DEPARTMENT OF MINES AND RESOURCES

MINES AND GEOLOGY BRANCH

THE CANADIAN MINERAL INDUSTRY IN 1938

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THE CANADIAN MINERAL INDUSTRY IN 1938

(By Staff, Bureau of Mines, Ottawa)

	Product	Article number	Author
1 METALS :	Aluminium	(1)	Buisson, A.
	Antimony	(2)	Buisson, A.
	Bismuth	(3)	Buisson, A.
	Cadmium	(4)	Buisson, A.
	Cobalt	(5)	Buisson, A.
	Copper	(6)	Buisson, A.
	Gold	(7)	Buisson, A.
	Iron Ore	(8)	Buisson, A.
	Lead	(9)	Buisson, A.
	Manganese	(10)	Buisson, A.
	Mercury	(11)	Buisson, A.
	Molybdenum	(12)	Eardley-Wilmot V.
	Nickel	(13)	Buisson, A.
	Platinum	(14)	Buisson, A.
	Radium & Uranium	(15)	Spence, H.S.
	Selenium	(16)	Buisson, A.
	Silver	(17)	Buisson, A.
	Tellurium	(18)	Buisson, A.
	Titanium	(19)	Buisson, A.
	Tungsten	(20)	Buisson, A.
	Zinc	(21)	Buisson, A.
11 INDUSTRIAL MINERALS :	Arsenious Oxide	(22)	Buisson, A.
	Asbestos	(23)	Goudge, M.F.
	Barite	(24)	Spence, H.S.
	Bentonite	(25)	Spence, H.S.
	Beryl	(26)	Spence, H.S.
	Bituminous sands	(27)	Ells, S.C.
	Cement	(28)	Goudge, M.F.
	Chromite	(29)	Buisson, A.
	Clays and Clay Products	(30)	Phillips, J.C.

	Product	Article number	Author
11 INDUSTRIAL MINERALS : cont'd.	Diatomite	(31)	Eardley-Wilmot V.L.
	Feldspar	(32)	Spence, H.S.
	Fluorspar	(33/	Spence, H.S.
	Garnet	(34)	Eardley-Wilmot, V.L
	Granite	(35)	Cole, L.H.
	Graphite	(36)	Spence, H.S.
	Grindstones	(37)	Eardley-Wilmot, V.L
	Gypsum	(38)	Cole, L.H.
	Iron Oxides	(39)	Waite, E. H.
	Kaolin (see : Clay)		Frechette, H.
	Lime	(41)	Goudge, M.F.
	Limestones (General)	(42)	Goudge, M.F.
	Limestones (Structural)	(43)	Goudge, M.F.
	Lithium Minerals	(44)	Spence, H.S.
	Magnesite & Brucite	(45)	Goudge, M.F.
	Magnesium sulphate	(46)	Cole, L.H.
	Marble	(47)	Goudge, M.F.
	Mica & Vermiculite	(48)	Spence, H.S.
	Moulding Sands	(49)	Freeman, C.H.
	Nepheline Syenite	(50)	Spence, H.S.
	Phosphate	(51)	Spence, H.S.
	Pyrites	(52)	Buisson, A.
	Salt	(53)	Cole, L.H.
	Sand & Gravel	(54)	Picher, R.H.
	Silica	(55)	Cole, L.H.
	Sodium Carbonate	(56)	Cole, L.H.
	Sodium Sulphate	(57)	Cole, L.H.
	Sulphur	(58)	Buisson, A.
	Talc & Soapstone	(59)	Spence, H.S.
	Volcanic Dust	(60)	Eardley-Wilmot, V.L.
	Whiting	(61)	Goudge, M.F.

	Product	Article Number	Author
111 FUELS :	Coal	(62)	Strong,R.A. & Buisson,A.
	Coke	(63)	Strong,R.A. & Buisson,A.
	Natural Gas	(64)	Rosewarne, P.W.
	Oil Shale	(65)	Swinnerton, A.A.
	Peat	(66)	Leverin H. & Buisson, A.
	Petroleum	(67)	Rosewarne, A. W.

Note : The figures of production are preliminary figures, as published by the Dominion Bureau of Statistics,

Imports and exports are taken from the "Trade of Canada", Dominion Bureau of Statistics, and cover the calendar year.

The market quotations are obtained chiefly from standard marketing reports issued in Montreal New York & London.

Ottawa, March 1939.

ALUMINIUM IN 1938

Canadian requirements of bauxite, the ore of aluminium, are all met by import, no commercial deposit having as yet been found in Canada. Direct delivery of bauxite from British Guiana, which was discontinued in 1930, was resumed in 1935, and in each of the following years imports from British Guiana showed marked increases rising to 309,954 short tons in 1938. There are also substantial imports annually from the United States, and occasionally small amounts are re-exported from Great Britain, most of which is used in the abrasive and chemical trades.

Bauxite for the production of abrasives, or for the chemical trade, is usually calcined in the country of origin. Bauxite from British Guiana, used for the production of aluminium, is washed and dried before being shipped; at Arvida, Quebec, it is treated by a standard chemical process to remove impurities, and pure aluminium oxide is recovered. Cryolite, necessary in the production of aluminium, is imported from the west coast of Greenland, the only known commercial source of supply.

The Aluminum Company of Canada at its two refineries at Arvida and Shawinigan Falls, Quebec, is the only Canadian producer of the metal; most of the output is exported. This company has also two fabricating plants, one at Shawinigan Falls, Que., and the other at Toronto, Ont. A number of other plants, mainly in Ontario and Quebec, manufacture aluminium cooking utensils, automobile parts, and other articles of aluminium.

The world output of aluminium in 1937 was 482,000 metric tons, as reported by the U.S.Bureau of Mines, (1938 figures not yet available). The principal producing countries, in order of output capacity were: United States, Germany, Russia, Canada, and France. The world consumption in 1937 was estimated at 450,300 metric tons.

Imports of bauxite, alumina and cryolite were valued at $2,919,632 in 1938, as compared with $4,397,782 in 1937. Imports of metallic aluminium and its products were valued at $1,979,622, as against $2,181,619 in 1937.

The total exports of aluminium and its products were valued at $23,743,887, as compared with $18,623,475 in 1937. Aluminium ranks third in Canada's exports of base metals.

Aluminium metal and alloys, because of their lightness, their high tensile strength, and their resistance to corrosion are much used in industry and many new alloys have found continually wider use in structural shapes and sheet metal for railway cars, automobiles, aeroplanes, skips and cages for the mining industry; roofing sheets, shipping barrels, tanks, and industrial equipment of many kinds. Aluminium powder is used in paints for preserving wood and steel surfaces such as on oil storage tanks, water tanks, tank cars and other containers. Aluminium foil is an efficient insulator for hot or cold pipe-lines, refrigerator linings, furnace jackets, and similar applications; it is also being used as a wrapper for food products. Many new uses are being found for tubes and other shapes. Alloy pistons with specially developed surfaces of oxide to reduce wear are in general use in the construction of automobile and aeroplane engines.

A new possible use for aluminium dust is in combatting silicosis. The miners are said to gain immunity from silicosis by passing through a chamber of aluminium-dust laden air before entering mines. The discovery is due to J. J. Denny and Dr. W. D. Robson of the McIntyre mine, in cooperation with the Banting Institute of Toronto. The principle involved in the experiments is the impregnation of mine dust with aluminium powder, which decreases the solubility of the mine dust.

The main markets for the Canadian aluminium industry now lie within the British Empire. Canada with vast quantities of low-cost power, is advantageously situated with respect to raw materials as well as markets. There are three producers of aluminium in the British Empire, namely the British Aluminum Co.Ltd. with three smelters in Scotland; the Aluminum Corporation with a smelter in Wales and the Aluminum Company of Canada with two smelters in Canada. The Canadian company is not only by far the largest producer, but is also the only producer mining its own bauxite, through its subsidiary the Demerara Bauxite Company in British Guiana.

The United States "Tariff Act of 1930" provides for a duty of 5 cents per pound on silicon-aluminium, ferro-silicon-aluminium, and ferroaluminium-silicon (par.302). The trade agreement (Nov.1938) between the United States and the United Kingdom provides for a duty of 6 cents per pound on aluminium and alloys (except those provided for in paragraph 302, above mentioned) in which aluminium is the component material of chief value, in coils, plates, sheets, bars, rods, circles, disks, blanks, strips, rectangles and squares (schedule IV, Par.374). Under the terms of Article I of the "Canadian-United States Trade Agreement" these concessions (if any) are automatically extended to Canadian products.

The nominal price in New York of aluminium metal 99 per cent pure remained at 20 cents per pound throughout 1938.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

ANTIMONY IN 1938

The Consolidated Mining and Smelting Company produces an antimonial residue as a by-product of its silver-refining operations at Trail, British Columbia. This residue was treated for the first time in 1938 in the new antimony refinery at Trail, for the production of metallic antimony.

The silver-lead-bismuth bullion obtained as a by-product in the treatment of the silver-cobalt-nickel-arsenical ores at Deloro, Ontario, contains small quantities of antimony. This is exported to Germany for further treatment, but no payment is received for the small antimony content.

Antimony-gold ores were mined in a small way in 1937 from the Congress and the Reliance mines in the Bridge River area, British Columbia. These operations were not resumed in 1938.

The production of antimony in 1938 amounted to 24,560 pounds valued at $2,200.

No antimony ore or refined antimony had been produced in Canada since 1917, with the exception of occasional small experimental shipments; small amounts of refined antimony as well as antimony ores were, previous to 1917, produced intermittently for a number of years in the Maritime Provinces.

Small deposits of antimony ore are known in several parts of Canada. The present high price for antimony and the difficulties facing the antimony industry in China as a result of war are an incentive to explore for new deposits and to resume development at the deposits already known in Canada.

A treatment plant was completed in 1938 at Trail, British Columbia, for the production of high grade electrolytic antimony; the antimony is recovered in the form of flue dust, a by-product of the company's silver refinery; the production is gradually being brought up to the plant capacity of 4 tons of refined antimony a day, or at the rate of over 1,400 tons a year, an amount about double our present annual import. No production was reported from the Trail plant for 1938.

Canada's requirements of antimony up to 1938 have been supplied from abroad; in 1938 there were imported 856,986 pounds of antimony metal or regulus valued at $85,461 and 66,016 pounds of antimony salts valued at $9,376. The imports of antimony oxide are not given separately in the report "Trade of Canada".

The world's production of antimony in 1937 (1938 not yet available), as published by the American Bureau of Metal Statistics, amounted to 35,750 short tons, the highest figure of production since the War years. The decline in output from China was more than made up by the large increase in production in Mexico.

The market for antimony depends upon general industrial activity and especially upon the demand from automobile manufacturers, as it is used largely in alloys for storage-battery plates, bearing and babbitt metals, solder, rubber goods, paints and fixtures.

The antimony trade of the last few years has shared in the substantial progress toward recovery made by the world's trade. The expansion in the manufacture of munitions of war has also been an important factor in the increased demand for antimony. The Chinese antimony trade has been these last few years under government control.

The bulk of the production has come, in the past from China, although Bolivia and Mexico have been for years important producers of antimony, and during the last few years, there has been a noticeable increase in output from Czechoslovakia and Algeria and, to a less degree, from several other countries.

The New York price of antimony (ordinary brand) in 1938 averaged 12.349 cents a pound, as against 13.36 cents in 1937. The New York domestic price has been fluctuating slightly, while the price for Chinese brand, duty paid, remained constant at 14.0 cents from June to December.

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BISMUTH IN 1938

Refined bismuth has been produced in Canada since 1928 and is obtained as a by-product from the treatment of the lead-zinc ores of British Columbia. Some bismuth is obtained also as a by-product from the treatment of the silver ores of northern Ontario.

Most of the world's supply is obtained from the treatment of lead refinery slime and as a by-product of the mining of gold, tin, and tungsten ores.

In British Columbia, the Consolidated Mining and Smelting Company of Canada completed a plant for the electrolytic treatment of bismuth residue resulting from the electrolytic treatment of lead bullion. The operation of the plant has been intermittent since it was constructed in 1928.

In Ontario, the Deloro Smelting and Refining Company of Deloro, from the treatment of the silver-cobalt-nickel-arsenical ores of Cobalt and adjoining areas, obtains a lead bullion that contains bismuth as well as some gold and silver; this is exported to Germany for refining.

The Canadian production of bismuth in 1938 was 9,516 pounds valued at $9,754, as against 5,711 pounds valued at $5,654 in 1937. No metallic bismuth was produced in 1937 or 1938.

No separate records of exports of bismuth or bismuth salts are available.

The imports in 1938 were: metallic bismuth 297 pounds valued at $303 and bismuth salts valued at $16,756 as against metallic bismuth 34 pounds valued at $40 and bismuth salts valued at $17,489 in 1937.

Statistics of the world production are incomplete and it is estimated at between 800 and 1,000 tons annually. The United States is the principal producer, but the publication of figures is withheld as most of the production is from the plants of two companies only; the American Smelting and Refining Company and the U. S. Smelting, Refining and Mining Company. Canada appears to hold second place as a source of supply of bismuth. Other important sources are Germany, Spain, Peru, Mexico, and Japan. Bolivia was for more than half a century the principal source of supply, but in recent years its production has decreased considerably.

Until recently most of the bismuth has been used in the manufacture of pharmaceutical products; a much larger proportion is now used in the making of so-called fusible or low-melting alloys, as for automatic sprinkler nozzles. Fusible bismuth alloys usually include lead, tin, cadmium, mercury or antimony. An alloy of bismuth, lead, tin and antimony has been introduced for use in mounting dies and punches.

Although many new applications of bismuth, introduced the last few years, have increased the demand for this metal, potential supplies from various sources very much exceed present demand.

The price of bismuth at New York in ton lots remained fixed at $1.00 a pound from September 1935 to May 1938 when the price was raised to $1.05 at which level it remained to the end of 1938. For several years the United States price has been maintained a little below the European parity, plus duty of 7½ per cent ad valorem, chargeable upon imports into the United States. For several years now the price has been well controlled.

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CADMIUM IN 1938

Cadmium is obtained as a by-product in the production of zinc, and in some cases of lead, being present in small amount in most zinc ores and in some lead ores.

Metallic cadmium is produced at Trail, British Columbia, and at Flin Flon, Manitoba.

The plant for the recovery of metallic cadmium of the Consolidated Mining and Smelting Company, at Tadanac, British Columbia, started production early in 1928 and has been treating the cadmium residue from the zinc refinery. It has a capacity of 500 tons annually.

The Hudson Bay Mining and Smelting Company at Flin Flon, Manitoba, completed a cadmium recovery plant in 1936, having an annual capacity of 180 tons. The residue treated is from the zinc refinery, and consists of current precipitate; the procedure being similar to that followed at Trail (Tadanac).

The Canadian production in 1938 was 699,138 pounds valued at $561,799 as against 745,207 pounds valued at $1,222,140 in 1937.

Canadian production of cadmium is believed to be exported chiefly to Europe, small amounts going to the Orient.

The world's production in 1938 is estimated at 4,000 short tons. The production in 1937 as published by the American Bureau of Metal Statistics was 3,924 short tons. The chief producing countries are in order of output: the United States, Canada, Mexico, Belgium, Germany, Australia (Tasmania), Poland, Norway, England, Russia and France. The Mexican output is contained in ores exported for treatment in various countries.

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

The market has been more buoyant these last few years owing to the increased use of cadmium, principally in the manufacture of alloys and compounds and as a plating material. The use of cadmium alloys in automobile bearings has created in recent years a strong demand for the metal, and the future of the alloy for this purpose is said to be dependent upon the ability of the producers to supply the metal at a relatively low price. Cadmium also finds application in the arts, medicine, and dyeing, etc. It is marketed in metallic form 99.5 per cent pure and better, and as a sulphide. The principal compounds are cadmium sulphide, Cadmium oxide, cadmium lithopone and cadmium selenide.

The price of cadmium in 1938 averaged 80.36 cents per pound as against $1.64 in 1937 (London prices in Canadian funds). From a high of $1.24 in January, the price gradually dropped to 49 cents in December. The price in New York averaged 98.04 cents as against $1.22 in 1937. The American product is protected by a duty of 7½ cents per pound; previous to the November Trade Agreement the duty was 15 cents per pound.

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COBALT IN 1938

Most of the cobalt produced in Canada has come from the silver-cobalt mining camps at Cobalt, Gowganda, and South Lorrain in northern Ontario. The greater part of it is obtained as a by-product of silver mining, consequently production varies more or less in accordance with activity in the latter. Some ore is, however, mined chiefly or solely for its cobalt content.

The only plant in Canada treating ores for the recovery of cobalt is that of the Deloro Smelting and Refining Company, Limited, at Deloro, Ontario, which produces cobalt metal, oxides and salts, chiefly for the British market. A considerable portion of the Canadian cobalt ore is sold for treatment abroad.

Small amounts of by-product cobalt are said to be recovered in Europe from the refining of Canadian nickel-copper matte, but these are not recorded in Canadian statistics.

There are no known occurrences of cobalt in Canada outside the silver-cobalt camps of northern Ontario that give promise of commercial importance. A stable high price for silver would probably result in renewal of operations at some of the old silver mines high in cobalt and thus increase the cobalt output.

Production of cobalt in Canada in 1938 was 459,060 pounds valued at $788,576 as against 507,064 pounds valued at $848,145 in 1937.

The imports in 1938 were: cobalt oxide 736 pounds valued at $1,094 as against 617 pounds valued at $871 in 1937.

The exports were as follows:

	1937		1938	
	Pounds	Value $	Pounds	Value $
Cobalt contained in ore	92,400	58,712	66,400	40,983
Cobalt alloys..............	51,939	84,629	49,674	79,278
Cobalt metallic............	7,576	10,834	83,579	122,101
Cobalt oxides & salts......	597,869	754,965	382,408	523,218
	749,784	$909,140	582,061	$765,580

Mainly owing to the agreement reached in 1935 amongst the principal producers, the price of cobalt has remained fairly constant these last few years. The nominal New York price (as quoted by Metals and Mineral Markets) for cobalt metal imported from Belgium, remained at $1.92 per pound throughout the year. The price for cobalt ore, 13 per cent grade, f.o.b. cars, Ontario, was 47½ to 52½ cents per pound from January to July, and 75 cents per pound from August to December 1938.

The Cobalt Association comprises leading Canadian, Belgium, Northern Rhodesian and Moroccan producers, the Association of German Cobalt Producers, and the Vuoksenniske Company of Finland. The Cobalt Association now controls probably about 90 per cent of the world's output. The agreement, which was to expire in August, 1936, was renewed for five years.

The total world annual output is estimated to approximate 1,500 short tons. The greater part of the world's requirements are now supplied from the extensive deposits of the Belgian Congo and Northern Rhodesia, the remainder being contributed mainly by Canada, India, and French Morocco. Other producing countries so far of less importance are Australia, Japan, Germany, and Russia.

The principal uses of cobalt are in the metallurgical and ceramic industries; about 75 per cent of the world production is used in the former and the balance of 25 per cent in the latter industry. The metallurgical uses are for high-speed cutting steels, for making stellite (alloys of cobalt, chromium, and usually small quantities of other metals) used for cutting metals at high speed, and for making permanent magnets. The alloy stellite continues to be more extensively used throughout the world, and has been found of great value in the manufacture of valves for aeroplane engines. Small quantities of cobalt used with other chemicals in nickel-plating solutions are said to produce a bright nickel electro deposit as an undercoating for later chromium plating. The invention of a new cobalt steel, employing 36 per cent of cobalt, for use in fine machine operations was reported in 1937, the other metals being cobalt, molybdenum, chromium, with small quantities of carbon and vanadium. A large amount of cobalt is now used for catalytic purposes.

Cobalt oxide is used mainly in the ceramic industry, on account of its fine colouring properties. Other compounds of cobalt are used as driers in paint and varnish.

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BITUMINOUS SAND IN 1938

Deposits of bituminous sand occur along Athabaska river between the 23rd and 26th base lines, in the northern part of the province of Alberta; exposures may be seen along both sides of the Athabaska river and its tributaries. Between the years 1927 and 1930 2,000 tons were shipped for laboratory investigations and 3,000 tons for the construction of demonstration pavements and road surfaces.

During 1938, the International Bitumen Company processed a small amount of bituminous sand at its plant at Bitumont, Alberta, producing about 45,000 gallons of fuel oil, upwards of 300 tons of asphalt of varying penetration, and a small quantity of prepared roofing. Fuel oil was disposed of to northern mining interests. Part of the asphalt was shipped to a manufacturer of roofing products in Indiana and part to the City of Edmonton. The company's equipment at Bitumont includes a separation plant, a refinery with a capacity of 350 barrels per day, shipping dock and complete housing facilities.

Abasand Oils,Limited, continued construction work on separation, distillation and refining units during 1938 on Horse River near McMurray. The separation plant has a through-put of 400 tons of bituminous sand per day, and the distillation and refining equipment has a capacity of 600 barrels per day. It is proposed to produce gasoline, tractor fuel, Diesel fuel, road oils, asphalt, and coke.

The Bureau of Mines has conducted a comprehensive investigation of these deposits of natural asphalt. In addition to field exploration during fifteen field seasons, extensive laboratory studies of the bituminous sand and of bitumen separated from it have been made. Various industrial applications for the separated bitumen, as for example, in the manufacture of paints and varnishes and in the manufacture of certain rubber goods, are also being investigated. Results obtained have directed attention to the extent and potential economic importance of the deposits. Products that may be derived include motor fuels and other liquid hydrocarbons as well as certain solid and semi-solid bitumens.

A large market for petroleum products exists in the provinces of Alberta, Saskatchewan and Manitoba. The extent to which this market can be supplied from the processing of bituminous sand will depend on ability to meet competition from other fields and on production and transportation costs. Production costs have not yet been definitely determined but apparently will be low. Transportation costs will apparently be governed to a considerable extent by tonnage of freight offered by producing companies.

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COPPER IN 1938

Canada's supply of copper is obtained from the copper-nickel ores of Sudbury, Ontario; the copper-gold ore of the Horne mine at Noranda, the copper-zinc ores of Waite-Amulet and Normetal mines, and the copper-pyrites ores of the Aldermac and Eustis mines, in Quebec; the copper-zinc ores of the Flin Flon and Sherritt-Gordon mines in northern Manitoba; the copper-zinc-pyrites ore of the Britannia mine and the copper ore of Copper Mountain mine in British Columbia.

In British Columbia the Britannia Mining & Smelting Company's mine and the 6,500-ton concentrator at Britannia Beach were operated at full capacity, producing copper and zinc concentrates, which are exported. The Granby Consolidated Company, which resumed operations in the summer of 1937, operated its Copper Mountain mine and the Allenby 3,600-ton concentrator near Princeton; the copper concentrate produced is being exported.

In Manitoba the 5,000-ton concentrator and the smelter at the Flin Flon mine of the Hudson Bay Mining & Smelting Company operated at full capacity; sinking was continued during the year to the 2750 ft. level, at which level development has been encouraging, both as to size and grade of ore; preparations are being made to sink a new South Main shaft; a research department was established towards the end of 1938. At the Sherritt-Gordon property the 1,500-ton mill was also operated at full capacity, the copper concentrate being smelted at Flin Flon.

In Ontario the International Nickel Company operated the Creighton, Frood, Garson and Levack mines; the daily concentrating capacity was increased during the year by 4,000 tons; both the concentrator and the smelter were operated at capacity; The No. 2 shaft at the Levack mine was completed to 1,860 feet and stations were cut at the 1st to 16th levels and connections made to the present No. 1 shaft workings. Operations at the Frood Open Pit began in July 1938 with stripping overburden and excavating hanging-wall rock in preparation for ore production; a new crushing and sorting plant for handling the surface ore was constructed.

At the Falconbridge mine of the Falconbridge Nickel Mines, Limited, No. 5 shaft was deepened to 2,450 feet at which horizon good ore was intersected; development of the 2,100 ft. level between Nos. 1 and 5 shafts was carried out in average ore. Further diamond drilling of the Levack prospect revealed substantial tonnage of ore; ore reserves have again been largely increased over and above the ore mined; the capacity of the reduction plant has been increased gradually to a 1938 production of 14,800 tons of copper-nickel matte shipped to the refinery.

The Denison Nickel Mines Limited with property in Denison township, northwest of Sudbury built an electric plant and deepened the shaft from the 500 foot to the 1,000 foot horizon.

The Ontario Nickel Company, owning property in the Sudbury district and other parts of Ontario, has diamond drilled its Moose Lake property in McLennan township, north of Falconbridge.

In Quebec the Noranda Mines, Limited, operated the Horne mine and smelter at normal rate throughout the year; an increasing tonnage of custom ores and concentrates was treated; exploration work was continued from No. 5 shaft on the levels from 3,500 to 4,000 feet in depth, and in preparation for the commencement in 1939 of large scale back-filling with smelter slag, a considerable footage of raising was done for fill transfer purposes.

The Aldermac Mines Limited operated its 1,000-ton concentrator, and the Waite-Amulet Mines Limited operated its 500-ton concentrator. An important copper deposit was discovered during the year at the Waite-Amulet property, by means of deep diamond drilling; the ore body occurs at a depth of about 1,000 feet; it is estimated to contain 3,393,000 tons of ore averaging 6.4 per cent of copper, 4.6 per cent of zinc, 0.05 oz. per ton of gold, and 1.62 oz. per ton of silver. A central shaft and a ventilating shaft are to be sunk, and connected by a 2,000 ft. drift; a 1,000-ton mill will be erected and probably be in operation before the end of 1939.

The Eustis mine in southern Quebec, Canada's oldest copper mine operated by the Consolidated Copper & Sulphur Co.Ltd., continued in regular operation, exporting its copper concentrate to the United States.

The Abana mine of the Normetal Mining Corporation, north of Dupuy station of the Canadian National Railway, started production in 1937, after completing the new 250-ton concentrator, the capacity of which was increased to 500 tons in 1938; the copper concentrate produced is shipped to Noranda smelter and the zinc concentrate is exported to Belgium.

The refinery of the Ontario Refining Company at Copper Cliff, Ontario, and that of the Canadian Copper Refiners,Ltd. at Montreal East, Quebec, were operated at their nominal annual capacities of 120,000 tons and 81,000 tons, respectively; the latter plant, which was enlarged during 1938 by 6,000 tons to the capacity of 81,000 tons, will again be enlarged in 1939 to a capacity of approximately 100 000 tons a year; the Montreal East plant treated the anode copper from Noranda and the blister copper from Flin Flon, and the Copper Cliff plant treated the entire output of blister copper of the International Nickel Company's smelter. At Copper Cliff the blister goes in molten form to the refinery's anode furnace; refined copper is produced both from reverberatory and electric furnaces of the arc type, the output from the latter increasing; a second unit of the electric furnace is now under construction. A feature of the special shapes department was the production of machine-pointed vertically-cast wire-bars.

The total Canadian production in 1938 was 293,010 tons, valued at $58,026,972, as against 265,014 tons valued at $68,917,219 in 1937; of the total production Ontario contributed 56 per cent, Quebec 19 per cent, Manitoba and Saskatchewan 14 per cent, and British Columbia 11 per cent.

Exports were:	Pounds	$
Copper fine in ore, matte,etc.	109,806,100	7,637,581
Copper blister	30,527,300	3,056,241
Copper, old and scrap	3,437,400	205,059
Copper in ingot,bar,rod, etc..	363,528,700	35,858,006
Copper in rod,strip,sheet,plate and tubing	53,512,900	5,767,622
Copper wire and cable		435,784
Copper manufactures		354,509
		$53,314,802

Imports were:		
Copper in bar,rod,block,pig, ingot,tube,wire & scrap...	1,930,523	322,398
Copper manufactures and compounds		640,530
		$962,928

Owing to the special revenue tariff of 4 cents a pound, sales of Canadian refined copper in the United States had ceased since 1933, but were resumed in 1937 and continued in 1938; concentrate shipped to the United States, chiefly from British Columbia, but also from Quebec, was treated in bond, the metal recovered being all offered for sale abroad. On account of its excellent quality Canadian refined copper is much in demand from foreign buyers and is finding its way into ever-widening markets. Most Canadian producers have the advantage of producing copper more or less as a by-product in the recovery of gold and silver, nickel or zinc.

The world production in 1937 (1938 not yet available) as reported by the American Bureau of Metal Statistics, was 2,505,300 short tons, compared with the previous high point of 2,118,000 short tons in 1929. The gradual improvement during recent years is largely owing to increased consumption in Great Britain and Europe, and in Japan.

The greater part of Canadian refined copper goes to Great Britain, where the consumption of new copper is at the rate of about 250,000 tons annually. The increase is attributed mainly to house building, the improvement in the transportation and engineering industries, and to the increasing domestic use of electricity; the electrical industry is by far the biggest consumer of copper in Great Britain.

The United States is by far the largest consumer of copper, the principal industries using copper in that country being in order of importance: the electrical manufacturers, automobiles, buildings, electric refrigerators, and air conditioning—an industry still in its infancy and expected to consume large quantities of copper. The total for the year 1937 (1938 not yet available) approximated 750,000 tons. In normal times the building industry is as large a consumer of copper and its alloys as is the automobile industry.

The world's consumption of copper in 1937 (1938 not yet available), as given by the American Bureau of Metal Statistics, was 2,442,600 short tons, as compared with the previous high point of 2,076,800 short tons in 1929. Canada is now contributing about 15 per cent of the total world production.

The European cartel restrictions in 1938 were 105 per cent of the scheduled capacities of the cartel members, from January to June, 95 per cent, from July to September, 105 per cent during part of October, then unlimited for a short period, and finally 110 per cent for November and December.

The price of electrolytic domestic copper (London price transferred to Canadian funds) averaged 9.972 cents per pound in 1938, as against 13.078 cents in 1937.

The New York price of domestic electrolytic copper averaged 10.0 cents a pound in 1938, compared with 13.18 cents in 1937. Owing to the 4 cent duty, there is a differential between the foreign and domestic price.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

GOLD IN 1938

The chief source of gold in Canada in 1938 was, as for many years past, the gold quartz mines of Porcupine and Kirkland Lake areas in northern Ontario. The combined output of these two camps has been for the last few years about fifty per cent of the total production of the Dominion.

With the exception of that obtained as a by-product in the refining of nickel and copper, practically all Ontario's gold comes from the gold-quartz mines. As stated previously, Porcupine and Kirkland Lake are the principal producing areas in Ontario. Nevertheless, important contributions have been made in recent years from Little Long Lac and adjoining areas in Thunder Bay district; from Red Lake, Crow River, Sachigo River and Lake of the Woods areas in Kenora district; Larder Lake and Matachewan areas in Timiskaming district, and from Goudreau and Michipicoten areas in Algoma district.

Quebec's chief producer is still the Noranda gold-copper mine, but the relative amount contributed by gold-quartz mines in the northwestern part of the province is increasing rapidly. Important contributions are being made by the mines in the Bourlamaque, Siscoe, Malartic and Cadillac areas in Abitibi county, and the Arntfield, Duparquet, Rouyn and Mud Lake areas in Témiscamingue county.

The chief source of gold in British Columbia is the gold quartz mines of Bridge River area, in Lillooet division; of the Salmon River area, in Portland Canal division; of Wells camp, in the Cariboo division; of Hedley camp, in Osoyoos division; of Sheep Creek, Ymir and other adjoining areas in Nelson division; and of Zeballos river, on the west coast of Vancouver Island. Next come auriferous base metal ores, notably those of the Britannia and Copper Mountain mines. A relatively small amount (50,000 ozs.) is obtained from placer operations.

Manitoba's gold is derived chiefly from the copper-zinc-gold ores of the Flin Flon and Sherritt-Gordon mines, with a relatively increasing production from the gold-quartz mines of Rice Lake district in Eastern Manitoba, of God's Lake district, and of The Pas district.

In Saskatchewan the production is still virtually all from that portion of the Flin Flon mine lying west of the interprovincial boundary; contribution will be made in the near future from the new mines near Goldfields, Lake Athabaska district.

In the Northwest Territories production was started in 1938, this being obtained from the Yellowknife River area, on the north shore of Great Slave lake.

Yukon's gold output is virtually all from placers and is won chiefly in large-scale dredging operations, mainly in the vicinity of Dawson City.

Nova Scotia's output is from the gold-quartz mines of Seal Harbour, Montague, Caribou, Moose River, Goldenville, and a few other areas.

In Alberta a small amount of placer gold is reported annually.

Plants for the production of fine gold are operated by: the Royal Canadian Mint at Ottawa; the Hollinger Consolidated Gold Mines, Ltd. at Timmins, Ontario; the Ontario Refining Company, Ltd. at Copper Cliff, Ontario; Canadian Copper Refiners, Ltd. at Montreal East, Quebec; and the Consolidated Mining and Smelting Company, Ltd. at Trail, British Columbia. The Copper Cliff refinery provides a service for several of Canada's gold mines by working up their accumulation of slags, mattes, and other gold bearing materials.

During 1938, great activity was manifest in the development of new mines, especially in the old Porcupine and Kirkland Lake (Larder Lake section) areas, in the Patricia section of Kenora district and near Opeepeesway Lake, Sudbury district, Ontario; in the Cadillac-Malartic and adjoining areas, in western Quebec; in new areas of Yellowknife River, in the Northwest Territories; near Lake Athabaska in Saskatchewan; and in the Zeballos river area, on the west coast of Vancouver Island in British Columbia.

There were in operation 163 gold mills with a combined total daily capacity of 55,600 tons. Of this total, 25 small plants, mostly in Nova Scotia, were in operation only intermittently. New mills completed and put in operation in 1938 numbered 38 with a combined daily capacity of 6,300 tons. There were 11 new mills, with a combined daily capacity of 3,600 tons already under construction and scheduled to come into production in 1939.

In Nova Scotia several old properties were again put in operation in a small way. The Seal Harbour mill, by far the largest in the province, was enlarged by 100 tons to a capacity of 250 tons.

In Quebec, the new mills were: the 900-ton mill of East Malartic; the 200-ton mill of Francoeur; the 300-ton mill of Lapa-Cadillac; the 300-ton mill of Sladen-Malartic; the 150-ton mill of Pan-Canadian; and smaller mills at Payore and Lake Rose.

In Ontario, the new mills were: the Kerr-Addison 700-ton mill; the MacLeod-Cockshutt 600-ton mill; the Madsen 365-ton mill; the Hallnor 250-ton mill; also 200-ton mills at the Moneta, Cline, and Hard Rock; the 100-ton mills at Golden Gate, Bilmac and Tombill; and several other smaller mills.

In Manitoba, no new mills were brought into production during the year.

In Saskatchewan, the 1,500-ton mill of the Box property near Goldfields operated by the Consolidated Mining and Smelting Company was under construction. The adjoining Athona property was under development.

In British Columbia, the 750-ton mill of the Big Missouri, in the Portland Canal area was put in operation early in 1938. It is unique in Canadian metallurgy as it was built entirely under ground. Other new mills were: the B.R.X. 100-ton mill, Bridge River; the Gold Belt 150-ton mill, Sheep Creek; the Cariboo-Hudson 100-ton mill, Quesnel; and several smaller mills such as Privateer, Spud Valley and Rey Oro in Zeballos area, and a few others in other parts of British Columbia.

In the Northwest Territories a 100-ton mill was built by the Consolidated Mining and Smelting Company near Yellowknife Bay, Great Slave Lake. The Negus 50-ton mill in the same area started operations in January 1939.

The gold production of the Dominion in 1938 was 4,715,480 fine ounces valued at $165,867,009, a gain of $22,540,516 over 1937 and an all-time high record. By provinces the production was as follows:

	1937 Fine ounces	1937 $	1938 Fine ounces	1938 $
Nova Scotia	19,918	696,931	26,613	936,112
Quebec	711,480	24,894,685	879,881	30,949,814
Ontario -				
Porcupine	1,120,525	39,207,170	1,258,797	44,278,184
Kirkland Lake...	999,446	34,970,615	1,030,747	36,256,526
Other	467,124	16,344,669	607,857	21,381,370
Total Ontario	2,587,095	90,522,454	2,897,401	101,916,080
Manitoba	157,949	5,526,636	185,672	6,531,[illegible]13
Saskatchewan	65,886	2,305,351	50,021	1,759,489
Alberta	46	1,610	305	10,728
British Columbia..	505,857	17,699,936	596,279	20,974,114
Yukon & N.W.T. ...	47,982	1,678,890	79,308	2,789,659
CANADA	4,096,213	143,326,493	4,715,480	165,867,009

The value of Canada's gold production in 1938 was 51 per cent of the total value of all metals and 37 per cent of the total value of the entire output of the Canadian mineral industry.

The world production of gold in 1938 is estimated at 37,109,400 fine ounces (as given by the Engineering and Mining Journal) compared with 36,266,500 fine ounces in 1937 (as given by the American Bureau of Metal Statistics). Canada ranks third after South Africa and Russia as a world producer and contributes about 12 per cent of the total output.

The average price of gold for the year in Canadian funds was $35.165 per fine ounce, as compared with $34.99 in 1937.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH,1939.

IRON ORE IN 1938

No iron ore for blast furnace use has been mined in Canada since 1923, but three large iron and steel-making plants and one merchant furnace are in operation on imported ore. The Dominion Steel and Coal Corporation's plant at Sydney, Nova Scotia, draws its ore supply from its own mines at Wabana, Newfoundland; and the plants of the Steel Company of Canada, at Hamilton, Ontario, of the Algoma Steel Corporation at Sault Ste. Marie, Ontario, and of the Canadian Furnace Company's blast furnace at Port Colborne, Ontario, at present all draw their supplies from the Lake Superior region of the United States.

