udon Thani South and Udon Thani North. The deposits contain roughly 225 Mt of sylvinite with an ore grade of about 24% KCl. APPC applied to the Government of Thailand in 2003 for a mining lease to mine potash in the Udon Thani South deposit. The project is expected to have a 25- to 30-year life span at a production rate of 2 Mt/y. The Udon Thani potash project required that the Thai government change the *Mineral Act* as there had not been any previous large-scale underground mining in Thailand. There are some concerns about the depth of the mining project. APR plans to mine at depths less than 350 m beneath the surface, but the geology above the salt deposits is not stable and subsidence is a concern. Local opposition is against mining potash based on fears of surface subsidence, groundwater contamination, and contamination of agricultural land. So far, the project has not been able to obtain the mining licence and its future is uncertain.

The other potash project, "the ASEAN project" at Bamnet Narong, remained inactive after the Government of Thailand withdrew its financial support in 2004. The Thai government indicated that any developments would have to be supported by the private sector. The project is supposed to produce 1.0 Mt/y of potash with a mine life of 20 years. No development on this project is expected in the near future.

In Laos, a small 50 000-t MOP facility was commissioned in early 2007. The facility, with Chinese investments, is located close to Vientiane. Sylvinite resources are known to be relatively extensive in Laos.

A new potash venture was being considered at Dekhanabad in Uzbekistan that would develop the Tobegat potash deposit.

Latin America

Brazil was one of the two countries that had a production increase in 2006 with an output of 733 000 t KCl, up 14%

from 641 000 t in 2005. Brazil's only potash mine, the Taquari-Vassouras mine of Companhia Vale do Rio Doce (CVRD), is located in northern Sergipe State, approximately 45 km north of Aracaju. Petrobrás discovered the Taquari-Vassouras potash deposit in 1963 during petroleum exploration. The deposit is estimated to contain a total of 7.8 Mt KCl with an ore grade of about 31.80% KCl, on average. Petromisa, a mining subsidiary of Petrobrás, developed the mine, with production beginning in 1985. CVRD had a production capacity of 850 000 t/y KCl in 2006 after a three-year capacity expansion project that was completed in September 2005. CVRD operated at 85% in 2006. CVRD continues to assess the feasibility of its "Carnality Project" in Sergipe with the prospect of starting a 1-Mt KCl solution mining operation after 2010.

Brazil's CVRD also plans to undertake a geological assessment and pre-feasibility study to identify and evaluate a potash deposit in the Neuquen Province in Argentina. The survey work will be on a 454-km² area of the Neuquen basin potash deposit. A 1-Mt KCl production capacity and a start-up date in 2010/11 are also planned.

Chile produced 623 000 t KCl in 2006, a decline of 13% from 718 000 t in 2005. Chile's potash producer, Sociedad Quimica y Minera de Chile S.A. (SQM), extracts potash using solar evaporation from the brine of Salar de Atacama, an underground lake measuring 2900 km² in the desert of Atacama. The products derived from the Salar de Atacama brine include potassium chloride, potassium sulphate, potassium nitrate, other specialty fertilizers, industrial potash, and chemicals. SQM continues to work on a new potassium nitrate facility in Nueva Victoria that is projected to be completed by 2008.

The most significant development will be a new potash solution mine in Argentina. During the past three years, Rio Tinto has been assessing the feasibility of solution mining at a large potash deposit near Rincon de los Sauces in the southern part of the Mendoza Province. The deposit is located in a remote area in the foothills of the Andes. It is estimated at more than 1 billion t KCl, of which about 200 Mt is recoverable reserves. The potash ore is a mixture of carnallite and sylvinite. Rio Tinto bought Potsio Rio Colorado S.A. in 2005 to form Rio Colorado Potash to control the project. The project is planning a solution mining operation with a production capacity of 2.4 Mt/y KCl at a cost estimated to be around US\$735 million. The decision is expected in mid-2007 with a construction completion date and production start-up set by 2010.

Admiralty Resources NL, a resource exploration company listed on the Australian Stock Exchange, has a project that will also produce potash in Argentina. The Rincon Salar project is located in northwestern Argentina near the Chilean border. The Rincon Salar deposit is a hyper saline lake covering an area of 250 km². The brine is enriched with lithium, magnesium, potash, and carbon. The ponded evaporate deposit is estimated to contain about 2.5 Mt of

KCl and 1.5 Mt of potassium sulphate. Admiralty is planning to produce lithium carbonate, lithium hydroxide, lithium chloride, and potash from the project.

AFRICA

A feasibility study was completed on the Kouilou potash project near Pointe-Noire in Congo (Brazzaville). The proposed project is to build a solution mine to extract carnallite ores to produce granular and standard-grade potash fertilizer for export. Capital costs are derived for a facility to operate at either 600 000 t/y or 1.2 Mt/y, depending on market conditions in 2009 when the plant is scheduled for completion.

CONSUMPTION AND TRADE

More than 95% of potash is consumed as agriculture fertilizer. All major potash-consuming countries have large agricultural sectors or agriculture-based economies. Asia is the world's largest potash-consuming region with two leading potash consumers, China and India. The United States was the largest consuming country until 2004 when it was overtaken by China. The third largest consuming country is Brazil. In recent years, Malaysia and Indonesia emerged into the top-tier potash-consuming group, ahead of France and Belgium.

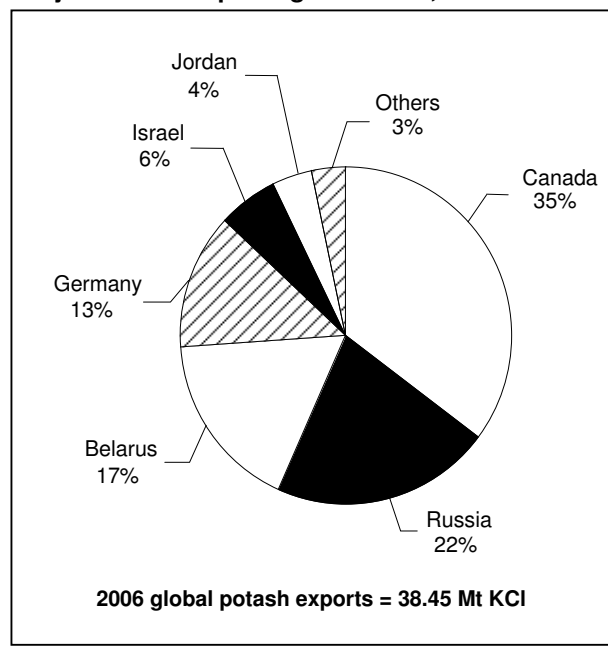
China's potash consumption has been steadily increasing over the last two decades. In 2005, China overtook the United States and became the world's largest potash consumer with an apparent consumption of 11.3 Mt KCl. In 2006, China's apparent consumption declined to 9.6 Mt KCl. Domestic production supplied 2.6 Mt KCl while imports were 7 Mt KCl. The nine-month-long contract negotiation stalled China's imports with the volume reduced to 7 Mt KCl in 2006, compared to 8.9 Mt in 2005, a decline of 1.9 Mt.

The apparent consumption for the United States was estimated to be about 8 Mt KCl in 2006, representing a 1-Mt KCl decline from 9 Mt in 2005. Its apparent consumption included imports of 7.1 Mt KCl and a domestic supply of 0.9 Mt KCl.

Brazil was the third largest consumer; its apparent consumption bounced back to 6.1 Mt KCl in 2006. Although it did not match the level of 6.9 Mt KCl seen in 2004, all signs indicated that Brazil's economy and agriculture sector were back on track. Brazil's domestic supply increased to 710 000 t in 2006 and imports accounted for 5.4 Mt KCl of Brazil's apparent consumption. With the biofuel development, Brazil's potash consumption is expected to increase.

The drive towards biofuel development continues to boost potash consumption in Malaysia and Indonesia. Palm tree

Figure 3
Major Potash Exporting Countries, 2006



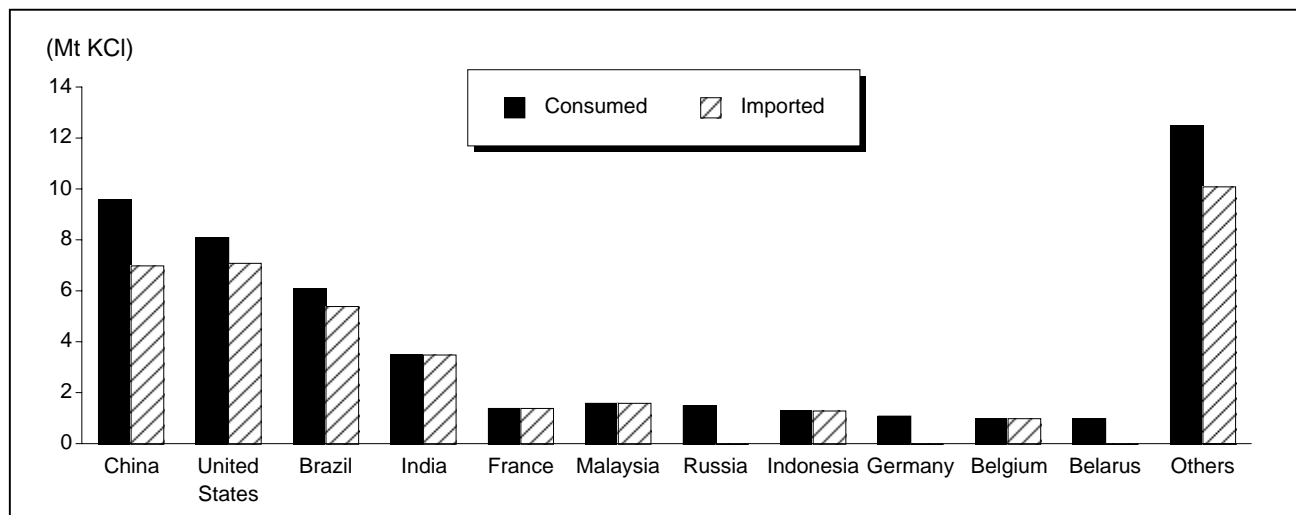
Source: Natural Resources Canada.

growing relies heavily on potassium fertilizer. In 2006, apparent consumption for Malaysia and Indonesia was 1.6 Mt KCl and 1.3 Mt KCl, respectively. France and Belgium are two other major potash consumers with volumes of 1.4 Mt KCl and 1 Mt KCl in 2006, respectively.

With many consumers but only a few producers, global potash trade is significant. Close to 80% of global potash production is traded across borders. In 2006, the global potash trade volume was 38 Mt KCl, 8% lower than the 42 Mt KCl in 2005. Six leading potash-producing countries (Canada, Russia, Belarus, Germany, Israel, and Jordan), accounted for 97% of global potash trade. The export volumes were 13.5 Mt for Canada, 8.3 Mt for Russia, 6.6 Mt for Belarus, 5 Mt for Germany, 2.2 Mt for Israel, and 1.5 Mt for Jordan. This unique situation defines potash trade and production, which are largely driven by importing countries.

In 2006, the reduction of imports by some leading consuming countries resulted in a decline in global potash trade and production. China imported 1.2 Mt KCl in 2006 from Canada, compared to 2.3 Mt in 2005, a reduction of 0.9 Mt in volume. China's imports from Russia/Belarus were also reduced to 5 Mt in 2006, compared to 5.7 Mt in 2005. China's imports from Israel and Jordan in 2006 were lower than the import volume in 2005. The only exception was China's imports from Germany, which increased to 388 000 t KCl, compared to 133 000 t in 2005. The United States recorded a reduction in imports of 0.6 Mt KCl.

Figure 4
Apparent Potash Consumption and Imports, by Country, 2006



Source: Natural Resources Canada.

India's potash imports fell to 3.5 Mt KCl in 2006 from 5 Mt in 2005.

PRICES

During 2006, potash spot market prices were relatively inactive. This was largely due to the contract price negotiations as buyers were waiting for the outcome of the negotiations. Table 4 shows the movement of major spot prices.

The global potash contract price indicator (standard grade f.o.b. Vancouver contract price) was at US\$145-\$148/t from January 1 to July 31. Upon completion of the price negotiation with China and India, the price increased to US\$170-\$173/t from August 1, 2006.

In North America, Canadian producers sell potash directly to customers. In 2006, PotashCorp reported that the average sales price to North American markets was US\$168.75/t, an increase of 7% from 2005's average price of US\$157.64/t. The other producers were selling potash at a similar price range.

OUTLOOK

The primary driver for potash production is the demand for food. Global potash production is mainly used in growing rice, soybeans, sugar cane, corn, palm, rubber, bananas, oranges, and coffee. The world's population reached 6.6 billion on January 1, 2007, and is forecast to reach 7.1 billion by 2010 and 8.2 billion by 2020. Not only will the

global agricultural sector have to meet the needs for food of this growing population, but it will also need to meet the demand for changes in dietary components, e.g., the move towards a high-protein diet from a carbohydrate diet. This propels the global agriculture sector to nurture the land to meet the increasing demand for foods that feed the world. The demand for potash to produce both food and fuel will certainly boost global potash production. It is realistic to forecast that potash production will continue to increase and that new projects will come on stream quicker than previously expected.

Recent developments to extract biofuel from agricultural products have also quickly driven up the demand for fertilizer, particularly the demand for potash. The crops used to produce ethanol and other biofuels vary, but all are heavy users of potash. The United States, the largest ethanol producer, uses mainly corn, as do China and Argentina. Brazil, the second largest biofuel producer, and India rely on sugar cane. The United States uses soybeans to produce biodiesel, while Malaysia and Indonesia plan to use palm oil.

Grains, as major sources for food and now biofuels, rely heavily on fertilizer usage to increase production. In recent years, more grain has been consumed than produced. The stocks-to-use ratio has been continuously declining since the 2003/04 marketing year. In the 2006/07 marketing year, the stock-to-use ratio declined to 15.6% for total grains and 13% for coarse grains. The low inventory level and demand for grains for biofuels production have driven grain prices globally. This has already boosted the grain planting increases, which will transform into more demand for fertilizer, particularly potash.

Natural Resources Canada forecasts that China's potash demand will likely reach 13 Mt in 2010. The apparent consumption in 2005 was 11.3 Mt, which indicated that the previous forecast level was too conservative. The demand for potash might be higher than 13 Mt as the Chinese government's policy on improving agricultural production and on improving farmers' income and living standard would further increase fertilizer use in order to achieve higher yields. China's potash use could reach 25 Mt KCl if it follows the agriculture scientists' recommended nutrient level. The same applies to India, which could reach 10 Mt KCl. Brazil could use 11 Mt KCl in its main production of soybeans.

The outlook for potash demand in 2007 is positive. Global demand for potash will continue to grow and most of the growth will come from developing countries, notably China and India, as well as Brazil and some Asian countries.

Potash supply will undoubtedly increase as some capacity expansions by Canadian potash producers were completed in 2006, which added about 1.7 Mt of new capacity to Canada's production. The Canadian potash industry has a production capacity of 23.8 Mt/y of KCl from 2007 onward. Globally, the potash supply will likely return to its 2005 production level and may be even higher. Both potash spot and contract prices are expected to increase in 2007 for the reasons given above.

RELEVANT CANADIAN POTASH WEB SITES

Potash Corporation of Saskatchewan	www.potashcorp.com
The Mosaic Company	www.mosaicco.com
Agrium Inc.	www.agrium.com
Canpotex Ltd.	www.canpotex.com
Canadian Fertilizer Institute	www.cfi.ca
International Fertilizer Industrial Association	www.fertilizer.org
International Plant Nutrition Institute	www.ipni.net

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of March 31, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2815.20	Sodium hydroxide; potassium hydroxide; peroxides of sodium or potassium: potassium hydroxide	Free	Free	Free	Free	5.5%	3.9%
2834.21	Nitrates; nitrates: nitrates; of potassium	Free	Free	Free	Free	5.5%	3.9%
2835.24	Phosphinates, phosphonates and phosphates; polyphosphates, whether or not chemically defined: phosphates: of potassium	3%	Free	Free	Free	5.5%	3.9%
2836.40	Carbonates; peroxocarbonates; commercial ammonium carbonate containing ammonium carbamate: potassium carbonates	Free	Free	Free	Free	5.5%	3.9%
2839.20	Silicates; commercial alkali metal silicates: of potassium	3%	Free	Free	Free	5%	3.9%
31.04	Mineral or chemical fertilizers, potassic						
3104.20	Potassium chloride	Free	Free	Free	Free	Free	Free
3104.30	Potassium sulphate	Free	Free	Free	Free	Free	Free
3104.90	Other	Free	Free	Free	Free	Free	Free

Sources: Canadian Customs Tariff, effective January 2006 and 2007, Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2006 and 2007; Official Journal of the European Union (October 27, 2005 and October 17, 2006 editions); Customs Tariff Schedules of Japan, 2006 and 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties.

(2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, POTASH PRODUCTION, SHIPMENTS AND TRADE, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION , Potassium chloride							
	Gross weight	16 520 133	..	17 315 209	..	13 669 933	..
	K ₂ O equivalent	10 109 170	..	10 596 607	..	8 368 264	..
SHIPMENTS							
	K ₂ O equivalent	10 331 656	2 162 774	10 139 718	2 437 488	8 528 132	2 212 084
EXPORTS (1,2)							
2815.20	Potassium hydroxide (caustic potash)	781	675	501	261	625	1 743
2834.21	Potassium nitrate	1	...	—	—	...	...
2835.24	Potassium phosphate	...	...	—	—	19	22
2836.40	Potassium carbonates	—	—	...	1	...	3
2839.20	Potassium silicates	266	310	443	394	20	35
3104.20	Potassium chlorides						
	United States	8 868 802	1 130 447	9 160 135	1 557 782	7 989 356	1 408 511
	China	1 784 292	274 527	2 430 954	435 482	1 337 873	243 837
	Brazil	1 642 738	240 320	1 158 866	212 407	1 175 359	211 219
	India	588 928	90 046	763 028	138 899	657 153	118 478
	Malaysia	571 898	88 186	476 767	85 869	528 131	96 139
	Indonesia	600 321	91 395	470 736	85 760	497 498	91 039
	Vietnam	230 100	35 111	142 071	26 115	186 157	34 288
	Thailand	219 433	33 440	232 962	41 847	157 104	28 842
	New Zealand	138 084	21 260	138 941	24 534	138 542	25 224
	Colombia	101 209	14 892	158 298	28 269	136 473	24 208
	Belgium	118 480	20 692	70 708	12 972	130 904	24 008
	Philippines	84 257	13 178	35 304	6 505	95 908	17 247
	Mexico	90 830	12 345	103 977	18 711	73 262	13 035
	Cuba	17 464	2 488	31 311	6 059	56 951	11 811
	Taiwan	121 782	18 718	62 599	11 469	52 481	9 560
	Spain	37 372	5 851	60 569	11 185	44 942	8 270
	Venezuela	—	—	6 500	1 102	46 550	8 156
	Honduras	17 250	2 100	38 729	6 940	39 246	7 173
	Guatemala	47 383	6 965	29 792	5 353	31 003	5 825
	Costa Rica	47 602	7 283	35 400	6 313	30 392	5 469
	Japan	72 889	11 358	23 427	4 320	29 976	5 393
	Dominican Republic	30 645	3 741	35 050	6 426	28 815	5 134
	South Korea	120 608	18 551	12 772	2 322	24 813	4 464
	Peru	27 553	4 189	35 600	6 646	24 777	4 440
	Ecuador	48 343	7 679	22 800	4 180	15 399	2 779
	Italy	26 569	4 038	19 406	3 580	14 238	2 628
	Argentina	11 951	1 858	—	—	13 000	2 440
	Singapore	11 097	1 693	12 000	1 963	10 477	1 969
	Jamaica	10 084	1 275	6 237	1 219	8 285	1 354
	Fiji	—	—	5 221	949	7 000	1 273
	El Salvador	9 700	1 537	20 735	3 770	5 000	906
	Uruguay	12 592	1 791	—	—	4 900	899
	Nicaragua	5 500	892	3 300	604	5 000	896
	Guyana	—	—	—	—	5 000	859
	France	—	—	—	—	2 610	494
	Barbados	270	36	152	41	1 291	243
	Australia	441	88	300	59	202	39
	Others	14 341	2 303	2 916	483	29	5
	Total	15 730 808	2 170 273	15 807 563	2 760 135	13 606 097	2 428 554
3104.30	Potassium sulphate						
	United States	18 274	7 349	13 008	5 829	9 163	4 803
	Others	837	374	899	378	645	344
	Total	19 111	7 723	13 907	6 207	9 808	5 147

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (1,2) (cont'd)							
3104.90	Other potassic fertilizer						
	United States	3 454	786	1 962	1 377	576	364
	Others	57	30	12	4	61	34
	Total	3 511	816	1 974	1 381	637	398
	Total exports	15 754 478	2 179 797	15 824 388	2 768 379	13 617 206	2 435 902
IMPORTS (1,2)							
2815.20	Potassium hydroxide (caustic potash)						
	United States	16 050	10 129	15 799	9 225	17 326	9 461
	South Korea	1 023	858	1 280	1 088	516	506
	Others	769	1 103	586	762	722	893
	Total	17 842	12 090	17 665	11 075	18 564	10 860
2834.21	Potassium nitrate						
	Israel	4 106	2 395	2 753	2 099	1 538	1 153
	United States	1 347	899	553	490	411	397
	Denmark	1 113	607	587	364	524	363
	Chile	3 857	1 992	1 106	742	333	308
	Others	228	129	58	113	140	271
	Total	10 651	6 022	5 057	3 808	2 946	2 492
2835.24	Potassium phosphates	1 935	2 554	1 646	2 601	1 314	2 322
2836.40	Potassium carbonates						
	United States	2 114	1 679	2 859	2 504	3 737	3 183
	Others	736	503	462	319	611	379
	Total	2 850	2 182	3 321	2 823	4 348	3 562
2839.20	Potassium silicates						
	United States	3 225	2 039	5 396	3 774	8 987	6 067
	Others	1	1	8	8	2 034	1 580
	Total	3 226	2 040	5 404	3 782	11 021	7 647
3104.20	Potassium chloride						
	United States	3 945	1 294	1 662	1 767	1 825	2 040
	Others	278	68	63	70	52	73
	Total	4 223	1 362	1 725	1 837	1 877	2 113
3104.30	Potassium sulphate						
	United States	5 912	2 356	21 570	4 191	13 785	3 356
	Others	501	251	221	93	172	156
	Total	6 413	2 607	21 791	4 284	13 957	3 512
3104.90.00.10	Magnesium-potassium sulphate						
	United States	54 925	5 735	59 152	7 378	58 881	6 256
	Others	—	—	134	16	129	13
	Total	54 925	5 735	59 286	7 394	59 010	6 269
3104.90.00.90	Other potassic fertilizer						
	United States	14 225	2 818	2 298	1 994	1 479	1 294
	Others	2 089	943	15 921	4 305	3 573	2 076
	Total	16 314	3 761	18 219	6 299	5 052	3 370
	Total imports	118 379	38 353	134 114	43 903	118 089	42 147

Sources: Natural Resources Canada; Statistics Canada.

— Nil; . . Not available; . . . Amount too small to be expressed; (p) Preliminary; (r) Revised.

(1) Countries are ranked in descending order of value for 2006. (2) Total includes other countries.

Note: Numbers may not add to totals due to rounding.

TABLE 2. WORLD POTASH PRODUCTION, 1998-2006

	1998	1999	2000	2001	2002	2003	2004	2005	2006 (p)
(000 tonnes)									
POTASSIUM CHLORIDE (KCl) (1)									
Canada	15 051	13 564	15 056	13 357	13 911	14 924	16 557	17 370	13 705
United States	1 454	1 511	1 368	1 348	1 438	1 166	1 499	1 363	1 215
Belarus	5 752	6 022	5 620	6 145	6 318	7 048	7 687	8 213	7 676
Russia	5 768	6 750	6 193	7 096	7 386	7 756	9 332	10 443	9 540
France	695	519	535	407	213	—	—	—	—
Germany	5 970	5 908	5 682	5 918	5 752	5 942	6 044	6 108	6 026
Spain	828	915	870	785	678	844	922	824	728
United Kingdom	1 014	825	1 001	887	900	1 036	899	732	716
Israel	2 780	2 836	2 913	2 957	3 197	3 264	3 563	3 707	3 539
Jordan	1 527	1 800	1 936	1 963	1 956	1 960	1 929	1 829	1 699
Brazil	526	561	567	575	606	636	617	620	707
Chile	467	520	550	650	682	733	717	718	623
China	280	363	458	658	717	1 033	1 880	2 417	2 620
Total	42 112	42 094	42 749	42 746	43 754	46 342	51 646	54 344	48 794
POTASSIUM OXIDE (K₂O) (1)									
Canada	9 201	8 304	9 205	8 181	8 515	9 104	10 100	10 596	8 360
United States	872	907	821	809	863	711	914	832	741
Belarus	3 451	3 613	3 372	3 687	3 791	4 229	4 612	4 928	4 605
Russia	3 461	4 050	3 716	4 258	4 432	4 653	5 599	6 266	5 724
France	665	417	321	244	128	—	—	—	—
Germany	3 582	3 545	3 451	3 551	3 451	3 565	3 626	3 665	3 616
Spain	497	549	522	471	407	506	553	494	437
United Kingdom	608	495	600	532	540	621	540	439	430
Israel	1 668	1 702	1 748	1 774	1 918	1 958	2 138	2 224	2 123
Jordan	916	1 080	1 162	1 177	1 176	1 176	1 157	1 098	1 020
Brazil	327	337	340	345	364	382	370	372	424
Chile	280	312	330	390	409	440	430	431	374
China	168	218	275	395	430	620	1 128	1 450	1 572
Total	25 696	25 529	25 863	25 814	26 422	27 965	31 167	32 794	29 426

Sources: Natural Resources Canada; International Fertilizer Industry Association.

— Nil; (p) Preliminary.

(1) Potassium chloride (KCl) is used in the measurement of production tonnage, while potassium oxide (K₂O) is used to measure fertilizer content in KCl.Notes: Statistics show potassium chloride (KCl) only, excluding other forms of potash. One tonne of KCl contains 60-62% K₂O.**TABLE 3. POTASH SITUATION, 1996-2006**

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 (p)
(000 tonnes KCl)											
CANADA											
Capacity	22 183	22 317	22 333	22 342	22 433	21 400	21 400	21 400	21 400	22 106	22 106
Production	13 403	15 050	15 051	13 564	15 056	13 357	13 911	14 851	16 557	17 370	13 705
Capacity use (%)	60	67	69	61	67	62	65	69	77	79	62
Sales	13 283	15 850	13 778	13 817	15 055	13 595	14 182	15 514	17 196	16 193	14 079
Domestic	592	817	748	710	758	710	743	762	751	735	576
United States	7 225	8 825	7 213	7 077	7 617	7 451	7 368	7 451	8 067	6 846	6 169
Offshore	5 467	6 208	5 817	6 030	6 680	5 434	6 071	7 302	8 378	8 612	7 334
WORLD											
Capacity	60 882	61 393	60 817	62 215	62 828	62 405	62 220	61 448	62 208	64 300	65 312
Production	38 885	42 445	43 115	42 266	43 015	43 099	44 144	46 420	51 836	54 344	48 795
Capacity use (%)	64	69	71	68	68	69	71	76	83	85	75
Sales	37 483	42 908	40 432	40 982	42 200	41 960	43 545	47 175	51 834	52 186	48 568
Exports	28 460	33 995	31 958	32 925	34 167	33 683	35 196	38 727	42 273	41 920	38 450
Consumption	34 663	37 417	36 403	36 633	36 825	38 370	41 150	41 666	42 580	45 130	44 070
CANADA/WORLD											
Production (%)	34	35	35	32	35	31	32	32	32	32	28
Capacity (%)	36	36	37	36	36	34	34	35	34	34	34

Sources: Natural Resources Canada; International Fertilizer Industry Association.

(p) Preliminary.

Note: World production capacity includes all forms of potash from 1996 to 1998, and only includes potassium chloride (KCl) after 1999.

TABLE 4. 2006 POTASH PRICES

	KCI Standard Spot			KCI Granular Spot			KCI Standard Contract
	f.o.b. Vancouver	f.o.b. Baltic	f.o.b. Black Sea	f.o.b. Vancouver	f.o.b. Baltic	f.o.b. Black Sea	f.o.b. Vancouver
	(US\$t)						
Jan. 1	155-190	160-180	145-175	165-195	170-200	155-170	145-148
Feb. 14	160-190	160-180	145-175	170-200	165-200	155-170	145-148
May 23	160-190	155-180	145-175	170-200	160-200	155-170	145-148
Aug. 1	160-190	150-180	150-175	170-200	160-200	165-170	170-173
Oct. 24	160-190	150-180	150-175	170-200	157-195	165-170	170-173
Dec. 31	160-190	150-180	150-175	170-200	157-195	165-170	170-173

Source: FERTECON.

Recycled Metals

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Metals are the most recyclable materials in our economy. In fact, they can be recycled repeatedly without any decrease in the properties of the metal. To speak of recycled content when discussing a metallic item is misleading since all of the metal elements within the item are physically identical regardless of feedstock source.

The amount of metal recycled and recovered in Canada has never been accurately measured. The structure of the scrap metal recycling industry is complex and layered with a great potential for double-counting since the same material will pass through many hands before it reaches the smelter, refiner, or furnace. The Canadian Association of Recycling Industries and staff of the Minerals and Metals Sector (MMS) have estimated that around 15 Mt of metal material is recycled each year in Canada.

For comparison purposes, more accurate and reliable data are available from Statistics Canada on the international trade of recyclable commodities. These data are provided to Natural Resources Canada's Minerals and Mining Statistics Division where the information is loaded into an internal database for synthesis and analysis.

In addition, for the benefit of sellers and buyers around the world, the values of these commodities are closely tracked and, from these activities, historical data can be assembled. In the 2005 *Canadian Minerals Yearbook* (CMY) article on Recycled Metals, quantity and value data were assembled and presented for the years 1990 through 2005. This year the focus is mainly on 2006, although some of the tables and charts cover years past, particularly where it is beneficial to appreciate multi-year trends in commodity price changes and quantities traded.

Recyclable metals are a resource (although they may be discarded in the absence of effective collection programs

and systems). Previous labeling of these resources as "waste" resulted in onerous regulations that were intended to deal with real waste-handling issues. The resulting high cost of handling and transporting hazardous recyclable metals has hindered some recovery efforts (e.g., electric arc dust that may contain up to 25% zinc is typically stockpiled in Canada rather than shipped to U.S. facilities that can process it). Regardless, reference is made throughout this article to "waste and scrap" because that common perception is entrenched in the various trade and customs systems used globally to track these materials as they are exported and imported.

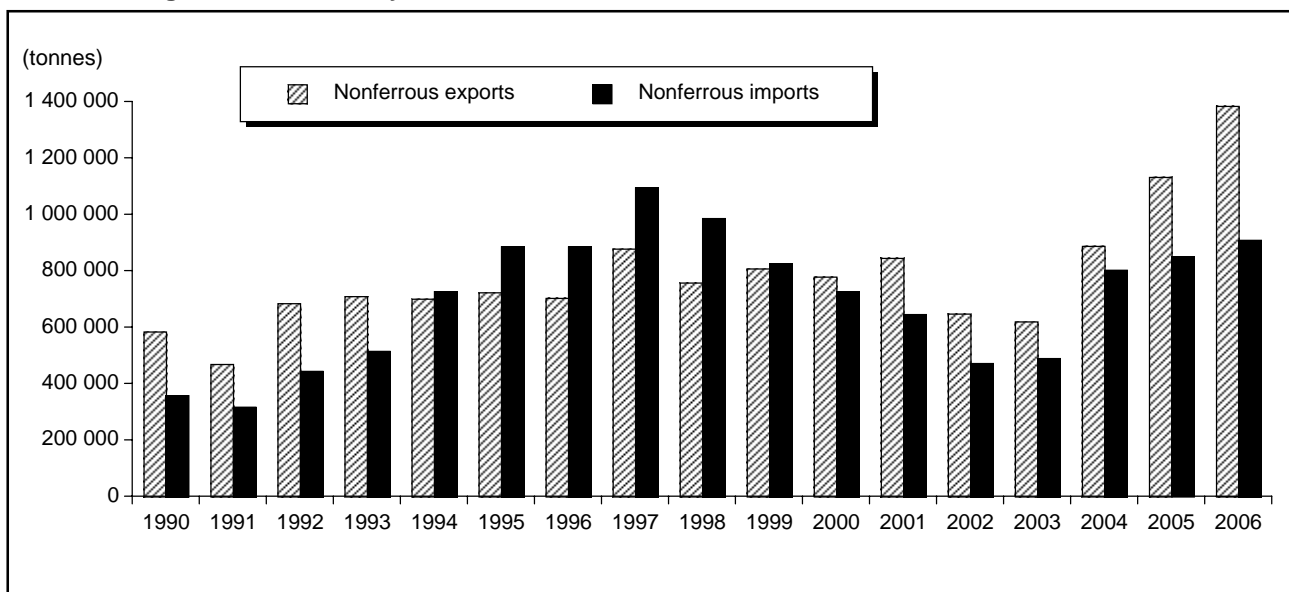
CANADIAN TRADE IN RECYCLABLE METALS

From a sheer tonnage perspective, Canada's trade in recyclable metal is dominated by the movement of ferrous scrap metal compared to nonferrous scrap metal. Figures 1 (nonferrous) and 2 (ferrous) illustrate this point well. In 2006, Canada exported almost three times as much ferrous metal as nonferrous metal. About 30% more ferrous metal was imported than nonferrous metal. The growth in exports of both metal types in 2006 appears to have been more robust than for imports.

Canada has many trading partners. However, Figures 3 and 4 highlight the fact that a significant amount of recyclable metal is traded with our closest neighbour, the United States. These figures also provide an overview of the value of all recyclable metals exported (\$3.5 billion) and imported (\$3.0 billion).

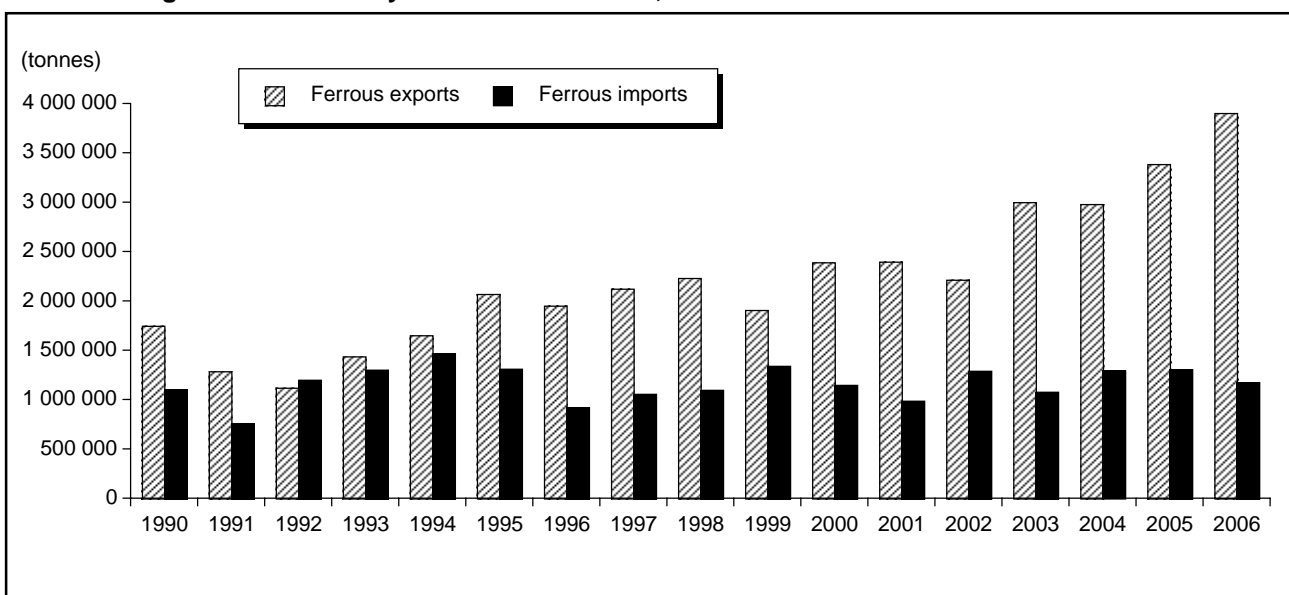
In 2006, the total amount of ferrous and nonferrous recyclable metal exported was 5.3 Mt, while the amount imported was 2.1 Mt. Recyclable metals is a very general heading under which a vast array of different metal and mineral materials are covered. In Figure 5, four separate but still general distinctions are made: (1) ferrous waste and scrap, (2) nonferrous waste and scrap, (3) ferrous slag, and (4) nonferrous ash and residue. For more detail regarding the types of recyclable metals and minerals tracked by Statistics Canada, refer to Table 2 (Harmonized System [HS] Codes for Recyclable Metals) in the 2005 *Canadian Minerals Yearbook*.

Figure 1
Total Tonnage of Trade in Recyclable Nonferrous Metal, 1990-2006



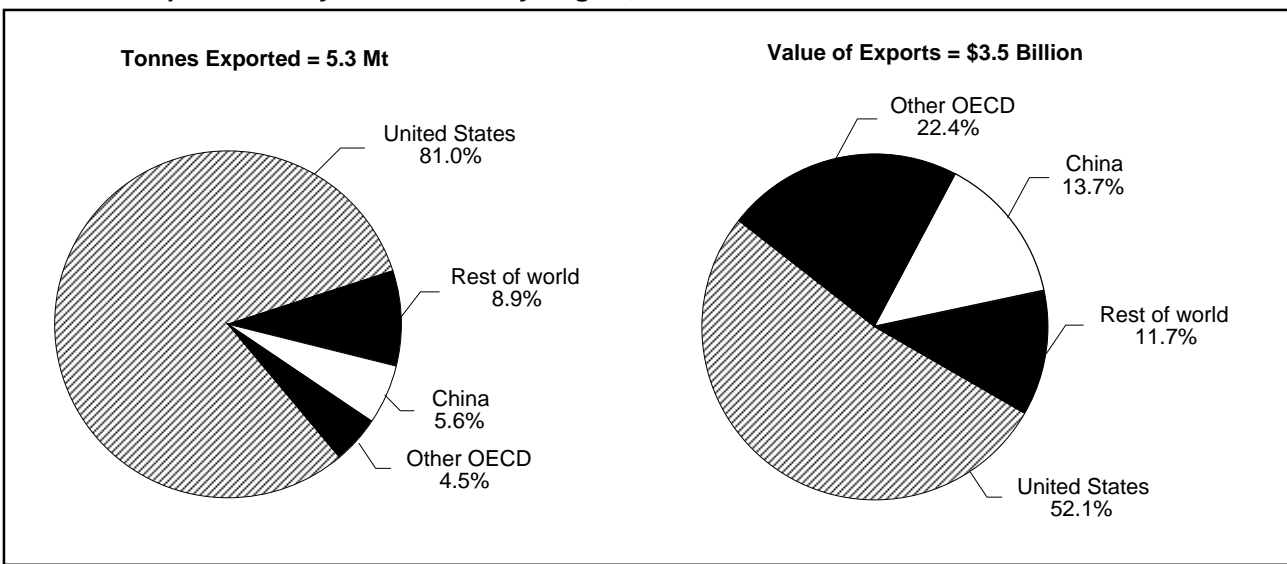
Source: Natural Resources Canada, Trade Retrieval and Aggregation System.

Figure 2
Total Tonnage of Trade in Recyclable Ferrous Metal, 1990-2006



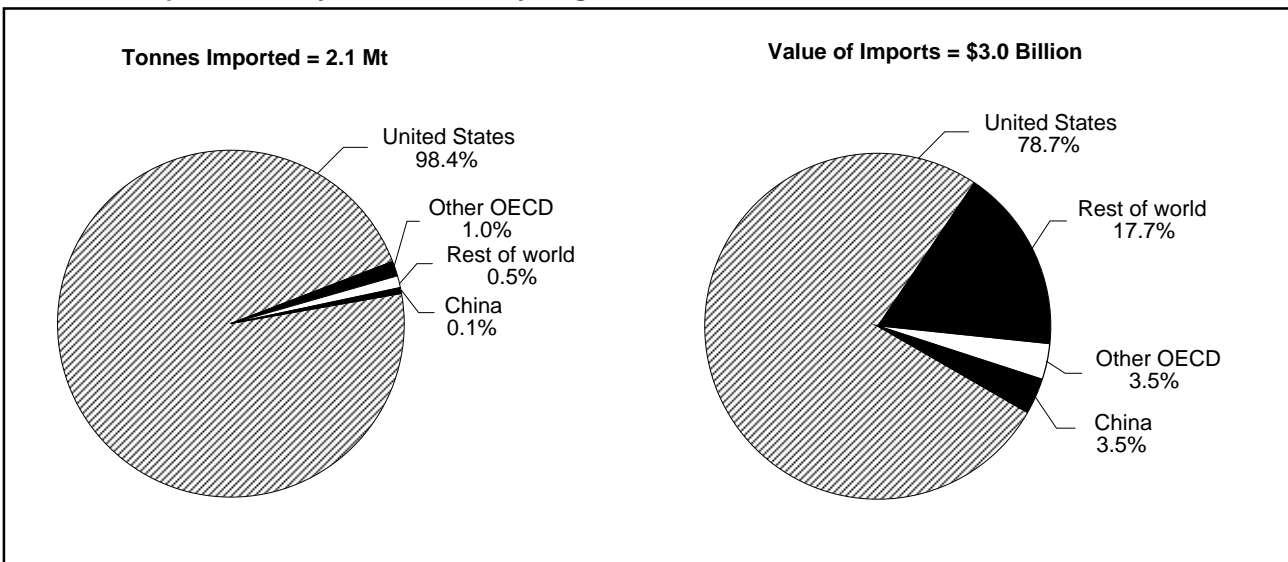
Source: Natural Resources Canada, Trade Retrieval and Aggregation System.

Figure 3
Canadian Exports of Recyclable Metals by Region, 2006



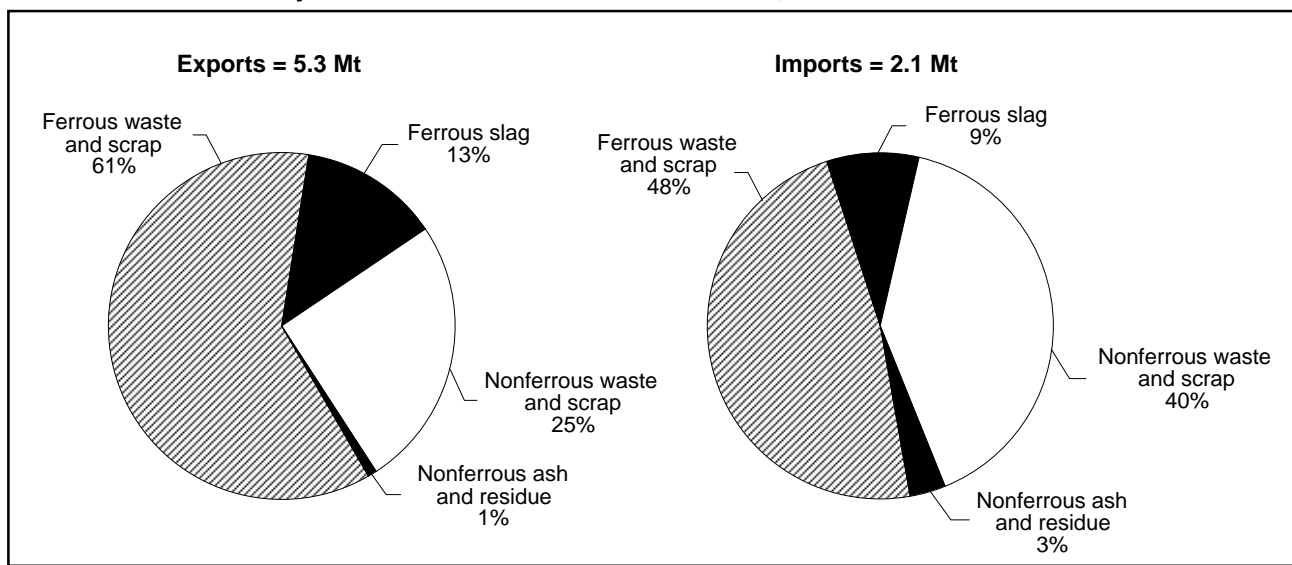
Source: Natural Resources Canada, Trade Retrieval and Aggregation System.

Figure 4
Canadian Imports of Recyclable Metals by Region, 2006



Source: Natural Resources Canada, Trade Retrieval and Aggregation System.

Figure 5
Canadian Trade in Recyclable Nonferrous and Ferrous Metals, 2006



Source: Natural Resources Canada, Trade Retrieval and Aggregation System.

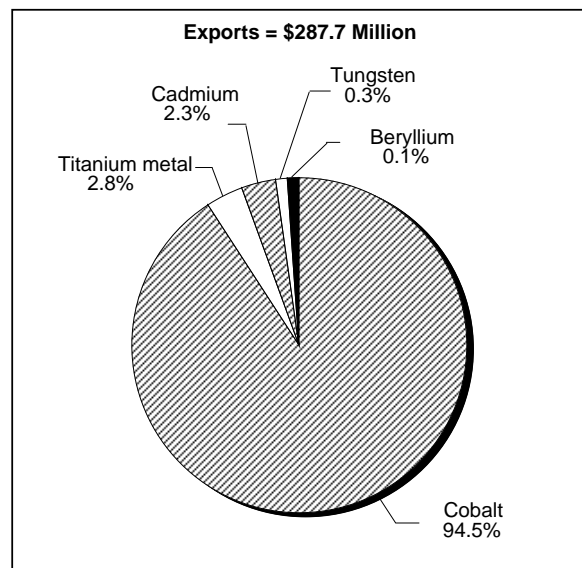
Tables 1 and 2 provide a more detailed summary of the trade in recyclable metals. The major trading partners are the United States, other Organization for Economic Co-operation and Development (OECD) countries, China, and other non-OECD countries.¹ Table 1 separates the nonferrous and ferrous data whereas Table 2 combines them. In each table, a distinction is made between waste and scrap on the one hand, and slag, ash and residue on the other.

Compared to 2005, Canada's exports of recyclable metals increased by 17% (from 4.5 Mt to 5.3 Mt). Total imports decreased slightly by about 0.1 Mt.

Of the nonferrous waste and scrap exported, 96% by weight comprises three metal groups: stainless steel (709 000 t), aluminum (417 000 t), and copper (165 000 t). The remainder comprises lead, zinc, nickel, tin, magnesium, precious metals, and "not elsewhere specified." The dominant imports are stainless steel (508 000 t), aluminum (140 000 t), lead (80 000 t), and copper (56 000 t), representing 94% of total nonferrous waste and scrap imported in 2006. Table 3 provides an overall summary of nonferrous metal scrap traded by Canada. In fact, Table 3 summarizes the data from Tables 4-13.

The group referred to as "precious metals" comprises gold, platinum, and other metals. Table 11 provides trade statistics from 2000 to 2006. Of the \$1.5 billion worth of precious metals imported into Canada in 2006, gold scrap represented 81%. However, in terms of exports, 80% were "other (precious) metals." The average price for gold in 2006 was US\$604 per troy ounce.²

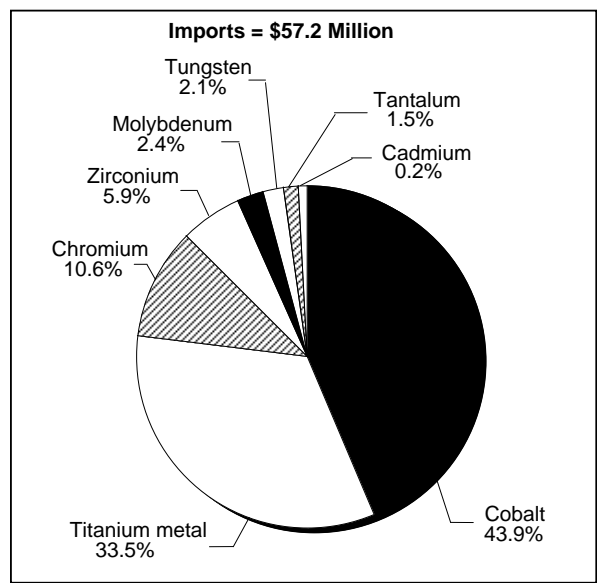
Figure 6
Canadian Exports of Scrap Metals, Not Elsewhere Specified, 2006



Source: Natural Resources Canada, Trade Retrieval and Aggregation System.

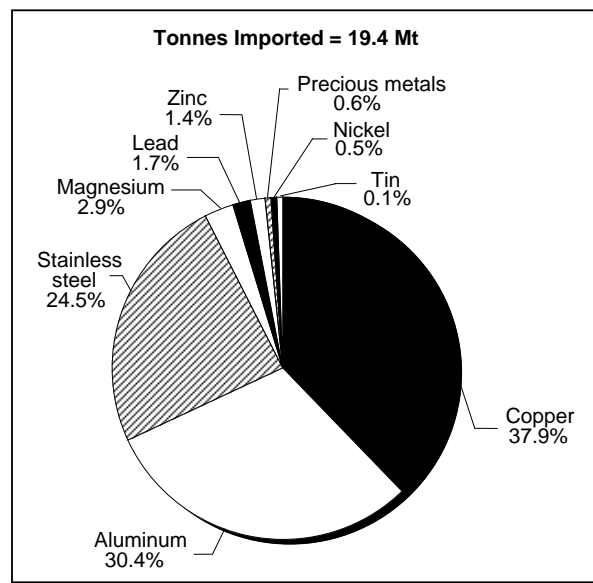
With respect to the category of "not elsewhere specified," Figures 6 and 7 show the metal scrap materials that are traded, with cobalt the dominant player (in terms of value). As presented in the two figures, Canada exported \$287.7 million of scrap "not elsewhere specified" metal in 2006 while importing \$57.2 million. More details are presented in Table 12.

Figure 7
Canadian Imports of Scrap Metals,
Not Elsewhere Specified, 2006



Source: Natural Resources Canada, Trade Retrieval and Aggregation System.

Figure 8
Global Imports of Nonferrous Waste and Scrap,
Tonnage, 2006



Source: Global Trade Information Service (the *Global Trade Atlas* includes data from over 35 of the world's major economies representing over 90% of global trade).

INTERNATIONAL TRADE

Global trade in nonferrous metal “waste and scrap” was in the order of US\$24 billion in 2004 and 2005, rising to US\$44 billion in 2006. The amount of this metal trade has grown steadily from 16 Mt in 2004 to 19 Mt in 2006. Figures 8 and 9 present an overview of nonferrous metal trade (total global imports) for the “waste and scrap” category (ash, powders, and other residues are not included). Copper, aluminum, and stainless steel dominate in terms of weight and value with precious metals emerging as a significantly valuable recyclable material. The quantity data for precious metals appear to be incomplete since, in some instances, only the dollar trade values are available. It may be that some trade numbers are not reported in some countries or that they may be too low to report.

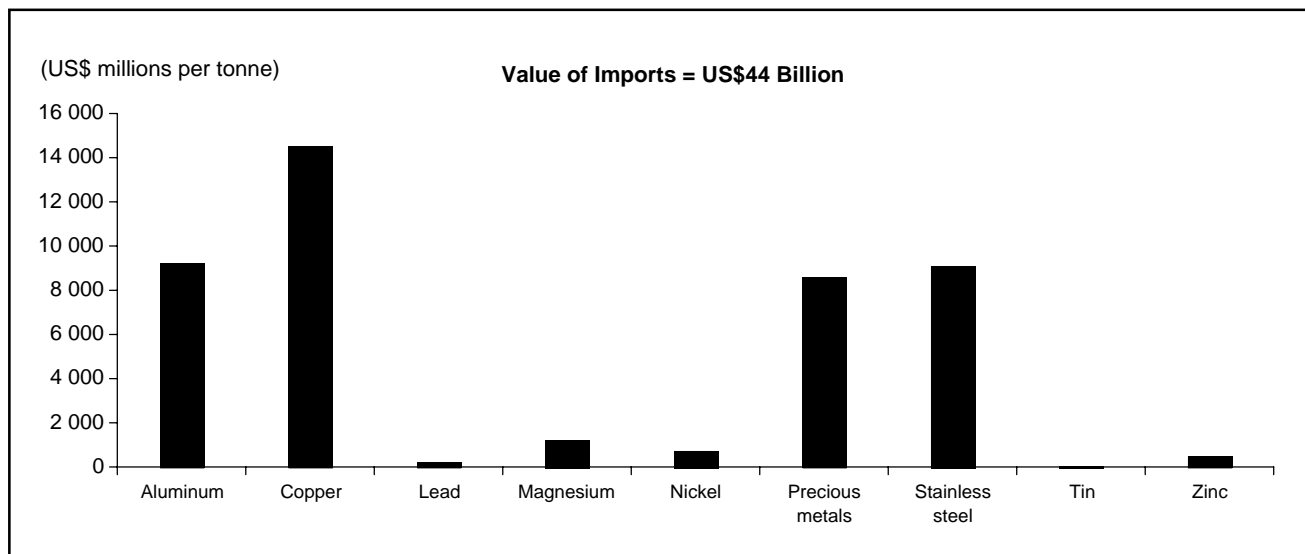
The global trade in ferrous “waste and scrap” is enormous, as shown in Figure 10. Worldwide imports show a slight decline from 2004 to 2006, but the value of this trade increased in 2006. According to Recycling International, higher freight rates (due to rising energy costs) and a dropping U.S. dollar have hurt some scrap metal exporters.³ In addition, fewer ships were apparently available for dismantling in 2006 and this may also have contributed to the lower tonnage of ferrous metal recovered.

According to the Institute of Scrap Recycling Industries Inc., the United States exported 34 million short tons (st) of scrap worth approximately US\$15.7 billion in 2006. Of that total, ferrous metal accounted for 14 million st, exceeded only by paper at 16 million st (of which Canada received well over 2 Mt/y). The four largest nonferrous scrap metals exported from the United States were aluminum (1.5 million st), nickel and stainless steel (1.4 million st), and copper (0.8 million st).⁴

Canada’s share of U.S. aluminum waste and scrap exports has been gradually declining in value from 19% in 2004 to 13% in 2005 and 9% in 2006. Figure 11 illustrates Canada’s share of 2006 aluminum waste and scrap exports from the United States (which amounted to about 132 000 t). This apparent “loss” of aluminum scrap metal has not been offset by gains from any other country (Canada’s second largest source of aluminum scrap is Cuba from which 590 t were imported in 2006).

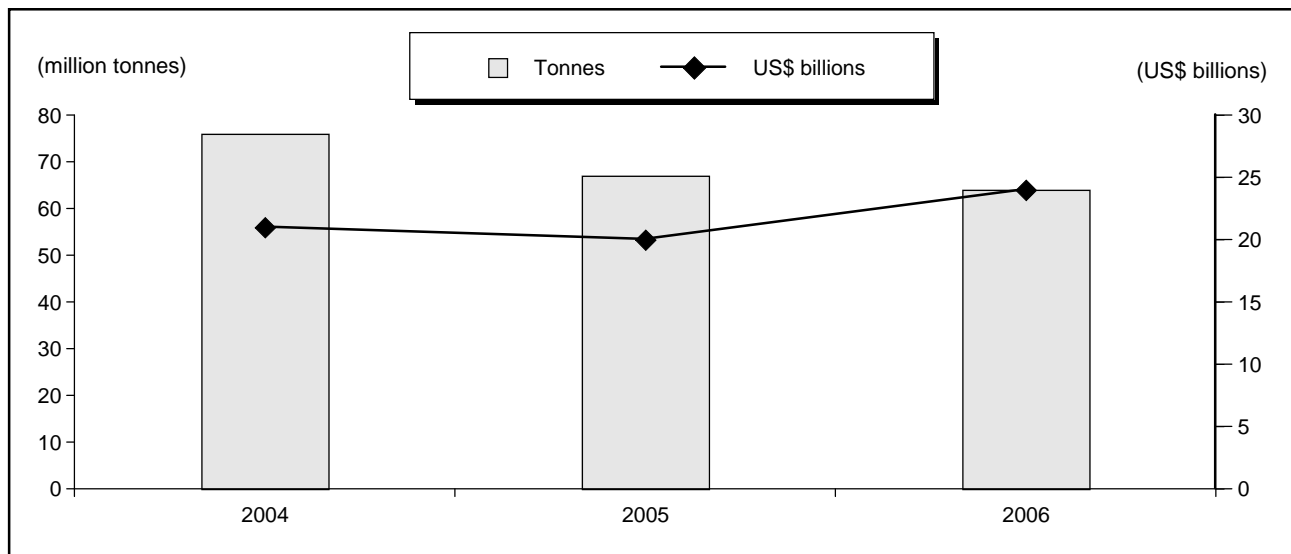
Compared to aluminum scrap, Canada received 100% of U.S. nickel waste imports in 2005 and 2006; in sharp contrast, Canada received only 4-6% of U.S. stainless steel scrap exports whether tonnage or value is considered. As for copper scrap, quantities imported increased from around 6% of total U.S. exports in 2004 and 2005 to 13% in 2006.

Figure 9
Global Imports of Nonferrous Waste and Scrap, Value, 2006



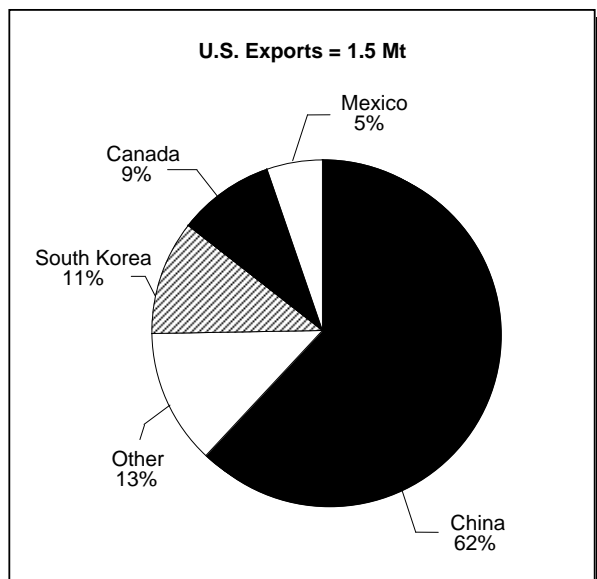
Source: Global Trade Information Service (the *Global Trade Atlas* includes data from over 35 of the world's major economies representing over 90% of global trade).

Figure 10
Global Imports of Ferrous Waste and Scrap, 2004-06



Source: Global Trade Information Service (the *Global Trade Atlas* includes data from over 35 of the world's major economies representing over 90% of global trade).

Figure 11
U.S. Aluminum Waste and Scrap Exports, 2006



Source: Global Trade Information Service (the *Global Trade Atlas* includes data from over 35 of the world's major economies representing over 90% of global trade).

national commodity market forums such as the London Metal Exchange (LME) continue to use that currency as the indicator of material value.

Figure 12 compares the value of two recyclable metal commodities: aluminum and copper. In contrast to copper no. 1 burnt wire, the value of aluminum used beverage cans (UBC) was relatively stable throughout 2006, peaking at US\$2458/t in May and finishing the year at US\$2089/t.

Recycling International suggested that copper scrap had a record year in 2006. Prices peaked as shown in Figure 12 at about US\$9000/t and then gradually declined throughout the remainder of the year as stock levels rose.

In 2006, the value of metal scrap containing nickel soared to new heights. One explanation for the enormous jump in nickel between January and December 2006 is as follows: "Only a small increase was driven by fundamentals such as strong stainless steel demand, low nickel stock levels and a lack of new capacities coming on stream. Speculation has been definitely the major price driver throughout 2006."⁵

Figure 13 provides prices for nickel contained in cobalt-nickel scrap from 2002 to 2006. In January 2006, nickel began its climb from about US\$6000/t to US\$16 000/t by December, a 267% increase over 12 months.

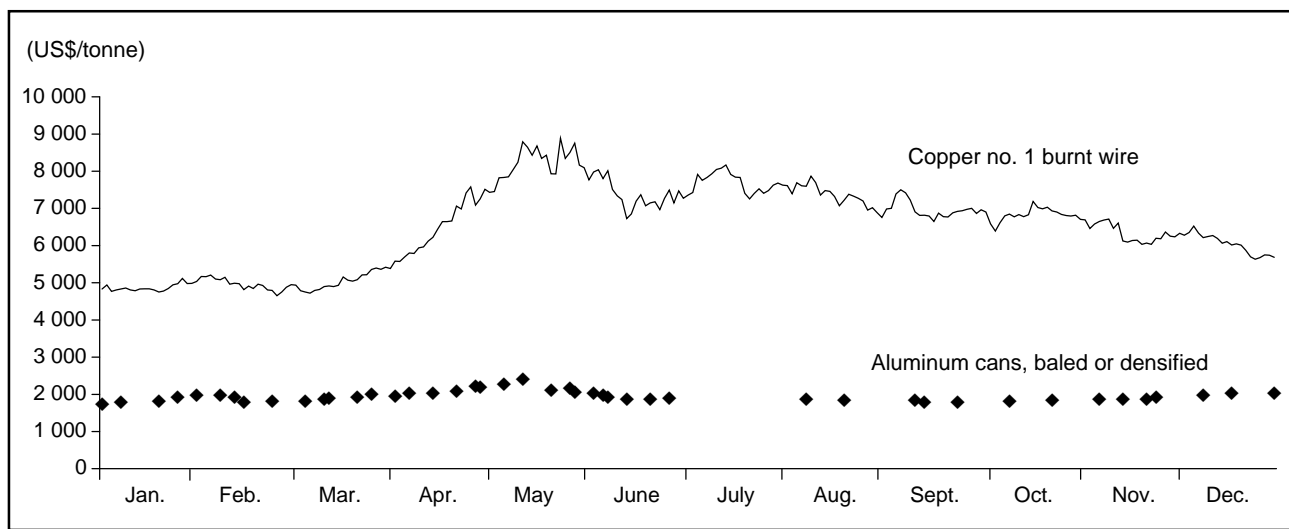
Since stainless steel contains nickel, the value of stainless steel scrap followed a similar trend in 2006, as illustrated in Figure 14.

The value of ferrous scrap metal is considerably lower than nonferrous scrap metal. However, significantly more

SCRAP METAL PRICES

Given that the Canadian dollar increased in value against the U.S. dollar throughout 2006, all scrap metal prices are quoted in U.S. dollars per metric tonne. Further, inter-

Figure 12
Value of Copper and Aluminum Scrap Metal, 2006



Source: MetalPrices.com.

ferrous metal scrap is traded, as reflected in Figure 2 versus Figure 1. In mid-2005, some ferrous scrap metals were traded at relatively low levels, as shown in Figure 15. In contrast, 2006 prices for selected ferrous metal scrap peaked mid-year and then declined towards the end of the year.

The number of ferrous scrap categories is extensive, as discussed in the 2005 CMY Recycled Metals article, where some references are provided for interested readers. Figure 16 duplicates the CMY 2005 Figure 12, but with 2006 average price data added in. As shown, ferrous scrap metal prices appear to have increased in 2006 across most of the selected ferrous scrap metal grades.

ENDNOTES

¹ For a list of countries in the Organization for Economic Co-operation and Development (OECD), consult www.oecd.org.

² www.MetalPrices.com.

³ www.recyclinginternational.com.

⁴ www.isri.org, "Scrap Recycling Industry Facts."

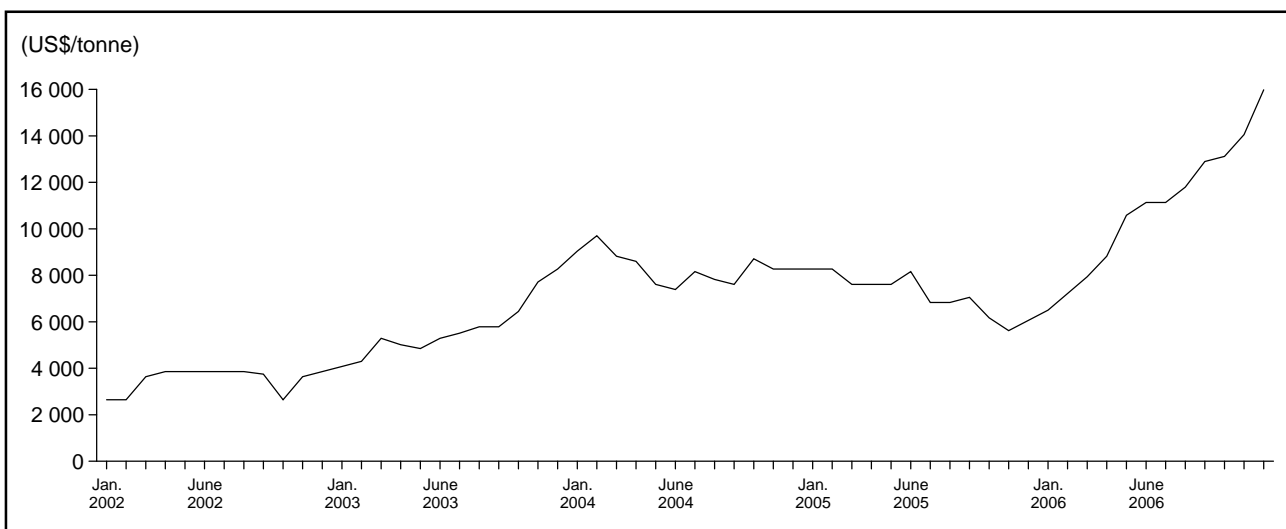
⁵ Recycling International, Jan./Feb., 2007, No. 1, p. 39.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

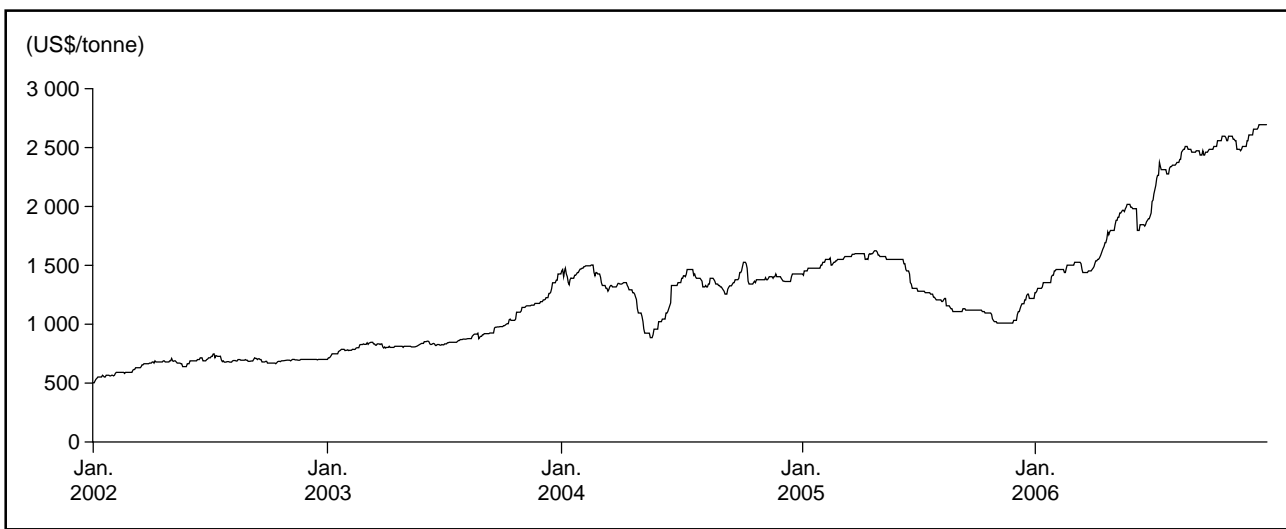
The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

Figure 13
Cobalt-Nickel Scrap Nickel Contained, 2002-06



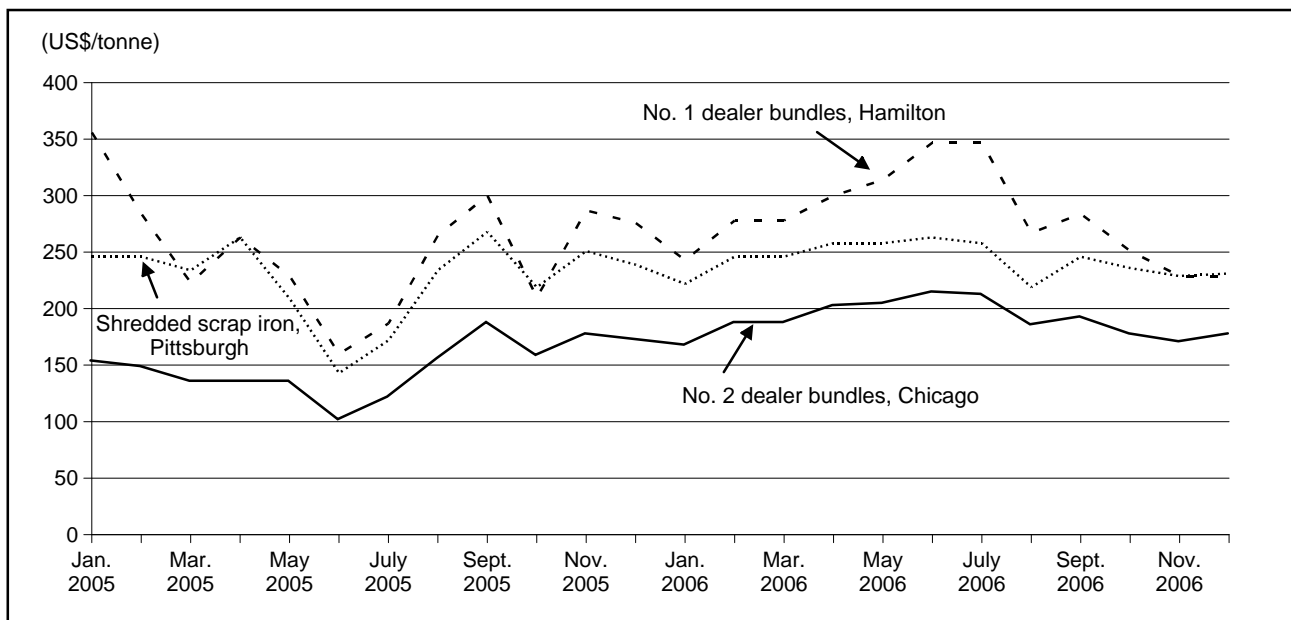
Source: MetalPrices.com.

Figure 14
Stainless Steel Scrap (18/8), Processor Solids, 2002-06



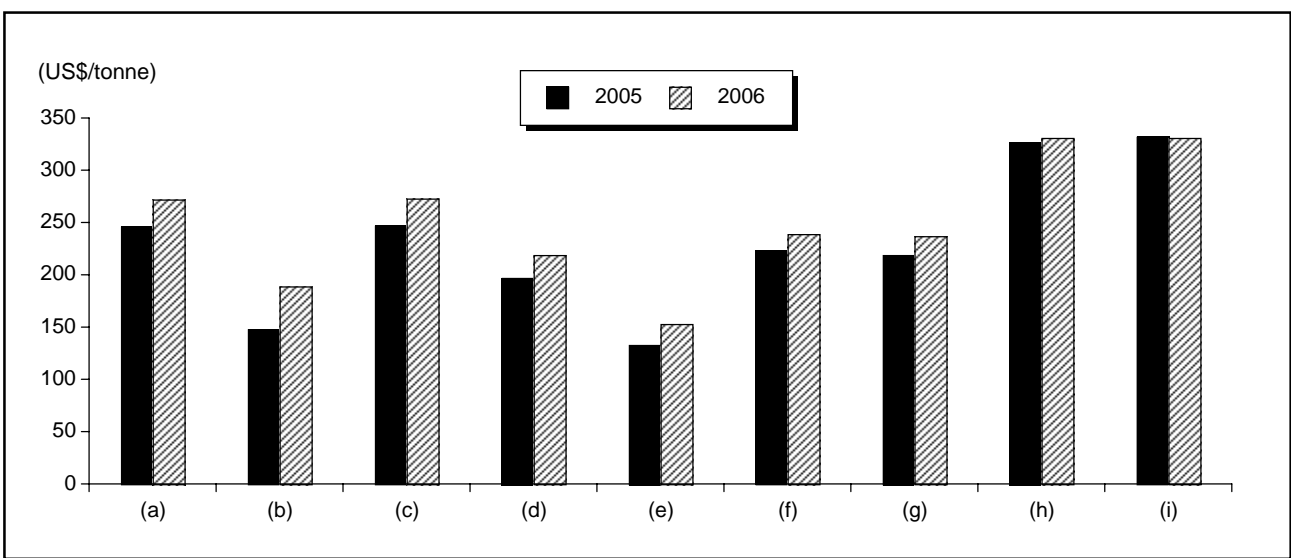
Source: MetalPrices.com.

Figure 15
Ferrous Scrap Metal Prices, 2005 and 2006



Source: MetalPrices.com.

Figure 16
Various Ferrous Scrap Metal Items, Chicago, Average Prices, 2005 and 2006



Source: MetalPrices.com.

(a) No. 1 dealer bundles mill; (b) No. 2 dealer bundles mill; (c) No. 1 bushelings mill; (d) No. 1 heavy melting mill; (e) Machine shop turnings mill; (f) Shredded scrap iron mill; (g) 5' plate and structural scrap mill; (h) Basic pig iron; (i) Ductile pig iron.

TABLE 1. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE METAL, 2006

	Waste and Scrap		Slag, Ash or Residue	
	(tonnes)	(\$000)	(tonnes)	(\$000)
RECYCLABLE EXPORTS				
Ferrous				
United States	2 642 030	640 350	684 822	17 201
Other OECD	50 868	9 912	—	—
China	84 293	68 081	—	—
Other non-OECD	441 738	68 381	4	1
Total exports	3 218 929	786 724	684 827	17 202
Nonferrous				
United States	914 703	1 394 777	43 183	29 163
Other OECD	188 190	886 867	42	83
China	211 208	480 110	—	—
Other non-OECD	26 181	80 170	995	885
Total exports	1 340 282	2 841 924	44 220	30 131
Total Exports				
United States	3 556 733	2 035 127	728 005	46 364
Other OECD	239 058	896 779	42	83
China	295 501	548 191	—	—
Other non-OECD	467 919	148 551	999	886
Total exports	4 559 211	3 628 648	729 047	47 333
RECYCLABLE IMPORTS				
Ferrous				
United States	996 525	192 632	176 937	6 000
Other OECD	2 119	496	1 172	47
China	88	96	29	1
Other non-OECD	886	384	10	1
Total imports	999 618	193 609	178 147	6 048
Nonferrous				
United States	813 577	2 057 529	67 247	94 617
Other OECD	17 309	99 419	792	4 172
China	1 113	4 235	—	—
Other non-OECD	6 154	519 990	3 638	8 881
Total imports	838 154	2 681 174	71 677	107 670
Total Imports				
United States	1 810 102	2 250 162	244 184	100 617
Other OECD	19 428	99 915	1 964	4 219
China	1 202	4 331	29	1
Other non-OECD	7 040	520 374	3 648	8 882
Total imports	1 837 772	2 874 783	249 824	113 718

Source: Statistics Canada.

— Nil.

OECD = Organization for Economic Co-operation and Development.

Notes: Domestic exports exclude re-exports. Nonferrous metal group includes stainless steel.

TABLE 2. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE NONFERROUS AND FERROUS WASTE AND SCRAP, ASH AND RESIDUE, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	2 386 610	1 262 636	18 052	237 623	42 793	51 642	12 475	98 212	2 459 929	1 650 113
2001	2 329 026	1 209 017	23 764	215 227	223 652	72 504	39 289	74 925	2 615 730	1 571 673
2002	2 133 449	1 068 170	80 493	197 660	145 933	95 354	179 571	131 382	2 539 446	1 492 566
2003	2 610 611	1 031 533	39 735	420 981	284 356	152 241	35 016	128 854	2 969 718	1 733 609
2004	2 950 595	1 598 623	67 498	765 594	349 639	198 221	78 432	346 231	3 446 164	2 908 669
2005	3 125 186	1 590 305	112 717	785 174	270 170	289 640	82 293	375 425	3 590 366	3 040 545
2006	3 556 733	2 035 127	239 058	896 779	295 501	548 191	467 919	148 551	4 559 211	3 628 648
IMPORTS, WASTE AND SCRAP										
2000	1 633 574	1 059 137	61 957	196 516	811	2 210	85 995	563 008	1 782 337	1 820 872
2001	1 376 194	1 016 753	73 635	226 309	631	2 672	76 874	438 547	1 527 333	1 684 281
2002	1 551 179	1 204 380	20 579	64 333	1 435	1 696	67 546	104 897	1 640 738	1 375 306
2003	1 408 788	1 267 376	10 339	36 743	1 754	2 313	6 234	104 358	1 427 115	1 410 790
2004	1 849 829	1 588 348	12 680	69 335	528	1 206	7 495	121 528	1 870 533	1 780 418
2005	1 897 410	1 456 681	12 204	71 125	819	3 155	5 044	117 078	1 915 476	1 648 040
2006	1 810 102	2 250 162	19 428	99 915	1 202	4 331	7 040	520 374	1 837 772	2 874 783
EXPORTS, ASH AND RESIDUE										
2000	706 123	72 589	4 924	2 928	7	2	206	221	711 260	75 739
2001	624 569	49 221	1 456	676	..	..	1 521	797	627 547	50 694
2002	323 347	47 247	422	260	..	..	179	130	323 948	47 637
2003	648 910	45 833	..	..	2 272	682	254	183	651 436	46 699
2004	421 715	40 517	3	4	..	..	347	354	422 065	40 874
2005	851 808	50 956	13	13	76 502	6 214	359	222	928 681	57 405
2006	728 005	46 364	42	83	..	..	999	886	729 047	47 333
IMPORTS, ASH AND RESIDUE										
2000	92 576	28 525	1 048	3 990	19	30	277	1 185	93 920	33 731
2001	104 835	24 318	3 227	2 621	..	..	114	68	108 176	27 007
2002	122 636	20 454	1 969	2 498	451	268	140	11	125 196	23 231
2003	141 065	28 293	1 877	3 410	1	..	2	..	142 944	31 703
2004	215 795	55 980	11 043	6 269	..	..	63	34	226 901	62 283
2005	231 972	47 885	10 696	8 483	..	..	328	86	242 997	56 454
2006	244 184	100 617	1 964	4 219	29	1	3 648	8 882	249 824	113 718

Source: Statistics Canada.

.. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 3. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE NONFERROUS WASTE AND SCRAP, ASH AND RESIDUE, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	707 987	1 015 741	17 223	236 246	15 299	22 408	9 289	95 329	749 797	1 369 724
2001	767 435	986 695	20 908	212 036	19 289	28 409	10 076	67 696	817 707	1 294 835
2002	530 640	818 112	9 252	189 464	39 709	50 251	7 999	108 718	587 600	1 166 544
2003	469 897	668 502	20 115	414 894	61 212	74 664	13 244	123 879	564 468	1 281 939
2004	708 245	1 021 522	31 754	755 312	70 884	100 123	26 461	333 644	837 344	2 210 601
2005	786 487	1 052 822	62 253	778 590	184 647	241 343	46 361	362 490	1 079 748	2 435 244
2006	914 703	1 394 777	188 190	886 867	211 208	480 110	26 181	80 170	1 340 282	2 841 924
IMPORTS, WASTE AND SCRAP										
2000	568 984	927 876	51 037	194 940	504	2 187	85 355	562 910	705 880	1 687 913
2001	484 747	912 437	69 857	225 604	417	2 640	74 547	438 073	629 567	1 578 755
2002	439 481	1 060 997	18 436	64 022	621	1 592	3 951	92 961	462 489	1 219 571
2003	460 556	1 141 425	9 864	36 520	528	2 084	3 466	103 934	474 414	1 283 962
2004	724 739	1 380 846	11 681	69 172	195	1 151	5 947	121 163	742 562	1 572 332
2005	777 031	1 243 849	10 588	70 828	815	3 154	3 208	116 430	791 641	1 434 261
2006	813 577	2 057 529	17 309	99 419	1 113	4 235	6 154	519 990	838 154	2 681 174
EXPORTS, ASH AND RESIDUE										
2000	24 628	16 504	4 924	2 928	7	2	206	221	29 765	19 655
2001	25 357	17 261	1 456	676	..	..	1 521	797	28 335	18 734
2002	59 903	36 139	422	260	..	..	179	130	60 504	36 529
2003	55 532	32 864	..	..	..	..	254	183	55 785	33 047
2004	50 047	27 636	3	4	..	..	347	354	50 397	27 994
2005	52 415	32 355	13	13	..	..	352	221	52 780	32 590
2006	43 183	29 163	42	83	..	..	995	885	44 220	30 131
IMPORTS, ASH AND RESIDUE										
2000	19 565	22 647	1 007	3 980	19	30	258	1 183	20 849	27 840
2001	13 889	16 647	2 943	2 565	..	..	86	65	16 918	19 277
2002	8 740	10 028	1 298	2 404	441	266	50	5	10 530	12 704
2003	15 069	18 704	1 084	3 305	..	..	..	..	16 154	22 009
2004	50 152	46 606	10 539	6 208	..	..	20	20	60 710	52 835
2005	50 526	40 785	7 512	7 235	..	..	250	83	58 288	48 103
2006	67 247	94 617	792	4 172	..	..	3 638	8 881	71 677	98 789

Source: Statistics Canada.

.. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 4. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE ALUMINUM WASTE AND SCRAP, ASH AND RESIDUE, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	274 239	494 299	6 221	13 748	8 404	11 893	1 257	1 908	290 121	521 849
2001	267 557	467 709	8 016	17 838	9 147	13 101	2 910	2 975	287 630	501 624
2002	266 776	446 007	4 715	9 409	17 814	24 509	1 586	2 446	290 891	482 372
2003	248 567	383 388	15 284	33 707	24 350	32 662	3 037	3 901	291 238	453 658
2004	324 837	498 168	2 666	4 588	21 852	29 613	5 391	7 933	354 746	540 301
2005	293 695	488 417	8 622	13 681	39 816	55 524	11 211	15 966	353 343	573 587
2006	330 566	632 358	17 074	38 716	64 484	116 712	5 244	10 226	417 368	798 012
IMPORTS, WASTE AND SCRAP										
2000	117 346	165 864	8 965	12 594	39	57	5 497	8 602	131 848	187 117
2001	107 578	145 863	11 321	16 103	20	16	1 006	1 390	119 926	163 371
2002	129 306	180 421	12 664	19 448	116	47	2 178	3 442	144 264	203 358
2003	138 352	211 245	6 800	10 981	..	..	1 396	1 980	146 547	224 207
2004	161 664	224 463	5 344	8 015	..	..	845	1 347	167 854	233 825
2005	170 280	231 353	343	556	1	2	1 053	1 445	171 676	233 356
2006	138 789	238 337	391	610	3	5	623	1 116	139 806	240 068
EXPORTS, ASH AND RESIDUE										
2000	16 790	9 179	996	424	..	..	..	..	17 786	9 603
2001	17 425	11 094	1 436	653	..	..	1 265	602	20 125	12 349
2002	48 515	27 904	362	192	..	..	..	..	48 877	28 096
2003	44 259	25 215	..	..	..	..	..	..	44 259	25 215
2004	35 965	17 640	..	..	..	..	..	..	35 965	17 640
2005	40 296	22 711	..	..	..	..	..	..	40 296	22 711
2006	31 515	14 491	..	..	..	..	20	21	31 535	14 512
IMPORTS, ASH AND RESIDUE										
2000	4 211	4 142	1	1	..	..	..	..	4 212	4 143
2001	5 747	5 013	..	..	..	..	..	..	5 747	5 013
2002	5 699	5 113	505	336	..	..	..	..	6 204	5 449
2003	6 775	5 652	..	..	..	..	..	..	6 775	5 652
2004	18 252	18 036	..	..	..	..	..	..	18 252	18 036
2005	18 534	13 776	..	..	..	..	..	..	18 534	13 776
2006	6 819	2 916	..	..	..	..	..	..	6 819	2 916

Source: Statistics Canada.

.. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 5. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE COPPER WASTE AND SCRAP, ASH AND RESIDUE, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	63 475	127 668	1 866	2 806	6 098	8 588	1 622	2 702	73 060	141 764
2001	56 447	110 866	3 155	5 595	8 539	12 978	2 104	3 448	70 245	132 887
2002	52 621	113 670	2 091	3 771	13 771	17 533	2 714	3 569	71 197	138 543
2003	41 392	81 429	1 995	2 100	24 118	26 258	1 907	2 702	69 412	112 490
2004	50 981	135 189	2 420	5 542	25 894	33 536	1 491	3 057	80 786	177 324
2005	56 844	176 143	7 818	12 838	44 682	72 941	9 362	7 487	118 706	269 408
2006	51 594	257 171	29 494	18 902	80 949	216 224	2 600	12 884	164 637	505 181
IMPORTS, WASTE AND SCRAP										
2000	85 620	156 076	580	838	..	..	3 067	5 904	89 266	162 818
2001	72 401	128 765	12 726	15 689	..	..	5 958	15 401	91 085	159 856
2002	39 371	68 299	540	1 746	5	10	1 583	2 393	41 499	72 448
2003	35 380	57 517	448	1 371	1	..	1 263	2 030	37 092	60 919
2004	53 182	87 649	867	2 047	3	8	1 194	2 397	55 246	92 100
2005	46 378	72 416	134	394	..	..	1 510	2 470	48 022	75 280
2006	54 766	178 979	195	883	193	731	1 037	2 474	56 191	183 067
EXPORTS, ASH AND RESIDUE										
2000	..	49	3 887	2 462	..	..	..	..	3 887	2 511
2001	43	106	..	..	..	..	..	..	43	106
2002	64	155	20	34	..	..	..	..	84	189
2003	187	478	..	..	..	..	..	..	187	478
2004	96	430	3	4	..	..	..	..	98	433
2005	120	723	..	..	..	..	..	..	120	723
2006	318	1 838	..	..	..	..	..	..	318	1 838
IMPORTS, ASH AND RESIDUE										
2000	13 190	14 097	980	3 930	..	..	172	917	14 341	18 944
2001	6 880	9 958	2 943	2 565	..	..	86	65	9 909	12 588
2002	2 686	4 586	661	1 895	441	266	..	..	3 788	6 748
2003	7 765	12 616	1 078	3 302	..	..	..	..	8 843	15 919
2004	31 480	28 163	10 539	6 208	..	..	20	20	42 038	34 392
2005	30 666	26 434	7 512	7 235	..	..	250	83	38 428	33 752
2006	59 016	90 544	792	4 171	..	..	3 508	8 743	63 316	103 458

Source: Statistics Canada.

.. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 6. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE LEAD WASTE AND SCRAP, ASH AND RESIDUE, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	4 016	1 320			31	39			4 047	1 359
2001	1 632	729							1 632	729
2002	352	369			8	7	41	24	401	400
2003	817	568	39	250	171	135			1 027	953
2004	928	646			75	54	105	92	1 109	792
2005	2 614	1 722			116	75	180	81	2 911	1 878
2006	1 435	867	—	—	123	54	45	48	1 603	969
IMPORTS, WASTE AND SCRAP										
2000	65 354	14 241			20	15	34	24	65 407	14 280
2001	54 956	11 882	47	8	86	37	88	57	55 178	11 983
2002	41 058	7 354	282	76	42	17	34	15	41 415	7 462
2003	40 965	6 779	292	55	108	58	23	5	41 389	6 896
2004	44 869	10 844	439	118			201	219	45 509	11 180
2005	53 702	14 365	1 236	485	20	9	25	19	54 983	14 878
2006	79 753	23 912	401	119	18	5			80 172	24 036
EXPORTS, ASH AND RESIDUE										
2000	..	..	..	..	7	2	..	..	7	2
2001	..	..	..	..	..	..	..	..	..	..
2002	..	..	..	..	..	..	..	..	..	..
2003	..	..	..	..	..	..	..	..	..	..
2004	..	..	..	..	..	..	..	..	..	..
2005	..	..	..	..	..	..	..	..	..	..
2006	48	18	..	..	..	..	58	16	106	34
IMPORTS, ASH AND RESIDUE										
2000	705	2 737	1	3	..	..	45	200	751	2 939
2001	690	1 337	..	..	..	..	..	..	690	1 337
2002	..	..	..	..	..	..	..	..	..	..
2003	..	..	..	..	..	..	..	..	..	..
2004	..	..	..	..	..	..	..	..	..	..
2005	..	..	..	..	..	..	..	..	..	..
2006	1 023	724	..	1	..	..	..	..	1 023	725

Source: Statistics Canada.

— Nil; .. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 7. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE ZINC WASTE AND SCRAP, ASH AND RESIDUE, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	33 547	22 705	20	18	20	22	2 821	2 694	36 408	25 439
2001	37 446	16 844	164	87	71	78	2 669	2 719	40 350	19 728
2002	28 935	13 178	40	19	611	670	685	710	30 271	14 578
2003	8 089	6 628	..	..	5 177	5 951	1 115	577	14 381	13 155
2004	9 448	9 042	..	..	15 003	17 627	3 663	4 338	28 115	31 007
2005	7 914	9 148	19	35	10 736	12 216	598	636	19 268	22 034
2006	11 883	18 213	—	—	6 399	10 329	365	489	18 647	29 031
IMPORTS, WASTE AND SCRAP										
2000	357	328	..	..	..	..	51	65	408	393
2001	300	241	..	..	..	..	2	3	303	244
2002	331	306	..	..	..	..	12	9	342	315
2003	247	263	..	..	..	..	..	..	247	263
2004	350	342	..	..	..	..	19	30	369	372
2005	203	205	..	..	..	..	..	..	203	205
2006	1 050	1 060	2	2	—	..	..	..	1 052	1 062
EXPORTS, ASH AND RESIDUE										
2000	7 838	7 277	40	42	..	..	206	221	8 085	7 539
2001	7 889	6 061	21	23	..	..	256	195	8 166	6 279
2002	11 323	8 080	41	34	..	..	179	130	11 543	8 244
2003	11 086	7 171	..	..	..	..	254	183	11 339	7 355
2004	13 987	9 566	..	..	..	..	347	354	14 334	9 920
2005	11 999	8 921	13	13	..	..	351	221	12 364	9 155
2006	11 302	12 816	42	83	..	..	917	848	12 261	13 747
IMPORTS, ASH AND RESIDUE										
2000	1 459	1 671	25	46	19	30	40	66	1 544	1 814
2001	572	338	..	..	..	..	..	..	572	338
2002	355	329	132	173	..	..	50	5	538	507
2003	529	436	7	3	..	..	..	..	535	438
2004	420	407	..	..	..	..	..	..	421	407
2005	1 326	574	..	..	..	..	..	..	1 326	574
2006	389	433	..	..	..	..	130	138	519	571

Source: Statistics Canada.

— Nil; .. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 8. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE NICKEL WASTE AND SCRAP, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	5 100	34 103	557	3 773	..	..	..	..	5 657	37 876
2001	2 573	10 783	207	471	..	..	..	..	2 781	11 253
2002	1 888	5 919	146	672	..	..	53	108	2 087	6 699
2003	2 502	9 643	210	1 170	..	..	..	..	2 711	10 813
2004	3 606	19 155	504	3 278	..	..	..	..	4 110	22 433
2005	4 150	25 309	436	2 694	68	366	7	44	4 661	28 412
2006	3 307	23 767	753	9 413	..	..	—	—	4 060	33 180
IMPORTS, WASTE AND SCRAP										
2000	17 926	48 612	1 259	4 944	..	..	1 339	7 620	20 524	61 176
2001	21 246	46 487	799	5 272	..	..	163	1 056	22 207	52 815
2002	20 983	48 316	531	3 327	..	..	41	138	21 555	51 780
2003	14 564	40 463	1 526	6 253	..	..	159	894	16 250	47 610
2004	20 481	51 177	1 584	7 784	..	1	452	1 332	22 517	60 294
2005	19 089	47 147	1 297	3 868	1	4	84	695	20 471	51 714
2006	18 463	70 971	1 007	4 689	100	470	414	1371	19 984	77 501

Source: Statistics Canada.

— Nil; .. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 9. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE MAGNESIUM WASTE AND SCRAP, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	6 450	19 316	638	1 983	..	..	..	..	7 087	21 298
2001	8 585	27 083	34	202	..	..	2	5	8 621	27 290
2002	10 245	24 670	21	118	..	..	..	..	10 266	24 788
2003	10 131	20 523	..	..	..	..	3	6	10 134	20 529
2004	10 046	20 510	1	2	..	..	..	..	10 047	20 512
2005	8 902	15 034	22	24	..	..	..	..	8 924	15 058
2006	11 522	16 714	—	—	..	..	—	—	11 522	16 714
IMPORTS, WASTE AND SCRAP										
2000	6 860	24 758	67	256	20	52	1 827	6 272	8 774	31 339
2001	7 530	26 945	122	427	67	148	2 801	10 561	10 520	38 080
2002	6 607	22 000	92	319	162	268	51	179	6 911	22 766
2003	5 712	15 591	111	310	106	223	405	1 260	6 333	17 384
2004	5 273	13 564	298	766	186	564	2	7	5 759	14 900
2005	5 221	13 057	277	659	783	1 718	..	..	6 282	15 433
2006	3 329	7 917	1 188	2 804	481	1 024	..	..	4 998	11 745

Source: Statistics Canada.

— Nil; .. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 10. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE TIN WASTE AND SCRAP, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	929	534	..	..	..	..	..	..	929	534
2001	2 849	1 054	..	..	..	..	..	..	2 849	1 054
2002	174	219	..	..	..	..	..	..	174	219
2003	538	351	98	231	..	..	..	..	635	582
2004	1 208	384	35	118	..	..	..	..	1 243	502
2005	3 161	850	132	416	..	..	..	..	3 294	1 265
2006	1 811	573	—	—	..	..	—	—	1 811	573
IMPORTS, WASTE AND SCRAP										
2000	424	1 587	7	33	..	..	..	..	431	1 620
2001	418	1 551	..	..	..	..	..	..	418	1 551
2002	455	1 918	1	2	..	..	..	..	456	1 920
2003	505	1 632	2	5	..	..	..	..	507	1 637
2004	793	1 054	37	157	..	..	40	363	869	1 574
2005	2 392	533	1 786	374	..	..	..	..	4 178	906
2006	2 830	2 808	1 321	567	19	155	..	..	4 170	3 530

Source: Statistics Canada.

— Nil; .. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 11. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE PRECIOUS METALS, WASTE AND SCRAP, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	423	126 182	1 465	29 240	..	..	..	..	1 888	155 422
2001	567	111 033	545	43 243	..	9	..	..	1 112	154 285
2002	693	110 377	861	62 585	22	89	..	..	1 575	173 052
2003	1 272	65 966	867	248 383	88	397	57	104	2 285	314 849
2004	495	67 995	155	350 962	209	6 510	..	327	858	425 794
2005	536	100 476	1 228	431 290	..	547	1	878	1 765	533 190
2006	654	138 353	735	495 522	120	1 571	—	1 298	1 509	636 744
IMPORTS, WASTE AND SCRAP										
2000	11 136	382 878	985	27 020	..	7	40	3 030	12 161	412 935
2001	10 951	447 939	357	45 379	..	5	41	8 332	11 348	501 655
2002	10 323	641 418	2 635	24 947	..	..	2	2 756	12 960	669 121
2003	12 334	717 415	463	3 649	..	96	125	10 539	12 923	731 699
2004	10 956	885 175	1 509	9 066	..	3	318	15 249	12 783	909 493
2005	10 322	750 523	1 892	26 447	..	..	132	11 880	12 347	788 850
2006	12 511	1 391 355	6 158	61 917	1	108	79	3 661	18 749	1 457 041

Source: Statistics Canada.

— Nil; .. Not available.

OECD = Organization for Economic Co-operation and Development.

Notes: Domestic exports data exclude re-exports. There is no precious metals ash and residue in the Trade Retrieval and Aggregate System (Minerals and Mining Statistics Division).

TABLE 12. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE WASTE, SCRAP AND POWDERS, NOT ELSEWHERE SPECIFIED, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE, SCRAP AND POWDERS										
2000	127 804	131 671	47	176 759	2	1 063	10	18 473	127 864	327 965
2001	259 171	197 375	8 655	143 932	2	702	9	12 369	267 837	354 378
2002	108	27 023	17	112 074	3	1 164	7	21 012	135	161 273
2003	152	15 735	22	126 791	4	2 186	8	26 988	186	171 701
2004	11	57 735	22	347 676	2	5 395	11	46 286	46	457 093
2005	9	54 902	27	235 327	3	3 890	9	31 480	48	325 599
2006	1 833	43 780	7 276	205 867	631	8 434	854	29 648	10 594	287 729
IMPORTS, WASTE, SCRAP AND POWDERS										
2000	14 263	30 293	38 848	149 127	8	1 615	73 436	428 065	126 556	609 101
2001	11 107	22 538	43 888	141 757	5	2 175	64 438	320 031	119 438	486 500
2002	26	8 421	43	13 788	5	937	13	1 165	87	24 312
2003	26	6 954	51	13 784	7	1 391	16	3 529	100	25 659
2004	27	14 262	56	40 627	7	576	14	6 877	104	62 342
2005	24	20 452	67	37 442	8	1 421	14	5 081	113	64 397
2006	2 453	25 388	2 099	26 843	113	1 697	313	3 314	4 978	57 242

Source: Statistics Canada.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 13. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE STAINLESS STEEL, WASTE AND SCRAP, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	191 778	57 818	6 636	8 042	744	804	3 579	69 552	202 737	136 217
2001	130 130	43 042	610	845	1 530	1 541	2 381	46 179	134 651	91 608
2002	168 750	76 651	1 460	842	7 480	6 279	2 913	80 849	180 603	164 621
2003	156 292	84 242	1 746	2 291	7 303	7 075	7 118	89 600	172 459	183 209
2004	306 685	212 698	25 951	43 146	7 849	7 389	15 799	271 610	356 284	534 844
2005	408 661	180 823	43 948	82 285	89 226	95 785	24 993	305 919	566 828	664 813
2006	500 098	262 981	132 858	118 447	58 502	126 786	17 073	25 577	708 531	533 791
IMPORTS, WASTE AND SCRAP										
2000	249 699	103 238	325	129	417	441	63	103 328	250 504	207 135
2001	198 259	80 227	597	970	238	259	50	81 243	199 145	162 699
2002	191 023	82 544	1 647	369	292	313	38	82 863	193 000	166 089
2003	212 470	83 566	172	111	307	315	78	83 696	213 026	167 689
2004	427 143	92 316	1 547	592	..	..	2 862	93 342	431 553	186 250
2005	469 420	93 798	3 556	604	..	..	391	94 840	473 366	189 242
2006	499 634	116 803	4 547	985	186	40	3 688	508 054	508 054	625 882

Source: Statistics Canada (no stainless steel ash and residue trade reported by Statistics Canada, 2000-2006).

.. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 14. CANADA, DOMESTIC EXPORTS AND IMPORTS OF RECYCLABLE FERROUS WASTE AND SCRAP, AND SLAG, 2000-2006

To/From	OECD				Non-OECD				Total	
	United States		Other		China		Other		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS, WASTE AND SCRAP										
2000	1 678 623	246 895	829	1 378	27 494	29 233	3 186	2 883	1 710 132	280 389
2001	1 561 591	222 322	2 856	3 191	204 363	44 095	29 213	7 229	1 798 023	276 837
2002	1 602 809	250 058	71 241	8 197	106 224	45 103	171 572	22 664	1 951 846	326 022
2003	2 140 714	363 031	19 620	6 087	223 144	77 577	21 772	4 975	2 405 250	451 670
2004	2 242 350	577 102	35 744	10 282	278 755	98 097	51 971	12 587	2 608 820	698 068
2005	2 338 699	537 483	50 464	6 584	85 523	48 298	35 932	12 935	2 510 618	605 300
2006	2 642 030	640 350	50 868	9 912	84 293	68 081	441 738	68 381	3 218 929	786 724
IMPORTS, WASTE AND SCRAP										
2000	1 064 590	131 262	10 921	1 576	307	23	640	99	1 076 457	132 959
2001	891 447	104 316	3 778	704	214	33	2 327	473	897 766	105 527
2002	1 111 697	143 383	2 143	311	814	104	63 594	11 937	1 178 249	155 735
2003	948 232	125 951	475	224	1 226	229	2 768	424	952 701	126 828
2004	1 125 090	207 502	999	164	333	55	1 549	365	1 127 971	208 086
2005	1 120 379	212 833	1 616	297	4	1	1 836	648	1 123 835	213 778
2006	996 525	192 632	2 119	496	88	96	886	384	999 618	193 609
EXPORTS, SLAG										
2000	681 495	56 084	..	..	..	..	..	..	681 495	56 084
2001	599 212	31 960	..	..	..	..	..	..	599 212	31 960
2002	263 444	11 108	..	..	..	..	..	..	263 444	11 108
2003	593 378	12 969	..	..	2 272	682	..	..	595 650	13 651
2004	371 668	12 881	..	..	..	..	..	..	371 668	12 881
2005	799 392	18 601	..	..	76 502	6 214	7	1	875 901	24 816
2006	684 822	17 201	..	..	..	..	4	1	684 827	17 202
IMPORTS, SLAG										
2000	73 011	5 879	41	10	..	..	19	2	73 072	5 891
2001	90 946	7 671	284	56	..	..	28	3	91 258	7 731
2002	113 896	10 426	670	93	10	2	90	6	114 666	10 527
2003	125 996	9 589	793	105	1	—	1	—	126 790	9 693
2004	165 644	9 375	504	60	..	..	43	13	166 191	9 448
2005	181 446	7 101	3 184	1 248	..	..	79	3	184 709	8 352
2006	176 937	6 000	1 172	47	29	1	10	1	178 147	6 048

Source: Statistics Canada.

— Nil; .. Not available.

OECD = Organization for Economic Co-operation and Development.

Note: Domestic exports data exclude re-exports.

TABLE 15. CANADA. SCRAP STEEL USE AS A PERCENT OF RAW STEEL PRODUCTION, 2000-2006

	Home Scrap		Purchased Scrap		Total Scrap		Steel Production
	(000 t)	(%)	(000 t)	(%)	(000 t)	(%)	
2000	2 440	14.8	6 399	38.8	8 839	53.6	16 496
2001	2 261	14.9	6 093	40.1	8 354	55	15 179
2002	2 276	14.3	6 274	39.4	8 550	53.7	15 907
2003	2 389	15.1	6 221	39.2	8 610	54.3	15 861
2004	2 323	14.3	6 262	38.6	8 585	53	16 202
2005	2 121	13.8	6 245	40.7	8 366	54.6	15 327
2006	2 034	13.2	6 117	39.7	8 151	52.9	15 399

Sources: Statistics Canada (www.statcan.ca/bsolc/english/bsolc?catno=41-019-XWE); Canadian Steel Producers Association (www.canadiansteel.ca).

**TABLE 16. UNITED STATES,
IMPORTS OF ALUMINUM USED
BEVERAGE CONTAINERS FROM
CANADA, 1995-2006**

Year	Tonnes	Kilograms Per Capita
1995	27 246	0.93
1996	26 898	0.91
1997	34 404	1.15
1998	39 310	1.30
1999	41 503	1.37
2000	42 456	1.38
2001	43 290	1.40
2002	40 966	1.31
2003	47 111	1.49
2004	49 396	1.54
2005	55 438	1.72
2006	52 484	1.61

Sources: www.gtis.com for tonnage;
Canadian population data are from Statistics
Canada, www.statcan.ca.

Salt

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BRIEF HISTORICAL FACTS

Human history was shaped by the need for salt. Wars were fought over the possession of salt deposits. Salt bought slaves and at times was traded at twice the value of gold. Armies and civilians required salt to maintain health, preserve meat, and tan leather. Salt became one of the world's first commodities.

Salt (i.e., sodium chloride) is such a common part of our everyday lives that we rarely think of it as a natural resource that must be discovered, boiled/evaporated or mined, processed, marketed, and consumed. Each human being contains about 113 g of salt. Unless we get enough of it, our muscles won't contract, our blood won't circulate, our food won't digest and our hearts won't beat. The same is true for livestock; therefore, salt is important in diets.

The salt markets in developed regions such as North America and Western Europe are mature and expanding at a rate a little below the average growth of the world economy. The main consuming regions are North America, Asia and the Middle East, and Western Europe. World salt consumption is on the rise, mainly in response to increasing demand in Southeast Asia and other developing nations. China is the world's leading producer of synthetic soda ash (source: U.S. Geological Survey [USGS] 2005 salt review), which uses large quantities of salt as feedstock, and many of China's salt operations have not been able to keep up with the strong demand created by the rise in soda ash production. China has had to rely on salt imports from Australia and India to satisfy its supply requirements. Unfortunately, these two nations would not have been able to supply China for long with China's increasing salt demand if not for the recent discovery of a large salt deposit with proven reserves of 14.5 billion t in the Xinjiang Uygur Autonomous Region of northwestern China.

In 2005, total estimated world production (source: USGS) increased to 238 Mt from the revised 229 Mt of the previous year. Salt consumption for chemical uses, particularly chlor-alkali manufacture, can fluctuate depending on the demand for chlorine and co-product sodium hydroxide. Demand for chlorinated bleaching agents has declined while demand for oxygenated bleaching compounds has increased. Most of the other uses of salt (e.g., food processing, water treatment, and industrial uses) tend to follow population trends. Although de-icing salt is not significantly affected by economic events, the quantity of salt consumed for road de-icing each year is directly related to winter weather conditions.

CANADIAN SUMMARY

Canada, like many countries, extracts, processes, consumes, exports and imports salt. Canada has a vast territory with many known deposits and some that are yet to be discovered. Only a few areas are exploited by a small number of companies that are large players in the industry. Most of the salt use is for de-icing, chemical production, and domestic (e.g., table, food-grade, livestock feed) consumption.

Major Canadian salt deposits are found in Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, and Alberta. Since similar geological conditions are necessary for these types of deposits to exist, many salt deposits have been discovered while exploring for oil and gas and potash. In Prince Edward Island, a rock salt deposit of undetermined size was encountered at a depth of over 4200 m under Hillsborough Bay on the southern side of the island. Brine springs, usually indicative of salt deposits, have been found in Newfoundland and Labrador and in British Columbia. Production in most provinces is by two main methods of extraction (i.e., underground room-and-pillar mining and brining). Recovery as a co-product of potash mining is also practised.

Canada's high level of consumption, which at one time was estimated at over 360 kg of salt per person per year (consumption statistics were available until 1987), is due to severe winter conditions in many parts of the country and to the use of road salt to improve winter driving conditions.

Canada (source: USGS 2005 salt review) was the fifth largest producer of salt (Table 3) for the year 2005. Preliminary 2006 data indicate that Canadian salt shipments were valued at \$439.1 million (for 13.3 Mt shipped), a \$7.1 million increase from 2005 (for 13.5 Mt shipped). This 2006 value reflects the cyclical production level from year to year in response to winter conditions. Exports were valued at \$85.5 million (for 4.1 Mt exported), a \$6.8 million increase from 2005 (for 4.0 Mt exported), while imports were valued at \$56.7 million (for almost 1.6 Mt imported), an increase of \$6.7 million from 2005 (for 1.3 Mt imported).

Although salt prices in Canada are not made available, other sources cited further below under "Prices" provide an indication of prices by type and by packaging.

Environmentally, the use of road salt in Canada has been an issue. In April 2004, Environment Canada issued a *Code of Practice for the Environmental Management of Road Salts*. The Code applies to any organization that uses more than 500 t/y of road salts.

TRADE

Salt is a widespread, low-value, bulk commodity. It is relatively easy to extract, and transportation represents a significant proportion of the total delivered price. Many global markets are served by neighbouring countries producing salt; therefore, long-distance trade is limited (Table 1). Nevertheless, even if both Canada and the United States produce salt for their own consumption, some regions on both sides of the border still rely, for economic reasons and convenience of supply, on large quantities of imports and exports with each other.

Preliminary data (Table 1) for 2006 show that Canada exported a total of 4.1 Mt (valued at \$85.5 million), of which 99.9% was exported to the United States (valued at \$85.0 million). This represented a 140 881-t increase from 2005. The export of 4.1 Mt to the United States in 2005 was that country's largest source of salt imports, accounting for about 33% of its total imports (source: USGS). Data for 2006, once released by the USGS, should again confirm this position.

Canada also imports salt. Preliminary data (Table 1) show that Canada imported 1.6 Mt in 2006 (valued at \$56.7 million), mostly from the United States (65.5%) and Mexico (24.5%).

CONSUMPTION

Of the millions of tonnes of dry salt produced annually in North America, a very small percentage finds its way to family dining tables either in commercially processed

foods, in home preparations, or in the salt shaker. Globally, the biggest part of salt produced as brine and dry salt is used in the chemical industry. Directly or indirectly, salt plays a part in the manufacture of a seemingly endless list of chemicals and chemical products. Chemical raw materials represent 60% of world salt consumption, followed by table salt (20%) and road de-icing salt (10%); the remaining 10% is used in animal feed and water treatment.

Consumption patterns differ in North America. On a per-capita basis, Canada is the largest consumer of salt in the world, and this is due mainly to its winter conditions. Most of the salt used as a de-icing agent is consumed in Ontario, Quebec, and Atlantic Canada. The apparent domestic consumption (source: Canadian Salt Institute) is as follows: chemical and de-icing uses account for between 90% and 95%, while the remainder is used for water conditioning, food processing, fisheries, and other industrial uses.

The United States provides consumption details and these could be used to reflect, to a certain degree, the North American consumption of Canadian salt. In 2005, the U.S. distribution of salt (source: USGS) by major end use was for ice control (40%), chemicals (37%), distributors (grocery, other wholesalers and retailers) (7%), general industrial (6%), agricultural (3%), food processing (3%), primary water treatment (2%), and other uses combined with exports (2%).

The U.S. Salt Institute's web site provides an explanation of the many uses of salt. It can be found at www.saltinstitute.org/16.html.

The industrial chemicals industry (source: Natural Resources Canada) consumes salt for the manufacture of chlor-alkali such as caustic soda (sodium hydroxide), chlorine, and sodium chlorate. Salt for caustic soda and chlorine plants (i.e., facilities) in Canada is obtained from on-site brining and natural brines; other plants use mined rock salt or imported solar or evaporated salt. Other industrial chemicals that require significant quantities of salt include sodium bicarbonate, sodium chlorite, sodium hypochlorite, sodium carbonate (soda ash), and calcium chloride. For example, salt goes into the production of chlorine and into the manufacture of soda ash; in turn, these two products are used in the processing or manufacture of a wide variety of end products ranging from rayon, polyester and other synthetics to plastics for explosives, fertilizers, glass, and cosmetics.

Most pulp and paper mills in Canada have carried out extensive process modifications and improvements in effluent treatment. Several have opted to reduce chlorine usage by installing other bleaching processes such as extended lignification, oxygen delignification, sodium chlorate bleaching, integrated chlorine dioxide with hydrochloric acid recycling, and ozone and hydrogen peroxide bleaching processes.

Sodium chloride, or salt, remains the primary highway de-icing agent. Different de-icers are used in accordance with site requirements. Calcium chloride is the second most used de-icer, being effective at temperatures ranging between -10° and -20°C ; this chemical is usually mixed with salt at a 2-4% rate. Growing concerns over the environment and the corrosion of infrastructure, such as bridge decks and parking lots, have led to numerous experiments with de-icing salt substitutes.

PRODUCTION

Canada has abundant salt reserves. The vast Canadian territory has three known major salt formations, all of great area and thickness in economically strategic locations. The largest deposits are in western Canada, followed by Ontario and the Atlantic provinces.

In western Canada, the salt beds extend from the Northwest Territories down through Alberta, Saskatchewan, and into Manitoba. This immense deposit, averaging 122 m (400 ft) in thickness and covering an area of approximately 390 000 km² (150 000 square miles), contains more than one million billion tonnes of salt.

In Ontario, salt is found along the shores of Lake Huron and Lake Erie. This deposit is part of the known Michigan Basin and is a saucer-shaped formation underlying part of Michigan, part of Ohio, and lakes Huron and Erie.

In the Atlantic provinces, large, thick deposits have been found underlying New Brunswick, Nova Scotia, part of Newfoundland and Labrador, and even the Gulf of St. Lawrence. These deposits occurred in various geologic eras and all of them are the remains of ancient inland seas. The shorelines of these ancient seas, which outline the edges of the salt beds, mark the occurrences of the oil, gas and coal deposits that have been found in such abundance in Canada.

Major salt deposits and dry salt production in North America can be viewed on the Internet at www.saltinstitute.org/images/map.pdf.

In 2005 (sources: USGS and Table 3), the top eight salt-producing nations that collectively accounted for 69.8% of total world output of 238 Mt, in descending order of quantity (Mt) produced, were the United States (45.2), China (44.5), Germany (18.7), India (15.5), Canada (13.5), Australia (12.4), Mexico (9.2) and France (7.0). In North America, some 67.9 Mt of salt were produced in 2005: 66.6% by the United States and 19.8% by Canada. The United States was the largest salt-producing nation, representing about 19.0% of total world output. Canada's share was 5.7% of world production, compared to 7.0% in 2003. Canada still has the largest underground mine in North America located in Goderich, Ontario.

Preliminary data for Canada for 2006 (Table 2) show shipments decreasing to 13.3 Mt (85.6% being mined rock, 6.8% being fine vacuum, and 7.6% being brine and salt recovered in chemical operations). Production came from major rock salt mines in Ontario, Quebec, and New Brunswick, and from vacuum pan refineries in Alberta, Saskatchewan, Ontario, New Brunswick, and Nova Scotia. Over three-quarters of this production was rock salt, used primarily for highway de-icing.

Preliminary data also indicate that Canadian salt shipments for 2006 were valued at \$439.1 million (for 13.3 Mt shipped), a \$7.1 million increase from 2005 (for 13.5 Mt shipped). This 2006 value reflects the cyclical production level from year to year in response to winter conditions.

Two major methods are used to obtain salt from Canada's deposits: underground room-and-pillar mining and brining. Recovery as a co-product of potash mining is also practised. The most important Canadian producers are described below (refer also to Table 4).

In Nova Scotia, The Canadian Salt Company Limited operates an underground rock salt mine at Pugwash in Cumberland County. Most of the salt from this mine is used for snow and ice control. The company also operates an evaporated salt plant where saturated brine is fed to a quadruple-effect vacuum pan; the brine solution is evaporated to produce high-quality salt crystals for use in the chemical and food industries.

Sifto Canada Inc.'s (a subsidiary of Compass Minerals Group Inc.) production process in eastern Canada is a brining operation at Amherst, Nova Scotia. Its vapour re-compression process produces an unequaled salt purity in North America and its evaporated salt products are sold for table salt, fisheries, and water conditioning. This operation is one of the newest, most modern evaporation plants on the continent.

In New Brunswick, Potash Corporation of Saskatchewan Inc. (New Brunswick Division) produces potash and salt at its underground mine near Sussex. It extracts salt and sells it mainly to the United States and eastern Canada. It also pumps brine back to the surface for re-use. This brine is produced from the clay slimes, and excess brine slurries from the processing plant are piped underground as backfill where rock salt has been extracted.

In Quebec, Seleine Mines Division (a subsidiary of The Canadian Salt Company Limited, owned by Rohm and Haas Company of Philadelphia, Pennsylvania, United States) is the only operating salt producer. Located on the Magdalen Islands in the Gulf of St. Lawrence, it produces de-icing salt for markets in Quebec and the eastern United States.

Junex, an oil and gas exploration company, discovered a natural brine zone while drilling for gas in Bécancour. In 2001, Junex created Junex Solnat, which operates two natural brine well operations. Its natural brine is sold as a dust control agent for dirt roads (i.e., suppressor) and for ice removal products.

In Ontario, Sifto Canada Inc. operates an underground rock salt mine in Goderich Harbour on the shores of Lake Huron. It also operates an evaporating plant for brine production on the escarpment of the Maitland River. The products serve the home water softeners, packaged icemelts, agricultural salts, food processing, table salts, and industrial salts markets.

More commonly recognized under the leading consumer brand of Windsor, The Canadian Salt Company Limited is headquartered in Pointe-Claire, Quebec. It produces both rock salt from the Ojibway underground mine and vacuum salt from brine wells near Windsor. Salt products include road de-icing salt, and water softening, agricultural, and chemical fine salt.

In Saskatchewan, Sifto Canada Inc. operates a brining operation near Unity for the production of fine vacuum pan salt, which is used for water softening, for agriculture, in food processing, and for the production of some de-icing salt for local use.

The Canadian Salt Company Limited at Belle-Plaine produces evaporated salt from by-product brines sourced from an adjacent potash solution mine operated by The Mosaic Company (an amalgamation of IMC Global Inc. and Cargill Crop Nutrition). Most of the production goes towards water softening; other uses are for agriculture, food processing, and ice control.

NSC Minerals Inc. is a leading supplier of industrial mineral products, specializing in salt mineral crystals. It produces coarse and fine salt products from potash tailings. The head office for NSC Minerals Inc. is located in Saskatoon. It has two modern operating plants with a total daily production capacity in excess of 6000 t located at Rocanville and Vanscoy, Saskatchewan. The Rocanville plant is located in southeastern Saskatchewan near the Manitoba border and the Vanscoy plant is located in central Saskatchewan approximately 20 miles southwest of Saskatoon. Products are used for a variety of applications such as highway de-icing, livestock feed supplements, hide curing, drilling muds, water softening, road stabilization, and industrial applications.

In Alberta, The Canadian Salt Company Limited, at Lindberg, produces fine vacuum pan salt, which is also used for water softening, agriculture, and food processing; the company also produces some de-icing salt for local use.

Other companies known to produce salt (mainly brine) are as follows:

- In Saskatchewan, Mosaic Potash Esterhazy Limited Partnership (formerly IMC Esterhazy Canada Limited Partnership) supplies by-product rock salt from its potash operation at Esterhazy to Kayway Salt, which distributes it locally for road de-icing. Saskatoon Chemicals ("SaskChem," a division of Sterling Chemicals Holdings, Inc.) produces brines from wells near Saskatoon for the manufacture of caustic soda, chlorine, and sodium chlorate to be used internally for its pulp chemicals operations.
- In Alberta, Dow Chemical Canada Inc. at Fort Saskatchewan near Edmonton extracts salt brines for the manufacture of chlor-alkali. Nexen Inc. (formerly Canadian Occidental Petroleum Ltd. [Canadian Oxy Ltd.]) and Albchem Industries Ltd. operate solution mines near Bruderheim. They produce sodium chlorate using feed from the large and very pure Upper Lotsberg salt deposit. Their product is mostly used for pulp bleaching in the Prairie provinces and western Canada. Ward Chemical Inc. produces calcium chloride from its natural source brine at Calling Lake.

METHODS OF RECOVERY

The type of salt produced is a function of geology, geography, and climate. Large rock salt deposits occur in central and eastern North America and Europe, as well as in large areas in the Middle East. Solar evaporation accounts for the bulk of production in Australia, Mexico, Chile, the western United States, China, India, and Brazil where the climate is suitable.

Rock Salt Mining

Rock salt is mined by the room-and-pillar method. The pillar widths are controlled by the percentage of extraction permissible at the various depths and room widths. Most room-and-pillar operations recover about 45-65% of the resource, with the remainder left behind as pillar supports for the structural integrity of the mine. The salt is drilled, cut, blasted, mucked, crushed, and transported to the surface for processing, which usually involves removing the impurities and screening the material to finer-size fractions. The mining of bedded deposits usually involves roof bolting haulageways and permanent work areas.

Underground mining practices for bedded halite (commonly referred to as "rock salt") and domal salt formations are similar except for the height differences within the mines of the two types of operations. For example, bedded formations usually are laterally extensive, but are vertically restricted. Salt domes are laterally restrictive, but are vertically extensive. Many salt domes have depths in excess of 6100 m (20 000 feet), yet many outcrop at the surface. Most Gulf Coast salt mining operations are generally less than 300 m (1000 ft) below the surface. Working at

increasing depths is difficult because of higher temperatures and denser rocks.

Salt domes are large cylindrical bodies that have been thrust up from buried deposits of rock salt through underlying layers of sediments by static pressure. Salt domes have been penetrated during exploration drilling for oil in Germany, Russia, Romania, the Persian Gulf region, and in the Gulf Coast district of the United States where several hundred salt domes are known to exist. In Canada, salt domes are believed to exist on a few of the Arctic Islands. The Seleine Mines operation on the Magdalen Islands in the Gulf of St. Lawrence, Quebec, is a salt dome.

The advantages of rock salt mining, when compared to solution or evaporation methods, are that rock salt can generally be produced at a lower cost, a wider range of sizes is possible, and the production rate is higher. The production size ranges from -16 mm to -3 mm. The chief disadvantage is the purity of salt produced, which varies from 95 to 98% NaCl.

Solution Mining

In solution mining, holes are drilled into deep salt deposits, an injection well is sunk, and pressurized freshwater is introduced to hydraulically fracture and dissolve the bedded salt. Once communication with the production well is established, the brine is pumped to the surface for treatment. Every two years, a sonar log is performed to verify the cavity size and to correct any discrepancies with the simulated model. By controlling the quality of the water being injected into the well and the area being brined, the resultant brine is of the highest purity possible.

Solution mining is used to obtain a sodium chloride feedstock for vacuum pan salt production and for chlorine, caustic soda, and synthetic soda ash manufacture. The quantity of underground salt dissolved and recovered as brine to make vacuum pan salt usually is not reported. Only the quantity of vacuum pan salt manufactured is reported as primary salt production. The quantity of brine used to make chlor-alkali chemicals is reported as either the amount of captive brine used or brine sold. The chemical industry is the largest consumer of salt brine in the world.

Processing Rock Salt

Crushing and screening to the proper physical size is usually the only processing that road salt undergoes. In many operations, these steps are done underground in the mine to minimize haulage and storage costs. In addition, the extremely fine fraction, which often is unusable and would represent a waste product if brought to the surface, remains underground.

An exception to this procedure is the use of colour sorting and the thermo-adhesive process to upgrade bedded rock

salt products from an average sodium chloride content of 97% to a product with a content higher than 99.0%. The colour sorter measures the translucence of salt and uses a jet of compressed air to separate salt from waste. The thermo-adhesive process depends on the absorption of light by dark-heated particles of anhydrite, shale, and dolomite.

The purest grades of commercial salt are produced by the treatment of fine crystal, 1.7-mm rock salt in a recrystallizer. The fine granular rock salt is dissolved in high-temperature brine in the production of a very pure hot brine. The salt produced by the recrystallizer may be as pure as 99.99% NaCl. Salt is produced in the evaporator by flash evaporation and by cooling.

Standard means for producing granulated salt for human consumption are by either the enclosed vacuum pan or open-pan methods.

Solar Salt

Salt can be obtained from seawater along coastal margins and from landlocked bodies of natural saline water and artificial brines. Salt production uses the wind and the sun to evaporate the water, leaving behind relatively pure crystals of salt. Solar salt production is restricted to areas of the world that have high evaporation rates and low precipitation.

Mechanical Evaporation

Vacuum pan salt is produced using mechanical evaporation technology. Although rock salt and salt brine may be used to make vacuum pan salt, virtually all domestic vacuum pan salt is obtained from solution mining underground salt formations. Vacuum pan salt is obtained by dehydrating brine using heat alone or in combination with a vacuum. The vacuum pan process conserves energy by utilizing multiple-effect evaporators connected to vacuum pumps. A saturated salt solution will boil at a higher temperature than pure water. When a vacuum is applied, the brine boils at a lower temperature, enabling the superheated vapour that is generated to act as the heating medium for the next evaporator.

The grainer or open-pan process uses open rectangular pans with steam-heated immersion coils to evaporate the water in the brine. Rotating rakes scrape the salt precipitate into a sump or up a ramp, depending on the method, and onto conveyors for debrining and drying treatment. The final product is usually flake-shaped rather than the typical cubic form. Flake salt is preferred for the production of cheese, butter, and baked goods.

The Alberger process is a modified grainer operation that produces cubic salt with some flake salt. The pans are shallow, circular units with external heating units, rather than heating coils. The open-pan process cannot be operated

successfully in regions with high humidity because the evaporation rate is too slow and more energy is required to evaporate the brine.

APPLICATIONS

The direct and indirect uses of salt number about 14 000, according to industry sources.

Aside from the different types of salt, there are various distinctions in the packaging and applications of salt. Salt for human consumption is packaged in different-sized containers for several specialized purposes. Table salt may contain 0.01% potassium iodide as an additive, which provides a source of iodine that is essential to the oxidation processes in the body. Kosher salt, sea salt, condiment salt, and salt tablets are special varieties of salt.

Water conditioning salt and animal feed salt are made into 22.7-kg (50-lb) pressed blocks, among other sizes. Sulphur, iodine, trace elements, and vitamins are occasionally added to salt blocks to provide nutrients not found naturally in the diet of certain livestock. Salt is also compressed into pellets that are used for water conditioning.

Chemical Uses

Within the chemical industry, which is a heavy consumer, if not the largest consumer, of salt brine, the chlor-alkali sector remains the major consumer of salt for manufacturing chlorine, co-product sodium hydroxide, and synthetic soda ash. Salt is used as the primary raw material in chlorine manufacture because it is an inexpensive and widely available source of chlorine ions. Salt is also used as feedstock in chemical establishments that make sodium chlorate and metallic sodium, and in other downstream chemical operations. For example, in powdered soaps and detergents, salt is used as a bulking agent and as a coagulant for colloidal dispersion after saponification; in pharmaceuticals, salt is a chemical reagent and is used as the electrolyte in saline solutions.

Ice Control and Road Stabilization

The second largest or largest end use of salt (in the United States and Canada, respectively) is for highway de-icing. Rock salt applied to snow or ice forms a brine and prevents water from freezing into ice and bonding with the road surface, thus causing the snow and ice to melt. Salt is an inexpensive, widely available, and effective ice control agent. It does, however, become less effective as the temperature decreases below about -7° to -10°C. At lower temperatures, more salt would have to be applied to maintain a higher brine concentration in order to provide the same degree of melting.

Salt is also added to stabilize the soil and to provide firmness to the foundation on which highways are built, particularly for stabilizing clay and sand and gravel aggregate used in the base of primary roads and in the surface of secondary roads. Finer grades of salt are generally used in most road-stabilizing programs. The salt acts to minimize the effects of shifting caused in the subsurface by changes in humidity and traffic load.

Distributors

A tremendous amount of salt is marketed through various distributors, some of which specialize in markets such as agricultural and water treatment services, two sectors where the salt companies also have direct sales.

General Industrial Uses

The industrial uses of salt are diverse. They include, in descending order, oil and gas exploration, other industrial applications, textiles and dyeing, metal processing, pulp and paper, tanning and leather treatment, and rubber manufacture.

In oil and gas exploration, salt is an important component of drilling fluids in well drilling. It is used to coagulate and increase the density of the drilling fluid to overcome high down-well gas pressures. Wherever a drill hits a salt formation, salt is added to the drilling fluid to saturate the solution and to minimize the dissolution within the salt stratum. Salt is also used to increase the set rate of concrete.

In textiles and dyeing, salt is used as a brine rinse to separate organic contaminants, to promote “salting out” of dye-stuff precipitates, and to blend with concentrated dyes to standardize them. One of its main roles is to provide the positive ion charge to promote the absorption of negatively charged ions of dyes.

In metal processing, salt is used in concentrating uranium ore into uranium oxide (yellow cake). It is also used in processing aluminum, beryllium, copper, steel, and vanadium.

In the pulp and paper industry, salt is used to bleach wood pulp. It is also used to make sodium chlorate, which is added along with sulphuric acid and water to manufacture chlorine dioxide, an excellent oxygen-based bleaching chemical.

In tanning and leather treatment, salt is added to animal hides to inhibit microbial activity on the underside of the hides and to replace some of the moisture in the hides.

In rubber manufacture, salt is used to make styrene-butadiene rubber, neoprene, and white types. Salt brine and

sulphuric acid are used to coagulate and emulsify latex made from chlorinated butadiene.

Agricultural Industry

Wild animals satisfy their salt hunger by locating salt springs, salt licks, or playa lake salt crusts. Barnyard and grazing livestock need supplementary salt rations to maintain proper nutrition. Veterinarians advocate adding loose salt in commercially mixed feed or in block forms sold to farmers and ranchers because salt acts as an excellent carrier for trace elements not found in the vegetation consumed by grazing livestock; selenium, sulphur, and other essential elements are commonly added to salt licks or salt blocks for free-choice feeding.

Food Processing

Every person uses some quantity of salt in their food. The salt is added to the food by the food processor or by the consumer through free choice as a flavour enhancer, preservative, binder, fermentation-control additive, texture-control agent, and colour developer. This major category is subdivided, in descending order of salt consumption, into other food-processing categories such as meat packing, canning, baking, dairy, and grain mill products.

In meat packing, salt is added to processed meats to promote colour development in bacon, ham, and other processed meat products. As a preservative, salt inhibits the growth of bacteria that would lead to spoilage of the product. Salt acts as a binder in sausage to form a binding gel composed of meat, fat, and moisture. Salt also acts as a flavour enhancer and a tenderizer.

In the dairy industry, salt is added to cheese as a fermentation-control agent and as a colour- and texture-control agent. The dairy sub-sector includes companies that manufacture creamery butter, natural and processed cheese, condensed and evaporated milk, ice cream, frozen desserts, and specialty dairy products.

In canning, salt is primarily added as a flavour enhancer and preservative. It is also used as a dehydrating agent, tenderizer, enzyme inhibitor, and carrier for other ingredients.

In baking, salt is added to control the rate of fermentation in bread dough. It is also used to strengthen the gluten (the ergastic protein-water complex in certain doughs) and as a flavour enhancer, such as a topping on baked goods.

The food-processing category also contains grain mill products, which consist of milling flour and rice, and manufacturing cereal breakfast food and blended or prepared flour.

In the “other food processing” category, salt is used mainly as a seasoning agent. Other food processing includes miscellaneous establishments that make food for human consumption (such as potato chips and pretzels) and for domestic pet consumption (such as cat and dog food).

Water Treatment

Many areas have hard water, which contains excessive calcium and magnesium ions that contribute to the build-up of a scale or film of alkaline mineral deposits in household and industrial equipment. Commercial and residential water-softening units use ion exchange resin that is supersaturated with sodium ions to remove the calcium and magnesium ions that cause the hardness. Periodically, the water-softening units must be recharged because the sodium ions become depleted. Salt is added and dissolved, and the brine replenishes the lost sodium ions.

PRICES

Salt has unique production, processing, and packaging factors that determine its selling price. The price of salt depends on the type of salt, location, product form, and type of sale. Generally, salt sold in bulk is less expensive than salt that has been packaged, pelletized, or pressed into blocks. Salt in brine is the least expensive salt form because mining and processing costs are less. Vacuum pan salt is the most expensive because of the higher energy costs involved in processing it and the purity of the product.

Due to the unavailability of prices from Canada’s salt industry, the following price examples from other sources are provided. The June 2007 edition of *Industrial Minerals* (IM) magazine reported that salt prices (ground rock salt, 15-20 short ton lots, average price delivered U.K.) were in the range of £20-£30 (converted: C\$42.75-\$64.15). As the last basis of price breakdown comparison (source: USGS) for the North American market, 2002 average prices (net selling value, free on board plant, excluding container costs, U.S. dollars per tonne) are as follows: bulk (vacuum pan and open pans, \$58.12; rock, \$20.10; brine, \$5.89); compressed pellets (vacuum pan and open pans, \$134.61; rock, n.a.; brine, n.a.); packaged (vacuum pan and open pans, \$135.39; rock, \$70.62; brine, n.a.); and pressed blocks (vacuum pan and open pans, \$107.18; rock, \$101.81; brine, n.a.).

Canadian producers and others are well aware of the globalization factor affecting prices. A slight difference in price can result in usual orders made in previous years being lost to a foreign competitor.

HEALTH/ENVIRONMENTAL ISSUES

Health Concerns

In Canada, the Workplace Hazardous Materials Information System (WHMIS) (see www.hc-sc.gc.ca/hecs-sesc/whmis) is Canada's hazard communication standard. WHMIS is implemented through coordinated federal, provincial, and territorial legislation for working environments.

Each human being contains about 113 g of salt and, unless we get enough of it in our diet, our muscles won't contract, our blood won't circulate, our food won't digest and our hearts won't beat. Therefore, reasonable consumption of salt is necessary for life. Although dietary intake can vary for people from various countries, on average, an adult's total salt intake should be no more than 6 g per day and a child's no more than 4 g. But the average person's diet incorporates at least 9 g per day. Dietary sodium is measured in milligrams (mg). The most common form of sodium used is table salt, which is 40% sodium. One teaspoon of table salt contains 2300 mg of sodium.

As mentioned above in the section on food processing, salt is added for many applications. Food packaging labels only state part of the amount of sodium in food. This only makes up part of the total salt content as salt contains both sodium and chloride. Sodium is shown in fractions per 100 g of food. You need to multiply the amount of sodium per 100 g by two and a half in order to get the total salt content. In other words, 1g of sodium is the same as 2.5 g of salt. Health and heart organizations recommend that people should aim to get their salt intake to less than 5 g per day, which is 2 g of sodium. This is the same as about a teaspoonful. As a simple guide, people should avoid consuming on a regular basis foods with a packaging content that contains more than 0.2 g of sodium per 100 g, and choose ones that contain less than 0.1 g of sodium per 100 g.

Environmental Concerns

The effects of salt-spreading on the environment depend on a variety of factors such as weather conditions, road characteristics, traffic loads, winter maintenance methods, and local topography. Environmental effects may include adverse impacts on plant growth and crop productivity in the immediate vicinity of highways, as well as higher salinity levels in streams and groundwater systems. Because of its low price, de-icing salt is the favoured de-icing agent. The optimization of spreading rates and methods to avoid dispersion at the time of spreading, in combination with the search for adequate abrasive mixtures, continues to be evaluated. For many years, provincial/territorial and regional agencies in charge of road maintenance have pursued the objective of optimizing the use and selection of ice and snow control methods. Cost, operational reliability, public safety, and environmental issues must be considered,

and these agencies will continue to evaluate improvements to existing methods and better road safety and rideability.

Although the benefits of de-icing agents were recognized by the Environment Minister's Expert Advisory Panel on the Second Priority Substances List, the Panel recommended that they be assessed for potential impact on the environment but that "any measures developed as a result of the assessment must never compromise human safety." The overall conclusion of Environment Canada's *Canadian Environmental Protection Act, 1999* (CEPA 1999) report entitled *Priority Substances List Assessment Report – Road Salts* is as follows: "Based on the available data . . . road salts that contain inorganic chloride salts with or without ferrocyanide salts be considered 'CEPA toxic' . . . as defined under paragraphs 64(a) and (b) of CEPA 1999."

A working group that includes representatives of governments, industry, and environmental groups met three times in 2002 to discuss best practices for the application, storage, and disposal of road salt, and to develop a guideline under CEPA 1999. In April 2004, Environment Canada issued a *Code of Practice for the Environmental Management of Road Salts*. The Code applies to any organization that uses more than 500 t of road salts per year. These organizations have to prepare and implement a salt management plan that contains best management practices to protect the environment from the negative impacts of road salts. Environment Canada will review the effectiveness of the Code after five years and decide whether further steps are needed to protect the environment. The salt industry hopes that the Code is effective and that Environment Canada does not act on a recommendation that road salts be added to Canada's list of toxic substances.

Although evidence of environmental loading of salt has been found during peak usage (as surface runoff, vehicle spraying, and windblown actions), which affects soil, roadside vegetation, and local surface water and ground water, the spring rains and thaws usually dilute the concentrations of sodium in the area where salt is applied. In highway de-icing, salt has been associated with the corrosion of bridge decks, motor vehicles, reinforcement bar and wire, and unprotected steel structures used in road construction.

Concerns and distrust by environmental groups and citizens are legitimate, and expectations regarding how their tax dollars are being well spent on the proper material utilized are justifiable. Those promoting alternative products have claimed superiority in terms of corrosion reduction and lessened impacts on the environment, arguing that salt's adverse environmental and infrastructure impacts outweigh the higher costs of alternative products. Notwithstanding the above directions/actions taken with the Code of Practice, studies and analysis are finally coming out in reports on the evaluation results of the effects of other alternative/substitute materials. In May 2007, the US Transportation Research Board published a new set of research-based *Guidelines for the Selection of Snow and Ice Control*

Materials to Mitigate Environmental Impacts. This article is based on the U.S. National Cooperative Highway Research Program (NCHRP) Report 577, available on the Internet at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_577.pdf.

Report 577 examined all de-icers being used, 42 in total, including sodium chloride, calcium chloride, magnesium chloride, calcium magnesium acetate, potassium acetate, organic matter from biomass, and abrasives (the latter, of course, not a de-icer, but sometimes used as an alternative to using a de-icer). The report also examined application amounts, exposure pathways, chemical-specific impacts, and site-specific characteristics, among many other considerations like areas of greatest environmental concern (water quality, aquatic life, air quality, vegetation impacts). A brief summary of this report is available on the Salt Institute's web site at www.saltinstitute.org/publications/shd/shd-spring-2007.pdf.

Overall, communities that have been restive with the choice of sodium chloride as its primary de-icer when examining options and community priorities should not consider salt

as a bad investment since, among the findings, non-chloride de-icers have superior corrosion rates to chlorides for some metals, but worse for others, and salt had an edge among the alternatives.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmty/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2501.00	Salt (including table salt and denatured salt) and pure sodium chloride, whether or not in aqueous solution or containing added anti-caking or free-flowing agents; sea water	Free-2.5%	Free	Free	Free	Free-£2.6/1000 kg	Free

Sources: Canadian *Customs Tariff*, effective January 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2007; *Official Journal of the European Union* (October 17, 2006 Edition); *Customs Tariff Schedules of Japan*, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, SALT SHIPMENTS AND TRADE, 2004-06

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
SHIPMENTS						
By type						
Fine vacuum salt	923 924	96 468	925 437	101 238	900 988	102 163
Mined rock salt	12 000 704	329 069	11 404 899	323 142	11 416 991	326 741
Salt content of brines used or shipped	1 171 660	7 105	1 132 689	7 640	1 019 688	10 230
Total	14 096 288	432 642	13 463 025	432 020	13 337 667	439 134
By province						
Nova Scotia	x	x	x	x	x	x
New Brunswick	x	x	x	x	x	x
Quebec	x	x	x	x	x	x
Ontario	8 713 084	256 123	8 402 888	257 682	8 257 815	259 936
Manitoba	x	x	x	x	x	x
Saskatchewan	1 134 219	45 870	1 120 859	48 035	1 131 635	47 456
Alberta	1 199 778	18 519	1 132 816	18 041	1 016 036	21 272
Total	14 096 288	432 642	13 463 025	432 020	13 337 667	439 134
EXPORTS (1)						
2501.00	Salt (including table salt and natural salt) and pure sodium chloride whether or not in aqueous solution or containing added anti-caking or free-flowing agents; sea water					
United States	4 242 994	83 101	3 979 355	78 244	4 120 677	84 974
Barbados	1 037	131	969	118	912	115
Costa Rica	37	6	1 283	72	418	97
France	989	127	1 195	141	566	94
Belgium	—	—	—	—	183	38
Spain	22	3	44	6	129	37
Jamaica	41	6	40	14	149	30
Philippines	—	—	52	10	104	28
South Korea	892	22	82	13	132	27
Saint Kitts and Nevis	253	27	174	32	96	19
Dominica	—	—	—	—	184	16
New Zealand	2	...	—	—	195	11
Austria	—	—	—	—	39	11
Iceland	—	—	—	—	51	10
Saint Pierre and Miquelon	527	71	99	8	777	6
Hong Kong	—	—	52	8	18	5
Antigua and Barbuda	22	3	6	...	84	3
Germany	1	...	361	12	40	3
Singapore	—	—	23	4	13	3
Cuba	—	—	2	1	9	2
Netherlands Antilles	..	...	1	...	136	2
Bermuda	2	1	22	1	3	1
Israel	1	...	—	—	3	1
Colombia	2	...	2	...	..	...
Cayman Islands	—	—	—	—	1	...
Bahamas	—	—	—	—	1	...
Turks and Caicos Islands	—	—	1	...	..	...
Guatemala	2	...	2	...	..	...
United Kingdom	9	1	—	—	..	...
India	—	—	—	—	1	...
Saint Lucia	—	—	56	...	4	...
Jordan	—	—	—	—	..	...
United Arab Emirates	—	—	—	—	1	...
Suriname	1	...	—	—	—	—
Taiwan	200	3	—	—	—	—
Belarus	—	—	42	6	—	—
French Southern Territories	1	...	—	—	—	—
Italy	—	—	1	...	—	—
Netherlands	—	—	..	...	—	—
Peru	—	—	..	...	—	—
Australia	—	—	142	22	—	—
Uruguay	..	...	..	...	—	—
Trinidad and Tobago	21	2	—	—	—	—
Tanzania	1	...	—	—	—	—
Venezuela	—	—	..	...	—	—
Virgin Islands	—	—	..	...	—	—

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)						
Senegal	202	13	38	6	—	—
Panama	1	...	—	—	—	—
Malta	1	...	—	—	—	—
Haiti	1	...	—	—	—	—
Greenland	80	2	—	—	—	—
Greece	1	...	1	...	—	—
Anguilla	1	...	—	—	—	—
Brazil	..	...	—	—	—	—
Argentina	..	...	—	—	—	—
Total exports	4 247 344	83 519	3 984 045	78 718	4 124 926	85 533
IMPORTS (1)						
2501.00	Salt					
United States	1 622 162	40 149	856 258	38 636	1 066 522	41 154
Mexico	405 913	6 320	348 366	4 773	398 666	6 513
France	29 333	1 293	4 406	2 292	25 757	2 573
Brazil	300	31	2 027	10	37 502	1 779
Chile	1	...	27 443	1 058	70 839	995
Bahamas	22 467	584	25 421	716	16 816	577
Ireland	4 299	394	4	243	14	525
Greece	1 382	201	214	208	404	345
Italy	2 218	112	2 351	224	1 405	321
Pakistan	1 064	84	1 174	170	890	296
Israel	1 636	208	1 283	223	1 545	288
South Korea	1 403	174	611	123	1 858	235
China	16 198	199	4 223	157	2 406	196
Austria	10 639	91	44	127	57	144
United Kingdom	2 245	95	1 021	103	291	144
Germany	5 925	163	1 726	386	69	100
Portugal	2 130	98	8 541	120	763	95
Netherlands	77	13	5 510	34	155	68
India	772	63	630	35	1 010	49
Canada	368	22	165	11	1 133	48
Belgium	12 503	132	79	46	26	41
Spain	16	21	1 102	46	20	40
Singapore	60	4	2	7	2	32
Indonesia	150	1	108	18	32	28
Slovenia	26	10	122	17	58	21
South Africa	293	45	203	32	234	20
Madagascar	168	8	3	...	11	18
Australia	232	41	15	22	2	18
Norway	—	—	—	—	33	11
Japan	171	17	192	62	107	9
Turkey	2	1	...	1	20	8
Poland	71	2	157	3	187	8
Hong Kong	485	7	17	4	11	7
Jordan	12	5	2	2	5	5
Iceland	..	1	9	3	10	4
Switzerland	2 878	3	..	1	3	4
Thailand	3	3	8	2	105	3
New Zealand	246	40	555	18	1	3
Taiwan	388	7	101	10	71	2
Colombia	—	—	—	—	2	2
Iran	—	—	...	...	5	1
Bolivia	—	—	—	—	..	1
Vietnam	3	1	32	...	22	1
Cyprus	—	—	—	—	..	1
Croatia	3	1	3	1	3	1
Peru	—	—	—	—	4	1
Sri Lanka	2	...	17	1	16	1
Ukraine	—	—	—	—	1	...
Paraguay	1	...	7	...	1	...
Nigeria	—	—	—	—	..	...
Morocco	—	—	—	—	1	...
Egypt	—	—	—	—	..	...
Cuba	3	...	—	—	...	...
Fiji	—	—	2	...	...	...
Jamaica	1	...	4	1	1	...
Sweden	—	—	..	...	..	...
Ghana	..	...	220	...	...	...
Finland	..	...	116	...	1	...
Bosnia-Herzegovina	—	—	..	...	..	...

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)						
Trinidad and Tobago	...	...	—	—	...	...
Denmark	—	—	13	22	..	...
Haiti	—	—	..	1	9	...
Russia	—	—	176	62	...	...
Bulgaria	—	—	—	—	..	...
Czech Republic	..	...	—	—	..	...
Sudan	—	—	—	—	...	...
Cameroon	—	—	1	...	—	—
Guatemala	3	...	—	—	—	—
Lebanon	—	—	...	...	—	—
Malaysia	—	—	..	...	—	—
Greenland	292	8	17	14	—	—
United Arab Emirates	—	—	300	...	—	—
El Salvador	1	...	—	—	—	—
Macao	...	...	—	—	—	—
Nepal	119	3	—	—	—	—
Niger	7	15	—	—	—	—
Papua New Guinea	1	1	—	—	—	—
Argentina	1	1	—	—	—	—
Serbia and Montenegro	1	1	—	—	—	—
Philippines	...	...	—	—	—	—
Total imports	2 148 674	50 673	1 295 001	50 045	1 629 106	56 736
By province or territory of clearance						
Newfoundland and Labrador	15 467	485	19 453	680	59 127	1 102
Prince Edward Island	—	—	—	—	—	—
Nova Scotia	7 002	103	6 007	74	...	3
New Brunswick	323	14	127	79	172	93
Quebec	89 878	3 455	104 884	6 398	169 490	7 636
Ontario	1 482 512	34 637	697 525	32 136	894 081	34 459
Manitoba	5 688	628	2 955	681	4 272	655
Saskatchewan	4 634	310	2 038	433	5 850	604
Alberta	11 407	1 114	17 599	1 285	8 920	1 206
British Columbia	531 763	9 923	444 412	8 278	487 192	10 982
Yukon	—	—	—	—	..	...
Northwest Territories	—	—	—	—	—	—
Nunavut	—	—	—	—	—	—
Total	2 148 674	50 670	1 294 999	50 046	1 629 105	56 741

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; ... Amount too small to be expressed; (p) Preliminary; x Confidential.

(1) Includes table salt, pure sodium chloride, and seawater salt.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, SALT SHIPMENTS AND TRADE, HISTORICAL, SALT AND SODIUM COMPOUNDS, 1988-2006

	Producers' Shipments			Total	Imports	Exports
	Mined Rock	Fine Vacuum	In Brine and Recovered in Chemical Operations			
(tonnes)						
1988	7 126 762	783 368	2 777 050	10 687 180	1 202 220	3 030 124
1989	7 548 732	821 284	2 788 395	11 158 411	2 360 433	2 137 321
1990	7 704 499	778 428	2 708 458	11 191 385	2 095 324	1 897 816
1991	8 615 755	799 563	2 455 541	11 870 859	1 202 879	2 783 021
1992	7 912 989	770 370	2 404 667	11 088 026	1 041 424	2 650 921
1993	8 073 435	817 859	2 101 711	10 993 005	1 051 029	3 079 298
1994	9 446 002	822 181	1 975 704	12 243 887	940 130	3 638 674
1995	8 077 661	850 676	2 029 047	10 957 384	1 294 994	2 986 802
1996	9 499 189	853 858	1 895 430	12 248 477	1 137 603	3 816 788
1997	10 923 966	863 112	1 709 778	13 496 856	1 262 836	3 634 009
1998	10 517 641	834 944	1 681 710	13 034 295	977 943	4 177 880
1999	10 004 167	823 983	1 857 745	12 685 895	1 375 143	3 808 093
2000	9 458 260	827 630	1 878 179	12 164 069	1 141 063	3 475 755
2001	11 528 499	844 719	1 351 761	13 724 979	1 644 424	4 616 739
2002	10 581 246	870 370	1 284 861	12 736 477	1 375 136	3 689 799
2003	11 739 364	905 096	1 073 362	13 717 822	969 125	4 196 741
2004	12 000 704	923 924	1 171 660	14 096 288	2 148 674	4 247 344
2005	11 404 899	925 437	1 132 689	13 463 025	1 294 999	3 984 045
2006 (p)	11 416 991	900 988	1 019 688	13 337 667	1 629 105	4 124 926

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

TABLE 3. WORLD SALT PRODUCTION, 1996-2005

	1996	1997	1998	1999	2000 (r)	2001 (r)	2002 (r)	2003 (r)	2004 (r)	2005 (p)
	(000 tonnes)									
United States (1)	42 300	41 500	41 300	45 000	45 600	44 800	40 300	43 700	46 500	45 200
China	29 035	30 830	22 420	28 124	31 280	34 105	36 024	32 424	37 101	44 547
Germany	15 907	15 787	15 700	15 700	15 700	14 343	15 632	16 299	18 696	18 700
India	14 466	14 251	11 964	14 453	14 453	14 503	14 503	15 003	15 000	15 500
Canada (2)	12 248	13 264	13 296	12 686	12 164	13 725	12 736	13 718	14 096	13 463
Australia	7 905	8 801	(r) 9 033	(r) 9 888	8 778	9 536	9 887	9 800	11 221	12 384
Mexico	8 508	7 933	8 412	8 236	8 884	8 501	7 802	7 547	8 566	9 242
France	7 860	7 085	7 000	7 000	7 000	7 000	7 000	7 000	7 000	7 000
Brazil	5 384	6 516	6 837	5 958	6 074	5 578	6 109	6 564	6 648	6 660
United Kingdom	6 610	6 600	6 600	5 800	5 800	5 800	5 800	5 800	5 800	5 800
Italy	3 541	3 510	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600
Spain	4 000	4 000	3 500	3 200	3 200	3 200	3 200	3 200	3 200	3 200
Russia	2 100	2 100	2 200	3 200	3 200	2 800	2 800	2 800	2 800	2 800
Ukraine	2 800	2 500	2 500	2 185	2 287	2 300	2 300	2 300	2 300	2 300
Other countries	178 687	183 867	174 004	84 123	86 580	89 009	44 307	48 245	46 472	47 604
Total	204 000	207 000	200 000	207 000	209 000	214 000	212 000	218 000	229 000	238 000

Sources: Natural Resources Canada; U.S. Geological Survey.

(p) Preliminary; (r) Revised.

(1) Excludes Puerto Rico. (2) The U.S. Geological Survey is the source for all data, excluding data for Canada, for which the source is Natural Resources Canada.

Note: Numbers may not add to totals due to rounding.

TABLE 4. CANADIAN SALT PRODUCERS, 2005 AND 2006

Company	Location/ Initial Production	Mill/Plant Capacity	Remarks
		(t/d)	
ERCO Worldwide	Hargrave Facility, Man./2002	65 t/y	Brining to produce sodium chlorate
	Bruderheim, Alta./1991	129	Brining to produce sodium chlorate (salt brine)
Nexen Chemicals Canada Limited Partnership	Bruderheim, Alta./1991	100	Brining to produce sodium chlorate (salt brine)
Canadian Salt Company Limited, The	Pugwash, N.S./1959	7 800	(Rock salt)
	Pugwash, N.S./1963	7 800	Brine made from mined rock salt used to produce fine evaporated salt (rock salt)
	Mine Seleine, Iles-de-la-Madeleine, Que./1982	4 800	(Rock salt)
	Ojibway, Ont./1955	10 500	Salt graded and prepared for markets (rock salt)
	Windsor, Ont./1892	710	Evaporated salt
	Belle-Plaine, Sask./1969	726	Plant uses sodium chloride brines produced at the nearby potash solution mine of IMC Kalium Canada Ltd. (evaporated salt)
	Lindbergh, Alta./1968	400	Produces coarse and fine salt (evaporated salt)
Dow Chemical Canada Inc.	Fort Saskatchewan, Alta./1967	3 500	Brining to produce caustic soda and chlorine (salt brine)
The Mosaic Company (an amalgamation of IMC Global Inc. and Cargill Crop Nutrition)	K1 and K2 mine, Esterhazy, Sask./1962	180 t/y	By-product rock salt from potash mine (standard, coarse and granular grades)
Junex Inc.	Bécancour, Que.	..	Natural brine for de-icing and dust control
NSC Minerals Inc.	Rocanville, Sask./1990	200 t/y	Produces coarse and fine products (rock salt)
	Vanscoy, Sask./1988	300 t/y	Produces coarse and fine products (rock salt)
Potash Corporation of Saskatchewan Inc.	Sussex, N.B./1983	700	Three grades of muriate of potash (KCl) are produced from a flotation circuit and a crystallizer circuit (salt)
Sterling Pulp Chemicals (Sask) Ltd.	Saskatoon, Sask./1979	130	Primarily a manufacturer of pulp and water treatment chemicals; brining to produce caustic soda, chlorine and sodium chlorate
Sifto Canada Corp.	Amherst, N.S./1947	310	Brining for vacuum pan evaporation (evaporated salt)
	Goderich, Ont./1959	20 000	Rock salt mining
	Goderich, Ont./1872	500	Brining for vacuum pan evaporation (evaporated salt)
	Unity, Sask./1949	454	Brining for vacuum pan evaporation (evaporated salt)
Ward Chemical Inc.	Edmonton, Alta.	1 300	Calcium chloride

Source: Natural Resources Canada, company surveys.

.. Not available.

Silica/Quartz

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Quartz (i.e., SiO_2 , also referred to as silicon dioxide or silica) is one of the most common minerals on the face of the earth with numerous uses. It is produced and consumed in most countries. Annual world production of silica is estimated at 120-150 Mt.

Quartz is not the only mineral composed of SiO_2 . There are eight other known structures composed of SiO_2 . They are polymorphs of silicon dioxide and belong to an informal group called the Quartz Group or Silica Group.

SUMMARY

In Canada, silica is recovered in: a) lump form for use as metallurgical flux and in the manufacture of silicon and ferrosilicon alloys; b) as sand for glass and glass fibre manufacture, foundry moulding, silicate chemicals, silicon chips, and optical fibres; and c) as finely ground silica flour for ceramics, chrysotile cement, and concrete products (Table 4).

Although Canada is self-sufficient for most of its silica requirements, significant tonnages of high-quality sand for glass and foundry applications are imported from the United States, mainly by Ontario. As a result of widespread availability and low prices, trade is restricted to convenient cross-border shipments. However, silica with the desired specifications for specific applications may be shipped to large, distant markets.

Preliminary data reported by users (Table 3) in Canada show that silica use was almost 2.6 Mt in 2005, a decrease of 66 255 t from the previous year. Preliminary data (Table 1) reported by Canadian producers for 2006 indicate production was valued at \$64.8 million, a \$5.1 million increase from 2005, reflecting the increase in shipments to 1.9 Mt from 1.8 Mt in 2005. Preliminary imports were val-

ued at \$105.4 million for 2006, an \$8.3 million increase from 2005, with the tonnage for imports increasing to 2.1 Mt from 1.7 Mt. Preliminary exports for 2006 were valued at \$29.0 million, an increase of \$2.4 million compared to 2005, even though the quantity decreased to 373 669 t from 617 235 t.

Preliminary data for 2005 (Table 3)¹ show that the nonferrous smelting and refining industry represents 33.5% of the total use of silica in Canada, a decrease of 3.2% from 2004. The primary glass and glass containers, and glass fibre wool sectors represented 19.5% of total use, an increase of 1.3% from 2004. Foundries, which represented 8.5% of the total use of silica in Canada, decreased 3.9% compared to 2004. Silica use by the chemicals industry represented 3.0% of the total use of silica in Canada, a 2.9% decrease compared to 2004. The use of silica in the cement industry represented 21.0%, but it also suffered a 2.6% decrease compared to 2004. The "other products" category represented 14.5% of total use, a 4.8% decrease compared to 2004.

With respect to the reported quantity of silica used by category (Table 4), sand represents 68.6% (1.8 Mt) of the total, a decrease of 42 863 t from 2004. For lump silica, which represents 28.9% (742 573 t) of the total, a slight decrease of 11 299 t from 2004 was observed. Preliminary data for silica flour, which represents 2.5% (64 963 t) of the total, indicate a decrease of 12 093 t from 2004.

OCCURRENCE

Silica occurs mainly as the mineral quartz. Quartz occurs in many forms, the common being vein and massive intrusive bodies, silica sand, sandstone, and quartzite. Quartz also occurs as crystals and as masses or aggregates in igneous rocks such as granites or pegmatites. Amorphous, non-crystalline varieties of quartz are less common and include opal, flint, chalcedony, tripoli, and diatomaceous earth.

Although all occurrences of silica are of interest from a geological point of view, commercial interest and development are usually restricted to vein or intrusive deposits and to silica sand, sandstone, and quartzite deposits. Vein and intrusive deposits are igneous in origin and vary widely in

shape and size. Such deposits are widespread throughout Canada. The quartz usually varies from white to grey and is relatively free of impurities.

Silica sand has a high silica content (95% SiO₂ or more). The silica or quartz particles, derived from the mechanical disintegration and chemical decomposition of siliceous rocks, have been selectively sorted and concentrated by the action of wind or water during transport to new locations where they accumulated to form high-grade deposits.

Sandstone is a sedimentary rock composed of quartz grains cemented by a bonding mineral. Sandstones, in which the bonding material is clay, calcite or iron oxide, are usually quite friable and easily reduced to grain size. Others may be more firmly cemented by a siliceous cement and thus are more difficult to reduce to grain size. Most sandstones are white, grey or brown and usually contain varying amounts of mineral impurities, e.g., feldspar, hornblende, magnetite, pyrite, iron oxide stain, and mica.

Quartzite is a hard, compact, metamorphosed sandstone composed of grains of quartz firmly bonded with a siliceous cement. The original quartz grains, having coalesced with the siliceous cement to form a continuous homogeneous mass, are not apparent to the naked eye.

TRADE

Imports for 2006 (Table 1) from the United States accounted for 98.1% of all imports (over 2.0 Mt). Imports of silica sands and quartz sands from the United States have increased 21.4% (361 155 t) from 2005. Imports from the United States come from loosely consolidated and easily processed sandstone or lake sand deposits located near the Great Lakes. Major U.S. operations are located in the states of Illinois, Wisconsin, Michigan, and Indiana. Canada is the leading recipient (source: U.S. Geological Survey [USGS]) of U.S. exports (73%).

Combined 2006 imports from the foundry and glass industry totaled almost 1.3 Mt. The tonnage of imports by the foundry industry increased by 33.4% from 2005 to 2006. Demand for foundry sand is dependent mainly on automobile and light truck production. The tonnage of imports by the glass manufacturing industry increased by 6.9% from 2005 to 2006.

Preliminary data for 2006 indicate that Canada's exports (Table 1) of silica totaled 373 669 t, a decrease of 39.5% from 2005. The value of these exports totaled over \$29.0 million, a 9.2% increase compared to the 2005 value of over \$26.5 million. Of the total exports from Canada, 368 726 t (94.7%) went to the United States.

PRODUCTION AND MARKET CONSIDERATIONS

The economics of the production and sale of the many types of silica are governed by many factors, but world demand for silica is controlled mostly by the fortunes of the glass and foundry industries. Throughout North America, the silica sand industry is highly competitive and the industry is dominated by a few large producers. A silica sand source location close to its users is important due to transportation cost considerations and, thus, silica is shipped only to local or regional markets. Beneficiation is the key to producing high-quality glass or foundry sand from most deposits.

The diverse uses of silica and quartz complicate market demand analysis. In the glass sector, construction and automobile markets drive flat glass sales, new construction being the basis for fibreglass sales. These markets are driven by the Gross Domestic Product. Silica sand demand in container glass is influenced by: reductions in the number of consumption points through industry rationalization; decreased production as a result of strong competition from PET bottles (i.e., made of virgin resin of polyethylene terephthalate), aluminum, and paper containers; and increasing and mandated recycling rates in the glass container industry. Use in foundry applications depends on metal production (depending upon automobile sales, etc.) combined with recycling efficiencies and competitive sands. Hydraulic fracturing sand demand is influenced by the price of oil, regional oil production factors such as flow rate and pressure, and changes in drilling technologies.

SUPPLY

Silica deposits of commercial interest occur in all 10 provinces. The important Canadian production sites are discussed below. The provinces of Quebec, Ontario, and Alberta are the main producers of silica, followed by Saskatchewan, British Columbia, and Nova Scotia. Generally, silica is extracted in open pits or by dredging.

Newfoundland and Labrador

Shabogamo Mining and Exploration Co. Ltd. began mining its Roy's Knob quartzite deposit near Labrador City in October 1999. The company's washing and screening plant is located in Wabush, Labrador. The quartzite product is sent by rail to Sept-Îles, Quebec. Shabogamo supplies quartzite to Silicium de Bécancour Inc. of Quebec, which uses the material to manufacture silicon metal.

Prince Edward Island

There are no silica quarries currently in operation.

Nova Scotia

Shaw Resources Ltd., a member of The Shaw Group Limited, produces a high-purity (98.5-99.5%) silica from sand deposits located at Nine Mile River, Hants County, near Shubenacadie. In addition, fine sand from its silica operation is beneficiated to flint glass-grade material. Fine sand products are sold in the Maritimes, Quebec, and northeastern United States for use in sandblasting, filter sand, traction sand, cement and concrete manufacturing, refractory and decorative sand, and as a flux for base-metal smelters.

Black Bull Resources Inc. still has no production or revenue mining at its White Rock quartz project in Yarmouth County. The site is located 42 km northwest of the deep port of Shelburne. Reserves of 16.3 Mt of high-quality angular and bright white quartz have been estimated. The material would be aimed at five different specialized markets: pool plaster aggregate, engineered stone, exterior insulation and finishing systems (EIFS), landscape stone, and golf course sand.

New Brunswick

Shaw Resources' Chaleur Silica Ltd. – a division of The Shaw Group Limited currently operates the Bass River silica quarry, providing silica as flux material to the nearby Belledune lead smelter and for use in cement manufacture. It also manufactures abrasive products using raw material from Nova Scotia, Ontario, and the United States.

