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CANADA

DEPARTMENT OF TRADE AND COMMERCE

DOMINION BUREAU OF STATISTICS

CENSUS OF INDUSTRY

MINING, METALLURGICAL & CHEMICAL BRANCH

Report

on

MISCELLANEOUS METALS IN CANADA, 1943

including

Aluminium
Antimony
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium
Iron
Indium
Lithium
Magnesium
Manganese
Mercury
Molybdenum
Monazite-Pitchblende
Selenium
Tantalum-Columbium
Tellurium
Tin
Titanium (ilmenite)
Tungsten
Vanadium
Zirconium

OTTAWA
1944

Price 50 cents

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MISCELLANEOUS METALS, 1943

The mining of certain metal-bearing ores, other than those commonly classified as gold, silver, copper, nickel, cobalt, lead and zinc, have been grouped, for statistical purposes, as a single industry, by the Dominion Bureau of Statistics. Their production in some instances is confined to a relatively few operators and the annual extraction of certain types often fluctuates in an erratic manner according to demand and supply. Included in this report, with the finally-revised statistics relating to the Canadian production of these ores or metals, are notes and statistical data pertaining to various rare or semi-rare metals or metalliferous ores produced in other countries. Metals and metal-bearing ores produced in Canada during 1943 and classified as miscellaneous include antimony, bismuth, cadmium, chromite, iron ore, magnesium, manganese ore, mercury, molybdenite, pitchblende, selenium, tellurium, titanium ore, tin and tungsten concentrates. In addition to particulars relating to these metals or minerals, the bulletin contains notes of a summary nature on aluminum, beryllium, lithium, vanadium and a few of the rarer metals.

It is to be noted that the majority of the metals listed above as Canadian products and including bismuth, cadmium, selenium and tellurium, represent by-products recovered in the refining of lead, zinc or copper and, for this reason, such statistics as relate to their production in Canada are included with those of either the silver-lead-zinc mining industry, the copper-gold-silver mining industry, or the non-ferrous smelting and refining industry.

The number of firms reported as active in the miscellaneous metals mining industry during 1943 totalled 54; capital employed amounted to $15,603,307 and $4,295,153 were distributed in salaries and wages to 1,964 employees. The cost of fuels, process supplies, freight and treatment, etc., consumed aggregated $2,540,873, and the gross value of production totalled $9,062,368; the corresponding net value of same was estimated at $6,521,495.

Table 1 - PRINCIPAL STATISTICS(x) OF THE MISCELLANEOUS METAL MINING INDUSTRY IN CANADA, 1942 and 1943

		1942	1943
Number of firms		68	54
Number of plants		67	59
Capital employed (/)	$	5,956,427	15,603,307
Number of employees—On salary		191	277
On wages		1,161	1,687
Total		1,352	1,964
Salaries and wages—Salaries	$	286,952	600,684
Wages	$	2,109,799	3,694,469
Total	$	2,396,751	4,295,153
Value of production (gross)	$	5,516,241	9,062,368
Cost of fuel and electricity	$	623,665	1,055,552
Process supplies used	$	600,900	1,215,049
Smelter charges	$	33,910	2,759
Freight	$	261,211	263,513
Value of production (net)	$	3,996,555	6,521,495

(x) Does not include data relating to smelters and refineries or to mining in the Northwest Territories.
(/) Exclusive of ore reserves.

Table 2 - CAPITAL EMPLOYED IN THE MISCELLANEOUS METALS MINING INDUSTRY IN CANADA, 1943

Capital employed as represented by -	$
Present cash value of the land (excluding minerals)	4,809,832
Present value of buildings, fixtures, machinery, tools and other equipment	7,119,387
Inventory value of materials on hand, ore in process, fuel and miscellaneous supplies on hand	1,087,909
Inventory value of finished products on hand	635,958
Operating capital (cash, bills and accounts receivable, prepaid expenses, etc.)	1,950,241
TOTAL	15,603,307

Table 3 - AVERAGE NUMBER OF WAGE-EARNERS EMPLOYED, BY MONTHS, 1942 and 1943

Month	1942	1943				
		Surface		Under-ground	Mill	
	Total	Male	Female		Male	Female
January	785	949	12	530	154	...
February	826	928	13	485	157	...
March	858	978	13	475	150	...
April	906	928	12	430	157	...
May	911	957	14	451	165	23
June	1,024	1,036	15	511	197	14
July	1,152	1,081	17	525	207	19
August	1,282	1,095	34	552	200	19
September	1,344	1,004	35	460	207	22
October	1,465	951	37	480	198	22
November	1,602	930	34	521	189	20
December	1,678	825	24	475	175	5

Table 4 - NUMBER OF WAGE-EARNERS WHO WORKED THE NUMBER OF HOURS SPECIFIED, DURING ONE WEEK IN MONTH OF HIGHEST EMPLOYMENT (Including overtime)

	50 hours or less	51-43 hours	44 hours	45-47 hours	48 hours	49-50 hours	51-54 hours	55 hours	56-64 hours	65 hours and over	Grand total	Total wages paid in that week (x)
												$
Male ...	57	89	14	95	750	58	150	21	727	185	2,084	86,870
Female..	2	1	2	5	8	...	2	3	7	18	46	1,809

(x) Including the actual money wages paid, any bonus, the value of room and board, where provided, deductions from employees for income tax and for social services, such as sickness, accident, insurance, pensions, etc., as well as any other allowances forming part of the employees' wages.

Table 5 - FUEL AND ELECTRICITY USED DURING 1943

Kind		Quantity	Cost at Plant
			$
Bituminous coal (a) From Canadian mines	short ton	505	2,739
(b) Imported	short ton	4,517	53,069
Anthracite coal (a) From United States	short ton	86	1,672
(b) Other	...	...	...
Lignite coal	short ton	154	1,956
Coke (for fuel only)	short ton	21,425	102,711
Gasoline (including gasoline used in cars and trucks)	Imp.gal.	152,754	49,301
Kerosene or coal oil	Imp.gal.	3,365	1,005
Fuel oil and diesel oil	Imp.gal.	2,014,882	343,017
Wood (cords of 128 cubic feet of piled wood)	cord	50,615	318,298
Other fuel	...	...	...
Electricity purchased for power and lighting (including service charge)	K.W.H.	25,218,193	185,784
TOTAL	...	...	1,059,552
Electricity generated (a) For own use	K.W.H.	5,159,498	...
(b) For sale	...	...	...

Table 6 - POWER EQUIPMENT, 1943

Description	Ordinarily in Use		In Reserve or Idle	
	Number of units	Total horse power	Number of units	Total horse power
Steam engines	...	...	2	511
Steam turbines	...	...	...	...
Diesel engines	21	5,107	10	1,500
Gasoline, gas and oil engines, other than Diesel engines	25	959	6	535
Hydraulic turbines or water wheels	...	...	...	...
Electric motors -				
(a) Operated by purchased power	454	17,118	30	506
Total	500	21,164	48	2,852
(b) Operated by power generated by the establishments	80	1,840	7	343
Stationary boilers	16	1,248	3	259
Motor generator sets	8	776	4	267

ALUMINUM - The reduction of aluminum ores and the production of primary aluminum metal in Canada is confined to the province of Quebec. In this province the Aluminum Company of Canada Limited operates an ore treatment plant at Arvida and reduction works at Arvida, Shawinigan Falls, La Tuque, Isle Maligne and Beauharnois. These were all in continuous production throughout 1943 with the exception of Isle Maligne where metal output commenced in August. Secondary fabricating plants are also operated by the company at Shawinigan Falls in Quebec and at Toronto and Kingston in Ontario. No aluminum ores are mined in the Dominion and Canadian production of aluminum represents the recovery of the metal from foreign ores. During recent years imports of bauxite (aluminum ore) into Canada have come largely from British and Dutch Guiana with lesser quantities from the United States. At Arvida, Quebec, the bauxite is treated by a standard chemical process to remove impurities prior to its reduction to the metal. Cryolite, necessary in the production of aluminum, is largely imported from Greenland; synthetic cryolite is also used in making aluminum. A very large amount of electrical energy is utilized in the production of new aluminum metal from bauxite concentrates and the extensive expansion in the development of hydro power resources recently completed in the Saguenay district of Quebec has provided the aluminum industry with a greatly increased supply of electrical power.

The principal bauxite producing countries are France, Hungary, United States, Yugoslavia, Italy, British Guiana, Dutch Guiana and Russia. Complete data relating to aluminum and bauxite production by countries have not been available since 1938. Canadian production of new aluminum during 1943 totalled 991,499,296 pounds compared with 681,192,951 pounds in 1942 and 93,812,965 pounds in 1937. The output during 1943 was the largest ever attained by the Canadian aluminum industry.

According to the United States Bureau of Mines, the production of aluminum in the United States during 1943 totalled 920,179 short tons, exceeding the previous peak reached in 1942 by nearly 77 per cent; apparent United States consumption of primary aluminum in 1943 totalled an estimated 959,600 tons compared with 302,788 tons in 1941. Of the primary and secondary aluminum consumed in the form of fabricated products, about 70 per cent went into aircraft construction in airframes, landing gear, engines, propellors and fittings; the bulk of the remainder was consumed in ship construction, tank and truck engines, ordnance and other military uses, while only a minimum of essential civilian needs were met.

The Mining Journal, London, estimates that at the end of 1943 existing world capacity for production of aluminum, which was at last sufficient to meet all consumption needs, was probably not far short of 2 million tons, and total world production in 1943 can hardly have been less than 1¾ million tons.

Aluminum prices, New York, January, 1944, were: per pound delivered, commercial and mill ingot, 99 per cent, 15 cents; in pigs, 14 cents. The London home market, ingot £110 per long ton (nominal).

Data relating to employment, etc., in the Canadian aluminum industry are included with those of the Canadian non-ferrous smelting and refining industry, and are therefore not included with corresponding statistics shown in this report.

Table 7 - PRODUCTION OF PRIMARY ALUMINUM IN CANADA, 1934-1943

Year	Pounds	Year	Pounds
1934	34,865,362	1939	165,680,869
1935	46,342,747	1940	218,288,565
1936	59,280,250	1941	427,746,554
1937	93,812,965	1942	681,192,951
1938	142,407,743	1943	991,499,296

Table 8 - IMPORTS OF ALUMINUM AND BAUXITE INTO CANADA, 1942 and 1943

Item	1942 Cwt.	1942 Value	1943 Cwt.	1943 Value
		$		$
Alumina	1,573	25,041	1,780	31,795
Bauxite ore	26,170,948	11,711,899	60,211,389	21,242,907
Cryolite	507,407	1,573,105	448,521	1,893,762
Aluminum pigs, ingots and blocks	1	58	23	650
Aluminum scrap	80	903	1,548	17,013
Aluminum angles, channels and beams	67	3,281	7,481	355,880
Aluminum bars, rods and wire	27,775	824,507	22,270	533,720
Aluminum leaf	...	3,052	...	3,054
Aluminum pipes and tubes	490	28,286	1,429	129,718
Aluminum plates, sheets and strips	457	25,191	12,578	438,034
Aluminum powder	8.5	214	38.5	2,083
Aluminum wire and cable	5	210	7	285
Aluminum household hollow ware	...	23,602	...	3,551
Aluminum manufactures n.o.p.	...	321,940	...	489,593

Cwt. = 100 pounds.

Table 9 - EXPORTS OF ALUMINUM FROM CANADA, 1942 and 1943

Item	1942 Cwt.	1942 Value	1943 Cwt.	1943 Value
		$		$
Aluminum scrap	54	556	2,005	18,305
Aluminum in bars and ingots	6,289,666	112,154,078	7,507,670	124,460,894
Aluminum wire and cable	...	11,785	...	2,082
Aluminum manufactures, n.o.p.	...	5,108,108	...	4,780,904

Cwt. = 100 pounds.

The Engineering and Mining Journal, Metal and Mineral Markets, New York, September 7, 1944 stated: "In announcing cutbacks in production of aluminum on August 30, involving about 30,000,000 pounds of ingot a month, War Production Board (U.S.A.) officials said that scheduled imports from Canada had been reduced sharply for the remainder of 1944 and that delivery of 250,000,000 pounds of Canadian metal under contract had been postponed indefinitely".

ANTIMONY - Production of antimony metal in Canada during 1943 totalled 1,114,166 pounds valued at $189,408 compared with 5,041,108 pounds worth $516,988 in 1942. Production in both years, with the exception of 78 pounds contained in crude ore exported from Yukon in 1942, represents antimony electrolytically refined by the Consolidated Mining and Smelting Company of Canada Limited at Trail, British Columbia; the metal is recovered at Trail as a by-product from the flue dust of the company's silver refinery.

Antimony ore in the form of stibnite occurs in various parts of Canada and for a number of years prior to 1917 small amounts of refined antimony and of antimony ore were produced intermittently in the Maritime Provinces. Small shipments of antimony ore have also been made during recent years from the Fort St. James district of northern British Columbia, Nova Scotia, and from the Yukon. In 1942 an antimony deposit at Gates Lake, in the Kenora district of Ontario, was investigated. No crude antimony ores were commercially produced in Canada in 1943.

The world production of antimony in 1938 (1939-1942 figures not available), as published by the United States Bureau of Mines, amounted to about 38,000 tons. The production in 1937 was 42,100 tons, the highest figure since the 1914-1918 war years. The decline in output from China has been more than made up by the large increase in production in other countries. World production at present is probably in excess of 50,000 tons a year.

Most of the production of antimony has come from China, although Bolivia and Mexico have been important producers for year. In recent years, there has been a marked increase in output from Bolivia, Mexico, Yugoslavia, and Algeria and, to a lesser extent, from several other countries. In 1939 Bolivia produced 29 per cent of the world output of antimony; Mexico, 23 per cent; China, only 20 per cent; and Yugoslavia, 10 per cent. Prior to the war, most of the refined antimony was produced in the United States, Great Britain, France, and Belgium from ores of foreign origin.

Canada's requirements are now supplied mainly from the electrolytic plant at Trail, British Columbia, according to the Bureau of Mines, Ottawa.

Antimony is an important war metal. It is used largely in alloys for storage-battery plates, bearing and babbitt metals, solder, rubber goods, paints and fixtures. The use of antimony in the manufacture of chemicals increased considerably during the past two years. The principal compound is the oxide of antimony, which is employed extensively as a pigment in sanitary enamelware and nitro cellulose enamels.

The New York price of antimony metal (ordinary brand) in 1943 remained fixed at 16 cents a pound throughout the year. The price for Chinese brand, duty paid, remained at 16.5 cents throughout the year. The price of antimony ore, c.i.f. New York in 1943, per unit of antimony contained was; for 50 to 55 per cent Sb., $2.10 to $2.20; for 55 to 60 per cent Sb., $2.15 to $2.20; and for 60 to 65 per cent Sb., $2.20 to $2.30.