Bounties on the production of iron ore are offered by the provinces of Ontario and British Columbia.

Algoma Ore Properties, Limited, a subsidiary of the Algoma Steel Corporation, stimulated by the bounty of 2 cents a unit offered by the Ontario government, started in 1937 opening up its New Helen mine in the Michipicoten district, and is expected to bring the property into production in the early summer of 1939. The New Helen deposit is estimated to contain some 100,000,000 tons of carbonate ore averaging about 35 per cent iron; to fit it for use in the blast furnace a roasting and sintering plant capable of treating 2,000 tons of ore a day will be built; the sinter will carry about 50 per cent iron.

The iron deposits at Steeprock lake, north of Atikokan, about 100 miles west of Port Arthur were discovered in the winter of 1937-38 by diamond drilling through the ice. The property was under development during 1938 by the Steerola Exploration Company, now Steep Rock Iron Mines, Ltd., with Joseph Errington of Toronto, as president. The diamond drilling has proved the existence of a large deposit of hematite ore. The core analyses have shown 51 to 60 per cent iron. Further development is being carried on (1939) with three diamond drills.

In the Sudbury district, the M. A. Hannan Company of Cleveland, Ohio, sampled the old Moose Mountain mine and is reported to have shipped in 1937 some 60 tons of ore for experimental purposes. The Moose Mountain deposit is estimated to contain at least 33,000,000 tons of proved and probable low-grade siliceous, magnetite ore carrying 35 per cent iron. It was worked in a more or less experimental way for a number of years and an exceptionally high-grade material for the blast furnace was produced by fine crushing the ore, followed by magnetic separation and sintering of the concentrate. Under present day conditions and aided by the Ontario bounty of 2 cents a unit it may now be found possible to work this deposit profitably.

Imports of iron and its products (including iron ore to the value of $2,830,482) in 1938 were valued at $162,554,216 of which $134,844,204 came from the United States and $21,646,236 from Great Britain. Exports were valued at $2,188,077 of which $1,812,448 went to the United States and $217,219 to Great Britain.

The demand for primary iron and steel was supported these last two years by the improvement in business and by the advances made by the heavy manufacturing industries, including the automoble industry, railway rolling stock, agricultural implements, and industrial machinery industries.

ISSUED BY THE BUREAU OF MINES,
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OTTAWA, MARCH, 1939.

LEAD IN 1938

The greater part of the lead produced in Canada has come from the great Sullivan silver-lead-zinc mine at Kimberley, British Columbia. Other important sources of production in British Columbia have been the Monarch silver-lead-zinc mine near Field, and numerous silver-lead and silver-lead-zinc mines in the Kootenay and other districts; the high-grade silver-lead mines of the Mayo area, Yukon Territory; various lead mines in Ontario, from which there has been no production for a number of years; the lead-zinc mine in Portneuf county, Quebec; and in Nova Scotia, the lead-zinc-copper mine at Stirling, Cape Breton.

The Sullivan mine at Kimberley, British Columbia, owned and operated by the Consolidated Mining and Smelting Company of Canada, produces the greater part of Canadian lead; the lead and zinc concentrates produced at its 6,500-ton concentrator are shipped by rail 185 miles to the company's smelter and refinery at Tadanac, near Trail, British Columbia; some improvement was made in the metallurgy at the Sullivan concentrator at Kimberley. The Monarch mine, near Field, British Columbia, has been an important producer, exporting to Europe both lead and zinc concentrates; operations in 1938 were confined to development, the equipping for production of the adjoining Kicking Horse property, and the overhauling of the 300-ton concentrator. The mines and concentrators of the Mammoth, at Silverton, the Whitewater at Retallack, and the Noble Five at Sandon were worked for part of the year; several other properties in this area (Ainsworth-Slocan) such as the Lucky Jim, McAllister and Utica, were under active development and occasional shipments were made. With higher lead and zinc prices, the above mentioned properties and several others in British Columbia would become fairly regular producers.

In the Yukon Territory, the Treadwell-Yukon Company continued producing from its several small but high-grade silver-lead properties near Mayo.

In Quebec, the Tetreault property near Notre-Dame-des-Anges, Portneuf county, and the Stirling property, at Stirling, Cape Breton, Nova Scotia, were not producing in 1938; the lead and zinc concentrates when produced are shipped to Europe.

The lead smelter and electrolytic refinery at Trail, British Columbia, the only one in Canada, with a capacity rating of 560 tons of refined lead a day, or 205,000 tons a year, was operated at full capacity for the first 10 months of the year and at 500 tons for November and December; a new casting wheel with mechanical pig handling was installed in 1938.

The Canadian production of lead in 1938 was 209,457 tons valued at $14,008,459, as against 206,000 tons valued at $21,053,200 in 1937.

The exports of lead in ore, pig, etc., in 1938 were 158,513 tons valued at $8,983,191, as against 184,835 tons valued at $17,841,000 in 1937; and white lead, 35 tons valued at $5,712 in 1938, compared with 108 tons valued at $17,842 in 1937.

The total imports of lead and lead products in 1938 were valued at $2,879,838, as against $2,532,563 in 1937.

The world production in 1938, as published by the American Bureau of Metal Statistics, was 1,829,741 short tons, as compared with 1,886,300 tons in 1937 and a maximum production of 1,933,000 short tons in 1929. Canada contributes about 11 per cent of the world lead production. The principal producing countries are, in order of importance, United States, Mexico, Australia, Canada, Germany, Belgium, India (Burma), and Spain.

The world consumption in 1937 (1938 not yet available), as given by the American Bureau of Metal Statistics, was 1,918,400 short tons. The Canadian consumption of lead is probably between 35,000 and 40,000 tons a year. In the United States the principal consumption continues to be in the storage battery, lead pigment, cable covering, building and ammunition industries.

In the United Kingdom consumption of lead for the last few years has been increasing more or less regularly and is much in excess of that for the year 1929; the chief influence continued to be the further advance in building activity and the increased armament requirements. The consumption is estimated at 350,000-400,000 short tons.

The average price of pig lead (quotations on the London market, converted to Canadian funds) in 1938 was 3.35 cents a pound, as against 5.11 cents in 1937. The average price at New York was 4.74 cents as against 6.01 cents in 1937.

ISSUED BY THE BUREAU OF MINES,
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OTTAWA, MARCH, 1939.

MANGANESE IN 1938

The production of manganese ore in Canada has been small and irregular and was confined mainly to Nova Scotia and New Brunswick with occasional shipments from British Columbia.

The manganese ores that have been mined in Canada are pyrolusite, manganite, psilomelane, and bog manganese. These, with the exception of the bog manganese, were mostly of a high manganese content and fairly free from deleterious constituents. They were usually in small lots and were derived from various localities in Nova Scotia, New Brunswick and British Columbia.

No production of manganese ore in Canada was reported in 1938. There was a production of 85 tons valued at $817 in 1937. ~~There was no production during the previous three years.~~

The imports of "manganese oxide" in 1938 were 21,050 tons valued at $463,673, as against 77,226 tons valued at $802,269 in 1937.

The manganese ore imported into Canada comes mainly from the Gold Coast, West Africa. The ore is principally used in the making of ferro-manganese.

Notwithstanding the duty of nearly 2 cents per pound of metallic manganese in ferro-manganese of a grade of 30 per cent or more, most of the Canadian ferro-manganese is exported to the United States.

The world's production of manganese, as reported by the United States Bureau of Mines, for the year 1936 (complete statistics for 1937 and 1938 not yet available) amounted to 5,136,000 metric tons. The present output is estimated to exceed 5,000,000 metric tons.

Russia is by far the largest producer, followed by British India, West Africa (the Gold Coast), the Union of South Africa, Japan, Brazil, Egypt and Cuba.

The trade agreement between the United States and Canada signed on November 15, 1935, and proclaimed by the President on December 2, 1935, provided for reduction of the duty on ferro-manganese containing not less than 4 per cent carbon imported into the United States. This agreement went into effect January 1, 1936, and is still in force.

The metallurgical industry is the largest consumer of manganese ore; the next in importance is the battery industry; the chemical, ceramic and glass industries consume relatively small quantities.

The price of manganese ore in 1938 at North Atlantic ports for 46 to 48 per cent manganese, Brazilian, decreased from 45 cents per unit in January to 27 cents in December and averaged 34 cents per unit for the year; for South African ore, 50 to 52 per cent manganese, the price varied from 45 cents down to 28 cents per unit and averaged 35 cents for the year; for chemical grades 80 per cent MnO_2, the price was $47-$52 per ton for the first six months and $43-$47 for the last half of the year.

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OTTAWA, MARCH, 1939.

MERCURY IN 1938

Occurrences of mercury in the form of cinnabar or sulphide of mercury have been reported from a few localities in British Columbia and from one in Ontario. Mercury, associated in the form of an amalgam with the silver ores of the Cobalt area, Ontario, has been also noted.

The improvement in the price of mercury during the last few years has encouraged further exploration for mercury deposits in Canada. In British Columbia development work was done on claims in the vicinity of Savona, and near Minto, Bridge River area. The Empire Mercury Mines, Ltd., which has taken over the property of the Manitou Mining Company, in the Bridge River area, built a 10-ton Gould reduction furnace, really a testing unit, and started production in the fall of the year. The product is marketed in Vancouver and is sold mainly to gold mine and placer operators in British Columbia.

The production in 1938 was 760 pounds valued at $760. With the exception of a small output (138 flasks) of mercury produced between 1895 and 1897 from a property near Savona, Kamloops Lake, British Columbia, and about 12 flasks recovered between 1910 and 1918 in the treatment of the Cobalt camp silver ores, no mercury was produced in Canada previous to 1938.

The mercury imports into Canada in 1938 were 49,584 pounds valued at $49,564, as against 394,354 pounds valued at $371,178 in 1937. In addition mercury salts were imported valued at $5,083 as compared with $9,681 in 1937.

The world production of mercury is about 3,000 tons a year, chiefly from Spain and Italy. The civil war in Spain, the principal producing country (one third of world production) has created a very serious situation for the principal mercury-consuming countries, which have no producing mines or small sources of supply. The Italian output was just slightly below that of Spain but under the stimulus of present conditions, world shortage and high prices, it has been considerably increased. Other important producers are: the United States, Mexico, and Bolivia.

The average New York price of mercury in 1938, in flasks of 76 pounds, was $75.47 as compared with $90.18 in 1937.

Considerable quantities of mercury are still consumed by the gold mining industry, although the introduction of "corduroy" blankets for the concentration of gold ores has decreased the demand. Substantial quantities are being required in new chemical and metallurgical plants as a catalyser, and for mercury arc rectifiers. It is used in boiler-compounds, and in the preparation of drugs and chemicals. Mercury is now being used extensively in connection with the latest process of artificial silk manufacture. Research is being carried on and the prospects for increased consumption in new uses are said to be encouraging.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

Article 12

MOLYBDENUM IN 1938.

Molybdenite the chief ore of molybdenum, is a very soft steel-blue coloured sulphide, usually found in pegmatite dykes and along the contacts of limestone and gneiss. Greenish-grey pyroxenites are common associated rocks in which other minerals such as pyrite and pyrrhotite occur.

Prospecting for molybdenite was more active than in 1937.

In Ontario the Phoenix Molybdenite Corporation was taken over by the Zenith Molybdenite Corporation. Much surface trenching was done on the Bagot property, 8 miles southwest of Renfrew, where previously a 200-foot shaft had been sunk and underground work carried on; a few tons of concentrate were sold that had been produced in 1937. The Regnery Metals continuously prospected the claims near Hawk Junction, 20 miles northeast of Michipicoten Harbour; about 15 tons of low-grade ore, intimately associated with pyrite and chalcopyrite, tested in the laboratories of the Bureau of Mines, Ottawa, gave poor results on account of the grade and high copper content; subsequent underground work, diamond drilling and surface trenching are said to have proved a large tonnage of higher grade and cleaner molybdenite; about 1,000 tons of 0.50 per cent molybdenite ore is said to be stockpiled.

The Brough Lake Molybdenum Limited performed about 600 feet of diamond drilling at Cheddar, near Wilberforce, but assay results of the drilling have not yet been received. Stripping and the sinking of a shaft to 40 feet were undertaken by the McCoy Molybdenite Limited, on a deposit located on the northwest corner of Lyndoch township, Renfrew county. The Kaskabowie Mining Syndicate put down 5 diamond-drill holes of 100 feet each on the Sam Young claim on Concession 3, Conme township near Port Arthur, but commercial ore was not found. The Molydor Mines Limited, controlled by the Cook Lake Gold Mines Limited, shipped 23 tons of 0.5 per cent molybdenite ore to the Bureau of Mines, Ottawa, for testing, which resulted in a good recovery; this property is situated in McTavish township two miles northeast of Loon Station, east of Port Arthur. The Amorada Gold Mines Limited, Beardmore, shipped a few hundred pounds to Ottawa for testing from Dorothea township, east of Lake Nipigon. Prospecting was also carried out during the year by the following:- C.W. Shosenberg of Burnt River, on the old Padwell deposit at Essonville, near Wilberforce; La Reine Gold Mines Limited, for a few weeks early in the year; A.V. Dukes on the property at Mace, near Cochrane where about 30 tons of ore were set aside.

In Quebec, the Molybdenite Corporation of Canada Limited prospected the property on the southwest corner of LaCorne township, 20 miles south of Amos, Abitibi district; seven diamond-drill holes were put down totalling about 4,000 feet, extending the previously known field of molybdenite mineralization; in its 30-ton pilot mill, the company started to treat the 2,500 tons of ore mined in 1937 and 1938; several years ago when this small mill was erected some concentrate was shipped. Surface stripping was also carried out in the vicinity by Ovila Legault of Amos.

The Quyon Molybdenite Company (H.E. Wood and Associates) opened the old Moss mine at Quyon, 33 miles west of Ottawa, the world's leading molybdenite producer during the Great War period. The main pit and underground workings were dewatered, the shaft was retimbered and trenching and quarrying work were done at the No.2 deposit to the northwest of the main pit; ore was found in the sides of the pit and what appears to be a high-grade lens was uncovered at No.2 deposit; work was started on a geophysical survey of the area and other ore bodies have already been recognized. Surface development started in 1937 by the Kindale Mines Limited was carried on for a few months on the Bain property, Masham township, 36 miles north of Ottawa. The Maniwaki Molybdenum Mines Limited did surface trenching and stripping on a series of deposits in Egan township about 25 miles north of Ottawa that were worked in 1917. A few miles to the north of Maniwaki near Montcerf some stripping was done on the La Fleur property and high grade ore occurring in a flat vein was uncovered.

In British Columbia prospecting was undertaken by the following: The Canadian Explorations Limited, at the headwaters of Clear creek on the east side of Harrison lake, and later at the Little Ken group, 6 miles from Salmo, Sheep Creek area, work on which is being continued; C.H.Foot and associates of Fraser Lake P.O. on the Stella group, 5 miles southwest of Endako; A.J.Cleeton of Cascade, on the Midas group, 4 miles east of Farron station on the Kettle Valley railway; John Cowie of Nanaimo, on the Allies group at the head of Jump creek, Nanaimo river, Vancouver Island; H.A.Fraser of Armstrong continued work on his claims near Westwold, 40 miles southeast of Kamloops.

Work was done by the B.C.Molybdenite Company,Limited, on trail construction from Alvin at the head of Pitt lake, 12 miles northwest to the property on Boise creek; a framework of rough timbers for a small mill was erected; samples taken at various places indicated a wide zone of low grade ore.

Although there was considerable activity throughout Canada,no molybdenite concentrate was produced other than a few hundred pounds resulting from ores shipped to Ottawa for testing. About 6½ tons valued at $4,500,produced in 1937, was sent to England and to France.

Canada imported 181,377 pounds of calcium molybdate and 59,317 pounds of ferro-molybdenum for use in the manufacture of steel alloys: in the previous year the imports were 221,300 pounds of the molybdate and 63,800 pounds of the ferro. The former contains about 41 per cent and the latter about 60 per cent of metallic molybdenum.

The world production in 1938 of metallic molybdenum was about 17,000 tons against 9,500 tons in 1937. The United States contributed 16,500 tons, again constituting an all-time record. The Climax Molybdenum Company at Climax, Colorado, as a result of increasing the capacity of its mill to 12,000 tons of ore daily, produced concentrate containing 14,000 tons of molybdenum,a 27 per cent increase over 1937. The output of all other producers in the United States was 2,500 tons of contained molybdenum, there being a slight decrease by producers such as Arizona Molybdenum Corporation, Molybdenum Corporation of America, and large copper producers having a molybdenum by-product such as Utah Copper Company and Nevada Consolidated Copper Company. The Mammoth-Saint Anthony Limited increased its output of molybdenite and wulfenite concentrates from the Mammoth mine, Arizona.

Outside the United States the largest production comes from Cananea in Mexico, which in 1938 had an output of high-grade concentrate of molybdenum sulphide containing 800 tons of the metal. The Knaben mine in Norway increased its output, which amounted to 795 tons of molybdenite concentrate in 1937. Several other companies were active in Norway. In Australia, there are several small producers distributed throughout New South Wales, and one in Queensland. A few tons are produced from Peru, Korea, and Turkey, and about 200 tons of concentrate annually from the Azagour district in French Morocco.

Molybdenum is used chiefly to intensify the effects of other alloying metals, particularly nickel, chromium, and vanadium. The extended use of molybdenum in many fields has caused a steady and considerable increase in consumption.

In general, molybdenum alloy steels are outstanding for their uniformity, response to heat treatment, relative freedom from distortion during quenching, toughness and hardness. They have high impact-strength at sub-zero temperatures, hence are used in automobiles for cold climates.

The use of carbon-molybdenum steels is increasing, especially for sheeting and piping. Molybdenum alloys are now used in seamless steel tubing for aeroplane construction. Nearly all tungsten tool-steels now have some molybdenum added, and in some instances it is actually replacing the tungsten in the high-speed tool-steel industry. For use in hard-wearing and special parts, especially in automobiles, molybdenum steels are gaining favour both on the American continent and in Europe. The use of molybdenum in cast iron has increased greatly in recent years. Much molybdenum wire and sheet is used in the radio industry. The chemical applications of the metal continue to grow, and it has been found recently that molybdenum pigments (orange) have very high covering power and tinting strength.

Molybdenum is introduced into steel either as calcium molybdate or as ferro-molybdenum, usually the former; the ratio used is about 4 to one on the American continent, but in England this ratio is reversed.

The consumption of molybdenum in England is substantial. During 1938, about 1,800 tons of metallic molybdenum was consumed, slightly less than in 1937.

The price at New York of 90 per cent molybdenite concentrate is nominally 42 cents per pound of contained molybdenum sulphide. The duty on ore or concentrate into the United States is 35 cents per pound on the metallic molybdenum contained therein. The price in England declined towards the end of the year and now ranges from 31 cents per pound for 65 per cent molybdenite concentrate to 42 cents for 85 per cent concentrate. The price of calcium molybdate is about 86 cents and ferro-molybdenum $1.05 per pound of contained molybdenum, f.o.b. Montreal.

As in the previous year activity in molybdenite prospecting and mining continued to increase appreciably throughout the world. There were a considerable number of inquiries for Canadian material especially in England. Although most of these call for regular tonnage of a consistent grade of concentrate over fairly long periods, there is nevertheless some demand for small odd shipments of 5 to 10 tons.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

NICKEL IN 1938

Nearly all Canada's nickel is derived from the nickel-copper ores of the Sudbury district, in Ontario, though a small amount is a by-product from the silver-cobalt ores of Cobalt and similar camps in the northern part of the same province.

Production during the year was from the Frood, Creighton, Garson and Levack mines of the International Nickel Company and from the Falconbridge mine of the Falconbridge Nickel Mines Ltd.

Both the International and Falconbridge companies produced at a high rate throughout the year, the result being slightly below the 1937 all time high record for nickel production in Canada.

International Nickel Company operated the Creighton, Frood, Garson and Levack mines. The daily concentrating capacity was increased during the year by 4,000 tons. Both the concentrator and the smelter were operated close to capacity. The No. 2 shaft at the Levack mine was completed to 1,860 feet, and stations were cut at the 1st to 16 levels, and connections were made to the present No. 1 shaft workings. Operations were begun at the Frood Open Pit in July 1938, consisting in stripping overburden and excavating hangingwall rock in preparation for ore production. A new crushing and sorting plant for handling the surface ore was constructed.

At the Falconbridge mine No. 5 shaft was deepened to 2,450 feet, good ore being intersected at that horizon; development of the 2,100 level between Nos. 1 and 5 shafts was carried out in average ore. Diamond drilling of the Levack prospect revealed a further substantial tonnage of ore. Ore reserves have again been largely increased over and above the ore mined. The capacity of the reduction plant has been increased gradually to a 1938 production of 14,800 tons of copper-nickel matte shipped to the refinery.

In the early part of 1937, B.C. Nickel Mines,Limited, now known as the Pacific Nickel Mines,Limited with property at Choate, B.C., made some experimental shipments of concentrate to Japan; but no work was done at the mine in 1938, pending the outcome of negotiations to supply Japanese interests with nickel concentrate for smelting in Japan.

Important new activities in Ontario were the continued development by Denison Nickel Mines,Limited, of its property near Worthington in the Sudbury district. The Cross nickel property at Shebandowan lake, west of Port Arthur, in the Thunder Bay district, purchased in 1937 by the International Nickel Company, remained idle in 1938.

The Cuniptau mine, now merged in the Ontario Nickel Corporation, was inactive.

The production of nickel in 1938 was 105,337 tons valued at $53,949,311, as compared with 112,452 tons valued at $59,507,176 in 1937.

The exports of nickel in 1938 were 98,852 tons valued at $52,496,417 as compared with 111,385 tons valued at $58,913,217 in 1937. The imports were valued at $1,401,338 as compared with $1,472,720 in 1937.

The success of the International Nickel Company in expanding the use of its products is a striking illustration of the effective use of research in solving marketing problems. Before and during the World War the greater part of the world's nickel was used in armaments. Today all but a small part of the world's nickel is absorbed by industry for peace-time uses.

The approximate distribution of the consumption of nickel in 1938, as given by the International Nickel Company, was as follows:

	Percentage
Steels .... (Construction Steels, Stainless Steels and other Corrosion and Heat Resisting Steels, and Steel Castings)	60%
Nickel Cast Iron	3
Nickel-Iron Alloys	1
Nickel-Copper Alloys and Nickel Silvers	14
Nickel Brass,Bronze and Aluminium Alloy Castings	2
Heat Resistant and Electrical Resistance Alloys	3
"Monel",Malleable Nickel,Nickel Clad,"Inconel"	9
Electrodeposition	6
Non-Metallic Materials for the Chemical Industry Nickel Salts,Ceramic Materials,Storage Battery Materials and Catalysts	1
Miscellaneous and Unclassified	1

The world production in 1938 is estimated at 115,000 short tons, all of which, with the exception of about 10,000 tons, was produced in Canada. The other producing countries are New Caledonia, Greece, India, Norway and Russia.

The estimated world consumption in 1938 was in excess of 100,000 short tons.

The base spot price of nickel in the United States in 1938 was 35 cents per pound. This same price has ruled for the last 13 years.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

PLATINUM GROUP METALS IN 1938

Except for a few ounces of platinum from the black sands of British Columbia, and a small production as an impure residue in the refining of gold at Trail, B. C., all the Canadian platinum and allied metals are obtained from the treatment of the Sudbury nickel-copper matte. The successful development of the copper-nickel mines near Sudbury has added considerably to the Canadian production of metals of the platinum group, as the ores usually contain a notable amount of these metals.

The refinery at Acton, England, owned by the International Nickel Company through its subsidiary the Mond Nickel Company, is designed to treat precious metal residues. It has an annual capacity of 300,000 ounces of metals of the platinum group. All the platinum metals obtained are sold by the Mond Nickel Company, Limited, and by its regular distributors throughout the world.

The Falconbridge Nickel Company, which exports its nickel-copper matte to Norway for refining, added in 1935 a precious metal recovery unit to its copper-nickel refinery at Christiansand and now produces and sells refined gold, silver, platinum, and palladium.

The Canadian production of platinum in 1938 was 161,317 ounces valued at $5,196,504, as against 139,377 ounces valued at $6,752,816 in 1937. The production of palladium and other associated metals of the group was 130,893 ounces, valued at $3,677,392 as against 119,829 ounces, valued at $3,179,782 in 1937.

The imports of platinum products in 1938 were valued at $292,711, as against $310,048 in 1937.

Exports in 1938 were valued at $9,364,815 as against $8,402,555 in 1937; export records do not show the metals of the platinum group present in exported copper-nickel matte.

The average price in New York of refined platinum for the year was $35.90 per ounce, as compared with $51.77 in 1937.

Since 1934 Canada has been the leader in the world's production of platinum, displacing Russia; the other principal producers, by order of importance, are: Russia, South America (Colombia) and South Africa. Canada also leads the world as producer of palladium, a consequence of the great increase in the Canadian output of nickel.

The world production of platinum and allied metals approximated 500,000 ounces, and that of platinum alone approximated 392,000 ounces in 1938.

The world consumption of platinum metals for 1936 (1937 and 1938 not yet available) as estimated by Baker & Company, approximated 400,000 ounces, a remarkable gain over the 1935 figure of 275,000 ounces.

The continuous growth in the consumption of the platinum group of metals is in part due to the improvement in the jewellery trade, which is using increasing quantities of platinum and palladium. The activity in the chemical industry has led to several new developments and to further inquiry for platinum catalysts and laboratory equipment. Industrial uses of the platinum metals continue to advance, particularly in the manufacture of rayon and in the electrical field.

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RADIUM AND URANIUM IN 1938

Canadian production of radium and uranium in 1938 continued to be confined to Eldorado Gold Mines, Limited, now in its eighth year of operating the pitchblende deposits discovered in 1931 at LaBine Point, Great Bear lake, in the Northwest Territories. A few other occurrences of the mineral have since been reported in the same general region, even as far south as lake Athabaska; development work has been conducted on some of these and a few tons of ore mined.

The Eldorado mine continued in full operation and production throughout the year. Shaft sinking was carried 300 feet below the 500-foot horizon, and levels were started at 650 and 800 feet. The new third vein developed during the year to the 500-foot level is reported similar to the No. 1 or No. 2 veins, and a number of rich ore-shoots were opened up. Mill equipment was enlarged by the addition of a Symons cone crusher, 2 James jigs, and a magnetic separator, to raise milling rate to 125 tons per day. Two new power units, each of 200 H.P., were installed, bringing the total power to 1,234 H.P. Additional oil storage was provided through the erection of a new 70,000 gallon tank.

Consolidated Mining and Smelting Company did much work on a group of claims at Common lake, adjoining the Eldorado property disclosing both silver and pitchblende, but work was suspended in June,1936. Small amounts of pitchblende have been found in the mine being operated by B.E.A.R. (Bear Exploration and Radium, Limited) at Contact lake, 10 miles south of LaBine Point,but this property carries mainly silver, cobalt, and nickel. Current milling operations are on a 25-ton per day basis, and a few tons of concentrate containing pitchblende are reported to have been shipped to the Eldorado refinery at Port Hope in 1938.

No further development has been reported on the pitchblende discoveries made several years ago at Beaverlodge and Hardisty lakes, about 100 miles south of Great Bear lake. From the Arden group of claims at Beaverlodge lake, several tons of crude pitchblende ore were mined and shipped in 1934; this ore consisted of an intimate mixture of pitchblende and hematite, occurring in pockets or lenses in a large quartz body; it is thus distinctly different from that at Great Bear lake, where the pitchblende occurs in definite veins, associated with native silver and cobalt-nickel arsenides.

Near Goldfields, on lake Athabaska, in Saskatchewan, pitchblende occurs in extremely narrow veinlets with cobalt and nickel; samples of the vein material have yielded high gold assays; some further underground prospecting on one of the claims was reported during the year.

In Ontario, Canada Radium Mines, Limited has been conducting underground exploration of pegmatite bodies in recent years at Cheddar, in Cardiff township, Haliburton county. The pegmatites are stated by the company to carry radio-active and other valuable minerals. Work was suspended in 1937.

The additions to the Eldorado radium refinery at Port Hope, Ontario, more than doubled the capacity to 75 tons per month of ore treated, equivalent to about 8 grammes of radium. Products made comprise radium bromide, yellow and orange sodium uranate, and black uranium oxide, used as colouring agents in the ceramic trade; silver, recovered as silver sulphide; and minor amounts of other uranium salts. The new plant also provides for the recovery in chloride and oxide form of radio-lead, for which industrial use has been found, and of which about one ton is present in 20 tons of ore. Investigations have been conducted by the National Research Council, at Ottawa, into the possibility of recovering polonium and ionium from the refinery residue. The radium is mostly consigned to England for measurement and loading into needles; uranium salts are shipped principally to England and the United States; silver sulphide is consigned to the United States for final refining.

Figures of production of ore and refinery products for 1938 are not yet available, but there was a substantial increase over 1937. In that year, ore milled totalled 23,827 tons, with a recovery of 475 tons of jig and table pitchblende-silver concentrates, and 193 tons of flotation silver-copper concentrate; in addition, 36.7 tons of crude high-grade pitchblende and silver, and 6 tons of cobalt was recovered as cobbed ore, making a gross total of 711 tons of shipping products. Up to the end of 1937, pitchblende production had totalled 1,235 tons, radium recovery was reported at 54 grammes, and production of uranium salts, 255 tons.

The world output of radium and uranium salts comes mainly from the Belgian Societe Generale Metallurgique de Hoboken, a subsidiary of Union Miniere du Haut Katanga, using ores from the Belgian Congo, and the Eldorado Company. Small amounts have been produced at Joachimsthal, in Czechoslovakia (now German), and by two American concerns treating carnotite ore from Utah and Colorado. A small production is credited to France, where Portugese ore is processed and to the U.S.S.R. (Russia). No world statistics of radium and uranium production or trade are available.

Exports and imports of uranium compounds are not shown separately in trade statistics. Radium imported into Canada for medical and scientific use during the last 5 years has had the following values: 1934, $211,140; 1935, $150,643; 1936, $109,032; 1937, $6,402; 1938, $22,559. These values, however, represent largely radium imported on a temporary rental basis and also radium of Canadian origin sent to London for loading into needles and shipped back.

The use of radium still remains largely therapeutic, for the treatment of cancer. Recovered in the form of the bromide salt (90 per cent purity), it is usually converted into sulphate for hospital use, the salt being loaded into fine gold or platinum needles containing only a few milligrammes. Larger dosages are given by means of so-called radium "bombs" containing up to 5 grammes. It is also employed at certain clinical centres for the production of radon, or radium emanation, a heavy gas of short-lived radioactivity, also used for hospital treatment. Radium may be used in place of X-rays in engineering, to detect flaws in heavy castings, etc., but has not as yet found important application. High cost of the element is a serious deterrent factor against its more widespread employment, and much of the radium used in hospitals, research, and for other purposes is hired or loaned from the producers or smaller concerns engaged in such business.

Uranium finds its principal use in the form of various salts, mainly sodium uranate or oxide, employed as colouring agents in the ceramic industry. The metal, as ferro-uranium, imparts desirable properties to steel and other ferro-alloys, but restricted supply and high cost, coupled with difficulty in preparing it in the pure form, has hitherto retarded expansion in this field.

Chemically pure uranium is difficult to prepare, but recently metal of 98 per cent purity has been made in the form of powder by the hydride process. Production of a new binary alloy of uranium and nickel, with 66 per cent of uranium, has recently been reported as extremely highly resistant to corrosion, being attacked with difficulty even by aqua regia; it has a low melting point and mixes rapidly in molten steel, nickel or copper. Another alloy of uranium and copper, with up to 20 per cent uranium, is reported as highly resistant to corrosion and of high conductivity. The probability of an assured supply of uranium may lead to important outlets in the metallurgical field.

When Canada became a potentially important producer, competition developed between the Eldorado and Belgian companies for both radium and uranium, resulting in greatly-reduced prices. Previously radium sold at around $60 per milligramme in lots of one gramme and upwards, but by 1938 the price had dropped to $20 to $25. There is no open market for the element, sales usually being based on individual tender and contract and thus occasioning intensive price-cutting. An agreement was recently reported as reached between the Eldorado and Belgian companies for sharing world sales on a basis of 40 per cent by the former and 60 per cent by the latter, the agreement to run for a term of 5 years: the price level is not divulged. The price of sodium uranate, which had previously stood at $1.50 per pound, was advanced to $1.75 in October, 1938, and that of black oxide from $2.05 per pound to $2.50. World demand for both radium and uranium salts is reported to be showing a steady increase, radium commitments having been materially raised during 1938 by large-scale programmes for hospital use undertaken by both the British and American Governments.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

SELENIUM IN 1938

Selenium, although fairly widely distributed, is not abundant in nature; it occurs in association with sulphur, and frequently accompanies the sulphides of heavy metals in the form of selenides; in no case does it occur in quantity large enough to be mined for itself alone. Commercial selenium is recovered from the slime or residue produced in the refining of copper; in Canada it is recovered during the refining of blister copper produced in Manitoba, Ontario, and Quebec.

It was produced for the first time in Canada in 1931 at the copper refinery of the Ontario Refining Company, at Copper Cliff, Ontario; the only other producer in Canada is Canadian Copper Refiners, Ltd., with refinery at Montreal East, Quebec; this company first started production in November 1934.

It is obtained in association with tellurium in the refinery slime of the copper refinery, and considerable quantities are now being produced annually by both companies. The Copper Cliff product is derived from the treatment of the copper-nickel ore of Sudbury district, and that at Montreal East is obtained from the treatment of the gold-copper ore of Noranda, Quebec, and the gold-copper-zinc ore of the Flin Flon mines situated on the boundary line between Manitoba and Saskatchewan. Production was curtailed at the Copper Cliff plant during the last half of the year, owing to adverse market conditions.

The production of selenium in 1938 was 358,929 pounds valued at $622,742, as against 397,227 pounds valued at $687,203 in 1937.

Although most of the production is exported, no separate records of exports of this commodity are published; neither are imports recorded.

Canada is now in a position to produce selenium in notable quantity and the output is marketed chiefly in Great Britain.

Figures of world production of selenium are not available, as Canada appears to be the only country that publishes annual figures of production. The United States and Canada are the principal sources of supply. Small quantities are produced by several countries including Russia, Japan, and Mexico.

The chief use at present is in the glass and pottery industries, both as a colouring agent, as in ruby glass, and to neutralize the effect of objectionable oxides; the most important development is probably the photo-electric cell or electric eye which is finding many industrial applications; it is being used in alloying stainless steel for screw and bolt stock, developing improved cutting and threading qualities; a large potential market exists in certain rubber-compounding industries, and it is being now used for vulcanizing and fireproofing switch-board cables and to increase the resistance of rubber to abrasion, these applications still being subjects of research; it finds an application in the manufacture of certain kinds of paint; selenium oxychloride is a powerful solvent of many substances. Selenium is also used for the manufacture of certain dyes, and there are numerous other uses. Its application to the production of improved cutting-tool steels and to the vulcanizing of rubber seems to offer the best opportunities for the expansion of the market.

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

A nominal price for selenium, black powdered, 99.5 per cent pure, of $2 per pound at New York has prevailed for the last few years up to August 1938, when the price dropped to $1.75 at which level it remained to the end of the year.

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OTTAWA, MARCH, 1939.

SILVER IN 1938

The silver production of Canada is obtained mainly as a by-product from the treatment of base metal ores. Important contributions are also made from the silver ores of Ontario and British Columbia, from the gold-quartz ores and to a small extent from gold alluvial deposits.

The rapid expansion of mining in western Quebec during the last few years, has resulted in a noticeable increase in the production of silver from the copper-gold ores of Noranda, the copper-zinc ores of Waite-Amulet, the copper-pyrites ores of Aldermac and Eustis, and the numerous gold-quartz mines of western Quebec. Contributions have also come in past years from the lead-zinc mines of Portneuf county.

In Ontario, for everal years the silver-cobalt mines of Cobalt and adjoining areas have shown a gradual falling-off in production,accentuated by the low price of silver. The demand for cobalt, however, is helping to keep numerous small concerns in operation in these areas. The increased production from the Sudbury nickel-copper mines in the last few years has partly made up for the loss from the Cobalt area. Important contributions are also made from the gold-quartz mines of Porcupine, Kirkland Lake and other areas in Ontario.

In Manitoba, the production is from the copper-zinc ores of Flin Flon and Sherritt-Gordon and to a less degree from the various gold-quartz mines of the province.

In Saskatchewan, the output is credited to that part of the Flin Flon orebody that overlaps the provincial boundary of Manitoba.

In British Columbia, the Sullivan silver-lead-zinc mine is by far the largest silver producer of the whole Dominion. Important contributions are also made by Silbak-Premier, Bralorne, Pioneer and several other gold-quartz mines, by the silver mines of Beaverdell camp, and by various relatively small silver-lead-zinc mines.

In the Yukon, production is mainly from the silver-lead ores of the Mayo district.

In the Northwest Territories, production is obtained from the silver-radium ores of Eldorado mine in the vicinity of Echo Bay, Great Bear Lake district.

