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DEPARTMENT OF MINES & RESOURCES

BUREAU OF MINES

THE CANADIAN MINERAL INDUSTRY IN 1941.

Ottawa, 1942.

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(by Staff, Bureau of Mines, Ottawa)

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Product	Article Number	Author
I - METALS:		
Aluminium	(1)	Buisson, A.
Antimony	(2)	Buisson, A.
Bismuth	(3)	Buisson, A.
Cadmium	(4)	Buisson, A.
Chromite	(5)	Eardley-Wilmot, V.L.
Cobalt	(6)	Buisson, A.
Copper	(7)	Buisson, A.
Gold	(8)	Buisson, A.
Iron Ore	(9)	Buisson, A.
Lead	(10)	Buisson, A.
Manganese	(11)	Eardley-Wilmot, V.L.
Mercury	(12)	Eardley-Wilmot, V.L.
Molybdenum	(13)	Eardley-Wilmot, V.L.
Nickel	(14)	Buisson, A.
Platinum	(15)	Buisson, A.
Radium and Uranium	(16)	Spence, H. S.
Selenium	(17)	Buisson, A.
Silver	(18)	Buisson, A.
Tellurium	(19)	Buisson, A.
Tin	(20)	Buisson, A.
Titanium	(21)	Buisson, A.
Tungsten	(22)	Eardley-Wilmot, V.L.
Zinc	(23)	Buisson, A.
II - INDUSTRIAL MINERALS:		
Arsenious Oxide	(24)	Buisson, A.
Asbestos	(25)	Goudge, M.F.
Barite	(26)	Spence, H.S.
Bentonite	(27)	Spence, H.S.
Beryl	(28)	Spence, H.S.
Bituminous Sand	(29)	Ells, S.C.
Brucite (see Magnesite)		Goudge, M.F.
Celestite	(30)	Spence, H.S.
Cement	(31)	Goudge, M.F.
Clay and Clay Products	(32)	Phillips, J.G.
Diatomite	(33)	Eardley-Wilmot, V.L.
Feldspar	(34)	Spence, H.S.
Fluorspar	(35)	Spence, H.S.
Garnet	(36)	Eardley-Wilmot, V.L.
Granite	(37)	Cole, L.H.
Graphite	(38)	Spence, H.S.
Grindstones	(39)	Eardley-Wilmot, V.L.
Gypsum	(40)	Cole, L.H.
Iron Oxides	(41)	Buisson, A.
Kaolin (see Clays)		Phillips, J.G.
Lime	(42)	Goudge, M.F.
Limestone (General)	(43)	Goudge, M.F.
Limestone (Structural)	(44)	Goudge, M.F.
Lithium Minerals	(45)	Spence, H.S.
Magnesite and Brucite	(46)	Goudge, M.F.

Product	Article Number	Author
II - INDUSTRIAL MINERALS (cont'd):		
Magnesium Sulphate	(47)	Cole, L.H.
Marble	(48)	Goudge, M.F.
Mica and Vermiculite	(49)	Spence, H.S.
Moulding Sands	(50)	Freeman, C.H.
Nepheline Syenite	(51)	Spence, H.S.
Phosphate	(52)	Spence, H.S.
Pyrites	(53)	Buisson, A.
Salt	(54)	Cole, L.H.
Sand and Gravel	(55)	Picher, R.H.
Silica	(56)	Cole, L.H.
Sodium Carbonate	(57)	Cole, L.H.
Sodium Sulphate	(58)	Cole, L.H.
Sulphur	(59)	Buisson, A.
Talc and Soapstone	(60)	Spence, H.S.
Vermiculite (see Mica)		Spence, H.S.
Volcanic Dust	(61)	Eardley-Wilmot, V.L.
Whiting	(62)	Goudge, M.F.
III - FUELS:		
Coal	(63)	Burrough, E.J.
Coke	(64)	Burrough, E.J.
Natural Gas	(65)	Madgwick, T.G.
Oil Shale	(66)	Swinnerton, A.A.
Peat	(67)	Leverin, H.
Petroleum	(68)	Madgwick, T.G.

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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.

O T T A W A, MARCH, 1942.

ANTIMONY IN 1941

ORES MINED AND PRODUCING LOCALITIES:

Antimony ore in the form of stibnite occurs in various parts of Canada. With the exception of small experimental shipments made in 1939 and 1940 from the Fort St. James deposit in northern British Columbia, no antimony ore has been produced in Canada since 1917. For a number of years prior to 1917, small amounts of refined antimony as well as antimony ore were produced intermittently in the Maritime Provinces. The Canadian output is at present derived mainly from the treatment of the antimonial residue produced as a by-product of silver refining at Trail, British Columbia. The present high price for the metal and the difficulties facing the industry in China as a result of war are an incentive to explore for new deposits and to resume development at those already known in Canada.

In Nova Scotia, a small amount of surface trenching was done in 1940 on the antimony property near West Gore, Hants county. Owing to difficulty of shipment of the ore to the United Kingdom, no stibnite was produced during the year 1941.

In New Brunswick, extensive deposits of stibnite are known to occur at Lake George, York county, and stibnite-bearing boulders occur at Marrtown, Queens county, and at Stewarton, Kings county. No work was done at any of these localities in 1941.

In Quebec, some preliminary exploration work was undertaken in 1940 on an old antimony deposit in South Ham township, Wolfe county, and on an antimony-gold deposit on lot 9 range VI, New Richmond township, Bonaventure county. No operations were reported in 1941.

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

In British Columbia, some exploration work was done on a property at Stuart lake, near Fort St. James.

A treatment plant completed in 1938 at Trail, British Columbia, commenced the production of high grade electrolytic antimony in the last quarter of that year. The antimony is recovered from flue dust, a by-product of Consolidated Mining and Smelting Company's silver refinery. The production has been gradually brought up to the capacity of the plant. The smelter at Trail does not accept custom antimonial ore.

In the United States, Texas Mining and Smelting Company, with plant at Laredo, Texas, handles Mexican and South American antimony ores for the production of metallic antimony. Early in 1940, the Bunker Hill smelter, Bradley, Idaho, put in operation a new plant for the recovery of antimony in the form of antimony oxide and electrolytic antimony, using the "Lee-Muir Process", which separates the silver, copper, antimony, and bismuth components of tetrahedrite. Menardi Metals Company operate a plant for the recovery of metallic antimony at Los Angeles, California. American Smelting and Refining Company produces antimony at its Perth Amboy plant in New Jersey and the metallic antimony produced is converted into antimonial lead and other products.

PRODUCTION AND TRADE:

Canadian production and trade figures are not available for publication owing to the war.

The world production of antimony in 1939 (1940 and 1941 figures not available), as published by the United States Bureau of Mines, amounted to about 32,000 metric tons. The production in 1937 was 37,300 metric tons, the highest figure since the 1914-1918 war years. The decline in output from China has been more than made up by the large increase in production in other countries. The present production is probably in excess of 37,000 metric tons a year.

Most of the production of antimony has come from China, although Bolivia and Mexico have been important producers for years. During the last few years, there has been a marked increase in output from Bolivia, Mexico, Yugoslavia, and Algeria and, to a lesser degree, from several other countries. In 1939 Bolivia produced 29 per cent of the world output of antimony; Mexico, 23 per cent; China, only 20 per cent; and Yugoslavia, 10 per cent. Most of the refined antimony is produced in the United States, Great Britain, France, and Belgium from ores of foreign origin.

Canada's requirements are now supplied mainly from the plant at Trail, which explains the noticeable decrease in our imports.

MARKET AND PRICES:

The market for antimony depends especially upon the demand from automobile manufacturers, as it is used largely in alloys for storage-battery plates, bearing and babbitt metals, solder, rubber goods, paints and fixtures. The use of antimony in the manufacture of chemicals has increased considerably during the last two years. The principal compound is the oxide of antimony, which is employed extensively as a pigment in sanitary enamelware and nitrocellulose enamels. The expansion in the manufacture of munitions of war is also an important factor in the increasing demand for antimony. Since December, 1935, the Chinese antimony trade has been under government control.

The New York price of antimony (ordinary brand) in 1941 remained fixed at 14 cents a pound. The price for Chinese brand, duty paid, remained at 16 cents throughout the year.

TARIFF:

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

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

BISMUTH IN 1941

SOURCE OF SUPPLY:

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, Consolidated Mining and Smelting Company of Canada operates 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, Deloro Smelting and Refining Company of Deloro obtains a lead bullion that contains bismuth and some gold and silver from the treatment of the silver-cobalt-nickel-arsenical ores of Cobalt and adjoining areas. This bullion is exported for refining.

PRODUCTION AND TRADE:

Canadian production and trade figures are not available for publication owing to the war.

Statistics of the world production of bismuth are incomplete, but the output is estimated at about 1,500 tons annually. The United States is the principal producer, but the publication of figures is withheld. American Smelting and Refining Company produces bismuth-lead alloy at its plants at Selby, California, Perth Amboy, New Jersey, and Monterrey, Mexico, and the alloy is refined at the company's refinery at Omaha, Nebraska. Anaconda Copper Mining Company obtains its bismuth from the Montana copper and the Utah lead ores, the final bismuth recovery being made by International Smelting and Refining Company at East Chicago, Indiana. United States Smelting, Refining, and Mining Company operates a bismuth refinery at East Chicago, where slime from the Belts electrolytic lead process is treated for its bismuth content. Bunker Hill and Sullivan Mining and Concentrating Company operates since 1940 a plant for the production of refined bismuth obtained from the residues produced at the company's lead refinery at Kellogg, Idaho.

Canada holds third place as a source of supply of bismuth, other important sources being Peru and Mexico. For more than half a century Bolivia was the principal source, but in recent years its production has decreased considerably. The United States Bureau of Mines reports that about 90 per cent of the world production is obtained from the United States, Peru, Canada, and Mexico, while the remainder is obtained from Argentina, Belgium, Bolivia, France, Germany, Japan, and Spain.

MARKET AND PRICES:

Bismuth is used mostly in the manufacture of pharmaceutical products. A much larger portion than formerly is now used in the making of so-called fusible or low-melting alloys. 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, for electroforming with iron, has provided an outlet for bismuth in the form of "cerrobase", a nonshrinking bismuth-lead (Bi-Pb) alloy. One application of the Ekko process is the production of dies or molds from which a photographic likeness can be transferred to iron. Although many applications of bismuth, introduced in recent years, have increased the demand for this metal, potential supplies greatly has exceeded the present demand. The war has restricted international trade in bismuth and encouraged the use of substitutes. The demand for bismuth increased considerably during 1941 owing to its greater use in metallurgical and pharmaceutical applications. Alloys containing bismuth find use to a greater extent in the aircraft, machine tool, munitions and other industries.

It is reported that bismuth makes stainless steel machinable without impairing corrosion resistance. The effect of this addition (o.1 - 0.5 per cent Bi) is said to be so remarkable that it is predicted it will quickly displace selenium for this purpose.

The price of bismuth at New York remained fixed at $1.25 a pound throughout 1941. For several years the United States price has been maintained at a little below the European parity, plus duty of 7½ per cent ad valorem, chargeable upon imports into the United States. For several years the price has been well controlled.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

CADMIUM IN 1941

SOURCE OF SUPPLY:

Cadmium is present in small amounts in most zinc ores and in some lead ores, and is obtained as a by-product in the production of these metals.

Metallic cadmium is produced by Consolidated Mining and Smelting Company at Tadanac (Trail) British Columbia, and by Hudson Bay Mining and Smelting Company at Flin Flon, Manitoba. The former plant started to produce early in 1928 and like the latter, which has been in operation since 1936, treats the cadmium residue from the zinc refinery, the procedure being similar. The cadmium plant at Flin Flon was in continuous operation and treated all current purification precipitates from the zinc plant. A few minor changes were made in the plant's process and equipment.

PRODUCTION AND TRADE:

Canadian production and trade figures are not available for publication owing to the war.

The world production in 1941 is estimated at 5,000 short tons, the production in 1938, the latest year for which figures are available being 4,200 short tons. The chief producing countries in order of output are: 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 1941 was ~~3,850~~ 3,420 tons, and sales were ~~3,857~~ 3,360 tons, the highest on record.

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

MARKET AND PRICES:

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 a strong demand for the metal in recent years and the future of the alloy for this purpose is said to depend upon the ability of the producers to supply the metal at a relatively low price. Cadmium is used also 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 1941(in Canadian funds) averaged \$1.17 cents a pound, compared with \$1.16 cents in 1940. The price of metallic cadmium, f.o.b. New York, in commercial sticks averaged 88.4 cents a pound, compared with 80 cents in 1940. The American product is protected by a duty of 7½ cents a pound. Previous to the Trade Agreement of November, 1938, the duty was 15 cents a pound.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

CHROMITE IN 1941

Ores Mined and Producing Localities:

Pure chromite ($FeCr_2O_3$) contains 68 per cent chromic oxide, but in nature it always contains, besides iron, varying amounts of magnesia and alumina. It is a heavy, almost black, lustrous and brittle mineral and the ore usually occurs in dunite bands in serpentine rocks. Fresh dunite is a fine-grained dark grey-green olivine rock. Chromite is distinguished in the field from other black minerals of similar appearance by its chocolate brown powder or streak when struck or scratched with a hammer.

Shipments were made by six producers operating in the Eastern Townships of Quebec, the chief of which are Chromite Limited at St. Cyr, 30 miles north of Sherbrooke, and Bruce Fletcher, operating deposits about 15 miles northwest of Sherbrooke. Other shippers were Union Carbide Company, which operates the old Montreal pit and the Hall mine in Coleraine township, near Black Lake, and Asbestos Corporation, which operates the Beaver pit, near Thetford.

Important Developments and Prospective Producing Localities:

Chromite Limited did considerable development work in the old Sterrett mine southeast of St. Cyr station on the C.N.R. in Cleveland township, Range X, lots 7 and 8. During the last war this property was opened by surface pits and underground workings for a length of 1,400 feet, and about 15,000 tons of ore was sold as crude or concentrate. Because of the favourable indications on the second level, a 100-ton mill was erected in the fall of 1941 and production started early in 1942. During development, several car lots of crude ore were shipped. Prospecting by Mr. Bruce Fletcher of Sherbrooke revealed at least 30 showings of chromite in the vicinity of Webster and Little Brompton lakes, 15 to 20 miles northeast of Sherbrooke. A number of car lots of good quality hand-cobbed ore were shipped from several of these deposits to a Canadian refractory company and to the United States. Several showings have recently been discovered over an area of a few square miles and production is expected to increase.

The old Montreal pit in Coleraine township, Range II, lots 25 and 26, was dewatered by Orel Paré under contract for Union Carbide Company (U.S.A.) and some car lots of crude ore were shipped to Welland, Ontario. The main pit, 460 feet long, 85 feet wide, and nearly 100 feet deep, was started in 1894 and during the last war, over 20,000 tons of ore was shipped from it. Recent work indicates the existence of a substantial amount of ore. Union Carbide is also working, under contract, the old Hall mine in Coleraine township, Range A, lot 16, about 4 miles southeast of Thetford Mines. The property was first operated in 1899 and from three large connected open pits, about 2,500 tons of ore was shipped prior to 1918. A few car lots were shipped during 1941. Asbestos Corporation, in working the Beaver pit for asbestos, encountered a lens of good quality chromite and several car lots were shipped during the year.

On the Belanger and adjoining Reed properties in Coleraine township, Range X, lot 19, the ore zone has a length of about 2,500 feet and is the largest known deposit of chromite in the Dominion. Approximately 100,000 tons was milled or sold as crude from the deposit between 1916 and 1921. Diamond drilling on the Belanger section in 1923 indicated about half a million tons of ore with a chromic oxide content of 10 per cent or higher to a depth of 300 feet. The pit was bulk-sampled in 1941 and tests at Ottawa indicated that a commercial grade of concentrate could be made from even the low grade ore. Arrangements have been made with the joint owners, the Mutual Chemical Company, and United States Vanadium Corporation of New York, for the Government to explore the properties thoroughly and to erect a 500-ton customs mill. Many chromite deposits are known in the Black Lake - Thetford area and a mill in the district will encourage production from a number of small or partly worked out deposits. The Geological Survey continued with the geological and magnetometer mapping of several areas in the Eastern Townships.

In British Columbia, some prospecting was carried out in the known chromite areas north of Ashcroft and at Cascade near the United States boundary.

Production and Trade:

Canadian production is small and is far short of requirements, but output and trade figures for 1940 and 1941 are not available for publication owing to the war. From 1886, when records were first kept, until the end of 1941, Canada had produced about 170,300 tons of chromite, of which 165,000 tons was from the Eastern Townships of Quebec, mainly from the Coleraine district. During the last war and in the two succeeding years, the total output of high grade ore and concentrate amounted to 93,000 tons, the record of 24,000 tons being in 1917.

Imports and consumption showed an increase of 200 per cent over the figures for 1940. Southern Rhodesia contributed 34 per cent of the 1941 imports; India, 29 per cent; South Africa, 15 per cent; United States and New Caledonia, 11 and 10 per cent; and Cuba, one per cent.

