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1963

Formerly The Miscellaneous Metal Mining Industry

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EXPLANATORY NOTES

Establishment

The reporting unit in the Census of Mines, Quarries and Oil Wells is the **establishment**. Beginning with the 1961 Census, the establishment is defined as follows:

The smallest unit which is a separate operating entity capable of reporting all the following:

Materials and supplies used,
Goods purchased for resale as such,
Fuel and power consumed,
Number of employees and their pay,
Inventories,
Shipments or sales.

The establishment is to be distinguished from smaller subdivisions or departments which do not have records which permit them to report all items required of an establishment. Prior to 1961, some establishments were required to submit two or more separate reports when they were engaged in operations which were classifiable to different industries. Beginning with 1961, separate reports for such operations will be required only in cases where accounting records can provide all the elements of principal statistics enumerated above. Special reporting arrangements were made with respondents when the acceptance of combined reports would have seriously affected the statistics for particular industries or areas. Where continuity of industry statistics was affected by this change in reporting procedures, adjustments to the data were made back to 1957 in order to maintain comparability of the series for recent years.

A mining establishment is typically a mine, mine/mill, quarry, pit or bog principally engaged in mining operations. Prior to 1961, the Census of Mines, Quarries and Oil Wells attempted to cover the mining activities of all establishments, whether or not they were principally engaged in mining operations. Beginning with the 1961 Census, establishments (accounting entities) which are not primarily engaged in mining are no longer included as mining establishments in the basic industry statistics. Again adjustments to the industry statistics were made to reflect the removal of such reporting units for the period 1957-1960. These reporting units are now listed as establishments in other Bureau industry surveys, such as Wholesale Trade, Construction, etc. In order, however, to maintain complete coverage of certain commodity items produced mainly in mining establishments, many non-mining establishments are now surveyed for commodity information only and the latter are included in the appropriate tables of industry reports.

SYMBOLS

The following standard symbols are used in Dominion Bureau of Statistics publications:

.. figures not available.

... figures not appropriate or not applicable.

— nil or zero.

-- amount too small to be expressed.

p preliminary figures.

r revised figures.

SUMMARY

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

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 of ores often fluctuates in an erratic manner according to demand and supply. Included in this report, with the statistics relating to the Canadian production of these ores or metals, are notes and statistical data pertaining to various rare or semi-rare metals of metalliferous ores produced in other countries. Metals and metal-bearing ores produced in Canada during 1963 and classified as miscellaneous, include antimony, bismuth, cadmium, calcium, columbium, indium, magnesium, molybdenum, selenium, tellurium, titanium ore, thorium, tungsten, and uranium. In addition to particulars relating to these metals or minerals, the bulletin contains notes of summary nature on aluminum, beryllium, 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 smelting and refining industry.

Since 1955 the data on the iron ore mining industry have been excluded from the Miscellaneous Metal Mining Industry, thus the figures are not directly comparable with those of the preceding years.

Of the 35 active establishments in the Miscellaneous Metal Mining Industry, there were 14 which made shipments of ore or metal-bearing concentrates.

The industry employed an average of 4,468 persons to whom $27,924,566 were distributed as salaries and wages. Fuel cost $2,532,568 and 326,507,359 kwh. of electricity were purchased for $2,222,502. Process supplies, containers, freight and treatment charges amounted to $1,263,538.

TABLE 1. Principal Statistics of the Miscellaneous Metal Mines, Significant Years, 1921-59

Basis: Standard Industrial Classification in use prior to 1960

Year	Establishments	Employees	Salaries and wages	Cost of fuel and electricity	Cost of process supplies and containers	Gross value of products	Net value added[1]
	number		dollars				
1921	4	44	68,606	45,376	..	230,164	..
1929	8	94	42,837	10,217	..	6,400	..
1931	7	32	25,694	576	..	13,434	..
1933	5	24	14,275	1,178	..	343	..
1937	15	121	155,191	15,668	17,466	86,040	52,655
1939	31	331	455,278	92,405	81,991	524,977	349,404
1941	47	725	1,141,244	359,005	217,494	3,428,886	2,618,483
1944	27	1,385	2,809,013	951,929	657,430	5,360,993	3,303,143
1946	21	1,037	2,338,442	739,531	670,648	7,187,445	3,708,109
1949	21	3,275	8,894,642	1,160,558	1,286,989	21,466,327	15,689,997
1951	31	3,891	12,251,755	1,864,309	3,299,651	31,474,736	21,765,843
1954[2]	180	6,494	24,603,658	3,553,358	10,174,222	83,379,952	66,138,130
1955[3]	223	2,826	12,663,195	1,844,436	4,355,385	35,103,488	28,305,111
1957	139	8,705	42,386,402	6,539,935	20,949,018	144,689,661	115,788,076
1958	91	14,375	78,320,507	9,293,152	50,827,573	284,367,777	223,484,942
1959	84	13,645	76,604,136	9,023,750	57,982,723	333,770,291	265,835,151

[1] Gross value of production, less the value of fuel, electricity, process supplies, containers, freight and treatment charges.
[2] Data for 1954 includes uranium which was not shown in preceding years.
[3] Iron ore data excluded since 1955, but included in preceding years.

TABLE 1 A. Principal Statistics of the Miscellaneous Metal Mines, 1959-63

Basis: Revised Standard Industrial Classification and New Establishment Concept

Year	Establishments	Employees	Salaries and wages	Cost of fuel and electricity	Cost of process supplies and containers	Gross value of products	Net value added[1]
	numbers		dollars				
1959	84	13,645	76,604,136	9,023,750	57,982,723	333,770,291	265,835,151
1960	68	9,380	54,453,208	7,570,803	40,059,514	273,409,628	224,482,268
1961	43	5,919	34,332,063	5,856,827	22,992,059	201,214,250	170,664,295
1962	29	5,120	30,354,642	4,989,168	22,129,854	164,135,270	135,816,670
1963	35	4,468	27,924,566	4,755,070	19,752,181	144,412,912	118,642,123

[1] Gross value of production, less the value of fuel, electricity, process supplies, containers, freight and treatment charges.

TABLE 2. Employees and their Earnings in the Miscellaneous Metal Mines, 1959-63

Year	Employees					Man-hours worked (all employees)	Earnings		
	Office and administrative		Workmen		Total		Office and administrative	Workmen	Total
	Male	Female	Male	Female					
	number						dollars		
1959	2,127	230	11,270	18	13,645	29,361,649	13,083,871	63,520,265	76,604,136
1960	1,568	171	7,616	25	9,380	19,037,034	9,795,299	44,657,909	54,453,208
1961	877	102	4,925	15	5,919	12,019,515	5,967,071	28,364,992	34,332,063
1962	737	91	4,287	5	5,120	10,435,396	5,241,755	25,112,887	30,354,642
1963	731	77	3,658	2	4,468	9,524,449	5,500,460	22,424,106	27,924,566

TABLE 3. Average Number of Workmen, by Months, 1962 and 1963

Month	1962						1963					
	Surface		Underground	Mill		Total	Surface		Underground	Mill		Total
	Male	Female		Male	Female		Male	Female		Male	Female	
	number											
January	899	2	2,542	801	2	4,246	747	—	2,334	779	2	3,862
February	880	2	2,524	804	2	4,212	706	—	2,298	781	2	3,787
March	963	3	2,512	798	2	4,278	690	—	2,257	779	2	3,728
April	1,050	3	2,508	815	2	4,378	829	—	2,271	793	2	3,895
May	1,089	3	2,507	822	2	4,423	841	—	2,274	806	2	3,923
June	1,135	3	2,450	830	2	4,420	785	—	2,012	771	2	3,570
July	1,145	3	2,415	827	2	4,392	829	1	1,991	777	2	3,600
August	1,114	3	2,448	819	2	4,386	814	1	2,017	764	2	3,598
September	1,022	3	2,488	794	2	4,309	782	1	2,003	747	2	3,535
October	990	3	2,501	801	2	4,297	788	1	2,006	741	2	3,538
November	879	3	2,473	775	2	4,132	764	—	2,033	726	2	3,537
December	824	3	2,403	777	2	4,009	692	—	1,938	719	2	3,351
Averages	**999**	**3**	**2,480**	**808**	**2**	**4,292**	**773**	**—**	**2,120**	**765**	**2**	**3,660**
Man-hours worked					*10,435,396*						*7,967,923*	

TABLE 4. Fuel and Electricity Used in the Miscellaneous Metal Mines, 1963

Kind		Quantity	Cost at plant
			$
Bituminous coal (a) From Canadian mines	short ton	—	—
(b) Imported		67,308	992,559
Sub-bituminous coal (from Alberta mines only)		—	—
Anthracite coal		—	—
Lignite coal		—	—
Coke (for fuel only)		—	—
Gasoline, (includes gasoline used in cars and trucks)	Imp. gal.	345,955	133,864
Kerosene or coal oil	"	1,530	402
Fuel oil	"	7,358,212	1,390,019
Wood (cords of 128 cubic feet of piled wood)		—	—
Gas (a) Liquefied petroleum gases (propane, etc.)	Imp. gal.	38,804	15,484
(b) Other manufactured gas		—	—
(c) Natural gas		—	—
Other fuel		—	—
Electricity purchased for motors and lighting	kwh.	326,507,359	2,222,502
Electricity purchased for other purposes		—	—
Steam purchased	pound	237,560	240
Total (cost only)		...	**4,755,070**
Electricity generated (a) For own use	kwh.	108,535,400	...
(b) For sale	"	3,017,400	..

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 output of aluminum ingots measured as molten metal amounted to 719,390 tons in 1963.

The Aluminum Company of Canada, Limited, operated its alumina plant at Arvida and the reduction plants at Arvida, Ile Maligne, Shawinigan Falls and Beauharnois. The Canadian British Aluminum Company Limited operated a reduction plant at Baie Comeau. All these plants are located in the province of Quebec.

In British Columbia the plant at Kitimat is supplied by power generated at Kemano which is about fifty miles distant. Alumina for the smelter is obtained from Jamaica.

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

TABLE 5. Production, Consumption, Imports and Exports of Aluminum Ingots, 1954-63

Year	Production	Domestic consumption[1]	Exports	Imports
	tons (2,000 pounds)			
1954	557,897	80,355	468,494	115
1955	612,543	91,522	510,631	99
1956	620,321	91,869	508,994	1,405
1957	556,715	77,984	478,670	2,122
1958	634,102	101,886	482,927	11,257
1959	593,630	88,797	505,342	852
1960	762,012	120,831	552,155	501
1961	663,173	135,575	487,034	636
1962	690,297	151,893	576,206	3,855
1963	719,390	161,833	635,187	1,954

[1] Producers' domestic shipments to 1959, consumer reports, since 1960, which includes secondary aluminum.

TABLE 6. Imports of Aluminum and Bauxite, 1962 and 1963

Item	1962		1963	
	Tons	Value	Tons	Value
		$		$
Alumina and bauxite, n.o.p.	221,609	6,452,315	184,583	5,695,788
Bauxite ore	2,012,573	55,525,255	2,019,400	61,210,583
Cryolite	5,110	1,057,930	4,857	841,766
Aluminum:				
Pigs, ingots and block	3,855	2,269,600	1,954	1,364,959
Scrap	1,313	299,088	1,492	318,527
Angles, channels and beams	1,126	1,826,206	1,046	1,684,446
Bars, rods and wire	772	854,163	888	948,511
Leaf or foil	...	1,318,747	...	1,431,929
Pipes and tubes	683	1,007,851	460	709,858
Plates, sheets and strips	15,932	13,450,628	28,740	21,621,217
Powder and paste	122	146,610	164	190,771
Wire and cable	310	301,174	491	473,724
Household hollow-ware	...	1,106,941	...	1,080,065
Manufactures, n.o.p.	...	17,310,163	...	15,223,787

TABLE 7. Exports of Aluminum, 1962 and 1963

Item	1962		1963	
	Tons	Value	Tons	Value
		$		$
Aluminum ores, concentrates	3,873	397,341	2,644	357,571
Aluminum scrap	30,245	8,933,359	43,596	12,643,746
Aluminum, pigs, ingots, slabs	576,206	266,228,425	635,187	287,181,031
Aluminum, bars, rods, plates	22,643	12,585,462	12,787	7,152,765
Aluminum foil	463	531,484	465	463,584
Aluminum fabricated materials, n.e.s.	7,887	5,208,319	14,303	7,932,763

TABLE 8. World Production of Bauxite, by Countries[1]

Country[1]	1959	1960	1961	1962	1963
	in thousand long tons				
North America (dried equivalent of crude ore):					
Dominican Republic	759	678	739	706	761[2]
Haiti	255	268	263	370	327
Jamaica	5,125	5,745	6,663	7,495	6,903
United States	1,700	1,998	1,228	1,369	1,525
Totals	**7,839**	**8,689**	**8,893**	**9,940**	**9,516**
South America:					
Brazil	95	119	110	188	167
British Guiana	1,674	2,471	2,374	3,035	2,342
Surinam	3,376	3,400	3,351	3,202	3,453
Totals	**5,145**	**5,990**	**5,835**	**6,425**	**5,962**
Europe:					
Austria	24	26	18	17	18
France	1,729	2,035	2,190	2,160	1,997
Germany West	4	4	4	5	4
Greece	904	870	1,100	1,300	1,261
Hungary	923	1,171	1,344	1,450	1,340
Italy	290	308	322	304	265
Rumania	70	87	68	30	10
Spain	8	3	6	6	12
U.S.S.R.[3]	3,000	3,500	4,000	200	4,300
Yugoslavia	802	1,009	1,213	1,311	1,265
Totals[3]	**7,754**	**9,013**	**10,265**	**10,783**	**10,472**

See footnotes at end of table.