Plants for the production of fine silver are operated by: the Royal Canadian Mint, at Ottawa; the Hollinger mine, at Timmins, Ontario; the Ontario Refining Company, at Copper Cliff, Ontario; the Canadian Copper Refiners, at Montreal East, Quebec; and the Consolidated Mining and Smelting Company, at Trail, British Columbia. A new electrolytic silver refinery is scheduled for construction at Trail in 1939.

The Canadian production of silver in 1938 was 22,157,154 fine ounces, valued at $9,633,265, as compared with 22,977,751 fine ounces, valued at $10,312,644 in 1937.

The exports in 1938 were 5,868,827 fine ounces of silver in ore and concentrate valued at $2,540,860, and 22,682,687 fine ounces of silver bullion valued at $9,838,462. In addition Canadian silver coins to the value of $32,325 were exported.

The imports in 1938 included unmanufactured bullion to the value of $850,488, and manufactures of silver to the value of$293,193.

The world production of silver in 1938 as estimated by Handy and Harman of New York was 264,800,000 fine ounces, this compared with 274,700,000 fine ounces in 1937.

The world consumption of silver in 1938 is estimated by Handy and Harman at 494,000,000 ounces as compared with 478,500,000 ounces in 1937. Of the total consumption of 494 million ounces in 1938, 403 million ounces was purchased by the United States Government, 14 million represent Indian consumption, 23 million was used for coinage and 54 million consumed in the arts and industries.

Ratification of the London Agreement of July, 1933, regarding silver was made in March,1934, by the Canadian Government, and Canada agreed to purchase or otherwise withdraw from the market 1,671,802 fine ounces of silver (current mine production) each year beginning with the calendar year 1934. The agreement terminated on January 1,1938, and no effort was made to renew it. The Bank of Canada, acting for the Government of Canada, purchased each year, the stipulated amount.

The United States President's proclamation of December 31, 1938 continues until June 30,1939 the government's subsidy to domestic producers of silver in the United States. The price remains at 64.65 cents an ounce as fixed in the President's proclamation of December 30,1937. From December 31,1933, when the silver purchase programme began to September 30,1938, the American Treasury bought 235,713,400 ounces of domestic silver. The estimated holding by the United States Treasury amounts to 2,575 million ounces. Under the American Silver Producer's Research Project investigations are being carried on to find new uses for silver.

The average price of silver in 1938 was 43.477 cents per fine ounce as against 44.881 cents in 1937 (New York prices transposed to Canadian funds).

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TELLURIUM IN 1938

Tellurium occurs native and as an essential constituent of several minerals, none of which have been found in quantities large enough to constitute commercial ore. Tellurium-bearing minerals also occur in minute quantities in association with other metallic ores, and the element may be recovered as a by-product in the refining of copper or lead, and also when sulphuric acid is manufactured from certain forms of pyrites. The potential recovery and production of tellurium are great, but the demand remains small so that the quantity of refined metal produced is small. Tellurium can be recovered from residues of lead and copper refineries; ores containing tellurium occur in British Columbia, Saskatchewan, Manitoba, Ontario and Quebec.

Two electrolytic copper refineries are operating in Canada, both having plants for the recovery of tellurium from their refinery sludges, and for the production of refined metal; that of the Ontario Refining Company at Copper Cliff, Ontario, started production in 1934; and that of the Canadian Copper Refiners, Limited, at Montreal East, Quebec, in 1935. The former treats the slime from the refining of the blister copper produced by the International Nickel Company at Copper Cliff, Ontario; and the latter, the slime from the refining of the anode copper of Noranda Mines, Limited, at Noranda, Quebec, and the blister copper of Hudson Bay Mining and Smelting Company, whose smelter is at the Flin Flon mine on the boundary line between Manitoba and Saskatchewan. There has been no recovery so far in Canada from the sludge of sulphuric acid chambers.

The Copper Cliff plant was not in production during 1938, owing to adverse market conditions.

The production in 1938 was 48,237 pounds valued at $82,967, as against 41,490 pounds valued at $71,777 in 1937. Most of the output was marketed in the United Kingdom and a small amount was sold locally.

Canada and the United States appear to be the main sources of supply.

Metallic tellurium, until quite recently, was of very minor industrial importance; formerly it was used to a very small extent in some radio work; it finds slight application as a colouring agent in the ceramic industry; was used in the photographic arts and also for blackening art-silverware. More recently industrial research has shown that when alloyed with lead the tensile strength and toughness of the lead is increased greatly; the use of small quantities of tellurium as a substitute for tin in the lead used for sheathing electric wire cables is reported to improve their resistance to both heat and corrosion; it has also been used for improving the machining qualities of certain steels. Very finely powdered tellurium may be used as a rubber-compounding material; it is stated that its presence shortens the time of curing, and greatly improves the resisting qualities of the product. These two recently developed uses have increased the commercial demand for the metal. Tellurium is also used in the steel industry, but so far mainly in an experimental way.

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

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TITANIUM IN 1938

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

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

A few thousand tons are shipped annually from the St. Urbain deposits, in part to Niagara Falls, New York, presumably to be used in the manufacture of ferro-titanium, and in part to plants of the General Electric Company in the United States. No shipments from the Ivry deposits have been reported for a number of years.

In 1937, the Canadian Titanium Pigments, Ltd., was formed to manufacture titanium oxide in Canada. The Canadian market for titanium pigments is not believed to be large enough to justify the immediate establishment of a plant in Canada. Nevertheless, preliminary preparations are being made, looking to the future possibility of such a market.

The Canadian production of titanium ore in 1938 was 207 tons valued at $1,449, as compared with 4,229 tons valued at $26,432. This production came entirely from St. Urbain, Quebec.

The imports of titanium are not reported separately. The consumption of titanium pigments in the Canadian paint industry, as published by the Dominion Bureau of Statistics, were, in 1936: 2,456,265 pounds, valued at $269,130; in 1937: 3,748,341 pounds valued at $362,869 (1938 not yet available).

The world production of titanium ore in 1937 (1938 not yet available) as given by the United States Bureau of Mines was: 225,000 tons of ilmenite, which would yield 100,000 tons of titanium pigment, and 3,000 tons of rutile. India is the principal producer of ilmenite; the others being Norway, Malaya, Portugal and Canada. Brazil is the principal producer of rutile, with Norway second in importance.

Commercial uses for titanium in recent years have continued to advance independently of the course of general business. The most important use continues to be for the manufacture of white pigment. Nevertheless, various other fields of use are being developed. In metallurgy titanium is not only an effective dioxide and cleansing agent, but also an alloying element. By addition of titanium, chrome-nickel steels are made more resistant to corrosion and chrome-molybdenum steels become easier to weld. In aluminium and sundry non-ferrous alloys, titanium refines the grain and otherwise contributes to better structure. A variety of carbon-titanium alloys are now available. Titanium treated rails are said to be superior to silicon treated rails. In other industries titanium compounds have many different uses.

The New York quotations for ilmenite 45 to 52 per cent TiO_2 f.o.b. Atlantic seaboard were $10 to $12 per gross ton according to grade and impurities. These quotations have remained unchanged for several years and are evidently nominal. The price of carbon titanium alloys, f.o.b. plant, was $142.50 per ton throughout the year.

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TUNGSTEN IN 1938

Occurrences of tungsten-bearing minerals, usually in the form of scheelite, are known in Nova Scotia New Brunswick, Manitoba, British Columbia, and in the Yukon Territory.

In Nova Scotia development has been carried on in a small way for the past few years at Indian Path mine, near Lunenburg. The Moose River district deposits have not been worked for several years.

In New Brunswick a deposit is known at Burnt Hill Brook, York County, and was worked during the War years, but has since been idle.

Some exploratory work was done about 1918 on a scheelite deposit near Falcon Lake in southeastern Manitoba.

In British Columbia the old deposit on Hardscrablle Creek, Cariboo District, was under development during the last few years and a small treatment plant was erected by D. D. Fraser of Quesnel.

In the Yukon Territory scheelite sands have been recovered in a very small way from the alluvial deposits of Dublin Gulch, Mayo District.

Tungsten in the form of ferberite, a very rare tungsten mineral, has been noted in some of the gold-bearing zones found on Outpost Island, Great Slave Lake, Northwest Territories.

No tungsten has been produced in Canada except a few hundred tons of concentrate between 1912 and 1917.

The imports in 1938 of chromium metal and tungsten metal for alloying purposes totalled 43,527 pounds valued at $30,328, compared with 122,288 pounds valued at $96,900 in 1937. Imports of metallic elements, and tungstic acid for use in the manufacture of metal filaments for electric lamps were valued at $71,730, compared with $128,781 in 1937.

The world production of tungsten ore, in metric tons of concentrate containing 60 per cent WO_3, in 1936, as given by the U. S. Bureau of Mines, was 25,000 metric tons (data for 1937 and 1938 not yet available).

The principal producing countries are: China, British India (Burma), Federated Malay States, United States, Bolivia and Portugal.

The principal uses of tungsten are in the manufacture of high-speed tool steels, stellites, electric lights and radio tube filaments; in the preparation of various chemicals, such as pigments and in the tanning of leather.

The price of domestic tungsten ore (scheelite) in New York, per unit of WO_3 dropped from $22-$25 in January to a minimum of $17-$20 in December. The price of Chinese wolframite dropped from $25 in January to $20 in December.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

ZINC IN 1938

Nearly three-quarters of the zinc produced in Canada comes from the Sullivan silver-lead-zinc mine near Kimberley, British Columbia. The rest is from the Flin Flon copper-zinc mine at Flin Flon on the boundary line between Manitoba and Saskatchewan; the Sherritt-Gordon copper-zinc mine, in northern Manitoba; the Britannia copper mine on Howe Sound, and several small lead-zinc properties in West Kootenay district, British Columbia; and from the Normetal and the Waite-Amulet copper-zinc mines in northwestern Quebec.

In British Columbia, the Sullivan mine and the 6,500-ton a day concentrator at Kimberley of the Consolidated Mining and Smelting Company were operated at full capacity throughout the year. The Trail zinc plant of this company had its capacity increased in recent years by various additions and improvements to a total of 400 tons of slab zinc a day, or 145,000 tons a year and was operated close to its full capacity. The Monarch mine, near Field, owned by the Base Metals Mining Corporation carried on extensive development work during the year. The Monarch mill has been idle since December,1935. The Britannia mine did not produce any zinc concentrate during 1938.

Several relatively small lead-zinc properties in West Kootenay district continued working intermittently during the year. The mines and concentrators of the Mammoth at Silverton, the Whitewater at Retallack and the Noble Five at Sandon operated for part of the year; several other properties in this area (Ainsworth-Slocan) such as the Lucky Jim, McAllister and Utica, were under active development and occasional shipments were made. With higher lead and zinc prices, these and several other properties in British Columbia would become fairly regular producers.

In Manitoba, development at the Flin Flon mine of the Hudson Bay Mining and Smelting Company added considerably to the known ore reserves and the 5,000-ton concentrator and the zinc refinery were operated at full capacity; producing at the annual rate of about 30,000 tons of slab zinc; sinking was continued to the 2750 ft. level, and development in this bottom level has so far been very satisfactory, both as to size and grade of orebodies; preliminary steps have been taken for the sinking in 1939 of a new South Main shaft; some improvements and additions to the zinc plant were made possible by the valuable work in the company's Research Department.

The Sherritt-Gordon copper-zinc mine and 1,500-ton concentrator situated about 50 miles northeast of Flin Flon, were operated at full capacity in 1938.

In Ontario, the property of the Sudbury Basin Mines, Limited, in the Sudbury basin, remained idle throughout the year. The ores of the property are copper-zinc-lead.

In Quebec, the Waite-Amulet mine and 500-ton mill, and Normetal (Abana) mine and 500-ton mill were in operation during the year, while the Tetreault property in Portneuf county remained idle.

In Nova Scotia, the Stirling copper-lead-zinc property in Cape Breton, ceased operations in the latter part of 1937, and remained idle in 1938.

The Canadian production of zinc in 1938 was 190,753 tons valued at $11,723,697, as against 185,169 tons valued at $18,153,949 in 1937.

The exports in 1938, chiefly in the form of spelter, were valued at $9,816,008, as against $15,491,186 in 1937.

The imports in 1938 of zinc products of all kinds including oxide and chemicals, were valued at $1,925,020, as against $2,484,425 in 1937.

The world's production of zinc in 1937, as reported by the American Bureau of Metal Statistics, was 1,830,300 short tons, as compared with 1,639,700 in 1936 (1938 not yet available).

The principal producing countries, according to the origin of the ore, are as follows: United States, Canada, Australia, Germany, Poland, Russia, and Mexico. Canada contributes about 10 per cent of the world's total.

Canada is the fourth largest producer of slab zinc. The largest producers of slab zinc are the United States,Belgium and Germany; the latter two countries treat large quantities of imported ore in addition to domestic ore.

The world consumption in 1937 (1938 not yet available), as given by the American Bureau of Metal Statistics, was 1,625,600 metric tons, an increase of 7 per cent over the previous peak of 1936, and 11 per cent over 1929.

The galvanizing industry consumes the greater part of both primary and secondary zincs; other important uses are: brass and castings industry, paint pigments, radio and flash light batteries, and for making zinc oxides.

The average price of zinc for 1938 in Canadian funds based on London quotations, was 3.07 cents per pound as against 5.59 cents in 1937. The St.Louis price was 4.61 cents as against 6.52 cents in 1937.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH,1939.

ARSENIOUS OXIDE IN 1938

Arsenic is obtained in Canada as a by-product from the treatment of the silver-cobalt-arsenic ores of Northern Ontario; and to a less extent from the gold arsenical ores of the Beattie and the O'Brien mines in Quebec and the Little Long Lac mine in Ontario. Other mines such as the Bralorne and the Hedley in British Columbia export arsenical gold concentrate to the United States, but no payment is made for the contained arsenic.

Deposits containing arsenopyrite associated with gold are known to occur in various parts of Canada. Some are being worked for gold in the provinces of British Columbia, Ontario, Quebec, and Nova Scotia. In the aggregate they could supply considerable amounts of concentrate suitable for the production of arsenic were it profitable to do so.

Refined white arsenic (As_2O_3) and arsenical insecticides are made in Canada by one company only— the Deloro Smelting and Refining Company, Limited, of Deloro, Ontario— which obtains its raw material from the silver-cobalt-arsenic mines of Northern Ontario.

Baghouses to extract arsenic from the fumes of roasting plants used in the recovery of gold from arsenical concentrate have been installed at the Beattie, Little Long Lac and O'Brien gold mines. The Beattie roasting plant has a capacity of about 225 tons of concentrate a day. The other two plants treat from 8 to 10 tons of concentrate a day.

Production of arsenious oxide in Canada in 1938 was 2,175,646 pounds valued at $56,538, as against 1,389,426 pounds valued at $41,032 in 1937.

Exports of arsenic in 1938 were 1,378,300 pounds valued at $32,590, as against 735,000 pounds valued at $26,938 in 1937.

Imports were: arsenious oxide 201,009 pounds valued at $3,854 as against 7,604 pounds valued at $462 in 1937; and other compounds of arsenic valued at $48,464 as against $33,155 in 1937.

Though world consumption of white arsenic has fluctuated considerably during the last ten years the quoted price has remained at 3½ cents a pound; and as most of it is a by-product of metal recovery, through necessity rather than choice, and the potential supply is far in excess of any probable demand, there seems little likelihood of any sustained increase in price. It is estimated that 40,000 tons of white arsenic, roughly equivalent to the world's total consumption, is extracted annually from roaster gases at the Boliden mine, in Sweden, alone. Only a small fraction of this is refined for sale and appears in production returns. The remainder, in the form of crude arsenic, is placed in huge storehouses, in the hope that through research a use may ultimately be found for it.

The chief uses of arsenic are in insecticides, weed killers, sheep and cattle dip, wood preservatives, and in the manufacture of glass; minor uses are in pigments, tannery supplies, and pharmaceutical preparations.

The nominal price of arsenious oxide in New York in 1938 remained at 3 cents a pound throughout the year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

ASBESTOS IN 1938

Asbestos produced in Canada is all of the chrysotile variety and comes entirely from areas of serpentinized rock in the Eastern Townships of Quebec, the centres of production being Thetford Mines, Black Lake, Vimy Ridge, East Broughton, and Asbestos (Danville). Production has been continuous from the Thetford district since 1878, and reserves of asbestos-bearing rock are enormous. Core-drilling to depths greater than 1,700 feet has revealed the presence of fibre comparable in quantity and quality with that in the present workings.

In 1938 nine properties were being operated by five companies. The great proportion of the output consists of vein fibre obtained from veins ¼ to ½ inch in width, though veins exceeding 5 inches in width do occur. The fibres run crosswise of the veins and thus the width of the vein determines the length of fibre. Slip fibre, occurring in fault planes, is obtained largely in the East Broughton district. On the average, the yield of fibre from the Quebec deposits is 5 per cent of the rock mined and 7.7 per cent of the rock milled.

The asbestos-bearing rock is mined both by open pit and underground. In 1934 the method of block-caving was instituted at the King mine of Asbestos Corporation, Limited, and has resulted in a remarkable reduction in the cost of mining and improvement in the grade of mill feed. In 1938 a vertical shaft was sunk to a depth of 1,153 feet at the King mine and several of the other companies have sunk vertical shafts and are proceeding with underground mining, one company following the block-caving method used at the King mine.

Deposits of chrysotile asbestos are known in other parts of Quebec as well as in Ontario and British Columbia, and several have been worked from time to time, but are not now in production. In 1937, however, Rahn Lake Mines Corporation, Limited undertook development of a chrysotile asbestos deposit in Bannockburn township, Matachewan area, Ontario and a mill is being built to handle 200 tons of crude per day.

Numerous deposits of other varieties of asbestos occur in Canada including anthophyllite, and fibrous tremolite and actinolite, all referred to commercially as amphibole asbestos. The fibres are harsher and weaker than those of chrysotile and are in little demand, none of the deposits being worked. The deposits reported during 1937 and 1938 in Manitoba east of Lake Winnipeg, and in Ontario in the Lake of the Woods district, and 260 miles north of North Bay are of the amphibole varieties.

Production of Canadian asbestos in 1938 was 289,877 tons, valued at $12,893,806 as compared with 410,026 tons valued at $14,505,791 in the preceeding year, being a reduction of nearly 30 per cent in quantity and 11 per cent in value. The 1937 production, however, constituted a record both as to tonnage and value. The quantities and values of the several grades produced in 1938 were as follows:- crudes 2,911 tons valued at $955,424 ($328.32 per ton); fibres 163,097 tons valued at $9,714,509 ($59.53 per ton); cement stock, floats and shorts 123,182 tons valued at $2,223,873 ($17.97 per ton).

World production in 1937, the latest year for which statistics are available, amounted to 657,561 tons having a value of $24,815,920. These data include an estimated production of 125,000 tons from Russia, the next largest asbestos-producing country to Canada. The other producing countries in order of their importance are Rhodesia, Union of South Africa, Cyprus, and the United States. Despite the rapid growth of the asbestos mining industry in Russia, Rhodesia, and the Union of South Africa, the Canadian industry more than holds its own in the world markets. In 1937 Canadian production comprised 62.3 per cent of the tonnage and 58.5 per cent of the worlds production, whereas in 1934 the corresponding figures were 48.2 per cent and 33.8 per cent.

Most of the Canadian production of asbestos is exported, chiefly to the United States; other countries to which large exports are made are Japan, Belgium, Germany, France and the United Kingdom. In 1938 the exports were as follows:- asbestos 165,744 tons valued at $10,872,435; asbestos sand and waste, 123,143 tons valued at $2,237,751; and manufactures of asbestos valued at $206,372. This compares with 1937 exports of: asbestos 196,511 tons valued at $10,972,852; asbestos sand and waste, 194,530 tons valued at $3,242,457; and manufactures of asbestos valued at $330,061.

Imports in 1938 consisted of 47 tons of asbestos packing valued at $45,866; brake and clutch linings valued at $257,037; other products not specifically designated, valued at $581,989.

Asbestos has many uses, the chief being for the manufacture of automobile brake-band linings, heat insulation materials, and building materials such as roofing shingles, corrugated sheeting, and tiles. For these latter the short non-spinning grades of fibre are mainly employed.

Prices remained stable during 1938 and were as follows:- No. 1 crude $700 per ton; No. 2 crude $150 to $350; spinning fibre $110 to $170; shingle fibre $57 to $75; paper fibre $40 to $45; cement stock $21 to $25; floats $18 to $20; shorts $12 per ton.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

BARITE IN 1938

A number of occurrences of barite are known in Canada, but there has been no important production of the mineral since 1917. The known occurrences of barytes are in Nova Scotia, Quebec, Ontario, and British Columbia.

Many of the known deposits are large enough to supply a moderate tonnage of ore, but competition of cheaper foreign barite, high freight rates, and the necessity for concentration to remove impurities in the case of certain of the deposits, have combined to discourage operations.

Most of the comparatively small output within recent times has come from the Lake Ainslie district, Cape Breton, Nova Scotia, and was consumed locally. Interest is now being shown in the deposits of the Lake Ainslie district, and tests have been run in the Bureau of Mines Laboratories on small lots of this ore for the removal of impurities; some of the ore contains appreciable amounts of fluorspar that might be recoverable as a by-product. Other deposits in the same province are in Colchester, Hants and Pictou counties, but no mining has been done for many years.

The northern Ontario deposits have attracted the most attention in recent years, and a few small shipments of both crude and milled ore have been made. A company, Canada Baryte Mines Ltd., 305 Kent Building, Yonge St., Toronto, was formed in 1938 to take over an idle property in Langmuir township, in the Porcupine district, ~~and put it into production~~ to supply barite for rotary oil-well drilling in the Turner Valley region, Alberta.

Interest in domestic barite in recent years has been prompted largely by the possibility of exporting it to Trinidad for use in oil-wells for weighting the rotary drilling mud; so far, this project has not materialized. There being no manufacture of lithopone or barium chemicals in Canada, no demand exists for crude ore; domestic requirements for powdered barite are met chiefly by imports from Germany and the United States.

Barite (barium sulphate) is the principal and practically the only barium mineral of commerce, serving a variety of industrial uses in the ground natural state and being used also as the raw material for the manufacture of barium chemicals and metal, as well as of the important pigment lithopone, a mixture of barium sulphate and zinc sulphide.

Most of the total recorded output (41,210 tons since 1885) has come from deposits in Nova Scotia, with small tonnages derived also from Quebec and Ontario. For the last 15 years, production has been sporadic and relatively insignificant, seldom reaching 100 tons in any one year. There was no production of the mineral in 1938.

Total world production of barite in 1937 was returned at around 916,000 long tons. Germany is currently the leading producer, supplying about 48 per cent of the total, followed by the United States, with nearly 36 per cent; the remainder is obtained chiefly from the United Kingdom, Italy, France and India. The only other barium mineral of commerce is witherite (barium carbonate), the production of which is confined to the United Kingdom and the output of which in 1937 was reported as nearly 12,000 long tons.

Imports of ground barite in 1938 totalled 2,187 tons, valued at $38,012, compared with 2,078 tons, valued at $32,869, in 1937. Of the 1938 imports 1,266 tons came from Germany, 562 tons from the United States, 163 tons from the United Kingdom, and 3,898 tons from Italy.

The above 1938 figures of imports do not include about 200 tons contained in the proprietary material "Baroid", imported from the United States and used for oil drilling in Turner Valley, Alberta.

Barite may be marketed either in the crude or ground state, depending on the use to which it is to be put. Such use is governed to some extent by the nature of the crude ore. The harder, crystalline variety is usually marketed in the crude state and employed for the manufacture of lithopone and barium chemicals, including barium metal, whereas the softer ores, being more readily powdered and yielding a whiter product, are preferred for the production of ground barite. The best grades of the latter often require bleaching with acid to remove adhering iron oxide or iron stain; sometimes roasting, followed by magnetic separation or screening, is employed for the same purpose.

Ground barite is used as an inert filler or loader in many products, including rubber, paper, oilcloth, textiles, leather, plastics and resins. To some products it adds desirable properties, in others its main function is to impart weight and volume. In paints, it has long served as a pigment and as an extender. Increasing amounts are now being used in rotary oil-well drilling. Depending on use, various grades and degrees of fineness are employed, from off-colour material to prime, bleached barite. Low-iron barite (less than 0.1 to 0.4 per cent Fe_2O_3) is finding increasing use as an ingredient of moulded flint glass batches, for which a relatively coarse, granular product (minus 16 — plus 100 mesh) is generally specified, and this use is already consuming important tonnages. Some barite is used for its fluxing and scavenging properties in ferrous and non-ferrous founding.

No standard tests or specifications for ground barite are in use: for a good part of the trade, however, a minimum of 95-96 per cent $BaSO_4$ content, with not over 1 per cent Fe_2O_3 is a general stipulation.

Up to the present, beneficiation of low-grade vein barites, or of richer ore contaminated by sulphides or other minerals, has not been largely practised, removal of impurities having been mostly confined to hand-picking, and, in some cases, jigging. Latterly, however, in the Southern States (Georgia and Tennessee) the removal of impurities, mainly iron oxide and silica from the residual ores of that region, by the use of magnetic separators, tables, and decrepitation and flotation methods has been successful.

Barite is a relatively low-priced mineral. Using the United States as an index of recent consumption and price trends, average f.o.b. value of crude ore shipped in 1937 was $6.25 per short ton: prices remained at substantially the same level in 1938. Ground barite has sold for several years past at $23 per ton f.o.b. Missouri mills. Strong demand for crude in 1937 raised production in that year to nearly 87,000 tons more than in 1936, an increase of over 30 per cent. At the same time, ground barite consumption jumped to an all-time high of nearly 150,000 tons, almost double that of 1936 and nearly equalling the quantity (162,000 tons) of crude used in lithopone manufacture. Barium chemicals used nearly 75,000 tons, or about one-fifth of the total consumption of crude. In addition to the domestic production of 360,000 tons in 1937, the United States imported in that year 65,000 tons, nearly double the imports of 1936. The foregoing figures indicate the recent considerable increase in the employment of barite in various branches of industry.

Canadian Trade Journal quotations in 1938 on imported ground barite were $39.45 per ton for No. 1 white grade and $20 to $28 per ton for off-colour grades. Natural barium carbonate (witherite), which shares the market for this salt with the artificial product made from barite, sold in Canada and the United States at $42 to $44 per short ton. Barite enters Canada free under the British preferential tariff; imports from other countries pay 25 per cent ad valorem. The United States imposes a duty of $4 per ton on imports of crude barite, and of $7.50 per ton on imports of ground or otherwise manufactured material.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

BENTONITE IN 1938

Bentonite is the name originally given to a peculiar clay resulting from the alteration (hydration) in place of the glassy substance of volcanic dust or ash beds. The principal clay constituent is usually the mineral montmorillonite, a hydrous silicate of alumina, generally mixed with gritty impurities such as fine grains of quartz or mica. The particles of clay material are exceedingly fine and are often colloidal. More recently, the term bentonite has been extended to include a rather broad class of clays in general petrographically similar to the typical bentonite but differing considerably from it in physical properties. Many such clays come within the activable bleaching clay group, now being utilized more and more extensively in the activated or acid-treated form for the bleaching of mineral, vegetable and animal oils. Some of them bear little resemblance to the original colloidal bentonite; unlike the colloidal material they do not swell noticeably when wetted, or form gels, and settle rapidly from thin water dispersions. Only activation and decolourizing tests can determine the general suitability of such clays for bleaching and their relative efficiency. Broadly speaking, the typical colloidal bentonites are most widely distributed over the northern (plains) section of the American continent, including the Prairie Provinces of Canada, whereas the activable varieties are most prevalent in the southern and southwestern regions.

Occurrences of clay of bentonitic character are numerous in the Prairie Provinces, some deposits probably being thick enough to possess economic importance. Several extensive beds also exist in the Princeton-Merritt area in British Columbia. Only a few of the known deposits, notably at Princeton, British Columbia, Edson and Drumheller, Alberta, and Morden, Manitoba, have as yet received any attention as sources of production. The Princeton beds are thick (maximum about 9 feet) and are probably the most important known reserves: in recent years, a few carloads have been mined annually and the material shipped to Vancouver for grinding, being utilized mainly in oil and gasoline refining and as a concrete admixture. Small shipments were reported in 1937 from the Drumheller district, Alberta, to the Turner Valley oil field, for use in drilling, and in 1938 nearly 1,150 tons, by far the largest output from any single Canadian deposit to date. The clay is shipped to Calgary for preliminary processing (drying,grinding,etc.) and is stated to sell at around $40 per ton, as against $55 per ton for clay ("Aquagel") imported from Wyoming.

Deposits in the Morden district, in southern Manitoba, have attracted some attention during the past two or three years, and a small tonnage has been shipped to Winnipeg; the clay, after grinding is utilized in foundry work. At the National Research Council,at Ottawa, the material, after activation, was found to possess high bleaching power, and small-scale experimental work along commercial activation lines was carried out in a Winnipeg plant in 1937. The Morden Bentonite Company, Toronto, hopes to develop the deposits to produce ground clay for foundry use, bleaching, water purification, etc., and eventually perhaps to engage in activation, 1½ tons of crude Morden bentonite being said to have the equivalent in bleaching power of 1 ton of standard activated clay, such as Filtrol.

Production of bentonite in 1938 was reported as 1,136 tons, all of which was shipped from deposits at Drumheller, Alberta, for processing at Calgary for use in oil-well drilling in Turner Valley; a little was also produced from the Morden district, Manitoba, for use in Winnipeg foundries. The above figure compares with 163 tons,valued at $1,971, produced in 1937.

Bentonite being merely a clay of rather indefinite type and classification, there are no statistics of world production. The United States has long been the principal producer,but only recently has an attempt been made there to report definite output on the basis of a stricter classification. American sales of bentonite in 1937 were returned at 194,768 tons, valued at $1,500,758, the main reported sources, by states, being Wyoming, Texas and California; nearly half the output, howwver, came from a number of other unspecified states, including South Dakota, Utah and Mississippi, all important producers.

Although originally developed industrially in the United States and at first thought to be peculiar to the North American continent, it has since been found that bentonite is of world-wide distribution, and deposits are known and some now being exploited in a number of countries.

Bentonite, both crude and activated, is often marketed and distributed under a variety of trade names (e.g.Aquagel, Volclay, Filtrol, Revivo), and it may even be sold as "common clay": it is thus difficult to obtain accurate figures of the amounts imported and consumed in Canada, even users of the material often not being aware of its bentonitic nature.

Canada exports no bentonite. Owing to the varied trade designations for the material as noted above, it is virtually impossible to discover even approximate figures of imports, or of world trade in it generally. Substantial tonnages of activated clay of the Filtrol type are, however, imported from the United States for bleaching in the oil industry, as well as, possibly, some ground natural bentonite for similar use. High-grade activated clay of German origin is employed for bleaching in the packing-house trade, and ground colloidal bentonite is imported in some amount from the United States for foundry use.

Bentonite finds a wide variety of uses, dependent in large measure on the variable physical character of the material. The bentonite clays may be conveniently classed as of (a) swelling type and (b) non-swelling type, when they are wetted. Swelling is a measure of relative water absorption, determined by the colloidal and gel-forming properties of the clay, often combined with the ability to form comparatively stable dispersions or suspensions. The more highly colloidal bentonites find their principal use in foundry work, as a bonding ingredient for the moulding sand, for rejuvenating spent sand, and in core washes. They are also used extensively in soaps and detergents, for laundering, wool-scouring, and other uses, as well as in many cosmetic, medicinal and pharmaceutical preparations; as a suspending, spreading and adhesive agent in horticultural sprays and insecticides; as a plasticizing ingredient in ceramic bodies, and in slips ~~and~~ glazes, and in refractories; for emulsifying asphalts, resins,etc.; to improve the workability, flow and water resistance of concrete; in the clarifying of wines, honey, vinegar, etc.; and for a variety of other minor products and processes. They are employed, on account of their swelling, to stop water seepage through and around dams, abutments, or other structures, and recently for clarifying turbid water supplies and for sewage purification. A novel application that may have serious import for the mica industry is the production of thin sheets or films ("Alsifilm") from centrifuged or otherwise purified colloidal bentonite; it is claimed that such sheets can be produced very cheaply and that they have high electrical insulating strength, as well as practically all the other properties that have hitherto made mica an indispensible mineral for electrical and other purposes.

Further recently announced uses are for processing beer; as a binder in briquetting coal-zinc ore mixtures for smelting in vertical furnaces; and as a paste to hold the electrolyte in dry batteries.

The non-swelling (non-colloidal) bentonites find their principal application in the activated form (after treatment with sulphuric acid) for bleaching in the petroleum and other industries, and for use in oil-well drilling, the clay serving to stabilize the viscosity of the mud column, acting as a suspending medium for the barite or other heavy mineral used to weight the column against gas pressure, and to float up the drillings, as well as to seal the wall pores of the drill hole. Both uses have occasioned a large increase in recent years in the consumption of bentonite, and in the United States the production of activated clay, particularly in the Southern States, is growing rapidly.

Canadian deposits of colloidal bentonite are probably adequate to fill domestic requirements for this kind of clay, most of the occurrences in the Prairie Provinces being of such character. They are seldom of the activable type, though the clay of the Morden district, Manitoba, possesses good bleaching power in the natural state, and, after activation, is claimed to be superior to many industrial bleaching clays. The deposits in British Columbia are less highly colloidal, but data on their activable properties are not on record.

Prices of powdered natural bentonite, as reported by Canadian users, have varied in recent years from $23 to $43 per ton, laid down at plant. A leading American producer in 1938 quoted $10.25 per ton for minus 200-mesh material, f.o.b. Wyoming, with a $13.54 freight rate per ton to Montreal. Dried coarsely-crushed material was priced at $8.50 and crude at $8 per ton; the price of activated bentonite, carload lots, averages around $65 to $75 per ton, delivered eastern Canadian points.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

BERYL IN 1938

The mineral beryl, a silicate of aluminium and beryllium, with 12 to 14 per cent beryllium oxide and one of the comparatively few natural beryllium compounds, is the only important known source of the element. Beryl is not exactly an uncommon mineral, though it is by no means abundant: its occurrence is confined to pegmatite dykes, usually in the form of disseminated crystals. Almost all the beryl sold represents by-product material from the working of pegmatites for their feldspar, lithium minerals, or mica content. Beryl-pegmatites are known in a number of countries, and small tonnages have been produced in various states in the United States, in India, South Africa, Brazil, Argentina, Madagascar, Scandinavia, France, Portugal, Spain, and Russia. The total produced and sold annually in recent years has been only a few hundred tons, but the known world reserves are believed capable of meeting considerably increased demand.

Known deposits of beryl of possible commercial importance in Canada include one in Lyndoch township, Renfrew county, Ontario, and several scattered occurrences in the Pointe du Bois district, in southeastern Manitoba. The Lyndoch deposit has been worked intermittently on a small scale since 1926 by various operators, including T. B. Caldwell, of Perth, Ont., Madawaska Minerals Limited, Renfrew Minerals Limited, and Canadian Beryllium Mines and Alloys Limited. The last-named company was incorporated in 1937 to take over the assets of Renfrew Minerals Limited and manufacture beryllium alloys and chemicals: its head office is at 901 Royal Bank Building, Toronto. At the end of 1938 the company reported about 50 tons of cobbed beryl crystals stock-piled. Small shipments of feldspar have been made from the property, and a few tons of hand-picked mixed rock containing columbite and certain rare-element minerals, principally euxenite was recovered. Analysis of the Lyndoch beryl has shown from 13.4 to 14.4 per cent of beryllium oxide. The beryl occurs as scattered crystals, sometimes large, in localized shoots or zones in a large pegmatite body. In 1937, a second company, International Beryllium Mining Syndicate, 371 Bay Street, Toronto, was formed to prospect and mine for beryl in adjacent sections of Lyndoch township and in the adjoining township of Brudenell.

Some of the Manitoba pegmatites carry beryl as scattered crystals, sometimes large, and small rich pockets have been found in which the beryl, as small crystals, constitutes possibly half the rock. Occasionally yellow, green or colourless crystals are found, and a small amount of such material has been cut into gem stones for the local Winnipeg jewellery trade.

American supplies, other than domestic have been drawn largely from India, but recently shipments have come from Argentina, and small amounts from the Union of South Africa and from Brazil. No statistics are available of either production or consumption of beryl in the United States; present American consumption is, however, estimated to be under 500 tons per year, or half the world's consumption. The United States is the chief consumer of beryl on any scale for the production of beryllium metal and alloys, as well as for beryllium salts and compounds, though there is a moderate consumption in Germany, France, Italy, and possibly Japan. Despite the somewhat sparse known world resources of beryl, American consumers are reported being offered more supplies than they can use.

No statistics of world production, exports and imports, of beryl are published. With the exception of a couple of tons shipped from the Lyndoch property around 1926 to Germany, no exports of

Canadian beryl are known to have been made. United States imports in 1938 were reported as 124 tons, valued at $5,036, most of which came from British India and Argentina: domestic supplies were drawn mainly from South Dakota and Colorado.

