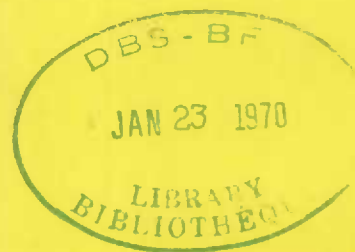


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ANNUAL

2



# MISCELLANEOUS NON-METAL MINES

1967

DOMINION BUREAU OF STATISTICS



DOMINION BUREAU OF STATISTICS  
Manufacturing and Primary Industries Division

MISCELLANEOUS NON-METAL MINES

1967

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### 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.

▸ preliminary figures.

⋆ revised figures.

x confidential to meet secrecy requirements of the Statistics Act.

# SUMMARY

Miscellaneous non-metal Mines are part of other non-metal mines--Industry 079 of the Standard Industrial Classification Manual, Catalogue No. 12-501.

Canadian operators which produce certain industrial or non-metallic minerals, and which are usually too few in number to permit the publication separately of complete details of operations,

have been classified for statistical purposes to a group which has been designated as the Miscellaneous Non-metal Mining Industry. Minerals or primary mineral products recovered by this industry during 1967 included barite, brucite, diatomite, fluorspar, gemstones, grindstones, iron oxides, magnesitic dolomite, lithis, potash, and sodium sulphate.

TABLE 1. Principal Statistics Miscellaneous Non-metal Mines, 1963-67

Year	Estab- lish- ments	Mining activity							Total activity				
		Production and related workers			Cost of fuel and elec- tricity	Cost of mate- rials and sup- plies	Value of pro- duction	Value added	Working owners and partners		Total employees		Total value added
		Number	Man- hours paid	Wages					Number	With- drawals	Number	Salaries and wages	
	No.		'000		\$'000					'000		\$'000	
1963 .....	15	988	2,152	4,464	2,550	4,338	36,809	29,920	x	x	1,311	6,735	29,936
1964 .....	17	1,139	2,459	5,453	3,425	6,249	47,838	38,165	x	x	1,567	7,979	38,260
1965 .....	17	1,498	3,284	7,837	5,210	10,320	75,072	59,542	—	—	2,052	11,523	59,699
1966 .....	14	1,530	3,330	8,798	5,274	10,587	77,291	61,430	—	—	2,054	12,581	61,179
1967 .....	15	1,979	4,095	11,922	6,449	14,368	85,085	64,268	—	—	2,620	16,976	64,573

TABLE 2. Employment and Payroll, Miscellaneous Non-metal Mines, 1963-67

Year	Employees										Salaries and Wages				
	Production and related workers		Other		Adminis- trative and office		Sales and distribution		Total		Pro- duction and related workers	Other	Admin- istrative and office	Sales and distrib- ution	Total
	Mining														
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Mining				
	number										\$'000				
1963 .....	986	2	—	—	293	30	—	—	1,279	32	4,464	—	2,271	—	6,735
1964 .....	1,137	2	—	—	377	51	—	—	1,514	53	5,453	—	2,526	—	7,979
1965 .....	1,497	1	3	—	487	64	—	—	1,987	65	7,837	17	3,668	—	11,522
1966 .....	1,530	1	11	1	513	64	—	—	2,054	66	8,798	79	3,704	—	12,581
1967 .....	1,978	1	6	1	568	66	—	—	2,552	68	11,922	56	4,998	—	16,976

TABLE 3. Production and Related Workers, Miscellaneous Non-metal Mines, 1966 and 1967

	Mine			Mill	
	Surface		Under-ground	Male	Female
	Male	Female			
	number				
1966					
January .....	152	—	570	739	1
February .....	169	—	567	743	1
March .....	160	—	575	763	1
April .....	165	—	580	798	1
May .....	208	—	598	789	1
June .....	200	—	592	801	1
July .....	196	—	584	804	1
August .....	197	—	595	806	1
September .....	194	—	608	803	1
October .....	182	—	534	801	1
November .....	168	—	531	742	1
December .....	161	—	526	746	1
Averages .....	179	—	572	778	1
1967					
January .....	145	—	589	831	1
February .....	145	—	630	848	1
March .....	153	—	616	869	1
April .....	167	—	839	1,146	1
May .....	181	—	887	1,170	1
June .....	178	—	845	1,090	1
July .....	200	—	831	1,077	1
August .....	188	—	834	1,077	1
September .....	178	—	827	1,067	1
October .....	164	—	861	1,053	1
November .....	160	—	845	1,052	1
December .....	135	—	824	1,032	1
Averages .....	166	—	786	1,026	1

TABLE 4. Purchased Fuel and Electricity Used, Miscellaneous Non-metal Mines 1966 and 1967

Description	1966		1967	
	Quantity	Cost	Quantity	Cost
		\$'000		\$'000
1. Large establishments reporting commodity detail:				
Bituminous coal:				
(a) From Canadian mines .....	ton	6	6	—
(b) Imported .....	—	—	—	—
Sub-bituminous coal (from Alberta mines only) .....	—	—	—	—
Anthracite coal .....	ton	—	150	3
Lignite coal .....	"	18,995	23,704	88
Coke .....	—	—	—	—
Gasoline (including gasoline used in cars and trucks) .....	Imp. gal.	267,415	315,753	110
Fuel oil including kerosene or coal oil .....	—	8,268,289	6,824,155	664
Wood .....	—	—	—	—
Gas:				
(a) Liquefied petroleum gases .....	Imp. gal.	32,271	15,012	2
(b) Other manufactured gas .....	—	—	—	—
(c) Natural gas .....	M cu. ft.	9,477,794	12,092,473	3,153
Other fuel .....	—	—	—	—
Electricity purchased .....	kwh.	237,725,350	345,588,386	2,429
Steam purchased .....	—	—	—	—
Total fuel and electricity used .....	...	5,274	...	6,449
Electricity generated:				
(a) For own use .....	kwh.	87,599,308	109,070,399	...
(b) For sale .....	"	90,312	118,501	...



TABLE 5. Materials and Supplies, Miscellaneous Non-metal Mines, 1966 and 1967

Description	Cost	
	1966	1967
	\$'000	
One or other semi-processed materials purchased and used in mine/mill operations.....	66	—
Containers, shipping materials and supplies used.....	331	350
Operating, maintenance and repair supplies used (excluding fuel).....	8,835	12,182
Amount paid out to others for work done on materials owned by establishments.....	1,355	1,836
<b>Totals .....</b>	<b>10,587</b>	<b>14,368</b>

TABLE 6. Value of Production, Miscellaneous Non-metal Mines, 1966 and 1967

Description	Value	
	1966	1967
	\$'000	
Value of production .....	77,291 <sup>1</sup>	85,085
Amount received in payment for work done on materials and products owned by others .....	—	—
<b>Total value of production and work done .....</b>	<b>77,291</b>	<b>85,085</b>

TABLE 7. Drilling Completed on Miscellaneous Non-metal Deposits, 1966 and 1967

	Footage drilled	
	1966	1967
Diamond drilling for exploration and testing:		
By mining companies with their own personnel and equipment .....	26,422	28,533
By diamond drilling contractors .....	6,616	23,449
Other diamond drilling:		
Blast hole diamond drilling:		
By mining companies with their own personnel and equipment .....	—	—
By diamond drilling contractors .....	—	—
Drilling by percussion on other machines <sup>1</sup> .....	718,152	760,974

<sup>1</sup> Not complete as records are unobtainable at certain mines.

TABLE 8. Specified Taxes Paid by Companies in Miscellaneous Non-metal Mines Operations,<sup>1</sup> 1966 and 1967

Taxes paid	1966	1967
	\$'000	
Domestic income taxes .....	2,644	1,751
Provincial taxes .....	2,547	2,321
Municipal taxes .....	736	990

<sup>1</sup> Includes related corporate activities associated with operations of Miscellaneous Non-metal Mines.

**TABLE 9. Miscellaneous Expenditures Made by Companies Engaged in Miscellaneous Non-Metal Mines Operations,<sup>1</sup> 1967**

Description	Amount
	\$'000
(a) Workmen's compensation .....	281
(b) Silicosis Assessment .....	2
(c) Unemployment insurance .....	114
(d) Aggregate cost of structures, roads, machinery, equipment, etc., built by or purchased from outside contractors or suppliers and chargeable to Fixed Assets Account.....	8,199
(e) Book value of fixed assets (new structures, roads, machinery equipment etc., including major repairs and alterations) produced by own employees and chargeable to Fixed Assets Account .....	4,595
(f) Other capital expenditures not reported in (d) and (e).....	13
(g) Cost of materials and supplies used in the production of machinery and equipment and in the construction of roads and new structures (including major repairs and alterations by own employees and chargeable to Fixed Assets Account).....	3,651
(h) Cost of office supplies used during the year, not chargeable to Fixed Assets Account. Excludes cost of stamps and meter expenses .....	234

<sup>1</sup> Includes related corporate activities associated with Canadian operations of Miscellaneous Non-metal Mines not allocable separately elsewhere.

**TABLE 10. Producers' Shipments of Miscellaneous Non-metallic Minerals, 1966 and 1967**

Item	1966		1967	
	Quantity	Value	Quantity	Value
		\$'000		\$'000
Barite ..... ton	221,376	2,199	172,270	1,573
Diatomite ..... "	70	4	..	..
Fluorspar ..... "	..	1,896 <sup>r</sup>	x	x
Gemstones ..... lb.	11,633	13	24,160	28
Grindstones ..... ton	5	1	10	3
Iron oxides..... "	390	10	664	37
Lithia ..... lb.	253,566	261	436,894	266
Magnesitic dolomite, brucite .....	..	3,949	..	3,516
Mica ..... "	270	18	—	—
Potash (K <sub>2</sub> O) ..... ton	1,990,053	62,665	2,383,253	67,395
Sodium sulphate ..... "	405,314	6,472	428,316	6,359
Pyrite, pyrrhotite <sup>1</sup> ..... "	326,954	1,139	377,941	1,703
Sulphur <sup>2</sup> in smelter gases .....	500,338	6,051	592,035	7,182
Sulphur, elemental <sup>3</sup> ..... "	2,041,528	40,254	2,499,205	68,614
Arsenious oxide <sup>1</sup> .....	351	36	378	48
Titanium dioxide, etc. <sup>1</sup> .....	..	20,497	..	23,737

<sup>1</sup> General statistics relating to pyrite, arsenious oxide and titanium dioxide are included with the smelting industry.

<sup>2</sup> Data for 1966 and 1967 include sulphur in smelter gases in the form of acid or sulphur dioxide. General statistics relating to the production of sulphur are included with those of the metal mining and non-ferrous smelting industries.

<sup>3</sup> Produced from sour gas, includes sulphur recovered in processing nickel-copper matte.

**Note:** (a) The value of containers is excluded.

(b) The above and subsequent tables contain data on commodities in various forms and sources, therefore the figures are not directly comparable to those appearing in the industry series, that is, Tables 1-8.

TABLE 11. Consumption<sup>1</sup> of Non-metallic Minerals, 1966 and 1967

Item	Used during	
	1966	1967 <sup>2</sup>
	tons	
Arsenic trioxide (refined) .....	345	325
Barite: <sup>3</sup>		
Lump .....	x	x
Ground .....	2,873	2,974
Bentonite: <sup>3</sup>		
Swelling (also called sodium or Wyoming bentonite) .....	154,034	171,295
Non-swelling (also called calcium or Southern decolorizing bentonite) .....	13,820	13,647
Clay:		
China clay (Kaolin) .....	162,360	169,348
Fire clay .....	199,115	134,641
Ball clay .....	146,021	46,125
Diatomite (diatomaceous earth, Kieselguhr, Celite, etc.)		
Ground or powdered:		
Natural .....	13,621	13,101
Calcined .....	1,755	23,451
Other .....	1,584	2,198
Feldspar .....	12,046	9,021
Fluorspar:		
Metallurgical grade (lump) .....	147,995	138,407
Ceramic and other .....	2,839	1,072
Acid .....	15,456	15,870
Fullers earth .....	1,838	4,213
Graphite:		
Natural .....	4,253	3,336
Magnesia:		
Dead burned .....	78,628	72,175
Calcined .....	39,528	45,268
Mica - Muscovite:		
Sheet, splittings .....	46	206
Wet ground .....	619	627
Other ground .....	511	444
Nepheline syenite .....	52,937	50,286
Phosphate rock .....	1,735,488	2,275,067
Potash (muriate of potash):		
Agricultural .....	202,631	192,282
Chemical .....	2,215	2,399
Silica:		
Lump (quartz, quartzite, sandstone) .....	746,607	766,951
Sand (including foundry sand but excluding concrete sand) .....	1,875,758	1,805,156
Flour or pulverized .....	128,263	73,065
Sodium sulphate:		
Lump crude .....	7,408	7,241
Salt cake .....	325,479	276,024
Glauber's salts .....	665	1,308
Sulphur:		
Elemental (lump, powder, liquid etc.) .....	751,807 <sup>r</sup>	743,278
Liquid sulphur dioxide (sulphur content only) .....	61,302 <sup>r</sup>	90,393
Talc, soapstone, pyrophyllite .....	34,048	33,934
Whiting or Whiting substitute:		
Ground chalk, precipitated calcium carbonate .....	60,449	42,307
Whiting substitute, ground limestone and ground marble .....	87,728	86,339
Sold to oil well drilling firms: <sup>4</sup>		
Barite .....	12,223	155,878
Bentonite .....	35,239	20,628

<sup>1</sup> Due to a difference in coverage and concept the data in this table will differ from those relating to "Available consumption" as reported by specified industries shown in subsequent tables e.g. Tables 14, 19, 24, 25, 29, 34, and 50.

<sup>2</sup> May not necessarily be comparable with 1966 due to increased coverage of establishments.

<sup>3</sup> In addition barite and bentonite were sold to oil well drilling firms. See end of table.

<sup>4</sup> Not included in the consumption of barite and bentonite above.

Source: Special survey "Consumption of Non-metallic Minerals" conducted by Manufacturing and Primary Industries Division, DBS.



## ARSENIOUS OXIDE

During 1967 the producers of arsenious oxide (arsenic trioxide) shipped 755,050 pounds valued at \$48,193. Included in the output was some arsenic which was recovered from foreign ores. The Canadian and foreign ores are mixed for treatment and separate data are not available.

Production in Ontario was at the smelter of the Cobalt Refinery, Cobalt, Ont. which treated the cobalt-silver concentrates from Cobalt and Gowganda, and other custom ores.