TABLE 8. World Production of Bauxite, by Countries[1] — Concluded

Country	1959	1960	1961	1962	1963
	in thousand long tons				
Asia:					
China (diasporic)[3]	330	350	400	400	400
India	215	381	468	568	556
Indonesia	381	389	413	454	485
Malaysia:					
Malaya	382	452	410	349	444
Sarawak	207	285	253	225	155
Pakistan	2	1	1	—	—
Taiwan (Quemoy)	—	—	—	—	—
Totals	**1,487**	**1,858**	**1,945**	**1,996**	**2,040**
Africa:					
Ghana (exports)	148	224	196	287	207
Guinea, Republic of	296	1,356	1,739	1,427	1,638
Mozambique	4	5	5	6	6
Rhodesia (formerly Southern)	—	—	—	1	2
Sierra Leone	—	—	—	1	20
Totals	**448**	**1,585**	**1,940**	**1,721**	**1,873**
Oceania: Australia	15	69	16	30	354
World totals (estimate)	**22,690**	**27,205**	**28,895**	**30,895**	**30,220**

[1] This table incorporates a number of revisions of data published in previous bauxite chapters. Data do not add to tables shown due to rounding where estimated figures are included in the detail.
[2] United States imports.
[3] Estimate.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

TABLE 9. World Production of Aluminum

Country[1]	1959	1960	1961	1962	1963
	short tons				
North America:					
Canada	593,630	762,012	663,173	690,297	719,390
Mexico	—	—	—	—	6,100
United States	1,954,112	2,014,498	1,903,711	2,117,929	2,312,528
Totals	**2,547,742**	**2,776,510**	**2,566,884**	**2,808,226**	**3,038,018**
South America: Brazil	19,950	20,034	22,078	22,202	19,412
Europe:					
Austria	72,271	74,924	74,578	81,668	84,287
Czechoslovakia	28,700	44,100	55,100	65,000	65,000
France	190,712	262,890	308,047	325,288	328,891
Germany, East[2]	38,600	44,000	50,000	50,000	50,000
West	166,631	186,221	190,212	196,017	230,142
Hungary	50,340	54,602	56,286	58,127	61,176
Italy	82,658	92,206	91,881	89,549	100,784
Norway	160,881	181,662	189,109	226,966	241,583
Poland (includes secondary)	25,143	28,640	52,488	53,007	51,365
Spain	24,959	31,680	41,500	45,953	50,142
Sweden, including alloys	17,100	17,619	17,463	17,580	20,172
Switzerland	37,886	43,795	46,530	54,640	67,440
U.S.S.R.[2]	690,000	705,000	980,000	990,000	1,060,000
United Kingdom	27,462	32,390	36,169	38,113	34,243
Yugoslavia	21,214	27,635	30,211	30,843	39,567
Totals[2]	**1,635,000**	**1,825,000**	**2,220,000**	**2,325,000**	**2,485,000**
Asia:					
China	77,600	88,200	110,000	110,000	110,000
India	19,131	20,123	20,263	39,025	60,856
Japan[3]	110,385	146,853	169,424	188,991	246,854
Taiwan	8,251	9,106	9,938	12,135	13,148
Totals[2]	**215,400**	**264,300**	**309,600**	**349,400**	**430,900**
Africa: Cameroon, Republic of	46,644	48,436	52,446	57,596	58,327
Oceania: Australia	12,734	13,054	14,789	18,090	46,214
World totals[1,2]	**4,480,000**	**4,950,000**	**5,185,000**	**5,580,000**	**6,080,000**

[1] This table incorporates some revisions. Data do not add exactly to totals shown because of rounding where estimated figures are included in the detail.
[2] Estimate.
[3] Includes superpurity 1959, 549 tons; 1960, 2,187; 1961, 1307; 1962, 1,969; 1963, 2,060 tons.

Source: "Mineral yearbook" published by United States Bureau of Mines.

ANTIMONY

Antimony production consists 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; and antimony in flue dust and Doré slag shipped from that smelter.

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 babbit 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 canvas goods used by the armed forces.

The New York price quotations on antimony were 36.25 cents per pound in December, 1963. This price was for grade 99½% in lots of 10,000 pounds or more.

TABLE 10. Production of Antimony, 1954-63

Year	In ores and slags exported		In antimonial lead produced		Total	
	Pounds	Value	Pounds	Value	Pounds	Value
		$		$		$
1954	271,350	19,334	1,030,983	329,915	1,302,333	349,249
1955	455,732	38,737	1,565,994	524,608	2,021,726	563,345
1956	331,790	27,373	1,808,642	660,154	2,140,432	687,527
1957	452,184	37,934	908,547	332,508	1,360,731	370,442
1958	—	—	858,633	284,208	858,633	284,208
1959	—	—	1,657,797	540,276	1,657,797	540,276
1960	—	—	1,651,786	538,482	1,651,786	538,482
1961	—	—	1,331,297	469,948	1,331,297	469,948
1962	—	—	1,931,397	748,223	1,931,397	748,223
1963	—	—	1,601,253	624,489	1,601,253	624,489

TABLE 11. Imports of Antimony Metal, by Principal Countries of Supply

Country	1962		1963	
	Pounds	Value	Pounds	Value
		$		$
United Kingdom	164,536	35,312	—	—
Belgium-Luxembourg	44,800	12,171	—	—
China	842,229	135,401	866,090	136,273
Yugoslavia	—	—	66,247	18,819
Netherlands	—	—	57,795	14,683
France	—	—	45,635	13,554
United States	4,122	1,428	468	296
Germany, West	110,000	23,605	—	—
Czechoslovakia	110,230	23,670	—	—
Totals	**1,275,927**	**231,587**	**1,036,235**	**183,625**

TABLE 12. Consumption of Antimony Metal, 1961-63

	1961	1962	1963
	pounds		
Used in production of:			
Antimonial lead alloys	500,877	749,850	648,126
Babbitt	121,417	101,056	91,187
Solder	22,674	14,698	14,691
Type metal	132,667	180,751	180,273
Other commodities	251,284	164,301	41,350
Totals accounted for	**1,028,919**	**1,210,656**	**975,627**

TABLE 13. World Production of Antimony (Content of Ore), by Countries[1]

Country	1959	1960	1961	1962	1963
	short tons				
North America:					
Canada[2]	829	826	666	966	801
Guatemala (U.S. Imports)	97	119	71	32	31
Mexico[3]	3,622	4,664	3,978	5,257	5,320
United States	678	635	689	631	645
Totals	**5,226**	**6,244**	**5,404**	**6,886**	**6,797**
South America:					
Argentina	4	—	—	—	—
Bolivia (exports)[3]	6,065	5,872	7,430	7,331	8,337
Peru[3]	793	901	870	575	815
Totals	**6,862**	**6,773**	**8,300**	**7,906**	**9,152**
Europe:					
Austria	631	676	668	767	548
Czechoslovakia[4]	1,800	1,800	1,800	2,200	2,200
France	—	—	—	—	110
Italy	231	238	276	369	266
Portugal	7	—	—	—	—
Spain	180	243	190	175	65
U.S.S.R.[4]	6,100	6,300	6,300	6,600	6,700
Yugoslavia (metal)	2,514	2,657	2,715	2,966	2,933
Totals[5]	**11,500**	**11,900**	**11,900**	**13,100**	**12,800**
Asia:					
Burma[3]	240	180	175	138	126
China[4]	16,500	16,500	16,500	16,500	16,500
Iran[5]	160[5]	55[5]	—	—	—
Japan	340	299	215	190	212
Pakistan	119	69	15	75	9
Ryukyu Islands	26	159	112	—	—
Sarawak	—	—	—	—	—
Thailand	11	—	25	19	676
Turkey	1,380[7]	1,507	1,502	1,962	1,981
Totals[4]	**18,800**	**18,800**	**18,500**	**18,900**	**19,500**
Africa:					
Algeria	1,658	886	720	149	—
Morocco	252	358	406	449	744
South Africa, Republic of	13,619	13,537	11,804	11,697	12,410
Southern Rhodesia	104	100	68	61	66
Totals	**15,633**	**14,881**	**12,998**	**12,356**	**13,220**
Oceania: Australia	703	172	132	74	83
World totals (estimate)[1]	**58,700**	**58,800**	**57,200**	**59,200**	**61,600**

[1] This table incorporates some revisions. Data do not add exactly to totals shown because of rounding where estimated figures are included in the detail.
[2] Antimony content of smelter products exclusively from mixed ores.
[3] Includes antimony content of smelter products derived from mixed ores.
[4] Estimate.
[5] Year ended March 20 of year following that stated.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

TABLE 14. Imports of Antimony Oxide, by Principal Countries of Supply, 1959-63

Country	1959	1960	1961	1962	1963
	pounds				
United Kingdom	300,000	253,375	170,560	332,280	511,480
United States	80,254	139,476	100,150	128,055	82,200
Belgium-Luxembourg	42,714	44,000	44,007	67,354	11,200
Germany, West	88,184	—	—	—	—
France	—	—	44,000	—	—
China (Communist)	—	—	—	99,900	44,092
Totals	**511,152**	**436,851**	**358,717**	**627,589**	**649,332**

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 during the years 1950-63.

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 stockpiled. in 1950, a carload of this material was shipped to the United States. No shipments were made in 1963.

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-colombite. Some of these are considered to be of possible economic interest.

In Quebec scattered occurrences of beryl are known in the Lacorne 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.

New York price quotations, at the end of the year, for beryllium ore, f.o.b. mine, were $29 to $32 per unit of BeO, basis 10 to 12 per cent BeO.

TABLE 15. World Production of Beryl, by Countries[1]

Country	1959	1960	1961	1962	1963
	short tons				
Argentina	3,336[1]	1,157[1]	1,488[1]	998[1]	825[1]
Brazil	2,927	3,827	3,503	3,319	2,169[2]
Congo (Léopoldville)	280	369	184	304	235
Malagasy Republic	474	701	836	743	453
Mozambique	1,559	1,649	1,073	627	613
Southern Rhodesia	440	539	396	559	249
Uganda	235	470	1,136	1,116	419
U.S.S.R.[3]	550	750	900	1,000	1,100
Other[4]	1,433	2,838	3,384	2,334	1,637
Totals (estimate)[1]	**11,200**	**12,300**	**12,900**	**11,000**	**7,700**

[1] Exports.
[2] United States imports.
[3] Estimates.
[4] Comprises Australia, Burundi and Rwanda, Portugal, Republic of South Africa, South-West Africa, Sweden and United States.

BISMUTH

Bismuth is recovered from the lead-zinc ores which are smelted at Trail by the Consolidated Mining and Smelting Company of Canada. The silver-cobalt ores of Cobalt, Ontario contain bismuth, which is recovered by Cobalt Refinery. Bismuth metal is a by-product in the smelting of the copper ores at Gaspé, Québec. The Molybdenite Corporation of Canada produces bismuth metal and bismuth salts at Lacorne, Quebec.

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 solder, dental amalgams 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 New York price of bismuth December, 1963 was $2.25 per pound, in ton lots.

TABLE 16. Production of Primary Bismuth in All Forms,[1] 1954 - 63

Year	Pounds	Value	Year	Pounds	Value
		$			$
1954	258,675	572,183	1959	334,736	590,212
1955	265,896	572,362	1960	423,827	762,048
1956	285,861	544,900	1961	478,118	957,625
1957	319,941	584,917	1962	425,102	839,912
1958	412,792	771,267	1963	359,125	704,103

[1] Refined metal from Canadian Ores, plus bismuth content of bullion and concentrates exported.

TABLE 17. Imports of Bismuth Metal, Residues and Salts, 1962 and 1963

Country	1962		1963	
	Pounds	Value	Pounds	Value
		$		$
Metallic bismuth:				
United States	1,116	2,799	2,107	5,249
Bolivia	55,947	35,695	4,276	3,299
Totals	**57,063**	**38,494**	**6,383**	**8,548**
Bismuth salts:				
United Kingdom	10,855	27,988	6,243	16,374
United States	320	1,378	550	2,790
Totals	**11,175**	**29,366**	**6,793**	**19,164**

TABLE 18. Consumption of Bismuth Metal, in Canada, 1962 and 1963

	1962	1963
	pounds	
Used in:		
Fusible alloys and solders	29,130	31,707
Other[1]	8,120	16,106
Totals	**37,250**	**47,813**

[1] Pharmaceuticals, chemicals and malleable iron.