Until a few years ago, beryllium held little commercial interest, owing chiefly to the exceedingly high cost of extraction of the pure metal. This while still high has been reduced, enabling the metal to be used in industry, and the production of beryllium alloys, chiefly copper-beryllium and nickel-beryllium, is expanding rapidly. Beryllium imparts high tensile strength to copper, and tools made of the above alloys have the valuable properties of hardness and toughness, approaching that of steel, and of being non-sparking. Where wear, resistance to corrosion or high fatigue value combined with good electrical conductivity are essentail, beryllium-copper, with about 2.25 per cent beryllium, fills an important requirement. The price of such master alloy now stands at $23 per pound of contained beryllium, in standard commercial shapes and sizes, as sheets, plates, rods and wire. Many forms of tool made of beryllium-copper are now on the market, and it is used for firing-pins for fire-arms, precision bearings, bushings, valve parts, moulding dies, wire cloth for special uses, and for many other purposes. Such fabricated articles sold in 1938 on the basis of $1.12 per pound, an increase of 23 cents over 1937.

Despite the publicity given to the possible field for beryllium in alloys with the light metals aluminium and magnesium for use in aircraft engines and parts, commercial developments along such lines have so far been unimportant. A beryllium-aluminium master alloy is however now on the market at a price of $50 per pound of contained beryllium. The addition of beryllium alloys to silver, in order to prevent tarnish, has not proved to effect the anticipated improvement under all conditions. Alloys with nickel, nickel-iron, and nickel-chrome-iron are more promising: they are very strong, non-magnetic, resistant to heat and corrosion, and find a use in springs of various kinds. Beryllium-iron, with 10 per cent beryllium, is now being offered at $50 per pound of beryllium content. Although at first metallic beryllium was made and marketed, there is now little demand for the straight metal and the various alloys are made direct.

Initial development of the beryllium industry took place in Germany, but two concerns are now established in the United States manufacturing beryllium alloys: these are Beryllium Corporation of Pennsylvania (formerly Beryllium Corporation of America), Reading, Pa., and Brush Beryllium Company, Cleveland, Ohio. The latter also makes a number of beryllium chemicals, including the high refractory oxide. In recent years a comparatively large proportion (estimated at 20 per cent) of the beryl utilized in the United States has gone into the production of the super-refractory oxide and other compounds. Beryllium salts are used in certain kinds of glass, in ceramic glazes, refractories (mainly crucibles and insulators), and in lithopone, to increase light-fastness, and in high-duty abrasives.

Throughout 1938, New York trade journal quotations for beryl, carload lots, f.o.b. mines, were $30 per ton for mineral carrying a minimum of 10 per cent BeO and $35 per ton, minimum 12 per cent BeO. These prices, which showed no change from those of 1937, were nominal, actual sales usually being by individual contract.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

BITUMINOUS SAND IN 1938

Deposits of bituminous sand occur along Athabaska river between the 23rd and 26th base lines, in the northern part of the province of Alberta; exposures may be seen along both sides of the Athabaska river and its tributaries. Between the years 1927 and 1930 2,000 tons were shipped for laboratory investigations and 3,000 tons for the construction of demonstration pavements and road surfaces.

During 1938, the International Bitumen Company processed a small amount of bituminous sand at its plant at Bitumont, Alberta, producing about 45,000 gallons of fuel oil, upwards of 300 tons of asphalt of varying penetration, and a small quantity of prepared roofing. Fuel oil was disposed of to northern mining interests. Part of the asphalt was shipped to a manufacturer of roofing products in Indiana and part to the City of Edmonton. The company's equipment at Bitumont includes a separation plant, a refinery with a capacity of 350 barrels per day, shipping dock and complete housing facilities.

Abasand Oils,Limited, continued construction work on separation, distillation and refining units during 1938 on Horse River near McMurray. The separation plant has a through-put of 400 tons of bituminous sand per day, and the distillation and refining equipment has a capacity of 600 barrels per day. It is proposed to produce gasoline, tractor fuel, Diesel fuel, road oils, asphalt, and coke.

The Bureau of Mines has conducted a comprehensive investigation of these deposits of natural asphalt. In addition to field exploration during fifteen field seasons, extensive laboratory studies of the bituminous sand and of bitumen separated from it have been made. Various industrial applications for the separated bitumen, as for example, in the manufacture of paints and varnishes and in the manufacture of certain rubber goods, are also being investigated. Results obtained have directed attention to the extent and potential economic importance of the deposits. Products that may be derived include motor fuels and other liquid hydrocarbons as well as certain solid and semi-solid bitumens.

A large market for petroleum products exists in the provinces of Alberta, Saskatchewan and Manitoba. The extent to which this market can be supplied from the processing of bituminous sand will depend on ability to meet competition from other fields and on production and transportation costs. Production costs have not yet been definitely determined but apparently will be low. Transportation costs will apparently be governed to a considerable extent by tonnage of freight offered by producing companies.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH,1939.

CEMENT IN 1938

Portland cement, the principal raw materials for which are limestone and clay, is manufactured in five provinces of Canada. The Canada Cement Company, Limited, operates plants at Hull and Montreal East in Quebec; Port Colborne and Belleville in Ontario; Fort Whyte, Manitoba; and Exshaw, Alberta. The St. Mary's Cement Company, Limited, operates a plant at St. Mary's, Ontario. Medusa Products Company of Canada, Limited, has a plant at Paris, Ontario. The British Columbia Cement Company operates at Bamberton, British Columbia; and Coast Cement Company, Limited, has a plant at Vancouver for the grinding of imported clinker. The total rated daily capacity of all ten plants is about 35,000 barrels.

Medusa Products Company of Canada, Limited, began operations at Paris, Ontario, in June, 1938, manufacturing white Portland cement, waterproofed white Portland cement, white masonry cement, cement paints, etc., from imported clinker. These products are being imported from the United States, the United Kingdom and Belgium.

Within recent years at all but one of the eight plants making clinker from domestic raw materials the dry process has been replaced by the wet and remarkable uniformity in the product is now achieved throughout the country. To further this uniformity and to obtain a better fluxing of the clinker, iron oxide in the form of residue from burned pyrites is added to the raw mix at certain plants where the raw materials are deficient in this constituent.

A recent development of interest to all manufacturers of cement is the application of froth flotation to remove a portion of the siliceous material from limestone. This process is in use at several cement plants in various parts of the world and limestone deposits advantageously situated but too impure in their natural state can now be utilized for cement manufacture.

Production of cement in 1938 was 5,519,102 barrels valued at $8,241,350 as compared with 6,168,971 barrels valued at $9,095,867 in 1937. Sales held up well during the first half of the year in comparison with the previous year but fell off in the latter half.

Cement is manufactured in most countries of the world. In 1936, the latest year for which fairly complete data are available, the world's production amounted to 75,080,000 metric tons, to which total Canada contributed 784,000 metric tons. The principal producing countries in order of tonnage were United States, Germany, United Kingdom, Russia, Japan, France, Italy, and Belgium.

Exports of cement during 1938 were 89,419 barrels valued at $101,059, a decided increase from the 72,568 barrels valued at $82,978 exported in the previous year. Trinidad took 34.4 per cent and Columbia 16.7 per cent, other countries being Newfoundland, British West Indies, Peru, British Guiana, Bermuda, and the United States.

Imports of cement totalled 48,497 barrels valued at $105,326, a decided decrease from the 61,082 barrels valued at $134,113 imported in 1937. Belgium supplied 71.4 per cent of the year's imports; the United States 16.5 per cent; Great Britain 12.0 per cent; and Italy and Japan the remainder. These imports include some high-priced special cements.

Cement is one of the most important of our structural materials and finds use in all construction work such as bridges, dams, highways, foundations or buildings. In addition, an industry, known as the cement products industry, making building blocks, bricks, pipe, artificial stone garden furniture, etc., uses cement as its principal raw material.

The average selling prices of cement per barrel f.o.b. plant in the several producing provinces during 1937 and 1938 were as follows:

	1937	1938
Quebec	$1.37	$1.35
Ontario	1.38	1.40
Manitoba	2.27	2.28
Alberta	1.99	2.01
British Columbia	1.81	1.87

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

CHROMITE IN 1938

Practically all the chromite ever mined in Canada has been derived from the Coleraine area in the Eastern townships, Quebec. Fairly heavy shipments were made from this area during the Great War period. Since 1923 only a few small shipments have been made. The Asbestos Corporation of Canada of recent years has mined chrome ore at one of its properties in the Thetford asbestos field, in southern Quebec.

In Ontario, the Obonga Lake property situated 26 miles south of Collins, a station on the Canadian National Railway and in the Thunder Bay district, has been under development these last few years by the Chromium Mining and Smelting Corporation. Experimental shipments have been made from the property to test plants, and to the company's own smelter in Sault Ste.Marie, where a large modern electric smelting plant is in operation for the production of ferro-chrome and ferro-silicon. The ferro-chrome produced to date has been mainly from imported chrome ore.

In British Columbia exploration and development has been done at several properties and occasional experimental shipments have been made, but no recent activities have been reported.

No production of chromite was reported in 1938, while the shipments were valued at $43,250 in 1937.

Imports of chromium ore into Canada in 1938 were 9,105 tons valued at $142,399. Imports of chromium products included: sodium bichromate 1,776,372 pounds valued at $106,150; potassium bichromate 121,531 pounds valued at $10,435; chrome firebrick, to the value of $47,885; nickel-chromium bars and rods, containing more than 10 per cent chromium 43,472 pounds valued at $41,805; and chromium metal and tungsten metal and scrap alloys of these two metals 43,527 pounds valued at $30,328.

The world's annual production of chromite is estimated at 1,300,000 to 1,500,000 metric tons. The production in 1936 (1937 and 1938 not yet available), as reported by the United States Bureau of Mines, was 1,069,000 metric tons. Russia is the largest producer followed closely by the Union of South Africa, Southern Rhodesia and Turkey. Other important sources are Cuba, New Caledonia and Yugoslavia.

World consumption has been estimated at 40 per cent for refractory brick, 30 per cent for ferrochrome and 25 per cent for the chemical industry (London Mining Journal,March 5,1938).

The Chromium Mining and Smelting Corporation Ltd.,however, are still actively engaged in the production of chromium products. They have just completed an expansion of their Sault Ste.Marie smelting plant. To date apparently all work has been of an experimental nature but they are now in a position to start commercial operations. They expect to smelt imported ores. The plant has a possible annual capacity of about 10,000 tons of contained chromium.

The Chromium Mining and Smelting Corporation Ltd. have developed a new method of making chromium additions to steel which does not require a high grade, high chromium-iron ratio chromite as a raw material. Briefly the process consists of a two furnace preferential reduction treatment followed by a roasting operation. In the first furnace the greater part of the iron and some of the chromium is reduced. The remainder of the chromium and iron are contained in the slag and are reduced to ferrochromium in the second furnace. The reduction of iron in the first furnace makes possible a production of high chromium-iron ratio ferrochromium from low chromium-iron ratio ore. The ferrochromium is roasted with lime in a rotary kiln, the carbon being burned off and the metals converted to oxides in this operation. The material is then given a second roast at a lower temperature in order to convert a portion of the chromium into chromate. This mixture of oxides is mixed with ferrochromesilicon, packed into steel barrels and sold under the name Chrom-X. Chrom-X is added to the steel bath where the oxides are reduced to metals.

Large scale tests made at various steel plants have demonstrated the feasibility of the Chrom-X method of making chromium additions to steel. It has also been shown that because of the largely exothermic nature of Chrom-X, stainless steels can be made by this method in standard open hearth furnace. At present practically all stainless steel is of the more expensive electric furnace variety, as a high temperature is required for its production. Chrom-X has also been used successfully as a ladle addition. The Chromium Mining and Smelting Corporation Ltd. claims that the cost of making chromium additions by the Chrom-X method compares favourably with the cost of ferrochromium additions.

The growing use of chromium alloy steels and of various corrosion and abrasion-resistant chromium-bearing alloys has been the chief cause of the increased demand for chromite in recent years.

The physical and chemical characteristics of the chromite required vary with the particular consuming industry. For metallurgical use ores high in Cr_2O_3 and low in iron are desired. Ores with a chromium-iron ratio of 3 to 1 are usually chosen. Hard, lumpy ores are preferred in the refractory industry, but much ground chromite is used for patching and protecting parts of furnaces. Ores relatively low in chromic acid may be used in refractories if the percentage of alumina is correspondingly high. Chromite containing less than 45 per cent Cr_2O_3 is not desired in the chemical industry, and chromite concentrates are acceptable; the ore should be low in sulphur, easily crushed or friable, and with a silica content not in excess of 8 per cent. In addition to the chromite use in the manufacture of chromic acid for electroplating, much chromite is consumed in chemicals used principally in the dyeing, tanning, and pigments industries. The principal markets in the United States for chemical-grade chromite are the plants of the chemical manufacturers in New Jersey,Maryland and Ohio (Minerals Yearbook,1938, U.S.Bureau of Mines).

The New York price for chrome ore, per long ton, c.i.f. Atlantic ports for 48 to 50 per cent ore in 1938 decreased from about $26 in January to $22 in August, at which price it remained to the end of the year; the average for the year was about $24. The price for metallic chromium (97 to 98 per cent pure) remained at 85 cents per pound throughout the year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

CLAYS AND CLAY PRODUCTS IN 1938

The industrial clays of Canada may be classified into the following: common clays, stoneware clays, fireclays and china clays. For statistical purposes, the clay products industry of Canada is conveniently classified into: (1) Production from domestic clays, which includes building brick, structural tile, drain tile, roofing tile, stoneware, sewer pipe, pottery and refractories, and (2) production from imported clays, which includes electrical porcelain, sanitary ware, sewer pipe, table ware, pottery, ceramic floor and wall tile, and various kinds of fireclay refractories. The total value of all clay products manufactured in Canada from domestic clays in 1938 was $4,437,100 as compared with 4,516,900 in 1937.

Common Clays

Common clays suitable for the production of building brick and tile are to be found in all the provinces of Canada. The value of structural clay products (building brick, hollow building tile, drain tile, roofing tile, etc., was $3,185,506 as compared with $3,223,691 in 1937.

Stoneware Clays

The largest producing area in Canada of stoneware clays or semi-fireclays lies in the vicinity of Eastend and Willows, Saskatchewan, where large quantities of the clays are selectively mined and shipped to Medicine Hat, Alberta, for the manufacture of stoneware, sewer pipe and pottery through the agency of cheap gas fuel.

Stoneware clays and moderately refractory fireclays occur near Shubenacadie and Musquodoboit, Nova Scotia. A small amount of the Musquodoboit clay is used for the production of pottery, but there has been no extensive exploitation of these clays for ceramic purposes.

Stoneware clays or low-grade fireclays are also known to occur near Williams Lake, Quesnel, and Chimney Creek Bridge in British Columbia; in the Cypress Hills of Alberta, and near Swan River, Manitoba, but there has been little or no development, owing to the comparative inaccessibility.

The value of stoneware articles (sewer pipe, pottery, etc.) produced in Canada from domestic clays in 1938 is reported to have been $1,009,312 as compared with $1,022,419 in the previous year.

Fireclays

At two large and a few small plants in Canada fireclay refractories are manufactured from domestic clay. At one plant, about 50 miles south of Vancouver, B. C., a high grade, moderately plastic fireclay is obtained by underground mining, from the clay beds in the Sumas Mountain, and is manufactured into firebrick and special shapes ~~other refractory materials~~. At another plant at Claybank, Saskatchewan, the highly plastic, refractory clays recovered by selective mining from the "White Mud" beds of southern Saskatchewan are used.

A small amount of the most refractory clay in the deposits near Shubenacadie is mined for refractory use by the steel plant at Sydney, and the Musquodoboit clay is utilized to some extent for the production of stove linings. Except for a few small concerns manufacturing refractory specialities, and companies producing firebrick, blocks, etc., for their own use, all other manufacturers of fireclay refractories in Canada utilize imported clay.

The value (sales) of the refractories produced in Canada from domestic clays in 1938 was $190,366 as compared to $218,258 in 1937; the value of refractories produced from imported clays totalled $659,599 in 1937.

China Clays and Ball Clays

China clay has been produced commercially in Canada only from the vicinity of St. Remi d'Amherst, Papineau county, Quebec. A group of open pits was operated for several years prior to 1923. The property remained idle until 1937, when a reorganized company was formed to extract the kaolinized material by underground mining and to refine it into high grade china clay, with washed silica sand as a by-product. A shaft has been sunk to 365 feet, and a modern mill was erected for washing. In 1931 a nearby property was developed, mainly for the production of silica sand, but a small amount of china clay has also been produced.

Important deposits of high grade, plastic white-burning clays, and buff-burning clays, occur on the Mattagami, Abitibi, and Missinaibi rivers in northern Ontario. Some may be classed as china clays, some as fireclays, and others as ball clays. They have attracted considerable interest but have not yet been developed commercially, owing to remoteness from industrial centres, and lack of transportation facilities.

In British Columbia, along the Fraser river, about 25 miles above Prince George, is an extensive deposit of high-grade clay, parts of which yield a grade of china clay comparing favourably with the best found on this continent. The possibility of transporting this clay by barge to railway has been considered.

In the manufacture of such products as porcelain, sanitary ware, dinner ware, or ceramic floor and wall tile, etc., china clay imported from England is used almost entirely. Besides clay for ceramic use, large annual importations of china clay are made for use in the production of fine paper, in the rubber industry, and for other industrial purposes. The imports of china clay in 1938 were valued at $324,933 and at $445,073 for the previous year.

Ball clays of high bond strength occur in the white mud beds of southern Saskatchewan. The market in Canada for ball clay if not large is growing, and prospects of developing a profitable export market in the United States are good. The reported value of clays exported from Canada (which are chiefly ball clays) in 1938 is $2,652 as compared with $3,117 in 1937.

Compared to world production, the value of clay products manufactured in Canada is very small, and large quantities of the various kinds of ceramic products are imported annually. The total value of manufactured clay products imported into Canada was $6,872,952 in 1938, and $8,127,943 in 1937.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

DIATOMITE IN 1938

The International Diatomite Industries, Limited, Tatamagouche, Nova Scotia was the only Canadian producer in 1938. The Company's calcination plant at New Annan operated most of the year, and its output was slightly greater than that of 1937, but sales were lower. The calcined diatomite is treated in a small mill at Tatamagouche station, 12 miles to the north. About 20 percent of the sales were in Canada, mainly as a sugar filter-aid, which is a very carefully prepared product. Other outlets for the Nova Scotia diatomite were as a filler in various trades, for insulation, and as a metal polish base.

In the Muskoka region of Ontario the Muskoka Diatomite Ltd., Toronto, ran a few tons of raw material through the mill erected on their property south of Gravenhurst. A small amount of prepared product was distributed locally for experimental purposes. The plant closed down pending improvements in the treatment mill.

In the Cariboo district of central British Columbia a little prospecting work was carried out on the deposits about 15 miles south of Quesnel. An appreciable quantity of the diatomite mined from the Quesnel area during the past two years is still unsold and until this is disposed of, further production is unlikely. Less than a car lot was sold by Fairey and Company, Vancouver, from the stock of material mined from the P. G. Lepitich farm near Quesnel on the Fraser river, British Columbia.

The Canadian production in 1938 was 494 tons, and sales were 414 tons, valued at $13,562, against 643 tons valued at $18,606 in 1937.

Export records are not available, but from private information it is known that about 42 percent of the total sales were for England and about 34 percent for the United States; sales within Canada in 1938 amounted to 85 tons as against 207 in 1937.

The imports in 1938 were 3,700 tons, almost all from California, U.S.A., as against 3,350 tons in 1937.

There was very little change in the consumption of diatomite used in the home industries during the year. About 92 percent of the diatomite now being consumed in Canada is in the form of filter-aids, about 4 percent is used for insulation, and the remainder is absorbed as a filler, concrete admixture, silver polish base, and in chemicals. One or two companies are manufacturing diatomite insulation bricks and stove pads. Amongst the recent applications, the use of diatomite in the paint and varnish industry, has demonstrated its advantages as a flattening agent and as an extender.

Deposits containing medium quality diatomite are very common in some parts of Canada. Owing, however, to foreign competition and to the, at present, comparatively small Canadian demand, only the properly prepared diatomite of the highest quality can now be successfully marketed on a scale sufficiently large to warrant the operations of a property and the erection of a plant.

In the United States during 1938 there were 17 producers, the total sales for that year being estimated at 125,000 short tons, a decrease of about 5 percent below the estimated 1937 sales. The United States is by far the largest of the 25 other world producers. Denmark, Germany, Japan, Algeria, and Northern Ireland in order of their importance, all produce over 5,000 tons annually.

There is a fair demand in England, which is still the worlds largest importer, but mainly for a pure white high quality diatomite and it is being used principally as a filler for composite floorings and hard rubber products.

The present price in Canada varies from $35.00 to $40.00 per ton for concrete admixture; $35.00 to $75.00 for insulation and filtration; up to $200.00 in small lots for material suitable for polishes; imported insulation bricks vary from $85.00 to $140.00 per 1,000 according to grade and density.

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FELDSPAR IN 1938

Pegmatite dykes, the main source of commercial feldspar, are distributed widely throughout the Pre-Cambrian rocks of eastern and northern Canada, and the reserves of the mineral are large. Production has come from mines in Ontario and Quebec, except for a few thousand tons mined in Manitoba from 1934 to 1938.

During 1938 production continued to be drawn in the main from established mines. In Ontario, most of the production came from the large quarry of Bathurst Feldspar Mines in Bathurst township, Lanark county, with some from the nearby Macdonald mine, and a small tonnage from operations in McKellar township, Parry Sound district, and in Nipissing district. In the early days of the industry, the most important centre of production was the Verona area, Frontenac county; later the Hybla, Mattawa, Sudbury, Parry Sound, and Bathurst areas, in Ontario, and the Buckingham area in Quebec, each in turn became prominent; most of the production is now derived from the last two areas.

In Quebec, the entire output came from three established mines, contiguous to the Lievre river, north of Buckingham, Papineau county; this district supplies the entire small tonnage of dental spar produced in Canada.

In Manitoba, there was no production reported during the last two years; a single mine in the Pointe du Bois area, southeastern Manitoba was in operation from 1933 to 1936 with a total production of about 7,000 tons.

The feldspar production in 1938 was 14,128 tons valued at $129,719 as against 21,346 tons, valued at $178,222 in 1937, a decrease of about 34 per cent in quantity and 27 per cent in value. The output of crude spar goes in part to domestic grinding mills and part to mills at Rochester, N.Y.; all the former Manitoba production was shipped to a mill at Warroad, Minnesota. A small amount of specially-selected high-grade "dental spar" is exported for use in the manufacture of artificial teeth.

Canada has been a producer of feldspar for nearly fifty years; the peak production of 45,000 tons was recorded in 1924 and the total output to date stands at over three quarters of a million tons.

Exports of feldspar in 1938 amounted to 29,242 tons valued at $139,408, compared with 27,462 tons, valued at $197,000 in 1937. Virtually all of the exports comprise crude spar shipped to United States mills. Under the new American tariff provided in the Trade Agreement of 1938 and in force from January 1, 1939, the rate of duty on crude Canadian feldspar entering the United States is reduced from 35 cents to 25 cents per long ton; the duty on ground feldspar is also reduced, from 30 per cent ad valorem to 15 per cent.

Imports of ground spar, all from the United States, were 615 tons valued at $10,083 in 1938, compared with 1,356 tons valued at $22,937 in 1937. Imports of crude feldspar (used to a small extent for blending purposes) were 42 tons valued at $367, as against 439 tons valued at $2,197 in 1937. Crude feldspar enters Canada duty-free; ground spar from the United States pays 15 per cent ad valorem.

World production of straight feldspar (exclusive of "china stone", a variety of granite mined in the United Kingdom and used in place of feldspar) totalled nearly 380,000 tons in 1936, the last year for which fairly complete figures are available. Canada then ranked fourth in point of output, with about 5 per cent of the total tonnage.

In view of the comparatively low unit value of the mineral, development hinges upon freedom of the run-of-mine from iron-bearing impurities and the cost of transportation to grinding plant; mechanical (magnetic) methods of cleaning spar have not yet been adopted in this country, sole dependence being placed on cobbing and hand-picking; truck transport has done much to extend the limit of road haul from mine to mill or rail, and distances up to 25 miles are now economical

The two domestic mills grinding for the ceramic trade, those of Frontenac Floor and Wall Tile Company, at Kingston, Ontario, and of Canadian Flint and Spar Company, at Buckingham, Quebec, were in steady operation throughout the year, as was also the grinding unit of the Bon Ami Company, at Montreal East. The first-named draws its supply from the Bathurst district, in Ontario, and the second from mines along the Lièvre river, in Quebec. The Bon Ami Company requires a light-coloured spar and in 1938 obtained most of its requirements from Quebec, with a small tonnage also from New Hampshire.

Domestic prices remained at the level of the previous year with No.1 ceramic grade quoted at $5.50 f.o.b. rail or mill. Ground spar sold at $16.00 per ton, ex.mill. In the United States, the average price of ground spar for the pottery trade was $17 per short ton, for the enamel trade $14.50, and of granular glass spar $10.30.

Nepheline syenite, a material finding increasing use as a substitute for straight feldspar in the glass trade, is doubtless largely responsible for the decreased sales of Canadian feldspar, for in the United States one half the feldspar now used is consumed in glass manufacture. Canadian spar, however, enjoys a high reputation as a standard grade for various ceramic uses.

The modern trend towards supplanting hand methods (cobbing and picking) by mechanical means in the production of minerals is making itself increasingly felt in the feldspar industry. Magnetic separation is now employed on a considerable scale in the United States and may eventually become standard practice as deposits of clean spar become exhausted. Flotation methods, investigated for some years past in Germany, are also attracting the attention of American producers for making a clean feldspar product from mixed quarry-run feldspar-quartz rock or from dump material formerly discarded as waste. Agglomerate tabling and electrostatic separation of feldspar-quartz mixture have recently been investigated in the U.S. Bureau of Mines laboratories. The successful commercial development of such methods would permit recovery of important tonnages of spar from the waste piles of many of the larger mines, as well as assuring consumers of a cleaner and more uniform product. It might also ultimately lead to the production of feldspar from rocks other than pegmatite, e.g., granite, syenite, gneiss, particularly where such rock contains other minerals of industrial value, such as garnet, cyanite, sillimanite, mica, etc. A report of the U.S. Bureau of Mines stated that a plant for this purpose was expected to come into operation in 1938. Technical research on feldspar is also receiving increasing attention, directed towards a further understanding of its properties and function for ceramic uses generally and more particularly in the glass industry, which now consumes a very large proportion (over half) of the total spar used. Much work is also being done on improved methods of analysis of feldspars.

Nepheline syenite is not the only mineral product now threatening competition with, and reduced use of, feldspar in the ceramic industries. The lithium mineral spodumene has recently been under investigation for ceramic use, and being a more active flux than feldspar, may come to replace it, at least in part, in both pottery and glass. Pyrophyllite (silicate of alumina) and talc have also been shown to have valuable ceramic properties; their production and use for ceramic purposes have been expanding rapidly in recent years and may result in a progressively lessened use of feldspar. In addition, production commenced in 1938 in Virginia of a rock termed "aplite", a mixture of feldspar and zoisite, designed to furnish a granular material for the coloured glass trade.

As indicating present consumption trends, an official survey of the feldspar industry in the United States showed that sales of ground spar in 1937 were distributed as follows to the various consuming industries: glass, 51 per cent; pottery, 37 per cent; enamel and sanitary ware, 9 per cent; the remainder being divided between other ceramic uses, scouring preparations and abrasive wheels. In the same year, total grinding capacity of American mills was estimated to be nearly 600,000 tons, or more than double the volume of sales.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

FLUORSPAR IN 1938

Few important occurrences of fluorspar are known in Canada, and practically the whole of the domestic requirements for the metallurgical, ceramic and other industries are imported; the only localities where the mineral occurs in important amount are the Madoc district, in Hastings county, Ontario, and near Grand Forks, British Columbia.

During the Great War a number of properties in the Madoc area produced considerable tonnages; since 1920 the small amount produced (seldom over 100 tons in any year) has been derived mainly by pick-and-shovel methods at surface workings. Occasional reports of plans to re-open old properties or to build plants to recover the fluorspar from old dumps have not materialized.

The Rock Candy mine of the Consolidated Mining & Smelting Company, near Grand Forks, B. C., is by far the largest known deposit of fluorspar in Canada; it was operated intermittently between 1918 and 1929, the total output being estimated at about 70,000 tons of crude fluorspar, from which about 30,000 tons of concentrate was produced; some was exported, but most was utilized for the production of hydrofluosilicic acid, used in the electrolytic purification of lead at the Trail smelter. Recovery of by-product fluorine from the phosphate rock used in the large fertilizer plant at Trail has obviated the use of fluorspar. The whole of the fluorine recovered is now consumed in the lead refinery, but other outlets are being considered, such as in the manufacture of sodium fluosilicate, used in the ceramic and glass industries, for laundry purposes, and as an insecticide; lead and zinc fluosilicates, also of value as grasshopper poisons; and ammonium fluosilicate, used as a detergent.

Production of fluorspar in 1938 was 217 tons, valued at $3,906 compared with 150 tons, valued at $2,550, in 1937. As in recent years, this was recovered by a single operator from small surface workings at Madoc, Ont., and was of gravel grade, being shipped to domestic steel plants.

Imports of fluorspar into Canada in 1938 totalled 15,057 tons, valued at $212,131 compared with 11,444 tons, valued at $168,082, in 1937. The material came from the United States (1,388 tons), United Kingdom (675 tons), Newfoundland (6,092 tons), Belgium (599 tons), Germany (858 tons), and Italy (440 tons).

There are no exports of the mineral.

From a census made by the Dominion Bureau of Statistics, the consumption of fluorspar in Canada in 1937 was 12,826 tons, of which 9,000 tons went to steel foundries and 3,500 tons to the chemical trade.

Total recorded world production of fluorspar in 1937 was nearly half a million short tons, of which the United States and Germany together furnished roughly three quarters, each with over 150,000 tons: the remainder came mainly from France, the United Kingdom, Korea, Italy and Newfoundland, in order of tonnage.

Commercial fluorspar is usually graded according to the following specifications: acid grade, lump or ground, 98 per cent CaF_2, not over 1 per cent SiO_2: glass and enamel grade, ground. 95 per cent CaF_2, not more than 3 per cent SiO_2 and 0.1 per cent Fe_2O_3; fluxing gravel or lump grade, 85 per cent CaF_2, not more than 5 per cent SiO_2.

Fluorspar is used mainly in the metallurgical industries, chiefly as a flux in the production of basic, open-hearth steel ("fluxing gravel" grade); some is also similarly used in the melting of electric furnace steels, ferro-alloys, non-ferrous metals, and in general foundry work ("foundry lump" grade). The glass and pottery trades consume important amounts of ground fluorspar, and a considerable tonnage ("acid lump" grade) is consumed in the manufacture of hydrofluoric acid, used largely for the production of synthetic cryolite, a material employed in the electrolytic bath in the extraction of aluminium from bauxite and also, to a smaller extent, in glass and other ceramic products, insecticides, etc. Smaller uses for fluorspar include the manufacture of Portland cement, the bonding of emery wheels, and in the making of carbon electrodes, calcium carbide and cyanamid. A demand showing promise is in the manufacture of the organic refrigerating medium known as "Freon", or "F-12". This compound (dichloro difluoro methane) is being made on an increasing scale by Kinetic Chemicals, Ltd., a unit of E. I. DuPont de Nemour Company. According to Minerals Yearbook 1938, published by the U. S. Bureau of Mines, sales of fluorspar from domestic mines in the United States in 1937 were divided as follows, by consuming industries: steel and foundry, 77 per cent; hydrofluoric acid and derivatives, 10 per cent; glass, 7 per cent; enamel, 3.5 per cent; miscellaneous, 2.5 per cent.

Clear, glassy, crystal fluorspar finds employment in various types of optical instrument, such as spectroscopes and microscopes, for correcting colour and spherical aberration of lenses, and similar, coloured fluorspar is sometimes used in jewelry, though its softness is a drawback. Fluorspar of optical quality is exceedingly rare and commands high prices: during the War fine crystals ~~have been~~ were obtained from the Keene mine, near Madoc, Ontario; the discovery in Siberia of exceptionally large, clear crystals, measuring 4 to 6 inches across, has recently been announced.

Prices of fluorspar in the United States market, which had stiffened in 1937, with a rise of $2.60 per short ton in the average f.o.b. value of all grades to $20.33, showed a decline in 1938; according to Metal and Mineral Markets, quotations on fluxing gravel spar dropped from $20 per net ton, f.o.b. Illinois and Kentucky mines, in January to $18 at the close of the year, while acid lump declined from $21 to $18-19; ground fluorspar, enamel grade, dropped from $35 to $30 in the same period. Canadian quotations on ground spar, various grades, as taken from trade journals, declined from $37 per ton in January to $32 in December.

The recovery of marketable grades of fluorspar from mine-run ore is usually accomplished by handpicking of the clean lump mineral, followed by crushing, jigging and tabling of the impure material and fines. Recently flotation methods for recovering the fluorspar content of mill tailings have been under investigation in the United States, and a plant employing this process is now in operation in the Illinois field. In general, flotation effects satisfactory separation of fluorspar-quartz ores, and is stated to be practised in three German mills, as well as in a mill in South Africa. On fluorspar-calcite-quartz ores, flotation has not yet been shown to work as satisfactorily, grade of concentrate and recovery both being rather low. It therefore would probably not be particularly successful on the Madoc type of ore, which is usually a fluorspar-calcite-barite mixture. Concentration tests have recently been run in the laboratories of the

Bureau of Mines on Madoc material, as well as on fluorite-barite ore from the Lake Ainslie district, Nova Scotia, but the separation and recovery achieved have not thus far been very promising.

Fluorspar entering the United States pays a duty under the general tariff of $5.60 per long ton if containing more than 97 per cent of calcium fluoride; $8.40 per ton if it contains less than 97 per cent. Under the new Trade Agreements of 1938, effective January 1st, 1939, the rate on imports of the first-mentioned grade from Canada and the United Kingdom is reduced to $4.20 per ton. No duty is levied on fluorspar imported into Canada.

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OTTAWA, MARCH, 1939.

GARNET IN 1938

Commercial garnet belongs to a group of complex silicate minerals of which almandite, the brownish-red iron-aluminium silicate is generally considered the hardest and the best as an abrasive. Garnet crushed and suitable graded as to size, is used for making abrasive-coated papers and cloth for rather clearly defined special uses in certain manufacturing industries, particularly in the wood working and shoe leather trades. About 110 tons of prepared garnet, used in Canada during 1938 is imported as graded grains, there being no Canadian production. Attempts in the past to produce commercial garnet have failed, owing to the existing market being small, to competition from high quality United States material, and because garnet possessing abrasive efficiency equal to that obtained in the United States has not as yet been found in sufficient quantity.

During 1938 there was very little activity in garnet in Canada. Some prospecting work was carried out by the Garnet Concentrates Inc., Quebec, on a property near Langlade in the Abitibi region, Quebec, on which a little work was done several years ago. During the latter part of the year the Canada Garnet Company, Montreal, continued with the erection of a concentration mill that was started late in 1937 on their property in Joly township, 2 miles southwest of Labelle, Quebec. The Damigo Mining Syndicate, Toronto, shipped 15 tons of ore to the Industrial Minerals Laboratories of the Bureau of Mines, Ottawa, for concentration tests. This was part of the 400 tons of ore mined in 1937 from the property in ~~Ashley~~ Ashby township, east of Bancroft, and the concentrate was used for the trial manufacture of cement-garnet pulpstones by Mr. Robin Boyle of Toronto.

About 90 to 95 per cent of the world garnet output comes from the United States. The Barton Mines Corp., North Creek, N.Y., is by far the largest producer. The total 1938 United States production of the three active companies was 3,155 tons and sales only 2,012 tons, against 5,307 tons produced and 4,863 tons valued at $382,535 sold in 1937. The 1938 United States shipments were, with the exception of 1,950 tons sold in 1932, the lowest in the past 40 years. This was partly due to general business conditions, but principally to increased competition from artificial abrasives.

Outside of the North American continent, England is by far the largest individual user, with an estimated annual consumption of less than 800 tons of graded garnet. The quality of this abrasive is gauged by the United States product so that Canadian garnet must be at least equal in every way to that standard before it can successfully compete.

Prices of the best quality concentrate from which grain is prepared for abrasive papers and cloths dropped during 1938 and is now $76 per ton f.o.b. mines (U.S.A.) and graded grain $90 per ton. About 30 tons of garnet fines was sold in the United States by the sandpaper manufacturers at about $26 per ton delivered, for use in the surfacing of plate glass. A very small amount of garnet was used for sand-blasting.

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GRANITE IN 1938

(Building, Ornamental, and Crushed)

The stone quarried in this industry consists of granite and related crystalline igneous rocks used for building, decorative, ornamental or constructional purposes. Producing properties are situated in the provinces of Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, and British Columbia.

Much of the granite produced in Canada is used for foundations for highways, for permanent ballasting of railway road beds, for heavy aggregate in large concrete structures, for filling breakwaters and for bridge piers. The heavy curtailment of such operations during the depression seriously affected production. Production is still far below the record years, but recovery with occasional set-backs is likely to be steady.

The industry in the Maritime Provinces has been comparatively quiet, although the search for new deposits of material suitable for monumental dies has been active.

The province of Quebec furnishes most of the granite for building, the Stanstead, St. Samuel, Lake St. John and Riviere-a-Pierre districts being the biggest producers. The low ebb of building construction during the past few years has seriously affected this part of the industry.

Renewed activity is evidenced in the district south of St. Gerard, Quebec, where the Deschambault Quarry Corp. have re-opened the Plamondon quarry and erected a dressing shed at the railway at St. Gerard. They produce a light grey dimension stone for building.

