DEPARTMENT OF MINES AND RESOURCES.
BUREAU OF MINES.

THE CANADIAN MINERAL INDUSTRY IN 1939.

March 1940

THE CANADIAN MINERAL INDUSTRY IN 1936

(By Staff, Bureau of Mines, Ottawa.)

	Product	Article Number	Author
I METALS:	Aluminium	(1)	Buisson, A.
	Antimony	(2)	Buisson, A.
	Bismuth	(3)	Buisson, A.
	Cadmium	(4)	Buisson, A.
	Chromite	(5)	Buisson, A.
	Cobalt	(6)	Buisson, A.
	Copper	(7)	Buisson, A.
	Gold	(8)	Buisson, A.
	Iron Ore	(9)	Buisson, A.
	Lead	(10)	Buisson, A.
	Manganese	(11)	Buisson, A.
	Mercury	(12)	Buisson, A.
	Molybdenum	(13)	Eardley-Wilmot, V. L.
	Nickel	(14)	Buisson, A.
	Platinum	(15)	Buisson, A.
	Radium & Uranium	(16)	Spence, H. S.
	Selenium	(17)	Buisson, A.
	Silver	(18)	Buisson, A.
	Tellurium	(19)	Buisson, A.
	Titanium	(20)	Buisson, A.
	Tungsten	(21)	Buisson, A.
	Zinc	(22)	Buisson, A.
II INDUSTRIAL MINERALS:	Arsenious Oxide	(23)	Buisson, A.
	Asbestos	(24)	Goudge, M. F.
	Barite	(25)	Spence, H. S.
	Bentonite	(26)	Spence, H. S.
	Beryl	(27)	Spence, H. S.
	Bituminous Sand	(28)	Ells, S. C.
	Cement	(29)	Goudge, M. F.
	Clays & Clay Products	(30)	Phillips, J. G.
	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)	Wait, E. H.
	Kaolin (see Clays)	~~(40)~~	~~Frechette, H.~~
	Lime	(41)	Goudge, M. F.
	Limestone (General)	(42)	Goudge, M. F.
	Limestone (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.

	Product	Article Number	Author
II INDUSTRIAL MINERALS: cont'd.:	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.
III FUELS:	Coal	(62)	Strong, R. A. & Buisson, A.
	Coke	(63)	Strong, R. A. & Buisson, A.
	Natural Gas	(64)	Warren, T. E. & Wait, E. H.
	Oil Shale	(65)	Swinnerton, A. A.
	Peat	(66)	Leverin, H. & Buisson, A.
	Petroleum	(67)	Warren, T. E. & Wait, E. H.

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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 and London.

OTTAWA, MARCH, 1940.

ALUMINIUM IN 1939

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 506,982 short tons in 1939. 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 with 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.

In the latter part of 1939 the British Government signed with the Aluminum Company of Canada, Limited, a contract under which the United Kingdom takes all of Canada's exports, although provision has been made whereby contracts signed previous to the war (Sept. 1939) will be fulfilled, thus the British Government has first call on all of Canada's productive capacity, over and above Canadian domestic requirements, or on about 90 per cent of the present capacity output. Additions to plants which will be completed about March 1940, will bring Canada's total annual productive capacity to about 100,000 tons of ingot aluminium.

The world output of aluminium in 1938 was 583,600 metric tons compared with 489,800 metric tons in 1937, (as reported by the American Bureau of Metal Statistics.) The 1939 figures are not yet available. The principal producing countries, in order of output were: Germany, United States, Canada, Russia and France. Because of the large secondary-metal industry world production of aluminium is considerably below the consumption.

The world consumption in 1937 was estimated at 501,700 metric tons, a 26 per cent increase over 1936. While no figures are available for 1938 and 1939, it is probable that the consumption is approximately 600,000 metric tons.

Imports of bauxite, alumina and cryolite were valued at $3,708,494 in 1939, as compared with $2,919,600 in 1938. Imports of metallic aluminium and its products were valued at $3,708,494 as against $1,979,600 in 1938.

The total exports of aluminium and its products were valued at $26,428,186, as compared with $23,747,900 in 1938. Aluminium ranks third in Canada's exports of base metals.

Aluminium and its alloys find numerous applications in industry owing to the special properties of the metal, such as lightness, high tensile strength, ductility and malleability, high heat conductivity and reflective power, electrical resistivity and resistance to corrosion.

Aluminium and its alloys are consumed in the following industries: transportation, electrical conductors, cooking utensils, machinery and electrical appliances, iron and steel metallurgy, foundry and metal working, building construction, chemical, food and beverage, and general miscellaneous industries.

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 ferro-aluminium-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 and 1939.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

ANTIMONY IN 1939.

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 content of antimony.

Antimony ores were mined in a small way in 1939 and experimental shipments were made from the new Fort St.James deposit in northern British Columbia, and from the old West-Gore antimony-gold mine of Nova Scotia.

The production of antimony in 1939 amounted to 1,224,385 pounds valued at $151,359, as compared with 24,560 pounds valued at $2,200 in 1938, which was the estimated recoverable metal contained in auriferous ore mined at West Gore, N.S.

Since 1917 the production of antimony ore in Canada had consisted only of experimental shipments. Production of refined antimony was started at Trail, British Columbia, during the last quarter of 1938, but shipments were made only in 1939. Previous to 1917, small amounts of refined antimony as well as antimony ore were 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 from 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.

The Trail smelter does not accept custom antimonial ore. In the United States the Texas Mining & Smelting Company with plant at Laredo, Texas, handles Mexican & South American antimony ores. The American Smelting & Refining Company is said to be considering the production of antimony at its Perth Amboy plant. The Bunker Hill smelter, Bradley, Idaho, will have in operation early in 1940, a new plant for the recovery of antimony in the form of antimony oxide and electrolytic antimony, using the new "Lee-Muir Process", which separates the silver, copper, antimony and bismuth components of tetrahedrite.

The imports of antimony in 1939 were: antimony metal or regulus, 238,909 pounds valued at $27,092, and antimony salts, 28,292 pounds valued at $7,380; the imports in 1938 were: antimony metal, 856,986 pounds valued at $85,461, and antimony salts, 66,041 pounds valued at $9,399. Canada's requirements are now being supplied mainly from the Trail plant, which explains the noticeable decrease in our imports.

The world production of antimony in 1937 (1938 and 1939 not yet available), as published by the United States Bureau of Mines, amounted to 37,300 metric tons, the highest figure of production since the 1914-1918 War years. The decline in output from China was more than made up by the large increase in production in Mexico.

The bulk of the production of antimony 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.

Refined antimony, obtained mainly from the treatment of foreign ores, is mostly produced in the United States, Great Britain, France, and Belgium.

The market for antimony depends upon general industrial activity and especially upon the demand for 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 New York price of antimony (ordinary brand) in 1939 averaged 12.359 cents a pound, as against 12.349 cents in 1938. The New York domestic price started the year at about 11½ cents and gradually increased to 14 cents in October, at which price it remained fixed up to the end of the year. The price for Chinese brand, duty paid, remained constant at 14 cents from January to the end of October, then at 16½ cents up to the end of 1939.

The United States tariff on antimony is: antimony as regulus or metal, two cents per pound; needle or liquated antimony, ¼ cent per pound.

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OTTAWA, MARCH, 1940.

BISMUTH IN 1939

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 operated 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 for refining.

The Canadian production of bismuth in 1939 (mostly metallic) was 409,449 pounds valued at $466,362 as against 9,516 pounds valued at $9,754 in 1938. No metallic bismuth was produced in 1937 or 1938.

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

The imports in 1939 were: metallic bismuth 10,252 pounds valued at $10,835 and bismuth salts valued at $8,671 as compared with metallic bismuth 297 pounds valued at $303 and bismuth salts valued at $16,756 in 1938.

Statistics of the world production are incomplete and it is estimated at between 1,000 and 1,500 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 three companies only; the American Smelting and Refining Company, The Anaconda Copper Mining 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. The Ekko process evolved by the United States Rubber Company, of Detroit, for electroforming with iron may provide a future outlet for bismuth in the form of "cerrobase," a nonshrinking Bi-Pb alloy of melting point 255 deg. C., patented by the Cerro de Pasco Copper Corporation. One application of the Ekko process is the production of dies or molds in which a photographic likeness can be transferred to iron.

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. The price in 1939 was $1.00 for January and February; $1.10 from March to October, and $1.25 for November and December. For several years the United States price has been maintained a little below the European parity, plus duty of $7\frac{1}{2}$ per cent ad valorem, chargeable upon imports into the United States. For several years now the price has been well controlled.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

CADMIUM IN 1939.

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, operates a cadmium recovery plant 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 cadmium plant, which started production in 1936, operated continuously throughout the year treating all current purification precipitates from the Company's zinc plant. The metallic cadmium production was somewhat lower than it was for the previous year.

The Canadian production in 1939 was 939,691 pounds valued at $662,209, as against 699,138 pounds valued at $561,799 in 1938.

Canadian production of cadmium is exported chiefly to Europe. The exports in 1939 were 1,049,853 pounds valued at $788,180. Of this amount, 978,525 pounds went to Great Britain, 60,128 pounds to the United States, and 11,200 pounds to the Netherlands. The exports previous to 1939 are not reported separately.

The world's production in 1939 is estimated at 5,000 short tons. The production in 1938, as published by the American Bureau of Metal Statistics, was 4,200 short tons. The chief producing countries are in order of output: the United States, Germany, Canada, Mexico, Belgium, Australia (Tasmania), Poland, Norway, England, Russia, and France. The Mexican output is contained in ores exported for treatment in various countries. The United States production in 1939 was 2,050 tons, and sales were 2,400 tons, the highest on record.

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.

Cadmium is used 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 1939 averaged 70.47 cents per pound, as against 80.36 cents in 1938 and $1.64 in 1937, (London prices in Canadian funds). The price in New York averaged 64.06 cents, as against 98.04 cents in 1938 and $1.22 in 1937. The American product is protected by a duty of 7½ cents per pound; previous to the November 1938 Trade Agreement the duty was 15 cents per pound.

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OTTAWA, MARCH, 1940.

CHROMITE IN 1939

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 1914-1918 war period. Since 1923, only a few small shipments have been made. The Asbestos Corporation of Canada, in recent years, has mined chrome ore at one of its properties in the Thetford asbestos field, in southern Quebec. Some of the old chromite deposits in the Eastern townships are being investigated, and, if market conditions are favourable, production may be obtained from this source in 1940.

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, was under development in recent years by the Chromium Mining and Smelting Corporation. Experimental shipments were made from the property to test plants, and to the company's own smelter in Sault Ste. Marie. The ore proved to be too low grade for economic operation under present conditions.

In British Columbia, exploration and development have been done at several properties and occasional experimental shipments have been made in the past.

Several deposits of chromite have been investigated in the vicinity of Ashcroft. The only known large occurrence in this area is that near Scottie creek, about 20 miles north of Ashcroft. This deposit was extensively explored and developed several years ago by the Consolidated Mining and Smelting Company of Canada. The ore proved to be too low grade (10 to 15 per cent) to permit operations except under specially favourable market conditions, and would necessitate the building of a beneficiation plant.

The Calgary Mineral Syndicate did some prospecting in 1939 on a chromite deposit situated about 5 miles northeast of Ashcroft. A chromite occurrence on Castle Mountain, about 6 miles southeast of Cascade, was prospected in a small way.

A new discovery of interest was made during the year on Chrome ridge. This occurrence is about 25 miles west of the village of Westbank, which is on the west shore of Okanagan lake. The property is being developed by Chrome Ridge Mining Syndicate of Penticton. An analysis of a sample of the ore made by the Bureau of Mines, Ottawa, gave 26.6 per cent chromium oxide (Cr_2O_3) and 10.7 per cent iron.

No commercial production of chromite was reported in 1938 and 1939, whereas the shipments were valued at $43,250 in 1937.

The imports of chrome ore into Canada in 1939 were 16,584 tons valued at $232,851, compared with 9,103 tons valued at $142,400 in 1938 (last nine months).

Imports of chromium products in 1939 include sodium bichromate, 3,246,413 pounds valued at $211,173; potassium bichromate, 188,479 pounds valued at $16,819; chrome firebrick to the value of $88,367; nickel-chromium bars and rods, containing more than 10 per cent chromium, 48,597 pounds valued at $48,616; and chromium metal and tungsten metal, and scrap alloys of these two metals, 55,428 pounds valued at $50,769.

The world annual production of chromite is estimated at 1,000,000 to 1,300,000 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.

The Chromium Mining and Smelting Corporation, Limited, continued their programme of plant expansion and research development at Sault Ste. Marie, Ontario. The Company now have five furnaces, sintering plant, roasting plant, and complementary equipment for the production of their various chrome products; also a new line of exothermic alloying materials in which the silicon thermal principle has been adapted to Ni, Cu, Si, Fe, etc. The expansion programme included the erection of two new buildings, one of which houses the roasting and sintering plants, the other a complete machine shop for maintenance and repair work. The Company's former furnace building was also considerably extended so as to provide sufficient room for the two new 5500 KVA furnaces which were installed.

In the Chrome field, in addition to manufacturing the low carbon Chrom-X, the Chromium Mining and Smelting Corporation, Limited, have now developed a high carbon Chrom-X. This product, similar to the low carbon Chrom-X, is an exothermic chromium alloying agent and differs chiefly in having a higher carbon and also a higher metallic content. This new grade of Chrom-X is used in the foundry trade, and also for the making of the lower chrome high carbon steels.

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 use. For metallurgical use, ores high in chromium oxide (Cr_2O_3) and low in iron are desired, a chromium-iron ratio of 3 to 1 being 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 containing not more than 8 per cent of silica. In addition to the chromite used in the manufacture of chromic acid for electroplating, much chromite is consumed in chemicals used principally in dyeing, tanning, and pigments. 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 1939 decreased from about $22 in January to $18 in August, then rose to $25 in October, and was quoted at $26 to $28 for December. 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, 1940.

COBALT IN 1939

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 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.

Production has been mentioned in recent years by lessees working over old surface dumps, mining narrow surface veins and old underground workings.

Cobalt Products Limited, of Cobalt, Ontario, put in operation in the latter part of 1938 a 100-ton concentrating plant and is now the main cobalt producer in Canada. The ore is obtained from various surface dumps and from underground work at one or two properties. Flotation concentrate carrying 10 to 18 per cent cobalt is either sold direct or is treated in a cupola to produce a silver-cobalt matte.

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 1939 was 732,561 pounds valued at $1,137,599 as against 459,226 pounds valued at $790,913 in 1938.

The imports of Cobalt ore in 1939 were 271 tons valued at $148,410. The imports of Cobalt oxide were 525 pounds, valued at $301 compared with 736 pounds valued at $1,094 in 1938.

The exports were as follows:

	1939		1938	
	Pounds	Value $	Pounds	Value $
Cobalt contained in ore	204,100	178,043	66,400	40,983
Cobalt alloys	133,679	264,861	49,674	79,278
Cobalt metallic	2,600	3,250	83,579	122,101
Cobalt oxides & salts	606,942	814,807	382,408	523,218
	947,321	$1260,961	582,061	$765,580

The Cobalt Association comprises leading Canadian, Belgian, 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 annual world 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.

In 1939, the Union Minière du Haut Katanga produced more cobalt than in 1938. In 1939 it started operations at a big cobaltiferous mine at Kabolela, where it built a concentrator to enrich its ores. This did, however, not prevent the Union Minière from continuing to treat at Jadotville-Panda cobaltiferous ores from other mines.

The cobalt alloys produced at Jadotville-Panda (white alloy containing 40 per cent cobalt and red alloy containing 5 to 6 per cent cobalt) are, like the Kabolela concentrates, shipped to Oolen, Belgium where the Société Génerale Métallurgique de Hoboken produces cobalt metal, cobalt oxide and cobalt salt.

Cobalt is now produced in the United States as a by-product of the new electrolytic manganese manufacture, in as much as nearly all manganese ores contain from a hundredth to a few tenths of a per cent of cobalt.

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 most of 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.

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 Metal and Mineral Markets) for cobalt metal imported from Belgium, remained at $1.92 per pound throughout the year. The nominal price for cobalt ore, 13 per cent grade, f.o.b. cars, Ontario, 70 cents per pound of cobalt throughout the year. The price paid during 1939 averaged about $1.00 per pound of cobalt contained in the concentrate.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

COPPER IN 1939

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 mine, in Quebec; the copper-zinc ores of the Flin Flon and Sherritt-Gordon mines in northern Manitoba; the copper-zinc-pyrites ores 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 pyrites concentrates, which are exported. Improvements and additions to the mill resulted in record metallurgical recoveries during the year. The Granby Consolidated Company operated at full capacity its Copper Mountain mine and the Allenby 4000-ton concentrator near Princeton; the copper concentrate produced is being exported.

In Manitoba the Flin Flon mine, concentrator and smelter of Hudson Bay Mining & Smelting Company operated at capacity during the year. During the latter part of 1939 the daily tonnage of ore treated in the concentrator was increased to 5,000 tons per day from the previous average of 4,550 tons, and certain changes were made in the flow sheet to permit satisfactory handling of the increased tonnage. A second main hoisting shaft for the mine was started during the year. The surface plant for this new shaft was completed except for the ore hoist. Full size sinking was completed from the surface to a depth of about 700 feet, and an additional 1,300 feet of pilot raise and winze work was done from underground workings.

The installation of a fifth generating unit at the Island Falls hydro-electric power plant of the Churchill River Power Company, Limited, was completed and the unit was put into operation in April. The present total rated generating capacity of the power plant is 90,000 H.P.

The copper smelter with an annual rated capacity of 45,000 short tons treated a slightly higher tonnage of both Flin Flon materials and Sherritt-Gordon custom concentrate, and operated up to capacity throughout the year. The third converter was installed late in the year.

In Ontario, the International Nickel Company of Canada, Limited, operated Frood, Frood Open Pit, Creighton, Levack and Garson mines. No.2 Shaft installation at Levack mine went into ore production in July. Ore shipments from the Frood Open Pit development started in January. At Garson mine the sinking of No.2 Shaft was started in the month of April and had reached a depth of 407 feet by the end of the year. The 16,000-ton concentrator and the smelter at Copper Cliff were operated to capacity.

Development at the Falconbridge mine was restricted to lateral development, the shaft remaining at the 2450 level plus sump. Enough new ground was opened up to replace the 585,661 tons of ore hoisted and to add over 600,000 tons to the reserves, which stood at 7,502,000 tons at the end of the year. No exploration was undertaken at any of the outside properties of the Company.

A fourth ball mill was added to the concentrator during the year, and the percentage of ore milled, which averaged 57.7 for the year, rose to 62 by year-end. A dryer for the largely increased tonnage of concentrate was added, and by sundry changes of flow-sheet, the milling capacity was increased to produce 16,965.3 short tons of matte, containing 9,232.5 short tons Nickel and 4,691.9 short tons of Copper, all of which was shipped to the Company's plant in Norway for refining.

The Denison Nickel Mines, Limited, with property in Denison township, northwest of Sudbury, continued its development program.

The Ontario Nickel Company, owning property in the Sudbury district and other parts of Ontario, did not operate in 1939.

In Quebec, Noranda Mines, Limited, operated the Horne Mine, the 3,000-ton concentrator and the smelter at capacity during the year. Exploration and diamond drilling were continued on the levels from 3500 to 4000 feet and sinking was commenced of an inside shaft from the 3000 foot level to an immediate objective of 5000 feet. Backfilling of underground stopes was begun in May, at a rate of 7000 - 8000 tons per day, using a mixture of reverberatory furnace slag reclaimed from old dumps, granulated current slag and pyrrhotite tailings from the concentrator. About 100 tons per day of pyrite concentrate, a by-product of the milling process, is being marketed for acid manufacture. Smelter output is about 55,000 tons of anode copper per year.

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 are produced copper concentrate and a high grade iron pyrites concentrate; the latter is being exported to chemical plants in the United States.

The Waite-Amulet continued the exploration and development of the large high-grade orebody discovered in 1938. The new development and ventilating shaft was completed to a depth of 1120 feet and connection on the 1000-foot horizon with the central shaft by a 2000-foot drift is expected to be completed in the spring of 1940. The new 1000-ton concentrator was completed and put in operation in October.

The Eustis mine in southern Quebec, operated by the Consolidated Copper & Sulphur Company, Limited, was closed in June, 1939, and the surface plant dismantled and sold. This was Canada's oldest copper mine. It had been in almost continuous operation and production for close to 75 years, and had reached a depth on the incline of 7,400 feet. The extensive development of recent years failed to prove any extension of the orebody.

The Abana mine of the Normetal Mining Corporation, north of Dupuy Station on the Canadian National Railway, operated to capacity its 500-ton concentrator. The copper concentrate produced is shipped to Noranda, and the zinc concentrate is exported.

The copper refinery of the International Nickel Company at Copper Cliff, Ontario, was operated at full capacity. This plant was enlarged during 1939 by about 25,000 tons to an annual capacity of 145,000 tons. It treats the entire output of blister copper produced at its nearby smelter. The blister copper goes in molten form to the refinery's anode furnace; refined copper is produced from reverberatory furnaces and from electric furnaces of the arc type; a second unit of the electric furnace was put in operation in 1939. A feature of the special shapes department is the production of machine-pointed vertically-cast wire bars.

The copper refinery of the Canadian Copper Refiners, Limited, at Montreal East, Quebec, was also operated to capacity. This plant was enlarged during the year by 20,000 tons to an annual capacity of 100,000 tons of refined copper. It treats the anode copper from Noranda smelter and the blister copper from the Flin Flon smelter.

The total Canadian production in 1939 was 304,051 tons, valued at $60,860,234, as against 285,625 tons valued at $56,554,034 in 1938; of the total production, Ontario contributed 54 per cent, Quebec 19 per cent, Manitoba and Saskatchewan 14 per cent, and British Columbia almost 12 per cent.

The exports of copper were valued at $53,227,919, compared with $53,314,802 in 1938. The exports were as follows:

	Pounds	$
Copper fine in ore, matte, etc.	121,500,900	8,505,064
Copper blister	31,111,800	3,113,742
Copper, old and scrap	6,930,000	544,901
Copper in ingot, bar, rod, etc.	331,637,700	33,730,487
Copper in rod, strip, sheet, plate and tubing	58,739,300	6,501,892
Copper wire and cable		776,888
Copper manufactures		54,945

The imports were valued at $1,171,475, compared with $962,928 in 1938. The imports in 1939 included: copper in bar, rod, block, pig, etc., valued at $393,611, and manufacturers and compounds valued at $777,864.

Owing to the special revenue tariff of 4 cents a pound, sales of Canadian refined copper in the United States had ceased in 1933, but were resumed in 1937 and continued in 1938 and 1939; 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 1939, as reported by the American Bureau of Metal Statistics, was 2,356,800 tons, compared with 2,184,300 tons in 1938, and 2,504,000 tons in 1937.

Comparative Table of World and Canadian Production
(in short tons)

Year	World	Canada	Percentage of total
1913	1,099,500	38,500	3.5
1929	2,119,200	124,000	5.9
1938	2,140,100	285,600	13.3
1939	2,356,800	303,100	12.9

The greater part of Canadian refined copper goes to Great Britain, where the consumption of new copper, previous to 1939, was at the rate of about 250,000 tons annually.

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 United States domestic consumption rose from a low of 50,000 tons a month in April to about 90,000 tons for December. The total consumption for the year 1938 (1939 not yet available) approximated 522,000 tons compared with 878,200 tons in 1937. In normal times the building industry is as large a consumer of copper and its alloys as is the automobile industry. Copper is considered one of the principal strategic metals in war-time.

Possibly one of the most interesting recent outlets for copper is the inclusion of small amounts in steels and irons to improve their resistance to corrosion and their mechanical properties. As this is a relatively new development, for the time being it represents complete absorption of copper, as hardly any of the material has had time to revert to the steel market in the form of scrap. Beryllium-copper is a new alloy, the use of which is gradually increasing; its consumption is partly curtailed owing to the fact that beryllium-copper is a material demanding special treatment and proper understanding. (London Metal Bul. January 26, 1940.)

The world's consumption of copper in 1938 (1939 not yet available) as given by the American Bureau of Metal Statistics, was 2,177,800 short tons, compared with 2,407,700 short tons in 1937. Canada is now contributing about 15 per cent of the total world production.

Canadian copper producers cooperated in the fall of 1939 in arranging a contract with the Government of the United Kingdom to supply 210,000 short tons (about 70% of this output) of electrolytic copper at prices prevailing immediately prior to the outbreak of the war. Producers on the Pacific coast are continuing to export their product for treatment abroad.

The price of electrolytic domestic copper (London price transferred to Canadian funds) averaged 10.092 cents per pound in 1939, as against 9.972 cents in 1938 and 13.078 cents in 1937.

The New York price of domestic electrolytic copper averaged 10.965 cents a pound in 1939, compared with 10.0 cents in 1938. 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, 1940.

GOLD IN 1939.

The chief source of gold in Canada in 1939 was, as for many years past, the gold-quartz mines which contributed about 85 per cent of the total. The base metals mines contribution was 12 per cent, and the balance of about 3 per cent was obtained from alluvial placer operations.