The world annual production just prior to the present war was about 1,300,000 tons. Russia, Turkey, and Southern Rhodesia were each producing 200,000 tons or more a year, while South Africa, the Philippines, Cuba, New Caledonia, Yugoslavia, Greece, and India were each producing 50,000 tons or more. Russia is probably the largest producer, but no records are available since 1936, when the output was about 217,000 tons. The most important deposits are in the Saranov district of the Ural Mountains. The exports are said to be small as the output is consumed in domestic industries.

Turkey is one of the most important sources of high grade chromite. The deposits are widely distributed, but in recent years much of the ore has come from the Guleman mines in Eastern Anatolia, now a leading producer of chromite. The ore is lumpy and of good metallurgical grade (49 to 52 per cent Cr_2O_3), low in silica, and has a chrome-iron ratio of three to one. The deposits are controlled by the Eti bank. Chromite represented 45 per cent of Turkey's total mineral output in 1939.

In Southern Rhodesia, production reached a peak of 275,617 tons in 1937, the amount being higher than that of any other country, but in 1939 the output was only half of that tonnage. Chrome Producers (an association of five independent producers) obtains its supply from the Great Dyke seam, which extends north from Darwindale for 70 miles, and the shipments are made from Beira. Rhodesian Corporation, the largest producer, ships from the deposits in the Selukwe district. Its output is expected to reach, and may already have reached a rate of 300,000 tons a year. Most of the Corporation's ore comes from the underground workings and is hand-sorted and shipped in lump form in two grades. No. 1 grade is guaranteed to meet all specifications for metallurgical ore, whereas No. 2 grade is semi-friable, tends to crumble in transit, and its chrome-iron ratio is less than 3 to 1.

Output from the Union of South Africa in 1940 was 163,646 metric tons, the Rustenburg district being one of the principal producers. The iron content is somewhat high, but ore containing 43 to 46 per cent Cr_2O_3 is available in large tonnages.

The Philippine Islands has been an important producer of chromite since 1937. The mineral is known to occur in twelve scattered areas, the principal of which is the Luzon zone in Zembales Province, where ore of a grade in excess of 51 per cent has been shipped. The largest single deposit, near Masinloc, is reported to contain 10 million tons of medium grade (33 per cent) ore, suitable for refractory uses. Many large areas in which chrome may occur are as yet unexplored. Exports of chrome ore in 1940 amounted to 194,393 metric tons, most of which went to the United States.

The Cuban production, which in 1940 amounted to 52,789 metric tons, is all shipped to the United States. Exports in the first nine months of 1941 were 113,034 metric tons. As the ore has a low chrome content, it is used mainly in the refractory industry. Reserves are stated to be over two million tons of refractory grade ore.

The Free French Colony of New Caledonia, an island off the east coast of Australia, has been shipping over 50,000 tons a year for a number of years and in 1940 shipped 66,392 metric tons. The mines are operated by British and American concerns. The ore contains about 55 per cent Cr_2O_3.

Greece, prior to the war, was producing about 50,000 tons of 37 to 40 per cent refractory grade ore. The largest mine, at Xinia, produced about 30,000 tons a year.

In British India, the States of Mysore and Baluchistan are the principal sources of supply, the total annual output being about 50,000 tons. The grade of the ore imported into Canada, mainly for refractory use, is from 45 to 50 per cent Cr_2O_3, the silica content being 0.66 per cent. The Mysore Government has approved of a plan to establish a factory at Belagola to make about 400 tons of sodium bichromate annually from local ore.

In Albania, deposits containing large tonnages of good grade ore were discovered recently in the northeast and are being operated by an Italian company. In Brazil, deposits containing several million tons are known to exist, mainly in the State of Bahia, and development is being fostered by the Government. Japan is believed to be producing nearly 50,000 tons a year, the principal source being on Hokkaido Island. Most of the ore, however, is low grade and is suitable only for refractory use. The Annam deposits in French Indo China, from which 52 per cent Cr_2O_3 concentrate can be made, are now under Japanese control.

In Newfoundland, prospecting and diamond drilling by Springer Sturgeon Gold Mines, Limited of Toronto, was started late in 1941 on a deposit near Fox Island river in the Port au Port Bay district. There are indications of a large low grade zone of disseminated ore through which small nodules of chromite are sparsely scattered, but results of the work are not as yet conclusive.

Production in the United States rose from 2,662 tons in 1940 to over 12,000 tons in 1941, the consumption in 1941 being estimated at 750,000 tons. Most of the output is from California, Rustless Mining Company at Pilliken, Eldorado county, being by far the largest producer. The largest deposit in the United States occurs along a stretch of 27 miles on the northern margin of the

Beartooth mountains in Stillwater and Sweetgrass counties, Montana. The deposits, leased through the Government-controlled Metals Reserve Company, are being developed by Anaconda Copper Company. The ore contains about 18 per cent Cr_2O_3, and has a rather low chrome-iron ratio. A plant is being erected in which the ore will be treated by water concentration and double smelting to drive off impurities. Operations will be on a non-profit basis and 650 tons of 40 to 43 per cent Cr_2O_3 concentrate daily is expected. Other deposits occur in Oregon and Washington. Production from the Montana and other deposits along with the restrictions in the uses of chromite will greatly alleviate the present situation in respect to chromium in the United States.

Supplies from Yugoslavia, Greece, and recently the Philippines have been cut off and imports into the United States are mainly from Rhodesia, South Africa, Portugese Africa, New Caledonia, and India, from which delivery is hazardous. The ore from Cuba is mainly used for refractories, the requirements for which are about 125,000 tons annually. The recent lowering of the specifications of ferrochrome will further the use of the medium grade ores, and may make possible the use of Cuban ores for metallurgical purposes.

Uses:

Chromium is one of the principal alloying elements in a great variety of steels, chief of which in the amount of chromium used are the highly important stainless and corrosion-resistant steels. It is the vital ingredient with nickel and molybdenum in the making of armour plate steels and is used as a hard, toughening element in tank axles and frames, and in aeroplane parts. The ore is usually converted into ferrochrome before being added to the steel bath. Large quantities of chromite, with certain specifications as to physical and chemical properties are used in the making of refractories, and chromite is also the source of the chromium chemicals used in the electroplating, dyeing, tanning, and paint industries.

Concentration and Addition Agents into Steel:

Most Canadian chromites are relatively free of heavy sulphides and can be concentrated by ordinary gravity methods. High iron or magnetite-chrome ores must undergo a preliminary roasting or straight magnetic separation. The 67,000 tons of ore milled from the chromite deposits in Quebec during the last war averaged about 11.5 per cent Cr_2O_3 and from it 11,000 tons of concentrate made by the gravity process and containing 49 to 50 per cent Cr_2O_3 was shipped. At present prices, it is doubtful if an ore with less than 10 per cent Cr_2O_3 could be treated profitably. The use of the "Sink and Float" method of raising the grade of an ore from as low as 5 per cent up to 25 per cent Cr_2O_3 as a preliminary to gravity treatment is being investigated.

Chromium Mining and Smelting Company, Sault Ste. Marie, Ontario, produces an addition agent known as Chrom X, an exothermic alloying agent compounded with chromium and silicon. High and low carbon Chrom X products are on the market.

Specifications:

Until recently, metallurgical chromite had to contain a minimum of 48 per cent Cr_2O_3 and a chrome-iron ratio of not less than 3 to 1, but in December, 1941, the following specifications were drawn up by the United States Metals Reserve Company: "High grade", minimum of 45 per cent Cr_2O_3, and maxima of 11.0 per cent silica; 0.2 per cent phosphorus; 0.5 per cent sulphur; and a chrome-iron ratio of 2.5 to 1; "Low grade A", minimum of 40 per cent Cr_2O_3; maxima of 13 per cent silica; 0.5 per cent phosphorus; 1 per cent sulphur; and a 2 to 1 ratio: "Low grade B", minimum of 40 per cent Cr_2O_3 with no limits set on impurities or ratio. For the special Canadian product, Chrom X, low grade ores have been used in which the chrome-iron ratio has been as low as 0.6 to 1, with the Cr_2O_3 content ranging from 25.0 to 43.0 per cent.

Specifications for refractory ore suitable for bricks vary somewhat, and depend upon the kind of brick to be made. A Canadian manufacturer indicates maxima allowances of 20 per cent Fe_2O_3, 18 per cent Al_2O_3, and 4 per cent SiO_2. The silica should be as low as possible and it usually occurs in the ore as serpentine, a hydrated magnesium silicate, having a comparatively low melting point. It is very important that the chromite be present in an evenly and finely distributed form, not as coarse grains mixed with blobs of the silicate. The ore should be hard and lumpy, and the lumps should be plus 10 mesh. Provided the impurities are within the above specifications, the chromium content may vary within certain limits, but it is generally between 40 per cent and 45 per cent Cr_2O_3.

Standard grades of ferro-chrome contain a minimum of 60 to 70 per cent chromium and are produced in two grades, one being high (4 to 6 per cent) in carbon and the other low (less than 2 per cent) in carbon.

Market Conditions and Prices:

The principal Canadian buyers of chromite for metallurgical use are:- Chromium Mining and Smelting Corporation, Sault Ste. Marie, Ontario, and the Electro-Metallurgical Company of Canada, Welland, Ontario. The only important purchaser of refractory ore is Canadian Refractories Limited, Canada Cement Building, Montreal, Quebec. The types and grades of ore acceptable to these buyers are indicated under "Specifications".

United States price quotations early in 1942 per long ton of 48 per cent Cr_2O_3 imported ores c.i.f., Atlantic ports, excluding war risk insurance were \$35 to \$40 for lump ore and \$33 for concentrate. Prices effective December 1941 for domestic ores of the specifications given above, per long dry ton f.o.b. buyers stock piles, are as follows: "High grade" - \$40.50, plus 90 cents per long unit (22.4 pounds) for each per cent Cr_2O_3 in excess of 45 per cent, or plus \$1.50 for each 0.1 per cent increase of chrome-iron ratio to a maximum of 3 to 1; "Low grade A" - \$28, plus same amounts extra for grade and ratio; "Low grade B" - \$24, plus 60 cents for each additional unit of Cr_2O_3. The grade of the shipment is determined by the specifications it meets; thus, an ore containing 45 per cent Cr_2O_3 and 0.5 per cent phosphorus is classified as "Low grade A".

Canadian ores containing 35 to 45 per cent Cr_2O_3 ranged in price from \$17.50 to \$26.00 per ton on cars at mines.

United States prices of ferrochrome are as follows: high carbon ferrochrome, 66 to 70 per cent chromium and 4 to 6 per cent carbon, 13 cents a pound; and low carbon ferrochrome, 2 per cent carbon, 20 cents, and 0.1 per cent carbon, 22 cents a pound of contained chromium.

Canada is now a large consumer of chromite and the requirements are likely to increase. It is becoming increasingly difficult also to obtain the necessary supplies from outside sources and, accordingly, there is an urgent need for a greater domestic production. Although an eventual large output of high grade lump ore is not expected, the known low grade deposits should yield a substantial output of concentrate of metallurgical grade.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

COBALT IN 1941

Ores Mined and Producing Localities:

Most of the cobalt produced in Canada has come from the mining camps at Cobalt, Gowganda, and South Lorrain, in northern Ontario. In the early years of these camps, it was obtained mainly as a by-product of silver mining, but activity in recent years has been mostly in the production of cobalt ores, with silver as a by-product. Production from the Cobalt and nearby areas has been maintained in recent years by lessees working over old surface dumps and mining narrow surface veins and old underground workings. Cobalt ore is also being produced from a property at Werner lake about 40 miles north of Minaki, Ontario, and 15 miles east of the Ontario-Manitoba boundary. There are some cobalt occurrences in British Columbia, but there is no production as yet from that Province.

Cobalt Products, Limited, Cobalt, Ontario, has been operating a concentrating plant since 1938 and is now the principal producer of cobalt ore in Canada. It obtains its ore from various surface dumps and also from the underground workings of a few properties. Its flotation concentrate, which contains from 8 to 12 per cent of cobalt, is sold directly.

Deloro Smelting and Refining Company, Limited, has the only plant in Canada that treats ores for the recovery of cobalt. The plant is located at Deloro, Ontario, and produces cobalt metal, oxides, and salts, chiefly for the British market. For the past two years, the company has been treating cobalt residues from Africa and has processed little or no Canadian ores. About half of the Canadian production in 1941 was exported to the United States and the remainder was purchased by Deloro Smelting and Refining Company and stockpiled.

In the United States, most of the cobalt produced is obtained from cobalt residues imported from Africa. These are converted to metal at Niagara Falls, N.Y., and to oxide at New Brighton, Wilmington, and Canonsburg, Pennsylvania, and at Cleveland, Ohio.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

The total annual world output is estimated to approximate 6,000 metric 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 are Australia, Japan, Germany, and Russia.

Market and Prices:

About 75 per cent of the world production of cobalt is used in the metallurgical industry and most of the remainder in the ceramic industry. The metallurgical uses are for high-speed cutting steels; for making stellite (alloys of cobalt, chromium, and usually small quantities of other metals) which is used for cutting metals at high speed; and for making permanent magnets. The use of stellite continues to spread and it is 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. A large amount of cobalt is used as a catalyst. Cobalt oxide is used mainly in the ceramic industry owing to its fine colouring properties. Other compounds of cobalt are used as driers in paint and varnish.

Consumption of cobalt in the United States, chiefly in the production of high-speed cutting tools and permanent magnets, increased substantially in 1941.

Owing mainly to the agreement reached in 1935 by the principal producers, the price of cobalt has remained fairly steady in recent years. The nominal New York price (as quoted by Metal and Mineral Markets) for cobalt metal imported from Belgium, remained at $2.11 a pound throughout the year. The United States domestic quotations for metal in 100-lb. lots and for black oxide in 350-lb. lots remained unchanged at $1.50 and $1.84 a pound, respectively. The nominal price for cobalt ore, 13 per cent grade, f.o.b. cars, Ontario remained at about $1.00 a pound of cobalt.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

COPPER IN 1941

Ores Mined and Producing Localities:

Canada's output 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 the 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 the Copper Mountain mine in British Columbia.

In British Columbia, Britannia Mining and Smelting Company operated its mines and concentrator at Britannia Beach. The copper concentrate, as in past years, was shipped to the Tacoma smelter in Washington State. The pyrites concentrate was partly shipped to the acid plant of Nichols Chemical Company at Barnet, B. C., and partly exported. Development work, below the 4,100-foot or bottom level, started in 1940, was continued in 1941. Exploration work is now largely concentrated at a horizon 400 feet below the main haulage adit and has met with encouraging results.

Granby Consolidated Mining, Smelting and Power Company, Limited operated its Copper Mountain mine and its concentrator at Allenby, near Princeton, at a slightly increased capacity. The copper concentrate was shipped to the Tacoma smelter of the American Smelting and Refining Company, Tacoma, Washington, U.S.A. A total of 1,935,000 tons of ore was added to the reserves during the year, as a result of mining operations.

At Flin Flon, Manitoba, Hudson Bay Mining and Smelting Company, Limited operated its mine, concentrator, copper smelter, and zinc plant at an increased capacity. The new South Main shaft was extended and completed full size from the 2500-foot level to the 3000-foot level, and work started on the ore-pockets and crusher stations immediately below the 2750-foot level. Ore bins were installed at the mill crushing plant to facilitate handling of the ore from the south main shaft. Changes in the grinding section of the mill and other alterations in the flow-sheet permitted the treatment of a higher daily tonnage of ore than in 1940. With the completion of the holding furnace, pelletizing plant, and flux handling equipment, it was possible for the copper smelter to treat a larger tonnage of pay materials.

In Ontario, the International Nickel Company of Canada, Limited operated its Frood, Frood Open Pit, Creighton, Levack, and Garson Mines, and sinking operations were started at Murray and Stobie Mines. Underground development was carried on in all mines at a rate to conform with mining schedules and provide for increased production. The concentrator at Copper Cliff was operated to capacity and plans have been approved to increase the capacity in order to treat additional tonnages of ore from the Open Pit mining operations.

Falconbridge Nickel Mines Limited, operating mines and smelter at Falconbridge, after completion, early in the year, of arrangements for the disposal of additional matte, stepped up production to full capacity as rapidly as possible. By mid-summer a considerable program of construction was under way. This program of expansion was still under way early in 1942 and is expected to be completed during the first half of the year. Considerable exploration and development was carried on during the year with encouraging results. Some gain was made in ore reserves despite the fact that greater tonnage was mined than in any previous year.

A considerable program of exploration by diamond drilling was undertaken on the company' holdings in the Sudbury district resulting in increased ore reserves at these properties as well as at the Falconbridge mine, with grades comparing favourably with recent years. The expansion program above mentioned included additions to the concentrator, the sintering plant, and the smelter. Following arrangements made in 1940 with the International Nickel Company, the matte produced is being handled at the company's plants at Copper Cliff and Port Colborne.

Nickel Offsets, Limited, with a property in Foy and Bowell townships, west of Capreol, Sudbury district, continued the extensive surface exploration and diamond drilling that was started in 1939. A shaft was sunk to a depth of 500 feet, to open three levels, at 250-foot, 350-foot, and 500-foot horizons, and underground development was started in the latter part of the year.

Ontario Nickel Corporation did not operate its holdings at Moose lake, McLennan township, Sudbury district. The company is said to be considering resumption of operations early in 1942, and of erecting a 200-ton concentrating plant.