Since 1986, Atlantic Silica Inc. mines and processes a high-grade (+98%) silica deposit located 22 km southwest of Sussex near Cassidy Lake. The quartz pebbles have been used to produce silicon metal and decorative stone. The quartz sand has been marketed for use in sandblasting, silicon carbide, nursery grit, cement powder, glass, golf course sand, smelter flux sand, and filtration sand. Most of it is used in eastern Canada, although some is shipped to the United States.

Quebec

Unimin Canada Ltd., a subsidiary of Unimin Corp. of the United States, is the largest producer of silica in the province. Silica is mined from a quartzite deposit at Saint-Donat-de-Montcalm and from a sandstone deposit at Saint-Canut. Silica from Saint-Donat is shipped and refined at the Saint-Canut plant near Montréal. The majority of the silica produced by Unimin originates from Saint-Canut where the ore is ground, screened, and beneficiated by magnetic separation. Most of Unimin's output is used in the production of glass containers, flat glass, and fiberglass; it is also in the silicon carbide industries.

Silicium Bécancour Inc. (now owned by Timminco Ltd. of Toronto) operates the silica plant in Bécancour. Its facility

has the capacity to produce 50 000 t/y of chemical silicon, electronics-grade silicon metal, and specialty ferrosilicon. Although hampered by a furnace problem at its plant and a strike at its rail carrier (CN), it intends to construct a 3600-t/y facility for the production of solar-grade silicon metal. The company also sells silica fume to the construction industry. In addition, it owns a quartzite deposit north of La Malbaie that is being developed by Sitec Inc. Sitec Inc. is a joint venture between Baskatong Quartz Inc. and SOQUEM Inc. Sitec mines and processes high-purity quartz for a range of end uses, including silicon metal and silicon carbide. The company also operates a custom crushing, drying, and screening plant in Shawinigan, Quebec.

La Compagnie Bon Sable Ltée mines silica sand at Saint-Joseph-du-Lac and Ormstown. The material is used mainly for sandblasting and as a concrete sand; it is also suitable for the production of fibreglass.

Silco Sands Inc. mines and grinds silica at its plant in Sainte-Clotilde-de-Châteauguay. The products are sold to a chemical company, a cement plant, and a ferromanganese plant.

Temisca Inc., a division of Opta Minerals Inc., mines and processes silica near Saint-Bruno-de-Guigues for the golf course, filtration sand, hydraulic fracturing (frac), abrasives, and construction markets. The processing facility includes a 200 000-t/y hydrosizer, as well as screening, drying, and packaging equipment.

Béton provincial Ltée operates a silica sandstone quarry in Gaspé's La Rivière County and Société Minière Gerdin Inc. operates a silica sand quarry on a seasonal basis in Saint-Rémi-d'Amherst.

Exploration Québec/Labrador (EQL) Inc. mines its quartz deposit from Lac Daviault, near Fermont. Production is crushed on site, but is processed at the Granirex plant (division of DuPont Canada of Ontario) in Thetford Mines, Quebec, for the manufacturing of decorative and durable engineered stone products used in decorative surface applications. EQL is planning to explore other markets for the quartz, including silicon metal.

Ontario

Unimin Canada Ltd. is also the largest producer of silica in Ontario with a capacity of about 500 000 t/y. Lump quartzite from Badgeley Island (150 000-t/y capacity) in northern Georgian Bay is shipped by boat to Canadian destinations for the manufacture of ferrosilicon. The finer material, produced by grinding, is shipped to Unimin's plant at Midland (400 000-t/y capacity), south of Georgian Bay, where it is further processed to a glass-grade silica sand and to silica flour for ceramic and other uses.

Crystal Quartz Canada, located near Dryden in western Ontario, is the only lascas-grade silica producer in North America. It supplies lascas quartz to North American cultured quartz producers.

Significant amounts of silica are extracted by others across Ontario for use as flux for base-metal ore smelting operations in Timmins and Sudbury, for silicon metal production, for specialty brick production, and for decorative uses. Other Ontario producers are: Arriscraft International Inc. with its Elgin Quarry in Bastard Township; Rapier Resources Inc. with its Deagle Township Quarry, west of Sudbury; Great White Minerals Ltd. with its Fripp Quarry, near Timmins; Northern Mining and Exploration Inc. with its Shaw Township Quarry, in Timmins; and Roseval Silica with its Penhorwood Township Quarry, also near Timmins.

Manitoba

There are no known silica quarries currently in operation in Manitoba. Nevertheless, Gossan Resources Ltd. of Winnipeg has consolidated its land position at its Manitogagan silica property (source: Blendon Information Services) by acquiring two adjacent quarry leases. The expanded property now encompasses 274 ha. A composite of 19 samples from the property has been tested and yielded a silica content of 94.2%. Tests have also concluded that the silica meets metallurgical requirements and may potentially be used as frac sand in shallow gas wells.

Saskatchewan

Hudbay Minerals Inc. (formerly Hudson Bay Mining and Smelting Co., Limited) produces silica in the Amisk Lake area of northern Saskatchewan and is the largest user of the province's silica sand at its Flin Flon, Manitoba, smelter. Hudbay uses sand as a fluxing agent that, in the molten state, reacts with impurities in the copper concentrate to produce a slag. The slag, with some of the impurities, is drawn off, leaving matte, a crude form of metal that requires further processing.

Red Deer Silica Inc. produces a small amount of silica, northeast of the village of Hudson Bay, for use in golf course bunkers, stucco sand, and sandblasting sand.

In mid-2002, the mineral deposit of the Hanson Lake silica sand project was appropriated by Trican Well Services and Saskatchewan Opportunities Corporation (SOCO). The mineral dispositions have been optioned to Winn Bay Sand Ltd., a company affiliated with the Ochapwace First Nation. Lonesome Prairie Sand and Gravel Ltd. is the contractor carrying out all quarrying operations. All processing takes place on site. The silica sand is used as frac sand, predominantly in the gas fields in Saskatchewan. It is transported to Burstall, Saskatchewan, just west of the Great Sand Hills, where it is offloaded. Customers pick up their orders from this site.

Alberta

Sil Industrial Minerals Inc. of Edmonton produces silica sand from local sand dunes in the Bruderheim area. It also operates a silica processing facility near Edmonton. The silica is sold mainly for the manufacture of fibreglass and as sandblasting material. Other uses are in foundry, filtration, fracturing, and railway traction applications. The company also produces silica flour by processing the silica sand through a ball mill. The flour is used in thermal insulating cement in the oil and gas industries.

Cementec Industries Inc. of Calgary produces, among other unique and proprietary products, silica flour, silica fume, and sandblasting sand for use in the oil and gas and construction industries.

Hexion Specialty Chemicals of Columbus, Ohio, announced plans (source: Blendon Information Services) to construct a plant in Alberta to produce resin-coated proppants² for use in the oil and gas industry. The 150 million-lb/y plant will be built in Sturgeon County.

British Columbia

Heemskirk Consolidated Ltd. of Australia (who purchased Dynatec Corp.'s western operations) mines a high-purity (99.5%) silica sand for diverse industrial applications (e.g., glass grade, foundry sand, additive in refractory cements and ceramics, and use as a functional filler/extender for paints) at the Moberly mine in the Golden area. The friable sandstone is ground, screened, washed, dried, and separated into several sizes at a plant near Golden. These different sizes are sold mainly as glass sand, but also as sandblasting sand, foundry sand, filter media sand, and golf course bunker sand. In 2006, Heemskirk Canada Ltd., a subsidiary of Heemskirk Consolidated Ltd., expects to ship 80 000 t of silica, mainly to Lavington, B.C.

Lafarge Canada Inc. mines silica-alumina material from the Buse Lake deposit as feedstock for its Kamloops cement plant.

PRICES

Prices for actual transactions vary according to geographic region and will take into account the quantity purchased, application, colour, impurities, exact grade purchased, credit terms, and other parameters. Due to the unavailability of Canadian prices, the following price examples are provided to facilitate an understanding.

According to the U.S. Geological Survey³ (*USGS 2005 Review*), the value of silica increased by about 7% between 2004 and 2005 (average value, free on board [f.o.b.] plant). The average price for sand ranged from US\$6.75/t for

metallurgical flux to US\$103.85/t for ground foundry sand. For gravel, prices ranged from US\$9.29/t for non-metallurgical flux to US\$49.79/t for filtration. U.S. producer prices reported to the USGS for silica commonly ranged from several dollars per tonne to hundreds of dollars per tonne, and occasionally exceeded the US\$1000/t level. In the United States, ground sand for foundry molding and core, at US\$103.85/t, had the highest value per tonne, followed by silica for swimming pool filters, US\$81.81/t; ground sand used as fillers for paint, putty and rubber at US\$59.32/t; ground sand for ceramics, US\$50.30/t; ground sand for scouring cleansers, US\$47.96/t; silica for municipal water filtration, US\$46.02/t; sand for hydraulic fracturing, US\$43.45/t; and ground sand for fibreglass, US\$40.81/t.

MAJOR USES AND SPECIFICATIONS

Silica in the form of quartz, sand, sandstone, and quartzite is used in many applications. Uses may be subdivided on the basis of particle size requirements, e.g., lump silica, 2 or 3 mm to 15 cm or more in size; silica sand, 2 or 3 mm in size down to 75 μm ; and silica flour, which is essentially minus 75 μm in size. Applications for the silica with general specifications are discussed under the three general size categories stated (CANMET, *Summary Report No. 4: Silica*).

Lump Silica⁴

Flux: Quartz, quartzite, and occasionally sandstone and sand are used as fluxes in smelting base-metal ores with low silica contents. The silica content of the flux should be as high as possible, but a small percentage of impurities such as iron oxide and alumina can be tolerated. Size is generally minus 2.5 to 0.5 cm.

Silicon Alloys: Quartz, quartzite, and well-cemented sandstone are used in the manufacture of silicon, ferrosilicon, and other alloys of silicon. The silica content of ferrosilicon should be 98% and the total iron oxide and alumina less than 1.5%. Lime and magnesia should not exceed 0.20% each; phosphorous and arsenic should also be very low. Silicon metal manufacture requires a high-purity quartz grading 99.5% SiO_2 or better with less than 0.04% iron oxide and alumina. Size specifications vary between 5 and 10 cm.

Silica Brick: Quartz and quartzite crushed to 2.5 mm are used in the manufacture of silica brick for high-temperature refractory furnace linings. The silica content should be a minimum of 95%, and iron oxide and alumina should each be less than 0.1%. Other impurities such as lime and magnesia should be low.

Other Uses: Lump quartz and quartzite are used as linings in ball and tube mills, and as lining and packing for acid towers. Naturally occurring flint pebbles may be used as a grinding medium for nonmetallic ores.

Silica Sand⁴

Glass and Glass Fibre: Naturally occurring quartz sands and sands produced by crushing quartz, quartzite, or sandstone are used in the manufacture of glass, glass fibre, and fused silica ware. The silica content should be greater than 99% and the iron oxide content should be uniform and less than 0.025%.

Other impurities such as alumina, lime and magnesia should be less than 0.15% each. Chromium, cobalt and titanium are undesirable and should be less than 2 or 3 ppm. Uniformity of grain size is important and sand should generally be between 600 and 100 μm in size with a minimum of coarse and fine material.

Silicon Carbide: Sand for silicon carbide manufacture should have a silica content of 99% and iron oxide and alumina should each be less than 0.1%; lime, magnesia and phosphorus are particularly objectionable. Although coarse-grained sand is preferred, finer sands are used where coarser grades are not available. All sand should be plus 150 μm , with the bulk of the sand being minus 2.0 to plus 0.5 mm in size.

Hydraulic Fracturing: Silica sand is used as a "propping agent" in the hydraulic fracturing of oil-bearing formations to improve the recovery of oil. The sand should be clean, dry, and have a high compressive strength. The silica content should be high and carbonates and other acid-consuming minerals should be low. The sand grains should be between 850 and 500 μm in size and well rounded to facilitate placement and provide maximum permeability.

Foundry Moulding: Naturally occurring sand and sand produced by the reduction of sandstone to grain size are used extensively in the foundry industry for moulding purposes. The purity and size of sand used depend on the type of casting and on the particular foundry practice. Iron and steel foundry sands vary in grain size between 850 and 75 μm in closely sized fractions. American Foundry Society (AFS) numbers vary between 55 and 65 μm , with the bulk of the sand being preferably on three adjacent sieves; a rounded grain shape is preferred. The silica content should be high (99% SiO_2) with low aluminum, iron, sodium, and potassium oxides.

Silicate Chemicals: Sand for the manufacture of sodium silicate and other chemicals should be of high purity. Sodium silicate requires a silica content of 99%, the alumina less than 1%, the combined lime and magnesia less

than 0.5%, and iron oxide less than 0.1%. All sand should be between 840 and 150 µm in size.

Other Uses: Coarsely ground, closely sized quartz, quartzite, sandstone, and sand are used as abrasive grit for sandblasting purposes and for the manufacture of abrasives papers. Various grades of closely sized, round-grained sand are used in water filtration plants as a filtering medium. Silica sand is used as an additive in portland cement manufacture when the source cement is low in silica.

Silica Flour

Silica flour, formed by grinding quartz, quartzite, sandstone, and sand to 75 µm and finer, is used in the ceramic industry for enamel frits and pottery flint. It is also used in the manufacture of chrysotile cement and autoclave-cured concrete products, as an inert filler/extender mineral in rubber and paints, and as an abrasive ingredient in soaps and scouring powders.

MINING, PROCESSING, AND BENEFICIATION

Mining

Commercial silica is obtained from vein quartz, sand, sandstone, and quartzite deposits. Mining is usually by open-pit benching using standard quarrying methods. Following primary breakage, the rock is trucked to the mill site for further size reduction, processing, and beneficiation.

Processing

Silica may be used in lump form, as sand, as a finely ground powder, and as silica flour. Primary crushing of lump silica is readily accomplished by jaw and cone crushers, and secondary crushing is done by hammer or impact-type mills. Further reduction to sand size may be accomplished by roll crusher or rod mill, and to flour size or finer by ball, vibratory or jet-milling, or by attrition grinding in a “stirred” ball mill using small ceramic pebbles as grinding media.

Following primary and secondary crushing, lump quartz, sandstone and quartzite for use as flux in the manufacture of silicon and ferrosilicon, etc., must be screened to meet size specifications. Screening may result in minor upgrading through the removal of impure fines, but such material is essentially used as quarried with no beneficiation apart from sizing.

Beneficiation

Uses requiring silica in the form of sand or flour, e.g., glass, silicon carbide, foundry and chrysotile cement, usually

require precise sizing and a high-purity product. Thus, further processing and beneficiation are normally required to both size and upgrade the raw silica feed material.

Further reduction of the silica to a specific size, e.g., minus 850 µm to plus 150 µm, must be carefully carried out to avoid introducing extraneous impurities such as mill iron and other contaminants, and care must be exercised to avoid over-grinding. Whole unfractured grains are preferred in foundry moulding, and fines are detrimental in both foundry and glass sand applications. Over-grinding is more difficult to control when the starting material is quartz or quartzite, which do not possess a well-defined granular structure such as when crushing a more weakly cemented friable sandstone. The choice of grinding unit is also important; for example, impact mills produce more fractured grains and fines than jaw, cone, or roll crushers.

Following reduction to the size required, various beneficiation steps may be used to remove impurities, typically clay, feldspar, carbonates, and ferromagnesian minerals. Beneficiation can include one or more of the following:

- Screening to remove the coarse and fine fractions, which usually contain a significant percentage of the total impurity;
- Magnetic separation to remove iron-bearing minerals;
- Jigging or tabling to remove heavy minerals;
- Attrition scrubbing and washing to remove clay and slimes;
- Flotation to remove minerals that do not respond to magnetic or gravity methods, e.g., feldspar and pyrite; and
- Acid leaching to further reduce iron and carbonate minerals.

HEALTH AND SAFETY CONCERNS

Crystalline silica is silicon dioxide (SiO₂). Most mined minerals contain some SiO₂. “Crystalline” refers to the orientation of SiO₂ molecules in a fixed pattern. The three most common crystalline forms of silica encountered in industry are quartz, tridymite, and cristobalite.

Silicosis is a disabling, non-reversible, and sometimes fatal lung disease caused by overexposure to respirable crystalline silica. Silicosis can be prevented when crystalline silica is used safely and appropriate precautions are taken. Silicosis is preventable if employers, workers, and health professionals work together to reduce exposures (source: U.S. Department of Labor, Occupational Safety & Health Administration). In the United States, any mineral product with a crystalline silica content of >0.05% (down from the

previous >0.1% level) may be regulated under the U.S. Occupational Safety & Health Administration Hazard Communication Standards (see www.osha.gov/SLTC/silicacrystalline/).

Recently, the American Conference of Governmental Industrial Hygienists (ACGIH) Board of Directors ratified the recommended Notice of Intended Change (NIC) for the Threshold Limit Values (TLV) for quartz and cristobalite. The changes will lower the TLVs from 0.05 mg/m³ to 0.025 mg/m³. This is the second 50% reduction in the past five years from the former TLVs of 0.1 mg/m³. The 2006 TLV book containing the new values was expected to be published in March.

In Canada, the Workplace Hazardous Materials Information System (WHMIS) (see www.hc-sc.gc.ca/hecs-sesc/whmis/) is Canada's hazard communication standard. WHMIS is implemented through coordinated federal, provincial, and territorial legislation. Canada requires and enforces a 90-day timeframe for updates to both Material Safety Data Sheets (MSDSs) and labels on particulars of which the supplier reasonably should be aware. A change in TLV may fall into this category.

On July 28, 2006, the Ontario Ministry of Labour (MOL) posted on its web site a 2006 Notice of Proposal to Adopt New or Revised Occupational Exposure Limits or Listings for 27 Hazardous Chemical Substances. Of significance is a proposal to reduce the crystalline silica Occupational Exposure Limit (OEL) from 0.1 mg/m³ to 0.025 mg/m³. This proposal combines in a single OEL all types of crystalline silica that are regulated in Ontario as a designated substance. The MOL specifically relies on the American Conference of Governmental Industrial Hygienists (ACGIH) Documentation of Threshold Limit Values as the justification for its proposal.

RECYCLING

The use of recycled glass (cullet) is still increasing, which in turn is reducing the need for virgin raw material in the glass batch. The second largest use for recycled container glass is as a feedstock for insulation fibreglass manufacture (up to 40% of the feed). Silica sand used in abrasive blasting is usually single pass as it is cheap and breaks down rapidly during use. The reclamation and re-use of foundry sands are on the increase due to escalating purchasing and disposal costs.

OUTLOOK

The demand for foundry sand (source: USGS) is dependent mainly upon automotive and light truck production levels that parallel GDP growth. Sales of glass are

expected to vary from market to market (e.g., flat glass and specialty glass). The demand for quartz crystal devices is likely to continue to increase; thus, quartz crystal production will probably remain strong.

Over the long term, glass demand has been growing at around 3.5%/y, which is a slower rate than GDP (source: Pilkington). The demand for value-added products is growing at a faster rate than demand for basic glass. These value-added products are becoming increasingly important in the automotive market, delivering greater functionality to a vehicle's glazing.

The Freedonia Group forecasts that U.S. demand for advanced flat glass will increase at 6.5%/y and reach US\$6.7 billion in 2008. Increased demand will be driven largely by the introduction and commercialization of new products, specifically smart glass products, self-cleaning window glass, and heads-up display wide screens for motor vehicles. More mature product lines, such as low-emissivity solar control glass and automotive safety glass, will continue to dominate overall demand, but will record slower growth.

The silicon (source: Roskill) that is used in the aluminum, chemical and electronics industries is expected to show growth in demand of about 6%/y over the next three years, with silicon chemicals being the fastest-growing sector in volume. Ferrosilicon demand depends upon demand for cast iron. Market growth for ferrosilicon is expected to be less than 1.5%/y up to 2007, but demand for steel will exceed 2%.

ENDNOTES

¹ Reported use of silica by Canadian manufacturing companies is done by surveys on a voluntary basis and might not reflect 100% consumption coverage. In addition, data may not include silica purchased for exports resale.

² Proppant materials are particles carefully sorted for size and sphericity mixed with fracturing fluid to hold fractures open after a hydraulic fracturing treatment. In addition to naturally occurring sand grains, man-made or specially engineered proppants, such as resin-coated sand or high-strength ceramic materials like sintered bauxite, are used to provide an efficient conduit for the production of fluid from the reservoir to the wellbore.

³ Different countries have different terminology and specifications for silica. In the United States, industrial sand and gravel is often called "silica," "silica sand" and "quartz sand," which include sand and gravel with a high silicon dioxide content.

⁴ High-purity quartz, quartz crystal, and silica sand are used as starting materials in the production of artificial quartz crystal, fused quartz, and optical fibres. The silica content should be as high as possible and the metallic elements should be as low as possible, usually in the ppm range.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2505.10	Natural sands of all kinds, whether or not coloured, other than metal-bearing sand of chapter 26: silica sand and quartz sands	Free	Free	Free	Free	Free	Free
2506	Quartz (other than natural sands); quartzite, whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
2506.10	Quartz	Free	Free	Free	Free	Free	Free
2506.21	Quartzite: crude or roughly trimmed	Free	Free	Free	Free	Free	Free
2506.29	Quartzite: other	Free	Free	Free	Free	Free	Free
2811.22	Other inorganic acids and other inorganic oxygen compounds of nonmetals: other inorganic oxygen compounds of non-metals: silicon dioxide	Free	Free	Free	Free	4.6%	3.3%

Sources: Canadian Customs Tariff, effective January 2006 and 2007, Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2006 and 2007; Official Journal of the European Union (October 27, 2005, and October 17, 2006 editions); Customs Tariff Schedules of Japan, 2006 and 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. SILICA, CANADIAN PRODUCTION AND TRADE, 2004-06

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION (Shipments)						
By province						
Newfoundland and Labrador	x	x	x	x	x	x
Nova Scotia	x	x	x	x	x	x
New Brunswick	x	x	x	x	x	x
Quebec	548 106	14 840	588 972	14 995	523 313	15 706
Ontario	x	x	435 537	14 510	435 537	14 510
Manitoba	x	x	x	x	x	x
Saskatchewan	x	x	x	x	x	x
Alberta	319 266	14 698	393 847	16 357	515 409	19 069
British Columbia	x	x	x	x	x	x
Total	1 466 471	50 976	1 807 360	59 707	1 893 022	64 823
EXPORTS						
2505.10						
Silica sands and quartz sands						
United States	641 770	11 378	571 520	19 942	346 084	22 383
Cuba	110	3	298	25	588	111
Japan	108	46	408	82	388	76
China	190	78	553	158	200	57
Taiwan	9	2	74	11	212	38
South Korea	271	175	1 093	242	86	14
Chile	18	4	20	6	16	8
France	—	—	—	—	133	7
Belgium	208	48	455	144	100	5
Mali	—	—	—	—	27	5
Uruguay	—	—	—	—	13	3
Bermuda	—	—	—	—	15	3
Ireland	3	...	19	3	21	3
Saint Pierre and Miquelon	120	22	58	10	20	2
Switzerland	—	—	2	...	30	1
Dominican Republic	—	—	1	1	2	1
Saint Lucia	—	—	—	—	2	1
Philippines	—	—	21	5	11	1
Italy	4 694	475	1 479	523	10	...
Russia	50	10	12	...	..	...
Bahamas	20	...	2	...	40	...
Saint Kitts and Nevis	—	—	—	—	..	...
Niger	—	—	—	—	..	...
Saudi Arabia	—	—	—	—	4	...
Greenland	—	—	—	—	..	...
Hong Kong	2	...	12	2	6	...
Greece	12	...	15	...	19	...
Germany	46	9	—	—	18	...
Suriname	—	—	7	...	1	...
Malaysia	3 437	12	1 728	4	—	—
Netherlands	42	1	—	—	—	—
Portugal	52	13	—	—	—	—
Jamaica	44	9	—	—	—	—
Spain	106	51	369	72	—	—
Venezuela	6 353	117	204	40	—	—
Australia	—	—	11	2	—	—
Colombia	—	—	1	...	—	—
Guyana	2	...	—	—	—	—
Poland	—	—	19	4	—	—
Nicaragua	—	—	41	...	—	—
Turks and Caicos Islands	—	—	25	9	—	—
United Kingdom	—	—	31	3	—	—
Norway	2 485	7	—	—	—	—
Czech Republic	66	19	—	—	—	—
Turkmenistan	4	...	—	—	—	—
Brazil	20	6	1 436	5	—	—
South Africa	18	5	—	—	—	—
Israel	5 009	63	192	3	—	—
India	34	10	—	—	—	—
Trinidad and Tobago	7	2	31	8	—	—
Barbados	21	6	31	6	—	—
Total	665 331	12 571	580 168	21 310	348 046	22 719

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
2506.10	Quartz (other than natural sands)						
	Belgium	—	—	3 158	797	2 183	717
	United States	6 148	976	2 053	302	1 793	184
	China	5 200	241	3 725	168	1	12
	France	118	9	—	—	44	3
	Brazil	—	—	—	—	35	2
	Bermuda	—	—	—	—	15	1
	Japan	51	4	60	4	5	..
	Germany	168	11	64	4	—	—
	Bulgaria	—	—	112	6	—	—
	Switzerland	—	—	30	2	—	—
	Total	11 685	1 241	9 202	1 283	4 076	919
2506.21	Quartzite, crude or roughly trimmed						
	United States	1 374	489	1 373	509	898	377
	Norway	—	—	8 640	412	—	—
	Total	1 374	489	10 013	921	898	377
2506.29	Quartzite, n.e.s.						
	United States	42	21	9 459	1 277	19 399	2 401
2811.22	Silicon dioxide						
	United States	302	958	418	984	552	1 417
	United Kingdom	846	113	3 112	297	372	366
	Belgium	53	5	358	34	71	204
	Switzerland	1 223	165	393	37	35	113
	Ireland	87	17	51	5	42	104
	China	19	2	106	10	30	74
	Japan	833	66	1 122	107	17	59
	Taiwan	100	9	220	22	9	29
	Thailand	112	24	207	20	6	28
	France	77	7	199	19	24	26
	Malaysia	—	—	51	5	31	25
	India	...	...	75	7	34	24
	Italy	89	8	66	6	5	23
	Netherlands	259	40	901	86	4	18
	North Korea	—	—	—	—	11	17
	Singapore	—	—	22	2	2	10
	South Korea	24	2	268	25	1	7
	Brazil	—	—	—	—	2	5
	Romania	186	15	123	12	1	3
	Chile	55	5	48	5	1	3
	Germany	109	11	28	3	...	2
	Iceland	—	—	45	4	...	2
	Spain	—	—	108	10	...	2
	Iran	—	—	—	—	...	2
	Finland	—	—	—	—	...	1
	Mexico	26	2	2	...	...	...
	Hong Kong	709	136	151	14	...	...
	Cuba	—	—	2	...	...	...
	Dominican Republic	—	—	—	—	...	...
	Madagascar	—	—	—	—	...	...
	Mauritius	—	—	—	—	...	...
	Saint Kitts and Nevis	—	—	—	—	...	...
	Philippines	3	...	—	—	—	—
	Russia	10	1	—	—	—	—
	Jamaica	128	12	14	1	—	—
	Egypt	21	2	34	3	—	—
	Ukraine	...	1	—	—	—	—
	Denmark	50	5	—	—	—	—
	Australia	—	—	19	2	—	—
	Israel	77	9	105	10	—	—
	Sweden	—	—	18	2	—	—
	Trinidad and Tobago	—	—	1	...	—	—
	Turkey	—	—	126	12	—	—
	South Africa	84	8	—	—	—	—
	Total	5 482	1 623	8 393	1 744	1 250	2 564
	Total exports	683 914	15 945	617 235	26 535	373 669	28 980

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (1)						
2505.10	Silica sands and quartz sands					
	1 242 266	42 409	1 684 185	35 998	2 045 340	40 805
United States	29 702	1 888	2 939	2 251	3 317	3 273
Australia	2 202	736	4 016	1 289	2 318	1 407
Germany	190	14	535	183	5 167	321
China	388	351	420	359	336	308
Venezuela	4 220	214	454	310	454	193
Sweden	271	5	133	19	19 135	118
Canada	93	64	143	93	68	62
Poland	1 222	57	—	—	327	50
Norway	6 755	234	—	—	62	26
Belgium	3 233	77	8 443	172	82	25
Netherlands	1	4	1	9	5	18
Mexico	—	—	..	...	404	16
India	—	—	24	25	7	10
Japan	48	47	6	20	10	8
United Kingdom	16	31	76	3	16	5
France	14	2	...	4	5	4
Austria	212	3	3	...	84	3
Italy	...	...	—	—	2	2
Brazil	—	—	—	—	..	...
Thailand	—	—	—	—	...	...
Bolivia	—	—	—	—	...	...
Morocco	—	—	—	—	...	...
Spain	—	—	..	1	..	...
Taiwan	1	...	1	...	2	...
Ireland	...	1	5	5	—	—
New Zealand	4	...	...	...	—	—
United Arab Emirates	...	...	—	—	—	—
Ukraine	1	...	—	—	—	—
Sri Lanka	88	1	6	...	—	—
Russia	5	5	—	—	—	—
Jordan	—	—	...	...	—	—
Mongolia	2	...	—	—	—	—
Armenia	...	...	—	—	—	—
Hong Kong	5	1	1	...	—	—
Denmark	1	...	—	—	—	—
Total	1 290 940	46 144	1 701 391	40 741	2 077 141	46 654
2506.10	Quartz (other than natural sands)					
	23 752	1 500	1 473	1 127	1 070	979
Spain	6 694	390	3 636	654	2 650	618
United States	518	60	300	35	1 000	159
Egypt	1 730	140	368	172	1 034	61
Brazil	544	45	854	57	10	52
China	1	...	2	...	2	41
France	206	27	66	126	25	35
Germany	450	26	53	26	79	27
India	—	—	21	43	3	4
Czech Republic	2	...	—	—	..	3
Mexico	1	...	1	2	1	3
Hong Kong	1	...	2	4	4	3
United Kingdom	22	1	1	3	8	2
Madagascar	5	...	10	20	...	...
Belgium	—	—	—	—	...	...
South Korea	12	1	—	—	..	...
Azerbaijan	1	...	50	35	..	...
Italy	1	...	7	8	1	...
Japan	—	—	1	...	..	...
Peru	2	1	—	—	2	...
Taiwan	—	—	1	1	1	...
Austria	—	—	—	—	..	...
Cape Verde	—	—	—	—	..	...
Switzerland	80	1	...	2	...	...
Australia	—	—	—	—	..	...
Belize	—	—	—	—	..	...
Colombia	—	—	—	—	...	...
Morocco	—	—	—	—	1	...
Tanzania	15	1	—	—	—	—
Argentina	—	—	..	1	—	—
Canada	—	—	..	...	—	—

TABLE 1 (cont'd)

Item No.	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)						
Israel	—	—	2	5	—	—
Nepal	—	—	93	19	—	—
Sweden	3	...	1	...	—	—
South Africa	—	—	..	...	—	—
Congo	—	—	..	...	—	—
Chad	2	...	—	—	—	—
Total	34 042	2 193	6 942	2 340	5 891	1 987
2506.21	Quartzite, crude or roughly trimmed					
United States	2 913	442	2 680	402	1 736	366
Brazil	173	39	788	196	562	151
Switzerland	—	—	..	...	35	62
China	—	—	7	1	65	40
Mexico	—	—	14	3	..	3
Russia	—	—	8	2	..	3
South Africa	—	—	2	1	...	2
Madagascar	24	5	6	1	2	1
Argentina	—	—	26	5	..	1
Australia	—	—	8	1	..	1
Bolivia	—	—	2	...	..	1
Congo	—	—	6	1	..	1
India	—	—	145	30	1	1
Morocco	—	—	2	...	...	1
Peru	—	—	6	1	..	1
Uruguay	—	—	1	...	..	1
Czech Republic	—	—	4	1	..	...
Germany	—	—	..	...	..	...
Namibia	—	—	3	1	..	...
Belize	—	—	—	—	1	...
France	—	—	—	—	...	...
Indonesia	—	—	—	—	..	...
Israel	708	133	112	23	—	—
Italy	156	36	—	—	—	—
Belgium	—	—	2	...	—	—
Dominican Republic	—	—	2	...	—	—
Tanzania	—	—	1	...	—	—
Total	3 974	655	3 825	669	2 402	636
2506.29	Quartzite, n.e.s.					
United States	1 609	124	693	236	786	362
Germany	52	3	33	15	85	54
Brazil	262	18	3	13	20	11
Mexico	26	3	..	2	1	...
Switzerland	—	—	..	...	..	...
Australia	4	...	..	1	—	—
China	82	6	..	2	—	—
Congo	1	...	—	—	—	—
Czech Republic	8	...	..	1	—	—
India	202	5	..	...	—	—
Japan	29	2	17	7	—	—
Madagascar	15	1	..	1	—	—
Morocco	3	...	—	—	—	—
Peru	15	1	..	...	—	—
Poland	2	...	—	—	—	—
Russia	20	1	..	1	—	—
South Africa	116	9	..	5	—	—
Spain	11	1	—	—	—	—
Ukraine	1	...	—	—	—	—
United Kingdom	466	35	4	27	—	—
Uruguay	1	...	—	—	—	—
Bolivia	—	—	..	...	—	—
France	—	—	18	1	—	—
Italy	—	—	1	1	—	—
Lebanon	—	—	...	...	—	—
Namibia	—	—	..	...	—	—
Portugal	—	—	1	...	—	—
Total	2 925	209	770	313	892	42

TABLE 1 (cont'd)

TABLE 1 (cont'd)							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2811.22	Silicon dioxide						
	United States	25 753	43 380	21 991	38 225	25 165	41 779
	Germany	1 425	8 053	1 084	7 028	1 075	5 967
	China	1 690	2 331	2 391	2 772	2 120	2 595
	United Kingdom	251	2 225	365	1 899	414	2 002
	Japan	268	1 086	145	1 303	130	1 808
	Switzerland	64	667	62	930	81	876
	France	2	10	4	7	136	167
	Venezuela	122	124	155	176	133	139
	Sweden	16	54	38	101	11	55
	Canada	9	37	1	51	44	49
	Italy	57	125	3	11	10	49
	Turkey	55	63	113	148	38	48
	Ukraine	3	24	18	135	5	47
	Norway	9	12	66	81	38	43
	Georgia	—	—	—	—	5	31
	Taiwan	1	2	9	18	1	16
	Mexico	1	4	19	24	5	12
	Morocco	—	—	—	—	...	5
	Belgium	...	3	29	69	...	3
	Ireland	5	17	...	3	...	2
	South Korea	1	7	1	14	...	2
	Sri Lanka	—	—	—	—	...	...
	Denmark	...	...	...	...	...	...
	Hong Kong	1	4	...	2	...	...
	Australia	...	...	...	...	...	...
	Vietnam	—	—	—	—	...	...
	Netherlands	15	35	—	—	...	...
	India	1	4	...	...	...	...
	Austria	—	—	—	—	...	...
	Hungary	—	—	—	—	...	...
	Thailand	—	—	—	—	...	...
	Russia	24	45	—	—	—	—
	Dominican Republic	—	—	...	1	—	—
	Indonesia	—	—	...	...	—	—
	Malaysia	—	—	...	...	—	—
	New Zealand	—	—	...	...	—	—
	Spain	—	—	10	43	—	—
	Finland	...	1	—	—	—	—
	Chile	1	3	—	—	—	—
	Brazil	3	9	1	10	—	—
	Singapore	57	50	...	...	—	—
	Total	29 834	58 375	26 505	53 051	29 411	55 695
	Total imports	1 361 715	107 576	1 739 433	97 114	2 115 737	105 399

Sources: Natural Resources Canada; Statistics Canada.

— Nil; . . Not available; ... Amount too small to be expressed; n.e.s. Not elsewhere specified; (p) Preliminary; x Confidential.

(1) Includes sand for use in foundries and glass manufacturing, ground and flour sand, and volatized and silica flue dust.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, IMPORTS OF SILICA SAND FROM OTHER COUNTRIES, BY PROVINCE AND BY USE, 2004-06

	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
FOUNDRY (1)						
New Brunswick	2 759	59	2 683	66	2 354	57
Quebec	50 864	1 099	47 638	611	16 148	544
Ontario	477 733	9 798	802 599	8 229	311 815	7 912
Manitoba	25 739	548	21 227	562	843 155	417
Saskatchewan	1 752	33	320	78	148	26
Alberta	2 000	55	5 518	157	2 119	101
British Columbia	3 339	54	8 224	123	9 036	109
Total	564 186	11 645	888 209	9 827	1 184 775	9 166
GLASS MANUFACTURING (2)						
Nova Scotia	3 097	70	6 724	102	—	—
New Brunswick	54	1	56	1	9	1
Quebec	36 457	793	47 194	669	52 894	752
Ontario	15 096	406	20 858	322	27 079	414
Manitoba	446	16	669	10	3	—
Saskatchewan	—	—	664	9	1 663	24
Alberta	108	2	166	14	—	—
British Columbia	380	8	263	13	216	10
Total	55 638	1 296	76 593	1 139	81 863	1 202

Sources: Natural Resources Canada; Statistics Canada.

— Nil; (p) Preliminary.

(1) Foundry refers to HS code 2505.10.00.10. (2) Glass manufacturing refers to HS code 2505.10.00.20.

Note: Numbers may not add to totals due to rounding.

TABLE 3. REPORTED USE (1) OF SILICA IN CANADA, BY INDUSTRY, 2003-05

	2003	2004	2005 (p)
	(tonnes)		
Nonferrous smelting and refining	735 914	889 080	860 500
Primary glass and glass containers, and glass fibre wool	497 476	493 708	500 115
Foundries	244 977	230 087	221 052
Chemicals	85 655	78 348	76 087
Cement	575 054	553 051	538 808
Other products (2)	358 601	390 374	371 831
Total	2 497 677	2 634 648	2 568 393

Source: Natural Resources Canada.

(p) Preliminary.

(1) Available data, as reported by users. (2) Includes abrasives, asbestos products, asphalt roofing products, cement (construction), ceramic products, structural clay products, cleansers, fertilizers, paint and varnish, pulp and paper products, refractory brick, rubber products, ferroalloys, primary steel, and other miscellaneous products.

TABLE 4. SILICA, REPORTED QUANTITY USED (1) IN CANADA, 2003-05

	2003	2004	2005 (p)
	(tonnes)		
Sand	1 659 889	1 803 720	1 760 857
Lump	767 821	753 872	742 573
Flour	69 967	77 056	64 963
Total	2 497 677	2 634 648	2 568 393

Source: Natural Resources Canada.

(p) Preliminary.

(1) Available data, as reported by users.

Stone

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INTRODUCTION

This report deals with the dimensional stone industry in Canada, comprising operating dimension stone quarries and stone-processing facilities. Dimensional stone, or architectural stone, refers to any stone that can be quarried into large blocks and processed into slabs, small blocks, flagstones, etc. Source material includes many different rock types, and these rocks are known in the industry by their commercial names.

The following definitions are taken from *Industrial Minerals and Rocks, 7th Edition* (2006) and originate in ASTM (American Society for Testing and Materials) specification C119. Commercial “granite” includes feldspathic igneous rocks such as granite, gabbro, gneiss, and anorthosite. Fine-grained diabase and basalt are often termed “black granite.” Commercial “marble” is a crystalline rock composed primarily of calcite, dolomite, or serpentine that is capable of taking a polish. This classification includes true marble, limestone, travertine, and serpentinite. Some stone marketed as marble, such as the Adair marble of Ontario, is actually fine-grained limestone or dolostone. Commercial “limestone” is a rock of sedimentary origin composed primarily of calcium carbonate or a combination of calcium and magnesium carbonate. Commercial “sandstone” is defined as a sedimentary rock composed mostly of mineral and rock fragments within the sand-size range (2-0.06 mm) and having a minimum of 60% free silica. Commercial “slate” is described as a microgranular metamorphic rock derived from argillaceous sediments.

For dimension stone to be accepted by architects for use in building construction projects, it must pass standard ASTM tests, including absorption, bulk specific gravity, modulus of rupture, compressive strength, and abrasion resistance. The stone industry determines the value of different stone products based on colour, grain texture, surface finish, and durability.

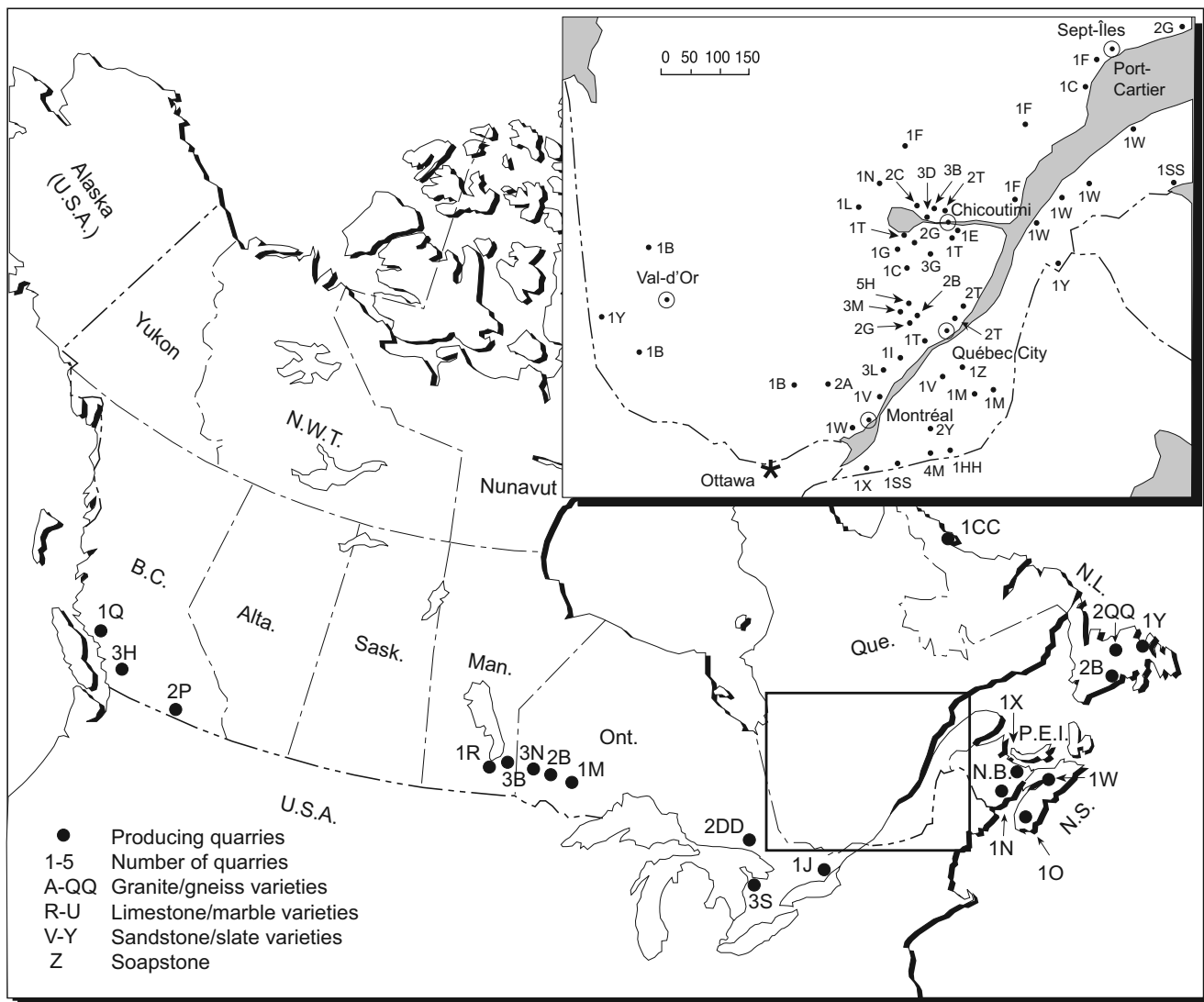
CANADIAN INDUSTRY

Total stone produced in Canada in 2006 (includes dimension stone and crushed stone) was 140.8 Mt valued at \$1.267 billion, based on preliminary figures, compared to 141.2 Mt the previous year. Virtually all of this production is crushed stone for the construction and chemical industries. Table 2 shows stone production broken down by rock type for 2001-06. Crushed stone is used for a variety of construction, chemical, metallurgical, and miscellaneous uses. Pulverized stone is used as a mineral filler, and for agricultural and environmental applications. The reader is referred to the chapter entitled “Mineral Aggregates” for more detailed information on crushed stone and sand and gravel, along with information on lightweight aggregates comprising perlite, vermiculite, pumice, and expanded clays.

Architectural and monumental stone-producing centres are shown in Figure 1. The majority of stone quarries are located in southern and central Quebec and central Ontario, with lesser production coming from other regions. In Quebec, stone quarries are primarily located northwest of Québec City, near Rivière-à-Pierre, in the Lac-Saint-Jean area, and in the Sherbrooke-Stanstead area near the U.S. border. In central Ontario, limestone and marble quarrying is carried out in the Owen Sound and Wiarton areas of the Bruce Peninsula. Granite quarries are found in central Ontario near Sudbury, and in the Vermilion Bay-Kenora district.

In 2005, 789 000 t of dimensional stone valued at \$103.2 million were quarried in Canada, an increase of 18.4% from 2004 figures. Production can be broken down by stone type as follows: limestone, 394 000 t (49.9%); marble, 9000 t (1.1%); granite, 241 000 t (30.5%); sandstone, 86 000 t (10.8%); and shale (including slate), 58 000 t (7.7%). Production figures for individual stone types are given in Tables 4 to 8 and include a summary by province or territory and a breakdown by use into dimension stone and crushed stone applications. Table 9 gives a breakdown of rough granite production and trade for the period 1988-2006. Figures 2a and 2b illustrate the trends in crushed and dimension stone production during the period 1994-2006, broken down by stone type. For the two main commercial types of stone produced in Canada, granite and limestone, there has been a general increase in the tonnage

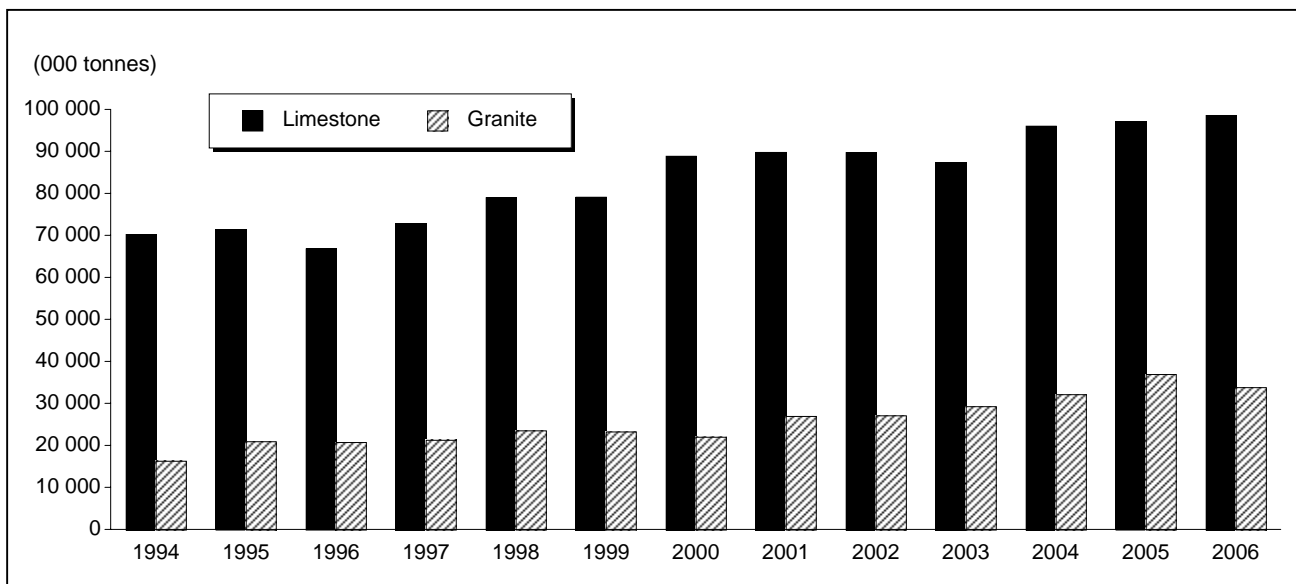
Figure 1
Canada, Architectural and Monumental/Ornamental Stone-Producing Centres, 2006



- | | |
|--|--|
| A Fine-grained pinkish-grey banded gneiss | O Fine-grained blue-grey granite |
| B Medium-grained pink granite | P Coarse coral pink granite |
| C Coarse-grained black anorthosite | Q Medium-grained blue-grey granite |
| CC Medium-grained "Reflect blue" anorthosite | QQ Medium-grained gabbro |
| D Medium-grained black gabbroic anorthosite | R Light-coloured mottled dolomitic limestone (Tyndall) |
| DD Blue-grey, and black and white anorthosite | S Fine-medium crystalline blue-grey to buff marble/dolostone |
| E Medium-grained pinkish-grey quartz monzonite | SS Fine-grained, multicoloured pre-Cambrian marble |
| F Fine-grained pink granitic gneiss | T Medium-grained light brownish-grey limestone |
| G Coarse-grained green charnockite | U Medium-grained blue-grey limestone |
| H Coarse-grained pink-grey or brown-grey granite | V Medium-grained olive sandstone |
| I Medium-grained grey dioritic gneiss | W Fine-medium-grained olive-brown and blue-grey sandstone |
| J Medium-grained red granite | X Fine-medium-grained white to buff sandstone (Potsdam) |
| L Coarse-grained brown or red quartz monzonite | Y Very fine-grained varicoloured slate |
| M Medium-grained grey granite | Z Soapstone (steatite) |
| N Medium-grained pink, brown or gold granites | |

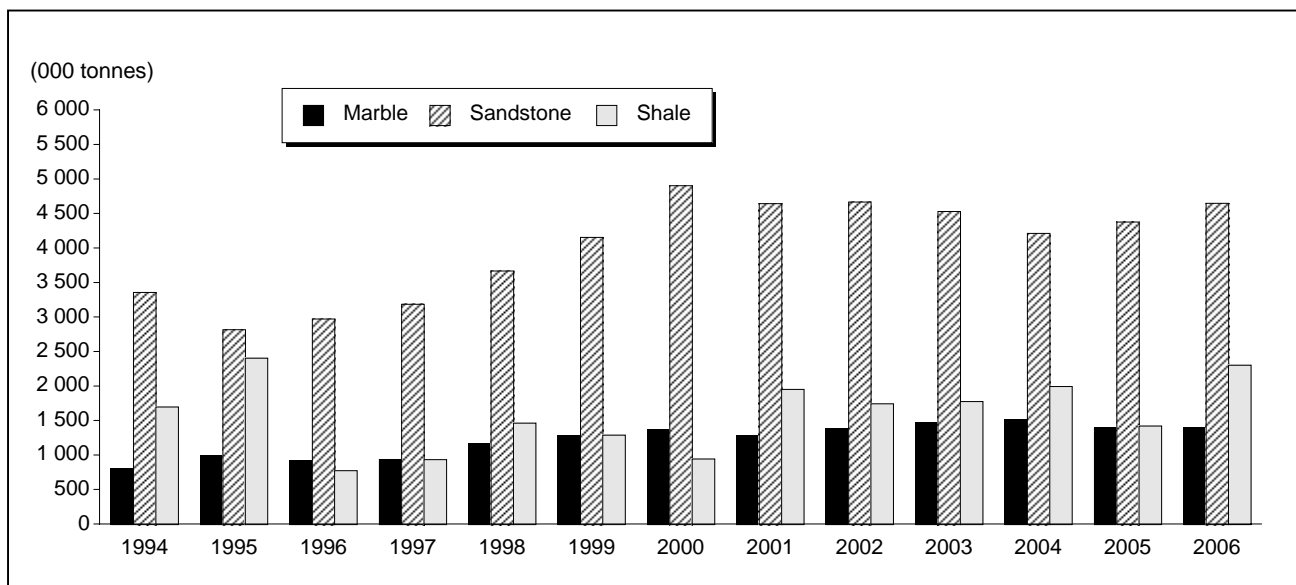
Source: Mainly provincial departments of Mines and Energy.

Figure 2a
Canada, Stone Production by Type, 1994-2006



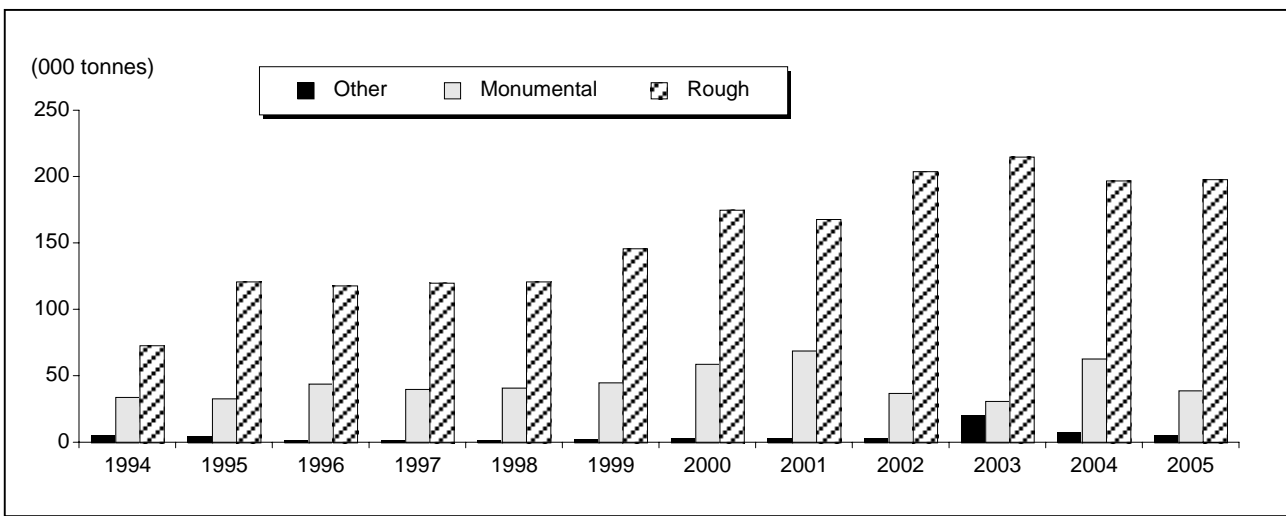
Source: Natural Resources Canada.

Figure 2b
Canada, Stone Production by Type, 1994-2006



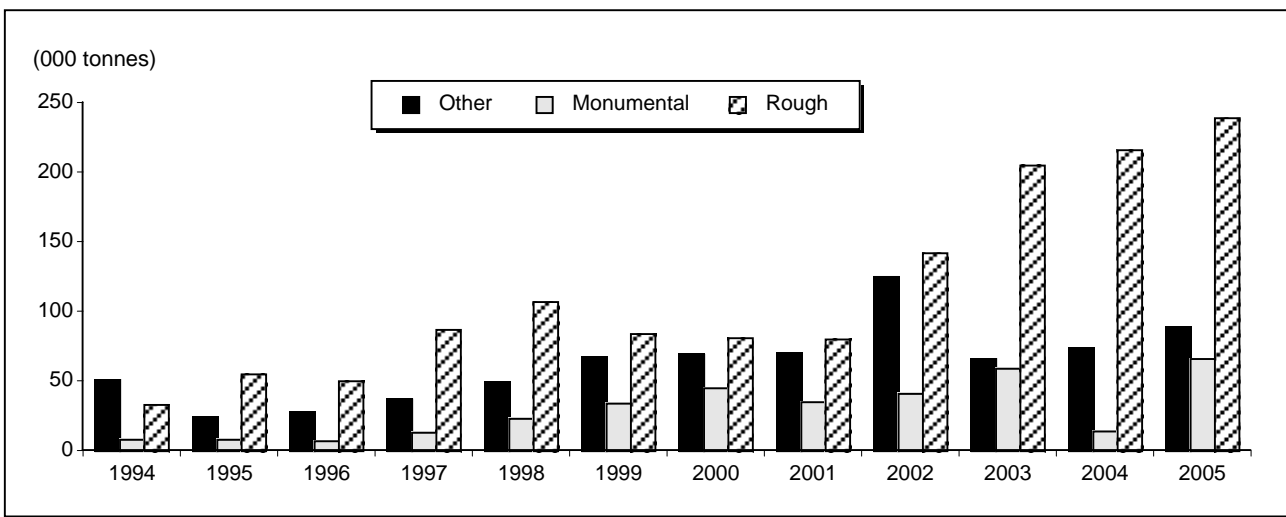
Source: Natural Resources Canada.

Figure 3
Canada, Granite Production, by Use, 1994-2005



Source: Natural Resources Canada.

Figure 4
Canada, Limestone Production, by Use, 1994-2005



Source: Natural Resources Canada.

produced in the last 10 years. Figure 3 illustrates granite dimensional stone production for the period 1994-2005. Figure 4 shows limestone dimensional stone production for the same period. The production of rough limestone blocks increased 10.6% in 2005 over the previous year.

Most of the dimension stone fabrication facilities in Canada are located in British Columbia, Ontario, and Quebec. Stone-producing companies ship rough stone blocks, usually weighing 20-40 t, to their own or to third-party fabrication plants in Canada and elsewhere, where the stone is cut into a wide range of sizes for use as exterior cladding on buildings (cut-to-size projects), interior walls, floors and counter tops, monuments and memorials, and other miscellaneous uses such as landscaping and curbing. Fabricators also source numerous stone types from other countries around the world.

A Statistics Canada publication (catalogue no. 26-226-XIB, *Non-Metallic Mineral Mining and Quarrying*, Tables 10 and 11) provides additional information on shipments of stone by province, type, and use. This publication is available on the Internet at www.statcan.ca/english/freepub/26-226-XIB/free.htm.

TRADE

Imports and exports of rough trimmed stone and other stone products are shown in Table 1. Total exports of crude or rough trimmed granite were 25 981 m³ (72 746 t, using a density of 2.8) in 2006, up substantially from 15 955 m³ the

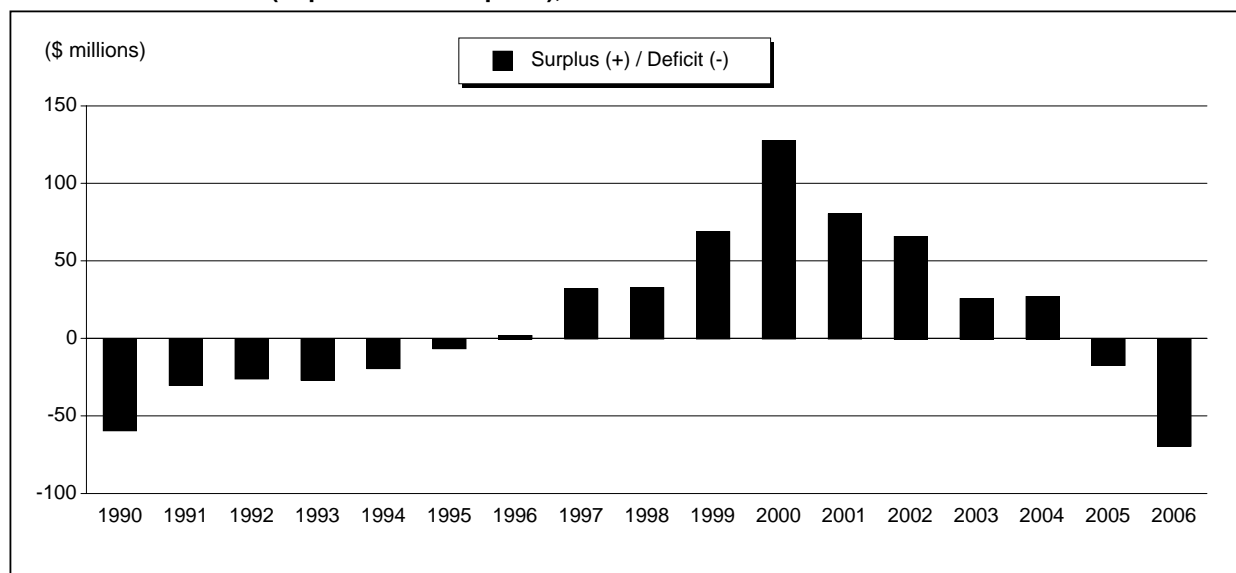
previous year. Stone was exported primarily to the United States, China, and South Korea. Regarding granite slabs, a total of 14 304 t were exported, up slightly from 2005.

Canada imported 42 646 t of rough granite in 2006, down from 57 673 t in 2005. Source countries were the United States, Brazil, South Africa, Zimbabwe, and Italy. In terms of slabbed granite products, imports in 2006 were 6135 t versus 9829 t the previous year, originating mainly in China, India, and the United States.

In terms of total value of stone trade, the trade deficit that first appeared in 2005 continues to grow. For 2006, the value of imports exceeded exports by \$69.1 million. Figure 5 shows the stone trade balance (exports minus imports) during the period 1990-2006. Between 1990 and 2000, the industry went from a trade deficit of almost \$60 million to a surplus of \$128 million. Since 2000, the surplus has steadily reduced the current deficit position. Part of this trend can be explained by the increased influence of stone products being exported from countries such as Brazil and China into Canada.

According to 2006 trade data published by *Stone World* magazine, the United States imported 2.58 million tons of granite, primarily from four countries: Brazil (38%), India (23%), China (19%), and Italy (13%). Only 1.6% of U.S. granite imports originated in Canada. The situation was quite different for marble. The United States imported 1.82 million tons of marble in 2006 (*Stone World*, May 2007). The breakdown by exporting country was: Turkey, 43%; Canada, 10%; Italy, 9%; and Mexico, 8%.

Figure 5
Stone Trade Balance (Exports Minus Imports), 1990-2006



Source: Natural Resources Canada.

WORLD OVERVIEW

According to statistics published by IMM Carrara (Internazionale Marmi e Macchine Carrara SpA, www.immcarrara.com/stat/english-version/index-stone-sector.html), world stone production for 2005 was estimated at 93 Mt, up 3.18% from the previous year. The estimated production from the top five countries was: China, 22.0 Mt; India, 12.5 Mt; Iran, 10.4 Mt; Italy, 10.2 Mt; and Spain, 8.7 Mt. Since 2001, countries that have seen the largest growth in production include Turkey (215%), Brazil (125%), China (31%), and India (23%), while production trends in Canada and the United States have remained flat. Figure 6 shows world stone production for 2004 and 2005.

The United States produced 1.5 Mt of dimensional stone in 2005 valued at US\$269 million (U.S. Geological Survey). Preliminary figures for 2006 indicate production of about 1.53 Mt valued at US\$275 million. A comparison of Canadian and U.S. production by dimension stone type for 2005 is as follows: limestone, 394 000 t vs. 581 000 t; granite, 241 000 t vs. 416 000 t; marble, 9000 t vs. 207 000 t; and sandstone, 86 000 t vs. 192 000 t.

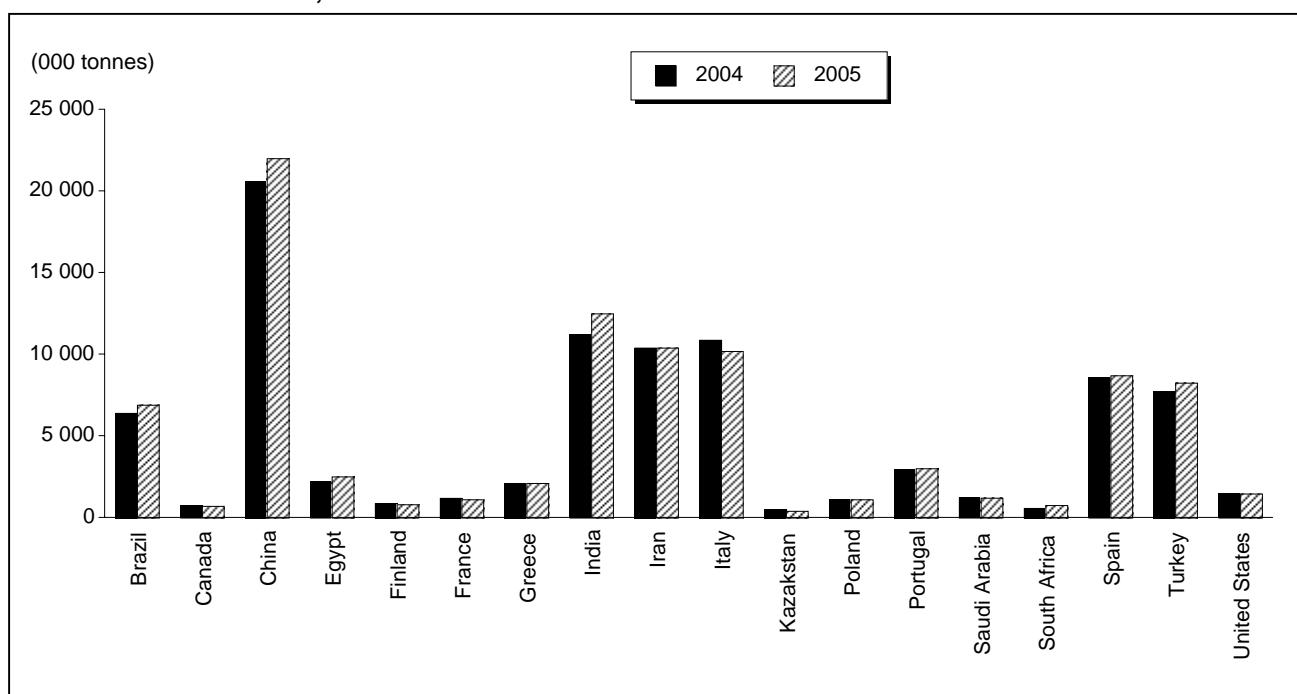
PRICES

Realized prices for dimensional stone are quite variable and depend on factors that include colour, texture, finish, and consistency. Average prices, in US\$/tonne, as reported by the U.S. Geological Survey for 2005, were \$254 for granite, \$165 for limestone, \$126 for sandstone, \$91 for marble, and \$617 for slate.

OUTLOOK

Demand for finished dimension stone products is expected to decline in 2007, due primarily to the significant slowdown in the U.S. construction industry. A strengthening Canadian dollar will have a negative impact on stone exports into the U.S. market. The balance of trade could continue its negative trend given the continuing pressure from lower-cost production in China, India, and Brazil.

Figure 6
World Stone Production, 2004 and 2005



Source: IMM Carrara.

RELEVANT DIMENSION STONE INDUSTRY WEB SITES

Minerals and Metals Sector, Natural Resources Canada
www.nrcan.gc.ca/mms/stone/index_e.htm

British Columbia government
www.em.gov.bc.ca/mining/Geolsurv/IndustrialMinerals/naturalstone/

Manitoba government
www.gov.mb.ca/iedm/mrd/busdev/industrial/com-sum.html

Ontario government
www.mndm.gov.on.ca/mndm/mines/mg/dimstone/intro_e.asp

Quebec government
www.mrnfp.gouv.qc.ca/mines/industrie/architecturale/index.jsp

Canadian Stone Association
www.stone.ca

U.S. Geological Survey
www.minerals.usgs.gov/minerals/pubs/commodity/stone_dimension

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2514.00	Slate, whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape	Free-3.5%	Free	Free	Free	Free	Free
25.15	Marble, travertine ecaussine and other calcareous monumental or building stone of an apparent specific gravity of 2.5 or more, and alabaster, whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
2515.11	Marble and travertine: crude or roughly trimmed	Free	Free	Free	Free	Free	Free
2515.12	Marble and travertine: merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape	Free	Free	Free	Free	Free	Free
25.16	Granite, porphyry, basalt, sandstone and other monumental or building stone, whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
2516.11	Granite: crude or roughly trimmed	Free	Free	Free	Free	Free	Free
2516.12	Granite: merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape	Free-3.5%	Free	Free	Free	Free	Free
2516.21	Sandstone: crude or roughly trimmed	Free	Free	Free	Free	Free	Free
2516.22	Sandstone: merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape	3.5%	Free	Free	Free	Free	Free
2516.90	Other monumental or building stone	Free-3.5%	Free	Free	Free	Free	Free
25.17	Pebbles, gravel, broken or crushed stones, of a kind commonly used for concrete aggregates, for road metalling or for railway or other ballast, shingle and flint, whether or not heat-treated; macadam of slag, dross or similar industrial waste, whether or not incorporating the materials cited in the first part of the heading; tarred macadam; granules, chippings and powder, of stones of heading 25.15 or 25.16, whether or not heat-treated						

TARIFFS (cont'd)

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2517.10	Pebbles, gravel, broken or crushed stone, of a kind commonly used for concrete aggregates for road metalling or for railway or other ballast, shingle and flint, whether or not heat-treated	Free	Free	Free	Free	Free	Free
2517.41	Of marble	Free	Free	Free	Free	Free	Free
2517.49	Other	Free	Free	Free	Free	Free	Free
6801.00	Setts, curbstones and flagstones, of natural stone (except slate)	3.5%	Free	Free	Free	Free	Free
68.02	Worked monumental or building stone (except slate) and articles thereof, other than goods of heading 68.01; mosaic cubes and the like, of natural stone (including slate), whether or not on a backing; artificially coloured granules, chippings and powder, of natural stone (including slate)						
6802.10	Tiles, cubes and similar articles, whether or not rectangular (including square), the largest surface area of which is capable of being enclosed in a square the side of which is less than 7 cm; artificially coloured granules, chippings and powder	Free-8%	Free-5%	Free	Free	Free	Free
6802.21	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: marble, travertine and alabaster	3.5%	Free	Free	Free	1.7%	Free
6802.22	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: other calcareous stone	5%	Free	Free	Free	1.7%	Free
6802.23	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: granite	3.5%	Free	Free	Free	1.7%	Free
6802.29	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: other stone	5%	Free	Free	Free	1.7%	Free
6802.91	Other: marble, travertine and alabaster	6%	Free	Free	Free	1.7%	Free
6802.92	Other: other calcareous stone	6.5%	3%	Free	Free	1.7%	Free
6802.93	Other: granite	6.5%	6.5%	Free	Free	Free-1.7%	Free
6802.99	Other: other stone	6.5%	6.5%	Free	Free	Free-1.7%	Free
6803.00	Worked slate and articles of slate or of agglomerated slate	Free-6.5%	Free-6.5%	Free	Free	1.7%	Free
68.04	Millstones, grindstones, grinding wheels and the like, without frameworks, for grinding, sharpening, polishing, trueing or cutting, hand sharpening or polishing stone, and parts thereof, of natural stone, of agglomerated natural or artificial abrasives, or of ceramics, with or without parts of other materials						
6804.10	Millstones and grindstones for milling, grinding or pulping	6.5%	Free	Free	Free	Free	1.5%-2.3%
6804.23	Other millstones, grindstones, grinding wheels and the like: of natural stone	6.5%	Free	Free	Free	Free	1.5%

Sources: Canadian *Customs Tariff*, effective January 2006 and 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2006 and 2007; *Official Journal of the European Union* (October 27, 2005 and October 17, 2006 editions); *Customs Tariff Schedules of Japan*, 2006 and 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, STONE TRADE, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS							
2514.00	Slate: whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
	United States	435	287	628	410	613	423
	Japan	—	—	—	—	125	14
	Costa Rica	—	—	—	—	1	1
	Italy	—	—	—	—	1	1
	Other countries	7	3	51	27	—	—
	Total	442	290	679	437	740	439
2515.11	Marble and travertine: crude or roughly trimmed						
	Bermuda	18	7	38	13	63	16
	United States	6	6	19	4	8	12
	Australia	—	—	4	1	—	—
	Bahamas	—	—	1	10	—	—
	Total	24	13	62	28	71	28
2515.12	Marble and travertine: merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
	Italy	388	168	476	154	450	181
	China	—	—	—	—	51	22
	United States	10	31	15	30	3	8
	Spain	—	—	—	—	17	6
	Bermuda	409	136	21	7	5	2
	Bahamas	—	—	—	—	8	2
	Barbados	1	...	—	—	—	—
	Hong Kong	330	103	—	—	—	—
	Other countries	2	6	210	68	—	—
	Total	1 140	444	722	259	534	221
		(m³)	(\$000)	(m³)	(\$000)	(m³)	(\$000)
2516.11	Granite: crude or roughly trimmed						
	United States	30 549	4 975	10 137	4 489	11 919	4 484
	China	7 080	3 979	2 379	961	9 079	2 801
	South Korea	598	336	—	—	2 761	614
	Japan	1 307	665	2 463	1 181	1 632	561
	Italy	422	212	384	153	308	154
	Taiwan	412	180	518	205	132	74
	Bermuda	20	15	—	—	113	43
	Spain	—	—	36	22	37	18
	Other countries	538	157	38	15	—	—
	Total	40 926	10 519	15 955	7 026	25 981	8 749
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
2516.12	Granite: merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
	China	7 247	2 058	4 790	2 702	7 792	2 193
	United States	556	698	824	556	1 493	592
	Bermuda	182	179	3 325	1 697	809	370
	Taiwan	2 374	567	1 485	992	1 024	301
	India	18	4	22	8	547	279
	Italy	7 887	3 550	572	231	1 340	253
	South Korea	4 136	1 698	188	170	957	185
	Saint Kitts and Nevis	6	8	—	—	176	154
	United Arab Emirates	...	...	12	19	21	28
	Japan	169	70	21	36	99	21
	Croatia	—	—	—	—	23	20
	Turks and Caicos Islands	6	5	156	119	18	15
	Other countries	443	153	2 614	505	5	4
	Total	23 024	8 990	14 009	7 035	14 304	4 415
		(m³)	(\$000)	(m³)	(\$000)	(m³)	(\$000)
2516.21	Sandstone: crude or roughly trimmed						
	United States	29	39	232	88	178	78
	Bermuda	—	—	5	1	644	36
	Other countries	1	—	—	—	1	—
	Total	30	39	237	89	823	114

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
2516.22	Sandstone: merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
	United States	10	23	108	254	42	153
	Bermuda	—	—	—	—	32	6
	Jamaica	4	1	—	—	—	—
	France	—	—	2	...	—	—
	Romania	—	—	6	1	—	—
	Total	14	24	116	255	74	159
2516.90	Other monumental or building stone						
	United States	6 200	1 754	6 749	2 035	5 553	1 406
	China	—	—	368	56	7 597	1 055
	Taiwan	—	—	177	18	5 552	793
	South Korea	—	—	23	10	1 799	251
	Spain	—	—	—	—	232	28
	Hong Kong	—	—	—	—	155	22
	Other countries	642	38	14	3	226	37
	Total	6 842	1 792	7 331	2 122	21 114	3 592
2517.10	Pebbles and gravel of a kind commonly used for concrete aggregates, for road metalling or for railway or other ballast, shingle and flint, whether or not heat-treated						
	United States	5 795 879	56 862	6 302 073	56 787	6 138 961	59 099
	Trinidad and Tobago	53 451	988	—	—	377 627	2 695
	Bermuda	650	4	122 395	797	78 168	820
	Barbados	351 660	2 153	57 794	344	38 001	555
	Guyana	—	—	—	—	105 056	531
	Netherlands Antilles	—	—	—	—	64 433	325
	Hong Kong	25	19	13 912	82	16 752	99
	Bolivia	—	—	—	—	2 773	14
	Poland	—	—	—	—	109	2
	Other countries	3 137	22	87 250	453	226	1
	Total	6 204 802	60 048	6 583 424	58 463	6 822 106	64 141
2517.41	Granules, chippings and powder, of stones of heading nos. 25.15 or 25.16, whether or not heat-treated: of marble						
	United States	45 054	8 140	41 243	7 170	43 073	7 429
	Uganda	—	—	—	—	2	...
	Italy	30	4	—	—	—	—
	Total	45 084	8 144	41 243	7 170	43 075	7 429
2517.49	Granules, chippings and powder, of stones of heading nos. 25.15 or 25.16, whether or not heat-treated: other						
	United States	9 039	505	9 772	581	11 990	680
	Other countries	9632	53	5 686	72	359	69
	Total	18 671	558	15 458	653	12 349	749
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6801.00	Setts, curbstones and flagstones, of natural stone (except slate)						
	United States	..	3 027	..	1 466	..	1 379
	Germany	—	—	—	—	..	13
	Other countries	—	2	—	7	—	7
	Total	..	3 029	..	1 473	..	1 399
6802.10	Tiles, cubes and similar articles, whether or not rectangular						
	United States	..	11 979	..	16 154	..	21 477
	Belgium	—	—	..	754	..	2 585
	Bermuda	..	15	..	4	..	1
	Other countries	—	291	—	31	—	1
	Total	..	12 285	..	16 943	..	24 064

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
EXPORTS (cont'd)							
6802.21	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: marble, travertine and alabaster						
	Bahamas	—	—	..	6	..	375
	Cayman Islands	..	4	—	—	..	269
	Bermuda	..	8	..	7	..	82
	United Arab Emirates	—	—	—	—	..	29
	Other countries	—	105	—	102	—	19
	Total	..	117	..	115	..	774
6802.22	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: other calcareous stone						
	United States	..	773	..	1 912	..	1 467
	Other countries	—	—	—	21	—	2
	Total	..	773	..	1 933	..	1 469
6802.23	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: granite, building stone						
	United States	..	1 587	..	1 291	..	964
	Italy	..	...	..	500	..	850
	Bermuda	..	60	..	31	..	328
	Other countries	—	54	—	44	—	208
	Total	..	1 701	..	1 866	..	2 350
6802.29	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: other stone						
	United States	..	752	..	1 124	..	636
	Bermuda	..	14	..	42	..	21
	Other countries	—	1297	—	133	—	11
	Total	..	2 063	..	1 299	..	668
6802.91	Other: marble, travertine and alabaster						
	United States	..	2 844	..	1 492	..	1 060
	Bahamas	—	—	..	131	..	134
	Bermuda	..	7	..	12	..	53
	Other countries	—	34	—	238	—	89
	Total	..	2 885	..	1 873	..	1 336
6802.92	Other: other calcareous stone						
	United States	..	4 784	..	6 390	..	6 033
	Bermuda	..	21	—	—	—	—
	Total	..	4 805	..	6 390	..	6 033
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
6802.93.10	Other: granite, monuments, bases and markers, finished						
	United States	12 176	19 989	11 030	17 563	13 346	19 755
	Bermuda	—	—	18	15	73	53
	Other countries	57	73	44	42	2	2
	Total	12 233	20 062	11 092	17 620	13 421	19 810
6802.93.90	Other: granite, other						
	United States	35 803	42 389	33 768	34 438	33 101	27 292
	Netherlands Antilles	1	...	—	—	41	223
	Saint Pierre and Miquelon	—	—	—	—	64	137
	Bahamas	—	—	351	220	63	135
	Turks and Caicos Islands	—	—	—	—	19	81
	Netherlands	—	—	—	—	18	38
	Bermuda	37	80	170	291	16	35
	United Kingdom	56	110	—	—	39	24
	Other countries	697	1 342	301	255	—	—
	Total	36 594	43 921	34 590	35 204	33 361	27 965
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6802.99	Other: other stone						
	United States	..	37 636	..	30 396	..	32 972
	Other countries	—	233	—	268	—	29
	Total	..	37 869	..	30 664	..	33 001

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
EXPORTS (cont'd)							
6803.00	Worked slate and articles of slate or of agglomerated slate						
	France	..	21 241	..	25 737	..	6 064
	United States	..	2 703	..	3 608	..	5 494
	United Kingdom	..	4 411	..	4 240	..	3 166
	Belgium	..	3 810	..	4 763	..	1 886
	Germany	—	—	..	1 000	..	470
	Ireland	..	140	..	340	..	356
	Australia	..	334	..	75	..	268
	Netherlands	..	177	..	70	..	20
	Bermuda	—	—	—	—	..	5
	Cuba	—	—	—	—	..	1
	Russia	—	—	..	1	—	—
	Total	..	32 816	..	39 834	..	17 730
6804.10	Millstones and grindstones for milling, grinding or pulping						
	United States	..	1 619	..	1 619	..	1 204
	Finland	..	718	..	724	..	506
	Germany	..	579	..	737	..	407
	Brazil	..	506	..	266	..	259
	South Africa	..	27	..	31	..	200
	Sweden	..	563	..	291	..	173
	Russia	—	—	..	173	..	139
	Japan	..	89	..	128	..	118
	Spain	..	248	..	167	..	84
	Chile	..	55	..	122	..	59
	Other countries	—	615	—	684	—	121
	Total	..	5 019	..	4 942	..	3 270
6804.23	Other millstones, grindstones, grinding wheels and the like: of natural stone						
	United States	..	50	..	178	..	176
	Bermuda	..	12	..	8	..	7
	Other countries	—	27	—	—	—	8
	Total	..	89	..	186	..	191
	Total exports	..	258 295	..	243 879	..	230 096
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS							
2514.00	Slate: whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
	India	7 764	2 833	9 322	3 137	13 660	4 474
	China	16 218	2 437	104 850	1 823	7 451	1 961
	United States	10 476	447	1 991	679	978	286
	Brazil	380	153	359	178	987	208
	Italy	112	62	19	19	19	20
	Other countries	207	100	64	29	61	23
	Total	35 157	6 032	116 605	5 865	23 156	6 972
2515.11	Marble and travertine: crude or roughly trimmed						
	United States	2 214	844	4 973	986	2 808	908
	Italy	327	317	1 251	120	3 511	279
	Spain	...	2	3	7	58	80
	Czech Republic	—	—	22	27	35	47
	Turkey	400	387	617	28	1 035	42
	Iran	—	—	840	13	1 794	27
	China	16	13	21	16	18	21
	Other countries	40	35	5	6	36	22
	Total	2 997	1 598	7 732	1 203	9 295	1 426