Ontario is by far the most important producing province, contributing over three million ounces, or three-fifths of the total Canadian production. With the exception of the gold obtained as a by-product in the refining of nickel and copper (about 85,000 ounces), virtually all Ontario's gold comes from gold-quartz mines, Porcupine and Kirkland Lake being the principal producing areas. Important contributions (about 719,000 ounces) 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 Temiskaming 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 country, and the Arntfield, Duparquet, Rouyn and Mud Lake areas in Temiscamingue county.

The chief source of gold in British Columbia is the gold-quartz mines of the 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 the 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 partly from the copper-zinc-gold ores of the Flin Flon mine supplemented to a small extent by the Sherritt-Gordon mine, and to a greater extent (about 55%) 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 mainly from that portion of the Flin Flon mine lying west of the interprovincial boundary, and to a small extent 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; Hollinger Consolidated Gold Mines, Ltd., at Timmins, Ontario; International Nickel Company of Canada, Ltd., at

Copper Cliff, Ontario; Canadian Copper Refiners, Ltd., at Montreal East, Quebec; and 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 1939, 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.

In 1939, 158 gold mills were in operation, with a combined daily capacity of 57,400 tons. Of this total 15 small plants were in operation only intermittently, and 14 plants ceased operation in the course of the year. New mills completed and put in operation numbered 25 with a combined daily capacity of 4,830 tons. In addition, there were 5 mills, with a combined daily capacity of 640 tons, under construction and scheduled to come into production in 1940.

In 1938 the total number of mills was 157, with a combined daily capacity of 50,925 tons. Twenty-five small mills operated intermittently and 15 plants ceased operation in the course of the year. New mills put in operation numbered 37, with a combined daily capacity of 6,265 tons. In addition, 11 mills were under construction.

Increases to plant capacity in 1939 took place at 32 plants and totalled 2,985 tons, compared with 34 plants and a total of 2,430 tons in 1938.

In Nova Scotia, the Killag mill was renovated and operated for a short time. Several old properties were again put in operation in a small way. The two largest plants in Nova Scotia, the Seal Harbour (250-ton) and the Guysborough (100-ton) were operated continuously and to capacity.

In Quebec, the new mills were: Malartic Goldfields with 300 tons, Wood-Cadillac with 225 tons, Amm gold with 175 tons, and Central Duverny with a 25-ton mill.

In Ontario, the new mills were: Chesterville Larder Lake and Uchi, each with a capacity of 500 tons; Preston East Dome with 400 tons; Berens River with 250 tons; Tyranite and Upper Canada, each with 200 tons; Cochenour Willans and De Santis, each with 150 tons; Cordova and Ronda (now idle), each with 125 tons; Kenricia and Magnet, each with 100 tons; Hiawatha with 50 tons, and the Ranson with a capacity of 25 tons.

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

In Saskatchewan, the 1,000-ton mill of the Box property near Goldfields operated by the Consolidated Mining and Smelting Company, was put in operation in June. The adjoining Athona property was under development.

In British Columbia, the new mills were: Monashee Development 60-ton mill, near Lumby; Mount Zeballos 50-ton mill, and Central Zeballos 25-ton, both on the west coast of Vancouver Island.

In the Northwest Territories, the only new mill was the 50-ton mill of the Negus, Yellowknife Bay, Great Slave Lake.

In the Yukon Territory, a 25-ton mill was put in operation by Richards and Keobke of Carmacks.

The gold production of the Dominion in 1939 was 5,095,176 fine ounces, valued at $184,144,756, compared with 4,725,117 fine ounces, valued at $166,205,990 in 1938, a gain of 370,000 fine ounces and of $17,939,000. The 1939 output was an all-time high record.

By provinces the production was as follows:-

	1939		1938	
	Fine ounces	$	Fine ounces	$
Nova Scotia	29,943	1,082,170	26,560	934,248
Quebec	953,478	34,459,648	881,263	30,998,426
Ontario -				
Porcupine			1,258,671	44,273,752
Kirkland Lake ..			1,030,829	36,259,410
Others			606,977	21,350,416
Total Ontario	3,086,224	111,539,222	2,896,477	101,883,578
Manitoba	180,867	6,536,714	185,706	6,532,209
Saskatchewan	77,120	2,787,194	50,021	1,759,489
Alberta	359	12,975	305	10,728
British Columbia..	629,037	22,734,026	605,617	21,302,578
Yukon & N.W.T. ...	138,148	4,992,807	79,168	2,784,734
CANADA	5,095,176	184,144,756	4,725,117	166,205,990

The value of Canada's gold production in 1939 was about 50 per cent of the total value of all metals and 35 per cent of the total value of the entire output of the Canadian mineral industry.

The world production of gold in 1939 is estimated at 39,780,000 fine ounces (as given by the Engineering and Mining Journal), compared with 37,942,700 fine ounces in 1938 (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. In the past 15 years the gold production of the world has more than doubled. The United States Treasury continued to add to its gold reserves, now valued at 17.7 billion dollars, said to be equal to about two-thirds of the world's monetary gold.

The price of gold during the first eight months of 1939 was slightly more than $35 per fine ounce. After war was declared the price rose in September to an average of $37.21 as a result of the adverse exchange with the United States; in the latter part of the year, in view of the premium of 10 per cent on United States funds, the price has been averaged about $38.50. The average at which Canada's gold production was computed for the year was $35.926 per fine ounce.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

IRON ORE IN 1939

Deposits of iron ore in Canada are numerous and widespread. These deposits include hematite, siderite, magnetite, bog iron and magnetic sand. Because of the availability of higher grade ores in the Lake Superior (United States) iron ranges, and in Newfoundland at relatively low cost, the domestic iron and steel industry used no Canadian ore from 1923 until 1939 (a period of 16 years) when the production of iron ore in Canada was resumed.

Algoma Ore Properties, Limited, a wholly owned subsidiary of Algoma Steel Corporation, Limited, stimulated by the bounty of two cents a unit provided by the Ontario Government, began in 1937 preliminary development work at its new Helen Mine in the Michipicoten area, Algoma district, Ontario, and the property was brought into production in the summer of 1939, the first sinter being made in July, 1939.

The New Helen deposit is estimated to contain at least 100,000,000 tons of carbonate ore, averaging about 35 per cent iron, and to fit it for commercial use in blast furnaces a Sintering Plant capable of treating 3,000 tons of ore a day has been built, the sinter being of the following analysis:

Iron	53.40%	Alumina	2.06%
Phosphorus	0.03	Lime	3.95
Silica	7.00	Magnesia	7.50
Manganese	3.00	Sulphur	0.035

Total shipments of sintered ore in 1939 were 110,315 tons. The beneficiated ore is shipped to the company's blast furnaces at Sault Ste. Marie, Ontario.

A new and important producer in 1940 will be the Steep Rock Lake Iron Mines Ltd., from its Steep Rock Lake property, near Atikokan, Thunder Bay district, and about 135 miles west of Port Arthur, Ontario. This property was discovered in the winter of 1937-1938 by diamond drilling through the ice, and has since been under intensive development. A shaft is being sunk to the ore body to a depth of about 1,000 feet and production is expected by the summer of 1940. This deposit is probably one of the most important mineral discoveries made in Canada for some time.

Under present day conditions and aided by the Ontario bounty of 2 cents a unit, it is possible to work these deposits profitably.

In Nova Scotia, the Dominion Steel & Coal Corporation with plants at Sydney, Cape Breton, draws its ore supply from its own mines at Wabana, Newfoundland.

In Ontario, the plants of Steel Company of Canada at Hamilton, and of Canadian Furnace Limited, at Port Colborne, draw all their iron ore supplies from the Lake Superior region of the United States. The Algoma Steel Corporation supplements its requirements with imports from the same source.

Bounties on the production of iron ore are offered by the provinces of Ontario (as above stated) and British Columbia.

The production of iron ore in 1939 was 123,598 tons valued at $341,594. As previously stated there had not been any production since 1923.

Imports in 1939 of iron and its products (including iron ore to the value of $4,179,353) were valued at $183,159,650 of which $158,138,245 came from the United States and $19,253,070 from Great Britain.

Imports in 1938 of iron and its products (including iron ore to the value of $2,830,500) were valued at $162,554,200, of which $134,844,200 came from the United States and $21,646,200 from Great Britain.

Exports in 1939 were valued at $63,102,432 of which $4,954,238 went to the United States and $15,976,901 to Great Britain. The exports in 1938 were valued at $60,139,369 of which $4,148,832 went to the United States and $13,517,445 to Great Britain.

The demand for primary iron and steel was supported in 1939 by the heavy demand for war purposes.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

LEAD IN 1939

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.

In British Columbia, the Sullivan mine at Kimberley, 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. The lead-zinc mine of the Base Metals Mining Corporation, Limited, located near Field, B.C. was idle all the year until about December 15th, 1939, when preparations were started to re-open the mine and operate the 300-ton concentrator. Production did not, however, get started until January 15th, 1940. The mine and concentrator of the Whitewater at Retallack was worked for part of the year; several other properties in this area (Ainsworth-Slocan) such as the Lucky Jim, Mammoth, McAllister and Utica, were under development and occasional shipments were made. With higher lead and zinc prices, the above mentioned properties and several others in British Columbia are expected to become fairly regular producers in 1940.

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 1939; the lead and zinc concentrates when produced were exported.

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 close to capacity.

The Canadian production of lead in 1939 was 194,189 tons valued at $12,307,727, compared with 209,464 tons valued at $14,008,940 in 1938.

The exports of lead in ore, pig, etc., in 1939 were 184,838 tons, valued at $9,850,076, compared with 158,513 tons valued at $8,983,200 in 1938; and white lead, 128 tons valued at $20,931 in 1939, compared with 35 tons valued at $5,700 in 1938.

The total imports of lead and lead products in 1939 were valued at $3,367,822, compared with $2,879,800 in 1938.

The world production in 1939, as published by the American Bureau of Metal Statistics, was 1,904,900 short tons, compared with 1,845,636 tons in 1938, and a maximum production of 1,933,000 short tons in 1929. Canada contributes over 10 per cent to the world's production of lead. The principal producing countries are, in order of importance: United States, Mexico, Australia, Canada, Germany, Belgium, India(Burma), and Russia.

Comparative Table of World and Canadian Production
(in short tons)

Year	World	Canada	Percentage of total
1913	1,297,600	18,800	1.4
1929	1,932,500	163,300	8.4
1938	1,845,600	209,500	11.3
1939	1,904,900	194,200	10.2

The world consumption in 1938 (1939 not yet available, as given by the American Bureau of Metal Statistics, was 1,802,150 short tons, compared with 1,908,870 short tons in 1937. The Canadian consumption of lead is probably between 35,000 and 40,000 short 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. Lead has so many diversified uses that improved business in any direction is bound to reflect in the lead market.

Radio-active lead chloride and radio-active lead oxide is now being produced as a by-product at the radium refinery at Port Hope, Ontario.

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 has been the building activity and the increased armament requirements. The consumption is estimated at 425,000 - 450,000 short tons.

The average price of pig lead (quotations on the London market, converted to Canadian funds) in 1939 was 3.169 cents a pound, compared with 3.35 cents in 1938. The average price at New York was 5.05 cents, compared with 4.74 cents in 1938.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

MANGANESE IN 1939

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. Manganese being considered a war mineral, much interest in old properties and search for new deposits have been in evidence since September 1939.

The production of manganese ore in Canada in 1939 was 396 tons valued at $3,688. There was no production reported in 1938. There was a production of 85 tons valued at $817 in 1937.

The imports of "manganese oxide" in 1939 were 29,787 tons valued at $621,931 compared with 21,050 tons valued at $463,673 in 1938.

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 is estimated to exceed 6,000,000 metric tons. The production in 1937 (1938 & 1939 not yet available), as reported by the United States Bureau of Mines.

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 duty on manganese ore or concentrate and manganiferous iron ore, containing in excess of 10 per cent of metallic manganese, imported into the United States is ½ cent per pound of metallic manganese.

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 duty on ferro-manganese of a grade of 30 per cent or more, imported into the United States is approximately 2 cents per pound.

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 electrolytic production of metallic manganese announced two years ago by the U. S. Bureau of Mines has been improved and commercial production was begun in 1939 at Knoxville, Tenn., by the Electro Manganese Corporation.

The process for making electrolytic manganese and the properties of many of the alloys made from electrolytic manganese have been described by the U. S. Bureau of Mines (R. I. 3477, Nov. 1939). Manganese alloys with a few per cent of copper and nickel are said to be ductile and may be rolled or drawn. With suitable heat treatment they develop exceptionally high vibration damping capacity and electrical resistance.

Under the Strategic Materials Act considerable reconnaissance work was conducted in the United States by the Government agencies in areas that are known to contain manganese.

The price of manganese ore in 1939 at North Atlantic ports for 46 to 48 per cent manganese, Brazilian, was 27 cents per unit from January to September, 40 cents for October, 43 cents for November and 45 cents for December; for South African ore, 50 to 52 per cent manganese, the price was 28 cents per unit from January to September, and 45 to 50 cents from October to December; for chemical grades 80 per cent MnO_2, the price was $45 per ton throughout the year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

MERCURY IN 1939.

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 also been noted.

The improvement in the price of mercury and war requirements have encouraged further exploration for mercury deposits in Canada. In British Columbia development work was done on a number of properties. The new Pinchi Lake deposit near Fort St.James in nearing the production stage, and a substantial output is expected from this source in 1940. This property, which is controlled by the Consolidated Mining & Smelting Company, is located 19 miles, by water and trail, northwest of Fort St.James, which is 42 miles north of Vanderhoof, a station on the Canadian National Railways line. A 50-ton reduction plant is being considered.

The Empire Mercury Mines, Ltd., in the Bridge River area, built a 10-ton Gould reduction furnace, really a testing unit, and started production in the fall of 1938. The plant was operated for two months early in 1939. The product is marketed in Vancouver, and is sold mainly to gold mine and placer operators in British Columbia.

The production in 1939 was 436 pounds (5.7 flasks), valued at $1,226, compared with 760 pounds (10 flasks), valued at $760 in 1938. 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 1939 were 109,232 pounds valued at $165,489, compared with 49,504 pounds valued at $49,564 in 1938. In addition, mercury salts were imported valued at $9,486 as compared with $5,083 in 1938.

The world production of mercury in 1939 approximated 5,000 tons, chiefly from Spain and Italy. Under the stimulus of increased demands and higher prices, it has considerably increased over the production of recent years. Other important producers are: the United States, Mexico, and Bolivia.

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.

Mercurio Europeo resumed combined selling of Italian and Spanish mercury in May, 1939.

The average New York price of mercury in 1939, in flasks of 76 pounds, was $103.94, compared with $75.47 in 1938. During the last quarter of 1939, due to war conditions, the price was $140 to $145 a flask. In January, 1940, the price fluctuated between $142 and $158, and in February, between $175 and $182 a flask.

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MOLYBDENUM IN 1939

Molybdenite, the chief ore of Molybdenum, is a soft and shiny steel blue-grey coloured sulphide containing 60 per cent of the metal. In Eastern Canada it is usually found in pegmatite dykes or along the contacts of limestone and gneiss, commonly associated with greenish-grey pyroxenites in which other metallic minerals, such as pyrite and pyrrhotite, often occur. In northern and western Ontario and in British Columbia, molybdenite is usually associated with quartz veins, intruding granites, or diorites.

During 1939 active prospecting or development was being undertaken on about seventy-five different properties throughout the Dominion, about half of which were in Ontario.

In southeastern Ontario there were about sixteen properties being actively prospected along the main molybdenite belt stretching northeasterly from Peterborough. In the northern part of the province from the Manitoba to the Quebec boundaries along and to the south of the Canadian National Railways main line, about seventeen properties were prospected and five in the Algoma district. The only producer was in the latter district where the Regnery Metals, near Hawk Junction, put a few hundred tons through a small 10-ton mill. Less than two tons of medium quality concentrate, somewhat high in copper was produced, a few hundred pounds of which were shipped. As the ore proved to be considerably lower grade than was originally estimated, the property closed down in January 1940.

In Quebec, activity was reported on eight properties in the vicinity of the Canadian National Railways main line. A bulk sample of eight tons of ore averaging 0.44 per cent molybdenite was sent to the Bureau of Mines, Ottawa, by the Molybdenum Corporation of Canada from its property twenty miles northwest of Val d'Or in the Abitibi district. A few years ago this company opened up some wide quartz-molybdenite veins to a depth of 250 feet and made some concentrate in their pilot mill; about a ton of this concentrate was shipped to England in 1939. In the southern portion of the province prospecting was active on thirteen properties in the region north and northwest of Ottawa. The most promising operations at present are those of the Quyon Molybdenite Company at the old Moss mine, near Quyon. This mine was the outstanding producer during the last war and accounted for 78 per cent of Canada's molybdenum output during 1915-18. Several of the ore bodies on this property were opened up during the year and two or three hundred tons of ore averaging 1.5 per cent molybdenite, mainly from No. 4 deposit, were shipped to the Bureau of Mines, Ottawa, for concentration tests, from which three to four tons of high grade concentrate was produced. The company also acquired the Kert (Old Ross) property, twelve miles northeast of the Moss Mine and shipped ten tons of almost 2 per cent ore to Ottawa. It is proposed to erect, early in 1940, a 100-ton mill and to produce about a ton concentrate daily.

In British Columbia there was activity on about a dozen properties, none of which at present show indication of being a probable future producer. Many of the British Columbia molybdenite properties have been examined and reported upon recently by Dr. John S. Stevenson of the Department of Mines, Victoria, B. C.

Prospecting was carried out on one property each in Saskatchewan, in Manitoba, and in New Brunswick.

In spite of considerable activity throughout Canada, the only molybdenite concentrate produced was a small amount by the Regnery Metals and about 3½ tons at the Bureau of Mines, Ottawa, from ore shipments from four or five properties, mostly from the Moss Mine, Quyon. This concentrate is at present stored at Ottawa. About 1½ tons of concentrate valued at $713 was shipped by individual companies.

Canada imported the equivalent of 72 tons of molybdenum in the form of calcium molybdate (41% Mo), ferromolybdenum (60% Mo) and molybdic oxide briquettes. In the previous year the imports were 181,377 pounds of the molybdate, and 59, 317 pounds of the ferro--equivalent to 55 tons of metallic molybdenum.

The world production in 1939 of metallic molybdenum was about 16,500 tons, against 17,000 tons in 1938. The United States contributed about 15,500 tons, which was about 1,000 tons of the metal less than the all-time record of 1938. The Climax Molybdenum Company at Climax, Colorado, produced 10,900 tons as against 14,000 tons in 1938. This decrease was due to a reduction in the ore treated from 12,000 to 7,500 tons daily for six months in the middle of the year; but from the last quarter to date the larger amount is being milled daily. The total output from the other United States producers increased from 2,500 tons in 1938 to 4,600 tons of metallic molybdenum in 1939. This was mainly due to the increase in the output of molybdenite concentrate as a by-product from several United States copper operations.

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 806 tons of the metal. The Knaben mine in Norway produced 750 tons of molybdenite concentrate. 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 Korea, Greece and Turkey; about 300 tons from Ricran in Peru; about 200 tons of concentrate annually from the Azagour district in French Morocco; and recently, molybdenite concentrate is being recovered as a by-product from the Braden copper mine at Sewell, Chile.

Molybdenum is used chiefly in steel to intensify the effects of other alloying metals, particularly nickel, chromium, and vanadium. The amount used in these steels is only from 0.15 to 0.4 per cent. The greatly extended use of molybdenum in many fields has caused a steady and considerable increase in consumption.

Molybdenum alloys are being extensively used for the hard-wearing and other important parts in aeroplane construction, for seamless steel tubing, and for the hollow steel propellor blades; also in the manufacture of shell steels and in armour plating; as high grade structural steels, etc. In Germany this metal is said to have entirely replaced nickel for automobile and heat-resisting steels. Molybdenum-vanadium high-speed tool-steels are replacing, in some instances, high tungsten high-speed steels with improved all-round efficiency, and in other instances molybdenum is successfully combined with the tungsten. The use of molybdenum in cast iron has increased considerably in recent years. A new magnetic alloy for permanent magnets contains 30 per cent of molybdenum combined with cobalt and iron.

Much molybdenum wire and sheet is used in the radio industry, and new alloys suitable for electrical contacts and for heating elements contain molybdenum. The chemical applications of the metal continue to grow. In a new blackplating process, 45 per cent of molybdenum combined with 10 per cent of nickel, known as "Moly Black", produces lustrous deep black electro-deposits, superior in colour to any before known. The rate of deposition is 20 times faster than with nickel alone, and is applicable to bases of many metals.

Until recently molybdenum was introduced into steel either as calcium molybdate or as ferro-molybdenum, but during the past year or two new forms of the addition agent have been marketed, such as molybdic oxide briquettes, or as "molyte", a compound of molybdenum oxide, lime and flux-forming oxides. The American product is sold in bags each containing 5 pounds of molybdenum and the English product of the same name is sold in solid blocks containing 4 pounds of the metal. It is now announced that the sulphide (concentrate) itself is being added direct with beneficial results from a machining standpoint.

The consumption of molybdenum in England is substantial. During 1938 about 2,000 short tons of metallic molybdenum was consumed, all of which came from the United States, except 20 tons from Australia. Consumption in England is expected to increase considerably during the present war.

The price at New York of 90 per cent molybdenite concentrate is nominally 45 cents per pound of contained molybdenum sulphide (49 cents in Canadian funds), but the duty on ore or concentrate into the United States is 35 cents per pound on the metallic molybdenum contained therein (about 20 cents per lb. for a 90 per cent concentrate). The price in England is nominally 48 cents (50 shillings a long ton unit) f. o. b. English port. Calcium molybdate is about 87 cents and ferro-molybdenum about $1.05 per pound of contained molybdenum f. o. b. Montreal.

The present situation for the production of molybdenite in Canada is very different from that of the last war when available supplies were comparatively small, and the price over double what it is today. At present there are no metallurgical plants in Canada converting the concentrate into suitable addition agents for alloy steels. Consequently there are no buyers in Canada of the concentrate, except perhaps for export to England through Canadian ore dealers. On account of the high duty, exports into the United States are prohibitive. The only remaining market, therefore, is England or France. The latest information (February, 1940) from English steel makers is to the effect that they have stocks on hand for some time to come, and also have contracted ahead. As will be seen from the paragraph on "world production", there are huge potential supplies in the United States--one mine alone produces in less than a week the same amount as the whole of Canada's four-year last war output. The price and supply of this metal is therefore controlled by the United States, and unless circumstances arise in which this supply is cut off from the Allies, there is little likelihood of there being any marked change in the situation. However, advice from England indicates that English agents will purchase, at market prices, small tonnages of high-grade Canadian concentrate free from impurities. It would appear, therefore, that any concentrate, up to specifications, that Canada will produce in the next year, can be sold to English ore dealers. Sales would be somewhat improved in the event of Canada converting the concentrate into an addition agent, or if the direct application of the sulphide into steel became general.

Molybdenite is comparatively common in Canada, several hundred deposits being known, but the great majority are either low grade, or small and "spectacular", or very irregular and discontinuous, and therefore difficult to mine profitably. Under present conditions, the indications are that in order to be commercial, the molybdenite should be fairly evenly distributed throughout a large body of rock in which the unselected ore mined would be not less than about one per cent. Some form of co-operation between the numerous potential producers and the erection of a central treatment plant should be considered.

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OTTAWA, MARCH, 1940.

NICKEL IN 1939

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 exceeding slightly the 1937 all time high record for nickel production in Canada.

In Ontario, the International Nickel Company of Canada, Limited, operated Frood, Frood Open Pit, Creighton, Levack, and Garson mines. No. 2 Shaft installation at Levack mine went into ore production in July. Ore shipments from the Frood Open Pit development started in January. At Garson mine the sinking of No. 2 Shaft was started in the month of April and had reached a depth of 407 feet by the end of the year. The 16,000-ton concentrator and the smelter at Copper Cliff were operated to capacity.

Development at the Falconbridge mine was restricted to lateral development, the shaft remaining at the 2450 level plus sump. Enough new ground was opened up to replace the 585,661 tons of ore hoisted and to add over 600,000 tons to the reserves which stood at 7,502,000 tons at the end of the year. No exploration was undertaken at any of the outside properties of the Company.

A fourth ball mill was added to the concentrator during the year, and the percentage of ore milled, which averaged 57.7 for the year, rose to 62 by year-end. A dryer for the largely increased tonnage of concentrate was added, and by sundry changes of flow-sheet, the milling capacity was increased to produce 16,965.3 short tons of matte, containing 9,232.5 short tons of Nickel and 4,691.9 short tons of Copper, all of which was shipped to the Company's plant in Norway for refining.

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 and 1939, 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 1939.

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

The production of nickel in 1939 was 113,053 tons, valued at $50,920,305, compared with 105,286 tons valued at $53,914,494 in 1938.

The exports of nickel in 1939 were 117,391 tons valued at $57,933,511 compared with 98,852 tons valued at $52,496,417 in 1938. The imports were valued at $1,581,970 as compared with $1,401,338 in 1938.

The world production in 1939 is estimated at 125,000 short tons, all of which, except 12,000 tons, was produced in Canada. The other producing countries are New Caledonia, Greece, India, Norway and Russia.

According to a statement published by the International Nickel Company, the estimated world consumption in 1939 was 125,000 short tons, compared with 80,000 tons in 1938, and 100,500 tons in 1937. This record consumption of nickel is attributed to the great improvement in the heavy industries in the United States and Canada, and to the general speeding up of industry in Europe and other parts of the world, in order to augment the production of necessary war supplies.