Compounds of arsenic such as lead arsenate and calcium arsenate are used in insecticides,

rodenticides and other pesticides. Other uses are as a decolourizer in glass, as preservatives and depilatories in the tanning of hides, in the chemical debarking of trees; in pyrotechnics; and in paint pigments.

The auriferous quartz ores exported to the United States from British Columbia mines contain considerable amounts of arsenic, but no data are available on the possible recovery of this arsenic and since the Canadian gold mines receive no payment for the arsenic content, it is not credited as commercial production.

TABLE 12. Producers' Shipments, Imports and Exports of Arsenic, 1966 and 1967

	1966		1967	
	Quantity	Value	Quantity	Value
	lb.	\$'000	lb.	\$'000
Producers' shipments:				
White arsenic (crude and refined) .....	701,537	36	755,050	48
Imports:				
Botanical arsenical formulation .....	1,243,200	434	1,207,700	345
Other .....	..	..	..	..
Exports:				
Arsenic .....	..	..	..	..

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007 and "Exports by Commodities", Catalogue No. 65-004.

TABLE 13. Production, Imports and Exports of White Arsenic, 1958 - 67

Year	Production, crude and refined, but no duplication	Imports <sup>1</sup>	Exports
			Refined
		pounds	
1958 .....	2,323,320	..	1,703,200
1959 .....	1,578,307	..	1,130,400
1960 .....	1,724,326	..	1,054,200
1961 .....	419,300	..	244,500
1962 .....	160,750	..	100
1963 .....	187,450	..	4,800
1964 .....	323,900	..	..
1965 .....	403,011	..	..
1966 .....	701,537	..	..
1967 .....	755,050	..	..

<sup>1</sup> Arsenious oxide and arsenic sulphide.



TABLE 14. Consumption of Refined White Arsenic, 1963-67

Industry	1963	1964	1965	1966	1967
	pounds				
Glass .....	172,404	168,793	196,095	158,336	189,862
Metal rolling, casting, extruding .....	69,731	112,234	154,395	154,044	232,801
Miscellaneous chemicals .....	393,860	437,099	421,646	539,077	469,318
<b>Totals accounted for .....</b>	<b>635,995</b>	<b>718,126</b>	<b>772,136</b>	<b>851,457</b>	<b>891,981</b>

TABLE 15. World Production of White Arsenic, by Countries, 1963-66

Country <sup>1</sup>	1963	1964	1965	1966
	short tons			
Brazil .....	323	207	282	275 <sup>2</sup>
Canada .....	94	162	202 <sup>2</sup>	225
France .....	11,668	12,563	11,436 <sup>3</sup>	11,200 <sup>2</sup>
Germany, West (exports) .....	62	42	78	416
Italy .....	..	..	..	..
Japan .....	904	550	528	603
Mexico <sup>4</sup> .....	14,666	16,380	15,188	18,000 <sup>2</sup>
Peru .....	683	685	550	550 <sup>2</sup>
Portugal .....	622	410	440 <sup>5</sup>	330 <sup>2</sup>
Rhodesia, Southern .....	605	206	70 <sup>3</sup>	..
South-west Africa .....	..	..	..	44
Spain .....	161	158	131	123
Sweden .....	16,369	19,809	18,188	18,200 <sup>2</sup>
<b>World totals<sup>1,2</sup> .....</b>	<b>61,000</b>	<b>64,500</b>	<b>66,300</b>	<b>66,300</b>

<sup>1</sup> Arsenic is also produced in Argentina, Austria, China, Czechoslovakia, Finland, East Germany, Hungary, U.S.S.R. United Kingdom and Yugoslavia but there is too little information to estimate production. Estimate is included in world total for Belgium and United States. U.S. figures withheld to avoid disclosing individual company confidential data.

<sup>2</sup> Estimate.

<sup>3</sup> Exports.

<sup>4</sup> Including black arsenic.

<sup>5</sup> Estimated equivalent recoverable arsenic trioxide content of concentrates produced.

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

## BARITE

The producers of barite in Canada shipped 172,270 tons valued at \$1,573,370 in 1967 compared with 221,376 tons worth \$2,199,054 in the preceding year. Nova Scotia produced most of the nation's barite. The open pit operation is located near Walton at the head of the Bay of Fundy. Shipments are made by boat from Walton. In British Columbia barite was quarried at Brisco in the East Kootenay district, then shipped to a grinding plant at Lethbridge, Alberta. Shipments were made from Spillimacheen, B.C., to a grinding plant at Onoway, Alberta.

The principal use of barite is in oil-well drilling muds with bentonite and minor conditioning agents. Barite is used also as a pigment and filler in paints, rubber, linoleum and papers; in the manufacture of barium chemicals; as an additive to

glass batches; as an aggregate in concrete where additional weight is required (such as coatings for under water pipes), or where shielding is required against radiation such as in X-ray rooms or atomic energy plants.

Barium compounds are used widely in industry. Barium carbonate is used to reduce "dry house" scum on bricks; in pharmaceuticals; as a flux in the enamelling and ceramic trades, and in heat-treatment compounds. The chloride is used as a pigment in lithographic inks; in the purification of salt brine and in water treatment; as a mordant in dyeing textiles; and in many other applications. Other compounds include the hydrate, phosphate, oxide, sulphide, stearate and chlorate.

**TABLE 16. Production of Barite, 1958 - 67**

Year	Short tons	Value	Year	Short tons	Value
		\$'000			\$'000
1958 .....	195,719	2,196	1963 .....	173,503	1,693
1959 .....	238,967	2,255	1964 .....	169,149	1,574
1960 .....	154,292	1,462	1965 .....	203,025	2,167
1961 .....	191,404	1,799	1966 .....	221,376	2,199
1962 .....	226,600	2,124	1967 .....	172,270	1,573

**TABLE 17. Imports of Barite, 1966 and 1967**

Imported from	1966		1967	
	Tons	Value	Tons	Value
		\$'000		\$'000
Germany, West .....	122	5	94	4
United Kingdom .....	—	—	30	2
United States .....	4,043	231	5,800	299
<b>Totals</b> .....	<b>4,165</b>	<b>236</b>	<b>5,924</b>	<b>305</b>

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007.

**TABLE 18. Exports of Barite, 1966 and 1967**

Destination	1966		1967	
	Tons	Value	Tons	Value
		\$'000		\$'000
Trinidad - Tobago .....	9,279	172	1,940	36
Venezuela .....	—	—	6,382	58
United States .....	189,774	1,738	137,781	1,260
<b>Totals</b> .....	<b>199,053</b>	<b>1,910</b>	<b>146,103</b>	<b>1,355</b>

Source: Trade of Canada, "Exports by Commodities", Catalogue No. 65-004.

**TABLE 19. Consumption of Barite, 1963 - 67**

	1963	1964	1965	1966	1967
	tons				
By uses:					
Paints and varnish .....	1,854	1,858	2,402	3,119	3,904
Glass .....	838	680	786	896	1,440
Oil well drilling .....	14,495	14,475	..	..	6,500 <sup>1</sup>
Rubber tire and tube .....	..	19	14	12	11
Rubber industries .....	..	284	190	197	227

<sup>1</sup> Estimate.

See footnote 1 Table 11.

TABLE 20. World Production of Barite, by Countries, 1963-67

Country <sup>1</sup>	1963	1964	1965	1966	1967
	short tons				
North America:					
Canada .....	173,503	169,149	203,025	221,376	199,576
Mexico .....	283,246	368,220	406,027	321,306	..
United States .....	803,106	816,706	845,656	1,006,965	944,082
South America:					
Argentina .....	25,350	15,989	21,843	23,700	..
Brazil .....	37,601	36,968	70,945	44,344	60,073
Chile .....	1,124	1,203	3,132	2,345	..
Colombia .....	11,574	11,244	9,700	9,900 <sup>2</sup>	..
Peru .....	137,557	138,252	122,104	128,579	..
Europe:					
Austria (marketable) .....	2,395	1,390	2,573	3,086	2,900 <sup>2</sup>
France .....	82,078	92,397	114,733	110,200 <sup>2</sup>	..
Germany West (marketable) .....	503,430	515,290	517,374	497,418	..
Greece .....	94,000	75,000	132,000 <sup>2</sup>	143,000	..
Ireland .....	14,918	45,232	92,581	137,789	..
Italy .....	114,229	115,461	156,412	190,411	171,000 <sup>2</sup>
Poland .....	50,376 <sup>2</sup>	50,376 <sup>2</sup>	50,376 <sup>2</sup>	51,800 <sup>2</sup>	51,800 <sup>2</sup>
Portugal .....	1,828	384	1,199	1,054	180 <sup>2</sup>
Rumania .....	..	..	50,000	55,000 <sup>2</sup>	61,000 <sup>2</sup>
Spain .....	53,312	65,183	61,140	..	..
U.S.S.R. .....	220,000 <sup>2</sup>	243,000 <sup>2</sup>	254,000 <sup>2</sup>	276,000 <sup>2</sup>	287,000 <sup>2</sup>
United Kingdom <sup>3</sup> .....	61,066	68,343	67,241	34,172	..
Yugoslavia .....	115,176	112,072	107,045	88,393	99,000 <sup>2</sup>
Africa:					
Algeria .....	32,421	32,665	47,142	82,700 <sup>2</sup>	88,000 <sup>2</sup>
Kenya .....	..	..	40	108	..
Morocco .....	104,228	99,036	114,508	117,126	99,779
Rhodesia, Southern .....	1,953	1,561	1,500 <sup>2</sup>	..	..
South Africa, Republic of .....	2,704	2,835	1,477	6,815	1,700 <sup>2</sup>
Swaziland .....	93	17	541	1,150	700 <sup>2</sup>
United Arab Republic (Egypt) .....	4,545	5,017	16,924	16,500 <sup>2</sup>	..
Asia:					
Burma .....	2,127	..	1,940	8,800 <sup>2</sup>	..
China (mainland) .....	88,000 <sup>2</sup>	110,000 <sup>2</sup>	110,000 <sup>2</sup>	121,000 <sup>2</sup>	110,000 <sup>2</sup>
India .....	41,752	51,763	53,223	56,949	..
Iran .....	16,500 <sup>2</sup>	47,399	68,000 <sup>2</sup>	68,000 <sup>2</sup>	68,000 <sup>2</sup>
Japan .....	41,360	43,810	46,606	44,396	41,417
Korea:					
North .....	77,000 <sup>2</sup>	77,000 <sup>2</sup>	88,000 <sup>2</sup>	110,000 <sup>2</sup>	110,000 <sup>2</sup>
South .....	3,040	3,024	1,419	40	..
Pakistan .....	5,422	13,235	9,740	8,624	..
Philippines .....	1,008	1,627	..	2	..
Turkey .....	1,081	6,669	13,206	18,700 <sup>2</sup>	34,822
Oceania:					
Australia .....	9,206	13,778	13,413	15,370	16,017
World totals (estimate) <sup>4</sup> .....	3,218,309	3,451,295	3,876,785	4,023,118	2,447,046

<sup>1</sup> In addition to countries listed, barite is produced in Bulgaria, Czechoslovakia and East Germany, but production data are not available.

<sup>2</sup> Estimate.

<sup>3</sup> Includes witherite.

<sup>4</sup> Total is of listed figures only; no undisclosed data included.

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



## CORUNDUM

No corundum has been produced in Canada since October, 1946, when treatment of the old tailings at the Craigmont property, Renfrew county, Ontario, for the recovery of corundum was completed. This operation was undertaken during the war at the request of the United States Government. During the two years of operation about 2,600 tons of concentrate were shipped from the Craigmont property to American Abrasive Company, Westfield, Massachusetts, the only handler of corundum on the continent.

The main and only zone from which production has been obtained is in a belt 100 miles long and

6 miles wide, in Haliburton, Hastings and Renfrew counties in Ontario. Several of the numerous deposits examined in 1961 contain fair amounts of corundum, the most promising being an extensive deposit in Monteagle township on the east side of the York River, about 10 miles northeast of Bancroft. (For a description of corundum-bearing nepheline syenite belts of south and eastern Ontario, see report No. 820 "The Corundum Mineral Industry in 1945", page 53, issued by the Bureau of Mines, Ottawa). It is doubtful, however, if the production of corundum alone would be economical and consequently marketable by-products would be necessary.

TABLE 21. World Production of Corundum, by Countries, 1963-67

Country <sup>1</sup>	1963	1964	1965	1966	1967
	tons				
India .....	725	595	530	424	338
Southern Rhodesia .....	5,940	2,870	4,630 <sup>2</sup>	4,630 <sup>2</sup>	5,000 <sup>2</sup>
South Africa, Republic of .....	79	60	344	400	351
<b>World totals (estimate).....</b>	<b>6,744</b>	<b>3,525</b>	<b>5,504</b>	<b>5,454</b>	<b>5,689<sup>2</sup></b>

<sup>1</sup> Corundum is produced in U.S.S.R., data on production are not available.

<sup>2</sup> Estimate.

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

## DIATOMITE

Diatomite, also known as diatomaceous earth and Kieselguhr, consists of microscopically small, opaline silica, skeletal remains of organisms known as diatoms. The purest varieties of diatomite are chalklike in appearance, free from grit, porous, and friable and an apparent specific gravity under one when dry.

It is the physical properties of porosity and chemical inertness that account for most of the uses of diatomite. The principal uses are as a filtering medium filler, and as an insulator against heat, cold and sound. Diatomite is important in many industries, such as sugar refining, liquor distilling, dry cleaning and water purification. For filtration the

important considerations are size and shape of principal diatoms present, purity, and density of the consolidated material.

Diatomite is used as a filler in rubber, paper, asphalt products, plastics, explosives, insecticides, paints, and many other products. It is used as a concrete admixture and as the mild abrasive in metal polishes and dentifrices. Important properties of diatomite to be considered for such uses include: color, freedom from grit, low density, inertness, and particle size. Diatomite imparts bulk with little increase in weight, along with certain desirable physical properties to the end products.



TABLE 22. Producers' Shipments of Diatomite, 1958-67

Year	tons	Value	Year	tons	Value
		\$			\$
1958 .....	27	540	1963 .....	798	26,830
1959 .....	5	100	1964 .....	1,143	64,555
1960 .....	44	1,430	1965 .....	82	4,420
1961 .....	214	8,817	1966 .....	70	3,755
1962 .....	211	10,228	1967 .....	x	x

TABLE 23. Imports of Diatomaceous Earth, 1966 and 1967

	1966		1967	
	Tons	Value	Tons	Value
		\$'000		\$'000
United States .....	29,220	1,579	33,309	1,790
West Germany .....	—	—	20	2
<b>Totals</b> .....	<b>29,220</b>	<b>1,579</b>	<b>33,329</b>	<b>1,792</b>

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007.

