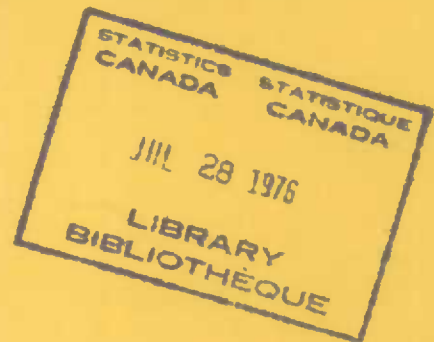


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GOVERNMENT OF CANADA

THE MISCELLANEOUS METAL MINING INDUSTRY  
1951



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DOMINION BUREAU OF STATISTICS—DEPARTMENT OF TRADE AND COMMERCE

# THE MISCELLANEOUS METAL MINING INDUSTRY 1951

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## NOTICE

The annual reports prepared by the Industry and Merchandising Division of the Bureau of Statistics are divided into 4 volumes, as follows: **Volume I**—The Primary Industries, including mining, forestry and fisheries; **Volume II**—Manufacturing; **Volume III**—Construction; **Volume IV**—Merchandising and Services. The volumes are made up of parts, and the parts in turn are subdivided according to the industries which they comprise.

Volume I consists of the following parts:

Part I—Mineral Statistics

Part II—Forestry Statistics—Operations in the Woods

Part III—Fisheries Statistics

Part I includes the following reports which constitute the complete series on Mineral Statistics of Canada. Individual reports are issued as the information becomes available; they are arranged in a form suitable for binding.

- A—General Review of the Mining Industry, 50¢.
- B—The Gold Mining Industry, 50¢.
- C—The Silver-Lead-Zinc Mining Industry, 25¢.
- D—The Nickel-Copper Mining, Smelting and Refining Industry, 25¢.
- E—The Miscellaneous Metal Mining Industry, 25¢.
- F—The Non-ferrous Smelting and Refining Industry, 25¢.
- G—The Coal Mining Industry, \$1.00.
- H—The Crude Petroleum and Natural Gas Industry, 25¢.
- I—The Asbestos Mining Industry, 25¢.
- J—The Feldspar and Quartz Mining Industry, 25¢.
- K—The Gypsum Industry, 25¢.
- L—The Peat Industry, 25¢.
- M—The Salt Industry, 25¢.
- N—The Talc and Soapstone Industry, 25¢.
- O—The Miscellaneous Non-Metal Mining Industry, 25¢.
- P—The Cement Manufacturing Industry, 25¢.
- Q—The Clay and Clay Products Industry, 25¢.
- R—The Lime Industry, 25¢.
- S—The Sand and Gravel Industry, 25¢.
- T—The Stone Industry, 25¢.
- U—Contract Diamond Drilling in the Mining Industry, 25¢.

# THE MISCELLANEOUS METAL MINING INDUSTRY

1951

including

Aluminum	Mercury
Antimony	Molybdenum
Barium	Pitchblende
Beryllium	Selenium
Bismuth	Tantalum-Columbium
Cadmium	Tellurium
Calcium	Thallium
Cerium	Tin
Chromium	Titanium (ilmenite)
Iron	Tungsten
Indium	Vanadium
Magnesium	Zirconium
Manganese	

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 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 1951 and classified as miscellaneous include antimony, barium, bismuth, cadmium, calcium, chromite, iron ore, magnesium, manganese ore, 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, mercury, vanadium, and a few of the rarer metals.

It should be noted that some 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, the statistics of employment, etc., relating 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.

There were 31 firms in the miscellaneous metals industry in 1951 but only 8 were classed as producers. Salaries and wages for the 3,891 persons employed amounted to \$12,251,755. Fuel cost \$1,087,611 and 113,612,019 k.w.h. of electricity were purchased for \$776,698. Process supplies, freight and ore treatment charges amounted to \$7,844,584. Gross value of production was \$31,474,736.

TABLE 1. Principal Statistics<sup>1</sup> of the Miscellaneous Metal Mining Industry, 1949-1951

	1949	1950	1951
Number of firms .....	21	16	31
Number of plants .....	21	16	31
Number of employees:			
Administrative and office .....	172	274	330
Workmen .....	3, 103	2, 951	3, 561
<b>Total</b> .....	<b>3, 275</b>	<b>3, 225</b>	<b>3, 891</b>
Yearly earnings:			
Administrative and office ..... \$	603, 313	986, 545	1, 232, 628
Workmen ..... \$	8, 291, 329	7, 592, 424	11, 019, 127
<b>Total</b> ..... \$	<b>8, 894, 642</b>	<b>8, 578, 969</b>	<b>12, 251, 755</b>
Gross value of products, f.o.b. shipping points .... \$	21, 466, 327	23, 646, 960	31, 474, 736
Cost of fuel and electricity ..... \$	1, 160, 558	1, 387, 828	1, 864, 309
Process supplies used ..... \$	1, 286, 989	3, 272, 336	3, 299, 651
Smelter charges ..... \$	—	—	200
Freight ..... \$	3, 328, 783	3, 878, 485	4, 544, 733

1. Does not include data relating to smelters and refineries or to mining in the Northwest Territories. Data for 1949-1951 cover only antimony, chromium, iron, manganese, molybdenum, titanium and tungsten.



TABLE 2. Average Number of Workmen, by Months, 1950 and 1951

Month	1950						1951					
	Surface		Under-ground	Mill		Total	Surface		Under-ground	Mill		Total
	Male	Female		Male	Female		Male	Female		Male	Female	
January .....	1,213	39	1,408	127	2	2,789	1,422	30	1,510	136	2	3,100
February .....	1,243	38	1,381	140	2	2,804	1,393	28	1,483	139	2	3,045
March .....	1,133	39	870	152	2	2,196	1,447	30	1,509	137	2	3,125
April .....	1,144	38	861	158	2	2,203	1,577	31	1,528	131	2	3,269
May .....	1,348	37	1,086	172	2	2,645	1,709	29	1,526	153	2	3,419
June .....	1,527	37	1,090	169	2	2,825	1,947	28	1,569	168	2	3,714
July .....	1,662	45	1,111	177	2	2,997	2,046	28	1,551	165	2	3,762
August .....	1,784	48	1,365	166	2	3,365	1,939	53	1,646	189	2	3,829
September .....	1,840	45	1,310	162	2	3,359	2,023	41	1,651	198	2	3,915
October .....	1,590	42	1,436	144	2	6,214	2,024	51	1,632	215	2	3,924
November .....	1,789	42	1,439	131	2	3,403	1,933	52	1,649	224	2	3,860
December .....	1,660	48	1,615	141	2	3,466	1,836	42	1,649	159	2	3,688
<b>Average .....</b>	<b>1,495</b>	<b>42</b>	<b>1,259</b>	<b>153</b>	<b>2</b>	<b>2,951</b>	<b>1,776</b>	<b>38</b>	<b>1,576</b>	<b>169</b>	<b>2</b>	<b>3,561</b>
									Man hours worked in 1951			
Administrative and office .....									688,047			
Workmen .....									7,305,632			
<b>Total .....</b>									<b>7,993,679</b>			

## Aluminum

Although there is no bauxite (the ore of aluminum) in Canada, the aluminum smelting industry in this country is exceeded in size only by that of the United States. The principal factor favouring the establishment of the industry in Canada is abundant and low-cost hydro-electric power at points where necessary raw materials can be cheaply and conveniently assembled.

The production of 447,095 tons of aluminum ingots in 1951 was approximately 13 per cent higher than in the previous year, approaching the peak production of 1943 when nearly a half-million tons of ingots were made.

Production in Canada is entirely by Aluminum Company of Canada, Limited, which has its alumina plant at Arvida, and reduction plants at Arvida, Ile Maligne, Shawinigan Falls, La Tuque, and Beauharnois, all in the province of Quebec. These reduction plants have a total rated capacity of about

550,000 tons of aluminum a year, or over 20 per cent of the estimated productive capacity of the world. The La Tuque plant was not operated during 1951.

The principal imported raw materials used in the Canadian aluminum industry are bauxite from British Guiana, coal and coke from the United States, fluorspar from Newfoundland, and cryolite from Greenland and the United States.

The price of aluminum ingot was 18 cents per pound at the close of 1951. Effective January 1, 1948, the United States import tariff on aluminum metal and alloys was reduced from 3 cents to 2 cents per pound.

Smelter capacity in the Saguenay area in Quebec is now being expanded by about 50,000 tons annually, effective early in 1953. Also new power and ingot facilities in British Columbia will add another 100,000 tons in 1954.

TABLE 3. Production, Consumption, Imports and Exports of Aluminum Ingots, 1942-1951

Year	Production	Consumption	Exports	Imports
Tons of 2,000 pounds				
1942 .....	340,596	32,700	314,483	—
1943 .....	495,749	40,100	375,383	1
1944 .....	462,065	38,400	295,226	66
1945 .....	215,712	40,800	382,286	51
1946 .....	194,117	33,825	187,336	246
1947 .....	299,066	50,265	230,175	616
1948 .....	367,079	65,433	328,551	25
1949 .....	369,466	58,767	288,364	40
1950 .....	396,882	65,185	335,726	63
1951 .....	447,095	86,241	354,414	270

TABLE 4. Imports of Aluminum and Bauxite, 1950 and 1951

Item	1950		1951	
	Tons	\$	Tons	\$
Alumina .....	240	79,933	274	99,021
Bauxite ore .....	1,861,627	9,890,125	2,401,759	15,373,013
Cryolite .....	3,734	598,668	6,516	1,102,415
Aluminum:				
Pigs, ingots and blocks .....	63	59,091	270	174,684
Scrap .....	425	73,785	45	10,375
Angles, channels and beams .....	241	414,725	237	432,811
Bars, rods and wire .....	281	191,738	1,128	944,356
Leaf or foil .....	—	131,090	—	185,404
Pipes and tubes .....	160	140,953	183	201,031
Plates, sheets and strips .....	1,697	1,135,111	3,860	3,202,396
Powder .....	65	57,128	205	143,311
Wire and cable .....	4	5,522	14	12,712
Household hollow ware .....	—	651,777	—	697,887
Manufactures, n.o.p. ....	—	5,286,144	—	5,491,990

TABLE 5. Exports of Aluminum, 1950 and 1951

Item	1950		1951	
	Tons	\$	Tons	\$
Aluminum scrap .....	4,643	1,343,393	3,951	1,247,924
Aluminum in primary forms .....	335,726	96,369,545	354,414	112,019,417
Aluminum manufactures, n.o.p. ....	—	2,964,111	—	1,748,207
Aluminum, semi-fabricated .....	11,445	5,492,753	14,805	7,585,927
Aluminum kitchen utensils .....	—	89,126	—	240,413
Aluminum foil .....	712	608,456	1,613	1,937,547

TABLE 6. World Production of Aluminum, 1948-1951 (From the Annual Report of the American Bureau of Metal Statistics)

Country	1948	1949	1950	1951
Tons of 2,000 pounds				
United States .....	623,456	603,462	718,622	836,881
Canada .....	367,079	369,466	396,882	444,741
<b>Total America</b> .....	<b>990,535</b>	<b>972,928</b>	<b>1,115,504</b>	<b>1,281,622</b>
Austria .....	14,723	16,309	19,828	14,063
France .....	71,418	59,679	66,926	100,423
Germany .....	8,053	31,789	30,686	81,718
Great Britain .....	33,629	33,986	33,004	31,052
Italy .....	36,466	28,302	40,862	54,839
Hungary .....	10,362	9,039	—	—
Norway .....	34,216	39,349	51,870	56,447
Spain .....	577	1,336	2,389	4,200
Sweden .....	3,614	4,331	4,451	7,300
Switzerland .....	20,994	23,148	20,944	29,762
Yugoslavia .....	2,077	2,748	2,129	3,209
<b>Total Europe</b> .....	<b>236,129</b>	<b>250,016</b>	<b>—</b>	<b>—</b>
China, Taiwan .....	2,766	1,446	1,941	2,864
India .....	3,765	3,909	4,028	4,311
Japan .....	7,672	23,393	27,793	36,906

1. Excluding Russia and Russian zone of Germany.
2. Production 1948 Bizonal area; beginning with 1949 Federal Republic of Germany.
3. Not available.