New application of nickel developed during recent years accelerated substantially the consumption of nickel steels and alloys in a great diversity of form and composition.

The approximate distribution of the consumption of nickel in 1939, 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	10
Nickel Brass, Bronze and Aluminium Alloy Castings	2
Heat Resistant and Electrical Resistance Alloys	3
"Monel", Malleable Nickel, Nickel Clad, "Inconel"	10
Electrodeposition	8
Non-Metallic Materials for the Chemical Industry Nickel Salts, Ceramic Materials, Storage Battery Materials and Catalysts	1
Miscellaneous and Unclassified	2

The base spot price of nickel in the United States in 1939 was 35 cents per pound. The same price has ruled for the last 14 years.

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PLATINUM GROUP METALS IN 1939

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 1939 was 148,902 ounces valued at $5,222,589, as against 161,326 ounces valued at $5,196,794 in 1938. The production of palladium and other associated metals of the group, was 135,402 ounces, valued at $4,199,622, as against 130,893 ounces, valued at $3,677,342 in 1938.

The imports of platinum products in 1939 were valued at $234,171 as against $292,711 in 1938.

Exports in 1939 were valued at $6,178,227, as against $9,364,815 in 1938; 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 $36.75 per ounce, as compared with $35.90 in 1938, and $51.77 in 1937.

Since 1934 Canada has been the leader in the world 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 as estimated by Baker & Company Inc. approximated 500,000 ounces, compared with 460,000 ounces in 1938.

The world consumption of platinum metals in 1939 was about equal to production, a remarkable gain over the 1935 figure of consumption of 275,000 ounces.

Industrial uses of the platinum group metals continued to advance in 1939 and it is believed that the market for these metals will continue to expand in 1940.

Palladium ranks second in consumption amongst the platinum group and iridium ranks third. The other metals of the group--osmium, rhodium and ruthenium are as yet consumed in relatively small quantities.

The market situation is explained by Charles Engelhard, president of Baker & Company, Incorporated, in the following words:

"Palladium was used more extensively as a substitute for gold for dental work and other purposes. Palladium was used in some instances as a substitute for gold in fountain pens, watch-cases, rings, and spectacle frames, as one ounce of the metal replaces about two ounces of gold, considering both price and specific gravity.

Industrial uses for the platinum metals made further gains. Commercial production of platinum and palladium-clad sheets of base metals was an outstanding example. Platinum alloys figured prominently in the new glass-fiber industry.

In the air service, platinum-iridium, platinum-ruthenium, and platinum-rhodium for magneto-contact points have been in demand. Because of better performance, interest has been shown in this country in platinum electrodes for aircraft spark plugs.

Platinum-rhodium spinnerets are being used more extensively in the rayon industry, replacing gold-alloy.

Platinum has retained its dominant position for diamond settings. Platinum leaf was made available during 1939, taking its place alongside of palladium leaf."

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RADIUM AND URANIUM IN 1939

Canadian production of radium and uranium in 1939 continued to be confined to Eldorado Gold Mines, Limited, now in its ninth year of operating the pitchblende deposits discovered in 1931 at LaBine Point, Great Bear Lake, in the northwest Territories. A few other occurrencesof 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, but with the exception of a small recovery from the B. E. A. R. (Bear Exploration and Radium) silver operation at Contact lake, a few miles south of the Eldorado mine, there has been no pitchblende production from any of these properties for several years.

Consolidated Mining and Smelting Company did considerable work in 1934-35 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 operated by B. E. A. R. at Contact lake, 10 miles south of LaBine Point, but this property carries mainly silver, cobalt, and nickel. A few tons of concentrate containing pitchblende are reported to have been shipped to the Eldorado refinery at Port Hope in 1938. Owing to the low price of silver, this mine was closed down in July, 1939.

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 underground prospecting on one of the claims was reported in 1938, but there were no further developments in 1939.

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 during 1937-38, but towards the end of 1939, construction of a mill was started, and it was reported that further underground work was to be undertaken and a chemical extraction plant installed.

The Eldorado mine and refinery continued in full-time operation throughout the year. Mine production is now stated to be on a scale of between $250,000 and $300,000 per month in value of finished refinery products. Mining is being conducted from a shaft at present bottomed at 822 feet below the development adit driven at 90 feet below surface, or at 912 feet beneath the original surface outcrop on the No. 2 vein, with six levels opened. All three of the parallel veins under development are reported to show good persistence of ore shoots and pitchblende values to the depth reached. Most of the ore raised in 1939 came from stopes opened on the 375-foot, 500-foot, and 800-foot levels on the No. 2 vein, and between the 375-foot and 800-foot levels on the No. 1 vein. New sections opened in 1939 on the 800-foot, or bottom, level of No. 2 vein are stated to have disclosed heavy silver mineralization, associated with cobalt and nickel values, a fact of interest since these sections had carried little or no silver on the two levels immediately above. It thus seems that both pitchblende and silver values may be expected to continue to considerably greater depths than those yet reached. Drift footage on the various levels opened on the No. 1 vein now totals 3,740 feet; on the No. 2, or middle vein, 9, 196 feet; and on the No. 3 vein, 1,610 feet, or 14,546 feet in all. Footage of cross-cuts totals 4,996 feet, and of raises, 1,316 feet, making a total of 20,858 feet, exclusive of shaft.

No further work was conducted during the year at the No. 2, or gulch, shaft, put down several years ago at a point 4,000 feet to the east of the main workings on surface showings believed to be an extension of the westerly vein system. Considerable use was made, however, in surface prospecting of ground in this section of a new and improved type of Geiger counter, an extremely sensitive instrument designed for detecting radioactive emanations. The instrument demonstrated its practical usefulness for such work, four small veins giving definite pitchblende indications being located by means of it. It was thought that the device might prove of service in conjunction with picking-belt operations in the mill, but it was found impracticable to shield it effectively enough from random emanation to permit of its use for this purpose.

Installation of two new 200 H. P. Diesel electric units delivered late in 1938 was completed, bringing current total power capacity to 1138 H. P. Crude oil storage capacity now stands at 250,000 gallons. Working force totals 85 to 100 men, depending on the season, extra hands being taken on for surface work, transportation, etc., during the open months. Mill capacity remains at 100 to 125 tons per day. Additional mill equipment installed during the year comprised one cleaner jig and one cleaner Wilfley table. Considerable improvement in slime table recovery of pitchblende has been achieved by the use of sodium silicate as a dispersing agent to free the grains ~~of~~ slimed gangue, from overall recovery of values being advanced nearly 2 per cent. Ore milled in 1939 totalled 33,326 tons, and mill shipments comprised 518 tons of pitchblende-silver concentrate, consigned to the Port Hope refinery, and 100 tons of silver-copper flotation concentrate, consigned to the smelter at Tacoma, Wash. These figures compare with 22,770 tons milled and shipments of 689 tons of pitchblende-silver concentrate and 104 tons of silver-copper concentrate in 1938.

During the year, provision was made for increased production at the Fort Norman oil wells of Imperial Oil Company, which supply the Eldorado and other mining operations in the Northwest Territories with fuel oil. Drilling of an additional well was undertaken and improved refinery equipment was installed, designed to raise processing capacity to 800 barrels daily, as compared with 300 barrels daily in the old plant. The new refinery will also provide for the production of aviation gasoline, thus materially reducing the cost of airplane fuel which hitherto has had to be freighted in from Vancouver.

Additions made to the Eldorado radium refinery at Port Hope, Ontario, in 1938, more than doubled previous capacity; present capacity stands at 100 tons per month of ore treated, equivalent to about 8 grams of radium and 40 tons of uranium salts. 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. One use for this lead, which contains radium D, a radioactive lead isotope, is for the "growing" from it of polonium, an element that has been found to have value for promoting the sparking efficiency of spark plugs by ionization of the air between the terminals. Polonium plugs were placed on the market in 1939 by the Firestone Tire and Rubber Company. Investigations have also been conducted by the National Research Council, at Ottawa, into the possibility of recovering polonium and ionium from the refinery residues. Uranium salts are shipped principally to England and the United States; silver sulphide is consigned to the United States for final refining.

At mid-year, total radium recovery to date was reported to have passed the 100 gram mark. Active demand for uranate resulted in the disposal of all surplus stocks on hand. Considerable laboratory research was undertaken in the field of developing new products of potential industrial usefulness, including fluorescent uranium salts. Some minor changes in plant procedure were made. The use of calcium carbonate in place of soda ash for the treatment of leach liquor was investigated and found to give improved removal of metallic impurities.

Figures of production of ore and refinery products for 1938 and 1939 have not been released for publication.

The world output of radium and uranium salts comes mainly from the Belgian Societé Générale Metallurgique de Hoboken, a subsidiary of Union Minière du Haut Katanga, using ores from the Belgian Congo, and the Eldorado Company. Small amounts are produced at Joachimsthal, in Czechoslovakia, and by two American concerns treating high-grade carnotite ore from Utah and Colorado. Considerable tonnages of such carnotite are processed for its vanadium content, but there has been no recent recovery of radium or uranium from the ore so treated, though formerly carnotite was the principal source of these elements. Large stocks of vanadium refinery residues have been built up, and while low in uranium, this material may eventually be treated for the recovery of its uranium and radium content. It is stated that Germany plans to step up production from the Czechoslovakian deposits, which in recent years have had an output of 3 to 5 grams of radium annually under state control. A small production is credited to France, where Portuguese autunite 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 five years has had the following values: 1935, $150,643; 1936, $109,032; 1937, $6,402; 1938, $22,559, 1939, $15,929. 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 milligrams. Larger dosages are given by means of so-called radium "bombs" containing up to 5 grams. 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 in this field. Some is also consumed in luminous paints for clock, watch and compass dials, instrument boards, gun-sights, etc. High cost of the element is a serious deterrent factor against wider sale, and much of the radium used in hospitals, research, and for other purposes, is hired or loaned from the producers or from smaller concerns engaged in such business.

Uranium, the heaviest known element, finds its principal use in the form of various salts, mainly sodium uranate or oxide, employed as colouring agents in the ceramic industry. These compounds impart a greenish-yellow colour to glass, and give rich reddish-orange shades in pottery glazes. Uranium glasses are strongly fluorescent, as are, also, many uranium salts, and the latter may find application in fluorescent paints and lighting appliances. Certain of the salts have limited use in the analytical laboratory, in photography and medicine, and in textile dyeing. A recent new use for the oxide is in the starting resistors of motors. 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, have 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.

Recent work has developed improved and extremely sensitive radium detector instruments of the Geiger-Muller counter type, for detecting radium contamination, tracing lost radium, prospecting for radium ores, etc. New preparations, consisting of a mixture of a radium salt with powdered beryllium metal and used as a source of neutrons, have recently come on the market. One of the outstanding scientific discoveries of 1939 was that the uranium atom could be split by neutron bombardment, resulting in "nuclear fission" and the production of radioactive isotopes of a long series of unexpected lighter-weight elements; the phenomenon is accompanied by the liberation of a tremendous amount of atomic energy, suggesting the possibility of employing uranium as a source of power.

When Canada became a potentially important producer, strong 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 milligram in lots of one gram 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 by the Eldorado company to \$1.75 in 1938, and to \$1.90 in 1939; black oxide, which sold at \$2.50 per pound in 1938, was raised to \$2.90 in 1939. Radium for Canadian sale was quoted in 1939 at \$33 per milligram. World demand for both radium and uranium salts is reported to be showing a steady increase, radium commitments having been materially raised by large-scale programmes for hospital use undertaken by both the British and American Governments; United States radium imports are reported to have reached an all-time high in 1939, being over 70 grams, or double the 1938 figure.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

SELENIUM IN 1939.

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.

Selenium 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 the 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 1939 was 367,884 pounds valued at $650,786 as against 358,929 pounds valued at $622,742 in 1938.

Most of the production is exported. No separate records of exports of this commodity were published previous to January, 1939. The exports in 1939 were 238,925 pounds valued at $374,700. Over half of the exports were to the United Kingdom and most of the other half to the United States, small amounts going to British India and Australia. There are no records of imports.

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, but it is believed to approximate 300 to 500 short tons a year. The United States and Canada are the principal sources of supply. Small quantities are produced by several countries including Russia, Japan, and Mexico. It is reported that selenium is now being recovered from the copper-gold-arsenical ores of the Boliden mine, Sweden.

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 now being 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 prevailed for a few years up to August, 1938, when the price dropped to $1.75, at which level it remained to the end of the year 1939.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

SILVER IN 1939

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 several 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 and to the gold-quartz ores of the "Box" property at Goldfields.

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, and from the gold-quartz ore of the "Con" property at Yellowknife River. The Bear Exploration and Radium Ltd., operated its Contact Lake mine up to July 1939. The 25-ton mill was operated from July 1938 until July 1st 1939. The tonnage milled was 6,658 tons with a recovery of 99.1 tons of concentrate containing 195,333 ounces of silver and 6,933 pounds of uranium oxide. Operations will be suspended until such time as the price of silver returns to its former level of about 45 cents an ounce.

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 was completed at Trail in 1939 to replace the old plant.

The Canadian production of silver in 1939 was 23,116,861 fine ounces, valued at $9,359,553 compared with 22,219,195 fine ounces, valued at $9,660,239 in 1938.

The exports in 1939 were 6,828,031 fine ounces of silver in ore and concentrate valued at $2,801,206 and 14,202,549 fine ounces of silver bullion valued at $5,723,967. In addition Canadian silver coins to the value of $5,340 were exported, and manufactures of silver valued at $6,974.

The imports in 1939 included unmanufactured bullion to the value of $1,532,891 and manufactures of silver to the value of $304,428.

The world production of silver in 1939, as estimated by Messrs. Handy and Harman, was 266,000,000 fine ounces, this compared with 262,933,000 fine ounces in 1938.

The world consumption of silver in 1939 is estimated by Handy and Harman at 441,300,000 ounces compared with 510,300,000 ounces in 1938. Of the total consumption of 441,300,000 ounces in 1939, 341,400,000 ounces was purchased by the United States Government, 26,000,000 represent Indian consumption, 8,900,000 was used for coinage, and 65,000,000 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 Congress passed the Act of July 6, 1939, which increased the domestic subsidy from 64.65 cents to 71.11 cents an ounce and made it permanent. The silver provisions of this act leave the Administration no discretionary power over domestic silver, but opened the U. S. mints permanently to all newly mined silver of domestic origin, (Eng. Min. Jnl., Feb. 1940.)

The ratio of silver to gold and silver in the monetary stock of the United States is set down in the Silver Purchase Act of 1934 at 25 per cent. Treasury acquisition of silver has resulted in an increase of the ratio from 10.3 per cent in June 1934, to 18.7 per cent at the end of 1938. By September 1939 the ratio had dropped to 17.9 per cent owing to the large coincident inflow of gold. The Monthly Bulletin of the U. S. Treasury Department reports that from January 1934, when the silver purchase programme began, to December 31, 1939, the American Treasury bought 314 million ounces of domestic silver. The purchase for the calendar year 1939 totalled 61 million ounces. The estimated holding by the United States Treasury, to the end of 1939, amounts to 2,923 million ounces.

Under the American Silver Producers Research Project investigations are being carried on to find new uses for silver. Industrial use of silver in brazing alloys and electrical contacts showed a substantial increase in 1939. A silver stainless steel, containing one quarter of one per cent of silver was announced by the Massachusetts Institute of Technology.

The average price of silver in 1939 was 40.563 cents per fine ounce as against 43.447 cents in 1938 (New York prices transposed to Canadian funds.)

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

TITANIUM IN 1939

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), which usually contains 54 to 59 per cent titanium, is found mixed with the ilmenite in parts of one of the St. Urbain occurrences and in sufficient quantities to make it of possible importance for the rutile alone; this 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 of ilmenite is 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 (ilmenite) in 1939 was 3,694 tons valued at $21,267, compared with 207 tons valued at $1,449 in 1938 and 4,229 tons valued at $26,432 in 1937. This production came entirely from the properties of the Baie St. Paul Titanic Ore Company and the Loughborough Mining Company of 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 and 1939 not yet available.)

It is reported that the use in Canada of titanium pigments increased considerably in 1939. Their use in this country has not replaced lithopone to the extent that this has occurred in the United States, chiefly because these pigments are somewhat higher priced than in the United States, whereas lithopone is cheaper.

The world production of titanium ore in 1937 (1938 and 1939 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 for ilmenite continues to be for the manufacture of white pigment. It is used to a smaller extent for making ferro-alloys. 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 principal uses of rutile are in welding-rod coatings and in the ceramic industry.

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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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

TELLURIUM IN 1939.

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 thelatter, 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 production in 1939 was 22,985 pounds valued at $37,281, compared with 48,237 pounds valued at $82,967 in 1938. 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. The world production is estimated at 40 to 70 short tons a year.

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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210882

TUNGSTEN IN 1939

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.

Tungsten being considered one of the important war metals, much interest and activity have recently been shown in previously known occurrences and deposits, and intensive search is being made for the discovery of new deposits.

In Nova Scotia, development has been carried on in a small way for the past few years at Indian Path mine, near Lunenburg. This property is reported to have recently been optioned to Siscoe Gold Mines Ltd. The property is being diamond drilled and sampled.

In Moose River district, Halifax county, the deposits have not been worked for several years, but are now being investigated by Lebel Oro Mines Ltd.

The Kirkpatrick Tungsten Syndicate is opening up a series of scheelite-bearing quartz lenses on the Goff property, near Enfield, Halifax county In December a few tons of concentrate assaying 70 per cent tungsten trioxide was made by hand sluicing methods.

Ventures Ltd. is investigating the scheelite occurrence on the property of the Guysborough Gold Mines Ltd. at Goldenville.

In New Brunswick, the Provincial Department of Lands and Mines, Fredericton, made a detailed survey during the year, of the area around the Burnt Hill Brook property, which is owned by the Arcadia Tungsten Mines Ltd., and which was last worked in 1917.

In Quebec, W. A. Manly dewatered the old workings of a property in La Reine township, near Dupuy, a station on the Canadian National railway, and a small sample of the ore has been sent to Ottawa for testing purposes.

Scheelite occurs in bunches and scattered through the quartz vein of the MacKenzie Red Lake gold mine, on MacKenzie Island, east of the town of Red Lake. Exploration and investigation is being done to ascertain its possible economic value. Samples have been sent to Ottawa for testing.

In Manitoba, some exploration was done about 1918 on a scheelite deposit near Falcon lake in the southeastern part of the province. An option has recently been taken by Rice Lake Gold Mines Ltd. on a group of claims in the Herb Lake area, where a tungsten deposit was outlined on the surface by previous operators.

In British Columbia, the deposit on Hardscrabble creek, Cariboo district, has been under development during the last few years and a 50-ton treatment plant was erected on the property by the Columbia Tungsten Company. A few tons of high grade concentrate was shipped to a steel plant in Ontario.

An interesting occurrence of white scheelite, situated north of Minto city, Bridge River area, is being opened up by Edwin Phillips. A shipment of two tons of ore was made to the Bureau of Mines laboratories, Ottawa, for concentration test.

Tungsten occurs in association with gold at the property of Esperanzo Mines Ltd., at Alice Arm, and the company is reported to be considering the possibility of developing this property for the recovery of the tungsten.

In the Yukon Territory, scheelite sands were recovered years ago in a very small way from the alluvial deposits of Dublin Gulch, Mayo district.

In the Northwest Territories, tungsten has been found in appreciable quantities usually associated with gold at the property of Slave Lake Gold Mines Ltd., on Outpost Island. The tungsten is in the form of ferberite, a very rare tungsten mineral.

The tungsten production in Canada in 1939 consisted of a few tons of concentrate shipped for experimental purposes. No tungsten had been previously produced in Canada, except for a few hundred tons of concentrate produced between 1912 and 1917.

The imports in 1939 of Chromium metal and tungsten metal for alloying purposes totalled 55,428 pounds valued at $50,769, compared with 43,527 pounds valued at $30,328 in 1938. Imports of metallic elements, and tungstic acid for use in the manufacture of metal filaments for electric lamps were valued at $157,369, compared with $71,730 in 1938. Imports of Tungsten Carbide, encased in metal tubes, for use in Canadian manufactures, was valued at $246 in 1939, compared with $720 in 1938 (from Nov. 12, 1938).

The world production of tungsten ore, in metric tons of concentrate containing 60 per cent tungsten trioxide (WO_3), in 1938 (1939 not yet available) was estimated at 32,000 metric tons, compared with 38,000 metric tons in 1937, (as given by the U.S. Bureau of Mines).

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 light and radio tube filaments; in the preparation of various chemicals, such as pigments, and in the tanning of leather. In recent years, cemented tungsten carbide has been employed widely in the commercial field. A new alloy of tungsten with 4 per cent copper and 6 per cent nickel is said to be a suitable material for radium containers. A new process for combining tungsten by electro deposition with other metals, is said to be susceptible to close control (U.S. Bureau of Mines Mineral Yearbook).

The price of domestic tungsten ore (scheelite) in New York, per unit of WO_3 was $16-$18 from January to May, $15-$17 from June to September, and $25 for the last quarter of the year. The price of Chinese wolframite dropped from $19.50 in January to $18 in June, and averaged $23.75 for the last quarter of 1939.

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DEPARTMENT OF MINES AND RESOURCES,
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ZINC IN 1939.

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 Conolidated 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 lead-zinc mine of the Base Metals Mining Corporation, Limited, located near Field, B.C., was closed down all year until about December 15th, 1939, when preparations were started to re-open the mine and operate the 300-ton concentrator. Production did not, however, get started until January 15th, 1940. The Britannia mine did not produce any zinc concentrate during 1939.

Several relatively small lead-zinc properties in West Kootenay district continued working intermittently during the year. The mine and concentrator of the Whitewater at Retallack operated for part of the year; several other properties in this area (Ainsworth-Slocan), such as the Lucky Jim, McAllister, Mammoth 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 are expected to become fairly regular producers in 1940.

In Manitoba the Flin Flon mine, concentrator and smelter of Hudson Bay Mining & Smelting Company operated at capacity during the year. During the latter part of 1939 the daily tonnage of ore treated in the concentrator was increased to 5,000 tons per day from the previous average of 4,550 tons, and certain changes were made in the flow sheet to permit satisfactory handling of the increased tonnage.

A second main hoisting shaft for the mine was started during the year. The surface plant for this new shaft was completed with the exception of the installation of the ore hoist. Full size sinking was completed from the surface to a depth of about 700 feet, while an additional 1,300 feet of pilot raise and winze work was done from underground workings. The installation of a fifth generating unit at the Island Falls hydro-electric power plant of the Churchill River Power Company, Limited, was completed and the unit put into operation in April. The present total rated generating capacity of the power plant is 90,000 H.P.

The zinc plant, with an annual rated capacity of about 40,000 tons of slag zinc, operated at full capacity during the year, treating a slightly greater tonnage of zinc concentrate and producing more slab zinc than in 1938.

The Sherritt-Gordon copper-zinc mine and 1,900-ton concentrator situated about 50 miles northeast of Flin Flon, were operated at full capacity during the year.

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 1939, the Normetal Mining Corporation, Limited, near Dupuy, Quebec, operated its copper-zinc concentrator all the year with the exception of a shut-down due to power shortage in March and April.

The main ore body was developed on four new levels at depths of 935', 1085', 1235', and 1385'. The copper concentrate was shipped to the Noranda smelter. Some shipments of zinc concentrate were made to Europe, but these ceased at the outbreak of the war.

In Nova Scotia, the Stirling copper-lead-zinc property in Cape Breton, ceased operations in the latter part of 1937, and remained idle in 1939.

The Canadian production of zinc in 1939 was 197,267 tons valued at $12,108,244, compared with 190,753 tons valued at $11,723,700 in 1938.

The exports in 1939, chiefly in the form of spelter, were valued at $9,922,232, compared with $9,816,000 in 1938.

The imports in 1939 of zinc products of all kinds, including oxide and chemicals, were valued at $2,289,690, compared with $1,945,602 in 1938.

The world production of zinc in 1938, (1939 not yet available), as reported by the American Bureau of Metal Statistics, was 1,751,900 short tons, compared with 1,838,500 short tons in 1937.

The principal producing countries, according to the origin of the ore, are as follows: United States, Canada, Australia, Germany, Poland, Mexico and Russia. Canada contributes about 11 per cent of the world total.

Comparative Table of World and Canadian Production
(in short tons)

Year	World	Canada	Percentage of total
1916	1,087,700	11,700	1.0
1929	1,623,500	98,600	6.0
1938	1,751,900	190,700	10.9
1939	1,822,700	197,500	10.8

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

The world consumption in 1938 (1939 not yet available), as given by the American Bureau of Metal Statistics, was 1,639,600 short tons, compared with 1,803,500 short tons in 1937.

The war requirements for munitions have greatly increased zinc consumption. In peace time 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 flashlight batteries, and for making zinc oxides.

The average price of zinc for 1939 in Canadian funds based on London quotations, was 3.069 cents per pound, compared with 3.073 cents in 1938. The St.Louis price was 5.11 cents, compared with 4.610 cents in 1938.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

ARSENIOUS OXIDE IN 1939

The world arsenic output is practically all obtained as a by-products from the treatment of gold, silver, copper, lead, zinc, cobalt, tungsten and tin ores.

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.

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.

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.

Production of arsenious oxide in Canada in 1939 was 1,741,917 pounds valued at $52,257 compared with 2,175,646 pounds valued at $56,538 in 1938.