Table 10 - ANTIMONY PRODUCED IN CANADA, 1937-1943

Year	In Ores Exported		Metal Produced in Canada		TOTAL	
	Pounds	$	Pounds	$	Pounds	$
1937	48,163	7,394	...	...	48,163	7,394
1938	24,560	2,200	...	...	24,560	2,200
1939	25,405	3,139	1,200,180	148,330	1,225,585	151,469
1940	44,700	3,800	2,549,792	392,668	2,594,492	396,468
1941	15,292	2,141	3,169,785	443,770	3,185,077	445,911
1942	78	13	3,041,030	516,975	3,041,108	516,988
1943	...	...	1,114,166	189,408	1,114,166	189,408

Table 11 - ANTIMONY USED IN SPECIFIED CANADIAN INDUSTRIES, 1941 and 1942

Industry	1941		1942	
	Pounds	$	Pounds	$
White metal alloys--Regulus	1,366,077	197,622	1,818,370	264,838
Antimony ore	11,044	539	...	...
Electrical apparatus and supplies	230,433	33,494	234,545	35,200

Table 12 - IMPORTS OF ANTIMONY AND SPECIFIED ANTIMONY-BEARING PRODUCTS INTO CANADA, 1942 and 1943

	1942		1943	
	Pounds	$	Pounds	$
Antimony or rugulus of, not ground, pulverized or otherwise treated	100	21	240,700	38,755
Antimony oxide and titanium oxide (x)	14,642,708	1,423,042	16,889,500	1,533,462
Antimony salts--tartar emetic, etc.	31,927	12,331	10,990	6,066
Antimony salts for dyeing	...	...	...	...
Type metal in blocks, bars, plates and sheets	10,097	1,524	268	63
Plates, cylinders (engravers)	...	152,260	...	144,952
Stereotypes for books (sq. inches)	1,286,933	115,686	1,756,520	131,684
Stereotypes for advertisements (sq. inches)	1,779,661	74,529	1,827,222	78,143
Printing plates for publications	...	125,234	...	162,648
Storage batteries and parts	...	401,945	...	513,463

(x) Including white pigments containing not less than 14 per cent by weight of titanium.

BARIUM - A report on barium minerals by the Imperial Institute, London, contains the following information:

"A series of lead-calcium-barium alloys known in some cases as Frary metal and others as Ferry metal, are used for bearing purposes. The amount of barium is about 2 per cent and the bulk of the alloy is lead. The alloys are manufactured electrolytically from molten chlorides using a cathode of molten lead, and are used in the same manner as other 'white' metals. Aluminium and barium form a series of alloys which have greater fluidity than pure aluminium. A range of barium-aluminium and barium-magnesium alloys are being produced by an English firm under the trade names 'Baral' and 'Barmag'. The proportion of barium varies up to as much as 50 per cent, but the consumers in the wireless valve trade usually require the 'Baral' alloy to contain 45 to 50 per cent of barium and the 'Barmag' alloy to carry 25 to 30 per cent barium. With nickel, barium forms an alloy (0.2 per cent barium) which is stated to exhibit greater resistance to the action of hot corrosive gases than does pure nickel, and on this account it has been used for the manufacture of sparking plug electrodes.

"The metal can be prepared by heating barium oxide (BaO) and peroxide (BaO_2) to 1350°C. in an electric furnace, with a metal having a high heat of oxidation, aluminium being suitable for this purpose. Barium is an extremely active deoxidizer, combines with many gases and in the radio industry is inserted, in the form of copper-clad wire, into valves (tubes) to remove the last traces of gas."

Barium has been produced in the United States, Germany, France and Great Britain, but not yet commercially in Canada. "Mineral Industry" reported in 1936 that the price of barium has been continuously reduced and it is probably now available at $5.00 per pound or less.

BERYLLIUM - The principal ore of beryllium is the mineral beryl--$Be_3Al_2(SiO_3)_6$. There are several known occurrences of this mineral in Canada and shipments of beryl have been made for experimental purposes from deposits in Renfrew county, Ontario, and the Oiseau river area in Manitoba. Beryl usually occurs in pegmatites and is sometimes recovered as a by-product in the mining of the feldspar and mica content of these rocks. No commercial production of beryl has ever been officially reported in Canada.

A report "Beryl in 1943", prepared by the Bureau of Mines, Ottawa, contains the following information:

"In Ontario, the most important occurrence is near Quadville, in Lyndoch township, Renfrew county, and this is probably the richest known Canadian concentration of beryl. The beryl-bearing pegmatite is believed to extend for a considerable distance along the strike, but owing to heavy overburden it is exposed at only two points about two miles apart. The property is owned by Canadian Beryllium Mines and Alloys, Ltd., 901 Royal Bank Building, Toronto, who have recovered a few tons of cobbed crystals, and stockpiled about 200 tons of rock that will require milling to recover the contained beryl. The mine has been inactive since 1940. In 1943, a detailed examination of the main working at the east end of the property was made by officers of the Bureau of Mines, Ottawa, and of the Metals Controller's Office, in an effort to appraise the economic possibilities of the deposit. The examination revealed an average content of 0.188 per cent of beryl in the total rock excavated, with a maximum for the richest quarry sections of 1.24 per cent. The grade of selected clean beryl crystals was 10.41 per cent BeO. Universal Light Metals Company, 28 James Street South, Hamilton, Ontario, has announced plans for the development of ground adjoining the Canadian Beryllium property.

"No figures of world production of beryl are available. The mineral, however, is produced on a very small scale, and the estimated output in 1940 was only about 2,500 tons. Because of increased demand and higher prices, production may have risen slightly since then.

"Brazil and Argentina are the present leading sources of beryl, and production in both countries has increased considerably in the past few years.

"The leading users of beryl on the American continent are Beryllium Corporation of Pennsylvania, Temple (Reading), Pennsylvania, and Brush Beryllium Company, 3714 Chester Avenue, Cleveland, Ohio, both of which are engaged in treating the mineral for the production of metal, alloys, and compounds. Beryllium oxide also is produced by Clifton Products Incorporated, Painesville, Ohio; and a plant for the manufacture of oxide and carbonate was being built in 1941 at Harbor City, California, by the Calloy Company.

"Importation of beryl into the United States, and purchase of the mineral, have been restricted to Government agencies, or their authorized representatives. Contracts for sale and export of beryl from Canada for United States Government account may be negotiated through the Metals Controller, Ottawa. All

such exports are subject to special export permit. From February until October, beryllium was placed in Group I (supply insufficient for war and essential industrial needs) of the list of critical materials issued by the Conservation Division of the United States War Production Board, but in the latter month it was moved down into Group II, comprising materials in adequate supply for current requirements.

"In the latter part of 1942 the price of beryl was stabilized by the United States Government at $8.33 per unit of contained BeO, equivalent to $83 and $100 per ton for 10 per cent and 12 per cent grades, respectively, this price being for purchases for Government account, f.o.b. New York. In 1943, quotations for Metals Reserve Company account were raised to $120 per ton, United States funds, for clean, cobbed crystals of 10 per cent grade, f.o.b. specified Purchase Depot. A premium or penalty of $12 per ton was provided for each one per cent BeO above or below 10 per cent, the minimum acceptable grade being 8 per cent. These prices were made effective until December 31, 1943.

"The price of beryllium-copper master alloy, containing 4 per cent beryllium, has remained unchanged for some time at $15 per pound of contained Be. The base price of beryllium-copper-cobalt alloys, with from 0.5 to 3.75 per cent Be content, ranged from $0.85 to $2.00 per pound as strip, rod or wire in 1943. Beryllium-iron, beryllium-nickel, and beryllium-aluminium sold at $47.00 per pound of contained Be, in minimum 5-pound lots, and at $50.00 for smaller quantities. Beryllium metal, 96 per cent pure, was quoted at $47.00 per pound for lump and turnings and $50.00 cast in bars. Calcined beryllium oxide continued firm at $4.00 per pound."

According to "Metal and Mineral Markets", New York, (May 25, 1944), the demand for beryllium-copper continued at a brisk pace, and the problem of obtaining sufficient quantities of beryllium ore was receiving increased attention from the United States War Production Board. To stimulate production further, Metals Reserve Company has instructed its agents to pay up to $14.50 per short ton unit of BeO, equivalent to $145.50 per ton, on acceptable ore containing 10 per cent BeO; the previous purchasing price was $120 per ton. Before the war market quotations varied between $30 and $35 per ton, depending on the grade.

BISMUTH - Production of bismuth in Canada during 1943 totalled 407,597 pounds valued at $562,484 compared with 347,556 pounds worth $479,627 in 1942. Production during recent years usually consisted of the metal recovered from silver-lead ores smelted by the Consolidated Mining and Smelting Company of Canada Limited at Trail, British Columbia, together with the bismuth content of a silver-lead-bismuth bullion produced in the treatment of silver-cobalt ores at Deloro, Ontario. Production in 1943 came entirely from the Trail metallurgical plants. The total output of bismuth in the Dominion to the end of 1943 amounted to 2,352,345 pounds worth $2,909,279.

Statistics of the world production of bismuth are incomplete, but the output is estimated at about 1,500 tons annually. The United States, Peru, Canada, and Mexico, supply about 90 per cent of the world output, their order of importance as producers being as given. The remainder of the output is obtained from Argentina, Australia, Belgium, Bolivia, China, France, Germany, Japan, Spain, and other countries.

The demand for bismuth increased considerably during the war period owing to its greater use in metallurgical and pharmaceutical applications. Bismuth is used mostly in the manufacture of pharmaceutical products. A much larger portion than formerly is now used in the making of so-called fusible or low-melting alloys. Fusible bismuth alloys usually include lead, tin, cadmium, mercury, or antimony. An alloy of bismuth, lead, tin, and antimony has been introduced for use in mounting dies and punches. Alloys containing bismuth are used to a greater extent than formerly in the aircraft, machine tool, munitions, and other industries. Additions of 0.1 to 1.5 per cent bismuth to stainless steel, copper and aluminium alloys improve machinability. There are numerous alloys of bismuth containing from 33 to 56 per cent bismuth.

The price of bismuth in 1943 (London price in Canadian funds) remained at $1.38 a pound. The price at New York remained fixed at $1.25 a pound throughout 1943. The American product is protected by a duty of 7½ per cent ad valorem. For several years the price has been well controlled.

Imports of bismuth salts into Canada during 1943 were appraised at $15,675 compared with $11,758 in 1942; there were no imports of bismuth metal in 1943 and only 5 pounds valued at $11 in 1942. Data relating to the bismuth content of alloys imported are not available.

Table 13 - PRODUCTION OF BISMUTH IN CANADA, 1930-1943

Year	Pounds	$	Year	Pounds	$
1930	12,732	6,366	1937	5,711	5,654
1931	118,207	157,650	1938	9,516	9,754
1932	16,855	7,340	1939	409,449(/)	466,362
1933	78,303	81,526	1940	58,529	81,004
1934	253,644	301,215	1941	7,511	10,396
1935	13,797	13,245	1942	347,556	479,627
1936	364,165	360,524	1943	407,597	562,484

(/) High record output.

Table 14 - BISMUTH USED IN THE MANUFACTURE OF CANADIAN MEDICINAL AND PHARMACEUTICAL PREPARATIONS, 1941 and 1942

Item	1941 Pounds	1941 $	1942 Pounds	1942 $
Bismuth metal	30,993	38,188	24,420	30,554
Bismuth salts	14,159	29,251	18,153	35,793

Canadian white metal alloy foundries consumed approximately 25,979 pounds of bismuth metal in 1942 and 1,810 pounds in 1941.

BORON - According to the United States Bureau of Mines, boron alloys are supplied by United States manufacturers, small quantities being used in the non-ferrous metals industries and in steel making. In cast iron, boron opposes graphitization on solidification and exerts an energetic whitening effect, producing a hard strong iron but reducing malleability. Recently boron has been found to be one of the so-called minor elements that stimulate plant growth and inhibit the development of certain plant diseases.

"The Mineral Industry" reported in 1941 that tests demonstrated that the use of boron deoxidizers and the incorporation of 0.002-0.007 per cent boron in 0.4 per cent carbon steel increases the hardenability, ductility and toughness; the boron is best supplied as a complex alloy of B-Mn-Si-Ti, rather than as ferroboron.

Boron carbide, boron carbide shapes and calcium boride are now produced in Canada.

World reserves of boron minerals are abundant, but known sources are confined to a few countries, chiefly the United States, Chile, Argentina, Peru, Italy and Turkey, although Borax also has been reported in Tibet, Persia, India and Ceylon.

Imports of Borax into Canada during 1943, in packages of 25 pounds or over, totalled 9,482,003 pounds valued at $288,867.

CADMIUM - Cadmium production in Canada represents the recovery of the metal as a by-product in the electrolytic refining of zinc. Production up to 1935 came entirely from the treatment of zinc-bearing ores at Trail, British Columbia, by the Consolidated Mining and Smelting Company of Canada, Limited. The commercial production of the metal from the copper-gold-silver-zinc ores of the Flin Flon mine was commenced in Manitoba for the first time in 1936.

The output of new cadmium in the Dominion in 1943 totalled 786,611 pounds valued at $904,602 compared with 1,148,965 pounds worth $1,355,776 in 1942; of the 1943 production, 598,675 pounds valued at $688,474 were recovered from British Columbia ores treated at Trail; 20,985 pounds at $24,130 from Manitoba ores, and 166,955 pounds worth $191,998 from Saskatchewan deposits. The production of cadmium at the Flin Flon plants of the Hudson Bay Mining and Smelting Company Limited is proportioned between Manitoba and Saskatchewan owing to the fact that the interprovincial boundary intersects the ore body of the Flin Flon mine.

Cadmium is consumed largely in the manufacture of alloys and for plating, also in the making of such pigments as cadmium lithopone, cadmium yellows, etc. A relatively large quantity of the metal is

used in the production of bearing metals for high-speed internal combustion engines.

The world production is estimated at 7,500 short tons, the production in 1938, the latest year for which figures are available being 4,200 short tons. The chief producing countries in order of output are: the United States, Germany, Canada, Mexico, Belgium, Australia (Tasmania), Poland, Norway, England, Russia, and France. The Mexican output is contained in ores exported for treatment in various countries.

Production is limited entirely to the by-product recovery from electrolytic zinc and from the manufacture of lithopone, and is thus dependent on the output of these products.

The following is from the annual 1944 review of the "Mining Journal, London":

"The shortage of cadmium in the United States in 1943, it was disclosed, was principally due to the high consumption of the metal by the aircraft industry, which was taking about 50 per cent of the total material available. Use of cadmium in the aircraft industry is mainly for corrosion-resisting electro-plating. It is interesting to note, therefore, that statistics of cadmium consumption by types of uses in the first half of 1943 showed that more than 90 per cent of the total cadmium consumption in the United States was for electro-plating compared with 62 per cent in 1941. There was thus less than 10 per cent of the total consumption for bearings, pigments, solders and fusible alloys in 1943. The use of cadmium in pigments had been considerably restricted in 1942, and in fact was only allowed for special, mostly military, purposes. Practically all of the cadmium which is in excess of Canada's own requirements was shipped to Europe, and a number of restrictions were placed on the use of cadmium and its alloys, by the Canadian Metals Controller in January, 1943."

Exports of cadmium from Canada in 1943 totalled 572,215 pounds valued at $626,379 compared with 800,710 pounds worth $855,618 in 1942.

The price of cadmium in 1943 (in Canadian funds) averaged $1.15 a pound, compared with $1.18 in 1942. The price of metallic cadmium, f.o.b. New York, in commercial sticks remained at 90 cents a pound thoughout 1942 and 1943. The American product is protected by a duty of 7½ cents a pound. Previous to the Trade Agreement of November, 1938, the duty was 15 cents a pound.

Table 15 - CADMIUM PRODUCTION IN CANADA, 1928-1943

Year	British Columbia		Manitoba		Saskatchewan	
	Pounds	$	Pounds	$	Pounds	$
1928 (x)	491,894	341,374	...	...	...	...
1929	773,976	675,294	...	...	...	...
1930	456,582	337,871	...	...	...	...
1931	323,139	180,958	...	...	...	...
1932	65,425	26,824	...	...	...	...
1933	246,041	78,733	...	...	...	...
1934	293,611	95,665	...	...	...	...
1935	580,530	441,203	...	...	...	...
1936	526,034	468,170	148,133	131,858	111,749	99,457
1937	436,431	715,747	164,223	269,326	144,553	237,067
1938	510,342	410,090	115,166	92,543	73,630	59,166
1939	799,253	563,241	73,850	52,029	66,608	46,939
1940	778,791	905,734	57,742	67,154	71,594	83,264
1941	1,081,374	1,269,533	61,085	71,714	108,852	127,769
1942	972,413	1,147,447	29,236	34,498	147,314	173,831
1943	598,673	688,474	20,985	24,130	166,955	191,998

(x) First production.