Denison Nickel Mines Limited did not operate its property in Denison township northwest of Sudbury.

In Quebec, Noranda Mines, Limited, operated its Horne mine, its concentrator, and its smelter at capacity. The sinking of the interior shaft (No.6) from the 3,000-foot level was completed to a depth of 6,000 feet, and lateral work begun on the 4,500-foot, 5,000-foot, 5,500-foot, and 6,000-foot levels.

Waite-Amulet Mines, Limited, continued the exploration and development of its large high-grade orebody discovered in 1938. Its new concentrator, completed and put in operation in October, 1939, was enlarged during 1940 and again in 1941 by additional copper cells and a 300-ton extension for treating zinc ores from the Waite mine.

Aldermac Copper Corporation, Limited, with mine and concentrator, situated twelve miles west of Noranda, Quebec, operated throughout 1941. The products consist of a copper concentrate, which is shipped for treatment to the Noranda smelter, and a high-grade iron pyrites concentrate, which is exported to chemical plants in the United States. The main shaft of the mine has been deepened to 1,375 feet; the tenth, or bottom level is being explored by crosscutting and diamond drilling.

Normetal Mining Corporation, Normetal, Quebec, shipped both copper and zinc concentrates steadily all year. No.3 shaft was completed to 2,000 feet, and four new levels were established at 150-foot intervals below the 1,400-foot level. Development results were very satisfactory, the bottom level being the best in the mine. In view of representations made to the directors respecting the increasing need for copper and zinc for war purposes, a mill addition of 150 tons daily was authorized. This new construction was virtually completed by the end of the year.

International Nickel Company's copper refinery at Copper Cliff, Ontario, was operated at capacity. It treats the output of blister copper produced at its nearby smelter, which 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.

The copper refinery of Canadian Copper Refiners, Limited, at Montreal East, Quebec, was also operated at capacity. This plant was enlarged during the year. It treats the anode copper from Noranda smelter and the blister copper from the Flin Flon smelter.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

Prior to the war, most of the Canadian refined copper went to Great Britain, where the consumption of new copper was at the rate of about 250,000 tons annually. By agreements reached in the early weeks of the war, Canadian producers are supplying about 70 per cent of their output of electrolytic copper to the United Kingdom at prices prevailing immediately prior to the outbreak of the war with certain adjustments to allow for increases in the cost of production. Producers on the Pacific coast are continuing to export their product for treatment in the United States.

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 are continuing. Concentrate shipped to the United States, chiefly from British Columbia, but also from Quebec, was treated in bond. Most Canadian producers have the advantage of producing copper largely as a by-product in the recovery of gold, silver, nickel, or zinc.

The world production of copper in 1941, as reported by the American Bureau of Metal Statistics, is estimated at 2,790,000 tons, compared with 2,625,470 tons in 1940. World consumption in 1938 (1939 - 1941 not available), as given by the American Bureau of Metal Statistics, was 2,174,000 short tons, compared with 2,407,700 short tons in 1937.

Market and Prices:

Owing to its excellent quality, Canadian refined copper was much in demand for peacetime uses. Most of the output, however, has since been diverted to war uses and the non-essential civilian uses have been increasingly curtailed. In the war effort, copper is used chiefly in the manufacture of brass; of generator and motor equipment; of degaussing cable used in the protection of ships from magnetic mines; of motor vehicle tubing; and of shell bands.

The United States is by far the greatest consumer of copper, the principal industries using the metal in that country in peacetime being, in order of importance: the electrical manufacturing, automobile, building, electric refrigerator, and air conditioning. The total consumption in 1940 (1941 not yet available) approximated 1,070,000 tons compared with 801,000 tons in 1939. Ordinarily, the building industry is as large a consumer of copper and its alloys as is the automobile industry. Copper is one of the principal metals in wartime.

The price of electrolytic domestic copper (London price in Canadian funds) averaged 10.086 cents per pound in 1940 and 1941. The New York price of domestic electrolytic copper averaged 11.797 cents a pound in 1941, compared with 11.296 cents in 1940. Owing to the 4 cent a pound duty, the foreign and domestic prices do not correspond.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

GOLD IN 1941

Ores Mined and Producing Localities:

The chief sources of gold in Canada are the gold-quartz mines which contribute about 82 per cent of the total. The base metals mines contribute 16 per cent, and the alluvial placer operations, two per cent.

Ontario contributes 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, virtually all of Ontario's gold comes from gold-quartz mines, Porcupine and Kirkland Lake being the principal producing areas. There is a large production also from Little Long Lac and adjoining areas in Thunder Bay district; Red Lake, Crow River, and Lake of the Woods areas in Kenora district; Larder Lake and Matachewan areas in Timiskaming district; and a small production from Goudreau and Michipicoten areas in Algoma district.

Quebec's chief single producer is still the Noranda gold-copper mine. About 75 per cent of the output, however, comes from gold-quartz mines in the Bourlamaque, Siscoe, Malartic, and Cadillac areas in Abitibi county, 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, Lillooet division; the Salmon River area, Portland Canal division; Wells camp, Cariboo division; Hedley camp, Osoyoos division; the Sheep Creek, Ymir, and other adjoining areas, Nelson division; and of Zeballos river, on the west coast of Vancouver Island. Next in importance are the gold-bearing base metal ores, notably those of the Britannia mine at Britannia Beach and Copper Mountain mine near Princeton. A relatively small amount is obtained from placer operations.

Manitoba's gold comes mostly (about 55 per cent) from the gold-quartz mines of Rice Lake district in eastern Manitoba, of God's Lake district, and of The Pas district, the sources of the remainder being the copper-zinc-gold ores of the Flin Flon and Sherritt-Gordon mines.

In Saskatchewan, the production is mainly from that portion of the Flin Flon mine lying within the Province, and there is a small output also from the new mines near Goldfields, Lake Athabaska district.

In the Northwest Territories, production was started in 1938, and is obtained from the Yellowknife River and adjoining areas north 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, Klondike district.

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

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

Treatment Plants:

Plants for the production of fine gold are operated by:

The Royal Canadian Mint, Ottawa, Ontario.
Hollinger Consolidated Gold Mines, Limited, Timmins, Ontario.
International Nickel Company of Canada, Copper Cliff, Ontario.

Canadian Copper refiners, Limited, Montreal, Quebec.
Consolidated Mining and Smelting Company, Trail, B. C.

The Copper Cliff refinery provides a service for several of Canada's gold mines by treating their accumulation of slags, mattes, and other gold-bearing materials.

Important Developments:

During 1941, there was considerable activity in the development of new mines, especially in the Porcupine and Larder Lake 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 parts of the Yellowknife River area, the Northwest Territories; near Lake Athabaska in Saskatchewan; and in the Zeballos River area, on the west coast of Vancouver Island.

A total of 144 gold mills were in operation with a combined daily rated capacity of 65,635 tons and operating capacity of 62,630 tons. Of this total, 10 small plants were in operation intermittently, and 15 plants, with a combined capacity of 2,825 tons, ceased operation in the course of the year. Thirteen new mills with a total daily capacity of 2,120 tons were brought into production and five mills, with a combined daily capacity of 935 tons, were under construction at the end of the year. Increases to plant capacity in 1941 took place at 18 plants and totalled 2,940 tons, compared with 60 plants and a total of 5,690 tons in 1940.

Operating Milling Plants

Year	New Mills		Total Mills		Increases	
	No.	Capacity Tons	No.	Capacity Tons	No.	Capacity Tons
1941	13	2,120	144	65,635	18	2,940
1940	12	1,605	143	62,485	60	5,690
1939	25	4,830	161	57,815	33	3,085
1938	37	6,265	157	50,925	32	2,985

In Nova Scotia, the two largest plants, Seal Harbour (250-ton), and Guysborough (100-ton), were operated at capacity, but the former ceased operation on November 1, 1941.

In Quebec, 24 mills with a daily capacity of 13,850 tons were in continuous operation. The Senator-Rouyn mill (300-ton daily capacity) was the only addition to the list of producers.

In Ontario, 72 mills with a total rated capacity of 38,925 tons and operating capacity of 36,800 tons a day were in continuous operation. The new mills were: Hoyle, with a capacity of 600 tons a day; Jerome, with a capacity of 500 tons; and Yama, with a capacity of 50 tons a day. One renovated plant, the Goldwood, resumed operations.

In Manitoba and Saskatchewan there were no new mills. Five mills with a total capacity of 5,025 tons a day were in operation in Manitoba and one, (the Box) in Saskatchewan, with a capacity of 1,500 tons.

In British Columbia, 30 mills with a total daily capacity of 5,300 tons were in operation. The new mills were: Euphrates, with a capacity of 100 tons a day; Buccaneer and Homeward, each 35-ton mills; and Midnight with a 15-ton mill.

In the Northwest Territories, five mills were in continuous operation, three of which, the Ptarmigan (100 tons), Thompson-Lundmark (100 tons), and Slave Lake (60 tons), entered production during the year. The other two are the Con (175 tons) and the Negus (65 tons).

Construction of the following mills was nearing completion at the end of 1941: in Quebec, Mic Mac (500-ton), and West Malartic (300-ton); in Ontario, the Gold Frontier, (100-ton); in the Northwest Territories, Giant Yellowknife, (25-ton).

Gold production in Canada reached a record total of 5,351,689 fine ounces, valued at $206,040,026 in 1941, compared with 5,311,145 fine ounces, valued at $204,479,083 in 1940.

Production by Provinces

	1941		1940	
	Fine Ounces	$	Fine Ounces	$
Nova Scotia	19,170	738,045	22,219	855,432
Quebec	1,088,860	41,921,110	1,019,175	39,238,238
Ontario	3,190,786	122,845,260	3,261,688	125,574,988
Manitoba	150,523	5,795,135	152,295	5,863,357
Saskatchewan	138,004	5,313,154	102,925	3,962,613
Alberta	215	8,277	215	8,277
British Columbia .	615,838	23,709,763	617,011	23,754,924
Northwest Terr. ..	77,334	2,977,359	55,159	2,123,621
Yukon	70,959	2,731,922	80,458	3,097,633
CANADA	5,351,689	206,040,026	5,311,145	204,479,083

The value of Canada's gold production in 1941 was about 52 per cent of the value of all metals and 36.7 per cent of the value of the entire output of the Canadian mineral industry.

World production of gold in 1941 is estimated (Engineering and Mining Journal) at 42,000,000 fine ounces, compared with 41,398,000 fine ounces in 1940 (American Bureau of Metal Statistics). In the past 15 years the gold production of the world has more than doubled. Canada is headed only by South Africa and Russia as a world producer of gold and contributes about 12 per cent of the total. The United States Treasury continued to add to its gold reserves, which are now valued at 23 billion dollars, and which represent more than two-thirds of the world's monetary gold. Following the passing of the Lend-Lease Act, imports of gold into the United States have declined considerably.

The average price at which Canada's gold production was computed for 1940 and 1941 was $38.50 a fine ounce.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

IRON ORE IN 1941

Ores Mined and Producing Localities:

Deposits of iron ore in Canada are many and widespread and include hematite, siderite, magnetite, bog iron, and magnetic sand. Because of the availability at low cost of higher grade ores in the Lake Superior iron ranges of the United States and in Newfoundland, no iron ore from domestic sources was produced in Canada from 1923 until 1939.

Algoma Ore Properties, Limited, a wholly owned subsidiary of Algoma Steel Corporation, Limited, encouraged by the bounty of two cents per unit (22 pounds) of metallic iron provided by the Ontario Government, began in 1937 preliminary development work at its New Helen mine in the Michipicoten area, Ontario, and the first sinter was produced in July, 1939.

The New Helen deposit is estimated by the company to contain at least 100,000,000 tons of siderite or 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 was built, the sinter produced approximating 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 1941 were 460,747 tons. It was shipped partly via Michipicoten Harbour, 8 miles from the sintering plant, to the company's blast furnaces at Sault Ste. Marie, Ontario, partly to the Canadian Furnace Company at Port Colborne, but mostly to United States ports on the Lower Lakes for use in United States blast furnaces. The manganese content is of special interest to users.

Steep Rock Iron Mines Limited continued its program of exploratory and development work on its hematite property east of Atikokan, and about 135 miles west of Port Arthur, Ontario. This work indicates that the deposits, which were discovered in the winter of 1937-38 under the bed of Steep Rock lake by diamond drilling through the ice, are large and high in grade. A shaft on the shore west of orebody "A" was sunk during the winter of 1939-40 to a depth of over 800 feet, and a crosscut was then driven on the 800-foot horizon toward the orebody. Water difficulties were so serious that the crosscut could not be completed, and it became evident that drainage of the lake was necessary to mine the ore. The company's development program includes the diversion of the Seine river, which now flows through the lake, and the pumping out of the lake itself for open-pit mining of the large orebodies already indicated. This deposit appears to be one of the most important mineral discoveries made in Canada in recent years. During the past winter churn-drilling operations were carried on through the ice to determine the continuity of the orebodies in depth. These holes showed similar high grade ore as outlined by the earlier diamond drilling. Detailed surveys of the route of the diversion are being made and negotiations are under way toward the financing of the diversion of the river, the drainage of the lake, and to bring the property into production.

The old Josephine mine in the Michipicoten area, Algoma district, has been taken over by Ventures Limited. The deposit is under the bed of Parks lake, three quarters of a mile from the Algoma

Central railway and about 20 miles from Michipicoten Harbour. The property was drilled first in 1900 and again in 1913-14. Two shafts were sunk in 1901, one to a depth of 150 feet. During the spring and summer of 1941, a total of 6,500 feet of diamond drilling was done to check the previous work. Results were sufficiently encouraging to justify underground exploration. Camps were built, and a mining plant is being installed preparatory to shaft sinking. It is proposed to sink to a depth of approximately 1,000 feet, and to explore the ore-bearing zone on the 500-foot and 1,000-foot horizons. No estimate of ore tonnages or grade has been given out by the present operators. According to the former owners some 850,000 tons of hematite were reported as proved by diamond drilling.

Ventures Limited is also investigating the Bessemer, Childs and Runkin properties, in Mayo township, Hastings county about 80 miles north of Trenton, and other iron deposits in Ontario.

Extensive surveys and exploration work have been carried on by Labrador Mining and Exploration Company of Montreal, near Sawyer lake and vicinity, along the Quebec-Labrador boundary line. The company reports that six deposits of iron ore were discovered during the short summer field seasons of 1936 to 1939 inclusive. The principal deposit located at Sawyer lake, in the Newfoundland Labrador Concession, about 280 miles north of Seven Islands in the Gulf of St. Lawrence, is estimated by the Company to contain 2,200,000 tons of hematite ore (averaging 65% iron) per 100 feet of depth. The phosphorus content is under 0.04 per cent. Four other deposits are of good grade, and one of them is rich in manganese. The total possible reserve in these four deposits is estimated by the Company at 70,000,000 tons to a depth of 1,000 feet. The other deposit is high in silica, and is believed to represent a large tonnage. Field work on this deposit is being planned for the 1942 season under the direction of Hollinger Consolidated Gold Mines, Limited which has acquired an interest in Labrador Mining and Exploration Company. Geological and exploration work are also planned on the Concession in a contiguous area in Quebec, which area embraces a total of approximately 20,000 square miles. The exploitation of these deposits would necessitate the construction of a railway line from Seven Islands, which port is open to navigation the year around.

The report on the proposed iron and steel works in British Columbia by Arthur G. McKee and Company of Cleveland, Ohio, for the British Columbia Department of Mines was made public on February 26, 1942. The general plan involves the annual production of 75,000 tons of finished steel products. The proposed site is at Union Bay, on the east coast of Vancouver Island. The province contains many deposits of magnetite and a few of hematite and limonite. Three deposits, owing to their proximity to Union Bay, have been selected for consideration; Zeballos, on the northwest coast of Vancouver Island, with 500,000 tons of magnetite averaging 68½ per cent iron with low manganese and no undesirable elements; Iron Hill, south of Campbell river, on the east coast of Vancouver Island, with 1,000,000 tons of magnetite ore available; Texada Island, within 20 miles of Union Bay with several deposits of good grade ore. The proposed site is adjacent to coking coal and limestone supplies.

Ventures Limited made the announcement in the latter part of February, 1942, of its acquisition of the old Anyox copper plant at Anyox and the proposed erection in British Columbia of a plant for the production of iron and steel from scrap.

Dominion Steel and Coal Corporation, Limited, with plants at Sydney, Nova Scotia, obtains its iron ore from its own mines at Wabana, Newfoundland. Steel Company of Canada, Limited, at Hamilton, Ontario, and Canadian Furnace, Limited, at Port Colborne, Ontario, obtain their iron ore supplies from the Lake Superior region of the United States. Algoma Steel Corporation obtains most of its requirements from the United States and the remainder from the New Helen mine.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

The demand for primary iron and steel was supported in 1941 by the heavy requirements for war purposes.