Exports of arsenic in 1939 were 906,300 pounds valued at $26,389 compared with 1,378,300 pounds valued at $32,590 in 1938.

Imports were: arsenious oxide 516,236 pounds valued at $7,976 compared with 201,009 pounds valued at $3,854 in 1938; and other compounds of arsenic valued at $79,674 compared with $48,464 in 1938.

The world production in 1938 (1939 not yet available) is estimated at 55,000 metric tons compared with 57,000 metric tons in 1937 (as reported by the U. S. Bureau of Mines). Accurate production data are not available, since some countries fail to record arsenic statistics and others give only sales or exports.

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 1939 remained at 3 cents a pound throughout the year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

BITUMINOUS SAND IN 1939

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

During the period 1931-1938, International Bitumen Company has processed small amounts of bituminous sand at its plant at Bitumont, Alberta. Bituminous products have included various grades of asphalt for paving and roofing, and 37,500 gallons of fuel oil. Fuel oil was disposed of to mining companies operating on Lake Athabaska. Roofing asphalt was shipped to consumers at Crown Point, Indiana, and at Calgary, Alberta; paving asphalt was shipped to Edmonton and Banff, Alberta. The value of the above shipments was approximately $11,000.00. The equipment of the International Bitumen Company at Bitumont includes a separation plant, a refinery with a rated capacity of 700 barrels per day, a shipping dock, and complete housing facilities. This plant was inactive during 1939.

Abasand Oils, Limited, continued construction work on its separation, ~~distillation~~, and refining units on Horse River, near McMurray. The separation plant has a rated capacity of 400 tons of bituminous sand, and the refinery a rated capacity of 600 barrels of charging stock per twenty-four hours. It is expected that initial production will include gasoline, distillate, road oil, asphalts, and coke. On November 1, 1939, construction of separation and refining units was well advanced. Work had been somewhat delayed owing to difficulty in securing delivery of necessary piping, but it was expected that all necessary work would be completed by March 1, 1940. A large shale planer for excavating bituminous sand has been delivered at the Horse River quarry, and it is hoped that gasoline and Diesel oil will be available for the northern market by May, 1940.

The Bureau of Mines at Ottawa has been conducting a comprehensive investigation of these deposits of natural asphalt. In addition to field exploration during fifteen seasons, extensive laboratory studies of the bituminous sand and of bitumen separated from it have been made. Various industrial applications for the separated bitumen, including its use in the manufacture of certain rubber goods, are also being investigated. The 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, and certain solid and semi-solid bitumens.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH 1940.

ASBESTOS IN 1939

The asbestos production of Canada is all of the chrysotile variety and, with the exception of a small quantity from northern Ontario, comes entirely from areas of serpentinized rock in the Eastern Townships of Quebec where the producing centres are Thetford Mines, Black Lake, East Broughton, Vimy Ridge, and Asbestos. The Canadian deposits are the largest known in the world. 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. Most of the output consists of vein fibre obtained from veins $\frac{1}{4}$ to $\frac{1}{2}$ 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. The average yield of fibre from the Quebec deposits is 5 per cent of the rock mined and 7.7 per cent of the rock milled.

In 1939 five companies were operating in Quebec. Asbestos Corporation, Limited, worked two properties at Thetford Mines, and one each at Black Lake and Vimy Ridge. Johnson's Company worked a property at Thetford Mines and another at Black Lake, and is opening a new property at Black Lake. Bell Asbestos Mines, Limited, operated at Thetford Mines, Quebec Asbestos Corporation, Limited, at East Broughton; and Canadian Johns-Manville Company, Limited, at Asbestos.

The Ontario production came from the initial operations of Rahn Lake Mines Corporation, Limited, in Bannockburn township, Matachewan area. This company, in 1939, completed a mill at Elk Lake designed to handle 200 tons of asbestos-bearing rock per day. The property is near the former Ashley mine, 42 miles by road from the mill.

In Quebec the asbestos-bearing rock is mined both in open pits and underground. The method of block-caving instituted at the King mine of Asbestos Corporation in 1934, has resulted in a remarkable reduction in cost of mining and improvement in grade of mill feed. This development, coming at a time when many of the open pits had been worked almost to the economic depth and operators were faced with rising costs and with the prospect of being unable to recover much valuable rock in the walls of the pits, is of the utmost importance to the industry. During the year Asbestos Corporation put its new 1,160-foot vertical shaft at the King mine into operation, as well as the new vertical drying plant, and a new crushing plant having a peak capacity of 400 tons per hour. Johnson's Company sank a 916-foot shaft preparatory to beginning block-caving operations at its Thetford Mines property and opened a new property at Black Lake following extensive diamond drilling. Bell Asbestos Mines, Limited, sank a 500-foot, 4-compartment shaft in preparation for glory-holing beneath the present pit. Canadian Johns-Manville Company, Limited, continued its extensive deep diamond-drilling campaign at Asbestos.

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, with the exception of the deposit owned by Rahn Lake Mines Corporation, Limited, in northern Ontario, none are being worked.

Numerous deposits of other varieties of asbestos occur in Canada including anthophyllite, fibrous tremolite, and fibrous 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 as found during 1937 and 1938 in Manitoba east of Lake Winnipeg, 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 1939 was 364,472 tons valued at $15,859,212, compared with 289,793 tons valued at

$12,890,195 in the preceding year, being a gain of 26 per cent in quantity and 23 per cent in value. The quantities and values of the several grades produced in 1939 were as follows:- crudes 3,121 tons valued at $938,718 ($300.68 per ton); fibres 193,992 tons valued at $12,049,539 ($62.12 per ton); cement stock, floats and shorts 167,359 tons valued at $2,870,955 ($17.15 per ton).

Complete data on world production in 1938 and 1939 are not yet available, but it is known that Canada easily maintains her position as the principal asbestos-producing country of the world. Other producing countries in order of tonnage produced are Russia, Rhodesia, Union of South Africa, the United States, and Cypress. A new and important source of chrysotile became available in June, 1939, with the beginning of shipments from Swaziland, Africa. It is also reported that a new deposit of blue asbestos (crocidolite) is being developed in Australia; previously this was obtainable only from South Africa.

Asbestos is marketed by the producer in the crude condition (long-fibred material only); in a partly opened state; and in a condition ready for use, i.e., completely fluffed out and freed as much as possible from impurities. The world's largest market is in the United States, and Canada's proximity to this market confers very real advantages on the asbestos industry in this country.

Most of the Canadian production of asbestos is exported in the unmanufactured state--chiefly to the United States. Other countries to which large exports are made: Japan, United Kingdom, Belgium, France, Australia, and Italy. Prior to the outbreak of war, Germany was a large importer of Canadian asbestos. On September 20, 1939, the Dominion Government assumed control over the export of asbestos. In 1939 the exports were as follows:--asbestos 186,238 tons valued at $12,463,177, asbestos sand and waste, 159,780 tons valued at $2,902,111, and manufactures of asbestos valued at $479,415. This compares with 1938 exports of:--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.

Imports in 1939 consisted of 65 tons of asbestos packing valued at $65,074, brake and clutch linings valued at $242,423, other products not specifically designated valued at $764,946. These latter products included some asbestos from Africa of a kind not produced in Canada, and required for certain manufactures.

Asbestos has many uses, the chief being for the manufacture of automobile brake linings and clutch facings, asbestos cloth, heat insulation materials, packing and building materials such as roofing shingles, corrugated sheeting, tile and piping, and also for asbestos paper.

Prices throughout 1939 remained the same as in 1938, and were as follows:--No. 1 crude $700 to $750 per ton; No. 2 crude $150 to $350; spinning fibre $110 to $200; shingle fibre $57 to $78; paper fibre $40 to $45; cement stock $21 to $25; floats $18 to $20; shorts $12 to $16.50 per ton.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

BARITE IN 1939

A number of occurrences of barite are known in Canada, but there has been no important production of the mineral since 1917, when 3,500 tons was shipped. The known occurrences are in Nova Scotia, Quebec, Ontario, and British Columbia. Many of the 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 some 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. Renewed interest in the deposits of the Lake Ainslie district developed in 1939, and plans are reported for re-opening some of the old mines. 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. In 1938, ~~the~~ Canada Baryte Mines, Ltd., 305 Kent Building, Yonge St., Toronto, was formed to take over an idle property in Langmuir township, in the Porcupine district, and in 1939 a few cars of ore were shipped to Montreal for grinding. The company reported plans for further underground development, and for the installation of new processing equipment in the existing mill on the property. In the latter part of the year, several cars of crude ore were taken from an undeveloped deposit in Lawson township, near Gowganda, and shipped to a Toronto grinding plant.

Recent interest in domestic barite has been prompted largely by the possibility of exporting it to Trinidad for use in oil-well drilling, a market reported to require 25,000 to 30,000 tons annually, hitherto obtained mostly from Germany. Domestic requirements for powdered barite have been around 2,500 tons per annum, about half of German origin; current developments may result in displacing the German product by domestic material. There are indications that consumption may be increased considerably by the introduction of the use of barite in glass manufacture, an important new application for the mineral. There being no manufacture of lithopone or barium chemicals in Canada, no demand exists for crude ore.

Barite (barium sulphate) is the principal and virtually the only barium mineral of commerce, serving a variety of industrial uses in the ground natural state, and is 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 (around 42,000 tons since 1885) has come from deposits in Nova Scotia, with small tonnages from Quebec and Ontario. For the last 15 years, production has been sporadic, seldom reaching 100 tons in any one year. Production was reported in 1939 for the first time since 1933 but figures are not yet available for publication.

Total world production of barite in 1937 was 916,000 long tons. Incomplete statistics for 1938 indicate a probable production of around 975,000 tons in that year. Germany has been 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, Greece, 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 1938 was reported as nearly 10,000 long tons.

Imports of ground barite in 1939 totalled 2,175 tons, valued at $38,607, compared with 2,187 tons, valued at $38,012 in 1938. Of the 1939 imports, 607 tons came from Germany, 1,392 tons from the United States, 93 tons from the United Kingdom, 50 tons from Italy, and 33 tons from the Netherlands.

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 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 being used in rotary oil-well drilling, and this use took nearly 80 per cent (126,697 tons) of the total sales of ground barite in the United States in 1938. 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 ferric-oxide(Fe_2O_3) is finding increasing use as an ingredient in batches of moulded flint glass 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 content of 95-96 per cent barium sulphate ($BaSO_4$) with not over 1 per cent ferric-oxide is a general stipulation. Fineness of grinding is usually required to be around 300 mesh. For oil-well drilling, specifications call for a gravity of 4.17 to 4.25, a $BaSO_4$ content of 92 to 95 per cent, and a fineness of 98 per cent through 300 mesh.

Precipitated barium sulphate, known commercially as "blanc fixe", is an important barium chemical and is preferred to the natural product for certain high-grade uses, e.g., in paints, paper, and cosmetics. It is a very fine-grained, white powder, prepared from a solution of barium sulphide by the addition of salt cake (sodium sulphate), but is also a by-product in the manufacture of hydrogen peroxide. Witherite, or natural barium carbonate, is sometimes the raw material used in its manufacture.

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 proved 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 1938 was $6.47 per short ton; prices remained at substantially the same level in 1939. 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; but in 1938 there was a drop of 25,000 tons from the 1937 figure, to 335,000 tons. Ground barite production rose to an all-time high of 186,000 tons in 1938, owing largely to increased demand for oil-well drilling, a jump of over 37,000 tons. In 1938, barium chemicals used over 54,000 tons of crude, while lithopone manufacture took 117,000 tons, both substantial drops from the amounts used in 1937. In addition to the domestic production of 335,000 tons in 1938, the United States imported in that year 25,000 tons, 40,000 tons less than in 1937.

Canadian trade journal quotations in 1939 for imported ground barite rose from $39.45 per ton for No. 1 white grade in January to $47 in December. Off-colour grades remained steady at $20 to $28 per ton. 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 $41 to $47 per long 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.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

BENTONITE IN 1939

Bentonite is a peculiar form of 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, which is often mixed with gritty impurities such as fine grains of quartz, mica, etc. The particles of clay material are exceedingly fine and often of colloidal size. 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 Cretaceous beds of the Prairie Provinces, some deposits probably being thick enough to possess economic importance. Several extensive beds also exist in Tertiary beds of 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 began in 1937 from the Drumheller district, Alberta, to the Turner Valley oil field, for use in drilling mud. Production from this source in 1939 was 889 tons, compared with 1,150 tons in 1938; these shipments constitute the only important tonnage output of bentonite in Canada to date. The bulk of the material has come from a surface deposit near Drumheller, operated by Gordon L. Kidd, and is shipped to the plant of the Calgary Mud Company, 510 Lancaster Bldg., Calgary, for drying and pulverizing; the processed clay is marketed under the name of 'Altamud'. A few cars have also been taken from a thin bed lying between coal seams in the mine of the Aetna Coal Company, at East Coulee, a few miles south of Drumheller; this clay is shipped to a small plant at Longview, in Turner Valley, for processing, and is sold under the name of 'Viscolite'. In 1939, the Altamud clay sold at $38 per ton, ex mill, in bags, and the Viscolite clay was quoted at $43 per ton.

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, has been utilized mostly in foundry work. Winnipeg foundries report, however, that the Morden clay lacks the desirable properties of standard foundry bentonite, such as is produced in Wyoming, and have largely abandoned its use. Tests made on the clay by the National Research Council, at Ottawa, have shown it to have high value for bleaching, and small-scale experimental work along commercial activation lines was carried out in a Winnipeg plant in 1937. In bleaching efficiency, 1½ tons of crude Morden bentonite is said to be equivalent to one ton of a standard activated clay, such as Filtrol. The Morden Bentonite Company, of Toronto, formed in 1937 to develop the original O'Day claims, went into liquidation in 1939. In the latter part of the year, it was reported that several groups of Winnipeg interests were planning development of deposits in the Morden-Thornhill area, and about 150 tons of clay was shipped to Winnipeg by one such group, who are stated to have installed drying and grinding equipment for processing it.

Total production of bentonite in 1939 was reported as 988 tons, compared with 1,179 tons in 1938 and 163 tons in 1937. The bulk of these shipments represents material from Drumheller, Alta., for use in oil-well drilling in Turner Valley.

Bentonite being 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 1938 were returned at 192,183 tons, valued at $1,373,182, the quantity being about the same as in 1937. The main reported sources, by states, were: Wyoming, South Dakota, Texas and California; two-fifths of the output, however, came from a number of other unspecified states, including Utah, Mississippi, Arizona, New Mexico and Oklahoma.

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 are now being exploited in a number of countries, including Italy, Germany, and Russia.

Bentonite, both crude and activated, is often marketed and distributed under a variety of trade names (e.g. Aquagel, Volclay, Altamud, 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 being unaware of its bentonitic nature.

Canada exports no bentonite. Substantial tonnages of activated clay of the Filtrol type are imported from the United States for bleaching oil, as well as, possibly, some ground natural bentonite for similar use. High-grade activated clay of German origin has been employed for bleaching in the packing-house trade, and ground colloidal bentonite is imported from the United States for foundry and other purposes.

Imports of activated clay, for oil refining, in 1939 were valued at $130,231, with no record of quantity.

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: (a) swelling, and (b) non-swelling, when 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, 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 plasters, and in slips and glazes in refractories; for emulsifying asphalts, resins, etc.; to improve the workability, flow, and water resistance of concrete; in the clarifying of wines, 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. Further recently announced uses are for processing beer; as a binder in briquetting coal-ore mixtures for smelting in vertical furnaces; and as a paste to hold the electrolyte in dry batteries.

A novel application for bentonite that may have serious import for the mica industry was announced in 1938, as the result of research at the Massachusetts Institute of Technology, by Dr. E.A. Hauser. It was found that by centrifuging, or other suitable means, a clear gel fraction could be extracted from bentonite aqueous dispersions. This gel, depending on the character and colour of the raw clay from which it is extracted, and on the particle size of the contained solids, is a pale yellowish jelly or paste, which can be formed into thin sheets or films by extrusion or other means. Such films, to which the name 'Alsifilm' has been given, possess high electrical insulating strength, as well as practically all of the other properties that have hitherto made mica an indispensible material for electrical and other purposes. By a hardening process, the films can be made waterproof. It is claimed that the cost of manufacturing is only a few cents per pound, and that large sheets can be made that may be cut to any desired dimension, and the waste can be re-converted to gel and returned to the batch, thus eliminating the high trimming losses that add so materially to the cost of mica. Commercial development of Alsifilm is being undertaken by the Research Corporation, 137 Newbury Street, Boston, Mass., and it is announced that important commercial interests will shortly undertake manufacture of the product and place it on the market. Other industrial uses suggested for the material are for making food and beverage containers, wrapping, and for the printing of permanent documents, etc.

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. They are used extensively in oil-well drilling, the clay (sometimes specially processed for the purpose, or blended with a proportion of swelling bentonite) 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.

Of comparatively small importance only a few years ago, the bentonite industry in the United States has grown to substantial proportions in the last decade, with a number of large-scale plants engaged in production. The material has become practically indispensable in the foundry trade (the largest consumer) and for oil-well drilling, and its use for water impedance and in insecticides is taking increasingly important tonnages. Intensive research is constantly developing new applications, many of which (including those mentioned above) are covered by basic patents.

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 kind, 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. Trade journal quotations in 1939 were $27 to $30 per ton, whereas Alberta producers quoted $38 to $43 per ton, ex plant. A leading American producer in 1939 quoted $10.25 per ton for standard minus 200-mesh material, and $14 for minus 300-mesh clay, 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, 1940.

BERYL IN 1939

The mineral beryl, one of the comparatively few natural beryllium compounds, is a silicate of aluminium and beryllium, with 12 to 14 per cent beryllium oxide, and is the only commercial source of the beryllium. Although not exactly an uncommon mineral, it is by no means abundant, its occurrence being confined to pegmatite dykes, usually as disseminated crystals. Almost all the beryl sold represents by-product material from the working of pegmatites for feldspar, lithium minerals, or mica. Small tonnages of beryl have been produced in various parts of the United States, Canada, 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 to be 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 to manufacture beryllium alloys and chemicals; its head office is at 901 Royal Bank Building, Toronto. At the end of 1939 the company reported about 50 tons of cobbed beryl crystals stock-piled, while another 50 tons was estimated to be contained in uncobbed rock awaiting concentration. Small shipments of feldspar have been made, and a few tons of hand-picked mixed rock containing columbite and certain rare element minerals, principally euxenite, have been 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 of large size, in localized shoots or zones in a large pegmatite body.

Some of the Manitoba pegmatites carry beryl as large, scattered crystals, 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. No attempt has as yet been made to exploit the occurrences, the most important of which are understood to be controlled by the Winnipeg River Tin Company. Early in 1940, press reports stated that work was planned by a new company (Mobkirk Beryllium Mining, Ltd.) on a group of claims near Bernic and Shatford lakes, on which beryl was discovered some ten years ago during tin prospecting operations.

Of interest, though hardly of any present economic significance, is the recently reported discovery of beryl in the Northwest Territories. Field parties of the Geological Survey working in the Yellowknife region have recorded the occurrence of numerous pegmatite bodies in the area lying about 20 miles northeast of the Yellowknife camp. In some of the outcrops, scattered beryl crystals have been noted, associated in some cases with the lithium minerals spodumene and lepidolite. Tantalite also occurs. This association indicates the existence in the area of a lithium-beryllium pegmatite series similar to that of southeastern Manitoba. The beryl crystals range up to several inches across and are usually of a greenish-white colour.

Occurrences of beryl have been reported from Rainy River and Patricia districts, in Ontario, and in Northern Quebec.

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 and Italy. It was reported in 1939 that a production plant was being built in Japan. Despite the somewhat sparse known world resources of beryl, American consumers continue to report being offered more supplies than they can use.

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.

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 146 tons, valued at $5,990, compared with 182 tons valued at $8,031 in 1937, and 162 tons valued at $6,681 in 1936, 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, has expanded 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. Where wear, resistance to corrosion, or high fatigue value combined with good electrical conductivity, are essential, beryllium-copper, with about 2.25 per cent beryllium, fills an important requirement.

The price of the master alloy, containing 3.5 per cent to 5.0 per cent beryllium, was reduced in 1939 to $15 per pound of contained beryllium metal, previous levels being $25 per pound in 1935 and $23 per pound from 1936 to 1938. This master alloy is made by the primary producers and sold to manufacturers of fabricated articles who add it to their melts so as to produce a final alloy of around 2 per cent beryllium content. Trade quotations for such final alloy in the form of sheet, wire, or rod, in 1939 were $1.11 to $1.29 per pound; one producer in June dropped the price 15 cents from these levels. The high price demanded for products made from beryllium alloys is stated to be largely due to the cost of the heat treatment required in fabricating, for which special equipment is required. This treatment, as well as the process of reduction of beryllium from its ores, is covered by basic patents, involving licences and royalties. Many tools made of beryllium-copper are now on the market, and it is used for springs, firing-pins for firearms, precision bearings, bushings, valve parts, moulding and casting dies, wire cloth for special uses, and for many other purposes.

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 effective 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.

The beryllium industry had its beginning in Germany, but two concerns are now established in the United States for extracting beryllium from its ores and manufacturing beryllium alloys; these are Beryllium Corporation of Pennsylvania (formerly Beryllium Corporation of America), Reading, Pa., and Brush Beryllium Company, Cleveland, Ohio. Until recently, the manufacture of articles from the alloys was in the hands of the American Brass Company, Waterbury, Conn., and the Riverside Metal Company, Riverside, N.J., but the Beryllium Corporation has now installed fabricating equipment at its plant at Reading, Pa. The Brush Company also makes a number of beryllium chemicals, including the highly 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); in lithopone, to increase light-fastness; and in high-duty abrasives.

Beryllium came prominently to public attention in 1939 through an investigation into practices in the industry conducted by the Temporary National Economic Committee of the United States Congress, a body empowered to enquire into supposed trade monopolies. Evidence presented at the hearings tended to show that the high price of the master alloys and expense of fabrication and heat treatment of the finished products have left insufficient profit to manufacturers of the latter to enable them to increase output to a point where volume of sales would permit of the alloy definitely supplanting phosphor bronze, with which it competes. The price drop of $8 per pound, from $23 to $15, for the master alloy in 1939 was an important step, and it is stated that the price may be still further reduced, perhaps to $5, if a market can be built up. Such a price might enable the standard 2.25 per cent alloy to be sold at not over twice the cost of phosphor bronze. Numerous articles on the applications of beryllium and its alloys continue to appear in technical journals, indicating the extensive research being conducted on the subject. One of the leading fabricating companies has stated at the above-mentioned hearings that its purchases of master alloy had totalled only 15,000 pounds in five years, while total beryl consumption by the oldest established producer of the alloy was given at around 1,000 tons in its ten years of operation.

Throughout 1939, 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 1938, were nominal, actual sales usually being by individual contract. Some transactions were reported at $3.25 per unit of BeO, or $32.50 to $39.00 for the above grades.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

BITUMINOUS SAND IN 1939

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

During the period 1931-1938, International Bitumen Company has processed small amounts of bituminous sand at its plant at Bitumont, Alberta. Bituminous products have included various grades of asphalt for paving and roofing, and 37,500 gallons of fuel oil. Fuel oil was disposed of to mining companies operating on Lake Athabaska. Roofing asphalt was shipped to consumers at Crown Point, Indiana, and at Calgary, Alberta; paving asphalt was shipped to Edmonton and Banff, Alberta. The value of the above shipments was approximately $11,000.00. The equipment of the International Bitumen Company at Bitumont includes a separation plant, a refinery with a rated capacity of ~~3[illegible]~~ 700 barrels per day, a shipping dock, and complete housing facilities. This plant was inactive during 1939.

Abasand Oils, Limited, continued construction work on its separation, ~~distillation~~, and refining units on Horse River, near McMurray. The separation plant has a rated capacity of 400 tons of bituminous sand, and the refinery a rated capacity of 600 barrels of charging stock per twenty-four hours. It is expected that initial production will include gasoline, distillate, road oil, asphalts, and coke. On November 1, 1939, construction of separation and refining units was well advanced. Work had been somewhat delayed owing to difficulty in securing delivery of necessary piping, but it was expected that all necessary work would be completed by March 1, 1940. A large shale planer for excavating bituminous sand has been delivered at the Horse River quarry, and it is hoped that gasoline and Diesel oil will be available for the northern market by May, 1940.

The Bureau of Mines at Ottawa has been conducting a comprehensive investigation of these deposits of natural asphalt. In addition to field exploration during fifteen seasons, extensive laboratory studies of the bituminous sand and of bitumen separated from it have been made. Various industrial applications for the separated bitumen, including its use in the manufacture of certain rubber goods, are also being investigated. The 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, and certain solid and semi-solid bitumens.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH 1940.

CEMENT IN 1939

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.

Within recent years the dry process of cement manufacture has been replaced by the wet at all but one of the eight plants making clinker from domestic raw materials, and remarkable uniformity in the principal product is now achieved throughout the country, as a result of close technical control and improvements in plant equipment. Incidentally, the rotary kilns now generally used throughout the industry are the largest units of moving machinery in existence.

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 now in use at several cement plants in various parts of the world and limestone deposits advantageously situated but too impure in their natural state for cement manufacture can now be utilized.