Table 16 - CADMIUM CONSUMED BY SPECIFIED CANADIAN INDUSTRIES, 1939-1942 - (Pounds)

Industry	1939	1940	1941	1942
White metal alloys	76,072	121,008	243,717	347,725
Steel foundries	1,825	6,000	32,000	18,000
Iron foundries	2,658	9,528	12,000	34,000
Non-ferrous smelters	1,344	...	...	2,000
Other industries	309	5,483	11,000	12,000
TOTAL ACCOUNTED FOR	82,208	142,019	298,717	413,725

CALCIUM - There is no commercial production of calcium metal in Canada and data relating to imports of metallic calcium into the Dominion are not published. Calcium metal was imported into the United States from France and Germany prior to the present world war. However, in 1939 a new plant was built for the production of the metal at Sault Ste. Marie, Michigan, by the Electro Metallurgical Company. Metallic calcium is utilized as a scavenger in steel and secondary aluminum, to produce magnesium castings and calcium hydride, and to harden lead. Calcium is used as a deoxidizer and final addition in obtaining particularly clean steels and in imparting better working properties to high nickel-chromium steels. Calcium-silicon (28-35 per cent calcium and 60-65 per cent silicon) and calcium-manganese-silicon are likewise employed for this purpose, although the unalloyed metal may have specific effects. Calcium-bearing alloys are now being made in Canada.

New York quotation for calcium, January, 1944, was $1.25 per pound, ton lots. Data relating to imports into Canada of calcium are not shown separately in Canadian trade reports.

CHROMITE - Canadian production of chromite during 1943 totalled 29,595 short tons valued at $919,878 compared with 11,456 short tons worth $343,568 in 1942. Commercial shipments by primary producers in both years were confined to the Eastern Townships of the province of Quebec. The 1943 annual output was exceeded only by the production of 36,725 tons valued at $499,682 in 1917.

During the year under review, there were 15 firms engaged in mining or developing chromite deposits in Canada; capital employed by these operators totalled $1,691,315 and $569,284 were distributed to 370 employees in salaries and wages. Process supplies, freight, fuel and electricity used amounted to $189,770 and the net value of production was estimated at $730,108.

The principal operations in 1943 were those conducted by Chromite Limited near St. Cyr, Quebec and those of the Wartime Metals Project at Chromeraine, near Black Lake, Quebec.

The following information is from a report "Chromite in 1943" as prepared by the Bureau of Mines, Ottawa:

"In Manitoba, large bodies of low-grade chromite deposits were discovered early in 1942 north of Bird River in the southeastern part of the Province. The chromite occurs in alternate narrow bands of high and low-grade ore and various zones have been traced for lengths of several thousand feet. The run-of-mine ore ranges between 15 and 20 per cent Cr_2O_3, but it is complex and high in iron and an economical method of bringing the chrome-iron ratio to within market requirements has not yet been devised. Many claims have been staked and drilled by Hudson Bay Exploration Company, God's Lake Gold Mines, Gunnar Gold Mines, Central Manitoba Mines, Stanmore Mines, and others. Late in 1943 Hudson Bay Exploration Company formed a subsidiary, Manitoba Chromium, Limited to work the Page claims and although no development is intended in the near future, research on the treatment of the ore is being continued. Diamond drilling is being done by Stanmore Mines, Limited on some recently discovered showings near Maskwa Lake, 16 miles north of Bird River; and Gunnar Gold Mines, Limited is exploring showings at Euclid Lake to the northeast.

"In British Columbia, during 1942 and 1943, a number of chromite deposits were examined by geologists of the Federal and Provincial Departments of Mines. There was no production in this province in 1943 and prospecting for the mineral appears to have ceased.

"Canadian consumption of chromite in 1943 was 131,276 tons, a 29 per cent increase over that of 1942.

"About 48 per cent of the total imports of nearly 112,210 tons came from Africa, mainly from Rhodesia; 29 per cent from India, which included some refractory ore purchased by the Government; and 23 per cent from the United States, mainly from Montana.

"Canadian production of ferrochrome and other chrome addition agents was about 47,000 short tons, an increase of 40 per cent over that of 1942.

"The principal chromite-producing countries are Russia, South Africa, Turkey, Southern Rhodesia, Cuba, New Caledonia, Yugoslavia, India and Philippine Islands.

"Chromium is one of the principal alloying elements in a great variety of steels, chief of which in the amount of chromium used are the highly important stainless and corrosion-resistant steels. It is the vital ingredient with nickel and molybdenum in the making of armour plate, armour-piercing projectiles, and high-speed tool steels, and is used as a hard, toughening element in tank axles and frames, in aeroplane parts and in other essential war materials. Chromium is also used in some types of cast iron and in

non-ferrous alloys. The ore is usually converted into ferrochrome before being added to the steel bath. Large quantities of chromite, with certain specifications as to physical and chemical properties are used in the making of refractories. Chromite is the source of such chemicals as sodium and potassium chromates. It is also used in the electroplating, dyeing, tanning, and paint industries.

"Until recently, metallurgical chromite had to contain a minimum of 48 per cent Cr_2O_3 and a chrome-iron ratio of not less than 3 to 1. Basic ceiling prices are for ores of this grade and ratio, but ores as low as 40 per cent Cr_2O_3 and 2 to 1 ratio are acceptable at lower prices. When possible, lower grade ores are mixed with those of the highest grade, the proportion depending upon whether the ferrochrome produced is to be used for low or for high-carbon steels. The maximum allowance for sulphur is 0.5 per cent and for phosphorus 0.2 per cent. Although lump ores are preferred, fines and concentrates are used in quantity and in some instances they are briquetted before use. The low iron content of the ore or concentrate is of the utmost importance.

"Specifications for refractory ore suitable for bricks depend upon the kind of brick to be made. A Canadian manufacturer indicates maxima allowances of 25 per cent Fe_2O_3, 18 per cent Al_2O_3, and 4 per cent SiO_2. The silica should be as low as possible and it usually occurs in the ore as serpentine, a hydrated magnesium silicate, having a comparatively low melting point. The chromite should be present in an evenly and finely distributed form, not as coarse grains mixed with blobs of the silicate. The ore should be hard and lumpy, and the lumps should be plus 12 mesh. Provided the impurities are within the above specifications, the Cr_2O_3 content may vary within certain limits, but it is generally over 40 per cent.

"Standard grades of ferrochrome contain a minimum of 60 to 70 per cent chromium and are produced in two grades, one being high (4 to 6 per cent) in carbon and the other low (less than 2 per cent).

"The principal Canadian buyers of chromite for metallurgical use are: Chromium Mining and Smelting Corporation, Sault Ste. Marie, Ontario, and Electro-Metallurgical Company of Canada, Welland, Ontario. The only important purchaser of refractory ore is Canadian Refractories Limited, Canada Cement Building, Montreal, Quebec.

"Canadian prices for high-grade ores are based upon the United States ceiling price, which is $43.50 per long ton at seaboard for ore containing 48 per cent Cr_2O_3 with a chromium-iron ratio of 3 to 1; plus or minus 90 cents per long ton unit of 22.4 pounds of contained Cr_2O_3 above or below 48 per cent; plus or minus $1.25 for each 0.1 chromium-iron ratio above or below 3 to 1, the limits being 3.5 to 1 and 2 to 1. The price at a Canadian mine at Black Lake in the Eastern Townships of Quebec would, for example, approximate to this basic ceiling price; plus freight of $2.28 from seaboard to Niagara Falls (near a Canadian consuming centre); plus exchange at 11 per cent to convert into Canadian funds; less $5.12 freight from Black Lake to Niagara Falls. For a 46 per cent Cr_2O_3 ore with Cr-Fe ratio of 2.8 to 1, this price per long ton at Black Lake would thus amount to about $43.50, less penalties of $4.30, plus freight of $2.28, plus $4.56 exchange, less $5.12 freight, or to about $40.93 in Canadian funds; a 48 per cent ore would be about $42 a long ton. Prices of other grade ores can be obtained from the Metals Controller, Ottawa.

"United States prices of ferrochrome delivered on contracts are as follows: high-carbon ferrochrome, 66 to 70 per cent chromium and 4 to 6 per cent carbon, 13 to 14 cents a pound; and low-carbon ferrochrome, 67 to 72 per cent chromium and 2 per cent carbon, 19½ cents, and 0.1 per cent carbon, 22½ cents a pound of contained chromium."

Table 17 - PRODUCTION OF CHROMITE IN CANADA, 1928-1943

Year	Short tons	$	Year	Short tons	$
1928	...	...	1936	(x)	13,578
1929	126	900	1937	(x)	43,250
1930	...	...	1938	...	...
1931	...	...	1939	...	...
1932	78	1,113	1940	335	5,780
1933	30	343	1941	2,372	42,679
1934	111	1,578	1942	11,456	345,568
1935	1,144	14,947	1943	29,595	919,878

(x) Quantity not published.

Table 18 - CONSUMPTION OF CERTAIN CHROMIUM PRODUCTS AND CHROME ORE IN SPECIFIED CANADIAN INDUSTRIES, 1941 and 1942

Industry	Item	1941 Pounds	1941 $	1942 Pounds	1942 $
Ingots and castings	Chrome ore	1,248,000	30,619	2,464,000	58,095
Ingots and castings	Ferrochrome	6,878,000	690,600	11,262,000	1,445,089
Paints, pigments and varnishes	Chrome colours	2,370,872	464,089	2,669,978	551,855
Paints, pigments and varnishes	Sodium bichromate	887,797	88,329	1,015,065	105,731
Leather tanning	Sodium bichromate	1,905,201	179,306	2,107,737	203,305
Glass manufacture	Chromite	4,000	204	16,000	460

Note: In addition to the items listed above, a considerable quantity of chromite is utilized in the manufacture of Canadian ferro-alloys, also a relatively small quantity of sodium bichromate is consumed in the chemical industry. Chromite is also employed in Canada in the manufacture of refractories.

INDIUM - Indium was commercially recovered in Canada only in 1942 when 470 troy ounces valued at $4,710 were produced at Trail, British Columbia by the Consolidated Mining and Smelting Company of Canada Limited. The metal was obtained in the treatment of zinc refinery residues. The United States produces a considerable quantity of indium but data relating to entire world production are not available. Indium is used for plating and as an alloy with other metals. The Bureau of Mines, Ottawa, reports that the augmented production of engine bearings and war restrictions on ordinary plating metals have stimulated interest in indium during the past three years. "E and M J Metal Markets", New York, August, 1944, quoted indium at $7.50 per troy ounce 99.9 per cent pure.

IRON ORE - Production of iron ore in Canada during 1943 totalled 641,294 short tons valued at $2,052,240 compared with 545,306 short tons worth $1,517,077 in 1942. Of the 1943 output, 143,062 tons came from a property near Bathurst, New Brunswick and 498,232 tons from deposits in the province of Ontario. The number of firms engaged in the development, exploration or mining of Canadian iron ore deposits totalled 14 in 1943; capital employed amounted to $7,570,964; fuel, electricity and process supplies consumed and freight paid aggregated $982,282, and the net value of production was estimated at $1,049,958.

A report on "Iron Ore in 1943", as prepared by the Bureau of Mines, Ottawa, contains the following information:

"Deposits of iron ore in Canada are many and widespread and include hematite, siderite, magnetite, bog iron, and magnetic sand. Because of the availability of low cost of higher grade ores in the Lake Superior iron ranges of the United States and in Newfoundland, no iron ore from domestic sources was produced in Canada from 1923 until 1939.

"Dominion Steel and Coal Corporation, Limited, with plants at Sydney, Nova Scotia, obtained its iron ore in 1943 chiefly from its own mines at Wabana, Newfoundland. Steel Company of Canada, Limited, at Hamilton, Ontario, and Canadian Furnace, Limited, at Port Colborne, Ontario obtain their iron ore supplies from the Lake Superior region of the United States. Algoma Steel Corporation obtains most of its requirements from the United States and the remainder from the New Helen mine, Michipicoten area.

"In Ontario, Algoma Ore Properties, Limited, a wholly owned subsidiary of Algoma Steel Corporation, Limited, began in 1937 development work at its New Helen mine in the Michipicoten area, Ontario, and the first sinter was produced in July, 1939. Operations during the past three years consisted mainly in open-cut mining. The New Helen deposit is estimated by the company to contain at least 100,000,000 tons of siderite or carbonate ore, averaging about 35 per cent iron, and, to fit it for commercial use in blast furnaces, a sintering plant capable of treating 3,000 tons of ore a day was built, the sinter produced approximating 53.4 per cent iron, 7.0 per cent silica, 0.04 per cent sulphur, and 3.0 per cent manganese. The sintered ore is shipped from Michipicoten Harbour, 8 miles from the sintering plant, partly to the company's blast furnaces at Sault Ste. Marie, Ontario, and partly to United States ports on the Lower Lakes for use in United States blast furnaces. The manganese content is of special interest to users.

"Exploratory work on the hematite property of Steep Rock Iron Mines, Limited, situated near Atikokan, and about 155 miles west of Port Arthur, indicated that the deposits, which were discovered in the winter of 1937-38 under the bed of Steep Rock Lake by diamond drilling through the ice, were large and high in grade. The size of the hematite bodies can be gauged from what has been reported, namely, that the probable average widths of A, B, and C bodies are 205, 155, and 200 feet respectively, with explored lengths of over 5,000 feet in the case of A, which is still open at one end, and of 5,000 and 800 feet for B and C,

each of which is open at both ends. Under the A orebody the greatest depth at which the ore has been found in a borehole is 1,400 feet below the surface of Steep Rock Lake, or 1,035 feet below the ledge; under the B zone ore was encountered 700 feet below lake level. High-grade ore occurs within these deposits and presumably makes up a considerable, but as yet very incompletely defined part of them. The company reports that the property has "proven ore" totalling 17,244,000 long tons and "probable ore" 14,336,000 long tons, making a total of 31,580,000 long tons, and assuring production for a number of years to come. Most of this ore is available for open pit mining. No estimate has been prepared of "possible ore".

"Iron ore properties located in the Atikokan area were also explored in 1943 by the Great Lakes Iron Mines Limited, Midwest Iron Corporation Limited and Rebair Gold Mines Ltd. Gunflint Iron Mines Limited conducted exploratory work in Ontario on iron deposits located at Round Lake on the Gunflint Iron Range and at Shebandowan on the Mattawin iron range.

"At the Josephine mine of Michipicoten Iron Mines Ltd., underground development was carried on continuously throughout 1943. This work was mainly confined to the three lowest levels, the fourth, fifth and sixth levels, the greatest amount being done on the sixth level where a length of over 1,200 feet of continuous ore was opened up, with ore still showing at one end. Surface diamond drilling indicates that this length (1,200 feet) will ultimately be doubled. As a result of this development the tonnage of ore reserves was more than doubled during the year and the grade of ore was appreciably improved. The reserves are estimated to total 2,666,000 long tons of hematite assaying (dry analysis) 53.94 per cent iron, 15.67 per cent silica, and 1.18 per cent sulphur.