TABLE 19. World Production of Bismuth, by Countries[1,2]

Country	1959	1960	1961	1962	1963
	pounds				
Argentina (in ore)	40,000[3]	14,900[3]	8,600[3]	7,100	7,600
Australia (in ore)	—	265	602	97	—
Bolivia[4]	487,400	403,700	502,023	669,987	560,874
Canada (metal)[5]	334,736	423,827	478,118	425,102	395,125
China (in ore)	[6]	[6]	660,000	660,000	660,000
France (in ore)	101,400	112,400	116,800	138,890	150,000[3]
Japan (metal)	223,187	261,089	422,326	572,841	823,314
Korea, South (in ore)	227,000	317,000	333,000	353,000	349,000
Mexico[5]	527,600	599,400	643,700	780,000	941,400
Mozambique	22,900	30,000	38,800	13,889	24,317
Peru[5]	737,617	908,438	1,031,795	1,084,227	1,244,367
South West Africa (in ore)	530	310	485	154	5,115
South Africa, Republic of (in ore)	527	511	168	130	2,619
Spain (metal)	53,168	29,875	21,427	18,799	25,836
Sweden[3]	66,000	79,000	79,000	155,000	155,000
Uganda	19,140	3,640	1,433	110	65
Yugoslavia (metal)	200,026	231,582	216,348	199,765	194,657
World total (estimate)[1,2]	**5,000,000**	**5,300,000**	**5,700,000**	**6,700,000**	**6,800,000**

[1] United States figure withheld to avoid disclosing individual company confidential data; included in world total. Bismuth is believed to be produced also in Brazil, Germany and U.S.S.R. Production figures are not available for these countries, but estimates are included in the total.

[2] This table incorporates some revisions. Data do not add to totals shown due to rounding where estimated figures are included in the detail.

[3] Estimate.

[4] Content in ore and bullion exported, excluding that in tin concentrates.

[5] Refined metal, plus bismuth content of bullion exported.

[6] Data not available; estimate included in total.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

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 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. Cadmium was recovered from the zinc concentrates shipped by Sullico Mines Limited and Salbec Copper Mines Limited which operate mines in Quebec.

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, 1963 was $3.00 per pound.

TABLE 20. Production of Cadmium in all Forms, 1954-63

Year	British Colombia and Yukon		Manitoba and Saskatchewan		Canada	
	pounds	$	pounds	$	pounds	$
1954	932,184	1,584,713	154,596	262,813	1,086,780	1,847,526
1955	1,727,390	2,936,564	191,691	325,875	1,919,081	3,262,439
1956	2,182,435	3,710,140	156,986	266,876	2,339,421	3,977,016
1957	2,141,782	4,025,821	226,348	384,791	2,368,130	4,025,821
1958	1,413,463	2,148,463	342,587	520,732	1,756,050	2,669,195
1959	1,837,571	2,352,091	322,792	413,174	2,160,363	2,765,265
1960	1,924,363	2,732,594	366,636	520,623	2,357,497	3,347,646[1]
1961	1,050,117	1,680,187	307,757	492,411	1,357,874	2,172,598
1962	2,221,185	4,070,841	317,495	546,092	2,604,973	4,730,957[1]
1963	2,115,889	5,078,134	316,050	758,520	2,475,485	5,941,164[1]

[1] Includes production from Quebec ores.

TABLE 21. Exports of Cadmium, 1962 and 1963

Destination	1962		1963	
	Pounds	Value	Pounds	Value
		$		$
Argentina	3,306	5,552	—	—
United Kingdom	1,467,650	2,274,901	1,306,465	2,957,358
France	2	59	8	238
Sweden	—	—	5,063	14,176
Switzerland	—	—	3	163
India	2,997	4,869	33,390	90,694
Australia	10	212	—	—
Brazil	13,820	25,730	9,036	18,161
Netherlands	22,400	33,152	—	—
United States	829,664	1,270,233	584,929	1,375,682
Germany, West	—	—	16	102
Israel	—	—	200	540
Colombia	440	727	—	—
Totals	**2,340,289**	**3,615,435**	**1,939,110**	**4,457,114**

TABLE 22. Consumption of Cadmium, 1962 and 1963

	1962	1963
	pounds	
Used for:		
Plating	195,654	185,251
Solders	14,694	19,645
Other products	6,488	3,700
Totals accounted for	**216,836**	**208,596**

TABLE 23. World Production of Cadmium, by Countries[1]

Country	1959	1960	1961	1962	1963
	thousands of pounds[2]				
North America:					
Canada (all forms)	2,160	2,357	2,222	2,605	2,475
Honduras	—	10	10	31	192
Mexico (refined metal)[3]	133	179	104	63	326
United States	8,710	10,445	10,466	11,137	9,990
South America: Peru	141	185	232	235	382
Europe:					
Austria	43	32	42	49	41
Belgium[3]	1,512	1,583	1,988	1,854	1,943
France	539	560	560	567	655
Germany:					
East	—	—	—	7	11
West	926	902	952	560	492
Italy	552	648	767	536	622
Netherlands[4]	88	88	88	88	88
Norway	284	243	231	254	243
Poland[4]	860	860	880	880	930
Spain	14	26	76	133	119
U.S.S.R.	3,310	3,000	3,300	3,500	3,700
United Kingdom[5]	310	236	217	237	247
Yugoslavia	72	84	88[4]	88[4]	88[4]
Asia: Japan	1,082	1,252	1,596	1,948	2,231
Africa:					
Congo, (Léopoldville)	1,047	1,115	1,173	677	871
Zambia	—	58	42	37	33
Oceania: Australia	764	672	697	791	1,089
World totals (estimate)[1,2]	**22,500**	**24,500**	**25,700**	**26,300**	**26,800**
Exports:					
Guatemala[3]	—	123	94	27[5]	
Mexico[3]	2,074	1,201	2,557	2,422	
Peru[3]	29	56	57	47	
South-West Africa[5]	1,294	1,732	1,747	1,219	

[1] Data derived in part from bulletins of the World Non-ferrous Metal Statistics and annual issues of Metal Statistics (Metallgesellschaft)

[2] This table incorporates some revisions. Data do not add exactly because of rounding. No estimate included for Bulgaria.

[3] Exports.

[4] Estimate.

[5] Including secondary.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

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. From 1950 to 1955 the value of output was included in the data on magnesium.

Calcium has found increasing use as a deoxidizer in ferrous metallurgy and as an alloy constituent with non-ferrous metals. It has been employed in the reduction of refractory ores of metals, such as chromium, thorium, uranium and zirconium.

TABLE 24. Production (Shipments) of Calcium Metal, 1950-63

Year	Pounds	Value
		$
1950-55	[1]	[1]
1956[2]	394,900	515,305
1957[2]	221,225	282,378
1958	25,227	31,256
1959	67,429	76,409
1960	134,801	159,241
1961	99,355	100,881
1962	123,511	124,412
1963	98,673	117,247

[1] Not available for publication.

[2] Output.

TABLE 25. Exports of Calcium, by Countries to which Shipped, 1961-63

Countries	1961	1962	1963
	dollars		
United Kingdom	10,803	44,059	11,663
Belgium-Luxembourg	31,525	5,100	11,015
United States	30,439	54,002	32,969
Germany, West	10,890	23,362	22,700
India	28,171	22,345	23,667
Italy	3,055	2,318	7,055
South Africa, Republic of	—	5,900	—
Japan	1,958	—	—
Norway	—	136	—
Totals	**116,841**	**157,222**	**109,069**

CERIUM

A few tons of rock containing cerium and other Rare Earths were shipped from the Parry Sound district to a metallurgical plant in the United States, during 1955. This experimental shipment was valued at $988. No production was reported in 1956-63.

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 thoria (THO_2). Monazite is distributed widely in igneous rocks throughout the world, especially in gneisses that have been intruded by pegmatities, 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.

CHROMITE

There was no Canadian production of chromite in 1963. 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 supercharges. 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 course grains mixed with blobs of silicate. The Cr_2O_3 content is usually over 40 per cent.

TABLE 26. Production of Chromite, 1946-63

Year	Short tons	Value	Year	Short tons	Value
		$			$
1946	3,110	61,123	1951	—	—
1947	2,162	42,159	1952	—	—
1948	1,715	33,568	1953	—	—
1949	361	7,148	1954-63	—	—
1950	—	—			

TABLE 27. World Production of Chromite, by Countries[1]

Country	1959	1960	1961	1962	1963
	short tons[2]				
North America:					
Cuba	43,732[3]	32,774[4]	27,600[3]	38,600[3]	55,800[3]
Guatemala	452	200	110	22	—
United States	105,000[5]	107,000[5]	82,000[5]	—	—
Totals	**149,184**	**139,974**	**109,710**	**38,600[3]**	**58,800[3]**
South America:					
Brazil	6,861	6,246	17,037	27,380	48,546
Colombia	55	77	204	154	121
Totals	**6,916**	**6,323**	**17,241**	**27,534**	**48,667**
Europe:					
Albania	273,373	318,650	256,241	277,007	322,977
Greece (marketable)	22,803	38,451	34,324	26,633	18,347
Portugal	—	—	—	—	—
U.S.S.R.[3,6]	940,000	1,010,000	1,015,000	1,270,000	1,355,000
Yugoslavia	117,965	110,873	119,188	106,974	103,364
Totals[1,3]	**1,380,000**	**1,510,000**	**1,450,000**	**1,710,000**	**1,830,000**
Asia:					
Cyprus (exports)	13,637	15,702	21,078	10,669	448
India	105,376	110,354	50,625	73,467	71,419
Iran[7]	60,627	74,957	81,268	121,254	110,000[3]
Japan	63,578	74,394	73,373	64,024	48,205
Pakistan	17,946	20,265	28,116	23,671	16,023
Philippines	720,345	809,579	705,811	585,643	506,094
Turkey	427,324	530,676	443,932	580,964	312,817
Viet-Nam North[3]	7,300	21,400	32,500	35,900	33,400
Totals	**1,416,133**	**1,657,327**	**1,440,703**	**1,495,592**	**1,098,406**
Africa:					
Malagasy Republic	—	—	11,600	20,342	12,346
Sierra Leone	19,974	6,023	—	12,621	3,067
South Africa, Republic of	749,878	850,921	989,725	1,006,173	873,212
Southern Rhodesia	543,104	668,401	590,888	507,685	412,392
Sudan	—	—	—	8,000	18,700[3]
United Arab Republic (Egypt)	276	331	1,532	—	—
Totals	**1,313,232**	**1,525,676**	**1,593,745**	**1,555,621**	**1,319,717**
Oceania:					
Australia	134	592	—	413	180
New Caledonia	48,463	43,166	40,413	17,036	—
Totals	**48,597**	**43,758**	**40,413**	**17,449**	**180**
World totals (estimate)[1]	**4,315,000**	**4,885,000**	**4,650,000**	**4,845,000**	**4,355,000**

[1] In addition to countries listed, Bulgaria and Rumania produce chromite, but data on output are not available; estimates are included in total.
[2] This table incorporates some revisions. Data do not add to totals shown due to rounding where estimated figures are included in the detail.
[3] Estimate.
[4] United States imports.
[5] Produced for Federal Government only; excludes quantity consumed by American Chrome Company.
[6] Output from U.S.S.R. in Asia included with U.S.S.R. in Europe.
[7] Year ended March 20 of year following that stated.

Source: ''Minerals Yearbook'' published by the United States Bureau of Mines.

TABLE 28. Imports of Chrome Ores, 1954-63

Year	Tons	Value	Year	Tons	Value
		$			$
1954	37,566	571,984	1959	48,678	1,525,438
1955	51,854	971,522	1960	59,023	1,521,812
1956	64,965	1,529,411	1961	71,267	1,908,920
1957	111,453	2,751,372	1962	71,969	2,122,407
1958	38,136	812,286	1963	49,654	1,688,568

TABLE 29. Imports of Chrome Ores, by Principal Countries of Supply, 1962 and 1963

Imported from	1962		1963	
	Tons	Value	Tons	Value
		$		$
Cyprus	2,800	121,850	—	—
Rhodesia and Nyasaland	14,313	466,471	14,131	446,458
United States	27,402	929,934	13,912	477,866
South Africa, Republic of	5,219	63,576	1,115	19,284
Philippines	19,040	453,301	18,256	664,162
Cuba	3,196	87,275	—	—
Turkey	—	—	2,240	80,798
Total	**71,969**	**2,122,407**	**49,654**	**1,688,568**

COLUMBIUM, TANTALUM

The St. Lawrence Columbium and Metals Corporation operated a mine at Oka, Quebec, about 30 miles west of Montreal. The large pyrochlore deposit has been estimated at 62 million tons with an average content of 0.4 per cent columbium pentoxide, Cb_2O_5. The ore is milled to produce a concentrate containing about 52 per cent Cb_2O_5.

Tantalum usually occurs with columbium minerals, but the content is too low in the ores at Oka for economical recovery. Columbium-tantalum occurrences have been reported in British Columbia, Northwest Territories and Ontario.

The E. & M. Journal price quotations in December, 1963 were: Columbite-per lb. of pentoxide, basis 65% Cb_2O_5 and Ta_2O_5 columbium-tantalum ratio 10 to 1, $.90-$1.00 ratio 8½ to 1, $.85 to $.90 columbium metal $36 to $50 per pound. Tantalum metal per lb. powder, $30 to $49 sheet, $47 to $60 rod, $52 to $65.