Bounties on the production of iron ore are offered by the provinces of Quebec, Ontario, and British Columbia. In Quebec, the premium is at the rate of four-fifths of one cent for each unit (22 lbs.) of iron metal contained in every ton of iron ore. In Ontario, the bounty is 2 cents per unit of metallic iron in the long ton of low grade iron ore beneficiated in Ontario so as to be suitable for use in the blast furnace, or on natural ore of commercial quality smelted in Canada. In British Columbia, the bounty paid must not exceed $3.00 a ton on the proportion of pig iron produced from ore mined in the Province, and must not exceed $1.50 a short ton on the proportion of pig iron produced from ore mined outside the Province. A bounty not to exceed $1.00 a short ton is also offered on steel shapes of commercial utility manufactured in British Columbia.

There are no official Canadian price quotations for iron ore. Prices f.o.b. Lake Erie ports, per long ton for Lake Superior, U.S.A., iron ore, 51½ per cent iron ore are: Messabi, Non-Bessemer - $4.45, Bessemer - $4.60; Old Range, Non-Bessemer - $4.60, Bessemer - $4.75. The price of Brazilian ore, f.a.s. Brazilian ports, 68 per cent iron, is 7 cents per long ton unit or $4.76 a long ton.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

LEAD IN 1941

Ores Mined and Producing Localities

Most of the lead produced in Canada comes from Consolidated Mining and Smelting Company's great Sullivan silver-lead-zinc mine at Kimberley, British Columbia. Other important sources of production 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 in British Columbia; the high-grade silver-lead mines of the Mayo area, Yukon; and from the Lake Geneva zinc-lead mine, Sudbury district, Ontario. There has been no production for a number of years from various other lead mines in Ontario nor from the lead-zinc mine in Portneuf county, Quebec; and from the lead-zinc-copper mine at Stirling, Cape Breton, Nova Scotia.

In British Columbia, the lead and zinc concentrates produced in the concentrator at the Sullivan mine are shipped by rail 185 miles to the company's smelter and refinery at Tadanac, near Trail. The Monarch mine of Base Metals Mining Corporation, Limited, reopened in the latter part of 1939, has been in production since January, 1940. Western Exploration Company at Silverton was retreating the old tailings accumulated during previous operations, mainly for the purpose of recovering the zinc. The company's Mammoth mine was also in production. The Lucky Jim mine, at Zincton, was taken over late in 1940 by Zincton Mines, Limited, a new company owned by Sheep Creek Gold Mines, Limited. The mine and concentrator were in production early in 1941. Several small lead-zinc properties, mainly in the Ainsworth-Slocan district were shipping crude ore to the Trail smelter. The Reeves McDonald Zinc-lead mine on the Pend d'Oreille river was being prepared for production early in 1942. The lead smelter and the electrolytic lead refinery at Trail, the only such plants in Canada, were in continuous operation.

In Yukon, Treadwell-Yukon Company discontinued operations in October, 1941, at its several small but high-grade silver-lead properties near Mayo.

In Ontario, the Lake Geneva Mining Company resumed operations during the year and started milling in August, producing zinc and lead concentrates for the export market.

The Tetreault property near Notre-Dame-des-Anges, Portneuf county, Quebec, and the Stirling property, Cape Breton, Nova Scotia, remained idle in 1941. When produced, the lead and zinc concentrates are exported.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

World production in 1939, (figures for 1940 and 1941 not available) as published by the American Bureau of Metal Statistics, was 1,899,000 short tons, compared with 1,878,500 tons in 1938, and a peak production of 1,933,000 short tons in 1929. The principal producing countries are, in order of importance: United States, Mexico, Australia, Canada, Germany, Belgium, India (Burma), and Russia.

Markets and Prices:

The world consumption in 1938 (1939 - 1941 not available), as given by the American Bureau of Metal Statistics, was 1,638,100 metric tons, compared with 1,741,400 metric tons in 1937. The Canadian peacetime consumption of lead is probably between 35,000 and 40,000 short tons a year. In the United States lead continues to be used chiefly in the storage battery, lead pigment, cable covering, building, and ammunition industries. In peacetime, lead is used in so many industries that business improvement in any direction is reflected in the demand for the metal. So far in the present war, it is the least scarce of the metals, but as a result of direct and indirect war demands and the substitution of lead for copper and brass, consumption has been increasing, and consideration is being given to the allocation of production. The demand in the United Kingdom is now governed largely by the use being made of the metal in the manufacture of armaments.

Tetraethyl lead, which has become an important outlet for lead, plays an indispensible role in aviation gasoline. Much interest has been shown in combinations of lead with iron, particularly leaded steel. A lead coating is being used as a lubricant for successive wire-drawing operations on alloy steel, the coating being removed finally with the use of solvents. Lead-base bearings are still used extensively in low speed applications.

Radio-active lead chloride and radio-active lead oxide are being produced as by-products at the radium refinery at Port Hope, Ontario.

The average price of pig lead (quotations on the London market, converted to Canadian funds) in 1941 and 1940 was 3.362 cents a pound, compared with 3.169 cents in 1939. The average price at New York in 1941 was 5.793 cents, compared with 5.18 cents in 1940.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

MANGANESE IN 1941

Ores Mined and Producing Localities:

The manganese ores that have been mined in Canada are pyrolusite (MnO_2), psilomelane (H_4MnO_5), manganite ($Mn_2O_3H_2O$) and braunite (Mn_2O_3), all of which are black or grey-black and comparatively hard; bog manganese, a soft earthy black oxide; and a small amount of rhodochrosite ($MnCO_3$), a pink, fairly soft, mineral. Pyrolusite is the most common and most important and when pure contains 63 per cent manganese. It is much softer than the other hard rock ores and can be distinguished in the field by the ease with which it blackens the fingers. Most of the hard rock deposits are replacements in limestone, but they also occur in the form of accumulated nodules and cementing material in siliceous sediments, and as veins in metamorphosed pre-carboniferous rocks. Canadian production is small and is far short of wartime requirements.

East Mountain Mining Company, 7 miles east of Truro, Nova Scotia, was the only steady producer in 1941 and its small output was converted into metallic manganese. Some ore was shipped in 1940 by Atlantic Manganese Corporation from a property 8 miles north of New Ross, Lunenburg county, Nova Scotia.

Prospective Producing Localities:

Most of the 200 deposits of manganese known in Canada are in the Maritime Provinces. They are mostly low grade replacement or bog deposits, and high quality ore has been mined in only a few localities.

Since the outbreak of the present war, much attention has been given to the development of known deposits, to the search for new sources of supply, and to the exploration of several old properties. Little high grade ore remains in these old properties, though it is possible that a fair tonnage of medium grade ore is available. Bog manganese is used only if it is of the highest grade manganese dioxide.

Activity in 1941 was confined mainly to New Brunswick. Nabco Manganese Mining Company continued to develop its deposit on Gowland Mountain, near Elgin, southeast of Sussex. The ore is high grade and occurs in a four-foot vein the walls of which are penetrated by lower grade disseminated and brecciated ore. The property was opened by a cross-cut tunnel at 100 feet below the outcrop and by several drifts and raises. A 100-ton mill was completed late in 1941 and shipments of concentrate were started early in 1942. Douglas Manganese Company prospected some showings on the Harrison claims within a mile of the Nabco vein. Sussex Manganese Mining Company did further work on the old Jordan Mountain deposit, 7 miles north of Sussex, which it re-opened in 1940. The old shaft was cleaned out, machinery was installed, and buildings and a mill were erected. Most of the ore is fine-grained, disseminated, and brecciated, and is difficult to treat by the ordinary gravity methods. For this reason, operations were suspended, awaiting the solving of concentration problems.

Early in 1942, Mount Forest Manganese Mining Company started to prospect the Turtle Creek deposit near Berryton in Hillsborough parish. About 400 tons of cobbed ore was shipped from the north side of the creek in 1939 and the property was diamond drilled, but no work has been done for nearly two years. The ore zone, in the form of high grade lenses of pyrolusite in a flat bed of limestone, is being developed by means of tunnels along the south bank of the creek. J. H. Dunright prospected a deposit of medium grade ore near Quaco Head, 30 miles east of St. John, and stock-piled about a car lot of hand-cobbed ore. The old Markhamville mine, 8 miles south of Sussex, was taken over by Martin Manganese Mining Syndicate which examined the underground workings. The ore in sight was apparently considered to be insufficient to mine. The Syndicate made a deal recently with Nabco Manganese Company, which plans to make a more intensive investigation. Close to 25,000 tons of high grade ore is estimated to have been mined from the Markhamville deposits between 1862 and 1895. The ore occurred as lenses in a flat-dipping bed of limestone and near the surface as nodules in residual clay. The presence of lumps of manganese float for a distance of 5 miles south of Markhamville was the reason for the staking in 1940 of at least 70 claims. It was disclosed by the Geological Survey, Ottawa, however, that the float is from the Markhamville deposit from which it was carried south and beyond the rim of the limestone by glacial action. Ore may still exist along the limestone rim in the immediate vicinity of the old mine.

Prospecting was continued intermittently by C. W. Singleton on a bog manganese deposit near North Renous in Northumberland county. Several bog deposits in this vicinity were surveyed in 1940 by the New Brunswick Department of Mines and areas in which the grade is appreciably higher than the average of bog deposits were located. R. D. Irwin and H. D. Bishop prospected a deposit in the Tetagouche river, 9 miles east of Bathurst. The ore is mainly disseminated and is low grade and the property has not been worked since 1842.

In Nova Scotia, East Mountain Mining Company (W. H. Moore) opened the old East Mountain mine, 7 miles east of Truro and from a small tonnage of the ore treated in an alumino-thermite plant near the deposit, produced about four tons of metallic manganese. Early in 1942, operations were discontinued as the supply of aluminium was cut off, but production of the manganese by another process is contemplated. A. Leadbetter of Springhill prospected a small deposit of bog manganese near Shulie river.

In Quebec, deposits of manganese ore occur in the Magdalen Islands in the Gulf of St. Lawrence, about half way between New Brunswick and Newfoundland. The principal known deposits are on Grindstone Island, the centre of the group, and on Amherst Island. Late in 1939, claims were staked by J. W. Storer of Toronto, representing British American Oil Company and by W. G. Porter, representing R. F. Hardy of Toronto. Early in 1941, the Storer holdings were incorporated under Magdalen Manganese Mines, Limited. Some of the deposits on the Magdalen Islands were examined and reported upon in the fall of 1940 by F. J. Alcock of the Geological Survey, Ottawa. About three-quarters of the surface of all the islands is covered by a Recent capping of red sandstone, under which, in places, the manganese-bearing rocks occur. The manganese mineralization occurs as high grade nodules in limestone that contain 47 to 48 per cent manganese, this variety being characteristic of Grindstone Island, and as silicified and disseminated nodules up to two feet across as a replacement in sandstone. The nodules in the sandstone contain from 25 to 30 per cent manganese and from 45 to 50 per cent silica and are characteristic of Amherst Island. Nodules in both islands occur in several places mixed with the soil. Bulk samples of both types of mineralization were tested at Ottawa in 1940 and high grade concentrate was made from the limestone material, but the silicified material from Amherst Island was not successfully concentrated. Little work was done on the properties in 1941, but further prospecting is planned for 1942.

In Manitoba, intermittent prospecting was continued on several bog manganese deposits, mainly in the vicinity of Riding Mountain, near Rossburn and Birtle, about 200 miles west of Winnipeg. Many of the deposits, which are in the form of small shallow basins, were examined and tested in 1940 by the Manitoba Department of Mines and Natural Resources, Winnipeg. Large or commercial deposits have not as yet been discovered.

In British Columbia, A. J. Curle did further work on his bog manganese deposits seven miles northwest of Kaslo on the west side of

Kootenay lake and on his claims seven miles farther west, where a belt of manganiferous siderite occurs along the bank of Kaslo creek. Early in the year, Dan. McIntosh of Revelstoke prospected a deposit of rhodochrosite ($MnCO_3$) on Sproat Mountain, 4 miles north of Arrowhead, and later turned the property over to J. Campbell of Vancouver. F. B. Bess of Wells did some prospecting on a pyrolusite deposit at Chimney creek bridge near Williams lake in the southern part of Cariboo area. Fairly extensive prospecting was carried out by Great West Coal Company, Winnipeg, on a bog deposit near Nazko, 75 miles west of Quesnel in the Cariboo. So far, there is little to indicate that the deposit will prove to be of economic interest.

Production and Trade:

Canadian production and trade figures for 1940 and 1941 are not available for publication owing to the war.

About 80 per cent of the imports of manganese ore in 1941 were from the Gold Coast, Africa, and nearly 20 per cent from the United States.

Since 1886, when records were first kept, about 16,500 short tons of manganese ore has been produced in Canada, close to half of it in the succeeding four years. More than 20,000 tons is known to have been produced, however, between 1862, when manganese mining first started, and 1886. During the war period, 1915-1918, 1,784 tons was shipped, the largest output being 957 tons in 1916. Canadian production since 1918 has been small and intermittent. Canadian production of manganese ferro-alloys continued to increase. In 1941, about 45 per cent of these alloys was in the form of silico-manganese; 34 per cent in the form of ferromanganese, and 15 per cent in the form of spiegeleisen.

Since the outbreak of the war, figures of production for many countries are unobtainable, but there have been marked changes in the flow of supplies. Estimates of world production are in the neighbourhood of 6,000,000 tons annually, the chief producing countries in order of output being Russia, British India, Union of South Africa, Gold Coast (West Africa), Brazil, Egypt, and Cuba. Soviet Russia produces close to 3,000,000 tons annually, the output in 1940 being mainly from the Chiaturi deposits in Georgia on the southern slope of the central part of the Caucasus. The mines occur in a 55-square mile area and the deposits are estimated to contain about 160 million tons of 40 to 45 per cent ore. Other deposits in the northern Caucasus and in the Urals are said to contain about 90 million tons of ore. Prior to the German occupation, a large output was obtained from Nikopol, on the Dneiper river, north of the Crimea. Russia was for many years the principal source of supply of high grade manganese ore for the United States, but in 1941 only about 4 per cent of the American imports of the ore came from Russia. India produces close to a million tons of metallurgical grade ore a year, mainly from the Central Provinces, the principal district being Balaghat. Much of the exports of manganese in 1941 from India were taken by Great Britain, and India was also the second greatest source of supply for the United States, the exports to that country being estimated at 240,000 long tons of 50 per cent manganese.

South Africa in 1940 produced about 406,000 long tons, mostly from Griqualand West, Cape province. The ore was shipped in five grades of 35 to 52 per cent manganese. Exports through the port of Durban were mainly to the United States and are estimated at 204,000 long tons in 1941. One of the largest known single manganese deposits occurs on the Gold Coast at Nsuta, Wasaw district, and is operated by African Manganese Mines Company, Limited. The ore is of excellent metallurgical grade (48 to 52 per cent manganese). Exports from the district in 1939 were 342,000 long tons. Much of the output is being taken by England, but in 1941 about 80 per cent of Canada's imports of the ore were from the Gold Coast.

The output from Brazil reached more than 500,000 tons in 1917, but declined to 7,000 tons in 1934, after which there was a marked increase as a result of large exports to the United States. This country in 1941 took most of the total output of 426,151 long tons of ore averaging 42 per cent manganese and Brazil became its chief source of supply. This was nearly double the output in 1940. The principal deposit at Mato Grosso is estimated to have reserves of 25 million tons of 45 per cent manganese or better ore.

In Cuba, the Cuban-American Manganese Corporation is the principal producer, its deposits being in Orient province. The plant was recently expanded to produce 130,000 tons annually, most of which is in the form of nodulized concentrate containing 52 per cent manganese from an ore averaging 19 per cent manganese. Exports to the United States in 1941 are estimated at 218,000 long tons.

Prior to the war, Egypt was producing about 190,000 tons of 30 per cent ore annually from the Sinai peninsula. Czechoslovakia, French Morocco, Japan, Rumania and Italy were producing from 50,000 to 70,000 tons of manganese ore annually.

The United States produced 76,000 long tons of high grade (35 per cent and over) manganese ore in 1941, a 90 per cent increase over 1940. About 50 per cent of the output came from Montana and 30 per cent from Tennessee and Arkansas, the remainder being from thirteen other states. About 1,300,000 long tons of ferruginous manganese, containing 10 to 35 per cent manganese, and manganiferous iron ore containing 5 to 10 per cent manganese were also produced. Minnesota and New Mexico contributed 93 per cent of the lower grade ores. During the first 9 months of 1941, the United States imported 838,239 long tons of metallurgical ore grading 48 per cent manganese and over, and 14,951 long tons of battery grade ore (80 to 85 per cent MnO_2). In order of importance, the imports in 1941 (9months) were obtained from Brazil, India, Cuba, and British South Africa, with lesser amounts from the Philippine Islands, Gold Coast, and Belgian Congo. Annual consumption in the United States is now at the rate of about 1,300,000 tons of standard grade ore.

For many years the United States produced only about three per cent of its requirements of ferro grade manganese ore from domestic sources and most of its high grade ore requirements came from countries of the Eastern Hemisphere. The Government has taken steps to prepare for future supplies and to increase domestic production. By the end of 1940, the Metals Reserve Company, which is associated with the Procurement Division of the Treasury Department, had contracted for more than 2,000,000 tons of ore from all sources.