"The Ruth property, which is two miles from the Josephine and owned by the same company, was drilled extensively during 1942 and during the first three months of 1943. The indicated ore reserves to a depth of 800 feet are 28,600,000 long tons of siderite averaging 31.26 per cent iron, 15.15 per cent silica and 5.14 per cent sulphur. These reserves include 16,840,000 tons of low silica siderite averaging 34.54 per cent iron and 6.81 per cent silica. The remainder (11,760,000 tons) is high silica siderite and averages 26.57 per cent iron and 21.46 per cent silica. A pilot plant has been in operation since the summer of 1942 for testing purposes.

"The Frobisher Exploration Company, Ltd., an exploration subsidiary of Ventures Limited and associated companies, investigated in 1941 and 1942 certain magnetite deposits in Mayo township, Hastings county.

"Tomahawk Iron Mines Ltd. has been developing a property on Whetstone Lake, Lake township, Hastings county, eastern Ontario. The company reports estimated ore reserves of 500,000 tons of 60 per cent magnetite, above the 300-foot level. Test shipments have been made to steel plants in southern Ontario, and a truck road to the property is being built.

"Hollinger Consolidated Gold Mines Ltd., under an agreement with Beverly Iron Prospecting Syndicate, did some exploration in 1943 on the Beverly iron ore holdings near Milton, Halton county, Ontario. From 1940 to 1942 the Syndicate made extensive dip-needle surveys followed by detailed magnetometer surveyings. In the spring of 1943 drilling to a depth of 3,000 feet was undertaken and an electric survey made by Hollinger. The option was afterwards surrendered.

"Extensive surveys and exploration work have been carried on since 1936 by Labrador Mining and Exploration Company of Montreal, near Sawyer Lake and vicinity, along the Quebec-Labrador boundary line. Important iron ore deposits are indicated on the concession held by this company.

"Hollinger North Shore Exploration Company, a subsidiary of Hollinger Consolidated Gold Mines, was engaged in exploring an area in Quebec, immediately north of the Labrador concession and covering an area of 3,900 square miles. Many indications of iron-ore deposits were encountered, and the area on which non-ferrous minerals might be expected was also investigated. Hollinger has completed negotiations with M. A. Hanna Company of Cleveland, Ohio, for their participation in the future exploration and developments of the iron deposits in both areas. The exploitation of these deposits would necessitate the construction of a railway line from the St. Lawrence River at Seven Islands, which port is open to navigation throughout the year.

"The iron ore mining operations conducted during 1942 and 1943 at Bathurst, New Brunswick, by the Dominion Steel and Coal Corporation Limited were closed down indefinitely on November 25, 1943; the plant was dismantled and removed elsewhere.

"Bounties on the production of iron ore are offered by the provinces of Quebec, Ontario, and British Columbia. In Quebec, the premium is at the rate of four-fifths of one cent for each unit (22 lbs.) of iron metal contained in every ton or iron ore. In Ontario, the bounty is 2 cents per unit of metallic iron in the long ton of low-grade iron ore beneficiated in Ontario so as to be suitable for use in the

blast furnace, or on natural ore of commercial quality smelted in Canada. In British Columbia, the bounty paid must not exceed $3.00 a ton on the proportion of pig iron produced from ore mined in the province, and must not exceed $1.50 a short ton on the proportion of pig iron produced from ore mined outside the province. A bounty not to exceed $1.00 a short ton is also offered on steel shapes of commercial utility manufactured in British Columbia.

"There are no official Canadian price quotations for iron ore. Prices f.o.b. Lake Erie ports, per long ton for Lake Superior, U.S.A., iron ore, 51½ per cent iron ore are: Messabi, Non-Bessemer--$4.45, Bessemer--$4.60, Old Range, Non-Bessemer--$4.60; Bessemer--$4.75. The price of Brazilian ore, f.a.s. Brazilian ports, 68 per cent iron, is 7 cents per long ton unit or $4.76 a long ton."

Complete data on world production of iron ores have not been available since the commencement of the present world war.

Table 19 - PRODUCTION OF IRON ORE(x) IN CANADA, 1939-1943

Year	Short tons	Value
		$
1939	123,598	341,594
1940	414,603	1,211,305
1941	516,037	1,426,057
1942	545,306	1,517,077
1943	641,294	2,032,240

(x) Exclusive of titanium-bearing iron ores and all from Ontario with the exception of 187 tons from Quebec in 1942 and 143,062 tons from New Brunswick in 1943.

Table 20 - IMPORTS AND EXPORTS OF IRON ORE, 1942 and 1943

	1942		1943	
	Short tons	$	Short tons	$
Imports	2,701,968	6,230,197	3,906,425	9,056,389
Exports	295,960	1,055,861	374,677	1,450,985

Table 21 - ORES USED IN CANADIAN STEEL FURNACES, 1941 and 1942

Ore	1941		1942	
	Net tons	$	Net tons	$
Crude iron ore	148,807	1,792,029	98,986	616,617
Calcined roasted, or treated ore	5,778	21,833	98,156	1,757,431
Manganiferous ore	64	3,316	32	1,600
Chrome ore	624	30,619	1,232	58,095
Calcium molybdate and molybdenum oxide briquettes	...	525,671	1,145	1,167,579

Table 22 - MATERIALS CHARGED TO CANADIAN IRON BLAST FURNACES, 1941 and 1942

Material	1941		1942	
	Quantity	Cost at furnace	Quantity	Cost at furnace
	Net tons	$	Net tons	$
Iron ore--Imported (crude)	2,542,826	9,238,799	3,383,439	13,726,346
Canadian (beneficiated)	163,890	569,853	229,253	798,974
Canadian (crude)	2,373	6,662	...	...
Mill cinder, roll scale, flue dust, etc.	136,698	514,248	177,343	386,750
Scrap (net charge)	47,271	581,717	64,624	803,172
Limestone -				
From Canadian quarries	182,605	237,578	301,143	447,107
From foreign sources	465,960	551,773	559,650	799,302
Coke	1,562,530	7,203,703	1,795,875	13,402,828
Other materials	...	136,245	...	163,675
TOTAL	...	18,840,578	...	30,528,134

LITHIUM - The principal commercial lithium ores are amblygonite, a fluophosphate of lithium and aluminum; spodumene, a silicate of these two elements, and lepidolite, or lithia mica, also a silicate. The lithia content of these minerals, as mined, commonly ranges around 8 to 9 per cent for amblygonite, 4 to 7 per cent for spodumene, and 3 to 5 per cent for lepidolite. All of the above minerals are known to occur in Canada but there has, as yet, been only a small production, mainly of lepidolite and spodumene. The important known deposits of economic interest are all in Manitoba. The first commercial shipment of Canadian lithium ore to be officially recorded was reported during 1937. This production came from deposits located at Bernic Lake, Manitoba, and was valued at $1,694; the mineral was consigned to the United States for the manufacture of lithium compounds and possible lithium metal. No commercial shipments of lithium ores from Canadian mines were reported since 1937.

In 1942 Sherritt Gordon Mines Limited conducted an exploration by diamond drill of a spodumene-bearing pegmatite on the east shore of Crowduck Bay, Herb Lake, Manitoba; encouraging results were reported from this undertaking.

Prospecting in the Cat Lake area of Manitoba during 1943 disclosed extensive surface showings of spodumene pegmatite over considerable distances beyond the previously known Irgon deposit, with estimated contents of 25 to 30 per cent spodumene over widths of 25 to 30 feet in many sections; the discoveries were under option to the Hudson Bay Mining and Smelting Company Limited.

The principal uses of the lithium ores and salts have been in ceramics, glassware, air conditioning and pharmaceuticals. The United States Bureau of Mines reported that the use of lithium for high-conductivity copper castings more than doubled in the United States in 1941 compared with 1940, and its use in special bronzes is now on a commercial scale. The element is added either in the form of a 50-50 lithium-calcium alloy or as an alloy of 98 per cent copper and 2 per cent lithium.

"E and M J Metal and Mineral Markets", New York, quoted lithium metal, August, 1944, at $15 per pound 98 to 99 per cent in 100 pound lots. Spodumene--per unit LiO_2 contained $5 to $6 on a 6 per cent grade, carlots, North Carolina--nominal.

Data relating to imports of lithium or lithium compounds are not shown separately in Canadian trade reports, also statistics on world production of lithium minerals are not available at present; however, the United States and southwest Africa are the two principal producers of lithium minerals.

MAGNESIUM - Production of magnesium metal in Canada during 1943 totalled 7,153,974 pounds valued at $2,074,652 compared with 808,718 pounds worth $355,836 in 1942. The metal in 1943 was produced entirely by Dominion Magnesium Limited in its plant located at Haley, Ontario; recovery was made from Ontario dolomite and the ferrosilicon process was employed. In addition to extracting magnesium from Ontario dolomite in 1942, there was a recovery of the metal at Haley in that year, from brucite produced at Wakefield, Quebec and at Trail, British Columbia from magnesite mined in that province. The extraction of magnesia from sea water is being done on a very large scale in England and the United States, the material so obtained being used for making magnesium metal as well as for various industrial and pharmaceutical purposes.

The United States Bureau of Mines reported that production of primary magnesium in the United States during 1943 totalled 183,584 short tons compared with 48,963 short tons in 1942; companies using electrolytic processes for producing magnesium accounted for over 85 per cent of the total output, and the ferrosilicon and carbothermic processes accounted for the remaining 15 per cent. Of the primary magnesium shipped in 1943 (170,267 tons), approximately 64 per cent was used in the manufacture of magnesium-base alloy structural products; 8 per cent in other alloys, chiefly aluminum; 7 per cent in powder; and 21 per cent for export account (includes 20,911 tons of magnesium-base alloy). Of the magnesium-alloy structural products sold or used, the aircraft industry took 50 per cent, incendiary bomb casings 50 per cent and other industries less than 1 per cent.

According to the United States Bureau of Mines, the world production of magnesium in 1943 reached another all-time high mark of more than 269,000 metric tons—92 per cent more than the previous record of 140,000 tons set in 1942, and more than eight times the 1939 output. On the basis of estimates, it is thought that about 28 per cent of the output was under axis control and 72 per cent under control of the United Nations. Production in 1944 will not greatly exceed that of 1943, inasmuch as all the major expansion programs of the various nations are thought to be virtually complete.

"E and M J Metal and Mineral Markets", New York, quoted magnesium metal, September, 1944: Per pound, ingots (4 x 16 inches), 99.8 per cent, carload lots 20½ cents; 100 pounds or more l.c.l., 22½ cents. Extruded sticks, carload lots 27½ cents; 100 pounds or more l.c.l. 29½ cents. Data relating to Canadian imports and exports of magnesium metal are not shown separately in Canadian trade reports. Imports of magnesium oxide into Canada in 1943 totalled 1,900,513 pounds valued at $180,039 compared with 1,393,965 pounds appraised at $90,613 in 1942.

Table 25 - PRODUCTION OF PRIMARY MAGNESIUM METAL IN CANADA, 1916-1943

Year	Quebec		Ontario		British Columbia		CANADA	
	Pounds	$	Pounds	$	Pounds	$	Pounds	$
1916-1918 ...	(a)	(a)	...	...	200,000(b)	(b)	...	...
1941	...	...	...	...	10,905(c)	2,944	10,905	2,944
1942	141,081(d)	62,076	475,910	208,520	193,727	85,240	808,718	355,836
1943	...	...	7,153,974	2,074,652	...	...	7,153,974	2,074,652

(a) Magnesium metal produced in 1918 at Shawinigan Falls, Quebec by Shawinigan Electro Metals Company Limited from imported magnesium chloride but data not available.
(b) Approximately 200,000 pounds produced at Trail from imported magnesium chloride; complete data not available.
(c) Powder.
(d) Produced in Ontario from Quebec brucite.

Table 24 - CONSUMPTION OF MAGNESIUM INGOTS IN CANADA, 1939-1942

	1939	1940	1941	1942
	(pounds)			
In non-ferrous smelters	31,990	192,000	825,717	1,072,346
In white metal alloy foundries	774	7,770	9,515	9,850
In brass and bronze foundries	16	163	42,821	44,553
In aluminum products	...	240	127	...
In ammunition	...	404	...	...
In pharmaceuticals	200	...	...	...
TOTAL ACCOUNTED FOR	32,980	200,577	878,180	1,126,749

MANGANESE - Canadian mine shipments of manganese ore in 1943 totalled only 48 short tons valued at $985 compared with 455 tons worth $8,932 in 1942. The 1943 output represents concentrates shipped by British Manganese Mines Limited from its mine and concentrator located at Jordan Mountain, near Sussex, New Brunswick. The following information is taken from a report "Manganese in 1943" as prepared by the Bureau of Mines, Ottawa:

"The manganese ores that have been mined in Canada are pyrolusite (MnO_2), psilomelane (H_4MnO_5), manganite ($Mn_2O_3H_2O$), and braunite (Mn_2O_3), all of which are black or grey-black and comparatively hard; bog manganese, a soft earthy black oxide; and a small amount of rhodochrosite ($MnCO_3$), a pink, fairly soft, mineral. Pyrolusite is the most common and most important and when pure contains 63 per cent manganese. It is much softer than the other hard rock ores and can be distinguished in the field by the ease with which it blackens the fingers. Most of the hard rock deposits are replacements in limestone, but they also occur in the form of accumulated nodules and cementing material in siliceous sediments, and as veins in metamorphosed precarboniferous rocks. Canadian production since 1918 has been insignificant. During the first three and a half years of the present war it was increasingly difficult for Canada to obtain supplies from abroad, but this is no longer the case.

"Most of the 200 deposits of manganese known in Canada are in the Maritime Provinces. They are mostly low-grade replacement or bog deposits, and a small amount of high quality ore has been mined in only a few localities.

"Since the outbreak of the war, much attention has been given to the development of known deposits, to the search for new sources of supply, and to the exploration of several old properties. Little high-grade ore remains in these old properties, though it is possible that a fair tonnage of medium-grade ore is available. No new deposits have been found, however, and attempts to operate some of the better old properties have been given up after a few months' work. Manganese activities in Canada, including the aforementioned operations at Jordan Mountain have ceased and indications are that they will not be renewed. In any event, production is likely to be small and costly.

"World production is probably about 6,000,000 tons annually, the leading producing countries being Russia, British India, Gold Coast, Brazil, Union of South Africa, the United States and Cuba.

"It is estimated that over 90 per cent of the world consumption of manganese ore is used in the manufacture of iron and steel, the ore so used being termed "Metallurgical". The remainder is termed "Chemical". Metallurgical ore is used for making ferro-manganese, silico-manganese, and spiegeleisen, in which forms it is added to the steel bath. Manganese is beneficial mainly in improving the workability of the steel and in improving the product by acting as a deoxidizer, a desulphurizer, and a re-carbonizer.

"Such ore should contain at least 48 per cent of manganese and not more than 7 per cent iron, 8 per cent silica, 0.15 per cent phosphorus, 6 per cent alumina, and one per cent zinc. It must be low in copper, lead, and barium, and the ratio of manganese to iron should not be less than seven to one. The ore should be hard and in lumps of less than four inches, and not more than 12 per cent should pass a 20-mesh screen. Soft ores, such as bog manganese, are objectionable unless they are briquetted. It takes about two tons of 48 per cent ore to make one ton of standard ferro.

"The Canadian market for metallurgical ore is confined mainly to two manufacturers of manganese ferro-alloys: Electro Metallurgical Company at Welland, and Canadian Furnace Limited, Port Colborne, both in Ontario.

"Chemical grade ores are used mainly in the manufacture of dry batteries. Specifications call for high-grade pyrolusite because of its high available oxygen, which acts as a depolarizer. The ore should contain not less than 75 per cent manganese dioxide (MnO_2) and not more than 1.5 per cent iron; 1.0 per cent alumina; 6.0 per cent silica; 0.05 per cent copper; less than 0.10 per cent of any other metal; and 1.0 per cent moisture. Most of the ore is ground to 200 mesh, but some coarse ground ore of 8 to 12 mesh is also used. Canadian requirements of chemical ore range from 3,000 tons to 4,000 tons a year, most of it being ore from the Gold Coast. Nearly all of it is used by three manufacturers of dry batteries in Ontario.