TABLE 24. Consumption of Infusorial Earth in the Sugar Refining Industry, 1958-67

Year	Tons	Value	Year	Tons	Value
		\$'000			\$'000
1958 .....	1,965	164	1963 .....	2,317	219
1959 .....	2,113	167	1964 .....	2,243	222
1960 .....	2,218	191	1965 .....	2,325	214
1961 .....	2,089	189	1966 .....	2,043	202
1962 .....	2,093	189	1967 .....	1,680	157

See footnote 1 Table 11.

TABLE 25. Consumption of Diatomaceous Earth in the Manufacture of Fertilizers, 1963-67

Year	Tons	Value
		\$'000
1963 .....	15,771	780
1964 .....	12,387	759
1965 .....	12,296	753
1966 .....	13,530	814
1967 .....	..	..

See footnote 1 Table 11.

TABLE 26. World Production of Diatomite, by Countries, 1964-67

Country <sup>1</sup>	1964	1965	1966	1967
	short tons			
North America:				
Canada .....	1,143	82	70	..
Costa Rica .....	3,968 <sup>r,2</sup>	3,307 <sup>r,2</sup>	3,307 <sup>r,2</sup>	11,023 <sup>2</sup>
Mexico .....	2,260	987	9,327	7,921
United States <sup>3</sup> .....	580,275 <sup>r</sup>	580,275 <sup>r</sup>	627,292 <sup>r</sup>	627,292
South America:				
Argentina .....	8,567	6,774	12,063 <sup>r</sup>	8,979
Colombia .....	255	220	—	—
Peru .....	2,858	2,724	1,742	4,118
Europe:				
Austria .....	4,224	4,447	4,138	4,031
Denmark:				
Diatomite .....	20,393 <sup>r,2</sup>	13,779 <sup>r,2</sup>	11,023 <sup>r,2</sup>	11,023 <sup>2</sup>
Moler <sup>4</sup> .....	210,761 <sup>r,2</sup>	234,461 <sup>r,2</sup>	223,939 <sup>r,2</sup>	220,462 <sup>2</sup>
Finland .....	2,392	1,047	1,323	1,785
France <sup>5</sup> .....	146,699 <sup>r</sup>	166,046	155,710 <sup>r</sup>	176,370
Germany, West (marketable) <sup>5</sup> .....	116,845 <sup>r,2</sup>	126,766 <sup>r,2</sup>	98,106 <sup>r,2</sup>	98,106 <sup>2</sup>
Italy .....	76,445	66,739 <sup>r</sup>	69,131 <sup>r</sup>	66,088
Portugal <sup>5</sup> .....	2,207	2,896	3,765	4,308
Spain <sup>5</sup> .....	12,507 <sup>2</sup>	13,131	17,637 <sup>2</sup>	17,637 <sup>2</sup>
Sweden <sup>6</sup> .....	955 <sup>r</sup>	1,342 <sup>r</sup>	3,617 <sup>r</sup>	2,205
U.S.S.R. ....	352,739 <sup>r,2</sup>	363,762 <sup>r,2</sup>	385,808 <sup>r,2</sup>	396,832 <sup>2</sup>
United Kingdom .....	15,363	16,888	16,460 <sup>r</sup>	16,424 <sup>2</sup>
Yugoslavia .....	11,600 <sup>2</sup>	11,600 <sup>2</sup>	11,600 <sup>2</sup>	—
Africa:				
Algeria .....	22,163	18,092	17,637 <sup>r,2</sup>	20,128
Kenya .....	3,368	2,445	1,953	2,079
Rhodesia, Southern <sup>5</sup> .....	347	529 <sup>r</sup>	529 <sup>r,2</sup>	..
South Africa, Republic of .....	546	1,076	240	645
Asia:				
Korea, South .....	620 <sup>r</sup>	638	303 <sup>r</sup>	2,467
Oceania:				
Australia .....	9,780	7,793	8,006 <sup>r</sup>	9,313
New Zealand .....	1,881	1,937	5,219	1,577
<b>Totals<sup>7</sup> .....</b>	<b>1,599,561<sup>r</sup></b>	<b>1,641,183<sup>r</sup></b>	<b>1,678,475</b>	<b>1,710,813</b>

<sup>1</sup> Diatomaceous earth is produced in Brazil, Bulgaria, Hungary, Japan, Mozambique, Rumania, United Arab Republic and Yugoslavia, but outputs are insignificant or not available.

<sup>2</sup> Estimate.

<sup>3</sup> Average annual production from the appropriate 3 year totals, 1963-65 and 1966-68.

<sup>4</sup> Moler earth used as a raw material in making refractory bricks plus moler earth exported in bulk form.

<sup>5</sup> Includes tripoli.

<sup>6</sup> Includes calcined.

<sup>7</sup> Total is of listed figures only.

## FLUORSPAR

Fluorspar is mined in Newfoundland and is produced as a by-product from a silica deposit in British Columbia.

In Canada fluorspar is consumed chiefly by the aluminum industry. The fluorspar is used to make hydrofluoric acid, which in turn is used to make a flux (artificial cryolite). The flux, together with a small amount of fluorspar, dissolves alumina, and from this solution aluminum is recovered electrolytically. Fluorspar finds its other major use as a flux in the steel industry. In smaller but increasing amounts, fluorspar is used in the heavy-chemical, glass, enamelling, glazing, white-metal alloy and metal refining industries.

In the United States the largest consumer is the steel industry, which is followed by the hydrofluoric acid manufacturers. Hydrofluoric acid is used in large amounts by the aluminum, fluorine,

years, the rate of fluorspar consumption is growing faster in the manufacture of hydrofluoric acid than in the use of fluorspar as a flux in steel plants.

Standard fluxing gravel or lump grade for metallurgical purposes is usually sold on a specification of a minimum of 85 per cent  $\text{CaF}_2$  and a maximum of 5 per cent  $\text{SiO}_2$  (silica) and 0.3 per cent sulphur. Fines should not exceed 15 per cent.

Ceramic or glass and enamel grades call for not less than 94 per cent  $\text{CaF}_2$  with a maximum 3.5 per cent  $\text{CaCO}_3$  (calcium carbonate), 3 per cent  $\text{SiO}_2$  and 0.1 per cent  $\text{Fe}_2\text{O}_3$  (ferric oxide). The material must be in mesh sizes ranging from coarse to extra fine.

Acid grade has the most rigid specifications. It must be over 97 per cent  $\text{CaF}_2$  and not over 1 per cent  $\text{SiO}_2$ . Like ceramic grade, it is used in powdered form.

TABLE 27. Production of Fluorspar, 1958 - 67

Year	Selling value f.o.b. works	Year	Selling value f.o.b. works
	\$'000		\$'000
1958 .....	1,543	1963 .....	1,976
1959 .....	1,850	1964 .....	2,259
1960 .....	1,922	1965 .....	2,680
1961 .....	1,990	1966 .....	1,896
1962 .....	1,870	1967 .....	x

TABLE 28. Imports of Fluorspar, 1958 - 67

Year	Tons	Value	Year	Tons	Value
		\$'000			\$'000
1958 .....	30,408	763	1963 .....	66,798	1,946
1959 .....	26,588	719	1964 .....	69,986	2,061
1960 .....	59,690	1,286	1965 .....	69,848	2,100
1961 .....	32,769	914	1966 .....	75,324	2,143
1962 .....	67,847	2,052	1967 .....	94,244	2,609

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007.



TABLE 29. Consumption of Fluorspar, 1963-67

	1963	1964	1965	1966	1967
	tons				
By uses:					
Steel .....	41,822	41,533	37,399	33,842	28,530
Glass .....	1,968	2,744	2,598	2,424	2,002
Heavy chemicals .....	8,982	11,246	12,827	14,028	14,167
Smelting and refining .....	84,995	65,104	105,935	111,040	107,361
<b>Totals accounted for .....</b>	<b>137,767</b>	<b>120,627</b>	<b>158,759</b>	<b>161,334</b>	<b>152,060</b>
By provinces:					
Nova Scotia .....	7,880	6,882	5,664	5,597 <sup>1</sup>	3,438 <sup>1</sup>
Quebec .....	92,849	75,866	118,573	124,871	121,398
Ontario .....	35,215	36,526	33,324	30,167	26,756
Manitoba .....	324	332	369	382	165
Alberta .....	693	489	419	172	192
British Columbia .....	806	532	410	145	111
<b>Totals accounted for .....</b>	<b>137,767</b>	<b>120,627</b>	<b>158,759</b>	<b>161,334</b>	<b>152,060</b>

<sup>1</sup> Includes small amount used in Newfoundland.

See footnote 1 Table 11.

TABLE 30. World Production of Fluorspar, by Countries, 1963-67

Country <sup>1</sup>	1963	1964	1965	1966	1967
	short tons				
North America:					
Canada .....	85,000 <sup>2</sup>	96,000 <sup>2</sup>	112,000 <sup>2</sup>	79,000 <sup>2</sup>	88,000
Mexico .....	530,893	708,644	810,618	799,602	785,114
United States (shipments) .....	199,948	217,137	240,932	253,068	895,643
South America:					
Argentina .....	10,761	12,703	12,883	10,472	..
Europe:					
France <sup>3</sup> .....	160,307	215,119	215,573	237,476	243,000 <sup>2</sup>
Germany:					
East .....	77,000 <sup>2</sup>	77,000 <sup>2</sup>	88,000 <sup>2</sup>	88,000 <sup>2</sup>	..
West <sup>3</sup> .....	115,272	98,960	91,402	93,195	95,000 <sup>2</sup>
Italy .....	148,407	137,449	162,990	215,193	224,000 <sup>2</sup>
Spain <sup>3</sup> .....	169,094	164,995	243,248	230,315	267,509
Sweden (sales) .....	3,253	—	—	—	—
United Kingdom <sup>4</sup> .....	96,342	114,199	128,750	138,891	..
U.S.S.R. ....	300,000 <sup>2</sup>	330,000 <sup>2</sup>	385,000 <sup>2</sup>	385,000 <sup>2</sup>	420,000 <sup>2</sup>
Africa:					
Morocco .....	7,000	7,242	3,307	3,300 <sup>2</sup>	—
Rhodesia, Southern .....	343	77	165 <sup>2</sup>	..	..
South Africa, Republic of .....	57,761	66,431	72,517	90,266	108,000 <sup>2</sup>
South-West Africa .....	480	—	—	—	..
Tunisia .....	—	—	3,300 <sup>2</sup>	2,894	4,400 <sup>2</sup>
Asia:					
China (mainland) .....	220,000 <sup>2</sup>	220,000 <sup>2</sup>	240,000 <sup>2</sup>	280,000	280,000 <sup>2</sup>
India .....	780	429	607	1,178	1,385
Japan .....	23,037	21,078	18,205	15,472	12,866
Korea, North .....	33,000 <sup>2</sup>	33,000 <sup>2</sup>	33,000 <sup>2</sup>	33,000 <sup>2</sup>	33,000 <sup>2</sup>
Korea, South .....	43,855 <sup>2</sup>	62,167 <sup>2</sup>	43,174 <sup>2</sup>	35,283	62,796
Mongolia .....	54,000	63,000 <sup>2</sup>	83,000 <sup>2</sup>	83,000 <sup>2</sup>	83,000 <sup>2</sup>
Thailand .....	32,221	70,039	57,132	52,941	146,775
Turkey .....	719	1,436	1,187	1,659	..
Oceania:					
Australia .....	17	—	—	—	—
<b>World totals<sup>2,5</sup> .....</b>	<b>2,369,490</b>	<b>2,717,105<sup>2</sup></b>	<b>3,046,990<sup>2</sup></b>	<b>3,129,205</b>	<b>3,150,488</b>

<sup>1</sup> Fluorspar is also produced in Brazil and Bulgaria; data are not available.<sup>2</sup> Estimate.<sup>3</sup> Marketable.<sup>4</sup> Excludes recovery from lead and zinc mine dumps.<sup>5</sup> Total is of listed figures only; no undisclosed data included.



## GARNET

The garnet deposit near River Valley, Ontario has not been in production since 1961. The garnets which were mined in the earlier years were used as abrasives for cutting granite building stone at the firm's other stone plants.

The garnet group of minerals are aluminum silicates containing variable amounts of iron, magnesium, manganese, calcium and chromium. They

are common constituents of many rocks, particularly metamorphic types, and some beach sands.

Garnet is used for making abrasive-coated papers and cloth, which in turn are used mainly in the wood-working and shoe-leather industries. Garnet flour of superfine grade is used as a partial substitute for corundum flour for polishing optical lenses.

## GEM STONES

In 1967 there was a small shipment of amethyst from Ontario. The bulk of production was Jade from British Columbia.

TABLE 31. Producers' Shipments of Gem Stones, 1960-67

Year	Pounds	Value	Year	Pounds	Value
		\$'000			\$'000
1960 .....	50,300	10	1964 .....	11,537	14
1961 .....	69,751	21	1965 .....	71,129	16
1962 .....	56,935	21	1966 .....	11,663	13
1967 .....	12,000	16	1967 .....	24,160	28

## GRAPHITE

There were no shipments of graphite during the year. With the exception of 1961 there have been no shipments since 1954 when the Black Donald mine closed in Renfrew county, Ontario. This mine was flooded by the mountain chute hydro project in 1967.

Graphite has many uses, but is employed principally in foundry facings, lubricants, crucibles, retorts and stoppers, packings, pencils and crayons, paints and stove polish. Important quantities, mostly amorphous or artificial, are used in dry batteries, electrodes and commutator brushes. Flake from the Black Donald deposit is too small for crucible use and finished products consist

mainly of amorphous foundry grades, but include high-grade fine flake and dust sold for use in lubricants, packings and polishes. Prepared facings for the domestic foundry trade also are made.

In Canada, graphite is used chiefly in the foundry, dry battery, packings, lubricants and paint trades. Foundry needs are met in part by domestic production, and in part by plumbago from Ceylon. The battery trade uses mainly Mexican amorphous, and paint requirements are filled largely by low-grade amorphous flake. American imports of Canadian graphite are used chiefly in foundry facings, lubricants and pencils.