Stone used in the National Memorial at Ottawa was quarried during the year from the Riviere-a-Pierre district northeast of Three Rivers, Quebec, and shipped to St. Samuel for dressing. In all, over 800 tons of granite (dressed was used and necessitated the quarrying of about 7,000 tons to obtain sufficient material free from blemishes, and of proper sizes. The largest block used weighed over 40 tons dressed.

Prospecting for granite deposits suitable for both building and ornamental use has been active in the province of Manitoba.

Granite for monumental use is produced in the Maritime Provinces as well as in Quebec, Ontario, Manitoba, and British Columbia, and finds a small but steadily increasing market. An appreciable amount of foreign stone, principally black, is still being imported for this use, and a quarry of similar material in Canada of equal grade, should find a ready market for its product. One company producing black granite near Lake St. John, Quebec, has recently greatly extended its operations and added to its plant by the erection of gang saws and other equipment. Its product has been employed in a number of public buildings and as monumental dies in the province. Other deposits of 'black granite' exist in the Maritime Provinces, Quebec, Ontario, and Manitoba, that give promise of yielding stone of good quality.

Large areas in Canada are underlain by granite, and the prospects of finding stone suitable for the several uses are good.

Granite is employed for building purposes mainly in the larger buildings such as public and semi-public structures and institutions.

The Canadian production of granite in 1938 was 491,375 tons, valued at $1,126,419 as against 1,135,099 tons valued at $1,827,433 in 1937.

Our exports were 657 tons, valued at $5,042 (granite and marble unwrought), as against 1,234 tons valued at $11,408 in the previous year.

Imports of granite were valued at $99,103 in 1938, compared with imports valued at $114,935 in 1937.

Small amounts of granite were imported during the year from the United States and Europe for monumental use, but in time the importation should be replaced by Canadian material. The demand for a certain class of stone for monumental use varies, and a variety enjoying a steady market for a number of years may be completely superseded. At present the so-called 'black granite' and the 'grey' seem to be in most demand for monuments.

In the building trade coloured granites are used to a greater extent than heretofore in the form of thin polished slabs for trim for buildings in which the main colour scheme calls for contrast.

Canadian granites are suitable for all the purposes for which granite is used, and with persistent advertising there is no reason why this industry should not have a flourishing future.

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OTTAWA, MARCH, 1939.

GRAPHITE IN 1938

For a number of years past, the entire Canadian graphite production has come from a single operator, the Black Donald Graphite Company, with mine and mill at Whitefish lake, 22 miles west of Calabogie, Renfrew county, Ontario. This now has a record of 30 years of sustained operation; the deposit has proved of exceptional size and richness, and although the graphite flakes are too small for crucible use, the products are well adapted for lubricants and foundry facings; in recent years, the highest grade has been successfully employed in pencil manufacture, being exported to the United States and there reduced to the requisite degree of fineness in a new type of impact pulverizer ("micronizer"), using high-pressure dry steam. All other graphite mines and mills in Ontario and Quebec have been inactive for many years and the plants mostly dismantled.

The situation in this country is essentially similar to that in the United States, where, despite the fact that large known reserves of graphite exist in a number of States, attempts to mine and process the graphite for domestic consumption have usually led to failure, and that country has for a number of years past relied almost entirely on foreign graphite to fill its requirements for flake and crystalline (plumbago) grades, obtained mainly from Madagascar and Ceylon, respectively. The economic considerations affecting graphite mining in the United States apply even more strongly to Canada, where climatic conditions impose added production difficulties, and where the hard, unweathered character of the ore renders milling and refining more costly. In addition, many makers of crucibles in the United States have developed a preference for Madagascar flake, claiming that it is superior to either the American or Canadian product.

The production of Canadian graphite in 1938 was valued at $41,590, compared with $125,343 in 1937: a decrease of 66 per cent: tonnage figures are not available. The drop was occasioned by slackened demand, the Black Donald operations being closed down during the latter half of the year.

Canadian graphite exports, including both natural and artificial, totalled 1,150 tons, valued at $54,366 in 1938, compared with 2,948 tons, valued at $133,262, in 1937.

Total imports, including ground, unground and manufactures of, but exclusive of crucibles, were valued at $87,888 as against $114,733 in 1937.

Recorded world graphite production of all grades, including flake, crystalline (plumbago), and amorphous, totalled nearly 140,000 long tons in 1937, the leading producers, in order of tonnage, being Chosen (Korea), Germany, Austria, Ceylon, Madagascar and Mexico.

There were no important changes during the year in the world graphite industry. The chief use for the flake and crystalline grades continues to be in the crucible and foundry trades, though in the first-named consumption has shown a big drop in recent years owing to lessened crucible demand. Improved technique in manufacture and changes in type of furnaces used make for longer life of pots; the addition of important amounts of refractory silicon carbide in crucible mixtures has been an important factor. Fine flake graphite also finds extensive employment in lubricants, as well as in paints and polishes, and to some extent in pencils, though much of the paint and pencil graphite used is of the amorphous variety. Much of the amorphous paint graphite used is relatively impure, consisting of natural graphite shale or slate that is ground for use without any beneficiation (difficult to accomplish) and containing only around 50-60 per cent of actual graphite. Large amounts of amorphous graphite are taken by the dry battery trade and by manufactures of dynamo brushes. According to the U. S. Bureau of Mines, the use of the cheaper amorphous graphites, obtained largely from Mexico and Chosen, has expanded greatly in various branches of industry and has tended progressively to reduce sales of the more expensive crystalline grades, which now represent only about 10 per cent of the total consumption. A recent estimate of the consumption of natural graphite in the United States, by industries, showed roughly 20 per cent going into crucibles, 40 per cent used for general foundry work, 15 per cent for pencils and crayons, 15 per cent in lubricants, and 10 per cent for paints, stove polish and miscellaneous minor uses.

Artificial graphite, made in the electric furnace by reduction of coal or petroleum coke, also finds important use in industry, notably in the form of graphitized electrodes; in dry batteries; and in special (colloidal graphite) lubricants, both of the oil and water type; for filming or plating metal surfaces, to prevent corrosion and abrasion; as well as in self-lubricating, oil-less bearings and in some branches of powder metallurgy.

The graphite market is highly competitive, and price quotations as given in trade journals can only be taken as an approximate index. This is due to the intensive competition existing between Madagascar and Ceylon producers of high-grade crucible and foundry grades, which have long been derived mainly from those two countries. Currency fluctuations complicate the situation, which is always readily disturbed by business recessions; in general, the 1938 situation showed little change from that of the preceding year. In the American trade, Ceylon lump sold at around 7 cents per pound, Ceylon chip at 5½ cents, and Ceylon dust at 3½ cents; Madagascar No. 1 flake ranged from 9½ to 17 cents, with No. 2 flake at 7 cents, and ground (dust) at 3 cents; crude amorphous was quoted at $12 to $23 per ton, according to grade, and ground at 3 cents per pound: all prices f.o.b. New York.

Graphite imports into the United States, under the general tariff, pay a duty of 10 per cent ad valorem on natural amorphous and artificial grades, and of 30 per cent on crystalline lump, chip and dust grades. By the new Trade Agreements of 1938, in effect from January 1st, 1939, these duties are reduced one-half, to 5 per cent and 15 per cent, respectively, on importations from Canada and the United Kingdom. The Canadian tariff provides as follows: graphite, not ground or otherwise manufactured, British, free; intermediate, 7½ per cent ad valorem; general (including United States, 10 per cent; on ground and manufactures of, including foundry facings but not crucibles, British, 15 per cent; intermediate, 22½ per cent; general, 25 per cent.

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GRAVELS AND SANDS IN 1938

Deposits of gravel and sand are numerous throughout eastern Canada, with the exception of Prince Edward Island, where gravels are scarce. On account of the wide-spread occurrence of gravels and sands and their bulk in relation to value, local needs for these materials are usually supplied from the nearest deposits, as their cost to the consumer is governed largely by the length of haul. Hence the large number of small pits and the comparative rarity of large plants. Some grades of sand particularly suitable for certain industries command a much higher price than the ordinary.

The total production of sand and gravel for 1938, amounted to 30,557,306 tons valued at $11,113,723, as compared with 27,001,300 tons valued at $10,492,696 for 1937. Following are the output and value by provinces for these two years:

	1937		1938	
	Tons	Value	Tons	Value
		$		$
Nova Scotia	2,992,429	1,457,266	2,120,378	1,021,290
Prince Edward Island..	-	-	-	-
New Brunswick	1,136,013	715,652	3,883,950	1,832,273
Quebec	9,476,000	2,637,495	11,710,281	3,180,199
Ontario	8,832,526	3,613,854	8,221,593	2,808,262
Manitoba	1,380,957	551,464	1,411,827	558,642
Saskatchewan	822,447	470,343	767,284	454,122
Alberta	711,966	312,687	803,907	524,240
British Columbia	1,648,963	733,935	1,638,086	734,695

Road improvement, concrete works and railway ballast absorb by far the most gravel and sand used. Gravel in particular has proved a good material for building all-weather roads at low cost, its use having steadily increased along with the growth of motor traffic. In Ontario, half the gravel and sand consumed in 1937 was absorbed in road construction and maintenance, and the proportion for the other provinces is still higher.

Most of the gravel used for road work comes from pits worked for that purpose. Usually a portable or semi-portable plant is used to extract enough gravel to supply the immediate need and then a sufficient reserve is built up, in the form of stock piles, for a couple of years requirements. Road pits may remain idle for two years or more. The amount of gravel produced from year to year thus fluctuates, depending on the programme of road construction and improvement. Intermittent operation also applies to railway pits, which may remain idle for several years.

Part of the gravel used is crushed, screened and in some cases even washed, the proportion thus processed increasing steadily. Some Provincial Highway Departments have used crushed instead of pit-run gravel on their main highways for a number of years. Most of the large commercial plants are equipped for producing crushed gravel, a product that can compete with crushed stone.

The amount of sand consumed follows the trend of building activity, as most of it is used in the building industry for concrete work, cement and lime mortar, or wall plaster. The sand must be clean, that is, exempt from dust, loam, organic matter or clay, and hold but little silt, and is usually obtainable from local deposits.

Other important uses of sand are for moulding in foundries, filtering of water supply and glass making, which require special grades of sand.

Prices of sand, gravel and crushed stone in the four largest cities in Canada were as follows, at the end of 1937 and 1938. Prices are per ton and do not include cost of delivery, except for Winnipeg.

	Montreal		Toronto		Winnipeg		Vancouver	
	1937	1938	1937	1938	1937	1938	1937	1938
Sand	$1.25	1.25	1.00	1.00	1.50	1.35	1.40	1.40
Screened gravel 3/8 inch	-	-	1.85	1.85	1.50	-	1.40	1.40
Screened gravel ¾ inch	-	-	1.75	1.75	1.50	1.50	1.40	1.40
Pit run gravel	-	-	1.50	1.50	1.50	1.05	1.40	1.40
Crushed stone 3/8 inch & under	1.10	1.00	1.85	1.85	2.50	2.25	2.00	2.00
Crushed stone ¾ inch & over	1.15	.75 @.85	1.75	1.75	2.50	2.25	2.00	2.00
Screenings (under 3/16 inch)	1.00	.40	1.50	1.50	2.50	2.25		

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GRINDSTONES, PULPSTONES, AND SCYTHESTONES IN 1938

Grindstones. Although no actual quarrying was carried out by the Read Stone Company, Sackville, New Brunswick, stones were made up from material quarried in previous years. Some of these grindstones came from near Stonehaven on the Bay of Chaleur, New Brunswick, and a few from Quarry Island, Pictou county, Nova Scotia. The Stanley Rule and Level Company, New Britain, Conn., U.S.A. operated the Mic Mac quarry at Woodburn in Merigomish Harbour, N.S. and shipped about 80 grindstones. The output during the past few years has been gradually decreasing. The total grindstone sales amounted to 292 tons valued at $13,368 as against 293 tons valued at $14,507 in 1937.

Pulpstones. For the first time since 1916, there has been no production of pulpstones. In recent years the only output has been maintained by J. A. & C. H. McDonald Company, Vancouver, British Columbia, from the sandstone beds on the northwest end of Gabriola Island, near Nanaimo, Vancouver Island, British Columbia.

Scythestones. These stones are now manufactured in Montreal by the Read Stone Company from material quarried at Stonehaven, New Brunswick and Wallace, Nova Scotia. Sales amounted to 21 tons, valued at $3,408, against 74 tons valued at $4,147 in 1937.

The production of all grades of stone in 1938 was 311 tons valued at $16,198; in the previous year the production was 412 tons valued at $21,429.

The exports of these stones in 1938 were valued at $5,441 as against a valuation of $135 in the previous year. The imports, which consisted chiefly of pulpstones, were valued at $118,623, as against $185,358 in the previous year. Most of these come from the United States and some from England.

The large-size Canadian grindstones are mainly used for sharpening pulp-mill and tobacco knives, and in the United States are used in the file, machine-knife, granite tool, and shear manufacturing industries. The small stones are used for scythe and axe grinding. Substantial competition from the artificial grinding wheel and to some extent from foreign natural stones are causes of the dwindling of this business.

Good pulpstones are in demand, particularly for use in the large magazine grinders, but as known Canadian deposits containing thick beds of the proper quality sandstone appear to have been worked out, production for the present has ceased.

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GYPSUM IN 1938

The materials produced are the hydrous calcium sulphate, commonly known as gypsum, the partly dehydrated material known as plaster of Paris or wall plaster, and the anhydrous calcium sulphate known as anhydrite. Gypsum is marketed in the crude lump form, ground as "land plaster" and "terra alba", or ground and calcined, as plaster of Paris or wall plaster. Each year an increasing proportion of the calcined material enters into the manufacture of wall-board, gypsum blocks, insulating material, acoustic plaster, etc. Anhydrite is used mainly as a fertilizer for the peanut crop in the Atlantic seaboard states of the southern United States.

Nova Scotia is the largest producer of gypsum in Canada followed by Ontario, New Brunswick, Manitoba and British Columbia.

In Nova Scotia, the National Gypsum Company of Buffalo, N.Y., throughout the year made shipments from its Cheticamp and Dingwall properties to London, England and also to the United States; at the Cheticamp property they changed from the regular bench operation of drilling and blasting to the use of 6-inch well drill-holes. These are drilled from the top to the bottom of the quarry, an average of about 115 feet in depth; the largest single blast of the season consisted of twenty holes and about 9,000 lbs. of explosive; prima cord fuse, the first used in Canada, was tried in this blast and proved very successful. Operations at the Dingwall property increased during the year; dumping the gypsum directly from trucks on to a storage pile at the point for water shipment was tried; a ramp was built of the gypsum and the pile gradually increased in height; the usual tunnel and belt for loading boats was located beneath the stock pile which was open to the weather; in the spring it will be seen whether the usual building to house the pile is necessary. A new loading pier and equipment was begun as well as the construction of a paved highway from the loading pier to the quarry; a 2½ yard diesel shovel is being added to the quarry; the Department of Public Works was dredging the channel so that large boats can be loaded.

The Victoria Gypsum Company, from its plant at Little Narrows, Cape Breton, Nova Scotia, more than doubled the shipments, two-thirds of their production being marketed in England and practically all the rest going to the United States; the largest cargo loaded was 6,200 tons of gypsum; a coarse was surveyed last winter to mark a channel of at least 28 feet of water from the pier to the sea.

The St.Andrews (N.S.) Gypsum Company, Limited, incorporated under Nova Scotia charter in 1937, was unable to complete the plans for the erection of a plant at Boulardarie, N.S., but hope to be active during 1939.

The deposits in the vicinity of Windsor, Hants county, Nova Scotia, were actively worked throughout the year, the bulk of the material being shipped crude to the United States.

The plant of the Canadian Gypsum Company at Hillsborough, New Brunswick, was active throughout the year shipping crude gypsum to the United States and producing all grades of plaster and wall boards for the eastern Canadian market.

Extensive deposits of gypsum are known in northern Ontario; the Moose River Gypsum Company, Limited, Cochrane, Ontario, has been incorporated to exploit some of them.

In southern Ontario the gypsum industry was active in the district south of Hamilton, supplying all grades of plaster and plaster products to the Ontario and Quebec markets.

The markets in the prairie provinces were quiet but steady, the demands being supplied by the already existing plants.

Much diamond drilling was done by the Gypsum, Lime and Alabastine, Canada, Limited, at its deposit at Falkland, B.C., and a new opening was made at a lower level and to the east of the aerial tram-head; gypsum will be hand-sorted and transported in trucks to the railway.

Two car-loads of gypsite were produced from the Rogers and Little property at Knutsford, about 3 miles south of Kamloops, B.C., and sold for use in agriculture.

Deposits in northern Alberta, although distant from markets and railway, are of good grade. Several deposits are known in British Columbia, in addition to those already being worked.

A large tonnage of by-product gypsum results from the production of phosphate fertilizers at the plant of the Consolidated Mining and Smelting Company, Limited, at Tadanac, B.C., and work is in progress to find an outlet for this material.

The production of gypsum in 1938 was 1,019,188 tons valued at $1,517,070 as against 1,047,187 tons valued at $1,540,483 in 1937.

Canada is a major tonnage producer in the world trade of gypsum, being fifth on the list in 1937, the last year for which figures are available. It stands second in the British Empire being exceeded only by the United Kingdom. Its production amounts to about 8 per cent of the world production, and about 38 per cent of the production of the British Empire.

The imports of gypsum were 1,752 tons valued at $39,278 as compared with 1,769 tons valued at $40,642 in 1937.

The exports of gypsum were 811,567 tons valued at $966,748 compared with 842,425 tons valued at $990,263 in 1937.

The use of anhydrite in England for the manufacture of sulphuric acid, ammonium sulphate, and special plasters is rapidly increasing, and the shipment of 2,500 tons of anhydrite during 1937 marked the entry of Canada into this market. Canada is fortunate in having extensive deposits favourably situated for commercial exploitation, the material from which has been proved by tests carried out by the Department of Mines and Resources to be of excellent grade. Previous to 1937 the small production of anhydrite in Canada was exported, principally as a fertilizer for the peanut crop, but it may well be than an industry will be started in this country in which our anhydrite may be used for the manufacture of special plasters, similar to the material now being marketed in England.

The upward trend in the building industry, an industry that usually lags from six months to a year behind any general improvement of business conditions, has not developed as fast as might be expected from the general business improvement in Canada. The gypsum industry, which is entirely dependent on the building industry, has therefore not shown so rapid a rate of increase as some of the other industries, nevertheless the improvement since 1933 has been quite marked and although the total production is down slightly in 1938 over the total for the previous year there were signs of a distinct improvement during the last two months of the year over the corresponding months of 1937 which gives promise of an increase production in 1939.

The use of gypsum products in the building trades has made rapid progress in past years because of their lightness, durability, fire-resisting, insulating and acoustic properties; and tiles, wall-boards, blocks, and special insulating and acoustic plasters have been developed. As the larger proportion of the crude gypsum quarried in Canada is shipped to the United States for the manufacture of gypsum products, industrial conditions in that country have an important bearing on the industry.

Crude gypsum is a low-priced commodity, and its selling price f.o.b. quarry is dependent largely on the quantity produced and the production facilities available. For export, contracts are generally made with a producer for the year's requirements of the purchaser and these contracts are generally made early in each year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

IRON OXIDES (MINERAL PIGMENTS) IN 1938

Ochreous iron oxide, sold uncalcined and used chiefly in the purification of illuminating gas, constitutes the major production of the minerals classed under this title. The calcined form of ochreous iron oxide is produced for use in the manufacture of paints; a smaller quantity of natural iron oxides associated with clay-like materials in the form of umbers and siennas is produced in both the raw and calcined state, for use as pigments in paint manufacture.

Most of the production for many years has come from Red Mill and Pointe du Lac, in the vicinity of Three Rivers, Quebec. Other deposits in Quebec from which production was recorded in 1938 are near Lacoste, Marchand Township, Labelle County; Almaville and St. Adelphe, Champlain County. A calcining plant erected near Lacoste in 1937 came into production in 1938, but a small tonnage only of calcined products was shipped for experimental purposes.

Other deposits worked in the past in Quebec are near Ste. Anne de Beaupre, Montmorency county; at Les Forges, near Three Rivers; in Lynch Township, Labelle County; and at St. Raymond, in Portneuf County.

A new source of iron oxide that will shortly add to the Quebec production will be the by-product iron oxide produced in the sulphur plant being erected at the Aldermac mine for the production of elemental sulphur from iron pyrites.

A small production of iron oxide from British Columbia has been reported since 1923 and is used chiefly for gas purification.

The iron oxide industry is comparatively small, and the quantity produced varies but little from year to year. The present producing localities have met the requirements of the domestic pigment trade for the cheaper grades for many years. Other deposits could be worked in Quebec and Ontario, if the demand warranted their development. In Nova Scotia, beds of ochre and umber have been worked in the past to a small extent. In Alberta and Saskatchewan several deposits of ochre are known, some having commercial possibilities, but, owing to their present inaccessibility and to the limited market, have had little development, and large deposits near Grand Rapids and Cedar Lake in northern Manitoba remain undeveloped for similar reasons.

The records of Canadian production of ochres include in a single item all grades of material from the low priced raw material to the high priced calcined products; sales of ochreous iron oxide in Canada in 1938 totalled 5,322 tons valued at $70,019, as compared with 6,197 tons valued at $83,640 in the previous year. The production during the past ten years has averaged practically 6,000 tons per year.

Our exports of mineral pigments were 1,685 tons valued at $104,814 in 1938, as against 1,755 tons valued at $105,240 in 1937.

Imports of all kinds of ochres, siennas, and umbers totalled 1,167 tons and were valued at $37,631 in 1938; as compared with 1,623 tons valued at $56,084. In addition there were imported prepared oxides, fillers, and related products, some of which were probably not ochres, valued at $718,329, as against a valuation of $844,149 in 1937.

The demand within the country for these products is fair. Most of the higher grade oxides, ochres, and umbers used in the paint trade are imported from Europe, and some of the cheaper grades of European oxides even compete with the domestic products, as they do not require calcining to produce the desired colour.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

LIME IN 1938

Lime is manufactured in every province except Prince Edward Island, though the Saskatchewan production is intermittent and very small. Fifty-two plants were in operation during 1938. Both high-calcium and dolomitic limes are produced in Nova Scotia, New Brunswick, Ontario, and Manitoba, but only high-calcium lime is made in Quebec, Alberta, and British Columbia. Ontario is the leading lime-producing province and supplies over one-half of the total output, and Quebec comes next with slightly more than one-quarter of the total production.

During 1938 natural gas was made available in the Beachville, Ontario, area and both of the large plants producing chemical lime at Beachville are now using it for fuel instead of coal.

A large new market for white, high-calcium lime has been opened up by the use of calcium carbonate filler in place of imported clay in newsprint and magazine paper. Its manufacture in Canada was begun in 1937. At present the paper companies using it purchase the quicklime and make the carbonate filler at their own plants. This filler also has other uses, and preparations to manufacture it in 1939 to supply these other uses have been made by a newly incorporated company.

Aged lime putty and lime mortar for use in building construction are now available in a number of Canadian cities. Lime mortar is coming back into favour as a binder in masonry, and sales of lime for construction may be expected to increase.

There are many prospective lime-producing localities in Canada owing to the abundance of suitable limestone throughout the country, and considerable interest has been taken recently in deposits of high-calcium limestone in northern Ontario because of their proximity to mines and pulp mills.

Lime production in 1938 amounted to 418,031 tons of quicklime valued at $2,945,057, and 71,053 tons of hydrated lime valued at $591,378 as compared with the 1937 production of 466,538 tons of quicklime valued at $3,252,383 and 82,815 tons of hydrated lime valued at $572,534.

Very little trade in lime exists between Canada and other countries because lime is made in practically all countries. Exports of lime in 1938 amounted to 6,381 tons valued at $51,346 as compared with 10,373 tons valued at $85,489 exported in the previous year. The great proportion of these exports go to the United States but small shipments are made to Peru, Newfoundland, Columbia, and the British West Indies.

Imports, which are all from the United States, amounted in 1938 to 6,940 tons valued at $37,255 as compared with 5,661 tons valued at $41,417 in 1937, according to data supplied from the United States Bureau of Foreign and Domestic Commerce.

Lime is marketed in the form of quicklime and in the hydrated state, the latter being a specially prepared slaked lime in the form of fine powder and marketed in 50-pound, multi-wall paper bags. Quicklime, which comprises about 80 per cent of the total sales, is marketed in the lump, pebble, crushed, and pulverized forms; lump lime and pebble lime are sold either in bulk or packed in barrels; crushed lime (1-inch and under) and pulverized lime (ground to minus 20 mesh, and in some plants to minus 50 mesh) are sold in airtight, multi-wall paper bags. In these various forms lime finds a multitude of uses in chemical and metallurgical processes and in construction, agriculture, and other industries. Lime is one of the great basic raw materials for the chemical industry, and of the current production about 85 per cent is used in chemical processes, thus the old conception of lime as being primarily a structural material is no longer true.

Prices of the various lime products vary over a wide range depending on the geographical location of the plants and on differences in quality of the lime. There were no significant changes in prices of lime during 1938.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

LIMESTONE (GENERAL) IN 1938.

Limestone, on account of the great variety and importance of its industrial uses the most useful of all rocks, is quarried in all provinces of Canada except Prince Edward Island and Saskatchewan, by far the greater part of the production coming from Ontario and Quebec. The 1938 production of limestone for all purposes, including the manufacture of lime and cement, constituted well over 90 per cent of the total production of Canadian stone.

Limestone is available in great bedded formations and in massive, highly metamorphosed deposits -- the former being much more common and yielding most of the production. At present almost all Canadian limestone is won by open pit methods, but in recent years underground mining of the rock has been adopted by several companies producing limestone for chemical and metallurgical uses and for making lime. Underground mining will undoubtedly become more common in the future, particularly for the production of high-grade stone for chemical uses.

Of significance in connection with future production of pure limestone is the progress being made in beneficiation whereby siliceous material is in part removed from limestone by flotation. This method of purifying limestone is now in use at several Portland cement plants in various parts of the world.

The 1938 production of limestone for general use, exclusive of that used for building stone, lime, and cement is estimated at 4,499,072 tons valued at $3,667,878, compared with a production of 5,512,865 tons valued at $4,326,649 in 1937. The production for all purposes in 1938 is estimated at 7,000,000 tons as against 8,000,000 tons in the previous year. The decrease is due largely to the lesser amount of highway surfacing and railway ballasting done in 1938, as well as to a general decline in industrial activity.

Limestone is widely distributed and is quarried on a large scale in all industrial countries. Rarely is there any considerable international trade in it, but, because foreign limestone can be obtained more cheaply at certain large consuming centres in Canada than the domestic, considerable quantities are imported from the United States and Newfoundland for use as blast furnace flux, and from the United States alone for road metal and for use in some pulp mills in Ontario near the International Boundary. Comparatively small tonnages are exported to the United States for use in agriculture and in sugar refineries. No separate record is maintained of the trade in limestone.

For domestic use limestone is marketed in a variety of forms ranging from huge squared blocks of dimension stone used in construction, to extremely fine dust used chiefly as a mineral filler. Some few of the products are processed but little if at all from the condition in which they are obtained after blasting, as for example limestone used in the wood pulp industry, but the bulk of the output is crushed and screened for use as road metal, concrete aggregate, railroad ballast, and as flux in metallurgical plants. Large quantities are used in the manufacture of Portland cement, lime, rock wool and various chemical products. It is of interest to note that in 1938 Canadian rock wool made from argillaceous dolomite was exported to England, Switzerland, Sweden, Holland and the Argentine.

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New uses for limestone are continually being developed. The dolomitic variety when crushed or when calcined has long been used as a refractory material for fettling the bottoms of basic open-hearth furnaces, but its applications as a refractory have been limited because of the readiness with which it air-slakes and also because of its chemical activity. Recently, however, a method has been found of combining dolomite (and also calcium limestone) with silica in the presence of a stabilizing agent to give a refractory product that contains no active lime or silica, does not disintegrate, and is comparable in refractoriness with materials that are several times as expensive. Dolomite is assuming a position of importance in Europe as a raw material for making metallic magnesium. Canada possesses ample deposits of high-grade dolomite and developments are being watched with interest in this country. A present use for limestone, capable of enormous development is in agriculture. Though the necessity of applying limestone or lime to agricultural land in order to maintain or increase soil fertility has been emphasized for years by authorities on agriculture, the quantity so used in Canada is still very small, whereas if the proper quantity were applied it would constitute one of the principal outlets for limestone.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

LIMESTONE (STRUCTURAL) IN 1938

Limestone in blocks of large dimensions for building is quarried in the provinces of Quebec, Ontario, and Manitoba. In Quebec there are three quarries at St. Marc des Carrieres, Portneuf county, producing grey limestone, and several in and near Montreal producing limestone of similar colour. In Ontario a large quarry near Queenston in the Niagara peninsula yields silver-grey limestone as well as small quantities of buff and of variegated buff and grey; and at Longford Mills, near Orillia, buff, silver-grey, and brown limestone for use both as marble and building stone is quarried. The Manitoba quarries, three in number, are near Tyndall and yield mottled grey, mottled buff, and mottled variegated limestone. Besides these large quarries, the products of which have a wide shipping range, small quarries producing building stone for local use are worked near Quebec City, Montreal, and Hull in the province of Quebec; and at Ottawa, Kingston, Erin, and Wiarton in Ontario. Rubble is their chief product.

Some of the quarry companies market stone in all stages of manufacture from the mill block to elaborately carved material; others sell stone only in the mill block. Waste material is utilized for crushed stone, rubble, riprap, flagging, chemical and metallurgical purposes, and for lime manufacture. The tonnage and value of waste products are not included in the production data given below.

During 1938 no noteworthy new developments occurred in connection with the production of limestone for building but there was a substantial increase in the production as compared with 1937 when 30,134 tons valued at $354,620 was marketed. Data on production for 1938 are not yet complete but it is estimated that the increase will be at least 20 per cent. The increased production was largely from quarries in Ontario and Quebec. The value of production given refers only to stone marketed in mill blocks or in the finished condition by the quarry companies, and does not include the value of the work done on the stone by cut-stone contractors.

Very little trade in building stone exists between Canada and other countries. Exports of building limestone are very small and are not separately recorded, but exports of all kinds of building stone except granite and marble had a value of only $16,383 in 1938. Imports of all varieties of building stone excepting marble and granite, during 1938, were valued at $34,754 as compared with imports valued at $43,272 in 1937. This imported stone is mostly limestone.

Prices of limestone in the mill block f.o.b. quarry have remained almost stationary in recent years, and range from 50 cents to $1 per cubic foot, depending on the size of block and grade of stone.

The limestone deposits now being worked for building stone are favourably situated with respect to centres of population and the supply of stone is adequate for present and future demands.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

LITHIUM MINERALS IN 1938

The principal commercial lithium ores are amblygonite, a fluophosphate of lithium and aluminium; spodumene, a silicate of these two elements; and lepidolite, or lithia mica, also a silicate. The lithia content of these minerals, as mined, commonly ranges from around 8 to 9 per cent for amblygonite, 4 to 7 per cent for spodumene, and 3 to 5 per cent for lepidolite. The minerals triphylite and lithiophilite, respectively phosphates of lithium with either iron or manganese and carrying theoretical contents of lithia as high as 8 to 9 per cent, are also classed as lithium ores; they are rarely found in commercial quantities however, and, in addition, may often have lost a large proportion of their original lithia by natural leaching.

All the above minerals occur in Canada, but there has as yet been only a small production, mainly of lepidolite and spodumene. The important deposits are all in Manitoba, chiefly in the Pointe du Bois region, in the southeastern part of the province, where a number of lithium-bearing pegmatites have been found.

The first discoveries were made in 1925, and intermittent mining and development has been undertaken, mostly on the Silver Leaf property (the original discovery), on the south side of Winnipeg river, and on the Buck claims at Bernic lake, between Winnipeg and Bird rivers. From the Silver Leaf mine, a couple of trial cars of lepidolite and spodumene were shipped between 1925 and 1928.

At Bernic lake, a number of outcrops of lithium minerals were found in 1930 during prospecting for tin, and about 100 tons of spodumene and 50 tons of amblygonite were mined and stock-piled. The Lithium Corporation of Canada, 403 Avenue Building, Winnipeg, which controls the deposits, diamond-drilled the property during 1936, to determine the thickness of a number of pegmatite dykes having the character of comparatively thin, flat-dipping sills carrying local zones rich in amblygonite, spodumene and lithiophilite. In the winter of 1936-37 on the Buck claim the company raised 600 tons of rock yielding 50 tons of clean, cobbed amblygonite and 30 tons of mixed rock containing about 50 per cent amblygonite, as well as small amounts of spodumene and triphylite. A shipment of 32 tons of amblygonite, averaging 7.9 per cent Li_2O, was made to the Maywood Chemical Company, Maywood, N.J., in 1937, and slightly less was hauled out to rail at Pointe du Bois before the spring break-up. Lithium Corporation has acquired control of lithium deposits at Cat Lake, north of the Bird river, where important amounts of spodumene occur.

In 1937, a discovery of spodumene was reported near Falcon lake, 85 miles east of Winnipeg, and 1½ miles from a siding of the Greater Winnipeg Water District Railway. The deposit is stated to carry rich concentrations of spodumene close to both highway and railroad. The claims are controlled by R.T.Pickard, of Winnipeg, who proposes to employ a process of calcination of the crude ore with calcium carbonate, followed by digestion with sulphuric acid, yielding lithium carbonate, by-product potash-alum, and finely-divided silica, all commercial products.

Some interest has been shown in deposits of spodumene on the Kobar claims, at Wekusko Lake, near Mile 81 on the Hudson's Bay railway, in northern Manitoba.

In Wakefield township, Hull county, Quebec, lepidolite occurs in small amount in the form of large platey crystals in a small pegmatite body: no commercial value is thought to attach to this deposit. In 1937, samples of pegmatite sent to the Bureau of Mines from Lacorne township, Abitibi county proved to contain sonsiderable spodumene; the deposit is stated to lie about 10 miles from Barraute station on the Canadian National railway.

No production of lithium minerals was reported in 1938, while in 1937 the production was valued at $1,694.

Figures of world production of lithium minerals, exports, and trade, are not published. Most of the supply is from deposits in the United States, South West Africa, Germany and France. The United States is believed to contain by far the largest reserves; up to the end of 1935, the total American production of lithium minerals (spodumene, lepidolite and amblygonite) since the industry began in 1898 is estimated at around 70,000 tons, valued at $1,300,000. The Black Hills district, in South Dakota, has been the chief source of lithium minerals, with a total of about 22,000 tons of spodumene and 4,000 tons of amblygonite. Lepidolite has been obtained mainly from California and New Mexico, each with a total of around 25,000 tons and 20,000 tons, respectively. Total production of lithium minerals in the United States in 1937 was 1,357 tons, valued at $36,206. Extensive deposits of low-grade spodumene have recently been discovered in North Carolina, and are regarded as one of the world's largest potential sources of supply of lithium; other large occurrences of similar ore are reported in the Tinton district, in the northern section of the Black Hills, South Dakota. Both of these occurrences are currently attracting attention since it has been found from experiments conducted in the laboratories of the U.S. Bureau of Mines that the spodumene can be readily recovered by a relatively simple and cheap process of calcination: on heating, the spodumene decrepitates to a fine powder which can be screened from the admixed impurities; this method has been tried in the laboratories of the Department of Mines and Resources at Ottawa on samples of Manitoba spodumene, with good results. One test made on a shipment from the Kobar claims, Wekusko Lake, yielded a concentrate with 6.13 per cent Li_2O content, recovery being 90.44 per cent. Commercial-scale trials have been under way in North Carolina, and if successful, may lead to a substantial increase in the production of the mineral owing to the current interest in it as a ceramic raw material. Production of amblygonite in South West Africa has been increasing, the output being given as 764 tons in 1938. Portugal was formerly an important source, but output has declined severely since 1933, when 870 tons was shipped. The German production consists of the mineral Zinnwaldite, a variety of lithium mica, obtained from the tin-bearing greisen rock of the Erzgebirge.

The small shipments of Canadian lithium minerals have comprised mainly lepidolite and amblygonite and were exported to the United States, the former for glass use and the latter for the manufacture of lithium chemicals. There were no recorded exports in 1938. There are no imports of such minerals. Trade reports do not show Canadian importations of lithium compounds separately.

The principal outlet for lithium minerals has been for the production of lithium chemicals and metal, lepidolite being used also as a constituent of the batch in certain types of glass (Pyrex). The treatment of lithium ores is in the hands of a few important concerns, with plants in England, France, Germany, and the United States. The lithium chemicals trade is comparatively small and the world consumption of lithium salts is steady. Lithium chloride is being tried as a drying agent in air-conditioning, it being one of the most hygroscopic inorganic compounds known. A method was recently devised by the U.S. Bureau of Mines for recovering the lithium of spodumene in the form of the chloride by volatilization from a charge of the mineral with calcium chloride and limestone. A recent development is the perfection of a process for making lithium fluoride in the form of single crystals having valuable optical properties.