TABLE 30. Producers Shipments of Columbium, 1954-63

	Cb_2O_5 content	Value
	pounds	$
1954	90	2,294
1955	42	1,034
1956-60	—	—
1961	62,229	65,619
1962	1,016,514	1,006,349
1963	1,393,444	1,300,009

TABLE 31. World Production of Columbium and Tantalum Mineral Concentrates, by Countries[1]

Country	1960		1961		1962		1963	
	Columbium	Tantalum	Columbium	Tantalum	Columbium	Tantalum	Columbium	Tantalum
	pounds[2]							
North America:								
Canada	–		119,261[3]	–	1,909,433[3]	–	2,692,935[3]	–
United States (mine shipments)	–		–		–		–	
South America:								
Argentina	–		–	4,444[4]	–	3,637[4]	–	4,519[4]
Brazil (exports)	26,460	257,951	38,477	264,519	38,164	322,804	1,729,767[5]	231,000
French Guiana	–		–		–		–	5,031
Europe:								
Norway	762,792	–	708,118	–	656,971	–	782,633	–
Portugal (U.S. imports)	35,383	34,062	22,457	29,793	42,565	95,692	4,465	72,711
Spain (U.S. imports)	976	3,157	–	11,148	–	2,645	–	
Sweden (U.S. imports)	–		–		–		–	
Asia:								
Malaya, Federation of	208,320	–	212,800	–	246,400	–	197,120	–
Africa:								
Burundi-Rwanda	[6]		[6]		[6]		[6]	
Congo, Republic of the (Léopoldville)[6,7]	227,724[4]	332,424[4]	113,085[4]	164,277[4]	55,846[4]	228,185[4]	163,437	147,257
Malagasy Republic (Madagascar)	22,300		46,750		20,720		37,920	
Mozambique	335,487		303,166		231,437		177,867	
Nigeria	4,587,520	24,640	5,257,280	26,230	5,066,880	38,013	4,506,880	33,600
Sierra Leone	–	–	–	–	–	–	–	–
South Africa, Republic of	–	14,000	–	20,000	–	8,000	–	64,000
Southern Rhodesia	–	108,080	–	138,380	–	159,820	–	151,000
South-West Africa	2,899	7,491	670	5,790	1,116	10,444	418	4,143
Uganda	5,226		16,240		28,851		19,841	
Oceania:								
Australia	23,677		31,808		43,097		30,889	
World totals (estimate)[2]	**7,020,000**		**7,540,000**		**9,210,000**		**11,060,000**	

[1] Frequently the composition (Cb_2O_5—Ta_2O_5) of these mineral concentrates lies in an intermediate position, neither Cb_2O_5 nor Ta_2O_5 being strongly predominant. In such cases the production figure has been centered.

[2] This table incorporates some revisions. Data do not add to totals shown due to rounding where estimated figures are included in the detail. The world total does not include U.S.S.R. for which country no production data are available.

[3] Shipments.

[4] United States imports.

[5] Includes 1,687,000 pounds of pyrochlore concentrate exported to the United States. This represents a portion of 3,527,000 pounds produced in Brazil during 1961-62.

[6] Burundi-Rwanda included in Republic of the Congo through 1963.

[7] In addition, tin-columbium-tantalum were produced as follows: 1959, 2,773,387 pounds; 1960 estimated 1,500,000 pounds; 1961, estimated 1,400,000 pounds; 1962-3 not available, columbium-tantalum content averaging about 10 per cent.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

INDIUM

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 non-corrosive 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 1963 the quoted price of indium at New York was $1.50 to $2.25 per troy ounce, for lots over 5,000 ounces.

TABLE 32. Production of Indium, 1949-63

Year	Troy ounces	Value	Year	Troy ounces	Value
		$			$
1949	689	1,550	1954	477	1,278
1950	4,952	12,083	1955	104,774	232,598
1951	582	1,368	1956	363,192	795,390
1952	404	909	1957	384,360	693,770
1953	6,752	9,588	1958-63	..	..

MAGNESIUM

Magnesium was produced from dolomite by the Dominion Magnesium Limited, Haley, Ontario. This firm uses the Pidgeon process.

Magnesium is a constituent of aluminum-base alloys that possess high strength and resistance to corrosion. In Canada, this use accounts for the largest quantity. Magnesium finds other applications in cathodic protection of steel structures by magnesium anodes, pyrotechnics, the production of nodular cast iron, and use as a reducing agent in the production of uranium, titanium, beryllium, zirconium and platinum.

Technical information on magnesium is shown in a review published by the Department of Mines and Technical Surveys, Ottawa.

TABLE 33. Producers' Shipments of Magnesium Metal, 1947-63

Year	Quebec		Ontario		Canada	
	Pounds	Value	Pounds	Value	Pounds	Value
		$		$		$
1947-55	[1]	[1]	[1]	[1]	[1]	[1]
1956	4,572,564	1,536,688	14,639,734	4,543,202	19,212,298	6,079,890
1957	1,585,998	487,853	15,184,373	4,767,043	16,770,371	5,254,896
1958	4,504,343	1,317,070	9,087,362	2,747,755	13,591,705	4,064,825
1959	4,059,508	977,123	8,144,940	2,202,392	12,204,448	3,179,515
1960	–	–	14,577,138	4,313,987	14,577,138	4,313,987
1961	–	–	15,270,618	4,307,570	15,270,618	4,307,570
1962	–	–	17,631,310	4,821,823	17,631,310	4,821,823
1963	–	–	17,810,348	5,357,816	17,810,348	5,357,816

[1] Not available for publication.

TABLE 34. Exports of Magnesium Metal, 1961-63

Destination	1961	1962	1963
	dollars		
United Kingdom	3,188,691	2,796,590	2,118,500
South Africa, Republic of	—	2,950	—
India	4,640	4,302	10,627
Australia	86	13,454	43,059
Portugal	—	—	125
Belgium-Luxembourg	1,866	39,382	189,608
Brazil	2,153	8,256	3,123
Chile	—	—	302
Japan	—	—	57,916
France	100,558	130,939	258,852
Germany W.	231	573,332	493,710
Mexico	1,160	—	93,304
Philippines	—	—	1,127
Sweden	28,730	—	7,850
Switzerland	19,719	20,710	12,450
Yugoslavia	379	—	85,844
United States	84,121	253,260	243,991
New Zealand	—	—	1,354
Colombia	—	—	3,015
Greece	—	—	1,635
Italy	—	—	250
Israel	14,325	18,155	10,103
Spain	6,590	—	—
Uruguay	5,992	1,893	1,583
Czechoslovakia	79,330	31,260	—
Hungary	26,742	—	6,100
Taiwan	—	4,892	28,816
Argentina	—	1,909	—
Venezuela	—	—	2,723
Poland	43,210	66,580	—
Cuba	—	68	—
Bermuda	—	—	758
Totals	**3,608,523**	**3,967,932**	**3,676,725**

TABLE 35. Consumption of Magnesium Metal, 1962 and 1963

	1962	1963
	tons (2,000 pounds)	
Used for:		
Castings	252	314
Extrusions (shapes and tubing)	556	355
Aluminum alloys	2,175	2,569
Other products	631	403
Totals accounted for	**3,614**	**3,641**

TABLE 36. World Production of Magnesium Metal, by Countries[1]

Country	1959	1960	1961	1962	1963
	short tons[1]				
Canada	6,102	7,289	7,635	8,816	8,904
China[2]	1,000	1,000	1,000	1,000	1,000
France	1,938	2,359	2,282	2,392	1,981
Germany, West	550	330	440	550	550
Italy	4,960	6,004	6,365	6,288	6,092
Japan	1,724	2,363	2,477	2,301	2,689
Norway	10,567	11,373	16,018	16,400	22,700
U.S.S.R.[2]	22,000	27,600	34,000	35,000	35,000
United Kingdom[3]	2,387	4,119	5,824	5,559	5,219
United States	31,033	40,070	40,745	68,955	75,845
Totals (estimate)[1]	**82,300**	**102,500**	**116,800**	**147,300**	**160,000**

[1] This table incorporates a number of revisions of data published in previous magnesium chapters. Data do not add to totals shown due to rounding where estimated figures are included in the detail.
[2] Estimate.
[3] Primary metal and remelt alloys.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

MANGANESE

Production of manganese ore in Canada has been spasmodic due to the limited number of known deposits. During 1956 a small shipment of manganese bearing silica was exported from British Columbia. During recent years in New Brunswick extensive development work was done by Strategic Materials Corporation on the manganese-iron deposits. Test lots of ores were shipped to the firm's pilot plant where a process was developed for the production of ferro-manganese. Operations did not progress beyond the experimental basis, and eventually ceased.

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.

TABLE 37. Production of Manganese Ore, 1943-63

Year	Tons	Value	Year	Tons	Value
		$			$
1943	48	985	1949	...	–
1944	–	–	1950	–	–
1945	–	–	1951	–	–
1946	–	–	1952-55	–	–
1947	225	7,875	1956	...	1,900
1948	3	88	1957-63	–	–

TABLE 38. Imports of Manganese Ore, 1954-63

Year	Tons	Value	Year	Tons	Value
		$			$
1954	48,962	2,277,043	1959	118,454	5,017,112
1955	175,282	7,338,269	1960	56,350	2,543,763
1956	207,977	9,137,278	1961	76,016	3,465,313
1957	131,318	7,519,746	1962	90,725	4,037,672
1958	42,060	1,722,965	1963	106,841	3,821,972

TABLE 39. Imports of Manganese Ore, by Principal Countries of Supply, 1959-63

	1959	1960	1961	1962	1963
	tons				
From					
Congo, Republic of (formerly Belgian)	5,777	17,032	–	–	23,972
Japan	3	4	83	61	190
Ghana	66,246	22,399	25,484	49,632	40,439
India	12,314	–	13,291	893	–
France	1	4	13	7	11
United States	13,887	4,345	6,388	28,013	16,535
United Kingdom	111	44	44	65	29
Brazil	20,115	6,522	16,785	10,746	20,633
Mexico	–	512	–	–	82
South Africa, Republic of	–	5,488	13,928	–	–
Greece	–	–	–	1,308	–
Total imports	**118,454**	**56,350**	**76,016**	**90,725**	**106,841**

TABLE 40. World Production of Manganese Ore, by Countries[1]

Country	Per cent Mn.	1959	1960	1961	1962	1963
		short tons[2]				
North America:						
Costa Rico (exports)	35+	—	—	—	—	661
Cuba	36-50+	58,806[4]	17,644[5]	46,000[3,4]	83,000[3]	83,400[3]
Mexico[3]	30+	181,900[3]	171,400[3]	155,900[3]	184,900	189,300
Panama	44+	—	—	—	—	—
United States (shipments)	35+	229,199	80,021	46,088	24,758	10,622
Totals[3]		**469,905**	**269,100**	**248,000**	**292,700**	**284,000**
South America:						
Argentina	30-40	21,358	24,251	19,724	13,921	16,500[3]
Bolivia (exports)		—	—	53	291	—
Brazil	38-50	1,138,649	1,101,387	1,120,336	1,290,461	1,382,727
British Guiana	40	—	137,454	237,582	303,636	157,331
Chile	40-50	42,744	50,594	35,012	47,578	51,234
Peru	40+	2,803	1,655	3,879	7,403	457
Venezuela	38+	3,955	—	—	—	—
Totals		**1,209,509**	**1,315,341**	**1,416,586**	**1,663,290**	**1,608,249**
Europe:						
Bulgaria	30+	28,700	27,558	40,785	38,581	42,432
Greece	35+	38,581	34,410	31,195	15,097	16,389
Hungary	30+	170,086	135,888	137,610	142,447	167,960
Italy	35+	57,520	54,561	54,196	49,053	49,920
Portugal	35+	7,703	8,197	12,492	12,666	9,434
Rumania	35	216,910	192,872	227,076	208,337	286,601
Spain	30+	44,924	24,586	17,092	14,101	16,858
U.S.S.R.[6]		6,080,300	6,473,000	6,583,000	7,057,000	7,345,000
Yugoslavia	30+	8,911	14,676	15,595	16,357	8,964
Totals[1]		**6,653,635**	**6,965,748**	**7,119,041**	**7,553,639**	**7,943,558**
Asia:						
Burma	35+	606	324	196	213	220[3]
China[3]	30+	1,100,000	1,323,000	882,000	882,000	1,102,000
Goa	32-50	83,584	118,195	109,790	96,732	115,290[4]
India	35+	1,298,472	1,321,411	1,355,868	1,351,432	1,184,983
Indonesia	35-49	47,172	12,026	14,007	5,460	1,903
Iran[7]	36-46	2,425	8,488	2,315	2,205	1,100[3]
Japan	32-40	383,699	357,131	335,236	340,162	305,028
Korea, South	30-48	496	1,521	1,518	1,105	4,580
Malaysia	60	—	3,222	7,130	341	7,696
Pakistan	42	32	327	—	1,036	1,553
Philippines	35-51	38,365	19,159	20,986	13,160	8,450
Tailand	40+	452	582	588	3,194	7,285
Turkey	30-50	39,341	31,112	33,951	23,422	6,949
Totals[3]		**2,995,000**	**3,196,000**	**2,764,000**	**2,720,000**	**2,747,000**
Africa:						
Angola	38-48	39,314	25,728	22,695	9,115	—
Bechuanaland	50+	20,138	25,032	31,737	26,458	11,878
Congo, Republic of the (Léopoldville)	48+	425,694	420,671	348,595	348,527	297,660
Ethiopia (shipments)	51	1,455	10,202	7,716	6,614	—
Gabon, Republic of	50-52	—	—	—	224,038	712,381
Ghana (exports)[8]	48	577,694	600,261	431,282	513,622	434,410
Ivory Coast	48	—	80,748	137,825	117,928	153,291
Morocco	35-50	518,711	532,508	629,512	517,377	369,217
Rhodesia (formerly Southern)	30+	2,126	1,676	205	7,977	—
South Africa, Republic of	30+	1,069,202	1,316,732	1,562,729	1,614,599	1,441,503
South West Africa	45+	49,442	67,439	50,295	—	—
Sudan[3]	36-44	440	—	—	1,120	—
United Arab Republic (Egypt)[9]	57	67,318	22,046	2,272	42,577	23,798
Zambia	30+	60,297	59,299	58,517	51,501	38,856
Totals		**2,831,831**	**3,161,742**	**3,283,380**	**3,481,473**	**3,482,994**

See footnotes at end of table.