## Antimony

Antimony production in 1951 consisted of the antimony content of antimonial lead alloys varying from 5 to 25 per cent antimony made by the Consolidated Mining and Smelting Co. of Canada, Limited, at Trail, British Columbia; a small amount of antimony in flue dust and Dore slag shipped from that smelter; and the metal content of antimony ore exported by the Greyrock Mining Co., Gold Bridge, British Columbia. The 3,351 tons shown for shipments in 1951 included some antimony in flue dust and slag produced in earlier years but not previously recorded.

The greatest single use for antimony is as an alloying element with lead to which it adds

hardness and mechanical strength such as in the manufacture of storage batteries and cable covering. It is alloyed with tin in the manufacture of babbitt bearings and with lead and tin in solders, foil, collapsible tubes, and type metal. Its property of expansion on cooling when alloyed makes it particularly useful in the manufacture of type metal. During the war it was used to harden the lead used in ammunition and to flame proof canvass goods used by the armed forces.

The Canadian price for antimony was about 47 cents per pound at the end of the year.

TABLE 7. Production of Antimony 1942-1951

Year	In ores exported		Metal produced <sup>1</sup> in Canada		Total	
	Pounds	\$	Pounds	\$	Pounds	\$
1942 .....	78	13	3,041,030	516,975	3,041,108	516,988
1943 .....	—	—	1,114,166	189,408	1,114,166	189,408
1944 .....	—	—	1,937,933	281,000	1,937,933	281,000
1945 .....	—	—	1,667,951	290,557	1,667,951	290,557
1946 .....	—	—	642,145	96,332	642,145	96,322
1947 .....	—	—	1,150,463	384,255	1,150,463	384,255
1948 .....	—	—	310,062	113,173	310,062	113,173
1949 .....	—	—	158,288	61,020	158,288	61,020
1950 .....	—	—	643,540	215,586	643,540	215,586
1951 .....	5,398,328 <sup>2</sup>	817,391	1,303,836	619,322	6,702,164	1,436,713

1. No refined metal in 1945-1951; figures represent antimony content of antimonial lead.

2. Includes antimony in flue dust and Dore slag produced in 1949 and 1950 but not previously recorded.

TABLE 8. Production of Antimony Metal, Consumption, Imports and Exports, 1942-1951

Year	Production in Canada	Consumption in Canada	Imports	Exports <sup>1</sup>
Tons of 2,000 pounds				
1942 .....	1,521	1,187	—	166
1943 .....	567	1,303	120	6
1944 .....	968	1,515	779	—
1945 .....	—	778	517	—
1946 .....	—	871	455	—
1947 .....	—	1,189	1,440	—
1948 .....	—	812	547	—
1949 .....	—	767	1,292	—
1950 .....	—	997	1,606	—
1951 .....	—	740	681	—

1. Shipped for export; data not available from customs' records.

2. Not including antimony in antimonial lead produced at the Trail smelter.

TABLE 9. Consumption of Antimony Metal, by Industries, 1948-1951

Industry	1948	1949	1950	1951
Tons of 2,000 pounds				
White metal foundries .....	700	683	907	632
Electrical apparatus plants .....	53	63	68	72
Brass foundries .....	13	11	14	16
Silverware factories .....	23	10	8	20
Ammunition plants .....	—	—	—	—
Miscellaneous .....	20	—	—	—
<b>Total accounted for .....</b>	<b>812</b>	<b>767</b>	<b>997</b>	<b>740</b>



**TABLE 10. World Production of Antimony (content of ore), by Countries, 1947-1950**

(Taken from the "Minerals Yearbook" published by the United States Bureau of mines.)

Country	1947	1948	1949	1950
	Metric tons			
<b>North America:</b>				
Canada <sup>2</sup> .....	522	141	72	295
Honduras .....	—	6	9	3
Mexico <sup>2</sup> .....	6,925	7,380	5,753	5,868
United States .....	4,823	5,887	1,484	2,265
<b>South America:</b>				
Argentina .....	—	—	—	3
Bolivia (exports) .....	10,857	12,260	10,275	3
Peru .....	1,164	1,556	815	3
<b>Europe:</b>				
Austria .....	89	269 <sup>5</sup>	379 <sup>5</sup>	409 <sup>5</sup>
Czechoslovakia .....	4,500	4,100	3	2,000 <sup>4</sup>
France .....	201	275	294	330 <sup>4</sup>
Greece .....	—	—	210	1,505
Italy .....	513	460	360	400
Portugal .....	25	41	3	3
Spain .....	91	144	171	400 <sup>6</sup>
Yugoslavia .....	1,361	1,980	2,789	3
<b>Asia:</b>				
British Borneo: Sarawak .....	—	4	1	2
Burma <sup>4</sup> .....	46	121	70	3
China .....	1,909	3,251	6,000 <sup>4</sup>	3
Iran .....	—	—	3	3
Japan .....	108	135	172	161
Turkey (Asia Minor) .....	140	600	450	1,600
<b>Africa:</b>				
Algeria .....	130	746	1,338	1,450
French Morocco .....	470	520	660	670
Southern Rhodesia .....	83	9	41	21
Spanish Morocco .....	139	261	144	7
Union of South Africa .....	3,302	4,106	4,461	8,300
<b>Oceania:</b>				
Australia .....	173	188	177	222
New Zealand .....	—	5	3	3
<b>Total (except U.S.S.R.) .....</b>	<b>38,000</b>	<b>45,000</b>	<b>37,000</b>	<b>50,000</b>

1. Approximate metal content of ore produced, exclusive of antimonial lead ores; U.S.S.R. produces antimony, but data are not available. (Data differ from those given in "Antimony" chapters for previous years where they were in terms of recoverable metal content computed at 92 per cent of reported gross content.)

2. Includes antimony content of antimonial lead.

3. Data not available; estimate included in the total.

4. Estimate

5. Excludes Soviet Zone, data for which are not available.

6. Including Spanish Morocco.

7. Included in Spain.

## Barium

The commercial production of barium metal was introduced in Canada by the Dominion Magnesium Limited, at Haley, Ontario, in 1947. There was a small production in 1950 and 1951.

The raw material for making barium metal is imported so the output figures are not included in the statistics of Canada's mineral production.

## Beryllium

No beryllium ore has been mined since 1941 when some was produced in Renfrew County and stock piled. In 1950 a carload of this material was shipped to the United States. No shipments were made in 1951.

In Manitoba, a little work was done several years ago on beryl showings in pegmatites opened originally for feldspar and lithium minerals in the Winnipeg River and Oiseau (Bird) River areas, but no shipments were reported.

In the Northwest Territories, exploration in the area north and east of the Yellowknife gold camp has disclosed numerous occurrences of beryl in pegmatites which also contain lithium minerals and tantalite-columbite. Some of these are considered to be of possible economic interest.

In Quebec, scattered occurrences of beryl are known in La Corne and Preissac townships, Abitibi county, often associated with molybdenite. None of

these, however, is believed to be of economic importance.

Beryllium is used chiefly in the form of beryllium-copper alloys, the most important of which contains about 5 per cent beryllium. A beryllium-aluminum alloy containing 5 per cent beryllium is used as a deoxidizer in making aluminum-magnesium products. Straight beryllium metal has only limited applications, notably for the windows of X-ray tubes, where it is used for its transparency to the rays.

Ground beryl is used as a batch ingredient in spark plugs and other ceramic specialties, to which it imparts high electrical and impact resistance and transverse strength. Some is also used in cooking utensil enamels. Consumption for such uses in the United States is estimated at about 100 tons a year.

New York price quotations, at the end of the year, for beryllium ore, f.o.b. mine, were \$33 to \$36 per unit of BeO, 10 to 12 per cent.

## Bismuth

Bismuth was produced at the Trail smelter of the Consolidated Mining and Smelting Company of Canada, Limited, from the firm's own ores and also from custom ores. The Deloro Smelting and Refining Company Limited, Deloro, Ontario, made a bismuth-silver-lead bullion from ores received from the cobalt area in Ontario. In Quebec, the Molybia Corporation, Limited, produced bismuth oxychloride concentrates.

Bismuth is too brittle to be used alone, but its alloys have many uses, such as in the manufacture of sprinkler plugs and other fire-protection devices, electrical fuses, low melting solders, dental amal-

gams, and tempering baths for small tools. Like antimony, bismuth expands on solidification and retains this property in a number of alloys, and is used in type metal. This group of bismuth-lead-tin-cadmium alloys is used by the airplane and automotive industries to prepare spotting fixtures, to make moulds for electroforming, to fill thin-walled tubing during bending, and to spray-coat wooden patterns and core boxes in foundries.

According to the "E & M J Metal and Mineral Markets", the price of bismuth December 1951 was \$2.25 per pound, in ton lots.

TABLE 11. Production of Primary Bismuth in all Forms<sup>1</sup>, 1942-1951

Year	Pounds	\$	Year	Pounds	\$
1942 .....	347,556	479,627	1947.....	284,372	560,213
1943 .....	407,597	562,484	1948.....	240,242	480,484
1944 .....	123,875	154,844	1949.....	102,913	210,972
1945 .....	189,815	260,047	1950.....	191,621	431,147
1946 .....	240,504	336,706	1951.....	230,298	543,504

1. Refined metal from Canadian ores plus bismuth content of bullion and concentrates exported.

TABLE 12. Production of Bismuth Metal, Consumption, Imports and Exports, 1942-1951

Year	Production	Domestic consumption	Exports <sup>1</sup>	In ports
Tons of 2,000 pounds				
1942 .....	159	36	199	—
1943 .....	204	65	73	—
1944 .....	62	46	25	—
1945 .....	95	35	41	—
1946 .....	120	40	95	—
1947 .....	142	71	61	—
1948 .....	120	44	79	—
1949 .....	105 <sup>2</sup>	18	89	—
1950 .....	97 <sup>2</sup>	33	57	—
1951 .....	104 <sup>2</sup>	54	45	—

1. Shipped for export by Canadian producers.

2. Includes bismuth from foreign ores.

TABLE 13. Consumption of Bismuth Metal, by Industries, 1948-1951

Industry	1948	1949	1950	1951
Tons of 2,000 pounds				
Medicinals and pharmaceuticals.....	28	8	14	29
White metal foundries.....	15	10	14	18
Miscellaneous .....	1	—	5	7
<b>Total</b> .....	<b>44</b>	<b>18</b>	<b>33</b>	<b>54</b>

TABLE 14. World Production of Bismuth, by Countries, 1947-1950

(Taken from the "Minerals Yearbook" of the United States Bureau of Mines).