Production of cement in 1939 was 5,731,264 barrels valued at $8,511,211 as compared with 5,519,102 barrels valued at $8,241,350 in 1938. Sales were under those of the corresponding months of 1938 during the first half of the year, but increases showed during the latter half.

Cement is manufactured in most countries of the world. In 1937, the latest year for which fairly complete data are available, the world's production amounted to 83,040,000 metric tons, according to the United States Bureau of Mines Minerals Year Book for 1939. To this total Canada contributed 975,231 metric tons. The principal producing countries in order of tonnage were United States, Germany, United Kingdom, Japan, Russia, France, Italy, and Belgium.

Exports of cement during 1939 amounted to 156,556 barrels valued at $159,579 a decided increase from the 89,419 barrels valued at $101,059 exported in the previous year. Trinidad took 42 per cent and Jamaica 13 per cent. Other countries to which exports were made were Newfoundland, Barbadoes, Bermuda, other British West Indies, Peru, British Guiana, and the United States.

Imports of cement totalled 16,622 barrels valued at $58,316, compared with 48,497 barrels valued at $105,326 imported in 1938. Belgium supplied 41 per cent of the year's imports; the United States 38 per cent; Great Britain 19 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, 1938 and 1939 were as follows:

	1937	1938	1939
Quebec	$1.37	$1.35	$1.33
Ontario	1.38	1.40	1.13
Manitoba	2.27	2.28	2.25
Alberta	1.99	2.01	1.97
British Columbia	1.81	1.87	1.91

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OTTAWA, MARCH, 1940.

CLAYS AND CLAY PRODUCTS IN 1939

The industrial clays of Canada may be classified as common clays, stoneware clays, fireclays and china clays. Statistically the ceramic industry of Canada is conveniently classified into two divisions: (1) Production from domestic clays, which includes the production of building brick, structural tile, drain tile, roofing tile, stoneware, sewer pipe, pottery and refractories, and (2) production from imported clays, which includes the manufacture of 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 ceramic products manufactured from domestic clays in 1939 was $4,949,830 compared with $4,515,182 in 1938.

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 made from domestic clays (building brick, hollow building tile, drain tile, roofing tile, etc.), was $3,603,173 in 1939, compared with $3,276,193 in 1938.

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, to be extensively utilized (owing to the availability of cheap gas fuel) in the manufacture of stoneware, sewer pipe and pottery.

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

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

The value of stoneware articles (sewer pipe, pottery, etc.) produced in Canada from domestic clays in 1939 is reported to have been $1,091,500 compared with $1,013,997 in 1938.

Fireclays

Two large plants and a few small plants in Canada manufacture fireclay refractories from domestic clay. One, about 50 miles south of Vancouver, B. C., extracts a high grade, moderately plastic fireclay (by underground mining) from the clay beds in the Sumas Mountain, and manufacturesfirebrick and other refractory materials. Another plant at Claybank, Saskatchewan, by selective mining, utilizes the highly plastic, refractory clays from the "White Mud" beds of southern Saskatchewan.

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

The value (sales) of the refractories produced in Canada from domestic clays in 1939 was $213,987 compared with $187,093 in 1938; the value of refractories produced from imported clays is reported to have been $755,525 in 1938 (1939 not yet available) compared with $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, where a group of open pits was operated for several years prior to 1923. In 1937 a reorganized company was formed to extract the kaolinized material by underground mining and to refine it into high grade china clay, washed silica sand forming a by-product. A shaft has been sunk to a depth of 365 feet, and a mill erected to carry out the washing process in accordance with the most modern methods. 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 aroused much interest in recent years, but have not as yet been commercially developed, owing to their remoteness from industrial centres, and the 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 that compares favourably with the best china clays found on this continent. Transport by barge to railway has been considered but as yet little development has taken place.

In the manufacture of such products as porcelain, sanitary ware, dinner ware, ceramic floor and wall tile, etc., china clay imported from England is used almost entirely. In addition to clay for ceramic use, large annual importations of china clay are made into Canada for use in the production of fine paper, in the rubber industry, and for other industrial purposes. The imports of china clay in 1939 were valued at $376,750 compared with $324,933 for the previous year.

Ball clays of high bond strength occur in the white mud beds of southern Saskatchewan. Although the market in Canada for ball clays is not large, it is growing, and there are good prospects of developing a profitable export market in the United States. The reported value of clays exported from Canada (which are chiefly ball clays) in 1939 is $2,065 compared with $2,652 in 1938.

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 ceramic products imported into Canada is $7,011,350 in 1939 compared with $6,910,268 in 1938.

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DIATOMITE IN 1939

Diatomite is the microscopically small remains of siliceous shells of diatoms, a form of algae that at one time lived under water. The material of recent origin, which is the most common in Canada, usually occurs as a grey or brown mud or peat, whereas the Tertiary diatomite is in more or less dry and compact beds, very light in weight and white to cream in colour.

The International Diatomite Industries Ltd. Tatamagouche, Nova Scotia, continued to be by far the largest Canadian producer, but its output was about thirty per cent less than in 1938. The crude diatomite from Rhudes pond, near New Annan, is calcined and treated in a small mill at Tatamagouche station, 12 miles to the north. About 90 per cent of the sales was exported, mainly to England, while of the remaining 10 per cent sold in Canada, nearly all was used for insulation. G. Wightman, Smith's Cove, made about 40 tons of calcined diatomite in a small kiln erected on the Digby neck deposit, N.S., and shipped a few tons. Pulverizing equipment is now being erected.

About 1½ tons of crude diatomite from the Pocotogan area, near St. John, New Brunswick, was shipped by J. A. Morton of Montreal to the Department of Mines and Resources laboratories in Ottawa. Experiments to make an efficient filter-aid are being conducted on the 550 pounds of calcined diatomite produced. The deposit is owned by W. M. Campbell of St. John, N. B.

In the Muskoka region of Ontario, the Muskoka Diatomite Ltd., Toronto, ran about 100 tons of raw material, mined in 1938, through the mill erected on the property south of Gravenhurst. Five tons of calcined material was shipped mainly for filtering. The plant is again closed pending changes in the process of treatment.

In British Columbia the West Coast Silica Products Co., under the management of W. S. Chow, erected in 1939 a treatment mill near the north end of Gabriola Island, opposite Nanaimo on Vancouver Island. The crude material in James Rowan's swamp is loosened by tractor and plough and is hauled a quarter mile and spread out to air-dry on the flat bare rock alongside of the mill. The diatomite was at first calcined in a 30-foot circular Beehive-Kiln, but this has now been changed to eight small flat Kilns resulting in a more evenly burned product. The calcined material is sent through a system of pulverizers and cyclone separators from which a number of different products are bagged. About fifteen tons of various grade was made during the year, but only one or two tons have been sold up to the end of the year. About sixteen tons of the diatomite stocked in Vancouver was sold, mainly for insulation, some being used for experimental insulating bricks made by Fairey and Company, Vancouver. Several car lots of this crude diatomite was mined in the vicinity of Quesnel a few years ago.

The Canadian production in 1939 was 362 tons, and sales were 301 tons, valued at $10,397, against 398 tons valued at $13,842 in 1938.

Export records are not available, but from private information it is known that about 68 per cent of the total sales was for England and about 13 per cent for the United States; sales within Canada in 1939 amounted to 56 tons as against 85 in 1938.

The imports in 1939 were 4,300 tons, almost all from California, U.S.A., as against 3,700 tons in 1938.

Very little change occurred in the consumption of diatomite used in the home industries during the year. 90 per cent of the diatomite now being consumed in Canada is in the form of filter-aids, 5 per cent 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 insulating 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 properly prepared diatomite of the highest quality can be successfully marketed on a scale sufficiently large to warrant the operation 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 per cent 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.

A fair and increasing demand exists in England, which is still the world's largest importer, the consumption being about 50,000 short tons in 1938. The requirements are 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 insulating bricks vary from $85.00 to $140.00 per 1,000 according to grade and density.

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OTTAWA, MARCH, 1940.

FELDSPAR IN 1939

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 the adjacent sections of eastern Ontario and western Quebec, except for a few thousand tons mined in Manitoba from 1934 to 1938.

During 1939, 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, and a small tonnage from operations near Madawaska, 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 in recent years has been derived from the last two areas.

In Quebec, the entire output in 1939 came from mines contiguous to the Lièvre river, north of Buckingham, Papineau county; this district supplies the entire small tonnage of dental spar produced in Canada.

In Manitoba, there has been no mining reported during the last three 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 1939 was 12,463 tons, valued at $112,084, against 14,058 tons, valued at $129,293, in 1938, a decrease of about 11 per cent in quantity and 13 per cent in value. The output of crude spar goes in part to domestic grinding mills and in part to mills in the United States, most of the latter to 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 and nepheline syenite in 1939 amounted to 32,362 tons, valued at $137,444, compared with 29,242 tons, valued at $139,408, in 1938. The exports of feldspar were not given separately previous to April 1938; in 1939 they totalled
-9,957 7,661 tons, valued at $~~51,921~~. Virtually all of the feldspar 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 was reduced from 35 cents to 25 cents per long ton; the duty on ground feldspar was also reduced, from 30 per cent ad valorem to 15 per cent.

Imports of ground spar, all from the United States, were 607 tons, valued at $10,379, in 1939, compared with 615 tons, valued at $10,083, in 1938. Imports of crude feldspar (used to a small extent for blending and for the manufacture of cleansers) were 257 tons, valued at $1,302, as against 42 tons, valued at $367, in 1938. Crude feldspar enters Canada duty-free; ground spar from the United States pays 15 per cent ad valorem.

World production of feldspar (including "china stone", a variety of granite used in place of feldspar) totalled nearly half a million tons in 1937, the last year for which fairly complete figures are available. Canada then ranked sixth in point of output, with about 4 per cent of the total tonnage.

In view of the comparatively low unit value of the mineral, successful development of deposits 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 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 1939 obtained most of its requirements from Quebec, with a small tonnage also from New Hampshire. Canadian Flint and Spar Company, formerly a subsidiary of M. J. O'Brien, Ltd., was taken over in 1939 by N. B. Davis and associates: headquarters of the company are at 207 Victoria Building, Ottawa.

Domestic prices for crude remained at the level of the previous year, with No. 1 ceramic grade quoted at $5 to $7 per ton, f. o. b. rail or mill. Ground spar sold at $16 to $17 per ton, ex mill. In the United States, prices of both crude and ground domestic spar have shown a steady decline in recent years, with a wide spread in the price of both commodities in the different producing regions. In 1938, the value of crude ranged from $2.90 per long ton, f. o. b. mine, in the western States, to $5.30 in New England and North Carolina, with an average of $4.56, the lowest figure in years. In the same year, the value of ground domestic spar ranged from $6.50 to $21 per short ton, according to source, with an average of $11.50. Ground Canadian feldspar commands a premium, and in 1938 sold at an average level of $19.25.

Nepheline syenite, a material finding increasing use as a substitute for straight feldspar in the glass trade, as well as for blending with feldspar to raise the alumina content for various ceramic uses, 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. The production of nepheline syenite in Canada, begun in 1936, has risen rapidly and is already approaching the figure of maximum feldspar output (45,000 tons in 1924). In addition to the large plant of the American Nepheline Corporation, at Rochester, N. Y., processing solely nepheline syenite, two American feldspar mills are now taking substantial tonnages. Canadian spar, however, enjoys a high reputation as a standard grade for various ceramic uses and will probably continue in demand by American mills.

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 is becoming 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 mixtures 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 states that a plant employing flotation and agglomerate tabling was erected at a feldspar mill at Keene, New Hampshire, in 1938 and is now in successful operation. Technical research on feldspar is receiving 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 treatening 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 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. Other, low-cost, materials threatening encroachment on feldspar for ceramic uses, more particularly in the glass trade, are volcanic ash and furnace slag, the latter reported to be already successfully employed for coloured glass in India.

As indicating present consumption trends, an official survey of the feldspar industry in the United States showed that sales of ground spar in 1938 were distributed as follows to the various consuming industries: glass, 55 per cent; pottery, 35 per cent; enamel and sanitary ware, 9 per cent; the remainder being divided between other ceramic uses, scouring preparations and abrasive wheels. In 1937, 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, 1940.

FLUORSPAR IN 1939

Few important occurrences of fluorspar are known in Canada, and practically the whole of the domestic requirements for the metallurgical, ceramic and other industries is imported. No shortage due to war conditions is foreshadowed, as adequate supplies can probably continue to be drawn from Newfoundland and the United States, the present chief sources of imports.

The only localities where the mineral is known to occur in important amounts are the Madoc district, in Hastings county, Ontario, and near Grand Forks, in southern British Columbia.

During the 1914-1918 war, a number of properties in the Madoc area produced large tonnages, with a total output for the five-year period 1916-1920 of 20,000 tons; since 1920 the small amount produced (seldom over 100 tons in any year) has been won mainly by pick-and-shovel at surface and by picking over old waste dumps. In recent years there have been occasional reports of plans to re-open some of the old mines, but nothing developed until 1939, when the Moira Fluorspar Mining Syndicate, of Belleville, Ontario, took over the Noyes property, one of the larger of the old producers; in November small shipments from the upper mine levels were reported, and a mill was being built for recovery by jigging, tabling and flotation. Milling of the old waste dumps estimated to contain around 40 per cent fluorspar is contemplated, and the company also reports having options on other properties in the area. This is the first time concentration has been attempted for Madoc fluorspar ore, all previous recovery having been by cobbing and picking. Late in 1939, several other properties in the district were reported to have been optioned by Gilman Exploration Ltd. of Montreal.

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 70,000 tons of crude fluorspar, from which 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 now rendered the use of fluorspar unnecessary. The whole of the fluorine so recovered is at present 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 electrolytic baths, laundry purposes, and as an insecticide and wood preservative; lead and zinc fluosilicates, also of value as grasshopper poisons; and ammonium fluosilicate, used as a detergent.

Production of fluorspar in 1939 was 240 tons, valued at $4,995, compared with 217 tons valued at $3,906 in 1938. As in recent years, all of this was from workings at Madoc, Ontario.

Imports of fluorspar into Canada in 1939 totalled 16,321 tons, valued at $258,796, compared with 15,057 tons valued at $212,131 in 1938. The material came from Newfoundland (5,639 tons), the United States (6,502 tons), United Kingdom (1,122 tons), Belgium (305 tons), Germany (127 tons), and France (2,626 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 upwards of 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, enamel, 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 important increase 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 Nemours Company. According to Minerals Yearbook 1939, published by the U.S. Bureau of Mines, sales of fluorspar from domestic mines in the United States in 1938 were divided as follows, by consuming industries: steel and foundry, 67 per cent; hydrofluoric acid and derivatives, 14 per cent; glass, 11 per cent; enamel, 5 per cent; miscellaneous, 2 per cent.

Clear, glassy, crystal fluorspar finds employment in various types of optical instruments, such as the spectroscope and microscope, 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 1914-1918 War, fine crystals were obtained from the Keene mine, at Madoc, Ontario. The discovery in Siberia of exceptionally large, clear crystals, measuring 4 to 6 inches across, has recently been announced, and good material is stated to be found occasionally in mines in the Illinois-Kentucky field, as well as in California.

Prices of fluorspar in the United States market showed a slight decline in 1938; gravel spar (including fluxing grades and acid grade flotation concentrate) sold at an average of $18 per ton f.o.b. mines; acid lump sold at $23; and ground (including glass and enamel grade flotation concentrate) at $26. Trade journal quotations at the end of 1939 were $22 for the first two grades, and $31 for ground. Canadian quotations on ground spar, various grades, as taken from trade journals, rose from $32 per ton in January 1939 to $40 in December.

The recovery of marketable grades of fluorspar from mine-run ore is usually accomplished by hand-picking of the clean lump mineral, followed by crushing, jigging and tabling of the impure material and fines. In the last decade flotation has been increasingly employed in the United States, and total production of flotation concentrates to date has been around 50,000 short tons. Its use has effected important recoveries of high-grade fluorspar contained in table middlings and tailings, materials formerly discarded as waste. Such concentrates have hitherto been sold mainly to the acid, glass, and enamel trades, but recent work has shown that they can be sintered or briquetted successfully for open-hearth steel use. In general, selective flotation effects satisfactory separation of fluorspar-quartz-sulphide 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. Separation and recovery results from concentration tests run in the laboratories of the Bureau of Mines on Madoc material, usually a fluorite-calcite-barite mixture, as well as on fluorite-barite ore from the Lake Ainslie district, Nova Scotia, have not thus far been very promising. Results of operations in the newly-installed mill of Moira Fluorspar Mining Syndicate, at Madoc, will be awaited with interest since, if successful, they may lead to a substantial increase in production from that district.

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 Trade Agreements of 1938, effective January 1st, 1939, the rate on imports of the first-mentioned grade from Canada and the United Kingdom was reduced to $4.20 per long ton ($3.75 per short ton). No duty is levied on fluorspar imported into Canada.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

GARNET IN 1939

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 suitably 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 100 tons of prepared garnet, used in Canada during 1939, 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 1939 there was a little activity in garnet in Canada. Development work was continued by the Garnet Concentrates Inc., Quebec, on a property near Langlade in the Abitibi region, Quebec, and samples were sent to different firms in the United States for testing. During May, the unfinished 100-ton mill of the Canada Garnet Ltd. was blown down and later was rebuilt, but the installation of the machinery is not as yet completed. The property is in Joly township, 2 miles southwest of Labelle, Quebec. Some prospecting work was carried out and samples sent to the United States, by A. G. Chew from a deposit 4 miles north of River Valley station, 40 miles northwest of North Bay, Ontario. Some of the concentrate produced in 1937 from the deposit in Ashley township, east of Bancroft, Ontario, was used for the trial manufacture of cement-garnet pulpstones by Robin Boyle of Toronto, Ontario, but, up to the present, an economical stone has not been made.

About 90 to 95 per cent of the world output of garnet comes from the United States. The Barton Mines Corp., North Creek, N.Y., is by far the largest producer. The total 1939 United States production of the three active companies was 3,600 tons and sales were 3,900 tons, against 3,200 tons produced and 2,669 tons valued at $191,658 sold in 1938. This increase over 1938 was partly due to general business conditions and partly because the increased inventories of consumers at the end of 1937 were not absorbed until early in 1939.

Outside of the North American continent, England is by far the largest individual user, with an estimated annual (pre-war) 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 is $75-$80 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. Also about 300 tons of garnet at $25.00 per ton was used for sandblasting.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

GRANITE IN 1939

(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 roadbeds, for heavy aggregate in large concrete structures, for filling breakwaters and for bridge piers. The big curtailment of such operations during the past several years has 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, and there is little change from the preceding year. No new deposits have been opened and production has come from the well established firms.

The province of Quebec furnishes most of the granite for building, the Stanstead, St. Samuel, Lake St. John and Rivière-à-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.

National Granite Limited, Saint Joseph d'Alma, Lake St. John county, Quebec, added extensively to its equipment, including a sand-blasting machine, carborundum machine, polishing machines, etc., and greatly increased its output over that of the previous year.

Material from quarries in the province of Quebec was furnished to a number of public buildings including the Supreme Court Building, Ottawa, the Ottawa Post Office, several buildings in British Columbia as well as for the T. Eaton Company stores in Port Arthur, Ontario, and Edmonton, Alberta.

Prospecting for granite deposits, suitable for both building and monumental use, has been active in the province of Manitoba, and a company named the Keystone Granite Quarries, Limited, has located several deposits of varying coloured red granite, and hopes to develop a market for the product.

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. In the earlier part of the year an appreciable amount of foreign stone, principally black and red, was imported, mainly from Finland and Sweden, but this source of supply is now cut off. Black granite has been quarried in Canada, notably in the vicinity of lake St. John, Quebec, and from quarries along the north shore of lake Superior, and stone from these areas, at the present time, should find a ready market for monumental use. Other deposits of 'black granite' in the Maritime Provinces, Quebec, Ontario, and Manitoba give promise of yielding stone of good quality.

Large areas in Canada are underlain by granite, and the prospects of finding stone suitable for its 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 1939 was 985,921 tons valued at $1,737,771 as against 705,307 tons valued at $1,379,417 in 1938.

Our exports were 925 tons, valued at $10,235 (granite and marble unwrought), as against 657 tons, valued at $5,042 in the previous year.

Imports of granite were valued at $94,738 in 1939, compared with imports valued at $99,103 in 1938.

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, although the various shades of reds are still popular in many districts.

With the cutting off of the shipments from the Scandinavian countries to the United States as well as to Canada, there has been created a possible market that is worth careful study on the part of Canadian producers of monumental stock, especially in the blacks and reds.

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.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

GRAPHITE IN 1939

For a number of years past, the entire production of Canadian graphite has come from a single operator, the Black Donald Graphite Company, with mine and mill at Whitefish lake, 13 miles west of Calabogie, Renfrew county, Ontario. This mine now has a record of over 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 are 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 the American trade for a number of years past has relied almost entirely on foreign graphite for flake and crystalline (plumbago) grades, obtained mainly from Madagascar and Ceylon, respectively, as well as for amorphous graphite, obtained from Mexico. In recent years, the comparatively small American output of graphite (no figures of production published) has consisted mainly of amorphous material, mined for paint use in Michigan and Nevada, some flake being produced in Texas and some recovered as a by-product of kyanite operations in Georgia. In 1938 and 1939, production was increased by the opening of a rich deposit of fine flake near Morristown, in northwestern New York State: the ore runs around 22 per cent carbon and is milled at Morristown, the products going to the foundry and battery trades. The economic considerations affecting graphite mining in the United States apply even more strongly to Canada, where climatic conditions impose added difficulty in production and 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 milled graphite in 1939 was valued at $61,684 compared with $41,590 in 1938, an increase of 48 per cent; tonnage figures are not available. A substantial part of the Black Donald production now consists of material recovered by treating old mill tailings, the carbon content of which may run as high as 45 per cent.

Canadian graphite exports, including both natural and artificial, totalled 1,321 tons, valued at $56,614 in 1939, compared with 1,150 tons, valued at $54,366 in 1938.

Total imports, including ground, unground, and manufactures of, but exclusive of crucibles, were valued at $100,328 as against $87,888 in 1938.

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, Mexico, and Madagascar.

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 lessenned demand for crucibles. Improved technique in manufacture and changes in the type of furnace used make for longer life of pots, and the use of important amounts of refractory silicon carbide in crucible mixtures has also been an important factor. Fine flake graphite 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. A large part of the amorphous paint graphite used is relatively impure, consisting of natural graphitic shale or slate that is ground for use without any beneficiation and often containing less than 50 per cent of actual graphite. Large amounts of amorphous graphite are taken by the dry battery trade and by manufacturers 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; in various electronic and electrical devices, and in some branches of powder metallurgy. A recently introduced product, "Karbate", is a structural form of artificial graphite rendered non-porous and impermeable by impregnation with an inert resin. The material possesses high heat conductivity and chemical resistance, and is advocated for use in pipelines, tanks, etc., in which these properties enable it to displace metals and other materials to advantage. Artificial graphite is made in Canada by the Electro-Metallurgical Company of Canada, at Welland, Ont., and by the Exolon Company, at Thorold, Ont.; the American market for this class of graphite is supplied mainly by these two concerns.

The graphite market is highly competitive, and price quotations 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 1939 price situation showed little change from that of the preceding year, but levels, particularly of Ceylon graphite, commenced to rise towards the end of the year, owing to increased rates of ocean freight and insurance consequent on the outbreak of the war. No shortage of supplies seemed imminent at the year-end, and stocks on hand both in Canada and the United States were estimated as adequate for at least twelve months. In the American trade, Ceylon lump sold at 7½ - 8½ cents per pound, Ceylon chip at 5½ cents, and Ceylon dust at 3½ - 4 cents; Madagascar No. 1 flake ranged from 7 - 9 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, from Metal and Mineral Markets, December, 1939.

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 Trade Agreements of 1938, in effect from January 1st, 1939, these duties were 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 (including the United States), 7½ per cent ad valorem; general, 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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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

GRINDSTONES, PULPSTONES, AND SCYTHESTONES IN 1939

Grindstones - Although no actual quarrying was done 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 Works Company, New Britain, Conn., U.S.A., operated the Mic Mac quarry at Woodburn in Merigomish Harbour, N.S., and shipped approximately 150 tons of grindstones. The total grindstone sales 283 amounted to ~~[illegible]~~ tons valued at $12,188, as against 292 tons valued at $13,368 in 1938.

The large-size Canadian grindstones are used mainly for sharpening pulp-mill and tobacco knives, and in the United States 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.

Pulpstones - There has been no output of pulpstones since the J.A. and C.H. McDonald Company ceased production two years ago from the sandstone beds on the northwest end of Gabriola Island, near Nanaimo, Vancouver Island, British Columbia.

Good pulpstones are in demand, particularly for use in the large magazine grinders, but as known Canadian deposits containing thick beds of sandstone of the proper quality appear to have been worked out, production for the present has ceased. Added to this there is substantial and increasing competition from Canadian made artificial segmental pulpstones of silicon carbide grit, there being at present about 360 of these stones in operation in the various Canadian pulp mills. The imported natural pulpstones come mainly from West Virginia, U.S.A.

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 20 tons valued at $3,088, as against 21 tons valued at $3,408 in 1938.

The production of all grades of stone in 1939 was 3 403 tons valued at $15,276; in the previous year the production was 311 tons valued at $16,198.