TABLE 32. Producers' Shipments of Graphite, 1956-67

Year	Tons	Value
		\$
1956-60 .....	—	—
1961 .....	1	146
1962-67 .....	—	—

TABLE 33. Imports and Exports of Graphite<sup>1</sup> and Carbon Products 1965-67

	1965	1966	1967
	\$'000		
Imports:			
Battery carbons .....	166	107	109
Carbon or carbon electrodes .....	2,825	2,248	2,395
Graphite and carbon basic products .....	1,633	2,968	2,816
Graphite and carbon brush stock .....	252	492	495
Graphite and carbon crucibles .....	278	278	232
Graphite and carbon refractories .....	361	790	979
Lighting and welding carbons .....	177	264	128
Exports:			
Carbon and carbon electrodes .....	1,096	1,054	879

<sup>1</sup> Includes artificial graphite.

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007 and "Exports by Commodities", Catalogue No. 65-004.

TABLE 34. Available Data<sup>1</sup> on the Consumption of Graphite, 1963-67

	1963	1964	1965	1966	1967
	pounds				
By industries:					
Paints .....	60,722	46,645	—	—	—
Copper and alloy .....	119,445	139,941	902,175	446,100	224,403
Industrial chemicals .....	955,130	1,544,005	838,881	1,185,310	1,890,296
Boilers and platework .....	1,219	1,462	1,944	—	—
Iron and steel mills .....	2,660,000	2,506,000	2,568,000	2,010,000	3,660,000
Agricultural implements .....	1,950	1,450	1,600	28,800	25,100
Railroad rolling stock .....	8,000	6,209	22,591	13,250	10,100
Iron foundries .....	789,671	1,045,821	2,049,009	3,059,623	3,827,839
Heating equipment .....	240	306	45,000	71,600	49,000
Refractories .....	372,000	486,000	564,000	696,000	704,000
Electrical industrial equipment .....	1,005	150	225	225	833
Batteries .....	316,039	217,696	359,832	272,211	87,576
Miscellaneous non-metallics .....	—	—	344,430	149,950	317,501
Miscellaneous metal fabricating .....	880,600	694,110	837,430	1,483,036	1,004,728
Motor vehicle parts .....	430,500	622,700	795,300	910,788	931,896
Communications equipment .....	262	525	—	—	—
Miscellaneous machinery and equipment .....	612,625	504,652	712,854	373,588	334,163
Miscellaneous electrical equipment .....	736,343	864,898	387,664	170,650	2,425
Truck body and trailer .....	—	—	3,359	—	—
Smelting and refining .....	169,206	138,398	178,434	1,408,000	2,410,000
Fabricated structural metals .....	—	—	5,500	6,000	6,000
Hardware, tool and cutlery .....	—	—	5,002	2,000	2,150
Major appliances .....	—	—	80	150	140
Totals for above industries .....	8,114,957	8,820,968	10,623,310	12,287,281	15,488,156
By provinces:					
Newfoundland .....	21,384	23,375	1,303,522	929,520	2,233,300
Nova Scotia .....					
New Brunswick .....					
Quebec .....	2,835,867	2,690,433	2,804,245	4,021,959	3,631,642
Ontario .....	4,460,073	5,243,349	4,963,682	5,923,136	5,999,254
Manitoba .....	76,288	31,979	162,135	51,630	2,701,500
Saskatchewan .....	1,650	8,752	2,200	10,720	6,875
Alberta .....	414,391	237,771	314,576	455,574	604,475
British Columbia .....	305,304	585,309	1,072,950	894,742	311,110
Totals accounted for .....	8,114,957	8,820,968	10,623,310	12,287,281	15,488,156

See footnote 1 Table 11.



TABLE 35. World Production of Natural Graphite, by Countries, 1963-67

Country <sup>1</sup>	1963	1964	1965	1966	1967
	tons				
North America:					
Mexico .....	20,176	33,441	44,548	42,717	..
South America:					
Argentina .....	306	245	202	154	..
Brazil .....	1,650	1,270 <sup>2</sup>	1,292	1,408	..
Europe:					
Austria .....	109,778	112,697	94,529	87,677	35,300 <sup>2</sup>
Germany, West .....	14,122	14,796	15,005	14,488	14,300 <sup>2</sup>
Italy .....	2,053	1,443	1,353	1,179	2,000 <sup>2</sup>
Norway .....	8,408	7,983	9,348	9,458	8,800 <sup>2</sup>
U.S.S.R. ....	60,000 <sup>2</sup>	66,000 <sup>2</sup>	66,000 <sup>2</sup>	72,000 <sup>2</sup>	72,000 <sup>2</sup>
Africa:					
Malagasy Republic .....	21,214	14,521	18,756	18,040	17,600 <sup>2</sup>
South Africa, Republic of .....	671	1,042	447	1,161	660 <sup>2</sup>
South West Africa .....	—	276	396	400	..
Asia:					
Ceylon (exports) .....	9,280	11,957	9,789	11,051	11,428
China (mainland) <sup>2</sup> .....	45,000 <sup>2</sup>	45,000 <sup>2</sup>	45,000 <sup>2</sup>	45,000 <sup>2</sup>	34,000 <sup>2</sup>
Hong Kong .....	891	795	—	—	21
Japan .....	3,305	2,700	2,482	2,428	..
Korea:					
North .....	77,000 <sup>2</sup>	77,000 <sup>2</sup>	77,000 <sup>2</sup>	83,000 <sup>2</sup>	83,000 <sup>2</sup>
South .....	374,428	291,515	283,315	144,338	70,147
World totals <sup>1,2,3</sup> .....	748,282	682,681	669,462	534,499	349,526

<sup>1</sup> Graphite has been produced in Czechoslovakia but production data are not available; U.S. figure withheld to avoid disclosing individual company confidential data.

<sup>2</sup> Estimate.

<sup>3</sup> Total is of listed figures only; no undisclosed data included.

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

## GRINDSTONES, PULPSTONES AND SCYTHESTONES

Sandstone beds in Nova Scotia, New Brunswick and British Columbia contain material suitable for grindstones. The output is only from the New Bruns-

wick coast where the stones are removed along the shore area of the Bay of Chaleur.

TABLE 36. Production of Grindstones, Pulpstones and Scythestones, 1956-67

Year	Tons	Value	Year	Tons	Value
		\$'000			\$'000
1956-58 .....	—	—	1963 .....	10	2
1959 .....	60	9	1964 .....	—	—
1960 .....	10	2	1965 .....	5	1
1961 .....	10	2	1966 .....	5	1
1962 .....	10	2	1967 .....	10	3

## IRON OXIDES

Iron oxide pigments are used also as colouring agents and fillers in the manufacture of imitation leather, shade cloth, shingle stain, paper and cardboard. Siennas and umbers are used in wood stains and wood fillers. The natural ochre is used as a pigment for linoleum and oilcloth; as a pigment in wood stains and wood fillers; and in colouring cement, stuccos and mortar.

Canadian producers of ochreous iron oxides shipped 644 tons valued at \$37,023 in 1967 compared with 390 tons worth \$10,199 in 1966.

The ochreous iron oxide used in the manufacture of paints is largely in the calcined form. However, a small quantity of natural iron oxides associated with clay-like materials in the form of umbers and siennas is also used as pigments in paints, both in the raw and calcined state.

TABLE 37. Production of Natural Iron Oxides, 1958 - 67

Year	Tons	Value	Year	Tons	Value
		\$'000			\$'000
1958 .....	1,632	113	1963 .....	978	75
1959 .....	1,235	108	1964 .....	1,033	79
1960 .....	909	77	1965 .....	309	14
1961 .....	808	68	1966 .....	390	10
1962 .....	771	58	1967 .....	664	37

TABLE 38. Imports and Exports of Ochres and Colours, 1966 and 1967

	1966		1967	
	Tons	Value	Tons	Value
		\$'000		\$'000
Imports:				
Orange and yellow pigments .....	692	1,408	831	1,536
Pigments, color lakes, toners .....	2,464	2,823	2,653	3,728
Exports:				
Iron oxides .....	4,577	911	4,944	1,085

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007 and "Exports by Commodities", Catalogue No. 65-004.

TABLE 39. Consumption of Iron Oxides in Paints and Varnishes, 1963 - 67

Year	Iron oxides <sup>1</sup> pigments		Ochres, siennas and umbers	
	Tons	Value	Tons	Value
		\$'000		\$'000
1963 .....	2,009	520	168	74
1964 .....	2,178	584	191	76
1965 .....	2,097	550	250	83
1966 .....	2,448	629	286	102
1967 .....	2,176	608	308	106

<sup>1</sup> Includes synthetic iron oxides.



## LITHIA

During 1967 the producers of lithia shipped 436,894 pounds valued at \$266,226 compared with 253,566 pounds worth \$260,611 in 1966. These figures on quantities are the lithia or lithium oxide content of spodumene concentrates exported for processing and of lithium compounds. The Quebec Lithium Corporation operated the chemical plant which produced lithium carbonate and other lithium chemicals. The mine, mill and chemical plants are located at Barraute, Quebec.

Lithium compounds find their most important applications in the ceramic industry and in the manufacture of lubricating greases. Practically all lithium concentrates are converted chemically to lithium carbonate or hydroxide, the usual basic compounds used in industry. For chemical processing, the only specification available is for the spodumene that Quebec Lithium Corporation is exporting. Four and a half per cent lithia is required as a minimum in the concentrate. However, practically all producers of lithium compounds either own or have a share in mining properties from which they obtain concentrates; standard specifications have, therefore, not been established and grades are a matter of individual negotiation.

Lithium greases, first evolved in 1943, came to play an important role in lubrication wherever operational extremes of temperature were experienced, as they maintain their lubricating qualities between  $-60^{\circ}$  and  $+320^{\circ}\text{F}$  and, moreover, have excellent water-insolubility characteristics. In wartime, lithium greases were invaluable for aircraft engines. Since the war their industrial use has grown rapidly, as their unique properties make possible the production of multi-purpose greases, simplifying both manufacture and application.

In ceramics, lithia serves primarily as a flux, permitting the development of low-temperature ceramic bodies with the attendant benefits of refractoriness, fuel economies and wider colour use. It

also makes possible the production of glass transparent to ultraviolet light for use in germicidal lamps. Lithium compounds reduce the maturing temperature and increase the fluidity and gloss of glass, glazes and enamels, facilitate production of certain glasses of high electrical resistance and have many other desirable effects that render them of great benefit in the field of ceramics.

Lithium as a metal has so far had limited application. Its principal use appears to be as a scavenger of impurities in refining non-ferrous metals and as a grain-refining agent. Only very small amounts are added for these purposes. Lithium alloys of magnesium, aluminum, copper, lead and zinc are under development and have promise.

The use of lithium in nuclear-energy production and as a source of fuel for rockets and guided missiles has received much publicity and speculation as to its exact function has been widespread. Little information is available in either case, but from scientific publications it has become generally known that tritium, a reported constituent of the hydrogen bomb, is obtained by bombarding the lithium-6 isotope with neutrons. The association of lithium with solid fuels is in the form of lithium hydride. The chemical compound furnishes a readily available source of hydrogen, which is a high-energy fuel.

Other common applications include the use of lithium hydroxide as a constituent of the electrolyte in alkaline storage batteries; of lithium chloride and bromide in air-conditioning units, and in refrigeration systems; of lithium fluoride as a flux in the welding and brazing of aluminum; and of compounds in the production of single-crystal optical units, in the control of reactions leading to the formation of alkyd resins for use in paints and in the manufacture of dry-cell batteries which will function at extremely low temperatures where normal cells are inoperative.

TABLE 40. Producers' Shipments of Lithia, 1958 - 67

Year	Pounds	Value	Year	Pounds	Value
		\$'000			\$'000
1958 .....	3,853,322	2,048	1963 .....	644,354	682
1959 .....	2,756,280	1,422	1964 .....	1,056,408	1,155
1960 .....	204,666	84	1965 .....	1,013,565	1,141
1961 .....	536,190	393	1966 .....	253,566	261
1962 .....	499,736	559	1967 .....	436,854	266

TABLE 41. World Production of Lithium Minerals, by Countries, 1963 - 67

Country	Mineral produced	1963	1964	1965	1966	1967
short tons						
North America:						
Canada <sup>1</sup>	Spodumene	322	528	507	127	283
United States	Lithium minerals					
South America:						
Argentina	Lithium minerals	1,583	799	686	287	..
Brazil	Amblygonite (exports)	—	—	28	—	..
	Spodumene (exports)	28	—	7,512	100 <sup>3</sup>	..
Surinam	Amblygonite (exports)	568	..	..	..	..
Africa:						
Mozambique	Lepidolite	115	—	83	—	..
Rhodesia, Southern	Eucryptite	1,142	806	705 <sup>3</sup>	..	..
	Amblygonite	52	—	—	..	..
	Lepidolite	16,157	22,943	17,700 <sup>3</sup>	..	..
	Petalite	29,946	36,449	29,900 <sup>3</sup>	..	..
	Spodumene	2,235	6,965	15,300 <sup>3</sup>	..	..
Rwanda	Amblygonite	406	325	—	—	..
South Africa, Republic of	Lithium minerals	417	179	958	337	400 <sup>3</sup>
South-West Africa	Amblygonite	128	13	39	30	..
	Lepidolite	86	407	298	365	..
	Petalite	865	798	1,332	1,344	..
Uganda	Amblygonite	53	22	22	—	..
Oceania:						
Australia	Petalite	437	233	347	1,112	..
	Amblygonite	22	—			
	Spodumene	24	58			

<sup>1</sup> Tons of lithia in spodumene concentrates.<sup>2</sup> Figure withheld to avoid disclosing company confidential data.<sup>3</sup> Estimate.

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

## MAGNESITE AND BRUCITE

Magnesitic dolomite is mined at Kilmar, Argenteuil county, Quebec, by Canadian Refractories Limited, and is processed there into basic refractory products. These include dead burned grain material, bricks and shapes (burned and unburned), and finely-ground refractory cements.

Most of the magnesia output is sold for the manufacture of basic refractories, but some is used as a soil conditioner. Hydrated lime, the co-

product, is produced in the process of recovering the magnesia and is sold for the various purposes for which lime is used.

Brucitic limestone, a rock composed of granules of the mineral brucite (magnesium hydroxide) thickly distributed throughout a matrix of calcite, was quarried from large deposits near Wakefield, Quebec, but this mine is now closed.