During the past two years the United States Bureau of Mines has prospected and developed many deposits of varying grades of ore and has worked out processes of beneficiation for medium and low grade ores. In order to offset the possible lack of overseas supplies, a program has been evolved for the treatment of some 50 different deposits in nine states. The program calls for the processing of a total of close to 12,000,000 tons of ore annually in 12 plants this being the equivalent of more than 500,000 tons of manganese metal. The estimated cost of mining and of erecting the plants is about $38,000,000. One of the largest deposits developed by the United States Bureau of Mines is at Chamberlain, South Dakota.

Anaconda Copper Company started the production of manganese ores in Montana in the fall of 1941. The ore is rhodochrosite ($MnCO_3$) averaging 22.0 per cent manganese and the output is in the form of 60 per cent manganese nodulized concentrate.

Uses and Specifications:

It is estimated that 95 per cent of the world consumption of manganese ore is used in the manufacture of iron and steel, the ore so used being termed "Metallurgical". The remainder is termed "Chemical". Metallurgical ore is used for making ferro manganese, silico-manganese, and spiegeleisen, in which forms it is added to the steel bath. Manganese is beneficial mainly in improving the workability of the steel, and in improving the product by acting as a deoxidizer, a desulphurizer, and a re-carbonizer. Until recently, about 14 pounds of manganese was used on the American Continent in each ton of steel, but in order to conserve manganese, the average has been reduced to about 11.8 pounds per short ton of steel. Ferro manganese, containing 75 to 82 per cent manganese, is by far the most important addition agent, and to make it, the highest, or "ferro grade" ore is used.

Ferro grade ore should contain at least 48 per cent of manganese and not more than 7 per cent iron, 10 per cent silica, 0.18 per cent phosphorous, 6 per cent alumina, and one per cent zinc. It must be low in copper, lead, and barium, and the ratio of manganese to iron should not be less than seven to one. The ore should be hard and in lumps of less than four inches, and not more than 12 per cent should pass a 20-mesh screen. Soft ores, such as bog manganese, are objectionable. The United States Metals Reserve Company is buying three grades of ore, that of the above specifications being termed "High Grade". Specifications for "Low Grade A" are; manganese, 44 per cent; aluminium and iron, each 10 per cent; silica, 15 per cent; phosphorus, 0.30 per cent. "Low Grade B" specifications are Mn, 40.0; P, 0.50; Zinc, 1.0, and no maxima for other impurities.

Specifications of ore required for silico-manganese, used for high silicon alloys and steels, are much the same as for ferro, except that slightly less manganese and considerably more silica is allowed. Ores in which the manganese-iron ratio is too low for making "ferro" can in some instances be used for making spiegeleisen, which contains 19 to 28 per cent manganese. If spiegel could be used instead of ferromanganese, almost every manganiferous ore on the American Continent would be suitable, provided the phosphorous were not too high. Unfortunately, steel requirements, except in some instances, cannot be satisfied with spiegel alone because of the much larger weight of spiegel than ferromanganese that would have to be added to bring the steel to the required manganese content. There is little demand for spiegeleisen in Canada and the price of the ores is at present too low to encourage the mining of such deposits.

The Canadian market for metallurgical ore is confined mainly to two manufacturers of manganese ferro alloys, one at Welland and the other at Port Colborne, Ontario.

Chemical grade ores are used mainly in the manufacture of dry batteries. Specifications call for high grade pyrolusite because of its high available oxygen, which acts as a depolarizer. The ore should contain not less than 80 per cent manganese dioxide (MnO_2) and not more than 1.5 per cent iron; 1.0 per cent alumina; 6.0 per cent silica; 0.07 per cent copper; less than 0.05 per cent of any other metal; and 1.0 per cent moisture. It should also be finely ground (85 to 90 per cent through 200-mesh). Canadian requirements of chemical ore range from 3,000 tons to 4,000 tons a year and nearly all of it is used by two manufacturers of dry batteries in Toronto and another in Niagara Falls, Ontario. Chemical ore is used also in the glass and ceramic industries; as paint and varnish driers; as pigments and dyeing materials; and as salts for disinfecting, bleaching, and fertilizers.

Beneficiation:

Each ore or individual deposit presents a separate treatment problem, thus differing from the ores of copper, zinc, lead, and of other non-ferrous metals.

Some coarse ores can be cleaned by hand picking, screening or washing; others can be concentrated by ordinary gravity methods. Flotation, using soap reagents, has been successful on a variety of oxide (low grade Cuban) and carbonate (Anaconda) ores. Recently, the siliceous gangue has been floated by cationic reagents and in some instances the silica is floated from high manganese ores; in other cases the manganese oxide is floated from high silica ores. Roasting is successful in some high-iron ores or concentrate, and is followed by magnetic separation, yielding manganese and iron concentrates. As fines are objectionable for the manufacture of ferromanganese, concentrate produced by any process must be sintered or nodulized. Some success has been achieved by the "Sink and Float" process in which a coarse mesh product is separated by means of a dense solution containing fine galena in suspension. The gangue floats and the heavy minerals sink.

In the case of some disseminated ores or those of large low grade deposits, it may be necessary to use hydrometallurgical processes. Several such processes are available, including a percolation leach with sulphuric acid; a sulphating bake, using metallic sulphates and sulphuric acid as reagents; the ammonium sulphate bake or roast; and the nitric acid process (for carbonate ores). The manganese in solution may be made either into a chemical precipitate that must be dried or nodulized, or converted into pure metallic manganese by an electrolytic process such as that in use at Knoxville, Tennessee. Ores having as low as 10 per cent manganese have been treated, though the average is about 15 per cent.

Prices:

Prices of manganese ore remained fairly steady in 1941. Quotations in the United States are based on a long ton unit (22.4 pounds) of metallic manganese in a 48 per cent or over manganese ore c.i.f. Atlantic ports, exclusive of duty of one-half cent per pound of the metal. Prices in the United States, effective December 19, 1941, on ores under the Metal Reserve Company specifications are as follows: "High Grade" $36, per long ton of ore, with an increase of 75 cents for each long unit over 48 per cent manganese; "Low Grade A" $28, plus 65 cents for each unit over 44 per cent manganese; "Low Grade B" $22, plus 55 cents for each unit over 40 per cent manganese. Each shipment is priced in accordance with the impurities specifications it meets; thus, a 45 per cent manganese ore, with 0.5 per cent phosphorus, would come under "Low Grade B" and not "Low A" which allows a maximum of 0.3 phosphorus. All prices quoted are those delivered to buyers. Canadian prices of imported chemical grade ores, minimum of 80 per cent manganese dioxide are $60 to $75 a short ton delivered.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

MERCURY IN 1941

Ores Mined and Producing Localities:

Cinnabar (HgS), the principal ore of mercury, is a very heavy mineral (g=8.1) with a deep cochineal-red colour and scarlet streak, and contains 86 per cent mercury. In Canada, the ore occurs in porous rocks such as altered limestones (ankerite), volcanic breccias or greenstones, and green and purple andesitic lavas. The cinnabar often occurs in veins and stringers of calcite or dolomite within these rocks, and may be associated with stibnite (antimony sulphide) and accompanied by globules of metallic mercury. The presence of mercury can be readily detected by heating a small piece of rock to about 300°C and placing it between an ultra-violet-ray lamp with purple filter and a screen coated with powdered willemite (zinc silicate). If mercury is present, a fume shadow will be cast on the screen. As little as 0.02 per cent mercury can be detected in this manner, but better results are achieved with a powdered sample.

The only known deposits of cinnabar in Canada are in British Columbia, by far the most important development being that on the north-west side of Pinchi lake, Omineca Mining Division, about 40 miles north of Vanderhoof station on the Canadian National Railway. The deposit was discovered in the summer of 1937 by J. G. Gray of the Geological Survey, Ottawa, and claims were staked in May, 1938, by A. J. Ostram and others. Late in that year they were optioned to Consolidated Mining and Smelting Company. Prospecting disclosed large cinnabar-bearing areas in veins and impregnations mainly in dolomitized and brecciated limestone along zones of fracturing and shearing. A roasting and condensing plant was erected, and production was started in June, 1940. The grade of ore treated is about 0.5 per cent mercury. The deposit, which is on a steep mountain side, has been developed by adits at a number of different levels and the capacity of the plant has been periodically increased. Prior to the discovery of the Pinchi lake deposits, little mercury was produced in Canada and their successful operation has brought about a complete change in the Canadian situation in respect to the metal. The output is now far in excess of the domestic requirements and the ore reserves are estimated to be sufficient to assure continuous output at the present rate for several years.

A number of cinnabar claims have been staked on both sides of Yalakom river, above the mouth of Shulaps creek, 30 miles northwest of Lillooet. The Red Eagle group, staked in 1937 by C. J. Parker, has changed hands several times and is now being worked by John Thompson of Moha. Ore was treated in a small crushing unit and a retort, and two or three flasks of mercury was produced in 1941. At the property of Empire Mercury Mines Limited, 16 miles north of Minto City, in the Bridge River area, about 20 flasks of mercury was produced in 1939 - 1940 in a 10-ton Gould furnace and condenser system erected on the property. The ore occurs in small pockets in a purple andesitic lava, but it was found that the average grade was too low and the property has been idle since March 1940.

Prospective Producing Localities:

A number of deposits are known to occur on both sides of the western end of Kamloops lake. The original discovery at Copper creek on the north shore of the lake was worked in 1894, and during the next three years, about 138 flasks was produced, and five more between 1924 and 1927. From then until 1940, all these properties have been idle, but there has been considerable prospecting and re-staking of claims during the past two years. Frank L. Gorse of Kelowna now owns most of the old Copper Creek claims and has opened up some interesting showings of cinnabar and intends to erect some retorts in the near future. Some tunnelling and stripping was done in the Hardie Mountain group, two miles north of Copper Creek Station by Gordon F. Dickson, D. B. Sterrett and others; some zones of ore averaging about 0.35% mercury and fairly large zones of lower grade were discovered. Early in 1942 a deal was made with the Granby Copper Company to explore this property and put it into production if found satisfactory. Mr. Dickson also did some more prospecting in the Tunkwa lake property, 15 miles south of Savona, from which a flask or two was produced in 1940.

Prospecting work was carried out on the Golden Eagle group on the east side of the Yalakom river, opposite the Red Eagle group. Exploration work is being conducted in various parts of the province by some of the large mining companies:- The Consolidated Mining and Smelting Company, The Hollinger Exploration Company and the Bralorne Mines Limited are prospecting the area 50 to 100 miles northwest of the Pinchi lake mine. Several discoveries have been made, such as the Small claims on Silver creek, 18 miles east of Takla Landing, near Indata lake and others, which are not at present spectacular, but are of interest since they are more or less on the strike of the Pinchi cinnabar showings. Cinnabar float has been found in the Shulaps mountains, north of Bridge River and is being followed up.

Many of the mercury deposits in British Columbia were examined and reported upon in 1941 by officers of the Federal Bureau of Geology and Topography, Department of Mines and Resources. Details are given of all known occurrences of mercury in "Mercury Deposits of British Columbia" (Bulletin No. 5, 1940), by J. S. Stevenson of the B. C. Department of Mines, Victoria.

Production, Consumption and Trade:

Canadian figures of production and trade are not available for publication owing to the war.

World production in recent years is estimated to be slightly in excess of 5,000 metric tons a year. For many years Italy and Spain have shared honours as the leading producer and prior to the war they accounted jointly for 70 per cent of world output, while the United States contributed about 15 per cent. Mexico, Russia, and Czecho-slovakia are also producers of mercury.

During the period of the recent civil war in Spain, Italy maintained the lead with an annual output of over 2,000 metric tons. About 55 per cent of its output comes from the Monte Amiata mines in the province of Sienna and 40 per cent from the Idria mines in the Julian Alps. The average grade of the Italian ore is 0.75 per cent mercury. Since March, 1940, exports of mercuty from Italy have been taxed and prohibited, except under licence. In Spain, output from the famous Almaden mine was greatly increased in 1939, and reached a record of 12,000 flasks (413 metric tons) in December of that year. The Almaden is one of the oldest known mines and is said to have been first worked in 400 B. C. A continuous record of its production has been kept since 1500 A.D. The grade of the ore is over 5 per cent. Until the present war, Spanish and Italian mercury were both sold in London. In July, 1939, a cartel "Mercurio Europeo" was formed with an agent in London, but early in 1940 a commercial agreement was reached between the Spanish and French Governments. All former marketing arrangements have since become disorganized.

The United States in 1941 produced about 44,000 flasks of 76 pounds each, a 16 per cent increase over 1940 and over double the output of 1939 and a record since 1883.

This large increase was the result of the difficulty of obtaining mercury from Europe and of the high price. About 87 mines were producing and California, (62 per cent of output), followed by Oregon, and Nevada continued to be the leading producers. H. W. Gould and Company of San Francisco, the principal producer in the United States, operates six mines in California and Nevada, and contributes about one-third of the total output. During the year, this company's New Idria mine in San Benito county, California, was the largest producer in the Western Hemisphere, and from it is recovered an average of 550 flasks monthly from 450 tons of ore roasted daily. Most of the increase in output in the United States in 1941 came from new disclosures of ore in old mines, the average grade being slightly under 0.5 per cent mercury.

United States consumption in 1941 is estimated at 44,800 flasks and is slightly greater than her production. Stocks at the end of 1941 were about 13,000 flasks, slightly less than for the previous year. There is an import duty into the United States of 25 cents a pound of mercury.

About a century ago, the Santa Barbara mine, Peru, was the largest mercury producer in the Western Hemisphere. The supply of the richer ore was exhausted, but on account of the prevailing high price, the old workings have recently been sampled and large bodies of 0.1 to 0.2 per cent mercury are reported and the erection of a 500-ton treatment plant is being considered. The Panamina Incorporated, a subsidiary of Ventures Limited, Canada, is developing the Chonta deposits and the erection of a small Gould furnace has been ordered. England is now dependent upon imports from the United States, Mexico, and Canada for a large part of her requirements, and the improvement in the Canadian situation is accordingly of timely importance.

Grade and Treatment:

Canadian and United States cinnabar ores seldom average over 1.0 per cent mercury but at present high prices a 0.35 per cent ore can be worked commercially. The ore is, as a rule, treated by roasting the coarsely crushed material in furnaces, usually rotary kilns through which air is circulated. The sulphur is oxidized to sulphur dioxide, which escapes into the outside air, and the mercury is driven off as vapour and is condensed in cooling chambers. Occasionally ores are roasted in circular, or D-shaped horizontal cast-iron retorts one foot in diameter and 15 feet long. The interior of the retort is not in contact with the flame or air so that very little oxidation takes place, but lime is usually added to convert the sulphur into calcium sulphide, and is necessary when pyrite is present to take care of the excess of sulphur. The mercury vapour is caught in condensing chambers. This process is used in very small operations at the earliest stages, a small water-cooled pipe being used for a condenser. Retorts are also used on a large scale for very high-grade ores and for concentrates. Several attempts have been made to concentrate mercury ores by gravitation and flotation methods, but the results have not been as satisfactory as by direct roasting of the crude ore.

Uses:

Mercury enters into the manufacture of acetic acid and anhydride, acetone, chlorine, and caustic soda, which are required for manufacturing military supplies. In the past, an appreciable amount of the metal was consumed as fulminate of mercury, a powerful detonator, but this has been replaced by other compounds such as lead azide, and only a small quantity of mercury is now used for a special type of detonator.

Mercury is also used in the manufacture of mercury salts, thermometers, medical supplies, mirrors, mercury vapour lamps; and in the extraction of gold from ores by amalgamation; in the manufacture of electrical and chemical apparatus; for automatic electrical contacts; in catalysts; in electric rectifiers; in pharmacy; as cathodes in electrolytic chemical processes; in felt manufacture; in boiler compounds; in specially designed mercury boilers to replace steam in power production; and in cosmetics. Many of these applications are for military as well as for civilian use.

In Canada, about 75 per cent of the mercury consumed is used in the medicinal, pharmaceutical, and in heavy chemical industries, particularly in the form of mercury sulphate as a catalyst. The consumption of mercury in Canadian gold mines has decreased, owing to wider use of cyanidation and improvements in the recovery of the mercury after amalgamation. Gold mining now absorbs about 7 per cent of the total mercury consumed.

In the United States in 1940, 45 per cent of the consumption of mercury was used in the preparation of mercurial salts, one of the largest single uses being as mercuric oxide for anti-fouling paint for ship bottoms, but this has since been largely discontinued. Other chemical uses such as fulminate, pigments, and dye stuffs, take 15 per cent; mechanical adaptations, 13 per cent; the preparation of hatters' felt, 10 per cent; the electrical field, 8 per cent; gold amalgamation, 2 per cent; and dental amalgams, 2.5 per cent.

Prices:

The New York prices for the iron flask of 76 pounds of mercury averaged $75.00 in 1938, and $104.00 in 1939. By January, 1940, the price had increased to $142.00 and following the entry of Italy into the war it reached $202.00. The price rose from $167.00 in January, 1941, to $200.00 in December with an average of $186.00 for the year. Early in 1942 it was $198.00, but on the Pacific coast a price ceiling was set at $191.00. Imports of mercury into Canada from the United States are not subject to duty, but have a sales and war tax amounting to 18 per cent of the value in Canadian funds. The present price of Canadian mercury is largely governed by that of the United States.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

MOLYBDENUM IN 1941

Ores Mined and Producing Localities:

Molybdenite, the chief ore of molybdenum is a soft and shiny steel blue-grey 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. It generally occurs in the form of soft, pliable flakes or leaves, but is sometimes semi-amorphous, filling cracks and smearing the rock surface. It can readily be distinguished in the field by rubbing on glazed white porcelain or enamel when it leaves an olive grey-green smear. Graphite, which it closely resembles and for which it is often mistaken, leaves a grey-black smear.