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2515.12	Marble and travertine: merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
	United States	427	246	243	116	788	815
	Iran	300	320	227	249	299	323
	Italy	678	763	271	306	217	303
	Spain	223	242	103	135	195	211
	Brazil	5	6	21	19	98	130
	China	191	212	210	174	82	60
	Pakistan	80	53	90	98	36	56
	India	3	4	13	9	35	44
	Greece	4	2	8	9	22	43
	Turkey	76	58	36	39	26	20
	Portugal	55	63	47	57	39	18
	Israel	84	76	42	44	20	16
	Other countries	34	35	128	138	58	31
	Total	2 160	2 080	1 439	1 393	1 915	2 070
2516.11	Granite: crude or roughly trimmed						
	United States	32 210	7 693	28 385	6 970	20 259	6 651
	Brazil	6 850	4 138	6 197	3 333	3 779	3 141
	Italy	1 191	487	2 660	1 453	3 360	2 530
	South Africa	11 322	3 241	11 619	2 707	4 084	2 069
	Zimbabwe	2 565	1 164	656	281	3 593	1 904
	India	2 397	936	2 871	1 308	2 214	1 177
	Norway	2 536	1 484	1 269	656	1 078	990
	China	2 289	719	2 563	586	1 702	854
	Spain	356	110	2	4	1 428	341
	Taiwan	668	197	116	148	534	184
	Finland	341	68	464	150	271	135
	Saudi Arabia	272	119	144	129	170	114
	Sweden	614	214	100	33	66	31
	United Kingdom	248	52	39	22	26	30
	Other countries	120	73	588	134	82	36
	Total	63 979	20 695	57 673	17 914	42 646	20 187
2516.12	Granite: merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
	China	2 163	1 886	2 364	2 308	2 109	2 091
	India	1 396	1 513	2 612	2 121	1 181	1 332
	Brazil	999	994	2 118	1 652	731	887
	Italy	727	533	512	679	493	811
	United States	2 219	708	1 178	704	1 007	778
	Spain	172	191	267	369	244	303
	Czech Republic	..	...	—	—	85	112
	Portugal	30	18	78	80	73	93
	Taiwan	13	31	89	73	24	48
	South Africa	158	107	10	17	54	45
	Other countries	311	186	601	98	134	108
	Total	8 188	6 167	9 829	8 101	6 135	6 608
2516.21	Sandstone: crude or roughly trimmed						
	United States	5 459	1 306	5 688	1 421	5 016	1 085
	India	605	155	868	196	2 153	446
	United Kingdom	77	36	2 320	729	924	211
	China	434	98	2	1	173	27
	Other countries	20	9	17	21	85	13
	Total	6 595	1 604	8 895	2 368	8 351	1 782
2516.22	Sandstone: merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape						
	United States	5 146	1 891	4 402	1 794	3 304	1 447
	India	956	304	1 076	283	2 027	648
	China	103	20	246	35	151	39
	Germany	—	—	—	—	2	6
	France	—	—	—	—	1	1
	United Kingdom	3	1	10	11	...	...
	Brazil	2	1	35	35	—	—
	Total	6 210	2 217	5 769	2 158	5 485	2 141

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
2516.90	Other monumental or building stone						
	United States	11 937	2 570	22 513	4 104	11 650	4 814
	India	105	35	160	152	523	278
	Brazil	33	4	486	200	169	199
	Italy	13	42	9	11	114	69
	Other countries	748	140	1 528	209	395	283
	Total	12 836	2 791	24 696	4 676	12 851	5 643
2517.10	Pebbles and gravel of a kind commonly used for concrete aggregates, for road metalling or for railway or other ballast, shingle and flint, whether or not heat-treated						
	United States	2 293 245	15 329	2 153 882	14 901	2 292 095	14 784
	China	41 388	336	11 346	396	2 207	277
	Philippines	3 784	24	3 467	135	254	62
	Brazil	2 115	29	2 374	30	395	27
	Mexico	398	11	289	28	225	22
	France	1 990	22	635	22	73	19
	Germany	18	1	5	30	21	16
	Belgium	489	4	88	8	328	13
	Other countries	10707	111	6737	92	1903	48
	Total	2 354 134	15 867	2 178 823	15 642	2 297 501	15 268
2517.41	Granules, chippings and powder, of stones of heading nos. 25.15 or 25.16, whether or not heat-treated: of marble						
	United States	98 003	18 663	68 514	11 310	97 456	12 452
	France	—	—	—	—	579	101
	Germany	..	..	—	—	23	16
	Other countries	91	17	396	111	198	35
	Total	98 094	18 680	68 910	11 421	98 256	12 604
2517.49	Granules, chippings and powder, of stones of heading nos. 25.15 or 25.16, whether or not heat-treated: other						
	United States	15 972	1 487	103 321	1 844	23 339	2 520
	China	860	47	2 774	55	365	181
	South Korea	3	..	—	—	98	56
	Germany	82	1	12	1	446	26
	Indonesia	—	—	3	..	11	22
	France	922	44	129	29	59	17
	New Zealand	—	—	..	11	1	16
	Brazil	63	10	17	5	7	7
	Other countries	845	54	1090	24	1133	27
	Total	18 747	1 643	107 346	1 969	25 459	2 872
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6801.00	Setts, curbstones and flagstones, of natural stone (except slate)						
	United States	..	551	..	937	..	937
	China	..	141	..	270	..	270
	Turkey	—	—	—	—	..	86
	India	..	52	..	592	..	47
	France	—	—	—	—	..	27
	Other countries	—	8	—	16	—	20
	Total	..	752	..	1 815	—	1 387
6802.10	Tiles, cubes and similar articles, whether or not rectangular						
	China	..	2 417	..	1 560	..	2 849
	United States	..	335	..	1 430	..	1 823
	Italy	..	49	..	90	..	139
	Turkey	..	41	..	25	..	104
	South Africa	..	50	..	87	..	53
	Other countries	..	259	..	410	..	94
	Total	..	3 151	..	3 602	..	5 062

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
IMPORTS (cont'd)							
6802.21	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: marble, travertine and alabaster						
	Italy	..	7 209	..	8 715	..	8 403
	Spain	..	1 345	..	1 785	..	1 589
	Turkey	..	1 038	..	1 827	..	1 544
	India	..	208	..	326	..	1 276
	China	..	488	..	996	..	1 053
	United States	..	96	..	210	..	601
	Iran	..	117	..	313	..	525
	Greece	..	279	..	313	..	267
	Israel	..	91	..	125	..	260
	Peru	..	67	..	74	..	218
	Taiwan	..	11	..	53	..	192
	Portugal	..	74	..	103	..	165
	Brazil	..	43	..	79	..	152
	United Arab Emirates	..	24	..	60	..	151
	Other countries	—	311	—	375	—	289
	Total	..	11 401	..	15 354	..	16 685
6802.22	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: other calcareous stone						
	United States	..	789	..	251	..	517
	Germany	—	—	..	29	..	468
	Italy	..	387	..	177	..	204
	Gibraltar	..	218	..	183	..	166
	France	..	11	..	48	..	123
	Portugal	..	93	..	110	..	109
	Ukraine	..	125	..	48	..	67
	Spain	..	26	..	15	..	54
	Other countries	..	246	..	193	..	138
	Total	..	1 895	..	1 054	..	1 846
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
6802.23.00.10	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: granite, building stone						
	Brazil	2 659	1 938	2 909	2 386	3 860	3 910
	Italy	3 047	4 270	3 521	4 380	2 753	3 791
	India	1 914	2 452	2 297	2 790	2 860	3 132
	China	2 567	2 149	2 587	2 285	3 199	2 091
	Taiwan	173	177	707	492	470	551
	Spain	270	299	98	98	149	176
	United States	23	32	129	138	122	71
	Saudi Arabia	108	136	39	44	56	53
	Other countries	178	90	139	45	64	66
	Total	10 939	11 543	12 426	12 658	13 533	13 841
6802.23.00.20	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: granite, monumental stone						
	China	1 029	797	1 404	1 379	2 168	1 977
	Taiwan	403	656	474	576	448	505
	Brazil	113	148	77	117	189	277
	Italy	3	7	22	31	116	147
	India	600	430	503	276	57	79
	Spain	87	129	21	24	40	53
	United States	151	140	63	98	23	46
	Other countries	56	74	7	12	7	9
	Total	2 442	2 381	2 571	2 513	3 048	3 093
6802.23.00.90	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: granite, monumental stone: other						
	Brazil	11 304	7 951	26 130	11 899	15 675	18 021
	Italy	9 757	12 469	11 923	10 989	12 439	14 538
	India	7 019	6 265	15 705	9 539	11 280	12 980
	China	4 148	3 823	7 443	6 517	9 857	8 977
	Taiwan	2 781	3 826	2 630	3 620	2 149	2 796
	Spain	740	775	1 806	2 379	1 077	1 892

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
	United States	1 301	1 043	770	593	769	623
	South Africa	682	261	249	231	340	298
	Hong Kong	—	—	3	23	144	118
	Saudi Arabia	72	88	57	72	46	80
	Other countries	680	530	1288	659	503	526
	Total	38 484	37 031	68 004	46 521	54 279	60 849
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6802.29	Other monumental or building stone and articles thereof, simply cut or sawn, with a flat or even surface: other stone						
	United States	..	103	..	2 255	..	2 902
	China	..	451	..	547	..	1 010
	India	..	1 133	..	844	..	616
	Spain	..	84	..	287	..	171
	Ireland	—	—	—	—	..	122
	Brazil	—	—	..	11	..	111
	Italy	..	90	..	166	..	94
	Other countries		190		222		131
	Total	..	2 051	..	4 332	..	5 157
6802.91	Other: marble, travertine and alabaster						
	Turkey	..	13 531	..	22 641	..	30 528
	Italy	..	13 472	..	13 621	..	12 786
	China	..	4 862	..	6 769	..	8 142
	Spain	..	3 899	..	3 458	..	3 594
	India	..	483	..	1 747	..	2 069
	Mexico	..	1 578	..	1 371	..	1 179
	Greece	..	631	..	731	..	1 088
	Peru	..	37	..	94	..	1 007
	United States	..	611	..	574	..	711
	Israel	..	481	..	565	..	532
	Germany	..	457	..	485	..	462
	Taiwan	..	442	..	439	..	358
	Portugal	..	537	..	327	..	315
	Pakistan	..	337	..	273	..	299
	Iran	..	450	..	524	..	219
	Egypt	..	91	..	210	..	145
	Vietnam	..	60	..	140	..	137
	Other countries		515		583		550
	Total	..	42 474	..	54 552	..	64 121
6802.92	Other: other calcareous stone						
	Israel	..	405	..	432	..	725
	Portugal	..	562	..	578	..	551
	Turkey	..	126	..	107	..	446
	Italy	..	460	..	767	..	416
	Germany	..	140	..	127	..	344
	Mexico	..	428	..	482	..	331
	United States	..	489	..	384	..	330
	France	..	134	..	384	..	195
	China	..	144	..	162	..	167
	Other countries		256		626		519
	Total	..	3 144	..	4 049	..	4 024
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
6802.93.00.10	Other: granite, monumental or building						
	Brazil	797	843	1 571	1 186	1 014	1 154
	China	313	235	1 150	902	1 015	1 008
	Italy	452	766	642	999	646	935
	India	209	353	249	400	372	517
	United States	310	464	154	217	158	264
	Taiwan	18	27	234	254	90	88
	Other countries	265	297	61	106	48	92
	Total	2 364	2 985	4 061	4 064	3 343	4 058

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
6802.93.00.20	Other: granite, monuments, bases and markers, finished						
	India	2 034	2 217	2 300	2 605	2 496	2 455
	China	2 021	1 896	2 144	1 767	2 492	1 800
	United States	1 119	1 492	1 223	1 234	1 174	1 030
	Brazil	99	186	83	141	25	71
	Italy	20	29	11	20	25	41
	Other countries	104	130	272	142	88	83
	Total	5 397	5 950	6 033	5 909	6 300	5 480
6802.93.00.90	Other: granite, other						
	China	6 242	3 723	8 223	5 138	8 196	7 275
	India	1 720	2 237	2 036	2 387	2 880	3 121
	Italy	5 533	3 525	6 815	4 306	1 807	2 638
	Brazil	1 014	1 147	2 319	1 458	1 083	1 317
	United States	536	194	857	534	505	586
	Spain	97	47	30	25	87	112
	Mexico	—	—	144	7	519	97
	Other countries	367	219	220	117	225	249
	Total	15 509	11 092	20 644	13 972	15 302	15 395
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
6802.99	Other: other stone						
	United States	..	563	..	1 260	..	2 076
	China	..	514	..	1 484	..	1 366
	France	..	33	..	6	..	657
	Italy	..	90	..	436	..	480
	India	..	203	..	220	..	320
	Israel	..	152	..	124	..	283
	Portugal	..	296	..	2	..	159
	Finland	..	150	..	149	..	120
	Brazil	..	77	..	27	..	102
	Mexico	..	21	..	41	..	100
	Other countries	..	268	..	714	..	541
	Total	..	2 367	..	4 463	..	6 204
6803.00	Worked slate and articles of slate or of agglomerated slate						
	China	..	2 930	..	3 563	..	5 660
	India	..	2 697	..	3 445	..	2 666
	United States	..	1 493	..	1 632	..	1 758
	Brazil	..	1 773	..	1 618	..	1 663
	South Africa	..	60	..	111	..	123
	Italy	..	291	..	123	..	115
	United Kingdom	..	10	..	49	..	82
	Spain	..	...	..	32	..	63
	Other countries	..	142	..	210	..	90
	Total	..	9 396	..	10 783	..	12 220
6804.10	Millstones and grindstones for milling, grinding or pulping						
	United States	..	2 452	..	1 075	..	739
	Norway	..	294	..	139	..	69
	India	..	21	..	10	..	65
	Japan	..	...	..	7	..	62
	Germany	..	28	..	28	..	46
	Italy	..	37	..	36	..	43
	China	..	15	..	21	..	39
	Taiwan	..	11	..	24	..	12
	Spain	..	42	..	28	..	10
	Israel	..	8	..	5	..	9
	Mexico	..	9	..	7	..	9
	Other countries	..	56	..	187	..	34
	Total	..	2 973	..	1 567	..	1 137

TABLE 1 (cont'd)

		2004		2005		2006 (p)	
		(n.a.)	(\$000)	(n.a.)	(\$000)	(n.a.)	(\$000)
IMPORTS (cont'd)							
6804.23	Other millstones, grindstones, grinding wheels and the like: of natural stone						
	United States	..	791	..	744	..	816
	China	..	21	..	53	..	82
	Japan	..	2	..	32	..	33
	Italy	..	60	..	26	..	28
	Germany	..	29	..	14	..	25
	Austria	..	1	..	3	..	22
	Sweden	..	1	..	—	..	14
	Switzerland	..	27	..	25	..	12
	Mexico	..	46	..	4	..	11
	United Kingdom	..	11	..	14	..	8
	Other countries		11		41		21
	Total	..	1 000	..	956	..	1 072
	Total imports	..	230 960	..	260 874	..	299 204

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; ... Amount too small to be expressed; n.a. Not applicable; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, STONE PRODUCTION BY TYPE, (1) 2001-06

	2001		2002		2003		2004		2005		2006 (p)	
	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)
Granite	27 005	233 463	27 127	238 116	29 306	248 386	32 177	252 402	36 988	293 083	33 830	273 478
Limestone	89 845	578 245	89 808	606 758	87 440	623 511	96 077	734 310	97 078	758 096	98 651	820 050
Marble	1 284	93 764	1 390	102 267	1 467	97 184	1 519	108 409	1 399	102 727	1 397	106 183
Sandstone	4 649	33 984	4 672	38 409	4 535	37 395	4 217	38 059	4 383	39 202	4 654	38 838
Shale (2)	1 976	17 590	1 749	18 235	1 781	17 401	1 999	22 584	1 426	21 929	2 308	28 562
Total	124 758	957 047	124 746	1 003 785	124 528	1 023 876	135 988	1 155 765	141 275	1 215 036	140 840	1 267 110

Source: Natural Resources Canada.

(p) Preliminary.

(1) Data exclude stone used in the Canadian cement, lime and clay industries. (2) May include slate.

Note: Numbers may not add to totals due to rounding.

TABLE 3. CANADA, STONE PRODUCTION, 2004-06

Item No.	2004		2005		2006 (p)	
	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)
BY PROVINCE/TERRITORY (1)						
Newfoundland and Labrador	4 624	28 767	5 561	33 450	5 664	32 897
Nova Scotia	10 118	67 896	11 650	80 102	11 719	82 934
New Brunswick	5 256	32 762	5 452	37 049	4 994	37 348
Quebec	42 578	346 163	44 738	370 953	42 505	366 772
Ontario	59 584	585 117	58 086	578 284	59 362	626 525
Manitoba	3 583	18 604	3 964	20 753	4 118	23 905
Alberta	370	6 228	372	5 799	960	9 000
British Columbia	9 112	66 494	9 972	74 279	10 469	81 743
Northwest Territories	763	3 733	1 480	14 366	1 050	5 987
Total	135 988	1 155 765	141 275	1 215 036	140 840	1 267 110
BY USE (2)						
Stone (Dimension)						
Dimension stone						
Rough	535	62 442	566	76 896	..	..
Monumental and ornamental stone (n.f.)	77	6 492	105	8 884	..	..
Other (flagstone, curbstone, paving blocks, etc.)	118	18 158	117	17 380	..	..
Total dimension stone	730	87 091	789	103 160	..	..
Stone (Crushed)						
Crushed stone for						
Concrete aggregate	34 520	292 828	35 813	278 644	..	..
Asphalt aggregate	12 867	85 721	13 366	96 503	..	..
Road metal	33 421	207 698	38 228	243 761	..	..
Railroad ballast (includes traprock)	1 934	16 784	2 420	21 178	..	..
Other uses	41 978	269 301	40 591	282 183	..	..
Chemical and metallurgical						
Cement plants, Canada	17 750	56 185	17 298	56 587	..	..
Cement plants, foreign	1 773	9 341	1 750	8 953	..	..
Flux in iron and steel furnaces	209	813	216	702	..	..
Flux in nonferrous smelters	51	887	47	845	..	..
Glass factories	28	317	18	118	..	..
Lime plants, Canada	3 622	25 510	3 270	24 057	..	..
Lime plants, foreign	609	6 749	730	7 828	..	..
Pulp and paper mills	75	699	80	679	..	..
Sugar refineries	2	10	2	10	..	..
Other chemical uses	2 461	15 265	2 545	15 951	..	..
Miscellaneous stone						
Manufacture of artificial stone	12	652	10	897	..	..
Roofing granules	798	14 786	682	8 775	..	..
Poultry grit	145	978	145	1 065	..	..
Stucco dash	21	3 223	16	2 726	..	..
Terrazzo chips	9	740	8	704	..	..
Rock wool	45	541	89	1 174	..	..
Rubble and riprap	628	4 067	732	4 089	..	..
Other uses	2 493	16 869	1 891	14 670	..	..
Pulverized stone						
Whiting	49	4 920	50	5 202	..	..
Asphalt filler	185	1 176	172	1 928	..	..
Agricultural purposes and fertilizer plants	601	11 802	451	8 990	..	..
Other uses	1 695	106 879	1 803	108 966	..	..
Total crushed stone	157 982	1 154 741	162 423	1 197 182	..	..
Total all stone	158 712	1 241 832	163 212	1 300 341	..	..

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; n.f. Not finished or dressed; (p) Preliminary.

(1) Data exclude stone used in the Canadian cement, lime, and clay industries. (2) Data include stone used in the Canadian cement, lime, and clay industries.

Note: Numbers may not add to totals due to rounding.

TABLE 4. CANADA, LIMESTONE PRODUCTION, 2004-06

	2004		2005		2006 (p)	
	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)
BY PROVINCE/TERRITORY (1)						
Newfoundland and Labrador	1 953	13 840	2 284	16 320	2 446	16 521
Nova Scotia	272	x	334	x	257	x
New Brunswick	565	x	593	x	500	x
Quebec	30 592	210 478	32 014	229 535	31 486	240 338
Ontario	55 687	453 138	54 221	450 158	55 712	493 142
Manitoba	3 125	15 373	3 648	18 592	3 404	19 494
Alberta	344	2 246	345	2 267	934	5 572
British Columbia	3 460	27 131	3 361	27 241	3 707	31 378
Northwest Territories	79	x	279	x	205	x
Total	96 077	734 310	97 078	758 096	98 651	820 050
BY USE (2)						
Stone (Dimension)						
Dimension stone						
Rough	216	10 692	239	23 803	..	..
Monumental and ornamental stone (n.f.)	14	760	66	2 578	..	..
Other (flagstone, curbstone, paving blocks, etc.)	74	8 842	89	12 891	..	..
Total dimension stone	304	20 294	394	39 272	..	..
Stone (Crushed)						
Crushed stone for						
Concrete aggregate	28 920	255 021	29 478	234 346	..	..
Asphalt aggregate	7 070	48 129	6 425	46 780	..	..
Road metal	23 956	150 686	26 880	177 189	..	..
Railroad ballast (includes traprock)	70	495	70	524	..	..
Other uses	29 304	188 834	27 158	188 386	..	..
Chemical and metallurgical						
Cement plants, Canada	17 057	53 380	16 500	53 130	..	..
Cement plants, foreign	1 749	9 149	1 733	8 879	..	..
Flux in iron and steel furnaces	209	813	216	702	..	..
Flux in nonferrous smelters	51	887	47	845	..	..
Glass factories	18	117	18	118	..	..
Lime plants, Canada	3 622	25 510	3 270	24 057	..	..
Lime plants, foreign	609	6 749	730	7 828	..	..
Pulp and paper mills	75	699	80	679	..	..
Sugar refineries	2	10	2	10	..	..
Other chemical uses	1 109	10 892	1 175	11 289	..	..
Miscellaneous stone						
Manufacture of artificial stone	–	60	–	4	..	..
Roofing granules	103	819	101	834	..	..
Poultry grit	194	2 243	145	942	..	..
Stucco dash	17	2 778	21	3 143	..	..
Rock wool	2	14	2	14	..	..
Rubble and riprap	367	3 233	230	1 550	..	..
Other uses	617	5 799	976	8 135	..	..
Pulverized stone						
Whiting	49	4 920	50	5 202	..	..
Asphalt filler	23	207	28	245	..	..
Agricultural purposes and fertilizer plants	535	8 141	409	6 290	..	..
Other uses	547	13 643	632	16 316	..	..
Total crushed stone	116 451	792 906	116 453	796 010	..	..
Total all stone	116 756	813 200	116 847	835 282	..	..

Source: Natural Resources Canada.

– Nil; . . Not available; n.f. Not finished or dressed; (p) Preliminary; x Confidential.

(1) Data exclude stone used in the Canadian cement and lime industries. (2) Data include stone used in the Canadian cement and lime industries.

Notes: Includes dolomite/dolostone. Numbers may not add to totals due to rounding.

TABLE 5. CANADA, MARBLE PRODUCTION, (1) 2004-06

	2004		2005		2006 (p)	
	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)
BY PROVINCE						
Nova Scotia	—	118	—	100	—	183
Quebec	618	x	516	x	484	x
Ontario	900	x	883	x	913	x
Manitoba	—	—	—	4	—	—
British Columbia	1	x	—	x	—	x
Total	1 519	108 409	1 399	102 727	1 397	106 183
BY USE						
Stone (Dimension)						
Dimension stone						
Rough	12	954	9	790	..	..
Other (flagstone, curbstone, paving, blocks, etc.)	10	2 436	—	100	..	..
Total dimension stone	22	3 390	9	891	..	..
Stone (Crushed)						
Crushed stone for						
Concrete aggregate	91	1 372	68	920	..	..
Asphalt aggregate	17	139	28	253	..	..
Road metal	102	632	108	730	..	..
Other uses	123	3 321	105	3 988	..	..
Chemical process stone						
Glass factories	10	200	—	—	..	..
Miscellaneous stone						
Manufacture of artificial stone	3	240	3	240	..	..
Roofing granules	65	1 756	—	1	..	..
Poultry grit	—	9	—	9	..	..
Stucco dash	1	80	1	80	..	..
Terrazzo chips	9	740	8	704	..	..
Other uses	8	624	6	547	..	..
Pulverized stone						
Agricultural purposes and fertilizer plants	66	3 661	42	2 700	..	..
Other uses	1 002	92 246	1 021	91 664	..	..
Total crushed stone	1 497	105 019	1 390	101 836	..	..
Total all stone	1 519	108 409	1 399	102 727	..	..

Source: Natural Resources Canada.

— Nil; .. Not available; (p) Preliminary; x Confidential.

(1) Marble refers to a commercial definition that may also include limestone, travertine and greenstone (serpentinite or amphibole).

Note: Numbers may not add to totals due to rounding.

TABLE 6. CANADA, GRANITE PRODUCTION, 2004-06

	2004		2005		2006 (p)	
	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)
BY PROVINCE/TERRITORY						
Newfoundland and Labrador	1 989	9 699	2 495	10 264	2 129	7 829
Nova Scotia	8 369	54 226	9 712	65 151	9 498	64 119
New Brunswick	4 443	23 438	4 778	28 072	4 457	29 946
Quebec	8 215	81 242	9 153	89 327	7 678	77 480
Ontario	2 969	x	2 954	x	2 715	x
Manitoba	277	x	139	x	534	x
British Columbia	5 608	x	6 575	x	6 719	x
Northwest Territories	306	x	1 182	x	100	x
Total	32 177	252 402	36 988	293 083	33 830	273 478
BY USE						
Stone (Dimension)						
Dimension stone						
Rough	197	30 030	198	28 545	..	..
Monumental and ornamental stone (n.f.)	63	5 707	39	6 306	..	..
Other (flagstone, curbstone, paving blocks, etc.)	7	1 688	5	756	..	..
Total dimension stone	267	37 424	241	35 607	..	..
Stone (Crushed)						
Crushed stone for						
Concrete aggregate	5 226	34 754	6 052	42 002	..	..
Asphalt aggregate	5 277	34 041	6 416	46 013	..	..
Road metal	7 448	45 268	8 953	52 204	..	..
Railroad ballast (includes traprock)	1 799	15 987	2 320	20 512	..	..
Other uses	9 688	61 286	11 036	76 503	..	..
Chemical process stone						
Cement plants, Canada	—	—	4	396	..	..
Miscellaneous stone						
Manufacture of artificial stone	4	396	7	657		
Roofing granules	632	12 195	584	7 977	..	..
Poultry grit	—	27	1	124	..	..
Stucco dash	—	—	—	57	..	..
Rock wool	43	527	87	1 159	..	..
Rubble and riprap	361	2 340	340	1 766	..	..
Other uses	1 269	7 134	807	6 807	..	..
Pulverized stone						
Asphalt filler	162	969	144	1 683	..	..
Other uses	1	54	—	11	..	..
Total crushed stone	31 910	214 978	36 747	257 476	..	..
Total all stone	32 177	252 402	36 988	293 083	..	..

Source: Natural Resources Canada.

— Nil; .. Not available; n.f. Not finished or dressed; (p) Preliminary; x Confidential.

Notes: Numbers may not add to totals due to rounding. Data include shipments by producers regardless of industrial classification. Granite may include other igneous rocks (e.g., basaltic roofing granules).

TABLE 7. CANADA, SANDSTONE PRODUCTION, 2004-06

	2004		2005		2006 (p)	
	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)
BY PROVINCE (1)						
Newfoundland and Labrador	544	3 082	725	3 996	979	4 220
Nova Scotia	1 360	8 570	1 404	8 906	1 791	12 586
New Brunswick	38	x	82	x	37	x
Quebec	2 249	23 279	2 144	22 922	1 823	18 983
Ontario	19	2 352	20	2 464	16	2 468
Manitoba	0	0	1	2	—	—
Alberta	2	x	3	x	3	x
British Columbia	5	x	5	x	5	x
Total	4 217	38 059	4 383	39 202	4 654	38 838
BY USE (2)						
Stone (Dimension)						
Dimension stone						
Rough	65	10 668	67	11 141	..	..
Other (flagstone, curbstone, paving blocks, etc.)	14	1 239	19	1 812	..	..
Total dimension stone	79	11 907	86	12 953	..	..
Stone (Crushed)						
Crushed stone for						
Concrete aggregate	240	1 483	215	1 376	..	..
Asphalt aggregate	503	3 413	497	3 456	..	..
Road metal	1 012	6 629	1 411	8 891	..	..
Railroad ballast (includes traprock)	39	179	30	142	..	..
Other uses	2 130	13 201	1 933	11 138	..	..
Chemical process stone						
Cement plants, Canada	215	1 177	322	1 756	..	..
Miscellaneous stone						
Manufacture of artificial stone	5	12	—	—	..	..
Rubble and riprap	37	177	29	137	..	..
Other uses	28	122	31	134	..	..
Pulverized stone						
Other uses	145	937	150	975	..	..
Total crushed stone	4 353	27 329	4 619	28 005	..	..
Total all stone	4 431	39 236	4 705	40 958	..	..

Source: Natural Resources Canada.

.. Not available; (p) Preliminary; x Confidential.

(1) Data exclude stone used in the Canadian cement industry. (2) Data include stone used in the Canadian cement industry.

Note: Numbers may not add to totals due to rounding.

TABLE 8. CANADA, SHALE PRODUCTION, (1) 2004-06

	2004		2005		2006 (p)	
	(000 t)	(\$000)	(000 t)	(\$000)	(000 t)	(\$000)
BY PROVINCE/TERRITORY (2)						
Newfoundland and Labrador	139	x	56	x	111	x
Nova Scotia	117	x	200	x	172	x
New Brunswick	210	x	—	x	—	x
Quebec	904	x	911	x	1 034	x
Ontario	8	x	9	x	6	x
Manitoba	181	x	176	x	180	x
Alberta	24	x	25	x	23	x
British Columbia	38	x	31	x	37	x
Northwest Territories	378	x	18	x	745	x
Total	1 999	22 584	1 426	21 929	2 308	28 562
BY USE (3)						
Stone (Dimension)						
Dimension stone						
Rough	45	10 098	53	12 616	..	..
Monumental and ornamental stone (n.f.)	1	25	—	—		
Other (flagstone, curbstone, paving blocks, etc.)	12	3 952	5	1 820	..	..
Total dimension stone	58	14 076	58	14 436	..	..
Stone (Crushed)						
Crushed stone for						
Concrete aggregate	43	199	—	—	..	..
Road metal	902	4 484	877	4 747	..	..
Railroad ballast (includes traprock)	27	122	—	—	..	..
Other uses	733	2 658	359	2 168	..	..
Chemical process stone						
Cement plants, Canada	478	1 628	477	1 700	..	..
Cement plants, foreign	24	192	17	74	..	..
Other chemical uses	1 353	4 372	1 369	4 662	..	..
Miscellaneous stone						
Rubble and riprap	—	—	3	22	..	..
Other uses	212	853	112	483	..	..
Total crushed stone	3 772	14 508	3 214	13 855	..	..
Total all stone	3 829	28 584	3 272	28 291	..	..

Source: Natural Resources Canada.

— Nil; .. Not available; n.f. Not finished or dressed; (p) Preliminary; x Confidential.

(1) May include slate. (2) Data exclude stone used in the Canadian cement and clay industries. (3) Data include stone used in the Canadian cement and clay industries.

Note: Numbers may not add to totals due to rounding.

TABLE 9. CANADA, ROUGH GRANITE, SUMMARY OF PRODUCTION AND TRADE, 1988-2006

	Quantity Value	Production (1)	Imports (2)	Exports (2,3)
1988	t	153 110	46 283	234 738
	\$ millions	24.42	11.18	16.16
1989	t	161 859	52 338	289 184
	\$ millions	24.78	11.73	17.26
1990	t	165 860	46 146	363 258
	\$ millions	33.55	11.25	19.82
1991	t	122 108	35 036	99 622
	\$ millions	24.10	8.5	22.62
1992	t	127 025	44 950	95 909
	\$ millions	20.30	10.47	21.42
1993	t	133 730	41 481	136 841
	\$ millions	18.07	10.85	20.34
1994	t	112 888	35 618	116 164
	\$ millions	16.91	10.10	20.02
1995	t	157 780	41 098	94 200
	\$ millions	19.58	11.38	17.94
1996	t	163 153	53 494	102 037
	\$ millions	24.61	15.32	20.95
1997	t	160 811	54 640	116 142
	\$ millions	24.51	16.04	16.39
1998	t	162 167	75 187	69 937
	\$ millions	27.26	23.01	15.01
1999	t	192 944	68 769	73 686
	\$ millions	32.80	23.15	16.49
2000	t	237 644	66 040	95 681
	\$ millions	40.48	21.86	19.41
2001	t	239 883	85 469	110 828
	\$ millions	41.59	27.86	20.03
2002	t	243 587	84 281	126 482
	\$ millions	37.44	28.99	16.58
2003	t	265 482	83 671	317 657
	\$ millions	36.52	27.36	11.69
2004	t	267 126	72 167	133 524
	\$ millions	37.42	26.86	19.51
2005	t	241 243	67 503	57 088
	\$ millions	35.61	26.01	14.06
2006 (p)	t	..	48 779	84 453
	\$ millions	..	26.79	13.16

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; (p) Preliminary.

(1) Includes rough granite for construction, monumental/ornamental and other uses, as per Table 6. (2) Includes codes 2516.11 (roughly trimmed block) and 2516.12 (cut block by sawing or otherwise). Some re-exports to the United States may also be involved.

(3) All export numbers were revised to reflect the conversion from cubic metres to tonnes.

Editions of the *Canadian Minerals Yearbook* prior to 2003 did not reflect that conversion.

Note: A factor of 2.7 was used for converting cubic metres to tonnes.

Sulphur

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CANADIAN DEVELOPMENTS

Preliminary figures show Canadian sulphur production was 9 Mt in 2006, almost exactly the same as in 2005. Elemental sulphur accounted for 7.9 Mt, mainly from the processing of natural gas, as well as from oil sands processing and oil refining. An additional 1.1 Mt of sulphur equivalent, in the form of sulphuric acid and liquefied sulphur dioxide, was recovered from the smelting of metals.

Canada exported approximately 8.6 Mt of sulphur in 2006, a decline of 1.4% compared to 8.7 Mt in 2005. Elemental sulphur exports amounted to 7.9 Mt and sulphur in other forms (SOF) was 680 000 t of sulphur equivalent. Exports to offshore markets were 5.8 Mt in 2006, a decline of 5% from 6.1 Mt in 2005. The decline was mainly from exports to China, which decreased to 3.6 Mt in 2006 from 3.9 Mt in 2005.

Canada is the second largest sulphur producer in the world with production coming mainly from the western provinces of Alberta, British Columbia, and Saskatchewan. Other provinces produce limited amounts of sulphur from oil refining and metals smelting.

Canada's sulphur production peaked in 2000, with a total output of close to 10 Mt of sulphur in all forms (SAF). Production declined in 2001 and 2002, but recovered in 2003 and 2004. In 2006, Canadian sulphur production remained at the same level as in 2005 (9 Mt).

Elemental sulphur is mainly recovered from natural gas processing in Alberta and a limited amount is also recovered in British Columbia. Although natural gas still remained the main source for elemental sulphur production, its share in total sulphur output has been declining. In 2006, sulphur recovered from natural gas accounted for 66% of total output. This was due to a decline of natural

gas reserves in Canada, particularly in Alberta. In 2006, sulphur recovered from natural gas processing in Alberta was 5.17 Mt, a decline of 3.3% from 5.35 Mt in 2005.

Sulphur recovered from oil sands processing increased to 1.4 Mt in 2006, up 17% from 1.2 Mt in 2005. Sulphur recovered from oil refining is limited in Canada and production remained stable in the last several years.

Sulphur recovered from metal smelting operations, mainly in the form of sulphuric acid (H_2SO_4), was 1.16 Mt of sulphur equivalent in 2006, an increase of 10% from 1.06 Mt in 2005.¹ More than half of the sulphur recovered from smelters was sold to the United States (2 Mt H_2SO_4) and the remainder was consumed domestically in the production of fertilizer, pulp and paper, industrial chemicals, etc.

Canada has built up a huge sulphur inventory over the years, mainly in the form of sulphur blocks in Alberta. The Alberta Energy and Utilities Board (AEUB) recorded a sulphur inventory of 12.1 Mt at the end of 2006, a decrease of 579 000 t from 12.7 Mt in 2005. Syncrude's inventory in Fort McMurray, Alberta, was estimated at 7 Mt at the end of 2006. It is the largest in the world. Logistical difficulties, particularly the lack of railway access, continue to be a major obstacle for sulphur to be shipped out of oil sands processing sites in northern Alberta.

Oil sands developments in Alberta continued in full swing in 2006. Oil sand is a mixture of sand, clay, water and bitumen, which is a black, asphalt-like hydrocarbon as thick as molasses. Oil sands contain roughly 18% bitumen on average. To extract bitumen, mined oil sands are put into a coker, which mixes hot water and oil sands in order to separate the bitumen from the oil sands. The bitumen is then heated in an upgrader to separate hydrocarbon vapours and remove naphtha and sulphur to produce synthetic crude oil. Bitumen contains roughly 5% of sulphur, on average, and most of the sulphur is recovered in the upgrading process. There is about 0.1% sulphur contained in the synthetic crude oil, which is further recovered in the refining process. It takes about two tonnes of oil sands to produce a barrel of

¹ One tonne of sulphuric acid (H_2SO_4) contains approximately 33% sulphur.

oil. About 174 billion barrels of proven oil reserves, the second largest in the world, rest in the oil sands underneath 140 800 km² in northern Alberta. The deposits are scattered in three regions: Athabasca (Wood Buffalo region with Fort McMurray as its population centre), Peace River, and Cold Lake.

The commercial development of oil sands started in the 1960s when the Great Canadian Oil Sands (now Suncor Energy) began construction of a mine and upgrader north of Fort McMurray. In 1967, the world's first oil sands operation commenced. In the 1970s, the Syncrude consortium constructed its mine and plant in the same area and production began in 1978. In early 2003, the Athabasca Oil Sands Project (a joint venture between Shell Canada, Chevron Canada Resources, and Western Oil Sands) commenced operations in the same region. Imperial Oil started *in situ* production in Cold Lake in 1985. BP Resources Canada and Petro-Canada also initiated *in situ* operation at Wolf Lake in the Cold Lake region in the same year (1985). In the following year (1986), Shell commenced an operation in Peace River.

Sulphur is mainly produced from the upgraders that process mined oil sands. In 2006, the AEUB reported that bitumen production reached 1.255 million barrels per day (bpd), up from 1.06 million bpd in 2005. About 61% of the total bitumen output came from mining operations that use the truck and shovel mining method. This indicated that, along with about 765 550 bpd of bitumen output, about 1.4 Mt of elemental sulphur are being recovered during oil sands processing.

Oil sands upgrading capacity is growing in Alberta. The existing producers (Syncrude, Suncor, Husky, and Athabasca Oil Sands project) are all expanding their upgraders. Three new upgraders are currently under construction by Canadian Natural Resources Horizon, Opti-Nexen Long Lake, and BA Heartland. Additional upgrader expansions and new facilities are being planned, particularly in Alberta's Heartland region near Edmonton. This indicates that sulphur output will continuously increase in Canada. It is forecast that sulphur output will increase from 1.4 Mt in 2006 to more than 4 Mt/y within the next 10 years.

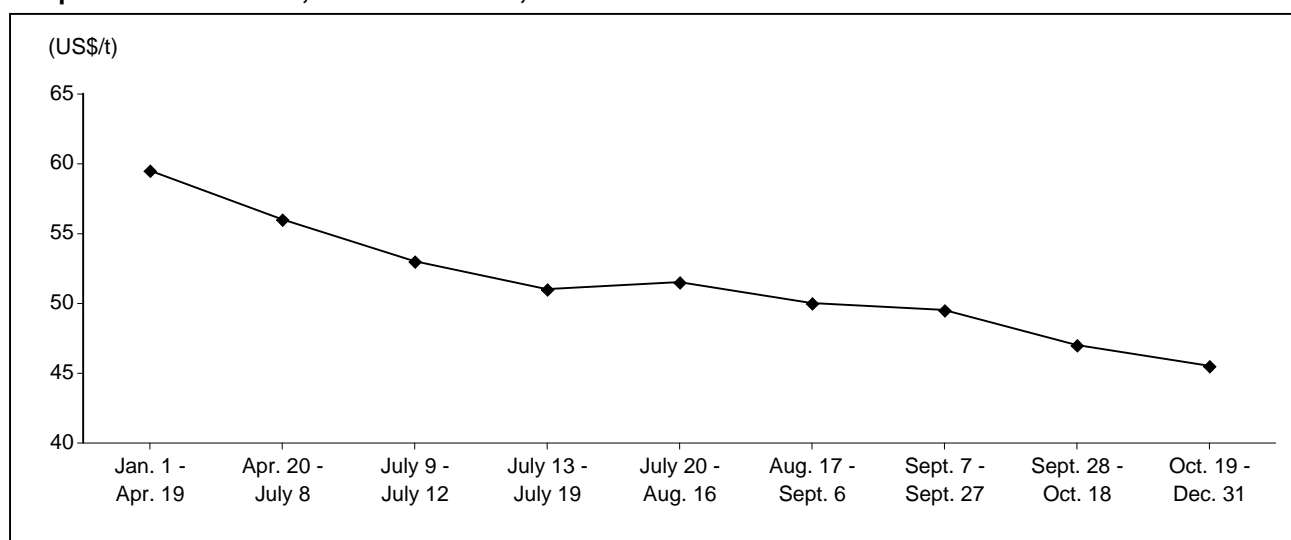
In 2006, Canada produced approximately 4.5 Mt of sulphuric acid (H₂SO₄), an increase of 7% from 4.2 Mt in 2005. Production from metal smelters was 3.3 Mt H₂SO₄, up from 3 Mt H₂SO₄ in 2005. Production from elemental sulphur remained at 1.2 Mt H₂SO₄.

Over the years, tough measures to improve overall environmental performance and reduce sulphur emissions have resulted in greater capture of sulphur, which in turn contributes to sulphur production increases.

CONSUMPTION

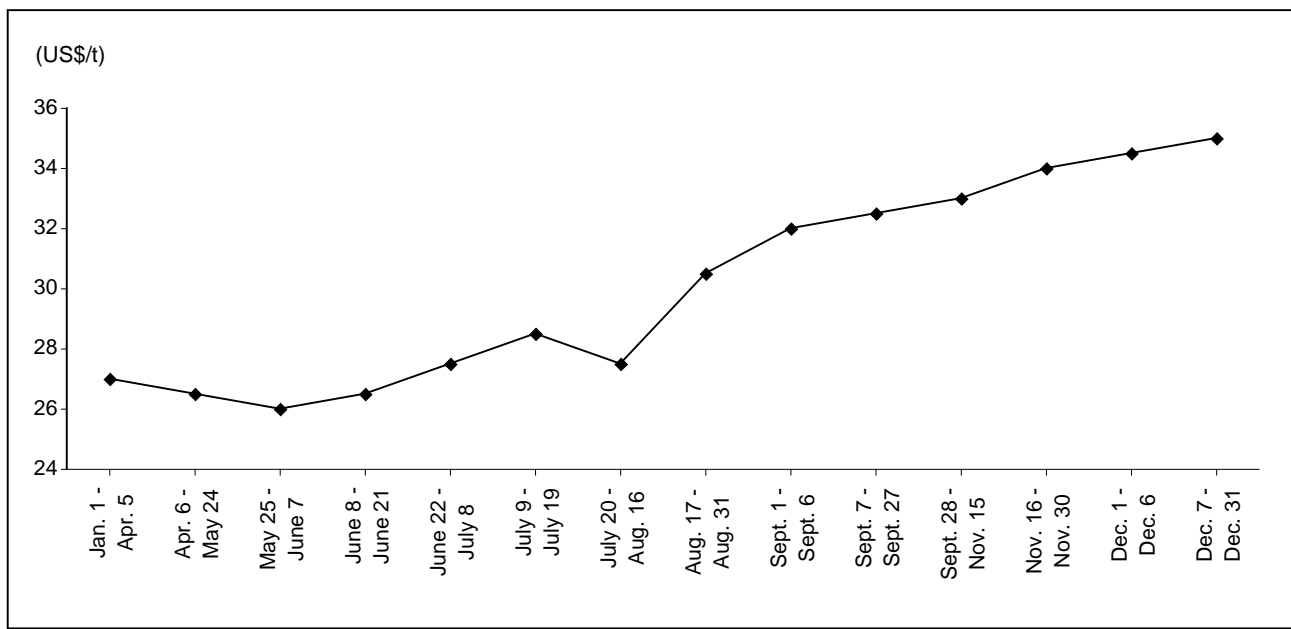
Canada's sulphur consumption is limited. Preliminary survey figures showed that Canada consumed about 700 000 t of sulphur and sulphur equivalent in 2006, mainly in the form of sulphuric acid. Preliminary results showed that Canada's sulphuric acid consumption was 2.2 Mt H₂SO₄, a decline of 150 000 t H₂SO₄, compared to 2005's 2.4 Mt

Figure 1
Sulphur Contract Price, f.o.b. Vancouver, 2006



Source: FERTECON Limited.

Figure 2
Ocean Freight Rates for Sulphur, 50 000-t Ship, Vancouver to China, 2006



Source: FERTECON Limited.

H₂SO₄. The largest consumer was the fertilizer industry, which used about 900 000 t H₂SO₄ to produce agricultural fertilizers in 2006. The remaining 1.3 Mt was consumed by various industries in the production of pulp and paper, industrial inorganic chemicals, etc., and by nonferrous smelting and refining, uranium mining, etc.

TRADE

Canada usually exports approximately 95% of its sulphur output; it exported approximately 8.6 Mt of sulphur in 2006, slightly lower (1.4%) than the 8.7 Mt exported in 2005. Elemental sulphur exports amounted to 7.9 Mt and SOF was 680 000 t of sulphur equivalent. Exports to off-shore markets were 5.8 Mt in 2006, a decline of 5% from the previous year's exports of 6.1 Mt. The decline was mainly from exports to China, which decreased to 3.6 Mt in 2006 from the previous year's 3.9 Mt. Still, China was the largest export destination for Canada, even though its volume declined in 2006. Exports to China accounted for 45% of Canada's elemental sulphur exports.

The United States is the second largest market for Canada. In 2006, Canada exported approximately 2.7 Mt of sulphur to the United States, including 2.1 Mt of elemental sulphur and 650 000 t of SOF, mainly in the form of sulphuric acid H₂SO₄ (2 Mt).

Sulphur imports into Canada continued to be minimal and were mostly from the United States.

PRICES AND FREIGHT

Canada's sulphur export prices were on a downward trend during 2006. The sulphur contracts price f.o.b. Vancouver continuously declined during the year, from US\$57-\$62/t at the beginning of the year to US\$35-\$56/t by year-end. The reason for the price decline was that sulphur supply exceeded demand and major sulphur consumers and importers had plenty of inventories. Spot markets were not active at all. In the first half of the year, spot prices were listed at US\$56-\$60/t and US\$50-\$54/t f.o.b. Vancouver. However, sulphur trading activities remained at a minimum and no spot prices were reported in the second half of the year.

Ocean freight rates for shipping sulphur from Vancouver to China were slowly increasing during 2006. Freight rates started at US\$26-\$28/t at the beginning of the year and remained around that price range until early August, when they increased to US\$30-\$31/t and slowly climbed up to US\$30-\$40/t by year-end.

WORLD OVERVIEW AND OUTLOOK

About 80 countries around the world produce sulphur in all forms (SAF). In 2006, total global production of SAF was approximately 70.3 Mt, an increase of 2% from the previous year's 69 Mt. China took the title as the world's largest

sulphur producer from the United States in 2006 with total production of 9.25 Mt SAF. Sulphur output from Asia, the Middle East, and the former Soviet Union (FSU) continued on an upward trend. Europe and Latin America remained at a production level similar to in 2005. North America was the only region reporting a production decline with output decreasing to 18.2 Mt SAF in 2006 from 18.4 Mt in 2005.

China, the newly emerged, largest SAF producer, produced 9.25 Mt of sulphur and sulphur equivalent in 2006, an increase of 391 000 t from the previous year's production of 8.8 Mt SAF. More than half of China's sulphur came from pyrite, with 4.7 Mt of sulphur equivalent produced in 2006. The second source of China's sulphur production was sulphur in other forms (SOF), such as sulphuric acid recovered from smelting metals; China produced 3.6 Mt of sulphur equivalent in SOF. The remaining 1 Mt was elemental sulphur recovered from oil refineries and natural gas processing.

Other countries with large production increases in 2006 were Saudi Arabia, India, Russia, South Korea, and Germany. Saudi Arabia produced nearly 3 Mt of elemental sulphur in 2006, an increase of 11%, or 275 000 t, from the previous year's 2.7 Mt. A significant production increase was recorded in India, where sulphur output increased 389 000 t to reach 1.6 Mt in 2006. Russia, South Korea, and Germany also recorded a production increase of over 100 000 t in 2006.

Global sulphur production is forecast to grow significantly in the next five years (2007-11). Production of SAF is forecast to reach 89.6 Mt in 2011, an increase of 19.6 Mt over the next five years from the current 70 Mt (2006). The annual growth rate is expected to be at 5.5% for 2007-09 and 4.5% for 2010-11. The production growth is mainly driven by increasing energy production and the drive to achieve cleaner fuels.

Most growth will be elemental sulphur, which is forecast to increase at 6.4% per year over the next five years (2007-11). Global elemental sulphur production is expected to increase from 47 Mt in 2006 to 64 Mt in 2011. The largest production increase is expected from the Middle East, where output is expected to reach 13.7 Mt in 2011, up from the current 8 Mt (2006), an increase of 5.7 Mt in volume. The second largest increase is expected from Asian countries, where output is expected to reach 11.2 Mt in 2011, up from the current 6.1 Mt (2006), an increase of 5 Mt. North American sulphur production is expected to increase 3 Mt over the next five years; most increases will come from oil sands production in Canada, and refineries in the United States will also contribute. An increase of 1.5 Mt in sulphur production is also expected from the FSU; its volume is expected to increase to 10.1 Mt in 2011 from the current 8.6 Mt (2006).

The consumption of SAF is expected to grow at an annual rate of 3% over the next five years (2007-11). Demand for

SAF is expected to increase from the current 70 Mt (2006) to 84 Mt in 2011. The largest increase will come from demand for elemental sulphur, which is expected to increase from the current 47 Mt (2006) to 59 Mt in 2011. Demand for elemental sulphur is derived from the demand for sulphuric acid (H_2SO_4). About 90% of elemental sulphur is used in the form of sulphuric acid and the remaining 10% is used in solid form. Half of the sulphuric acid is used in making agricultural fertilizer and the other half is used as industrial chemical ingredients. Global demand for sulphuric acid is forecast to increase from the current 191 Mt H_2SO_4 (2006) to 239 Mt in 2011. Demand for fertilizer uses will increase to 123 Mt H_2SO_4 , and for industrial uses will increase to 116 Mt H_2SO_4 in 2011.

In the next five years, growth in global sulphur supply is expected to exceed the demand growth. Sulphur will be in an oversupply situation and more sulphur output will find no demand and no markets. The supply surplus is expected to continue to grow in larger volumes. The global sulphur industry has to explore alternative ways to use, store, or dispose of sulphur.

China is the world's largest sulphur consumer; its consumption increased significantly from 2000 to 2005. China's sulphur consumption increases were largely driven by its self-sufficient policy on phosphate fertilizers. The increasing trend continued in 2006, but appeared to slow down a bit compared to the phenomenal growth between 2000 and 2005. China's apparent consumption was at 17.9 Mt SAF in 2006, an increase of only 5% from the previous year's 17 Mt. Although China became the world's largest sulphur producer in 2006, it still needs a large amount of imported sulphur to meet its demand. China was still the world's largest sulphur importer in 2006 with 8.8 Mt of elemental sulphur imported, an increase of 6% compared to 8.3 Mt in 2005. Canada continued its position as the largest supplier of elemental sulphur for China, but its share declined to 42% from the previous year's 50%. Meanwhile, China's imports from the Middle East increased. For example, imports from Saudi Arabia increased 400 000 t in 2006 to reach 1.1 Mt and its share increased to 12.5% of China's total sulphur imports. China's imports from Kazakhstan doubled in 2006, and imports also increased from other suppliers such as the United Arab Emirates, Japan, the United States, South Korea, Kuwait, Iran, Qatar, and Russia.

India is one of the leading sulphur-consuming countries that use sulphur in its phosphate fertilizer production. Given the size of its agriculture sector, India's fertilizer demand is expected to continue to grow. Sulphur production in India increased to 1.6 Mt SAF in 2006, up nearly 400 000 t from the previous year's 1.2 Mt. Half of India's sulphur output was elemental sulphur and other half was SOF. India's apparent consumption was 3.3 Mt of sulphur in 2006, used mostly in phosphate fertilizer production. More than half of India's consumption, 1.8 Mt of elemental sulphur, came from imports, mainly from Middle Eastern countries. It is forecast that India's sulphur production will

double and that imports will also increase by at least 25% over the next five years.

Brazil is the main sulphur consumer in Latin America, where it is used principally in phosphate fertilizer production. Brazil produces a limited amount of sulphur; its output was 399 000 t while its consumption was about 2 Mt in 2006, including 1.6 Mt from imports and 0.4 Mt that was domestically produced. It is expected that fertilizer demand will boost Brazil's demand for sulphur over the next five years to about 3.3 Mt, including 2.5 Mt from imports.

Morocco and Tunisia are the two major consumers in North Africa. Both countries do not produce sulphur, but rely on imported sulphur for phosphoric acid and phosphate fertilizer production. Morocco imported 3.7 Mt and Tunisia imported 1.9 Mt of elemental sulphur in 2006, an increase of 200 000 t each. It is expected that the import volume will continue to increase in the next five years.

The world's elemental sulphur trade increased to 28 Mt in 2006, up 2% from the previous year's 27.4 Mt. It is forecast that the trade volume will increase at 4.6%/y over the next five years. The global sulphuric acid trade volume is expected to increase 2% in the next five years, and most increases will occur in Asia. Sulphuric acid trade is a limited, short-haul, regional business within Europe, Asia, and North America.

Canada's sulphur production is expected to increase in the next five years (2007-11) thanks to the fast-growing oil sands industry. Its sulphur recovered from natural gas production is expected to decline as natural gas reserves decrease. However, sulphur recovered from oil sands production is expected to offset the production loss from natural gas. The offset rate is faster than previously forecast. It is expected that Canada's sulphur production will be increasing in the mid-to-long term as the oil sands industry matures. It is expected that Canadian exports may stagnate in the next five years as the global sulphur supply is forecast to exceed demand.

GENERAL INFORMATION

Sulphur is a nonmetallic element that occurs in both combined and free states and is widely distributed over the earth's surface. It is tasteless, odourless, insoluble in water, and often occurs in yellow crystals. It is the 16th most abundant element in nature and the 4th most important plant nutrient.

Sulphur contained in ores that can be mined is referred to as native sulphur. Native sulphur is limited in quantity. Sulphur is abundant in sulphide minerals such as copper, iron, lead, and zinc, and can be recovered as sulphuric acid from metal smelting. Sulphur also occurs in many liquid and gaseous hydrocarbons that can be recovered as

by-products from natural gas and oil sands production and from the oil refining process.

Sulphur production can be traced back for centuries. The use of the Frasch process in the late 1800s, a technique to mine underground native sulphur, was generally considered to be the beginning of the sulphur industry. Since the 1950s, sulphur recovery from natural gas processing and petroleum refining was gradually replacing Frasch sulphur to the point that, by the 1980s, it became the world's main supplying source.

The principal use of all sulphur in the world is as a process agent in the manufacture of fertilizers such as superphosphates, ammonium phosphate, and ammonium sulphate. The fertilizer industry uses more than half of the sulphur production, converting most of it into sulphuric acid to produce fertilizers. The second-largest consuming sector is the chemical industry, where sulphur is used as sulphuric acid in products ranging from pharmaceuticals to synthetic fibres. Other consumers of sulphur include manufacturers of pulp and paper, iron and steel, nonferrous metals, and titanium dioxide pigments. These industries also use sulphur in the form of sulphuric acid. Overall, 90% of worldwide sulphur consumption is in the form of sulphuric acid.

The remaining 10% of worldwide sulphur consumption is in non-acid form. Sulphur is directly used as fertilizer to enrich soils. Manufactured products that require sulphur in non-acid form in their production include insecticides and fungicides, pulp and paper, photographic supplies, leather products, rayon, and rubber.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of March 30, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2503.00	Sulphur of all kinds, other than sublimed sulphur, precipitated sulphur and colloidal sulphur	Free	Free	Free	Free	Free	Free
2802.00	Sulphur, sublimed or precipitated; colloidal sulphur	Free	Free	Free	Free	4.6%	Free
2807.00	Sulphuric acid; oleum	Free	Free	Free	Free	3%	2.5%
2811.23	Other inorganic acids and other inorganic oxygen compounds of nonmetals: other inorganic oxygen compounds of non-metals: sulphur dioxide	Free	Free	Free	Free	5.5%	Free

Sources: Canadian *Customs Tariff*, effective January 2006 and 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2006 and 2007; *Official Journal of the European Union* (October 27, 2005 and October 17, 2006 editions); *Customs Tariff Schedules of Japan, 2006 and 2007*.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties.

(2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, SULPHUR SHIPMENTS AND PRODUCTION, 2004-06

	2004		2005		2006 (p)	
	(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
SHIPMENTS (1)						
Sulphur in smelter gases (2)	1 007 209	67 594	1 001 344	55 250	1 093 793	60 418
Elemental sulphur (3)	7 739 845	216 603	7 864 466	238 280	8 065 299	157 049
Total sulphur content (2)	8 747 054	284 197	8 865 810	293 530	9 159 092	217 467
PRODUCTION						
Sulphur in smelter gases (2)	1 105 376	..	1 057 632	..	1 160 620	..
Elemental sulphur (3,4)	7 995 795	..	7 914 616	..	8 443 211	..
Total sulphur content (2)	9 101 171	..	8 972 248	..	9 603 831	..

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; (p) Preliminary.

(1) Data compiled regardless of origin (i.e., domestic and foreign source materials). (2) Sulphur in liquefied SO₂ and H₂SO₄ recovered from the smelting of metallic sulphides and from the roasting of zinc sulphide concentrates. (3) Figures for elemental sulphur shipments and production were compiled in February 2007, based on the locations where natural gas and oil sands are being processed, and crude oil and synthetic oil are being refined. (4) Figures reported by producers indicated that total elemental sulphur production in Canada was about 7 885 789 t as of June 30, 2007.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, SULPHUR PRODUCTION AND SHIPMENTS, 1994-2006

	Production			Shipments (1)		
	Elemental Sulphur	In Smelter Gases	Total Production	Elemental Sulphur	In Smelter Gases	Total Shipments
(000 tonnes)						
1994	7 975	1 048	9 023	5 791	1 026	6 817
1995	7 935	1 083	9 018	7 089	1 074	8 164
1996	8 446	1 044	9 490	7 433	1 033	8 466
1997	8 408	1 073	9 481	7 901	1 061	8 962
1998	8 542	1 153	9 694	7 406	1 048	8 454
1999	8 813	1 160	9 972	8 144	1 073	9 217
2000	8 779	1 167	9 945	8 089	1 138	9 227
2001	8 320	1 124	9 444	7 042	1 076	8 118
2002	7 816	1 109	8 925	6 673	1 078	7 751
2003	8 036	992	9 028	7 988	909	8 897
2004	7 996	1 105	9 101	7 740	1 007	8 747
2005	7 316	1 058	8 974	7 864	1 001	8 866
2006 (p)	7 886	1 161	9 047	8 065	1 094	9 159

Source: Natural Resources Canada.

(p) Preliminary.

(1) Shipments data compiled regardless of origin (i.e., domestic and foreign source materials).

TABLE 3. CANADA, SULPHURIC ACID PRODUCTION, TRADE AND APPARENT CONSUMPTION, 1996-2006

	Production (3)	Imports (1)	Exports (1)	Apparent Consumption (2)
(tonnes, 100% acid)				
1996	4 355 592	76 027	1 858 561	2 573 058
1997	4 314 773	95 554	1 857 902	2 552 425
1998	4 590 056	129 201	2 081 324	2 637 933
1999	4 282 151	138 807	1 986 068	2 434 890
2000	4 440 812	158 148	2 125 740	2 473 220
2001	4 056 948	162 636	1 872 643	2 346 941
2002	4 423 865	128 105	1 970 566	2 581 404
2003	4 065 821	170 173	1 765 770	2 470 224
2004	4 706 462	97 933	2 095 901	2 708 494
2005 (r)	4 209 008	92 086	1 910 408	2 390 686
2006 (p)	4 275 514	77 349	2 116 776	2 236 087

Source: Natural Resources Canada, compiled from the reports of producing companies.

(p) Preliminary; (r) Revised.

(1) Imports and exports include HS code 2807.00. (2) Production plus imports, less exports.

(3) Source of data is Natural Resources Canada annual survey of Sulphuric Acid Used By End Use.

TABLE 4. CANADA, SULPHURIC ACID, REPORTED CONSUMPTION BY END USE, 2002-06

Reported Use	2002 (a)	2003 (a)	2004 (a)	2005 (a)	2006 (p)
(tonnes)					
Agricultural chemicals and fertilizers	1 110 325	1 013 001	1 200 056	1 101 641	895 363
Pulp and paper	608 733	588 012	526 884	504 240	497 221
Industrial inorganic chemicals	348 115	456 604	446 779	420 935	360 262
Nonferrous smelting and refining	188 216	116 787	206 622	79 357	75 350
Uranium mines	x	x	x	x	x
Crude and refined petroleum products	31 030	x	19 453	14 456	22 425
Other mines, metal and nonmetal	37 833	x	39 903	x	x
Soap and cleaning compounds	x	x	x	x	x
Metal rolling and extruding	x	x	x	15 394	9 444
Electrical products	x	x	x	2 831	x
Food, brewery and distillery	x	x	x	x	x
Plastics and synthetic resins	x	x	x	x	x
Leather and textile	—	—	—	x	x
Other end uses	116 169	98 240	103 872	147 633	164 297
Total (1)	2 517 385	2 382 580	2 617 976	2 402 526	2 139 778

Source: Natural Resources Canada, compiled from the reports of producing companies.

— Nil; (p) Preliminary; x Confidential.

(a) Confidential numbers are included in the total.

(1) Reported consumption does not include imported acid.

Note: Numbers may not add to totals due to rounding.

TABLE 5. WORLD PRODUCTION OF SULPHUR BY SELECTED COUNTRIES, 2003-06

	2003		2004		2005 (e)		2006 (e)	
	All Forms (1)	Elemental	All Forms (1)	Elemental	All Forms (1)	Elemental	All Forms (1)	Elemental
WESTERN EUROPE								
Finland	719	61	700	65	..	..	..	..
France	904	709	960	765	..	..	..	..
Germany	2 736	1 661	2 155	1 565	..	..	..	..
Italy	699	565	690	575	..	..	..	..
Netherlands	497	384	550	410	..	..	..	..
Spain	854	306	630	145	..	..	..	..
Others	1 237	683	1 155	675	..	..	..	..
Total, Western Europe	7 646	4 369	6 840	4 200	7 017	4 578	7 191	4 804
CENTRAL EUROPE								
Poland	1 215	918	1 270	960	..	..	..	..
Others	609	228	660	250	..	..	..	..
Total, Central Europe	1 824	1 146	1 930	1 210	1 969	1 249	1 976	1 227
FORMER SOVIET UNION								
	9 522	7 940	9 600	8 200	9 824	8 482	9 969	8 572
AFRICA								
	757	340	535	280	598	353	648	379
NORTH AMERICA								
Canada	9 024	8 138	9 510	8 422	8 973	7 915	9 047	7 886
United States	10 869	8 920	10 076	9 390	9 511	8 800	9 135	8 395
Total, North America	19 892	17 058	19 586	17 812	18 484	16 715	18 182	16 281
LATIN AMERICA								
Chile	1 497	25	1 530	20	..	..	..	..
Mexico	1 475	1 032	1 825	1 120	..	..	..	..
Venezuela	550	550	800	800	..	..	..	..
Others	957	426	775	260	..	..	..	..
Total, Latin America	4 479	2 033	4 930	2 200	5 095	2 276	5 046	2 352
MIDDLE EAST								
Iran	1 405	1 405	1 400	1 400	..	..	..	..
Kuwait	714	714	680	680	..	..	..	..
Saudi Arabia	2 600	2 600	2 225	2 225	..	..	..	..
United Arab Emirates	1 660	1 660	1 925	1 925	..	..	..	..
Others	883	765	770	740	908	831	908	831
Total, Middle East	7 262	7 144	7 000	6 970	7 866	7 789	8 123	8 032
ASIA								
China	6 412	420	8 980	800	8 859	950	9 250	1 000
India	1 024	515	1 070	500	..	..	..	..
Japan	3 503	1 951	3 440	1 900	..	..	..	..
South Korea	1 486	700	1 675	880	..	..	..	..
Others	1 399	858	1 705	1 220	..	..	..	..
Total, Asia	13 824	4 444	16 870	5 300	17 227	5 707	18 148	6 059
OCEANIA								
	973	80	930	80	1 004	89	1 004	89
Total world	66 179	44 554	68 000	46 000	68 976	47 223	70 262	47 867

Sources: Natural Resources Canada; British Sulphur Consultants.

.. Not available; (e) Estimate by Natural Resources Canada.

(1) All Forms include elemental sulphur, sulphuric acid and sulphur dioxide recovered from pyrites roasting and metals

Note: Only countries with over 500 000 t of sulphur production were selected.

Talc and Pyrophyllite

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In various reviews it has been common practice to discuss talc, soapstone, and pyrophyllite under the same general heading. A mineralogical term distinction between talc and soapstone associated with purity can be interpreted as pure talc and impure talc (i.e., soapstone, a type of steatite mineral). Steatite talc generally is found in massive, high-purity form, while impure varieties of massive or block talc are still commonly termed “soapstone.”

The same mineralogical term distinction applies to the misunderstanding between pyrophyllite and montmorillonite and between talc and hectorite. Talc and pyrophyllite are sometimes referred to as clay minerals since, once finely divided and combined individually with water in proportions to make a slurry, the end product does have the appearance of a clay-water mixture.

MINERALOGY AND GEOLOGY

Talc is a hydrated magnesium silicate that, when pure, has the formula $\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$ corresponding to a theoretical composition of 63.5% SiO_2 , 31.7% MgO and 4.8% H_2O . The aluminum analogue of talc is pyrophyllite. Pyrophyllite contains the hydrous aluminum silicate with a theoretical chemical formula of $\text{Al}_2\text{Si}_4\text{O}_{10}(\text{OH})_2$, and in its pure form contains 28.3% Al_2O_3 , 66.7% SiO_2 and 5.0% H_2O .

Talc is derived from the alteration (hydration) of non-aluminous magnesium silicate rocks in an intensive metamorphic environment. The most common host rocks for the formation of talc are dolomite and ultramafic rocks. However, talc can also be found associated with mafic igneous rocks and sedimentary rocks. The mineral occurs as veinlets, tabular bodies, or irregular lenses.

Pyrophyllite is formed by the hydrothermal alteration of acid igneous rocks, predominantly those that are andesitic to rhyolitic in composition. It occurs in low- and medium-grade metamorphic rocks rich in aluminum.

TALC AND PYROPHYLLITE DEPOSITS IN CANADA

Talc occurrences or deposits of interest in Canada have been recorded in Newfoundland and Labrador, Quebec, Ontario, Manitoba, Saskatchewan, and British Columbia.

Pyrophyllite is not as common as talc, and known commercial occurrences in Canada are essentially limited to three provinces: Newfoundland and Labrador, Quebec, and British Columbia.

Newfoundland and Labrador

Talc occurrences have been identified in the Baie Verte Peninsula at Timms Brook, and in the Great Bend ultramafics in the east-central part of the province 75 km southwest of Gander.

The most important deposits of pyrophyllite occur on the Avalon Peninsula near the small town of Foxtrap, about 18 km west of St. John's. Three main deposits were identified: Fox Trap, Trout Pond, and Dog Pond. These deposits occur as lenses of massive pyrophyllite associated with pyrophyllite-sericite-quartz schists. The Trout Pond and Dog Pond deposits are, respectively, 3 and 6 km south of the main Fox Trap deposit. Mining of pyrophyllite in the Fox Trap area has been carried out intermittently since the early 1900s. The other deposits have been drilled and sampled.

Quebec

Talc occurrences/deposits in this province are essentially confined to the Eastern Townships region, south of the St. Lawrence River. Occurrences are also found in the Magog-Thetford Mines region and in various townships, including Sutton, Potton and Bolton, all in Brome County; Ireland, Inverness, Thetford and Leeds, all in Megantic County; and Broughton in Beauce County.

Pyrophyllite deposits occur in northwestern Quebec in Carpentier Township in the Abitibi region, in an area 10 km northeast of Barraute. Occurrences of pyrophyllite in the southeastern part of the province in the counties of Brome and Beauce, at the Stanstead, Saint-Nicholas and Saint-Francis localities, have also been analyzed.

Ontario

Talc occurrences exist in Penhorwood Township, south of Timmins, but also in southern and northwestern Ontario; in Hastings, Frontenac, Lennox, Addington, and Lanark counties; and in the Sudbury and Kenora districts. The more important occurrences are in Hastings County in Madoc, Huntington, Elzevir and Grimsthorpe townships. Commercial production of talc has been carried out in the Madoc area for over 85 years.

Manitoba

Occurrences of talc in this province have been reported at Iskwasum Lake and along the Grass River in the Flin Flon-Snow Lake area of northern Manitoba.

Saskatchewan

Occurrences have been reported in the Mosher Lake area of northeastern Saskatchewan.

British Columbia

Over 38 deposits of talc have been identified with 4 main deposits in the southeastern end of Vancouver Island within 50 km of Victoria. The remaining occurrences are scattered throughout the central and eastern part of the province from the Canada-U.S. border northwesterly to the Yukon border.

Pyrophyllite occurrences have been identified in the northwestern portion of Kyuquot Sound, a large inlet on the west coast of northern Vancouver Island. Two deposits were reported on the north side and two on the south side of a small peninsula between Kokshittle Arm and Easy Cove.

CANADIAN SUPPLIERS

Newfoundland and Labrador

Newfoundland Pyrophyllite Division (a division of Trinity Resources & Energy Ltd.) mines pyrophyllite from an open-pit operation near Manuels, 19 km southwest of St. John's, Newfoundland and Labrador. The ore is crushed, sized and hand-cobbed at the mine site to produce a pyrophyllite-quartz product, which is shipped under the brand name ALTIFIL to the United States where it is finely ground for use in high-quality ceramic tiles. A minor quantity of some lower-grade pyrophyllite is also used in the local manufacture of joint cement, paint, and other products.

Quebec

The ophiolite zone in the Appalachians of southwestern Quebec (Estrie and Beauce regions) were once mined in the 19th century and throughout the 20th century. This ophiolite zone lies along the Baie-Verte-Brompton Line, a regional-scale intense deformation corridor. Numerous talc and steatite deposits associated with this zone have also been mined in the past. However, the only talc operation in Quebec, located near Saint-Pierre-de-Broughton, shut down in 2001 due to the presence of asbestos fibres in the ore.

Nevertheless, steatite is still being extracted at the Fraser mine near East-Broughton by Les Pierres Stéatites Inc. who bought, in January 2000 from Luzenac Inc., the soapstone cutting division and continues to produce quality stones for sculptures, refractory stone for stoves, and slabs for tombstones.

Ontario

Mining of the metamorphic deposits near Madoc in eastern Ontario, which dates back to 1896, is carried out by Dynatec Corporation's Mineral Products Division (under the brand name of CANTAL for Canada Talc) and is now the only North American underground talc mine. The milling operation is located in nearby Marmora, approximately three hours northeast of Toronto. The ore ranges from 30% to 80% talc, with dolomite, calcite, tremolite, and mica as the major impurities. It is white to grey in colour and is milled without beneficiation for applications in plastics and paints. Unfortunately, Dynatec reported a loss of \$8.2 million from discontinued operations in the fourth quarter of 2006. It also reported a joint agreement whereby Sherritt International Corporation of Toronto would acquire Dynatec in a transaction valued at \$1.6 billion. Of particular interest to Sherritt is Dynatec's 45% interest in the Ambatovy nickel mine under development in Madagascar. It is not clear what will happen to Dynatec's talc/dolomite business that is currently being held for sale.

An altered, ultramafic deposit in Penhorwood Township in northeastern Ontario near Timmins was developed by open-pit mining in 1975, and a froth flotation plant was built adjacent to the mine by Luzenac Inc., which is part of the Luzenac Group and a market-focused global talc producer. The ore is about 45% talc, with magnesite, magnetite, chlorite, and serpentine as the impurities. This operation is now the major (if not the only) talc producer in Canada; it makes products for the paper, plastics, paint, and ceramic industries.

Thorgrimson Stone Art Inc. operates a quarry near Eagle Lake in the Kenora area from a family quarry in western Ontario and produces high-quality soapstone that has not been blasted. The stone is available in sizes ranging from two pounds to several thousand pounds and is medium to light grey in colour, sometimes with black running through it.

MINING AND PROCESSING

Talc is obtained by either open-pit or underground mining. Open-pit mining involves removal of overburden, blasting, and transporting the broken ore to a mill for processing. The production of steatite talc blocks used for sculpting necessitates that blasting be kept to a minimum. In poorly indurated areas, backhoes may be adequate to rip the talc ore loose. Open-pit mining becomes uneconomical when the waste rock-to-ore ratio becomes too large; underground mining then becomes necessary. Room-and-pillar and shrinkage stoping methods are used to mine talc underground. Room-and-pillar mining is used on flat or gently dipping ores where, as the orebody is mined, pillars of ore are left in a regular pattern to support the roof of the mine. Shrinkage stoping is used on steeply dipping orebodies where tunnels are driven into the base of the ore; drilling and blasting proceed upward into the orebody.

Talc milling has traditionally involved dry-processing in uncomplicated grinding plants, but now uses sophisticated processing operations. The new generation of talc mills includes new grinding techniques, hydro-cycloning, sedimentation, froth flotation, dry and wet magnetic separation, centrifugal sizing, and spray drying. Grinding is required both to prepare the ore for processing and to finish off the final product, which usually must meet stringent particle size demands. The processing of talc ores is complicated by the fact that extreme white colour is a very desirable feature. Therefore, the grinding equipment used should not discolour the talc in any way. This generally rules out conventional rod and ball milling with steel grinding media, and requires ceramic grinding media for good grinding performance. Some very sophisticated grinding facilities are often required for final preparation of processed talc sold to specific markets; as an example, ultrafine grinding requirements are met with vertical-shaft pulverizing mills and jet-milling equipment.

Pyrophyllite is usually mined by conventional open-pit methods (i.e., overburden removed, drilling and blasting, ore sorted according to size). Lump pyrophyllite ore is generally hauled to the processing plant by road trucks.

Many processing methods apply to pyrophyllite and each operation has a processing plant layout based on individual ore characteristics and local market requirements. Nevertheless, the principal processing methods comprise crushing and screening to provide a series of size fractions.

CANADIAN SHIPMENTS, CONSUMPTION AND TRADE¹

Preliminary data (Table 1) reported by Canadian producers for 2006 indicate talc shipments were valued at \$22.3 million, more than a \$3.9 million decrease from 2005, for a quantity of 67 809 t (a decrease of 2528 t from 2005). The

historical statistics (Table 2) demonstrate that shipments from 1988 have declined dramatically (from 146 493 t in 1988 to 108 327 t in 1995) and stabilized afterwards in the 70 000-t range. The U.S. Geological Survey's 2006 review on talc and pyrophyllite shows global production for 2006 was estimated at over 8.9 Mt, led by China with 3.0 Mt, followed by South Korea with 920 000 t and the United States with 895 215 t.

Imports (Table 1) were estimated at \$17.4 million for 2006, a decrease of almost \$0.5 million (2.7%) from 2005. The quantity of imports also decreased (38.8%) from 134 644 t in 2005 to 82 432 t in 2006. The bulk of imports was supplied by the United States with 76 337 t (92.6%) valued at \$10.9 million (92.6%). The quantity imported (Tables 1 and 3, talc only) decreased (48.3%) from 152 465 t in 2005 to 78 763 t in 2006.

Exports (Tables 1 and 3, talc only) were valued at almost \$22.9 million for 2006, a slight increase of almost \$0.5 million from 2005; the quantity exported also increased (52.3%) from 56 039 t in 2005 to 85 350 t in 2006. The bulk of exports was delivered to the United States, amounting to 85 108 t (99.8%). Exports to the United States increased by 29 248 t in 2006 (52.4%), continuing a trend from 2002.

Reported consumption of talc and pyrophyllite (Table 4) from a Natural Resources Canada industry survey shows a 9318-t decrease (15%) from 2004 (62 228 t) to 2005 (52 910 t). The pulp and paper, and paper products sector is the most important consumer with 59.3% of all consumption.

MARKET AND DRIVERS CONSIDERATIONS

Talc is an extremely versatile mineral that is used primarily in a fine-ground state. Steatite is essentially used in massive or block form. There are many industrial applications of ground talc, although fewer than a dozen countries use talc on a major scale.

The talc market (source: Peter W. Harben's 4th Edition of *The Industrial Minerals HandyBook*) feeds into construction (paint, plastics, roofing, ceramics), the paper industry, and consumer durables, all of which are connected to the Gross National Product and population growth. Major

¹ Producers' confidentiality is protected when calculating the quantity and average unit value by aggregating the values of all three mineral products (talc, steatite, and pyrophyllite). Since these data vary considerably from each other, the reader should consider that changes from year to year may sometimes reflect variations in shipments of individual products and are not always indicative.

growth will be in developing countries where the United Nations' medium world population projection for 1998-2050 is from 4.75 to 8.20 billion people. The development of certain talc-filled plastics on a large scale relies on construction activity and on the replacement of traditional metal parts in automobiles. Over the past 25 years, world paper and board output has doubled to more than 250 Mt, split fairly evenly between North America, Europe, and the rest of the world. The average worldwide consumption of paper and board per capita is approximately 45 kg, although this figure is composed of regional values that range from almost 300 kg in North America and 160 kg in the European Union (EU) down to 36 kg in non-EU Europe, 29 kg in Latin America, 24 kg in Australasia, and to just 7 kg for the Middle East and Africa. There is considerable potential for growth in those regions falling short of the average. However, talc consumption patterns in paper are regional. In North America where kaolin and ground and precipitated calcium carbonate (GCC/PCC) are plentiful, talc is relatively unimportant as a paper filler and coater (5% of the minerals used), although it is used extensively for pitch control (90%), whereas in Europe talc is an important paper coater (15%) and a filler (60%) with modest use in pitch control (25%).

PRICES

Talc prices vary according to the degree of processing. In addition, quoted prices should be used only as a guideline because actual prices depend on the terms of the contract between seller and buyer.

According to *Industrial Minerals*, international talc prices were as follows: paint grade (20-25 micrometres [μm]) US\$185-\$195/t; paint grade (200 mesh), US\$126/t; paint grade (400 mesh), US\$210/t; ceramic grade (200 mesh), US\$92/t; ceramic grade (325 mesh), US\$115/t; plastic grade (10-20 μm), US\$200-\$205/t; and cosmetic grade (200-300 mesh), ex-work, US\$190-\$195/t.

According to the USGS's 2006 review on talc, the unit value of crude talc was estimated to be US\$31/t. Most of the talc sold in the United States was sold only after crushing and grinding. Following sorting to remove waste, primary crushing, and screening, the unit value of the unmilled talc probably would be in the range of US\$50-\$60/t at the mill. The average reported unit value of processed talc was US\$90/t, an increase from US\$86/t in 2005. The unit value of all U.S. crude pyrophyllite was US\$196/t in 2006, unchanged from 2005. The average customs unit value for U.S. imports of unground talc was US\$162/t in 2006, an increase from US\$148/t in 2005. The average customs value for ground talc was US\$151/t in 2006, a decline from US\$176/t in 2005. The average customs value for cut or sawed talc was US\$933/t, an increase from US\$876/t in 2005.

MAJOR USES AND SPECIFICATIONS

Commercial grades of both talc and pyrophyllite rarely approach the theoretical composition of the pure mineral because of the presence of associated minerals. Talc has a pearly lustre, greasy feel, and may be white, pale green, or grey in colour. Talc possesses good cleavage, is chemically inert, has low thermal and electrical conductivities, a high fusion point, and a hardness of 1.0 on the Mohs scale. Pyrophyllite also has a pearly lustre, greasy feel, and may be white to green, grey, or brown in colour. It also possesses good cleavage, is chemically inert, is relatively soft with a hardness of 1 to 2 on the Mohs scale, and has a specific gravity of 2.84. Due to their physical properties, talc and pyrophyllite are often used in similar applications. Talc is found in the paint, pulp and paper, ceramic, cosmetic, plastic, chemical, rubber, and construction products industries, while major markets for pyrophyllite are associated with ceramics, refractories, and insecticides.