"Prices of ferro-grade ore depend upon the manganese content and the amount of harmful impurities. Imported ore is usually quoted in cents per long ton unit of 22.4 pounds of contained manganese. United States prices for metallurgical ores are based on a standard duty-free ore containing 48 per cent manganese, 6 per cent iron, 11 per cent silica and alumina combined, and 0.18 per cent phosphorus. The quotation for this grade is 85 cents per long unit of contained manganese at Gulf of Mexico ports, and 90 cents at New York and other Atlantic ports. The premiums and penalties for ores varying from the standard grade can be obtained from the Metals Controller, Ottawa. The prices paid in 1943 by the Government and Canadian consumers for approximately 48 per cent manganese ore were $46.00 for Indian ore at Welland and $37.00 per long ton for Gold Coast ore at Canadian ports.

"Prices of chemical grade (battery grade) manganese ores throughout 1943 were $55 per ton for Brazilian or Cuban ores (80 per cent minimum content of MnO_2) in car lots, f.o.b. New York, exclusive of duty. The delivered price in Canadian currency for finely ground battery grade ore, in bags, imported into Canada from Africa or Montana, U.S.A., was $60 to $85 a short ton depending on mesh and origin."

Imports of manganese oxide into Canada during 1943 totalled 102,468,900 pounds valued at $1,445,252 compared with 114,777,700 pounds worth $860,248 in 1942; most of these imports, in both years, originated in the Gold Coast, British India and the United States.

Table 25 -- PRODUCTION (SALES) OF MANGANESE ORE IN CANADA FOR YEARS SPECIFIED

Year	Tons	Value	Year	Tons	Value
		$			$
1915	201	9,360	1935	100	800
1916	957	89,544	1936	221	1,596
1917	158	14,856	1937	85	817
1918	440	6,230	1938	...	...
1924	584	4,088	1939	596	5,688
1925-1929	...	...	1940	152	4,315
1930	273	1,356	1941	(x)	(x)
1931	117	2,895	1942	455	8,952
1932-1934	...	...	1943	48	965

(x) 7,500 pounds manganese metal produced at the mine from Nova Scotia manganese ore.

Table 26 -- CONSUMPTION OF MANGANIFEROUS ORE AND MANGANESE COMPOUNDS IN SPECIFIED CANADIAN INDUSTRIES, 1941 and 1942

Industry	Items		Quantity	Value
				$
1941				
Electrical apparatus and supplies	Manganese dioxide	pound	6,245,993	208,806
Paints, pigments and varnishes ..	Manganese salts	pound	68,623	9,416
Steel ingots and castings	Ore, manganiferous (foreign)..	pound	128,000	3,516
	Spiegeleisen	short ton	5,316	365,656
	Ferromanganese	short ton	21,250	1,811,031
	Silicomanganese	short ton	4,518	445,197

Table 26 - CONSUMPTION OF MANGANIFEROUS ORE AND MANGANESE COMPOUNDS IN SPECIFIED CANADIAN INDUSTRIES, 1941 and 1942 (Concluded)

Industry	Items		Quantity	Value
				$
1 9 4 2				
Electrical apparatus and supplies	Manganese dioxide	pound	5,377,595	202,273
Paints, pigments and varnishes ..	Manganese salts	pound	68,676	8,748
Steel ingots and castings	Ore, manganiferous (foreign)	pound	64,000	1,600
	Spiegeleisen	short ton	2,599	153,054
	Ferromanganese	short ton	1,714	2,484,783
	Silicomanganese	short ton	7,201	918,774

NOTE: In addition to the consumption recorded in the table above, a considerable quantity of manganiferous ore is employed in the manufacture of ferro-alloys. Also, approximately 94 tons of manganese metal was consumed chiefly in the non-ferrous industries in 1942 and 38 tons in 1941.

MERCURY - Mercury production in Canada during 1943 totalled 1,690,240 pounds valued at $4,559,200 compared with 1,035,914 pounds worth $2,943,807 in 1942. The recovery of the metal in Canada is made entirely from British Columbia ores. In 1943 the Consolidated Mining and Smelting Company of Canada Limited was the largest producer; the output of this company came from its Pinchi Lake property located 15 miles northwest of Fort St. James in the Omineca mining division of British Columbia; the mine was in continuous operation throughout the year. The balance of Canadian production in 1943 originated at the Takla property of Bralorne Mines Ltd.; this mine is also situated in the Omineca mining division approximately 100 air miles north of Fort St. James; development work was conducted during the entire year and production commenced towards the latter part of November.

The following information is taken from a report "Mercury in 1943" prepared by the Bureau of Mines, Ottawa:

"Cinnabar (HgS), the principal ore of mercury, is a heavy mineral (s.g.= 8.1) with a deep cochineal-red colour and scarlet streak, and contains 86 per cent mercury. In Canada the ore occurs in porous rocks, such as altered limestones (ankerite), volcanic breccias or greenstones, and green and purple andesitic lavas. The cinnabar often occurs in veins and stringers of calcite or dolomite within these rocks and may be associated with stibnite (antimony sulphide) and accompanied by globules of metallic mercury.

"The only known deposits of cinnabar in Canada are in British Columbia, by far the most important development being that on the northwest side of Pinchi Lake, Omineca Mining Division, about 40 miles north of Vanderhoof station on the Canadian National Railway. The deposit was discovered in the summer of 1937 and was optioned late in 1938 to Consolidated Mining and Smelting Company and production started in June, 1940.

"Prior to the discovery of the Pinchi Lake deposits little mercury was produced in Canada and the successful operation of the deposits has brought about a complete change in the Canadian situation in respect to the metal. This mine is the largest single producer of mercury on the American continent and its output is far in excess of the domestic requirements. Ore reserves are estimated to be sufficient to assure continuous output at the present rate for several years.

"A number of cinnabar claims have been staked and prospected along the so-called "Pinchi fault", which runs in a northwesterly direction for at least a 100 miles from Pinchi Lake. Of chief importance is the Takla property, east of the headwater of Silver Creek, 85 miles northwest of the Pinchi mine. It is being operated by Bralorne Mines, Limited and production from the 100-ton plant was started in November, 1943.

"Canadian and United States cinnabar ores seldom average over 1.0 per cent mercury, but at 1943 prices, an 0.30 per cent ore can be produced at a profit. As a rule, the ore is treated by roasting the coarsely crushed material in furnaces, usually rotary kilns, through which air is circulated. The sulphur is oxidized to sulphur dioxide, which escapes into the outside air and the mercury is driven off as vapour and is condensed in cooling chambers.

"World production just prior to the war was estimated to be slightly in excess of 5,500 metric tons a year. For many years Italy and Spain have shared honours as the leading producer and prior to the war they accounted jointly for 75 per cent of the world output, while the United States contributed about 11 per cent. Production from Mexico in 1943 reached a peak and is estimated to have shown a fivefold increase since 1939. The pre-war output from Russia, then the fourth largest producer, was about 300 metric

tons a year, being about the same as the output from Mexico in 1939. Czechoslovakia, China, Japan, Chile and Peru are also producers of mercury. The Union of South Africa started production at Monarch Kop in 1940 and its output has increased substantially each year since.

"The New York prices for the iron flask of seventy-six pounds of mercury averaged $75.00 in 1938. The price during most of 1943 was about $196 a flask, but it decreased to $190 in December, to $151.60 in January, 1944, and to $130 in February. Imports of mercury into Canada from the United States are not subject to duty, but are subject to a sales and war tax amounting to eighteen per cent of the value in Canadian funds. The present price of Canadian mercury is largely governed by that of the United States. Canadian imports into the United States are subject to a tariff of twenty-five cents per pound, or $19 a flask, in United States currency.

"Specifications call for a minimum of 99.5 per cent mercury and a maxima of 0.3 per cent antimony and 0.1 per cent arsenic.

"Canada is capable of producing at least eight times the amount of mercury required to meet its present needs and stocks are considerable. Output in the United States is sufficient to supply all of its war demands and production from Mexico in 1943 was mainly exported to the United States. Consequently the Metals Reserve Company (United States) cancelled all contracts with producers for purchase of mercury, effective January 31, 1944. Canadian producers now depend upon domestic orders, orders from the British Government, and upon private sales to United States consumers.

"The position of the Allied countries is now so strong that there is no longer an urgent need for a search for new deposits. Only large deposits of ore that can be mined cheaply are of interest as a reserve for the future.

"In Canada about seventy-five per cent of the mercury consumed is used in the medicinal, pharmaceutical, and in heavy chemical industries, particularly in the form of mercury sulphate as a catalyst. The consumption of mercury in Canadian gold mines has decreased owing to wider use of cyanidation and improvements in the recovery of the mercury after amalgamation. Gold mining now uses about seven per cent of the total mercury consumed."

Table 27 - PRODUCTION OF MERCURY IN CANADA

Year	Pounds	$	Year	Pounds	$
1895	5,396	2,343	1939	436	1,226
1896	4,408	1,940	1940	153,830	369,317
1897	684	324	1941	536,304	1,335,697
1924-1927 (x) ...	380	(x)	1942	1,035,914	2,943,807
1938	760	760	1943	1,690,240	4,559,200

(x) Data from a report issued by Bureau of Mines, Ottawa; value not recorded.

Table 28 - CONSUMPTION OF MERCURY IN SPECIFIED CANADIAN INDUSTRIES, 1939-1942

	1939	1940	1941	1942
	(Pounds)			
Medicinals and pharmaceuticals	20,473	30,246	67,607	78,362
Heavy chemicals (catalyst)	58,954	30,904	35,319	50,968
Electrical apparatus	2,161	1,899	25,738	42,313
Non-ferrous smelters	857	1,636	4,655	1,201
Petroleum refineries	359	328	920	684
Gold mines	6,313	6,000	11,091	10,000
Ammunition	...	4,630	8,217	...
Other industries	500	...	2,591	1,650
TOTAL ACCOUNTED FOR	89,617	75,643	156,118	185,178

MOLYBDENUM - Commercial shipments of molybdenite concentrates in Canada during 1943 were made solely from Quebec and Ontario mines. Production during the year under review totalled 784,715 pounds valued at $549,515 compared with 227,586 pounds worth $134,963 in 1942. The output in 1943 came principally from the properties of Indian Molybdenum Limited in the Abitibi region, La Corne mine near Val d'Or, and the Quyon Molybdenum Company at Quyon, Province of Quebec. A small amount of customs ore from Mont Cerf, Quebec and from the Algoma district, Ontario, was treated in the La Corne mill.

A report on "Molybdenum in 1943" as prepared by the Bureau of Mines, Ottawa, contains the following information:

"Molybdenite, the chief ore of molybdenum, is a soft and shiny steel blue-grey sulphide containing 60 per cent of the metal. In Eastern Canada it is usually found in pegmatite dykes or along the contacts of limestone and gneiss, commonly associated with greenish-grey pyroxenites in which other metallic minerals such as pyrite and pyrrhotite often occur. In northern and western Ontario and in British Columbia, molybdenite usually occurs in quartz veins, intruded into granites, or diorites. It generally occurs in the form of soft, pliable flakes or leaves, but is sometimes semi-amorphous, filling cracks and smearing the rock surface. It can readily be distinguished in the field by the olive grey-green smear it leaves when rubbed on glazed white porcelain or enamel. Graphite, for which it is often mistaken, leaves a grey-black smear.

"During 1941 and 1942 intensive investigation of all possible Canadian sources of molybdenum was necessitated because of the inadequate supply of the metal and the advice from Washington that there would be further curtailing of exports to Canada. As known Canadian deposits could not compete at the market price, the Metals Controller arranged to pay producers 85¢ per pound of contained sulphide in concentrate containing 80 per cent or more MoS_2. (U.S. market price is 45 cents). Since August, 1943, there has been a marked improvement in the supply as a result of the curtailment in production of certain armaments and of the large use of scrap metal containing molybdenum. Large stocks are on hand in Canada and the United States, consumption has decreased and production is abnormally high. Production from the Dome (Indian Molybdenum) and LaCorne mines in Quebec is more than sufficient to supply Canada's present requirements.

"Present indications are that the Abitibi area in Quebec will continue to be the principal source of production in Canada. The area is about 100 miles from the Ontario boundary and in general extends from Rouyn to Val d'Or. It is probably one of the most favourable localities for the discovery of other workable deposits.

"Owing to the greatly increased demand for molybdenum, there was much development and prospecting activity in the first half of the year on some of the 400 occurrences and deposits known throughout the Dominion, a few of which are mentioned below.

"In Quebec, Wartime Metals Corporation took over the LaCorne property of the Molybdenite Corporation of Canada in July 1942, and made arrangements for Biscoe Gold Mines, Limited to operate the mine. Production at the 200-ton mill began in May, 1943, and by the end of December, nearly 50,000 tons of ore containing between 0.6 and 0.7 per cent MoS_2 had been treated. The mine is the largest Canadian producer of molybdenite, which occurs as relatively small flake scattered through quartz veins in which white sericite schist is abundant in places.

"In 1942 Dome Exploration Company discovered a large body of disseminated molybdenite apparently of good grade on the southern part of the old St. Maurice Mines property in Preissac township, about 20 air miles northwest of the LaCorne mine. Indian Molybdenum, Limited, the operator, is developing the property by means of a flatly inclined shaft, which extends to a vertical depth of 200 feet. Diamond drilling on the surface had indicated an ore zone about 400 feet long and nearly 40 feet wide, averaging about 0.3 per cent MoS_2, but development has shown that the grade is less than 0.5 per cent. The molybdenite is similar to the LaCorne ore; it occurs in a quartzose-sericite zone dipping about 50° northeast and is bounded by faults between red and grey muscovite and biotite granites. At the end of May 1944, the mill was operating near its capacity rate of 500 tons of ore daily and was producing a concentrate containing about 90 per cent MoS_2. The Company has a contract with the Dominion Government to deliver 2,000,000 pounds of contained molybdenum sulphide in concentrate by the end of 1944.

"About 35 miles northwest of Ottawa, Quyon Molybdenite Company, the second largest Canadian shipper of molybdenite, treated close to 150 tons of ore a day of an average grade of 0.25 per cent MoS_2. The concentrate produced is converted to molybdic oxide in a small roasting plant on the property, and is then briquetted and shipped to steel manufacturers in Canada. During the last war this mine was the world's largest producer of molybdenum and it contributed nearly 80 per cent of Canada's output before 1939. Extensive diamond drilling by the Dominion Government in 1942 indicated considerable reserves of low-grade ore. The company had a contract with the Dominion Government to produce a total of 100 tons of contained molybdenum in the oxide. The contract was fulfilled early in May, 1944. Vic-Ore Molybdenite Company which

operates the old Bain mine in Masham township, 12 air miles northeast of the Quyon mine, increased the capacity of its pilot mill from the former rate of 10 tons a day to 50 tons a day and erected more buildings on the property.

"Farley Mining Company continued work on the LaFleur deposit in Egan township near Mont Cerf, 15 miles north of Maniwaki, for a few months. It shipped 76 tons of 1.15 per cent ore to the Zenith mine near Renfrew, Ontario, in the fall of 1942, and in March, 1943, a few tons of high-grade cobbed ore to the LaCorne mill; that shipped to the Zenith mine was re-cobbed and shipped to LaCorne for treatment.