Country <sup>1</sup>	1947	1948	1949	1950
Kilograms				
Argentina: Metal .....	22,000	2	2	2
In ore <sup>3</sup> .....	20,000	2	2	2
Australia (in ore) <sup>4</sup> .....	4,369	4,064	111	68
Belgian Congo (in ore).....	815	456	540	668
Bolivia (in ore and bullion exported) <sup>5</sup> .....	88,964	35,142	8,222	2
Canada (metal) <sup>6</sup> .....	128,988	108,971	46,680	101,152
China (in ore) <sup>3</sup> .....	2	2	2	2
France (in ore) .....	55,000	56,000 <sup>3</sup>	30,000	2
Japan (metal).....	22,862	23,327	25,946	33,049
Korea, South .....	—	104,000	173,420	2
Mexico (in impure bars) .....	256,000	154,000	249,000	263,000
Peru: Metal .....	233,794	205,861	213,137	2
In lead-bismuth alloy.....	3,043	47,225	2,398	2
Spain (metal).....	21,172	24,269	19,854	2
Sweden .....	10,998	—	2	2
Union of South Africa (in ore).....	—	437	5,045	7,649
United States .....	7	7	7	7
<b>World production, estimate</b> .....	<b>1,200,000</b>	<b>1,300,000</b>	<b>1,400,000</b>	<b>1,500,000</b>

1. Bismuth is believed to be produced also in Brazil, Burma, Germany, Norway, Romania, Uganda, U.S.S.R., United Kingdom and Yugoslavia. Production figures are not available for these countries, but estimates are included in total.

2. Data not available. Estimate included in total.

3. Estimate.

4. Partly estimated. Excludes content of some bismuth-tungsten concentrates.

5. Excludes bismuth content of tin concentrates exported.

6. Refined metal plus bismuth content of bullion exported.

7. Production included in total; Bureau of Mines not at liberty to publish separately.



## Cadmium

Cadmium is recovered in Canada as a by-product of the electrolytic refining of zinc. The zinc refineries at Trail, British Columbia, and Flin Flon, Manitoba, both produce metallic cadmium. In British Columbia the greater portion of cadmium is derived from the lead-zinc ores of the Sullivan mine, but also a considerable amount of cadmium is recovered from the customs ores shipped from various mines in British Columbia and Yukon to the smelter of the Consolidated Mining & Smelting Company of Canada, Limited, at Trail. Cadmium is found in the copper-gold-zinc ores of the Flin Flon deposit on the Saskatchewan-Manitoba boundary, and also in the zinc concentrates shipped by Sherritt-Gordon Mines, Limited, to Flin Flon for smelting and refining. Output in 1951 amounted to 663 tons.

Cadmium is used mainly in electroplating and in the manufacture of alloys and compounds, the most common use being as a protective coating for steel. To a much lesser extent it is used in copper alloys. The use of cadmium alloys, in motor vehicle bearings and for solders has created a strong demand for the metal. Cadmium is used also in the arts, paints, ceramics, and dyeing, etc.

Cadmium is marketed in metallic form, 99.5 per cent pure and better, and as a sulphide. The principal compounds are cadmium sulphide, cadmium oxide, cadmium lithopone, and cadmium selenite.

The New York price for commercial sticks of cadmium in December, 1951 was \$2.55 per pound.

TABLE 15. Production of Cadmium in all Forms, 1942-1951

Year	British Columbia		Manitoba		Saskatchewan	
	Pounds	\$	Pounds	\$	Pounds	\$
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
1944 .....	386,410	425,051	20,921	23,013	119,639	131,603
1945 .....	510,432	505,328	27,891	27,612	107,741	106,663
1946 .....	636,315	776,304	63,410	77,360	102,923	125,566
1947 .....	545,638	938,497	75,030	129,052	97,866	168,330
1948 .....	617,226	1,126,437	67,926	123,965	80,938	147,712
1949 .....	665,449	1,364,170	70,800	145,140	110,292	226,099
1950 .....	706,950 <sup>1</sup>	1,640,124	69,954	162,293	71,502	165,885
1951 .....	1,179,752 <sup>1</sup>	3,161,735	47,333	126,852	99,835	267,558

1. Includes Yukon production.

TABLE 16. Consumption and Exports of Cadmium Metal, 1942-1951

Year	Production	Domestic consumption	Exports
	Tons of 2,000 pounds		
1942 .....	574	207	400
1943 .....	393	168	286
1944 .....	263	108	192
1945 .....	319	87	175
1946 .....	401	96	296
1947 .....	359	72	309
1948 .....	383	92	275
1949 .....	423	111	317
1950 .....	419 <sup>1</sup>	116	349
1951 .....	633 <sup>1</sup>	146	460

Note. Statistics on imports are not available.

1. Includes cadmium recovered from foreign ores.



TABLE 17. World Production of Cadmium, by Countries, 1947-1950

(Taken from the "Minerals Yearbook" of the United States Bureau of Mines)

Country	1947	1948	1949	1950
	Kilograms			
Australia (Tasmania).....	209,030	293,352	211,133	287,603
Belgian Congo .....	26,040	18,056	24,635	36,000 <sup>1</sup>
Belgium .....	86,300 <sup>3</sup>	157,900 <sup>3</sup>	148,000 <sup>3</sup>	2
Canada .....	325,874	347,491	383,983	378,393
France .....	43,000	50,067	58,123	2
Germany .....	1,206 <sup>4</sup>	3,500 <sup>4</sup>	5,000 <sup>4</sup>	2
Italy .....	33,400	47,000	73,000	42,000 <sup>5</sup>
Japan .....	8,710	30,000	52,484	90,348
Mexico <sup>6</sup> .....	778,000	905,000	820,000	689,000
Norway .....	50,000	62,000	71,400	2
Peru .....	1,407	1,592	800	2
Poland .....	71,000 <sup>7</sup>	2	2	2
South-West Africa <sup>8</sup> .....	—	517,000	755,000	787,000
U.S.S.R. <sup>9</sup> .....	2	2	2	2
United Kingdom .....	106,440	115,769	102,662	118,878
United States: Metal .....	3,632,025	3,439,555	3,639,432	4,021,254
Cadmium compounds (Cd. content) .....	227,185	87,405	92,079	154,540
<b>Total (estimate) .....</b>	<b>4,927,000</b>	<b>4,844,000</b>	<b>5,113,000</b>	<b>5,619,000</b>

1. Exports.
2. Data not available; estimate included in total.
3. Estimate.
4. Bizonal area.
5. January to September, inclusive.
6. Cadmium content of flue dust exported for treatment elsewhere; represents in part shipments from stocks on hand. To avoid duplication of figures, data are not included in the total.
7. January to July, inclusive.
8. Cadmium content of concentrates exported for treatment elsewhere. To avoid duplication of figures, data are not included in the total.
9. Estimated average for 1936-1938 was 50,000

### Calcium

The commercial production of calcium in Canada started in 1945 when the metal was recovered from lime by Dominion Magnesium Limited, at its plant located at Haley, Ontario. In 1951 the value of output is included with the data on magnesium.

Calcium has found increasing use as a deoxidizer in ferrous metallurgy and as an alloy constit-

uent with non-ferrous metals. It has been employed in the reduction of difficultly reducible metals, such as chromium, thorium, uranium, and zirconium.

In 1951, the New York price for calcium, 97-98 per cent as cast, was \$2.05 per pound.

TABLE 18. Production (shipments) of Calcium Metal, 1945-1951

Year	Pounds	\$
1945 .....	22,720	19,312
1946 .....	53,548	68,720
1947 .....	602,665	642,607
1948 .....	895,203	1,723,266
1949 .....	520,069	1,040,138
1950-1951 .....	(Not available for publication)	

## Cerium

Cerium is obtained from monazite, a monoclinic phosphate of cerium metals containing about 32 per cent cerium oxide ( $Ce_2O_3$ ) and up to 18 per cent thorium ( $ThO_2$ ). Monazite is distributed widely in igneous rocks throughout the world, especially in gneisses that have been intruded by pegmatites, but usually it forms only a small fraction of one per cent of the containing rock, and only the natural concentrations in stream gravels and beach sands have paid for exploration. The chief commercial sources of monazite sand are beach deposits in Brazil and India. There are a few occurrences of monazite in Nova Scotia, Quebec and British Columbia, none of which is of commercial interest. 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 Quesnel river, Lillooet district, British Columbia. In the United States there are commercial deposits in Carolina, Florida and Idaho, and known occurrences in many other States.

In Canada, Shawinigan Chemicals, Limited, Shawinigan Falls, Quebec, has been producing cerium products from imported cerium chloride since 1940. The output is sold to the Belgo Canadian Manufacturing Company, Limited, of Montreal, for the manufacture of sparking flints.

## Chromite

There was no Canadian production of chromite in 1951. This mineral was mined for several years in the Black Lake area in Quebec.

Chromite is one of the principal alloying elements in a great variety of steels, chief of which in the amount of chromium used are the stainless and the corrosion-resistant steels. It is used in high-speed tool steels, and as a hard, toughening element in vehicle axles and frames, and in aeroplane parts. Chromium in high-temperature alloys is being used for gas turbines, jet-propulsion units, and gas engine superchargers. For metallurgical uses chromite should contain a minimum of 48 per cent  $Cr_2O_3$  with a chrome-iron ratio of 3 to 1 or higher, and the ore should be hard and lumpy.

Chrome ore is used for making refractory bricks or materials used in basic open-hearth furnaces, in

arches of furnaces, and in parts of combustion chambers of high-pressure steam boilers, etc. It is used with magnesia to make chrome-magnesia refractories, an important use in Canada being in the manufacture of brucite magnesia bricks that contain up to 30 per cent  $Cr_2O_3$ . Refractory chromite should be fairly high in  $Cr_2O_3$  and alumina, and as low as possible in silica and iron. The ore should be hard and lumpy and not under 10-mesh, and the chromite should be present in an evenly and finely distributed form, not as coarse grains mixed with blobs of silicate. The  $Cr_2O_3$  content is usually over 40 per cent.

The United States price, December, 1951, for chrome ore, 48 per cent  $Cr_2O_3$  was \$43.00 - \$54.00 per long ton, f.o.b. Atlantic ports.