Talc in a finely ground form is used as an additive in a wide variety of products. Ceramic-grade talc (e.g., average particle size between 6 and 14 μm , with 90-98% of the material passing through a 45- μm screen) is used to produce wall tile, electrical ceramics, sanitaryware, stoneware, opaque glasses, vitreous china, other whitewear, and catalytic converters. Cosmetic uses for talc encompass all varieties of face powders and body-dusting powders. Cosmetic-grade talc is also used in pharmaceutical products and medicinal tablets. The paint industry is also an important consumer of talc, chiefly as an inert extender or filler. Talc is used as an additive in both thermoplastics and thermosetting materials. The chief use for talc, as a filler, is in polypropylene. Talc is one of the few minerals used by the plastics industry as a reinforcer. It is also used in a variety of paper products (e.g., for filler applications, maximum particle size should generally not exceed 20 μm , although 40- μm grades are also used in some applications), including wrapping paper, writing paper, packaging paper, and paperboard (note: as a coater, the talc particle size must not exceed 10 μm ; as a pitch-control agent, it should be as close to 1 μm as possible). Talc also serves principally as a carrier to distribute fertilizer, insecticide, herbicide, or fungicide, and to dilute these chemicals to prevent damage from concentrated dosages. It is also used as an anti-caking agent for dry compounds. Talc is used in the manufacture of roofing products as both a filler and a dusting agent and it is used by the rubber industry in the production of tires, tubing, sheets, valves, flooring products, backing for textiles, and for electric cable insulation. Low-grade talc is used as a dusting agent for gypsum boards and as a filler in drywall seating compounds, floor tiles, and asphalt pipeline enamels. Low-grade talc is also used as a refractory filler in a wide variety of core and mould castings for both nonferrous and ferrous foundry castings.

In contact refractories, pyrophyllite use (in conjunction with zircon) in the making of ladle lining increases ladle life significantly. Pyrophyllite is used as a grog ingredient for kiln furniture shapes such as slabs, saggars, blocks, and pins. It is used in the manufacture of refractory mortars, and in the ceramics industry to manufacture floor and wall tile, sanitaryware, crockery, and electrical porcelain. Pyrophyllite with a low iron content contributes to maintaining high whiteness levels in the manufacture of white cement. When finely ground (e.g., minus 45 μm) and quartz-free, pyrophyllite may be substituted for talc in certain filler applications, including rubber, plastics, paints, cosmetics, and jointing compounds. Calcined pyrophyllite is used in road surface aggregate in applications requiring paint markings (e.g., pedestrian crossings). A major expanding use for pyrophyllite is as a carrier in the insecticide industry and in the manufacture of ceramic glazes.

Steatite (i.e., soapstone) is easily carved and sculptured and has been used for centuries for interior ornamental work. However, the material can also be used as refractory bricks or blocks and, because of its softness and resistance to heat, as marking crayons for metal workers.

WORLD OVERVIEW

China, South Korea, and the United States accounted for more than half of the world's production of 8.92 Mt in 2006, an increase from 8.84 Mt in 2005. Overall, with the above countries (including India, Finland, France, and Brazil), seven countries together accounted for around 83% of total world output in 2006. Some are noted for particular talc grades (e.g., France, Italy, and Australia for the production of cosmetic talc), while others dominate for steatite (e.g., India, Australia, and Spain). The accuracy of individual countries' production is severely compromised by the intermixing of talc, steatite, and pyrophyllite statistics and the use of the term "unspecified."

World production has remained stable from 2003 (8.6 Mt to 8.9 Mt). The U.S. production of talc in 2006 increased to 895 000 t (valued at US\$27.4 million) from 856 000 t (valued at US\$24.4 million) in 2005. Although Canada's reported production (source: USGS) seems to have remained the same for the last few years at 90 000 t, ranking it in 16th place, Natural Resources Canada's data reports 67 900 Mt for 2006, indicating a more appropriate ranking of 21st place.

OUTLOOK

Because talc is used in the manufacture of a myriad of everyday products including animal feed, automobiles, cables, sweets, ceramic tiles, chewing gum, cosmetics, fertilizers, foundry technology, olive oil processing, paint, paper, pharmaceuticals, plaster, plastics, printing inks, putties, refractories, roofing, sanitaryware, tires, and, of

course, body powder, it is closely related to international economic development.

Substitute minerals will continue to affect the talc market since one of the major characteristics of the nonmetallic minerals industry is that minerals with similar functions can replace each other.

With the continuing residential and commercial construction boom, construction-related applications will probably remain steady, as will applications in plastics used in consumer products.

By far the largest markets for talc worldwide (source: *ROSKILL* Ninth Edition, 2003 flyer on "The Economics of Talc and Pyrophyllite") lie in paper and ceramics, each of which accounts for some 30% of the total consumption of talc minerals. However, talc faces increasing competition in both markets as precipitated and ground calcium carbonate take an increasing market share for paper fillers and as the refractories industry adopts higher-performance magnesite-carbon and dolomite-carbon products in place of pyrophyllite. The result is that the main areas of growth for talc in the next few years are likely to lie outside these two end uses. Growth in talc consumption in plastics is forecast at over 3%/y in line with the increased use of polypropylene, especially for the automotive market where lightweight and recyclability are important factors. The development of very fine, compacted, sub-micrometre talc will enhance the properties imparted to plastics and raise the value of talc sales to the plastics industry. Growth in talc consumption in paints is estimated at over 2%/y in North America and Western Europe, and at 4-7%/y in industrializing Asian and Latin American countries as the consumption of paint per capita rises.

The future of the pyrophyllite industry worldwide (source: Society of Mining, Metallurgy and Exploration 7th edition of *Industrial Minerals and Rocks*) depends on the continued exploration and development of new deposits and on the development of new markets.

HEALTH AND SAFETY, ENVIRONMENT, AND SUSTAINABLE DEVELOPMENT

Talc has not been listed as a known or suspected human carcinogen by the International Agency for Research on Cancer (IARC), the National Toxicity Program (NTP), the Occupational Safety and Health Administration (OSHA), the American Conference of Governmental Industrial Hygienists (ACGIH), or the European Community DG XI Working Group.

All mining activities have an impact on the environment: quarrying, driving adits, sinking shafts, creating open pits, waste dumps and tailings ponds, grinding rock, and operating and maintaining mining machinery.

As an example of a world leader in the production of talc and sustainable development considerations, the company Luzenac defines its policy on its web site at www.luzenac.com/pdf/Sustainable_dvpt.pdf.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
25.26	Natural steatite, whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape; talc						
2526.10	Not crushed, not powdered	Free	Free	Free	Free	Free	Free
2526.20	Crushed or powdered	Free	Free	Free	Free	Free	Free
2530.90.90.94	Mineral substances not elsewhere specified or included: other: other: pyrophyllite	Free	Free	Free	Free	Free	Free

Sources: Canadian Customs Tariff, effective January 2007, Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2007; Official Journal of the European Union (October 17, 2006 Edition); Customs Tariff Schedules of Japan, 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, TALC, STEATITE AND PYROPHYLLITE, PRODUCTION AND TRADE, 2004-06

TABLE 1. CANADA, TALC, CRYSTALLINE AND AMORPHOUS, PRODUCTION AND TRADE, 2004-05							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
SHIPMENTS							
	Newfoundland and Labrador	x	x	x	x	x	x
	Quebec	x	x	x	x	x	x
	Ontario	x	27 481	x	25 599	x	21 757
	British Columbia	x	x	x	x	x	x
	Total	81 069	28 477	70 337	26 228	67 809	22 293
EXPORTS							
2526.10	Natural talc, not crushed, not powdered						
	United States	8	9	27	38	42	41
	United Kingdom	21	4	—	—	—	—
	Australia	—	—	13	3	—	—
	New Zealand	—	—	16	3	—	—
	Total	29	13	56	44	42	41
2526.20	Natural talc, crushed or powdered						
	United States	66 668	26 123	55 833	22 282	85 066	22 870
	Jamaica	—	—	90	17	91	25
	Trinidad and Tobago	—	—	—	—	135	9
	Germany	5	2	—	—	12	2
	Spain	—	—	—	—	3	1
	Ireland	—	—	—	—	1	...
	Malta	..	...	1	...	—	—
	China	—	—	59	11	—	—
	Total	66 673	26 125	55 983	22 310	85 308	22 907
	Total exports	66 702	26 138	56 039	22 354	85 350	22 948

TABLE 1 (cont'd)

TABLE 1 (cont'd)		2004		2005		2006 (p)	
Item No.		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS							
2526.10.00.10	Natural steatite, not crushed, not powdered						
	Brazil	310	170	469	274	774	454
	United States	161	108	205	151	105	64
	India	40	21	64	48	59	42
	China	24	10	23	12	..	1
	Denmark	12	4	16	11	..	...
	Canada	—	—	..	...	..	...
	Germany	—	—	..	...	..	...
	Eritrea	—	—	15	9	—	—
	Total	547	313	792	505	938	561
2526.10.00.20	Talc, not crushed, not powdered						
	United States	1 828	348	1 002	215	1 010	198
	Brazil	69	15	89	30	18	7
	Hong Kong	13	5	28	12	7	3
	China	13	1	11	3	..	1
	South Korea	—	—	—	—	1	...
	Denmark	—	—	1	...	—	—
	Total	1 923	369	1 131	260	1 036	209
2526.20.00.10	Talc of a particle size not exceeding 20 microns, crushed or powdered						
	United States	68 293	5 496	20 225	4 901	18 519	5 023
	China	3 023	455	37 881	532	643	402
	France	47	26	27	1	34	19
	Italy	—	—	—	—	12	4
	Japan	206	4	20	5	1	3
	Canada	—	—	—	—	1	1
	India	—	—	—	—	2	1
	Germany	...	...	15	4	..	...
	United Kingdom	1	...	1	...	..	...
	South Africa	—	—	—	—	...	...
	Austria	..	...	...	...	—	—
	Sweden	13	7	—	—	—	—
	Switzerland	1	...	—	—	—	—
	Total	71 584	5 988	58 169	5 443	19 212	5 453
2526.20.00.90	Other natural talc, crushed or powdered						
	United States	81 363	11 671	71 140	10 942	56 703	10 280
	France	1 225	466	1 535	592	1 339	493
	Japan	2 302	54	330	57	360	76
	Germany	12	1	4	1	29	39
	China	7	2	50	4	45	17
	Spain	1	...	—	—	15	16
	Italy	—	—	94	18	1	15
	United Kingdom	2	...	7	16	10	7
	South Korea	—	—	—	—	2	6
	Canada	..	...	1	...	9	...
	India	125	41	...	...	..	...
	Hong Kong	1	5	2	...	—	—
	Netherlands	...	...	1	...	—	—
	Sweden	...	...	—	—	—	—
	U.S. Minor Outlying Islands	20	6	—	—	—	—
	Austria	—	—	2	1	—	—
	Morocco	—	—	..	...	—	—
	Total	85 058	12 246	73 166	11 631	58 513	10 949
2530.90.90.94	Other: pyrophyllite						
	United States	1 481	116	1 386	91	2 733	270
	Total imports	160 593	19 032	134 644	17 930	82 432	17 442

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; ... Amount too small to be expressed; (p) Preliminary; x Confidential.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, TALC, STEATITE AND PYROPHYLLITE SHIPMENTS, HISTORICAL, 1988-2006

Year	Tonnes
1988	146 493
1989	144 828
1990	130 861
1991	114 898
1992	113 270
1993	110 730
1994	126 014
1995	108 327
1996	77 016
1997	72 444
1998	72 095
1999	79 493
2000	84 945
2001	45 086
2002	83 044
2003	81 999
2004	81 069
2005	70 337
2006 (p)	67 809

Sources: Natural Resources Canada;
Statistics Canada.

(p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 3. CANADA, TALC IMPORTS AND EXPORTS, HISTORICAL, 1988-2006

Year	Imports (1)	Exports to the United States (2)
	(tonnes)	
1988	179 343	44 501
1989	48 018	42 814
1990	43 739	39 808
1991	44 095	33 728
1992	46 704	31 643
1993	47 272	27 972
1994	52 161	31 262
1995	50 323	25 509
1996	57 560	25 631
1997	53 826	26 110
1998	45 899	29 657
1999	56 205	44 320
2000	60 362	58 274
2001	67 130	45 291
2002	85 268	68 920
2003	73 146	66 899
2004	158 566	66 676
2005	132 465	55 860
2006 (p)	78 763	85 108

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

(1) Data include HS Codes 2526.10.00.20, 2526.20.00.10 and 2526.20.00.90. (2) Data include HS Codes 2526.10.00 and 2526.20.00.

Note: Numbers may not add to totals due to rounding.

TABLE 4. REPORTED USE OF TALC AND PYROPHYLLITE, BY INDUSTRY, 2001-05

	2001	2002	2003	2004 (r)	2005 (p)
	(tonnes)				
REPORTED USE (1) (GROUND TALC, AVAILABLE DATA)					
Pulp and paper, paper products	36 408	39 739	35 356	33 944	31 385
Asphalt roofing products	29 748	5 640	18 159	13 849	x
Paint and varnish	5 663	6 158	6 079	6 086	5 152
Ceramic products	3 471	1 963	3 757	2 416	x
Rubber products	1 727	2 121	1 229	1 993	2 187
Other products	3 814	2 645	13 226	3 940	3 606
Total	80 831	58 266	77 806	62 228	52 910

Source: Natural Resources Canada.

x Confidential.

(1) Reported from NRCAN survey on the consumption of nonmetallic minerals by Canadian manufacturing plants.

Note: Numbers may not add to totals due to rounding.

Tungsten

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CANADIAN DEVELOPMENTS

Until 1986, Canada was a major producer of tungsten ore and concentrate. Annual production reached a high of 3715 t of tungsten content (8% of world production) in 1984, after which prices collapsed as a result of increased exports from the People's Republic of China. The low-priced material from China eventually forced the closure of the Canadian operations at the Cantung and Mount Pleasant mines in the Northwest Territories and New Brunswick, respectively.

The Cantung mine operated by Canada Tungsten Mining Corporation Limited (Cantung), Canada's leading tungsten company, was recognized as the largest producer of tungsten concentrate in the Western World. Located in the Northwest Territories, the Cantung mine was in operation between 1962 and 1986 at a rate of about 4450 t/y of tungsten trioxide (WO_3). Higher-grade concentrates were marketed directly while lower-grade concentrates were sent to the Fort Madison, Iowa, plant for conversion to ammonium paratungstate (APT).

North American Tungsten Corporation Ltd. re-opened the mine in 2001, but was again forced to close it in December 2003. After a restructuring of the company and additional fund raising, operations resumed at the Cantung mine in September 2005. The mill was ramped up to 1000 t/d by February 2006. A new tailings pond was built during the year and work has been conducted at the Mactung project in order to satisfy regulatory requirements relating to environmental impact to move the property through to the production stage. The company has published estimates of proven and probable reserves that provide for a mine life of three to four years. The company reports that it produced 57 556 metric tonne units (mtu) of WO_3 in 2005 and a further 250 000 mtu in calendar year 2006. Additional information is available on the Internet at www.northamericantungsten.com.

North American Tungsten has also invested in an advanced pilot plant and in research to develop a process to convert low-grade tungsten concentrate into ammonium paratungstate and other intermediate products, including powders, and is hopeful that tungsten concentrates can be directly converted into tungsten intermediaries with a significant simplification and reduction of production costs. Based on the results of test work, a decision will be made on whether to proceed with construction of a full-scale commercial plant located in Hoyt Lake, Minnesota, under a joint-venture agreement with Tundra Particles Inc. Additional information is available on the Internet at www.northamericantungsten.com.

WORLD DEVELOPMENTS

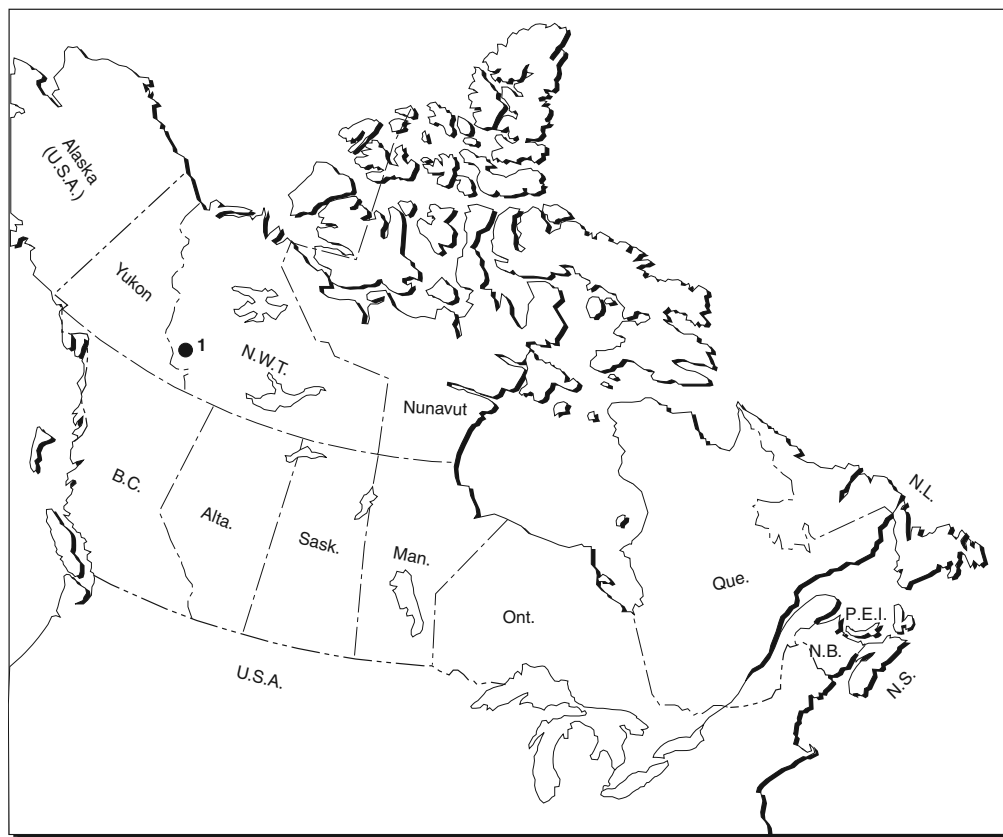
Peru

Malaga Inc. (previously Dynacor Mines Inc.) acquired the Pasto Bueno tungsten mine in northern Peru, 830 km from the city of Lima in late 2005. The mine site has two mills and the company owns 1 MW of associated hydro-electric power generation capacity with the potential for expansion of power generation. The mine started production in October 2006 at a rate of about 80 t/d and the company expected to reach the full capacity of 250 t/d in mid-2007. An agreement was signed with Peruvian energy producer Elektrokraft and a Swiss energy company to develop further hydro-electrical capacity. This capacity was expected to be on stream late in 2007.

Portugal

Beralit Tin and Wolfram (Portugal) S.A. (owned by Primary Metals Inc.) operates the Panasqueira tungsten mine in Portugal, one of the world's larger producers of tungsten concentrates outside of China (www.primarymetals.ca). Panasqueira has been operating at a rate of 2400 t/d, but has upgraded and purchased new mining equipment to allow an increase in its mining rate to 3000 t/d (with a maximum five days per week) in January 2006. Upgrades to the mill and mining methods are also expected to increase grades and recoveries. A new ore reserve estimate was published in 2006 that indicates a possible mine life of eight years. Exploration work was also under way on other properties in Portugal for tin and gold.

Figure 1
Location of Cantung Mine, Northwest Territories



1. Cantung mine, North American Tungsten Corporation Ltd.

Vietnam

Toronto-based Tiberon Minerals Ltd., which was working on development of its Nui Phao property in Vietnam, was taken over by Dragon Capital Management Limited (www.dragoncapital.com). Work was continuing on development of the property.

China

Demand for all metals within China is rapidly increasing and tungsten is no exception. The increased demand for energy and metals in China has been one of the most influential elements in the markets' dramatic rise in base-metal prices. Tungsten smelters within China suffered a lack of concentrates in 2006 and China implemented new regulations in January 2007 on the size and capital requirements for new tungsten smelters aimed at limiting expansion in the sector.

In addition, the Chinese government's export control policies for tungsten ores and intermediates have affected the world demand/supply balance. The Ministry of Commerce reduced the value-added tax rebates on various commodities, including tungsten, effective January 1, 2006, to 5% from the 8% applied in 2005, and implemented a 10% tax on exports of ferrotungsten on November 1, 2006, and a 5% export tax on APT on January 1, 2007. China cancelled toll trading tax benefits for minor metals, including tungsten concentrates, effective April 26, 2007.

In addition, its export quota for 2007 was reduced to 15 400 t from 15 800 t in 2006.

EXPLORATION ACTIVITY

The New Brunswick, Yukon and B.C. governments provide information on the tungsten occurrences within their province. Links to their web sites are available at www.nrcan.gc.ca/mms/cmy/lcom_e.htm#Tungsten.

Companies with Canadian exploration projects for tungsten, or with tungsten associated with other metals, include¹:

- Adex Mining Inc., former Mount Pleasant mine in New Brunswick;
- Arcturus Ventures Inc., property in Finlayson Lake area, Yukon (www.arcturusventuresinc.com);
- Brett Resources Inc., property in the Smart River area, Yukon (www.brettresources.com);
- Buchans River Ltd., Granite Lake, Newfoundland and Labrador (www.newlab.nf.ca), property optioned in early 2006 to Playfair Mining Ltd.;
- Cadillac Ventures Inc., option on Burnt Hill, New Brunswick, former producer from Noront Resources Ltd.;
- Copper Ridge Explorations Inc., option to acquire 100% of Kalzas property, Yukon (www.copper-ridge.com);
- Emgold Mining Corporation, option agreement to acquire the Stewart property from Sultan Minerals Inc. in southwestern British Columbia (www.emgold.com);
- Freeport Resources Inc., Red Rose property, former producer, Omineca, British Columbia;
- First Narrows Resources Corp., Falls Creek property, New Brunswick (www.uno.ca);
- Geodex Minerals Ltd., Sisson Brook property, New Brunswick (www.geodexminerals.com);
- Happy Creek Minerals Ltd., Fox property northeast of 100 Mile House, British Columbia;
- Noront Resources Ltd., Burnt Hill, New Brunswick, former producer (transferred option to Cadillac Ventures Inc.) (www.norontresources.com);
- North American Tungsten Corporation Ltd., Cantung and Mactung properties in the Yukon, current producer (www.northamericantungsten.com);
- International Bethlehem Mining Corp. (formerly Orphan Boy Resources Inc.), Rain project, Revelstoke, British Columbia (www.bethlehemmining.com);
- Largo Resources Ltd., Northern Dancer property, Yukon-British Columbia (www.largoresources.com);
- Playfair Mining Ltd., various properties, Grey River, Newfoundland and Labrador; Risby, Yukon; and Lened, N.W.T. (www.playfairmining.com);
- Strategic Metals Ltd., various properties in the Yukon and northern British Columbia (www.strategicmetalsltd.com);
- Sultan Minerals Inc., Jersey Emerald property, Salmo, British Columbia, former producer (www.sultanminerals.com); and
- Tyhee Development Corp., Nicholas Lake, Northwest Territories.

¹ If your company has a tungsten property that is not listed here and you would like to have it included, contact the Minerals and Metals Sector with details.

Other Canadian-based companies with international interests include:

- Primary Metals Inc., which owns 100% of Beralt Tin and Wolfram (Portugal) S.A.;
- Beralt, which owns and operates the Panasqueira tungsten mine in Portugal, one of the world's largest producers of tungsten concentrates outside of China (www.primarymetals.ca);
- Brett Resources Inc., Sleitat Mountain tin-silver-tungsten property, optioned from Solomon Resources Limited (www.brettresources.com);
- Dynacor Mines Inc., which acquired the Pasto Bueno tungsten mine in Peru (www.dynacor.com);
- Rome Resources Ltd., with various properties in Mexico (www.romermr.com); and
- Solomon Resources Limited, Sleitat Mountain, Alaska optioned to Brett Resources Inc. (www.solomonresources.ca).

USE AND PROPERTIES

Canada's use data for tungsten are confidential due to the low number of users.

Tungsten's properties include a very high density, the highest melting point of any metal at 3410°C, a low coefficient of thermal expansion, high tensile strength at elevated temperatures, high corrosion resistance, good thermal and electrical conductivity, and hardness. Tungsten metal is the hardest of the refractory metals and tungsten carbide is one of the hardest substances.

About 60% of tungsten concentrate is used for tungsten cemented carbide products such as tools and wear parts. Steel and metal products, including wire, electrical contacts, and welding equipment, each account for 15% of tungsten use, nonferrous alloys and pigments/catalysts account for an additional 5%, and other uses account for 5% of use.

Ammonium paratungstate (APT) is the most important intermediate in the production of tungsten metal powder and tungsten carbide, and for some chemical uses of tungsten. It is used to produce tungsten trioxide ("yellow oxide" and "blue oxide"), which can be converted into tungsten powder for use in the manufacture of cemented carbides and lightbulb filaments, as well as other uses.

Due to its hardness, tungsten carbide has widespread application where intense wear and abrasion are encountered. This product is the preferred metal-working material for the cutting edges of machine tools and as a metal surface in forming and shaping dies. It is produced by the chemical combination of tungsten metal powder and finely divided carbon. Tungsten carbide is compacted to the desired form, using cobalt as a binder, and sintered to produce cemented

tungsten carbide. Other uses of tungsten carbide include: tire studs, spikes for golf shoes, armour-piercing projectiles, and welding electrodes.

Tungsten can also replace lead in ammunition to produce environmentally friendly or “green” ammunition.

As an alloy constituent, tungsten is used primarily in the production of high-speed tool and die steels. Tungsten-bearing steels are used for the same applications as carbides, especially where lower operating temperatures are encountered.

Tungsten is also used in superalloys and nonferrous alloys. Tungsten-containing superalloys are being used increasingly in high-temperature applications and in highly corrosive environments because of their high-temperature strength and oxidation resistance.

Tungsten wire is used for filaments in incandescent lamps and for heating elements in both fluorescent lamps and vacuum tubes. Minor amounts of tungsten are also used to make chemicals and compounds for non-metallurgical applications. Some of the end uses include dyes, chemical reagents, catalysts, lubricants, paints, and varnishes.

PRICES

Tungsten prices increased substantially in 2006 and remained strong during the early part of 2007. The U.S. spot price for tungsten ore remained strong with an average

above US\$190/mtu in 2006. Prices for other intermediate tungsten products all around the world have enjoyed comparable increases.

Initiatives taken by the Chinese government in changing export quotas (discussed above) and export taxes are likely to have a continuing impact on tungsten markets.

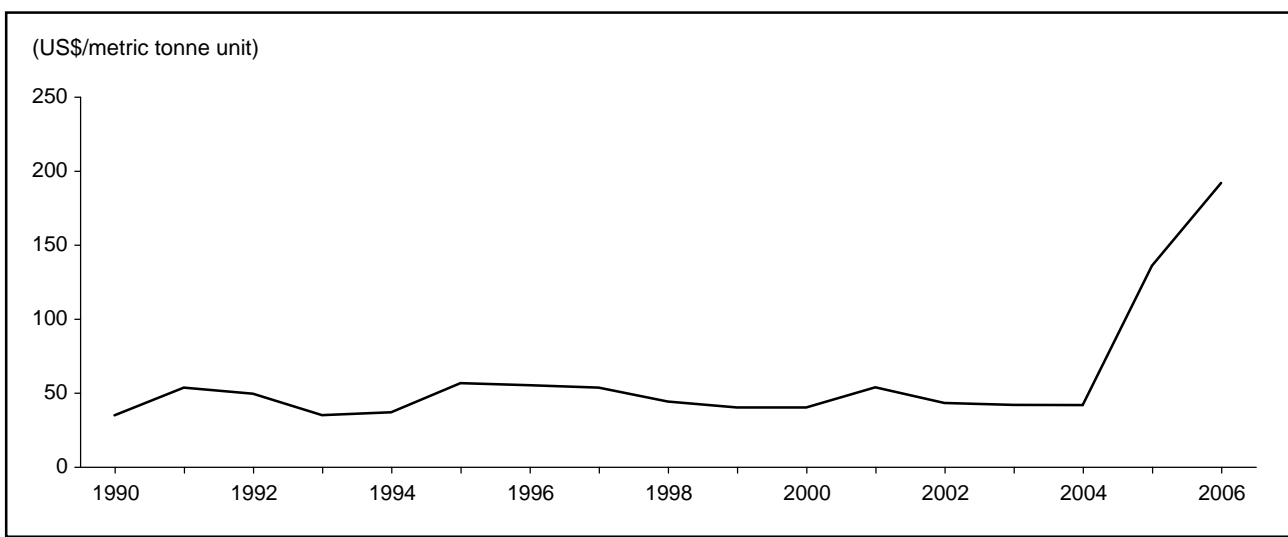
Various tungsten prices can be found in journals such as *Platts Metals Week* and *Metal Bulletin*. Most are given in metric tonne units, which is 1% of one metric tonne or 10 kg of contained tungsten trioxide (WO₃).

TRADE DATA

The trade tables that follow contain anomalous data that cannot be corrected due to publication deadlines. It should be noted that data on exports of ores and concentrates from Canada are not consistent with published Canadian production data. There are no imports of material reported to account for the differences. Users are cautioned to ensure data are appropriate for their needs.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Most information in this review was current as of March 30, 2007. (3) Although HS codes are often not specific enough to identify individual tungsten-containing compounds, if you feel that publication of additional trade statistics would assist you or your company,

Figure 2
Tungsten Ore, U.S. Spot Prices, 1990-2006



Source: *Platts Metals Week*, annual average of weekly prices.

please contact the Minerals and Mining Statistics Division by telephone at 1-800-267-0452 or by e-mail at info-mms@nrcan.gc.ca. (4) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2611.00	Tungsten ores and concentrates	Free	Free	Free	Free	Free	Free
2841.80	Salt of oxometallic or peroxometallic acids: tungstates (wolframates)	5.5%	3%	Free	Free	5.5%	3.3%
2849.90.10	Carbides, whether or not chemically defined: other: tungsten carbide	Free	Free	Free	Free	4.1%	2.5%
7202.80	Ferro-alloys: ferro-tungsten and ferro-silico-tungsten	Free	Free	Free	Free	Free	2%-2.5%
81.01	Tungsten (wolfram) and articles thereof, including waste and scrap:						
8101.10	Powders	Free	Free	Free	Free	5%	Free
8101.94	Other: unwrought tungsten, including bars and rods obtained simply by sintering	Free	Free	Free	Free	5%	Free
8101.95	Bars and rods, other than those obtained simply by sintering, profiles, plates, sheets, strip and foil	Free	Free	Free	Free	6%	Free
8101.96	Other: wire	Free	Free	Free	Free	6%	Free
8101.97	Other: waste and scrap	Free	Free	Free	Free	Free	Free
8101.99	Other: other	Free-3%	Free	Free	Free	6%-7%	Free

Sources: Canadian *Customs Tariff*, effective January 2006 and 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2006 and 2007; *Official Journal of the European Union* (October 27, 2005 and October 17, 2006 editions); *Customs Tariff Schedules of Japan*, 2006 and 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties.

(2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, TUNGSTEN TRADE, 2004-06

TABLE 1. CANADA, TUNGSTEN TRADE, 2004-06							
Item No.		2004		2005		2006 (p)	
		(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
EXPORTS							
2611.00	Tungsten ores and concentrates						
	China	157 169	301	341 690	5 405	2 731 310	39 162
	Germany	—	—	201 609	3 198	824 808	13 399
	United States	2 659 590	4 855	1 292 978	1 572	660 790	2 036
	Russia	—	—	—	—	31 968	550
	Japan	—	—	3 630	54	1 950	29
	Venezuela	—	—	—	—	2	...
	United Kingdom	—	—	20 263	350	—	—
	Total	2 816 759	5 156	1 860 170	10 579	4 250 828	55 176
8101.10	Tungsten (wolfram) powders						
	United States	99 004	1 952	100 198	3 816	156 547	5 321
	Germany	225 042	3 405	83 430	3 009	93 959	1 604
	Australia	891	50	2 607	113	4 738	250
	Sweden	132	7	1 300	63	3 000	158
	South Africa	6 175	497	6 308	171	2 580	136
	Other countries	10 559	451	5 684	223	1 398	73
	Total	341 803	6 362	199 527	7 395	262 222	7 542
8101.99	Tungsten (wolfram) and articles thereof, n.e.s.						
	Colombia	—	—	—	—	19	5
	United States	37	15	442	71	28	4
	Saint Pierre and Miquelon	20	1	—	—	—	—
	South Africa	424	19	30	13	—	—
	New Zealand	—	—	10	...	—	—
	Total	481	35	482	84	47	9
	Total exports	n.a.	11 553	n.a.	18 058	n.a.	62 727
IMPORTS							
2611.00	Tungsten ores and concentrates						
	United States	3 741	39	16	...	960	14
	Germany	68	1	—	—	—	—
	Total	3 809	40	16	...	960	14
2841.80	Tungstates (wolframates)						
	United States	10 264	34	498 206	1 769	28 510	101
	Australia	32 950	114	37 343	133	18 411	65
	Other countries	55 383	160	1 980	7	622	2
	Total	98 597	308	537 529	1 909	47 543	168
2849.90.00.10	Tungsten carbide						
	United States	105 998	3 370	101 420	4 295	89 669	4 511
	Germany	62 979	2 518	42 161	1 732	80 607	4 003
	China	16 338	327	27 650	849	31 750	1 400
	France	144	10	190	14	760	60
	Mexico	959	30	—	—	1 161	60
	United Kingdom	2 053	95	4 079	47	5 250	57
	Other countries	1 840	81	517	19	1 676	53
	Total	190 311	6 431	176 017	6 956	210 873	10 144
7202.80	Ferro-tungsten and ferro-silico-tungsten						
	China	7 270	78	10 393	180	20 371	396
	Brazil	—	—	—	—	1 500	41
	United States	1 620	19	7 613	128	1 012	18
	Russia	700	8	2 100	26	882	15
	Other countries	—	—	27	...	57	2
	Total	9 590	105	20 133	334	23 822	472

TABLE 1 (cont'd)

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
IMPORTS (cont'd)							
8101.10.00.10	Tungsten powders, not alloyed						
	United States	50 757	1 640	80 104	3 122	66 049	3 075
	China	21 050	401	18 113	587	42 194	1 641
	Germany	6 807	313	3 925	189	11 985	572
	Canada	—	—	—	—	7 380	299
	South Korea	13 000	307	4 000	91	—	—
	South Africa	18 442	711	—	—	—	—
	Other countries	125	5	276	16	704	41
	Total	110 181	3 377	106 418	4 005	128 312	5 628
8101.10.00.20	Tungsten powders, alloyed						
	Germany	8 445	407	41 827	2 167	28 816	1 570
	United States	15 794	797	13 047	790	40 171	1 568
	South Korea	—	—	5 000	223	24 285	1 208
	Other countries	164	5	523	24	944	43
	Total	24 403	1 209	60 397	3 204	94 216	4 389
8101.94.00.10	Unwrought tungsten, sintered bars and rods, not alloyed						
	United States	4 394	247	5 647	351	6 845	422
	China	—	—	—	—	567	44
	Austria	50	3	153	9	46	3
	Brazil	—	—	450	12	—	—
	Total	4 444	250	6 250	372	7 458	469
8101.94.00.91	Unwrought tungsten, not alloyed						
	United States	1 419	33	3 076	69	2 146	48
	India	—	—	2 250	28	—	—
	Other countries	...	...	80	2	—	—
	Total	1 419	33	5 406	99	2 146	48
8101.94.00.92	Unwrought tungsten, alloyed						
	United States	2 648	107	5 391	229	9 982	422
	Other countries	99	5	178	10	726	39
	Total	2 747	112	5 569	239	10 708	461
8101.95.00.10	Tungsten not alloyed, other than those obtained simply by sintering						
	United States	2 315	127	1 128	79	3 442	240
	Other countries	103	11	114	8	5	...
	Total	2 418	138	1 242	87	3 447	240
8101.95.00.21	Tungsten bars and rods, not alloyed; profiles, plates, sheets, strip and foil						
	China	3 710	116	6 061	233	3 812	205
	United States	2 029	139	1 718	140	2 037	162
	Other countries	176	15	488	42	443	37
	Total	5 915	270	8 267	415	6 292	404
8101.95.00.22	Tungsten bars and rods, alloyed other than those obtained simply by sintering; profiles, plates, sheets, strip and foil						
	Luxembourg	6 208	450	9 222	685	6 592	493
	United States	6 591	395	4 515	372	5 578	478
	China	107	4	76	2	2 646	251
	Other countries	1 320	103	1 039	80	103	3
	Total	14 226	952	14 852	1 139	14 919	1 225

TABLE 1 (cont'd)

Item No.		2004		2005		2006 (p)	
		(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
IMPORTS (cont'd)							
8101.96.00.10	Tungsten wire, not alloyed						
	United States	4 619	274	3 559	232	3 160	207
	Japan	—	—	—	—	762	31
	Germany	—	—	—	—	124	8
	Other countries	118	9	132	11	6	...
	Total	4 737	283	3 691	243	4 052	246
8101.96.00.21	Tungsten wire, alloyed, not coated or covered						
	Germany	3 829	225	7 193	364	7 443	488
	Japan	1	...	200	11	1 211	58
	United States	1 919	108	763	38	818	56
	Other countries	—	—	4	...	45	3
	Total	5 749	333	8 160	413	9 517	605
8101.96.00.22	Tungsten wire, alloyed, coated and covered						
	France	1 366	76	1 418	77	1 818	99
	Germany	1 441	74	20	1	1 245	58
	United States	927	57	955	52	799	43
	Japan	2 499	95	1 416	75	961	42
	Other countries	1 397	49	607	34	280	12
	Total	7 630	351	4 416	239	5 103	254
8101.97	Unwrought tungsten, waste and scrap						
	United States	4 553	224	11 311	493	25 911	1 178
	China	—	—	—	—	1 000	37
	Other countries	1 035	50	1 887	95	—	—
	Total	5 588	274	13 198	588	26 911	1 215
8101.99.10	Tungsten (wolfram) and articles, thereof, n.e.s.						
	United States	13 910	838	5 091	348	11 880	786
	Germany	2 216	201	2 048	195	2 350	148
	Spain	1 099	72	1 209	60	2 207	54
	China	—	—	29	3	1 134	38
	India	888	58	1 217	81	470	31
	Other countries	—	—	—	—	8	...
	Total	18 113	1 169	9 594	687	18 049	1 057
8101.99.90	Tungsten, other						
	United States	24 371	1 545	27 300	1 732	12 194	910
	United Kingdom	81	5	11	1	1 655	110
	China	7	...	1	...	1 684	108
	Other countries	410	14	80	4	215	15
	Total	24 869	1 564	27 392	1 737	15 748	1 143
Total imports		n.a.	17 199	n.a.	22 666	n.a.	28 182

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Amount too small to be expressed; n.a. Not applicable; n.e.s. Not elsewhere specified; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

Uranium

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OVERVIEW

In 2005 and 2006, Canada retained its position as world leader in uranium production with output totaling 11 628 tU (tonnes of uranium metal) and 9862 tU, respectively. As Figures 1a and 1b show, two of the world's three largest uranium-producing companies have operations in Canada. As of January 1, 2007, Canada's total known uranium resources amounted to approximately 423 200 tU, compared to 431 000 tU as of January 1, 2006, and 444 000 tU as of January 1, 2005. This downward adjustment of some 5% over two years is the result of depletion through mining and ongoing resource re-assessment.

Due to continuing supply constraints, uranium spot market prices increased 250% during the two-year period, growing from US\$20.70/lb U₃O₈ on December 31, 2004, to US\$72.00/lb U₃O₈ on December 31, 2006. Increased supply will help alleviate this situation, but a good deal of additional production capacity will be required before the end of this decade. The Canadian uranium mining sector continues to be very active. Production from the Cigar Lake mine was expected to begin in 2007, but has been delayed until 2011 due to flooding during mine construction. Strengthening market conditions were a key factor in the decision to seek regulatory approval to mine the Midwest deposit, and the environmental assessment of the project began on March 2, 2006.

The continued rise in uranium spot prices increased the already high level of exploration activity across the country and around the world. Although the exploration focus in Canada remains in the Athabasca Basin of Saskatchewan,

uranium exploration is also active in the Northwest Territories, Yukon, Nunavut, Quebec, Newfoundland and Labrador, Ontario, Manitoba, and Alberta. More than 200 junior exploration companies were involved in uranium exploration in Canada by the end of 2006. This surge in exploration activity will likely lead to the discovery of new ore deposits and higher levels of production in the long run. However, the development time for new mines is usually in excess of 10 years, suggesting that the market will continue to be under pressure for some time.

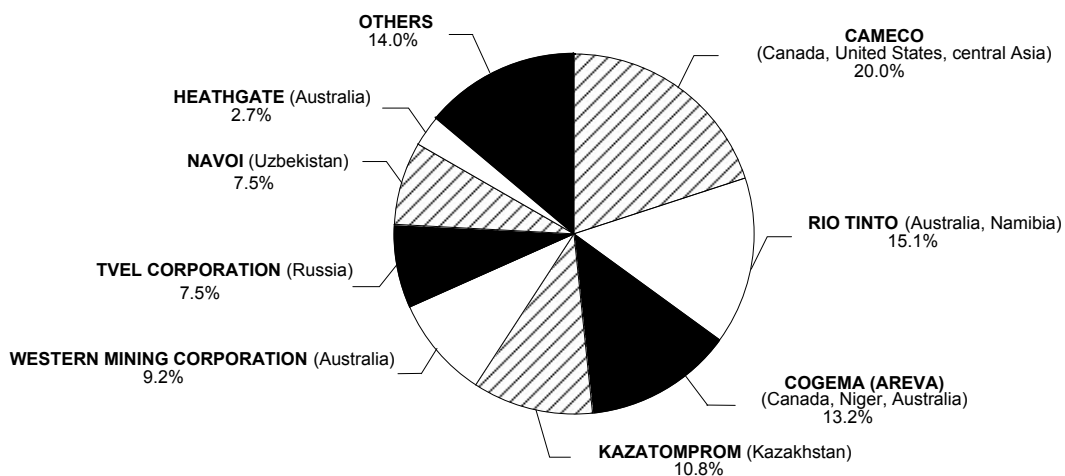
DOMESTIC PRODUCTION AND DEVELOPMENTS

In 2006, the most recent year with complete data available, uranium production amounted to a total of 9862 tU, down 15% from the 11 628 tU and 11 597 tU produced in 2005 and 2004, respectively. Direct employment in Canada's uranium mining industry increased from 974 in 2002 to 1113 in 2005 (Table 1). Shipments from mining centres increased in 2004 and 2005, as did their total value (Table 2). Uranium continues to rank among Canada's top 10 metal commodities in terms of output value. Tables 3a and 3b document the main operational characteristics of the existing uranium production centres in Canada in 2004 and 2005, respectively. Table 4 updates the status of new projects that represent Canada's future production capability. All current production and new projects awaiting development are located in the Athabasca Basin of northern Saskatchewan. Uranium production in Canada in 2004 and 2005 (Figures 3a and 3b) was once again dominated by Cameco Corporation and AREVA Resources Canada Inc. (formerly COGEMA Resources Inc.).

On March 24, 2005, the Supreme Court of Canada dismissed, with costs, an application to appeal the June 2004 Federal Court of Appeal decision that unanimously overturned a September 2002 Federal Court of Canada decision to quash a 1999 McClean Lake operating licence. The 2002 decision had been made on the grounds that an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) had not been conducted prior to issuing the licence. The end of this legal challenge to the McClean Lake operating licence significantly reduces uncertainties surrounding environmental assessment requirements at this and other uranium mines and mills in Canada.

¹ John French, Advisor, Uranium Markets (613-995-7474), has contributed to the text in those sections dealing with international uranium market developments and prices.

Figure 1a
World's Top Uranium Mining Companies in 2004

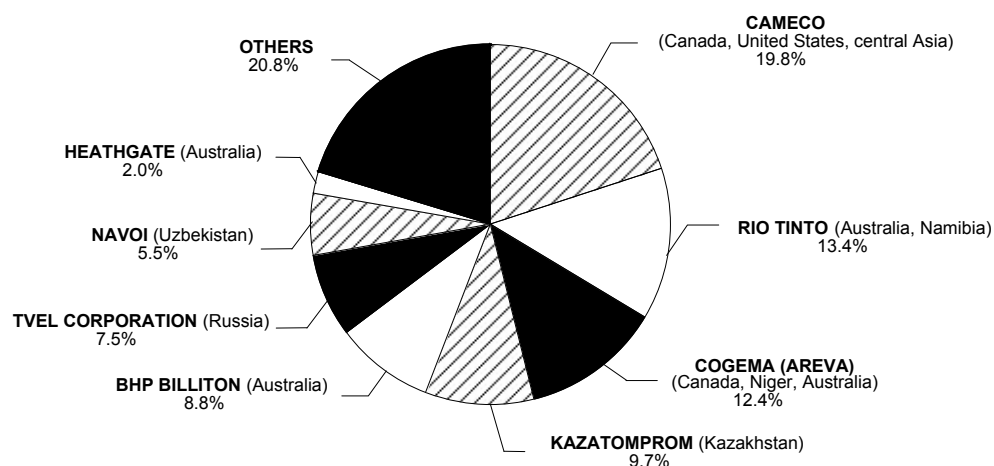


These eight companies accounted for 86% of 2004 world production of 40 263 tU.

Source: *World Nuclear Association Pocket Guide*.

Note: Ranking reflects equity interest in production facilities, not market share.

Figure 1b
World's Top Uranium Mining Companies in 2005

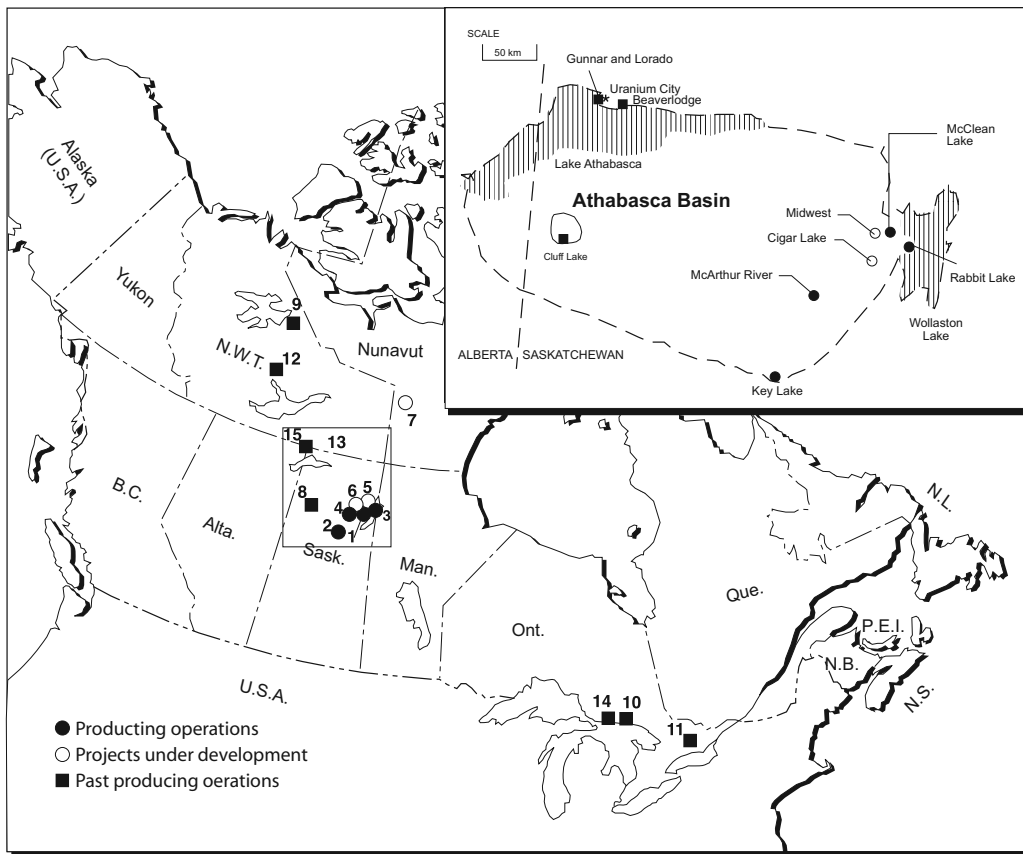


These eight companies accounted for 79% of 2005 world production of 41 702 tU.

Source: *World Nuclear Association Pocket Guide*.

Note: Ranking reflects equity interest in production facilities, not market share.

Figure 2
Uranium Mining in Canada, 2006



Numbers refer to locations on map above.

PRODUCING OPERATIONS

1. Rabbit Lake
2. Key Lake
3. McClean Lake
4. McArthur River

PROJECTS UNDER DEVELOPMENT

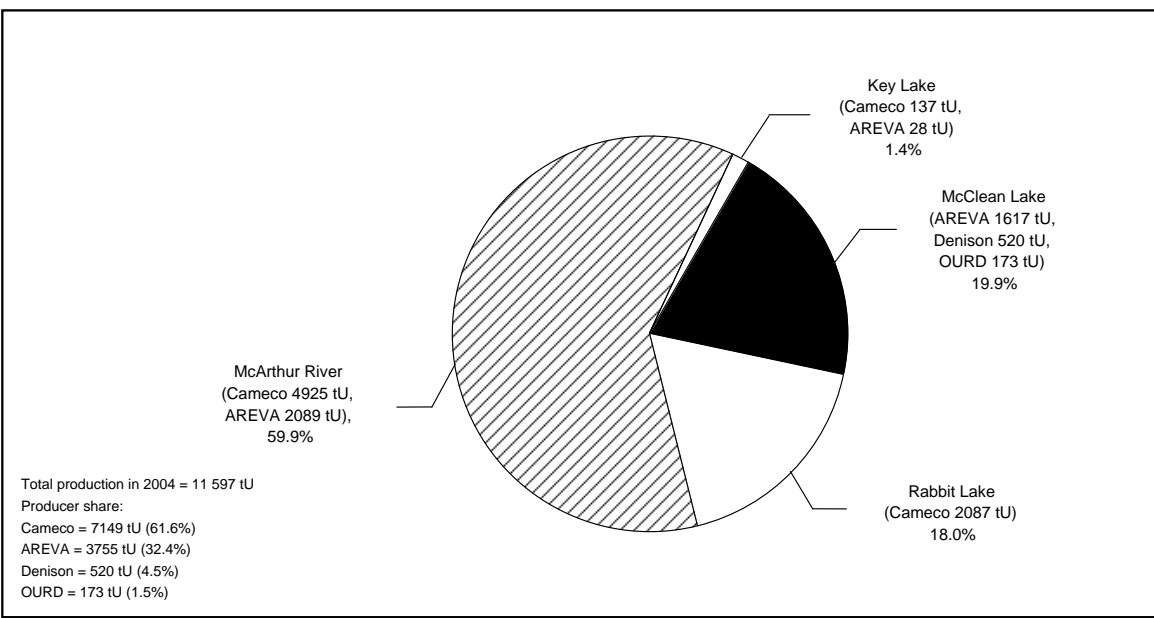
5. Midwest
6. Cigar Lake
7. Kiggavik

PAST PRODUCING OPERATIONS

8. Cluff Lake
9. Port Radium
10. Agnew Lake
11. Madawaska et al (Bancroft)
12. Rayrock (Marian River)
13. Beaverlodge et al
14. Quirke/Panel/Denison and Stanleigh et al (Elliot Lake)
15. Gunnar and Lorado et al

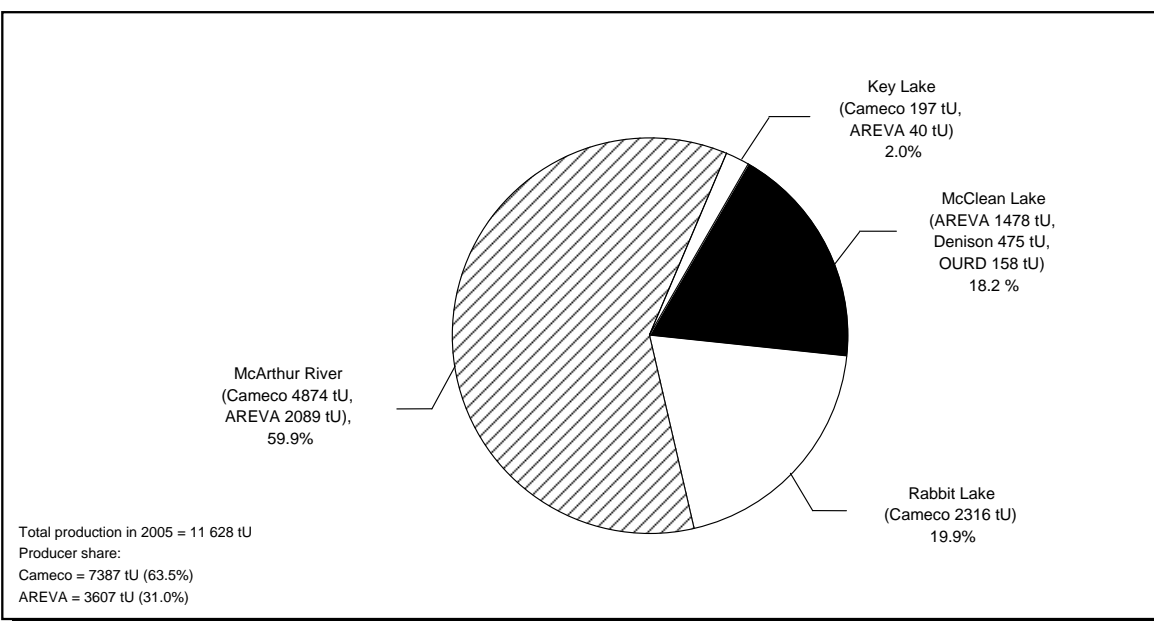
Source: Uranium and Radioactive Waste Division, Natural Resources Canada.

Figure 3a
Canadian Uranium Production and Ownership, 2004



Source: Uranium and Radioactive Waste Division, Natural Resources Canada.
 Cameco: Cameco Corporation; AREVA: AREVA Resources Canada Inc.; OURD: OURD (Canada) Co., Ltd.;
 Denison: Denison Mines Inc.

Figure 3b
Canadian Uranium Production and Ownership, 2005



Source: Uranium and Radioactive Waste Division, Natural Resources Canada.
 Cameco: Cameco Corporation; AREVA: AREVA Resources Canada Inc.; OURD: OURD (Canada) Co., Ltd.;
 Denison: Denison Mines Inc.

Regulatory approval was obtained in May 2005 for the renewal of the operating licence for McClean Lake and for a 50% increase in the annual production capacity of the mill. Construction has started on the expansion, which will allow the McClean Lake mill to process Cigar Lake ore.

Elliot Lake, Ontario

Elliot Lake was the major uranium mining centre in Canada for over 40 years. Since the last mining facility closed in 1996, uranium mining companies have committed well over \$75 million to decommission all mines, mills, and waste management areas. These companies continue to expend some \$2 million each year for treatment and monitoring activities. Water treatment and minor engineering works continued to be the main activities at the closed Elliot Lake area uranium mine and mill sites in 2005. The *Serpent River Watershed Annual Water Quality Report* was completed in 2005 (the second five-year cycle of a major monitoring program in the watershed that hosted uranium mining for over 40 years). Results indicate that, in general, the quality of the water and sediment throughout the watershed continues to improve, indicating a general improvement in the ecological health of the watershed.

Athabasca Basin, Saskatchewan

McArthur River

Cameco operates the McArthur River mine, which is a Cameco (70%) and AREVA (30%) joint venture. Production at this, the world's largest uranium producing mine, was 7035 tU, 6963 tU, and 7004 tU in 2004, 2005, and 2006, respectively. Mining this high-grade deposit is technically challenging. In order to control groundwater inflow, a freeze curtain is created in the area to be mined. The ore is then extracted using the raise bore mining method and collected in a tunnel below the orebody. A high-grade ore slurry is then produced in underground crushing, grinding, and mixing circuits, and then pumped to automated stations on the surface. The slurry is loaded into specially designed containers that are trucked 80 km to the Key Lake mill where all McArthur River ore is processed.

Key Lake

The Key Lake mill is a Cameco (83%) and AREVA (17%) joint venture operated by Cameco. Although mining was completed in 1997, the mill is being used to process all ore from the McArthur River mine and, consequently, it maintained its standing as the world's largest uranium production centre by operating at its maximum licensed output of 7200 tU annually in 2004, 2005, and 2006. The mill processes a blend of high-grade McArthur River ore slurry and stockpiled, mineralized Key Lake waste rock with a mill feed grade of about 3.4% U.

A proposal to increase annual production by 18% (from 7200 tU to 8500 tU) at the Key Lake mill is currently the subject of a screening-level environmental assessment initiated in January 2003. Pending receipt of regulatory approvals, Cameco expects that it will take about two years to ramp up to the increased production level.

A proposal to recycle uranium by-products from Cameco's Blind River refinery and its Port Hope conversion plant in the Key Lake mill is also the subject of an ongoing screening-level environmental assessment initiated in December 2002. Following the closure of the last uranium mill in Elliot Lake, Ontario, recyclable products from the Blind River and Port Hope facilities in Ontario have been processed at the White Mesa mill in Utah.

McClean Lake

The McClean Lake production centre, operated by AREVA, is a joint venture between AREVA (70%), Denison Mines Inc. (22.5%), and OURD (Canada) Co. Ltd., a subsidiary of Overseas Uranium Resources Development Corporation of Japan (7.5%). Production in 2004, 2005, and 2006 amounted to 2310 tU, 2111 tU, and 690 tU, respectively. The decrease in 2006 production is a result of the low-grade ore that is currently being milled. Modifications are being made to the mill to process ore from the Cigar Lake mine, which should result in increased production by 2011.

On May 19, 2005, the Canadian Nuclear Safety Commission (CNSC) renewed the facility's operating licence for four years with amendments that allow modification of the mill to receive and process ore from the Cigar Lake mine. Regulatory approval was also obtained to increase annual mill production from 3075 tU to 4600 tU, and to mine the Sue A and Sue E deposits in addition to the current Sue C ore. A \$60 million construction program began at the JEB mill to increase production and modify the facility to receive and process Cigar Lake ore. Open-pit mining began in July 2005 at Sue A and in late 2005 at Sue E. AREVA also received regulatory approval to test-mine small deposits on the McClean Lake property using surface mining techniques.

Rabbit Lake

The Rabbit Lake production centre, wholly owned and operated by Cameco, produced 2087 tU, 2316 tU, and 1972 tU in 2004, 2005, and 2006, respectively. The decline in 2006 production is the result of lower-than-expected ore grades. Over 144 km of underground exploratory drilling was completed in the Eagle Point underground mine in 2005 and 2006. This resulted in the delineation of additional assured resources, extending the life of the mine to 2011. Cameco has indicated that it intends to continue the drilling program in 2007.

The underground Eagle Point mine is, at present, the only operating mine at Rabbit Lake. Over 4 km of underground

development was completed in the Eagle Point underground mine in 2005 to access two new ore zones identified in the 2004 exploration program. It is expected that about half of the first phase of Cigar Lake ore will be partially processed at the Rabbit Lake mill, pending receipt of regulatory approvals. A proposal to produce and ship on a dedicated haul road a uranium-rich solution produced from Cigar Lake ore at McClean Lake for final processing at the Rabbit Lake mill is currently the subject of an environmental assessment.

Reclamation of the mined-out Collins Bay A and D zones began in 2005. Vegetation will be planted on the re-established shoreline to restore the natural appearance and habitat.

Cluff Lake

Mining and milling were terminated at Cluff Lake in May 2002 and a two-year decommissioning program was initiated in 2004 following a five-year comprehensive study environmental assessment. Work at the closed Cluff Lake uranium mining facility proceeded essentially as planned in 2005, although unusually wet conditions caused AREVA to postpone some earth-moving and seeding until 2006. The mill demolition was essentially completed in 2005 and the debris was buried in the Claude open pit. Backfilling of the Claude pit was completed with a layer of till that was planted with trees. The Claude waste rock pile was re-sloped and covered with 1 m of till, and the liquids pond backfilling and perimeter grading of the tailings management area were nearly completed. Pumping water to fill the DJX open pit was completed in 2006. The water treatment plant has been shut down and the site has entered a monitoring phase.

Cigar Lake

Cigar Lake, with about 89 000 tU at an average grade of approximately 18% U, is the world's second-largest high-grade uranium deposit. The mine is a Cameco (50.025%), AREVA (37.1%), Idemitsu Uranium Exploration Canada Ltd. (7.875%), and TEPCO Resources Ltd. (5%) joint venture operated by Cameco. When completed, the mine is expected to have a full annual production capacity of 6900 tU. It is expected that about half of the first phase of Cigar Lake ore will be partially processed at the Rabbit Lake mill, pending receipt of regulatory approvals. A proposal to produce and ship a uranium-rich solution produced from Cigar Lake ore at McClean Lake for final processing at the Rabbit Lake mill is currently the subject of an environmental assessment.

Construction of the Cigar Lake mine began on January 1, 2005, and completion was expected by 2007. However, in October 2006, a rock fall resulted in a major inflow of groundwater into the mine that could not be controlled and the mine became flooded. Cameco has begun the first phase of the remediation plan, which involves drilling holes down to the inflow and pumping concrete and grout

to seal off the breach. Subsequent phases include dewatering the mine, ground freezing in the area of the inflow, restoring underground areas, and resumption of mine development. Uranium production is anticipated to commence in 2011.

Midwest

On December 28, 2005, the Midwest project description was submitted to federal and provincial regulatory agencies and, on March 2, 2006, the environmental assessment began. The Midwest project is a joint venture between AREVA (69.16%), Denison Mines Ltd. (25.17%), and OURD (Canada) Co. Ltd. (5.67%), a subsidiary of Overseas Uranium Resources Development Corp. (OURD) of Japan. AREVA is the operator. It is proposed that the Midwest deposit (16 000 tU averaging 4.6% U) will be mined by open pit and the ore will be hauled about 15 km on a dedicated road to McClean Lake for milling (where a further expansion of the JEB mill would be required). Pending receipt of regulatory approvals, stripping of the deposit could begin in 2010. It is expected that it will take more than a year to strip the deposit and a further two years to mine it. Milling of the Midwest ore could take from five to seven years depending on the optimal milling rate determined by the owners and approved by regulators.

Additional Production Possibilities

Beyond the existing and committed centres of uranium production mentioned above, there are a number of projects that may be developed in the future. Table 4 updates, as of June 30, 2006, recent developments at the mining projects that could contribute to Canada's future uranium production capability.

Other Developments Affecting Canada's Uranium Industry

The two nuclear operators in Ontario, Ontario Power Generation Inc. (OPG) and Bruce Power Inc., are pursuing options to increase capacity. Of the eight units that had been laid up at Bruce and Pickering, three units were brought back to service in 2004, and Pickering A, Unit 1 was returned to service in November 2005 adding a total of 2530 MW of generating capacity to Ontario's grid.

OPG announced in August 2005 that it had decided not to proceed with the refurbishment of Pickering A, Units 2 and 3. The physical condition of Units 2 and 3 did not make them as good candidates for refurbishment as Units 1 and 4. OPG also noted that studying the case to extend the life of the Pickering B and ultimately the Darlington reactors were key elements of its future plans.

Meanwhile, in October 2005, Bruce Power and the Ontario Power Authority (OPA) announced that they had entered into an agreement to refurbish Bruce A, Units 1 and 2. Atomic Energy of Canada Limited (AECL) has been awarded the re-tubing contract by Bruce Power as part of

the refurbishment of the Bruce A units. As well, Bruce Power will extend the operating life of Unit 3 by replacing the steam generators and fuel channels when required. It will also replace the steam generators in Unit 4. The capital program for the refurbishment and restart of these units is expected to cost \$5.25 billion.

In December 2005, the OPA tabled with the government its report on key findings and recommendations in setting Ontario's future electricity supply mix. The report recommended substantial new nuclear power capacity for Ontario and refurbishment of existing CANDU nuclear power stations, aiming to keep the nuclear share of electricity generation at about 50%. The report highlighted a critical need to increase base load supply and identified a need for between 9400 and 12 400 MW of nuclear power to be added by 2025 in Ontario.

On June 13, 2006, the Government of Ontario announced an energy policy that included the building of new nuclear power stations and the refurbishing of existing nuclear power stations. In response to this policy, OPG has filed a site preparation licence application with the CNSC for a new nuclear facility with up to four reactors at Darlington. Similarly, Bruce Power has also begun a federal approvals process for the possible refurbishment or replacement of units at the Bruce site, also with up to four new reactors.

In July 2005, New Brunswick Power signed a contract with AECL for the refurbishment of its Point Lepreau nuclear power plant. The refurbishment is expected to take place in 2008-09 with an estimated cost for the project, including replacement electricity, of \$1.4 billion.

Hydro-Québec is currently considering the refurbishment of its nuclear power plant (Gentilly 2). A decision on refurbishment is expected in 2008. If approved, the refurbishment of Gentilly 2 is expected to take place in 2011-12. In December 2006, the CNSC renewed the operating licence of the Gentilly 2 station until December 31, 2010.

EXPLORATION

Uranium exploration activity remains concentrated in areas favourable for the occurrence of deposits associated with Proterozoic unconformities, notably in the Athabasca Basin of Saskatchewan and the Thelon Basin of the Northwest Territories and Nunavut. In 2005, overall uranium exploration expenditures amounted to \$99 million, compared to \$44 million reported in 2004. Uranium exploration and surface development drilling in 2005 totaled 274 600 m, up significantly from the 119 000 m reported in 2004 and the 74 000 m reported in 2003.

Continuing uranium spot price increases since 2005 have sustained the surge in exploration activity across Canada, principally in the Athabasca Basin, Nunavut, and the Northwest Territories, but also in Quebec, Newfoundland and Labrador, Ontario, Manitoba, Alberta, and the

Yukon. The strong market has also stimulated interest in re-examining deposits discovered in the late 1970s in British Columbia.

In 2004 and 2005, slightly less than one third of the overall exploration expenditures can be attributed to advanced underground exploration, deposit appraisal activities, and care-and-maintenance expenditures associated with those Saskatchewan projects awaiting production approvals. The Saskatchewan government estimates that "grassroots" uranium exploration in the province in 2005 amounted to \$74.6 million, a significant increase from the \$31.2 million spent in 2004 and the \$13 million spent in 2003. Table 5 summarizes uranium exploration activity in Canada from 1990 to 2005.

In recent years, due to rising uranium prices, the number of companies with major exploration programs in Canada has increased dramatically. Although major companies, such as Cameco and AREVA, account for the majority of exploration expenditures, more than 200 junior exploration companies are now active in uranium exploration.

RESOURCES

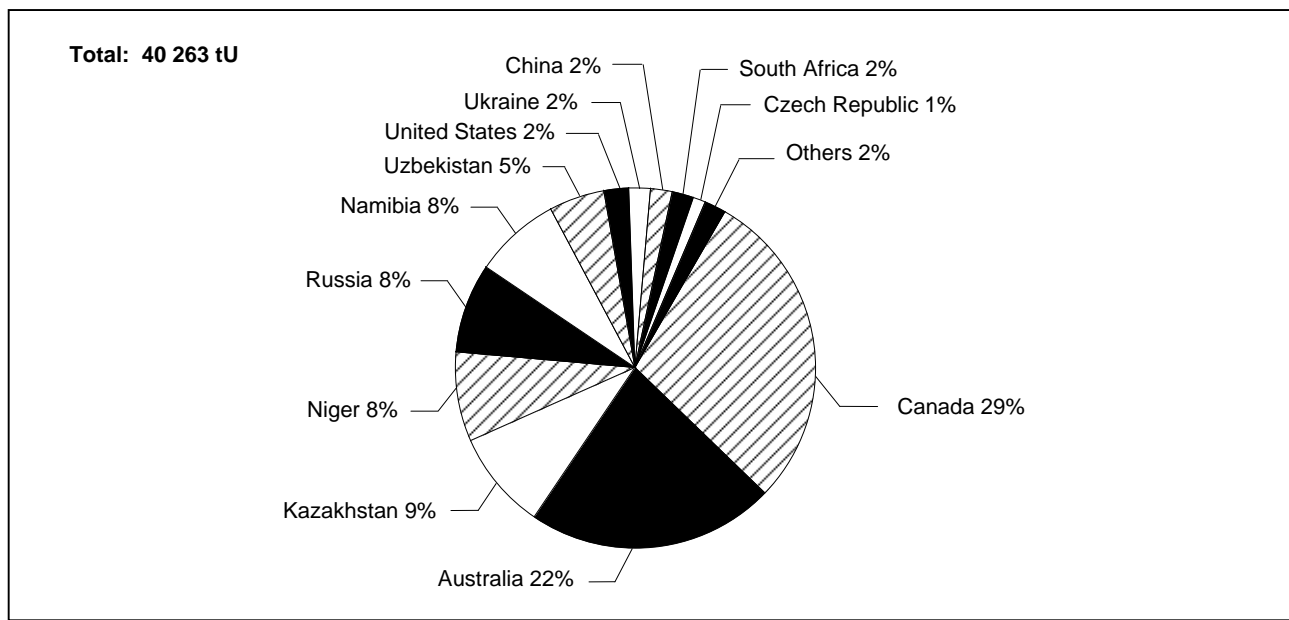
Natural Resources Canada's (NRCAN) annual assessment of domestic uranium supply capability provides a compilation of Canada's "known" uranium resources, based on the results of an evaluation of company data. Uranium supply from Canada in the next decade will come from known resources, estimates of which are divided into three major categories (measured, indicated, and inferred) that reflect different levels of confidence in the reported quantities. Most of these resources are associated with deposits identified in Figure 2.

Recent NRCAN assessments of Canada's uranium resources have been restricted to those recoverable from mineable ore at prices of \$100/kgU or less. Table 6 shows the breakdown of the latest resource estimates compared with those of the previous two years. As of January 1, 2006, total recoverable known uranium resources were estimated at 431 000 tU, compared with 444 000 tU as of January 1, 2005, and 432 000 tU as of January 1, 2004. This downward adjustment is the result of mining depletion and resource re-assessment.

SUPPLY CAPABILITY

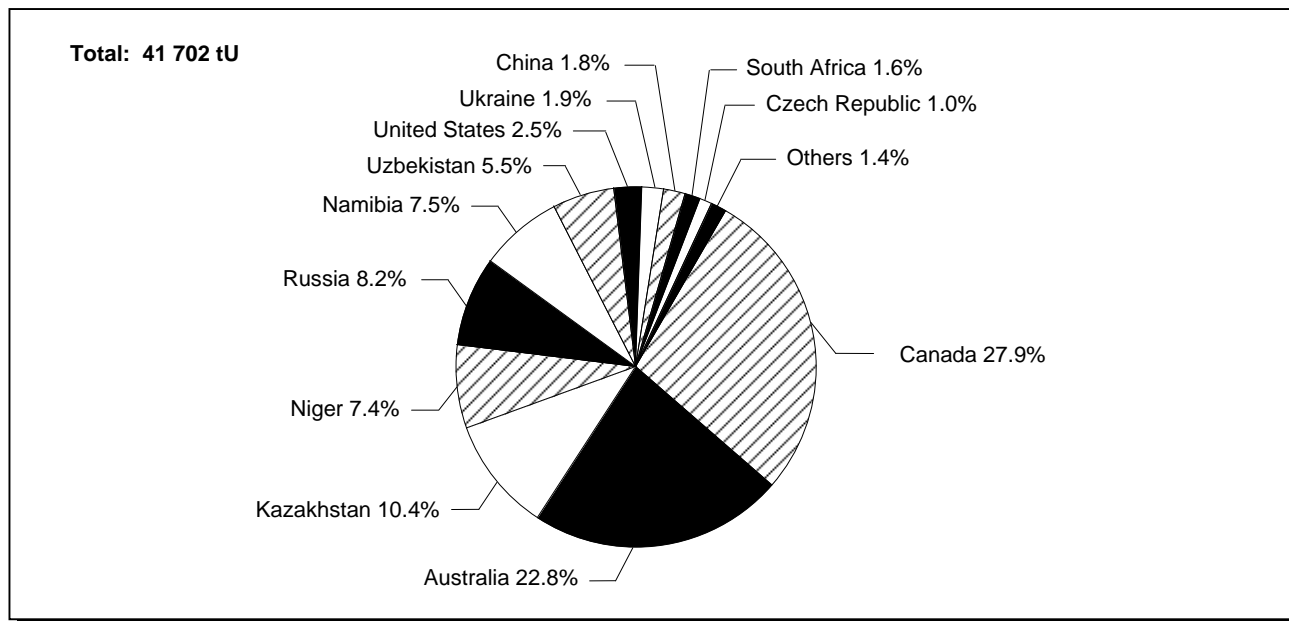
Canada's uranium supply capability declined as production at Cluff Lake ended in 2002. Supply capability will increase with the opening of new mines, notably Cigar Lake and Midwest, and with approval of the proposal to expand McArthur River production by almost 20%. Timely licensing approvals and continued positive market conditions will be required to allow Canada's production capability to expand to its full potential of over 15 000 tU annually.

Figure 4a
World Uranium Production, 2004



Source: Uranium and Radioactive Waste Division, Natural Resources Canada.

Figure 4b
World Uranium Production, 2005



Source: Uranium and Radioactive Waste Division, Natural Resources Canada.

Developments in the international uranium market, the rate at which projects receive environmental approvals, and uncertainty regarding the costs associated with the development of the planned new projects preclude projecting future production capability levels with much certainty. Table 7 ranks Canada first among the world's major producers, showing actual uranium production from 1999 through 2005. Figures 4a and 4b illustrate Canada's share of world output in 2004 and 2005, respectively, compared with other major producing countries.

GOVERNMENT INITIATIVES

In September 2006, the Government of Canada and the Government of Saskatchewan signed a Memorandum of Agreement to fund the clean-up of closed uranium mine and mill sites in northern Saskatchewan (principally Gunnar and Lorado). These facilities were operated from the 1950s until the early 1960s by private-sector companies that no longer exist. When the sites were closed, there was no regulatory framework in place to appropriately contain and treat the waste, which has led to environmental impacts on local soils and lakes. The total cost, which the governments of Canada and Saskatchewan will share, will be \$24.6 million.

URANIUM MARKET

Overview

The tightening of the uranium supply continued to push uranium spot market prices higher in 2005 and 2006. Although world production increased from 40 260 tU in 2004 to 41 700 tU in 2005, production in 2006 declined to 39 430 tU. This decline was chiefly due to low production at McClean Lake and flooding at the Ranger mine in Australia.

The uranium supply is expected to continue to be tight in the short term as production from the Cigar Lake mine, which was to start in 2007 and provide a significant portion of world uranium production, has been delayed until 2011 due to flooding of the mine in October 2006. However, production in other major uranium-producing countries is expected to increase significantly over the next few years. In Australia, a major change in government policy supports the development of additional uranium mines. This, along with the planned tripling of output for the Olympic Dam mine and the extension of the operating life of the Ranger mine, will lead to a significant increase in Australian uranium production. Kazakhstan continued to increase production, rising 42% from 3719 tU in 2004 to 5279 tU in 2006. Kazakhstan is expected to increase production by a further 25% in 2007 and is likely to surpass Canada as the world's largest uranium producer by the end of the decade. In Namibia, the operating life of the Rossing mine has been

extended to 2021 with a planned increase in annual production to 3800 tU.

The continued high level of exploration activity is expected to lead to a number of new discoveries in Canada and elsewhere over the next few years. The long planning and development cycle for both new mines and new nuclear power plants may provide sufficient time for production to catch up with current levels of demand for uranium.

Another factor that has led to the increase in uranium spot prices since 2004 is the increased participation of investment funds, which hold uranium for speculative reasons. The volume of uranium traded in the spot market is relatively small and these funds have been able to profit from the rising spot price caused by the imbalance between production and demand.

Uranium Prices

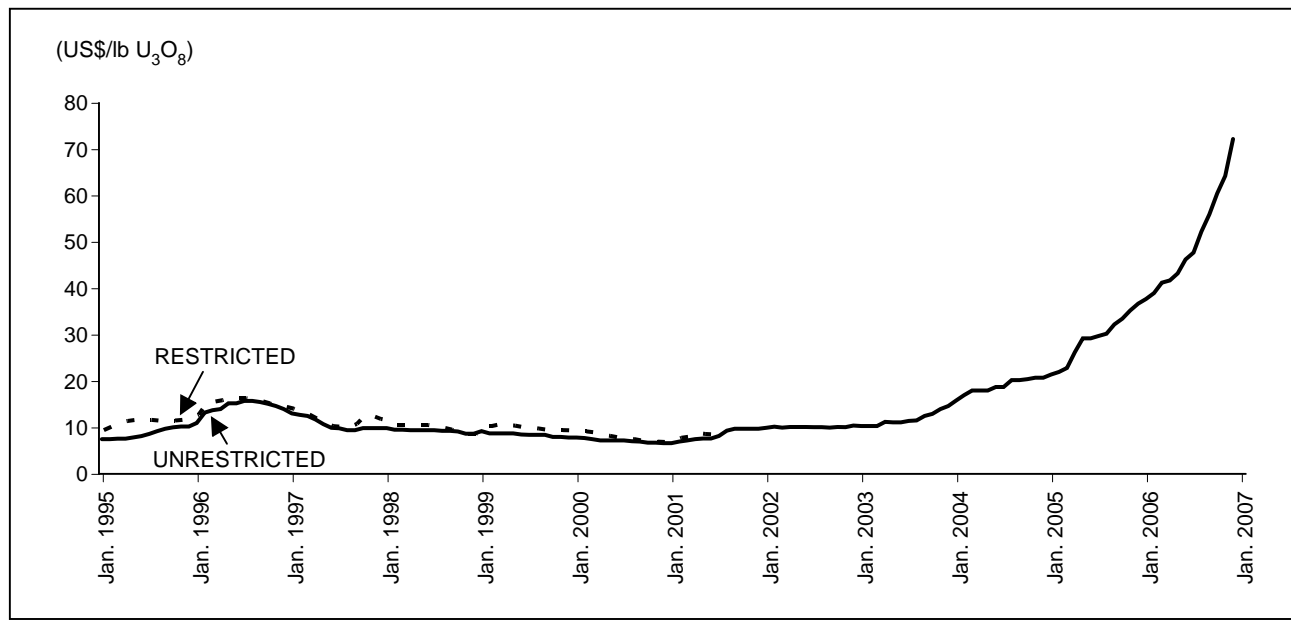
The uranium spot market price, as reported by Ux,² rose through 2005 and 2006 from its opening value in 2005 of US\$20.70/lb U₃O₈ (a standard measure of uranium metal content) to US\$72.00/lb U₃O₈ at the end of 2006 (Figure 5). This 250% increase reflected the continuing shortage of uranium available to the spot market, as well as the realization that it would take several years to develop new sources of supply sufficient to close the gap between consumption and production. Uranium spot market prices increased dramatically during the first half of 2007, peaking at US\$136.00/lb U₃O₈ in June 2007. The bulk of uranium is traded through long-term fixed-price contracts between the suppliers and utilities. During 2005 and 2006, the increase in the average long-term price for U₃O₈ kept pace with increases in the spot price, reaching US\$75/lb U₃O₈ at the end of 2006. A more gradual increase was observed in the long-term U₃O₈ price during the first half of 2007, leveling off at US\$95.00/lb U₃O₈ by May 2007.

REFINING AND CONVERSION

Cameco operates Canada's only uranium refining and conversion facilities, located at Blind River and Port Hope, Ontario, respectively. At the Blind River refinery, the world's largest, uranium mine concentrates from Canada and abroad are refined to uranium trioxide (UO₃), an intermediate product. The UO₃ is then trucked to the Port Hope facility, which has about one-quarter of the Western World's annual uranium hexafluoride (UF₆) conversion capacity and currently provides the only commercial

² The Ux Consulting Company, LLC (UxC) was founded in March 1994 as an affiliate of The Uranium Exchange Company (Ux). UxC publishes *The Ux Weekly* and the *UxC Market Outlook Reports* on uranium, enrichment, and conversion. UxC also prepares special reports on key topics of interest.

Figure 5
Trend in Uranium Spot Prices, 1995-2006



Source: TradeTech.

supply of fuel-grade natural uranium dioxide (UO₂). UF₆ is enriched outside Canada for use in foreign light-water reactors, while natural UO₂ is used to fabricate fuel bundles for CANDU reactors in Canada and abroad. About 80% of the UO₃ from Blind River is converted to UF₆, while the remaining 20% is converted to UO₂. Table 8 tabulates Canada's production of refined and converted uranium, and notes the associated work force, from 2001 to 2005, inclusive.