"Cremar Molly Mines, Limited did considerable diamond drilling in Gaudette township, near Searchmont, Algoma district. Fairly good ore was found on the surface, but very little was found at depth by drilling. The Company shipped a car lot of ore to the LaCorne mill. About 75 miles northeast, Deep Lake Gold Mines, Limited, Akron, Ohio, prospected the Peters-Quilty showings west of Limer station. Wartime Metals Corporation discontinued its operations at the Zenith mine southwest of Renfrew, early in 1943, as the deposit proved too low grade. The Company shipped a car lot to the LaCorne mill in March 1943. Some prospecting was also done in the Tory Hill property near Wilberforce.

"Molybdenite concentrate is converted into an addition agent that is introduced into steel as molybdenum trioxide, ferromolybdenum, or calcium molybdate. The oxide is moulded into briquettes and 81 per cent of the Canadian consumption of molybdenum in 1943 was in this form and 17 per cent in the form of ferromolybdenum. There are nearly 50 users of molybdenum in Canada, but 94 per cent of the total consumption is by five steel manufacturers. Consumption in 1943, exclusive of scrap, was about 600 short tons compared with 72 tons in 1939.

"Molybdenum has a widening range of uses, but by far the greater part of the output is used in steel to intensify the effects of other alloying metals, particularly nickel, chromium, and vanadium. These steels usually contain from 0.15 to 0.4 per cent molybdenum but in some instances the percentage is considerably higher.

"In Canada throughout 1943 the Metals Controller contracted to purchase all domestic molybdenum products of marketable grade at a bonus price of not less than 85 cents per pound of contained sulphide in concentrate or $1.75 per pound of contained molybdenum in the trioxide, f.o.b. Ottawa. After December 31, 1943, owing to changed conditions, no more contracts were given. New producers will have to sell in the open market at the normal price which is about 50 cents (Canadian funds). Canadian ore and concentrate shipped to the United States is subject to a duty of 17½ cents a pound of contained molybdenum.

"The price per pound of contained molybdenum, f.o.b. Toronto in Canadian funds for the following imported compounds is approximately: Calcined molybdate (42% Mo), 98 cents; ferromolybdenum (60% Mo), $1.15; and molybdic oxide (52% Mo), 98 cents. The calcium molybdate is sold in bags of about 12½ pounds containing exactly 5 pounds of molybdenum. The molybdic oxide briquettes weigh five pounds each and contain 2½ pounds of molybdenum.

"United States specifications for concentrate dried at 212°F. are: MoS_2, minimum 85 per cent; copper, maximum 0.6 per cent; iron, maximum 3.0 per cent; combined phosphorus, antimony and tin, maxima 0.2 per cent.

"Prior to the war, 91 per cent of the world production, estimated at 16,500 tons of metallic molybdenum, came from the United States. Climax Molybdenum Company, at Climax, Colorado, the world's largest producer, is treating daily 18,000 tons or more of ore containing about 0.5 per cent MoS_2 and probably contributes 70 per cent of United States total. The remainder is obtained as a by-product of some large copper producers in Utah, New Mexico, and Arizona. The Molybdenum Corporation of America near Questa, New Mexico, is the only Company except Climax, that produces molybdenite solely for the recovery of molybdenum. The Molybdenum Corporation is also developing the Urad mine, Colorado, for the United States Government and production is expected to start in the summer of 1944.

"Production from Cananea, Mexico, is estimated at the equivalent of 850 tons of the metal a year; and a slightly smaller production is obtained as a by-product from the Braden Copper Mine at Sewell, Chile. Prior to the war, the Knaben mine in Norway was the largest producer outside the American continent, its output in 1940 being 500 short tons. Other producing countries were Peru, French Morocco, Korea, Greece, Turkey, Yugoslavia, Australia, and recently Manchuria."

Table 29 - PRODUCTION OF MOLYBDENITE IN CANADA, 1902-1943

Year	Ores milled	Ores and concentrates shipped or used		Total MoS_2 content of shipments
	Tons	Tons	Value (a)	Pounds
			$	
1902	(c) 3	3.3	400	(b)
1903	(c) 600	85.0	1,275	(b)
1904-1913	...	...	...	...
1914	(c) 166	16.5	2,063	3,814
1915	216	39.0	28,920	29,210
1916	9,100	610.0	188,316	156,461
1917	22,605	1,554.3	320,006	330,316
1918	33,935	461.3	428,807	378,482
1919	6,783	46.0	69,203	33,002
1920-1923	...	...	...	...
1924	668	10.0	9,370	18,739
1925	2,779	15.3	11,176	22,350
1926	4,490	12.6	10,472	20,943
1927	...	...	...	...
1928	...	...	...	...
1929	2,900	9.5	6,400	16,150
1930	...	...	...	...
1931	12	0.61	280	1,222
1932-1936	...	...	...	...
1937	5,307	8.25	8,147	(b)
1938	(b)	6.5	4,500	(b)
1939	1,492	1.3	816	(b)
1940	3,936	11.1	10,280	(b)
1941	28,100	98.3	88,470	173,991
1942	39,708	113.7	134,963	158,780
1943	120,576	392.4	549,515	653,200

(a) Value as given by the operators 1902 to 1939; 1940-1943 value estimated using market or Government prices.
(b) Not known.
(c) Mined.

Imports into Canada of calcium molybdate for the manufacture of steel totalled 1,144,455 pounds worth $957,159 in 1943 compared with 1,455,769 pounds worth $1,119,531 in 1942.

MONAZITE - Monazite is the principal source from which are produced thorium, cerium and other rare earth oxides. No commercial production of monazite in Canada has ever been officially reported. The Bureau of Mines, Ottawa, reports that there are a few occurrences in Nova Scotia, Quebec and British Columbia; none of which are of commercial importance; it is usually found as small crystals in granites and pegmatites in the Canadian shield and small quantities occur in association with the black sands of the Quesnal River, British Columbia. The United States Bureau of Mines states that the beach deposits of black sands in Travancore in British India, along the coasts of Espirito Santo, Rio de Janeiro and Bahia in Brazil, and in Netherland Indies have supplied the bulk of United States monazite requirements in the past, as a by product in the recovery of ilmenite, rutile and zircon sands. Formerly, the only commercial constituent of monazite was thoria, which was used for gas mantles, and monazite is still (1941) marketed upon the basis of its thoria content, although commercial interest now centres on its content of ceria and other rare earth oxides; probably 50 per cent of monazite derivatives are consumed (chiefly as fluorides) in the cores of arc carbons to increase lighting intensity in motion picture projectors, therapeutic lamps and searchlights, in about that order. Pyrophoric alloys for use in sparking flints take about 25 per cent of the monazite consumed and the remainder is distributed among a large variety of specialty uses, principally optical glassware.

Cerium products are produced from cerium chloride in Canada at Shawinigan Falls, Quebec, by Shawinigan Chemicals Limited; sparking flints are manufactured in Montreal, Quebec by Cerium Company Limited.

Monazite was quoted by "E & M J Markets", New York, August, 1944, at $60 per ton minimum, 8 per cent thoria.

Complete data relating to world production of monazite are not at present available and imports of monazite described as such into Canada are not shown separately in Canadian trade reports. Imports into Canada of salts or bases of thorium in 1943 were valued at $11,187 compared with $15,587 in 1942.

PITCHBLENDE - Pitchblende, the ore from which radium and uranium products are made, is mined in Canada only in the Great Bear district of the Northwest Territories. The only company to officially report the mining and treatment of pitchblende ore in 1943 was the Eldorado Mining & Refining Company Ltd. Both the mine and mill of the company, located at Port Radium, were operated continuously throughout 1943 and a considerable tonnage of pitchblende concentrates were shipped to the Eldorado radium refinery situated at Port Hope, Ontario. In January, 1944 a new company, Eldorado Mining & Refining, was formed, as a Crown company, owned by the Dominion of Canada, to take over all assets of the old company. Data relating to the production of pitchblende products in Canada have not been available for publication since 1940.

In 1942 the radium-uranium property of Bear Exploration and Radium Limited, located at Contact Lake, Great Bear Lake district of the Northwest Territories, was acquired by the International Uranium Mining Company Limited; it was reported that a geological survey of the property was being made in 1944, and also that exploration of the deposit by diamond drilling had commenced.

A report prepared by the Bureau of Mines, Ottawa, states:

"Most of the world production of radium and uranium ores has come from the Belgian Congo, Canada, and the United States. The American material consists mainly of low-uranium carnotite, found mainly in Colorado and Utah, and now mined chiefly for its vanadium content, the present recovery of uranium and radium being small. Ores of the Belgian Congo are mainly a complex assemblage of secondary uranium minerals resulting from the weathering of original pitchblende. The remainder of the world production has come mostly from Czechoslovakia, Portugal, England, Australia, and Russia, but the deposits in most of these countries are small and low-grade and are of minor importance at present."

"E and M J Metal Markets", New York, quoted radium at $25 to $30 per Mg of radium content, depending on quantity; August, 1944.

Table 30 - CANADIAN REFINERY PRODUCTION OF PITCHBLENDE PRODUCTS

Year	$	Year	$
1933(b)	247,900	1938	1,045,458
1934	159,400	1939	1,121,553
1935	413,700	1940	410,176
1936	605,500	1941-1943	(a)
1937	876,540		

(a) Not available for publication.
(b) First production.

SELENIUM - Production of selenium in the Dominion during 1943 totalled 374,013 pounds valued at $654,525 compared with 495,369 pounds worth $951,108 in 1942. Of the 1943 output, 216,498 pounds were obtained from Quebec ores, 82,000 pounds from Ontario, 5,239 pounds from Manitoba and 70,276 pounds from Saskatchewan. The element is recovered as a by product in Canada in the treatment of copper refinery residues by the International Nickel Company of Canada Limited at Copper Cliff, Ontario, and at Montreal East, Quebec, by Canadian Copper Refiners Limited.

According to the Bureau of Mines, Ottawa, world production of selenium is believed to approximate 600 to 700 short tons a year, the United States and Canada being the principal sources of supply. Small quantities are produced by several countries, including Russia, Rhodesia, and Mexico. It is reported that selenium is being recovered from the copper-gold-arsenical ores of the Boliden mine, Sweden.

Selenium is used chiefly in the glass and pottery industries as a colouring agent (as in ruby glass) and to neutralize the effect of objectionable oxides. A large amount of selenium is used for controlling the colour of glass, especially in the production of pink or ruby glass. It is used in the photo-electric cell, or electric eye, which has many industrial applications, and in alloying stainless steel for screw and bolt stock, where it develops improved cutting and threading qualities. It is employed to improve the machinability of copper and copper alloys. Selenium and tellurium are used in the free machining of copper alloys where they offer certain advantages in lead and sulphur. Selenium has a large potential market in certain rubber compounding industries and is being used for the vulcanizing and fire-proofing of switchboard cables and to increase the resistance of rubber to abrasion, research for such uses

being still under way. It is used in the manufacture of certain kinds of paint and of certain dyes. As selenium oxychloride, it is a powerful solvent of many substances. Rapid progress is also being made in the production of high-quality selenium rectifiers, which require large quantities of selenium.

Selenium is marketed as a black to steel-grey amorphous powder, but cakes and sticks are also obtainable. Among the other products marketed are ferro-selenium, sodium selenite, selenious acid, and selenium dioxide.

Since August, 1938, the nominal price for selenium, black powdered, 99.5 per cent pure at New York has been $1.75 a pound. The Glass Industry periodical gives the following quotations for selenium salts in 1943: barium selenite, $1.40 to $1.60 a pound, and sodium selenite, $1.50 to $1.65 a pound.

Table 31 - PRODUCTION OF SELENIUM IN CANADA, 1931-1943

Year	Pounds	$	Year	Pounds	$
1931 (x)	21,500	40,850	1938	358,929	622,742
1932	...	...	1939	150,771	266,714
1933	48,221	70,345	1940	179,860	343,533
1934	104,924	171,311	1941	406,930	777,236
1935	366,425	703,536	1942	495,369	951,108
1936	350,857	621,017	1943	374,013	654,523
1937	397,227	687,203			

(x) First commercial production in Canada.

Consumption of selenium in the manufacture of glass in Canada during 1942 was estimated at 3,647 pounds compared with 4,211 pounds in 1941.

General statistics on employment, etc., as relating to the production of both selenium and tellurium are included with those compiled for the Canadian non-ferrous smelting and refining industry.

TANTALITE-COLUMBITE - Canada produces no tantalite or columbite and according to the Bureau of Mines, Ottawa, the known Canadian occurrences of these minerals are scarce and of undetermined economic interest. The minerals tantalite and columbite are the tantalate and columbate, respectively, of iron and manganese, with the general formula $(Fe,Mn)(Ta,Cb)_2O_6$. They grade one into the other according as whether tantalum or columbium predominates. Both tantalite and columbite are of increasing importance in the war effort and tantalite has been placed in the group of "strategic" minerals having the highest priority rating. The occurrence of all tantalum-columbian minerals is restricted to granite-pegmatites, or to residual or alluvial deposits derived from such rock. The chief world sources of tantalite proper have been Western Australia, Belgian Congo, Southern Rhodesia, Uganda, United States and Brazil. The supply of columbite has come mainly from Nigeria, Belgian Congo, Southwest Africa, Argentina and Brazil. The annual world output of tantalite-columbite is small and complete data on same are not available at present. Tantalum metal is highly resistant to corrosion and possesses remarkable conductivity for heat; one of its important uses is in equipment, such as stills, condensers, tubes and heaters in chemical plants and laboratories; it is being used to an increasing extent in the field of electronics. Columbium is employed chiefly as an alloying component in various special-purpose steels, and also in copper, aluminum and other metals.

There are no users of tantalum or columbium ores in Canada, the chief world market being in the United States. The principal American consumer-buyer of tantalite is Fansteel Metallurgical Corporation, North Chicago, Illinois, and of columbite, Electro-Metallurgical Company, 30 East 42nd Street, New York City. These companies have been pioneers in the fields of industrial applications for tantalum and columbium metals, alloys, and products, respectively, and are the leading companies engaged in treating the ores.

Under the latest purchasing schedule, of May, 1943, the following provisions were made for the two classes of ore by the Metals Reserve Company in the United States:

Tantalite: Minimum tantalum oxide content, 40 per cent, with maximum tin oxide content 3 per cent, and maximum titanium oxide 3 per cent. For small lots of 100 to 200 pounds, the material must consist of clean tantalite crystals. The price for 40 per cent ore was set at $1.75 per pound of contained tantalum oxide, rising by increments of 5 cents per pound to $3.25 for 70 per cent ore, with no payment made for contained columbium oxide.

Columbite: Minimum columbium oxide content, 50 per cent, with maximum tin oxide content 5 per cent, and maximum titanium oxide 7.5 per cent. The material must be in the form of clean crystals. The price for small lots of 100 to 500 pounds was set at 25 cents per pound of ore, and for larger lots at 50 cents per pound of contained columbium oxide, with no payment for contained tantalum oxide.

Tantalum metal prices in 1945 were $160.60 a kilogram for C.P. rod, and $145 for sheet, with discounts on volume business. Columbium metal was quoted at $560 a kilogram for rod, and $500 for sheet. Ferro-columbium, 50 to 55 per cent, sold for $2.25 per pound of contained columbium.

(Note: Additional information on the occurrence and distinguishing characteristics of tantalite and columbite, is contained in the Prospectors Guide, Third Edition, issued by the Mines and Geology Branch, Ottawa, in 1945.)