The mineral spodumene, which may be classed as a lithium feldspar, being relatively high in alumina (27 per cent), compared with potash feldspar, is a possible substitute for the latter mineral in glass-making. It may also find extended application in the pottery industry, both for bodies and glazes. The thermal expansion of natural spodumene has hitherto prevented its use in ceramics, but by the above-mentioned decrepitation process for recovering clean spodumene from mixed ore, the mineral is converted to the beta form, which undergoes no further expansion when fired. Use of this process, which recovers the spodumene as a fine powder requiring no grinding, is expected to make available the large tonnages of low-grade mineral recently discovered in North Carolina, both for ceramic use and for the lithium chemicals trade by the chloride-volatilization method. Cost of producing the concentrate is estimated at $10 to $12 per ton. It is reported that amblygonite, also, is currently attracting attention for glass manufacture.

In August, 1938, recovery of lithia from the brine of Searle's Lake in California, in the form of lithium-sodium phosphate, containing 20 per cent and upwards of Li_2O was commenced: probable output is stated to be on a scale of around 300 tons per year. The entire production is stated to be taken at present by the Maywood Chemical Company, Maywood, N.J., the sole concern in the United States engaged in the treatment of lithium minerals.

Some lepidolites, including that from the Silver Leaf deposit in Manitoba, contain important amounts of the rare elements rubidium and caesium, and methods of recovering these from lepidolite already treated for removal of its lithium content have recently been investigated.

Potential world reserves of lithium minerals, particularly spodumene and lepidolite, are unquestionably very large and widely distributed, and production could be increased enormously if demand warranted it. At the present time, however, world requirements appear to be satisfied with a few thousand tons per year. The price of amblygonite, the most preferred mineral for the manufacture of lithium chemicals owing to its relatively high Li_2O content held between $35 and $40 per ton, f.o.b. American mines in 1938, about the same level as in 1937. Lepidolite sold at $20 to $25; and spodumene, 6 per cent grade, at $5 per unit Li_2O, or $30 per ton. Metallic lithium, 98-99 per cent, was quoted at $15 per pound.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

MAGNESITE IN 1938

No magnesite, within the strict meaning of the term, is produced in Canada at the present time, but deposits of magnesitic dolomite consisting of an intimate mixture of magnesite and dolomite are quarried at Kilmar and Harrington East, in Argenteuil county, Quebec, and are processed for use as refractory materials. For many uses these magnesitic dolomite products have proved more suitable than those made from magnesite, and the deposits are well situated to supply markets for refractory material in eastern Canada. Products at present marketed include caustic-calcined magnesitic dolomite, dead-burned or grain material, bricks and shapes (both burned and unburned), finely ground refractory cements, and, in combination with chrome, the dead-burned material is used as an ingredient in certain other types of refractories. Magnesia products made in Canada from imported magnesite and magnesia include fused magnesia (artificial periclase), optical periclase, and "85 per cent magnesia" pipe covering.

Deposits of brucite-bearing limestone recently discovered in Ontario and Quebec were further investigated and a process of separating the brucite from the limestone was developed that gives hydrated lime as a by-product. Preliminary experiments indicate that the pure brucite recovered from these deposits will yield exceptionally high-grade refractory products and also possesses advantages over other materials for the making of metallic magnesium, The deposits are an important addition to the known Canadian resources of magnesium minerals and plans are being made to work one of the deposits in the coming year.

Further progress was made by Canadian Refractories, Limited, in developing refractory products made from magnesitic dolomite.

Large deposits of magnesite containing much silica and alumina occur in British Columbia near Marysville, between Cranbrook and Kimberley. These deposits have been acquired by Consolidated Mining and Smelting Company of Canada Limited and some development and experimental work has been done but there has been no commercial production to date. A number of other deposits of magnesite are known in British Columbia and Yukon but either because of their limited extent or remoteness from transportation they are not of commercial importance at the present time.

Deposits of earthy hydromagnesite occur in British Columbia near Atlin and Clinton, and at various times certain of them have been worked on a small scale but there has been no production of this material in recent years.

Calcined and clinkered magnesitic dolomite valued at $420,261 was marketed in 1938. Prior to 1938 the production data as published by the Dominion Bureau of Statistics included the value of manufactured products such as refractory bricks and similar materials, but present data show only the value of the calcined material sold plus the cost value of the calcined magnesitic dolomite used for further manufacture by the producing company, thus no direct comparison can be made between the present production and that of 1937 which was valued at $677,207.

Magnesite is available in many countries but the principal exporting countries are Greece, Manchukuo, India, Yugoslavia, and Germany. The German exports originate in the former countries of Austria and Czechoslovakia. Russia is probably the world's greatest producer of magnesite, but almost all is for domestic use. Holland though possessing no deposits of magnesite acts as an important distributing centre for Europe and for exports to the United States and Canada. For export the magnesite is generally shipped in either the calcined or the dead-burned states. Canada exports refractory products made from magnesitic dolomite to Australia, British South Africa, the United States and to Great Britain.

Exports of magnesitic dolomite products in 1938 are recorded at 3,971 tons valued at $95,607 as compared with 2,028 tons valued at $49,401 in the previous year.

Imports of magnesite products including brick, caustic and dead-burned magnesite, ground calcined magnesite, and magnesia pipe covering were valued at $659,778 in 1938 as compared with products having a value of $787,884 in 1937.

The principal uses of magnesite are for the making of refractory products to withstand extremely high temperatures, of oxychloride cement, and of magnesium metal. It is the basis of a number of magnesium salts and has many minor uses. The world-wide demand for magnesium metal has greatly stimulated interest in magnesite deposits. Although until three years ago almost all the world's magnesium was made from magnesium chloride brine and from waste water used in treating potash minerals, magnesite is now an important source of this light metal.

Competing with magnesite as sources of magnesia products are dolomite, brucite, and sea-water. Dolomite, in addition to its newly discovered possibilities for the making of refractories, has long been the principal source of basic magnesium carbonate, pure magnesium oxide, and magnesium carbonate, and processes have been worked out for the production of magnesium metal from it. Brucite is being quarried in the United States for the manufacture of refractories. The extraction of magnesia from sea-water has now reached the commercial stage in California and England, the material so obtained being now marketed in various forms for industrial and pharmaceutical uses, and in refractory products.

There are no published quotations on Canadian magnesite or on its primary products, calcined and dead-burned magnesite, because very little is so marketed, but according to Oil, Paint & Drug Reporter prices of magnesite products f.o.b. New York were as follows in March, 1939:- Calcined, domestic, in bags, $56 to $60 per ton; calcined, imported, in barrels, $60 to $65. Prices f.o.b. United States plants as reported by Engineering and Mining Journal Metal and Mineral Markets for March 30, 1939 are as follows:- Per ton f.o.b. California, dead-burned $25. Artificial periclase 94 per cent MgO, $65; 90 per cent, $35. Caustic, 95 per cent MgO, white colour, $40; 85 per cent MgO, no colour standard, $37.50. Washington: Dead burned grain magnesite, $22.

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MICA IN 1938

The production of sheet mica in Canada has always been almost wholly of the phlogopite ("amber mica") variety. It is derived practically entirely from adjacent parts of Ontario and Quebec, within an area extending roughly from Kingston, on Lake Ontario, north-eastward into Hull and Papineau counties, Que. The mica-bearing series (pyroxenites) is probably continuous throughout this entire region, but is hidden for some distance south of the Ottawa river by a belt of later, sedimentary rocks. In Quebec, the pyroxenites extend for some distance both west and east of the main productive area, into Pontiac and Argenteuil counties, respectively, but production from these districts has been comparatively small. A few scattered amber mica occurrences are known in the Province as far east as Quebec city, but very little mining has been conducted on them.

Production of muscovite, or white mica, in Canada has been negligible. Small amounts have been recovered occasionally as a by-product from feldspar mining, but, in general, the proportion of sound, merchantable sheet mica in Canadian pegmatites has proved too low for profitable mining for this mineral alone.

Mica mining in Canada has been at a low ebb for a number of years past, production being restricted for the most part to a few major operators working old, established mines. This has been in marked contrast to the situation in the earlier days of the industry, when large contributions were made to the total output by farmers and others who worked small mines on their properties during the off-season. Small operations were reported during 1938 on a few scattered properties in both Quebec and Ontario, but mostly of a short-lived, prospecting character and resulted in only a small aggregate production. A little white mica (muscovite) was sold during 1937-38 by small operators in the Saguenay region, lower St. Lawrence, as well as in Parry Sound district and near Mazinaw lake in Abinger township, Addington county; in the last case, the material was recovered from old waste dumps. Some of the Saguenay mica was an excellent grade of ruby muscovite. A small amount of sheet black mica (biotite or lepidomelane), was produced in Faraday township, near Bancroft, Ont., from deposits opened some years ago as a source of grinding scrap for a mill (now inactive) at Bancroft: this mica occurs in very large crystals and considerable quantities are available, but being of poor splitting quality and having a high iron content it would presumably be a poor electrical insulator.

Reference has been made in recent reviews (1935 to 1937) to an unusual kind of deposit of fine flake muscovite, or sericite, at Baker Inlet, near Prince Rupert, B. C., the material of which on account of its extremely friable nature and ease of grinding, should prove eminently suitable for the production of mica powder. The deposit is controlled by P. M. Ray, 23 Besner Block, Prince Rupert, who commenced to ship material from it several years ago and reports further development during 1938. About 200 tons of crude material has been mined to date and shipped to Vancouver for grinding and use in roofing. Production in 1938 was about 50 tons. The ground product is stated to have sold for $32.50 per ton f.o.b. Vancouver. Small trial shipments have also been made to the United States. On account of the friability and small particle size of the crude material, it breaks down to a fine powder with little destruction of the natural flakes; these are relatively thicker and heavier than those produced by grinding sheet mica, and use of this mica in roofing manufacture is stated to cut dust loss of powder materially. A report on tests made in the Ore Dressing Laboratories of the Bureau upon a shipment of crude mica from this occurrence has been published (Report No. 748, Investigation No. 606).

The mica-grinding plant at the Blackburn mine, in Templeton township, Que., continued to produce various grades (mesh-sizes) of ground amber mica from mine and shop scrap, but sales were reported off slightly from 1937: the product goes chiefly to the domestic roofing and rubber trades. Small amounts of scrap muscovite, imported from India, are ground for local roofing use in a plant in Vancouver. Scrap mica, as well as a small proportion of small-sized sheet, continues to be recovered from the waste dumps of old mines, and is exported to American grinding plants. Although many of such old dumps have been worked over, much mine and shop waste still remains on certain properties: the market for scrap, however, has been dull in recent years and the price currently offered ($9 per ton f.o.b. rail) is not very attractive to prospective shippers.

The following figures show the production of the five leading mica products in 1937 and 1938:

	1937		1938	
	Pounds	Value $	Pounds	Value $
Knife-trimmed	203,961	66,852	83,043	46,177
Thumb-trimmed	173,519	11,826	1,380	731
Splittings	72,500	32,495	51,444	22,254
Rough-cobbed	106,917	12,090	-	-
Scrap	1,333,479	10,468	619,165	6,251
Total	1,890,376	133,731	755,032	75,413

The figures show marked decreases both in quantities and values for all grades of mica produced.

By the new Trade Agreement of 1938, effective January 1st, 1939, the United States tariff on Canadian phlogopite underwent some revision. The duty on untrimmed small sheet (yielding rectangular pieces not over 2 x 1 ins.) was reduced from 15 per cent to 10 per cent ad valorem, and that on waste and scrap valued at not over 5 cents per pound was dropped from 25 per cent to 15 per cent. The duty on ground mica was reduced at the same time from 20 per cent to 15 per cent. Under the British Preferential tariff, imports of mica and manufactures of into Canada are dutiable at 15 per cent ad valorem; under both the Intermediate and General tariffs, at 25 per cent.

Total recorded world production of mica of all classes and grades in 1937 was nearly 42,000 long tons, but this figure included (definitely known) almost 25,000 tons of low-priced grinding scrap, and the remainder comprised both sheet mica in various styles of trimming and splittings. Total sheet mica production was, therefore, about 17,000 tons. The great bulk of this was muscovite, as only Canada and Madagascar, with together 844 tons, are sources of phlogopite. Canada's share of the world production if very small is important, because for certain uses, e.g., for heater plate, amber mica is preferred, if not, indeed, indispensable.

Exports of mica of all classes in 1938 were valued at $89,259 as compared with $171,770 in 1937. Imports, which consist mainly of splittings, were valued at $86,803 as against $83,596 in 1937.

Sheet mica is marketed in various classes, depending on the amount of preparation the mine-run material receives. Much of the Canadian output was sold formerly in the semi-rough form, termed "thumb-trimmed," but the trade now calls largely for a knife-trimmed, a much higher grade of product. Price is governed largely by dimensions of sheet, and rises rapidly for the larger sizes. Quality, which is gauged by colour, softness, ability to split readily, as well as by freedom from cracks, creases, pin-holes and inclusions of foreign mineral substance, is also highly important. Good di-electric strength is a prime consideration, but most amber mica, except perhaps the very dark, high-iron varieties, possesses this in the required degree. For heater use, the mica must be able to withstand temperature up to red heat without puffing or swelling, and phlogopite is inclined to be variable in this respect, particularly when it has undergone some degree of natural alteration (hydration), as sometimes is the case. Of all industrial minerals, mica, in the sheet form, through the various stages of its mining, preparation for market, grading, etc., involves the greatest expenditure of labour and time per unit of quantity production, and it is by far the most costly of all such commodities. From its extraction from the earth to preparation in the form of trimmed or split sheets, each piece entails an individual hand operation. Mechanical preparation has made little progress; the great bulk of the production is still handled by primitive hand-and-knife methods. The making of splittings by hand, particularly, is a slow and costly operation (an expert worker can split only about one pound per hour, at a labour cost of around 15 cents): consequently, comparatively little mica is made into splittings on the American continent, most of this class of product coming from India, Madagascar, and other countries having an abundant supply of cheap labour.

The use of sheet mica is almost entirely for electrical insulation. It is cut or punched into an enormous variety of shapes and sizes, and in the form of splittings is bonded and pressed into large sheets that can be sawn, bored and machined into any desired article. Some clear mica (mostly muscovite) finds employment as stove windows, and in lighting equipment. Mica is used in making heavy-duty spark plugs for aeroplanes, though a new ceramic product ("corundite") of equal efficiency is said to be replacing it. Of possible vital importance to the mica trade is the recent discovery that films or plates having many of the desirable properties of mica, including comparable di-electric strength, can be made from colloidal dispersions of bentonite clay. Commercial development of the product ("Alsifilm") is now being planned and a "synthetic mica" in sheets or rolls of any desired size and thickness may become possible by a process similar to that followed in the making of paper and at a very low cost.

Mica is a comparatively insignificant mineral from the point of view of tonnage production. Sheet mica is, however, a vital key mineral in industry, particularly in all forms of electrical equipment, in which no substitute for it has ever, up to the present, been found. Although the muscovite variety fills by far the largest share of the world demand, amber mica is essential for certain purposes, more especially where high heat-resistance is demanded. Although already drawn on extensively, Canadian reserves of amber mica are held still adequate to furnish important supplies and any material price advance would probably result in a revival of mining and increased production. Canada shares the world market for amber mica with Madagascar, the two countries constituting the principal known sources of this variety. The depression in the Canadian industry in recent years has been largely attributable to the competition of more cheaply produced Madagascar mica, this being especially pronounced in the case of splittings. The better grades of Canadian amber mica are, however, considered superior in point of heat-resistance to much of the Madagascar product, and the improvement in trimming practice has resulted in a revived interest by the British trade in Canadian supplies of sheet mica for heaters, as well as for use in spark-plugs.

Fine flake or powdered mica has become an important industrial product, particularly in the United States, where a number of plants are engaged in its manufacture both by wet and dry systems of grinding. Most of the production goes to the roofing and rubber trade. New uses for the material include its combination with resin varnishes as a coating for foodstuff cans, and as a base in cleanser compounds. Increased interest is also being shown in its possibilities as a protective inert pigment in paints, to which it is claimed to impart superior resistance to weathering and corrosion by fumes and liquids: the paint industry is foreseen as a large potential market for mica powder. Recent enquiries directed to the Bureau of Mines also indicate some interest in powdered mica as a fertilizer, presumably on account of its potash content, which runs around 8-10 per cent: mica being extremely resistant to ordinary weathering influences, however, it is not clear how the potash might be expected to be released and made available for plant use. Large amounts of wet-ground muscovite mica are consumed in wall-paper manufacture and some is also used in the ceramic type of insulating material termed "Mycalex": up to the present, most, if not all, of the supply of this product has been furnished by a single company in the United States, but in 1937 a plant for its manufacture was ~~reported to have been~~ established in England. A method of separating flake mica from crushed rock or sand by means of the frictional electricity induced in the flakes during their passage down inclined glass plates has recently been announced by the U. S. Bureau of Mines.

The demand for phlogopite mica, which had shown an encouraging upward trend in 1937, remained rather dull throughout the year, except for knife-trimmed larger sizes (2 x 4 ins., 3 x 5 ins., and upward). Japan was reported actively in the market for splittings, but, on the whole, dealers reported business as slack and spasmodic and trimming-shops were mostly only in part-time operation. The larger producers operate their own mica shops, but there are, in addition, various dealers who purchase rough-trimmed or mine-run mica from small operators and trim, grade and split it for sale either to other dealers and brokers or to consumers. There is also a considerable amount of farming out of this work, particularly splitting, in smaller rural communities, the labour being performed mostly by girls working at home on a piece-work basis.

Mica prices are difficult to ascertain, owing to the lack of reliable market quotations and to the system of trade discounts obtaining. Quality, also, has such a bearing on value that the only satisfactory method of getting information is to submit samples to an accredited dealer for a quotation. The mica market is subject to pronounced periodic fluctuations in demand owing to prevailing trade conditions, as well as to the practice by consumers of laying in stocks considerably ahead of current requirements. According to dealers' reports, general price averages in 1938 remained substantially unchanged from those of the previous year, quotations being approximately as under:

Knife-trimmed Sheet	Per Pound	Splittings	Per Pound
1 x 3 inches	.50	1 x 1 inches	.45
2 x 3 "	.75	1 x 2 "	.50
2 x 4 "	$1.00		
3 x 5 "	1.75		
4 x 8 "	2.25		
5 x 8 "	3.00		

Ground mica (phlogopite) continued to sell as follows, according to fineness: 20 mesh, $25 per ton; 60 mesh, $30; 120 mesh, $45; all prices f.o.b. Ottawa, in ton lots.

Vermiculite. Four plants now exist in Canada for the expanding by heat-processing of the hydrated variety of mica known as vermiculite. This mineral expands tremendously when heated, yielding an exceedingly light-weight product of wide application for heat- and sound-insulation, as well as, to some extent, for decorative purposes. Three of the plants, owned by Gypsum, Lime and Alabastine, Canada, Limited, are situated at Calgary, Alta., Winnipeg, Man., and Paris, Ont.; the fourth was built in 1937 by the W. E. Phillips Company at Oshawa, Ont., the expanded product being marketed by Dominion Insulation Limited, 57 Bloor Street West, Toronto. All these plants draw their supply of crude vermiculite from a deposit at Libby, Montana.

Vermiculite has been essentially an American mineral, the Montana deposits being the first to be commercially exploited, about 15 years ago. Since then, others have been found in Colorado, Wyoming, and North Carolina, in all of which States some development has taken place. In 1938, further extensive deposits were reported in the Gallatin Mountains, in northern Montana. Outside of the United States, vermiculite is known to occur in the Transvaal and Tanganyika, in Africa, and also in the U. S. S. R. (Russia). Some exploitation of the Russian deposits has recently taken place, and development of the Transvaal occurrences is being planned. The mineral is not known to occur in Canada, though there have been unconfirmed reports of discoveries in the Albreda district, British Columbia. Vermiculite is far from being a common mineral, and its occurrence seems to be restricted to areas of pyroxenite, carrying originally mica of phlogopite type, that have been invaded by later acid intrusions, resulting in serpentinization of the pyroxenite and alteration (hydration) of the phlogopite to vermiculite. It would not be unreasonable to expect that vermiculite might be found in some of the similarly intruded mica-bearing pyroxenites of Ontario and Quebec, but it does not seem ever to have been recorded there.

American sales of vermiculite have been expanding rapidly, reaching nearly 25,000 tons in 1937, as compared with 17,000 tons in 1936. Value of the 1937 production was $235,000. Montana remained the chief source, but there was a substantial increase in output from Colorado, which State probably ranks second in point of reserves of the mineral. Crude, cleaned and screened Montana vermiculite sold at $11 to $15 per ton f.o.b. mines, in 1937, while North Carolina material was quoted at $6: yield of first-quality expanded product is stated to be considerably lower from the latter than from Montana vermiculite. Grade of material, as gauged by its exfoliating properties, has been found to be distinctly variable from different sources, with resultant differences in the specific gravity, coherence and strength, and accordingly in the insulating efficiency of the expanded product. Size of crude flakes also plays a part, preference being for plates about one half inch in diameter, as these yield a product of optimum loose-fill packing quality. There was some development in 1938 in the utilization of formerly discarded smaller sizes, which are now being employed in fire-resisting plastics and in special refractories, such as those used in the combustion chamber of oil-burning equipment. Expanded material in 1937 sold for $55 to $65 per ton, equivalent to about 75 cents per bag of 25 pounds and containing 4 cubic feet. In loose-fill house insulation, vermiculite is proving a strong competitor to rock-wool. Substantial amounts are now exported for this purpose to Europe, and an expanding plant to process crude Montana vermiculite has been established in England.

Illustrating the decorative properties of the material, it may be noted that nearly 150 tons of vermiculite were used to impart a bright golden finish to the exterior stucco of the 1939 San Francisco World's Fair buildings.

Under the new Canadian-United States Trade Agreement of 1938, crude vermiculite imports from the latter country are made subject to a duty of 10 per cent ad valorem.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

MOULDING SAND (NATURAL BONDED)

Every province except New Brunswick and Prince Edward Island produces natural bonded moulding sand. A small production came formerly from New Brunswick; one deposit being operated in 1918 and another in 1921 and 1922. A small production also came from Prince Edward Island of a grade suitable only for light weight castings. By far the greatest part of the production has always taken place in Ontario in the Niagara peninsula from Niagara to and around Hamilton. Occasionally new deposits have been opened up, most of these being in Ontario and the western provinces.

A general investigation regarding such sands in Canada was recently made and the results of this were published in 1936 by the Mines Branch (now Bureau of Mines), Ottawa, as report No. 767, "Natural Bonded Moulding Sands of Canada"; this report draws attention to the large number of deposits from which supplies have been obtained for local foundries and the probability of replacing imported material with Canadian sands.

The Canadian production in 1937 was 100,668 tons, valued at $44,551 (the 1938 figures are not yet available), The production of late years has fallen off to a considerable extent.

It is estimated that 50 to 60 per cent of our consumption of natural bonded moulding sand is imported, mostly from the United States. Moulding sands as well as other sands and gravels enter Canada duty free.

Small quantities of moulding sands not tabulated in official records are produced in nearly all the provinces by foundrymen for their own use from nearby deposits; or by small part time operators such as farmers for local foundries.

Silica sands without clay bond, which are used in steel foundries, are not included in the above production figures.

The industry gives only seasonal occupation to producers, as foundrymen usually obtain their supplies in the summer and autumn.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

MAGNESIUM SULPHATE IN 1938

Natural hydrous magnesium sulphate (Epsom Salts) occurs in deposits in lake bottoms and 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 considerable production from several of the lakes in British Columbia, and experimental shipments were made from one of the lakes in Saskatchewan.

The largest producer has been the deposit at Basque, B. C., the material from which was at the start refined at a plant in Vancouver, but later a small plant was erected at the deposit. Epsom Refineries, Limited, obtained control of this deposit and in 1933 erected at Ashcroft, B. C., 15 miles from the deposit, a refining plant capable at first of producing 5 tons of refined salt per day, but later remodelled and now having a capacity of 10 tons. The plant is now owned and operated by the Ashcroft Epsom Salts Company of Ashcroft, B. C.

The material produced is of high grade, four samples, representative of the different crystal sizes in 1935 were analyzed and all ran over 99.5 per cent $MgSO_4.7H_2O$.

The production in 1938 was 470 tons valued at $9,400 as against 727 tons valued at $14,456 in 1937.

The imports in 1938 were 1,803 tons valued at $33,018 as against 1,678 tons valued at $33,116 in the previous year.

Magnesium sulphate is marketed in two grades namely, technical and B. P. (practically chemically pure). The technical grade, which should be over 90 per cent, finds a market principally in the tanning of leather. It is used to a smaller extent in the textile, paper and enamelling industries, in fireproofing compounds and in the manufacture of paints and soaps. The B. P. product is used mostly in the drug trade. Although a large part of the Canadian production is sold for technical use, its purity satisfies the pharmaceutical specifications.

Prices for epsom salts remained steady throughout the year. Quotations for the technical grade as given by Canadian Chemistry and Process Industries for Toronto or Montreal delivery ranged from $35.00 to $40.00 per ton in bags, while the B. P. material in barrels was quoted at from 2½ to 3 cents per pound.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

MARBLE IN 1938

Marble quarries are operated in the provinces of Quebec, Ontario, Manitoba, and British Columbia for the production of squared blocks for sawing into slabs and for making monuments, and for the production of broken marble for making terazzo, stucco dash, whiting substitute, marble flour, artificial stone, and building rubble. Part of the production of some quarries is marketed for chemical use.

In Quebec, four varieties of clouded grey marble, some tinted and lined with green, and black marble, are quarried at Phillipsburg by Missisquoi Stone & Marble Company, Limited. Trenton limestone quarried for building stone at St. Marc des Carrieres, takes a good polish and yields a brown marble, and some is so used. Dolomitic marble is quarried and crushed by White Grit Company at Portage du Fort, Pontiac county, and by Canada Marble & Lime Company at L'Annonciation, Labelle county, for the making of terazzo chips, stucco dash, poultry grit, artificial stone, and for chemical uses. A small quantity of dark red marble is quarried, chiefly for use as tombstones, at Cap St. Martin near Montreal.

In Ontario, black marble is quarried at St. Albert, near Ottawa, by Silvertone Black Marble Quarries, Limited. At Longford Mills, near Orillia, Longford Quarries Limited is producing buff, brown, and silver grey marbles; the stone from this quarry is also used for building and for sculpture. At Bancroft, Hastings county, a number of handsomely coloured marbles are available, the most striking of which, known as Bancroft Laurentian, is a clouded-grey breccia with a rich chocolate-coloured bond. White marble is quarried at Marmora by Bonter Marble & Calcium Company, Limited, and at Haliburton by Bolender Brothers for terrazzo chips, poultry grit, stucco dash, and artificial stone. Bonter Marble & Calcium Company also produce white marble in block form. Buff, red, white, green, and black marbles are quarried near Eldorado, Hastings county, by Karl Stocklosar, Madoc, for use as terrazzo.

In Manitoba, a number of highly-coloured marbles are available but there is only a very small production for use as terrazzo chips and as building rubble.

In Alberta, deposits of calcareous tufa near Calgary have been quarried for terrazzo chips.

In British Columbia are many deposits of marble but there is only a small production. White marble is quarried near Victoria and on Texada island for the production of terrazzo, poultry grit, marble sand, and whiting substitute.

Progress is being made in finding new ways of utilizing marble. Thin slabs of semi-translucent, light coloured marble have been used in large windows of buildings such as railway stations to give a soft diffused light free from the glare of direct sunlight. In England, plastic rubber, in place of cement, has been used in the laying of jointless marble terazzo floors to give a non-slippery, noiseless floor that is easily cleaned. Attention is being paid to methods of treating polished marble surfaces in order that the polish may be retained when the marble is exposed to the action of the weather, and processes involving the use of lacquers and synthetic varnishes have recently been patented. White marble sand is being produced for use in white cement mortar and for use with white cement in making permanent traffic markings on roads and streets. A promising field for the utilization of marble in lighting and decoration has been opened up by the Vermont Marble Company's method of treating specially selected marble to bring out the translucence and beauty of veining when either white or coloured lights are placed behind it. This company is also marketing an artificially coloured black marble.

Many deposits of beautifully coloured marbles, particularly in Ontario, Quebec, and British Columbia, have never been fully investigated, chiefly because the present demand in Canada for marble of any one colour other than for a staple variety such as white, is comparatively small. The demand for marble of a certain colour also changes from time to time; at present there is little call for red and blue, but buff and black marbles are in vogue.

The production of marble during 1938 amounted to 18,896 tons valued at $85,194 compared with the production of 21,642 tons valued at $88,595 in 1937.

Exports of marble are recorded with exports of granite and the exports of the two during 1938 amounted to 657 tons valued at $5,042, as compared with exports of 1,234 tons valued at $11,408 in 1937. Imports of marble during 1938 had a value of $81,416 against a value of $89,263 in 1937. Current imports of marble are largely in the form of unpolished slabs and in the form of sawn stock for tombstones - the finishing being done in the marble mills throughout Canada. Most of the imports of marble blocks are from the United States, France, Italy, Belgium, and Great Britain, though practically all of that coming from Great Britain originates in other European countries. Within recent years imports of black marble have practically ceased as the Canadian market is now being supplied from domestic quarries, principally from the recently opened black marble quarry at St. Albert.

The Canadian market calls for interior decorative marble almost entirely, and very little is used for the exteriors of buildings. A considerable quantity is, however, used for tombstones. In recent years there has been an increasing demand for marble in the form of terrazzo for flooring, instead of slabs or tiles and many inquiries have reached the Bureau of Mines as to where marbles of various colours could be obtained.

Prices of marble depend on the quality and rareness of colouring but they are governed largely by the prices of well known foreign marbles, many of which enjoy a world-wide market. The market for Canadian marbles is almost wholly domestic and production therefore depends on the volume of building in the Dominion.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

NEPHELINE SYENITE IN 1938

Nepheline syenite is a comparatively new mineral commodity, its production and use on the American continent having commenced in 1936, when a quarry and processing plant for its production were opened near Lakefield, Peterborough county, Ontario. Previously some interest had been shown in the industrial possibilities of a similar material occurring in Russia, where it is recovered as a by-product of phosphate (apatite) mining: the Russian syenite, however, is reported to contain too high a percentage of finely-divided iron, that cannot be removed by ordinary beneficiation methods, to permit of its use in white glass. The Canadian rock, although containing variable amounts of iron-bearing minerals, principally magnetite and biotite mica, can be readily cleaned of these impurities by a relatively cheap and simple process of magnetic separation of the crushed material, yielding a white product well below the tolerance in iron demanded by the glass trade.

The Canadian nepheline syenite development was started by Canadian Nepheline Ltd., which opened a quarry in 1936 at the west end of Blue Mountain, in Methuen township, shipping the rock to a small mill at Lakefield, 27 miles distant, for processing. This operation met with immediate and conspicuous success and has run steadily ever since. Designed originally to supply material to the domestic glass trade, operations were greatly expanded in 1937-38 by the formation of a subsidiary, American Nepheline Corporation, which has erected a large crushing and processing plant at Rochester, N. Y., to which crude, quarry-run rock is now shipped from the Methuen deposit and prepared for the American trade: full capacity of this plant is designed eventually for about 200 tons of feed per 24 hours. Capacity of the Lakefield mill originally was 20 tons of finished product per day, but this was stepped up in 1937 by the addition of a second magnetic separator and crushing equipment to 45 tons. The product made in both plants is a granular, minus 20-mesh material, consisting of a mixture of soda and potash feldspar and nepheline, that averages about 24 per cent of alumina and containing only 0.07 per cent of Fe_2O_3.

In 1937, further production of nepheline syenite was undertaken near Gooderham, Haliburton county, and also in Dungannon township, Hastings county, near Bancroft. At Gooderham, Messrs. Gooderham-Nepheline has opened a large quarry, and up to the end of 1938 had shipped a total of nearly 4,000 tons of crude rock: the production has gone mainly to the grinding plant of the Oxford Mining and Milling Company, West Paris, Maine, and some to Tennessee Mineral Products, Ltd., Spruce Pine, North Carolina, both units of the United Feldspar Corporation. In Dungannon township, two quarries have been operated by the New England Nepheline Company, an affiliate of the Golding-Keene Company, of Keene, New Hampshire, which up to the end of 1938 had shipped a total of about 6,500 tons of rock to its Keene mill. Both these concerns have magnetic separation equipment for cleaning the rock of contained impurities. In contrast to the rock of the Methuen occurrence, and of most of the other deposits in the region, which is a medium-grained and uniform-textured syenite, that of the Gooderham deposit and of the Hennessey quarry, in Dungannon, is coarsely pegmatitic, consisting largely of straight nepheline: it is used, after processing, for blending with feldspar to raise the alumina content. Much prospecting of other nepheline outcrops in Dungannon township was conducted during the year by various interests, but no developments resulted. A subsidiary of Messrs. M. J. O'Brien, of Ottawa, which holds ground at the east end of the Blue Mountain syenite body in Methuen township, 24 miles north of Havelock, proceeded with plans for opening a quarry and erecting a mill, and road improvement and construction was carried out: the project, which is expected to materialize in 1939, calls for a plant with a capacity of 10 tons of feed per hour, the output being designed both for domestic sale and export.

The potential nepheline syenite reserves of the central Ontario region are undoubtedly very large, the Blue Mountain occurrence alone being a massive body about 8 miles long and consisting in large part of such rock. Numerous smaller outcrops are known in the Bancroft and adjacent areas to the north. All indications point to the ~~possibility~~ probability of production being increased and maintained.

Official figures of nepheline syenite production for 1938 are not available, but the output of quarry rock is estimated at about 40,000 tons, of which Canadian Nepheline Ltd. produced about three-quarters; the value for the year was returned at $142,737 as compared with $121,481 in 1937 and $37,426 in 1936. The increase in value in 1938 was not so outstanding as in the preceding year (225 per cent), but this is due to the fact that most of the material produced was shipped in the crude state to American mills, whereas previously a large part had been processed in Canada. Since completion of the large Rochester, N. Y. plant of American Nepheline Corporation, output from the Lakefield mill of the parent company Canadian Nepheline Ltd., which formerly went largely to export, has been reduced to take care mainly of domestic sales.

Outside of Russia, whose production is not known, Canada is the only present known producer of nepheline syenite. Active search for similar material has been conducted in the United States, but although occurrences are known, the rock contains too much finely-divided and inseparable iron to be suitable for white glass manufacture. Rock of comparable high-alumina character, "Aplite", also high in iron but regarded as suitable for coloured bottle glass, occurs in Virginia, and production of this material is now under way. Anorthosite, a similar type of rock, occurs abundantly in Quebec and could probably be produced in quantity if demand for the material should arise.

Exports of nepheline syenite (practically all crude rock) totalled 22,787 tons, valued at $94,877 for the nine months April-December, 1938; the shipments all being consigned to grinding and processing mills in the United States, as noted above. Exports in the previous year and in the first three months of 1938 were included with feldspar. Nepheline syenite enters the United States under a special provision of the new Trade Agreement, effective January 1st, 1939, following representations made by American feldspar producers (notably those in North Carolina) to Washington that imports of the material were calculated to prejudice their business. Under this provision, crude rock has free entry and the tariff on ground material is cut in half from the previous figure of 30 per cent ad valorem to 15 per cent. It is specified, however, that these conditions shall only apply to a total aggregate quantity entered for consumption in any calendar year in any form, whether crude or ground, not exceeding 50,000 long tons, and that if this figure is exceeded, the rate of duty may be revised following consultation between the Governments of the two countries.

Up to the present, nepheline syenite has found practically its sole industrial use for the manufacture of glass, for which it is preferred to straight feldspar on account of its higher content of alumina (about 24 per cent as compared with 17-20 per cent in an average feldspar). One Canadian glass company now uses the material in all its plants, and four American companies are stated to have substituted it for feldspar. It is claimed that 1,500 pounds of syenite will replace 2,000 pounds of spar in the glass batch, on the basis of relative alumina content; and the slightly higher content of alkalies reduces fusion temperatures, with consequent fuel saving and longer tank life. Research is proceeding in the use of the material in other branches of ceramics, such as sanitary ware, porcelains and enamels, and these applications may considerably extend its present industrial field.

The price of finished material, f.o.b. Lakefield, was $10 per ton up to October, 1938, when it was advanced to $12. Material from the Rochester, N. Y. plant was quoted at $11 to $15.50 per ton, according to fineness.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

PHOSPHATE IN 1938

The only important recorded occurrences of phosphate rock in Canada are the Precambrian apatite deposits of the Ottawa-Kingston region, in Ontario and Quebec, and the rather low-grade sedimentary phosphate of the Crowsnest area just west of the boundary between southern Alberta and British Columbia. A belt of such sedimentary rock extends along the Rocky Mountains divide for a considerable distance north of the international boundary, being probably, in part at least, a northerly extension of the richer phosphatic beds of Montana and Idaho. Prospecting has picked up phosphate horizons at various points as far north as Jasper, Alberta, but nowhere have the deposits given promise of being rich or extensive enough to work.

The production of apatite has been almost negligible for many years, with the single exception of 1932, when there was a small revival of mining along the Lièvre River, in Quebec, with a reported output of 1,316 tons. The apatite occurs in mica-bearing pyroxenites, and most of the small output of the last twenty years has been by-product material won during mining for mica (phlogopite). The apatite is sold mostly to the Electric Reduction Company, at Buckingham, Que., for the production of phosphorus or phosphorus products. This company reported purchases of about 700 tons of apatite in 1936, mostly from the old High Rock phosphate mine on the Lièvre River, the remainder from mica mines in the Templeton-Gatineau district, Quebec. In 1937, purchases totalled only about 100 tons and in 1938, 200 tons, practically all accumulated stockpile material from the Blackburn mine in Templeton township, Que.: grade averaged 83 per cent, with a value of $8.90 per ton. Sales of apatite are usually based on 80 per cent tricalcic phosphate content, with a spread of around 10 cents per unit above or below this figure.