OUTLOOK

Continued increases in uranium prices, along with the prospect of a worldwide increase in the use of nuclear power, was good news for uranium producers in Canada. Dwindling inventories and the prospects of increased demand indicate that significant quantities of Canadian uranium will need to be produced to meet global demand well into the foreseeable future. With a large, low-cost uranium resource base and current output, Canada is well positioned to maintain leadership in uranium production for more than the next three decades. Given the high potential for economically attractive uranium occurrences in Canada, the recent marked increase in uranium exploration in many regions of the country will likely result in additions to the resource base. However, although there are significant quantities of uranium in the ground, bringing this material to the market is a challenging task that requires expertise,

time, and capital. Continued success in bringing environmentally sustainable Canadian uranium mining operations on stream in a timely fashion will ensure that Canada remains a leading uranium producer well into the future.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to chapter 65. (2) Information in this review was current as of June 30, 2007. (3) This paper on uranium and other information on developments in Canadian nuclear policy can be accessed on the Internet at <http://nuclear.nrcan.gc.ca>. (4) This and other reviews, including previous editions, are also available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TABLE 1. URANIUM PRODUCTION AND ASSOCIATED WORK FORCE IN CANADA, 2002-05

Production Centre and Producer	Company Work Force (1) (Dec. 31)				Annual Output (2) (tU)			
	2002	2003	2004	2005	2002	2003	2004	2005
ATHABASCA BASIN, SASKATCHEWAN								
Cluff Lake (AREVA, 100%)	56	22	—	—	1 626	27	—	—
Key Lake JV (Cameco operator)	281	291	300	307	117	79	165	237
Rabbit Lake JV (Cameco, 100%)	186	187	197	197	440	2 280	2 087	2 316
McClellan Lake JV (AREVA operator)	172	181	185	252	2 342	2 318	2 310	2 111
McArthur River JV (Cameco operator)	260	264	303	309	7 082	5 751	7 035	6 963
Cigar Lake JV (pre-production)	19	220	36	68	—	—	—	—
Total	974	965	1 021	1 133	11 607	10 455	11 597	11 628

Sources: Natural Resources Canada; Company annual reports.

— Nil.

(1) Figures are for company payroll employees only; on-site contractors (mining, construction, services, etc.) are not included. (2) Primary output only. With the closure of Rio Algom Limited's Stanleigh operation at Elliot Lake in mid-1996, by-products from Cameco's refinery/conversion facilities are no longer processed in Canada.

TABLE 2. VALUE (1) OF URANIUM SHIPMENTS (2) BY PRODUCERS IN CANADA, 2000-2005

	Unit	2000	2001	2002	2003	2004	2005 (p)
Total producer shipments	tU	9 921	12 991	12 855	9 939	11 548	12 597
Total value of shipments	\$ millions	485	600	615	485	520	620

Source: Natural Resources Canada.

(p) Preliminary.

(1) Value of shipments is estimated from an average market price. (2) Shipments in tonnes of uranium (tU), contained in concentrate, from ore-processing plants.

TABLE 3a. OPERATIONAL CHARACTERISTICS OF EXISTING CANADIAN URANIUM PRODUCTION CENTRES, 2004

Operating Entity (Operator)/Location	Ore-Processing Plant (1)			
	Capacity	Recovery	Annual Throughput	
	Nameplate	Overall	Total Ore	Ore Grade
	(t/d)	(%)	(t)	(%)
McClean Lake JV (AREVA)/ at McClean Lake, Saskatchewan	300	98	152 092	1.58
Rabbit Lake (Cameco Corporation)/ at Rabbit Lake, Saskatchewan	2 400	97	246 164	0.88
Key Lake JV (Cameco Corporation)/ at Key Lake, Saskatchewan (2)	750	99	222 622	3.3

Sources: Corporate annual reports; Canadian Nuclear Safety Commission open files.

(1) Figures are rounded. (2) All McArthur River ore is processed at the Key Lake mill.

TABLE 3b. OPERATIONAL CHARACTERISTICS OF EXISTING CANADIAN URANIUM PRODUCTION CENTRES, 2005

Operating Entity (Operator)/Location	Ore-Processing Plant (1)			
	Capacity	Recovery	Annual Throughput	
	Nameplate	Overall	Total Ore	Ore Grade
	(t/d)	(%)	(t)	(%)
McClean Lake JV (AREVA)/ at McClean Lake, Saskatchewan	300	97	176 670	1.23
Rabbit Lake (Cameco Corporation)/ at Rabbit Lake, Saskatchewan	2 400	97	311 918	0.75
Key Lake JV (Cameco Corporation)/ at Key Lake, Saskatchewan (2)	750	99	212 285	3.39

Sources: Corporate annual reports; Canadian Nuclear Safety Commission open files.

(1) Figures are rounded. (2) All McArthur River ore is processed at the Key Lake mill.

TABLE 4. CANADIAN URANIUM MINING PROJECTS PLANNED FOR PRODUCTION AS OF JUNE 30, 2006

Project, Province or Territory/Operator	Owners' Share	Deposit Type/ Discoverer and Discovery Date	Resources (Company Estimates as of January 1, 2004)	Ore Grade and Notes on Deposits	Mining Method, Milling Rate and Capacity	Project Particulars and Status	Location of Project/ Notes of Interest
(%)							
Cigar Lake, Sask./ Cameco Corporation	Cameco (50.025), AREVA (37.100), Idemitsu (7.875), TEPCO (5)	Unconformity-related/ AREVA, 1981	Overall property 89 000 tU <i>mineable</i>	Overall property grade of 17% U; grades vary from 5% to 70% U; orebody at depth of 450 m	"Non-entry" underground; "jet-boring" mining method; milling at McClean Lake and Rabbit Lake; contributing 6900 tU/y at full production	\$555 million project; test mining completed in 1992; EIS submitted in October 1995; Joint Panel reports November 1997; government response April 1998; final phase of construction initiated January 2005, mine flooded October 2006	670 km N of Saskatoon; 500-m-deep shaft sunk; brine freezing of ground is required to mine the ore; flooding of mine has delayed production until 2011
Midwest, Sask./AREVA Resources Canada Inc.	AREVA (69.1), Denison Mines (25.2), OURD (5.7)	Unconformity-related/ Esso Minerals Canada, 1977 (interests of Bow Valley, Numac Oil & Gas, <i>et al</i> bought by partners)	Overall property 16 000 tU <i>mineable</i>	Overall property grade of 4.6% U; grades vary from 2% to 30% U; orebody at depth of 200 m	Open-pit; milling at McClean Lake; contributing 2300 tU/y	\$80 million co-venture with McClean; in 1993, Joint Panel rejects proposal; new EIS in 1995; final hearings August 1997; Joint Panel report November 1997; government response April 1998, project description submitted December 2005, EA began December 2006	710 km N of Saskatoon; 185-m-deep test-mine shaft; pending regulatory approval, stripping to begin 2010, mining to begin in 2011
Kiggavik, Nunavut/ AREVA	AREVA (99), Daewoo Corporation (1)	Unconformity-related/ Urangesellschaft, 1977	Overall property 15 000 tU <i>mineable</i> ; (more incl. Andrew Lake <i>et al</i>)	0.41% U average overall; Centre pit depth 100 m, Main pit 200 m	Open-pit mining methods; mill feed at 1200 t/d; output rate of 1200 tU/y originally expected	EIS submitted but project deemed deficient by Panel; new EIS required before project start-up	75 km W of Baker Lake; AREVA to conduct feasibility study >11-year mine life with tributary ore included

Notes: Idemitsu Uranium Exploration Canada Ltd. is a wholly owned subsidiary of Idemitsu Kosan Co., Ltd. of Japan. TEPCO Resources Inc. is a subsidiary of Tokyo Electric Power Co., Inc. (TEPCO), Japan's largest nuclear power utility. Denison Mines Inc. is a wholly owned subsidiary of Denison Mines Corp. OURD (Canada) Co., Ltd. is a subsidiary of the Overseas Uranium Resources Development Corporation (OURD) of Japan. AREVA Resources Canada Inc. is a subsidiary of AREVA-NC Inc., which is wholly owned by the AREVA Group of France.

TABLE 5. URANIUM EXPLORATION ACTIVITY IN CANADA, 1990-2005

Year	Expenditures (1)	Drilling (2)	Million-Dollar Projects (3)
	(\$ millions)	(km)	(no.)
1990	45	66	6
1991	44	67	4
1992	46	79	4
1993	40	62	5
1994	36	67	8
1995	44	75	10
1996	39	79	8
1997	58	104	6
1998	60	95	6
1999	49	89	3
2000	46	77	3
2001	25	48	3
2002	35	78	7
2003	36	74	6
2004	44	119	8
2005	99	275	22

Source: Natural Resources Canada.

(1) Direct exploration and drilling expenditures in current dollars; from the late 1980s, includes advanced underground exploration and deposit appraisal expenditures; from the mid-1990s, may also include care-and-maintenance costs associated with deposits awaiting production approvals. (2) Exploration and surface development drilling; excludes development drilling on producing properties. (3) Number of projects where direct exploration and drilling expenditures exceeded \$1 million in current dollars.

**TABLE 6. ESTIMATES OF CANADA'S URANIUM RESOURCES RECOVERABLE FROM MINEABLE ORE, (1)
JANUARY 1, 2004, JANUARY 1, 2005, AND JANUARY 1, 2006**

Price Ranges Within Which Mineable Ore is Assessed (2)	Measured			Indicated			Inferred		
	1/1/04	1/1/05	1/1/06	1/1/04	1/1/05	1/1/06	1/1/04	1/1/05	1/1/06
	(000 tU)								
Up to \$50/kgU	252	270	256	81	10	19	44	85	82
\$50 to \$100/kgU	—	—	—	37	65	62	18	14	12
Total	252	270	256	118	75	81	62	99	94

Source: Natural Resources Canada.

— Nil.

(1) Actual or expected losses in mining recovery and ore processing have been accounted for; these factors were individually applied to resources tributary to existing or prospective production centres. In underground operations, mineable ore is generally 75-85% of the ore-in-place; higher mining recoveries are achievable in open-pit operations. Canada's weighted average ore processing recovery for existing conventional operations exceeded 97% over the 2004-06 survey period. (2) The Canadian dollar figures reflect the price of a quantity of uranium concentrate containing 1 kg of elemental uranium. The prices were used in determining the cut-off grade at each deposit assessed, taking into account the mining method used and the processing losses expected. The price of \$100/kgU was used by Natural Resources Canada to illustrate those resources that were of economic interest to Canada during the survey period.

Note: \$1/lb U₃O₈ = \$2.6/kgU.

TABLE 7. PRODUCTION OF URANIUM IN CONCENTRATES BY SELECTED MAJOR PRODUCING COUNTRIES, 1999-2005

	1999	2000	2001	2002	2003	2004	2005
(tonnes U)							
Canada	8 210	10 680	12 520	11 610	10 450	11 600	11 630
Australia	5 980	7 580	7 580	6 850	7 570	8 980	9 520
China	500	500	700	730	730	730	750
France	440	310	180	20	10	10	10
Gabon	290	—	—	—	—	—	—
Kazakhstan	1 350	1 740	2 110	2 820	3 330	3 720	4 360
Namibia	2 690	2 710	2 240	2 330	2 040	3 040	3 150
Niger	2 920	2 900	2 920	3 080	3 160	3 260	3 090
Russia	2 000	2 000	3 000	2 850	3 070	3 200	3 430
South Africa	980	870	880	820	760	750	670
Uzbekistan	2 130	2 350	1 950	1 860	1 600	2 090	2 300
United States	1 810	1 460	1 010	900	700	880	1 040
Other (1)	1 770	1 860	1 710	2 170	2 000	2 000	1 750
Total (2)	31 070	34 960	36 800	36 040	35 490	40 260	41 700

Sources: *Uranium: Resources, Production and Demand*, a biennial report published jointly by the Nuclear Energy Agency of the OECD and the International Atomic Energy Agency, and miscellaneous corporate, national and international reports.

— Nil.

(1) Includes Argentina, Brazil, Bulgaria, the Czech Republic, Germany, Hungary, India, Pakistan, Portugal, Romania, Spain, and Ukraine. (2) Totals are of the listed figures only and represent global production.

Note: Country figures are rounded to the nearest 10 tU.

TABLE 8. URANIUM PROCESSING PRODUCTION AND ASSOCIATED WORK FORCE IN CANADA, 2001-2005

Process and Location (Nameplate Capacity)	Production					Site Work Force				
	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
(tonnes U)						(number)				
Refining at Blind River (18 000 tU as UO ₃)	x	x	x	x	x	98	98	98	98	125
Conversion at Port Hope (12 500 tU as UF ₆ and 2800 tU as UO ₂)	10 958	12 428	13 273	9 500	11 400	264	271	275	320	370

Source: Cameco Corporation.

x For commercial confidentiality reasons, Cameco no longer reports a production figure for Blind River.

Zinc

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Canada is an important producer and exporter of zinc and zinc products. Zinc metal production in Canada dates from the early 1900s when the Consolidated Mining and Smelting Company of Canada (which became Cominco Ltd. in 1966, followed by Teck Cominco Limited in 2001) started production at a small electrolytic zinc plant at Trail, British Columbia. Today, with a smelting capacity of 843 000 t/y from four smelting facilities located across the country, Canada produces roughly 7.7% of the world's total supply of refined zinc.

INTRODUCTION

Zinc is a relative newcomer to the group of metals discovered and used by society. While the first use of copper pre-dates recorded history and the discovery of tin goes back 5000 years, the first recovery of metallic zinc, however, came much later. The production of metallic zinc was first described in India around 1200 A.D. By 1374, zinc was recognized as a new metal, the eighth to be discovered at that time, and a limited amount of commercial zinc production was under way. Although brass-making had developed much earlier, the zinc in brass was obtained by treating zinc ore to produce zinc vapour, which combined with granulated copper under heat. From India, zinc production was introduced to China sometime around 1600 A.D. and then began to be exported to Europe.

The first full-scale zinc smelting operation outside of Asia started in Bristol, England, about 1743. By the beginning of the 19th century, zinc production was established on the continent of Europe, notably in Belgium and parts of Eastern Europe. In the latter half of the century, large zinc industries developed rapidly in the United States and Germany.

HISTORY OF ZINC MINING IN CANADA

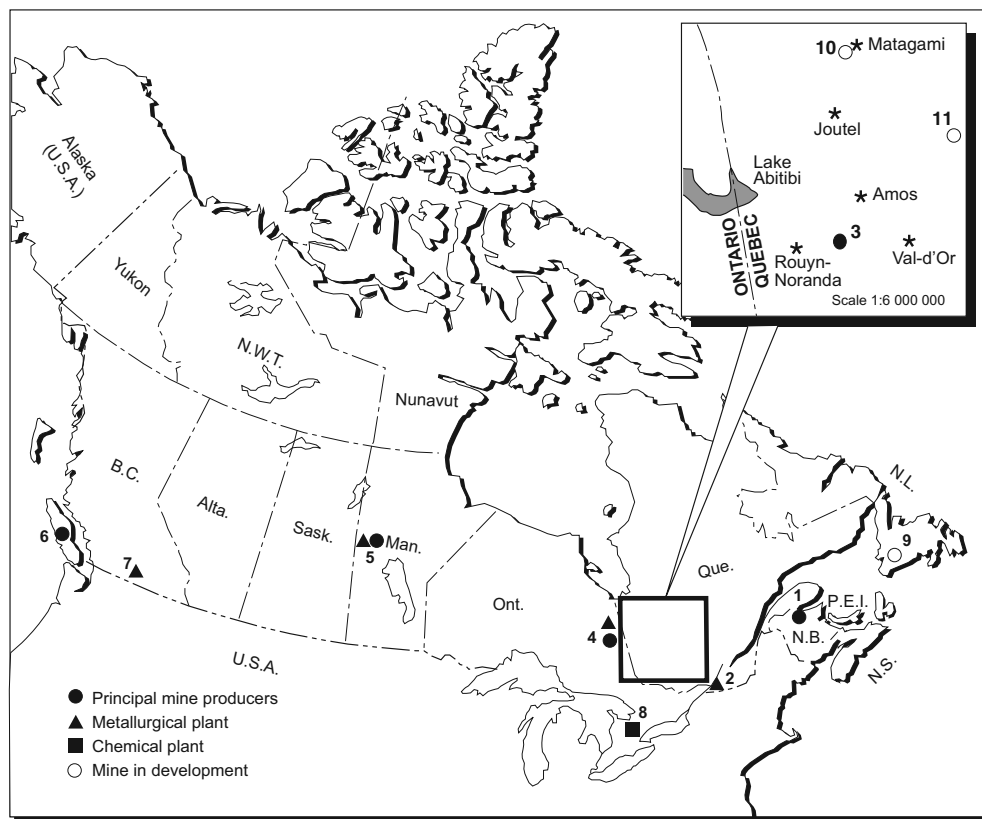
Zinc production in Canada dates back to the First World War when the Consolidated Mining and Smelting Company of Canada began operating a small electrolytic zinc plant at Trail, British Columbia, to help offset a critical wartime shortage of zinc in the United Kingdom. At that time, the Consolidated Mining and Smelting Company of Canada and the Anaconda Copper Mining Company in Montana were pioneering the production of zinc in North America by the electrolytic method.

The ores used at Trail came from the Sullivan mine near Kimberley, B.C., but production was hampered because the complex lead-zinc-iron ore was difficult to treat using existing methods. In 1920, however, the differential flotation method was successfully applied to separate the Sullivan ore into a lead concentrate, a zinc concentrate, and an iron by-product. This marked the beginning of significant zinc production in Canada. Today the Trail operations are the world's largest fully integrated lead and zinc smelting and refining complex. Owned and operated by Teck Cominco Limited of Vancouver, the Trail facility has a zinc production capacity of 295 000 t/y.

In Manitoba, the discovery of significant zinc and copper ore with important quantities of gold in 1915 led to the development of the Flin Flon-Snow Lake mining camp, smelter complex, and dedicated power plant in the late 1920s. Since 1930, Hudson Bay Mining and Smelting Co. Limited has owned and operated some 30 mines that have in turn fed the company's metallurgical complex at Flin Flon. The Flin Flon smelter and refinery complex has undergone significant capital improvements since it first commenced operations in 1930 with the introduction of zinc pressure leach technology in the early 1990s and a new tank house in 2000 that expanded zinc production capacity to 118 000 t/y.

The Kidd Creek orebody near Timmins, Ontario, was discovered in 1963 and Texasgulf Inc. began open-pit mining the deposit in 1966. The Kidd Creek zinc plant started production in 1972. In 1983, Kidd Creek started up a zinc pressure leaching facility plant. The mine and plant continued operation under Falconbridge Limited until 2006. Today, Xstrata Copper Canada owns and operates the Kidd Creek complex with a zinc production capacity of 150 000 t/y.

Figure 1
Zinc Producers in Canada, 2006



Numbers refer to locations on map above.

ZINC-PRODUCING MINES

- | | |
|---------------|----------------------------|
| 1. Brunswick | Xstrata Zinc Canada |
| 3. LaRonde | Agnico-Eagle Mines Limited |
| 4. Kidd Creek | Xstrata Copper Canada |
| 5. Trout Lake | HudBay Minerals Inc. |
| Chisel North | HudBay Minerals Inc. |
| 777 | HudBay Minerals Inc. |
| 6. Myra Falls | Breakwater Resources Ltd. |

WEB SITE

www.xstrata.com
www.agnico-eagle.com
www.xstrata.com
www.hudbayminerals.com
www.hudbayminerals.com
www.hudbayminerals.com
www.breakwater.ca

ZINC METALLURGICAL PLANTS

- | | |
|----------------|------------------------------------|
| 2. Valleyfield | Canadian Electrolytic Zinc Limited |
| 4. Kidd Creek | Xstrata Copper Canada |
| 5. Flin Flon | HudBay Minerals Inc. |
| 7. Trail | Teck Cominco Limited |

www.norandaincomefund.com
www.xstrata.com
www.hudbayminerals.com
www.teckcominco.com

ZINC OXIDE PLANTS

- | | |
|-----------|----------------------|
| 8. Zochem | HudBay Minerals Inc. |
|-----------|----------------------|

www.zochem.com

MINES IN DEVELOPMENT

- | | |
|------------------|---------------------------|
| 9. Duck Pond | Aur Resources Inc. |
| 10. Perseverance | Xstrata Zinc Canada |
| 11. Langlois | Breakwater Resources Ltd. |

www.aurresources.com
www.xstrata.com
www.breakwater.ca

With the discovery of significant zinc-bearing ores in the Matagami region of northern Quebec in the late 1950s and early 1960s, Noranda Inc. began looking at options to build an electrolytic zinc plant. Construction began at Valleyfield, Quebec, west of Montréal, in 1962 and Canadian Electrolytic Zinc (CEZ) was brought into production in 1963. Xstrata Zinc Canada has a 25% interest in the CEZ refinery held through the Noranda Income Fund. Plant capacity has increased steadily from its original 64 000 t/y at the time of opening to 280 000 t/y today.

CANADIAN OPERATIONS

In 2006, Canadian mines produced 633 500 t of zinc in concentrate, compared to 666 664 t in 2005, a 5% decrease (Table 1). Refined metal production for 2006 was 824 465 t, compared to 724 035 t for 2005, an increase of 13.8%. Table 4 shows zinc production and exports for the period 1988-2006.

Zinc is produced at seven mines located in five provinces (Figure 1). The trend in total Canadian zinc mine production for the period 1996-2006 is shown in Figure 2. Zinc metal is produced from domestic and foreign concentrates at four metallurgical sites in Quebec, Ontario, Manitoba, and British Columbia (Table 8). Refined zinc metal production for the period 1996-2006 is shown in Figure 3. Zinc oxide is produced at one plant located in Brampton, Ontario. Statistics on exports and imports of zinc concentrates, metal, and semi-fabricated products are provided in Table 2.

The following is a summary of Canadian zinc mines in production during 2006.

New Brunswick

Xstrata Zinc Canada owns the Brunswick zinc and lead mine. The mine is located about 21 km southwest of Bathurst, New Brunswick. In 2006, the mine produced 3.6 Mt of ore, resulting in the production of 271 800 t of zinc in concentrate (Xstrata 2006 annual report). At the end of 2006, the mine contained proven reserves of 11.3 Mt grading 8.6% Zn and 3.5% Pb and measured resources of 14.6 Mt at 9.5% Zn and 3.8% Pb (Xstrata Report, *Ore Reserves and Mineral Resources*, 2007).

Quebec

Zinc is produced at the LaRonde mine, owned by Agnico-Eagle Mines Ltd. The mine is situated about 60 km west of Val-d'Or, Quebec. It is a gold-silver-copper-zinc orebody

comprising massive to disseminated sulphide lenses within a regional shear zone. In 2006, the mine produced 82 182 t of zinc in concentrate from 2.673 Mt of ore (Agnico-Eagle 2006 annual report) with a zinc head grade of 4.13%. Zinc recoveries averaged 88% and the zinc concentrate grades 54% Zn. The mine contains proven ore reserves of 5.78 Mt grading 4.06% Zn and probable reserves of 10.0 Mt at 3.38% Zn (Agnico-Eagle 2007 Q1 Report).

Ontario

Xstrata Copper Canada operates the Kidd Creek mine, located about 25 km north of Timmins, Ontario, as well as the metallurgical site situated 22 km east of Timmins. The orebody was discovered in 1963 and open-pit mining commenced in 1966. Mining was later converted to underground. In 2006, the zinc plant produced 141 638 t of refined zinc (Xstrata Interim Report, 2007). The Kidd Creek mine, excluding Mine D, contains proven reserves of 19.6 Mt at 2.0% Cu and 5.29% Zn and measured resources of 21.3 Mt grading 2.24% Cu and 5.73% Zn (Xstrata Report, *Ore Reserves and Mineral Resources*, 2007).

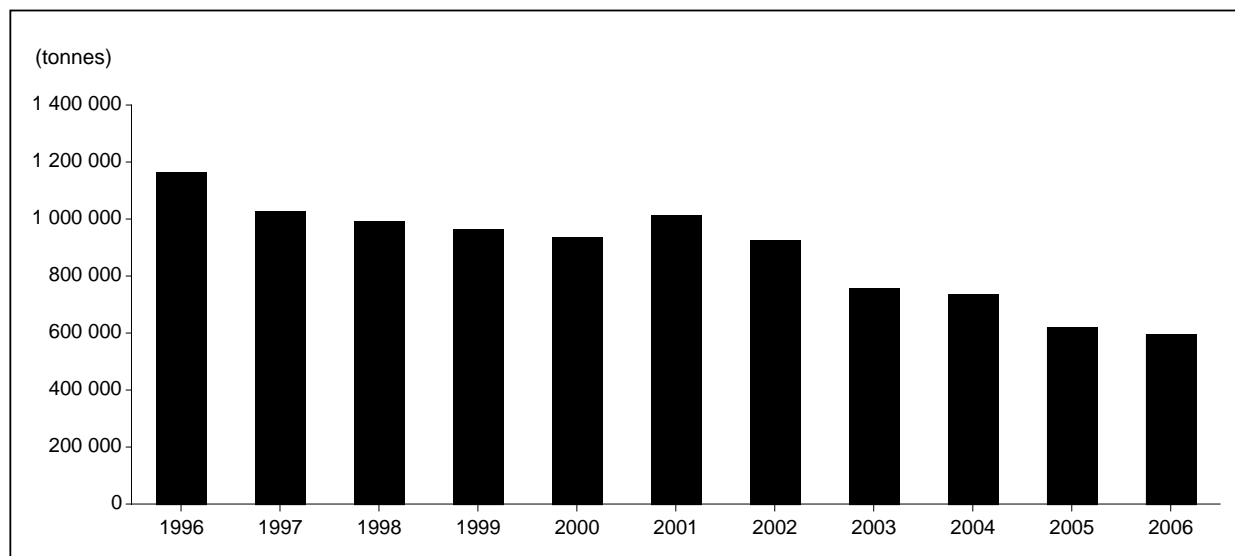
Manitoba

Hudbay Minerals Inc. operates two mines and a smelter complex in Flin Flon, Manitoba, situated about 630 km northwest of Winnipeg. It also owns the Chisel North mine, located in Snow Lake, Manitoba, 120 km east of Flin Flon. In addition, the company operates the Balmat mine in upstate New York, which re-opened in 2006. The two mines in Flin Flon are the 777 and Trout Lake mines. The Flin Flon concentrator produced 161 554 t of zinc in concentrate from ore mined at 777 and Trout Lake. The Snow Lake concentrator produced 53 000 t of zinc from ore mined at the Chisel North mine. The zinc metallurgical plant produced 117 966 t of refined zinc from 231 166 t of concentrate in 2006. The 777 mine contains proven and probable reserves of 16.85 Mt grading 4.5% Zn. The Trout Lake mine contains proven and probable reserves of 2.2 Mt grading 4.4% Zn. The Chisel North mine has proven reserves of 1.66 Mt grading 8% Zn (HudBay 2006 Annual Report).

British Columbia

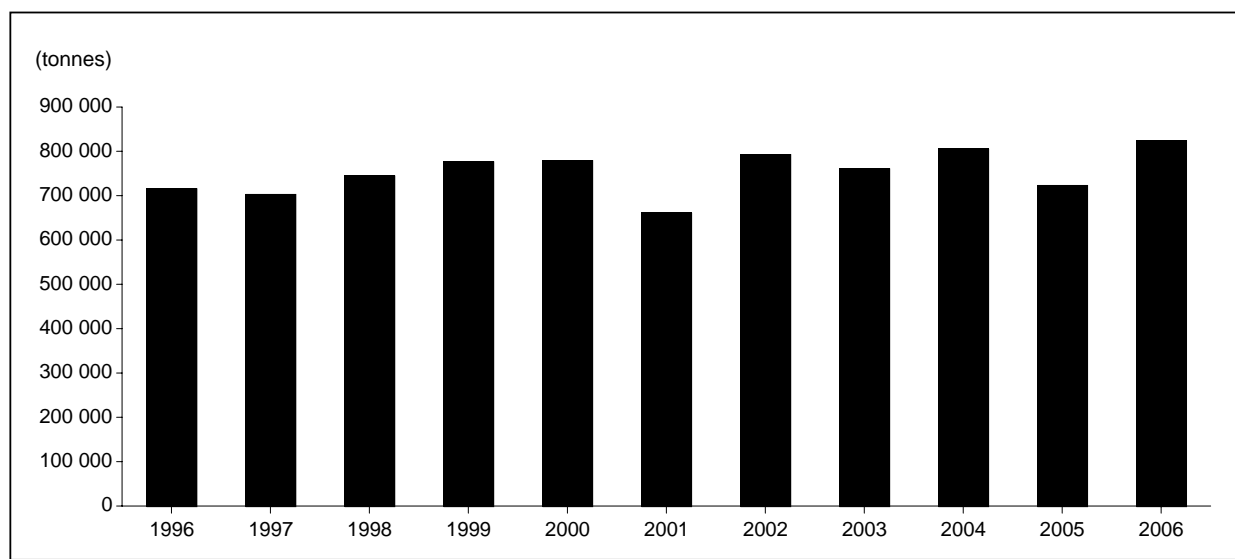
The Myra Falls zinc mine is owned and operated by Breakwater Resources Ltd. The mine is located within Strathcona Provincial Park on Vancouver Island, about 65 km southwest of Campbell River, B.C. Zinc production was 33 700 t in concentrate in 2006. The mine has proven and probable reserves of 6.134 Mt grading 5.7% Zn, plus measured and indicated resources of 7.2 Mt at 7.2% Zn (Breakwater Resources Ltd. 2006 Annual Report).

Figure 2
Canadian Mine Production of Zinc, 1996-2006



Source: Natural Resources Canada.

Figure 3
Canadian Refined Zinc Metal Production, 1996-2006



Source: Natural Resources Canada.

RECENT DEVELOPMENTS

Agnico-Eagle Mines Limited announced plans to develop the LaRonde II project, the deep extension of the Zone 20 North deposit at its gold mine west of Val-d'Or, Quebec.

This deposit is a gold-silver-copper-zinc deposit that is reported to contain 155 000 t of zinc.

Aur Resources Inc. continued to develop its Duck Pond property, located 90 km south of Buchans in Newfoundland and Labrador, in preparation for commercial production in

2007. The mine is expected to produce 25 000 t/y of zinc over an expected mine life of seven years. The deposit contains proven and probable reserves of 4.1 Mt grading 3.29% Cu and 5.68% Zn. It also has estimated measured and indicated resources of 3.54 Mt at 4.03% Cu and 7.05% Zn (Aur 2006 Annual Report).

Breakwater Resources completed the sale of the Caribou and Restigouche mine properties, located west of Bathurst, New Brunswick, to Blue Note Mining Inc. Breakwater retained a net smelter returns royalty on zinc metal production. The company also announced plans to advance the Langlois mine property in Quebec to commercial production in 2007.

HudBay Minerals Inc. sold the Gays River lead and zinc mine property to Acadian Mining Corporation. The Gays River property includes the former producing Scotia lead-zinc mine located 45 km northeast of Halifax, Nova Scotia. Production at the mine is expected to start in mid-2007. The company also announced production start-up at its Balmat mine located in New York State. Full production is planned for 2008. HudBay has entered into an agreement to earn a 100% interest in the Jason zinc project, situated 380 km northeast of Whitehorse, Yukon, and adjacent to its 100%-owned Tom project.

Teck Cominco Limited announced an agreement with the U.S. Environmental Protection Agency to conduct a comprehensive study of ecological and human health conditions along the Columbia River in the vicinity of Lake Roosevelt, immediately south of the Canadian border. The study will address concerns regarding pollution along the waterway.

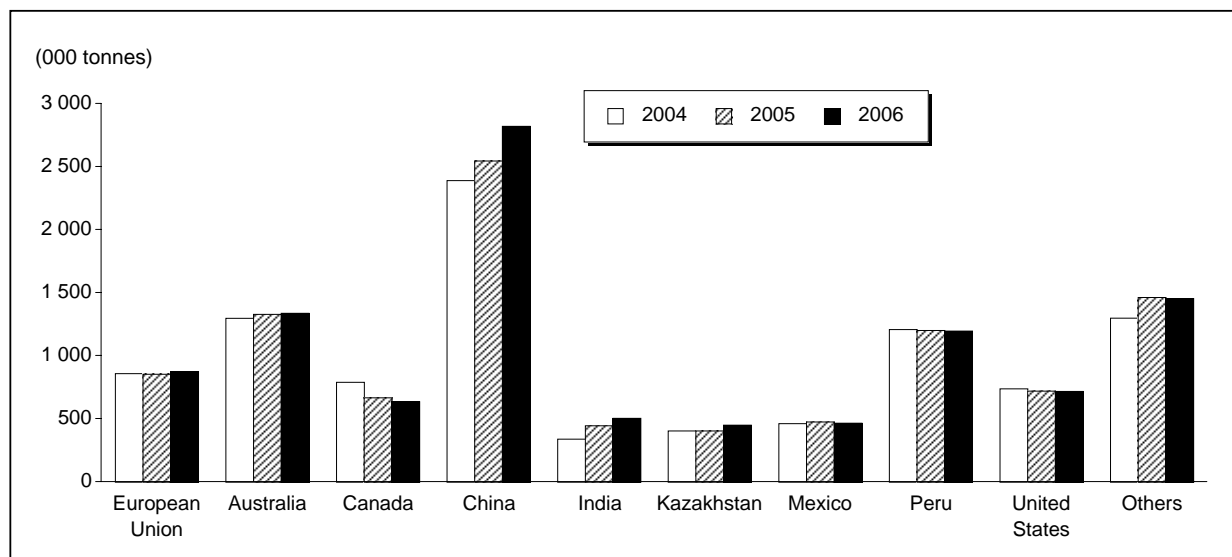
Xstrata plc made an offer to purchase Falconbridge Limited in August 2006, following the unsuccessful bid by Inco to purchase Falconbridge. This takeover followed the 2005 merger of Falconbridge with Noranda. Following the purchase of Falconbridge, Xstrata created three new divisions: Xstrata Copper, Xstrata Nickel, and Xstrata Zinc.

Xstrata is moving ahead with the development of the Perseverance deposit located near the town of Matagami, Quebec, as previously announced by Falconbridge prior to the Xstrata takeover. Development of the mine is estimated to cost \$128 million. Production is scheduled to commence during the third quarter of 2008. The mine is expected to have a five-year life and will produce 225 000 t/y of zinc concentrate that will be processed at the CEZ refinery in Montréal.

WORLD PRODUCTION

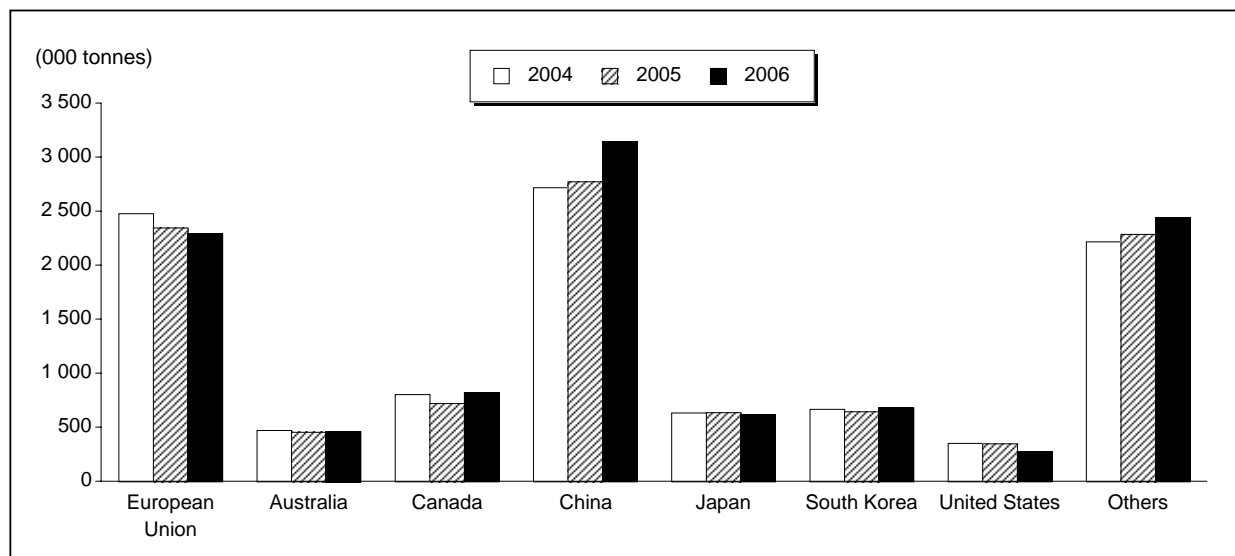
According to the International Lead and Zinc Study Group (ILZSG), world zinc mine production for 2006 was 10.42 Mt of zinc in concentrate, up 2.6% from the previous year (Table 5). World refined zinc metal production was 10.67 Mt, up 4.4% from 2005 (Table 6). In terms of mine production, Canada ranked fifth behind China, Australia, Peru, and the United States. The top five zinc metal-producing countries were China, Canada, South Korea, Japan, and Spain. Figure 4 shows world zinc mine production for the period 2004-06 while Figure 5 shows refined metal production for the same period.

Figure 4
World Zinc Mine Production, 2004-06



Source: International Lead and Zinc Study Group.

Figure 5
World Zinc Metal Production, 2004-06



Source: International Lead and Zinc Study Group.

USES

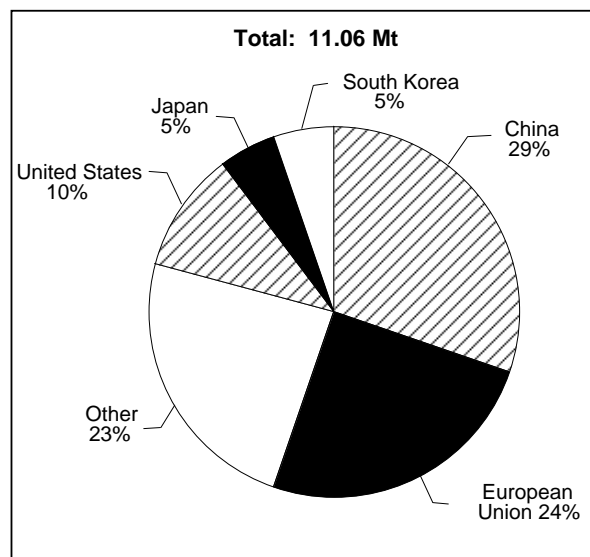
The greatest use for zinc is as a coating for iron and steel products to make them resistant to rust and corrosion. The application of a zinc coating, known as galvanizing, is accomplished electrolytically or by hot-dip methods. Galvanizing accounts for about 47% of the worldwide use of zinc.

The most commonly galvanized products are sheet and strip steel, tube and pipe, and wire and wire rope. The automobile industry is the largest user of galvanized steel. The desire to reduce weight and improve fuel efficiency has led to the increased use of galvanized steel by the automotive industry to protect the thinner gauges of steel from corrosion. Both hot-dipped and electro-galvanized steel are used, the thicker coating of hot-dipped steel giving more corrosion protection to unexposed surfaces and the thinner coating of electro-galvanized steel providing a smoother finish for exposed, painted surfaces.

Galvanized sheet and strip steel are also widely used by the construction industry for roofing and siding, and for heating and ventilation ducts, as well as for many other applications. Nails and other building materials are often hot-dip galvanized. Zinc and zinc-aluminum thermally sprayed coatings are used for the long-term corrosion protection of large steel structures such as bridges and hydro-electric transmission towers.

Another important use of zinc is in the manufacture of a vast range of die-cast products. Because it has a relatively low melting point and is very fluid, zinc diecast is easy to

Figure 6
World Refined Zinc Use, 2006

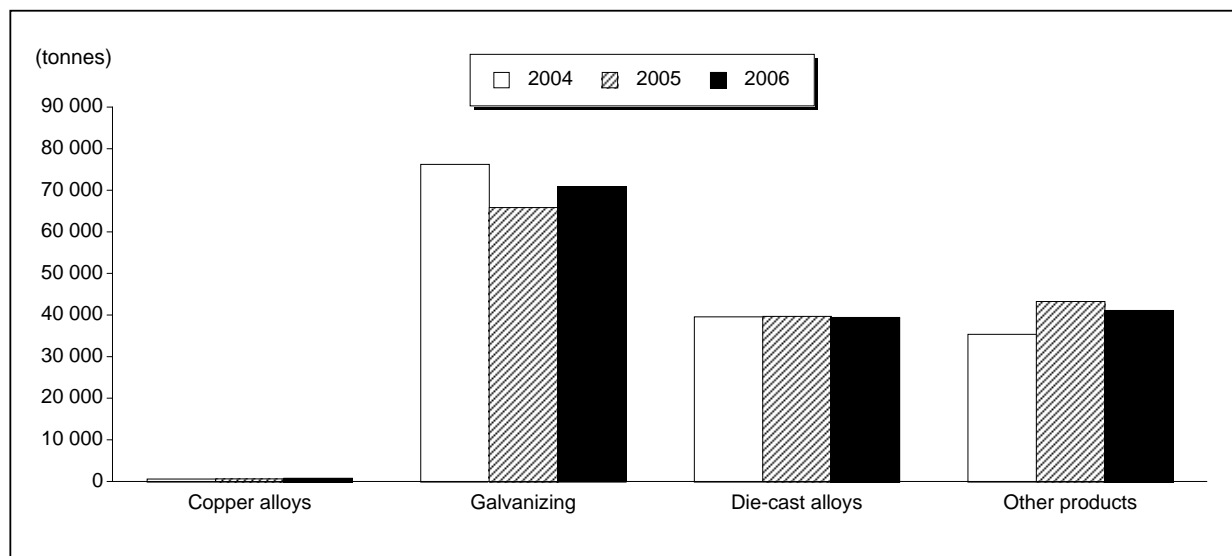


Source: International Lead and Zinc Study Group.

pour when melted. Therefore, it is well suited to rapid, assembly-line die-casting, particularly to produce small and intricate shapes.

A major use of die castings is in the automobile industry as trim pieces, grills, door and window handles, carburetors, pumps, and other components. However, with the trend

Figure 7
Canada, Zinc Use, 2004-06



Source: Natural Resources Canada.

toward lighter, more energy-efficient cars, zinc demand for this purpose has declined in recent years. Other familiar zinc die castings include small electrical appliances, business machines and other light equipment, tools, and toys.

Zinc is also an essential ingredient of brass, which is essentially an alloy of copper and zinc with the proportion of zinc ranging from 5 to 40%. The zinc brasses have good physical, electrical and thermal properties, and are corrosion resistant. They are used in plumbing, heat exchange equipment, and a wide range of decorative hardware, to name a few applications. Rolled zinc metal is a basic component in dry-cell batteries, and zinc oxide is used as a catalyst in the manufacture of rubber and as a pigment in white paint. It is also used in agricultural products, cosmetics, and medicinal products.

Table 7 and Figure 6 show a breakdown of zinc use by geographic region, according to data from the ILZSG. Table 3 and Figure 7 show a breakdown of zinc use in Canada for the period 2004-06. In Figure 7, other products include rolled and ribbon zinc and zinc oxides.

HEALTH AND ENVIRONMENT

Zinc plays an important role as a micro-nutrient in the development and health of a variety of plants and animals. In humans, zinc plays an important role in the function of more than 200 enzymes, for the stabilization of DNA and the expression of genes, and for the transfer of nerve signals.

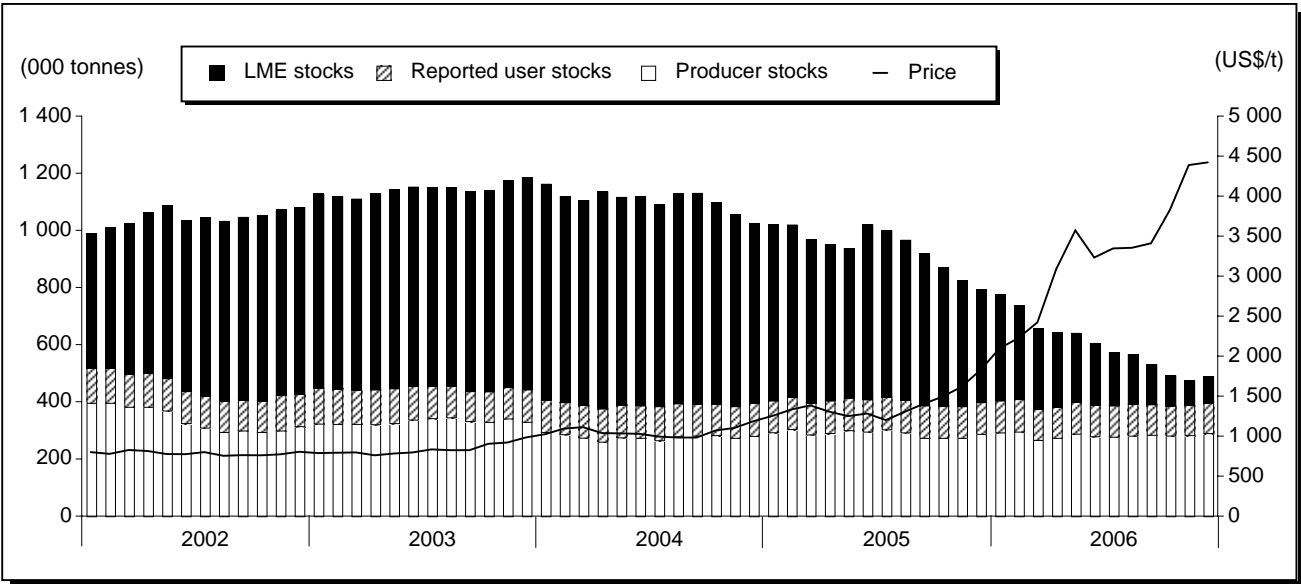
The human body contains 2-3 g of zinc. The recommended daily zinc intake is 12 mg/day for adult women and 15 mg/day for adult men. Daily intake is not only dependent on food, but also on sex, age, and general health status. Growing infants, children, adolescents, women in pregnancy, and the elderly have a higher zinc requirement.

Food is the primary source of zinc for humans with only a small part coming from drinking water. The major sources of zinc in the diet are red meat, poultry, fish, seafood, whole cereals, and dairy products.

PRICES AND STOCKS

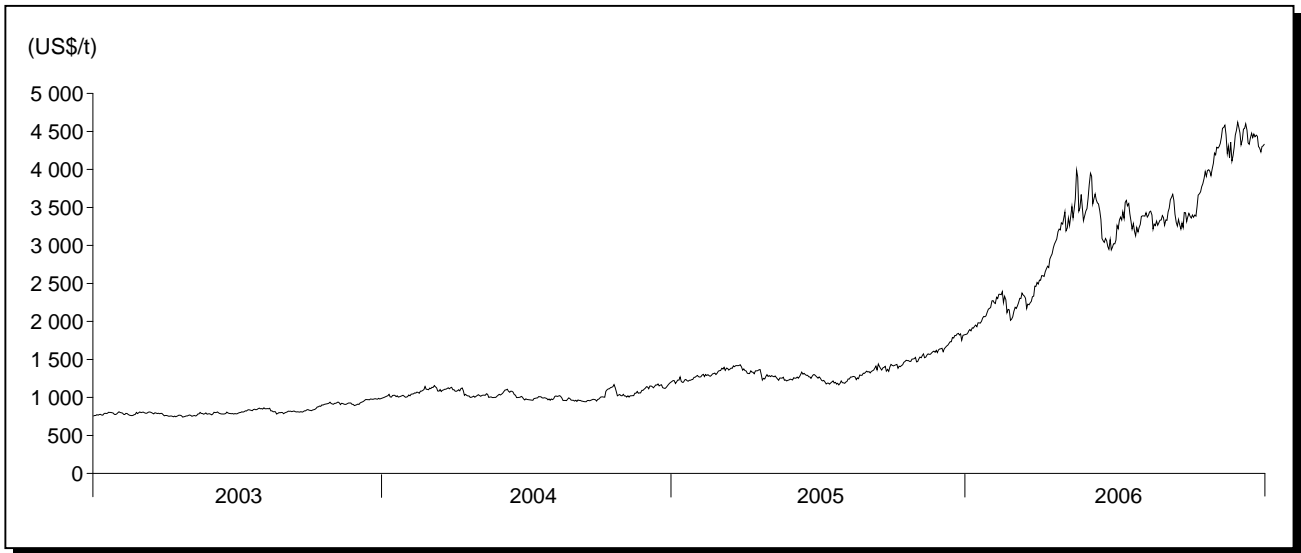
Figure 8 shows average monthly London Metal Exchange (LME) settlement prices for the period 2002-06, along with zinc metal stocks. Producers, fabricators and other merchants held an average 392 000 t of inventory at the end of 2006. Figure 9 shows LME daily cash settlement prices for the period 2003-06. LME stocks declined from 371 000 t in January to 91 000 t at year-end. Monthly average settlement prices on the LME increased dramatically from US\$2090/t to US\$4415/t over the period. World zinc usage is shown in Figure 10. Historical zinc prices for the 1985-2006 period are shown in Figure 11. Between 1991 and 2004, there was little fluctuation in price with an average for the period of US\$1032/t. Table 9 shows the monthly average zinc price for 2005 and 2006. The yearly average price jumped 136% year over year.

Figure 8
Zinc Prices and Stocks, 2002-06



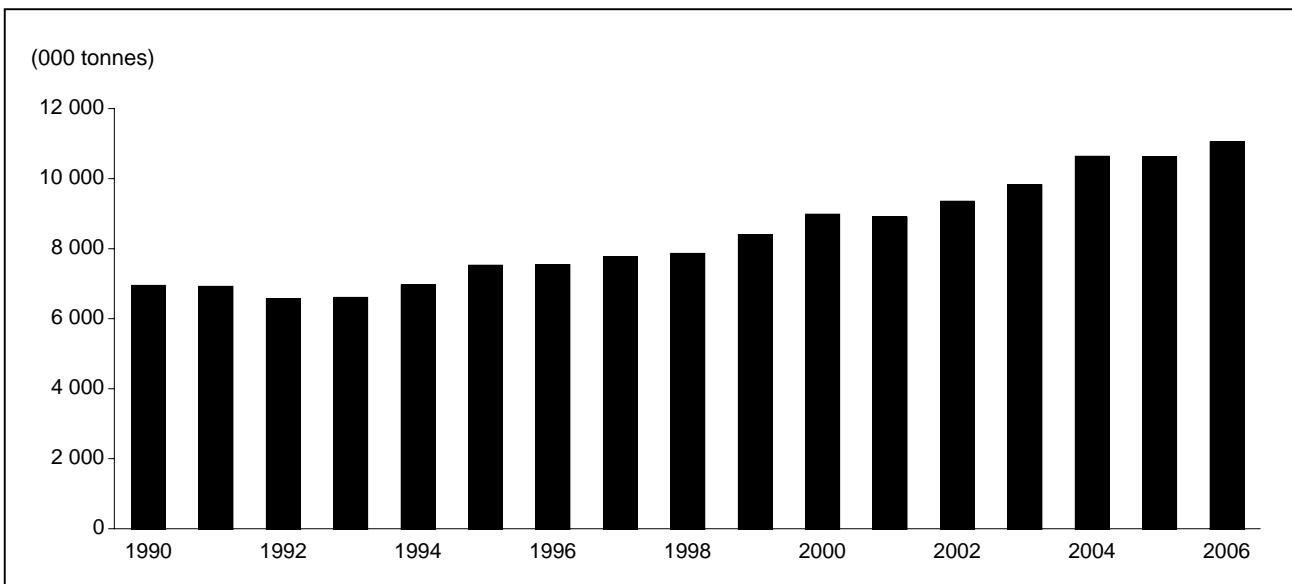
Source: International Lead and Zinc Study Group.

Figure 9
LME Daily Official Cash Settlement Prices, 2003-06



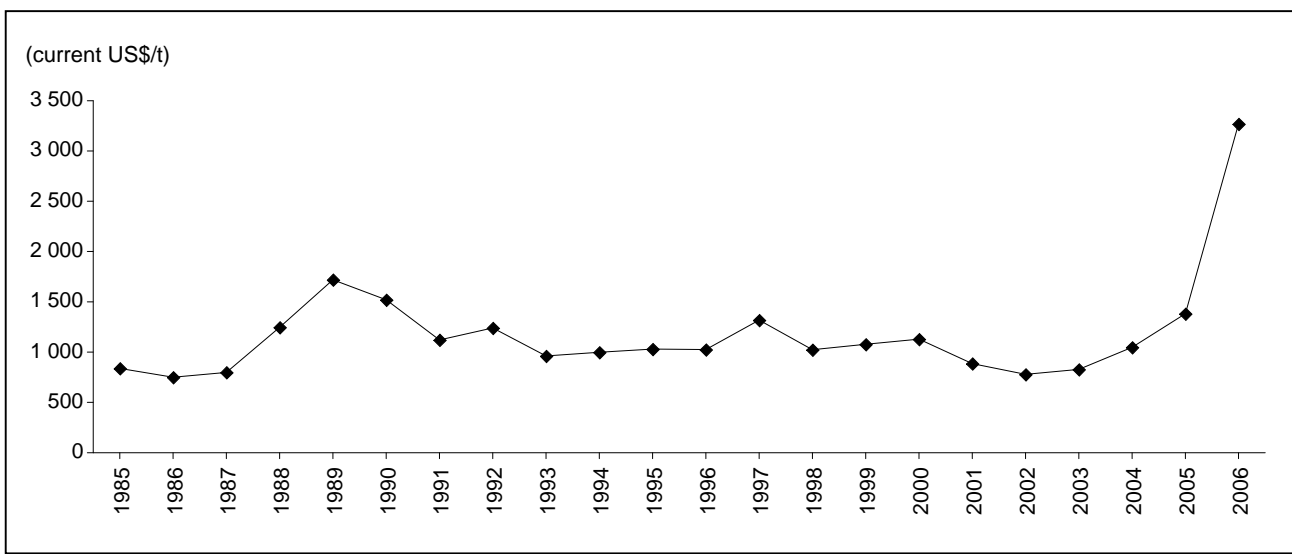
Source: International Lead and Zinc Study Group.

Figure 10
World Zinc Usage, 1990-2006



Source: International Lead and Zinc Study Group.

Figure 11
Average Cash Settlement Zinc Prices, 1985-2006



Source: International Lead and Zinc Study Group.

INTERNATIONAL LEAD AND ZINC STUDY GROUP

The International Lead and Zinc Study Group (ILZSG) is an intergovernmental organization that regularly brings together 28 member countries in an international forum to exchange information on lead and zinc. Particular attention is given to providing regular and frequent information on supply, demand, and the outlook for lead and zinc prices and markets.

The Study Group, headquartered in Lisbon, Portugal, represents most of the world's major lead- and zinc-producing and using nations. The Group has an extensive information-gathering and dissemination role, and acts as an effective mechanism for increasing market transparency related to the production, use, and trade of lead and zinc. The Group is also an important forum for communication among governments, among industry, and between governments and industry. It holds a general session each year in October.

More information about the Group's activities can be obtained from its web site at www.ilzsg.org.

OUTLOOK

Zinc prices are expected to decline from highs reached in 2006 and remain in the US\$2800-\$3000/t range. Monthly average zinc prices started 2006 at US\$2090/t and ended the year at a record US\$4415/t, an increase of 111% over the year. The average zinc price for 2006 was US\$3276/t, compared to US\$1382/t for 2005.

Consumer stocks remained relatively stable at about 109 000 t during the year; however, LME metal stocks declined from 371 000 t to 91 000 t by year-end.

The ILZSG predicts that global zinc mine output for 2007 will increase by 9.4% to 11.35 Mt as a result of new production from countries such as Australia, Canada, China, Kazakhstan, and Peru. Refined metal production should increase by 6.9% to 11.4 Mt. The ILZSG expects that refined zinc metal usage will increase by 4% to 11.45 Mt in 2007. As a result, there is still expected to be pressure on existing zinc supplies, which will in turn support sustained higher prices.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of June 29, 2007. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/com_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2603.00.30	Copper ores and concentrates: zinc content	Free	Free	Free	Free	Free	Free
2607.00.30	Lead ores and concentrates: zinc content	Free	Free	Free	Free	Free	Free
2608.00.30	Zinc ores and concentrates: zinc content	Free	Free	Free	Free	Free	Free
2616.00.30	Silver ores and concentrates: zinc content	Free	Free	Free	Free	Free	Free
2620.11	Slag, ash and residues (other than from the manufacture of iron or steel) containing metals, arsenic or their compounds: containing mainly zinc: hard zinc spelter	Free	Free	Free	Free	Free	Free
2620.19	Slag, ash and residues (other than from the manufacture of iron or steel) containing metals, arsenic or their compounds: containing mainly zinc: other	Free	Free	Free	Free	Free	Free
2817.00	Zinc oxide; zinc peroxide	Free-5.5%	Free	Free	Free	5.5%	4.3%
2833.26	Sulphates; alums; peroxosulphates: other sulphates: of zinc	Free	Free	Free	Free	2.5%	Free
7901.11	Unwrought zinc: zinc, not alloyed: containing by weight 99.99% or more of zinc	Free	Free	Free	Free	2.5%	Free
7901.12	Unwrought zinc: zinc, not alloyed: containing by weight less than 99.99% of zinc	Free	Free	Free	Free	2.5%	Free
7901.20	Unwrought zinc: zinc alloys	Free	Free	Free	Free	2.5%	Free
7902.00	Zinc waste and scrap	Free	Free	Free	Free	Free	Free
7903.10	Zinc dust, powders and flakes: zinc dust	Free	Free	Free	Free	2.5%	3%
7903.90	Zinc dust, powders and flakes: other	Free	Free	Free	Free	2.5%	3%
7904.00	Zinc bars, rods, profiles and wire	Free	Free	Free	Free	5%	3%
7905.00	Zinc plates, sheets, strip and foil	Free	Free	Free	Free	5%	3%
7906.00	Zinc tubes, pipes and tube or pipe fittings (for example, couplings, elbows, sleeves)	3%	Free	Free	Free	5%	3%
7907.00	Other articles of zinc	Free-3%	Free-3%	Free	Free	5%	3%

Sources: Canadian *Customs Tariff*, effective January 2006 and 2007, Canada Border Services Agency; *Harmonized Tariff Schedule of the United States*, 2006 and 2007; *Official Journal of the European Union* (October 27, 2005 and October 17, 2006 editions); *Customs Tariff Schedules of Japan*, 2006 and 2007.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, ZINC, TOTAL PRODUCTION BY PROVINCE, 2004-06

		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
PRODUCTION							
(All Forms) (1)							
New Brunswick		244 447	333 181	243 945	408 363	256 861	902 352
Quebec		255 863	348 742	102 958	172 352	90 810	319 015
Ontario		83 473	113 774	114 154	191 094	107 842	378 848
Manitoba		100 108	136 447	104 592	175 086	105 251	369 748
Saskatchewan		5 171	7 048	3 963	6 635	541	1 901
British Columbia		44 973	61 299	49 232	82 414	32 858	115 430
Total		734 035	1 000 489	618 844	1 035 944	594 163	2 087 293
Mine output (2)		791 373	..	666 664	..	633 500	..
Refined (3)		805 438	..	724 035	..	824 465	..

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; (p) Preliminary.

(1) New refined zinc produced from domestic primary materials (concentrates, slags, residues, etc.) plus estimated recoverable zinc in ores and concentrates shipped for export. (2) Zinc content of ores and concentrates produced. (3) Refined zinc produced from domestic and imported ores.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, ZINC TRADE, 2004-06

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS							
2608.00.30	Zinc content in zinc ores and concentrates						
	Belgium	96 398	71 007	55 830	53 423	26 717	66 131
	South Korea	18 008	12 259	33 867	27 795	17 246	50 868
	Poland	12 380	12 633	15 215	15 068	18 435	40 112
	Romania	2 422	1 641	3 213	4 092	8 121	32 667
	Japan	25 471	20 455	33 971	36 480	17 838	32 385
	Spain	50 090	36 553	19 778	16 060	11 738	21 560
	Norway	15 524	10 768	4 176	3 510	6 540	15 566
	United States	—	—	2 829	2 723	2 746	4 895
	Other countries	7 887	8 444	9 220	21 877	46	53
	Total	228 180	173 760	178 099	181 028	109 427	264 237
2620.11	Ash and residues containing hard zinc spelter						
	Malaysia	—	—	46	60	789	439
	Japan	—	—	—	—	22	43
	India	20	12	200	50	—	—
	Norway	—	—	13	13	—	—
	Total	20	12	259	123	811	482
2620.19	Ash and residues containing mainly zinc, n.e.s.						
	United States	13 987	9 566	11 999	8 921	11 302	12 816
	Other countries	326	342	105	111	148	448
	Total	14 313	9 908	12 104	9 032	11 450	13 264
2817.00	Zinc oxide; zinc peroxide						
	United States	49 711	70 163	61 976	101 182	49 133	145 364
	Germany	24	41	22	39	1 106	2 586
	Brazil	553	860	1 180	1 605	1 000	2 548
	France	261	347	383	572	971	2 438
	Other countries	2 027	2 609	3 570	4 679	2 662	6 021
	Total	52 576	74 020	67 131	108 077	54 872	158 957
2833.26	Zinc sulphate						
	United States	5 378	4 569	4 057	3 253	5 129	3 503
	Other countries	—	—	4	2	2	3
	Total	5 378	4 569	4 061	3 255	5 131	3 506
7901.11	Zinc, not alloyed, unwrought, containing by weight 99.99% or more of zinc						
	United States	359 478	501 322	357 258	566 618	458 382	1 201 985
	Taiwan	19 988	27 890	9 665	16 134	10 562	36 167
	Malaysia	6 792	9 611	4 498	7 967	6 542	22 521
	Hong Kong	8 347	12 155	3 155	5 414	3 556	12 215
	Other countries	7 737	11 347	16 533	28 545	10 372	34 683
	Total	402 342	562 325	391 109	624 678	489 414	1 307 571
7901.12	Zinc, not alloyed, unwrought, containing by weight less than 99.99% of zinc						
	United States	176 907	248 470	104 512	164 246	104 718	309 196
	Hong Kong	13 310	20 701	8 753	15 320	8 895	31 354
	Taiwan	7 601	11 235	5 084	9 118	4 301	15 431
	Indonesia	4 085	6 030	3 932	6 957	3 688	13 902
	China	769	1 003	4 936	8 365	3 793	10 015
	Philippines	1 376	1 949	1 238	2 264	2 439	8 669
	Other countries	7 668	11 396	7 739	13 521	7 920	28 215
	Total	211 716	300 784	136 194	219 791	135 754	416 782
7901.20	Zinc alloys, unwrought						
	United States	604	1 208	468	817	668	2 479
	China	19	37	141	264	35	189
	Other countries	1 212	1 980	21	46	75	219
	Total	1 835	3 225	630	1 127	778	2 887
7902.00	Zinc waste and scrap						
	United States	9 448	9 042	7 914	9 148	11 883	18 213
	China	15 003	17 627	10 736	12 216	6 399	10 329
	India	569	753	340	329	327	380
	Other countries	3 094	3 585	277	342	38	109
	Total	28 114	31 007	19 267	22 035	18 647	29 031

TABLE 2 (cont'd)

Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)							
7903.10	Zinc dust						
	United States	4 259	8 652	4 072	9 499	6 263	26 772
	Other countries	50	121	115	278	167	581
	Total	4 309	8 773	4 187	9 777	6 430	27 353
7903.90	Zinc powders and flakes						
	United States	12 349	24 145	11 414	25 206	12 615	48 792
	Belgium	391	615	593	888	577	1 888
	China	6	21	93	413	185	774
	Other countries	24	40	25	66	65	264
	Total	12 770	24 821	12 125	26 573	13 442	51 718
7904.00	Zinc bars, rods, profiles and wire						
	United States	365	1 758	355	1 821	197	1 274
	Other countries	192	441	45	125	88	392
	Total	557	2 199	400	1 946	285	1 666
7905.00	Zinc plates, sheets, strip and foil						
	India	—	—	157	291	59	103
	China	—	—	396	608	16	64
	United States	102	792	16	109	2	34
	Netherlands	—	—	10 608	15 562	—	—
	Other countries	—	—	1	3	—	1
	Total	102	792	11 178	16 573	77	202
7906.00	Zinc tubes, pipes, and tube or pipe fittings (for example, couplings, elbows, sleeves)						
	United States	1 318	9 446	1 375	10 514	1 572	10 921
	Other countries	1	15	6	53	12	110
	Total	1 319	9 461	1 381	10 567	1 584	11 031
7907.00	Other articles of zinc						
	United States	1 618	15 565	1 826	14 418	2 167	17 305
	Other countries	136	743	76	290	48	224
	Total	1 754	16 308	1 902	14 708	2 215	17 529
	Total exports	965 285	1 221 964	840 027	1 249 290	850 317	2 306 216
IMPORTS							
2603.00.00.30	Zinc content in copper ores and concentrates						
	United States	53	52	24	22	18	25
2607.00.00.30	Zinc content in lead ores and concentrates						
	United States	2 647	2 197	2 285	2 636	2 653	6 187
2608.00.00.30	Zinc content in zinc ores and concentrates						
	United States	192 044	147 250	146 193	164 403	182 821	418 861
	Peru	56 570	49 555	31 352	43 048	74 816	180 811
	Mexico	20 828	17 514	16 967	14 710	17 574	29 260
	Chile	3 564	2 770	—	—	2 927	5 279
	Other countries	1	1	11	11	—	—
	Total	273 007	217 090	194 523	222 172	278 138	634 211
2620.19	Ash and residues containing mainly zinc, n.e.s.						
	United States	420	407	1 326	574	389	433
2817.00	Zinc oxide; zinc peroxide						
	United States	8 915	12 424	6 283	10 481	6 889	19 275
	Mexico	3 142	2 886	3 722	3 702	3 687	6 792
	Other countries	472	491	8	31	225	414
	Total	12 529	15 801	10 013	14 214	10 801	26 481
2833.26	Zinc sulphate						
	China	1 921	1 122	2 038	1 669	3 052	3 334
	United States	2 738	2 111	2 253	1 980	1 662	2 226
	South Korea	96	76	19	14	84	80
	Other countries	114	103	105	162	124	168
	Total	4 869	3 412	4 415	3 825	4 922	5 808

TABLE 2 (cont'd)

TABLE 2 (cont'd)							
Item No.		2004		2005		2006 (p)	
		(tonnes)	(\$000)	(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)							
7901.11	Zinc, not alloyed, unwrought, containing by weight 99.99% or more of zinc						
	India	—	—	—	—	1 181	4 095
	United States	723	1 048	176	359	434	1 498
	Other countries	2 798	4 076	1 456	2 443	114	417
	Total	3 521	5 124	1 632	2 802	1 729	6 010
7901.12	Zinc, not alloyed, unwrought, containing by weight less than 99.99% of zinc						
	United States	137	195	94	146	258	376
7901.20	Zinc alloys, unwrought						
	United States	6 694	11 272	7 157	12 634	10 015	29 531
	China	...	1	313	751	274	640
	Other countries	8	15	—	—	1	5
	Total	6 702	11 288	7 470	13 385	10 290	30 176
7902.00	Zinc waste and scrap						
	United States	350	342	203	205	1 050	1 060
	Other countries	19	30	—	—	2	2
	Total	369	372	203	205	1 052	1 062
7903.10	Zinc dust						
	Belgium	5 685	10 206	3 433	6 886	2 786	10 811
	United States	634	1 352	421	1 213	441	2 221
	Other countries	1 039	1 919	1	12	96	410
	Total	7 358	13 477	3 855	8 111	3 323	13 442
7903.90	Zinc powders and flakes						
	United States	674	1 223	677	1 195	2 502	5 141
	China	3	7	65	141	69	124
	Other countries	9	16	24	53	35	79
	Total	686	1 246	766	1 389	2 606	5 344
7904.00	Zinc bars, rods, profiles and wire						
	United States	6 156	9 038	3 065	4 733	905	2 292
	China	317	959	362	1 110	563	1 752
	India	34	110	60	160	207	583
	Other countries	123	203	97	260	77	256
	Total	6 630	10 310	3 584	6 263	1 752	4 883
7905.00	Zinc plates, sheets, strip and foil						
	Germany	279	1 127	230	889	364	1 503
	United States	663	1 816	425	1 157	408	1 500
	France	365	1 654	279	1 336	326	1 312
	Other countries	35	69	71	133	24	83
	Total	1 342	4 666	1 005	3 515	1 122	4 398
7906.00	Zinc tubes, pipes, and tube or pipe fittings (for example, couplings, elbows, sleeves)						
	United States	223	1 738	167	1 585	159	1 422
	India	203	1 428	162	1 106	1 708	1 397
	Other countries	487	2 299	374	2 121	2 358	2 439
	Total	913	5 465	703	4 812	4 225	5 258
7907.00	Other articles of zinc						
	United States	2 031	10 340	1 675	6 583	2 158	9 191
	China	759	3 356	798	3 767	1 033	5 191
	Taiwan	459	2 660	411	2 460	506	2 478
	India	9	61	51	333	372	845
	Other countries	437	2 311	352	2 280	466	2 190
	Total	3 695	18 728	3 287	15 423	4 535	19 895
	Total imports	324 878	309 830	235 185	299 494	327 813	763 989

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Amount too small to be expressed; n.e.s. Not elsewhere specified; (p) Preliminary.

Note: Numbers may not add to totals due to rounding.

TABLE 3. ZINC USE IN CANADA, 2004-06

	2004			2005			2006		
	Primary	Secondary	Total	Primary	Secondary	Total	Primary	Secondary	Total
	(tonnes)								
Zinc used (1,2) for or in the production of:									
Copper alloys (brass, bronze, etc.)	x	x	685	x	x	714	x	x	873
Galvanizing: electro	x	x	1 637	x	x	1 174	x	x	1 393
hot dip	x	x	74 710	x	x	64 792	x	x	69 521
Zinc die-cast alloys	x	x	39 666	x	x	39 771	x	x	39 541
Other products (including rolled and ribbon zinc, zinc oxides electroplating)	x	x	35 477	x	x	43 350	x	x	41 216
Total	149 843	2 332	152 175	148 134	1 667	149 801	149 224	3 319	152 544
User stocks, year-end	12 522	7	12 529	9 586	24	9 610	16 540	268	16 808

Sources: Natural Resources Canada; Statistics Canada.

x Confidential.

(1) User survey does not represent all Canadian users and is therefore consistently less than the apparent quantity used. (2) Due to confidentiality in some end-use categories, a breakdown of primary and recycled sources is not provided in order to be consistent.

Note: Numbers may not add to totals due to rounding.

TABLE 4. CANADA, ZINC PRODUCTION AND EXPORTS, (1) 1988-2006

	Production		Exports		
	All Forms (2)	Refined (3)	In Ores and Concentrates	Refined	Total
	(tonnes)				
1988	1 370 000	703 206	816 885	551 521	1 368 406
1989	1 272 854	669 677	614 223	495 060	1 109 283
1990	1 179 372	591 786	716 185	452 251	1 168 436
1991	1 083 008	660 552	566 815	520 508	1 087 323
1992	1 195 736	671 702	678 172	509 744	1 187 916
1993	990 727	659 881	455 953	493 265	949 218
1994	976 309	690 965	450 320	551 168	1 001 488
1995	1 094 703	720 346	609 575	533 179	1 142 754
1996	1 162 720	716 467	670 790	581 608	1 252 398
1997	1 026 864	703 798	489 697	546 965	1 036 662
1998	991 584	745 131	425 340	576 925	1 002 265
1999	963 321	776 927	327 662	610 792	938 454
2000	935 713	779 892	318 752	602 626	921 378
2001	1 012 048	661 172	419 164	495 184	914 348
2002	923 931	793 410	409 343	598 251	1 007 594
2003	757 307	761 199	257 877	590 555	848 432
2004	734 035	805 438	228 181	614 060	842 241
2005	618 844	724 035	178 099	527 304	705 403
2006 (p)	594 163	824 465	109 427	625 168	734 595

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary.

(1) Beginning in 1988, exports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. Ores and concentrates include HS class 2608.00.30, 2603.00.30, 2607.00.30 and 2616.10.30. Refined production includes HS class 7901.11 and 7901.12. (2) New refined zinc produced from domestic primary materials (concentrate, slags, residues, etc.) plus estimated recoverable zinc in ores and concentrates shipped for export. (3) Refined zinc produced from domestic and imported ores.

TABLE 5. WORLD MINE PRODUCTION OF ZINC, 2001-06

	2001	2002	2003	2004	2005	2006 (p)
	(000 tonnes)					
EUROPE						
Finland	20	35	39	37	41	36
Ireland	298	253	419	438	429	426
Poland	153	152	154	148	136	135
Russia	164	162	159	162	186	190
Spain	161	70	15	—	—	—
Sweden	159	149	188	199	216	211
Others	97	89	45	37	32	68
Subtotal	1 052	910	1 019	1 021	1 040	1 066
AFRICA						
Morocco	89	91	69	87	128	130
Namibia	37	41	108	202	232	235
South Africa	61	64	41	32	32	31
Others	49	46	41	36	22	3
Subtotal	236	242	259	357	414	399
OCEANIA						
Australia	1 476	1 444	1 447	1 298	1 329	1 338
AMERICAS						
Bolivia	145	142	145	146	159	165
Brazil	111	133	147	165	171	180
Canada	1 065	916	788	791	667	636
Mexico	429	446	472	462	476	466
Peru	1 056	1 219	1 369	1 209	1 202	1 197
United States	842	784	768	739	720	718
Others	121	119	106	96	4	105
Subtotal	3 769	3 759	3 795	3 608	3 496	3 467
ASIA						
China	1 572	1 624	2 029	2 391	2 547	2 821
India	222	234	305	340	446	505
Iran	105	121	111	135	167	164
Japan	45	43	45	48	41	7
Kazakhstan	320	376	392	404	405	450
North Korea	28	32	52	62	65	68
Thailand	24	25	31	40	43	39
Turkey	36	43	40	39	56	58
Others	48	51	53	49	62	81
Subtotal	2 400	2 549	3 058	3 508	3 832	4 193
Total world	8 932	8 904	9 579	9 792	10 110	10 462

Source: International Lead and Zinc Study Group.
 — Nil; (p) Preliminary.

TABLE 6. WORLD ZINC METAL PRODUCTION, (1) 2001-06

	2001	2002	2003	2004	2005	2006 (p)
(000 tonnes)						
EUROPE						
Belgium	256	239	244	257	222	251
Finland	249	235	266	285	282	282
France	329	334	253	260	209	120
Germany	357	378	388	358	335	337
Italy	179	176	123	118	121	110
Netherlands	206	203	223	225	228	243
Norway	145	145	142	139	148	158
Poland	175	159	154	154	137	138
Russia	250	257	253	241	211	230
Spain	437	503	519	523	500	500
Others	295	275	179	161	166	156
Subtotal	2 877	2 904	2 744	2 721	2 559	2 525
AFRICA						
Algeria	26	34	32	30	37	36
Namibia	–	–	47	119	133	147
South Africa	109	111	112	105	104	92
Zambia	–	2	2	2	–	–
Subtotal	135	147	194	257	274	275
AMERICAS						
Argentina	40	39	39	35	41	40
Brazil	193	255	258	266	267	271
Canada	661	793	761	805	723	821
Mexico	304	306	320	337	336	288
Peru	190	170	202	196	164	171
United States	329	339	350	354	350	273
Subtotal	1 717	1 903	1 930	1 993	1 881	1 864
ASIA						
China	2 038	2 155	2 319	2 720	2 776	3 147
India	234	248	280	272	302	421
Japan	644	640	651	635	638	614
Kazakhstan	277	286	279	323	357	390
South Korea	508	608	645	669	647	680
Thailand	105	105	107	103	93	85
Others	130	147	169	190	244	268
Subtotal	3 936	4 189	4 450	4 912	5 057	5 605
OCEANIA						
Australia	556	567	553	474	457	463
Total world	9 221	9 710	9 871	10 357	10 228	10 732

Source: International Lead and Zinc Study Group.

– Nil; (p) Preliminary.

(1) Total production by smelters and refineries of zinc in marketable form or used directly for alloying, including production on toll in the reporting country, regardless of the type of source material from which it is produced, i.e., whether ores, concentrates, residues, slag or scrap. Remelted zinc and zinc dusts are excluded.

TABLE 7. ZINC USE, (1) BY COUNTRY AND BY REGION, 2001-06

	2001	2002	2003	2004	2005	2006 (p)
(000 tonnes)						
EUROPE						
Belgium	374	352	350	365	345	360
France	327	290	291	298	275	292
Germany	543	526	539	514	511	560
Italy	348	374	348	389	395	380
Russia	150	153	189	163	171	185
Spain	222	220	226	248	216	236
United Kingdom	191	185	188	185	175	172
Others	656	654	666	668	594	638
Subtotal	2 811	2 754	2 797	2 830	2 682	2 823
AFRICA						
South Africa	89	95	86	96	103	100
Others	87	92	88	97	101	102
Subtotal	176	187	174	193	204	202
OCEANIA						
Australia	222	249	254	250	239	259
New Zealand	16	17	13	13	14	14
Subtotal	237	266	267	263	253	273
AMERICAS						
Brazil	198	216	215	239	222	236
Canada	180	192	185	189	175	183
Mexico	210	225	236	240	244	250
United States	1 179	1 217	1 152	1 251	1 077	1 126
Others	169	173	162	204	186	200
Subtotal	1 936	2 023	1 950	2 123	1 904	1 995
ASIA						
China	1 500	1 750	2 155	2 690	3 041	3 140
India	286	310	339	362	394	428
Japan	633	603	619	623	602	592
South Korea	401	476	482	445	501	552
Taiwan	276	302	330	342	306	285
Turkey	103	107	116	129	117	120
Thailand	78	99	122	144	142	140
Others	482	500	497	512	495	514
Subtotal	3 759	4 147	4 660	5 247	5 598	5 771
Total world	8 920	9 376	9 848	10 657	10 641	11 064

Source: International Lead and Zinc Study Group.

(p) Preliminary.

(1) Total refined zinc use, including zinc used directly for the production of zinc alloys, regardless of the type of source material from which it is produced, i.e., ores, concentrates, residues, slags or scrap. Remelted zinc and zinc dusts are excluded.

TABLE 8. CANADA, ZINC METAL CAPACITY, 2006

Company and Location	Annual Rated Capacity
	(000 tonnes of slab zinc)
PRIMARY	
Canadian Electrolytic Zinc Limited Salaberry-de-Valleyfield, Quebec	280
Xstrata Zinc Canada Timmins, Ontario	150
HudBay Minerals Inc. Flin Flon, Manitoba	118
Teck Cominco Limited Trail, British Columbia	295
Total primary, Canada	843

Source: Natural Resources Canada.

TABLE 9. MONTHLY AVERAGE ZINC PRICES, 2005 AND 2006

	LME Special High Grade Settlement
	(US\$/t)
2005	
January	1 246.4
February	1 326.2
March	1 377.7
April	1 300.1
May	1 243.6
June	1 275.7
July	1 194.4
August	1 298.4
September	1 397.5
October	1 488.4
November	1 610.9
December	1 821.8
Yearly average	1 381.6
2006	
January	2 090.3
February	2 219.4
March	2 416.9
April	3 084.8
May	3 565.7
June	3 225.7
July	3 339.9
August	3 347.3
September	3 403.0
October	3 822.9
November	4 382.2
December	4 415.1
Yearly average	3 268.8

Source: International Lead and Zinc Study Group.

Statistical Report

This statistical summary of the Canadian mineral industry has been compiled by staff of the Minerals and Mining Statistics Division, Minerals and Metals Sector, Natural Resources Canada (NRCan), under the general direction of Yvan Gauthier, Director.

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Statistics contained in this summary are obtained from a variety of sources. Principal sources include the statistical survey programs of NRCan and Statistics Canada. The statistical survey program of the Minerals and Mining Statistics Division of NRCan is conducted jointly with the provincial/territorial governments and Statistics Canada in order to minimize the reporting burden on the mineral industry. The cooperation of the companies providing information is greatly appreciated.

Notes: (1) We continue to review the tables of this Report in order to establish the requirements of users. We would appreciate your feedback on which tables are important to you. Please contact Angela Kokkinos at tel. 613-992-6767 or e-mail akokkino@nrcan.gc.ca to provide your input. (2) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/mms/cmy/pref_e.htm.