TABLE 40. World Production of Manganese Ore, by Countries[1] — Concluded

Country	Per cent Mn.	1959	1960	1961	1962	1963
		short tons[2]				
Oceania:						
Australia	45-48	100,768	67,923	97,901	80,244	40,548
Fiji	40+	14,566	13,073	3,869	1,202	3,621
New Caledonia	48+	—	—	—	—	—
New Hebrides	46	—	—	5,060	21,859	28,016
New Zealand	48+	114	134	—	—	—
Papua	—	—	54	2	—	4
Totals	...	**115,448**	**81,184**	**106,832**	**103,305**	**72,189**
World totals (estimate)[1]	...	**14,275,000**	**14,989,000**	**14,938,000**	**15,814,000**	**16,138,000**

[1] In addition to countries listed, Czechoslovakia and Sweden report production of manganese ore, but because the manganese content averages less than 30 per cent, the output is not included in this table. Sweden averages annually 11,000 tons and Czechoslovakia approximately 110,000 tons.
[2] This table incorporates a number of revisions of data published in previous Minerals Yearbook manganese chapters. Data do not add to totals shown due to rounding where estimated figures are included in the detail.
[3] Estimate.
[4] Exports.
[5] United States imports.
[6] Grade unstated. Source: The Industry of the U.S.S.R. Central Statistical Administration.
[7] Year ending March 20 of year following that stated.
[8] Dry weight.
[9] In addition to high-grade ore shown in the table, Egypt produced the following tonnages of less than 30 per cent manganese content: 1959, 72,752; 1960, 282,191; 1961, 304,663; 1962, 162,102; 1963, 160,673.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

MERCURY

There was no production in 1963 but in 1955 a small quantity of mercury was produced in the Bridge River district of British Columbia. Previous production had been prior to September, 1944. 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.

The New York price quotations on mercury during 1963 were $187 per flask of 76 pounds in January: $185 in April: $183 in July and $222 in December.

TABLE 41. Production of Mercury, 1940-63

Year	Pounds	Value	Year	Pounds	Value
		$			$
1940	153,830	369,317	1944	735,908	1,210,375
1941	536,304	1,335,697	1945-54	—	—
1942	1,035,914	2,943,807	1955	75	250
1943	1,690,240	4,559,200	1956-63	—	—

TABLE 42. Production of Mercury, Consumption, Imports and Exports, 1954-63

Year	Production	Consumption	Imports	Exports
	pounds			
1954	—	193,894	244,783	6,310
1955	75	416,632	555,526	3,781
1956	—	212,800	450,006	5,953
1957	—	215,300	400,710	1,425
1958	—	151,021	197,073	2,830
1959	—	161,987	141,219	10,458
1960	—	139,627	243,091	1,918
1961	—	150,588	312,913	..
1962	—	135,291	245,059	..
1963	—	147,396	447,592	..

TABLE 43. Imports of Mercury, from Countries of Supply, 1962 and 1963

From	1962		1963	
	Pounds	Value	Pounds	Value
		$		$
Mercury metal				
Italy	—	—	131,125	311,479
United Kingdom	200	639	2,382	6,253
China (Communist)	7,590	17,230	37,988	84,123
Mexico	144,481	184,592	7,642	16,524
Netherlands	72	223	7,600	19,096
Yugoslavia	40,770	93,557	22,800	50,262
Spain	39,586	89,382	231,153	515,215
United States	8,560	24,404	6,902	19,313
Hong Kong	3,800	7,900	—	—
Totals	**245,059**	**417,927**	**447,592**	**1,022,265**
Mercury salts				
United Kingdom	...	1,719	...	4,532
United States	...	2,119	...	3,290
Germany West	—	—	...	1,259
France	—	—	...	443
Totals	...	**3,838**	...	**9,521**

TABLE 44. Consumption of Mercury, by Principal Uses, 1959-63

Industry	1959	1960	1961	1962	1963
	pounds				
Pharmaceuticals and fine chemicals	10,319	11,888	18,258	5,806	15,652
Heavy chemicals	116,011	86,649	96,362	104,189	124,528
Electrical apparatus	4,211	2,962	3,129	4,405	3,603
Gold mines[1]	3,628	4,904	4,086	3,738	3,050
Miscellaneous [1]	27,818	33,224	28,753	17,153	563
Total accounted for	**161,987**	**139,627**	**150,588**	**135,291**	**147,396**

[1] Estimated.

TABLE 45. World Production of Mercury, by Countries[1]

Country	1959	1960	1961	1962	1963
	flasks of (76 pounds) 34.5 kilograms				
North America:					
Mexico	16,420	20,114	18,101	18,855	16,302
United States	31,256	33,223	31,662	26,277	19,117
South America:					
Chile	2,007	2,876	1,509	791	613
Colombia	95	149	191	—	3
Peru	2,526	3,034	3,001	3,483	3,086
Europe:					
Austria	—	—	—	—	—
Czechoslovakia[3]	725	725	725	725	725
Italy	45,833	55,492	55,434	54,535	54,535
Rumania	387	413	350	222	194
Spain	51,680	53,369	51,202	52,798	56,954
U.S.S.R.[2]	25,000	25,000	25,000	35,000	35,000
Yugoslavia	13,344	14,069	15,954	16,273	15,838
Asia:					
China[2]	23,000	23,000	26,000	26,000	26,000
Japan	5,988	5,791	5,437	4,199	4,668
Philippines	3,539	3,041	3,167	2,767	2,651
Turkey	1,479	1,339	1,864	2,687	3,042
Africa:					
Tunisia	198	166	54	—	—
World totals[2]	**223,000**	**242,000**	**240,000**	**245,000**	**239,000**

[1] This table incorporates some revisions. Data do not add exactly to totals shown because of rounding where estimated figures are included in the detail.
[2] Estimate.
[3] Estimate according to the 49 Annual issue of Metal Statistics. (Metallgesellschaft), except Czechoslovakia 1964.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

MOLYBDENUM

The principal producer in Canada was the Molybdenite Corporation of Canada Limited at Lacorne, Quebec. The ore is molybdenum disulphide containing some bismuth minerals which are recovered as by-products. The roasting plant at Lacorne produces molybdic oxide. The firm also produces lubricant-grade molybdenum disulphide. Molybdenum concentrates were by-products in the treatment of the ores at Gaspé Copper Mines Limited.

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 added.

Molybdenum alloys are used widely for the hard-wearing and other important parts of aeroplanes. They are used in the automobile industry, 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 46. Producers' Shipments of Molybdenum, 1954-63

Year	Ores, concentrates, sulphides and oxides, shipped[1] or used		Molybdenum content of shipments
	tons	$	pounds
1954	411	457,912	451,450
1955	762	823,954	833,506
1956	705	955,828	842,263
1957	633	1,166,557	783,739
1958	744	1,152,838	888,264
1959	658	748,566	940,596
1960	649	1,015,380	767,621
1961	640	1,092,201	771,358
1962	675	1,261,451	817,705
1963	722	1,344,004	833,867

[1] Shipped from stockpile.

TABLE 47. World Production of Molybdenum in Ores and Concentrates, by Countries[1]

Country	1959	1960	1961	1962	1963
	thousands of pounds				
Australia	[3]	—	2	2	—
Canada	749	768	771	818	834
Chile	5,064	4,083	4,037	5,256	6,400
China[2]	3,300	3,300	3,300	3,300	3,300
Japan	842	840	807	825	732
Korea, Republic of	49	97	71	163	154
Mexico	57	132	7	128	90
Norway	498	542	531	575	443
Peru	—	—	937[4]	11	1,175
Philippines	97	62	249	249	236
Portugal	—	—	—	—	—
South Africa, Republic of	—	—	—	—	—
U.S.S.R.[2]	9,900	11,000	11,900	12,500	12,500
United States	50,956	68,237	66,563	51,244	65,011
Yugoslavia	[2]	—	—	—	—
World totals (estimate)[1]	**71,500**	**89,100**	**89,200**	**75,100**	**90,900**

[1] Small quantities of molybdenum were also produced in Australia, Austria, Portugal, Republic of South Africa and Yugoslavia during the 1955-59 period; and in Australia in 1961-63.
[2] Estimate.
[3] Less than ½ unit.
[4] Exports.

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, and Gaspé, 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 produced 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. 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 stop lights. 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 in December 1963 was $4.50 per pound for commercial grade to $6.00 per pound for high purity grade.

TABLE 48. Production[1] of Selenium, 1954-63

Year	Pounds	Value	Year	Pounds	Value
		$			$
1954	323,529	1,617,645	1959	368,107	2,576,749
1955	427,109	3,203,319	1960	521,638	3,651,466
1956	330,389	4,460,252	1961	430,612	2,798,978
1957	321,392	3,535,312	1962	487,066	2,800,630
1958	306,990	2,302,426	1963	468,772	2,273,545

[1] Includes some recoverable selenium in blister copper not necessarily recovered in the designated year.

TABLE 49. Refinery Output of Selenium from Primary and Scrap Materials, 1954-63

Year	Pounds	Year	Pounds
1954	297,479	1959	372,410
1955	422,588	1960	524,659
1956	355,024	1961	422,955
1957	332,011	1962	466,654
1958	342,141	1963	462,385

TABLE 50. Exports of Selenium and Selenium salts, 1962 and 1963

Destination	1962		1963	
	Pounds	Value	Pounds	Value
		$		$
United Kingdom	161,100	1,009,056	189,900	1,063,058
South Africa, Republic of	–	–	2,900	17,048
Australia	1,200	8,442	–	–
Argentina	3,100	16,949	2,100	11,325
Brazil	5,200	30,924	3,600	16,831
France	3,200	23,420	7,100	47,497
Italy	1,600	11,300	700	4,663
United States	142,300	889,740	230,200	1,216,210
India	1,700	7,364	600	2,692
Spain	1,700	11,294	1,700	9,649
Philippines	700	3,603	–	–
Chile	300	1,849	–	–
Germany, West	200	715	300	1,075
Switzerland	200	1,111	–	–
Israel	100	287	200	863
New Zealand	1,100	5,943	1,200	5,722
Colombia	700	3,969	3,800	18,682
Venezuela	1,200	8,012	1,400	6,432
Totals	**325,600**	**2,033,978**	**445,700**	**2,421,738**

TABLE 51. World Production of Selenium, by Countries[1]

Country	1959	1960	1961	1962	1963
	pounds				
North America:					
Canada	368,107	521,638	430,612	487,066	468,772
Mexico	8,891	6,944	5,642	6,953	6,336
United States	728,000	539,000	1,022,000	999,000	928,000
South America:					
Peru	8,155	10,681	16,305	18,382	19,790
Europe:					
Belgium-Luxembourg (exports)	124,560	72,531	51,808	29,542	54,013
Finland	13,196	11,358	13,296	11,797	15,417
Sweden	133,158	176,809	213,846	154,322	198,400
Asia: Japan	229,486	278,234	300,262	309,314	313,494
Africa: Zambia	33,448	50,119	38,292	40,526	62,891
Oceania: Australia	3,000[2]	3,500[2]	3,000[2]	3,500[2]	3,500[2]
World totals[1]	**1,650,000**	**1,671,000**	**2,095,000**	**2,060,000**	**2,071,000**

[1] This table incorporates a number of revisions of data published in previous chapters. Data do not add to exact total shown because of rounding.
[2] Estimate.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

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. The development of thermoelectric devices for refrigeration has brought an increased demand for tellurium and the price of the metal has risen from $1.75 per pound to $6.00 per pound.

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, and Gaspé, 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 $6.00 a pound in New York in December, 1963.

TABLE 52. Production[1] of Tellurium, 1954-63

Year	Pounds	Value	Year	Pounds	Value
		$			$
1954	8,171	14,300	1959	13,023	27,999
1955	9,014	15,774	1960	44,682	156,388
1956	7,867	13,767	1961	77,609	376,404
1957	31,524	55,167	1962	58,725	352,350
1958	38,250	65,025	1963	76,842	499,473

[1] Includes some recoverable tellurium in blister copper, which was not necessarily recovered in the designated year.