TELLURIUM - Canadian production of tellurium, as with selenium, represents the recovery of metal as a by product in the refining of converter copper at Copper Cliff, Ontario, by the International Nickel Company of Canada Limited, and of blister and anode copper at Montreal East, Quebec, by Canadian Copper Refiners Limited. The Canadian output in 1943 totalled 8,600 pounds valued at $15,050 compared with 11,084 pounds worth $17,735 in 1942. The 1943 production originated solely in the nickel-copper ores of the Sudbury district, Ontario; in addition to its recovery from these same ores, the metal was obtained in 1942 in the refining of blister copper produced by the Hudson Bay Mining and Smelting Company from the Flin Flon mine ores of Manitoba and Saskatchewan.

According to the Bureau of Mines, Ottawa, the world production is estimated at 150 short tons a year, or about double the pre-war figure, and Canada and the United States appear to be the main sources of supply.

Metallic tellurium, until quite recently, was of little industrial importance. Formerly it was used to a small extent in some radio work and also in the photographic arts and for blackening art-silverware. Small quantities are used as a colouring agent in the ceramic industry. When alloyed with lead, the tensile strength and toughness of the lead is increased greatly. Lead alloys containing from 0.1 to 0.5 per cent tellurium have been in use for some time in applications requiring resistance to vibration and corrosion. The use of small quantities of tellurium as a substitute for tin in the lead used for sheathing electric wire cables is reported to improve the resistance of the cables to heat and corrosion. It has also been used for improving the machining qualities of certain steels. Very finely powdered tellurium is used as rubber-compounding material. Its presence is stated to shorten the time of curing and to greatly improve the resisting qualities of the product. A new use for tellurium is as a carbon stabilizer in cast iron, when it is used in the form of a ferrotellurium.

A nominal price for tellurium of $1.75 per pound at New York prevailed throughout 1943.

Table 32 - PRODUCTION OF TELLURIUM IN CANADA, 1934-1943

Year	Pounds	$	Year	Pounds	$
1934 (x)	5,130	25,599	1939	2,940	4,769
1935	16,425	32,850	1940	3,491	5,607
1936	35,591	62,997	1941	11,453	18,594
1937	41,490	71,777	1942	11,084	17,735
1938	48,237	82,967	1943	8,600	15,050

(x) First commercial production in Canada.

In 1942 Canadian steel foundries consumed 50 pounds of tellurium compared with 185 pounds in 1941. White metal foundries used 612 pounds in 1942 against 492 pounds in 1941.

TIN - Data relating to Canadian production of new tin in 1943 are not available for publication. Production in Canada during 1942 totalled 1,237,865 pounds valued at $643,689 compared with 64,744 pounds worth $35,667 in 1941.

The following information has been supplied by the Bureau of Mines, Ottawa:

"Tin is widely distributed, but in only a few countries are the deposits sufficiently large for commercial development. Cassiterite (SnO_2) is the only important ore of tin and in the pure state it contains 78.6 per cent of the metal. Stannite, a sulphide of copper, iron, and tin, has little importance as an ore. In British Columbia, stannite is present in the ore of the Snowflake property, near Revelstoke,

and cassiterite and stannite have been noted at several other places in the province. The small cassiterite content of the silver-lead-zinc ore of the Sullivan mine, at Kimberley now being recovered from the zinc tailing, is the source of Canada's production of tin. Cassiterite occurs also in many other places in Canada, but no commercial deposits have so far been found. In the unglaciated parts of Yukon, stream tin has been found in small quantities, but no serious attempt seems to have been made to test the gravels thoroughly for tin. During the past few years it has become apparent that many creeks in the Mayo district carried some crystalline cassiterite in their gold placers. Some evidence has been gathered showing the likelihood of there being some 200 to 500 tons of tin available as cassiterite in the placers of Dublin Gulch and Haggart Creek. In August, 1943, a lode source of this tin was found on the north side of Dublin Gulch assaying from ¾ to 1½ per cent in tin across an approximate width of three feet.

"The tin concentration-plant of Consolidated Mining and Smelting Company at Kimberley commenced operation on March 1st, 1941, and has been functioning very satisfactorily. The plant for the production of refined tin was in commercial operation in April, 1942. The tin content of the ore is small and the recovery is proportionately small.

"The tin produced at Kimberley, British Columbia, and the small domestic recovery of secondary tin are far from sufficient to meet the Canadian requirements, which in peacetime amounted to about 3,000 tons a year, and are now much larger. They were obtained mostly from smelters in the Straits Settlements. The position of the allied countries in respect to tin became critical with the capture by Japan of these smelters and of the Malayan tin mines, and the civilian use of the metal has been greatly curtailed. The search for commercial deposits of tin in Canada was continued and some occurrences of possible economic interest were found by a Geological Survey party in the Yellowknife area, Northwest Territories. Elsewhere, the results were not encouraging.

"The prices of tin in New York were fixed in August, 1941 at 52 cents a pound and remained at that level to the end of the year and throughout 1942 and 1943."

In July, 1944 "E & M J Metal and Mineral Markets", New York, reported that the tin producers maintain that they performed a genuine economic service throughout international tin control, and hope to continue with the plan, perhaps in some modified form, in the post-war period. In reviewing tin control, the International Tin Committee holds that its inter-governmental scheme should merit the attention of economic experts of the United Nations, because the advantages of stabilizing prices of primary commodities are now generally acknowledged, and the issue may have to be decided very soon.

Table 35 - CONSUMPTION OF TIN IN CANADA BY INDUSTRIES, 1939-1942

	1939	1940	1941	1942
	(short tons)			
Brass and bronze foundries	129	277	437	217
White metal foundries	1,640	2,087	3,141	1,530
Steel foundries (chiefly for tin plate)	810	1,207	2,346	1,428
Iron foundries	52	84	224	49
Galvanizing plants	...	90	50	226
Jewellery and silverware plants	45	64	146	15
Electrical apparatus plants	54	43	56	24
Miscellaneous industries	77	16	36	30
TOTAL ACCOUNTED FOR	2,787	3,868	6,436	3,519

Production of secondary tin in Canadian plants in 1942 was estimated at 64,511 pounds compared with 384,000 pounds in 1941.

Table 34 - IMPORTS INTO CANADA AND EXPORTS OF TIN AND TIN PRODUCTS, 1942 and 1943

Item	1942 Pounds	1942 $	1943 Pounds	1943 $
IMPORTS				
Tin in blocks, pigs or bars	7,205,100	4,166,714	2,631,100	1,504,458
Tinfoil	337,691	53,366	829,394	106,174
Collapsible tubes	...	63,600	...	155,722
Tin bichloride and tin crystals	38,589	15,572	11,054	5,031
Oxide of tin and copper	129,715	36,427	142,986	30,274
Phosphor tin and phosphor bronze in blocks, bars, plates, etc.	711,305	329,039	708,624	321,408
Tin plate food containers	...	426,209	...	258,084
Tin plate containers, n.o.p.	...	445,485	...	84,721
Sheets, tin and lead coated	31,258,700	1,409,021	20,250,500	877,446
Manufactures of tin plate painted, etc., manufactures of tin, n.o.p.	...	703,298	...	498,633
Kitchen or dairy holloware of iron or steel coated with tin	...	149,567	...	82,892
Arseniate, biarseniate and stannate of soda	96,450	28,986	83,529	18,712
Tin plate scrap	1,754,000	15,813	2,354,000	21,285
EXPORTS				
Tinware	...	21,805	...	10,236
Tin plate scrap	38,799,000	222,573	26,799,600	135,557

TITANIUM - Commercial shipments of titanium ore from Canadian mines totalled 69,437 short tons valued at $308,290 in 1943 compared with 10,031 tons worth $50,906 in 1942. Production during both of these years came from deposits located at St. Urbain, Charlevoix county, Province of Quebec.

The following information is from a report prepared by the Bureau of Mines, Ottawa:

"All known occurrences of titanium in Canada of any possible economic interest are in the provinces of Quebec and Ontario.

"Ilmenite or titanic iron ($FeTiO_3$) in commercial quantities and carrying from 18 to 25 per cent of titanium is found at St. Urbain in Charlevoix county, and at Ivry in Terrebonne county, Quebec. Rutile (TiO_2), which usually contains 54 to 59 per cent titanium, is found mixed with the ilmenite in parts of one of the St. Urbain occurrences and in sufficient quantities to make it of possible importance for the rutile alone, this being the only known workable deposit of rutile in Canada. Titaniferous magnetite deposits (magnetite carrying 3 to 15 per cent titanium) occur on the Saguenay River, near Lake St. John, and at Bay of Seven Islands, both in Quebec, and on the shores of Seine Bay and Bad Vermilion Lake in western Ontario.

"A few thousand tons of ilmenite is shipped annually from the St. Urbain deposits, part of it to Niagara Falls, New York, presumably for use in the manufacture of ferrotitanium, and part of it to plants of the General Electric Company in the United States. No shipments from the Ivry deposits have been reported for several years.

"The world production of titanium ore is estimated at about 260,000 tons of ilmenite, which would yield 115,000 tons of titanium pigment, and 3,000 tons of rutile. India is the principal producer of ilmenite, the other producers being Norway, Malaya, Portugal, Australia, United States, and Canada. Brazil is the principal producer of rutile, and Norway is second in importance.

"The United States has become virtually self-sufficient in supplies of ilmenite with the completion of the plan to exploit the Adirondack titaniferous iron ores.

"Commercial uses for titanium in recent years have continued to increase independently of the trend of general business. Ilmenite continues to be used chiefly in the manufacture of white pigment, and it is used to a smaller extent for making ferro-alloys. In metallurgy, titanium is not only an effective deoxidizer and cleansing agent, but also an alloying element. By addition of titanium, chrome-nickel steels are made more resistant to corrosion and chrome-molybdenum steels become easier to weld."

"E and M J Metal and Mineral Markets", New York, August 1944, quotations for titanium ore were: Per gross ton, ilmenite, 60 per cent TiO_2, f.o.b. Atlantic seaboard, $28 to $30, according to grade and impurities; quotations nominal. Rutile, per pound, guaranteed minimum 94 per cent concentrate 8 to 10 cents, nominal.

Table 55 - PRODUCTION OF TITANIUM ORE IN CANADA (x), 1927-1943

Year	Short ton	$	Year	Short ton	$
1927	2,029	8,980	1936	2,566	18,318
1928	2,244	6,732	1937	4,229	26,432
1929	2,748	7,359	1938	207	1,449
1930	412	1,239	1939	5,694	21,267
1931	1,509	10,261	1940	4,535	24,510
1932	...	...	1941	12,651	49,110
1933	...	...	1942	10,031	50,906
1934	2,023	14,161	1943	69,437	308,290
1935	2,288	16,400			

(x) All from Quebec.

Table 56 - CONSUMPTION OF TITANIUM PIGMENTS IN CANADIAN PAINT INDUSTRY, 1931-1942

Year	Pounds	Cost at works	Year	Pounds	Cost at works
		$			$
1931	745,207	89,761	1937 (x)	3,748,341	362,869
1932	691,304	96,759	1938 (x)	3,905,337	378,548
1933	1,061,249	128,969	1939 (x)	5,088,234	494,914
1934	1,710,188	186,678	1940 (x)	6,138,760	616,360
1935	2,513,026	261,506	1941 (x)	8,971,865	1,004,591
1936 (x)	2,456,265	269,130	1942 (x)	7,034,376	578,894

(x) In 1936 includes 1,396,337 pounds of pure titanium white valued at $193,638. In 1937 the quantity of pure titanium white totalled 1,299,857 pounds valued at $193,107; in 1938, 1,341,359 pounds at $200,552; in 1939, 1,855,288 pounds worth $275,105; in 1940, 2,297,248 pounds valued at $344,945; in 1941, 3,076,490 pounds worth $560,621, and in 1942, 4,168,097 pounds worth $820,990.

In 1939 there were 118 tons of ferrotitanium valued at $23,498 consumed in the manufacture of steel in Canada; in 1940, 118 tons worth $24,233; in 1941, 181 tons valued at $52,128 and in 1942, 439 tons worth $66,555.

TUNGSTEN - Shipments of tungsten ore concentrates from Canadian mills during 1943 totalled 1,508,621 pounds valued at $1,083,538 compared with 520,981 pounds worth $406,275 in 1942. The WO_3 content of the 1943 shipments totalled 817,763 pounds or an average of 54.2 per cent of the total production from all sources. Of the 1943 output of tungsten concentrates, 19,374 pounds came from mineral deposits located in Nova Scotia, 5,401 pounds from Quebec, 494,405 pounds from Ontario, 16 pounds from Manitoba, 976,622 pounds from British Columbia, 720 pounds from the Northwest Territories and 12,083 pounds from Yukon.

The following information is from a report "Tungsten in 1943" as prepared by the Bureau of Mines, Ottawa:

"Wolframite, $(Fe_2Mn)WO_4$, is the principal ore of tungsten, the next in importance being scheelite, $(CaOW_4)$, a calcium tungstate. The former is a dark brown to black heavy mineral, which contains 76.4 per cent WO_3 (tungstic oxide) when pure, and is not common in Canada. Scheelite, the chief Canadian ore of tungsten, is a heavy, fairly soft, usually buff, but sometimes white mineral with a dull lustre, which contains 80.6 per cent WO_3 when pure. It is commonly associated with quartz and frequently occurs in gold-bearing veins and in certain contact metamorphic deposits. It can be detected readily (in the dark) by its brilliant pale bluish-white fluorescence under ultra-violet light and purple filter. Prospectors ultra-violet lamps for this purpose are not made in Canada, but may be imported duty free from the United States. Information on these lamps may be obtained from the Bureau of Mines, Ottawa, or from the Provincial Departments of Mines. As a result of the marked improvement in the supply situation in 1943, Canadian requirements of tungsten are no longer difficult to obtain.

"Consolidated Mining and Smelting Company's Red Rose property in British Columbia, and Hollinger Consolidated Gold Mines Limited, Timmins, Ontario, contributed about 61 and 30 per cent respectively of the

total WO_3 content of the shipments. About five per cent of the total was shipped by Little Long Lac Gold Mines, east of Lake Nipigon, Ontario, and Bralorne Gold Mines, Bridge River area, British Columbia. The remainder came from a number of shippers who sent their crude ore to the Bureau of Mines, Ottawa, or to Val d'Or, Quebec, for treatment. The figure for total shipments in 1943 does not include a production of approximately 135 tons of WO_3 in concentrate from the Emerald property in southern British Columbia, which was stockpiled. The property was operating during the two months ended September 30th, on which date it was closed down.

"Approximately 390 tons of tungsten metal (contained in addition agents, powders, wire, rod, etc.) were consumed in Canada in 1943. Three car lots of scheelite containing close to 48 tons of tungsten were imported from Mexico. Exports consisted of 254 tons of low-grade concentrates (containing 37 tons of WO_3) that were shipped to the United States for special treatment, chiefly to Salt Lake City.

"Atlas Steel Company, Welland, Ontario, is the only Canadian consumer of concentrate, but it takes scheelite concentrate only.

"World production of tungsten ore and concentrate in 1939, on a basis of 60 per cent WO_3, was about 40,000 metric tons, the principal producers being China, Burma, United States, Bolivia, Malaya, Portugal, Korea, Japanese controlled areas in south China, Australia, and Argentina.

"China was the chief source of tungsten for 20 years prior to 1939, the record production being 16,257 metric tons of 60 per cent WO_3 in 1937. In 1941, however, only 9,000 tons were produced. About 95 per cent of the output has come from Kiangsi, Human, and Kwangtung provinces, about 70 per cent being from the Nanling region in Kiangsi province. The ore mainly occurs as wolframite. Most of the mines in Kiangsi are still under Chinese control.

"During 1943 custom ores and crude concentrates were treated by the Bureau of Mines, Ottawa; by the Quebec Department of Mines plant, Val d'Or, Quebec; and by the War Metals Research Board, University of British Columbia, Vancouver. Ores are no longer being treated in the above plants, except by special arrangement.