NOTE TO READERS

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TABLE 1. MINERAL PRODUCTION OF CANADA, 2004-06

	Unit	2004		2005		2006 (p)	
		(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)
METALS							
Antimony	t	88	331	66	283	75	446
Bismuth	t	180	1 664	141	1 423	184	2 090
Cadmium	t	740	1 159	634	2 533	475	1 502
Calcium	t	x	x	x	x	—	—
Cesium	t	x	x	x	x	x	x
Cobalt	t	2 085	143 132	2 391	101 952	2 793	113 187
Columbium (niobium)	t	3 599	x	3 710	x	4 157	x
Copper	t	544 558	2 030 656	577 304	2 572 467	595 092	4 600 064
Gold	kg	129 478	2 217 050	119 549	2 071 787	103 402	2 246 831
Ilmenite	000 t	x	x	x	x	x	x
Indium	kg	x	x	x	x	x	x
Iron ore	000 t	28 596	1 317 743	30 387	2 339 451	34 094	2 584 151
Iron, remelt	000 t	x	x	x	x	x	x
Lead	t	72 773	83 907	72 828	86 083	81 528	116 585
Lithium	t	x	x	x	x	x	x
Magnesium	t	x	x	x	x	—	—
Molybdenum	t	9 946	x	7 667	x	7 042	x
Nickel	t	177 281	3 225 620	192 855	3 510 339	225 697	6 176 435
Platinum group	kg	26 164	458 780	22 709	405 356	22 878	492 299
Selenium	t	271	17 756	107	14 131	117	6 920
Silver	t	1 295	362 417	1 063	303 991	968	398 750
Tantalum	t	69	6 039	77	6 177	68	4 664
Tellurium	t	55	841	11	675	11	826
Tungsten	t	—	—	484	8 155	2 561	55 660
Uranium	t	11 548	621 630	12 597	1 131 568	9 781	1 430 463
Zinc	t	734 035	1 000 489	618 844	1 035 944	594 163	2 087 293
Total metals		..	12 361 826	..	14 582 608	..	21 199 267
NONMETALS							
Barite	000 t	21	4 505	23	4 825	18	4 596
Carbonatite	000 t	x	x	x	x	x	x
Cement (1)	000 t	14 842	1 629 163	14 656	1 661 314	14 571	1 702 912
Chrysotile (asbestos)	000 t	x	x	x	x	x	x
Clay products (2)	000 t	..	230 059	..	232 691	..	230 924
Diamonds	000 ct	12 680	2 096 718	12 314	1 762 053	13 206	1 590 737
Gemstones	t	107	2 534	78	3 492	103	4 182
Graphite	000 t	x	x	x	x	x	x
Gypsum (3)	000 t	9 205	112 499	8 570	113 928	9 072	123 913
Lime	000 t	2 386	256 942	2 289	261 848	2 211	271 713
Magnesitic dolomite	000 t	x	x	x	x	x	x
Marl	000 t	x	x	x	x	x	x
Mica	000 t	x	x	x	x	x	x
Nepheline syenite	000 t	714	62 731	745	63 286	719	66 488
Peat	000 t	1 347	203 710	1 304	219 107	1 245	211 186
Phosphate	000 t	x	x	x	x	x	x
Potash (K ₂ O) (3)	000 t	10 332	2 162 774	10 140	2 437 488	8 528	2 212 084
Potassium sulphate	000 t	x	x	x	x	x	x
Pumice	000 t	x	x	x	x	x	x
Quartz (3)	000 t	1 466	50 976	1 807	59 707	1 893	64 823
Salt	000 t	14 096	432 642	13 463	432 020	13 338	439 134
Sand and gravel (3)	000 t	250 067	1 167 648	243 440	1 180 266	236 505	1 189 185
Serpentine	000 t	—	—	—	—	—	—
Soapstone, talc, pyrophyllite, etc.	000 t	81	28 477	70	26 228	68	22 293
Sodium sulphate	000 t	x	x	x	x	x	x
Stone (3)	000 t	135 988	1 155 766	141 275	1 215 037	140 840	1 267 112
Sulphur, elemental	000 t	7 834	218 853	7 757	234 205	8 296	158 392
Sulphur, in smelter gas	000 t	678	45 526	653	36 018	693	38 285
Titanium dioxide	000 t	x	x	x	x	x	x
Tremolite	000 t	—	—	—	—	—	—
Zeolite	000 t	x	x	x	x	x	x
Total nonmetals		..	10 344 395	..	10 485 489	..	10 198 966
MINERAL FUELS							
Coal	000 t	65 997	1 596 459	65 345	2 329 021	62 987	2 205 105
Total all minerals		..	24 302 681	..	27 397 119	..	33 603 339

Sources: Natural Resources Canada; Statistics Canada catalogue no. 26-202 XIB.

— Nil; .. not available; (p) Preliminary; x Confidential.

(1) Includes exported clinker. (2) Production values for bentonite and diatomite have been included in clay products. (3) Shipments of gypsum, silica, stone, and sand and gravel to Canadian cement, lime and clay plants, and shipments of potash to Canadian potassium sulphate plants are not included in this table.

Notes: Numbers may not add to totals due to rounding. Confidential values are included in totals. This table excludes petroleum and natural gas.

TABLE 2. CANADA, VALUE OF MINERAL PRODUCTION, PER CAPITA VALUE OF MINERAL PRODUCTION, AND POPULATION, 1973-2006 (1)

Year	Value of Mineral Production				Per Capita Value of Mineral Production	Population of Canada
	Metals	Nonmetals (Including Structural Materials)	Coal	Total		
	(\$ millions)				(\$)	(000)
1973	3 947	1 292	180	5 419	241	22 492
1974	4 934	1 731	303	6 968	306	22 808
1975	5 022	1 899	586	7 507	324	23 143
1976	5 344	2 269	607	8 220	351	23 450
1977	6 031	2 612	610	9 253	390	23 726
1978	5 746	2 989	779	9 514	397	23 963
1979	8 006	3 516	860	12 382	512	24 202
1980	9 777	4 154	932	14 863	606	24 516
1981	8 841	4 491	1 073	14 405	580	24 820
1982	6 953	3 841	1 294	12 088	481	25 117
1983	7 528	3 857	1 304	12 689	500	25 367
1984	8 897	4 493	1 795	15 185	593	25 608
1985	8 745	4 864	1 845	15 454	598	25 843
1986	8 819	4 864	1 726	15 409	590	26 101
1987	10 962	5 125	1 641	17 728	670	26 449
1988	13 608	5 574	1 804	20 986	783	26 795
1989	13 982	5 566	1 907	21 455	786	27 282
1990	12 500	5 289	1 824	19 613	708	27 698
1991	10 462	4 783	1 917	17 162	612	28 031
1992	10 210	4 473	1 669	16 352	576	28 367
1993	8 871	4 459	1 768	15 098	526	28 682
1994	9 750	5 193	1 812	16 755	578	28 999
1995	12 173	5 436	1 835	19 444	664	29 302
1996	11 697	5 408	1 936	19 041	643	29 611
1997	11 549	5 912	1 920	19 381	648	29 907
1998	10 429	6 527	1 765	18 721	621	30 157
1999	9 704	7 333	1 474	18 511	609	30 404
2000	10 980	7 428	1 427	19 835	646	30 689
2001	10 359	7 621	1 557	19 537	630	31 021
2002	10 379	7 939	1 601	19 919	635	31 373
2003	9 670	8 915	1 492	20 077	634	(r) 31 676
2004	12 362	10 344	1 596	24 302	760	(r) 31 989
2005	14 583	10 485	2 329	27 397	848	32 299
2006 (p)	21 199	10 199	2 205	33 603	1 030	32 623

Sources: Natural Resources Canada, Statistics Canada.

(p): Preliminary; (r) Revised.

(1) This table has been revised to exclude the production of petroleum and natural gas.

Note: Numbers may not add to totals due to rounding.

TABLE 3. CANADA, VALUE OF MINERAL PRODUCTION BY PROVINCE, TERRITORY AND MINERAL CLASS, 2006 (p,1)

Province/Territory	Metals		Nonmetals		Coal		Total	
	(\$000)	(% of total)	(\$000)	(% of total)	(\$000)	(% of total)	(\$000)	(% of total)
Newfoundland and Labrador	3 075 404	14.5	46 511	0.5	—	—	3 121 914	9.3
Prince Edward Island	—	—	3 905	...	—	—	3 905	...
Nova Scotia	—	—	x	x	x	x	309 062	0.9
New Brunswick	1 185 271	5.6	x	x	x	x	1 485 208	4.4
Quebec	3 213 429	15.2	1 515 059	14.9	—	—	4 728 488	14.1
Ontario	6 898 764	32.5	2 492 160	24.4	—	—	9 390 925	27.9
Manitoba	1 958 971	9.2	127 138	1.2	—	—	2 086 109	6.2
Saskatchewan	1 474 990	7.0	x	x	x	x	3 834 083	11.4
Alberta	1 304	0.0	x	x	x	x	1 321 908	3.9
British Columbia	3 297 812	15.6	672 674	6.6	1 649 947	74.8	5 620 433	16.7
Yukon	37 663	0.2	5 442	0.1	—	—	43 105	0.1
Northwest Territories	55 660	0.3	1 573 337	15.4	—	—	1 628 996	4.8
Nunavut	—	—	29 201	0.3	—	—	29 201	0.1
Total	21 199 267	100	10 198 966	100	2 205 105	100	33 603 339	100

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Amount too small to be expressed; (p) Preliminary; x Confidential.

(1) This table has been revised to exclude the production of petroleum and natural gas.

Note: Numbers may not add to totals due to rounding.

TABLE 4. CANADA, VALUE OF MINERAL PRODUCTION BY PROVINCE AND TERRITORY, (1) 1997-2006

Province/Territory	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 (p)
	(\$ millions)									
Ontario	5 536	4 978	5 120	5 711	5 635	5 937	5 690	7 123	7 438	9 391
British Columbia	3 047	2 893	2 445	2 891	2 867	2 864	2 914	3 674	4 925	5 620
Quebec	3 437	3 560	3 657	3 653	3 604	3 742	3 563	4 012	3 914	4 728
Saskatchewan	2 214	2 426	2 319	2 283	2 457	x	2 277	3 038	3 794	3 834
Newfoundland and Labrador	1 008	1 095	820	967	863	873	845	770	1 745	3 122
Manitoba	1 021	893	811	1 069	885	850	892	1 210	1 249	2 086
Northwest Territories	549	401	653	682	779	874	1 667	2 112	(2) 1 790	(2) 1 629
New Brunswick	953	863	851	773	807	653	702	779	907	1 485
Alberta	1 032	1 154	1 092	1 064	990	1 053	1 191	1 197	1 284	1 322
Nova Scotia	378	335	326	295	285	x	263	286	305	309
Yukon	204	117	61	56	41	43	34	62	39	43
Nunavut	—	—	349	385	321	272	35	35	(2) 4	(2) 29
Prince Edward Island	3	6	7	5	4	5	4	3	4	4
Total	19 382	18 721	18 511	19 835	19 537	19 918	20 077	24 303	27 397	33 603

Sources: Natural Resources Canada; Statistics Canada.

— Nil; (p) Preliminary; x Confidential

(1) This table has been revised to exclude the production of petroleum and natural gas. (2) Mineral production of sand and gravel for Nunavut is included in the Northwest Territories.

Note: Numbers may not add to totals due to rounding.

TABLE 5. CANADA'S WORLD ROLE AS A PRODUCER OF CERTAIN IMPORTANT MINERALS, 2006

			Rank of Five Leading Countries				
World			1	2	3	4	5
Uranium (metal content) (mine production)	t	39 512	Canada	Australia	Kazakhstan	Niger	Russia
			9 862	7 606	5 279	3 434	3 262
	% of world total		25.0	19.2	13.4	8.7	8.3
Potash (K ₂ O equivalent) (mine production)	000 t	30 000	Canada	Russia	Belarus	Germany	Israel
			10 200	5 300	4 000	3 660	2 100
	% of world total		34.0	17.7	13.3	12.2	7.0
Nickel (mine production)	000 t	1 494	Russia	Canada	Australia	Indonesia	New Caledonia
			300	234	185	150	103
	% of world total		20.1	15.6	12.4	10.0	6.9
Cobalt (mine production)	t	60 748	Congo, D.R.	Australia	Canada	Russia	Zambia
			22 000	7 000	6 976	4 759	4 556
	% of world total		36.2	11.5	11.5	7.8	7.5
Magnesium (metal)	000 t	803	China	U.S.A.	Canada	Russia	Israel
			526	113	65	35	25
	% of world total		65.5	14.1	8.1	4.4	3.1
Titanium concentrate (ilmenite)	000 t	5 000	Australia	South Africa	Canada	China	Norway
			1 210	893	780	475	381
	% of world total		24.2	17.9	15.6	9.5	7.6
Platinum group metals (metal content)	kg	512 993	South Africa	Russia	Canada	U.S.A.	Zimbabwe
			307 000	143 000	22 878	18 693	10 000
	% of world total		59.8	27.9	4.5	3.6	1.9
Aluminum (primary metal)	000 t	33 945	China	Russia	Canada	U.S.A.	Australia
			9 349	3 718	3 051	2 283	1 932
	% of world total		27.5	11.0	9.0	6.7	5.7
Gypsum (mine production)	000 t	119 000	U.S.A.	Iran	Spain	Canada	Mexico/China
			21 200	13 000	11 500	9 450	7 400
	% of world total		17.8	10.9	9.7	7.9	6.2
Chrysotile (asbestos) (mine production)	000 t	2 300	Russia	China	Kazakhstan	Canada	Brazil
			925	400	350	240	236
	% of world total		40.2	17.4	15.2	10.4	10.3
Cadmium (metal)	t	21 162	China	South Korea	Japan	Canada	Kazakhstan
			4 600	3 320	2 286	2 094	2 000
	% of world total		21.7	15.7	10.8	9.9	9.5
Zinc (mine production)	000 t	10 694	China	Australia	Peru	U.S.A.	Canada
			2 996	1 362	1 202	727	638
	% of world total		28.0	12.7	11.2	6.8	6.0
Molybdenum (Mo content) (mine production)	t	178 342	U.S.A.	China	Chile	Peru	Canada
			60 500	41 000	38 700	17 500	7 842
	% of world total		33.9	23.0	21.7	9.8	4.4
Salt (mine production)	000 t	240 000	China	U.S.A.	Germany	India	Canada
			48 000	46 000	18 600	16 000	15 000
	% of world total		20.0	19.2	7.8	6.7	6.3
Lead (mine production) (1)	000 t	3 543	China	Australia	U.S.A.	Peru	Mexico
			1 251	686	453	313	134
	% of world total		35.3	19.4	12.8	8.8	3.8
Gold (mine production) (2)	t	2 344	South Africa	China	Australia	U.S.A.	Peru
			272	247	247	242	203
	% of world total		11.6	10.5	10.5	10.3	8.7
Silver (3)	t	19 961	Peru	Mexico	China	Australia	Chile
			3 471	2 700	2 600	1 727	1 607
	% of world total		17.4	13.5	13.0	8.7	8.1
Copper (mine production) (4)	000 t	15 064	Chile	U.S.A.	Peru	China	Australia
			5 361	1 220	1 050	915	875
	% of world total		35.6	8.1	7.0	6.1	5.8

Sources: Natural Resources Canada, from *World Nonferrous Statistics* and the *Canadian Minerals Yearbook*; U.S. Geological Survey (USGS).

(1) Canada ranked sixth. (2) Canada ranked seventh. (3) Canada ranked ninth. (4) Canada ranked eighth.

TABLE 6. CANADA, GROSS DOMESTIC PRODUCT OF INDUSTRIAL PRODUCTION, MINING AND MINERAL MANUFACTURING AT BASIC PRICES IN CHAINED (1997) DOLLARS, 1999-2006 (1)

	1999	2000	2001	2002	2003	2004	2005	2006
	(\$ millions)							
Total industrial production (2)	223 124	239 944	231 440	236 342	236 840	241 141	243 485	242 148
Total mining and oil and gas extraction (3)	34 457	35 504	35 309	36 861	38 004	38 789	38 865	39 612
METALS								
Iron ore mining	562	770	525	519	653	586	646	667
Gold and silver ore mining	1 301	1 258	1 325	1 198	1 128	1 035	923	791
Copper, nickel, lead and zinc mining	2 735	2 690	2 658	2 399	2 213	2 368	2 335	2 633
Other metal ore mining	503	819	700	994	860	852	911	679
MINERAL FUELS								
Oil and gas extraction	22 058	22 014	21 629	23 231	23 633	23 977	23 786	24 489
NONMETALS								
Miscellaneous nonmetals (including asbestos) mining	767	628	893	1 093	2 029	2 293	2 216	2 282
Potash mining	992	1 015	893	909	971	1 077	1 120	928
Salt mining	210	218	236	210	230	230	227	222
Coal mining	1 166	1 235	1 377	1 102	838	921	913	817
Quarries and sand pits	892	944	1 016	975	973	991	991	1 092
SUPPORT ACTIVITIES FOR MINING AND OIL AND GAS EXTRACTION								
	3 345	4 404	4 814	4 552	5 197	5 430	6 067	5 901
MINERAL MANUFACTURING								
Primary metals	10 681	11 591	11 357	11 809	11 438	11 596	11 977	11 960
Nonmetallic mineral products	4 152	4 566	4 772	4 869	5 120	5 145	5 149	5 159
Fabricated metal products	10 608	13 160	12 727	13 031	12 820	12 801	12 948	13 009
Petroleum and coal products	1 737	1 741	1 950	1 981	2 002	2 044	1 987	1 999

Source: Statistics Canada, *Gross Domestic Product by Industry*, catalogue no. 15-001-XIE, June 2007.

(1) This table was revised this year back to 2002. (2) Includes mining and oil and gas extraction, manufacturing, and utilities. (3) Includes metal mining, nonmetal mining (including coal mining), quarries and sand pits, oil and gas extraction, and support activities for mining and oil and gas extraction.

TABLE 7. CANADA, GROSS DOMESTIC PRODUCT BY INDUSTRY AT BASIC PRICES IN CHAINED (1997) DOLLARS, 1999-2006

	1999	2000	2001	2002	2003	2004	2005	2006
	(\$ millions)							
Gross domestic product, all industries	896 069	943 738	957 258	982 843	1 002 936	1 034 024	1 062 951	1 091 588
Agriculture	15 204	14 828	12 595	11 298	13 214	14 232	15 034	14 898
Fishing, hunting and trapping	807	832	916	944	967	982	940	962
Forestry and logging	5 845	6 209	6 257	6 497	6 509	7 146	7 135	6 856
Support activities for mining, oil and gas	3 345	4 404	4 814	4 552	5 197	5 430	6 067	5 901
Mining (including milling), quarries and oil and gas extraction	34 457	35 504	35 309	36 861	38 004	38 789	38 865	39 612
Manufacturing	161 634	177 618	170 247	171 800	170 465	173 726	174 987	172 639
Construction	46 433	48 992	52 575	54 689	56 627	60 228	63 689	68 432
Transportation and warehousing	43 666	45 838	47 014	46 911	47 517	49 528	51 241	52 764
Information and cultural industries	33 507	36 040	38 679	40 514	41 244	41 790	43 383	44 352
Electric power, gas and water utilities	26 626	26 688	25 158	26 535	26 629	26 806	27 948	27 506
Trade, wholesale	50 401	53 587	54 525	56 349	58 603	61 721	65 997	70 408
Trade, retail	46 941	49 924	52 445	55 530	57 301	59 454	62 219	65 442
Finance and insurance	53 234	55 936	57 610	58 369	59 249	62 456	64 745	68 021
Real estate and rental and leasing	114 576	118 365	123 106	127 600	130 879	135 609	140 544	145 203
Community, business and personal services	203 404	212 391	217 640	223 580	228 319	233 331	237 937	244 731
Public administration	51 652	52 831	54 414	56 071	57 541	58 677	59 462	61 055

Source: Statistics Canada, CANSIM Table 379-0017 and catalogue no. 15-001-XIE.

TABLE 8. CANADA, STAGES 1 TO 4, DOMESTIC EXPORTS OF MINERALS AND MINERAL PRODUCTS BY COMMODITY, 2004-06

2004-06							
	Unit of Measure	2004		2005		2006	
		(000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)
(000)							
(quantity)							
METALS							
Aluminum	..	..	8 843 711	..	(r) 9 591 637	..	12 251 288
Antimony	kg	87	1 043	112	1 512	215	1 375
Bismuth	kg	338	3 134	210	1 187	50	478
Cadmium	kg	1 998	3 862	2 492	5 629	2 355	7 340
Calcium	kg	523	2 110	1 442	2 548	1 330	2 668
Chromium	kg	3 685	17 116	2 991	14 030	2 733	13 290
Cobalt	kg	8 036	456 367	7 598	312 285	7 694	281 235
Copper	..	..	2 973 432	..	(r) 3 886 930	..	6 275 866
Gold	..	..	3 545 842	..	4 340 644	..	5 579 069
Iron and steel	..	..	12 157 551	..	(r) 13 106 732	..	13 514 464
Iron ore	t	22 549	930 326	27 304	1 592 076	27 569	1 896 084
Lead	..	..	285 174	..	302 611	..	392 022
Magnesium and magnesium compounds	kg	127 058	184 085	102 045	183 301	70 483	141 380
Molybdenum	kg	22 788	343 078	14 097	656 226	11 695	477 644
Nickel	..	..	4 343 529	..	4 093 549	..	5 806 535
Platinum group metals	g	..	76 758	..	(r) 87 090	..	184 146
Silver	..	..	467 924	..	503 447	..	752 783
Tin	..	..	15 856	..	13 449	..	17 904
Titanium	kg	85 638	26 289	68 906	41 948	93 051	61 527
Uranium and thorium	..	..	896 033	..	(r) 1 676 020	..	1 780 949
Zinc	kg	967 378	1 222 411	841 761	(r) 1 249 904	854 509	2 309 972
Other metals	..	..	5 190 605	..	(r) 5 287 258	..	5 573 156
Total metals	..	..	41 986 236	..	(r) 46 950 013	..	57 321 175
NONMETALS							
Barite and witherite	t	1	1 165	...	125	...	31
Cement	..	..	770 722	..	754 038	..	737 583
Chrysotile (asbestos)	..	..	166 694	..	123 380	..	112 381
Clay and clay products	..	..	69 577	..	(r) 67 318	..	66 089
Diamonds	..	..	2 023 159	..	(r) 1 759 494	..	1 671 824
Graphite	..	..	88 714	..	107 152	..	117 968
Gypsum	..	..	203 207	..	222 984	..	252 695
Lime	kg	136 705	22 140	199 928	26 912	201 347	28 542
Mica	t	21	11 199	24	11 828	22	11 083
Nepheline syenite	t	476	61 589	445	65 793	534	63 310
Peat	..	..	255 012	..	(r) 285 603	..	297 961
Potash and potassium compounds	kg	15 754 478	2 179 800	15 824 469	2 768 402	13 617 210	2 435 904
Salt and sodium compounds	t	5 287	533 905	5 015	548 850	5 145	518 111
Sand and gravel	t	5 633	51 316	6 173	(r) 55 137	6 593	62 148
Silica and silica compounds	..	..	37 846	..	(r) 48 253	..	53 006
Stone	..	..	161 739	..	(r) 148 621	..	116 730
Sulphur and sulphur compounds	t	5 935	456 886	9 333	683 942	9 247	571 315
Talc, soapstone and pyrophyllite	t	67	26 139	56	22 354	85	22 947
Titanium oxides	kg	76 011	167 417	105 100	205 828	88 610	195 963
Other nonmetals	..	..	3 580 172	..	(r) 3 790 166	..	3 833 339
Total nonmetals	..	..	10 868 398	..	(r) 11 696 180	..	11 168 930
FUELS							
Coal and coke	t	26 160	1 902 972	28 626	3 433 557	27 983	3 431 510
Natural gas	000 m ³	103 518	27 040 437	106 045	(r) 35 911 993	102 040	27 803 110
Natural gas by-products	000 m ³	9	2 148 879	9	2 377 822	8	2 307 784
Petroleum	..	..	37 428 713	..	(r) 44 685 278	..	53 648 263
Other fuels	kg	324 821	436 567	340 614	428 549	340 264	461 122
Total fuels	..	..	68 957 568	..	(r) 86 837 199	..	87 651 789
Total mining domestic exports (including fuels)	..	..	121 812 202	..	(r) 145 483 392	..	156 141 894
Total economy domestic exports	..	..	385 087 320	..	(r) 408 420 561	..	411 304 964

Sources: Natural Resources Canada; Statistics Canada.

.. Not available or not applicable; ... Amount too small to be expressed; (r) Revised.

Notes: Numbers may not add due to rounding. Trade data are based on Statistics Canada revisions dated September 13, 2007.

TABLE 9. CANADA, STAGES 1 TO 4, IMPORTS OF MINERALS AND MINERAL PRODUCTS BY COMMODITY, 2004-06

	Unit of Measure	2004	2005 (r)	2006
	(000)	(quantity)	(quantity)	(quantity)
		(\$000)	(\$000)	(\$000)
METALS				
Aluminum	..	5 002 957	5 415 166	6 203 455
Antimony	kg	11 187	11 689	13 327
Bismuth	kg	1 964	1 634	1 754
Cadmium	kg	1 676	1 735	1 727
Calcium	kg	149 740	51 988	52 425
Chromium	kg	55 853	63 732	52 900
Cobalt	kg	2 750	54 186	42 205
Copper	..	2 315 829	2 808 035	4 042 987
Gold	..	1 910 654	2 800 531	3 844 944
Iron and steel	..	18 317 991	20 542 073	21 534 585
Iron ore	t	7 924	660 627	669 442
Lead	..	384 739	405 530	411 254
Magnesium and magnesium compounds	kg	391 841	183 848	163 445
Molybdenum	kg	7 492	279 399	224 205
Nickel	..	707 889	695 270	568 760
Platinum group metals	g	2 691 337	322 730	375 804
Silver	..	364 359	276 713	430 751
Tin	..	64 903	58 936	64 766
Titanium	kg	6 194	133 772	154 442
Uranium and thorium	..	294 648	409 942	454 478
Zinc	..	321 598	308 235	774 142
Other metals	..	11 853 582	11 692 980	12 069 647
Total metals	..	42 866 437	47 178 751	52 151 445
NONMETALS				
Barite and witherite	t	85	14 241	18 787
Cement	..	254 825	279 968	281 552
Chrysotile (asbestos)	..	116 592	111 666	111 398
Clay and clay products	..	1 149 054	1 143 860	1 139 282
Diamonds	..	528 991	480 684	663 931
Graphite	..	403 545	348 056	400 398
Gypsum	..	89 904	90 100	94 342
Lime	kg	71 206	11 406	10 849
Mica	t	6	11 551	9 489
Nepheline syenite	t	..	26	41
Peat	..	2 420	3 970	4 715
Potash and potassium compounds	kg	108 976	45 271	48 028
Salt and sodium compounds	t	3 216	336 130	366 561
Sand and gravel	t	2 270	16 152	16 780
Silica and silica compounds	..	156 536	150 374	154 179
Stone	..	221 616	248 616	283 768
Sulphur and sulphur compounds	t	237	23 953	20 865
Talc, soapstone and pyrophyllite	t	161	17 932	17 447
Titanium oxides	kg	112 595	267 800	247 852
Other nonmetals	..	4 581 120	4 397 964	4 445 661
Total nonmetals	..	8 175 271	7 999 720	8 335 925
FUELS				
Coal and coke	t	20 186	1 535 819	1 523 708
Natural gas	000m ³	10 386	3 583 043	2 354 729
Natural gas by-products	000m ³	1	119 890	170 596
Petroleum	..	21 427 186	29 929 636	32 659 186
Other fuels	..	554 261	577 401	587 342
Total fuels	..	26 004 854	35 745 789	37 295 561
Total mining imports (including fuels)	..	77 046 562	90 924 260	97 782 931
Total economy imports	..	356 055 522	380 809 644	396 626 094

Sources: Natural Resources Canada; Statistics Canada.

.. Not available or not applicable; ... Amount too small to be expressed; (r) Revised.

Notes: Numbers may not add to totals due to rounding. Trade data are based on Statistics Canada revisions dated September 13, 2007.

TABLE 10. CANADA, STAGES 1 TO 4, VALUE OF MINERALS AND MINERAL PRODUCTS, DOMESTIC EXPORTS BY COMMODITY, BY DESTINATION, 2006

	United States	EU	Japan	Mexico	Other	Total
	(\$000)					
METALS						
Aluminum	10 721 969	443 913	483 673	101 324	500 409	12 251 288
Antimony	1 203	140	—	—	32	1 375
Bismuth	120	1	—	—	357	478
Cadmium	654	3 247	1 423	—	2 016	7 340
Calcium	234	1 399	185	...	850	2 668
Chromium	13 281	3	—	—	6	13 290
Cobalt	40 670	63 238	70 551	1	106 775	281 235
Copper	3 915 271	191 044	857 404	5 242	1 306 905	6 275 866
Gold	2 202 049	3 094 479	42 633	674	239 234	5 579 069
Iron and steel	12 080 991	296 326	35 066	349 723	752 358	13 514 464
Iron ore	411 870	778 272	82 479	5 174	618 289	1 896 084
Lead	353 312	25 059	320	5 703	7 628	392 022
Magnesium and magnesium compounds	128 968	7 124	4 582	...	706	141 380
Molybdenum	198 720	86 680	148 396	40 695	3 153	477 644
Nickel	1 425 559	1 204 706	253 042	738	2 922 490	5 806 535
Platinum group metals	91 791	89 832	248	92	2 183	184 146
Silver	649 517	38 028	48 600	9	16 629	752 783
Tin	16 991	51	453	2	407	17 904
Titanium	53 971	911	13	21	6 611	61 527
Uranium and thorium	681 779	951 644	55 448	2 033	90 045	1 780 949
Zinc	1 803 409	190 913	36 773	194	278 683	2 309 972
Other metals	4 311 553	765 474	35 173	30 388	430 568	5 573 156
Total Metals	39 103 882	8 232 484	2 156 462	542 013	7 286 334	57 321 175
NONMETALS						
Barite and witherite	17	—	—	—	14	31
Calcium (industrial minerals)	—	—	—	—	—	—
Cement	707 199	4 579	729	115	24 961	737 583
Chrysotile (asbestos)	164 281	186	1	...	218	164 686
Clay and clay products	25 188	117	125	4 613	82 338	112 381
Diamonds	38 017	21 639	390	329	5 714	66 089
Graphite	80 802	1 555 426	5	—	35 591	1 671 824
Gypsum	95 729	7 898	253	517	13 571	117 968
Lime	245 943	2 666	59	5	4 022	252 695
Mica	28 470	—	—	—	72	28 542
Nepheline syenite	6 719	705	2 431	65	1 163	11 083
Peat	52 119	7 128	996	—	3 067	63 310
Perlite	263 278	1 412	13 599	940	18 732	297 961
Potash and potassium compounds	1 413 819	35 795	5 393	13 036	967 861	2 435 904
Salt and sodium compounds	467 177	592	24 557	2	25 783	518 111
Sand and gravel	58 613	153	—	—	3 382	62 148
Silica and silica compounds	48 283	1 595	135	824	2 169	53 006
Stone	90 476	13 523	605	—	12 126	116 730
Sulphur and sulphur compounds	159 439	49	1	3 251	408 575	571 315
Talc, soapstone and pyrophyllite	22 910	3	—	—	34	22 947
Titanium oxides	193 003	1 273	11	—	1 676	195 963
Other nonmetals	3 414 542	104 542	16 105	8 017	125 447	3 668 653
Total nonmetals	7 576 024	1 759 281	65 395	31 714	1 736 516	11 168 930
FUELS						
Coal and coke	416 253	822 864	990 932	33 038	1 168 423	3 431 510
Natural gas	27 803 081	18	—	—	11	27 803 110
Natural gas by-products	2 307 591	170	—	—	23	2 307 784
Petroleum	52 821 187	421 139	23 108	29 213	353 616	53 648 263
Other fuels	356 996	30 493	25 240	2 418	45 975	461 122
Total fuels	83 705 108	1 274 684	1 039 280	64 669	1 568 048	87 651 789
Total mining domestic exports	130 385 014	11 266 449	3 261 137	638 397	10 590 898	156 141 894

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Amount too small to be expressed.

Notes: Numbers may not add to totals due to rounding. Trade data are based on Statistics Canada revisions dated September 13, 2007.

TABLE 11. CANADA, STAGES 1 TO 4, VALUE OF MINERALS AND MINERAL PRODUCTS, IMPORTS BY COMMODITY, BY ORIGIN, 2006

	United States	EU	Japan	Mexico	Other	Total
	(\$000)					
METALS						
Aluminum	3 846 394	285 324	14 383	15 621	2 041 733	6 203 455
Antimony	1 714	595	21	3 514	7 483	13 327
Bismuth	1 043	457	—	—	254	1 754
Cadmium	869	348	...	4	506	1 727
Calcium	45 596	2 809	111	...	3 909	52 425
Chromium	11 710	7 083	70	1 136	32 901	52 900
Cobalt	19 973	4 432	4 189	—	13 611	42 205
Copper	2 037 581	188 951	23 278	56 057	1 737 120	4 042 987
Gold	1 341 578	65 718	119	67 508	2 370 021	3 844 944
Iron and steel	12 892 810	2 436 014	632 503	536 287	5 036 971	21 534 585
Iron ore	668 514	415	1	...	512	669 442
Lead	299 756	31 206	6 079	23 910	50 303	411 254
Magnesium and magnesium compounds	46 683	11 815	1 696	2 750	100 501	163 445
Molybdenum	191 991	934	35	5 627	25 618	224 205
Nickel	225 072	109 055	6 601	554	227 478	568 760
Platinum group metals	174 781	49 147	2 593	—	149 283	375 804
Silver	227 324	25 639	575	41 643	135 570	430 751
Tin	17 208	2 204	309	437	44 608	64 766
Titanium	106 096	14 754	2 477	70	31 045	154 442
Uranium and thorium	85 066	30 149	105	—	339 158	454 478
Zinc	508 658	17 981	192	37 111	210 200	774 142
Other metals	6 877 940	1 259 116	268 477	1 057 976	2 606 138	12 069 647
Total metals	29 628 357	4 544 146	963 814	1 850 205	15 164 923	52 151 445
NONMETALS						
Barite and witherite	7 428	168	—	—	11 191	18 787
Cement	235 741	11 099	642	3 013	31 057	281 552
Chrysotile (asbestos)	84 146	2 636	4 577	2 342	17 697	111 398
Clay and clay products	413 228	239 730	22 625	43 621	420 078	1 139 282
Diamonds	104 265	99 654	34	71	459 907	663 931
Graphite	225 037	73 463	34 023	1 832	66 043	400 398
Gypsum	90 250	1 201	7	2 209	675	94 342
Lime	10 563	247	—	—	39	10 849
Mica	6 568	1 643	447	3	828	9 489
Nepheline syenite	37	—	—	—	4	41
Peat	2 827	591	—	5	1 292	4 715
Potash and potassium compounds	35 905	6 033	91	361	5 638	48 028
Salt and sodium compounds	299 071	18 538	5 090	6 988	36 874	366 561
Sand and gravel	15 981	75	1	24	699	16 780
Silica and silica compounds	114 067	17 538	2 353	192	20 029	154 179
Stone	56 376	63 813	1	1 672	161 906	283 768
Sulphur and sulphur compounds	20 143	429	25	—	268	20 865
Talc, soapstone and pyrophyllite	15 838	594	79	—	936	17 447
Titanium oxides	166 806	27 947	1 793	20 404	30 902	247 852
Other nonmetals	3 113 675	457 612	76 181	116 317	681 876	4 445 661
Total nonmetals	5 017 952	1 023 011	147 969	199 054	1 947 939	8 335 925
FUELS						
Coal and coke	1 250 237	3 569	264	40	269 598	1 523 708
Natural gas	2 337 796	5	9	...	16 919	2 354 729
Natural gas by-products	169 169	186	6	2	1 233	170 596
Petroleum	5 997 075	7 598 528	84 353	1 002 238	17 976 992	32 659 186
Other fuels	523 177	36 381	2 198	657	24 929	587 342
Total fuels	10 277 454	7 638 669	86 830	1 002 937	18 289 671	37 295 561
Total mining imports	44 923 763	13 205 826	1 198 614	3 052 196	35 402 533	97 782 931

Sources: Natural Resources Canada; Statistics Canada.

— Nil; ... Amount too small to be expressed.

Notes: Numbers may not add to totals due to rounding. Trade data are based on Statistics Canada revisions dated September 13, 2007.

TABLE 12. CANADA, REPORTED USE OF MINERALS AND RELATION TO PRODUCTION, 2003-05

Unit of Measure	2003			Use as a Percentage of Production	2004			Use as a Percentage of Production	2005			Use as a Percentage of Production
	Use	Production			Use	Production			Use	Production		
				(%)				(%)				(%)
METALS												
Aluminum (1)	t	1 010 089	2 791 915	36.2	1 059 038	2 592 160	(r) 40.9	1 099 499	2 894 204	38.0		
Antimony	kg	557 905	128 641	433.7	534 980	88 483	604.6	576 972	66 116	872.7		
Bismuth	kg	17 405	137 573	12.7	42 130	179 786	23.4	51 182	141 308	36.2		
Cadmium	kg	209 925	715 791	29.3	210 101	739 633	28.4	203 413	633 586	32.1		
Chromium (chromite)	t	x	—	x	x	—	x	x	—	x		
Cobalt	kg	88 367	1 841 586	4.8	95 394	2 084 895	(r) 4.6	89 941	2 391 388	3.8		
Copper (2)	t	257 326	540 998	47.6	297 184	544 558	(r) 54.6	289 721	577 304	50.2		
Lead (3)	t	68 359	92 934	73.6	71 738	72 773	98.6	68 066	72 828	93.5		
Magnesium	t	56 175	x	x	56 843	x	x	50 045	x	x		
Manganese ore	t	25 909	—	..	21 963	—	..	22 290	—	..		
Mercury	kg	4 865	—	x	x	—	x	4 180	—	..		
Molybdenum (Mo content)	t	2 331	8 887	26.2	2 410	9 946	(r) 24.2	2 014	7 667	26.3		
Nickel	t	13 010	155 475	8.4	9 491	177 281	(r) 5.4	9 251	192 855	4.8		
Selenium	kg	10 798	288 064	3.7	x	271 073	x	x	107 350	x		
Silver	kg	280 843	1 281 887	21.9	344 885	1 294 541	26.6	549 265	1 063 257	51.7		
Tellurium	kg	x	45 202	x	x	54 582	x	-	10 982	—		
Tin	t	2 245	—	..	2 891	—	..	3 629	—	—		
Tungsten (W content)	kg	x	3 635 630	x	x	—	x	x	484 170	x		
Zinc (3)	t	145 596	757 307	19.2	152 175	734 035	20.7	149 801	618 844	24.2		
NONMETALS												
Barite	t	28 820	27 369	105.3	55 531	20 601	269.5	23 748	23 179	102.5		
Feldspar	t	638	—	..	584	—	..	523	—	..		
Fluorspar	t	177 719	—	..	194 065	—	(r) ..	194 827	—	..		
Mica	t	3 708	x	x	3 455	x	(r) x	3 495	x	x		
Nepheline syenite	t	65 559	703 426	9.3	55 790	713 856	7.8	57 348	745 078	7.7		
Phosphate rock	t	x	x	x	x	x	x	x	x	x		
Potash (K ₂ O equivalent)	t	189 116	9 229 428	2.0	179 223	10 331 656	1.7	188 447	10 139 718	1.9		
Sodium sulphate	t	114 687	x	x	117 060	x	x	106 662	x	x		
Sulphur	t	(r) 831 839	8 505 391	9.8	918 034	8 512 213	(r) 10.8	837 977	8 409 682	10.0		
Talc, etc.	t	77 806	81 999	94.9	62 228	81 069	(r) 76.8	52 519	70 337	74.7		

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; (r) Revised; x Confidential.

(1) Use of primary and recycled aluminum and alloys, and scrap, reported by users. (2) "Use" is defined as domestic shipments of refined copper plus imports of refined copper. (3) Use of primary and recycled refined metal.

Notes: Unless otherwise stated, "use" refers to the reported use of refined metals or nonmetallic minerals by users. Production of metals, in most cases, refers to production in all forms and includes the recoverable content of ores, concentrates, matte, etc., and the metal content of primary products recoverable at domestic smelters and refineries. Production of nonmetals refers to producers' shipments.

TABLE 13. CANADA, DOMESTIC USE OF PRINCIPAL REFINED METALS IN RELATION TO REFINERY PRODUCTION, (1) 1996-2005

	Unit of Measure	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
ALUMINUM											
Domestic use (2)	t	676 935	764 438	889 973	999 242	1 016 506	964 609	1 019 713	1 010 089	(r) 1 059 038	1 099 499
Production	t	2 283 212	2 327 188	2 374 118	2 389 834	2 373 460	2 582 746	2 708 910	2 791 915	2 592 160	2 894 204
Use as a percentage of production		29.6	32.8	37.5	41.8	42.8	37.3	37.6	36.2	40.9	38.0
COPPER											
Domestic use (3)	t	218 280	224 777	246 212	266 505	272 075	265 209	274 132	(r) 257 338	(r) 297 184	289 721
Production	t	559 200	560 582	562 261	548 563	551 393	567 720	494 522	454 866	526 955	515 223
Use as a percentage of production		39.0	40.1	43.8	48.6	49.3	46.7	55.4	56.6	56.4	56.2
LEAD											
Domestic use (4)	t	93 373	92 997	87 466	92 557	81 365	56 956	66 575	68 359	71 738	68 066
Production (5)	t	310 791	271 395	265 487	266 415	284 333	230 928	251 560	223 434	241 169	230 237
Use as a percentage of production		30.0	34.3	32.9	34.7	28.6	24.7	26.5	30.6	29.7	29.6
ZINC											
Domestic use (4)	t	134 787	133 553	138 424	143 188	147 913	144 590	149 908	145 596	152 175	149 801
Production	t	716 467	703 798	745 131	776 927	779 892	661 172	793 410	761 199	805 438	724 035
Use as a percentage of production		18.8	19.0	18.6	18.4	19.0	21.9	18.9	19.1	18.9	20.7

Source: Natural Resources Canada.

(r) Revised.

(1) Production of refined metal from all sources, including metal derived from recycled materials at primary refineries. (2) Use of primary and recycled aluminum and alloys, and scrap, reported by users. (3) "Use" is defined as domestic shipments of refined copper plus imports of refined copper. (4) Use of primary and recycled refined metal, reported by users. (5) Production of primary and recycled refined lead.

TABLE 14. AVERAGE ANNUAL PRICES OF SELECTED METALS, (1) 1996-2006

	Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Aluminum, London Metal Exchange	¢/lb	68.296	72.544	61.574	61.738	70.267	66.458	61.231	64.922	77.816	86.097	116.547
Antimony, New York dealer	\$/lb	1.466	0.996	0.718	0.627	0.655	0.649	0.883	1.072	1.303	1.605	2.380
Bismuth, New York dealer	\$/lb	3.546	3.275	3.408	3.378	3.539	3.613	2.872	2.768	3.225	3.771	4.768
Cadmium, New York dealer	\$/lb	1.238	0.513	0.286	0.177	0.164	0.223	0.292	0.587	0.546	1.497	1.353
Copper, electrolytic cathode, COMEX	¢/lb	105.872	103.580	75.077	72.111	83.971	73.687	71.672	81.050	128.972	168.227	308.935
Gold, London (2)	\$/troy oz	387.696	331.096	294.160	278.825	278.600	269.984	309.970	363.509	409.212	444.882	604.336
Iridium, New York dealer	\$/troy oz	46.188	171.125	392.032	379.938	390.000	389.000	250.438	60.554	145.229	154.521	324.967
Lead, London Metal Exchange, cash	¢/lb	35.019	28.292	23.960	22.778	20.574	21.339	20.516	23.343	40.186	44.270	58.471
Magnesium, U.S. Spot Western Mean	¢/lb	187.236	165.759	159.238	155.229	137.229	125.406	121.281	108.675	148.094	145.973	118.267
Molybdenum, dealer, oxide	\$/lb	3.606	4.175	3.313	2.591	2.498	2.313	3.668	5.210	15.922	31.385	24.378
Nickel, New York dealer, cathode	\$/lb	3.501	3.221	2.179	2.750	3.987	2.825	3.095	4.446	6.341	6.814	10.982
Osmium, New York dealer	\$/troy oz	392.458	391.000	366.867	350.000	350.000	350.800	350.000	350.000	350.000	350.000	350.000
Palladium, London PM fix	\$/troy oz	128.079	177.951	284.678	357.902	681.100	651.676	336.614	200.292	230.525	201.665	320.431
Platinum, London PM fix	\$/troy oz	397.171	395.210	372.019	376.880	544.226	546.169	539.812	691.862	845.207	896.891	1 141.667
Rhodium, New York dealer	\$/troy oz	280.721	268.458	574.771	863.063	1 818.750	1 621.175	775.896	487.188	893.563	1 967.063	4 359.375
Ruthenium, New York dealer	\$/troy oz	34.921	32.896	39.208	34.721	118.275	126.050	57.050	27.851	56.947	68.004	172.629
Selenium, New York dealer	\$/lb	3.423	2.791	2.274	2.278	3.699	3.520	3.933	5.238	22.828	49.279	23.546
Silver, Handy & Harman	\$/troy oz	5.183	4.892	5.534	5.250	5.003	4.414	4.625	4.911	6.690	7.340	11.570
Tantalum, tantalite ore, spot	\$/lb	27.000	27.000	32.783	33.000	62.438	107.800	40.000	36.833	30.479	30.167	27.458
Tin, New York dealer	\$/lb	2.890	2.644	2.613	2.545	2.549	2.156	1.947	2.324	4.094	3.609	4.195
Tungsten, U.S. spot ore	\$/stu	55.000	53.333	44.021	40.000	40.000	53.600	43.000	41.667	41.563	123.188	173.875
Zinc, special high grade	¢/lb	51.109	59.697	46.453	48.805	51.150	45.163	38.643	40.633	52.467	67.139	145.150

Sources: Natural Resources Canada; *Metals Week*.

COMEX Commodities Exchange, Inc.; stu Short ton unit.

(1) Prices, except where noted, are in U.S. currency. (2) Average afternoon fixings of London bullion dealers.

TABLE 15. CANADIAN AVERAGE ANNUAL PRICES OF SELECTED METALS, (1) 1996-2006

	Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Aluminum, London Metal Exchange	\$/kg	2.054	2.215	1.952	2.021	2.301	2.321	2.120	2.006	2.233	2.300	2.914
Antimony, New York dealer	\$/kg	4.408	3.042	2.276	2.053	2.145	2.266	3.057	3.312	3.739	4.286	5.951
Bismuth, New York dealer	\$/kg	10.663	10.000	10.805	11.059	11.588	12.617	9.943	8.552	9.254	10.072	11.922
Cadmium, New York dealer	\$/kg	3.723	1.566	0.907	0.579	0.537	0.779	1.011	1.814	1.567	3.998	3.383
Copper, electrolytic cathode, COMEX	\$/kg	3.184	3.163	2.380	2.361	2.749	2.573	2.481	2.504	3.701	4.494	7.724
Gold, London (2)	\$/g	17.002	14.743	13.601	13.312	13.303	13.749	15.650	16.379	17.123	17.330	22.035
Iridium, New York dealer	\$/g	2.026	7.620	18.126	18.139	18.623	19.811	12.645	2.729	6.077	6.019	11.849
Lead, London Metal Exchange, cash	c/kg	77.204	62.373	52.823	50.217	45.358	47.044	71.029	72.125	115.306	118.249	146.193
Magnesium, U.S. Spot Western Mean	\$/kg	5.804	5.496	5.707	5.893	5.894	4.379	4.199	3.358	4.249	3.899	2.957
Molybdenum, dealer, oxide	\$/kg	10.844	12.748	10.504	8.482	8.179	8.077	12.699	16.098	45.685	83.832	60.952
Nickel, New York dealer, cathode	\$/kg	10.528	9.835	6.908	9.003	13.055	9.865	10.715	13.737	18.194	18.202	27.457
Osmium, New York dealer	\$/g	17.211	17.411	16.962	16.710	16.713	17.865	17.671	15.771	14.645	13.634	12.762
Palladium, London PM fix	\$/g	5.617	7.924	13.162	17.087	35.523	33.188	16.995	9.025	9.646	7.856	11.684
Platinum, London PM fix	\$/g	17.417	17.598	17.201	17.993	25.987	27.815	27.255	31.175	35.367	34.937	41.628
Rhodium, New York dealer	\$/g	12.311	11.954	26.575	41.205	86.846	82.561	39.175	21.952	37.390	76.625	158.952
Ruthenium, New York dealer	\$/g	1.531	1.465	1.813	1.658	5.648	6.419	2.880	1.255	2.383	2.649	6.294
Selenium, New York dealer	\$/kg	10.293	8.522	7.210	7.458	12.112	12.292	13.617	16.184	65.501	131.631	58.871
Silver, Handy & Harman	\$/kg	227.293	217.835	255.870	250.653	238.895	224.791	233.514	221.273	279.938	285.905	421.851
Tantalum, tantalite ore, spot	\$/kg	81.192	82.442	103.937	108.034	204.441	376.450	138.485	113.806	87.454	80.579	68.653
Tin, New York dealer	\$/kg	8.690	8.075	8.284	8.333	8.346	7.529	6.741	7.181	11.747	9.641	10.488
Tungsten, U.S. spot ore	\$/mtu	73.835	72.700	62.307	58.460	58.470	83.561	63.778	57.474	53.240	164.524	217.366
Zinc, special high grade	\$/kg	1.537	1.823	1.473	1.598	1.675	1.577	1.338	1.255	1.505	1.793	3.629

Sources: Natural Resources Canada; *Metals Week*.

COMEX Commodities Exchange, Inc.; mtu Metric tonne unit.

(1) This table is calculated using an average yearly exchange rate, and using the prices from Table 14. (2) Average afternoon fixings of London bullion dealers.

TABLE 16. CANADA, PRINCIPAL STATISTICS OF THE MINERAL INDUSTRY, (1,2) 2005

TABLE 10: CRUDE OIL, FURNACE OIL, AND FUEL OIL: THE MINERAL INDUSTRY, 1997												
NAICS Code	Establish- ments	Mining Activity							Total Activity (3)			
		Production and Related Workers			Costs		Value of Production	Value Added	Employees	Salaries and Wages	Value Added	
		Employees	Person- Hours Paid	Wages	Fuel and Electricity	Materials and Supplies						
	(number)	(number)	(000)	(\$000)	(\$000)	(\$000)	(\$000)	(\$000)	(number)	(\$000)	(\$000)	
BY INDUSTRY												
Metal Ore Mining												
Iron ore	21221	4	2 811	6 173	267 331	243 995	477 537	2 600 145	1 878 613	3 930	353 397	1 873 168
Gold and silver	21222	22	4 622	10 200	373 770	196 177	721 455	2 319 250	1 401 618	6 066	497 495	1 397 100
Lead-zinc	212231	1	x	x	x	x	x	x	x	x	x	x
Nickel-copper	212232	7	x	x	x	x	x	x	x	x	x	x
Copper-zinc	212233	11	3 534	7 597	247 320	144 357	749 894	2 540 044	1 645 793	4 083	296 745	1 646 185
Other metal ore mining (4)	21229	10	1 868	3 927	134 226	97 009	258 836	1 688 534	1 332 689	2 320	171 743	1 328 424
Total		55	17 894	38 814	1 356 514	871 844	3 516 737	14 394 477	10 005 896	23 571	1 862 805	9 996 150
Nonmetallic Mining and Quarrying												
Diamonds	212392	2	763	1 679	73 408	105 049	425 117	1 762 053	1 231 887	1 352	121 428	1 228 781
Salt	212393	10	1 044	2 426	74 342	29 278	62 765	411 715	319 672	1 427	102 339	316 575
Gypsum	212395	8	398	930	19 608	10 231	14 755	112 061	87 074	477	24 301	86 547
Potash	212396	11	3 051	6 479	236 012	229 874	223 034	2 553 360	2 100 452	3 844	310 437	2 103 113
Peat	212397	65	1 178	2 533	36 546	14 850	48 947	276 990	213 193	1 441	46 340	213 565
Stone (5)	21231	189	2 888	6 309	132 577	91 113	247 198	1 048 425	710 113	3 653	173 976	706 933
Sand and gravel	212323	429	3 321	7 753	152 660	96 556	173 749	973 899	703 594	4 478	205 139	747 087
Shale, clay and refractory minerals	212326	9	178	368	8 403	8 295	11 472	75 897	56 129	245	13 142	56 348
Other nonmetallic or mineral mining and quarrying (6)		16	805	1 815	44 060	42 277	54 376	198 112	101 459	1 099	63 592	101 441
Total		739	13 626	30 292	777 615	627 523	1 261 414	7 412 511	5 523 573	18 016	1 060 695	5 560 390
Mineral Fuels												
Coal	21211	19	3 822	8 030	278 767	185 302	326 215	2 828 557	2 317 040	4 451	334 176	2 318 300
Total mineral industry (1)		813	35 342	77 136	2 412 895	1 684 669	5 104 366	24 635 545	17 846 509	46 038	3 257 677	17 874 839
BY PROVINCE												
Newfoundland and Labrador		16	1 981	4 404	183 056	139 279	203 295	1 562 185	1 219 611	2 532	222 536	1 232 873
Prince Edward Island		1	x	x	x	x	x	x	x	x	x	x
Nova Scotia		31	836	1 987	40 432	22 625	36 257	219 421	160 540	1 046	51 627	161 109
New Brunswick		45	1 622	3 567	85 557	60 461	399 314	935 362	475 587	2 037	115 072	478 178
Quebec		185	5 855	12 706	391 179	287 084	862 453	3 242 914	2 093 377	8 681	583 117	2 082 525
Ontario		288	10 232	22 568	649 133	365 600	1 466 939	6 334 335	4 501 796	13 348	938 358	4 522 816
Manitoba		31	1 729	3 635	106 647	40 080	314 854	1 202 411	847 476	2 253	141 541	848 936
Saskatchewan		50	4 671	9 877	347 433	292 486	377 461	3 812 131	3 142 184	5 753	441 557	3 139 898
Alberta		89	2 186	4 841	124 844	65 996	125 676	847 660	655 988	2 683	156 435	662 316
British Columbia		72	5 402	11 733	407 958	301 943	889 989	4 703 055	3 511 124	6 292	483 177	3 510 553
Yukon		2	x	x	x	x	x	x	x	x	x	x
Northwest Territories		3	x	x	x	x	x	x	x	x	x	x
Nunavut		—	—	—	—	—	—	—	—	—	—	—
Total Canada		813	35 342	77 136	2 412 895	1 684 669	5 104 366	24 635 545	17 846 509	46 038	3 257 677	17 874 839

Sources: Natural Resources Canada; Statistics Canada.

NAICS: North American Industry Classification System. x Confidential.

(1) Cement manufacturing and lime manufacturing are included in the mineral manufacturing industry. (2) Excludes the oil and gas extraction industry (NAICS 211). (3) Total activity includes sales and head offices. (4) Includes uranium ore mining (NAICS 212291) and all other metal ore mining (NAICS 212299). (5) Includes NAICS 212314, 212315, 212316 and 212317. (6) Includes asbestos mining (NAICS 212394) and all other nonmetallic mineral mining and quarrying (NAICS 212398).

Note: Numbers may not add to totals due to rounding.

TABLE 17. CANADA, PRINCIPAL STATISTICS OF THE MINERAL INDUSTRY, (1,2) 1989-2005

Year	Mining Activity								Total Activity (3)		
	Production and Related Workers				Costs		Value of Production	Value Added	Employees	Salaries and Wages	Value Added
	Establish- ments	Employees	Person- Hours Paid	Wages	Fuel and Electricity	Materials and Supplies					
	(number)	(number)	(000)	(\$000)	(\$000)	(\$000)	(\$000)	(\$000)	(number)	(\$000)	(\$000)
1989	537	59 593	129 946	2 562 805	1 013 010	4 712 423	17 445 454	11 720 021	78 279	3 460 651	11 826 346
1990	521	55 558	121 448	2 510 817	1 061 769	4 619 245	16 158 688	10 477 673	73 156	3 391 151	10 571 448
1991	498	51 642	112 344	2 446 055	1 043 554	4 318 454	14 359 030	8 997 022	68 747	3 363 119	9 094 572
1992	469	46 819	101 065	2 278 504	960 413	4 249 868	13 705 148	8 494 868	62 257	3 136 794	8 566 223
1993	459	44 053	94 733	2 139 903	933 552	3 931 954	12 598 992	7 733 486	58 325	2 928 793	7 793 020
1994	555	44 083	95 756	2 227 755	970 304	3 938 223	13 872 653	8 964 126	58 195	3 019 806	9 059 983
1995	730	46 728	101 852	2 421 274	1 065 118	4 652 556	16 771 037	11 053 363	61 193	3 262 475	11 133 393
1996	727	45 552	99 532	2 466 512	1 129 784	4 939 053	16 568 618	10 499 781	59 555	3 306 371	10 575 169
1997	717	45 011	98 314	2 550 807	1 116 321	5 118 922	16 907 365	10 672 121	58 326	3 397 931	10 744 485
1998	708	42 554	92 746	2 437 877	1 056 510	4 920 070	16 172 637	10 196 057	55 929	3 309 255	10 254 270
1999	818	41 034	87 863	2 301 420	1 020 533	4 441 176	15 290 102	9 828 393	53 366	3 145 593	9 853 424
2000	828	39 443	86 152	2 330 708	1 218 214	4 567 183	17 019 475	11 234 052	51 576	3 176 123	11 236 741
2001	805	37 724	82 678	2 256 596	1 296 317	4 826 059	16 564 772	10 442 396	49 107	3 083 169	10 435 004
2002	808	36 811	78 166	2 226 644	1 266 580	4 777 199	16 573 134	10 529 355	47 624	3 020 647	10 509 587
2003	789	35 829	76 678	2 263 630	1 364 826	4 342 364	16 641 586	10 934 396	45 972	3 037 049	10 947 515
2004	801	34 786	75 589	2 247 100	1 450 505	4 473 682	20 753 018	14 828 831	45 287	3 060 080	14 818 032
2005	813	35 342	77 136	2 412 895	1 684 669	5 104 366	24 635 545	17 846 509	46 038	3 257 677	17 874 839

Sources: Natural Resources Canada; Statistics Canada.

(1) Cement manufacturing and lime manufacturing are included in the mineral manufacturing industry. (2) This table no longer includes data for the petroleum and natural gas industries. (3) Total activity includes sales and head offices.

TABLE 18. CANADA, PRINCIPAL STATISTICS OF THE MINERAL MANUFACTURING INDUSTRIES, 2005 (1)

	Mineral Manufacturing Activity					Total Activity (2)		
	Production and Related Workers		Costs (1)		Revenue from goods manufactured	Salaries and Wages		Total Revenue
	Employees	Wages	Energy and Water	Materials and Supplies		Employees		
	(number)	(\$000)	(\$000)	(\$000)	(\$000)	(number)	(\$000)	(\$000)
BY INDUSTRY								
Primary metal manufacturing	61 600	3 757 848	2 642 847	22 869 036	43 976 768	77 295	4 910 600	44 737 405
Nonmetallic mineral product manufacturing	37 123	1 594 809	929 886	5 147 545	12 262 494	47 828	2 311 507	13 237 364
Fabricated metal product manufacturing	127 333	5 154 825	591 293	17 594 889	33 441 127	170 562	7 783 650	36 207 032
Petroleum and coal products manufacturing	8 059	552 541	1 216 573	47 506 658	55 693 508	12 137	876 284	61 660 052
Total	234 115	11 060 023	5 380 599	93 118 128	145 373 897	307 822	15 882 041	155 841 853
BY REGION								
Atlantic	x	x	x	x	x	x	x	x
Quebec	60 320	2 731 408	1 578 773	23 188 309	38 607 751	80 063	3 948 938	43 591 842
Ontario	114 693	5 664 682	2 442 262	36 777 666	60 673 678	151 870	8 163 074	63 332 976
Prairies	x	x	x	x	x	x	x	x
British Columbia	x	x	x	x	x	x	x	x
Total	234 115	11 060 023	5 380 599	93 118 128	145 373 897	307 822	15 882 041	155 841 853

Source: Statistics Canada, Survey of Manufactures and Logging (ASML).

x Confidential.

(1) Changes in methodology starting in 2003, see notes in CANSIM table 301-0006. (2) Total activity includes sales and head offices.

TABLE 19. CANADA, PRINCIPAL STATISTICS OF THE MINERAL MANUFACTURING INDUSTRIES, (1,2) 1982-2005

Year	Mineral Manufacturing Activity										Total Activity (3)			
	Production and Related Workers			Costs			Revenue From			Value Added	Employees		Salaries and Wages	
	Establish-ments	Employees	Person-Hours Paid	Wages	Fuel and Electricity	Energy and Water	Materials and Supplies	Goods Manufactured	Value of Production		Employees	Salaries and Wages	Total Revenue	Value Added
	(number)	(number)	(000)	(\$000)	(\$000)	(\$000)	(\$000)	(\$000)	(\$000)					
1982	5 687	229 518	475 378	5 333 201	1 728 740	..	34 241 605	..	50 045 037	14 497 245	321 785	8 126 238	..	14 823 990
1983	7 370	216 944	447 947	5 420 307	1 905 777	..	34 720 416	..	52 773 875	15 861 491	301 112	8 143 674	..	16 196 749
1984	7 511	223 816	470 367	5 948 626	2 125 032	..	37 738 117	..	57 207 764	17 980 271	304 309	8 719 151	..	18 265 131
1985	7 625	238 544	506 377	6 507 081	2 229 270	..	39 497 925	..	61 241 939	19 305 730	313 850	9 271 447	..	19 646 938
1986	7 841	248 039	524 184	6 829 899	2 096 145	..	31 806 478	..	54 521 641	19 788 464	319 950	9 563 918	..	20 124 687
1987	7 598	..	..	..	2 154 276	..	35 570 988	..	59 787 220	22 189 903	333 536	10 188 110	..	22 733 514
1988	8 309	277 965	586 697	8 187 249	2 268 149	..	35 436 715	..	62 739 083	25 125 477	350 917	11 191 039	..	25 725 203
1989	8 300	288 494	606 841	8 893 139	2 341 578	..	38 785 940	..	64 981 175	24 317 984	360 004	12 014 330	..	29 859 105
1990	8 333	260 693	549 440	8 469 361	2 335 229	..	38 305 154	..	63 081 826	22 679 757	333 962	11 722 025	..	23 262 830
1991	7 820	242 783	510 984	8 226 481	2 456 144	..	34 628 749	..	58 093 646	20 169 425	309 678	11 288 852	..	20 698 450
1992	7 482	214 862	489 072	7 656 558	2 530 479	..	34 191 776	..	56 436 631	19 375 600	280 226	10 708 582	..	19 829 810
1993	7 202	211 316	381 263	7 656 373	2 641 864	..	35 060 212	..	58 685 636	21 008 722	273 767	10 688 689	..	21 445 279
1994	7 099	217 412	397 045	7 950 383	2 754 778	..	38 575 016	..	65 490 301	24 565 574	279 983	11 040 491	..	24 993 941
1995	7 151	230 185	492 240	8 537 700	2 862 100	..	41 112 900	..	71 292 500	27 936 100	293 594	11 841 500	..	28 766 000
1996	8 300	230 308	492 074	8 800 500	2 899 400	..	45 735 300	..	76 736 600	28 010 400	292 357	12 077 700	..	28 424 000
1997	8 057	256 877	540 163	9 830 200	3 110 100	..	48 440 400	..	81 124 600	29 829 800	321 152	13 447 700	..	30 254 500
1998	6 823	259 407	551 694	9 920 386	3 283 131	..	45 004 087	..	77 701 305	29 695 431	316 936	13 231 170	..	30 865 463
1999	6 319	259 468	546 696	10 171 350	3 442 897	..	49 963 931	..	84 657 218	32 353 132	318 493	13 704 920	..	33 964 186
2000	10 778	274 338	..	11 400 176	4 120 673	..	67 664 591	..	109 785 545	38 826 348	332 880	14 849 075	..	39 677 267
2001	11 063	279 447	..	11 893 060	4 191 316	..	66 522 900	..	108 742 433	37 823 575	335 062	15 167 850	..	38 739 249
2002	11 162	269 920	..	11 508 447	4 021 387	..	67 339 497	..	110 853 201	40 144 124	341 215	15 647 437	..	40 576 910
2003	11 084	269 519	..	11 819 626	4 611 151	..	72 447 593	..	116 272 623	38 942 347	343 674	16 210 043	..	39 714 112
2004 (2)	..	228 498	..	10 705 782	..	5 002 348	81 648 582	131 344 180	..	..	296 881	15 084 772	138 514 567	..
2005	..	234 115	..	11 060 023	..	5 380 599	93 118 128	145 373 897	..	..	307 822	15 882 041	155 841 853	..

Source: Statistics Canada.

.. Not available; ... Amount too small to be expressed.

(1) Includes the following industries: primary metals, nonmetallic mineral products, fabricated metal products, and petroleum and coal products. (2) Changes in methodology starting in 2003, see notes in CANSIM table 301-0006. (3) Total activity includes sales and head offices.

TABLE 20. CANADA, CONSUMPTION OF FUEL AND ELECTRICITY IN THE NON-FUEL MINERAL INDUSTRY, (1) 2004 AND 2005

	Unit	2004			2005		
		Metals	Nonmetals (2)	Total	Metals	Nonmetals (2)	Total
Coal	000 t	—	—	—	—	—	—
	\$000	—	—	—	—	—	—
Gasoline	000 litres	13 308	17 841	31 149	16 061	17 861	33 922
	\$000	9 034	11 391	20 425	12 958	12 183	25 141
Fuel oil, kerosene, diesel oil	000 litres	552 118	393 744	945 862	652 901	414 744	1 067 645
	\$000	215 616	216 917	432 533	340 919	272 836	613 755
Liquefied petroleum gas	000 litres	149 300	14 482	163 782	135 789	11 809	147 598
	\$000	53 484	4 686	58 170	52 372	4 665	57 037
Natural gas	000 m ³	73 518	751 579	825 097	67 742	663 130	730 872
	\$000	22 621	180 772	203 393	21 535	176 669	198 204
Other fuels (3)	\$000	33 615	683	34 298	43 070	719	43 789
Total value of fuels	\$000	334 370	414 448	748 818	470 855	467 072	937 927
Electricity purchased	million kWh	9 993	2 994	12 987	10 342	3 101	13 443
	\$000	389 852	161 766	551 618	400 989	160 452	561 441
Total value of fuels and electricity purchased, all reporting companies	\$000	724 221	576 214	1 300 435	871 844	627 523	1 499 367

Sources: Natural Resources Canada; Statistics Canada.

— Nil.

(1) Cement manufacturing and lime manufacturing are included in the mineral manufacturing industry. (2) Includes all nonmetallic minerals, stone, sand and gravel, shale, clay, and refractory minerals. (3) Includes wood, manufactured gas, steam purchased, and other miscellaneous fuels.

Note: Numbers may not add to totals due to rounding.

TABLE 21. CANADA, COST OF FUEL AND ELECTRICITY USED IN THE NON-FUEL MINERAL INDUSTRY, (1) 1996-2005

	Unit	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
METALS											
Fuel	\$000	289 723	283 374	244 801	213 351	294 700	319 030	299 211	332 485	334 370	470 855
Electricity purchased	million kWh	11 248	11 186	10 754	9 415	10 035	9 928	10 436	10 404	9 993	10 342
	\$000	396 358	383 009	375 095	335 715	338 056	345 500	399 061	381 213	389 852	400 989
Total cost of fuel and electricity	\$000	686 081	666 383	619 896	549 066	632 756	664 530	698 272	713 698	724 222	871 844
NONMETALS (2)											
Fuel	\$000	151 946	161 015	172 842	205 391	295 686	340 555	291 027	376 718	(r) 414 037	467 072
Electricity purchased	million kWh	2 767	2 795	2 760	2 811	2 889	2 716	2 778	2 815	(r) 2 992	3 101
	\$000	137 149	126 268	130 203	134 072	144 375	140 393	144 966	143 149	(r) 161 583	160 452
Total cost of fuel and electricity	\$000	289 095	287 283	303 045	339 463	440 061	480 948	435 993	519 867	(r) 575 620	627 524
TOTAL NON-FUEL MINERAL INDUSTRY											
Fuel	\$000	441 669	444 389	417 643	418 742	590 386	659 585	590 238	709 203	(r) 748 407	937 927
Electricity purchased	million kWh	14 015	13 981	13 514	12 226	12 924	12 644	13 214	13 219	(r) 12 985	13 443
	\$000	533 507	509 277	505 298	469 787	482 431	485 893	544 027	524 362	(r) 551 435	561 441
Total cost of fuel and electricity	\$000	975 176	953 666	922 941	888 529	1 072 817	1 145 478	1 134 265	1 233 565	(r) 1 299 842	1 499 368

Sources: Natural Resources Canada; Statistics Canada.

(r) Revised.

(1) Cement manufacturing and lime manufacturing are included in the mineral manufacturing industry. (2) Includes all nonmetallic minerals, stone, sand and gravel, shale, clay, and refractory materials.

Notes: Numbers may not add to totals due to rounding. This table does not include data for the coal industry.

TABLE 22. CANADA, EMPLOYMENT IN THE MINERAL INDUSTRY, STAGE 1 – MINERAL EXTRACTION AND CONCENTRATING (TOTAL ACTIVITY), (1) 1961-2006

Year	Metal Mines	Nonmetal Mines	Coal	Total
(number)				
1961	58 591	16 238	10 302	85 131
1962	58 243	16 922	9 897	85 062
1963	57 119	17 347	9 828	84 294
1964	57 648	17 771	9 796	85 215
1965	60 942	18 364	9 697	89 003
1966	61 670	18 734	9 281	89 685
1967	61 728	18 856	8 981	89 565
1968	63 369	19 509	8 427	91 305
1969	60 550	20 014	7 371	87 935
1970	66 590	20 660	7 874	95 124
1971	66 012	20 433	8 069	94 514
1972	61 994	20 020	8 704	90 718
1973	66 134	20 667	7 856	94 657
1974	70 038	22 395	8 142	100 575
1975	69 161	20 085	8 416	97 662
1976	68 269	21 334	8 995	98 598
1977	67 242	21 798	9 781	98 821
1978	56 447	20 882	10 574	87 903
1979	58 960	21 462	10 269	90 691
1980	66 118	21 440	11 416	98 974
1981	68 712	20 574	11 182	100 468
1982	61 503	17 171	13 113	91 787
1983	52 194	16 573	11 646	80 413
1984	52 683	17 258	11 905	81 846
1985	48 672	16 915	12 076	77 663
1986	46 487	17 263	10 747	74 497
1987	45 496	17 919	10 406	73 821
1988	48 277	17 596	11 122	76 995
1989	49 395	17 595	11 279	78 269
1990	45 248	16 891	11 017	73 156
1991	42 092	15 838	10 817	68 747
1992	37 774	14 757	9 726	62 257
1993	34 746	14 719	8 860	58 325
1994	33 380	15 927	8 888	58 195
1995	35 181	16 948	9 063	61 192
1996	34 257	16 121	9 177	59 555
1997	33 012	16 376	8 938	58 326
1998	30 734	17 038	8 157	55 929
1999	28 527	17 781	7 058	53 366
2000	27 574	18 154	5 850	51 578
2001	25 935	17 707	5 464	49 106
2002	25 172	17 359	5 135	47 666
2003	23 846	17 534	4 592	45 972
2004	22 614	18 332	4 341	45 287
2005	23 571	18 016	4 451	46 038
2006 (f)	24 791	19 663	4 719	49 173

Sources: Natural Resources Canada; Statistics Canada.

(f) Forecast.

(1) Total activity includes sales and head offices.

TABLE 23. CANADA, NON-FUEL MINERAL INDUSTRY EMPLOYMENT, BY STAGE (TOTAL ACTIVITY), (1) 1991-2006

Year	Total Mining (Including Coal)	Primary Metal Manufacturing	Nonmetal Manufacturing	Fabricated Metal Manufacturing	Total
(number)					
1991	68 747	108 830	46 460	145 259	369 296
1992	62 257	102 130	44 645	136 473	345 505
1993	58 325	101 751	43 123	132 273	335 472
1994	58 195	102 587	43 880	134 821	339 483
1995	61 193	102 127	47 077	139 590	349 987
1996	59 555	101 727	45 687	146 910	353 879
1997	58 326	98 829	48 554	157 630	363 339
1998	55 929	100 957	52 166	165 626	374 678
1999	53 366	100 529	53 286	173 072	380 253
2000	51 576	104 253	56 440	183 246	395 515
2001 (r)	49 107	91 936	53 719	187 521	382 283
2002 (r)	47 666	90 322	52 547	183 980	374 515
2003 (r)	45 972	85 394	53 351	183 364	368 081
2004 (r)	45 287	79 703	53 307	178 988	357 285
2005 (r)	46 038	78 297	53 066	178 727	356 128
2006 (f)	49 173	79 740	55 521	184 311	368 745

Sources: Natural Resources Canada; Statistics Canada.

(f) Forecast; (r) Revised.

(1) Starting with reference year 2001, Statistics Canada has modified their employment survey methodology with an aim to improving employment estimates derived from the survey. As a result, significant revisions to the Survey of Employment, Payrolls and Hours occurred, specifically to Primary Metal Manufacturing, Nonmetal Manufacturing, and Fabricated Metal Manufacturing.

Notes: Numbers may not add to totals due to rounding. Excludes petroleum and natural gas and services incidental to mining. Total activity includes sales and head offices.

TABLE 24. CANADA, NUMBER OF WAGE EARNERS EMPLOYED IN THE NON-FUEL MINERAL INDUSTRY (SURFACE, UNDERGROUND AND MILL), 1996-2005

	1996	1997	1998	1999	2000	2001	2002	2003	2004 (r)	2005
(number)										
METALS										
Surface	6 358	4 762	5 192	4 847	5 315	4 799	3 692	3 737	3 467	4 110
Underground	10 610	11 556	9 269	8 468	8 095	7 761	8 480	7 954	7 834	7 639
Mill	8 862	8 803	8 601	8 267	7 448	7 087	6 962	6 671	5 676	6 145
Total	25 830	25 121	23 062	21 582	20 858	19 647	19 134	18 362	16 977	17 894
NONMETALS										
Surface	6 051	6 185	6 286	6 770	7 101	6 834	6 784	6 992	7 059	7 079
Underground	1 926	1 964	2 009	2 008	1 864	1 980	1 924	1 954	2 075	2 186
Mill	4 211	4 392	4 506	4 907	4 861	4 732	4 638	4 598	4 944	4 361
Total	12 188	12 541	12 800	13 685	13 826	13 546	13 346	13 544	14 078	13 626
TOTAL NON-FUEL MINERAL INDUSTRY										
Surface	12 409	10 947	11 478	11 617	12 416	11 633	10 476	10 729	10 526	11 189
Underground	12 536	13 520	11 278	10 476	9 959	9 741	10 404	9 908	9 909	9 825
Mill	13 073	13 195	13 107	13 174	12 309	11 819	11 600	11 269	10 620	10 506
Total	38 018	37 662	35 862	35 267	34 684	33 193	32 480	31 906	31 055	31 520

Sources: Natural Resources Canada; Statistics Canada.

(r) Revised.

Note: Numbers may not add to totals due to rounding.

TABLE 25. CANADA, MINE AND MILL WORKERS, BY SEX, EMPLOYED IN THE NON-FUEL MINERAL INDUSTRY, 2005

	Mine Workers				Mill Workers		Total	
	Underground		Surface					
	Male	Female	Male	Female	Male	Female	Male	Female
(number)								
METALS								
Gold	2 471	32	764	20	1 284	51	4 519	103
Silver-lead-zinc	x	x	x	x	x	x	x	x
Uranium	x	x	x	x	x	x	x	x
Iron ore	—	—	1 027	55	1 649	80	2 676	135
Nickel-copper-zinc	x	x	x	x	x	x	x	x
Miscellaneous metal mines	x	x	x	x	x	x	x	x
Total	7 555	84	3 955	155	5 853	292	17 363	531
NONMETALS								
Peat	—	—	387	44	695	52	1 082	96
Gypsum	—	—	327	5	64	2	391	7
Potash	1 450	32	50	1	1 453	65	2 953	98
Salt	545	1	145	5	340	8	1 030	14
Diamonds	72	12	373	11	281	14	726	37
Stone	x	x	x	x	x	x	x	x
Sand and gravel	—	—	3 012	96	208	5	3 220	101
Shale, clay, and refractory minerals	—	—	53	2	122	1	175	3
Miscellaneous nonmetals (1)	x	x	x	x	x	x	x	x
Total	2 141	45	6 870	209	4 187	174	13 198	428
Total non-fuel mineral industry	9 696	129	10 825	364	10 040	466	30 561	959

Sources: Natural Resources Canada; Statistics Canada.

— Nil; x Confidential.

(1) Includes asbestos mining and all other nonmetallic mineral mining and quarrying.

TABLE 26. CANADA, LABOUR COSTS FOR METAL MINES IN RELATION TO TONNES MINED (SURFACE AND UNDERGROUND), 2003-05

	Number of Wage Earners	Total Wages	Average Annual Wage	Tonnage of Ore Mined	Average Annual Tonnes Mined Per Wage Earner	Wage Cost Per Tonne Mined
	(no.)	(\$000)	(\$)	(000 t)	(t)	(\$)
2003						
Gold	3 586	273 425	76 248	42 803	11 936	6.39
Nickel-copper-zinc	5 436	354 298	65 176	76 580	14 088	4.63
Silver-lead-zinc	251	13 100	52 191	3 610	14 381	3.63
Iron ore	1 364	115 036	84 337	89 683	65 750	1.28
Miscellaneous metals	1 054	65 719	62 352	19 008	18 034	3.46
Total	11 691	821 578	70 274	231 684	19 817	3.55
2004						
Gold	3 502	267 669	76 433	42 330	12 087	6.32
Nickel-copper-zinc	5 360	360 328	67 225	82 975	15 480	4.34
Silver-lead-zinc	331	19 056	57 572	3 442	10 399	5.54
Iron ore	1 170	101 573	86 814	(r) 80 140	68 493	1.27
Miscellaneous metals	938	64 480	68 742	18 995	20 251	3.39
Total	11 301	813 105	71 950	227 879	20 165	3.57
2005						
Gold	3 287	262 868	79 972	42 992	13 079	6.11
Nickel-copper-zinc	6 063	411 327	67 842	96 100	15 850	4.28
Silver-lead-zinc	335	19 998	59 694	3 529	10 533	5.67
Iron ore	1 082	107 910	99 732	87 737	81 088	1.23
Miscellaneous metals	982	67 712	68 954	20 161	20 531	3.36
Total	11 749	869 815	74 033	250 518	21 322	3.47

Sources: Natural Resources Canada; Statistics Canada.

(r) Revised.

Note: Numbers may not add to totals due to rounding.

TABLE 27. CANADA, PERSON-HOURS PAID FOR PRODUCTION AND RELATED WORKERS, AND TONNES OF ORE MINED IN METAL MINES AND OTHER MINERAL OPERATIONS, (3) 1995-2005

	Unit	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
METAL MINES (1)												
Ore mined	Mt	260.48	253.00	248.00	259.89	224.30	247.19	230.78	226.27	231.68	227.88	250.52
Person-hours paid (2)	million	57.14	56.08	54.60	50.18	46.12	46.58	44.13	40.58	39.22	36.66	38.81
Person-hours paid per tonne mined	number	0.22	0.22	0.22	0.19	0.21	0.19	0.19	0.18	0.17	0.16	0.15
Tonnes mined per person-hour paid	t	4.56	4.51	4.54	5.18	4.86	5.31	5.23	5.58	5.91	6.22	6.45
OTHER MINERAL OPERATIONS (3)												
Ore mined	Mt	169.44	167.01	177.59	167.50	152.06	151.59	149.10	143.26	142.29	148.62	156.06
Person-hours paid (2)	million	29.33	29.26	28.98	26.73	24.16	21.77	21.06	21.06	20.85	21.61	21.36
Person-hours paid per tonne mined	number	0.17	0.18	0.16	0.16	0.16	0.14	0.14	0.15	0.15	0.15	0.14
Tonnes mined per person-hour paid	t	5.78	5.71	6.13	6.27	6.29	6.96	7.08	6.80	6.82	6.88	7.31

Sources: Natural Resources Canada; Statistics Canada, catalogue nos. 26-201, 26-223, and 26-226.

(r) Revised.

(1) Excludes placer mining. (2) Person-hours paid for production and related workers only. (3) Includes chrysotile (asbestos), diamonds, potash, gypsum, salt, miscellaneous nonmetals, and coal.

TABLE 28. CANADA, AVERAGE WEEKLY WAGES (INCLUDING OVERTIME) FOR HOURLY RATED EMPLOYEES IN THE MINING AND MINERAL MANUFACTURING INDUSTRIES, 1996-2006

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	(\$)										
Oil and gas extraction	1 242.71	1 252.70	1 298.43	1 333.92	1 352.43	1 380.33	1 407.30	1 434.22	1 458.96	(r) 1 520.01	1 618.47
Mining	1 001.83	998.87	1 053.39	1 039.90	1 094.11	1 090.31	1 084.03	1 085.00	1 102.91	1 097.68	1 108.63
Coal mining	1 057.58	1 045.80	1 138.11	1 126.95	1 204.74	1 232.08	1 215.77	1 257.91	1 367.22	1 363.78	1 370.83
Metal ore mining	1 078.85	1 053.23	1 127.77	1 123.25	1 168.98	1 168.94	1 163.13	1 159.50	1 148.63	1 142.01	1 160.63
Nonmetallic mineral mining and quarrying	825.18	873.86	893.33	882.64	944.20	943.49	952.11	962.70	996.57	989.25	997.23
Support activities for mining and oil and gas extraction	895.53	948.30	978.06	970.21	1 013.57	1 049.05	1 074.27	1 087.43	1 218.52	1 320.91	1 326.92
Primary metal manufacturing	938.93	963.71	957.80	979.83	980.49	992.98	1 015.81	1 024.33	1 036.64	1 063.62	1 122.32
Nonmetallic mineral product manufacturing	759.85	766.11	773.91	751.64	763.65	775.08	806.41	815.45	833.46	840.70	831.85
Fabricated metal product manufacturing	708.08	729.36	752.52	767.44	774.18	785.81	817.22	828.38	828.79	759.85	865.65

Source: Statistics Canada; *Annual Estimates of Employment, Earnings and Hours*.