TABLE 19. Production of Chromite, 1942-1951

Year	Short tons	\$	Year	Short tons	\$
1942.....	11,456	343,568	1947.....	2,162	42,159
1943.....	29,595	919,878	1948.....	1,715	33,568
1944.....	27,054	748,494	1949.....	361	7,148
1945.....	5,755	160,752	1950.....	—	—
1946.....	3,110	61,123	1951.....	—	—

TABLE 20. World Production of Chromite, by Countries, 1947-1950

(Taken from the "Minerals Yearbook" of the United States Bureau of Mines.)

Country	1947	1948	1949	1950
Metric tons				
North America:				
Canada .....	1,981	1,553	347	1
Cuba .....	159,209	116,624	97,338	117,358 <sup>2</sup>
Guatemala.....	625	474	300	300
United States .....	860	3,283	393	367
South America:				
Argentina .....	—	—	1	1
Brazil (exports) .....	—	1,526	3	1
Europe: <sup>4</sup>				
Albania .....	—	16,500 <sup>5</sup>	1	1
Bulgaria .....	1	1	1	1
Greece.....	2,640	1,500	3,381	12,631
Portugal .....	533	440	500	1
Sweden .....	—	—	—	1
United Kingdom .....	—	1	1	1
Yugoslavia <sup>6</sup> .....	55,000	65,000	93,000	100,000
Asia:				
Cyprus (exports) .....	5,283	6,899	14,875	1
India .....	35,274	22,917	10,728	1
Indochina .....	—	—	—	1
Iran .....	1	1	1	1
Japan.....	2,407	9,340	27,003	31,953
Pakistan .....	22,040	18,160	15,925	18,000 <sup>6</sup>
Philippines.....	195,185	256,854	246,744	250,511
Turkey .....	102,875	285,353	434,117	350,000
U.S.S.R. ....	500,000	600,000	350,000	500,000
Africa:				
Egypt.....	266	191	50	1
Sierra Leone.....	16,769	7,886	22,101	1
Southern Rhodesia.....	155,149	239,703	243,506	201,525
Union of South Africa .....	373,094	412,783	404,351	496,324
Oceania:				
Australia.....	—	—	1	1
New Caledonia.....	50,530	75,021	88,792	1
<b>Total (estimate).....</b>	<b>1,700,000</b>	<b>2,150,000</b>	<b>2,100,000</b>	<b>2,300,000</b>

1. Data not available; estimate included in total.

2. Exports.

3. Less than 0.5 ton.

4. Output from U.S.S.R. in Europe included with U.S.S.R. in Asia.

5. Planned production as reported.

6. Estimate.



TABLE 21. Imports of Chrome Ores, 1942-1951

Year	Tons	\$	Year	Tons	\$
1942 .....	87,628	1,271,482	1947 .....	98,322	3,138,229
1943 .....	103,471	2,121,228	1948 .....	69,183	1,937,692
1944 .....	39,089	618,231	1949 .....	66,246	1,664,082
1945 .....	60,691	1,154,985	1950 .....	119,325	2,192,555
1946 .....	15,836	269,248	1951 .....	146,998	3,762,874

TABLE 22. Imports of Chrome Ores, by Principal Countries of Supply, 1950 and 1951

Imported from	1950		1951	
	Tons	\$	Tons	\$
Union of South Africa .....	57,610	498,973	55,569	445,484
Southern Rhodesia .....	5,058	184,700	23,717	918,227
India .....	2,800	104,237	—	—
Cuba .....	6,944	108,234	12,847	254,230
Turkey .....	12,317	409,964	11,090	419,853
French Oceania .....	1,671	27,320	—	—
United States .....	12,055	432,730	43,775	1,725,080
Philippines .....	10,332	147,766	—	—
Sierra Leone .....	10,427	276,321	—	—
Pakistan .....	110	2,310	—	—
<b>Total .....</b>	<b>119,325</b>	<b>2,192,555</b>	<b>146,998</b>	<b>3,762,874</b>

### Indium

Indium production in 1951 amounted to 582 ounces valued at \$1,368 as compared with 4,952 ounces valued at \$12,083 in 1950. Indium is recovered by the Consolidated Mining & Smelting Co. of Canada, Limited, from the treatment of zinc refinery residues.

The major use has been in heavy-duty composite metal bearings employed extensively in airplanes, tanks and other mobile equipment. A zinc-indium alloy was used in applying a noncorrosive plating to hollow-steel airplane propellers. Minor uses have been in solder and brazing alloys and alloyed with

gold and silver for jewellery and plated articles. The first commercial use about 1927 was as a non-tarnish coating on silverware. Low-melting paint alloys also have been manufactured recently. Indium foil was used as a neutron indicator in the atomic bomb project uranium-graphite piles. Low-energy neutrons, about 1.5 electron-volt, are particularly effective in inducing artificial radioactivity in indium.

At the close of 1951 the quoted price of indium at New York was \$2.25 per ounce troy. The price has remained at this level for the past six years.



## Iron Ore

During 1951 the Canadian producers of iron ore shipped 4,680,510 short tons of ore valued at \$31,141,112 compared with 3,605,261 short tons valued at \$23,413,547 in 1950.

In Newfoundland the increased shipments of hematite from the Wabana mines was largely due to European orders. Here the mining extends out to three miles under the sea and to speed up transport from mine face to portal a belt conveyor system was installed in 1951 as part of the mechanization and modernization program designed to raise production to two and a half million tons a year.

In Labrador and New Quebec the Iron Ore Company of Canada continued exploration. The proven ore reserves in this area are now in excess of 417 million tons. The railway from Seven Islands on the St. Lawrence to Knob Lake in Ungava is under construction and about 125 miles of grading had been completed on this 358 mile line.

In Bristol township of Pontiac county in Quebec the magnetite deposits were investigated by the Minnesota-Huron Iron Company. In Ontario the Algoma Ore Properties Limited drew its entire output of siderite in 1951 from the Helen mine in the Michipicoten area. This ore is concentrated in the sinter plant about three miles distant. Part of the sinter is consumed by the Algoma Steel Corporation at Sault Ste. Marie and the remainder is exported, principally to the United States. Other properties explored by this firm include Siderite Hill about three miles from the Helen Mine, the Britannia deposit about eight miles northeast of the Helen Mine, and a deposit in the Goulais River area about fifty miles northeast of Sault Ste. Marie. The Ruth and Lucy properties in the Michipicoten area were investigated by the Jalore Mining Company Limited and over 40 million tons of ore were outlined.

Steep Rock Iron Mines Limited mined hematite from the northern part of the Errington open pit on the company's "B" ore zone. All of the known ore bodies and ore zones in this sector, 8 in number, lie within the basin of Steep Rock Lake and are owned by the Steep Rock Iron Mines Limited which has leased some of the ore zones to other companies. During 1951 extensive exploration was carried out on "C" ore zone by the Caland Ore Company, a subsidiary of Inland Steel Company of Chicago, which has this deposit under option for lease on a royalty basis. Steep Rock Iron Mines continued its expansion program which is planned to reach an output of three million tons by 1955 and  $3\frac{1}{2}$  or 4 million tons by 1956. This program includes preparing the "A" or Hogarth ore body for open pit mining and the "B" or Errington Mine for underground production. The Hogarth open pit is designed to produce  $2\frac{1}{2}$  million tons per year and the Errington underground Mine,  $1\frac{1}{2}$  million tons per year. In the latter, a three compartment service shaft is being sunk to a depth of 1,250 feet to provide two production levels and one drainage level beneath the pit. All ore will be brought to surface by belt conveyors.

The magnetite deposits of Marmoraton Mining Company Limited near Marmora, in Hastings county, were explored by drilling and preliminary work was commenced on the removal of a 100 to 150 foot capping of limestone.

At Campbell River, British Columbia, the Argonaut Company Limited commenced production from its magnetite deposits near Quisam Lake on Vancouver Island. The ore is mined by open-cut methods and is beneficiated to raise the iron content. Exploration work on Texada Island was done by Texada Iron Mine, Limited. The Quatsino Copper-Gold Mines Limited continued drilling on the magnetite deposits in Elk River Area.

TABLE 23. Principal Statistics for the Iron Ore Mining Industry, 1949-1951

	1949	1950	1951
Active firms (including development) .....	No. 13	14	20
Producing mines .....	No. 4	4	5
Employees:			
Administrative and office .....	No. 171	268	302
Workmen .....	No. 3,086	2,834	3,336
<b>Total .....</b>	<b>No. 3,257</b>	<b>3,102</b>	<b>3,638</b>
Yearly earnings:			
Administrative and office .....	\$ 603,013	969,096	1,141,375
Workmen .....	\$ 8,248,733	7,261,589	10,216,315
<b>Total .....</b>	<b>\$ 8,851,746</b>	<b>8,230,685</b>	<b>11,357,690</b>
Gross value of production .....	\$ 21,203,907	23,413,549	31,141,112
Fuel and electricity used .....	\$ 1,160,183	1,342,198	1,806,356
Process supplies used .....	\$ 1,284,198	3,217,403	2,920,993
Freight and treatment charges .....	\$ 3,328,783	3,771,018	4,542,998

TABLE 24. Production of Iron Ore<sup>1</sup>, 1942-1951

Year	Short tons	Value	Year	Short tons	Value
		\$			\$
1942.....	545,306	1,517,077	1947.....	1,919,366	9,313,201
1943.....	641,294	2,032,240	1948.....	1,337,244	7,487,611
1944.....	553,252	1,909,608	1949 <sup>2</sup> .....	3,675,096	21,203,907
1945.....	1,135,444	3,635,095	1950.....	3,605,261	23,413,547
1946.....	1,549,523	6,822,947	1951.....	4,680,510	31,141,112

1. Exclusive of titanium-bearing ores.

2. Newfoundland iron ore included for first time.

TABLE 25. Imports and Exports of Iron Ore, 1942-1951

Year	Imports			Exports
	From United States	From Newfoundland	Total <sup>1</sup>	
	Tons of 2,000 pounds			
1942 .....	2,033,961	610,871	2,701,968	295,960
1943 .....	2,978,388	911,450	3,906,425	374,677
1944 .....	2,501,737	624,890	3,126,649	308,424
1945 .....	2,988,484	736,665	3,739,867	771,495
1946 .....	1,686,236	518,566	2,281,677	1,145,256
1947 .....	3,126,307	755,612	3,944,550	1,749,976
1948 .....	3,392,063	820,692	4,300,163	1,070,277
1949 .....	2,350,149	42,285	2,517,235	2,550,299
1950 .....	2,975,659	—	3,070,557	2,227,475
1951 .....	3,690,269	—	3,831,418	3,225,767

1. Includes some ore from other countries, principally Brazil and Sweden.

TABLE 26. Iron Ore Charged to Iron Blast Furnaces, 1942-1951

Year	Canadian	Imported	Total
	Tons of 2,000 pounds		
1942.....	229,253	3,383,439	3,612,692
1943.....	302,780	2,955,671	3,258,451
1944.....	266,150	3,227,039	3,493,189
1945.....	235,757	2,797,697	3,033,454
1946.....	358,173	2,167,900	2,526,073
1947.....	252,085	3,420,890	3,672,975
1948.....	193,935	3,716,683	3,910,618
1949.....	1,107,250	2,738,816	3,846,066
1950.....	1,398,712	2,774,801	4,173,513
1951.....	1,476,440	3,168,581	4,645,021

Note. Newfoundland ore, classified as Canadian in 1949 and thereafter, was included in imported ore in previous years.