TABLE 42. Production of Magnesitic Dolomite, 1958 - 67

Year	Value	Year	Value
	\$'000		\$'000
1958	2,529	1963	3,440
1959	3,051	1964	3,570
1960	3,279	1965	4,011
1961	3,064	1966	3,949
1962	3,432	1967	3,516

Note: Above figures include the value of brucite shipped, dead burned magnesitic dolomite and serpentine used or sold.



TABLE 43. Magnesite and Dolomite Used in the Canadian Primary Iron and Steel Industry, 1963-67

Year	Calcined dolomite		Dolomite, crude		Magnesite	
	Tons	Value	Tons	Value	Tons	Value
		\$'000		\$'000		\$'000
1963 .....	110,415	2,565	663,560	1,280	13,588	967
1964 .....	103,609	2,635	729,514	1,415	14,600	981
1965 .....	120,249	3,090	765,707	1,520	12,478	802
1966 .....	111,022	2,773	819,352	1,766	8,573	495
1967 .....	..	..	..	..	..	..

TABLE 44. World Production of Magnesite, by Countries<sup>1</sup>, 1963-67

Country	1963	1964	1965	1966	1967
tons					
North America:					
United States .....	527,655	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>
South America:					
Brazil .....	99,536	103,331	137,394	220,462 <sup>3</sup>	..
Colombia .....	276	243	209	209 <sup>1</sup>	..
Europe:					
Austria .....	1,447,099	1,826,058	2,001,363	1,779,829	1,692,386
Czechoslovakia .....	1,632,635 <sup>r</sup>	1,858,047 <sup>r</sup>	2,029,154 <sup>r</sup>	2,095,291 <sup>r</sup>	2,322,331
Greece .....	294,558 <sup>r</sup>	397,054 <sup>r</sup>	347,453 <sup>r</sup>	413,366 <sup>r</sup>	..
Italy .....	7,512	6,954	3,898	2,867	..
Poland .....	29,321	41,888 <sup>r</sup>	46,297 <sup>r</sup>	46,000 <sup>3</sup>	..
Spain .....	93,315	102,874	110,944 <sup>r</sup>	..	..
U.S.S.R. ....	2,980,000 <sup>3</sup>	3,090,000 <sup>3</sup>	3,200,000 <sup>3</sup>	3,200,000 <sup>3</sup>	3,300,000 <sup>3</sup>
Yugoslavia .....	454,107	548,311	579,750	580,570	468,219
Africa:					
Kenya .....	288	187	74	747	..
Rhodesia, Southern .....	12,067	42,410	39,242	33,000 <sup>3</sup>	..
South Africa, Republic of .....	108,309	93,443	95,789	102,847	90,000 <sup>3</sup>
Sudan .....	—	—	—	3,307	..
Tanzania (exports) .....	94	546	1,260	5,270	..
Asia:					
China (mainland) .....	990,000 <sup>3</sup>	1,100,000 <sup>3</sup>	1,100,000 <sup>3</sup>	1,100,000 <sup>3</sup>	880,000 <sup>3</sup>
India .....	258,564	228,985	263,128	255,736	..
Iran .....	..	6,033	..	..	..
Korea, North .....	880,000 <sup>3</sup>	990,000 <sup>3</sup>	990,000 <sup>3</sup>	1,100,000 <sup>3</sup>	1,100,000 <sup>3</sup>
Pakistan .....	968	680	577	812 <sup>r</sup>	..
Turkey .....	19,750	43,065	83,320	45,903	93,651
Oceania:					
Australia .....	63,780	35,001	29,525 <sup>r</sup>	21,903 <sup>r</sup>	..
New Zealand .....	875	676	937	624	..
World totals <sup>1</sup> .....	8,905,000	9,790,000	10,365,000	9,775,000	9,946,587

<sup>1</sup> Quantities in this table represent crude magnesite mined. Magnesite is also produced in Canada and Bulgaria but data on tonnage output are not available; estimates included in total.

<sup>2</sup> Withheld to avoid disclosing individual company confidential data.

<sup>3</sup> Estimate.

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



## MAGNESIUM SULPHATE

There has been no commercial production of magnesium sulphate in Canada since 1942.

Natural hydrous magnesium sulphate (Epsom salts of Epsomite) occurs in deposits in lake bottoms or in solution in brine lakes in British Columbia. In Saskatchewan it is found associated with sodium sulphate. Attempts have been made to produce refined salts, and a number of years ago there was a considerable production from several of the "lakes" in British Columbia. Experimental shipments have been made also from lakes in Saskatchewan.

Canada's output of magnesium sulphate has come chiefly from a deposit near Basque, British Columbia.

In Saskatchewan, two lakes south of Wiseton contain brines high in magnesium sulphate, and Muskiki Lake, just north of Dana, contains brine

high in magnesium and sodium sulphates, which at certain times of the year crystallizes into a bedded deposit with layers of both salts.

In the chemical industries Epsom salts has many uses. It is employed for tanning and in dyeing, and for textile and medicinal use. Magnesium sulphate is used in the paper industry for weighting paper. In the sole leather industry it is used to obtain a clean shiny cut, and it also helps to retain moisture in the leather and increases its weight. Magnesium salt is used to a small extent in the dyeing industry. In some cases it is used in the treatment of leather to increase the fastness of the colour in washing. It is used extensively and in large quantities in medicine and for various purposes in the manufacture of textiles. In bleaching wool, magnesium sulphate is added to destroy the corrosive effect of sodium peroxide. It is also used for weighting textile fabric, especially silk. Mixed with gypsum and ammonium sulphate, it is used in the manufacture of non-inflammable fabrics.

TABLE 45. Imports of Magnesium Sulphate, 1958-67

Year	Tons	Value	Year	Tons	Value
		\$'000			\$'000
1958 .....	2,453	71	1963 .....	3,361	88
1959 .....	2,721	71	1964 .....	..	..
1960 .....	2,434	64	1965 .....	..	..
1961 .....	2,591	70	1966 .....	..	..
1962 .....	2,806	81	1967 .....	..	..

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007.

TABLE 46. Available Data on Consumption of Magnesium Sulphate, 1963-67

Industry	1963	1964	1965	1966	1967
	tons				
Leather tanneries .....	436	397	368	362	..
Medicinals .....	408	513	492	750	808
Fertilizers .....	131	85	165	79	71
<b>Totals accounted for .....</b>	<b>975</b>	<b>995</b>	<b>1,025</b>	<b>1,191</b>	<b>879</b>

## MICA

There was no production of Mica reported in 1967.

TABLE 47. Mica Production (Primary Sales), by Classes, 1966 and 1967

Grade	1966		1967	
	Pounds	Total value f.o.b. shipping point	Pounds	Total value f.o.b. shipping point
		\$'000		\$'000
Ground or powdered .....	339,800	14	—	—
Scrap, mine or shop waste and mica mined and sold for grinding .....	199,960	4	—	—
Trimmed mica .....	960		—	—
<b>Totals, mica shipments .....</b>	<b>540,720</b>	<b>18</b>	<b>—</b>	<b>—</b>

<sup>1</sup> Less than \$1,000.

TABLE 48. Producers' Shipments of Mica, 1958-67

Year	Tons	Value	Year	Tons	Value
		\$'000			\$'000
1958 .....	752	90	1963 .....	592	44
1959 .....	407	63	1964 .....	599	86
1960 .....	856	94	1965 .....	274	25
1961 .....	908	125	1966 .....	270	18
1962 .....	602	85	1967 .....	—	—

TABLE 49. Imports and Exports of Mica, 1965-67

	1965		1966		1967	
	Pounds	Value	Pounds	Value	Pounds	Value
		\$'000		\$'000		\$'000
<b>Imports:</b>						
Rough, scrap or schist .....	228,000	10	..	..	..	..
Blocks, sheets or ground .....	6,007,600	482	6,368,300	579	6,984,700	487
Fabricated .....	...	605	...	682	...	726
<b>Exports .....</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007 and "Exports by Commodities", Catalogue No. 65-004.

TABLE 50. Consumption of Mica, in Specified Industries, 1963 - 67

	1963	1964	1965	1966	1967
	pounds				
By industries:					
Paints .....	1,938,765	2,071,989	1,712,211	1,461,634	1,334,352
Rubber tire and tube .....	...	542,815	506,360	560,018	473,351
Rubber footwear .....	7,123	273	290	240	55
Rubber industries .....	..	93,097	90,246	98,782	880,092
Roofing .....	38,000	456,000	—	—	—
Non-metallic mineral products .....	213,000	257,921	273,535	137,320	137,000
Small electrical appliances .....	54,770	32,673	62,985	90,435	78,530
Major appliances .....	255,000	240,000	98,561	55,314	190,255
Communications equipment .....	4,150	4,120	45,687	60,374	45,205
Electrical industrial equipment .....	390,728	459,945	379,468	367,905	311,571
Electrical wire and cables .....	13,900	1,250	2,105	2,359	1,678
Miscellaneous electrical products .....	8,000	40,400	150	—	—
<b>Totals accounted for .....</b>	<b>2,923,436</b>	<b>4,200,483</b>	<b>3,171,498</b>	<b>2,829,652</b>	<b>2,660,089</b>
By provinces:					
Quebec, Nova Scotia, New Brunswick and New- foundland .....	1,469,183	1,453,279	1,129,137	947,047	837,792
Ontario .....	1,271,958	1,965,249	1,638,030	1,394,406	1,490,726
Manitoba .....	54,217	70,887	66,729	66,667	63,442
Alberta .....	42,000	624,257	203,500	281,624	101,000
British Columbia .....	86,078	86,811	134,102	139,908	167,229
<b>Canada .....</b>	<b>2,923,436</b>	<b>4,200,483</b>	<b>3,171,598</b>	<b>2,834,381</b>	<b>2,660,089</b>

See footnote 1 Table 11.

TABLE 51. World Production of Mica by Countries, 1963 - 67

Country <sup>1</sup>	1963	1964	1965	1966	1967
	thousands of pounds				
North America:					
Canada (shipments):					
Block .....	16	89	13	4	..
Ground .....	814	616	298	340	..
Scrap .....	353	494	236	201	..
Mexico .....	578	670	1,204	873	..
United States (sold or used by producers):					
Sheet .....	103	243	716	4	20
Scrap .....	218,646	229,458	240,510	226,263	118,503
South America:					
Argentina:					
Sheet .....	196	315	231	990 <sup>2</sup>	..
Waste and splittings .....	—	1,173	260	260 <sup>2</sup>	..
Brazil .....	3,289	3,241	3,089	2,244	..
Europe:					
Austria <sup>3</sup> .....	—	—	—	—	—
France .....	381	646	430	440 <sup>2</sup>	..
Germany, West .....	11	18	26	25 <sup>2</sup>	..
Norway, including scrap .....	6,610 <sup>2</sup>	8,814	6,614	6,610 <sup>2</sup>	..
Sweden, ground .....	44	46	—	—	..
Yugoslavia .....	77	26	119	120 <sup>2</sup>	120

See footnote(s) at end of table.



TABLE 51. World Production of Mica by Countries, 1963-1967 - Concluded

Country <sup>1</sup>	1963	1964	1965	1966	1967
	thousands of pounds				
<b>Africa:</b>					
Malagasy Republic (phlogopite):					
Block .....	214	205	201	141	119
Splittings .....	1,914	1,299	1,186	1,440	1,074
Mozambique (including scrap) .....	—	—	22	..	—
Rhodesia, Southern:					
Block .....	60	75	64	..	..
Crude .....	225	157	181 <sup>2</sup>	..	..
South Africa, Republic of:					
Sheet .....	40	104	2	1	..
Scrap .....	4,680	6,764	5,000	4,927	10,181
South West Africa .....	1,197	831	260	55	..
Tanzania (exports):					
Sheet .....	236	212	227	194	201
Scrap .....	—	324	370	880	278
Zambia: Sheet .....	—	4	9	..	—
<b>Asia:</b>					
India (exports):					
Block .....	3,979	4,264	3,179	3,662	3,543
Splittings .....	15,595	19,378	20,781	14,138	12,185
Scrap .....	55,547 <sup>3</sup>	42,256 <sup>3</sup>	58,787 <sup>3</sup>	54,901 <sup>3</sup>	30,951
<b>Oceania:</b>					
Australia: Damourite .....	1,102	1,270	1,728	1,193	..
<b>World totals<sup>1,2,4</sup></b> .....	<b>315,907</b>	<b>322,992</b>	<b>345,738</b>	<b>319,906</b>	<b>..</b>

<sup>1</sup> Mica is also produced in China, Rumania and U.S.S.R., but data on production are not available.

<sup>2</sup> Estimate.

<sup>3</sup> Includes condenser film as follows: 1963, 234,000 pounds; 1964, 198,000 pounds; 1965, 176,000 pounds; 1966, 212,000 pounds.

<sup>4</sup> Total is of listed figures only; no undisclosed data included.

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

## PERLITE

Perlite is a volcanic glass characterized by a concentric "onion skin" fracture and usually a 2 to 6 per cent water content. When heated rapidly in a furnace it expands into a frothy material of low density.

Commercially-expanded perlite is granular material and is generally white. Because of its cellular nature it is light in weight and has good insulating and sound-proofing qualities. Expanded perlite is used chiefly in lightweight concrete aggregates, insulating and sound-proofing pre-cast wallboard, and in lightweight plaster. A sack of

expanded perlite containing 3 cubic feet weighs approximately 30 to 36 pounds.

Development work has been done on deposits of perlite at Francois Lake, British Columbia, about eighteen miles by road from Burns Lake on the C.N.R. Other deposits have been found in British Columbia at Empire Valley northwest of Clinton.

Shipments of 1,112 tons of perlite valued at \$11,120 were made from the British Columbia deposits to the expanding plant of Western Gypsum Products Ltd., Calgary, Alberta, during 1953. There has been no production reported since.

## PHOSPHATE

Phosphate in the form of apatite was mined in Canada on a fairly substantial scale up to 1895, but since then the production has been small and spasmodic. In 1951, about 6 tons were shipped but there were no shipments in subsequent years.

For many years, the Electric Reduction Company Limited, Buckingham, Quebec, has purchased most of the small output for use in the production of

elemental phosphorous and various phosphorous compounds. This company, however, obtains most of its phosphate rock requirements from Florida. That state and Montana supply the great bulk of the phosphate rock which Canada imports for the manufacture of fertilizer, occasional shipments being obtained also from North Africa. Rock low in fluorine is obtained from Curacao, Netherlands, West Indies, for use in stock feeds.