(r) Revised.

TABLE 29. CANADA, NUMBER OF STRIKES AND LOCKOUTS BY INDUSTRY, 2004-06

	2004			2005			2006 (p)		
	Strikes and Lockouts	Workers Involved	Duration in Person-Days	Strikes and Lockouts	Workers Involved	Duration in Person-Days	Strikes and Lockouts	Workers Involved	Duration in Person-Days
Agriculture	—	—	—	1	44	400	—	—	—
Logging and forestry	2	462	8 870	—	—	—	1	198	29 110
Fishing and trapping	—	—	—	—	—	—	—	—	—
Mining (includes utilities)	8	3 191	123 610	5	2 545	121 310	3	857	45 400
Construction	8	6 088	91 420	6	158	11 320	1	18	2 550
Manufacturing	95	13 833	538 630	65	12 449	454 670	61	11 082	346 443
Wholesale and retail trade	30	6 625	226 450	29	6 768	234 620	14	1 066	52 650
Transportation and warehousing	20	15 786	175 773	12	1 527	40 160	13	9 536	33 740
Information and culture	9	4 785	462 990	5	20 646	1 545 730	4	253	21 430
Finance, insurance and real estate	12	703	18 510	22	6 607	36 250	6	329	12 450
Education, health and social sciences	47	50 664	364 705	65	81 223	655 960	19	11 478	160 110
Entertainment and hospitality	46	7 402	218 780	42	26 099	440 270	17	2 899	78 153
Public administration	21	150 492	994 790	8	40 983	608 440	11	4 794	31 300
Total, all industries	298	260 031	3 224 528	260	199 049	4 149 130	150	42 510	813 336

Source: Human Resources and Social Development Canada, Workplace Information Directorate.

— Nil; (p) Preliminary.

TABLE 30. CANADA, NUMBER OF STRIKES AND LOCKOUTS BY MINING AND MINERAL MANUFACTURING INDUSTRY, 2004-06

	2004			2005			2006 (p)		
	Strikes and Lockouts	Workers Involved	Duration in Person-Days	Strikes and Lockouts	Workers Involved	Duration in Person-Days	Strikes and Lockouts	Workers Involved	Duration in Person-Days
MINING	8	3 191	123 610	5	2 545	121 310	3	857	45 400
Metals	3	2 659	101 810	3	1 683	60 190	1	117	5 240
Nonmetals	1	12	2 100	1	12	860	2	740	40 160
Mineral fuels	4	520	19 700	1	850	60 260	—	—	—
MINERAL MANUFACTURING	13	1 551	132 990	14	2 621	149 080	11	1 406	32 902
Primary metals	8	1 417	127 830	11	2 464	135 980	7	1 099	29 800
Nonmetallic mineral products	5	134	5 160	3	157	13 100	4	307	3 102

Source: Human Resources and Social Development Canada, Workplace Information Directorate.

— Nil; (p) Preliminary.

TABLE 31. CANADA, SOURCE OF MATERIAL HOISTED OR REMOVED FROM SELECTED TYPES OF MINES, 2005

	NAICS Number	Underground Ore	Open-Pit Ore	Total Ore	Underground Waste	Open-Pit Waste	Open-Pit Overburden	Open-Pit Tailings
(000 tonnes)								
METALS								
Iron ore mining	21221	—	87 737	87 737	—	—	8 995	76 706
Gold and silver ore mining	21222	10 408	32 584	42 992	1 909	59 355	4 577	39 937
Copper, nickel, lead and zinc ore mining	21223	24 405	75 223	99 628	1 339	53 044	128	97 008
Other metal ore mining (1)	21229	2 065	18 096	20 161	123	14 704	—	16 744
Total metals		36 879	213 639	250 518	3 371	127 103	13 700	230 395
NONMETALS								
Chrysotile (asbestos)	212394	x	x	x	x	x	x	x
Gypsum	212395	—	8 604	8 604	—	2 163	932	—
Potash (2)	212396	37 116	—	37 116	2 867	—	—	14 986
Salt (3)	212393	12 306	—	12 306	—	—	—	449
Diamonds	212392	522	6 248	6 770	364	58 134	—	—
Miscellaneous nonmetals	212398	x	x	x	x	x	x	x
Total nonmetals		50 922	21 142	72 065	3 231	66 215	10 195	19 021
MINERAL FUELS								
Coal (4)	21211	763	83 237	84 000	..	..	..	..
Total metals, nonmetals and mineral fuels		88 564	318 018	406 583				
Percentage		21.8	78.2	100.0	..	..	..	..

Sources: Natural Resources Canada; Statistics Canada.

— Nil; .. Not available; x Confidential; NAICS North American Industry Classification System.

(1) includes uranium ore mining (212291) and all other metal ore mining (212299). (2) Total ore includes from brine wells and/or bore holes. (3) Total ore includes tonnes of brine removed. (4) Crude ore from coal mines (includes coal and other associated rocks).

Note: Numbers may not add to totals due to rounding.

TABLE 32. CANADA, ORE MINED AND ROCK QUARRIED, 1997-2005

Mines	NAICS No.	1997	1998	1999	2000	2001	2002	2003	2004	2005
(000 tonnes)										
METALS										
Iron ore	21221	94 430	96 743	85 249	96 349	75 645	76 967	89 683	80 140	87 737
Gold and silver ore mining	21222	33 924	36 454	44 799	41 802	41 753	41 184	42 803	42 330	42 992
Copper, nickel, lead and zinc ore mining	21223	104 500	111 178	79 637	95 744	93 453	86 528	80 190	86 417	99 628
Other metal ore mining (1)	21229	15 145	15 519	14 617	13 298	19 930	21 592	19 008	18 995	20 161
Total metals		247 999	259 893	224 302	247 194	230 782	226 271	231 684	227 882	250 518
NONMETALS										
Chrysotile (asbestos)	212394	x	x	x	x	x	x	x	x	x
Gypsum	212395	9 141	8 863	9 665	8 949	8 407	9 103	8 002	9 142	8 604
Potash (2)	212396	38 932	39 514	29 346	33 560	29 395	28 052	31 051	34 486	37 116
Salt (3)	212393	12 690	13 277	11 816	11 102	13 331	11 674	12 950	12 589	12 306
Diamonds	212392	—	402	3 166	3 190	3 869	4 688	9 337	5 972	6 770
Miscellaneous nonmetals	212398	x	x	x	x	x	x	x	x	x
Total nonmetals		75 853	72 140	63 784	66 394	63 110	60 490	69 179	69 595	72 065
STRUCTURAL MATERIALS										
Stone of all kinds quarried (4)	21231	120 953	129 057	130 226	139 096	144 793	145 811	148 688	161 975	165 966
Sand and gravel (5)	21232	227 315	231 639	248 311	240 007	240 421	239 522	248 501	254 290	248 945
MINERAL FUELS										
Coal (6)	21211	101 735	95 363	88 272	85 201	85 986	82 766	73 107	79 028	84 000
Total ore mined and rock quarried		773 855	788 092	754 895	777 892	765 092	754 860	771 159	792 770	821 494

Sources: Natural Resources Canada; Statistics Canada.

— Nil; x Confidential; NAICS North American Industry Classification System.

(1) includes uranium ore mining (212291) and all other metal ore mining (212299). (2) Total ore includes from brine wells and/or bore holes. (3) Total ore includes tonnes of brine removed. (4) Includes stone used to make cement and lime. (5) Includes silica and quartz. (6) Crude ore from coal mines (includes coal and other associated rocks).

Note: Numbers may not add to totals due to rounding.

**TABLE 33. CANADA, ORE MINED AND ROCK QUARRIED, HISTORICAL,
1975-2005**

Year	Metals	Nonmetals (1)	Stone of All Kinds Quarried (2)	Sand and Gravel (3)	Coal (4)	Total
(million tonnes)						
1975	264.2	53.1	105.6	..	..	422.9
1976	296.5	62.4	104.7	..	..	463.6
1977	299.5	68.9	136.3	..	33.8	538.5
1978	248.1	67.1	138.4	..	36.3	489.9
1979	274.8	71.0	126.7	..	39.8	512.3
1980	290.1	71.2	122.3	..	43.9	527.5
1981	301.5	69.9	102.5	..	48.2	522.1
1982	238.4	48.0	73.2	..	53.0	412.6
1983	219.0	55.8	81.3	..	54.8	410.9
1984	246.4	71.7	96.1	..	71.2	485.4
1985	245.0	71.7	100.2	..	76.7	493.6
1986	256.3	66.4	112.7	..	72.7	508.1
1987	266.2	68.5	129.0	..	77.5	541.2
1988	282.1	73.2	135.0	291.5	89.3	873.1
1989	283.8	71.7	135.4	275.7	87.7	856.6
1990	280.6	68.7	126.7	245.3	89.5	810.7
1991	271.4	66.5	103.0	214.8	90.3	742.8
1992	248.2	63.9	104.5	239.9	81.4	738.7
1993	236.5	64.1	106.0	237.2	87.6	695.6
1994	233.7	73.9	110.4	247.1	96.6	761.8
1995	260.5	72.6	120.7	230.1	97.7	781.5
1996	253.0	67.5	112.4	217.4	100.4	750.6
1997	248.0	75.9	121.0	227.3	101.7	774.7
1998	259.9	72.1	129.1	231.6	95.4	788.1
1999	224.3	63.8	130.2	248.3	88.2	754.9
2000	247.2	66.4	139.1	240.0	85.2	777.9
2001	230.8	63.1	144.8	240.4	86.0	765.1
2002	226.3	60.5	145.8	239.5	82.8	754.9
2003	231.7	69.2	148.7	248.5	73.1	771.2
2004 (r)	227.9	69.6	162.0	254.6	79.0	793.1
2005	250.5	72.1	166.0	248.9	84.0	821.5

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; (r) Revised.

(1) From 1979 onwards, coverage includes miscellaneous nonmetal mines previously excluded.

(2) Includes stone used to make cement and lime. (3) Sand and gravel includes silica and quartz.

(4) Crude ore from coal mines (includes coal and other associated rocks).

Note: Numbers may not add to totals due to rounding.

TABLE 34. CANADA, CRUDE MINERALS TRANSPORTED BY CANADIAN RAILWAYS, 2000-2006

	2000	2001	2002	2003	2004	2005	2006
(000 tonnes)							
METALLIC MINERALS							
Iron ores and concentrates	38 964	28 978	30 091	32 975	27 908	32 345	33 976
Nickel and nickel-copper ores and concentrates	2 351	2 543	2 343	1 674	2 187	2 368	1 874
Zinc ores and concentrates	1 158	1 119	1 105	1 355	1 123	812	763
Copper ores and concentrates	1 484	1 683	1 290	1 144	1 312	1 404	1 306
Lead ores and concentrates	1 030	570	571	410	449	205	223
Metallic ores and concentrates, n.e.s.	99	169	372	3 046	6 049	6 095	5 962
Subtotal	45 086	35 062	35 772	40 604	39 029	43 229	44 105
NONMETALLIC MINERALS							
Potash (KCl)	14 197	12 819	13 094	14 735	16 591	16 224	13 556
Sulphur	7 446	6 373	7 070	7 388	7 945	7 952	7 836
Salt	1 218	1 414	1 357	1 378	1 399	1 305	1 138
Phosphate rock	468	773	1 011	997	1 057	889	535
Sand, gravel and stone	3 026	3 006	2 939	3 030	2 952	3 516	3 356
Other nonmetallic minerals	5 575	5 466	5 715	5 277	6 114	6 183	6 470
Subtotal	31 930	29 851	31 186	32 805	36 058	36 069	32 891
MINERAL FUELS							
Coal	39 253	40 119	35 171	30 608	31 850	33 504	31 135
Total crude minerals	116 269	105 032	102 129	104 020	106 938	112 802	108 131
Total revenue freight (1) moved by Canadian railways	252 116	240 633	236 911	234 839	250 194	259 395	258 666
Crude minerals as a percentage of total revenue freight	46.1	43.6	43.1	44.3	42.7	43.5	41.8

Source: Statistics Canada, catalogue no. 52-001-XIE.

n.e.s. Not elsewhere specified.

(1) Revenue freight refers to a local or interline shipment from which earnings accrue to a carrier.

TABLE 35. CANADA, PROCESSED MINERAL PRODUCTS TRANSPORTED BY CANADIAN RAILWAYS, 2000-2006

	2000	2001	2002	2003	2004	2005	2006
	(000 tonnes)						
METALLIC MINERAL PRODUCTS							
Alumina	5 107	5 520	5 909	5 850	3 228	3 363	3 283
Iron and steel, primary or semi-finished	3 650	3 826	4 432	4 035	5 199	5 109	5 554
Copper, primary or semi-finished	611	607	566	393	403	373	455
Aluminum, primary or semi-finished	1 460	1 977	2 116	2 276	2 567	2 661	2 719
Other nonferrous metals, primary or semi-finished	454	429	583	757	819	672	694
Articles of metal-based products	944	732	713	562	688	719	1 196
Metallic waste and scrap	2 022	1 968	2 174	2 403	2 538	2 661	2 883
Total metallic mineral products	14 248	15 059	16 493	16 275	15 443	15 558	16 783
NONMETALLIC MINERAL PRODUCTS							
Sulphuric acid	2 384	2 352	2 522	2 283	2 456	2 415	2 725
Fertilizers (excluding potash)	5 041	4 507	4 946	4 504	5 131	4 985	4 652
Cement	2 443	2 442	2 410	2 262	2 617	2 706	2 730
Other nonmetallic mineral products	828	1 149	1 505	452	626	655	427
Nonmetallic waste and scrap	..	829	604	515	471	424	528
Total nonmetallic mineral products	10 696	11 279	11 987	10 016	11 302	11 185	11 062
MINERAL FUEL PRODUCTS							
Gasoline and aviation turbine fuel	1 539	1 537	2 028	2 103	1 998	2 211	2 472
Fuel oils and crude petroleum	3 357	3 953	4 339	2 086	4 847	5 110	4 907
Gaseous hydrocarbons, including liquefied petroleum gases	4 451	4 421	4 955	4 991	4 931	4 551	4 483
Coal coke and petroleum coke	1 344	1 315	1 726	1 166	1 287	1 567	1 712
Other refined petroleum and coal products	1 994	2 090	2 319	2 181	2 585	2 633	2 563
Total mineral fuel products	12 685	13 317	15 368	15 528	15 648	16 072	16 138
Total processed mineral products	37 629	39 655	43 848	41 819	42 393	42 815	43 983
Total revenue freight (1) moved by Canadian railways	252 116	240 623	236 911	234 839	250 194	259 395	258 666
Processed mineral products as a percentage of total revenue freight	14.9	16.5	18.5	17.8	16.9	16.5	17.0
Total processed mineral products (excluding mineral fuel products)	24 944	26 338	28 480	26 291	26 745	26 743	27 845
Processed mineral products (excluding mineral fuel products) as a percentage of total revenue freight	9.9	10.9	12.0	11.2	10.7	10.3	10.8

Source: Statistics Canada, catalogue no. 52-001-XIE.

.. Not available.

(1) Revenue freight refers to a local or interline shipment from which earnings accrue to a carrier.

TABLE 36. CANADA, CRUDE MINERALS AND PROCESSED MINERAL PRODUCTS TRANSPORTED BY CANADIAN RAILWAYS, 1961-2006

Year	Total Revenue Freight (1)	Total Crude Minerals	Total Processed Mineral Products	Total Crude and Processed Minerals	Crude Minerals and Processed Mineral Products as a Percentage of Revenue Freight
	(million tonnes)				(%)
1961	138.9	54.1	13.6	67.7	48.7
1962	146.0	60.3	13.8	74.1	50.8
1963	154.6	62.9	15.5	78.4	50.7
1964	180.0	74.6	15.9	90.5	50.3
1965	186.2	80.9	17.3	98.2	52.7
1966	194.5	80.6	17.8	94.4	50.6
1967	190.0	81.2	17.7	98.9	52.1
1968	195.4	86.7	18.8	105.5	54.0
1969	189.0	81.9	27.6	109.5	57.9
1970	211.6	97.5	28.4	125.9	59.5
1971	214.5	95.6	27.4	123.0	57.3
1972	215.8	89.4	27.6	117.0	54.2
1973	241.2	113.1	29.1	142.2	59.0
1974	246.3	115.3	30.9	146.2	59.4
1975	226.0	110.6	26.6	137.2	60.7
1976	238.5	116.6	25.5	142.1	59.6
1977	247.2	121.1	25.7	146.8	59.4
1978	238.8	107.7	26.2	133.9	56.1
1979	257.9	127.2	26.6	153.8	59.6
1980	254.4	124.8	24.6	149.4	58.7
1981	246.6	120.7	26.4	147.1	59.7
1982	212.5	95.7	21.0	116.7	54.9
1983	222.8	95.3	22.7	118.0	53.0
1984	254.6	121.1	25.1	146.2	57.4
1985	250.6	125.2	24.3	149.5	59.7
1986	249.8	121.2	23.0	144.2	57.7
1987	261.4	122.2	22.7	144.9	55.4
1988	269.4	134.9	23.2	158.1	58.7
1989	247.0	122.3	23.1	145.4	58.9
1990	226.3	112.1	20.1	132.2	58.4
1991	233.3	114.4	19.1	133.5	57.2
1992	226.2	102.8	20.9	123.7	54.7
1993	224.0	100.8	21.4	122.2	54.6
1994	253.6	112.6	21.4	134.0	52.9
1995	253.7	118.4	22.0	140.4	55.4
1996	252.1	118.1	21.6	139.7	55.4
1997	288.9	118.2	31.5	149.7	51.8
1998	279.5	113.7	37.2	150.9	54.0
1999	236.7	110.0	36.9	146.9	62.1
2000	252.1	116.3	37.6	153.9	61.0
2001	240.6	105.0	39.7	144.7	60.1
2002	236.9	102.1	43.8	145.9	61.6
2003	234.8	104.0	41.8	145.8	62.1
2004	250.2	106.9	42.4	149.3	59.7
2005	259.4	112.8	42.8	155.6	60.0
2006	258.7	108.1	44.0	152.1	58.8

Source: Statistics Canada, catalogue no. 52-001-XIE.

(1) Revenue freight refers to a local or interline shipment from which earnings accrue to a carrier.

Notes: In previous years, this table was calculated using Statistics Canada's annual data series.

As of 1999, the annual data series was discontinued; therefore, the monthly data series is used for this table. Statistics for 1997 and 1998 have been recalculated using the monthly data series.

TABLE 37. CANADA, CRUDE MINERALS LOADED AND UNLOADED IN COASTWISE SHIPPING, 2003-05

	2003		2004 (r)		2005	
	Loaded	Unloaded	Loaded	Unloaded	Loaded	Unloaded
(tonnes)						
METALLIC MINERALS						
Iron ore and concentrates	5 167 141	5 309 528	5 492 731	5 453 941	4 543 818	4 630 565
Aluminum ores and concentrates	—	—	28 854	28 854	—	—
Other ores and concentrates	2 447 649	2 447 649	2 582 738	2 582 738	2 960 033	2 960 033
Total metallic minerals	7 614 790	7 757 177	8 104 323	8 065 533	7 503 851	7 590 598
NONMETALLIC MINERALS						
Salt	3 329 748	3 329 748	3 658 336	3 658 371	3 588 490	3 572 085
Limestone	3 456 028	3 456 028	4 125 889	4 125 889	4 214 992	4 198 102
Stone, sand and gravel	3 016 221	3 036 510	3 451 423	3 451 423	4 098 484	4 098 484
Potash	64 385	64 385	98 160	98 160	88 418	88 418
Sulphur	1 062	1 062	7 191	7 191	884	884
Other mineral products (including clays, gypsum and dolomite)	1 437 511	1 471 173	1 855 470	1 855 405	1 975 734	1 975 918
Total nonmetallic mineral products	11 304 955	11 358 906	13 196 469	13 196 439	13 967 002	13 933 891
MINERAL FUELS						
Coal and coke	863 755	863 755	1 005 690	1 005 690	824 218	824 218
Crude petroleum	20 063 757	20 063 757	17 762 913	17 838 572	17 601 845	17 601 845
Total mineral fuels	20 927 512	20 927 512	18 768 603	18 844 262	18 426 063	18 426 063
Total crude minerals	39 847 257	40 043 595	40 069 395	40 106 234	39 896 916	39 950 552
Total all commodities (1)	68 076 021	68 296 773	68 896 895	68 871 221	69 539 549	69 623 412
Crude mineral products as a percentage of all commodities	58.5	58.6	58.2	58.2	57.4	57.4
Total crude minerals (without crude petroleum)	19 783 500	19 979 838	22 306 482	22 267 662	22 295 071	22 348 707
Crude mineral products (not including crude petroleum) as a percentage of all commodities	29.1	29.3	32.4	32.3	32.1	32.1

Source: Statistics Canada.

— Nil; (r) Revised.

(1) Includes metallic minerals, nonmetallic minerals and mineral fuels, along with all other cargo loaded and unloaded in coastwise shipping.

Note: Numbers may not add to totals due to rounding.

TABLE 38. CANADA, PROCESSED MINERAL PRODUCTS LOADED AND UNLOADED IN COASTWISE SHIPPING, 2003-05

	2003		2004		2005	
	Loaded	Unloaded	Loaded	Unloaded	Loaded	Unloaded
(tonnes)						
METALLIC MINERAL PRODUCTS						
Iron, steel and alloys	25 622	25 622	28 618	28 618	5 712	5 712
Other base-metal products	344 037	344 037	371 553	371 553	582 817	582 817
Metallic waste and scrap	488 518	488 518	765 106	765 106	734 762	734 762
Total metallic mineral products	858 177	858 177	1 165 277	1 165 277	1 323 291	1 323 291
NONMETALLIC MINERAL PRODUCTS						
Cement and related products	580 231	580 231	602 672	602 639	591 530	591 576
Other nonmetallic minerals, n.e.s.	182 439	182 439	211 827	211 827	175 260	175 260
Nonmetallic waste and scrap	524 924	524 924	490 345	493 858	432 410	432 410
Total nonmetallic mineral products	1 287 594	1 287 594	1 304 844	1 308 324	1 199 200	1 199 246
MINERAL FUEL PRODUCTS						
Gasoline and aviation turbine fuel	2 163 405	2 163 405	2 021 542	1 995 270	2 286 021	2 330 577
Coke, petroleum and coal products	181 455	181 455	316 592	316 592	223 896	199 957
Other mineral fuels, n.e.s.	4 633 704	4 643 320	5 170 335	5 167 894	4 843 123	4 887 126
Total mineral fuel products	6 978 564	6 988 180	7 508 469	7 479 756	7 353 040	7 417 660
Total processed mineral products	9 124 335	9 133 951	9 978 590	9 953 357	9 875 531	9 940 197
Total all commodities (1)	68 076 021	68 296 773	68 896 895	68 871 221	69 539 549	69 623 412
Processed mineral products as a percentage of all commodities	13.4	13.4	14.5	14.5	14.2	14.3
Total processed mineral products (not including fuel products)	2 145 771	2 145 771	2 470 121	2 473 601	2 522 491	2 522 537
Processed mineral products (not including mineral fuel products) as a percentage of all commodities	3.2	3.1	3.6	3.6	3.6	3.6

Source: Statistics Canada.

n.e.s. Not elsewhere specified.

(1) Includes metallic mineral products, nonmetallic mineral products, and mineral fuel products, along with all other cargo loaded and unloaded in coastwise shipping.

Note: Numbers may not add to totals due to rounding.

TABLE 39. CANADA, CRUDE MINERALS AND PROCESSED MINERAL PRODUCTS LOADED AT CANADIAN PORTS IN COASTWISE SHIPPING, 1961-2005

Year	Total All Commodities (1)	Total Crude Minerals	Total Processed Minerals	Total Crude and Processed Minerals	Crude Minerals and Processed Mineral Products as a Percentage of All Products
		(000 tonnes)			(%)
1961	41 861	9 527	8 857	18 384	43.9
1962	39 763	8 361	9 768	18 129	45.6
1963	40 328	7 998	9 942	17 940	44.5
1964	47 171	8 522	11 194	19 716	41.8
1965	48 200	9 183	11 766	20 949	43.5
1966	55 122	10 155	12 653	22 808	41.4
1967	49 799	11 509	12 207	23 716	47.6
1968	50 921	13 698	13 245	26 943	52.9
1969	51 890	12 746	14 181	26 927	51.9
1970	57 301	14 415	14 818	29 233	51.0
1971	55 128	14 783	15 374	30 157	54.7
1972	55 326	14 197	15 290	29 487	53.3
1973	55 314	16 573	15 615	32 188	58.2
1974	53 633	11 723	16 575	28 298	52.8
1975	54 373	15 687	17 510	33 197	61.1
1976	53 882	15 924	16 208	32 132	59.6
1977	58 309	18 131	17 435	35 566	61.0
1978	60 668	18 318	16 619	34 937	57.6
1979	79 950	22 130	17 486	39 616	49.6
1980	82 761	22 947	17 134	40 081	48.4
1981	71 271	17 849	16 669	34 518	48.4
1982	65 881	16 473	13 214	29 687	45.1
1983	67 598	21 248	12 025	33 273	49.2
1984	68 698	22 798	11 909	34 707	50.5
1985	61 717	19 867	10 291	30 158	48.9
1986	60 506	19 901	10 264	30 165	49.9
1987	67 572	20 969	11 118	32 087	47.5
1988	69 974	23 325	11 676	35 001	50.0
1989	62 016	22 963	11 825	34 788	56.1
1990	60 360	22 430	16 096	38 526	63.8
1991	58 430	19 624	10 370	29 994	51.3
1992	52 262	22 125	9 325	31 450	60.2
1993	49 976	21 088	8 168	29 256	58.5
1994	51 534	21 221	9 510	30 731	59.6
1995	50 370	20 626	8 825	29 451	58.5
1996	48 829	22 393	7 634	30 027	61.5
1997	46 639	20 298	7 461	27 759	59.5
1998	47 928	23 358	8 142	31 500	65.7
1999	50 791	25 076	7 556	32 632	64.2
2000	54 507	26 821	9 234	36 055	66.1
2001	53 939	26 773	9 064	35 837	66.4
2002	62 780	36 256	8 527	44 783	71.3
2003	68 076	39 847	9 124	48 971	71.9
2004 (r)	68 897	40 069	9 979	50 048	72.6
2005	69 539	39 897	9 876	49 772	71.6

Source: Statistics Canada.

(r) Revised.

(1) Includes metallic mineral products, nonmetallic mineral products, and mineral fuel products, along with all other cargo loaded and unloaded in coastwise shipping.

TABLE 40. CANADA, CRUDE MINERALS LOADED AND UNLOADED AT CANADIAN PORTS IN INTERNATIONAL SHIPPING TRADE, 2003-05

	2003		2004		2005	
	Loaded	Unloaded	Loaded	Unloaded	Loaded	Unloaded
(tonnes)						
METALLIC MINERALS						
Iron ore and concentrates	29 913 618	6 705 192	25 110 718	7 512 153	27 482 248	9 140 599
Aluminum ores and concentrates	26 576	2 951 951	1 082	2 797 603	580	3 315 500
Lead and zinc ores and concentrates	..	..	..	..	..	..
Copper and nickel ores and concentrates	615 102	202 788	561 867	203 955	779 753	256 021
Other metallic ores and concentrates (1)	1 099 159	905 901	847 078	807 200	825 579	714 694
Total metallic minerals	31 654 455	10 765 832	26 520 745	11 320 911	29 088 160	13 426 814
NONMETALLIC MINERALS						
Limestone	2 857 426	2 316 202	2 952 614	2 441 880	3 077 290	2 988 957
Stone, sand and gravel	9 345 024	533 941	10 148 682	658 021	10 855 852	707 492
Salt	4 024 683	1 487 241	4 216 117	1 511 413	4 034 664	1 186 688
Sulphur	5 643 333	16 400	6 454 878	15 137	6 251 796	18 343
Potash	5 901 917	291	7 165 447	148	6 855 855	44
Other nonmetallic mineral products	7 333 029	1 463 752	8 339 716	1 371 955	8 622 254	1 543 800
Total nonmetallic minerals	35 105 412	5 817 827	39 277 454	5 998 554	39 697 711	6 445 324
MINERAL FUELS						
Coal and coke	26 122 208	21 542 669	25 355 228	19 137 386	26 519 109	20 333 152
Crude petroleum	21 478 444	34 284 802	22 821 454	37 482 297	23 734 579	41 031 296
Total mineral fuels	47 600 652	55 827 471	48 176 682	56 619 683	50 253 688	61 364 448
Total crude minerals	114 360 519	72 411 130	113 974 881	73 939 148	119 039 559	81 236 586
Total all commodities (1)	191 424 019	115 215 294	196 101 879	118 458 446	201 755 670	129 190 345
Crude minerals as a percentage of all commodities	59.7	62.8	58.1	62.4	59.0	62.9
Total crude minerals (not including crude petroleum)	92 882 075	38 126 328	91 153 427	36 456 851	95 304 980	40 205 290
Crude minerals (not including crude petroleum) as a percentage of all commodities	48.5	33.1	46.5	30.8	47.2	31.1

Source: Statistics Canada.

.. Not available.

(1) Includes lead, zinc, and other metallic ores and concentrates not specified.

Note: Numbers may not add to totals due to rounding.

TABLE 41. CANADA, PROCESSED MINERAL PRODUCTS LOADED AND UNLOADED AT CANADIAN PORTS IN INTERNATIONAL SHIPPING TRADE, 2003-05

INTERNATIONAL SHIPPING TRADE, 2003-05

	2003		2004		2005	
	Loaded	Unloaded	Loaded	Unloaded	Loaded	Unloaded
	(tonnes)		(tonnes)		(tonnes)	
METALLIC MINERAL PRODUCTS						
Iron, steel and alloys	959 018	2 357 685	533 317	3 468 306	811 577	3 053 803
Nonferrous metals, n.e.s.	1 049 697	6 474 464	1 187 335	6 216 560	1 055 946	6 852 103
Metallic waste and scrap	2 738 112	68 811	3 027 552	113 982	2 881 837	117 961
Total metallic mineral products	4 746 827	8 900 960	4 748 204	9 798 848	4 749 360	10 023 867
NONMETALLIC MINERAL PRODUCTS						
Cement and related products	3 365 447	439 436	3 700 329	514 431	3 453 524	355 265
Other nonmetallic minerals, n.e.s.	954 454	1 072 183	1 269 680	1 184 740	241 524	949 196
Nonmetallic waste and scrap	693 492	166 453	639 571	166 795	725 088	208 893
Total nonmetallic mineral products	5 013 393	1 678 072	5 609 580	1 865 966	4 420 136	1 513 354
MINERAL FUEL PRODUCTS						
Gasoline	8 853 046	4 129 182	8 423 212	4 756 995	8 149 093	6 781 330
Fuel oil	8 500 740	4 381 974	8 088 865	3 969 190	8 045 268	3 419 685
Coke, petroleum and coal products	804 319	3 022 829	935 037	2 431 055	883 366	3 306 268
Other mineral fuels, n.e.s.	1 148 744	1 610 651	951 508	1 704 158	1 461 217	2 099 672
Total mineral fuel products	19 306 849	13 144 636	18 398 622	12 861 398	18 538 944	15 606 955
Total processed mineral products	29 067 069	23 723 668	28 756 406	24 526 212	27 708 440	27 144 176
Total all commodities (1)	191 424 019	115 215 294	196 101 879	118 458 446	201 755 670	129 190 345
Processed mineral products as a percentage of all commodities	15.2	20.6	14.7	20.7	13.7	21.0
Total processed mineral products (not including mineral fuel products)	9 760 220	10 579 032	10 357 784	11 664 814	9 169 496	11 537 221
Processed mineral products (not including mineral fuel products) as a percentage of all commodities	5.1	9.2	5.3	9.8	4.5	8.9

Source: Statistics Canada.

n.e.s. Not elsewhere specified.

(1) Includes metallic mineral products, nonmetallic mineral products, and mineral fuel products, along with all other cargo loaded and unloaded at Canadian ports.

Note: Numbers may not add to totals due to rounding.

**TABLE 42. CANADA, CRUDE MINERALS AND PROCESSED MINERAL PRODUCTS
LOADED AT CANADIAN PORTS IN INTERNATIONAL SHIPPING TRADE, 1961-2005**

Year	Total All Commodities (1)	Total Crude Minerals	Total Processed Minerals	Total Crude and Processed Minerals	Crude Minerals and Processed Mineral Products as a Percentage of All Products
	(000 tonnes)				(%)
1961	48 771	23 241	2 133	25 374	52.0
1962	54 676	30 446	2 296	32 742	59.9
1963	62 031	32 214	2 503	34 717	56.0
1964	75 760	42 087	2 602	44 689	59.0
1965	74 521	41 338	2 746	44 084	59.2
1966	76 192	41 374	3 350	44 724	58.7
1967	72 598	42 704	3 701	46 405	63.9
1968	78 663	48 680	2 960	51 640	65.6
1969	70 432	42 442	3 456	45 898	65.2
1970	95 807	55 849	4 965	60 814	63.5
1971	95 887	53 245	5 022	58 267	60.8
1972	98 988	51 912	9 091	61 003	61.6
1973	112 434	64 195	10 103	74 298	66.1
1974	106 110	64 093	9 041	73 134	68.9
1975	102 444	61 970	7 495	69 465	67.8
1976	114 815	71 527	6 108	77 635	67.6
1977	119 770	70 257	5 979	76 236	63.7
1978	116 522	62 291	7 556	69 847	59.9
1979	134 639	79 685	8 901	88 586	65.8
1980	138 161	67 898	11 770	79 668	57.7
1981	145 445	83 007	9 022	92 029	63.3
1982	125 282	65 594	7 115	72 709	58.0
1983	129 490	67 152	6 197	73 349	56.6
1984	145 322	82 752	7 986	90 738	62.4
1985	143 421	83 878	10 814	94 692	66.0
1986	144 561	84 720	8 303	93 023	64.3
1987	158 994	86 085	10 488	96 573	60.7
1988	171 064	98 934	12 227	111 161	65.0
1989	159 069	90 807	13 624	104 431	65.7
1990	159 039	88 504	15 107	103 611	65.1
1991	168 030	90 165	16 138	106 303	63.3
1992	153 786	78 600	14 643	93 243	60.6
1993	152 162	81 418	16 723	98 141	64.5
1994	169 463	94 423	15 725	110 148	65.0
1995	176 540	100 103	16 346	116 449	66.0
1996	174 306	96 952	18 580	115 532	66.3
1997	187 717	110 983	18 467	129 450	69.0
1998	178 893	107 719	16 419	124 138	69.4
1999	179 648	103 364	20 165	123 529	68.8
2000	187 704	106 577	20 220	126 797	67.6
2001	174 724	95 533	24 804	120 337	68.9
2002	174 270	99 822	28 268	128 090	73.5
2003	191 424	114 361	29 067	143 428	74.9
2004	196 102	113 975	28 756	142 731	72.8
2005	201 756	119 040	27 708	146 748	72.7

Source: Statistics Canada.

(1) Includes metallic mineral products, nonmetallic mineral products, and mineral fuel products, along with all other cargo loaded and unloaded in coastwise shipping.

TABLE 43. CANADA, CAPITAL AND REPAIR EXPENDITURES BY SELECTED INDUSTRIAL SECTOR, 2005-07

TABLE 43. CANADA, CAPITAL AND REPAIR EXPENDITURES BY SELECTED INDUSTRIAL SECTOR, 2005-07							
	Year	Capital Expenditures			Repair Expenditures		
		Construction	Machinery and Equipment	Total	Construction	Machinery and Equipment	Total
(\$ millions)							
Agriculture, forestry, fishing and hunting	2005	1 359.4	3 156.4	4 515.8	850.9	2 788.7	3 639.6
	2006 (p)	1 330.2	3 145.4	4 475.6	..	..	..
	2007 (i)	1 342.6	3 113.1	4 455.7	..	..	..
Mining (1)	2005	39 397.4	9 592.8	48 990.1	1 044.5	3 453.0	4 497.6
	2006 (p)	45 938.8	7 695.8	53 634.6	..	..	..
	2007 (i)	43 714.6	8 644.8	52 359.4	..	..	..
Manufacturing	2005	2 235.7	17 194.7	19 430.4	1 231.9	9 293.4	10 525.3
	2006 (p)	2 326.8	17 130.6	19 457.4	..	..	..
	2007 (i)	2 484.2	17 997.0	20 481.1	..	..	..
Construction	2005	531.0	3 746.1	4 277.1	102.8	1 695.1	1 797.9
	2006 (p)	571.0	3 997.8	4 568.8	..	..	..
	2007 (i)	618.3	4 295.7	4 914.0	..	..	..
Transportation and warehousing	2005	3 966.3	7 760.8	11 727.1	1 622.5	4 361.8	5 984.3
	2006 (p)	5 483.5	8 427.3	13 910.8	..	..	..
	2007 (i)	6 454.9	8 906.2	15 361.1	..	..	..
Utilities	2005	9 861.4	3 638.9	13 500.3	1 279.5	1 498.1	2 777.6
	2006 (p)	12 357.2	4 892.6	17 249.8	..	..	..
	2007 (i)	15 218.0	5 260.7	20 478.7	..	..	..
Wholesale and retail trade	2005	4 772.5	7 300.9	12 073.5	628.6	1 230.2	1 858.9
	2006 (p)	5 199.8	7 173.2	12 373.4	..	..	..
	2007 (i)	5 627.2	7 254.0	12 881.2	..	..	..
Housing	2005	73 574.9	—	73 574.9	10 849.0	—	10 849.0
	2006 (p)	79 857.2	—	79 857.2	..	..	..
	2007 (i)	80 971.1	—	80 971.1	..	..	..
Total all industries (2)	2005	171 964.8	101 260.6	273 225.3	24 218.0	30 087.9	54 306.0
	2006 (p)	193 276.3	104 006.4	297 282.7	..	..	..
	2007 (i)	202 392.2	108 712.4	311 104.5	..	..	..
Mining as a percentage of total	2005	22.9	9.5	17.9	4.3	11.5	8.3
	2006 (p)	23.8	7.4	18.0	..	..	..
	2007 (i)	21.6	8.0	16.8	..	..	..

Source: Statistics Canada.

— Nil; .. Not available; (i) Intentions; (p) Preliminary actual.

(1) Includes mines, quarries and oil wells. (2) Includes finance, real estate, insurance, commercial services, institutions, and government departments.

Notes: Numbers may not add to totals due to rounding. Capital and repair expenditures are based on the North American Industry Classification System.

TABLE 44. CANADA, CAPITAL AND REPAIR EXPENDITURES IN THE MINERAL INDUSTRY(1) BY PROVINCE AND TERRITORY, 2005-07

AND TERRITORIES, 2005-07							
Province/ Territory	Year	Capital Expenditures			Repair Expenditures		
		Construction	Machinery and Equipment	Total	Construction	Machinery and Equipment	Total
(\$ millions)							
Newfoundland and Labrador	2005	1 653.7	237.9	1 891.6	5.0	76.3	81.3
	2006 (p)	1 593.8	72.1	1 665.9	..	..	..
	2007 (i)	1 070.7	26.0	1 096.7	..	..	..
Prince Edward Island	2005	x	x	x	x	x	x
	2006 (p)	x	x	x	..	..	..
	2007 (i)	x	x	x	..	..	..
Nova Scotia	2005	457.8	50.3	508.1	0.8	34.3	35.1
	2006 (p)	661.2	44.7	706.0	..	..	..
	2007 (i)	x	x	411.3	..	..	..
New Brunswick	2005	x	x	x	x	x	x
	2006 (p)	x	x	x	..	..	..
	2007 (i)	x	x	x	..	..	..
Quebec	2005	570.8	153.3	724.1	32.9	376.0	408.9
	2006 (p)	644.7	181.7	826.4	..	..	..
	2007 (i)	929.4	299.3	1 228.7	..	..	..
Ontario	2005	1 013.5	217.5	1 231.1	79.7	462.7	542.4
	2006 (p)	964.5	423.2	1 387.7	..	..	..
	2007 (i)	889.2	489.7	1 378.9	..	..	..
Manitoba	2005	297.8	25.5	323.3	0.3	93.8	94.1
	2006 (p)	346.0	43.1	389.1	..	..	..
	2007 (i)	336.1	70.4	406.5	..	..	..
Saskatchewan	2005	2 659.6	524.1	3 183.7	154.4	220.5	374.9
	2006 (p)	2 668.0	670.0	3 338.1	..	..	..
	2007 (i)	2 336.2	528.2	2 864.4	..	..	..
Alberta	2005	26 695.9	7 869.3	34 565.2	609.7	1 559.9	2 169.6
	2006 (p)	33 111.3	5 613.5	38 724.7	..	..	..
	2007 (i)	32 476.9	6 587.3	39 064.2	..	..	..
British Columbia	2005	4 732.2	294.6	5 026.9	114.6	429.7	544.3
	2006 (p)	4 639.5	445.0	5 084.5	..	..	..
	2007 (i)	3 993.5	371.4	4 364.9	..	..	..
Yukon	2005	86.0	1.7	87.7	0.0	1.1	1.1
	2006 (p)	77.6	2.6	80.2	..	..	..
	2007 (i)	49.2	19.6	68.8	..	..	..
Northwest Territories	2005	884.2	157.8	1 042.0	37.5	118.6	156.1
	2006 (p)	939.3	150.6	1 089.9	..	..	..
	2007 (i)	978.9	155.9	1 134.8	..	..	..
Nunavut	2005	273.9	9.4	283.3	0.7	0.1	0.8
	2006 (p)	191.9	7.8	199.8	..	..	..
	2007 (i)	142.5	6.7	149.1	..	..	..
Total Canada	2005	39 397.4	9 592.8	48 990.1	1 044.5	3 453.0	4 497.6
	2006 (p)	45 938.8	7 695.8	53 634.6	..	..	..
	2007 (i)	43 714.6	8 644.8	52 359.4	..	..	..

Source: Statistics Canada.

.. Not available; (i) Intentions; (p) Preliminary actual; x Confidential.

(1) Includes mines, quarries and oil wells.

Notes: Numbers may not add to totals due to rounding. Capital and repair expenditures are based on the North American Industry Classification System.

TABLE 45. CANADA, CAPITAL AND REPAIR EXPENDITURES IN THE MINING AND OIL AND GAS EXTRACTION INDUSTRIES, 2005-07

EXTRACTIVE INDUSTRIES, 2005-07

	2005			2006 (p)	2007 (i)
	Capital	Repair	Total	Capital	Capital
	(\$ millions)				
MINING					
Metal ore mining					
Iron	x	x	x	x	x
Gold and silver	581.4	190.2	771.6	458.8	728.7
Lead-zinc	x	x	x	x	x
Nickel-copper	942.3	323.6	1 265.8	595.3	727.4
Copper-zinc	325.3	215.3	540.6	400.2	253.9
Uranium	x	x	x	x	x
Other metal mines	81.2	64.0	145.2	63.1	41.3
Total	2 333.8	1 090.9	3 424.7	2 033.2	2 192.1
Nonmetallic mineral mining and quarrying					
Stone	98.0	77.3	175.3	77.4	80.0
Sand and gravel, clay, and ceramic and refractory materials	154.5	192.0	346.5	261.5	231.4
Chrysotile	x	x	x	x	x
Gypsum	x	x	x	x	x
Potash	308.6	151.4	460.0	442.4	384.2
Peat	x	x	x	x	x
Other nonmetal mines	728.0	207.7	935.7	1 062.2	1 107.8
Total	1 320.7	663.4	1 984.1	1 883.2	1 842.4
Coal	605.9	x	x	368.9	452.1
Oil and gas extraction	42 047.9	1 807.5	43 855.5	45 730.8	45 044.6
Support activities for mining and oil and gas extraction	2 681.8	666.8	3 348.6	3 618.5	2 828.2
Total mineral industry	48 990.1	4 497.6	53 487.7	53 634.6	52 359.4

Source: Statistics Canada.

(i) Intentions; (p) Preliminary actual; x Confidential.

Notes: Numbers may not add to totals due to rounding. Capital and repair expenditures are based on the North American Industry Classification System.

Definitions and Valuation: Mineral Production, Shipments and Trade

MINERAL STATISTICS

The publication of statistics on the mineral production of Canada was instituted by the Geological and Natural History Survey of Canada as early as 1886. The Department of Mines carried out this compilation through the early part of the twentieth century. Subsequently, the work was transferred to Statistics Canada, which published the data for the period 1921 to 1978. In January 1979, the responsibility for Canadian non-fuel mineral statistics was transferred from Statistics Canada to the Department of Energy, Mines and Resources (now Natural Resources Canada). Statistics Canada retains responsibility for fuels and mineral manufacturing statistics (including cement, lime, clay, and smelting and refining).

The construction of new metallurgical plants and the development of new types of ore have resulted in changes in methods of compilation over the period but, in general, the following principles have been followed.

For nonmetallic minerals such as asbestos, talc, barite, etc., and for structural materials such as stone, cement, etc., the mine or quarry shipments are taken to represent production. Usually there is little difference between actual output and mine shipments, and it is more convenient and practical to measure the product at the latter point. Values are computed on the free on board (f.o.b.) shipping point basis and they represent, therefore, the amounts actually received by the producers. Values are adjusted to exclude the costs of containers, taxes, duties, sales discounts, and outward-bound transportation.

Production data for certain simple metallic ores such as iron ore, uranium, etc., are compiled in a similar manner, that is, products shipped from a specific shipping point at f.o.b. values. For some metals, this is not practical and an attempt is made to measure output in terms of recoverable metals in concentrates shipped, which are then valued at current market prices.

The value of metallic mineral production calculated in this manner does not coincide with the amounts actually received by the producers.

DETAILS OF THE METHODS USED IN COMPUTING THE MINERAL PRODUCTION OF CANADA

Metallic Mineral Production

Antimony

Production includes recoverable antimony in concentrates shipped. The value is calculated using the yearly average New York dealer price.

Bismuth

Production includes recoverable bismuth in concentrates shipped. The value is calculated using the yearly average New York dealer price.

Cadmium

Cadmium is associated with zinc. Production includes the recoverable content of cadmium in the zinc-lead concentrates shipped, valued at the yearly average New York dealer price.

Calcium

Output figures represent calcium metal plus the calcium content of alloys from Canadian sources valued at the average yearly price of metal crowns.

Cesium

Production figures represent the cesium oxide content of pollucite ore shipped. The value is as reported by the producer.

Cobalt

Production includes recoverable cobalt in concentrates shipped. The value is calculated using the average yearly cathode dealer spot prices.

Copper

Production includes recoverable copper in concentrates shipped. The value is calculated using a combination of the

Commodities Exchange, Inc. (COMEX) first position price and the average London Metal Exchange Grade A Settlement price.

Germanium

Production includes germanium contained in concentrates shipped with values as reported by the shipper.

Gold

Production includes gold in crude bullion obtained directly from placer workings and lode gold mines, and recoverable gold in all types of ores and concentrates shipped. The value is calculated using the average final price as established by bullion dealers in London.

Ilmenite

Production includes shipments of direct shipping grade ore at Canada's sole shipper's reported value.

Indium

Production includes quantities recovered in the smelting of silver-lead-zinc ores from Canadian sources. The output is valued by the shipper.

Iron Ore

Production figures represent product shipments (pellets, concentrates, ores) at the values shown by the shippers. Production from steel plant waste oxides is excluded.

Iron (Remelt)

This is sometimes called pig iron or Sorel iron. It is a co-product in the smelting of ilmenite ores. Quantity and value figures are those reported by the producer.

Lead

Production includes recoverable lead in concentrates shipped. The value is computed at the average producer price for the year.

Lithium

Production figures represent the lithium oxide content of spodumene and amblygonite ore shipped. The value is as reported by the producer.

Magnesium

Output figures represent magnesium metal, plus the magnesium content of alloys from Canadian sources. Values are compiled using the average yearly price of primary ingots.

Molybdenum

Production figures are the molybdenum content of the oxides, ferromolybdenum and sulphides shipped; the value is that shown by the shipper.

Nickel

Production includes recoverable nickel in concentrates shipped. The value is calculated using an assessment price based on London Metal Exchange prices.

Niobium (Columbium)

Production includes niobium (columbium) contained in ferroniobium shipped with values as reported by the shipper.

Platinum Group Metals (PGM)

Production figures for iridium, palladium, platinum, ruthenium and rhodium include recoverable metal in concentrates shipped. Quantities are valued using average New York dealer prices or London Metal Exchange prices, depending on the metal.

Rhenium

Production figures reflect the content of concentrates shipped. Values are those reported by the shipper.

Rubidium

Production figures include the content of concentrates shipped. Values are as reported by the shipper.

Selenium

Production includes selenium produced as a refinery by-product from Canadian sources and recoverable selenium contained in concentrates exported. The quantities are valued at the average New York dealer price for the year.

Silver

Production includes silver in crude bullion obtained directly from placer workings and lode gold mines, and recoverable silver in all types of ores and concentrates shipped. The value is calculated using the average of Toronto quotations for the year.

Tantalum

Production comprises the tantalum pentoxide content of concentrates shipped. The value is calculated using the average spot price for the year.

Tellurium

Production includes tellurium produced as a refinery by-product from Canadian sources and recoverable tellurium contained in concentrates exported. The quantities are valued at the average producers' price for the year.

Tungsten

Production figures include the content of concentrates shipped. Values are as reported by the shipper.

Uranium

Producers of uranium precipitates or concentrates report the metal content (U) of the shipments and the value is calculated using the average spot price for the year.

Zinc

Production comprises recoverable zinc in concentrates shipped. The value is calculated using the average London Metal Exchange price for the year.

Nonmetallic Mineral Production

Owing to the fact that it is difficult to obtain figures of the actual production of nonmetallic minerals in Canada, and since the first actual measurement is when the product is sold, plant shipments have been taken to represent production in all cases.

Barite

Production is the shipments of the various grades at the selling value, f.o.b. shipping points.

Carbonatite

Production is the shipments from the plant. Values are f.o.b. plant, as reported by the producer.

Cement

Production comprises shipments of portland and masonry cements, exported clinker minus imported clinker, and transfers to other corporate divisions for use in other manufacturing processes. Values are f.o.b. plant, as reported by the shipper.

Chrysotile (Asbestos)

Production figures represent shipments of the various grades at the total selling value, f.o.b. shipping points, less the value of containers.

Clay Products

Production represents shipments of brick and other clay products made from domestic clays, and the shipments of unmanufactured clays (bentonite, diatomite) at the total selling value, f.o.b. works, as reported by the operators. Data relating to clay products manufactured from imported clays are not included.

Diamonds

Production is shipments from the mine. The value is reported by the producers.

Gemstones

Production is the tonnage of crude and rough cut gemstones (excluding diamonds) at the selling value, f.o.b. shipping points.

Graphite

Production is the shipments of various grades from the mill at its selling value, f.o.b. the mill, less container costs.

Gypsum¹

Production is taken as the tonnage of crude gypsum and anhydrite shipped from quarries or mines in lump, crushed or fine-ground forms. The value is that reported by the operators. (Note: Gypsum used in the manufacture of cement in Canadian cement plants is excluded.)

Lime

Production represents the tonnage of hydrated and quick-lime shipped (sold by the producer) together with the tonnage of these limes produced and used by the producers of chemicals and allied products. The values are as reported by the producer.

Magnesite

Production is the tonnage of crude material sold by primary producers, plus the tonnage of calcined or dead-burned material sold or used by primary producers. The value is that reported by the producers.

¹ To avoid duplication in computing a total value for Canadian mineral production, the quantity and value of gypsum, silica, stone, and sand and gravel used in the manufacture of lime, cement and clay products are not included in the totals for gypsum, silica, stone, and sand and gravel production. These particular data are recorded separately and are published in conjunction with data for the lime, cement and clay industries.

Marl

Production is producers' shipments from the plant. Values, f.o.b. plant, are reported by the producer.

Mica

Production is recorded as shipments from plants dressing new mica and exported shipments directly from the mines. The value of shipments is taken as reported by operators.

Nepheline Syenite

Production of crude and ground nepheline syenite is the amount of the various grades shipped at the total selling value, f.o.b. works, less container costs.

Peat

Production comprises crude peat shipped to Canadian non-producers as fuel or for export, baled peat shipped, and the peat content of mixed products shipped. The value is sales, f.o.b. works, less the cost of containers.

Phosphate

Production is shipments from the plant. Values are f.o.b. plant, as reported by the producer.

Potash

Production represents producers' shipments of various grades from the plant and is measured as the K₂O equivalent. The value of shipments, f.o.b. plant, is reported by the producers.

Potassium Sulphate

Production is producers' shipments from the plant. Values, f.o.b. plant, are reported by the producer.

Pumice

Production is producers' shipments from the plant. Values, f.o.b. plant, are reported by the producer.

Quartz (Silica)¹

Production represents the tonnage of crude or pulverized quartz, quartzite, pure silica sand, or other natural silica material shipped for sale, plus the tonnage of any of these materials used by producers. The value is taken as reported by producers.

Salt

Production is taken as the tonnage of various grades of dry salt shipped by primary producers, plus the salt content of

brine used by producers for industrial (chemical) purposes. The value is that reported by producers.

Sand and Gravel¹

Production represents shipments of natural gravel, sand and crushed gravel at the values reported by operators of sand and gravel pits or dredges.

Serpentine

Production represents producers' shipments of various grades, valued f.o.b. plant, as reported by the producer.

Soapstone, Talc, Pyrophyllite

Production comprises crude, ground or sawn soapstone shipments; crude, milled or refined talc shipments; and crude or ground pyrophyllite shipments. All shipments are f.o.b. the mill or plant and are valued by the shipper.

Sodium Sulphate

Production is the tonnage of crude or refined natural sodium sulphate shipped at its selling value, f.o.b. shipping points. The figures exclude the sodium sulphate produced as a by-product of paper or rayon manufacturing.

Stone¹

Production represents quarry shipments of crude or non-dressed stone, crushed stone, and dressed stone, if the latter is prepared by the quarry operators at values as reported by the operators. The figures include data for both private and public or municipally owned properties. Production figures do not include dressed stone prepared from imported stone or prepared from domestic stone in works not at the quarries.

Sulphur in Smelter Gas

Prior to final metal recovery, sulphide concentrates are smelted or roasted and the resultant gases may be used to produce marketable sulphur, sulphur dioxide or sulphuric acid. Production is considered as the sulphur content of sulphuric acid made, sulphur dioxide marketed and sulphur shipped. This sulphur is valued at the average price for sulphur sold in acid. Production is shown by the province/territory of origin of concentrates.

Sulphur, Elemental

In the western provinces, sour natural gas is processed to remove hydrogen sulphide, which is further reduced to yellow elemental sulphur. Sulphur recovered from the refining of Canadian crude petroleum is also included. Production is shown by the province/territory of origin of material and values are as reported by the shippers.

Titanium Dioxide

Ilmenite ore is smelted at Sorel, Quebec, to produce a slag containing titanium dioxide. Production is the titanium dioxide content of slag valued by the producer.

Tremolite

Production is shipments of various grades at the selling values, f.o.b. shipping point, less the value of containers.

Zeolite

Production is shipments from the plant. Values are f.o.b. plant, as reported by the producer.

Fuels**Coal**

Production figures are equal to shipments from the mine/plant plus "own" consumption as valued by shippers, f.o.b. mine/plant.

VALUATION OF TRADE DATA

(Note: The following has been extracted from Statistics Canada catalogue no. 65-001-X.)

For Customs purposes, imports are recorded at values established according to the provisions of the *Customs Act* which, since January 1, 1985, reflects valuation methods based on the General Agreement on Tariffs and Trade (GATT) Valuation Code System. It generally requires that the value for duty of imported goods be equivalent to the transaction value or the price actually paid.

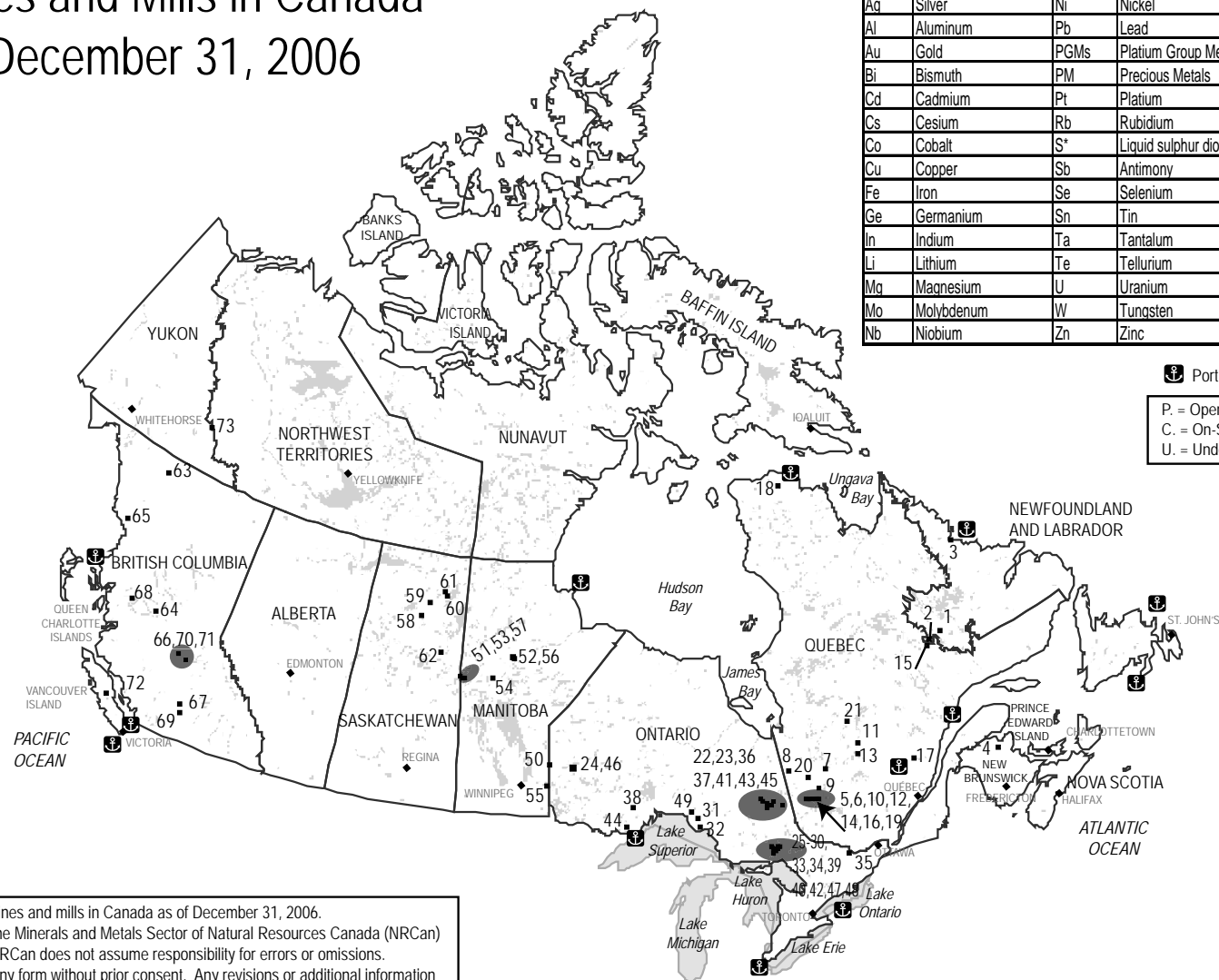
To determine the transaction value of imported goods, all transportation and associated costs arising in respect of the goods being appraised prior to and at the place of direct shipment to Canada are to be added to the price of the goods. Therefore, Canadian imports are valued f.o.b. (free on board), place of direct shipment to Canada. The value excludes freight and insurance costs in bringing the goods to Canada from the point of direct shipment.

To countries other than the United States, exports are, in principle, valued or recorded at the values declared on export documents, which usually reflect the transaction value, i.e., actual selling price, or in the case of a non-arm's-length transaction, the transfer price used for company accounting purposes. Canadian exports to overseas countries are valued at f.o.b. port of exit, including domestic freight charges to that point, but net of discounts and allowances. As of January 1990, Canadian exports to the United States are valued f.o.b. point of exit from Canada. Prior to 1990, they were valued f.o.b. place of lading net of freight charges, discounts and allowances.

APPENDIX A

Maps of Metal Mines and Mills,
and Selected Metallurgical Works
in Canada

Metal Mines and Mills in Canada as of December 31, 2006



Legend			
Ag	Silver	Ni	Nickel
Al	Aluminum	Pb	Lead
Au	Gold	PGMs	Platinum Group Metals
Bi	Bismuth	PM	Precious Metals
Cd	Cadmium	Pt	Platinum
Cs	Cesium	Rb	Rubidium
Co	Cobalt	S*	Liquid sulphur dioxide, sulphuric acid
Cu	Copper	Sb	Antimony
Fe	Iron	Se	Selenium
Ge	Germanium	Sn	Tin
In	Indium	Ta	Tantalum
Li	Lithium	Te	Tellurium
Mg	Magnesium	U	Uranium
Mo	Molybdenum	W	Tungsten
Nb	Niobium	Zn	Zinc

⚓ Port terminals

P. = Open Pit-Mine
C. = On-Site Concentrator
U. = Underground Mine

The present map portrays metal mines and mills in Canada as of December 31, 2006. The data have been compiled by the Minerals and Metals Sector of Natural Resources Canada (NRCan) from a variety of public sources. NRCan does not assume responsibility for errors or omissions. No portion may be reproduced in any form without prior consent. Any revisions or additional information known to the user would be welcomed by the Minerals and Mining Statistics Division.

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Metal Mines and Mills in Canada as of December 31, 2006

NEWFOUNDLAND AND LABRADOR

- 1 - Carol Lake Project - Iron Ore Company of Canada (IOC) Ltd. - (P.) - Fe
- 2 - Scully mine - Cliffs Mining Company - (P., C.) - Fe
- 3 - Voisey's Bay mine - CVRD Inco Limited - (P., C.) - Ni, Cu, Co

NEW BRUNSWICK

- 4 - Brunswick mine - Xstrata Plc - (U., C.) - Pb, Zn, Cu, Ag, Au

QUEBEC

- 5 - East Amphi mine - Richmond Mines Inc. - (P.) - Au
- 6 - Kiena mine - Wesdome Gold Mines Ltd. - (U.) - Au
- 7 - Langlois mine - Breakwater Resources Ltd. - (U.) - Zn, Cu, Au, Ag
- 8 - Casa Berardi mine - Aurizon Mines Ltd. - (U.) - Au
- 9 - Beaufor mine - Louvem Mines Inc./Richmont Mines Inc. - (U., C.) - Au, Ag
- 10 - Camfilo mill - Richmond Mines Inc. - (C.) - Au
- 11 - Copper Rand mine - Campbell Resources Inc. - (U., C.) - Au, Ag, Cu, Zn
- 12 - Doyon mine - IAMGOLD Corporation - (U.) - Au, Ag
- 13 - Joe Mann mine - Campbell Resources Inc. - (U., C.) - Au, Ag, Cu
- 14 - LaRonde mine - Agnico-Eagle Mines Limited - (U., C.) - Zn, Cu, Au, Ag
- 15 - Mount-Wright mine - Quebec Cartier Mining Company - (P.) - Fe
- 16 - Mouska mine - IAMGOLD Corporation - (U.) - Au, Ag
- 17 - Niobec mine - IAMGOLD Corporation - (U., C.) - Nb, Ta
- 18 - Raglan mine - Xstrata Plc - (P., U., C.) - Ni, Cu, Co, PGMS
- 19 - Sigma-Lamaque complex - Century Mining Corporation - (P.) - Au, Ag
- 20 - Sleeping Giant mine - IAMGOLD Corporation - (U., C.) - Au, Ag
- 21 - Troilus mine - Inmet Mining Corporation - (P., C.) - Au, Ag, Cu

ONTARIO

- 22 - Clavos mine - St. Andrew Goldfields Ltd. - (U.) - Au
- 23 - Redstone mine - Liberty Mines Inc. - (U.) - Ni
- 24 - Campbell mine - Goldcorp Inc. - (U., C.) - Au, Ag
- 25 - Clarabelle mill - CVRD Inco Limited - (C.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 26 - Coleman/McCreedy East mine - CVRD Inco Limited - (U.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 27 - Copper Cliff North mine - CVRD Inco Limited - (U.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 28 - Copper Cliff South mine - CVRD Inco Limited - (U.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te

- 29 - Craig mine - Xstrata Plc - (U.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 30 - Creighton mine - CVRD Inco Limited - (U.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 31 - David Bell mine - Teck Cominco Limited/Barrick Gold Corporation - (U., C.) - Au
- 32 - Eagle River mine - Wesdome Gold Mines Ltd. - (U., C.) - Au
- 33 - Fraser mine - Xstrata Plc - (U.) - Ni, Cu, Co, PGMS
- 34 - Garson mine - CVRD Inco Limited - (U.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 35 - Haley mine - Timminco Limited - (P.) - Mg
- 36 - Hoyle Pond mine - Goldcorp Inc. - (U.) - Au, Ag
- 37 - Kidd Creek mine - Xstrata Plc - (U., C.) - Cu, Zn, Ag, Se, Te, In, Cd
- 38 - Lac des Iles mine - North American Palladium Ltd. - (P., U., C.) - PGMS, Ni, Au, Cu, Co
- 39 - Lindsley mine - Xstrata Plc - (U.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 40 - Lockerby mine - First Nickel Inc. - (U.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 41 - Macassa mine - Kirkland Lake Gold Inc. - (U., C.) - Au, Ag
- 42 - McCreedy West mine - FNX Mining Company Inc. - (U.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 43 - Montcalm mine - Xstrata Plc - (U.) - Ni, Cu, Co, PGMS
- 44 - Musselwhite mine - Goldcorp Inc./Kinross Gold Corporation - (U., C.) - Au, Ag
- 45 - Pamour mine - Goldcorp Inc./Kinross Gold Corporation - (P.) - Au, Ag
- 46 - Red Lake mine - Goldcorp Inc. - (U., C.) - Au, Ag
- 47 - Stobie mine - CVRD Inco Limited - (U.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 48 - Strathcona mill - Xstrata Plc - (C.) - Ni, Cu, Co, PGMS, Au, Ag, Se, Te
- 49 - Williams mine - Teck Cominco Limited/Barrick Gold Corporation - (U., P., C.) - Au

MANITOBA

- 50 - Rice Lake mine - San Gold Corporation - (U.) - Au
- 51 - 777 mine - HudBay Minerals Inc. - (U.) - Cu, Zn, Au, Ag
- 52 - Birchtree mine - CVRD Inco Limited - (U.) - Ni, Cu, Co, PGMS
- 53 - Callinan mine - HudBay Minerals Inc. - (U.) - Cu, Zn, Au, Ag
- 54 - Chisel North mine - HudBay Minerals Inc. - (U., C.) - Cu, Zn
- 55 - Bernic Lake mine - Tantalum Mining Corporation of Canada Limited - (U., C.) - Ta, Li, Cs, Rb
- 56 - Thompson mine - CVRD Inco Limited - (U., C.) - Ni, Cu, Co, PGMS
- 57 - Trout Lake mine - HudBay Minerals Inc. - (U.) - Cu, Zn, Au, Ag

SASKATCHEWAN

- 58 - Key Lake operation - Cameco Corporation/AREVA Resources Canada Inc. - (C.) - U
- 59 - McArthur River mine - Cameco Corporation/AREVA Resources Canada Inc. - (U.) - U
- 60 - McClean Lake mine - AREVA Resources Canada Inc./Denison Mines Inc./OURD (Canada) Co., Ltd. - (P.) - U
- 61 - Rabbit Lake operations - Cameco Corporation - (U., C.) - U
- 62 - Seabee mine - Claude Resources Inc. - (U., C.) - Au, Ag

BRITISH COLUMBIA

- 63 - Table Mountain mine - Cusac Gold Mines Ltd. - (U.) - Au
- 64 - Endako mine - Thompson Creek Mining Limited/Nissho Iwai Moly Resources Inc. - (P., C.) - Mo
- 65 - Eskay Creek mine - Barrick Gold Corporation - (U., C.) - Au, Ag
- 66 - Gibraltar mines - Taseko Mines Limited - (P.) - Cu, Mo
- 67 - Highland Valley mine - Teck Cominco Limited/Highmont Mining Company - (P., C.) - Cu, Mo
- 68 - Huckleberry mine - Imperial Metals Corporation/Mitsubishi Materials Corporation/Marubeni Corporation/Dowa Mining Co., Ltd./Furukawa Co., Ltd. - (P., C.) - Cu, Mo, Au
- 69 - Iron concentrates operation - Craigmont Mines Ltd. - (P., C.) - Fe
- 70 - Kemess complex - Northgate Minerals Corporation - (P., C.) - Au, Cu
- 71 - Mount Polley mine - Imperial Metals Corporation - (P., C.) - Au, Cu
- 72 - Myra Falls operations - Breakwater Resources Ltd. - (U., C.) - Zn, Cu, Au, Ag

NORTHWEST TERRITORIES

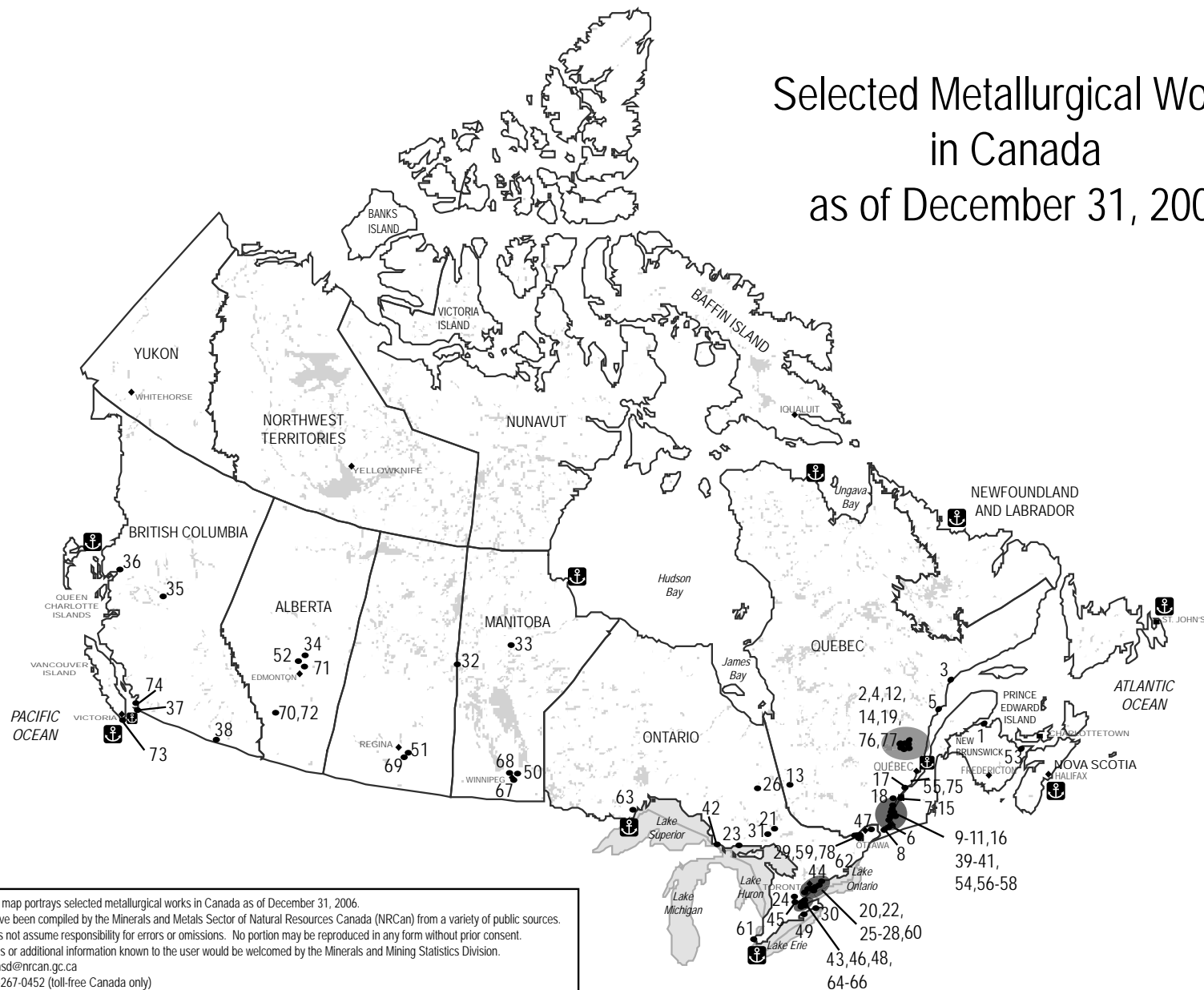
- 73 - CanTung mine - North American Tungsten Corporation Ltd. - (U., C.) - W



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Selected Metallurgical Works in Canada as of December 31, 2006



The present map portrays selected metallurgical works in Canada as of December 31, 2006. The data have been compiled by the Minerals and Metals Sector of Natural Resources Canada (NRCAN) from a variety of public sources. NRCAN does not assume responsibility for errors or omissions. No portion may be reproduced in any form without prior consent. Any revisions or additional information known to the user would be welcomed by the Minerals and Mining Statistics Division.
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Selected Metallurgical Works in Canada as of December 31, 2006

SMELTERS AND REFINERIES

NEW BRUNSWICK

1 - Brunswick Smelting Division - Xstrata Plc - (Sm.) - Pb, Bi, PM

QUEBEC

2 - Alma smelter - Alcan Inc. - (Sm.) - Al
3 - Alouette smelter - Alcan Inc./Aluminium Austria Metall Québec/Hydro Aluminum a.s./
Société générale de financement du Québec/Marubeni Québec Inc. - (Sm.) - Al
4 - Arvida smelter - Alcan Inc. - (Sm.) - Al
5 - Baie-Comeau smelter - Alcoa Inc. - (Sm.) - Al
6 - Beauharnois - Alcan Inc. - (Sm.) - Al
7 - Bécancour smelter - Alcoa Inc./Alcan Inc. - (Sm.) - Al
8 - Canadian Electrolytic Zinc Limited/Xstrata Plc/Noranda Income Fund - (Ref.) - Zn, Cd
9 - CCR refinery - Xstrata Plc - (Ref.) - Cu, PM, Se, Te
10 - Deschambault smelter - Alcoa Inc. - (Sm.) - Al
11 - General Smelting Company of Canada - Xstrata Plc - (Sec. Sm.) - Zn, Pb, Sb, Sn
12 - Grande-Baie smelter - Alcan Inc. - (Sm.) - Al
13 - Horne smelter - Xstrata Plc - (Sm.) - Cu, S*
14 - Laterrière smelter - Alcan Inc. - (Sm.) - Al
15 - Lithium carbonate refinery - Limtech Lithium Industries Inc. - (Ref.) - Lithium carbonate
16 - Sainte-Catherine operations - Nova Pb Inc. - (Ref., Sec. Sm.) - Pb
17 - Shawinigan smelter - Alcan Inc. - (Sm.) - Al
18 - Sorel-Tracy complex - Goldcorp Inc./Kinross Gold Corporation - (Sm.) - Titanium dioxide, Fe
19 - Vaudreuil alumina refinery - Alcan Inc. - (Ref.) - Alumina

ONTARIO

20 - Brampton operations - Johnson Matthey Limited - (Sm., Ref.) - Au, Ag
21 - Copper Cliff complex - CVRD Inco Limited - (Sm., Ref., Pl.) - Ni, Cu, PM, S*, Se, Te, PGMs
22 - Fuel Services Division - conversion facilities - Cameco Corporation - (Con. Fac.) - U
23 - Fuel Services Division - refinery - Cameco Corporation - (Ref.) - U
24 - Guelph plant - Wabash Alloys Inc. - (Sec. Sm.) - Al
25 - Handy & Harman of Canada, Limited - subsidiary of WHX Corporation - (Ref.) - PM
26 - Kidd Metallurgical Division - Xstrata Plc - (Sm., Ref., Pl.) - Cu, PM, Zn, In, S*, Cd
27 - Mississauga operations - Tonolli Canada Ltd. - (Sec. Sm., Ref.) - Pb
28 - Mississauga plant - Wabash Alloys Inc. - (Sec. Sm.) - Al
29 - Ottawa refinery - Royal Canadian Mint - (Ref.) - Au
30 - Port Colborne refinery - CVRD Inco Limited - (Ref.) - Co
31 - Sudbury smelter - Xstrata Plc - (Sm., Pl.) - Ni, Cu, Co, S*, PGMs, Au, Ag

MANITOBA

32 - Flin Flon zinc plant and copper smelter - HudBay Minerals Inc. - (Sm., Ref.) - Zn, Cu, Cd
33 - Manitoba operations - CVRD Inco Limited - (Sm., Ref.) - Ni, Co

ALBERTA

34 - The Cobalt Refinery Company Inc. - Sherritt International Corporation/General Nickel Company S.A. - (Ref.) - Ni, Co

BRITISH COLUMBIA

35 - Endako mines - Thompson Creek Mining Limited/Sojitz Moly Resources Inc. - (Proc. Pl.) - Mo
36 - Kitimat smelter - Alcan Inc. - (Sm.) - Al
37 - Richmond operations - Metalex Products Ltd. - (Sec. Sm.) - Pb
38 - Trail complex - Teck Cominco Limited - (Sm., Ref., Pl.) - Zn, Pb, Bi, Cd, In, Ge, PM, S*

Conversion Facility (Con. Fac.), Plant (Pl.), Processing Plant (Proc. Pl.), Refinery (Ref.),
Smelter (Sm.), Secondary Smelter (Sec. Sm.)

STEEL MILLS

QUEBEC

39 - Mittal Canada Inc. - (EAF) - Contrecoeur - Fe
40 - Norambar Inc. - (EAF) - Contrecoeur - Fe
41 - QIT-Fer et Titane inc. - (EAF) - Tracy - Fe

ONTARIO

42 - Algoma Steel Inc. - (BOF) - Sault Ste. Marie - Fe
43 - Dofasco Inc. - (BOF, EAF) - Hamilton - Fe
44 - Gerdau Ameristeel Corporation - (EAF) - Whitby - Fe
45 - Gerdau Ameristeel Corporation - (EAF) - Cambridge - Fe
46 - Hamilton Specialty Bar - (BOF) - Hamilton - Fe
47 - Ivaco Inc. - (EAF) - L'Orignal - Fe
48 - Stelco Inc. - (EAF) - Hamilton - Fe
49 - Stelco Inc. - (BOF) - Nanticoke - Fe

MANITOBA

50 - Gerdau Ameristeel Corporation - Selkirk - Fe

SASKATCHEWAN

51 - IPSCO Saskatchewan Inc. - (EAF) - Regina - Fe

ALBERTA

52 - AltaSteel Ltd. - (EAF) - Edmonton - Fe

Basic Oxygen Furnace (BOF), Electric Arc Furnace (EAF)

AUTOMOBILE SHREDDERS

NEW BRUNSWICK

53 - Fers et Métaux Recyclés Ltée - Cyclomet

QUEBEC

54 - Associated Steel Industries Ltd. - Sainte-Catherine
55 - Capitale Métal Recyclé Inc. - Saint-Augustin
56 - Fers et Métaux Recyclés Ltée - La Prairie
57 - Québec Métal Recyclé Inc. - Québec Division - Laval
58 - Sidbec-Feruni inc. - Contrecoeur

ONTARIO

59 - Bakermat Inc - Ottawa
60 - Co-Steel Inc. - Lasko Division - Whitby
61 - General Scrap & Car Shredder Ltd. - Windsor
62 - Glenview Iron & Metal Ltd. - Smith Falls
63 - Lakehead Scrap Metals Inc. - Thunder Bay
64 - Poscor Mill Services Corp. - Hamilton
65 - Triple M Metals Inc. - Hamilton
66 - Triple M Metals Inc. - Brampton

MANITOBA

67 - General Scrap & Car Shredder Ltd. - Winnipeg
68 - Mandak Metal Processors Ltd. - Selkirk

SASKATCHEWAN

69 - Wheat City Metals Inc. - Regina

ALBERTA

70 - Calgary Metal - Calgary
71 - GenAlta Recycling Inc. - Edmonton - Sherwood Park
72 - Navajo Metals Inc. - Calgary

BRITISH COLUMBIA

73 - Budget Steel Inc. - Victoria
74 - Richmond Steel Recycling Limited - Burnaby

FERROALLOY PLANTS

QUEBEC

75 - Bécancour Silicon Inc. - Bécancour - Silicon metal, ferrosilicon
76 - Elkem Métal Canada Inc. - Chicoutimi - Ferrosilicon
77 - Niobec Division - Saint-Honoré-de-Chicoutimi - Ferroniobium

ONTARIO

78 - Oxbow Corp. - Ottawa - Ferrovandium, ferromolybdenum



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