## Magnesium

Magnesium is produced from dolomite by the Dominion Magnesium Limited, Haley, Ontario. This firm uses the Pidgeon process. At Arvida, Quebec, the Aluminum Company of Canada Limited treats

brucite, brought from Wakefield, Quebec, by converting it to magnesium chloride and thence to magnesium metal.

TABLE 27. Production of Primary Magnesium Metal, 1941-1951

Year	Quebec		Ontario		British Columbia		Canada	
	Pounds	\$	Pounds	\$	Pounds	\$	Pounds	\$
1941 .....	—	—	—	—	10,905 <sup>1</sup>	2,944	10,905	2,944
1942 .....	141,081	62,076	473,910	208,520	193,727	85,240	808,718	355,836
1943 .....	—	—	7,153,974	2,074,652	—	—	7,153,974	2,074,652
1944 .....	—	—	10,579,778	2,575,695	—	—	10,579,778	2,575,695
1945 .....	—	—	7,358,545	1,607,264	—	—	7,358,545	1,607,264
1946 .....	—	—	320,677	75,538	—	—	320,677	75,538
1947-1951 .....	Not available for publication							

1. Magnesium powder.

TABLE 28. Consumption of Magnesium Metal, 1948-1951

—	1948	1949	1950	1951
	Pounds			
In non-ferrous smelters .....	425,088	334,542	—	—
In white metal alloy foundries .....	382,684	192,535	706,118	1,884,331
In brass and bronze foundries .....	31,782	105,651	69,543	270,325
In aluminum products .....	58,947	42,331	298,544	508,350
<b>Total accounted for .....</b>	<b>898,501</b>	<b>975,059</b>	<b>1,074,205</b>	<b>2,663,306</b>

TABLE 29. World Production of Magnesium Metal, by Countries, 1947-1950

(Taken from the "Minerals Yearbook" published by the United States Bureau of Mines.)

Country <sup>1</sup>	1947	1948	1949	1950
	Metric tons			
Australia .....	—	—	—	—
Canada .....	133	2	2	1,303
China: Formosa .....	—	—	2	2
Manchuria .....	—	—	2	2
France .....	1,043	1,507	700 <sup>3</sup>	300
Germany: Federal Republic .....	—	17 <sup>4</sup>	—	2
Soviet zone .....	2	2	2	2
Norway .....	—	—	—	2
Switzerland .....	500	—	—	—
United Kingdom .....	2,500 <sup>5</sup>	3,500 <sup>5</sup>	5,100 <sup>5</sup>	4,900 <sup>5</sup>
United States .....	11,198	9,075	10,521	14,233
<b>Total (estimate) .....</b>	<b>32,000</b>	<b>32,000</b>	<b>35,000</b>	<b>40,000</b>

1. Magnesium is also produced in U.S.S.R., but production data are not available; estimate included in total.

2. Data not available; estimate included in total.

3. Estimated figure.

4. British and American zones only.

5. Includes secondary metal.



## Manganese

Production of manganese ore in Canada has been spasmodic due to the limited number of known deposits. No production was recorded for 1951.

Most of the imported ore is used in making addition agents for steel manufacturing. High grade

manganese dioxide is used in making dry cell batteries. Manganese compounds are used in the glass, enamel, paint and rubber industries. Price quotations of manganese ore, basis 48% Mn, were 85 to 95 cents per long ton unit, C.I.F. U.S. ports.

TABLE 30. Production of Manganese Ore, 1942-1951

Year	Tons	Value	Year	Tons	Value
		\$			\$
1942 .....	435	8,932	1947 .....	225	7,875
1943 .....	48	985	1948 .....	3	88
1944 .....	—	—	1949 .....	—	—
1945 .....	—	—	1950 .....	—	—
1946 .....	—	—	1951 .....	—	—

TABLE 31. Imports of Manganese Ore, 1942-1951

Year	Tons	\$	Year	Tons	\$
1942 .....	57,389	860,248	1947 .....	223,503	6,145,568
1943 .....	51,234	1,445,252	1948 .....	230,298	6,449,819
1944 .....	85,795	2,370,109	1949 .....	137,854	4,475,522
1945 .....	198,277	4,571,592	1950 .....	135,697	4,993,912
1946 .....	144,023	2,484,797	1951 .....	222,082	9,078,011

TABLE 32. Imports of Manganese Ore, by Principal Countries of Supply, 1948-1951

—	1948	1949	1950	1951
	Tons			
From:				
Gold Coast .....	60,516	27,904	87,328	88,687
India .....	—	15,453	25,879	17,467
Chile .....	—	890	701	—
United States .....	169,746	93,571	21,718	95,386
United Kingdom .....	36	33	71	105
Brazil .....	—	—	—	8,238
French Oceania .....	—	—	—	7,744
Turkey .....	—	—	—	4,704
<b>Total imports .....</b>	<b>230,298</b>	<b>137,854</b>	<b>135,697</b>	<b>222,082</b>



TABLE 33. World Production of Manganese Ore, by Countries, 1947-1950

(Taken from the "Minerals Yearbook" of the United States Bureau of Mines.)

Country	1947	1948	1949	1950
	Metric tons			
North America:				
Canada (shipments) .....	204	3	—	—
Cuba .....	50,397	29,073	62,503	78,903
Mexico .....	31,400	53,800	53,900	32,400
United States (shipments) .....	119,409	118,931	114,427	121,974
South America:				
Argentina .....	—	—	—	—
Brazil (exports) .....	142,092	141,253	149,896	162,600
Chile .....	19,352	22,119	27,756	24,523
Europe:				
Greece .....	—	—	1,150	—
Hungary .....	33,470	40,000	—	—
Italy .....	26,547	24,689	24,219	16,208
Portugal .....	2,444	280	508	798
Romania .....	—	47,000	65,000	—
Spain .....	22,428	18,525	18,651	17,000
Sweden .....	10,697	8,417	10,850	—
U.S.S.R. (estimate) .....	1,800,000	1,800,000	1,500,000	2,000,000
Yugoslavia (estimate) .....	11,700	12,000	14,000	—
Asia:				
Burma (estimate) .....	—	—	—	—
China .....	20,000	22,000	—	—
India .....	458,274	534,316	656,190	679,163
Japan .....	34,473	55,000	100,000	134,066
Philippines .....	3,375	25,565	26,288	29,867
Portuguese India .....	100	6,503	11,197	20,144
Turkey .....	5,833	8,327	25,002	20,000
Africa:				
Angola .....	700	400	18,600	9,308
Belgian Congo .....	17,646	12,765	12,247	16,900
Egypt .....	29	59,919	138,568	152,169
French Morocco .....	114,290	214,412	233,830	287,265
Gold Coast (exports) .....	598,655	640,088	752,963	711,416
Southern Rhodesia .....	—	10	166	—
Spanish Morocco .....	—	13	653	750
Tunisia .....	25	—	—	—
Union of South Africa .....	288,213	276,393	655,175	790,937

## Mercury

There has been no production of mercury in Canada since September, 1944, and all shipments since then have been from producers' stocks. All of the Canadian production in the past came from the Pinchi mine of The Consolidated Mining and Smelting Company of Canada, Limited, and from the Takla

mine of Bralorne Mines Limited, both mines being in the Omineca Mining Division, British Columbia.

During 1951 the price of mercury fluctuated from \$195 to \$216 per 76 pound flask. The higher price was quoted at the close of the year.

TABLE 34. Production of Mercury, 1940-1951

Year	Pounds	\$	Year	Pounds	\$
1940 .....	153,830	369,317	1943 .....	1,690,240	4,559,200
1941 .....	536,304	1,335,697	1944 .....	735,908	1,210,375
1942 .....	1,035,914	2,943,807	1945-1951 .....	Nil	—

TABLE 35. Production of Mercury, Consumption, Imports and Exports, 1942-1951

Year	Production	Consumption	Imports	Exports
	Pounds			
1942 .....	1,035,196	185,118	1,971	692,753
1943 .....	1,690,240	201,982	2,047	1,304,692
1944 .....	735,908	130,515	35,428	362,670
1945 .....	—	100,700	27,101	261,720
1946 .....	—	102,320	152,719	57,005
1947 .....	—	344,516	412,649	17,084
1948 .....	—	552,216	803,878	175
1949 .....	—	460,577	278,069	8
1950 .....	—	166,716	614,005	8,100
1951 .....	—	171,886	308,172	58,235

TABLE 36. Consumption of Mercury by Principal Uses, 1947-1951

Industry	1947	1948	1949	1950	1951
	Pounds				
Pharmaceuticals and fine chemicals .....	60,578	41,565	62,309	56,088	32,041
Heavy chemicals .....	260,000	479,000	373,131	88,094	104,483
Electrical apparatus .....	5,438	13,151	9,137	6,534	19,362
Gold mines <sup>1</sup> .....	6,000	6,000	6,000	6,000	6,000
Miscellaneous <sup>1</sup> .....	12,500	12,500	10,000	10,000	10,000
<b>Total</b> .....	<b>344,516</b>	<b>552,216</b>	<b>460,577</b>	<b>166,716</b>	<b>171,886</b>

1. Estimated.

**TABLE 37. World Production of Mercury, by Countries, 1947-1950**  
(Taken from the "Minerals Yearbook" of the United States Bureau of Mines)

Country <sup>1</sup>	1947	1948	1949	1950
Flasks of 34.5 kilograms or 76 pounds				
Algeria .....	345	381	102	2
Austria .....	2	2	5	2
Chile .....	445	467	754	2
China .....	290	290	2	2
Czechoslovakia .....	768 <sup>3</sup>	800	2	2
Germany .....	2	2	2	2
Italy .....	53,984	38,233	44,527	53,346
Japan .....	1,622	1,689	2,461	1,312
Mexico .....	9,700	4,786	5,250	3,713
New Zealand .....	—	—	—	2
Peru .....	—	—	—	2
Romania .....	2	2	2	2
Spain .....	55,608	22,684	32,289	50,000 <sup>4</sup>
Turkey .....	98	27	—	2
United States .....	23,244	14,388	9,930	4,535
<b>Total<sup>4</sup> .....</b>	<b>164,000</b>	<b>104,000</b>	<b>115,000</b>	<b>136,000</b>

1. Mercury is also produced in Korea, Yugoslavia and U.S.S.R., but production data are not available; estimates included in total.

2. Data not yet available; estimates included in totals.

3. By-product of pyrites production in Slovakia only.

4. Estimate.

### Molybdenum

Operations at the La Corne mine were resumed in June 1951 by the Molybia Corporation Limited. The milled products were molybdenite concentrates and bismuth oxychloride. Most of the concentrates were shipped to European markets.