TABLE 52. Production of Phosphate Rock, 1943-67

Year	Tons	Value	Year	Tons	Value
		\$'000			\$'000
1943 .....	1,451	18	1948 .....	—	—
1944 .....	482	7	1949 .....	20	--
1945 .....	299	4	1950 .....	129	1
1946 .....	57	1	1951 .....	6	--
1947 .....	—	—	1952-67 .....	—	—

TABLE 53. Imports of Phosphate Rock, 1958-67

Year	Tons	Value	Year	Tons	Value
		\$'000			\$'000
1958 .....	744,164	6,854	1963 .....	1,297,427	12,204
1959 .....	747,068	7,468	1964 .....	1,406,424	11,719
1960 .....	941,998	8,320	1965 .....	1,695,296	13,991
1961 .....	1,056,885	9,679	1966 .....	2,181,341	19,850
1962 .....	1,155,966	10,843	1967 .....	2,279,767	20,563

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007.

TABLE 54. Consumption of Phosphate Rock, 1963-67

	1963	1964	1965	1966	1967
	tons				
By uses:					
Fertilizers, mixed .....	400,217	532,759	561,003	584,881	479,648
Chemicals .....	781,427	908,695	1,127,758	1,308,070	1,454,767
Feed manufacturers .....	30,325	37,951	42,751	50,942	53,462
Totals accounted for .....	1,211,969	1,479,405	1,731,512	1,943,893	1,987,877
By provinces:					
Newfoundland .....	} 773	947	1,154	1,415	1,189
Prince Edward Island .....					
Nova Scotia .....					
New Brunswick .....	1,587	2,305	1,589	1,798	1,451
Quebec .....	251,742	255,353	369,106	288,872	294,429
Ontario .....	352,031	474,800	488,620	480,997	553,726
Manitoba .....	2,093	2,608	24,710	49,445	9,903
Saskatchewan .....	961	967	1,156	1,482	1,601
Alberta .....	179,378	185,551	257,884	449,048	464,624
British Columbia .....	423,404	556,874	587,293	670,836	660,954
Totals accounted for .....	1,211,969	1,479,405	1,731,512	1,943,893	1,987,877

TABLE 55. World Production of Phosphate Rock by Countries, 1964-67

Country <sup>1</sup>	1964	1965	1966	1967
	thousand short tons			
North America:				
Mexico .....	37	44	61	54
Netherlands Antilles (exports) .....	132	127	163	127
United States .....	25,715	29,436	39,044	39,770
South America:				
Brazil: Apatite .....	215	211	325	330 <sup>2</sup>
Phosphate rock .....	56	96	92	100 <sup>2</sup>
Chile: Apatite .....	14	11	—	..
Guano .....	17	24	17	..
Peru: Guano .....	226	187	61	72
Venezuela .....	—	7 <sup>2</sup>	66 <sup>2</sup>	30 <sup>2</sup>
Europe:				
Belgium .....	24	24 <sup>2</sup>	24 <sup>2</sup>	..
France: Phosphatic-chalk .....	48	38	26	..
Poland .....	98	103	103 <sup>2</sup>	100 <sup>2</sup>
U.S.S.R.: Apatite .....	7,360 <sup>2</sup>	8,650 <sup>2</sup>	9,300 <sup>2</sup>	9,760 <sup>2</sup>
Sedimentary rock .....	4,800	6,670	7,440 <sup>2</sup>	8,270
Africa:				
Algeria .....	80	95	88 <sup>2</sup>	386 <sup>2</sup>
Morocco .....	11,131	10,830	10,405	11,624
Senegal: Aluminum phosphate .....	133	149	160	167
Calcium phosphate .....	746	956	1,091	1,229
Seychelles Islands: Guano (exports) .....	4	7	4	..
South Africa .....	638	672	1,172	1,433 <sup>2</sup>
Togo .....	829	1,065	1,228	1,323 <sup>2</sup>
Tunisia .....	3,032	3,351	3,527	3,527 <sup>2</sup>
Uganda: Apatite .....	11	18	17	..
United Arab Republic .....	676	654	728	675 <sup>2</sup>
Asia:				
China (mainland) .....	900 <sup>2</sup>	1,000 <sup>2</sup>	1,100 <sup>2</sup>	1,100 <sup>2</sup>
Christmas Island .....	868	828	1,065	1,000 <sup>2</sup>
India: Apatite .....	4	8	18	..
Indonesia .....	4	4 <sup>2</sup>	11 <sup>2</sup>	..
Israel .....	265	428	441 <sup>2</sup>	661 <sup>2</sup>
Jordan .....	666	913	1,142	..
Korea, North: Apatite .....	220 <sup>2</sup>	220 <sup>2</sup>	276 <sup>2</sup>	276 <sup>2</sup>
Viet-Nam, North: Apatite .....	1,100 <sup>2</sup>	1,100 <sup>2</sup>	1,100 <sup>2</sup>	1,100 <sup>2</sup>
Phosphate rock .....	55 <sup>2</sup>	55 <sup>2</sup>	55 <sup>2</sup>	55 <sup>2</sup>
Oceania:				
Australia .....	6	5	6	..
Makatea Island .....	428	340	195	..
Nauru Island (exports) .....	2,038	1,649	2,245	2,200 <sup>2</sup>
Ocean Island (exports) .....	362	414	419	500 <sup>2</sup>
Totals .....	62,262	69,735	82,487	86,969

<sup>1</sup> A negligible amount of phosphate rock was produced in Cambodia, Jamaica, Philippines and Tanzania and of Guano in Argentina, Territory of South-West Africa and Philippines.

<sup>2</sup> Estimate.

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



## POTASH

All producers of potash were located in Saskatchewan. The International Minerals and Chemical Corp. at Esterhazy and the Potash Company of America at Patience Lake operated underground mines. Kalium Chemicals Limited at Belle Plaine produced potash by solution mining.

Although the products may be potassium chloride, the market quotations and other calculations are usually based on the  $K_2O$  equivalent. In

recent years many millions of dollars have been expended in developing the extensive potash deposits in Saskatchewan. Drilling has indicated that these beds of sylvite and carnallite extend westward from the Manitoba border through the Saskatoon area to Unity, a distance of nearly 400 miles. Several firms were sinking shafts to mine these deposits which lie at depths of from 2,550 to 3,500 feet.

TABLE 56. Principal Statistics,<sup>1</sup> Potash Mines, 1966 and 1967

Year	Estab- lish- ments	Mining activity							Total activity				
		Production and related workers			Cost of fuel and elec- tricity	Cost of mate- rials and sup- plies	Value of pro- duction	Value added	Working owners and partners		Total employees		Total value added
		Number	Man- hours paid	Wages					Number	With- drawals	Number	Salaries and wages	
	No.		\$'000			\$'000				\$'000		\$'000	
1966 .....	3	749	1,706	5,067	3,347	8,660	62,608	50,601	—	—	1,195	7,880	50,308
1967 .....	4	1,237	2,538	8,180	4,548	11,776	70,014	53,690	—	—	1,724	12,134	53,918

<sup>1</sup> These statistics have been included in Table 1.

TABLE 57. Producers' Shipments of Potash ( $K_2O$ ), 1960-67

Year	Tons	Value \$'000	Year	Tons	Value \$'000
1960 .....	..	179	1964 .....	858,351	31,162
1961 .....	..	..	1965 .....	1,491,301	55,971
1962 .....	..	3,000	1966 .....	1,990,053	62,665
1963 .....	626,860	22,500	1967 .....	2,383,253	67,395

TABLE 58. World Production of Potash (Marketable) in Equivalent  $K_2O$ , by Countries, 1963-67

Country	1963	1964	1965	1966	1967
	tons				
North America:					
Canada .....	626,860	858,351	1,491,301	1,990,053	2,432,984
United States .....	2,864,037	2,897,000	3,140,000	3,320,000	3,299,000
South America:					
Chile nitrate .....	20,540 <sup>1</sup>	14,881 <sup>1</sup>	15,650 <sup>1</sup>	16,200	16,000
Europe:					
France .....	1,897,661	1,991,390	2,080,794	1,964,418	1,962,332
Germany:					
East .....	2,034,000	2,046,990	2,123,049	2,211,234	2,400,000 <sup>1</sup>
West .....	2,147,300	2,426,184	2,623,722	2,525,392	2,500,000 <sup>1</sup>
Italy .....	180,779	210,541	265,657	287,703 <sup>1</sup>	276,000 <sup>1</sup>
Spain .....	331,165	379,913	474,744	522,225	515,881
U.S.S.R. <sup>1</sup> .....	2,260,000 <sup>1</sup>	2,425,000 <sup>1</sup>	2,590,000 <sup>1</sup>	2,800,000 <sup>1</sup>	3,040,000
Asia:					
Israel <sup>2</sup> .....	124,561	281,640	341,700 <sup>1</sup>	410,100	419,000 <sup>1</sup>
World totals <sup>3</sup> .....	12,486,903	13,531,890	14,151,516	16,047,325	16,861,197

<sup>1</sup> Estimate.

<sup>2</sup> Year ended March 31 of year following that stated.

<sup>3</sup> Total is of listed figures only; no undisclosed data included.

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

## POZZOLAN

This mineral name has alternate spellings, pozzuolana, pozzuolane and pozzolana. It is a siliceous rock or leucitic tuff which was first quarried near Pozzuoli, Italy and used in the manufacture of hydraulic cement. Artificial pozzolan is made from slag, fly ash, etc. In British Columbia, at Bamberton the British Columbia Cement had

facilities to produce this commodity. At Salt Spring Island a rotary-kiln plant was operated by Holdfast Natural Resources Ltd. Producers' shipments were valued at \$4,927 in 1962; \$17,994 in 1963; 35,200 in 1964 and nil since 1965.

## PYRITE, PYRRHOTITE

Pyrite and pyrrhotite are by-products which are produced from the processing of the metal sulphide ores of Noranda, Quemont, and Normetal Mines in Quebec and Britannia Mine in British Columbia. At Kimberley the waste iron sulphides are used to produce acid for the fertilizer plant. Shipments of pyrite were made to pulp and paper mills and chemical plants in Canada and abroad.

At Copper Cliff, a plant of the international Nickel Co. of Canada Ltd. treats pyrrhotite, containing some nickel, to produce iron oxide pellets and nickel carbonate. Since 1961 the data on this material have been included in the figures on by-products iron ore. Falconbridge Nickel Mines Ltd. calcines the sulphide ore to produce a feed material for the iron and steel furnaces.

TABLE 59. Producers' Shipments Pyrite and Pyrrhotite, 1958 - 67

Year	Gross weight	Sulphur content	Value	Year	Gross weight	Sulphur content	Value
	tons		\$'000		tons		\$'000
1958 .....	1,191,731	512,427	4,249	1963 .....	476,438	235,410	1,644
1959 .....	1,099,564	465,611	3,433	1964 .....	351,850	173,182	1,126
1960 .....	1,032,288	437,790	3,316	1965 .....	382,177	186,960	1,285
1961 .....	517,258	255,376	1,831	1966 .....	326,954	162,300	1,139
1962 .....	517,308	257,084	1,880	1967 .....	377,941	182,377	1,703

TABLE 60. World Production of Pyrites (including Cupreous Pyrites), by Countries, 1965 - 67

Country	1965		1966		1967	
	Gross weight	Sulphur content	Gross weight	Sulphur content	Gross weight	Sulphur content
	thousand long tons					
North America:						
Canada (sales) .....	315 <sup>r</sup>	167	324 <sup>r</sup>	143 <sup>r1</sup>	335	164
Cuba .....	30 <sup>1</sup>	13 <sup>1</sup>	30 <sup>1</sup>	13 <sup>1</sup>	..	..
United States .....	875	354	872	356	861	355
Europe:						
Bulgaria .....	151	63	157 <sup>1</sup>	66 <sup>1</sup>	..	..
Czechoslovakia .....	369	144	346	135 <sup>1</sup>	..	..
Finland .....	573	278	508	261 <sup>1</sup>	..	..
France .....	132	57	87	36	84 <sup>1</sup>	34 <sup>1</sup>
Germany:						
West .....	432	194	443	203	541	232
Greece .....	102	46 <sup>1</sup>	133	60 <sup>1</sup>	..	..
Italy .....	1,379	609	1,284	578	1,407 <sup>1</sup>	633 <sup>1</sup>
Norway .....	698	312	667	297	632 <sup>1</sup>	281 <sup>1</sup>
Poland .....	235 <sup>1</sup>	90 <sup>1</sup>	235 <sup>1</sup>	90 <sup>1</sup>	..	..
Portugal .....	604	279	549	253	512 <sup>1</sup>	235 <sup>1</sup>
Rumania .....	405 <sup>1</sup>	160 <sup>1</sup>	354	138	354	138
Spain .....	2,386	1,131	2,380	1,115	2,255	1,069
Sweden .....	434	217	427	218	433 <sup>1</sup>	217 <sup>1</sup>
U.S.S.R. ....	3,250 <sup>1</sup>	1,720 <sup>1</sup>	3,250 <sup>1</sup>	1,720 <sup>1</sup>	3,450	1,820
Yugoslavia .....	401	160	372	156	418 <sup>1</sup>	175 <sup>1</sup>
Africa:						
Algeria .....	56	26	50 <sup>1</sup>	25 <sup>1</sup>	..	..
Morocco .....	18	5	15	4	..	..
Rhodesia, Southern .....	81 <sup>1</sup>	30 <sup>1</sup>	..	..	..	..
South Africa, Republic of .....	422	170 <sup>1</sup>	474	189 <sup>1</sup>	541 <sup>1</sup>	217 <sup>1</sup>

See footnote(s) at end of table.