TABLE 53. Refinery Output of Tellurium, 1954-63

Year	Pounds	Year	Pounds
1954	7,990	1959	8,900
1955	6,516	1960	41,756
1956	15,915	1961	81,050
1957	34,895	1962	57,630
1958	42,337	1963	79,640

TABLE 54. Consumption of Tellurium in Canada, 1960-63

Year	Tellurium content
	pounds
1960	4,238
1961	4,843
1962	4,306
1963	1,853

TABLE 55. World Production of Tellurium by Countries[1]

Country	1959	1960	1961	1962	1963
	pounds				
North America:					
Canada	13,023	44,682	77,609	58,725	76,842
United States	177,000	271,000	205,000	264,000	201,000
South America: Peru	62,600	59,343	76,279	50,472	26,634
Asia: Japan	2,761	13,671	16,486	23,168	13,256
World Totals	**255,400**	**388,700**	**375,400**	**396,400**	**317,700**

[1] This table incorporates a number of revisions of data published in previous tellurium chapters. Data do not add to exact world total shown because of rounding.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

THALLIUM

No production was reported in 1963 but in 1955 there were 275 pounds of thallium contained in the compounds shipped, which were valued at $378. This was the first shipment since 1944 when 128 pounds valued at $1,690 were contained in residues produced by Hudson Bay Mining and Smelting Company, 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 $7.50 per pound nominal, December, 1963.

THORIUM

Thorium oxide and other thorium salts were produced at Elliot Lake, Ontario by Rio Tinto Dow Limited. The waste liquor from the uranium plant is treated to recover the thorium contents. Calcined thorium oxide was shipped to Dominion Magnesium Limited for further processing. Thorium salts were exported for treatment. Data on the quantity and value of production are not available for publication.

TIN

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 1963 most of the tin concentrates were exported for treatment. Some tin was recovered as a lead-tin alloy during the processing of indium residues at the Canadian plant. Exploration work was done by Mount Pleasant Mines Limited on a tin-molybdenum, tungsten-copper-zinc prospect in Charlotte County, New Brunswick.

The New York quotations showed the monthly average price for tin was: January, $1.11 April, $1.13 July, $1.15 October, $1.20 December, $1.30 per pound.

TABLE 56. Production of Tin,[1] 1954-63

Year	Pounds	Value	Year	Pounds	Value
		$			$
1954	333,788	263,359	1959	747,443	630,094
1955	492,781	408,030	1960	621,718	522,243
1956	756,934	670,441	1961	1,119,350	727,578
1957	709,102	580,342	1962	650,941	442,640
1958	795,496	625,260	1963	927,062	648,943

[1] Tin content of concentrates and lead-tin alloy.

TABLE 57. Production of New Tin, Domestic Consumption and Imports, 1954-63

Year	Production	Domestic consumption	Imports
	tons (2,000 pounds)		
1954	167[1]	4,036	4,296
1955	246[1]	4,500	4,836
1956	378[1]	4,575	4,227
1957	355[1]	4,057	4,654
1958	398[1]	3,688	3,876
1959	374[1]	4,729	4,685
1960	311[1]	4,346	4,220
1961	560[1]	4,428	3,948
1962	325[1]	5,048	2,547
1963	464[1]	4,942	4,696

[1] Tin content of concentrates and lead-tin alloy.

TABLE 58. Imports of Tin, from Countries of Supply, 1962 and 1963

Country	1962		1963	
	Tons	Value	Tons	Value
		$		$
Tin blocks, pigs or bars				
United Kingdom	207	522,218	617	1,516,814
Malaya	1,670	4,029,800	3,410	8,522,998
Belgium-Luxembourg	427	1,041,455	246	584,412
Nigeria	—	—	62	164,256
United States	187	467,977	356	883,548
Bolivia	56	142,258	5	13,025
Totals	**2,547**	**6,203,708**	**4,696**	**11,685,053**
Tinfoil	pounds			
United States	13,633	18,567	12,628	19,342
Totals	**13,633**	**18,567**	**12,628**	**19,342**
Babbitt metal				
United Kingdom	1,200	1,186	1,100	1,190
United States	38,600	35,495	19,300	19,901
Totals	**39,800**	**36,681**	**20,400**	**21,091**

TABLE 59. Consumption of Tin (Ingots or Bars), 1962 and 1963

Used in production of	1962	1963
	tons (2,000 pounds)	
Babbitt	214	223
Bronze	232	197
Galvanizing	8	5
Solder	1,276	1,366
Tin plate and tinning	2,756	2,581
Other used (collapsible tubes, foil, etc.)	562	570
Total accounted for	**5,048**	**4,942**

TABLE 60. World Mine Production of Tin (Content of Ore), by Countries[1]

Country	1959	1960	1961	1962	1963
	long tons				
North America:					
Canada	334	278	500	291	414
Mexico	378	372	530	576	1,055
United States	50	10	[2]	[2]	[2]
Totals	**762**	**660**	[2]	[2]	[2]
South America:					
Argentina	225	238	515	231	220
Bolivia (exports)	23,811	19,407	20,408	21,492	22,752
Brazil[3]	567	1,556	582	731	1,150
Peru (recoverable)	43	6	14	11	22
Totals	**24,446**	**21,207**	**21,519**	**22,665**	**24,144**
Europe:					
Czechoslovakia[4]	200	200	200	200	200
France	—	21	156	319	276
Germany, East[5]	720	720	720	720	720
Portugal[5]	1,129	772	729	679	718
Spain	326	196	230	231	158
U.S.S.R.[6,7]	15,000	16,000	17,000	17,000	20,000
United Kingdom	1,252	1,199	1,210	1,181	1,226
Totals[3,7]	**18,600**	**19,100**	**20,200**	**20,300**	**23,400**
Asia:					
Burma[5]	1,200	1,200	1,130	1,041	1,000
China[6]	26,000	28,000	30,000	28,000	28,000
Indonesia	21,613	22,596	18,574	17,310	12,947
Japan	998	842	853	859	857
Laos	294	397	335	367	326
Malaysia	37,525	51,979	56,028	58,603	59,947
Thailand	9,684	12,080	13,270	14,679	15,587
Totals[3,7]	**97,300**	**117,100**	**120,200**	**120,900**	**118,700**
Africa:					
Cameroon, Republic of	62	65	65	23	30
Congo, Republic of the (Léopoldville)	9,194	8,636	6,314	6,875	6,883
Congo, Republic of (Brazzaville)	32	34	46	46	43
Morocco	9	10	11	10	10
Niger, Republic of	57	53	47	41	54
Nigeria	5,541	7,675	7,779	8,210	8,723
Rhodesia (formerly Southern)	605	642	716	705	498
Rwanda	1,124	1,277	1,474	1,400	1,271
South Africa, Republic of	1,273	1,276	1,430	1,408	1,530
South-West Africa	4	261	302	369	443
Swaziland	5	6	5	5	3
Tanzania (exports)	65	138	163	206	236
Uganda	36	32	33	69	163
Zambia	—	—	1	5	1
Totals	**18,007**	**20,105**	**18,386**	**19,372**	**19,888**
Oceania:					
Australia	2,351	2,202	2,745	2,715	2,852
World totals (estimate)	**161,500**	**180,400**	**184,100**	**186,600**	**190,400**

[1] This table incorporates some revisions of data published in previous tin chapters. Data do not add to totals shown due to rounding where estimated figures are included in the detail.

[2] Figure withheld to avoid disclosing individual company confidential data: included in world total.

[3] Estimated by authors of the chapter to appear in "Minerals Yearbook", and in a few instances, from the Statistical Bulletin of the International Tin Council, London, England.

[4] Estimate, according to 50th annual issue of Metal Statistics (Metallgesellschaft) through 1963.

[5] Includes tin content of mixed concentrates.

[6] Estimated smelter production.

[7] Output from U.S.S.R. in Asia included with U.S.S.R. in Europe.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

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 thence by boat to the smelter at Sorel, Quebec. There the ore was treated to produce iron (remelt) and slag.

The smelter slag, having a titanium dioxide content of about 72 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 Smelting and Refining Industry.

For several years titanium-bearing ores have been shipped from the Baie 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. Ferrotitanium and ferrocarbon-titanium are used under special circumstances to purify steel. It is all imported from the United States.

Prices (nominal) f.o.b. U.S. Atlantic ports at the end of 1963 were: Ilmenite, 59.5% TiO_2, $23 to $26 per gross ton. The nominal quotation for titanium metal, 99.3 per cent, was $1.32 per pound.

TABLE 61. Producers' Shipments of Titanium Ore to Outside Customers, 1952-63

Year	Short tons	Value	Year	Short tons	Value
		$			$
1952	51	459	1957	10,770	97,075
1953	9,292	80,085	1958	–	–
1954	1,541	9,462	1959	26,777	129,565
1955	1,464	10,634	1960	2,947	16,265
1956	2,310	16,561	1961-63	–	–

TABLE 62. Imports of Titanium Oxide and Titanium Dioxide extended, 1959-63

Year	From the United Kingdom		From the United States		Total imports	
	Pounds	Value	Pounds	Value	Pounds	Value
		$		$		$
1959	23,793,207	4,958,593	35,363,989	3,545,123	61,195,519	8,877,007
1960	19,350,694	4,052,615	33,348,008	3,386,029	53,792,895	7,648,278
1961	20,763,628	4,460,194	31,849,083	3,503,991	52,612,711	7,964,185
1962	23,557,187	5,263,425	26,285,469	2,819,218	49,887,795	8,090,102
1963	3,790,080	811,924	21,582,476	2,580,125	25,372,556	3,392,049

TABLE 63. Consumption of Titanium Oxide, by Industries, 1961-63

Industry	1961		1962		1963	
	Pounds	Cost at works	Pounds	Cost at works	Pounds	Cost at works
		$		$		$
Paints:						
Extended titanium dioxide pigments	26,207,395	2,953,377	21,869,760	2,513,447	17,176,191	1,904,951
Titanium dioxide	34,582,672	8,692,323	36,586,830	9,149,571	41,178,857	10,514,304
Miscellaneous chemicals	...	...	...	...	...	...
Pulp and paper	4,888,742	1,187,788	6,536,557	1,553,825	7,290,281	1,589,736
Linoleum coated fabrics industry	4,655,561[1]	1,110,929[1]	5,215,182	1,255,049	4,361,506	1,054,909
Rubber goods	1,869,110	465,436	1,901,147	483,422	1,943,543	496,173
Miscellaneous non-metallic minerals	1,143,366	305,912	1,208,697	304,415	1,569,556	358,602
Toilet preparations	48,937	15,199	57,010	18,210	41,835	16,098
Industrial chemicals	46,457	11,990	165,392	40,983	317,738	81,319
Synthetic textiles	64,650	19,875	..	..	79,640	25,649
Other chemical industries, n.e.s.	689,561	165,724	886,884	211,445	1,000,843	225,140
Totals accounted for	**74,196,451**	**14,928,553**	**74,427,459**	**15,530,367**	**74,959,990**	**16,266,881**

[1] Includes "Asphalt Roofing Manufacturers".

TABLE 64. World Production of Titanium Concentrates (Ilmenite and Rutile), by Countries[1,2]

Country	1959	1960	1961	1962	1963
	short tons[1,2]				
Ilmenite					
Australia (shipments)	93,606	119,377	186,369	201,034	227,834
Canada[3]	270,477	389,586	463,361	301,448	379,320
Ceylon	—	7,000	11,199	4,652	21,041
Finland	94,966	92,219	21,272	96,110	103,461
Gambia	14,553	—	—	—	—
India	334,024	275,303	192,018	152,241	28,619
Japan (titanium slag)	3,445	1,444	1,774	578	963
Malagasy Republic (Madagascar)	659	3,008	3,640	3,510	4,027
Malaysia (exports)	81,593	132,255	119,694	113,855	164,656
Mexico	—	—	—	—	155
Moxambique	11,400	784	—	—	—
Norway	250,206	258,542	342,723	276,788	267,090
Portugal	2,113	1,002	109	75	45
Senegal	32,941	24,159	19,286	24,727	13,436
South Africa, Republic of	87,233	90,432	99,010	87,096	31,039
Spain	8,113	12,267	33,184	45,935	55,745
Thailand	550	—	—	—	—
United Arab Republic (Egypt)	17,100	13,228	38,004	49,210	596
United States[5]	634,886	786,372	782,412	807,725	888,400
World totals ilmenite (estimate)[1,2]	**1,937,900**	**2,207,000**	**2,314,100**	**2,165,000**	**2,186,400**
Rutile					
Australia	91,734	99,274	113,603	133,499	205,725
Brazil	231	238	245	144	359
Cameroon, Republic of	—	—	—	—	—
India	429	1,082	898	1,781	2,062
Norway	—	—	—	—	—
Senegal	—	—	195	811	780
South Africa, Republic of	3,381	3,695	3,483	3,575	1,385
United Arab Republic (Egypt)	1,157	1,100[4]	1,100[4]	198	4
United States	9,466	8,808	9,045	9,981	11,915
World totals rutile (estimate)[1,2]	**106,400**	**114,200**	**128,600**	**150,000**	**222,200**

[1] In addition to the countries listed titanium concentrates are produced in U.S.S.R., and Brazil produces ilmenite but no reliable information is available; no estimates are included in the total.
[2] This table incorporates some revisions. Data do not add exactly to totals shown because of rounding where estimated figures are included in the detail.
[3] Represents Ti. slag containing approximately 70 per cent TiO_2 and small quantities of "titanium ore".
[4] Estimate.
[5] Includes a mixed product containing ilmenite, leucoxene and rutile.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

TABLE 65. Consumption of Ferrotitanium in the Manufacture of Steel, 1954-63

Year	Tons	Value	Year	Tons	Value
		$			$
1954	171	50,166	1959	252	84,683
1955	156	48,074	1960	418	207,489
1956	277	84,393	1961	236	109,615
1957	252	82,258	1962	123	78,613
1958	210	76,689	1963	90	96,000

TUNGSTEN

Tungsten concentrates were not produced in 1961. Mining of tungsten ores in British Columbia ceased in 1958. Tungsten bearing deposits occur in British Columbia, Yukon, North-west Territories, Ontario and New Brunswick.