The Quyon Molybdenite Company, at Quyon, Quebec, was the only producer in 1941. Early in the year the property was taken over by J. Poulin of St. Lambert, Quebec. A few car-lots of ore from the Kert property, a few miles to the east, were shipped to the Quyon mill for treatment.

Developments during 1941:

Owing to the entire lack of market throughout the year for Canadian molybdenite concentrate, there was very little prospecting or development, assessment work and sporadic development being carried out on a few properties in Quebec, Ontario and British Columbia.

Prospective Producing Localities:

Over 400 molybdenite occurrences and deposits are known throughout Canada and occur in every province except Alberta and Prince Edward Island. About 150 of these are in a belt some 200 miles long and 100 miles wide stretching in a northeasterly direction from Peterborough, Ontario, through Renfrew to Mount Laurier, Quebec. Although the deposits are small individually, a substantial tonnage could be obtained by working a number in conjunction and shipping to central concentrators. Other deposits of promise are in the Val D'Or-Amos-Rouyn area of Western Quebec; in Algoma near Michipicoten Harbour, Ontario; and in the Rainy River and Lake of the Woods regions near the western Ontario boundary, and in several localities scattered throughout British Columbia.

Production and Trade:

Canadian figures of production and trade are not available owing to the war.

Production was maintained throughout most of the year at Quyon, Quebec. Concentrate was produced in the mill erected in 1940 and was converted into molybdic oxide in a small furnace plant on the property, and the oxide was shipped to Canadian steel manufacturers.

World production in 1939 (1940 and 1941 not available), was 16,500 tons of metallic molybdenum, of which 91 per cent came from the United States. In 1941, the United States produced concentrate containing about 20,500 tons of the metal, against 17,200 short tons in 1940. The Climax Molybdenum Company, the world's largest producer, at Climax, Colorado, contributed about 67 per cent of the 1940 United States output. Most of the remainder was obtained as a by-product in the treatment of copper ores, the annual increase in the copper output showing a proportional increase in that of molybdenum.

Production from Cananea, Mexico, is estimated at the equivalent of 750 tons of the metal; and molybdenite concentrate is being recovered as a by-product from the Braden Copper Mine at Sewell, Chile. Prior to the war, the Knaben mine in Norway was the largest producer outside the American Continent, its output in 1938 being 750 tons of concentrate. Other producing countries were Peru, French Morroco, Korea, Greece, Turkey, and Australia.

Since the summer of 1941 the Climax mill has been treating 12,600 tons of ore daily and additions are now being made in order to treat 18,000 tons daily.

Consumption and Uses:

Molybdenite concentrate is not used direct but is converted into an addition agent that is introduced into steel either as calcium molybdate or as ferro-molybdenum, but during the past four years molybdic oxide briquettes, a compound of molybdenum oxide, lime and flux-forming oxides, have largely replaced the earlier forms of addition agent on the American Continent. About 70 per cent of the Canadian consumption of molybdenum in 1940 was in the form of the oxide briquettes, which contain 50 per cent of molybdenum. During the past two years Canadian consumption has very considerably increased.

Molybdenum is being used to an increasing extent in many fields, but chiefly in steel to intensify the effects of other alloying metals, particularly nickel, chromium, and vanadium, the molybdenum content of these steels generally being only from 0.15 to 0.4 per cent, but in some instances considerably higher.

Molybdenum alloys are widely used for the hard-wearing and other important parts of aeroplanes such as in seamless steel tubing, and in the hollow steel propeller blades. They are used also in the manufacture of shell steels; in armour plating; and in high grade structural steels, stainless steels, etc. Molybdenum-vanadium high-speed tool-steels are in some instances, replacing high tungsten high-speed steels with resulting greater efficiency and in other cases molybdenum is being used successfully in combination with the tungsten. Owing to the recent curtailment and cutting off of supplies of tungsten, obtained mainly in China and Burma, this substitution of molybdenum for tungsten has greatly increased, with corresponding increase in the demand for molybdenum. The use of molybdenum in cast iron has much increased in recent years. A 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 increase. Molybdenite is a very efficient lubricant for bearings subjected to high temperatures in which oils break down.

Market Conditions and Prices:

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

The price per pound of contained molybdenum, f.o.b. Toronto, in Canadian funds, for the following compounds is: Calcium molybdate (40% Mo), 98 cents; ferro-molybdenum (58 to 64% Mo), $1.23; and molybdic oxide (50% Mo), 98 cents. The calcium molybdate is sold in bags of about 12½ pounds containing exactly 5 pounds of molybdenum and the molybdic oxide briquettes weigh five pounds each and contain 2½ pounds of molybdenum.

The united States tariff of 35 cents prohibits the entry of Canadian molybdenum products into that country. With the exception of the small plant at Quyon, Quebec, there are no plants in Canada for the conversion of molybdenite concentrate into suitable addition agents. Consequently, all Canadian requirements of these agents are imported and there is no market for concentrate from Canadian sources. It is possible that the steadily increasing consumption of molybdenum in Canada, will lead to the erection of a conversion plant, which in turn will stimulate home production of concentrate.

In May, 1940, the British Government stopped issuing import licences for Canadian molybdenite concentrate or compounds. The action was taken as the result of an arrangement with United States producers whereby Great Britain agreed to take their surplus so as to obviate the danger of supplies reaching the Axis countries or to countries friendly thereto. At that time this surplus was more than sufficient to meet British needs. Early in 1942, however, the British Ministry of Supply intimated that they would take Canadian molybdenite. At the present low price of less than 50 cents a pound delivered in England, few, if any, operators in Canada could make a profit. Prospective producing localities are outlined earlier in this Review but unless production is stimulated by sufficiently raising the price or by other means, exports of Canadian molybdenite to England will be most unlikely.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

NICKEL IN 1941

Ores Mined and Producing Localities:

Canada produces by far the greater part of the world output of nickel, the source of all but a small percentage of the Canadian production being the nickel-copper ores of the Sudbury district in Ontario. Some nickel is also recovered as a by-product from the treatment of the silver-cobalt ores of Cobalt and other areas in northern Ontario.

In Ontario, the International Nickel Company of Canada, Limited, operated its Frood, Frood Open Pit, Creighton, Levack, and Garson mines, and sinking operations were started at Murray and Stobie mines. Underground development was carried on in all mines at a rate to conform with mining schedules and provide for increased production. The concentrator at Copper Cliff was operated to capacity and plans have been approved to increase the capacity in order to treat additional tonnages of ore from the Open Pit mining operations. Falconbridge Nickel Mines Limited, operating mines and smelter at Falconbridge, after completion early in the year of arrangements for the disposal of additional matte, stepped up production to full capacity as rapidly as possible. By mid-summer a considerable program of construction was under way. This program of expansion was still under way early in 1942 and is expected to be completed during the first half of the year. Considerable exploration and development was carried on during the year with encouraging results. Some gain was made in ore reserves despite the fact that greater tonnage was mined than in any previous year. A considerable program of exploration by diamond drilling was undertaken on the company's holdings in the Sudbury district resulting in increased ore reserves at these properties as well as at the Falconbridge mine, with grades comparing favourably with recent years. The expansion program above mentioned included additions to the concentrator, the sintering plant and the smelter. Following arrangements made in 1940 with the International Nickel Company, the matte produced is being handled at the former's plant at Copper Cliff and Port Colborne.

Nickel Offsets, Limited, with a property in Foy and Bowell townships, west of Capreol, Sudbury district, continued the extensive surface exploration and diamond drilling that was started in 1939. A shaft was sunk to a depth of 500 feet, to open three levels, at 250-foot, 350-foot and 500-foot horizon, and underground development was started in the latter part of the year.

Ontario Nickel Corporation did not operate its holdings at Moose lake, McLennan township, Sudbury district. The company is said to be considering resumption of operations early in 1942, and of erecting a 200-ton concentrating plant.

Denison Nickel Mines Ltd. did not operate its property in Denison township northwest of Sudbury.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

The world production in 1939 (figures for 1940 and 1941 not available) is estimated at 133,300 short tons, most of which was produced in Canada, the other producing countries being New Caledonia, Greece, India, Norway, and Russia.

Market and Prices:

International Nickel Company estimated world consumption of nickel in 1939 at 128,000 short tons, compared with 102,000 tons in 1938 and 120,000 tons in 1937. This record consumption has since been greatly exceeded owing to the great improvement in the heavy industries in the United States and Canada, and to the general speeding up of industry in order to augment the production of necessary war supplies. New applications of nickel developed during recent years have accelerated the consumption of nickel steels and alloys in a great diversity of form and composition.

The base spot price of nickel in the United States in 1941 was 35 cents per pound. The same price has ruled for the past 15 years.

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OTTAWA, MARCH, 1942.

PLATINUM GROUP METALS IN 1941

Source of Supply:

Except for a few ounces of platinum recovered from the black sands of British Columbia, and a small production obtained as an impure residue in the refining of gold at Trail in that province, the entire Canadian output of platinum and allied metals is obtained in the form of residue from the treatment of the Sudbury nickel-copper matte. As a result of the successful development of the copper-nickel mines near Sudbury, Canada has been for several years the leading producer of the platinum metals.

The precious metals residue produced at the Canadian plants of International Nickel Company is shipped to the company's refinery at Acton in England, which is operated by Mond Nickel Company, a subsidiary enterprise. The refinery has an annual capacity of 300,000 ounces of refined platinum metals. They are sold by Mond Nickel Company and by its regular distributors throughout the world.

Falconbridge Nickel Company, prior to the German invasion, exported its nickel-copper matte to its copper-nickel refinery at Christiansand, Norway, which is equipped to produce refined gold, silver, platinum, and palladium, in addition to the refined nickel and copper. About two-thirds of the Falconbridge matte is now being treated at the plants of the International Nickel Company.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

The world production of platinum and allied metals in 1939, (1940 and 1941 not available), as estimated by Baker and Company Incorporated, approximated 500,000 ounces, compared with 460,000 ounces in 1938. Canada has been the leading producer of platinum since 1934 when it displaced Russia, the other principal producers by order of importance being; Russia, Columbia, and South Africa. Canada also leads as a producer of palladium, as a result of the great increase in recent years in the Canadian output of nickel. Owing to the disorganized state of the world markets and government restrictions on publication of statistics, estimates on world production and consumption for 1940 are not available. The world consumption of platinum metals in 1939 was about equal to production, a notable gain over the 1935 figure of consumption of 275,000 ounces.

Market and Prices:

Industrial uses of the platinum metals continued to expand in 1941. Palladium ranks second in consumption and iridium third. Osmium, rhodium, and ruthenium, are as yet consumed in relatively small quantities.

The market situation in 1941 is explained by Charles Engelhard, President of Baker and Company, Incorporated, in the following, part of which is abstracted from his report:

> The outstanding feature of the year has been the rapid growth in the industrial use of platinum metals. More platinum metals are now used in industrial products and equipment than in jewelry, which formerly held a position of first importance in platinum consumption.
>
> Under present conditions it is unadvisable, if not impossible, to make estimates of world production and consumption of platinum metals, but it can be stated that the Allied nations practically have both the world's source and supply of these metals at their disposal.

Platinum is used as a catalyst in producing nitric acid and much of the contact sulphuric acid. These acids are consumed in large quantities for the manufacture of explosives and other war materials.

Palladium is being used increasingly as a catalyst in the hydrogenation of organic compounds and in various other processes. Palladium catalysts permit the use of lower temperature and pressure than catalysts made of the base metals.

Platinum metal alloy feeder dies are used in the manufacture of glass wool fibre for insulation and other purposes. These alloys are used because of their resistance to oxidation, abrasive and chemical corrosion. Platinum alloys also perform a most important function in producing rayon fibre.

Platinum is used in the production of electrochemical products, such as potassium perchlorate and persulphuric acid. Electric contacts of platinum metal alloys are required in the modern electrical instruments and equipment used by the fighting forces and in the industrial industry. For dental purposes, the consumption of platinum and palladium as alloying elements with gold has shown a marked increase. In jewelry, ruthenium-platinum alloys are replacing iridium-platinum alloys because of the need of iridium for war work. Ruthenium, like iridium, is an effective hardening agent for both platinum and palladium.

The use of rhodium for electroplating jewelry, because of its importance in the war effort, has been prohibited by the United States War Production Board. This precious metal is needed to coat reflectors in anti-aircraft searchlights and as an alloy of platinum to oxidize ammonia for the production of nitric acid. (M. & M. Markets, March 19, 1942).

With the exception of iridium, prices for the platinum group of metals remained virtually unchanged during 1941. The average price in New York of refined platinum remained at $36.00 per ounce throughout the year and compared with a range of $36.00 to $40.00 in 1940. Palladium at $24.00 per ounce has remained stable in price since 1935. Rhodium continued to be quoted at $125 per ounce, the same quotation prevailing since 1937. Ruthenium has remained at $35.00 to $40.00 since 1938. Iridium was quoted at $275.00 per ounce early in 1941, then dropped to $175 in February and remained at that figure for the remainder of the year. (M. & M. Markets, January 22, 1942.

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SELENIUM IN 1941

Source of Supply:

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 quantities large enough to be mined for itself alone.

Commercial selenium is recovered in association with tellurium 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, and was first produced in the Dominion in 1931 in Ontario Refining Company's copper refinery at Copper Cliff, Ontario. The only other producer in Canada is Canadian Copper Refineries, Limited, with refinery at Montreal East, Quebec, where production was commenced in November, 1934. 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 and Trade:

Canadian production and trade figures are not available for publication owing to the war.

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

Selenium is at present used chiefly in the glass and pottery industries, both as a colouring agent - as in ruby glass - and to neutralize the effect of objectionable oxides. To a minor extent it is used in the photo-electric cell, or electric eye, which is finding many industrial applications, and in alloying stainless steel for screw and bolt stock, where it develops improved cutting and threading qualities. It is employed to improve the machinability of copper and copper alloys. It has a large potential market in certain rubber compounding industries and is now being used for the vulcanizing and fireproofing of switchboard cables and to increase the resistance of rubber to abrasion, these applications being still subjects of research. Selenium is used in the manufacture of certain kinds of paint and of certain dyes. As selenium oxychloride, it is a powerful solvent of many substances. The use of the metal in the production of improved cutting-tool steels and in the vulcanizing of rubber appears to offer the best opportunities for the expansion of the market. Rapid progress is also being made in the production of high-quality, selenium rectifiers, which require large quantities of selenium.

Market and Prices:

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

A nominal price for selenium, black powdered, 99.5 per cent pure, of $2 per pound at New York prevailed for a few years prior to August, 1938, when the price dropped to $1.75, at which level it remained to the end of 1941.

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SILVER IN 1941

Ores Mined and Producing Localities:

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.

Approximately half of the silver produced in Canada comes from British Columbia, by far the largest producer in the Dominion being the Sullivan lead-zinc-silver mine at Kimberley in that Province. The remainder of the output in British Columbia comes from the Silbak-Premier, Bralorne, Pioneer, and several other gold mines; the silver mines of Beaverdell camp; and from various relatively small silver-lead-zinc mines. A small production is also obtained from gold placer operations.

In Saskatchewan, the output is from the portion of the Flin Flon deposits lying within that Province and from the "Box" gold property at Goldfields.

In Manitoba, the production is from the copper-zinc ores of the Flin Flon and Sherritt Gordon deposits and to a lesser extent from the San Antonio, Gunnar Gold, God's Lake, and other gold mines.

In Ontario, production from the mines of Cobalt and adjoining areas has been decreasing for several years and it is the demand for cobalt that is helping to keep many small concerns in operation in these areas. The increased production of silver from the nickel-copper mines of the Sudbury area in the last few years has partly offset the decline from the Cobalt area. Important contributions are also made by the gold mines of Porcupine, Kirkland Lake, and other areas.

The rapid expansion of mining in western Quebec in recent years has resulted in a marked 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 from the many gold mines of western Quebec.

In Yukon, production is mainly from the silver-lead ores of the Mayo district. Gold placer mining contributes about 20,000 ounces a year. 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 ores of the "Con", Negus, and other properties in the Yellowknife and adjoining areas.

Plants for the production of the fine silver are operated by the Royal Canadian Mint, Ottawa; Hollinger Consolidated Gold Mines Limited, Timmins, Ontario; International Nickel Company of Canada, Copper Cliff, Ontario; Deloro Smelting and Refining Company, Deloro, Ontario; Canadian Copper Refiners, Montreal East, Quebec; and Consolidated Mining and Smelting Company, Trail, British Columbia.

Production and Trade:

The Canadian production of silver in 1941 was 21,754,798 fine ounces, valued at $8,323,603, compared with 13,833,752 fine ounces valued at $9,116,172 in 1940.

World production of silver in 1941, as estimated by the American Bureau of Metal Statistics, was 274,300,000 fine ounces, a new high, compared with 273,690,000 fine ounces in 1940.