**TABLE 60. World Production of Pyrites (including Cupreous Pyrites), by Countries  
1964-67 - Concluded**

Country	1964		1965		1966		1967	
	Gross weight	Sulphur content	Gross weight	Sulphur content	Gross weight	Sulphur content	Gross weight	Sulphur content
	thousand long tons							
Asia:								
China.....	1,280 <sup>1</sup>	575 <sup>1</sup>	1,480 <sup>1</sup>	665 <sup>1</sup>	1,480 <sup>1</sup>	665 <sup>1</sup>	1,480 <sup>1</sup>	665 <sup>1</sup>
Cyprus .....	674	324	947	475	380	1,181 <sup>1</sup>	472 <sup>1</sup>	
Japan <sup>2</sup> .....	4,081	1,743	4,255	1,808	4,659	1,958	4,480 <sup>1</sup>	1,900 <sup>1</sup>
Korea:								
North <sup>1</sup> .....	415 <sup>1</sup>	167 <sup>1</sup>	445 <sup>1</sup>	177 <sup>1</sup>	490 <sup>1</sup>	195 <sup>1</sup>	490 <sup>1</sup>	195 <sup>1</sup>
South .....	5	5	5	5	4	1	4	1
Philippines.....	43	21	104	48	113	51	144	67
Taiwan.....	46	17	39	16	41	17	38	15
Turkey .....	111	51	130	60	171	81	123	59
Oceania:								
Australia .....	220	95	204 <sup>2</sup>	89	246	107	..	..
<b>World totals<sup>2</sup></b> .....	<b>20,096</b>	<b>9,149</b>	<b>20,978</b>	<b>9,563</b>	<b>21,100</b>	<b>9,513</b>	<b>21,618<sup>1</sup></b>	<b>9,764<sup>1</sup></b>

<sup>1</sup> Estimate.

<sup>2</sup> Tons of ore mined containing pyrites in thousand long tons: 1964, 1,631; 1965, 3,330; 1966, 3,507 and 1967, not available.

\* Less than ½ unit.

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

#### SODIUM CARBONATE (NATURAL)

Deposits of natural sodium carbonate in the form of "natron" (sodium carbonate with 10 molecules of water) and of brine occur in a number of small "lakes" throughout the central part of British Columbia, chiefly in the Clinton mining division and in the neighbourhood of Kamloops. As the deposits are far from the main eastern Canadian markets,

production is restricted to the requirements of consumers with economical rail haul.

Sodium carbonate has many industrial uses, notably in the manufacture of glass and soap, in the purification of oils, in the production of aluminum, in the flotation of minerals, in the refining of metals and in the production of caustic soda.

**TABLE 61. Production of Sodium Carbonate (Natural), 1941-67**

Year	Tons	Value	Year	Tons	Value
		\$			\$
1941 .....	186	1,488	1946 .....	—	—
1942 .....	256	2,048	1947 .....	163	1,793
1943 .....	468	5,148	1948 .....	—	—
1944 .....	44	484	1949 .....	47	513
1945 .....	286	3,146	1950-67.....	—	—

#### SODIUM SULPHATE (NATURAL)

All the natural sodium sulphate produced in Canada was obtained from the brine lakes in Saskatchewan. Producers shipped 428,316 tons valued at \$6,359,039 in 1967 compared with 405,314 tons valued at \$6,471,795 in the preceding year.

Sodium sulphate occurs as crystals or in the form of highly concentrated brines in many lakes and deposits throughout Western Canada. From these, hydrated sodium sulphate, known as Glauber's

salt, and anhydrous sodium sulphate, known to the trade as "salt cake", are produced in Canada.

Glauber's salt is used widely in the chemical industries and the demand is increasing. Sodium sulphate is used chiefly in the sulphate process for the manufacture of kraft pulp. It is used in the glass, dye and textile industries, and to a smaller extent for medicinal purposes and for tanning.



TABLE 62. Producers' Shipments of Natural Sodium Sulphate, 1958-67

Year	tons	Selling value f.o.b. shipping point	Year	tons	Selling value f.o.b. shipping point
		\$'000			\$'000
1958 .....	173,217	2,863	1963 .....	256,914	4,121
1959 .....	179,535	2,882	1964 .....	333,263	5,222
1960 .....	214,208	3,449	1965 .....	345,469	5,527
1961 .....	250,996	4,037	1966 .....	405,314	6,472
1962 .....	246,672	3,954	1967 .....	428,047	6,359

TABLE 63. Imports of Sodium Sulphate, 1958-67

Year	Salt cake		Glauber's salt	
	Tons	Value	Tons	Value
		\$'000		\$'000
1958 .....	25,812	478	1,217	39
1959 .....	27,157	511	966	40
1960 .....	24,706	472	1,156	38
1961 .....	32,310	575	899	29
1962 .....	31,347	609	426	23
1963 .....	19,002	386	495	28
1964 .....	30,833	599	1	1
1965 .....	29,347	537	1	1
1966 .....	31,262	583	1	1
1967 .....	27,621	572	1	1

<sup>1</sup> Included with salt cake.

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007.

TABLE 64. Exports of Sodium Sulphate, 1958-67

Year	Tons	Value	Year	Tons	Value
		\$'000			\$'000
1958 .....	39,763	646	1963 .....	65,348	1,077
1959 .....	47,922	752	1964 .....	107,318	1,776
1960 .....	63,831	1,026	1965 .....	116,345	1,927
1961 .....	87,131	1,331	1966 .....	101,417	1,687
1962 .....	74,049	1,211	1967 .....	123,833	2,093

Source: Trade of Canada, "Exports by Commodities", Catalogue No. 65-004.

**TABLE 65. Available Data on Consumption of Sodium Sulphate (Salt Cake) in Canada, by Industries, 1963-67**

Industry	1963	1964	1965	1966	1967
			tons		
Pulp and paper .....	221,107	242,858	261,835	323,911	329,409
Glass, including glass wool .....	3,035	3,264	3,281	3,987	5,587
Medicinals .....	71	151	79	55	63
Soaps .....	958	2,393	1,944	1,472	2,252
Mineral wool .....	306	301	209	299	285
Explosives and ammunition .....	200	..	..	..	..
<b>Totals accounted for .....</b>	<b>225,677</b>	<b>248,967</b>	<b>267,348</b>	<b>329,724</b>	<b>335,596</b>

**SULPHUR**

Native sulphur deposits of commercial grade have not been found in Canada, but large tonnages of metal sulphide ores are smelted. In smelting these ores sulphur dioxide gas is produced, some of which is recovered to make sulphuric acid or liquid sulphur dioxide. At Trail, British Columbia, the sulphur dioxide generated by smelting lead-zinc sulphide ores is converted into sulphuric acid. At Copper Cliff, Ontario, the Canadian Industries Limited uses the smelter gases from the International Nickel plant to make sulphuric acid and sulphur dioxide. Zinc sulphide concentrates are shipped to Arvida where the concentrates are roasted to produce sulphur dioxide which is used to make sulphuric acid. The roasted material is exported to smelters for the recovery of zinc and other metals. Concentrates are similarly processed at the

Sherbrooke Metallurgical Co. Limited, Port Maitland, Ontario and at Allied Chemical Canada Ltd., Valleyfield, Quebec.

Sour natural gas in the western provinces is processed to remove the hydrogen sulphide. The treatment of large volumes of natural gas means that there are large tonnages of elemental sulphur produced as a by-product. The output of sulphur has exceeded the market demand. Statistics on the operations of the sulphur plants are included in Petroleum and Natural Gas, Standard Industrial Classification-064.

Elemental sulphur is also produced in the processing of nickel sulphides at the nickel refineries.

**TABLE 66. Sulphur in Smelter Gases, 1958-67**

Year	Quantity <sup>1</sup>	Value	Year	Quantity <sup>1</sup>	Value
	tons	\$'000		tons	\$'000
1958 .....	241,055	2,361	1963 .....	353,243	3,486
1959 .....	277,030	2,716	1964 .....	443,448	4,262
1960 .....	289,620	2,855	1965 .....	444,758	4,317
1961 .....	277,056	2,708	1966 .....	500,338	6,051
1962 .....	292,728	3,090	1967 .....	592,035	7,182

<sup>1</sup> Includes sulphur in acid made from zinc sulphide at Arvida, Port Maitland and Valleyfield.

**TABLE 67. Sulphur (Elemental)<sup>1,2</sup> Recovered from Crude Petroleum, Natural Gas and Sulphides, 1958-67**

Year	Output	Shipments	
		Quantity	Value
	tons	tons	\$'000
1958 .....	186,055	94,377	1,873
1959 .....	294,775	145,656	2,621
1960 .....	454,045	274,359	4,299
1961 .....	550,101	394,762	7,288
1962 .....	1,167,999	695,098	9,287
1963 .....	1,440,802	1,249,887	13,386
1964 .....	1,664,413	1,788,165	18,638
1965 .....	1,812,612	2,068,394	26,395
1966 .....	1,979,298	2,041,528	40,254
1967 .....	2,476,007	2,499,205	68,614

<sup>1</sup> Does not include sulphur from imported crude petroleum.

<sup>2</sup> Includes sulphur produced at nickel refineries.

TABLE 68. Imports of Sulphur, 1958 - 67

Year	Tons	Value	Year	Tons	Value
		\$'000			\$'000
1958 .....	380,331	8,324	1963 .....	150,637	3,505
1959 .....	332,430	6,925	1964 .....	149,567	3,475
1960 .....	328,765	6,629	1965 .....	162,201	3,829
1961 .....	329,555	7,094	1966 .....	145,465	4,160
1962 .....	195,089	4,638	1967 .....	124,781	4,346

Source: Trade of Canada, "Imports by Commodities", Catalogue No. 65-007.

TABLE 69. Available Data on the Consumption of Sulphur (Brimstone), 1963 - 67

	1963	1964	1965	1966	1967
	tons				
By industries:					
Pulp and paper .....	332,550	349,568	367,233	397,726	358,634
Industrial chemicals .....	257,669	243,696	269,060	343,146	397,523
Rubber footwear .....	102	120	111	107	76
Rubber tire and tube .....	...	2,209	2,320	2,623	2,643
Other rubber .....	...	994	1,025	956	883
Miscellaneous foods .....	416	22	—	—	—
Fruit and vegetable canners .....	1	—	11	—	—
Sugar refining .....	147	338	211	224	225
Petroleum refining .....	160	156	107	207	99
Iron and steel .....	1,407	238	264	168	188
Miscellaneous chemicals, explosives .....	30,537	30,137	32,553	31,583	27,267
<b>Totals accounted for .....</b>	<b>622,989</b>	<b>627,478</b>	<b>672,894</b>	<b>776,740</b>	<b>787,538</b>
By provinces:					
Newfoundland and Prince Edward Island .....	23,115	25,337	25,375	26,107	22,275
Nova Scotia .....	11,456	13,661	13,042	14,957	15,693
New Brunswick .....	44,942	44,920	49,375	50,964	48,370
Quebec .....	174,867	166,874	176,109	211,345	174,431
Ontario .....	207,656	229,638	225,275	245,492	295,549
Manitoba and Saskatchewan .....	25,175	6,875	15,839	17,209	8,664
Alberta .....	71,904	73,213	93,496	142,336	154,506
British Columbia and Northwest Territories .....	63,874	66,960	74,383	68,330	68,050
<b>Canada .....</b>	<b>622,989</b>	<b>627,478</b>	<b>672,894</b>	<b>776,740</b>	<b>787,538</b>

TABLE 70. Exports of Sulphur and Pyrite, 1963 - 67

Year	Pyrite	Sulphur	
	Value	Tons	Value
	\$'000		\$'000
1963 .....	938	820,929	11,972
1964 .....	879	1,294,587	19,526
1965 .....	979	1,497,947	26,491
1966 .....	981	1,399,096	33,590
1967 .....	1,067	1,773,671	58,699

Source: Trade of Canada, "Exports by Commodities", Catalogue No. 65-004.



TABLE 71. World Production of Elemental Sulphur, by Countries, 1963-67

Country	1963	1964	1965	1966	1967
long tons					
Native sulphur:					
Frasch:					
Mexico .....	1,456,656	1,635,773	1,481,241	1,611,446	1,793,085
United States .....	4,881,927	5,228,365	6,116,406	7,001,503	7,014,448
Totals .....	6,338,583	6,864,138	7,597,647	8,612,949	8,807,533
From sulphur ores:					
Argentina .....	22,338	21,955	23,391	29,942	..
Bolivia (exports) .....	9,793	10,635	9,306	56,554	49,513
Canary Islands .....	6,889	9,842	7,000 <sup>1</sup>	7,000 <sup>1</sup>	7,000 <sup>1</sup>
Chile .....	42,751	43,185	34,413	39,671	..
China .....	120,000 <sup>1</sup>	120,000 <sup>1</sup>	120,000 <sup>1</sup>	120,000 <sup>1</sup>	120,000 <sup>1</sup>
Colombia .....	12,795	11,942	18,114	20,649	..
Ecuador .....	163	232	150	123	..
Indonesia .....	1,033	1,668	1,268	1,200 <sup>1</sup>	1,800 <sup>1</sup>
Italy .....	134,640	94,484	93,992	92,122	85,000 <sup>1</sup>
Japan <sup>2</sup> .....	219,095	237,413	209,881	226,087	250,315
Mexico .....	28,968	25,989	33,800	29,322	23,542
Philippines .....	47	68	47	14	..
Poland .....	231,486	289,948	424,195	468,976	..
Taiwan .....	7,144	6,389	4,424	4,522	..
Turkey .....	19,123	21,849	21,947	22,292	24,983
U.S.S.R. .....	950,000 <sup>1</sup>	950,000 <sup>1</sup>	1,000,000 <sup>1</sup>	1,000,000 <sup>1</sup>	1,050,000 <sup>1</sup>
United Arab Republic (Egypt) .....	490 <sup>1</sup>	..	..	..	..
United States .....	415	158	133	143	284
Totals <sup>3</sup> .....	1,807,170	1,845,757	2,002,061	2,117,294	2,203,137 <sup>1</sup>
Totals, native sulphur .....	8,145,753	8,709,895	9,599,708	10,730,243	11,010,670 <sup>1</sup>
Other elemental:					
Recovered:					
Belgium .....	4,921	4,921	3,445	4,921	..
Brazil <sup>4</sup> .....	5,659	..	4,943	5,825	6,112
Bulgaria <sup>5</sup> .....	6,291	6,720	6,720	11,000 <sup>1</sup>	..
Canada (sales) <sup>6</sup> .....	1,115,968	1,596,574	1,846,778	1,822,800	2,073,413
China <sup>4,5</sup> .....	130,000 <sup>1</sup>	130,000 <sup>1</sup>	130,000 <sup>1</sup>	130,000 <sup>1</sup>	130,000 <sup>1</sup>
Finland .....	37,611	67,063	72,606	72,478	75,000 <sup>1</sup>
France <sup>7</sup> .....	1,386,285	1,486,846	1,497,180	1,515,683	1,719,019
Germany:					
East .....	117,981	123,081	122,836	125,682	130,000 <sup>1</sup>
West .....	84,949	76,602	75,412	78,540	100,000 <sup>1</sup>
Hungary .....	2,938	3,050	3,396	3,500 <sup>1</sup>	..
Iran <sup>4</sup> .....	20,000 <sup>1</sup>	20,000 <sup>1</sup>	20,000 <sup>1</sup>	20,000 <sup>1</sup>	..
Italy .....	1,279	787	2,461	2,500 <sup>1</sup>	..
Japan <sup>4</sup> .....	11,429	18,499	35,988	52,187	61,201
Mexico <sup>7</sup> .....	43,308	36,284	45,984	38,111	47,577
Netherlands <sup>5</sup> .....	34,447	28,444	26,475	38,876	..
Netherlands Antilles: Aruba, Curacao .....	34,400 <sup>1</sup>	28,500 <sup>1</sup>	30,000 <sup>1</sup>	30,000 <sup>1</sup>	..
Portugal <sup>5</sup> .....	15,358	6,033	9,583	6,228	..
South Africa, Republic of <sup>4</sup> .....	1,981	5,701	7,102	8,904	9,000 <sup>1</sup>
Spain .....	68,036	75,452	43,253	27,819	42,120
Sweden <sup>8</sup> .....	25,885	27,009	21,082	9,842	..
Taiwan <sup>4</sup> .....	2,310	2,780	2,348	2,337	..
Trinidad <sup>4</sup> .....	6,629	5,322	3,723	4,010	..
U.S.S.R. .....	400,000	400,000 <sup>1</sup>	430,000 <sup>1</sup>	430,000 <sup>1</sup>	450,000 <sup>1</sup>
United Arab Republic (Egypt) .....	2,355	2,427	3,648	11,490	..
United Kingdom <sup>9</sup> .....	46,529	53,701	47,992	39,898	..
United States .....	946,753	1,021,358	1,215,168	1,240,386	1,267,955
Uruguay .....	—	—	—	49	..
Totals, other elemental .....	4,553,302	5,227,154	5,708,123	5,733,066	6,236,497 <sup>1</sup>
World Totals .....	12,699,055	13,937,049	15,307,831	16,463,309	17,247,167 <sup>1</sup>