As an alloying metal in steel, tungsten (usually as ferrotungsten, but sometimes as calcium tungstate 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.

The E. & M. Journal price quotations for tungsten ore in December 1963 were: Per short ton unit of WO_3 concentrates of known good analysis, basis 65%: Foreign ore per stu of WO_3 nearby arrival, c.i.f. U.S. ports duty extra: Wolfram $12.75 to $13.25 scheelite $12.75 to $13.25 U.S. mined tungsten concentrate, $18 per stu f.o.b. milling point, subject to penalties.

TABLE 66. Production (Commercial Shipments) of Tungsten Concentrate, 1954-63

Year	Concentrate	WO_3 content	Value
	pounds		$
1954	3,237,748	2,170,633	5,795,781
1955	3,255,100	1,942,770	5,508,437
1956	3,401,712	2,271,437	6,351,376
1957	2,994,000	1,921,483	5,279,275
1958	1,022,000	690,976	1,898,455
1959-61	—	—	—
1962	..	3,580	1,611
1963	..	1,224,305	683,814

TABLE 67. Imports of Tungsten Ores, from Countries of Supply, 1962 and 1963

Country	1962		1963	
	Pounds	Value	Pounds	Value
		$		$
Portugal	22,000	9,084	—	—
Bolivia	191,900	75,432	—	—
Korea	80,000	31,239	443,400	129,814
Peru	132,800	60,403	—	—
China (communist)	51,000	31,050	—	—
United States	60,000	37,315	2,100	1,604
Argentina	2,316,600	613,874	200,000	63,139
Totals	**2,854,300**	**858,397**	**645,500**	**194,577**

TABLE 68. World Production of Tungsten Ores, by Countries,[1] of Concentrates Containing 60 per WO_3

Country	1959	1960	1961	1962	1963
	short tons				
North America:					
Canada	—	—	—	3	—
Mexico	138	203	193	88	36
United States (shipments)	3,649	7,325	8,245	8,429	5,657
Totals	**3,787**	**7,528**	**8,438**	**8,520**	**5,693**
South America:					
Argentina	827	893	892	635	159
Bolivia (exports)	2,671	2,370	3,104	2,798	2,513
Brazil	2,302	1,867	1,361	1,368	612
Peru	542	538	428	435	572
Totals	**6,342**	**5,668**	**5,785**	**5,236**	**3,856**
Europe:					
Austria	152	243	317	320	246
Finland	42	—	58	—	—
France	959	753	806	757	772
Italy	6	8	3	1	2
Portugal	2,478	3,215	3,274	2,754	1,784
Spain	854	1,030	1,192	777	162
Sweden	268	311	345	295	380
U.S.S.R.[2]	9,900	10,500	11,000	11,600	12,100
United Kingdom	—	—	—	—	—
Yugoslavia	86	86	9	57	19
Totals[2]	**14,750**	**16,100**	**17,000**	**16,600**	**15,500**
Asia:					
Burma[3]	1,269	1,041	1,102	882	827
China[2]	22,500	24,900	24,900	24,900	24,900
Hong Kong	47	39	20	18	9
India	1	3	11	12	6
Japan	1,194	1,082	1,033	1,160	856
Korea: North[2]	4,400	5,500	5,500	4,400	4,400
Republic of	3,760	6,321	8,107	8,219	6,092
Malaysia	24	46	41	11	8
Thailand	553	487	568	471	228
Totals[2]	**33,750**	**39,400**	**41,300**	**40,100**	**37,300**
Africa:					
Congo, Republic of the (Léopoldville)[3]	1,038	634	595	406	223
Rhodesia (formerly Southern)	36	11	55	24	3
Rwanda	171	504	734	165	14
South Africa, Republic of	42	37	30	28	9
South-West Africa[3]	2	154	190	171	239
Tanganyika (exports)	—	—	—	—	—
Uganda (exports)	14	84	243	105	—
United Arab Republic (Egypt)	—	—	91	—	—
Totals	**1,303**	**1,424**	**1,938**	**899**	**488**
Oceania:					
Australia	1,218	2,075	2,866	1,946	1,793
New Zealand	11	10	6	10	6
Totals	**1,229**	**2,085**	**2,872**	**1,956**	**1,799**
World totals (estimate)	**61,200**	**72,200**	**77,300**	**73,300**	**64,600**

[1] This table incorporates some revisions. Data do not add exactly to totals shown because of rounding where estimated figures are included in the detail.
[2] Estimate.
[3] Including WO_3 in tin-tungsten concentrates.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

URANIUM

In 1963 the output of uranium precipitates from the mines in Ontario were valued at $102,951,146 The Beaverlodge area in Saskatchewan shipped $33,957,973 worth of U_3O_8. The mines in the Northwest Territories ceased production in 1960.

Detailed technical data on the uranium industry appears in "Uranium in Canada 1960" Review 26 issued by the Department of Mines and Technical Surveys, Ottawa.

The data for 1941-53 are restricted. The figures for 1954 and 1955 are the value of the products of the refinery at Port Hope, Ontario. The value of the U_3O_8 contained in the precipitates or concentrates shipped from the mines is shown in 1956-63.

TABLE 69. Producers' Shipments[1] of Uranium, Radium, etc., 1941-63

Year	U_3O_8	Value	Year	U_3O_8	Value
	pounds	$		pounds	$
1941-53	...	..	1959	31,784,189	331,143,043
1954	...	26,373,052	1960	25,495,369	269,938,192
1955	...	26,031,604	1961	19,281,465	195,691,624
1956	4,581,060	45,732,145	1962	16,859,169	158,183,669
1957	13,271,414	136,304,364	1963	12,770,421	102,951,146
1958	26,805,232	279,538,471			

[1] Compilation method is shown in text above.

TABLE 70. World Production of Uranium Oxide U_3O_8, by Countries[1,2,3]

Country	1959	1960	1961	1962	1963
	short tons[3]				
North America:					
Canada	15,892	12,748	9,641	8,430	8,141
United States	16,420[4]	17,760[4]	17,399[4]	17,010	14,218
South America:					
Argentina[5]	13	7	5	4	11
Europe:					
Finland[5]	—	40	20	—	—
France[6]	950	1,379	2,078	2,061	2,021
Spain[5]	—	60	55	55	55
Sweden[5]	10	10	10	10	10
Africa:					
Congo, Republic of the (Léopoldville)	2,300	1,200	—	—	—
Rhodesia and Nyasaland, Federation of	38	—	—	—	—
South Africa, Republic of	6,445	6,409	5,468	5,024	4,532
Oceania:					
Australia[5]	1,100	1,300	1,600	1,400	1,200
World totals (estimate)[1,2]	**43,350**	**41,130**	**36,490**	**34,600**	**30,200**

[1] In addition to the countries listed, uranium is also known to have been produced in Colombia, India, Italy, Japan, West Germany and Portugal, but production data are not available. An estimate for these countries has been included in the world total.

[2] Uranium is also believed to be produced in Czechoslovakia, East Germany, Hungary and U.S.S.R. but production data are not available; for these countries no estimate has been included in the world total. Extimates of production for these countries range from 10,000 to 20,000 tons per year.

[3] This table incorporates some revisions. Data do not add to exact total shown because of rounding where estimated figures are included in the detail.

[4] Data represent deliveries to A.E.C. Includes uranium production from phosphate rock in eastern United States.

[5] Estimate.

[6] Malagasy and Gabon included with France.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

TABLE 71. Exports of Uranium Ores and Concentrates, 1961-63

Destination	1961	1962	1963
	dollars		
United Kingdom	18,255,934	16,597,910	40,509,263
Germany, West	512,658	206,032	–
Japan	39,733	39,689	130,000
United States	173,914,072	149,165,248	96,879,093
Brazil	–	–	13,025
Totals	**192,722,397**	**166,008,879**	**137,531,381**

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, 1963 at 31 cents per pound, (V_2O_5 content) f.o.b. shipping point, by "E & M J Metal and Mineral Markets" New York. Vanadium metal was quoted at $3.45 per pound.

TABLE 72. World Production of Vanadium in Ores and Concentrates

Country	1959	1960	1961	1962	1963
	short tons[1]				
North America:					
United States (recoverable vanadium)	3,719	4,971	5,343	5,211	3,853
South America:					
Argentina	4	[2]	4[3]	9	6
Europe:					
Finland	556	625	701	629	771
Africa:					
Angola	3	–	–	–	–
South Africa, Republic of	320	656	1,423	1,393	1,391
South-West Africa (recoverable vanadium)	719	838	1,145	1,019	1,134
Zambia	–	146	112	3	–
World totals (estimate)[1]	**5,321**	**7,236**	**8,728**	**8,264**	**7,155**

[1] This table incorporates some revisions.
[2] Data not available.
[3] Estimate.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

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

Prices quoted in December, 1963 were: zircon ore, 65 per cent ZrO_2, $48 to $50 per long ton, at Atlantic seaboard; zirconium sponge, $5 to $10 per pound for commercial grade.

TABLE 73. World Production of Zirconium Ores and Concentrates, by Countries[1]

Country	1959	1960	1961	1962	1963
	short tons				
Australia	125,834	114,645	152,836	149,904	205,970
Brazil[2]	10,846	6,358	7,405	2,642	392
India	10[3]	10[3]	10[3]	[4]	[4]
Malagasy Republic	50	375	353	390	428
Malaysia	130	63	63[5]	67[5]	227
Nigeria	1,250	1,968	833	545[6]	886
Senegal	9,557	11,408	5,939	2,575	3,383
South Africa, Republic of	5,924	7,366	7,607	7,581	2,648
United Arab Republic (Egypt)	65[3]	408	105	188	44
United States	[7]	[7]	[7]	[7]	[7]

[1] This table incorporates some revisions.
[2] Chiefly baddeleyite.
[3] Estimate.
[4] Data not available.
[5] Exports.
[6] U.S. Imports.
[7] Figure withheld to avoid disclosing individual company confidential data.

Source: "Minerals Yearbook" published by the United States Bureau of Mines.