Molybdenum has a widening range of uses, but by far the greater part of the output is used in steel to intensify the effect 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. For high-speed tool-steels as much as 9 per cent is added.

Molybdenum alloys are used widely for the hardwearing and other important parts of airplanes. They are used in the automobile industry; in high-grade structural die and stainless steels; in heat and corrosion resistant alloys; and to some extent in high-speed tool steels. Molybdenum is used in cast iron and in permanent magnets. Much molybdenum wire and sheet is used in the incandescent lamp and in the radio industries, in new alloys suitable for electrical resistance and contacts, and for heating elements containing molybdenum. An appreciable amount of molybdenum is used in the glass industry in which heavy sheets of the metal act as electrodes to conduct the current through the molten glass in the electric furnaces.

**TABLE 38. Production of Molybdenite, 1942-1951**

Year	Ores milled	Ores and concentrates shipped or used		Total MoS <sub>2</sub> content of shipments
	Tons	Tons	\$	Pounds
1942 .....	39,708	113.7	134,963	158,780
1943 .....	120,576	392.4	549,515	653,200
1944 .....	187,130	1064.0	1,079,698	1,870,132
1945 .....	80,575	489.1	411,663	839,419
1946 .....	84,280	368.2	295,640	676,844
1947 .....	83,665	396.0	309,048	759,795
1948 .....	—	173.5	137,143	304,762
1949 .....	—	—	—	—
1950 .....	—	108.9 <sup>1</sup>	60,059	103,550
1951 .....	40,139	241	228,958	381,596

1. Shipped from stock pile.



TABLE 39. World Production of Molybdenum in Ores and Concentrates, by Countries, 1947-1950  
(Taken from the "Minerals Yearbook" of the United States Bureau of Mines)

Country <sup>1</sup>	1947	1948	1949	1950
	Metric tons			
Australia .....	2	2	4	3
Austria .....	1	2	9	2
Canada .....	207	83	—	28
Chile .....	402	532	558	800 <sup>3</sup>
China: Manchuria .....	2	2	2	2
Other provinces .....	2	2	2	2
Finland .....	70	—	—	—
France .....	—	—	2	2
Indochina .....	—	—	—	2
Italy .....	—	—	—	2
Japan .....	18	1	—	2
Korea, South .....	5	2	11	—
Mexico .....	136	—	—	—
Morocco .....	32	—	—	—
Norway .....	98	79	71	62
Peru .....	3	2	2	2
Sweden .....	—	2	9	2
United States .....	12,268	12,114	10,219	12,918
Total (estimate) .....	14,000	13,600	11,500	14,400

1. Molybdenum is also produced in Greece, Romania, Spain, Turkey, U.S.S.R. and Yugoslavia, but production data are not available. Estimates are included in the total.

2. Data not yet available; estimate included in total.

3. Estimated exports.

### Pitchblende

Pitchblende, the ore of radium and uranium, is mined in Canada only in the Great Bear district of the Northwest Territories. Prospecting reports indicate that radioactive minerals have been found at Contact Lake, Northwest Territories; Lake

Athabaska, Saskatchewan; and Theano Point, Ontario.

Statistics on pitchblende ores and products have not been available since 1940.

TABLE 40. Canadian Refinery Production of Pitchblende Products, 1933-1951

Year	\$	Year	\$
1933 <sup>1</sup> .....	247,900	1938 .....	1,045,458
1934 .....	159,400	1939 .....	1,121,553
1935 .....	413,700	1940 .....	410,176
1936 .....	605,500	1941-1951 .....	2
1937 .....	876,540		

1. First production.

2. Not available for publication.



## Selenium

The occurrence of selenium is fairly widespread throughout the world, but it is of commercial importance only in its association with copper sulphide ores from which it is recovered as a by-product in the refining of copper. A variety of uses have been developed for the metal, but relatively small quantities are involved. In Canada refined selenium and certain selenium salts are produced and most of the output is exported.

Canadian production of selenium is obtained from the refineries of The International Nickel Company of Canada, Ltd., at Copper Cliff, Ontario, and Canadian Copper Refineries, Ltd., at Montreal East, Quebec. At Copper Cliff, the metal is derived from International Nickel's copper-nickel ores. The plant has a demonstrated capacity of 270,000 pounds of selenium a year and is probably capable of a larger production. At Montreal East, selenium is recovered from the treatment of copper anodes made from the copper-gold ores of Noranda, Quebec, and from blister copper from the copper-zinc ores of Hudson Bay Mining and Smelting Co. Ltd., on the Manitoba-Saskatchewan boundary. The Montreal East plant has an annual rated capacity of 450,000 pounds of selenium, which is larger than any other selenium plant in the world. This plant also produces selenium dioxide, sodium selenate and sodium selenite.

Selenium is generally marketed as amorphous powder, but cakes and sticks are also obtainable. Other selenium products marketed are ferro-selenium, sodium selenate, sodium selenite, selenious acid and selenium dioxide. No figures are available to show the relative consumption of selenium by uses. The most important uses are in the glass, rubber, and paint industries, but many new uses have been developed as a result of research during the war. Among the more interesting of the latter is the use of selenium in electrical dry plate rectifiers for radar equipment and aircraft generators. Its use in rectifiers for numerous electronic devices, battery charging, electroplating, and welding has been increasing.

In the manufacture of glass, selenium is used to neutralize the green colour caused by iron impurities. When sufficient selenium is added the glass turns a ruby colour highly suitable for signal lenses. In the manufacture of rubber the addition of selenium, in concentrations of from 0.1 to 2.0 per cent, promotes resistance to heat, oxidation, and abrasion. It is also used as an accelerator in the vulcanization of synthetic rubber.

The New York price for selenium ranged from \$3.00 to \$3.50 per pound during 1951.

TABLE 41. Production of Selenium, 1942-1951

Year	Pounds	\$	Year	Pounds	\$
1942 .....	495,369	951,108	1947 .....	501,090	937,038
1943 .....	374,013	654,523	1948 .....	390,894	781,788
1944 .....	298,592	537,466	1949 .....	318,225	652,361
1945 .....	379,187	728,039	1950 .....	261,973	633,975
1946 .....	521,867	949,798	1951 .....	382,603	1,239,633

## Tantalum-Columbium

Canada produces no tantalite or columbite and the known 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  $(\text{Fe,Mn})(\text{Ta,Cb})_2\text{O}_6$ . They grade one into the other according as whether tantalum or columbium predominates. The occurrence of all tantalum-columbium 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.

Experimental tests on the milling of tantalum-columbite ore from the Peg Tantalum mine, Ross Lake, Northwest Territories, were made by Tantalum Refining and Mining Corporation, during 1947.

United States quotations for tantalum ore, December, 1951 were, per pound  $\text{Ta}_2\text{O}_5$ , \$2 to \$2.50 for 60 per cent concentrate, the price depending on the source. Columbium metal, per kilo, base prices: rod \$280; sheet \$250. Tantalum metal, per kilo, base prices, \$160.60 for C.P. rod; sheet \$143; discounts on volume business.

## Tellurium

Tellurium, like its associated element selenium, is commonly found in small amounts in copper-sulphide and gold ores. The potential production as a by-product in the refining of copper is great but its recovery is restricted to meet the relatively minor quantities required by industry.

Tellurium is recovered commercially in Canada at the Copper Cliff, Ontario, plant of The International Nickel Company of Canada, Limited, and at the Montreal East Refinery of Canadian Copper Refiners, Limited. At Copper Cliff it is recovered from

the slimes formed in the process of refining copper produced from the Sudbury nickel-copper ores. At Montreal East it is obtained from the refining of copper anodes made from copper ores at Noranda, Quebec, and from blister copper originating from the copper-zinc ores of Hudson Bay Mining and Smelting Co., Limited, at Flin Flon, on the Manitoba-Saskatchewan boundary.

The price of tellurium was quoted at \$1.75 a pound in New York throughout 1951.

TABLE 42. Production of Tellurium, 1942-1951

Year	Pounds	\$	Year	Pounds	\$
1942 .....	11,084	17,735	1947 .....	9,194	16,090
1943 .....	8,600	15,050	1948 .....	11,425	19,994
1944 .....	10,661	18,657	1949 .....	11,692	21,046
1945 .....	484	929	1950 .....	10,075	19,143
1946 .....	15,848	24,405	1951 .....	8,913	16,400

TABLE 43. Consumption of Tellurium Metal in Steel and White Metal Foundries, 1942-1951

Year	Steel foundries	White metal foundries	Year	Steel foundries	White metal foundries
	Pounds			Pounds	
1942 .....	50	612	1947 .....	—	974
1943 .....	135	453	1948 .....	—	947
1944 .....	398	531	1949 .....	—	310
1945 .....	—	308	1950 .....	—	962
1946 .....	—	1,372	1951 .....	—	672

## Thallium

There has been no production of thallium in Canada since 1944. The first commercial production of this element in this country was in 1944 when 128 pounds valued at \$1,690 were contained in residues produced by Hudson Bay Mining and Smelting Com-

pany, Limited, at the Flin Flon smelter, Manitoba. These residues were exported for treatment in foreign plants. Thallium metal was quoted in the United States at \$12.50 per pound nominal, December, 1951.



## Tin

No economic deposits of tin have been found in Canada up to the present. Minor occurrences, principally of cassiterite ( $\text{SnO}_2$ ) the most important tin mineral, are found in the New Ross area, Lunenburg county, Nova Scotia; in the Sudbury mining division of Ontario; in the Lac du Bonnet district of south-eastern Manitoba; in southern British Columbia; in the Mayo district, Yukon, and in the Yellowknife area, Northwest Territories. Those in Nova Scotia, Ontario, Manitoba, and the Northwest Territories are found largely in pegmatite dykes. In Yukon, crystalline cassiterite is found in placer gravels along numerous creeks and in one small lode deposit. In British Columbia, tin is found associated with base metal sulphide ores. The last mentioned type of

occurrence is the only one that has been exploited, and is the source of the small Canadian production. The lead-zinc-silver orebody of the Sullivan mine, Kimberley, British Columbia, contains a very small percentage of tin. Since 1941, The Consolidated Mining and Smelting Company of Canada, Limited, has been recovering a portion of this tin as a by-product from the concentration of its lead-zinc ore.

In 1951 the average price of tin quoted in New York was \$1.27 per pound. The quotation at the year-end was \$1.03 per pound. The Canadian price at Montreal was \$1.75 per pound in January and \$1.18 in December.