The exports of these stones in 1939 were valued at $6,312 as against a valuation of $5,441 in the previous year. The imports, which consisted chiefly of pulpstones, were valued at $155,859 as against $118,625 in the previous year. Most of these come from the United States, and some from England.

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GYPSUM IN 1939

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 early part of the year made shipments from its Cheticamp and Dingwall properties to London, England, and also to the United States. With the advent of war, overseas shipments were curtailed. At the company's property at Dingwall, Victoria county, an entirely new plant for the handling and shipping of its ore was added, and a new loading pier was installed. The storage and loading plant is operated by electric power generated by diesel engines. A new highway, about one mile in length, was constructed from the quarry to the storage plant at Dingwall Harbour.

The property at the head of Baddeck Bay, Victoria county, Nova Scotia, formerly owned by the North American Gypsum Company, Rutland, Vermont, was purchased late in 1938 by Gypsum, Lime and Alabastine, Canada, Limited. In the past year a new quarry was opened just north of the storage and loading pier and at least two shipments of high grade gypsum were made to their plant in Montreal. The loading equipment of the former Company was used but the present owners plan to install new equipment in 1940.

The Victoria Gypsum Company, from its plant at Little Narrows, Cape Breton, Nova Scotia, made steady shipments to England for the first eight months of the year as well as shipping to the United States, the overseas shipments being greatly curtailed since the outbreak of war.

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 gypsum quarries and plant at Hillsborough, New Brunswick, operated steadily and shipments of crude gypsum were made to the United States and all grades of plaster and wallboards were produced for the Eastern Canadian market.

Extensive deposits of gypsum are known in norther Ontario; to date these have not been developed.

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 supplied from the four plants at present operating namely two in Winnipeg, and two in the province of Alberta.

Production from the deposits at Falkland, B. C., were maintained to supply the plant at New Westminster, B. C.

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 still in progress to find an outlet for this material.

The production of gypsum in 1939 was 1,408,188 tons valued at $1,922,957 as against 1,008,799 tons valued at $1,502,265 in 1938. This production constitutes an all time record for Canada.

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: 2,218 tons valued at $48,352 compared with 1,752 tons valued at $39,278 in 1938.

The exports of gypsum were: 1,261,794 tons valued at $1,425,195 compared with 811,567 tons valued at $966,748 in 1938.

The use of anhydrite in England for the manufacture of sulphuric acid, ammonium sulphate, cement and special plasters is increasing, and in normal times there is a good opportunity for Canadian material in this market. Canada is fortunate in having extensive deposits, favorably 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 in Canada was exported principally as a fertilizer for the peanut crop, but it may well be that in time an industry will be started in this country in which our anhydrite may be used for the manufacture of sulphur or sulphur compounds as well as special plasters, similar to that 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 improvement in Canada. The gypsum industry, which is entirely dependent on the building industry, has not shown so rapid a rate of increase as some of the other industries, nevertheless the improvement since 1933 has been quite marked, and the year's production has made an all time record, although if times had been normal there is little doubt but that the increase shown would have been a great deal more.

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, wallboards, blocks, and special insulating and acoustic plasters have been developed.

It is doubtful if we can expect any great development in this industry during war time, in fact it is probable that there will be a decided decrease in production, although as long 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 will continue to 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 the 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, 1940.

IRON OXIDES (MINERAL PIGMENTS) IN 1939

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 1939 are at Almaville, Laviolette County; St. Adelphe, Champlain County; and near Lacoste, Marchand Township, Labelle County. In Quebec, the tonnage of crude oxide sold for purification of illuminating gas, was lower than for the preceding year, but on the other hand the quantity and value of the calcined oxide sold for use as pigments in paint manufacture showed a material increase. During the year, additions made to the oxide plant at Red Mill, Quebec, increased the capacity by 20 per cent.

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.

The execution of the plans made for a sulphur plant to be erected at the Aldermac mine, from which iron oxide was to be produced as a by-product, has been deferred owing to world conditions.

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, they 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 1939 totalled 5,822 tons valued at $87,463 as compared with 5,821 tons valued at $71,769 in the previous year. The production during the past ten years has averaged 6,000 tons per year.

Our exports of mineral pigments were ~~173~~ 2622 tons valued at ~~$15,612~~ 178,320 in 1939 as against 1,685 tons valued at $104,814 in 1938.

Imports of all kinds of ochres, siennas, and umbers totalled 1,547 tons and were valued at $56,873 in 1939 as compared with 1,167 tons valued at $37,631 in 1938. In addition there were imported prepared oxides, fillers, and related products, some of which were probably not ochres, valued at $954,927 as against a valuation of $718,329 in 1938.

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, 1940.

LIME IN 1939

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 1939. 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.

A large new market for white, high-calcium lime has been created 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 has other uses, and the possibility of its manufacture to supply them is being examined.

During 1939 Gypsum, Lime & Alabastine, Canada, Limited, erected new vertical, gas-fired lime kilns equipped with centre burners at their plants at Beachville, Ontario, and at St. Marc des Carrieres, Quebec. These kilns, which are claimed to be the most modern shaft kilns on the American continent, have proved very efficient in operation and represent a notable advance in the technology of manufacturing lime in vertical kilns.

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 1939 amounted to 473,617 tons of quicklime valued at $3,335,697 and 76,725 tons of hydrated lime valued at $670,271 compared with the 1938 production of 415,761 tons of quicklime valued at $2,953,091 and 71,161 tons of hydrated lime valued at $589,561.

Very little trade in lime exists between Canada and other countries because lime is made in virtually all countries. Exports of lime in 1939 amounted to 9,203 tons valued at $75,172 compared with 6,381 tons valued at $51,346 exported in the previous year. The bulk 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 1939 to 8,714 tons valued at $74,261 compared with 6,940 tons valued at $37,255 in 1938, 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 that is marketed in 50-pound, multi-wall paper bags. Quicklime 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.

New chemical uses for lime are continually appearing, for instance in the manufacture of a new plastic from pulp-mill waste liquor that promises to be one of the cheapest of all plastics, lime is used three times in the process.

Prices of the various lime products vary over a wide range depending on the geographical position of the plants and on differences in quality of the lime. No significant change occurred in prices of lime during 1939.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

LIMESTONE (GENERAL) IN 1939

Limestone, on account of the great variety and importance of its industrial uses is the most useful of all rocks. It is quarried in all provinces of Canada except Prince Edward Island and Saskatchewan with 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 about 86 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 use.

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 1939 production of limestone for general use, exclusive of that used for building stone, lime, and cement is estimated at 4,303,580 tons valued at $3,691,969 compared with a production of 4,288,507 tons valued at $3,864,619 in 1938. The production for all purposes in 1939 was 6,720,000 tons as against 6,501,000 tons in the previous year.

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 furnaces 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, and various chemical products. It is of interest to note that in 1939 Canadian rock wool made from argillaceous dolomite was exported to England, Switzerland, Finland, Holland, South Africa, British West Indies and the Argentine.

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, 1940.

LIMESTONE (STRUCTURAL) IN 1939

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, 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 1939 no noteworthy new developments occurred in connection with the production of limestone for building. Data on production for 1939 are not yet complete but there was an increase in the production as compared with 1938 when 34,432 tons valued at $424,147 was marketed. 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 $2,863 in 1939. Imports of all varieties of building stone excepting marble and granite, during 1939, were valued at $37,456 as compared with imports valued at $34,764 in 1938. 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.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

LITHIUM MINERALS IN 1939

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 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 of lithia (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 also reports having acquired control of lithium deposits on the Irgon claim, at Cat Lake, north of the Bird river, where important amounts of spodumene occur. In 1939, the company reported plans for financing further development of its holdings and the processing of its ores, but up to the end of the year these had not materialized.

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. No development of this occurrence has yet been undertaken.

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, but no attempt at development has yet been made.

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 considerable spodumene; the deposit is stated to lie about 10 miles from Barraute station on the Canadian National railway.

Of interest, though hardly of any present economic significance, is the recent report by field parties of the Geological Survey of the occurrence of lithium-bearing pegmatites in the Northwest Territories. Pegmatite dykes are stated to be extensively developed within an area lying about twenty miles northeast of the new gold camp at Yellowknife, on the north shore of Great Slave Lake, and certain of the dykes have been found to carry spodumene, as well as beryl, tantalite, and other minerals typical of lithium mineralization. These occurrences suggest the existence in the area of a lithium 'province', similar to that of southeastern Manitoba.

No production of lithium minerals was reported in 1938 or 1939. In 1937, production was valued at $1,694.

Figures of world production of lithium minerals, exports, and trade, are not published. Most of the supply comes 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 supply, 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, 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. Production in 1938 was reported as 'lithium compounds', and not 'minerals' as previously, owing to the initial recovery in that year of lithium phosphate from natural brines (see below); total lithium production in the form of both minerals and salt was 892 tons, a sharp decline in quantity from the previous year's level, but the value was nearly ten times as great owing to the high lithia content of the salt. 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 have recently attracted 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 Bureau of Mines at Ottawa on samples of spodumene from Manitoba, with good results; one test made on a shipment from the Kobar claims, Wekusko lake, yielded a concentrate with 6.13 per cent of lithia (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. The U.S. Bureau of Mines have also recently reported success in beneficiating spodumene-feldspar-quartz rock by froth flotation methods; it was found, however, that for best results, a preliminary cleaning of the surface of the grains was required, particularly in the case of stained or weathered rock, and such cleaning was effected by an "attrition scrubbing" treatment, also recently developed in the laboratories of the Bureau. Production of lithium minerals in South West Africa has been increasing, exports of amblygonite in the first nine months of 1939 being reported as 660 long tons, and of lepidolite, 500 tons. 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. Argentina has recently appeared as a producer of spodumene, with 84 metric tons reported in 1937, and 169 tons in 1938.

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.

No exports were recorded in 1938 and 1939. 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 is used also as a constituent of the batch in opal and heat-resistant 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 trade in lithium chemicals is comparatively small and the world consumption of lithium salts has remained fairly steady. Lithium chloride is being developed as a drying agent in air-conditioning, it being one of the most hygroscopic inorganic compounds known; progress in this field has been slow, but is reported to have made substantial headway in 1939, with sales of equipment ('Kathabar') tripled over 1938, involving a consumption of ten tons of the salt. 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; crystals up to five pounds in weight are said to have been made.

Industrial research has been proceeding during the last few years in the United States on the application of lithium metal, in the form of master alloys, for use in the ferrous and non-ferrous fields, and results are reported to be encouraging.

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 ceramic bodies, 7 per cent of spodumene is reported to have the same fluxing power as 20 per cent of feldspar.

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 Lithia (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 mineral most preferred for the manufacture of lithium chemicals owing to its relatively high Lithia (Li_2O) content, held between $35 and $40 per ton, f.o.b. American mines in 1939, about the same level as in 1938. 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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MAGNESITE IN 1939

No magnesite, within the strict meaning of the term, is produced in Canada at present, but magnesitic dolomite consisting of an intimate mixture of magnesite and dolomite is quarried at Kilmar and Harrington East, in Argenteuil county, Quebec, and is 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 refractory, Magnesia products made in Canada from imported magnesite and magnesia include fused magnesia (artificial periclase), optical periclase, and "85 per cent magnesia" pipe covering.

The recent discovery by the Bureau of Mines of deposits of a magnesium mineral known as brucite, at Rutherglen, Ontario, and at Bryson and Wakefield, Quebec, is considered a matter of importance. The brucite occurs as granules thickly disseminated through a matrix of crystalline limestone, and by a process developed in the Bureau of Mines laboratories, and described in a report recently issued by the Bureau, it is possible to recover these brucite granules in the form of magnesia of a high degree of purity, apparently at a cost that will enable it to compete with imported magnesia in eastern Canada. The magnesia so obtained is suitable for the manufacture of high-grade basic refractories, magnesium metal, and various chemical compounds. Hitherto, magnesia of equal purity has not been available from any Canadian source, but has had to be imported from Asia, Europe, or the United States. Being an essential war commodity, supplies of magnesia are often difficult to obtain during wartime, and a domestic source is of prime importance. At present the deposits are being investigated by several companies in cooperation with the Bureau of Mines.

Large deposits of magnesite containing much silica and alumina occur in British Columbia near Marysville, between Cranbrook and Kimberley. They 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 now of commercial importance.

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

Calcined and clinkered magnesitic dolomite valued at $474,418 was marketed in 1939, compared with $420,261 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 and previous years.

Magnesite is available in many countries, but the principal exporting countries are Greece, Manchuria, India and Yugoslavia. 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 state.

Exports of refractory products made from magnesitic dolomite in 1939 were 7,399 tons valued at $183,034, compared with 3,971 tons valued at $95,607 in the previous year. The exports in 1939 were mainly to the United Kingdom and Belgium.

Imports of magnesite products including brick, caustic and dead-burned magnesite, ground calcined magnesite, and magnesia pipe covering were valued at $779,038 in 1939, as compared with products having a value of $659,778 in 1938.

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 deposits of magnesite. 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.

Prices of calcined magnesite f.o.b. Montreal or Toronto, as quoted by Canadian Chemistry & Process Industries for March, 1940, were $70 to $90 per ton. This price has obtained since November, 1939, when the price rose from the $48 to $60 range that had prevailed for more than a year previously.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

MAGNESIUM SULPHATE IN 1939

Natural hydrous magnesium sulphate (Epsom Salts or Epsomite) occurs in deposits in lake bottoms or in solution in brine lakes in British Columbia; in Saskatchewan it is found associated with sodium sulphate. Attempts have been made to produce refined salts, and a number of years ago there was 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, Ltd., 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 salt per day, but later remodelled and now having a capacity of 10 tons. The plant at Ashcroft is now owned by the Ashcroft Epsom Salts Company, of Bancroft, B.C., and was operated till the early summer of 1939, when it was closed pending improved marketing conditions. The material produced is of high grade, four samples, representative of the different crystal sizes prepared, were analyzed and all ran over 99.5 per cent $MgSO_4.7H_2O$.

In addition to the Basque deposit, there are a number of other occurrences in British Columbia, namely, near Clinton, north of Kamloops, and in the southern part of the province in Kruger's Pass south of Penticton.

In Saskatchewan, two lakes south of Wiseton contain brines high in magnesium sulphate, and Muskiki lake, just north of Dana, Sask., contains brine high in magnesium and sodium sulphate, which at certain times of the year crystallizes into a bedded deposit with layers of both salts.

The production in 1939 was 550 tons valued at $9,900, as against 470 tons valued at $9,400 in 1938.

The imports in 1939 were 1,950 tons valued at $56,648, as against 1,803 tons valued at $33,018 in the previous year.

Since magnesium sulphate is not at present being manufactured in Canada, imports are dutiable at the rate of 17½ per cent, otherwise it would be 20 per cent. The tariff on the material entering the United States is 3/4 of one cent per pound, or $15.00 per ton.

Prices for Epsom salts remained steady for the greater part of the year, but with the cutting off of supplies from European countries, hitherto the main source of supply, prices increased rapidly. Quotations at the end of the year for the technical grade, as given by Canadian Chemistry and Process Industries for Toronto or Montreal delivery, ranged from $65.00 to $70.00 per short ton in bags, whereas the B.P. material in barrels was quoted at from 3-1/2 to 3-3/4 cents per pound.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

MICA IN 1939

The production of sheet mica in Canada has always been almost wholly phlogopite ("amber mica"), and 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 occurrences of amber mica are known in the Province as far east as Quebec city, but 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 on a restricted scale for a number of years past, production being confined 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. There was a slight revival in 1938-39, when the number of small operators showed a considerable increase; but most of this activity has been of a short-lived, prospecting character, and has resulted in only a small aggregate production. A little white mica (muscovite) continued to be produced by small operators in the Saguenay region, lower St.Lawrence, in Quebec, as well as near Mazinaw lake in Abinger township, Addington county, Ontario; in the last case, the material was recovered from old waste dumps. Some of the Saguenay mica is an excellent grade of ruby muscovite. A small amount of sheet black mica (biotite or lepidomelane), has been 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 content of iron, it would presumably be a poor electrical insulator.

Reference has been made in recent reviews (1935 to 1938) to a 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, is 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; about 300 tons of crude material has been mined to date and shipped to Vancouver for grinding and use in roofing. Production in 1939 was about 75 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 the loss of powder as dust 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, with sales reported up 50 per cent over 1938; 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 1938 and 1939:

	1938		1939	
	Pounds	Value $	Pounds	Value $
Knife-trimmed	81,127	45,419	(Not yet available)	
Thumb-trimmed	17,050	4,366		
Splittings	51,434	22,456		
Rough-cobbed	12,000	360		
Scrap	875,415	8,388		
Total	1,037,026	80,989	1,601,085	144,114

By the 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 the Intermediate tariff, at 25 per cent; and under the General tariff, at 27½ per cent. By the above Trade Agreement, such importations from the United States are dutiable at 20 per cent, but electric insulators, specially provided for, pay 25 per cent.

Total recorded world production of mica of all classes and grades in 1938 was 30,000 long tons, a drop of 12,000 tons, or nearly 30 per cent, from the 1937 level, but this figure included (definitely known) over 22,000 tons of low-priced grinding scrap; the remainder comprised both sheet mica in various styles of trimmings, and splittings. Total sheet mica production was, therefore, about 8,000 tons. The great bulk of this was muscovite, as only Canada and Madagascar, with together 728 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 and certain types of spark plug, amber mica is preferred, if not, indeed, indispensable.

Exports of mica of all classes in 1939 were valued at $165,252, as compared with $89,259 in 1938. Imports, which consist mainly of splittings, were valued at $61,835, as against $86,803 in 1938.

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 for knife-trimmed sheet, 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 dielectric 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 possibly 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, and 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 dielectric 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 unimportant mineral from the point of view of tonnage produced. 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 as yet been found. Mica is the only mineral in the "industrial minerals" class that is listed by the United States government as a "strategic mineral". 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 advance in price 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.

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 trades. 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 being shown in its possibilities as a protective inert pigment in paints, to which it is claimed to impart superior resistance to weathering and to 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 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 the manufacture of wall-paper, and some is used in the ceramic type of insulating material termed "Mycalex"; until recently, most 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 established in England. Advances are reported in the development of resin-bonded ground mica for insulation purposes, and a new product, ("Watsonite"), using dehydrated, heat-treated, powdered mica, similarly bonded, is announced as a flexible insulating material.

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 Bureau is also investigating a method of breaking down coarse flake mica to powder by means of a device termed an "attrition scrubber": designed originally to clean mineral particles prior to flotation, the device has been found to pulverize mica as readily as does ball-milling, and it may provide a cheaper means of producing ground mica —notoriously a difficult mineral to grind — than the machines now used. It has also proved successful in promoting recovery of vermiculite (see below) by agglomerate tabling.

The demand for phlogopite mica, which had been rather dull throughout 1938, picked up substantially in 1939, except for the larger sizes (2 x 4 ins., 3 x 5 ins., and upward), and dealers reported an improved volume of sales. Japan was reported actively in the market for splittings. 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 on piece-work.

Mica prices are difficult to ascertain, owing to the lack of reliable market quotations and to the system of trade discounts obtaining. Quality 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 retail price averages for best grades in 1939 remained substantially unchanged from those of the previous year, quotations being approximately as under: these prices, however, are no index of what producers may expect to receive from dealers for small parcels, as they include the dealers' overhead, culling, grading and marketing costs, profit, etc.

Knife-trimmed Sheet		Splittings	
Size	Per Pound	Size	Per Pound
1 x 3 inches	$0.50	1 x 1 inches	$0.50
2 x 3 "	0.75	1 x 2 "	0.55
2 x 4 "	1.10		
3 x 5 "	1.75		
4 x 6 "	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 Duplate Safety Glass Company at Oshawa, Ont. 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. No important occurrences of the mineral are known 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. In 1939, however, a small sample of vermiculite having fair expanding properties and said to come from Wicklow township, Hastings county, Ontario, was received by the Bureau; no data are available on the nature of the occurrence.

American sales of vermiculite have been expanding rapidly, reaching over 26,000 tons in 1937, as compared with 17,000 tons in 1936. Sales in 1938 were nearly 21,000 tons. Value of the 1937 production was $260,000, and of the 1938 production, $192,000. Montana remains the chief source, but there has been 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 sells at around $12 per ton f.o.b. mines, while North Caroline material is quoted at $6 - $7.50; 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 is an important increase, however, in the utilization of formerly discarded smaller sizes, which are now being employed increasingly in fire-resisting plasters and in special refractories, such as those used in the combustion chamber of oil-burning equipment. 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. A recent patent covers the coating of vermiculite granules with tar or asphalt, in order to render them waterproof, and to reinforce them. Patents have also been issued for vermiculite-bentonite insulating compositions. Vermiculite-gypsum compounds have been found highly fire-resistant. A recent introduction is products ("Mikolite") consisting of extremely fine (but not ground) expanded vermiculite powder; such powder is claimed to have value as an extender in aluminium paints, and as a lubricant; in automobile engines, it is recommended for increasing compression, and reducing oil consumption by coating worn surfaces of cylinder walls and pistons; and it is being increasingly used as insulating loose-fill, acoustical tile, and in insulating plasters, stucco, and cement. Freshly-expanded vermiculite is stated to be an extremely powerful desiccant, as well as being an excellent source of adsorptive silica.

Expanded material sells for around $55 - $65 per ton, equivalent to about 75 cents per bag of 25 pounds and containing 4 cubic feet, ex plant. Owing to the tremendous bulk of the product, it is not economic to ship it long distances, and the practice is to ship the crude mineral to strategically-placed plants for treatment and local distribution.

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

Under the 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, 1940.

MOULDING SAND (NATURAL BONDED) IN 1939.

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 1938 (1939 figures not yet available) was 18,845 tons valued at $19,698.

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, 1940.

NEPHELINE SYENITE IN 1939

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, as well as for general ceramic use.

The development of Canadian nepheline syenite 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 is 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 increased in 1937 to 45 tons by the addition of a second magnetic separator and crushing equipment. The product made in both plants is a granular material, minus 20-mesh, consisting of a mixture of soda and potash feldspar and nepheline, which averages about 24 per cent of alumina, and contains only 0.07 per cent Fe_2O_3. Some small shipments were made in 1939 to the mill of Frontenac Floor and Wall Tile Company, Kingston, Ont., to be finely ground for ceramic uses. Total sales by Canadian Nepheline, Ltd., and its American subsidiary in 1939 were 21,000 tons, compared with 17,000 tons in 1938.

In 1937, further production of nepheline syenite was undertaken near Gooderham, Haliburton county, and also in Dungannon township, Hastings county, near Bancroft. At Gooderham, the 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. The Gooderham quarry was not in operation in 1939. 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 1939 had shipped a total of about 11,000 tons of rock to its Keene mill.

In 1939, two other quarries were opened in Dungannon township, in the same area as the above, these being operations of the Temagami Development Company, 38 King Street West, Toronto, and of Canadian Flint and Spar Company, 207 Victoria Building, Ottawa, respectively. The first-named has installed small-scale crushing, picking and screening equipment at its quarry for the removal of mica-rich rock, and at the end of the year reported a daily output of 35 tons of crushed syenite running 24.8 per cent alumina and 0.07 per cent Fe_2O_3. Rock from this mine is shipped to the mill of Oxford Mining and Milling Company, West Paris, Maine; that from the Canadian Flint and Spar Company's mine to the mill of Consolidated Feldspar Corporation, Rochester, N. Y. In contrast to the rock of the Methuen occurrence, which is a medium-grained and uniform-textured syenite, that of the Gooderham and Dungannon deposits is coarsely pegmatitic, consisting largely of straight nepheline; it is used, after processing, for blending with feldspar to raise the content of alumina. Canadian Flint and Spar Company, which holds ground at the east end of the Blue Mountain syenite body, in Methuen township, 24 miles north of Havelock, proceeded further with plans for opening a quarry and erecting a mill, and additional road improvement and construction was carried out; the project, which is expected to materialize in 1940, calls for a plant with a capacity of 10 tons of feed per hour.

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 likelihood of increased production and demand.

Nepheline syenite production in 1939 was valued at $140,737, of which Canadian Nepheline, Ltd., produced over three-quarters, compared with $142,737 in 1938, $121,481 in 1937, and $37,426 in 1936. The increase in value in 1938 and 1939 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 is now shipped in the crude state to American mills, whereas the earlier output 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 suitable for coloured bottle glass, occurs in Virginia, and production of this material commenced in 1939. Anorthosite, a somewhat similar kind 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 24,701 tons, valued at $87,487 in 1939, the shipments being consigned to grinding and processing mills in the United States, as noted above. Exports in previous years and in the first three months of 1938 were included with feldspar. Nepheline syenite enters the United States under a special provision of the Canada-United States 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 be 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). Most Canadian glass plants now use the material, 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 the temperatures of fusion, with consequent saving of fuel 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, floor and wall tile, heavy clay products, semi-vitreous ware, etc., and its applicaion in these may considerably extend its present industrial field. In Russia, attention has been directed to the possibility of using straight (concentrated) nepheline as a source of alumina for the production of aluminium, in place of bauxite, and it is reported that a plant for this purpose is now being built in that country.