"Tungsten ores are concentrated to 60 per cent or higher of tungsten trioxide (WO_3). For adding to steel, the ore is generally converted into ferro-tungsten, but sometimes into tungsten oxide, calcium tungstate, or tungsten powder. Canada has no plants for the manufacture of ferro-tungsten or other tungsten addition agents and the only company making tungsten steels is Atlas Steels, Welland, Ontario. Only scheelite is used by the Company at present, and the high-grade concentrate (not less than 70 per cent WO_3) is added directly to the steel bath. This is possible because of the comparative ease with which the calcium forms a slag.

"Consumption of tungsten in largely dependent upon production of high speed alloy steels, but this production has declined considerably owing to the accumulation of stocks of bars and billets and to changes in the military program. As a result of this and because of the large supply of ferro-tungsten, concentrates, and scrap on hand, the Metals Controller, before the end of 1943, instructed all producers to discontinue their operations and to immediately ship the material on hand. He also gave notice that no new contracts to purchase would be made.

"The purchase price in the United States of domestic concentrate during 1943 was $30 per short ton unit (20 pounds) of contained WO_3 in the standard concentrate, less freight and penalties below 60 per cent WO_3 and above impurities specifications. This price is to remain until April 30, 1944, and will then be $24 a unit until June 30, 1944. Duty into the United States is 50 cents per pound of contained tungsten metal, but there is no duty on Canadian low-grade concentrates shipped for treatment. The United States price of 75 to 80 per cent ferro-tungsten is $1.80 per pound of contained tungsten metal. The price of tungsten metal of 99 per cent purity is $2.50 to $2.75 a pound; and of 99.7 per cent purity, $5.40 a pound.

"The price in Canada of scheelite concentrate containing 70 per cent WO_3 (within specifications) was $26.50 a short unit of WO_3, delivered at Welland, Ontario, this being equivalent to about $1,855 a short ton of 70 per cent concentrate, delivered. All sales of Canadian concentrate were made through the Metals Controller, Ottawa."

Table 57 - PRODUCTION (COMMERCIAL SHIPMENTS) OF CRUDE TUNGSTEN CONCENTRATES IN CANADA

Year	Pounds	$	Average per cent WO_3
1912	28,000	(a)	72
1917	580	234	69.41
1918	27,000(c)	11,700	73.8
1939	8,825	4,917	(a)
1940	12,002	7,303	70-75
1941	82,846(b)	38,712	51.1
1942	520,981	406,275	61.8
1943	1,508,621	1,083,538	54.2

(a) Not recorded.
(b) Includes export of considerable low-grade material to U.S.A.
(c) Included 11 tons produced at Burnt Hill, N.B., with smaller shipments from Yukon, Nova Scotia and Manitoba.

Table 58 - TUNGSTEN CONSUMED IN SPECIFIED INDUSTRIES, 1938-1942

Year	Tungsten wire used in manufacture of Canadian electrical apparatus and supplies	Ferro-tungsten consumed in Canada in the manufacture of steel (x)		Tungsten metal consumed in Canada in the manufacture of steel and alloys (x)
	Value	Long tons	Value	Pounds
	$		$	
1938	50,594	50	69,806	...
1939	52,207	95	173,250	13,089
1940	62,175	336	829,859	15,474
1941	82,696	482	1,003,314	29,729
1942	129,265	577	1,440,141	36,882

(x) Other than tungsten-chromium.

VANADIUM - Some of the magnetites of the Rainy River district in Ontario are known to contain relatively small quantities of vanadium and some research has been conducted as to its economic recovery. There is no production of either the metal or its ores in Canada at the present time.

The principal occurrences of vanadium are in Arizona, Colorado and Utah in the United States; Minasragra in Peru; Broken Hill in Northern Rhodesia; and Grootfontein district in South West Africa.

The metal is employed chiefly in the manufacture of alloy steels and irons. It is also used in the form of ammonia meta-vanadate as a catalyst in the manufacture of sulphuric acid and in the non-ferrous, glass, ceramic and color industries.

The United States Bureau of Mines reports that vanadium has been and is now being obtained by some countries from other than vanadium ores, including petroleum, bauxite, phosphate rock and titaniferous magnetites; the ever-increasing demand for vanadium directs attention to all possible vanadium sources, as well as to efforts to extend known deposits. In the United States the principal ores are roscoelite and carnotite in sandstones, disseminated or in spots, bunches, lenses and seams. Vanadium was among the metals included in the inventory control provided by General Metals Order 1, May 1, 1941, issued by the United States Office of Production Management.

Data relating to possible imports of vanadium ores or vanadium compounds or alloys are not shown separately in Canadian trade reports. In 1942 there were 203 tons of ferrovanadium valued at $524,007 consumed in Canada in the manufacture of steel.

Vanadium ore was quoted August, 1944: 27½ cents per pound contained V_2O_5, f.o.b. shipping point, by "E & M J Metal and Mineral Markets", New York.

ZIRCONIUM - The metal is not produced in Canada; zircon is the most common zirconium mineral and the Department of Mines and Resources, Ottawa, states that it, or cyrtolite, commonly occurs in greater or less amount in Canadian Precambrian pegmatites, also in the pegmatitic apatite-phlogopite deposits of the Grenville areas in Ontario and Quebec.

Zircon is used to a steadily growing extent in refractories, specialized porcelains and heat-resisting glass. The United States Bureau of Mines Yearbook for 1941 reports on the metal as follows:

"Zircon is recovered from the beach sands near Melboune, Florida, by the Riz Mineral Company, as an accessory of titanium ore and from the gravels near Lincoln, California, as a by product of gold dredging. Zironium metal purifies, hardens, and strengthens steels and acts with aluminum to harden cupronickel. Metallic zirconium as powder or ductile metal is used in photoflash bulbs, radio tubes, ammunition primers and welding rods. In 1941 (January-September) there were 20,101 short tons of zirconium ore valued at $446,286 imported into the United States; of these 73 per cent came from Australia, 24 per cent from Brazil and 3 per cent from British India. Canadian consumption of ferrozirconium in the manufacture of steel totalled 51 short tons valued at $7,337 in 1943."

Zircon ore was quoted in August, 1944 by "E & M J Metal and Mineral Markets", New York: per ton f.o.b. Atlantic seaboard, minimum 55 per cent ZrO_2, $65 to $75 nominal. Zirconium alloy, 12 to 15 per cent Zr, 39 to 45 per cent Si, $102.50 to $107.50 per gross ton; 35 to 40 per cent Zr, 47 to 52 per cent Si, 14 to 16 cents per pound.

DIRECTORY OF FIRMS IN THE MISCELLANEOUS METAL MINING INDUSTRY IN CANADA, 1943

(x) Active but not producing.

Name of Firm and Product	Head Office Address	Location of Mine or Plant
Aluminum -		
Aluminum Company of Canada Limited	1700 Sun Life Bldg., Montreal, Que.	Arvida, Que. Shawinigan Falls, Que. La Tuque, Que. Isle Maligne, Que. Beauharnois, Que.
Antimony -		
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Que.	Trail, B.C.
Beryl -		
Canadian Beryllium Mines & Alloys Ltd.(x)	room 401 ., 100 Adelaide St. W., Toronto, Ont.	Renfrew Co., Ont.
Universal Light Metals Co. (x)	28 James St. S., Hamilton, Ont.	Renfrew Co., Ont.
Bismuth -		
Deloro Smelting & Refining Co. Ltd. (x)	900 Victoria Bldg., Ottawa, Ont.	Deloro, Ont.
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Que.	Trail, B.C.
Cadmium -		
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Que.	Trail, B.C.
Hudson Bay Mining & Smelting Co. Ltd.	500 Royal Bank Bldg., Winnipeg, Man.	Flin Flon, Man.
Chromite -		
Alchrome Prospecting Synd. (x)	11 King St. W., Toronto, Ont.	Matapedia Co., Que.
Asbestos Corporation Ltd.	Thetford Mines, Que.	Thetford Mines, Que.
Chrome Association	c/o Simeon Bergeron, 142 Notre Dame St., Black Lake, Que.	Black Lake, Que.
Chromite Limited	404 Notre Dame St. W., Montreal, Que.	St. Cyr, Que.
Chromore Ltd.	Manoir Hebert, Thetford Mines, Que.	Thetford Mines, Que.
Corriveau, Alexandre (x)	Disraeli, Que.	Garthey Tp., Que.
Labbe, Ward & Lambert	Thetford Mines, Que.	Coleraine Tp., Que.
Labonte and Metivier	7 rue Notre Dame, Thetford Mines, Que.	Coleraine Tp., Que.

DIRECTORY OF FIRMS IN THE MISCELLANEOUS METAL MINING INDUSTRY IN CANADA, 1943 (Continued)
(x) Active but not producing.

Name of Firm and Product	Head Office Address	Location of Mine or Plant
Chromite (Con.) -		
Mount Albert Mining Co. Ltd. (x)	1010 Canada Cement Bldg., Montreal, Que.	Gaspé District, Que.
Morisset, R. and Co.	Black Lake, Que.	Coleraine Tp., Que.
Pare, Orel	Black Lake, Que.	Coleraine Tp., Que.
Roberge, J. W.	Thetford Mines, Que.	Thetford District, Que.
Thetford Ferro Chrome Reg.	Thetford Mines, Que.	Coleraine Tp., Que.
Wartime Metals Corp. (Chromeraine Project)	637 Craig St. W., Montreal, Que.	Coleraine Tp., Que.
Iron Ore -		
Dominion Steel & Coal Corp. Ltd.	Sydney, N.S.	Bathurst, N.B.
Goyette, A. E. (x)	4295 St. Hubert St., Montreal, Que.	Arthabaska Co., Que.
Hollinger North Shore Exploration Co. Ltd. (x)	721 Royal Bank Bldg., Montreal, Que.	New Quebec
Algoma Ore Properties Ltd.	Cornwall Bldg., Sault Ste. Marie, Ont.	Algoma District, Que.
Great Lakes Iron Mines Ltd. (x)	room 505 .. 67 Yonge St., Toronto, Ont.	Atikokan, Ont.
Gunflint Iron Mines Ltd. (x)	room 412 .. 11 King St. W., Toronto, Ont.	Round Lake, Ont. Shebandowan, Ont.
Hollinger Cons. Gold Mines Ltd. (x)	Timmins, Ont.	Halton Co., Ont.
Michipicoten Iron Mines Ltd. (x)	room 2810 .. 25 King St. W., Toronto, Ont.	Algoma District, Ont.
Midwest Iron Corp. Ltd. (x)	36 Toronto St., Toronto, Ont.	Atikokan, Ont.
Rebair Gold Mines Ltd. (x)	9 Adelaide St. E., Toronto, Ont.	Atikokan, Ont.
Steep Rock Iron Mines Ltd. (x)	25 King St. W., Toronto, Ont.	Atikokan, Ont.
Tomahawk Iron Mines Ltd. (x)	suite 405 .. 67 Yonge St., Toronto, Ont.	Hastings Co., Ont.
Indium -		
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Que.	Trail, B.C.
Lithium Ore -		
Hudson Bay Mining & Smelting Co. Ltd. (x)	500 Royal Bank Bldg., Winnipeg, Man.	Cat Lake, Man.
Lithium Corporation of Canada Ltd. (x)	403 Avenue Bldg., Winnipeg, Man.	Bernic and Cat Lakes, Man.
Sherritt Gordon Mines Ltd. (x)	25 King St. W., Toronto, Ont.	Crowduck Bay, Man. East Braintree, Man.
Magnesium -		
Consolidated Mining & Smelting Company of Canada Ltd. (x)	215 St. James St., Montreal, Que.	Trail, B.C.
Dominion Magnesium Ltd.	room 1107 .. 67 Yonge St., Toronto, Ont.	Haley, Ont.
Manganese Ore -		
British Manganese Mines Ltd.	room 1102 .. 45 Richmond St. W., Toronto, Ont.	Sussex, N.B.
Mercury -		
Bralorne Mines Ltd.	555 Burrard St., Vancouver, B.C.	Omineca District, B.C.
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Que.	Pinchi Lake, B.C.
Molybdenite -		
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Que.	Salmo, B.C.
Cresmar Moly Mines Ltd.	410 Royal Bank Bldg., Toronto, Ont.	Searchmont, Ont.
Farley Mining Co.	195½ Main St., Hull, Que.	Gatineau Dist., Que.
Gayhurst Prospecting Synd. (x)	room 428 .. 67 Yonge St., Toronto, Ont.	Prospecting, Que.
Indian Molybdenum Ltd.	Bourlamaque, Que.	Preissac, Que.
Norseman Mines Ltd. (x)	80 Richmond St. W., Toronto, Ont.	LaCorne Tp., Que.

DIRECTORY OF FIRMS IN THE MISCELLANEOUS METAL MINING INDUSTRY IN CANADA, 1943 (Concluded)

(x) Active but not producing.

Name of Firm and Product	Head Office Address	Location of Mine or Plant
Molybdenite (Con.) -		
Norwin Molybdenite Mines Ltd. (x)	room 405 .. 26 Queen St. E., Toronto, Ont.	Eardley Tp. Que.
Molyca Mines Ltd.	3778 Batrel St., Montreal, Que.	Oldfield Tp., Que.
Quyon Molybdenite Co. Ltd.	Quyon, Que.	Quyon, Que.
Steeloy Mining Corp. Ltd. (x)	80 King St. W., Toronto, Ont.	Preissac Tp., Que.
Sullivan Cons. Mines Ltd. (x)	1604 Aldred Bldg., Montreal, Que.	LaCorne Tp., Que.
Wartime Metals Corp.	637 Craig St. W., Montreal, Que.	LaCorne Tp., Que. Dagot Tp., Ont.
Pitchblende -		
Eldorado Mining & Refining	80 King St. W., Toronto, Ont.	Great Bear Lake, N.W.T.
Selenium-Tellurium -		
International Nickel Co. of Canada Ltd.	Copper Cliff, Ont.	Copper Cliff, Ont.
Canadian Copper Refiners Ltd.	1600 Royal Bank Bldg., Toronto, Ont.	Montreal East, Que.
Tin -		
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Que.	Trail, B.C.
Titanium Ore -		
Baie St. Paul Titanic Iron Ore Co.	Baie St. Paul, Que.	St. Urbain, Que.
Brossard, Hercule (x)	La Malbaie, Que.	La Malbaie, Que.
Coulombe, J.	71 Ave. Royal Monument, Quebec, Que.	St. Urbain, Que.
Tungsten Concentrates -		
B.C. War Metals Research Board (✓)	University of British Columbia, Vancouver, B.C.	Vancouver, B.C.
Bralorne Mines Ltd.	555 Burrard St., Vancouver, B.C.	Bralorne, B.C.
Bureau of Mines (Federal) (✓)	Booth St., Ottawa, Ont.	Ottawa, Ont.
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Que.	Nelson M.D., B.C.(x) Omineca M.D., B.C. Greenwood M.D., B.C. (x)
Eldridge, G. S. (x)	567 Hornby St., Vancouver, B.C.	Albert Canyon, B.C.
Hollinger Cons. Gold Mines Ltd. (✓)	Timmins, Ont.	Timmins, Ont.
Little Long Lac Gold Mines Ltd. (✓)	Geraldton, Ont.	Geraldton, Ont.
Phillips, Edwin	Gold Bridge, B.C.	Lillooet Dist., B.C.
Quebec Department of Mines (✓)	Quebec, Que.	Val d'Or, Que.
Wartime Metals Corp. (Emerald)	637 Craig St. W., Montreal, Que.	Salmo, B.C.

(✓) Treated ores from various Canadian mines.