<sup>1</sup> Estimate.<sup>2</sup> Includes sulphur from mixed sulphur-sulfide ore.<sup>3</sup> In some years Iran produces mined sulphur equivalent to 250-1,500 tons sulphur. No estimate in total.<sup>4</sup> From refinery gases.<sup>5</sup> From sulphide ores.<sup>6</sup> Produced from natural gas, includes a small quantity derived from treatment of nickel sulfide ores.<sup>7</sup> From natural gas.<sup>8</sup> From shale oil.<sup>9</sup> Including sulphur recovered from petroleum refineries.

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

## STRONTIUM MINERALS

In Ontario, several occurrences of celestite are known in the general Ottawa region, but very little mining has been undertaken for the mineral, and production has been small and intermittent.

Between 1918 and 1920, about 250 tons of white, fibrous celestite were mined from a deposit in Bagot township, Renfrew county, and after grinding in a small mill erected on the property, were sold for use in paint. The material was not very pure and contained about 18 per cent of barium sulphate. The old pit was pumped out in 1941 and a few tons of ore were scaled down from a small

drift. This, together with some stockpile material from the earlier work, was shipped to Montreal for grinding and pigment use. The property has since been idle. The above comprises the only production of strontium minerals in Canada of which there is any official record.

In British Columbia, celestite occurs near Birch Island, North Thompson River, Kamloops mining division. The deposit is reported to contain a large tonnage of ore consisting of a fine-grained intergrowth of fluorspar, celestite, feldspar, quartz, mica and pyrite.

## VERMICULITE

Vermiculite, a hydrated magnesian aluminum silicate, resembles mica closely but is softer and inelastic. Colours range from black through brown and dark green to almost colourless. Its principal characteristic is its ability to expand many times on heating, and in its expanded form it possesses low bulk density, low thermal conductivity, high heat resistance, chemical inertness and acoustic properties. Vermiculite is generally regarded as a product of alteration and is usually associated with metamorphosed ultra-basic rocks.

Known deposits of vermiculite in Canada are located at Stanleyville, near Perth, Ontario and

at Blue River, Kamloops mining division, British Columbia.

The principal uses for vermiculite are loose insulation in buildings; concrete and plaster aggregate; lightweight fire-resistant and acoustic tile and wallboard; rooting medium and soil amendment. It is also used in lubricants, dry chemicals, (as a diluent), combination refractory and insulating brick, as a pigment and extender in paint and as decorative filler in wallpaper. Vermiculite has been used as fireproof deck covering and partitions on ships, as loose insulation in fire and sound-proof partitions in vehicles and aircraft, as filler for life jackets and in finely-powdered forms, for oilless bearings.

TABLE 72. World Production of Vermiculite, by Countries, 1963-67

Country <sup>1</sup>	1963	1964	1965	1966	1967
	tons				
Argentina .....	3,064	4,071	1,857	2,200 <sup>2</sup>	..
Brazil .....	..	..	..	441	240
India .....	746	473	807	551	409
Kenya .....	101	37	24	84	277
South Africa, Republic of.....	98,758	111,872	126,911	113,732	111,886
Tanzania.....	30	144	108	177	100
United Arab Republic (Egypt) .....	33 <sup>3</sup>	459 <sup>3</sup>	639 <sup>3</sup>	2,057 <sup>4</sup>	..
United States (sold or used by producers).....	226,278	226,299	249,352	262,321	255,000
<b>Totals<sup>1,2</sup></b> .....	<b>329,010</b>	<b>343,355</b>	<b>379,698</b>	<b>381,563</b>	<b>367,912</b>

<sup>1</sup> Vermiculite is produced in U.S.S.R., but data are not available, and no estimates are included in the total.

<sup>2</sup> Estimate.

<sup>3</sup> Includes Mica.

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



## VOLCANIC DUST

Volcanic dust (pumice or pumice dust) is a natural glass or silicate, atomized by volcanic explosions and thrown into the air in great clouds which ultimately settle forming beds of varying thickness, often hundreds of miles from its source. In many instances the dust has been washed down from higher levels and redeposited by the agency of waters, in which case the beds are stratified and mixed with foreign substances. It consists of aluminum silicate (80 to 90 per cent) and of oxides and silicates of iron, sodium, magnesium, calcium, etc.

During 1924 to 1933 the annual production varied from 30 to 485 tons. There has been no production in recent years. The last recorded shipments were 50 tons in 1943.

Volcanic dust deposits have been found in Alberta, Saskatchewan and British Columbia. Pumice dust is used for concrete aggregate, acoustic plaster, cleansing compounds, paint fillers, absorbents, etc.

TABLE 73. World Production of Pumice, by Countries, 1963-67

Country <sup>1</sup>	1963	1964	1965	1966	1967
	tons				
Argentina <sup>2</sup> .....	13,467	4,383	7,158	8,900	..
Austria: Trass .....	23,349	25,223	22,516	23,238	24,950
Cape Verde Islands: Pozzolan.....	13,035	11,296	4,562	4,400 <sup>3</sup>	3,100
Chile: Pozzolan .....	142,002	155,885	156,094	160,291	147,905
France:					
Pumice .....	849	1,010	780	888	..
Pozzolan.....	601,488	645,547	782,136	740,370	..
Germany, West (marketable) .....	7,043,761	6,416,547	5,617,372	5,941,686	5,300,000 <sup>3</sup>
Greece:					
Pumice .....	111,858	252,500	220,000 <sup>3</sup>	330,000 <sup>3</sup>	390,000 <sup>3</sup>
Santorin earth.....	262,764	345,745	440,000 <sup>3</sup>	390,000 <sup>3</sup>	550,000 <sup>3</sup>
Iceland.....	13,800	11,000	11,000 <sup>3</sup>	11,000 <sup>3</sup>	11,000 <sup>3</sup>
Italy:					
Pumice .....	722,917	679,206	508,729	582,258	..
Pumicite .....	308,646	382,061	391,972	..	..
Pozzolan.....	4,765,354	4,483,622	4,265,113	4,197,750	..
Kenya.....	1,245	1,585	1,145	874	134
New Zealand.....	18,599	22,980	120,807	20,204 <sup>7</sup>	..
Spain <sup>4</sup> .....	1,685	2,528	62,099	..	..
United Arab Republic <sup>5</sup> .....	5,600 <sup>3</sup>	14,000 <sup>3</sup>	15,100 <sup>3</sup>	—	..
United States (sold or used by producers):					
Pumice and pumicite.....	1,050,178	1,165,379	484,047	548,433	776,388
Volcanic cinder .....	1,567,825	1,611,093	2,888,006	2,685,324 <sup>6</sup>	2,697,913 <sup>6</sup>
World totals <sup>7</sup> .....	16,668,422	16,231,600	15,998,636	15,646,219	9,901,390

<sup>1</sup> Pumice is also produced in Japan, Mexico and U.S.S.R. (sizeable quantity) but data on production are not available.

<sup>2</sup> Includes volcanic ash and cinders and pozzolan.

<sup>3</sup> Estimate.

<sup>4</sup> In 1963 and 1964 Spain produced pumice in the Canary Islands only production in Continental Spain began in 1965.

<sup>5</sup> Estimated on basis of 1 cubic meter = 1,300 pounds.

<sup>6</sup> Includes American Samoa.

<sup>7</sup> Totals are of listed figures only, no undisclosed data included.

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



## List of Establishments classified to these Industries, 1967

Product and name of firm	Head office address	Plant or mine location
<b>BARITE</b>		
<b>Nova Scotia:</b>		
Dresser Industries Inc. (Dresser Minerals Div.)	Walton .....	Walton
<b>British Columbia:</b>		
Baroid of Canada Ltd. ....	Box 250, Onoway, Alberta .....	Spillimacheen
Mountain Minerals Ltd. ....	Box 700, Lethbridge, Alberta .....	Brisco
<b>BRUCITE</b>		
<b>Quebec:</b>		
Aluminum Company of Canada Ltd. ....	Box 6090, Montreal .....	Wakefield
<b>FLUORSPAR</b>		
<b>Newfoundland:</b>		
Newfoundland Fluorspar Ltd. ....	327 Duckworth St., St. John's .....	St. Lawrence
<b>IRON OXIDES</b>		
<b>Quebec:</b>		
Red Mill Industries Ltd. ....	R.R. 1 Cap-de-la-Madeleine .....	Ste. Marthe du Cap-de-la-Madeleine
<b>MAGNESITIC DOLOMITE</b>		
<b>Quebec:</b>		
Canadian Refractories Ltd. ....	540 Canada Cement Bldg., Montreal .....	Kilmar
<b>POTASH</b>		
<b>Saskatchewan:</b>		
International Minerals & Chemical Corp. of Canada Ltd. (K1 and K2) .....	4 King St. W., Toronto, Ontario .....	Esterhazy
Kalium Chemicals Ltd. ....	400 Bank of Canada Bldg., Regina .....	Pense
Potash Company of America .....	Box 509, Saskatoon .....	Patience Lake
<b>SODIUM SULPHATE</b>		
<b>Saskatchewan:</b>		
Midwest Chemicals Ltd. ....	Box 66, Edmonton, Alberta .....	Palo
Ormiston Mining & Smelting Co. Ltd. ....	Box 502 Scott Bldg., Moose Jaw .....	Ormiston
Saskatchewan minerals (sodium Sulphate Division)	Chaplin .....	Chaplin, Bishopric
Sybouts Sodium Sulphate Co. Ltd. ....	Box 1911, Wilmington, Delaware, U.S.A.	Gladmar, Saskatchewan

## List of Establishments classified to these Industries, 1967 — Concluded

Product and name of firm	Head office address	Plant or mine location
<b>SUPPLEMENT</b>		
The following establishments classified to other industries e.g. Smelting and Refining recover the commodities indicated and are included for information purposes to support the statistical material relevant to these commodities which is presented in this report.		
<b>DIATOMITE</b>		
<b>British Columbia:</b>		
Clayburn Harbison Ltd. ....	P.O. Box 160, Abbotstord .....	Abbotstord
Fairey and Co. Ltd. ....	661 Taylor St., Vancouver .....	Quesnell
<b>FLUORSPAR</b>		
<b>British Columbia:</b>		
Pacific Silica Ltd. ....	Box 397, Oliver, B.C. ....	Oliver
<b>GEMSTONES</b>		
<b>British Columbia:</b>		
Bell A. ....	1190-2nd Ave. Prince George .....	Prince George
Osterlund, Ed. ....	Lillouet .....	Lillouet
Purvis, Ron. ....	Box 426, Lillouet .....	Lillouet
Seywerd, B. ....	R.R. # 1 Rosedale .....	Rosedale
Seywerd, J. ....	226-2nd Ave., Chilliwack .....	Chilliwack
<b>GRINDSTONES</b>		
<b>New Brunswick:</b>		
Read, H.C. ....	Sackville .....	Sackville
<b>LITHIUM MINERALS</b>		
<b>Quebec:</b>		
Quebec Lithium Corp. ....	507 Place D'Armes, Montreal .....	Barraute
<b>PYRITE-PYRRHOTITE</b>		
<b>Quebec:</b>		
Noranda Mines Ltd. ....	44 King St. W., Toronto, Ontario .....	Noranda
Normetal Mining Corp. Ltd. ....	44 King St. W., Toronto, Ontario .....	Normetal
Quemont Mining Corp. Ltd. ....	44 King St. W., Toronto, Ontario .....	Rouyn Twp.
<b>British Columbia:</b>		
Anaconda Co. (Canada) Ltd., (The) .....	260-8th St., Toronto, Ontario .....	Britannia Beach
<b>SULPHUR (IN SMELTER GAS)</b>		
<b>New Brunswick:</b>		
East Coast Smelting and Chemical Co. Ltd. ....	44 King St. W., Toronto .....	Belledune
<b>Quebec:</b>		
Allied Chemical Canada Ltd. ....	Valleyfield .....	Valleyfield
Aluminum Co. of Canada Ltd. ....	Sun Life Bldg., Montreal .....	Arvida
Canadian Electrolytic Zinc Ltd. ....	44 King St. W., Toronto .....	Valleyfield
<b>Ontario:</b>		
Canadian Industries Ltd. ....	Box 10, Montreal, Quebec .....	Copper Cliff
Sherbrooke Metallurgical Ltd. ....	Dunnville .....	Dunnville
<b>British Columbia:</b>		
Cominco Limited .....	Trail .....	Trail









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