The price of finished 20-mesh material, f.o.b. Lakefield, was $10 per ton up to October, 1938, when it was advanced to $12. Finely ground, 200-mesh material sells at $17 per ton, f.o.b. Kingston. Material from the Rochester, N. Y. plant is quoted at $11 to $15.50 per ton, according to fineness.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

PHOSPHATE IN 1939

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 small for many years, with the single exception of 1932, when there was a temporary revival of mining along the Lievre 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 160 tons of apatite in 1939, all from mines in the Lievre-Gatineau district, Que. In 1937, purchases totalled about 100 tons, and in 1938, 200 tons, practically all accumulated stock-pile material from the Blackburn mine in Templeton township, Que. Sales of apatite are based on the content of tricalcic phosphate and the price is currently around 14 cents per unit.

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 new 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 being of rather low grade and not amenable to concentration, the company discontinued operations and draws its supplies mainly from Garrison, Montana. Eastern Canadian plants using phosphate rock for fertilizer and other purposes obtain their supplies mainly from Florida or Tennessee.

Reported production (sales) of phosphate in 1939 totalled 157 tons, valued at $1,712 as against 208 tons valued at $1,886 in 1938.

The world production of phosphate is of enormous proportions, and in 1936, the last year for which complete statistics are available, totalled nearly 11 million long tons. The great bulk consists of sedimentary rock, but the Russian output of apatite amounts to around one million tons annually. The leading producer is the United States, with nearly 4 million tons in 1938, of which over one million tons went to export, followed by U. S. S. R. with probably 2 million tons; the French North African possessions of Tunis and Morocco with nearly 2 million tons, and 1½ million tons, respectively; Egypt and Algeria with around half a million tons apiece; and the Pacific islands of Nauru, Ocean, and Christmas, with an aggregate total of over 1¼ million tons.

Imports of phosphate rock into Canada in 1939 totalled 124,900 tons, valued at $477,317 as against 128,409 tons, valued at $455,697 in 1938, practically all from the United States. Canada also imported 104,126 tons of superphosphate, valued at $979,052 compared with 114,357 tons valued at $1,092,859 in 1938. Phosphate rock enters Canada duty free. Superphosphate, for use as fertilizer in the condition imported, 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 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; however, superphosphate intended for blending with other fertilizer ingredients enters Canada free under all tariffs.

The Quebec and Ontario apatite deposits were once of considerable importance and were actively mined as a source of phosphate for fertilizer, 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 it would appear to have little superiority for fertilizer and other purposes and owing to the much higher cost of mining any revival of active mining for the mineral in Canada can hardly be expected, though considerable reserves probably exist, particularly in the Templeton-Lievre river area, in Quebec. Enormous tonnages of apatite are now being produced by concentration from low-grade, cheaply mined 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 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 industry in phosphorus chemicals. 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 the cost of shipping. Production of concentrated phosphoric acids, containing up to 84 per cent of phosphorus pentoxide, by volatilization from phosphate rock in the electric furnace or blast furnace 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 centres of production 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 laundry 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, 1939, published by the U. S. Bureau of Mines, production of phosphate rock in that country showed a drop of about 400,000 tons in 1938, to slightly under four million tons; there was a small increase in exports (1,140,841 tons), and a slight drop in producers' stocks (1½ million tons). Sales of "low-grade" rock (under 60 per cent B. P. L.) are showing an upward trend as a result of the growing use of smelting methods to recover the phosphoric acid in such material, and of modern recovery methods in handling crude rock and formerly discarded tailings. Standard "high-grade" rock runs around 70 - 76% B. P. L., for which the 1939 price range was $2.15 to $3.65 per long ton, f. o. b. mines. Production continued to come chiefly from Florida, followed by Tennessee and Idaho. 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 in 1938 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 26 billion tons of commercial rock, and bringing the total United States reserves to around 50 billion tons, a quantity deemed sufficient for domestic requirements for 10,000 years at current consumption rates. The deposits in the Western States (Idaho, Wyoming, Utah, and Montana) are estimated to contain upwards of 20 billion tons, and those of Tennessee, over 5 billion tons.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

PYRITES IN 1939

Pyrites is produced in Canada as a by-product in the treatment of copper-pyrites ores at the Aldermac and Noranda 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 are produced copper concentrate and a high grade iron pyrites concentrate; the latter is being exported to chemical plants in the United States. The plant was designed to produce initially 50 tons of sulphur and 75 tons of iron oxide daily, these amounts to be doubled eventually. The design comprises equipment for drying the pyrites and for drying and pre-heating the air, two rotary kilns and condensers for sulphur. Construction has been suspended because of the existing favourable market for the pyrites concentrate in the United States. When operating at 100 tons of sulphur, the plant would consume 250 tons of pyrites a day out of a daily production of 500 tons of concentrate.

At the Noranda mine about 100 tons per day of pyrites concentrate, a by-product of the milling process, is being marketed for acid manufacture.

The Eustis mine, near Sherbrooke, Quebec, operated by the Consolidated Copper and Sulphur Company, Ltd., closed down definitely in June, 1939, and the surface plant has since been dismantled and sold. For a number of years this copper-pyrites mine had been producing flotation pyrites concentrate, which was shipped in part to the United States and in part to Three Rivers, Quebec, for use in the Freeman flash-roasting plant. The first pyrites used in America for the manufacture of sulphuric acid came from this mine. This was Canada's oldest copper mine. It had been in almost continuous operation and production for close to 75 years, and had reached a depth on the incline of 7,400 feet. The extensive development work of recent years failed to prove any extension of the ore body.

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 British Columbia, the Britannia mine, with a 6,500-ton concentrator, produces considerable quantities of pyrites, most of which was consigned to the United States Atlantic seaboard. Some was shipped to France and Holland, and some to an acid plant in British Columbia. Fairly large quantities were stored in previous years awaiting more favourable market conditions; some of this stock was exported in 1939.

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 three years. Considerable exploratory work by diamond drilling was done several 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~~ at about $1.00 per ton. If results of further development prove satisfactory and world markets are maintained, a large plant as well as a 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 210,704 tons valued at $1,668,025, compared with 112,395 tons valued at $1,044,817 in 1938, and 130,913 tons valued at $1,154,992 in 1937.

The exports of pyrites (sulphur content) in 1939 were 110,142 tons valued at $793,466, compared with 22,109 tons valued at $145,189 in 1938, and 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.

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OTTAWA, MARCH, 1940.

SALT IN 1939

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 1939 salt was produced in southern Ontario; at Malagash, Nova Scotia; at Neepawa, Manitoba; and at Waterways, Alberta. Ontario salt is obtained from brine wells, as is also that produced in Manitoba and Alberta. The Malagash salt is recovered by mining rock salt and by evaporation from brine produced by leaching and waste material in the mine.

In Ontario, production was steady throughout the year, all the well established plants operating. The caustic soda-chlorine plants of Canadian Industries Limited, at Cornwall, Ontario, and Shawinigan Falls, Quebec, obtained their salt from Sandwich, Ontario.

In Nova Scotia, the Malagash Salt Company produced slightly more than in the previous year. Underground development was continued by diamond drilling, crosscutting, and drifting. Definite zones in which indications of potash salts occur have been correlated from the second to the twenty-sixth level and there seems to be an increase in the potash content with depth. The study of these zones is being continued.

At Neepawa, Manitoba, the plant of Canadian Industries, Limited, has operated continuously throughout the year, and at the present time consideration is being given to the installation of a new plant utilizing vacuum evaporation with modern equipment to produce all grades.

At Waterways, Alberta, Industrial Minerals, Limited, controlled and operated by the Dominion Tar and Chemical Company of Montreal, remodelled its whole plant. The direct-fired pans of the original plant have been discarded and replaced by one set of quadruple effect vacuum pans, complete with all modern accessories. In addition, two grainers have been installed so that the coarser grades of salt can be produced. Additional equipment includes an Oliver filter with the necessary heaters and exhauster, one block press, weighing and bagging equipment for bags from 100 lbs. down to 3½ pound packets, as well as packaging and wrapping machinery for the 2 lb. cartons of table salt. With this new plant (which is expected to be in full operation by February 1940) the Company will be in a position to place all grades of salt on the market. To provide for contingencies a second production well has been drilled and made ready for production when needed.

In New Brunswick, a salt basin was discovered in 1921, being the result of drilling in the vicinity of Goutreau, 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. During this past year still another drill hole passed through the same salt formation, the thickness, however, being only around 100 feet indicating that the northern edge of the basin is being approached. Altogether, six drill holes have penetrated the salt so that a deposit of salt is already indicated over 1½ miles wide and four or more miles long, the greatest thickness so far encountered being 1,500 feet. There are, therefore, many millions of tons of salt in this basin, available for future development.

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 first met at a depth of 920 feet; one bed over 480 feet thick contained over 90 per cent of sodium chloride. The apparent great thickness of the salt may be due to the steep dip of the beds.

The production of salt in 1939 was 424,500 tons, valued at $2,486,632 as against 440,045 tons valued at $1,912,913 in 1938.

The production during 1939 showed a slight decrease from the preceding year amounting to less than 4 per cent, but this was compensated by a general increase in value amounting to over 20 per cent. Taken over a period of years the market for salt in Canada is steadily increasing, and the industry is in a sound condition.

The world production of salt is steaily increasing as its use in industries is extending and for the year 1937, the last year for which fairly complete figures are available, it amounted to well over 37,000,000 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 produces only slightly over 1 per cent of the world production and over 7 per cent of that of the British Empire.

The exports of salt from Canada in 1939 were 10,656 tons valued at $76,287 as compared with 11,844 tons valued at $68,293 in 1938. The imports of salt were 117,629 tons valued at $507,368 as against 108,133 tons valued at $453,765 in 1938. The greater part of this salt comes into Canada 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, and canning industries, to 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 this use of salt showed a decided increase this past year. The development of soil stabilized bases for runways at Canadian airports continued, and several new air fields were so prepared. The use of salt for mixing with sand piled each fall at regular intervals along main highways has increased greatly during the past few years, since it has been found that even in the coldest of weather the sand in piles which have been so treated remain loose and free flowing, thus allowing the easy distribution of the sand on the icy roadway.

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 increased during the year and at the end of the year were holding firm at an appreciably higher level than 1938. Quotations at the end of the year for specially purified (99.9% NaCl) salt in 280 lb. bbls. f.o.b. plant was $3.10 per barrel, while industrial fine in bulk car lots f.o.b. plant per ton was $6.32, and industrial coarse per ton was $10.00.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

SAND AND GRAVEL IN 1939

Deposits of gravel and sdnd 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 1939, amounted to 28,172,384 tons valued at $10,820,631 compared with 32,223,882 tons valued at $12,002,554 for 1938. Following are the output and value by provinces for these two years:

	1938		1939	
	Tons	Value $	Tons	Value $
Nova Scotia	2,077,378	1,013,266	2,072,405	1,213,918
New Brunswick	3,833,540	1,825,383	3,131,844	1,277,438
Quebec	12,523,404	3,532,873	10,114,941	2,628,397
Ontario	8,531,281	3,046,043	7,884,925	3,048,973
Manitoba	1,216,084	645,812	1,163,508	642,835
Saskatchewan	1,037,753	662,511	1,038,231	658,331
Alberta	792,760	525,175	853,680	611,666
British Columbia	2,211,682	751,491	1,912,850	739,073
	32,223,882	$12,002,554	28,172,384	$10,820,631

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.

A considerable tonnage of sand and gravel is also used in the mines for re-filling underground workings. Some mines use as much as several thousand tons a day.

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 1938 and 1939. Prices are per ton, carlots, f.o.b. cars:

	Montreal		Toronto		Winnipeg		Vancouver	
	1938	1939	1938	1939	1938	1939	1938	1939
	$	$	$	$	$	$	$	$
Sand	1.25	1.15	1.00	.85	1.75	.70	.70	.70
Pit run gravel	1.08	1.10	1.50	1.60	.75	.70	.70	.70
Crushed stone $\frac{3}{4}$ inch & over	.85	.75	1.75	1.55	-	-	.75	.75

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SILICA IN 1939

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, or sandstone in sizes from $\frac{1}{2}$ inch to 6 inches 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 may also be obtained from naturally occurring sands, the required grade being recovered by screening; it may also in special cases be 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.; this company has also gone into the production of rock wool.

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. Although the bulk of the output is consigned to glass manufacturers, an important part consists of sand blasting materials and other abrasives.

The Canadian China Clay Company at St. Remi d'Amherst, Amherst township, Papineau county, Quebec, has sunk a shaft to a depth of over 300 feet and has 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 it is hoped that operations will be started during 1940. China clay and high grade silica sand will be produced.

The Canadian Flint and Spar Company, operating a crushing plant at Buckingham, Quebec, produced a small tonnage of high grade quartz sand, 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 Melochville, Quebec, as well as high grade quartz from localities in Ontario. The sandstone from Melochville is trucked the 2 miles from the quarry to the plant where it is crushed and screened to pass 3 inch and be retained on 5/8 inch. The silicon is marketed mainly in Canada and the ferro-silicon finds a market both in Canada and abroad.

An appreciable amount of ferro-silicon of low silicon content is produced in Canada from the silica in the bauxite used in the manufacture of aluminous abrasive. Five companies, two at Niagara Falls, one at Chippawa, one at Thorold, all in Ontario, and one at Arvida, Quebec, produce this grade.

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

The demand for high grade silica sand was steady and although appreciable quantities are still imported Canadian producers are steadily improving their position. Silica sand for 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 those markets.

The use of Canadian sand for sandblasting is increasing.

Interest is active throughout the whole of Canada in the search for deposits of high grade silica strategically situated for supplying the increasing markets especially those in central Ontario and in western Canada; practically the whole consumption west of Winnipeg is supplied by imported material.

The production of quartz and silica sand in 1939 was 1,555,589 tons valued at $1,090,671 compared with 1,380,011 tons valued at $961,617 in 1938. There were 2,493 M silica brick produced in 1939 at a value of $124,807; in the previous year the production was 1,788 M valued at $100,403. The exports of silica and silica products in 1939 amounted to $108,397 tons valued at $196,418; in 1938 it was 109,061 tons valued total at $199,864. The ~~tonnage~~ of the various grades of silica imported in 1939 amounted to 171,372 tons with a value of $424,372 compared with 176,507 tons valued at $436,481 in 1938. The imports of silica brick in 1939 were valued at $312,413 compared with $240,184 in 1938.

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 situation 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 to be of interest to these markets should be 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, 1940.

SODIUM CARBONATE (NATURAL) IN 1939

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 1939 was 300 tons valued at $2,400 as against 252 tons valued at $2,268 in 1938.

Imports of soda ash or barilla totalled 1,573 tons valued at $45,377 as compared with 1,454 tons valued at $41,831 in 1938.

Sodium carbonate, or soda ash, has many industrial uses, being employed, for example, in the manufacture of glass, soap, and in the purification of oils. The location of the present known Canadian deposits, being far from the main markets for this material, restricts the output to the amount required to satisfy the consumers within economic rail haul from the deposits, and the eastern consumers of soda ash obtain their supplies from the chemically prepared material made from salt by the Solvay or ammonia process in Ontario.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

SODIUM SULPHATE (NATURAL) IN 1939
(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 partly saturated or saturated brine in many lakes throughout western Canada.

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

Natural Sodium Products Limited, at Bishopric, Sask., operated throughout the year and now has a capacity of about 500 tons daily. Production at this plant was increased during the last four months of the year.

The Horseshoe Lake Mining Company at Ormiston, Sask., after making extensive alterations to its plant during 1938, operated during the first part of 1939, but ceased production during the past summer, partly owing to the difficulty of obtaining a steady fuel supply from Estevan.

The Midwest Chemicals, Limited, at the central portion of Whiteshore lake, completed its new and modern plant, and commenced production early in the year, operating one rotary kiln. By the end of the year a start was made installing a second kiln. It is expected to have this second dryer in commission by the end of January, 1940.

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 work at several of these was carried on to prove their extent.

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 thick, mostly overlying the rock salt, the sodium sulphate running from 25 to 30 per cent. In additional drilling this past summer, both glauberite and sodium chloride were proved, thus further extending the salts basin. Many millions of tons of sodium sulphate would seem to be indicated in this deposit. The Bureau of Mines has done much investigating 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.

The industry in western Canada seems to be now well established, and it is encouraging to note the steady progress being 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 1939 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 900 tons of dried salts per day, and, if occasion warranted, the tonnage could be greatly increased.

The production of natural sodium sulphate in 1939 amounted to 71,453 tons valued at $627,941, as against 63,009 tons valued at $553,307 in 1938. Not included in the production data for 1939 are 30 tons, valued at $186, shipped from deposits in Alberta.

The Canadian production from the deposits of western Canada increased nearly 14 per cent over the preceding year, but is still some 10 per cent below the record production established in 1937 when approximately 80,000 tons was produced. Increased activity in the nickel and pulp and paper industries was responsible for this year's increase as well as the increased demand for the material in the north central United States during the last four months of the year.

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 in the past has been 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.

As in past years, there were small but steady shipments from the deposits in western Canada to the United States. It is interesting to note that during the last four months of the year there was a sharp rise in the tonnage exported. Export figures, however, are not available. The imports of sodium sulphate during 1939, including Glauber's salt, salt cake, and the acid sodium sulphate (nitre cake), amounted to 8,449 tons valued at $110,577, as compared with 8,638 tons valued at $109,593 in 1938.

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, owing to the high freight rates to the consuming plants which are situated mostly in eastern Canada.

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. Since the start of the war in September, there has been a decided decrease of shipments of salt cake from European countries to the United States and, in consequence, the prices have firmed materially and the demand for material from other sources has increased. There is, therefore, an opportunity for Canadian producers to increase their export shipments, especially to the north central States. At the same time the western producers will have to be on the watch to find new markets for their material, as there is always the possibility of the present consumers of their product finding new sources of supply nearer to their plants, or of making use of substitute material. For example, by-product salt cake and nitre cake may be available in large tonnages in eastern Canada if extensive manufacture of munitions is undertaken. In the southern States, some of the pulp mills are employing a synthetic material made from soda ash and sulphur as a substitute for salt cake in the manufacture of Kraft pulp.

Normally 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 market are not developed, or substitute materials do not come into general use, 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, 1940.

SULPHUR IN 1939.

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, the sulphur dioxide gas produced, formerly a waste product, 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, 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 being operated at Trail, B.C., by the Consolidated Mining and Smelting Company; it started production in the summer of 1936.

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 are produced copper concentrate and a high grade iron pyrites concentrate; the latter is being exported to chemical plants in the United States.

The plant was designed to produce initially 50 tons of sulphur and 75 tons of iron oxide daily, these amounts to be doubled eventually. The design comprises equipment for drying the pyrites and for drying and pre-heating the air, two rotary kilns and condensers for sulphur. Construction has been suspended because of the existing favourable market for the pyrites concentrate in the United States. When operating at 100 tons of sulphur, the plant 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 1939 to 210,704 tons valued at $1,668,025, compared with 112,395 tons valued at $1,044,817 in 1938, and 130,913 tons valued at $1,154,992 in 1937.

The imports of sulphur in all forms were 152,216 tons valued at $2,453,836, compared with 93,697 tons valued at $1,471,741 in 1938. Imports of sulphuric acid were 119 tons valued at $14,610, compared with 95 tons valued at $10,944 in 1938.

The exports were: pyrites (sulphur content), 110,142 tons valued at $793,466, compared with 22,109 tons valued at $145,189 in 1938; sulphuric acid, 1,605 tons valued at $21,203, compared with 1,260 tons valued at $17,900 in 1938. 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 Metal and Mineral Markets, New York, 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,
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TALC AND SOAPSTONE IN 1939

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 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, began that output started to rise, and this district, with two producing mines and mills, has since been the principal source of talc. 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, where 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, as well as sawing dust and grinding waste for the roofing trades. In 1938-39, a talc mine was opened and a mill erected by Baker Mining and Milling Company, of Montreal, on a property in Potton township, Brome county, close to the Vermont line, and small initial shipments were reported in 1939.

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 nine 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 10,000 to 15,000 tons, divided about equally between the two above-named operators.

A few years ago, tests were made in the Ore Dressing Laboratories of the Mines Branch (now Bureau of Mines) to determine whether the rather considerable proportion of dolomite in the Madoc talc could be removed satisfactorily. Flotation resulted in lowering the content of lime 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 by similar means from the tremolite-talc of the Gouverneur district, in New York State, has also been 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 might enable the finished mill product to compete successfully with imported talc in the higher-priced field for cosmetic and other uses.

In Quebec, substantial amounts of ground soapstone and soapstone sawing dust, as well as a little associated talc, are produced in the Broughton-Thetford Mines district, Eastern Townships, where, in 1939, 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 certain 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 also consume most of the soapstone sawing dust.

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, soapsone operations have been conducted in the same district by the following: L.C. Pharo of Thetford Mines, and Charles Fortin of Robertson, both working in Thetford township, and Louis Cyr of St.Pierre de Broughton, in Leeds township. All were operating intermittently during 1939. Broughton Soapstone and Quarry Company considerably expanded its grinding mill during the year; L.C. Pharo also installed grinding equipment in 1938.

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 ranges from fairly coarse-grained rock to fissile talc schist; it averages 180 pounds to the cubic foot. The schistose variety is the purer stone, and yields a fine grade of off-colour talc powder, substantially free from carbonate and grit, 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 development that has considerably reduced the demand for soapstone for pulp-mill use is the introduction of a new water-cooled alkali-recovery furnace; this is of steel, only the base being built of soapstone blocks. Such furnaces are being used in a number of Canadian and American mills, and sales of domestic soapstone have fallen off considerably. 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 the 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. Erection of a mill had been completed in 1938, and during 1939 underground work disclosed a substantial width of milling ore. The mill has a capacity of 5 tons per hour of finished products, and embodies a variety of equipment not hitherto employed in Canadian talc-grinding. Some prospecting for talc was done during the year in the Knowlton area, Brome county, where there are a number of old and long-abandoned properties.

In Ontario, Madoc Talc and Mining Company, of Trenton, did nothing further on its talc holdings in Cashel township, Hastings county, where a shaft was sunk in 1938 to 90 feet, with some cross-cutting and drifting; 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, Ont., where some work was done in 1937.

In British Columbia a small, intermittent production of ground grey talc has been utilized chiefly in the local roofing trade. The material has come from near McGillivray Falls (Anderson lake), on the P.G.E. railway, and from Wolfe 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. Neither mine has been in operation since 1936, 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 1939 was 13,114 tons valued at $128,595, compared with 10,853 tons, valued at $109,810, in 1938. The 1939 output of soapstone was valued at $41,471, as against $35,038 in 1938; 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 to kraft mills.

World production of talc in 1937, the latest year for which complete statistics are available, was nearly half a million long tons.

Leading producer was 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 1939 were 7,185 tons valued at $74,560, compared with 6,952 tons valued at $70,742, in 1938. Most of the material goes to the United States.

Imports totalled 3,193 tons valued at $51,380, compared with 2,647 tons valued at $40,386 in 1938. The great bulk of the imports is obtained from the United States.

Under the Canada-United States Trade Agreement of 1938, effective January 1, 1939, revision was made in the scale of duty on imports of Canadian talc 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 one-quarter cent per pound, whereas 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; under the above Trade Agreement, imports from the United States are dutiable at 20 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 increased steadily. 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 14 per cent of the total sales in 1938, and ranked as the second largest consumer. (A large part of such sales, however, 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 to the textile (bleachery) and cordage trades. It is 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. Rubber talc, employed mainly for coating moulds and finished goods, and for curing, is now finding increased use as a compounding ingredient.

So many grades of ground talc are on the market that prices range between very wide limits. Value is dependent largely 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 1939 at from $5.50 to $8 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 $21 for the two best grades, and $17 to $8 for 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 1938 (2,414 tons), closely followed by the paint industry (2,330 tons); the pulp and paper trade used 1,051 tons; the rubber trade 538 tons; 435 tons went into toilet preparations, and 241 tons into soaps and cleansers. According to Minerals Yearbook 1939, of the U.S. Bureau of Mines, the average value of all grades of ground talc (including soapstone and pyrophyllite) produced in the United States in 1938 was a little under $11 per ton. In 1939, trade journal quotations on individual grades ranged from $6 to $9 for the cheaper grey talcs from Georgia and Vermont; $12 to $16 for 325-mesh, fibrous, white talc from New York; and $17 to $20 for high-grade white talc from California, all f.o.b. mills. Imported French talc was quoted at $23 to $60, according to quality, and Italian talc (cosmetic grade) at $60 to $70, ex dock, New York. Lava steatite and crayon talc bring high prices, from $100 to $150 per ton, whereas at the other end of the scale are the coarse roofing granule products, often largely talc-coated gritty rejects of air separators, which may sell as low as $4 per ton.

PYROPHYLLITE: Pyrophyllite (hydrous silicate of alumina) is a mineral closely resembling talc in appearance and physical character, and in the ground state 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 value for the manufacture of a wide variety of high-grade ceramic products. Extensive deposits occur in Newfoundland, and in 1935 some material was shipped to Canada for grinding and sale; it is reported that active exploitation of the occurrences is planned, the company interested being the Clinchfield Sand and Feldspar Corporation, of Baltimore, Md., which has already made some considerable shipments.

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. The mineral appears 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 is currently quoted 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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VOLCANIC DUST IN 1939

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. In 1938, a deposit of ~~which~~ volcanic white dust overlain by bentonite was discovered 5 miles west of Rockglen. Laboratory experiments are being carried out by the University of Saskatchewan at Saskatoon, and by the Department of Natural Resources at Regina on the Rockglen and several of the other deposits of volcanic dust, and it is believed that as a result of such experiments, one or more of them may be put into active production shortly. Several deposits occur in British Columbia, of which the purest known is a snow-white, fine-grained volcanic dust from the Deadman river, north of Kamloops lake; extensive beds of compact dust also occur in the vicinity north of Quesnel lake in the Cariboo, but there has been no 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 1939 were valued at $29,314, compared with $24,688 in 1938.