The Crowsnest sedimentary phosphate was discovered some ten years ago as the result of extensive prospecting by the Consolidated Mining and Smelting Company for phosphate rock to supply its [redacted] fertilizer plant at Trail, B.C. Mining was conducted at two localities in the Crowsnest-Michel area, and several experimental shipments totalling nearly 5,000 tons were made to Trail. The rock, however, is of rather low grade and did not prove amenable to concentration; the company, therefore, discontinued operations and at present draws its supplies mainly from Garrison, Montana. In 1938, the company reported shipments to Trail from its Montana mine by its subsidiary, Montana Phosphate Products Company as 71,478 tons. Eastern Canadian plants using phosphate rock for fertilizer and other purposes obtain their supplies mainly from Florida or Tennessee.

Reported production (sales) of phosphate (apatite) totalled 208 tons valued at $1,886 as against 100 tons valued at $900 in 1937.

The world production of phosphate is of enormous proportions, and in 1936, the last year for which fairly complete statistics are available, totalled nearly 11 million tons. The great bulk consists of sedimentary rock, but the Russian output of apatite amounts to around $1\frac{1}{2}$ million tons annually. The leading producer is the United States, with $4\frac{1}{4}$ million tons in 1937, of which over one million tons went to export, followed by U.S.S.R. with over 2 million tons, the French North African possessions of Tunis and Morocco, each with nearly $1\frac{1}{2}$ million tons, Egypt and Algeria, with over $\frac{1}{2}$ million tons apiece, and the Pacific islands of Nauru, Ocean and Christmas islands, with an aggregate total of around 1 million tons.

Imports of phosphate rock into Canada totalled 128,409 tons, valued at $455,697, as against 113,971 tons, valued at $453,599 in 1937; practically the entire amount came from the United States. Canada also imported 114,357 tons of superphosphate, valued at $1,092,859, compared with 100,726 tons valued at $952,775 in 1937. Phosphate rock enters Canada duty free. Superphosphate is free under the British preferential tariff, but under the intermediate tariff pays 7½ per cent ad valorem, and under the general tariff, 10 per cent. Under the new United States-Canada Trade Agreement of 1938, superphosphate imports from the United States are dutiable at 5 per cent, provided that no restrictions are placed by the latter country on exports of either crude phosphate rock or superphosphate.

The Quebec and Ontario apatite deposits were once of considerable importance and were actively mined as a source of fertilizer phosphate, but the industry became unprofitable upon the discovery of the immense sedimentary phosphate deposits of the southern United States around 1890. Total production to date is estimated at around 350,000 tons. By flotation, a relatively higher-grade phosphate could probably be produced from apatite than from sedimentary rock, but such a product would appear to have little superiority for fertilizer and other purposes and could hardly compete on a price basis owing to very much higher mining costs. It seems doubtful, therefore, that any revival of active mining for the mineral in Canada can be expected, though considerable reserves probably exist, particularly in the Templeton-Lièvre river area, in Quebec. Enormous tonnages of apatite are now being produced by concentration from low-grade ores of the Murmansk region, in Russia, this being the principal world source of the mineral; small amounts are also similarly recovered in Virginia.

Growing interest has been shown in recent years in improved methods of treatment of crude phosphate rock for the extraction of its phosphoric acid content and for the production of more concentrated acid and compounds. In the United States, much research both by government and private agencies has been devoted to the problems involved, as well as to the development of new fields of utilization of elemental phosphorus, and this work is expected to bring about a large expansion in the phosphorus chemicals industry. Higher-strength superphosphates are now being made by acidulation of rock with phosphoric acid in place of sulphuric acid and by improved removal of contaminating calcium sulphate from the product, with resultant large saving in shipping costs. Production of concentrated phosphoric acids, containing up to 84 per cent of phosphorus pentoxide, from phosphate rock by electric furnace or blast furnace volatilization, in place of acid treatment, is now established commercial practice; elemental phosphorus is produced and later oxidized to acid for the production of calcium metaphosphate and superphosphate. Investigation of methods of handling phosphorus have also shown that this dangerous product can, with proper care, be shipped in steel drums or tank cars without risk, thus permitting it to be distributed from production centres to other points for the manufacture of acid and other derivatives at a material saving in freight costs. Research has also been proceeding on methods of rendering raw phosphate available as plant food by volatilizing the combined fluorine from fused rock, it having been determined that it is the latter compound that inhibits solubility in the soil. Removal of contained fluorine is required from acid phosphate to be used in stock feeds and food products generally, and defluorination of fertilizer superphosphate is also desirable in order to prevent reversion to the citrate-insoluble form during curing and storage, particularly of processed fertilizers diluted with calcareous materials. At the fertilizer plant of Consolidated Mining and Smelting Company, Trail, B.C., the fluorine so removed is now recovered for use in the manufacture of hydrofluosilicic acid, used in the electrolytic refining of lead, thus dispensing with the employment of fluorspar as a source of fluorine.

Although fertilizers will always continue to consume the great bulk of the world's phosphate produced, a growing future for phosphorus and its compounds seems to be assured. One of such chemicals that is rapidly coming into extensive use is trisodium phosphate, employed as a detergent in landry work and as a general cleanser, as well as for preventing scale or scum in boiler-feed and washing waters, and in the tanning, photographic, sugar and other industries.

According to Minerals Yearbook, 1938, published by the U.S. Bureau of Mines, the phosphate industry in that country reached the peak of another trade cycle in 1937, with another record production but a considerable drop in exports and a large increase in producers' stocks. Production continued to come chiefly from Florida, followed by Tennessee, but there was a sharp rise in the output from the Western States (Montana and Idaho), which almost doubled that of the preceding year. There was a decrease in production in 1938, when shipments fell off 200,000 tons from the 1937 level. Non-fertilizer uses are showing a steady expansion and now total about half a million tons annually. Fears of a possible dangerous depletion of reserves in the Southern States, bringing rumours of an impending embargo, or at least a curtailment, of exports, caused the appointment of a committee of Congress to study the situation, but it was found that the Florida deposits were much greater than had been suspected, probably totalling 2½ billion tons, and bringing the total national reserves to around 8½ billion tons, or one-third of the world's known supply, a quantity deemed sufficient for domestic requirements for 1,600 years at current consumption rates. The deposits in the Western States (Idaho, Wyoming, Utah and Montana) are estimated to contain upwards of 6 billion tons, 5 billions of which lie in Idaho.

The price of Florida rock, 76-77 per cent grade, was $4.35 per long ton, f.o.b. mines, at the close of 1938, the laid-down cost at eastern Canadian points being around $8.50: these levels showed little or no change from those of 1937.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA,

PYRITES IN 1938

Pyrites is produced in Canada as a by-product in the treatment of copper-pyrites ores at the Eustis and Aldermac mines in Quebec, and at the Britannia mine in British Columbia. No lump pyrites has been produced in Canada for a number of years.

In Quebec, the Aldermac Copper Corporation Ltd., with a mine and concentrator 12 miles west of Noranda, is concentrating 1000 tons of massive sulphides daily, from which is produced copper concentrate and a high grade iron pyrites concentrate; the latter is being stockpiled.

In the fall of 1938 the Company started construction of a plant for the production of sulphur and iron oxide, using the Wescott Process, as developed in an experimental plant at Niagara Falls, N. Y. The building will be capable of housing the equipment for a daily production of 100 tons of sulphur. The first unit will have a capacity of 50 tons of sulphur and 75 tons of iron oxide daily, and will contain equipment for drying the pyrites and for drying and preheating air used to oxidize the iron, two rotary kilns and condensers for sulphur. The plant should be in operation in 1939, and when operating at 100 tons of sulphur, it would consume 250 tons of pyrites a day out of a daily production of 500 tons of concentrate.

The Eustis mine, near Sherbrooke, Quebec, continued producing flotation pyrites concentrate, which is shipped in part to the United States and in part to Three Rivers, Quebec, for use in the Freeman flash-roasting plant.

The Freeman flash-roasting plant in the mill of the St. Lawrence Paper Mills Company, Limited, at Three Rivers, Quebec, was in operation during most of the year. It supplies all the sulphur dioxide and much of the steam required for the operation of the ~~sulphite~~ plant, in which four standard newsprint machines are in operation.

In Ontario, Westario Sulphur Mines, Limited, diamond drilled a group of 26 claims 1½ miles south of Hudson, Kenora mining division. A special process is to be used, said to be able to produce pig iron as well as sulphur. The Matachewan Hub Pioneer Mines, Limited, with property in the Matachewan area, west of Elk Lake, discovered in 1937, was reported to have a fairly large deposit of pyrites assaying about 40 per cent sulphur, and 39 per cent iron. Operations in 1938 consisted entirely in testing, research and experimental work; one unit of an experimental pilot plant was in operation in Toronto on a new process of sulphur recovery.

In British Columbia, the Britannia mine, with a 6,500-ton concentrator, produces considerable quantities of pyrites, most of which had been going to Japan, but in 1938 some shipments were made to France. Fairly large quantities have been stored, awaiting more favourable market conditions.

The Ecstall pyrites property of the Northern Pyrites Limited, situated on the Ecstall river, sixty miles south of Prince Rupert, B. C., has been under development for two years. Considerable exploratory work by diamond drilling was done ~~several~~ many years ago, by the Granby Company, under option from the B. C. Pyrites Company. The ore bodies are reported to contain 5,000,000 tons of ore averaging 49 per cent of sulphur, 42 per cent of iron, 2.3 per cent of zinc, under one per cent of copper and gold and silver valued to about $1.00 per ton. If results of further development prove satisfactory and world markets are maintained, a large plant as well as railway to tidewater would be required.

Although the Freeman process of flash roasting, designed for by-product flotation fines from the treatment of copper ore, has opened a prospective market for this class of ore, it is not to be assumed that the mining of pyrites will be stimulated. Ample supplies of pyrites fines are already available at strategic points to care for any demand that may arise in the immediate future.

No separate records are available showing the quantity of pyrites produced in Canada. The estimated sulphur recovered from all sources (sulphur in pyrites, and sulphur recovered from smelter gases) was 112,395 tons valued at $1,081,647, as against 130,913 tons and valued at $1,154,992 in 1937.

The exports of pyrites (sulphur content) in 1938 were 22,109 tons, valued at $147,189, as compared with 46,317 tons valued at $251,834 in 1937.

Canada exports a considerable amount of pyrites to the United States; a few thousand tons were also exported to France, but the exports to Japan ceased in the summer of 1938.

There are no recorded imports of pyrites. The imports of sulphur and of sulphuric acid are given in the chapter on sulphur.

In Canada, there does not appear to be any standard price for sulphur in pyrites; most contracts are believed to be based on a price of 5 cents (or better) per unit of sulphur (22.4 pounds) per long ton, f.o.b. cars at point of production.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

SALT IN 1938

Common salt (sodium chloride) is obtained in two forms, in solution in a brine from which the salt is extracted by evaporation, and in lump or solid form by direct mining.

During the year 1938 salt was produced in southern Ontario; at Malagash, Nova Scotia; at Neepawa, Manitoba; and at McMurray, Alberta. Ontario salt is obtained from brine wells, as is also the salt produced in Manitoba and Alberta. The Malagash salt is recovered by mining rock salt and by evaporation from brine produced by leaching the waste material in the mine.

In Ontario production was steady throughout the year. All the well established plants were operating. Extensions were made to the buildings of the Canadian Industries Ltd. at Sandwich, Ont., for the salt and chemical divisions. The caustic soda-chlorine plant of the Canadian Industries Ltd., at Shawinigan Falls, Quebec, begun in 1937, was completed and placed in operation early in 1938, the salt used being shipped from Sandwich, Ontario.

In Nova Scotia, the Malagash Salt Company showed a small decrease in production from the record established in 1937. Extensive underground development was continued by drilling, crosscutting and drifting. Work in progress suggests the possibility of finding workable bodies of some of the more valuable salts.

At Neepawa, Manitoba, the salt plant of the Canadian Industries Ltd. was operated throughout the year, the salt being recovered from brine by the grainer system, the product from which is passed through a copper-lined centrifuge and bagged for shipment.

The Northern Salt Syndicate erected a small experimental open pan salt plant at some salt springs near the mouth of the Red Deer river where it runs into Lake Winnipegosis, Manitoba; the pan is 6' wide by 100' long and wood is used for fuel; the brine carries 5 per cent of total salts and the plant is to produce about 4 tons per day. Further drilling is contemplated and a new company, the Northern Salt Company, Limited, is being incorporated.

At McMurray, Alberta, Industrial Minerals, Limited, operated the three-pan salt plant throughout the year, adding appreciably to the salt production in western Canada; the controlling interest was taken over by the Dominion Tar and Chemical Company of Montreal; a temporary rotary drier was erected late in the fall and two new exploratory wells are to be drilled, one to be later conditioned for a second production well.

In New Brunswick, a salt basin was discovered in 1921, being the result of drilling in the vicinity of Goudreau, south of Moncton on the east side of the Petitcodiac river; the extent of the basin was further determined when the New Brunswick Gas and Oilfields, Limited, in drilling at Weldon, on the west side of the Petitcodiac river penetrated over 1,500 feet of salt formation, this being the second drill hole to strike salt on this side of the river; the top of the rock salt was 1,473 feet below the surface.

Near Amherst, Cumberland County, Nova Scotia, a well drilled a number of years ago by Imperial Oil, Limited, in a search for oil and gas, penetrated 3,200 feet of alternating beds of salt, anhydrite, dolomite, limestone and shale, the salt constituting 45 per cent of the whole. Salt was met at a depth of 920 feet, one bed over 480 feet thick containing over 90 per cent of sodium chloride. The apparent great thickness of the salt may be due to the dip of the beds.

The production of salt in 1938 was 468,717 tons, valued at $1,941,585 as against 458,957 tons valued at $1,799,465 in 1937.

The production during 1938 showed a 2 per cent increase in volume over the preceding year, and, taken over a period of years, the market for salt in Canada is steadily increasing and the industry is in a sound condition. The production for 1938 marks an all time record, exceeding the former high record for 1937.

The world production of salt is steadily increasing as its use in industries is extending and for the year 1936 for which the last complete figures are available, it amounted to well over 35,000,000 short tons. Canada in that year was standing 13th on the world list but was the third largest producer in the British Empire, being exceeded only by Great Britain and India. Canada's export market is very small and she produces only slightly over 1 per cent of the world production and about 7 per cent of that of the British Empire.

The exports of salt from Canada in 1938 were 11,844 tons valued at $68,293, as compared with 9,329 tons valued at $61,522 in 1937. The imports of salt were 108,133 tons valued at $453,765 as against 116,459 tons valued at $466,190 in 1937. The greater part of this salt comes in free of duty for use in the fisheries on the Atlantic and Pacific coasts.

The production, except for small exports, is sold in Canada, principally to the dairy, meat curing, canning, fisheries, highway and transport departments for soil stabilization, the chemical industries, and as table salt for household use.

Soil stabilization with salt and clay for the foundations of highways and for a surface veneer for gravel roads is now firmly established and the use of salt for this purpose is steadily increasing. An interesting development of soil stabilization is seen in its application for runway bases at the airports of the Trans-Canada Air Lines. Already salt-stabilized runway bases have been or are being installed at Edmonton, Calgary, Pagwa, Earlton, North Bay and elsewhere.

An increasing demand for salt for the chemical industries may reasonably be expected, as at present, with the exception of caustic soda, soda ash, sodium sulphate, sodium silicate and acid sodium sulphate, practically all of the sodium compounds used in Canada are imported.

According to the Canadian Chemistry and Process Industries (Toronto), prices for the several grades of salt remained steady, at a low ebb for the greater part of the year, but took a sharp rise in October with increases ranging from 4½ to 18 per cent according to grade. Quotations at the end of the year for specially purified (99.9% NaCl) salt in 280 lb. barrels f.o.b. plant was $2.65 per bbl., while industrial fine in bulk car lots f.o.b. plant, per ton, was $5.60, and industrial coarse per ton was $7.60.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

SILICA IN 1938

The materials produced in this industry are quartz for smelter flux and ferro-silicon; quartzite for ferro-silicon and silica brick; silica sand for the manufacture of glass, carborundum, sodium silicate, etc., also for sand blasting, roofing and for use in the steel foundries; silex, the finely pulverized silica used in ceramics and the paint industry.

Quartz, quartzite, and sandstone in sizes from ½" to 6" are used in the manufacture of ferro-silicon and pure silicon, and the first two as a smelter flux. For silica brick quartzite is crushed to about 8 mesh. Some quartz is also crushed to make silica sand.

Silica sand is generally prepared from a friable sandstone by crushing, washing, drying, and screening to recover different grades of material according to the industry for which it is required. For example, for the manufacture of glass the material should range between 20 and 100 mesh. Silica sand is also prepared from a friable quartz and from vein quartz.

Silex is the washed sand or pure quartz crushed and ground in some form of mill, then either air-or-water floated to recover the fine flour. The ceramic industry requires 150 mesh or finer, whereas the paint trade requires air-floated material 250 mesh or finer.

Quartz is produced in Quebec and Ontario; and quartzite is quarried in Nova Scotia, Quebec, Ontario, Manitoba and British Columbia. Silica sand is obtained from Nova Scotia, Quebec, and Manitoba, and silex is prepared in the province of Quebec.

Although the deposit of silica sand near River Denys, Inverness County, Nova Scotia, was not operated during the past year, it has a good quality of sand suitable for a number of uses, and its product should find a ready market in the Maritime Provinces, especially in the steel foundries.

The Ottawa Silica and Sandstone Company, Templeton, Quebec, produced sand of different grades for steel foundries, the glass industry, and for sand blasting, etc., although its production was slightly lower than in 1937.

The Canadian Kaolin Silica Products, Limited, from its property at Lac Remi, Quebec, made regular shipments of silica sand to the glass companies and others in the Montreal district, having re-built its concentration mill to a capacity of 500 tons per day. Although the bulk of the output is consigned to glass manufacturers, an important part consists of sand-blasting materials and other abrasives.

The Canada China Clay Company at Lac Remi, Amherst township, Papineau county, Quebec, has sunk a shaft to a depth of over 300 feet and carried out extensive development on the 250 foot level. Two large mill buildings have been erected, one for clay preparation and the other for housing equipment for the production of silica sand, and the installation of machinery is now in progress with a view to starting production in 1939. China clay and high-grade silica sand will be produced.

H.C.F. Sands, Limited, New Liskeard, Ontario, formerly Flint Sands Limited, with property at Guigues, Temiscamingue county, Quebec, did not operate in 1938.

The Canadian Flint and Spar Company operating a crushing plant at Buckingham, Quebec, produced a small tonnage of high grade quartz, which was used as an abrasive.

The Canadian Carborundum Company at St. Canute, Quebec, produced silica sand almost entirely for the manufacture of carborundum at its plant at Shawinigan Falls, Quebec.

The St.Lawrence Alloys,Limited,produced ferro-silicon of several grades as well as metallic silicon running 97 per cent or better, in electric furnaces at Beauharnois,Quebec, and used sandstone from Melocheville,Quebec. The sandstone is trucked the 2 miles from the quarry to the plant where it is crushed and screened to pass 3" and be retained on 5/8". The silicon is marketed mainly in Canada and the ferro-silicon finds a market both in Canada and abroad.

An appreciable amount of low silicon content ferro-silicon is produced in Canada as a by-product in the manufacture of aluminous abrasive from the silica present in the bauxite used by five companies, two located at Niagara Falls, one at Chippawa, one at Thorold, all in Ontario, and one at Arvida, Quebec.

In the use of silica as a flux,smelters endeavour to obtain their material from the nearest possible source, and in many cases prefer a siliceous ore containing small amounts of the precious metals. The silica requirements for the manufacture of ferro-silicon and silica brick depends on the market for the finished product.

The demand for high-grade silica sand was steady and though appreciable quantities of Belgian sand are still brought into Montreal as ballast at a comparatively low cost, Canadian producers are steadily improving their position. Silica sand for use in the manufacture of glass and silicate of soda has to be of a high degree of purity and uniformity; and Canadian producers must adhere rigidly to specifications and guarantee regularity of shipments, if they hope to control these markets.

The use of Canadian sand for sandblasting is increasing.

Interest is active; especially in western Canada search is active for high grade silica deposits stratigically situated for supplying the western markets; practically the whole consumption west of Winnipeg is supplied by imported material.

The search for high grade quartz or quartz crystals suitable for the manufacture of fused silica ware continues and the results are promising. A good demand exists also for high grade quartz crystals from which plates could be cut for use in radio work.

The production of quartz and silica sand in 1938 was 1,470,991 tons valued at $993,460 as compared with 1,377,448 tons valued at $1,129,011 in 1937. There were 1,788 M silica brick produced in 1938 at a value of $100,403; in the previous year the production was 3,744 M valued at $181,126. No exports of silica or silica products were recorded during the year. The tonnage of the various grades of silica imported during 1938 amounted to 176,507 tons with a value of $436,481 as compared with 221,331 tons valued at $522,296 in 1937. The imports of silica brick in 1938 were valued at $240,184 compared with $539,253 in 1937.

The price per ton of the several grades of silica varies greatly, depending on its purity and on the purpose for which it is to be used. Silica generally is a low-priced commodity,and therefore the location of a deposit with respect to markets is of great importance. The larger markets for silica are in the provinces of Quebec and Ontario, and new deposits should be opened within economic reach of either Toronto or Montreal. In western Canada the main markets are in Alberta and Manitoba.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH,1939.

SODIUM CARBONATE (NATURAL) IN 1938

Deposits of natural sodium carbonate in the form of "natron" (sodium carbonate with 10 molecules of water) and also as brine, occur in a number of "lakes" throughout the central part of the Province of British Columbia, chiefly in the Clinton Mining Division, around 70 mile house, and in the neighborhood of Kamloops. Since 1921 there has been a small intermittent production from several of these deposits, the product being marketed in Vancouver, B.C., for use in soap manufacture.

During the past year the only shipments made were from the Clinton area.

Production in 1938 was 252 tons valued at $2,268 as against 286 tons valued at $2,574 in 1937.

Imports of soda ash or barilla totalled 1,454 tons valued at $41,831 as compared with 5,051 tons valued at $113,219 in 1937.

Sodium carbonate, or soda ash, has many industrial uses, being employed in the manufacture of glass, soap, and in the purification of oils.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

SODIUM SULPHATE (NATURAL) IN 1938

(Glauber's Salt and Salt Cake)

The material produced is either hydrated sodium sulphate, known as Glauber's salt, or anhydrous sodium sulphate, known to the trade as "salt cake". It occurs as crystals (Glauber's salt) or in the form of part saturated or saturated brines in many lakes throughout western Canada.

Production was mainly from the province of Saskatchewan, a small tonnage of the crude salts being harvested from a deposit in Alberta for local consumption. The principal producers were the Natural Sodium Products, Limited, Bishopric, Sask.; Horseshoe Lake Mining Company, Ormiston, Sask.; and the Midwest Chemical Company, Palo, Sask.; with small tonnages from several other properties.

Natural Sodium products, Limited, at Bishopric, Sask., operated its sodium sulphate plant, which now contains five drying units (direct oil-fired rotary kilns) and has a capacity of about 400 tons per 24 hours.

The Horseshoe Lake Mining Company at Ormiston, Sask., made extensive alterations including a complete new dehydrating plant, the process now employed being essentially that used in several other plants in the province, namely, direct-fired rotary kilns. These kilns, two in number, are 110 feet long by 8 feet in diameter and are heated by coal-fired furnaces using Estevan lignite coal and travelling chain grate stokers. The new plant is said to have a capacity of 200 tons of dried salts per 24 hours.

The Sodium Corporation at Alsask, Sask., was idle throughout the year, but a few tons were produced for local consumption by J. F. Mellor who has a lease on a small portion of this deposit.

At the central portion of Whiteshore lake, the Midwest Chemical Company produced steadily most of the year using direct rotary dryers working on harvested intermittent crystals. The plant was destroyed by fire on October 9th, but much of the equipment for a larger and more modern plant was on order at the time, so that operations should be resumed early in 1939, about one mile east of the old plant. A bay of Whiteshore lake has been dammed off by an earth and rock dam to form a reservoir of 23 acres, where the brine can crystallize and pure Glauber's salt will be available adjacent to the new plant. The magnesium sulphate will remain in the brine and be drained into the lake. The new rotary dryers are three in number, two 8 feet in diameter and one 6 feet, all being 80 feet in length. Either coal or oil may be used as fuel. A capacity of 200 tons of dried salts per day is expected.

The Oban Salt Company, a subsidiary of the Eastcrest Holding and Development Company, with head office at Calgary, Alberta, with plant at Oban, Sask., was closed down all year pending completion of arrangement for increasing the capacity of the plant to 50 tons per day.

Muskiki Sulphates, Limited, holding leases on Muskiki lake, 60 miles east of Saskatoon, Sask., erected a small 20-ton experimental plant during the latter part of 1937 and the summer of 1938, but did not produce. It is designed to recover anhydrous sodium sulphate from brines formed by dissolving Glauber's salt crystals in their own water of crystallization. The precipitated salts are removed continuously from the brine by a screw conveyer, thoroughly agitated in a salt basket from which spent brine is removed, and then passed through a steam jacketed centrifuge.

A small production of crude Glaubér's salt came from the province of Alberta, shipments from small deposits to the south and east of Cereal, Alberta, being used locally in the province for supplying cattle licks.

No production is reported from British Columbia, but in a number of deposits sodium sulphate is the predominant salt and during the past year prospecting at several was carried on.

A discovery, made in New Brunswick, during the year 1937, may in time prove to be of importance as a source of sodium sulphate. The New Brunswick Gas and Oilfields, Limited, in drilling for gas at Weldon, N. B. has proved large thicknesses of rock salt (sodium chloride). Two drill holes, 3,500 feet apart, from which cores have been obtained, have shown the presence of a bed of glauberite (Na_2SO_4 $CaSO_4$) from 60 to 100 feet, mostly overlying the rock salt, the sodium sulphate running from 25 to 30 per cent. Many millions of tons of sodium sulphate would seem to be indicated in this deposit. Further exploratory drilling and experimental work is to be done this coming season. The Bureau of Mines has done much investigatory work on the material recovered in these cores and has been able to indicate a probable method of recovery of the sodium sulphate, but further detailed work must be done to determine the full commercial possibilities of this deposit.

Activity has been marked in this comparatively new industry for Canada, and it is encouraging to note the progress made. The investigation of sodium sulphate deposits was started by the Bureau of Mines in 1921 and over 120,000,000 tons of hydrous salts was proved in the few deposits examined in detail. In 1921 none of this material was used commercially but by 1938 the revenue derived by Canadian railways from this industry in incoming and outgoing freight exceeded $1,500,000.

At the present time the operating plants in western Canada are capable of producing over 800 tons of dried salts per day. The development of these sodium sulphate deposits has been one of the major factors that has made possible the erection of the plant for separating nickel from copper, at Copper Cliff, Ontario, by the Orford process.

The production of natural sodium sulphate in 1938 amounted to 62,849 tons valued at $551,210 as against 79,884 tons, valued at $618,028 in 1937.

The Canadian production from the deposits of western Canada decreased slightly during the past year, due partly to the fact that two of the producing plants made extensive alterations necessitating shut downs during the normal producing season, and another plant was completely destroyed by fire during the time of its greatest producing activity with a consequent loss of a large tonnage of stock ready for shipment. The demand from the pulp and paper industry was also lighter than in previous years.

No complete figures for the world production of salt cake are available, and it is hard to compare the returns from different countries owing to the fact that the production comes both from chemical plants and from natural deposits. Germany is probably the largest producer of total salt cake production, Canada being well within the first ten world producers. Canada is, however, one of the largest producers of salt cake from natural deposits.

Although there were small shipments from the deposits in western Canada to the United States, the figures are not shown separately in the custom reports. The imports of sodium sulphate during 1938 including Glauber's salt, salt cake and the acid sodium sulphate (nitre cake) amounted to 8,638 tons valued at $109,593, as compared with 17,008 tons valued at $176,060 in 1937.

The producers in western Canada have always endeavoured to improve the quality of their product so as to compete in markets demanding a product of high purity, and the results have been gratifying during the past few years.

The price for natural anhydrous sodium sulphate from the deposits in western Canada remained steady throughout the year ranging from $6.50 to $8.50 per ton f.o.b. plant. The delivered price is considerably higher than this due to the high freight rates to the consuming plants which are situated mostly in eastern Canada.

The products from these western deposits should find a rapidly extending market, as the by-product material from the manufacture of hydrochloric acid is each year decreasing in volume owing to the manufacture of hydrochloric acid synthetically. With improved methods of refining, better quality of product, and reduced cost of production, and providing, other deposits nearer the main markets are not developed, the western sodium sulphate industry should look forward to the future with confidence.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

SULPHUR IN 1938

Deposits of elemental sulphur of commercial grade have not been found in Canada. Sulphur occurs in combination with copper, lead, zinc, nickel, or iron in many base metal sulphide ore-bodies in various parts of Canada. As noted in the article on pyrites, a small quantity of sulphur is utilized annually from that contained in by-product concentrate. In addition, wherever sulphide ores are treated to recover the valuable metal content, by-product sulphur dioxide gas is a waste product that has a potential value as a source of sulphur for industrial use.

In practice waste sulphur dioxide gas can be used directly for the manufacture of sulphuric acid, for the production of liquid sulphur dioxide, or for the production of elemental sulphur. Two plants in Canada, one at Trail, British Columbia, and the other at Copper Cliff, Ontario, are manufacturing sulphuric acid from waste gas. The Trail plant, operated by the Consolidated Mining and Smelting Company of Canada, has a capacity of 600 tons of sulphuric acid a day; the Copper Cliff plant, operated by the ~~International Nickel Company of Canada,~~ Canadian Industries Ltd., has a capacity of 150 tons a day.

At present no plant in Canada is producing liquid sulphur dioxide from waste gas, although this has been done experimentally.

Much research has also been directed towards the development of processes for the production of elemental sulphur from the waste gas or from the original sulphide ore, and a number of patents have been issued or are pending.

A plant with a capacity of over 150 tons of elemental sulphur per day from waste gases is operating at Trail, B.C., by the Consolidated Mining and Smelting Company; this plant started production in the summer of 1936.

In Quebec, the Aldermac Copper Corporation Ltd., with a mine and concentrator located 12 miles west of Noranda, are concentrating 1000 tons of massive sulphides daily, from which they are producing copper concentrate and a high grade iron pyrites concentrate; the latter is being stockpiled.

In the fall of 1938 the Company started construction of a plant for the production of sulphur and iron oxide, using the Wescott Process, developed in an experimental plant at Niagara Falls, N.Y. The building will be capable of housing the equipment for a daily production of 100 tons of sulphur. The first unit will have a capacity of 50 tons of sulphur and 75 tons of iron oxide daily, and will contain equipment for drying the pyrites and for drying and pre-heating air used to oxidize the iron, two rotary kilns and condensers for sulphur. The plant should be in operation in 1939, and when operating at 100 tons of sulphur, it would consume 250 tons of pyrites a day out of a daily production of 500 tons of concentrate.

The production of sulphur, including elementary sulphur and the sulphur content of sulphuric acid and of pyrites, amounted in 1938 to 112,395 tons valued at $1,081,647, as compared with 130,913 tons valued at $1,154,992 in 1937.

The imports of sulphur in all forms were 93,697 tons, valued at $1,471,741, as compared with 225,984 tons valued at $3,669,082 in 1937. Imports of sulphuric acid were 95 tons valued at $10,944, as compared with 108 tons valued at $12,437 in 1937.

The exports were: pyrites (sulphur content) 22,109 tons, valued at $145,189, as against 46,317 tons, valued at $251,834 in 1937; sulphuric acid, 1,260 tons, valued at $17,900, as against 1,608 tons valued at $20,276 in 1937. No exports of elemental sulphur are recorded.

The largest single sulphur-consuming industry in Canada is that which produces sulphite pulp used both for making artificial silk and for newsprint; other important consuming industries include the sulphuric acid and explosive groups; rubber manufacture, and fertilizer production. Metallurgical industries treating sulphide ores of copper, nickel, lead, or zinc necessarily produce large quantities of sulphur dioxide gas from roasting or oxidizing operations; until recently all this gas was wasted. Some years ago plants were erected, first at Copper Cliff, Ontario, and later at Tadanac, British Columbia, equipped with absorption apparatus to recover portions of these waste gases. At Copper Cliff the gas is used for the manufacture of high-grade sulphuric acid, the capacity of the units installed being about 150 tons per day of strong acid; this acid finds a market in numerous industries. In British Columbia the acid made is used chiefly for the manufacture of fertilizers, a small proportion is used elsewhere in the plant as required, and a small quantity is marketed.

According to trade journals sulphur was quoted at $16 per long ton, f.o.b. cars at the mines; the prices at consumers' plants in Canada vary according to location, the difference being due to transportation costs.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

TALC AND SOAPSTONE IN 1938

Records of talc production in Canada date back to 1886, a small annual output being reported during the twenty-year period 1886-1905. Most of this represented low-grade material obtained chiefly from deposits associated with the serpentine belt in the Eastern Townships, Quebec, with a little also from Nova Scotia and Ontario. It was not until 1906, when active development of a deposit of high-grade, white talc in the Madoc district, Ontario, commenced that output started to rise, and this district, with two producing mines and mills, has since continued to be the principal source of all the talc produced. The Madoc operators have been G. H. Gillespie and Company and Canada Talc Company: in 1937, the latter took over the holdings of the Gillespie Company, whose mill has been closed, and is now operating both properties under the name of Canada Talc, Ltd. Small amounts of talc have been produced in recent years from intermittent operations in British Columbia, and there is a small output from Quebec. In the latter Province, a small soapstone industry has been in steady operation since 1922, supplying sawn stone for use in the alkali recovery furnaces of domestic kraft mills.

The talc of the Madoc area is of the foliated variety, has a good white colour, and occurs as a series of vertical veins or bands in white, crystalline dolomite. The mill-output is marketed in six grades, according to purity and fineness. The products go principally to the textile, cosmetic, rubber, paper and roofing trades, and are marketed chiefly in Canada and the United States, some being exported to Great Britain. In recent years, the total annual production of talc from the Madoc area has averaged around 12,000 to 15,000 tons, divided about equally between the two above-named operators.

A few years ago, tests were made in the Ore Dressing and Metallurgical Division of the Mines Branch to determine whether the rather considerable proportion of dolomite in the Madoc talc could be removed satisfactorily. Flotation resulted in lowering the lime content to below 0.5 per cent; however, no process for improving the quality of products by such means has as yet been adopted at the Madoc mills. A report of the tests was published (Investigation No.469, Mines Branch Report No.736). A successful process for separating talc from a talc-magnesite ore by flotation has been developed by the U.S. Bureau of Mines, and a flotation unit has recently been installed at one of the larger Vermont talc mills. Purification of talc from the tremolite-talc of the Gouverneur district, in New York State, by similar means has also been satisfactorily accomplished by the U.S.Bureau of Mines. Flotation should be applicable to the beneficiation of Madoc dolomite-talc: the pure talc possesses fine white colour and good slip, and removal of dolomite from the finished mill products might enable it to compete successfully in the higher-priced field with imported talc used for cosmetic and other purposes.

In Quebec, small amounts of talc, including also ground soapstone and soapstone sawing dust, are produced in the Broughton-Thetford Mines district, Eastern Townships, where, in 1938, four operators were active. The talc occurs in the form of narrow seams or veins traversing the soapstone bodies and sometimes also as bands bordering the latter. Part of it, as well as soapstone quarry and sawing waste, is ground in small mills at the mines, and some is shipped to the grinding plant of Pulverized Products, Ltd., at Montreal: a large proportion of the output goes to the roofing and rubber trades, which consume most of the soapstone sawing dust produced.

The Broughton Soapstone Quarry Company, the largest operator, was in intermittent production throughout the year, supplying sawn blocks and bricks for the pulp-mill trade. Shipment is made as far west as Dryden, in western Ontario, but the bulk of the output has found employment in Quebec mills. In addition to furnace stone, the company has fashioned soapstone monuments, stoves, mantels, slabs and other interior trim, as well as a variety of turned ornamental objects and crayons. This concern was the pioneer Canadian producer of soapstone, and has been operating in the Broughton district since 1922. Since 1935, soapstone operations have been conducted in the same district by the following: L. C. Pharo, Thetford Mines, and Charles Fortin, Robertson, both working in Thetford township, and Louis Cyr, St.Pierre de Broughton, in Leeds township. All of the above were in intermittent operation during 1938. Broughton Soapstone and Quarry Company considerably expanded its grinding mill during the year, and L. C. Pharo also erected grinding equipment.

The soapstone of the Thetford district occurs as a persistent band or belt traversing the hilly terrain north of the valley of the Quebec Central railway, and outcrops are frequent along the flanks and upper levels of the ridges. The stone varies from fairly coarse-grained rock to fissile talc schist: it averages 180 pounds to the cubic foot. The schist variety is the purer stone, and yields a fine grade of off-colour talc powder, substantially carbonate- and grit-free and possessing high slip; it is, however, prone to spall in cutting and handling, for which reason the granular stone is preferred for sawn shapes.