TABLE 44. Production of New Tin, Domestic Consumption, Imports and Exports, 1942-1951

Year	Production	Domestic consumption	Exports	Imports	Stocks at end of period
Tons of 2,000 pounds					
1942 .....	619	3,571	—	3,601	5,120
1943 .....	390	2,865	—	1,311	3,920
1944 .....	258	3,383	—	1,341	2,622
1945 .....	425	4,108	—	3,597	2,565
1946 .....	437	4,152	—	3,514	2,430
1947 .....	357	4,063	—	2,601	3,152
1948 .....	346	4,531	—	4,029	2,944
1949 .....	310	4,835	—	4,117	739
1950 .....	398	5,069	—	5,395	1
1951 .....	173	5,299	—	6,872	1

1. Not available.

TABLE 45. Production of New Tin, 1942-1951

Year	Pounds	\$	Year	Pounds	\$
1942 .....	1,237,863	643,689	1947 .....	714,198	517,794
1943 .....	776,937	450,623	1948 .....	691,332	688,567
1944 .....	516,626	299,643	1949 .....	619,117	633,047
1945 .....	849,983	492,990	1950 .....	796,403	828,259
1946 .....	874,186	507,028	1951 .....	346,718	494,073

1. First commercial production.

TABLE 46. Consumption of Tin (Ingots or Bars), by Principal Industries, 1947-1951

	1947	1948	1949	1950	1951
Tons of 2,000 pounds					
In white metal foundries (solder, babbitt, etc).....	1,300	1,636	1,358	1,953	1,819
In steel plants (chiefly for tinplate) .....	2,347	2,443	2,853	2,439	3,000
In brass and bronze foundries .....	307	315	219	178	347
In other industries .....	109	137	405	499	133
<b>Total accounted for .....</b>	<b>4,063</b>	<b>4,531</b>	<b>4,835</b>	<b>5,069</b>	<b>5,299</b>



## Titanium

At Lac Tio, Quebec, the Quebec Iron and Titanium Corporation mined ilmenite and shipped the ore by rail to Havre St. Pierre on the St. Lawrence and and thence by boat to the smelter at Sorel, Quebec. Of the 372,112 tons of ore received at the smelter about 46,000 tons were treated to yield about 15,500 tons of iron (remelt) and steel ingots and over 19,600 tons of slag. The slag, having a titanium dioxide content of about 71 per cent, was exported for further treatment. General statistics on the mining of ilmenite are included in the Miscellaneous Metals Industry but the statistics on smelting are included in The Non-ferrous Smelting and Refining Industry.

For several years titanium-bearing ores have been shipped from the Bale St. Paul area in Quebec for treatment in the United States.

Some metallic titanium was produced from imported raw material by the Dominion Magnesium Limited, Haley, Ontario.

The paint industry uses, in addition to titanium white, a considerably larger amount of mixed pigments containing titanium, also imported from the United States. Titanium white has many other uses, such as: to make paper opaque, to make rubber white, in ceramic glazes, for printing inks, in linoleum, in cosmetics, and to de-lustre artificial silk.

Titanium is used in many other forms. Ferro-titanium and ferrocenon-titanium are used under special circumstances to purify steel. It is all imported from the United States.

Prices (nominal) f.o.b. Atlantic ports at the end of 1951 were: Ilmenite, 56 to 60%  $\text{TiO}_2$ , \$16 to \$18 per gross ton; rutile, 94%  $\text{TiO}_2$ ,  $5\frac{1}{4}$  to  $6\frac{1}{4}$  cents per pound. The nominal quotation for titanium metal, 96-98 per cent, was \$5 per pound.

TABLE 47. Producers' Shipments of Titanium Ore <sup>1</sup> to Foreign Smelters 1942-1951

Year	Short tons	\$	Year	Short tons	\$
1942 .....	10,031	50,906	1947 .....	7,104	36,036
1943 .....	69,437	308,290	1948 .....	4,441	21,091
1944 .....	33,973	165,195	1949 .....	540	2,892
1945 .....	14,147	67,575	1950 .....	1,253	7,706
1946 .....	1,406	7,735	1951 .....	1,674	9,790

1. All from Quebec.

TABLE 48. Imports of "Antimony Oxide, Titanium Oxide and White Pigments Containing Not Less Than 14 Per Cent by Weight of Titanium", 1942-1951

Year	From the United Kingdom		From the United States		Total imports	
	Pounds	\$	Pounds	\$	Pounds	\$
1942 .....	115,360	27,697	14,527,348	1,395,345	14,642,708	1,423,042
1943 .....	33,700	8,094	16,855,800	1,525,368	16,889,500	1,533,462
1944 .....	—	—	20,174,795	1,871,434	20,174,795	1,871,434
1945 .....	79,440	16,752	21,279,636	2,029,137	21,359,076	2,045,889
1946 .....	76,800	11,678	23,854,188	2,182,007	23,930,988	2,193,685
1947 .....	17,920	4,862	27,294,577	2,960,964	27,312,497	2,965,826
1948 .....	121,968	25,057	39,119,325	4,572,006	39,292,704	4,610,340
1949 .....	1,436,162	254,809	40,150,356	4,902,730	41,586,518	5,157,539
1950 .....	6,275,776	935,706	47,974,645	6,117,925	54,250,421	7,053,631
1951 .....	7,192,312	1,623,779	52,103,681	6,838,500	59,295,993	8,462,279

TABLE 49. Consumption of Titanium Oxide, by Industries, 1950 and 1951

Industry	1950		1951	
	Pounds	Cost at works	Pounds	Cost at works
		\$		\$
Paints:				
Extended titanium dioxide pigments .....	27,591,145	2,656,013	25,504,331	2,483,473
Titanium dioxide .....	15,892,741	3,723,784	16,666,584	4,030,835
Polishes and dressings .....	254,142	52,994	242,959	53,121
Pulp and paper .....	1,614,000	380,070	1,006,000	273,765
Linoleum and oilcloth .....	2,656,307	369,648	2,859,173	399,162
Rubber goods .....	1,080,072	240,637	1,116,101	295,149
Miscellaneous non-metallic minerals .....	417,412	28,671	403,806	121,192
<b>Total accounted for .....</b>	<b>49,505,819</b>	<b>7,451,817</b>	<b>47,797,954</b>	<b>7,656,697</b>

TABLE 50. World Production of Titanium Concentrates (Ilmenite and Rutile), by Countries, 1947-1950  
(Taken from the "Minerals Yearbook" published by the United States Bureau of Mines)

Country	1947	1948	1949	1950
	Metric tons			
<b>Ilmenite</b>				
Australia: New South Wales .....	3,551	7,489	5,958	7,000
Queensland .....	2,934	4,318	4,063	4,800
Tasmania .....	844	—	—	—
Western Australia .....	—	—	73	85
Brazil .....	—	7,900	650	—
Canada .....	6,445	4,029	490	91,172
Egypt .....	—	1,601	635	260
India .....	265,143	233,098	226,816	216,076
Malaya .....	13,291	12,909	20,034	25,315
Norway .....	69,711	90,017	99,013	105,000
Portugal .....	243	155	680	47
Senegal .....	11,282	3,690	8,338	788
Spain .....	150	181	376	637
United States .....	305,296	348,126	364,989	424,851
<b>Total ilmenite .....</b>	<b>678,890</b>	<b>713,513</b>	<b>732,115</b>	<b>877,000</b>
<b>Rutile</b>				
Australia: New South Wales .....	9,068	7,110	7,466	10,753
Queensland .....	4,338	6,411	5,149	7,853
Brazil .....	5	—	—	—
French Cameroon .....	755	576	403	25
French Equatorial Africa .....	—	—	—	6
India .....	160	129	—	—
Norway .....	51	—	16	—
United States .....	7,767	6,095	10,875	—
<b>Total rutile .....</b>	<b>22,144</b>	<b>20,921</b>	<b>23,909</b>	<b>25,600</b>

TABLE 51. Consumption of Ferrotitanium in Manufacture of Steel, 1942-1951

Year	Tons	\$	Year	Tons	\$
1942 .....	439	66,555	1947 .....	500	86,228
1943 .....	614	118,416	1948 .....	442	31,129
1944 .....	786	149,527	1949 .....	142	29,067
1945 .....	656	123,975	1950 .....	143	30,664
1946 .....	416	73,435	1951 .....	164	50,641



## Tungsten

The increase in price of tungsten ore renewed mining activity on deposits bearing scheelite and wolframite. A few mines produced tungsten concentrates but shipments were made from the Yukon territory only.

As an alloying metal in steel, tungsten (usually as ferrotungsten, but sometimes as calciumtungstate or scheelite concentrate) is used essentially to impart hardness and toughness, which are maintained even when the steel is heated to a high temperature. Almost 80 per cent of the consumption of tungsten in the United States is used for the production of high-speed steels for cutting tools, in which the tungsten

content is 15 to 20 per cent. Minor amounts of tungsten are used in steels for dies, valves, and valve seats for internal combustion engines, and for permanent magnets. Stellite, the best known non-ferrous alloy, contains 10 to 15 per cent tungsten with higher percentages of chromium and cobalt. Tungsten carbide is widely used as an extra hard cutting tool and is now being used as inserts into detachable bits for rock drilling. Pure tungsten is used in lamp filaments, in radio tubes, contact points, etc.

In United States a ceiling price was established at \$65 per short ton unit of  $WO_3$ .

TABLE 52. Production (Commercial Shipments) of Crude Tungsten Concentrates, 1942-1951

Year	Crude Pounds	$WO_3$ content Pounds	Value \$
1942 .....	520,981	321,847	406,275
1943 .....	1,508,621	817,763	1,083,538
1944 .....	886,745	283,253	245,780
1945 .....	1,153	792	1,045
1946 .....	—	—	—
1947 .....	668,000	496,023	680,792
1948 .....	1,409,297	1,046,160	1,046,160
1949 .....	334,000	252,380	252,380
1950 .....	1,836,000	284,078	160,343
1951 .....	4,145	2,833	7,093

1. Includes export of considerable low-grade material to United States.

TABLE 53. Consumption of Ferrotungsten in Steel Furnaces, 1943-1951

Year	Short tons	Cost at works \$	Year	Short tons	Cost at works \$
1943 .....	550	1,721,967	1948 .....	187	590,584
1944 .....	86	287,116	1949 .....	190	428,535
1945 .....	138	455,317	1950 .....	117	302,872
1946 .....	260	402,174	1951 .....	364	2,726,887
1947 .....	366	838,904			

## 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 world 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 colour 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.

Vanadium ore was quoted December, 1951, at 31 cents per pound contained  $V_2O_5$ , f.o.b. shipping point, by "E & M.J. Metal and Mineral Markets", New York.



## Zirconium

Zirconium ores are not mined in Canada. The Dominion Magnesium Limited, Haley, Ontario, produced zirconium from imported raw materials.

Zirconium is important in certain steel making, ordinarily being added in the form of zirconium-ferrosilicon alloy; its function is that of a powerful deoxidizer, degasifier, and grain refiner, zirconium-

treated steels being particularly suitable for tools subject to violent stresses, such as stock drills.

Prices quoted in December, 1951, were: zircon ore, 65 per cent  $ZrO_2$ , \$47 to \$50 per ton at Atlantic seaboard; zirconium powder, \$7. to \$8. per pound, according to quantity.