In the United States, annual shipments of volcanic dust and pumice are now over 65,000 tons, valued at $313,000, about twenty companies being actively engaged in production. About 71 per cent of this output is used for cleansing and scouring compounds; about 12 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 insulating media, paint filler, floor sweep, dusting inside tires, and in abrasive uses such as glass bevelling, or polishing aluminium. During 1939 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. The use of volcanic dust as a ceramic raw material has not been extensive in the United States, although its practicability has been indicated both by laboratory and industrial applications. In this connection it has been used successfully in some glazes, replacing feldspar.

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WHITING SUBSTITUTE IN 1939

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 products, 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 White Valley Chemicals, Limited, Toronto, by Gypsum, Lime and Alabastine, Canada, Limited, Winnipeg; and by F. J. Beale, Limited, Van Anda, Texada Island, British Columbia.

During 1939 White Valley Chemicals, Limited, built a plant at Bobcaygeon, Ontario, to produce whiting substitute from marl.

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 three 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 have enabled a product to be marketed that is very consistent in both chemical and physical properties. 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 1939 amounted to 13,195 tons valued at $152,397 compared with imports of 10,701 tons valued at $116,923 in 1938. These imports of chalk whiting originate in England, France and Belgium.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

COAL IN 1939

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.

Various collieries throughout Canada have been improving their coal preparation plants during the year. The increasing demand for graded and cleaner coal has necessitated more flexible methods of coal preparation.

Developments in Nova Scotia during the last few years include changes in and improvement 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 programme 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. This Company increased its banking facilities at Sydney to provide for the storage of a million tons of coal as compared to the previous quantity of approximately 650,000 tons. As No. 5 and No. 10 mines situated near Reserve are on the verge of closing down, consideration has been given to operating a new mine on the Gardiner Seam. The exact location of this mine has not as yet been decided upon.

It was reported during September that the Nova Scotia Government had provided funds to dewater the mine of the bankrupt Port Hood Coal Mines Limited at Port Hood. Shipments from this mine were expected to commence in December, these being at the rate of 200 tons per day. The mine of the Maritime Coal Railway and Power Company, Limited, in the Joggins area was permanently ~~closed down in November. The Maple Leaf No. 4 mine of The Maritime Coal Railway & Power Co. Ltd., was~~ closed down in May, 1939. The Joggins Coal Co. Ltd., started a new c~~ontinuing~~ operation during the year, partially within the town limits of Joggins.

The mechanization of coal mines throughout Canada has made some progress during 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 reconditioned by the Dominion Briquette and Chemical Company, Limited, continued the manufacture of briquettes. Further changes in the equipment have been made during the year, including the construction of a special conveying system to aid in the storage of increased quantities of briquettes. Production is expected to be approximately 40,000 tons, about double the 1938 production. While the bulk of shipments of the Saskatchewan Briquettes is made to points in Manitoba and Saskatchewan some shipments have also been made to Western Ontario, and as subvention assistance has been available on such movements since December 8, 1939, some extension of this trade is likely.

Operation in the Estevan lignite field of Saskatchewan was considerably modified during the year. The Truax-Traer Coal Company ceased operation in March, its modern preparation plant being dismantled and moved to the new location of the reorganized Western Dominion Coal Mines Limited. This Company started a new stripping operation during the summer, which toward the end of the year was producing over 4,000 tons per day. On December 10th, after a shutdown of seven weeks due to labour difficulties that affected most of the larger mines, production was resumed. The Bienfait No. 1 mine of the Western Dominion Coal Mines Limited was closed in July.

In Alberta, a briquetting plant has been in almost continuous operation during the year at the property of Brazeau Collieries Limited, at Nordegg, 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. An attempt is being made to obtain a domestic market for specially prepared briquettes.

From December 1st a new organization, known as the Hillcrest Mohawk Collieries Limited, comprising the Hillcrest Collieries Limited (in liquidation) and Mohawk Bituminous Mines Limited, has been operating the Mohawk Mine at Bellevue, Alberta. The Hillcrest Mine is to be closed.

In British Columbia, the B. C. Electric Company continued manufacturing briquettes under the name of "thermets" from a mixture of coke breeze and coal.

The production of coal in Canada amounted to 15,519,464 tons valued at $48,258,199 compared with 14,294,718 tons valued at $43,982,171 in 1938. Nova Scotia contributed over 45 per cent of the total, Alberta over 35 per cent, British Columbia about 10 per cent, Saskatchewan 6 per cent, and the rest was derived from New Brunswick and Manitoba. Nova Scotia with 7,051,276 tons showed an increase of 13 per cent from the output of 1938.

The imports of coal into Canada totalled 13,884,816 tons, compared with 13,464,060 tons in 1938.

Anthracite importations consisted of 3,977,805 tons, 65 per cent of which was from the United States and 26 per cent from Great Britain; the remainder being from Germany, Russia, Belgium, the Netherlands, French Indo-China, and Morocco.

Bituminous importations consisted of 9,903,613 tons, mainly from the United States and lignite imports amounted to 3,398 tons.

Exports of Canadian coal amounted to 376,203 tons, compared with 353,181 tons in 1938. The 1939 total included 368,204 tons of bituminous coal and 7,999 tons of lignite coal.

Movements of Canadian coal under Federal Government assistance in 1939 were 3,364,882 net tons, compared with 2,030,536 net tons in 1938. The increase is attributable to the enlarged fuel requirements during 1939 of industrial plants and the railways.

Broadly speaking, the assistance provided to coal movement 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.

The total amount of coal moved under subvention from 1928 when this assistance came into effect up to the end of 1939 was 19,597,205 tons, at a cost to the Government of $19,322,154 or 98½ cents per ton. The administration of this government assistance is carried out by the Dominion Fuel Board.

Several of the Orders-in-Council providing assistance to the coal industry were revised and became effective December 8th. Nova Scotia reverted to the rates in effect prior to November 8, 1938. Assistance to Alberta and British Columbia Crowsnest coals moving to Manitoba, except for railway use, was cancelled, and British Columbia bunker coal was placed on the uniform basis of 75 cents per ton.

The entire Canadian coal and coke industry has, since December, been subjected to Government licensing under the Wartime Prices and Trade Board. No Company or individual is permitted to operate without a licence, the order applying to manufacturers, importers, exporters, producers, jobbers, wholesalers and retailers of coal and coke. The licence system has been adopted "to keep the Government adequately informed of the situation surrounding the production, importation and distribution of coal, to assure an adequate distribution of coal and to protect the public against any undue advance in price."

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 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 completed 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 are of prime importance in aiding in the solution of its problems. The physical and chemical study of Canadian coals has now been extended to Alberta and British Columbia. Research 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. Investigational work on the preparation of activated charcoal for gas masks was undertaken soon after War was declared.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

COKE IN 1939

Coke was produced from coal in 25 plants distributed over all provinces except Prince Edward Island and Saskatchewan. These plants included two beehive, nine by-product, six vertical retort, and nine 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 coke from its ovens for its own use and as a domestic fuel for the Maritime Provinces. The Koppers Company of Pittsburgh was awarded a contract by this Company for the construction of a light oil recovery plant and the installation of new by-product recovery equipment. Work will be completed by the middle of March, 1940.

In Quebec the Montreal Coke and Manufacturing Company operated its coke ovens continuously, using about 35% Nova Scotia coal, the remainder being imported coal from the United States. The Quebec Power Company with a vertical retort plant used Canadian coal only, and marketed 76 per cent of its coke for domestic consumption, the remainder being used at the plant for the manufacture of gas and for its operation.

The Shawinigan Chemical Company are producing coke at their Shawinigan plant by a new process developed by the Company. The coke is utilized in the production of calcium carbide.

In Ontario, increased quantities of coke were produced for use as domestic fuel, 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. The Consumers' Gas Company of Toronto, with plants using both vertical and horizontal retorts, distributed 40 per cent of its total coke manufactured for domestic consumption, the remainder being used for the manufacture of gas and for operation of the plants.

During the year the municipally-owned gas plant of the City of Owen Sound was successfully operated. This plant, employing the Curran-Knowles system of carbonization, is designed to supply local requirements for gas and coke, and consists of three ovens; from 12,000 to 13,000 tons of coal it produces 10,000 tons of coke and 21,000 M cubic feet of gas per annum.

During the year, the Ottawa Gas Company, Ottawa, Ontario, built a Koppers water gas plant and closed its coke plant. A carburetted water gas is now being produced and distributed for city requirements. A feature of the plant is that it can be operated on a crude oil rather than gas oil.

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. This plant is equipped for blending, which permits of coal from more than one source being employed.

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. Nine continuous vertical retorts in the old plant have been rebuilt and converted to the intermittent coal gas type similar to the

Chamber ovens completed in 1933. Twelve of these Chamber ovens were rebuilt during the year, all of which will allow for an increased production of coke and gas.

In September, the Crow's Nest Pass Coal Co., Ltd., started operating its new Curran-Knowles by-product coke plant. This plant consists of a battery of ten ovens and is capable of processing approximately 40,000 tons of coal per annum. The coke is suitable for both domestic and industrial use. The Company continued to manufacture beehive oven coke for industrial use.

The total production of coke from coal in 1939 was reported as 2,388,027 tons, compared with 2,352,003 tons in 1938. The production in the eastern provinces (Nova Scotia, New Brunswick, and Quebec) in 1939 was 793,018 tons; in Ontario the production was 1,365,871 tons; while in Manitoba, Alberta, and British Columbia, the production was 229,138 tons. The amount of coal used for making coke was 3,312,078 tons, 33 per cent of which amount was Canadian coal. In addition to the coke made from coal, a relatively small amount of petroleum coke was produced at the oil refineries (63,375 tons in 1938 and 59,634 tons in 1937). About 5 per cent of this petroleum coke was consumed by the refineries themselves.

The exports in 1939 were: coke from coal, 48,114 tons, and petroleum coke, 7,396 tons, compared with 30,537 tons of coke from coal and 11,370 tons of petroleum coke in 1938.

The imports were: coke from coal, 512,278 tons, and petroleum coke, 147,505 tons, compared with 392,505 tons of coke from coal and 81,384 tons of petroleum coke.

There has been a steady improvement in the coke business during the last few years, owing to increased demand in the domestic market.

ISSUED BY THE BUREAU OF MINES,
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OTTAWA, MARCH, 1940.

NATURAL GAS IN 1939

Natural gas has been found in most of the provinces of Canada. It is produced commercially in large quantities in Alberta and Ontario and in smaller quantities in New Brunswick, Saskatchewan, Manitoba, Quebec and the Northwest Territories.

In Alberta the greater part of the production comes from the Turner Valley field, which supplies the cities of Calgary and Lethbridge and the adjacent district. The Edmonton areais supplied from the Viking field about 80 miles southeast of the city. The city of Medicine Hat is supplied from the field of the same name; Wainwright by the Fabyan field; and the town of Brooks from the field of the same name. During the year the Alberta Petroleum and Natural Gas Conservation Board increased restrictions to prevent wasteful gas production from Turner Valley. Test wells drilled during 1939 in the Steveville area, 110 miles east of Calgary were successful in locating large gas flows. Successful drilling operations were also carried out in the Battleview-Vermilion area and at Lloydminster. A gas well on the Battleview-Dome, which had been completed in 1937, was tested at the close of 1939, and is rated as the largest gas well in the British Empire, with a maximum flow of 76 million cubic feet, per day.

In Saskatchewan the eastern part of the Lloydminster field supplies the town of the same name. In this field seven commercial gas wells have been completed since 1933. Plans are underway to supply Saskatoon with natural gas from this field.

In Ontario natural gas is produced commercially only in the southwestern part of the province. The principal fields are Tilbury, Haldimand, Dawn, De Clute, Brownsville, Dover, Norfolk, Welland and Onondaga. Gas from these fields is supplied by a network of pipe lines to the principal cities and towns of southwestern Ontario. An important development during the year was the opening of the Malahide field, in Elgin county, in which 18 producing wells were completed in 1939.

In Quebec natural gas is produced in small amounts at several wells along the St. Lawrence river and is used locally.

In New Brunswick the Stoney Creek field supplies the city of Moncton and the town of Hillsborough.

The total production of natural gas in Canada during 1939 was 35,394,087 M cubic feet valued at $12,538,954, compared with 33,444,791 M cubic feet valued at $11,587,450 in 1938, which was 5 per cent greater than that of the previous year.

A relatively small amount of mixed natural and manufactured gas is imported. The imports in 1939 of gas for cooking, heating and illuminating were 114,396 M cubic feet valued at $75,380, compared with 133,062 M cubic feet valued at $87,311 in 1938.

Exports of natural gas from southern Alberta to the United States, for the twelve months ended March 31, 1939 amounted to 316 million cubic feet.

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OTTAWA, MARCH, 1940.

PEAT IN 1939

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 1939 were 520 tons valued at $3,095, as against 620 tons valued at $3,500 in 1938. 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 Melfort 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, Melfort, 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 1939 were 354 tons and cleaned, sized and ground mosses and grasses amounted to 1,057 tons, compared with 433 and 891 tons respectively in 1938.

Imports of peat moss into the United States from Canada in 1938 (1939 figures not yet available) were 1,239 tons valued at $17,293, compared with 2,974 tons valued at $68,730 in 1937, as given by the U. S. Bureau of Mines.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

OIL SHALE IN 1939

Large deposits of oil shale are known to exist in different parts of Canada, the largest and best known occurrences being in Pictou and Antigonish Counties, Nova Scotia, and Albert and Westmorland Counties, New Brunswick. As shale oil cannot compete with petroleum at present prices, none of these deposits has as yet been actively developed on a commercial scale.

Experimental plants were erected in 1929-30 near Rosevale, New Brunswick and New Glasgow, Nova Scotia, to treat local shales but they operated only for short periods. No oil shale is now being mined in Canada nor is any being imported. Activity has been confined chiefly to field exploration and to laboratory investigation. Laboratory work by the Department of Mines and Resources at Ottawa has included the determination of the petroleum content of representative samples from various localities; the determination of important factors affecting the recovery of crude petroleum by destructive distillation and of the character of the petroleum recovered; and the investigation of the processes designed for the distillation of oil shale.

For many years the large-scale production of oil shale was limited to Scotland, but deposits in Manchuria and Esthonia are now being developed on a large scale. The production of these countries in 1937 (1938 and 1939 not yet available) was: Scotland, 1,460,700 tons; Esthonia, 1,213,700 tons; and Manchuria approximately 3,000,000 tons. Austria, France, Germany, Italy, Spain, Russia and South Africa also produce small quantities of oil shale.

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OTTAWA, MARCH, 1940.

PETROLEUM IN 1939

Petroleum is produced commercially in the provinces of Alberta, Ontario and New Brunswick, and in the Northwest Territories. Crude oils from different localities range in quality from volatile naphtha to semi-solid bitumen.

The Turner Valley field southwest of Calgary, Alberta, produces approximately 98 per cent of the total Canadian output. This field, which, up until 1936 had produced mainly gas and naphtha, was in that year extended to the west flank and began producing crude oil of high quality of an average gravity of 43°. Extension and development of the field have continued actively up to the present, and at the close of 1939, 93 wells were producing crude oil and 17 were being drilled for oil. Thirty-five crude oil wells were completed in 1939 in Turner Valley and two abandoned. The field as it is now outlined has two principal producing areas. The larger of these is in the south and has a proved length of approximately 6 miles and an average width of about 1½ miles. About 9 miles farther north is a second producing area about three miles in length that during 1939 has become the centre of increased attention. In it is located the Home-Millarville No.2 well, which, at the end of 1939 had the greatest allowable production in the Turner Valley. Although tests have been made in the intervening 9 miles during the past year, the status of this area is not yet definitely established.

Small amounts of heavy crude oil and also oil of a lighter gravity are produced in other localities in Alberta, namely: Wainwright, Dina, Lloydminster, Vermilion, Taber, Red Coulee, Del Bonita, Moose Dome. With the exception of the older Wainwright and Red Coulee fields, whose production remained practically equal to the 1938 figures, the production from these other localities diminished considerably during 1939. In the McMurray field there was no commercial production of hydrocarbons from bituminous sand in 1939. Operations by International Bitumen, Ltd., at Butumunt on Athabaska river were temporarily discontinued. It is expected that commercial production by Abasand Oils, Ltd., at Abasand on Horse river will be commenced during the spring of 1940.

Outside Alberta, petroleum is produced in southwestern Ontario at Petrolia, Oil Springs, Bothwell, and in the townships of Dawn, Warwick, West Dover and Mosa; in New Brunswick at the Stoney Creek field about 9 miles southwest of Moncton; and in the Northwest Territories near Norman, about 50 miles west of Great Bear Lake.

Although there has been continued drilling activity throughout 1939 in Turner Valley, neither the actual nor the 'potential' production of crude oil has continued to increase as rapidly as it did in 1937 and 1938. This may be due in part to the fact that the market is at present limited to Alberta, Saskatchewan, and the western part of Manitoba. Another development in 1939 has been the increase of refinery capacity at Calgary, where a new 5000-barrel refinery was completed, and an existing refinery raised its capacity a further 2000 barrels.

Tests were made or are still under way at a number of prospective oil producing localities in Alberta: Brazeau, Cardston, Clearwater, Del Bonita, Grease Creek, Jumping Pound, Kootenay Dome, Pouce Coupe, Sheppard Creek, Spring Coulee, Steveville, Taber, Waite Valley, Whiskey Creek, and Wainwright. Outside Alberta, tests were conducted in Saskatchewan at: Kamsack, Lloydminster, Maple Creek, Riverhurst, and Simpson; in British Columbia, at Boundary Bay; in Ontario at several localities in Kent, Elgin, Lambton and Oxford counties; and in Quebec near York River, in Gaspé district.

Production of Petroleum in Canada

Barrels of 35 Imperial gallons - 42 U.S. gallons

	1938	1939
Alberta	6,742,039	7,594,411
Ontario	172,641	205,978
New Brunswick	19,276	20,101
Northwest Territories	22,855	17,013
Total	6,956,811	7,837,503

Production of Petroleum in Alberta, 1939.

Turner Valley limestone	7,547,598 Bbls.
Turner Valley shallow crude	8,431 "
Red Coulee light crude	13,022 "
Wainwright heavy crude	15,041 "
Miscellaneous	10,319 "
Total	7,594,411 Bbls.

Imports of petroleum and petroleum products during 1939 were valued at $55,913,177. The major portion of this expenditure was for 1,298,319,166 Imperial gallons of crude petroleum to be processed in Canadian refineries. Seventy-seven per cent of the crude petroleum was received from the United States, 8 per cent from Venezuela, and 14 per cent from Columbia, with small amounts from Peru, Trinidad, and Tobago. Imports of gasoline and naphtha were 109,021,177 Imperial gallons valued at $7,998,336, over 85 per cent of which was from the United States, 7 per cent from Trinidad and Tobago, 7 per cent from Peru, and a small amount from Alaska. Exports of petroleum and its products from Canada during 1939 were valued at $848,558.

Retail sales of gasoline in Canada in 1939 amounted to approximately 805 million gallons, an increase of 5.5 per cent over 1938. Although the potential production of the Turner Valley greatly exceeds the actual production, there is still some importation of Montana crude oil and gasoline into Alberta. At the end of 1939 the extremes of listed prices of regular grade gasoline less tax were 21 cents per Imperial gallon at Brandon and Saskatoon, and 14.5 cents at St.John and Halifax.

The world production of petroleum in 1939 was estimated at 284 million metric tons - compared with 278 million metric tons in 1938. The principal producers, in order of output, are: United States, Russia, Venezuela, Iran, Netherlands, India, Rumania, Mexico and Iraq. Canada occupies fifteenth place in the order of output.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1940.

GOLD IN 1939.

The chief source of gold in Canada in 1939 was, as for many years past, the gold-quartz mines which contributed about 85 per cent of the total. The base metals mines contribution was 12 per cent, and the balance of about 3 per cent was obtained from alluvial placer operations.

Ontario is by far the most important producing province, contributing over three million ounces, or three-fifths of the total Canadian production. With the exception of the gold obtained as a by-product in the refining of nickel and copper (about 85,000 ounces), virtually all Ontario's gold comes from gold-quartz mines, Porcupine and Kirkland Lake being the principal producing areas. Important contributions (about 719,000 ounces) 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 Temiskaming 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 country, and the Arntfield, Duparquet, Rouyn and Mud Lake areas in Temiscamingue county.

The chief source of gold in British Columbia is the gold-quartz mines of the 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 the 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 partly from the copper-zinc-gold ores of the Flin Flon mine supplemented to a small extent by the Sherritt-Gordon mine, and to a greater extent (about 55%) 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 mainly from that portion of the Flin Flon mine lying west of the interprovincial boundary, and to a small extent 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; Hollinger Consolidated Gold Mines, Ltd., at Timmins, Ontario; International Nickel Company of Canada, Ltd., at

Copper Cliff, Ontario; Canadian Copper Refiners, Ltd., at Montreal East, Quebec; and 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 1939, 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.

In 1939, 158 gold mills were in operation, with a combined daily capacity of 57,400 tons. Of this total 15 small plants were in operation only intermittently, and 14 plants ceased operation in the course of the year. New mills completed and put in operation numbered 25 with a combined daily capacity of 4,830 tons. In addition, there were 5 mills, with a combined daily capacity of 640 tons, under construction and scheduled to come into production in 1940.

In 1938 the total number of mills was 157, with a combined daily capacity of 50,925 tons. Twenty-five small mills operated intermittently and 15 plants ceased operation in the course of the year. New mills put in operation numbered 37, with a combined daily capacity of 6,265 tons. In addition, 11 mills were under construction.

Increases to plant capacity in 1939 took place at 32 plants and totalled 2,985 tons, compared with 34 plants and a total of 2,430 tons in 1938.

In Nova Scotia, the Killag mill was renovated and operated for a short time. Several old properties were again put in operation in a small way. The two largest plants in Nova Scotia, the Seal Harbour (250-ton) and the Guysborough (100-ton) were operated continuously and to capacity.

In Quebec, the new mills were: Malartic Goldfields with 300 tons, Wood-Cadillac with 225 tons, Amm gold with 175 tons, and Central Duverny with a 25-ton mill.

In Ontario, the new mills were: Chesterville Larder Lake and Uchi, each with a capacity of 500 tons; Preston East Dome with 400 tons; Berens River with 250 tons; Tyranite and Upper Canada, each with 200 tons; Cochenour Willans and De Santis, each with 150 tons; Cordova and Ronda (now idle), each with 125 tons; Kenricia and Magnet, each with 100 tons; Hiawatha with 50 tons, and the Ranson with a capacity of 25 tons.

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

In Saskatchewan, the 1,000-ton mill of the Box property near Goldfields operated by the Consolidated Mining and Smelting Company, was put in operation in June. The adjoining Athona property was under development.

In British Columbia, the new mills were: Monashee Development 60-ton mill, near Lumby; Mount Zeballos 50-ton mill, and Central Zeballos 25-ton, both on the west coast of Vancouver Island.

In the Northwest Territories, the only new mill was the 50-ton mill of the Negus, Yellowknife Bay, Great Slave Lake.

In the Yukon Territory, a 25-ton mill was put in operation by Richards and Keobke of Carmacks.

The gold production of the Dominion in 1939 was 5,095,176 fine ounces, valued at $184,144,756, compared with 4,725,117 fine ounces, valued at $166,205,990 in 1938, a gain of 370,000 fine ounces and of $17,939,000. The 1939 output was an all-time high record.

By provinces the production was as follows:-

	1939		1938	
	Fine ounces	$	Fine ounces	$
Nova Scotia	29,943	1,082,170	26,560	934,248
Quebec	953,478	34,459,648	881,263	30,998,426
Ontario -				
Porcupine			1,258,671	44,273,752
Kirkland Lake ..			1,030,829	36,259,410
Others			606,977	21,350,416
Total Ontario	3,086,224	111,539,222	2,896,477	101,883,578
Manitoba	180,867	6,536,714	185,706	6,532,209
Saskatchewan	77,120	2,787,194	50,021	1,759,489
Alberta	359	12,975	305	10,728
British Columbia..	629,037	22,734,026	605,617	21,302,578
Yukon & N.W.T. ...	138,148	4,992,807	79,168	2,784,734
CANADA	5,095,176	184,144,756	4,725,117	166,205,990

The value of Canada's gold production in 1939 was about 50 per cent of the total value of all metals and 35 per cent of the total value of the entire output of the Canadian mineral industry.

The world production of gold in 1939 is estimated at 39,780,000 fine ounces (as given by the Engineering and Mining Journal), compared with 37,942,700 fine ounces in 1938 (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. In the past 15 years the gold production of the world has more than doubled. The United States Treasury continued to add to its gold reserves, now valued at 17.7 billion dollars, said to be equal to about two-thirds of the world's monetary gold.

The price of gold during the first eight months of 1939 was slightly more than $35 per fine ounce. After war was declared the price rose in September to an average of $37.21 as a result of the adverse exchange with the United States; in the latter part of the year, in view of the premium of 10 per cent on United States funds, the price has been averaged about $38.50. The average at which Canada's gold production was computed for the year was $35.926 per fine ounce.

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