List of Operators of Miscellaneous Metal Mines, 1963

Name of firm and product	Head office address	Location of mine or plant
Aluminum:		
Aluminium Company of Canada Limited	1700 Sun Life Building, Montreal, Quebec	Arvida, Quebec; Shawinigan Falls, Quebec; Ile Maligne, Quebec; Beauharnois, Quebec; Kitimat, British Columbia
Canadian British Aluminum Co. Ltd.	Baie Comeau, Quebec	Baie Comeau, Quebec
Antimony:		
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Quebec	Trail, British Columbia
Barium:		
Dominion Magnesium Ltd.	Haley, Ontario	Haley, Ontario
Beryl:		
Canadian Beryllium Mines & Alloys Ltd.[1]	100 Adelaide St. W., Toronto, Ontario	Renfrew County; Ontario
Dalhart Beryllium Mines & Metals Corp.[1]	217 Bay St., Toronto, Ontario	Dalhart, Manitoba
Gill Mining Corp.[1]	4352 Beaubien Est., Montreal, Quebec	Temiscamingue, Quebec
Bismuth:		
Cobalt Refinery Ltd.	Cobalt, Ontario	Cobalt, Ontario
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Quebec	Trail, British Columbia
Gaspé Copper Mines Ltd.	44 King St. W., Toronto, Ontario	Murdockville, Quebec
Malybdenite Corp. of Canada Ltd.[4]	59 St. James St. W., Montreal, Quebec	LaCorne Twp, Quebec
Cadmium:		
East Sullivan Mines Ltd.	1403 Alfred Bldg., Montreal, Quebec	Bourlamaque, Quebec
Solbec Copper Mines Ltd.	507 Place d'Armes, Montreal, Quebec	Stratford Twp, Quebec
Sullico Mines Ltd.	507 Place d'Armes, Montreal, Quebec	Val d'Or, Quebec
Hudson Bay Mining & Smelting Co. Ltd.	500 Royal Bank Bldg., Winnipeg, Manitoba	Flin Flon, Manitoba
Canadian Exploration Ltd.	Royal Bank Bldg., Vancouver B.C.	Salmo, British Columbia
Consolidated Mining & Smelting Co. of Canada Ltd.	215 St. James St., Montreal, Quebec	Trail, British Columbia
Highland Bell Ltd.	789 W. Pender St., Vancouver, B.C.	Greenwood, British Columbia
Howe Sound Company, Britannia Division	500 Fith Ave., New York 36, U.S.A.	Britannia Beach, British Columbia
Mastodon Highland Bell Mines Ltd.	1200 West Pender St., Vancouver, B.C.	Revelstoke, British Columbia
New Cronin Babine Mines Ltd.	844 W. Hastings St., Vancouver, B.C.	Smithers, British Columbia
Rabbit Paw	New Denver, British Columbia	New Denver, British Columbia
Reeves Macdonald Mines Ltd.	413 Granville St., Vancouver, B.C.	Remac, British Columbia
Sheep Creek Gold Mines Ltd.	413 Granville St., Vancouver, British Columbia	Zincton, British Columbia
United Keno Hill Mines Ltd.	85 Richmond St. W., Toronto, Ontario	Elsa, Yukon
Calcium:		
Dominion Magnesium Ltd.	67 Yonge St. Toronto, Ontario	Haley, Ontario
Cerium:		
Atlin-Ruffner Mines (B.C.) Ltd.[1]	510 W. Hastings St., Vancouver, British Columbia	Parry Sound, Ontario
Chromite:		
Colonial Chrome Co. Ltd.[1]	420 Lexington Ave., New York, N.Y., U.S.A.	Black Lake, Quebec
Gunnar Gold Mines Ltd.[1]	80 King St., Toronto, Ontario	Bird River, Manitoba
Strannar Mines Ltd.[1]	25 Adelaide St. W., Toronto, Ontario	Lac du Bonnet, Manitoba
Columbium, Tantalum:		
Coulee Lead & Zinc Mines Ltd.[1]	55 Yonge St., Toronto, Ontario	Oka, Quebec
Headway Red Lake Gold Mines Ltd.[1]	55 Yonge St., Toronto, Ontario	Oka, Quebec
Main Oka Mining Corp.[1]	159, Ouest, rue Craig, Montrail, Quebec	Oka, Quebec
Manoka Minning & Smelting Co. Ltd.[1]	44 King, St. W., Toronto, Ontario	Oka, Quebec
Columbium Mining Products Ltd.[2,4]	55 Yonge St., Toronto, Ontario	Oka, Quebec
General Managers Inc.[2,4]	159 Ouest, rue Craig, Montreal, Quebec	Oka, Quebec
Quebec Columbium Ltd.[2,4]	630 Dorchester Blvd., Montreal, Quebec	L'Annonciation, Quebec
St. Lawrence Columbium & Metals Corp.[4]	159 Ouest, rue Craig, Montreal, Quebec	Oka, Quebec
Nova Beaucage Mines Ltd. [2,4]	170 Regina St. North Bay Ontario	Nipissing, Ontario
Germanium:		
Taiga Mines Ltd.[1]	837 W. Hastings St., Vancouver, B.C.	Powell River, B.C.
Indium:		
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Quebec	Trail, British Columbia
Manganese:		
Stratmat Ltd.[1]	620 Cathcart St., Montreal, Quebec	Woodstock, New Brunswick
Joburke Gold Mines Ltd.[1]	357 Bay St., Toronto, Ontario	Nastapoka Islands, N.W.T.
Magnesium:		
Dominion Magnesium Ltd.	67 Yonge St., Toronto, Ontario	Haley, Ontario
Mercury:		
Bralorne Mines Ltd.[1]	555 Burrard St., Vancouver, British Columbia	Omineca district, British Columbia
Consolidated Mining & Smelting Company of Canada Ltd.[1]	215 St. James St., Montreal, Quebec	Pinchi Lake, British Columbia

See footnotes at end of list.

List of Operators of Miscellaneous Metal Mines, 1963 — Continued

Name of firm and product	Head office address	Location of mine or plant
Molybdenum:		
Anglo-American Molybdenite Mining Corp.[2,4]	Box 577 Val D'Or, Quebec	Preissac Twp., Quebec
Copperstream-Frontenac Mines Ltd.[1]	266 Notre Dame Ouest, Montreal, Quebec	Frontenac County, Quebec
Gaspé Copper Mines Ltd.	44 King St. W., Toronto, Ontario	Murdochville, Quebec
Molybdenite Corp. of Can. Ltd.[4]	485 rue McGill, Montreal, Quebec	La Corne, Quebec
Portneuf Mineral Corp.[2,4]	437 St. James St. W., Montreal, Quebec	Portneuf, Quebec
Preissac Molybdenite Mines Ltd.[2,4]	485 McGill St., Montreal, Quebec	Preissac, Quebec
Provincial Molybdenum Corp. Ltd.[2]	132 Main St., Maniwaki, Quebec	Kinsington Twp., Quebec
Nortoba Mines Ltd.[2]	199 Bay St., Toronto, Ontario	Sturgeon River, Ontario
Endako Mines Ltd.[2,4]	1030 Georgia St., Vancouver 5, B.C.	Omineca, British Columbia
Gem Explorations Ltd.[2,4]	1272 W. Pender St. Vancouver, B.C.	New Westminster, B.C.
Huestis Molybdenum Corp. Ltd.[2,4]	402 W. Pender St., Vancouver, B.C.	Cariboo area, B.C.
Noranda Mines Ltd.[2,4]	1050 Davie St., Vancouver B.C.	Boss Mountain, B.C.
Torwest Resources Ltd.[2,4]	404-409 Gravelle St., Vancouver, B.C.	Endako, B.C.
Selenium-Tellurium:		
Canadian Copper Refiners Ltd.	1600 Royal Bank Building, Toronto, Ontario	Montreal East, Quebec
International Nickel Co. of Canada Ltd.	Copper Cliff, Ontario	Copper Cliff, Ontario
Thallium:		
Hudson Bay Mining & Smelting Co. Ltd.[2]	500 Royal Bank Building, Winnipeg, Manitoba	Flin Flon, Manitoba
Thorium:		
Dominion Magnesium Ltd.	67 Yonge St., Toronto, Ontario	Haley, Ontario
Rio Tinto-Dow Ltd.[4]	Box 190, Elliot Lake, Ontario	Elliot Lake, Ontario
Tin:		
Consolidated Mining & Smelting Company of Canada Ltd.	215 St. James St., Montreal, Quebec	Trail, British Columbia
Mount Pleasant Mines Ltd.[2,4]	30 The Driveway, Ottawa, Ontario	St. Andrews, New Brunswick
Titanium ore:		
Bersimis Mining Co.[2,4]	16 Blvd. des Capucins, Quebec	Saguenay Co., Quebec
Continental Titanium Corp.[4]	5165 Sherbrooke St. W., Montreal, Quebec	St. Urbain Co., Quebec
Laurentian Titanium Mines Ltd.[2]	4462 St. Denis St., Montreal, Quebec	Wexford Twp., Quebec
Les Mineraux Laurentiens Ltd.[1]	St. Joseph de Beauce, Quebec	St. Urbain Co., Quebec
Quebec Iron and Titanium Corp.[4]	Box 40, Sorel, Quebec	Parker Twp., Sorel, Quebec
Saguenay Exploration & Mining Inc.[1]	753 avenue Wilder, Outremont 8, Quebec	Jonquière, Quebec
Tungsten concentrates:		
Burnt Hill Tungsten and Metallurgical Ltd.[4]	510 McGill St., Montreal, Quebec	Gross Creek, New Brunswick
Piermond Mining Co. Ltd.[1]	12323 rue Notre Dame des Anges, Montreal	Risborough, Quebec
Canadian Exploration Ltd.[2]	Royal Bank Bldg., Vancouver, B.C.	Salmo, British Columbia
Consolidated Mining & Smelting Company of Canada Ltd.[1]	Trail, British Columbia	Kimberley, British Columbia
Taylor, F.[1]	Mayo, Yukon	Dublin Gulch, Yukon
Canada Tungsten Mining Corp. Ltd.[4]	12 Richmond St. E., Toronto, Ontario	Flat River, Northwest Territories
Uranium:		
New Brunswick:		
Aumacho River Mines Ltd.[1]	25 Adelaide St. W., Toronto, Ontario	Aumachó River, New Brunswick
New Brunswick Uranium Metals & Mining Ltd.[1]	80 Richmond St. W., Toronto, Ontario	Harvey, New Brunswick
Quebec:		
Calumet Uranium Mines Ltd.[1]	159 Ouest, rue Craig, Montreal	Isle Calumet
Consolidated Mogul Mines Ltd.[1]	25 Adelaide St. W., Toronto, Ontario	Figuery Twp.
Marlowe Mines Ltd.[1]	2157 Mackay St., Montreal	Pied des Monts
Molybdenum Corp. of America[1]	500 Fith Ave., New York, U.S.A.	Oka, Quebec
Quebec North Mines Ltd.[1]	2144 Mackay St., Montreal	Arrache Co.
Scandia Mining & Exploration Ltd.[2,5]	245 Beaconsfield Blvd., Beaconsfield, Que.	Mattagami
Ontario:		
Canadian Dyno Mines Ltd.[1]	25 Adelaide St. W., Toronto	Cardiff Twp.
Denison Mines Ltd.[5]	4 King St. W., Toronto	Quirke Lake
Duvex Oil & Mines Ltd.[1]	67 Yonge St., Toronto	Blind River
Faraday Uranium Mines Ltd.[5]	100 Adelaide St. W., Toronto	Bancroft
Lexindin Gold Mines Ltd.[1]	25 Adelaide St. W., Toronto	Blind River
Macassa Gold Mines Ltd. (Bicroft Division)[5]	85 Richmond St. W., Toronto	Bancroft
Milliken Lake Uranium Mines Ltd.[3,5]	335 Bay St., Toronto	Blind River
Northspan Uranium Mines Ltd.[3,5]	335 Bay St., Toronto	Elliot Lake
Pardee Amalgamated Mines Ltd.[3,5]	111 Richmond St., Toronto	Blind River
Pronto Uranium Mines Ltd.[3,5]	335 Bay St., Toronto	Long Twp.
Preston Mines Ltd.[1]	335 Bay St., Toronto	Elliot Lake
Rio Algom Mines Ltd.[5]	335 Bay St., Toronto	Elliot Lake, Quirke Lake
Stanrock Uranium Mines Ltd.[5]	15 Wellington St. W., Toronto	Elliot Lake
Zenmac Metal Mines[1]	200 Bay St., Toronto	Blind River

See footnotes at end of list.

List of Operators of Miscellaneous Metal Mines, 1963 – Concluded

Name of firm and product	Head office address	Location of mine or plant
Uranium – Concluded:		
Saskatchewan:		
Black Bay Uranium Ltd.[1,4]	Imperial Bank Bldg., Edmonton, Alta.	Athabaska
Baska Uranium Mines Ltd.[1]	2,108 Montagne St., Regina, Sask.	Beaverlodge
Cayzor Athabaska Mines Ltd.[1]	73 Adelaide St. W., Toronto, Ontario	Uranium City
Eldorado Mining & Refining Ltd.[5]	Box 379 Ottawa, Ontario	Beaverlodge
Gaitwin Explorations Ltd.[1]	25 Adelaide St. W., Toronto, Ontario	Milliken Lake
Gulch Mines Ltd.[1]	217 Bay St., Toronto, Ontario	Uranium City
Gunnar Mines Ltd.[5]	25 Adelaide St. W., Toronto, Ontario	Athabaska
Iso Mines Ltd.[1]	100 Adelaide St. W., Toronto, Ontario	Athabaska
Joburke Gold Mines[1]	357 Bay St., Toronto, Ontario	Beaverlodge
Lavant Mines Ltd.[1]	627 Bay St., Toronto, Ontario	Beaverlodge
Lorado Uranium Mines Ltd.[1]	25 Adelaide St. W., Toronto, Ontario	Uranium City
National Explorations Ltd.[1]	789 W. Pender St., Vancouver, B.C.	Athabaska
Nisto Mines Ltd.[1]	532 Burrard St., Vancouver, British Columbia	Black Lake
Pitch Ore Uranium Mines Ltd.[1]	200 Bay St., Toronto, Ontario	Beaverlodge
Radiore Uranium Mines Ltd.[1,5]	25 Adelaide St. W., Toronto, Ontario	Uranium City
Rix Athabaska Uranium Mines Ltd.[1]	335 Bay St., Toronto, Ontario	Uranium
British Columbia:		
Quebec Metallurgical Industries Ltd.[1]	88 Metcalfe St., Ottawa, Ontario	Golden
Rexspar Uranium & Metals Mining Co. Ltd.[2,5]	170 Bay St., Toronto, Ontario	Birch Island
Northwest Territories:		
Consolidated Northland Mines Ltd.[1]	25 Adelaide St. W., Toronto, Ontario	Marian River
Eldorado Mining & Refining Ltd.[2,5]	Box 379, Ottawa, Ontario	Port Radium, N.W.T.; Port Hope, Ontario
Rayrock Mines Ltd.[1]	25 Adelaide St. W., Toronto, Ontario	Sherman Lake
Zirconium:		
Dominion Magnesium Ltd.	67 Yonge St., Toronto, Ontario	Haley, Ontario

[1] Holds dormant property.
[2] Active but not producing.
[3] Amalgamated with Rio Algom Mines Ltd.
[4] Firms in this group refer to operators classified as establishments in Other Metal Mines, S.I.C.-059.
[5] Firms in this group refer to operators classified as establishments in Uranium Mines, 057 in accordance with the new S.I.C.

Note: Many of the metals listed above are by-products of firms classified to the Smelting and Refining industry. Columbium, molybdenum and tungsten mines are classified to S.I.C.-059 and uranium mines to S.I.C.-057.