Exports in 1941 were 4,069,487 fine ounces of silver in ore and concentrate valued at $1,513,388, and 13,165,833 fine ounces of silver bullion valued at $5,072,055. Manufactures of silver valued at $24,795 were also exported. Exports in 1940 were 5,633,106 fine ounces of silver in ore and concentrate valued at $2,052,298, and 13,612,952 fine ounces of silver bullion valued at $5,113,206. Manufactures of silver valued at $8,121 were also exported.

Imports in 1941 included unmanufactured bullion to the value of $100,555 and manufactures of silver to the value of $289,916. Imports in 1940 included unmanufactured bullion to the value of $519,247 and manufactures of silver to the value of $332,047.

Market and Prices:

World consumption of silver in 1939 (1940 and 1941 figures not available) was estimated by Handy and Harman at 441,300,000 ounces, of which 341,400,000 ounces was purchased by the United States Government, 26,000,000 ounces represented Indian consumption, 8,900,000 ounces was used for coinage, and 65,000,000 ounces was consumed in the arts and industries.

Messrs. Handy and Harman, in "Silver Market in 1941" state as follows:

"The United States and Canada set a new record by a very wide margin for the use of silver in the arts and industries. We estimate the 1941 figure of 80,000,000 ounces, an increase of nearly 95 per cent over 1940, when the previous high of 41,000,000 for the two countries was established. Canada's portion of the yearly totals has always been less than 5 per cent, and it was reduced to an even smaller fraction in 1941, because most of the expansion in industrial consumption occurred in the United States— the war was responsible for this tremendous expansion and its effects, both indirect and direct, were conspicuous in three main fields which may be classified as follows: a greater public demand for articles made of silver; a growing substitution of silver for nickel, copper or other metals under priorities; and a rapid increase in the employment of silver for war work.

"The substitution of silver for other metals has occurred both in industry and the arts, the purpose being to conserve scarce war materials such as copper, nickel, aluminum and tin. For example, silver alloys containing only small percentages of scarce metals are being used in place of brass and nickel alloys. Pure silver wire is replacing copper wire in certain electrical appliances and small motors. As a plating material, silver is producing corrosion-resistant surfaces upon substitute metals that are satisfactory in other respects but lacking in this quality. Also, because of its peculiar properties, silver may be used in combination with lead to substitute for tin-lead solders, thus saving large amounts of tin. These and many other substitute uses will absorb increasing quantities of silver as long as there continues to be a shortage of other metals.

"War requirements also are demanding millions of ounces of silver. This metal is playing an important part in the construction of ships, airplanes, tanks, trucks, guns, shells, bombs, torpedoes and a wide variety of miscellaneous equipment. Its most extensive use is in the form of brazing alloys, but other compositions are employed in the manufacture of electrical contacts, and pure silver is used for making airplane bearings, photographic film, surgical materials and pharmaceutical products. As the names indicate, these are not exclusively war items; nevertheless they are being diverted in increasingly larger quantities to the Army and Navy.

"The silver industry of the United States is fully alive to the service that silver can render in the country's war program, and accordingly knowledge acquired by years of research on industrial applications of silver is now being applied by metallurgists and engineers to the many metal problems arising from the present emergency."

The average price of silver in 1941 was 38.261 cents per fine ounce, compared with 38.249 cents in 1940. (New York prices in Canadian funds.)

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TELLURIUM IN 1941

Source of Supply:

Tellurium occurs native and as an essential constituent of several minerals, none of which has been found in commercial quantities. Tellurium-bearing minerals also occur in minute quantities in association with other metallic ores, and the element may be recovered from residues 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. Ore 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 the refined metal. One of them, Ontario Refining Company at Copper Cliff, Ontario, started production in 1934, and the other, Canadian Copper Refiners, Limited, at Montreal East, Quebec, commenced production in 1935. The former plant treats the slime from the refining of the blister copper produced by International Nickel Company at Copper Cliff; and the latter, the slime from the refining of the anode copper of Noranda Mines, Limited, at Noranda, Quebec, and the blister copper of Hudson Bay Mining and Smelting Company, whose smelter is at the Flin Flon mine on the boundary line between Manitoba and Saskatchewan. There has been no recovery as yet in Canada from the sludge of sulphuric acid chambers.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

The world production is estimated at 40 to 70 short tons a year and Canada and the United States appear to be the main sources of supply.

Market and Prices:

Metallic tellurium, until quite recently, was of little industrial importance. Formerly it was used to a small extent in some radio work and it was used also in the photographic arts and for blackening art-silverware. Small quantities are used as a colouring agent in the ceramic industry. 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 the resistance of the cables to heat and corrosion. It has also been used for improving the machining qualities of certain steels. Very finely powdered tellurium may be used as rubber-compounding material. Its presence is stated to shorten the time of curing, and to greatly improve the resisting qualities of the product. Tellurium is also used in the steel industry, but so far mainly in an experimental way. A newly patented "daylight lamp" employed tellurium vapor in a tube to fill in certain wave lengths to produce a continuous spectrum.

A nominal price for tellurium of $1.75 per pound at New York prevailed throughout 1941.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

TIN IN 1941

Occurrences and Sources of Supply:

Tin is widely distributed, but in only a few countries are the deposits sufficiently large for commercial development. Cassiterite (SnO_2) is the only important ore of tin and in the pure state it contains 78.6 per cent of the metal. Stannite, a sulphide of copper, iron, and tin, has little importance as an ore of tin. In British Columbia, stannite is present in the ore of the Snowflake property, near Revelstoke, and cassiterite and stannite have been noted at several other places in the province. The small cassiterite content of the silver-lead-zinc ore of the Sullivan mine, at Kimberley now being recovered from the zinc tailing, is the source of Canada's recently developed production of tin. Cassiterite occurs also in many other places in Canada, but no commercial deposits have so far been found. In the unglaciated parts of Yukon, stream tin has been found in small quantities, but no serious attempt seems to have been made to test the gravels thoroughly for tin.

The tin concentration plant of Consolidated Mining and Smelting Company at Kimberley commenced operation on March 1st, 1941, and has been functioning very satisfactorily. The plant for the production of refined tin is expected to be in commercial operation in April, 1942. The tin content of the ore is small and the recovery will be proportionately small. The refinery has an annual capacity of 500 tons of metallic tin.

Production and Trade:

Figures of production and trade are not available owing to the war.

The tin produced at Kimberley and the small domestic recovery of secondary tin are far from sufficient to meet the Canadian requirements, which in peacetime amounted to about 2,700 tons a year and are now much larger. They were obtained mostly from smelters in the Straits Settlements. The position of the Allied countries in respect to tin has become critical since the capture by Japan of these smelters and of the Malayan tin mines, with the result that the civilian use of the metal is being increasingly curtailed. The search for commercial deposits in Canada has acquired added importance.

Market Conditions, Uses, and Prices:

Because of changing conditions and the wide range in the market value of the metal, no definite statement can be made as to what constitutes payable ore. Most tin ores are too low in grade to be treated directly and accordingly must be concentrated. Concentrates are in most cases purchased on a 60 per cent tin basis and for each unit or fraction above or below 60 per cent the returning charge is reduced or increased. They are subject to penalties if they contain more than one per cent sulphur and 5 per cent iron. Antimony, arsenic, bismuth, copper, lead, and other impurities are not penalized. Consolidated Mining and Smelting Company is prepared to treat tin concentrate at its new smelter at Kimberley to the limit of its relatively small capacity.

The only other tin smelter on the North American Continent is the new smelter at Texas City, Texas. This Government-sponsored smelter was built by Tin Processing Corporation of New York and has a capacity of 50,000 tons of concentrate a year. It is expected to be ready for operation in April, 1942. Following its entry into the war, the United States took over all the supplies of the metal in that country and specific allocation of tin was taken over by the Director of Priorities.

Tin is used chiefly in the manufacture of tin plate, mainly for use in the making of tin cans and of containers of all kinds. It is a necessary ingredient of solder and is a component part of most babbit and other anti-friction metals, without which manufacturing and transportation would be impossible. Smaller quantities are used in foil, which in turn is used for wrapping food, tobacco, etc.; in terneplate; pipe and tubing; type metal; bronze; galvanizing; and in bar tin.

The prices of tin in New York in 1941 averaged 52.008 cents a pound. The price was fixed in August at 52 cents a pound and remained at that level to the end of the year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

TITANIUM IN 1941

Ores Mined and Producing Localities:

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 at St. Urbain in Charlesvoix county, and at Ivry in Terrebonne county, Quebec. 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 being the only known workable deposit of rutile 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, part of it to Niagara Falls, New York, presumably for use in the manufacture of ferro-titanium, and part of it to plants of the General Electric Company in the United States. No shipments from the Ivry deposits have been reported for several years.

During 1941 the situation remained unchanged with respect to the establishment, by Canadian Titanium Pigments Ltd., (630 Dorchester St., W., Montreal), of a plant in Canada for manufacturing titanium pigments. The necessary supply of finished pigments is all imported. While the Canadian market has continued to consume increasing quantities of titanium pigments, the difficulty of constructing a plant in wartime and the scarcity of essential raw materials have necessitated the postponement of any immediate development of a local industry.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

The world production of titanium ore is estimated at about 260,000 tons of ilmenite, which would yield 115,000 tons of titanium pigment, and 3,000 tons of rutile. India is the principal producer of ilmenite, the other producers being Norway, Malaya, Portugal, and Canada. Brazil is the principal producer of rutile, and Norway is second in importance.

Market and Prices:

Commercial uses for titanium in recent years have continued to increase independently of the trend of general business. Ilmenite continues to be used chiefly in the manufacture of white pigment, and it is used to a smaller extent for making ferro-alloys. In metallurgy, titanium is not only an effective dioxidizer 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 those treated with silicon. In other industries titanium compounds have many different uses. Rutile is used chiefly in welding-rod coatings and in the ceramic industry.

The shipping situation curtailed supplies of ilmenite from India, but the situation in the United States will be somewhat relieved in 1942 by increased domestic production. Heavy Army and Navy demands for titanium paints and increased consumption of weld-rod coatings compelled many paint manufacturers to return to the use of white lead.

The New York quotation for ilmenite of $18 to $20 per gross ton of 50 to 60 per cent TiO_2, f.o.b. Atlantic seaboard was replaced in February, 1941 with $28 to $30 for straight 60 per cent material. The price for rutile 94 per cent TiO_2 remained at 8 to 10 cents per pound of concentrate but the 88 to 90 per cent grades advanced $10 in April, 1941 to $95 a ton of concentrate. The price of ferrocarbontitanium f.o.b. plant remained at $142.50 a ton, and metallic titanium at $5 to $5.50 a pound throughout 1941.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

TUNGSTEN IN 1941

Ores Mined and Producing Localities:

Wolframite, $(Fe_2Mn)WO_4$, is the principal ore of tungsten, the next in importance being scheelite ($CaWO_4$) a calcium tungstate. The former is a dark brown to black heavy mineral, which contains 76.4 per cent WO_3 (tungstic oxide) when pure, and is not common in Canada. Scheelite, the chief Canadian ore of tungsten, is a heavy, usually buff, but sometimes white mineral with a dull lustre, which contains 80.6 per cent WO_3 when pure. It is commonly associated with quartz and frequently occurs in gold-bearing veins. It can be detected readily (in the dark) by its brilliant pale bluish-white fluorescence under ultra-violet light and purple filter. These lamps are at present made only in California. All duties into Canada on the lamps have been removed.

The production of concentrate is small, but shipments were made during 1941 from properties in southeast Nova Scotia; the Val d'Or area, Quebec; the Porcupine area, Ontario; the Bridge River region, south central British Columbia; and from Keno Hill in Yukon.

Prospective Producing Localities and Important Developments:

In Nova Scotia at the Indian Path mine, near Lunenburg, Guysborough Gold Mines Limited — a subsidiary of Ventures Limited — continued underground development and erected a pilot mill, in which a few hundred tons of ore in the form of bulk samples was treated to obtain rough concentrate. Scheelite-bearing zones were opened up and a 100-ton mill is being erected with a view to production in 1942. Several deposits were prospected along the Waverly anticline, northeast of Halifax. These include the Hyland deposit near Lower Sackville, being developed by J. W. Storer; the Goff property northeast of Bedford, owned by R. E. Kirkpatrick; and the Reynolds property, south of Middle Musquodoboit. Guysborough Gold Mines, Limited continued to develop the gold-tungsten property on both shores of Lake Charlotte, 30 miles northeast of Halifax. The scheelite is too low grade at present prices and operations were suspended during the summer. Some ore could be produced, however, from this property. The old properties of Scheelite Mines Limited near Moose River, owned by B. Lawler of Shubenacadie, were examined. A mill erected on the property in 1911 was operated intermittently until 1919, during which period 24 tons of scheelite concentrate was produced. The workings have caved and are full of water, but good ore is said to be still exposed. Some ore could be obtained from the old dumps and also from the old mill tailing, which assays about 0.5 per cent WO_3.

In New Brunswick, the Burnt Hill wolframite property in York county was actively prospected by Consolidated Mining and Smelting Company. It had been worked intermittently by Acadia Tungsten Mines, Limited between 1912 and 1918 and from ore treated in the mill, 14 tons of concentrate was produced. Recent prospecting has revealed a large number of quartz veins, many of which contain wolframite and some molybdenite. A fair tonnage of tungsten is available from three or four of the best veins, but no profit could be made on the production at present prices. It is expected that arrangements will be made to assure production in 1942.

Scheelite occurs in many of the gold mines of Quebec and Ontario. Mill samples from all mines equipped with concentrators were recently examined and a detailed investigation was then made, using the ultra-violet lamp, at those mines previously known to contain scheelite or at which it had been discovered in the samples. This work, which is still in progress, was done by officers of the Bureau of Mines, Ottawa, and the Quebec Bureau of Mines in co-operation with mine owners. No large tonnage is expected from any mine, but the total tonnage will contribute appreciably towards domestic requirements. The largest amount of scheelite yet found is at the Hollinger gold mine, Porcupine area, where a small treatment plant was completed early in 1942. Several other gold mines in this area will probably ship their hand-picked scheelite to the Hollinger mill.

In Ontario, the gold properties in the West Porcupine, Red Lake, and Long Lac areas are the principal active or potential sources of scheelite.

In Quebec, the most promising region is north of Rouyn and eastwards to Val d'Or, Abitibi county. Scheelite occurs in quartz veins and in some of the underground workings on the property of Manley Gold Mines, Limited in La Reine township. A little prospecting was done on the occurrence at Kayrand (formerly Nortrac) property northwest of Amos, and also on the claims of the Petosa Syndicate in Gaboury township, east of Ville Marie on Lake Timiskaming.

In British Columbia, Consolidated Mining and Smelting Company of Canada early in 1942 completed a small mill on the Red Rose property near Hazelton on the Skeena river. Some good grade scheelite ore was disclosed and shipments are expected throughout 1942. This company also took over the Phillips claim, now known as the Tungsten Queen, north of Minto city, in the Bridge River area, from which, during the past two years Mr. Phillips has shipped high grade massive white scheelite to Ottawa for treatment. No work was done on the property of Columbia Tungstens, Limited on Hardscrabble creek in the Cariboo district, but the remainder of the concentrate made in its mill during 1940 was shipped in 1941. Some ore was treated in the underground mill of the Regal Silver mine, now operated by Consolidated Tungsten-Tin Mines, Limited, at Albert Canyon northeast of Revelstoke. The company intends to treat the rough concentrate produced in the small underground mill in the finishing plant being erected alongside the C.P.R. track, 7 miles from the mine. The ore is a complex mixture of scheelite, stannite, and several metallic sulphides. The mill of Consolidated Nicola Goldfields, Limited in the south central part of the province is being equipped to treat the scheelite which occurs in small amounts in the mine.

The discovery of scheelite in the Bralorne gold mine, Bridge River area, is of interest and its recovery is under investigation. Prospecting was done on scheelite occurrences near Salmo, Nelson mining division; south of Barkerville; east of Hansard, on the Fraser river; and in several other localities. The Provincial Department of Mines, Victoria, is making a thorough investigation of the occurrences of tungsten in British Columbia.

In the Northwest Territories, Slave Lake Gold Mines Limited, with a property on Outpost Island in Great Slave Lake, shipped some rough concentrate containing ferberite, wolframite, tin, and gold for testing, upon the results of which will depend whether or not a plant will be built. About 50 miles to the north, in the Gilmour lake area, investigation by the Geological Survey, Ottawa, has revealed many quartz veins carrying scheelite; as yet, however, the amount found is small. Several of the gold mining companies are prospecting the area and a mill will be erected if a sufficient tonnage of ore is disclosed.

In Yukon, the placer holdings of Canadian Tungstens Limited on Canadian Creek, southwest of Selkirk, were acquired by Canbrae Exploration Company, a subsidiary of Bralorne Mines, Limited, and dredging will be undertaken during 1942. The tungsten occurs mainly as wolframite and ferberite with a little scheelite. Several placer deposits containing both wolframite and scheelite on Dublin Gulch and Haggart creek, near Keno, north of Mayo, are being worked by Fred Taylor and by others. Small shipments of the gold clean-up containing a high percentage of the tungsten minerals were made in 1941. Recent tests indicate that these minerals can be separated from each other by screening over 14 mesh. The wolframite is nearly all coarse and most of the scheelite passes through the screen.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

World production of tungsten ore and concentrate in 1939 (figures for 1940 and 1941 not available) on a basis of 60 per cent WO_3, was about 34,000 tons, the principal producing countries being, Burma, China, United States, Bolivia, Portugal, Korea, and Japanese controlled areas in south China.