## Directory of Firms in the Miscellaneous Metal Mining Industry, 1951

Name of firm and product	Head office address	Location of mine or plant
<b>Aluminum:</b>		
Aluminum Company of Canada Limited .....	1700 Sun Life Building, Montreal, Quebec.	Arvida, Quebec; Shawinigan Falls, Quebec; La Tuque, Quebec; Île Maligne, Quebec, Beauharnois, Quebec.
B.C. Aluminum Co. Ltd. ....	1840 West First St., Vancouver, B.C.	New Westminster.
<b>Antimony:</b>		
Consolidated Mining & Smelting Company of Canada Ltd. ....	215 St. James St., Montreal, Quebec .....	Trail, British Columbia.
Antimony Gold Mining & Smelting Co. Ltd. ....	67 Yonge St., Toronto, Ontario. ....	West Gore, N.S.
Gray Rock Mining Co. Ltd. ....	207 W. Hastings St., Vancouver, B.C. ....	Gold Bridge, B.C.
<b>Barium:</b>		
Deer Lake Magnesium Ltd. ....	Haley, Ontario .....	Haley, Ontario.
<b>Beryll:</b>		
Canadian Beryllium Mines & Alloys Ltd. <sup>1</sup> .....	100 Adelaide St. W., Toronto, Ontario .....	Renfrew County, Ontario.
<b>Bismuth:</b>		
Deloro Smelting & Refining Co. Ltd. ....	900 Victoria Building, Ottawa, Ontario .....	Deloro, Ontario.
Consolidated Mining & Smelting Company of Canada Ltd. ....	215 St. James St., Montreal, Quebec .....	Trail, British Columbia.
Molybdenite Corp. of Canada Ltd. <sup>1</sup> .....	59 St. James St. W., Montreal, Quebec .....	La Corne Tp., Quebec.
<b>Cadmium:</b>		
Consolidated Mining & Smelting Company of Canada Ltd. ....	215 St. James St., Montreal, Quebec .....	Trail, British Columbia.
Hudson Bay Mining & Smelting Co. Ltd. ....	500 Royal Bank Building, Winnipeg, Man....	Flin Flon, Manitoba.
Ainsmore Consolidated Mines Ltd. ....	London, Ontario .....	Ainsworth, B.C.
Base Metals Mining Corp. Ltd. ....	850 West Hastings St., Vancouver, B.C. ....	Kaslo, B.C.
Britannia Mining & Smelting Co. Ltd. ....	Britannia Beach, B.C. ....	Britannia Beach, B.C.
Canadian Exploration Ltd. ....	Royal Bank Bldg., Vancouver, B.C. ....	Salmo, B.C.
Highland-Bell Ltd. ....	844 W. Hastings St., Vancouver, B.C. ....	Beaverdell, B.C.
Reeves MacDonald Mines Ltd. ....	413 Granville St., Vancouver, B.C. ....	Remac, B.C.
Selkirk Mining Co. Ltd. ....	637 W. Hastings St., Vancouver, B.C. ....	Kaslo, B.C.
Sheep Creek Gold Mines Ltd. ....	413 Granville St., Vancouver, B.C. ....	Zincton, B.C.
Silver Standard Mines Ltd. ....	602 W. Hastings St., Vancouver, B.C. ....	Hazelton, B.C.
Silbak Premier Mines Ltd. ....	Premier, B.C. ....	Premier, B.C.
Tulsequah Mines Ltd. ....	Trail, B.C. ....	Tulsequah, B.C.
Van Rai Consolidated Mines Ltd. ....	525 Seymour St., Vancouver, B.C. ....	Silverton, B.C.
Vancouver Island Base Metals Ltd. ....	850 W. Hastings St., Vancouver, B.C. ....	Duncan, B.C.
Violamaac Mines (B.C.) Ltd. ....	New Denver, B.C. ....	New Denver, B.C.
Western Exploration Co. Ltd. ....	Silverton, B.C. ....	Silverton, B.C.
Western Mines Ltd. ....	1768 East Hastings St., Vancouver, B.C. ....	Ainsworth, B.C.
United Keno Hill Mines Ltd. ....	85 Richmond St. W., Toronto, Ont. ....	Elsa, Yukon.
<b>Chromium:</b>		
Colonial Chrome Co. Ltd. <sup>1</sup> .....	420 Lexington Ave., New York, N.Y., U.S.A.	Black Lake, Quebec.
Chromite Ltd. <sup>1</sup> .....	404 Notre Dame St. W., Montreal, Quebec ....	Cleveland Tp., Quebec.

## Directory of Firms in the Miscellaneous Metal Mining Industry, 1951 — Concluded

Name of firm and product	Head office address	Location of mine or plant
<b>Iron Ore:</b>		
Dominion Wabana Ore Ltd. ....	Sydney, Nova Scotia .....	Bell Island, Newfoundland
Peninsular Iron Mines Ltd. <sup>1</sup> .....	123 St. James St. W., Montreal, Quebec .....	New Quebec
Hollinger North Shore Exploration Co. Ltd. <sup>1</sup> .....	721 Royal Bank Building, Montreal, Que. ....	New Quebec
Iron Ore Company of Canada <sup>1</sup> .....	810 Cote de Liesse Road, Montreal, Quebec .....	New Quebec, Labrador
Noranda Exploration (Quebec) Ltd. <sup>1</sup> .....	Noranda, Quebec .....	Ungava district, Quebec
Quebec Labrador Development Co. Ltd. <sup>1</sup> .....	100 Adelaide St. W., Toronto, Ontario .....	New Quebec
Minnesota-Huron Iron Co. Ltd. <sup>1</sup> .....	248 Albert St., Ottawa, Ontario .....	Bristol Tp., Quebec
Pershing Amalgamated Mines Ltd. <sup>1</sup> .....	1410 Stanley St., Montreal, Que. ....	Beresford Twp., Quebec
Algoma Ore Properties Ltd. ....	Cornwall Building, Sault Ste. Marie, Ont. ....	Algoma district, Ontario
Bethlehem Mines Corporation <sup>1</sup> .....	701 East Third St., Bethlehem, Pa., U.S.A. ....	Marmora, Ontario
Canand Ore Company <sup>1</sup> .....	38 S. Deaborn St., Chicago, U.S.A. ....	Rainy River, Ontario
Head of the Lakes Iron Ltd. <sup>1</sup> .....	85 Richmond St. W., Toronto, Ontario .....	Quetico Park, Ontario
Belore Mining Co. Ltd. <sup>1</sup> .....	68 Yonge St., Toronto, Ontario .....	Michipicoten, Ontario
Mag-Iron Mining & Milling Co. Ltd. ....	49 Wellington St. E., Toronto, Ontario .....	Hastings Co., Ontario
Nanook Mines Ltd. <sup>1</sup> .....	29 Colborne St., Toronto, Ontario .....	Halsey Twp., Ontario
Steep Rock Iron Mines Ltd. ....	25 King St. W., Toronto, Ontario .....	Rainy River District, Ontario
The Argonaut Co. Ltd. ....	Box 1000, Campbell River, B.C. ....	Comox, B.C.
Quatsino Copper-Gold Mines Ltd. <sup>1</sup> .....	572 Howe St., Vancouver, B.C. ....	Vancouver Island, B.C.
Texada Mines Ltd. <sup>1</sup> .....	Box 35, Vananda, B.C. ....	Texada Island, B.C.
<b>Indium:</b>		
Consolidated Mining & Smelting Company of Canada Ltd. <sup>1</sup> .....	215 St. James St., Montreal, Quebec .....	Trail, British Columbia
<b>Lithium:</b>		
Canadian Lithium Co. Ltd. <sup>1</sup> .....	57 Queen St., Toronto, Ontario .....	Abitibi Co., Quebec
La Corne Lithium Mines Ltd. <sup>1</sup> .....	320 Bay St., Toronto, Ontario .....	La Corne, Quebec
<b>Manganese:</b>		
Quebec Manganese Mines Ltd. <sup>1</sup> .....	231 St. James St. W., Montreal, Quebec .....	Magdalen Islands, Quebec
<b>Magnesium:</b>		
Dominion Magnesium Ltd. ....	67 Yonge St., Toronto, Ontario .....	Haley, Ontario
Aluminum Co. of Canada Ltd. ....	1700 Sun Life Building, Montreal, Que. ....	Arvida, Quebec
<b>Mercury:</b>		
Bralorne Mines Ltd. <sup>1</sup> .....	555 Burrard St., Vancouver, B.C. ....	Omineca district, British Columbia
Consolidated Mining & Smelting Company of Canada Ltd. <sup>1</sup> .....	215 St. James St., Montreal, Quebec .....	Pinchi Lake, British Columbia
<b>Molybdenite:</b>		
Molybdenite Corp. of Canada Ltd. ....	59 St. James St. W., Montreal, Quebec .....	La Corne, Quebec
Quyon Molybdenite Co. Ltd. <sup>1</sup> .....	Quyon, Quebec .....	Quyon, Quebec
<b>Selenium — Tellurium:</b>		
International Nickel Co. of Canada Ltd. ....	Copper Cliff, Ontario .....	Copper Cliff, Ontario
Canadian Copper Refiners Ltd. ....	1600 Royal Bank Building, Toronto, Ont. ....	Montreal East, Quebec
<b>Tantalum — Columbite:</b>		
Tantalum Refining & Mining Corporation of America <sup>1</sup> .....	11 King St. W., Toronto, Ontario .....	Ross Lake, Northwest Territories
<b>Thallium:</b>		
Hudson Bay Mining & Smelting Co. Ltd. <sup>1</sup> .....	500 Royal Bank Building, Winnipeg, Man. ....	Flin Flon, Manitoba
<b>Tin:</b>		
Consolidated Mining & Smelting Company of Canada Ltd. ....	215 St. James St., Montreal, Quebec .....	Trail, British Columbia
Mountain Crest Mines Ltd. <sup>1</sup> .....	1445 MacKay St., Montreal, Quebec .....	Charlevoix, Quebec
<b>Titanium Ore:</b>		
Bate St. Paul Titanic Iron Ore Co. ....	Bate St. Paul, Quebec .....	St. Urbain, Quebec
Kemco Explorations, Ltd. <sup>1</sup> .....	244 Bay St., Toronto, Ontario .....	Allard Lake, Quebec
Quebec Iron and Titanium Corp. ....	1522 Sherbrooke St. W., Montreal, Que. ....	Lac Tio, Quebec
St. Lawrence Iron & Titanium Mines Ltd. ....	1200 St. Alexander St., Montreal, Que. ....	St. Urbain, Quebec
Terrebonne Titanium Co. Ltd. ....	Ste. Marguerite, Lac Masson, Quebec .....	Terrebonne, Quebec
<b>Tungsten Concentrates:</b>		
Canadian Exploration Ltd. ....	Royal Bank Building, Vancouver, B.C. ....	Salmo, British Columbia
Dublin Placers .....	Mayo, Yukon .....	Dublin Creek, Yukon
<b>Zirconium:</b>		
Dominion Magnesium Ltd. ....	67 Yonge St., Toronto, Ontario .....	Haley, Ontario

1. Active but not producing.







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