A recent development that has considerably reduced the demand for soapstone for pulp-mill use is the introduction of a new type of water-cooled alkali-recovery furnace; this is of steel construction, only the base being built of soapstone blocks. Such furnaces have already been installed in a number of Canadian and American mills, and it is stated that their use is likely to become general. As a result, domestic soapstone sales have fallen off considerably in the last few years, and increased competition has reduced prices of cut stone to around $2 per cubic foot, only half the figure formerly obtained.

Further progress was made during the year by Baker Mining and Milling Company, of Montreal, which for some time past has been planning development of a talc deposit near Highwater, in Potton township, Brome county, Que. By the end of the year, erection of a mill had been completed, and an adit was being driven to tap the downward extension of a body of talc uncovered by surface prospecting. The mill will have a capacity of 5 tons per hour of finished product, and embodies a variety of equipment not hitherto employed in Canadian talc-grinding. In Ontario, Madoc Talc and Mining Company, of Trenton, continued development of a body of talc in Cashel township, Hastings county, and completed a timbered shaft to a depth of 85 feet, with a small amount of cross-cutting and drifting at that level. Plans call for a grinding plant at Trenton. The ore is a grey talc, in part of soapstone character. No further development was reported on the Bell soapstone property in Pakenham township, Lanark county, Ontario.

In British Columbia, a small intermittent production of ground grey talc is utilized chiefly in the local roofing trade. The material comes from near McGillivray Falls (Anderson lake), on the P.G.E.railway, and from Wolf creek, near Sooke, on Vancouver Island. The Anderson Lake material was shipped to Vancouver for grinding, and that from Sooke was ground at the mine. In 1937 and 1938, neither mine was in operation, local roofing requirements being filled by soapstone waste imported from Washington State and ground in a small custom-grinding plant in Vancouver.

The production of ground talc in 1938 was 10,853 tons, valued at $109,810 compared with 12,457 tons, valued at $123,301, in 1937. The 1938 output of soapstone was valued at $35,038 as against $40,513 in 1937: these figures cover both sawn stone and quarry and sawing waste sold for grinding, as well as a small amount of sawdust from the cutting plants. With the exception of a shipment of 1,000 cubic feet made to Australia in 1937, the entire output of cut soapstone blocks and bricks has found domestic sale, chiefly for kraft mill use.

Recorded world production of talc in 1937 was nearly half a million long tons. Leading producer is the United States, with around 200,000 tons, followed by Manchuria with about 100,000 tons. France and Italy each produced around 50,000 tons. Canada, with 11,000 tons, ranked eighth among the producing countries in the same year, but her output was less than 3 per cent of the total.

Exports of talc in 1938 were 6,952 tons, valued at \$70,742 as compared with 8,698 tons, valued at \$85,953 in 1937.

Imports totalled 2,647 tons, valued at \$40,386 compared with 3,184 tons, valued at \$48,079, in 1937.

Under the Canada-United States Trade Agreement of 1938, effective January 1, 1939, revision was made in the scale of duty on Canadian talc imports into the latter country: whereas previously a duty of 25 per cent ad valorem was levied on ground talc, steatite or soapstone valued at not over \$12.50 per long ton, under the new tariff the unit value is raised to \$14 per ton and the duty dropped to 17½ per cent. On products valued above \$14 per ton, the duty remains at 35 per cent. Crude mineral pays ¼ cent per pound, while cut soapstone or talc, in the form of bricks, crayons, blanks, etc., is dutiable at 1 cent per pound. Talc, ground or unground, enters Canada under the British preferential tariff at 15 per cent ad valorem, and under the intermediate and general tariffs at 25 per cent.

No important developments in connection with new or improved industrial outlets for talc were recorded during the year, but world production and consumption have been showing a steady increase. Some shift in markets has been evidenced in the United States in recent years, the most noticeable being a large increase in the amount going to the ceramic trade: this industry, which 10 years ago took only a negligible quantity of talc, accounted for 13 per cent of the total sales in 1937 and ranked as the third largest consumer, only barely exceeded by the paper industry. (A large part of such sales comprised pyrophyllite, a mineral closely resembling talc in many respects and included with talc in the statistics gathered by the U.S. Bureau of Mines: see also below.) The main uses for ground talc (including soapstone) are in the paint, paper, rubber and roofing industries, with considerable quantities going also to the textile (bleachery) and cordage trades. It is also used in foundry facings, lubricants, concrete mixtures, plasters, insecticides, and for a wide variety of minor industrial purposes, including the polishing of rice and other grains, glass, and turned wooden articles. The finest grades find extensive employment in cosmetic products of all kinds, notably talcum powder.

So many grades of ground talc are on the market that prices range between very wide limits. Value is largely dependent on purity (governing freedom from grit and slip), colour, particle shape, and fineness of grinding, the specifications for which vary in the different consuming industries. The cheaper, impure, grey talcs (in part soapstone) sold in Canada in 1938 at from \$5.50 to \$7 per ton, f.o.b. mills, depending on fineness, which commonly ranges from 80-mesh to 150-mesh: these grades go mainly to the roofing and rubber trades. Quotations for white, foliated talc from the Madoc district were \$30 and \$17 for the two best grades, and \$12 to \$8 for the four lower grades. Imported superfine Italian talc, cosmetic grade, sells at \$80-\$100 per ton, eastern points. From a report of the Dominion Bureau of Statistics, the roofing industry was the largest consumer of talc (including ground soapstone) in 1937 (2,696 tons), closely followed by the paint industry (2,063 tons): the pulp and paper trade used 865 tons, 400 tons went into toilet preparations, and 151 tons into soaps and cleansers. Figures for the rubber trade, also an important consumer, are not available. According to

Minerals Yearbook, 1938, of the U.S.Bureau of Mines, the average value of all grades of ground talc (including soapstone) produced in the United States in 1937 was a little over $11 per ton. Current (February, 1939) trade journal quotations on individual grades range from $6 to $14 for the cheaper grey talcs from Georgia and Vermont, $14 to $17 for 325 mesh, fibrous, white talc from New York, to $17 to $20 for the high-grade white talc from California, all f.o.b. mills. Imported French talc is quoted at $23 to $60, according to quality, and Italian talc (cosmetic grade) at $60 to $67, ex dock, New York.

Pyrophyllite: Pyrophyllite (hydrous silicate of alumina) is a mineral closely resembling talc in appearance and physical character, and can be employed for many of the industrial uses served by the latter mineral. It is, however, far less common than talc and commercial deposits are relatively scarce. Most of the recorded world production is derived from North Carolina, where there is a growing pyrophyllite industry, a large part of the output going to the ceramic trade. When fired, pyrophyllite does not flux, as does talc, and has a value for the manufacture of high-grade refractory ceramic products and cements. Extensive deposits occur in Newfoundland, where there has been some attempt at development, and in 1935 some material was shipped to Canada for grinding and sale: it is reported that active exploitation of the occurrences is planned for 1939, the company interested being the Clinchfield Sand and Feldspar Corporation, of Baltimore, Md.

No important occurrences of the mineral are known in Canada, but some rather low-grade material exists at Kyuquot Sound, on the west coast of Vancouver Island: the deposits are reported to be extensive, but contain much admixed sericite and finely-divided silica. Around 1910 a small quantity was shipped to a Victoria pottery for use in refractories and to a plant at Esquimalt making polishing powders, soaps and cleansers. In Quebec, several occurrences of pyrophyllite are recorded in early reports of the Geological Survey of Canada. They appear to be restricted to areas of altered aluminous igneous rocks, notably dacites, trachytes, etc., or of tuffs derived from such rocks, the pyrophyllite originating as a result of their hydrothermal alteration.

Pyrophyllite was quoted in trade journals at the close of the year at $7.50 to $12.00 per ton for 200-mesh and 325-mesh material, respectively, f.o.b. North Carolina mills.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

VOLCANIC DUST IN 1938

Deposits of volcanic dusts (pumice dust) are found in Saskatchewan, Alberta, and British Columbia. The material is used mainly as the abrasive base in scouring and cleaning compounds and a very small amount in acoustic plaster and concrete admixture. There has been intermittent production from Waldeck near Swift Current, Saskatchewan, and from near Williams lake in British Columbia, but none since 1934, when 31 tons valued at $310 was produced from Waldeck.

Other deposits are known in Saskatchewan, namely, 5 miles north of Braddock; west of Beverley; near St. Victor, all of which are grey to buff in colour. A deposit of white volcanic dust was recently discovered 5 miles west of Rockglen. Tests are now being conducted on the latter material. Several deposits occur in British Columbia, the purest known of which is a snow-white, fine-grained volcanic dust from the Deadman river, north of Kamloops lake, but there has not been any production.

Imports are not separately recorded but are grouped with a number of similar products -- pumice, pumice stone, lava, and calcareous tufa. Imports of these products in 1938 were valued at $24,688 as compared with $26,238 in 1937.

In the United States annual shipments of volcanic dust and pumice are now over 70,000 tons valued at $300,000, there being about 20 companies actively engaged in production. About 70 per cent of this output is used for cleansing and scouring compounds; about 20 per cent for light weight concrete and aggregate; about 5 per cent for acoustic plaster and the remainder for asphalt filler, road grading, chicken litter, filtering and insulation mediums, paint filler, floor sweep, dusting inside tires, and in abrasive uses such as glass bevelling, polishing aluminium, etc. During 1938 some of the United States volcanic dust was used in the manufacture of fireproof walls, building tiles and slabs and in the refining of petroleum.

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WHITING SUBSTITUTE IN 1938

Whiting substitute, as the name implies, is chiefly used as a substitute for whiting made from chalk, from which it differs in certain of its characteristics and because of this it also has a field of usefulness of its own. It finds its principal uses in the manufacture of oilcloth, linoleum, certain kinds of rubber product, putty and explosives. In lesser quantities it is used in the manufacture of moulded articles, cleaning compounds and polishes, as a ceramic glaze, and for a number of other purposes. At present all whiting substitute produced in Canada is made from white marble or white limestone containing only a small percentage of magnesium carbonate, though in the past a whiting substitute made from white dolomite was produced in eastern Canada for making putty. The marble and limestone are pulverized to such fineness that practically all of the product will pass a 325-mesh screen, though for certain uses 200-mesh material is suitable.

The principal differences between whiting substitute and chalk whiting are that the former is generally much whiter, has a lower capacity for absorbing oil, and the individual particles are sub-angular rather than rounded.

Whiting substitute is manufactured by Pulverized Products, Limited, Montreal; by Claxton Manufacturing Company, Toronto; by Gypsum, Lime and Alabastine, Canada, Limited, Winnipeg; and by F. J. Beale, Limited, Van Anda, Texada Island, British Columbia.

During 1938 F. J. Beale, Limited, Van Anda, B. C., added additional equipment for the production of a more finely ground product than was formerly made at that plant. Investigations were continued by several companies in eastern Canada into the possibilities of producing whiting substitute from deposits of calcite and marl. The investigations of one of these companies--White Valley Chemicals, Limited, Toronto--have reached the stage where a mill is being planned.

Carbonate filler, a product closely akin to whiting substitute and made by introducing carbon dioxide gas into milk-of-lime made from high-calcium quicklime, has been produced in Canada for the past two years. Its use up to the present has been as a filler in newsprint and book paper, and its manufacture has been undertaken by the paper companies using it.

By-product precipitated chalk, made from waste sludge resulting from the manufacture of caustic soda from soda ash and lime, is classed as a whiting substitute, but its usefulness is restricted by the fact that it almost invariably contains a small amount of free alkali. The raw materials for the manufacture of by-product precipitated chalk are available but it is not yet being made in Canada.

No separate record is kept by the Dominion Bureau of Statistics of the production, imports, and exports of whiting substitute, but the industry has experienced a steady growth in recent years because improvements in grinding equipment and the maintenance of close technical control has enabled a product to be marketed that is very consistent in both chemical and physical properties, and many manufacturers now use the domestic product with entire satisfaction in place of imported whiting. There is little or no export of whiting substitute from Canada but a considerable quantity of specially processed whiting substitute is imported from the United States. Imports of chalk whiting in 1938 amounted to 10,201 tons valued at $116,923, as compared with imports of 11,992 tons valued at $126,015 in 1937. These imports of chalk whiting originate in England, France, and Belgium.

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COAL IN 1938

The provinces of Nova Scotia and New Brunswick and Yukon Territory produce only bituminous coal. Coal produced in the province of British Columbia is almost all bituminous, except for a small quantity classified as lignitic. Alberta production includes bituminous, sub-bituminous, and lignitic coals, and the provinces of Saskatchewan and Manitoba produce only lignitic coal.

Developments in Nova Scotia during the last few years include changes in and improvements to the washing and screening plants of the Dominion Steel and Coal Corporation, permitting a wider range of preparation of coal for special purposes. A program of consolidation of the company's various collieries has been under way, the objective being increased production at a decreased cost, by the construction of cross-measure tunnels cutting the coal seams at depths sufficient to allow the complete extraction of the coal in the submarine area.

During the year the Acadia No. 3 Mine at Thorburn, N. S., was finally closed and after an investigation by a Royal Commission it was decided that for the present no new mines would be opened in this area although the McBean seam is available for exploitation. Operation at the No. 1 Mine of the Inverness Coal Mines, under Government control, was discontinued during the latter part of the year, production being now confined to No. 4 mine. The Port Hood Coal Mines, Ltd., at Port Hood, has made an assignment under the Bankruptcy Act but to date it is not known whether the company will continue its operations.

Operations at Vancouver Island have been considerably modified during the year. The Nanaimo No. 1 Mine of the Western Fuel Corporation of Canada, Ltd., has been exhausted and the property closed. Production is now being obtained by reason of an expansion of the Northfield Mine in the same locality. This mine is a property of the Canadian Collieries (Dunsmuir) Ltd.

The mechanization of coal mines throughout Canada has made some progress during the year. The introduction of modern electrically-operated coal-cutting machines at the Dominion Steel and Coal Company's new No. 20 colliery, in an effort to reduce costs, caused a stoppage of work and has been the subject of a controversy between the miners and the company since early in the year. Urgent need for further mechanization of the coal mines in Nova Scotia has been stressed by officials of the Dominion Steel & Coal Company as, only by this means can costs be reduced enabling the retention of markets in competition with cheaper United States coal. Even with the aid of subventions, difficulty was encountered in meeting the competition of imported coals.

The plant for carbonizing and briquetting Saskatchewan lignite at Taylorton, Saskatchewan, which had been purchased and re-conditioned by the Dominion Briquette & Chemicals Company, Limited, continued the manufacture of briquettes. Production up to December 15th approximated 20,000 tons, more than double the 1937 production. The briquettes are marketed in Manitoba and Saskatchewan. The B. C. Electric Company continued manufacturing briquettes under the name of "thermets" from a mixture of coke breeze and coal.

A briquetting plant has been in operation during the year at the Brazeau Collieries Limited in Alberta, where the bituminous coal fines are briquetted with an asphalt binder and returned to the run of mine coal, which is sold for railway use.

A coal-cleaning plant has been in operation at the collieries of the Cadomin Coal Company, Limited, and a coal cleaning plant was completed in 1938 and is being operated by the Mountain Park Coals, Limited, for the preparation of a special low ash coal for the manufacture of coke, and for steam raising.

After the complete destruction by fire of the surface workings at the Michel Mines of the Crow's Nest Pass Coal Co., Ltd., in British Columbia in October, 1937, a new modern bankhead, complete with wet and dry cleaning equipment, was constructed and placed in operation. Many new features have been incorporated with a view to facilitating operation of the mine as well as allowing for a more flexible method of coal preparation. The tipple at these mines is probably the most modern of its kind in Canada.

The production of coal in Canada amounted to 14,247,783 tons valued at $43,912,204 as compared with 15,835,954 tons valued at $48,752,048 in 1937. Nova Scotia contributed over 43 per cent of the total, Alberta over 36 per cent, British Columbia about 10 per cent, Saskatchewan about 7 per cent, and the rest was derived from New Brunswick and Manitoba. Nova Scotia with 6,231,923 tons showed a decrease of 14 per cent from the output of 1937.

The imports of coal into Canada totalled 13,464,060 tons, compared with 16,023,147 tons in 1937.

Anthracite importations consisted of 3,716,447 tons, 53 per cent of which was from the United States and 32 per cent from Great Britain; the remainder being from Germany, Russia, Belgium, the Netherlands, French Indo-China, and Morocco.

Bituminous importations consisted of 9,744,652 tons, mainly from the United States.

Exports of Canadian coal amounted to 353,181 tons compared with 355,268 tons in 1937. The 1938 total included 343,731 tons of bituminous coal and 9,450 tons of lignite coal.

Movements of Canadian coal under Federal Government assistance were 2,041,940 net tons as compared with 2,637,345 net tons in 1937. The decline is attributable to the decreased fuel requirements during 1938 of industrial plants and the railways.

Broadly speaking, the assistance provided to coal movements is in the form of allowances in reduction of freight charges to enable the Canadian coal to compete on even terms with imported coal at points of consumption.

Declining prices of United States coal necessitated an increase in November in the rates of assistance granted to Nova Scotia coal moving to Ontario points, to enable the Canadian coal to maintain its competitive position.

The total amount of coal moved under subvention since 1928 when this assistance came into effect is 16,243,727 tons, at a cost to the government of $15,309,511 or 94 cents per ton. The administration of this government assistance is carried out by the Dominion Fuel Board.

The government assistance to the coal mining industry, as rendered by the Fuel Research Laboratories of the Canadian Bureau of Mines, Department of Mines and Resources, was continued during the year. Research work on coal preparation, storage properties and general characteristics of coal seams was carried out with a view to the increased use of these coals in Canadian plants to displace the imported product. A study of the physical and chemical characteristics of the coals from New Brunswick was started and in view of the unsatisfactory economic conditions of the coal mining industry in this province and the necessity for making changes in operation, preparation, and method of sales, the results of this survey is of prime importance in aiding in the solution of the problems of this coal field. Research work on the amenability of various Canadian coals to hydrogenation was studied throughout the year, in order that, when such a process becomes economic, information will be available as to the suitability of various Canadian coals for this purpose.

With continued assistance in the transportation of Canadian coal from the mine to the market, it is hoped that the improvement in the coal mining situation, shown during the last two years will be continued in 1939.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1939.

COKE IN 1938

Coke was produced from coal in all provinces except Prince Edward Island and Saskatchewan in 25 plants, which included two (2) beehive, eight (8) by-product, six (6) vertical retort, and nine (9) horizontal retort plants. Petroleum coke was produced at petroleum refineries in Nova Scotia, Quebec, Ontario, Saskatchewan and Alberta. Pitch coke was produced by distillation in Manitoba.

In Cape Breton, Nova Scotia, the Dominion Steel & Coal Corporation produced [redacted] coke from its ovens for its own use and as a domestic fuel for the Maritime Provinces.

In Quebec the Montreal Coke & Manufacturing Company operated its coke ovens continuously, using about 35 per cent Nova Scotia coal, the remainder being imported coal. The Quebec Power Company with a vertical retort plant used Canadian coal only, and marketed about 68 per cent of its coke for domestic consumption, the remainder being used at the plant for the manufacture of gas and for operation.

In Ontario from the coke ovens at Hamilton, comprising those of the Hamilton By-Product Coke Ovens,Limited, and the Steel Company of Canada, and those at Sault Ste.Marie, increased quantities of coke were marketed for use as domestic fuel. The Consumers' Gas Company of Toronto, using both vertical and horizontal retort type plants, distributed 41 per cent of its total coke manufactured for domestic consumption, the remainder being used for the manufacture of gas and in operation of the plants.

During the year the municipally-owned gas plant of the City of Owen Sound was put into operation. This plant employing the Curran-Knowles system of carbonization, is designed to supply local requirements for gas and coke and consists of 3 ovens; from 12,000 to 13,000 tons of coal it will produce 10,000 tons of coke and 21,000 M cubic feet of gas per annum.

In Manitoba the Winnipeg Electric Company, which formerly used only United States coal, is using all Canadian coal in its ovens at Winnipeg for the manufacture of domestic coke. The construction,during 1937,of a blending plant allows for the use of coal from more than one source.

In Alberta,the International Coal and Coke Company at Coleman, continued to supply the requirements of the smelter at Trail,B.C.,with beehive oven coke.

In British Columbia, the coke and gas plant of the British Columbia Electric Power and Gas Company, at Vancouver, continued to supply an improved quality of coke for domestic use in Vancouver. The foreign market continued to develop,most of the coke being marketed in Seattle. Beehive oven coke was manufactured by the Crow's Nest Pass Coal Company,Limited, mostly for industrial use.

The total production of coke from coal in 1938 was reported as 2,356,055 tons. The production in the eastern provinces (Nova Scotia, New Brunswick, and Quebec) in 1938 was 754,961 tons; in Ontario, production was 1,369,311 tons; while in Manitoba, Alberta and British Columbia, the production was 231,783 tons. The amount of coal used for making coke was 3,279,771 tons, 32 per cent of which amount was Canadian coal. In addition to the coke made from coal, a relatively small amount of petroleum coke is produced at the oil refineries (62,015 tons in 1937, the 1938 figures not available). About 5 per cent of this petroleum coke is consumed by the refineries themselves.

The exports in 1938 were: coke from coal 30,537 short tons, and petroleum coke 11,370 tons.

The imports were: coke from coal 414,682 tons, and petroleum coke 81,218 tons.

There has been a steady improvement in the coke situation during the last few years, owing to increased demand in the domestic market.

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OTTAWA, MARCH, 1939.

NATURAL GAS IN 1938

Natural gas has been found in almost all the provinces of Canada, but the principal fields producing in commercial quantities are in Alberta, Ontario, and New Brunswick. Comparatively small quantities are produced in Saskatchewan, Manitoba, Quebec, and in the Northwest Territories. The principal producing fields in Alberta are: Turner Valley, which supplies the cities of Calgary and Lethbridge and intermediate points; Viking, which supplies the Edmonton area; Medicine Hat, which supplies Medicine Hat and Redcliff; Fabyan, supplying the town of Wainwright; and Brooks, supplying the town of the same name. Some gas is exported to the United States from an isolated well in southern Alberta. In Saskatchewan, Lloydminster is being served with natural gas from wells near the town. In Ontario the greater part of the production comes from the southwestern part of the province, to the north of Lake Erie. The principal fields are: Tilbury, Haldimand, Dawn, De Clute, Brownsville, Dover, Norfolk, Welland, and Onondaga. A network of pipe-lines transmits the gas to nearby towns and cities for distribution. Practically all the centres of population in that area are served with natural gas. In New Brunswick, the only field of importance is at Stony Creek, which supplies the city of Moncton and the town of Hillsborough. Natural gas is obtained from a number of small wells along the St. Lawrence River in Quebec. The gas is used locally in private dwellings.

The outstanding event in Alberta during the year was the formation of the Petroleum and Natural Gas Conservation Board with headquarters at Calgary. The Board has managed to greatly decrease the amount of natural gas being burnt by flares in Turner Valley and plans are under way to reduce it still further by returning excess gas to the producing horizon. The Turner Valley field continued to supply natural gas for Calgary, Lethbridge and intervening municipalities, and for the repressuring of the Bow Island field. Exploratory drilling has been done in the Ponce Coupe area, in the Brazeau area, at Grease Creek, at Steveville, and in the Border area, north of the international boundary.

The most important development in Ontario during 1938 has been the large production obtained from new wells in the Brownsville field in addition to that from wells previously drilled. At the end of the year 71 wells were producing in this field, compared with 51 at the end of 1937. The largest of the new wells was estimated to be capable of producing 12,000,000 cubic feet of gas per day. The field has been extended westward and a little south, some of the new wells being in Elgin county. Two new purifiers have been erected to treat the gas, which now serves the town of Aylmer. Four new wells are reported as producers in the De Clute field in Raleigh Township, Kent County, with a combined flow of 12,000,000 cubic feet. The productive horizon is about 1550 feet. Three new wells were brought in in the Tilbury field at a depth of about 1300 feet. Four small wells, two in Haldimand county, one in the Eden field, one in the Brant county completed the new production of natural gas in Ontario for 1938.

In Saskatchewan, a new gas well near Lloydminster with a flow of 6,750,000 cubic feet per day was brought in during the year and a small flow was obtained near Kamsack from shallow depth. Test drilling in the province was done at Riverhurst, Veregin, and Thunderhill.

In Manitoba some further drilling was done at Pilot Mound in the southwestern part of the province, and in British Columbia drilling was done on Sage Creek and in the Boundary Bay district.

The total production of gas in 1938 was 33,441,139 M cubic feet, compared with 32,380,991 M cubic feet in 1937. These amounts do not include Turner Valley gas used for re-pressuring or for waste gas burned in the field.

Some natural gas was exported by the Range Oil and Gas Company of Calgary. The company owns a well in southern Alberta and exports intermittently to a company operating a distributing system in the state of Montana, which uses the gas principally for its peak load and as a standby. Some drilling was done in this area during the year.

Some mixed artificial and natural gas was imported into Ontario from Buffalo, N. Y., and was distributed in the Welland area. In 1938, 133,062 M cubic feet, valued at $87,311 was imported in this way as against 114,275 M cubic feet, valued at $74,799 imported during 1937.

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OTTAWA, MARCH, 1939.

OIL SHALE IN 1938

The best known occurrences of oil shale in Canada are in Pictou and Antigonish counties, Nova Scotia, and Albert and Westmorland counties, New Brunswick.

No important development took place during 1938. Experimental plants were erected in 1929-30 near Rosevale, New Brunswick and New Glasgow, Nova Scotia, to treat the local shales but they only operated for short periods. No oil shale is now being mined in Canada nor is any imported. Activity has chiefly been confined to field exploration and laboratory investigation. Laboratory work by the Dept. of Mines and Resources has included:-

1. Determination of petroleum content of representative samples from various localities.

2. Determination of important factors affecting the recovery of crude petroleum by destructive distillation and the character of the petroleum recovered.

3. Investigation of the processes designed for the distillation of oil shales.

The Department of Mines and Resources, Ottawa, has published several reports on the oil shale industry, the more recent of which include the following:

"Report on Oil Shales from Pictou,N.S., and Port Daniel,Bonaventure County, Quebec" (Mines Branch Report No.725,Investigations of Fuels and Fuel Testing, 1930-31, pp.136-148).

"A World Survey of Recent Oil Shale Developments (1932)" by A.A. Swinnerton (Mines Branch Memorandum Series No.53).

"Pritchard Process for the Distillation of Oil Shale" (Mines Branch Report No.689,Investigations of Fuels,1926, pp.106-120).

"Canadian Shale Oil and Bitumen from Bituminous Sands as Sources of Gasoline,etc." (Mines Branch Report No.689, Investigations of Fuels,1926, pp.121-132).

"Preliminary Report on the Investigation of Oil Shales", which includes New Brunswick shale(Mines Branch report No.590, Investigations of Fuels and Fuel Testing,1921,pp.239-252).

"Analyses of Canadian Crude Oils,Naphthas,Shale Oil,and Bitumen" (Mines Branch Report No.765,1936).

"Oil Shales of Canada",by A.A.Swinnerton (Paper presented to the Conference on Oil Shale & Cannel Coal,Glasgow,Scotland,1938).

For many years the large scale production of oil shale was limited to Scotland but now deposits in Manchuria and Esthonia are being developed on a large scale,the production being as follows:-

Scotland	(1936)	1,409,415 tons;	(1937)	1,460,729 tons.	
Esthonia	(1936)	754,306 "	(1937)	1,213,680 "	
Manchuria	(1935)	3,383,000 "	(1937)	3,000,000 "	(estim.)

Austria, France, Germany, Italy, Spain and Russia also produce small quantities of oil shale.

The increasing interest in oil shales in Europe was responsible for the holding of an International Conference on Oil Shale and Cannel Coal in Glasgow in June, 1938, at which a paper was presented dealing with the oil shales of Canada.

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PEAT IN 1938

Peat is a combustible substance produced by the incomplete decomposition of vegetable matter either in water or in the presence of water, under such conditions that atmospheric oxygen is excluded. The character of the peat depends upon the conditions under which it has been formed, and on the nature of the vegetation which has contributed to its formation. Though many species of plants are found in peat bogs, the most prominent are: mosses, such as sphagnum and hypnum, marsh and heath plants; grasses, rushes, etc.; marine plants; and sometimes trunks, roots and leaves of trees; the peat contained in a bog is described according to the plants that predominate in the formation.

Peat is found in every province of the Dominion.

(a) Peat Fuel

Small amounts of peat fuel have been produced intermittently from Quebec and Ontario bogs for several years. Bogs that have recently been operated are those at St. Arsene, in Quebec; at Galt, Gad's Hill, Grand Valley, Linwood, Morewood and St. Ann's in Ontario.

At the St. Arsene and Gad's Hill bogs the peat is put through macerators before being placed on the drying racks. At the East Luther bog near Grand Valley, operated by Industrial Compounds, Limited, the peat is excavated, using a suction pump capable of handling 1,400 gallons of peat pulp per minute; the pulp is piped to a settling tank having a peat-flow regulator, and the wet solids are afterwards piped to a series of level drying beds; the products made at this plant are peat fuel and fertilizer filler.

The sales of peat during 1938 were 500 tons valued at $3,000, as against 475 tons valued at $2,676 in 1937. The average annual output between 1932 and 1936 was about 1,800 tons.

Imports and exports of peat fuel are not separately recorded in the Department of Trade and Commerce reports.

(b) Peat Moss

During recent years a few bogs have been operated intermittently for the production of peat moss for use as insulation material, packing litter or fertilizer; these include bogs at Isle Verte and Waterville in Quebec; at Clinton, Grand Valley and Vars, in Ontario; at Cowan in Manitoba; at Melford in Saskatchewan, at Edmonton West in Alberta; and near New Westminster in British Columbia.

Insulating moss has been produced at Isle Verte, Clinton, Vars, Cowan, Melford, and Edmonton West; the fabricating plants at Isle Verte and Edmonton West produce a material known to the trade as "Spagmos" and "Mosstex", whereas loose material is produced at the other points.

Packing moss is produced at Waterville as loose material, and at New Westminster in the form of "Westpeco" sawn boards.

Litter or humus is produced at Isle Verte and New Westminster, and fertilizer filler at Isle Verte and Grand Valley.

Information covering the production of peat moss is not available.

Imports of peat moss during 1938 were 433 tons and cleaned, sized and ground mosses and grasses amounted to 891 tons.

Imports of peat moss into the United States from Canada during 1936 and 1937 were approximately 2,700 and 3,000 tons respectively.

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PETROLEUM IN 1938

Petroleum is produced in Canada in the provinces of Alberta, Ontario, New Brunswick and in the Northwest Territories. The product varies from a very volatile naphtha to semi-solid bitumen.

The largest production comes from Alberta, where Turner Valley is the main producing field, about 30 miles southwest of the city of Calgary. Other regularly producing fields are at Red Coulee, near the town of Coutts on the international boundary between Alberta and the State of Montana; at Wainwright and Ribstone about 160 miles east of the city of Edmonton; at Taber near Lethbridge; and at Moose Mountain, about 60 miles west of Calgary. In Ontario, crude oil is found in commercial quantities only in the southwestern part of the province. The principal producing fields are at Petrolia, Oil Springs, Bothwell, and in the townships of Dawn, Warwick, West Dover, and Mosa. In New Brunswick the production is from the Stony Creek field, about 9 miles southeast of the city of Moncton. A small production is obtained along the MacKenzie river at Fort Norman, and some bitumen from deposits near McMurray.

The most important development in 1938 was the greatly increased production from Turner Valley, the major producing field in the country. The province of Alberta produced 97 per cent of the total production of Canada and 99 per cent of this was from Turner Valley. Throughout the year the field was on proration, production being restricted so as not to exceed the amount the market could take, modified also by the available storage and transport facilities. The Petroleum and Natural Gas Conservation Board formed during the year by the provincial government now fixes the allowable production of each well periodically according to a formula in which the so-called 'potential' production enters only as one factor. The market demand reached a maximum during September, when the production from the limestone in Turner Valley rose to 862,413 bbls. and the aggregate of well allowables during the period September 12 to 24 was fixed at 28,300 bbls. daily. This had fallen towards the end of the year to 12,500 bbls. The 'potential' production, measured under prescribed conditions for each well is determined from time to time and expanded steadily throughout the year, having an aggregate for all wells at the close of between 50,000 to 60,000 bbls. daily.

During the year, 38 producing wells were drilled into the Palaeozoic limestone at the south end of the field, extending the total proved area of this part of the field to about 5 miles long and 1½ miles wide. The production is a light crude oil ranging from 40 to 50 degrees A.P.I. gravity, very different from the naphtha formerly produced from the limestone. An important factor in the development has been the very successful use of hydrochloric acid for increasing and periodically reviving the yield from the wells.

An event of importance in defining the extent of the field was the drilling of Home-Millarville No. 2 well in the north end. This well is 1 3/4 miles northwest of Royalite 29, the nearest producer. By the end of the year it gave signs of heavy pressure and when actually completed early in 1939 was found to rank as a large producer. During the year the structure was traced further northward for a matter of seven miles by Dr. G. S. Hume.

A large area between the northern and southern areas, representing a gap of eleven miles, as well as to the dip of the producing wells in Turner Valley has yet to be proved oil bearing. In the southern part of the field drilling has demonstrated the general saturation of the porous horizons in the limestone and again in the north encouraging results have been obtained. The prospects of much of the undrilled area are good. Further drilling in Alberta has been done at Taber, east of Lethbridge; Moose Dome, west of Calgary; Ribstone, southwest of Lloydminster; Del Bonita, in the international boundary area; Pouce Coupe, in Peace River country; Bearberry, west of Olds; Steveville, northwest of Medicine Hat; Lundbreck, in Crow's Nest Pass area; in the Brazeau area and in the Highwood area.

In Saskatchewan drilling has been done from Vera, which is situated east and a little south of Wainwright, Alberta, northward to the vicinity of Lloydminster. Some production was obtained which was of the heavy asphaltic type of crude. In Ontario, drilling was done in the southwestern part of the province and also on Manitoulin Island. Encouraging results were obtained. In Nova Scotia a show of oil was obtained in a bore hole in a coal mine, but the quantity was small.

Another important development was the discovery of oil in Warwick township in the county of Lambton in Ontario. The field is small and production was found at a depth of from 375 to 500 feet. An area about 6 miles long and 3 miles wide has been tested but not all of it was productive. The oil is of good quality with a gravity from 37° A.P.I. to 43° A.P.I. The wells have to be pumped and yield up to 110 barrels per day flush production. The production from this field accounts for most of the increased production for Ontario during the year. The balance of the increase may be attributed to reconditioning of old wells and new drilling in the Bothwell field. It has been estimated that about 300 wells are on the pump in this field and that deliveries during the year will be approximately 54,000 barrels.

The production of crude petroleum in Canada during 1938 was almost 7,000,000 barrels, being more than double that produced in 1937.

TABLE I
Production of Petroleum in Canada
(Barrels of 35 Imp. gallons = 42 U. S. Gallons)

	1937	1938
Alberta	2,749,085	6,742,039
Ontario	165,205	172,059
New Brunswick	18,089	19,277
Northwest Territories	11,371	22,854
Total	2,943,750	6,956,229

The production from Alberta is classified by the Provincial Department of Lands and Mines as shown in Table II.

TABLE II
Production of Petroleum in Alberta
(Barrels of 35 Imp. gallons = 42 U. S. Gallons)

Turner Valley, limestone*	6,681,883
Turner Valley, shallow crude	9,192
Red Coulee, light crude	14,458
Wainwright, heavy crude	18,344
Taber	15,098
Moose Dome	3,064
Total	6,742,039

*Includes both naphtha and light crude

The value of the exports of petroleum and its products from Canada is given by the Bureau of Statistics as $877,553 for the calendar year 1938. Exports of gasoline and naphtha for 1938 were 4,984,879 Imp. gallons, valued at $458,997.

The value of petroleum, asphalt, and their products imported during 1938 amounted to $55,606,622; crude petroleum imported into Canada during the same period was 1,228,560,309 Imp. gallons. The largest imports of crude oil were received from the United States, which supplied 74 per cent of the total; 6 per cent was received from Venezuela; 16 per cent from Colombia; and 4 per cent from Peru. The gasoline and naphtha imported into Canada amounted to 119,038,120 Imp. gallons, valued at $7,719,907. The greater part of these importations were from the United States, which supplied 84 per cent of the total; 15 per cent came from Peru; and the remaining small amount from Alaska.

The total retail sales of gasoline in Canada for the year 1938 has been estimated, from the returns received from the gasoline tax departments of the provincial governments, to be 762,591 thousands Imp. gallons.

The increased production of crude oil from Alberta has caused some changes in marketing conditions, particularly during the latter part of the year. Almost all the refineries in Alberta and Saskatchewan and Manitoba now use Turner Valley crude, and importation of crude oil to these provinces during 1938 was only a little over 500,000 barrels. Coincident with this change a number of the refiners are putting in improved equipment in order to reduce refining costs. In Turner Valley, the producing companies have enlarged the storage considerably and pipe-line capacity from the field to Calgary has been increased to 24,000 barrels of crude oil, and transportation costs both by pipe-line and by rail to refining centres have been lowered. Owing to the lower cost of crude oil, retail prices for gasoline and other petroleum products have been materially reduced in the prairie provinces.

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