China had dominated the tungsten industry for more than 20 years prior to 1939, exports being as high as 18,000 tons annually. The Chinese tungsten (wolframite) deposits are the largest in the world, and the principal deposits are still in unoccupied China. Estimated production in 1940 in this area, which is under Chinese Government control, was about 8,800 metric tons, and that of the whole of China was about 11,600 tons. Estimated reserves in Chinese controlled areas are said to be 700,000 tons, whereas those in Japanese areas are small. It is said, however, that under a recent Sino-Soviet barter agreement, 400 tons is being shipped monthly to Russia. A $25,000,000 loan granted early in 1940 to China by the United States is being repaid by the sales of wolframite to that country, but owing to enemy occupation of the ports and disruption of transportation, the amount at present reaching the United States is small.

Burma for the past two years has been the world's largest producer. Exports were controlled by the British Ministry of Supply and all shipments went to England. Exports in 1940 were 12,000 tons of wolframite and mixed tin-wolframite concentrates, and exports in the first six months of 1941 were 5,100 tons. The principal mines are at Tavoy in the south Burma peninsula and in south Kareni state, about 170 miles northeast of Rangoon. These mines are now in Japanese hands.

The deposits of wolframite in Portugal are scattered. Germany was said to be paying as much as $20,000 or more a ton for high grade Portuguese ore in the fall of 1941. Spain produced 250 tons in the first half of the year.

The United States is the third largest producer of wolframite, its output in 1940 being 5,319 tons and the estimated production in 1941 being about 6,500 short tons of 60 per cent WO_3. Shipments from the high grade deposit at Yellow Pine, Idaho, discovered by the engineers and geologists of the U.S. Bureau of Mines and Geological Survey, were started in August, 1941. Many new mills were completed, including the 1300-ton concentrating and chemical plant of Union Carbide Company at Bishop, California, which is taking custom ores and low grade concentrate. Nevada-Massachusetts Company's plant at Mill City, Nevada, is increasing its production. It was the largest single source of supply in the United States in 1940. New plants for treating tailings as well as new chemical treatment plants were completed in the United States early in 1941. Prospecting was active throughout the year.

General imports of ore and concentrate into the United States in 1940 were 9,240 short tons, nearly half of it from China, whereas in the first nine months of 1941, imports were 11,349 tons (60 per cent WO_3), China and Bolivia being the chief sources of supply. Consumption in 1942 is expected to be over 20,000 tons. To conserve tungsten, a General Preference Order issued in November, 1941 provided that 75 per cent of all orders for high speed tool steel should be for molybdenum and not more than 25 per cent for tungsten. Along with the present output, the tungsten that will be obtained from the large production from new plants, from expected imports from South America of about 6,000 tons of ore annually, from the salvaging of all tungsten steel scrap and grindings, and by the substitution of molybdenum for tungsten, will likely be sufficient to meet most of the United States requirements.

In Bolivia there was considerable activity on a number of small properties, as a result of a contract made by the United States Metal Reserve Company to buy the entire Bolivian output for three years at $21.00 a short unit (20 pounds). A similar contract was made with Argentina for 3,000 tons of concentrate annually. Argentina's tungsten comes from scheelite in calcareous schists and wolframite in pegmatite dykes, both in the Andes. Exports from Peru, mainly wolframite, in 1941 were 240 tons (147 tons of WO_3). In Cuba, production by Pan-American Steel and Alloy Company of Montreal, was suspended, but is expected to be resumed early in 1942. The deposit is on the west coast of the Isle of Pines.

<u>Uses:</u>

As an alloying metal in steel, tungsten is used essentially to impart hardness and toughness, which are maintained even when the steel is heated to a high temperature. Almost 85 per cent of the United States consumption of tungsten is used for the production of high speed steels for cutting tools, in which the tungsten content is 15 to 20 per cent, though recently this amount was reduced considerably by substitution. Alloy steels containing tungsten are being used more extensively in making armour plates, armour-piercing projectiles, and other military equipment. Minor amounts of tungsten are used in steels for dies, valves, and permanent magnets. Stellite, the best known non-ferrous alloy, contains 10 to 15 per cent tungsten with higher percentages of chromium and cobalt, and accounts for about two per cent of the tungsten consumed. Tungsten carbide is widely used as an extra hard cutting tool, and for projectiles and bullet inserts. Pure tungsten is used in lamp filaments (about 1.5 per cent of the total tungsten consumption), in radio tubes, contact points, etc. Small amounts of tungsten in the form of sodium tungstate and tungstic oxide are used in the preparation of chemicals and as salts in the pigment and tanning industries.

<u>Recovery and Treatment:</u>

In the concentrators of Canadian gold mines in which scheelite occurs, a portion of the picking belt can be darkened and an ultra-violet lamp set up. The lumps of ore containing the fluorescent scheelite can then be sorted and stock-piled. In some mines the lamp is used underground for collecting scheelite from the broken ore. Some zones high in scheelite are mined directly for the mineral.

Because of their high specific gravity, tungsten minerals, when present, are found in the clean-up of placer gold operations. Small lode operators can make rough concentrate by crushing and sluicing. Tungsten minerals can be readily concentrated by gravity methods, provided the ores are relatively high grade and free from metallic sulphides; otherwise, combined gravity and flotation methods should be employed. Most of the Canadian output for the past two years consisted of hand-picked ore shipped to the Bureau of Mines, Ottawa for treatment in the Ore Dressing plant, in which concentrate of 70 per cent WO_3, or better, was made and shipped to Atlas Steel Company, Welland, Ontario.

In the United States, material as low as 0.2 per cent WO_3 is being concentrated successfully, though the average is 0.5 per cent. Flotation methods are employed to produce a low grade concentrate, which is chemically treated to produce pure artificial calcium tungstate. Rough flotation concentrate, which averages 10 per cent WO_3, is being treated in this manner. Arrangements can be made to ship, on a custom basis, Canadian low grade concentrate to the Union Carbide plant at Bishop, California, or material from Eastern Canada to a subsidiary plant at Niagara Falls, New York. The charge for chemical treatment is about $2.50 a unit (20 pounds) of contained WO_3, the rate per unit decreasing as the grade increases. The degree of concentration that Canadian ores must undergo depends on freight rates from the mine to the plant at Bishop or Niagara Falls. The grade of concentrate that can be profitably shipped and chemically treated is probably not less than 10 per cent WO_3, and from distant points, such as the Northwest Territories, or Yukon, it may have to be at least 15 per cent. At most mills in the United States, shipping tungsten concentrate to the custom plant, the flotation concentrate is tabled to extract about 50 per cent of the contained tungsten as a high grade saleable product. Only table-tailings are shipped, the resultant recovery being over 90 per cent of the total tungsten. The streaking of mill tailings by passing over blankets and periodically removing the concentrate to produce a low grade scheelite concentrate that can be floated, is being investigated by a Canadian gold mining company. Unless there is a convenient mill to treat tungsten, hand-picked or cobbed ore from Canadian mines should be shipped to the Bureau of Mines at Ottawa for treatment. Information on proposed custom exports may be obtained from J. R. Van Fleet, U. S. Vanadium Corporation, 30 East 42nd Street, New York City.

Specifications:

Tungsten ores are concentrated to 60 per cent or higher of tungsten trioxide (WO_3). For adding to steel, it is generally converted into ferro-tungsten, but sometimes into tungsten oxide, calcium tungstate, or tungsten powder. At the plant at Welland, Ontario, only scheelite is used at present and the high grade concentrate of not less than 70 per cent WO_3 is added directly to the steel bath. This is possible because of the comparative ease with which the calcium forms a slag.

United States specifications for scheelite are:- WO_3 - 60 per cent minimum, the maxima percentage of the following harmful impurities being; copper and phosphorus each 0.05; arsenic, antimony and tin each 0.10; bismuth, 0.25; molybdenum, 0.40; sulphur, 0.75; and manganese, 1.00. For wolframite (or ferberite), 1.50 tin is allowed and a little more arsenic and bismuth. The ores may be in lumps, fines, or a mixture of both.

Prices:

The United States price of imported 60 per cent WO_3 ore at the close of 1941 was $24 per short unit (20 pounds) of contained WO_3, duty paid in car lots, c.i.f., United States ports. Domestic, $26.00, delivered. The duty into the United States is $7.93 a short unit of contained WO_3. The United States price of 75 to 80 per cent ferro-tungsten is $1.90 to $2.00 per pound of contained tungsten metal. The price of tungsten metal of 99 per cent purity is $2.50 a pound; of 99.5 per cent purity, $3.25 a pound; and of 99.9 per cent purity, $6.00 a pound.

The price in Canada of scheelite concentrate containing 70 per cent WO_3 (within specifications) is $20.00 a short unit of WO_3, delivered at Welland, Ontario.

Tungsten is one of the most important of the war metals, but its production in Canada is insignificant in relation to the steadily increasing amounts required in the manufacture of war products in the Dominion. This, together with the shipping hazards from Asia, the principal source of supply, give particular emphasis to the need for augmenting domestic production. Many gold deposits besides those already mentioned probably contain some scheelite and if so it can be readily detected by means of the ultra-violet lamp.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

ZINC IN 1941

Ores Mined and Producing Localities:

Close to 75 per cent of the zinc produced in Canada comes from Consolidated Mining and Smelting Company's Sullivan silver-lead-zinc mine near Kimberley, British Columbia. The remainder is from Hudson Bay Mining and Smelting Company's copper-zinc deposits at Flin Flon, which straddle the boundary line between Manitoba and Saskatchewan; the Sherritt-Gordon copper-zinc mine in northern Manitoba; several small lead-zinc properties in West Kootenay district, British Columbia; the Lake Geneva lead-zinc property, Sudbury district; and the Normetal and Waite-Amulet copper-zinc mines in northwestern Quebec.

In British Columbia, the Sullivan mine and concentrator at Kimberley were operated at capacity. The capacity of the Company's zinc plant at Trail has been increased in recent years and in 1941 the plant was operating to capacity. Base Metals Mining Corporation's lead-zinc mine and concentrator near Field, re-opened late in 1939, has been in production since January, 1940.

Western Exploration Company at Silverton, was retreating the old tailings accumulated during previous operations, mainly for the purpose of recovering the zinc. The Company's Mammoth mine was also in production. The Lucky Jim mine, at Zincton, was taken over late in 1940 by Zincton Mines, Limited, a new company owned by Sheep Creek Gold Mines, Limited. The mine and concentrator were prepared for production early in 1941, and exports of concentrates started in September. Several small lead-zinc properties, mainly in the Ainsworth-Slocan district were shipping crude ore to the Trail smelter.

The Reeves McDonald zinc-lead mine in the Pend d'Oreille river was being prepared for production early in 1942.

In Manitoba, the rate of output at the Flin Flon mine of Hudson Bay Mining and Smelting Company was appreciably higher than in 1940. The new south main shaft was completed to the 3,000-foot level, and ore pockets and an underground crusher were built below the 2,750-foot level. Alterations and additions were made to the concentrator and zinc plant. The zinc plant operated at capacity, treating a slightly greater tonnage of zinc concentrate and producing more slab zinc than in 1940. The Sherritt-Gordon copper-zinc mine and concentrator, about 50 miles northeast of Flin Flon, were operated at capacity throughout the year. A 300-ton unit was added to the mill, for the recovery of zinc concentrate.

In Ontario, the Lake Geneva Mining Company, resumed operations during the year, and started milling operations in August, producing zinc and lead concentrates for the export market. The copper-zinc-lead property of Sudbury Basin Mines, Limited, in the Sudbury basin, remained idle.

In Quebec, Normetal Mining Corporation, Normetal, Quebec, shipped both copper and zinc concentrates steadily all year. No. 3 Shaft was completed to 2,000 feet and four new levels were established at 150-foot intervals below the 1,400-foot level. Development results were very satisfactory, the bottom level being the best in the mine.

In view of the representations made to the directors respecting the increasing need for copper and zinc for war purposes, a mill addition of 150 tons daily, was authorized. This new construction and installation was practically completed by the end of the year.

The old Calumet mine, on Calumet Island, was being prepared late in 1941 for active exploration and development in 1942.

Golden Manitou Mines, Ltd., took over in 1941 part of the holdings near Val D'Or of Quebec-Manitou Mines Limited, and has started the erection of a 600-ton mill for the production of zinc and copper concentrates.

In Nova Scotia, the Stirling copper-lead-zinc property in Cape Breton has been idle since late in 1937.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

The world production of zinc in 1939 (1940 and 1941 not available), as reported by the American Bureau of Metal Statistics, was 1,849,700 short tons, compared with 1,752,300 short tons in 1938. The principal producing countries, according to the origin of ore, are: United States, Canada, Australia, Germany, Poland, Mexico, and Russia.

Canada holds fourth position as a producer of slab zinc, being headed by the United States, Belgium, and Germany. The last two countries, in addition to domestic ore, treat large quantities of imported ore.

Market and Prices:

World consumption in 1938 (1939 - 1941 not available), as given by the American Bureau of Metal Statistics, was 1,641,800 short tons, compared with 1,802,700 short tons in 1937.

Actually the uses of zinc under present war conditions are no different from those in peace time, but the increased demand on each of the many uses having a part in the military program pyramids the load for the zinc industry. In peacetime the galvanizing industry uses most of the primary and secondary output of zinc. Large quantities of the metal are used also in the brass and castings industry; as paint pigments; in radio and flashlight batteries; and in the making of zinc oxides.

The average price of zinc for 1941 in Canadian funds based on London quotations, was 3.411 cents per pound, compared with 3.069 cents in 1939. The St. Louis price was 7.474 cents, compared with 6.335 cents in 1940.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

ARSENIOUS OXIDE IN 1941

SOURCE OF SUPPLY:

The world output of arsenic is practically all obtained as a by-product from the treatment of gold, silver, copper, lead, zinc, cobalt, tungsten, and tin ores. In Canada, arsenic is obtained as a by-product from the treatment of the silver-cobalt-arsenic ores of northern Ontario, and to a lesser extent, from the gold arsenical ores of the Beattie and O'Brien mines in Quebec and the Little Long Lac mine in Ontario. At these three properties baghouses to extract arsenic from the fumes of roasting plants used in the recovery of gold from arsenical concentrate have been installed. The Bralorne and Hedley and other mines in British Columbia export arsenical gold concentrates to the United States, but no payment is made for the arsenic.

Deposits containing arsenopyrite in association with gold occur in various parts of Canada, and some of these deposits in Ontario, Quebec, and Nova Scotia, are being operated for the recovery of gold. If the arsenic could be recovered at a profit such properties could supply considerable amounts of concentrate suitable for the production of the mineral.

All the refined white arsenic (As_2O_3) and arsenical insecticides made in Canada are produced by Deloro Smelting and Refining Company, Limited, Deloro, Ontario, which obtains its raw material from the silver-cobalt-arsenic mines of northern Ontario.

PRODUCTION AND TRADE:

Canadian production and trade figures are not available for publication owing to the war.

The world production in 1940 (1941 not available) is estimated by the U. S. Bureau of Mines at 65,000 metric tons compared with 58,000 metric tons in 1939. Accurate production data are not available as some countries fail to record arsenic statistics and others give only sales or exports.

MARKET AND PRICES:

Arsenic is used chiefly in insecticides, weed killers, sheep and cattle dip, wood preservatives, and in the manufacture of glass, minor uses being in pigments, tannery supplies, and pharmaceutical preparations. Experiments are being made to determine whether arsenic salts can be used to replace creosoting in the preservation of wood. The use of arsenic to manufacture chemical warfare materials has notably increased its consumption.

Although the world consumption of white arsenic has varied greatly during the past ten years, the quoted price remains at $3\frac{1}{2}$ cents a pound. As most of it is a by-product of metal recovery, through necessity rather than choice, and as the potential supply is far in excess of any probable demand, there seems to be little likelihood of any sustained increase in price.

The nominal price of arsenious oxide in New York remained at $3\frac{1}{2}$ cents a pound in the first half of 1941 and at about $3\frac{3}{4}$ cents during the last half of the year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

ASBESTOS IN 1941

Ores Mined and Producing Localities:

Asbestos of commerce consists mostly of the three varieties known as chrysotile, amosite, and crocidolite or blue asbestos, with chrysotile being by far the most important and widely used. Three other varieties that have only a very limited field of usefulness are fibrous actinolite, fibrous tremolite, and anthophyllite.

The asbestos produced in Canada is all of the chrysotile variety and comes entirely from areas of serpentinized rock in the Eastern Townships, Quebec, where the producing centres are Thetford Mines, Black Lake, East Broughton, Vimy Ridge, Asbestos, and St. Remi de Tingwick. The Canadian deposits are the largest known in the world. Production has been continuous from the Thetford area 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 area. The average yield of fibre from the Quebec deposits is 5 per cent of the rock mined and 7.0 per cent of the rock milled.

In 1941 there were six producing companies. Asbestos Corporation, Limited worked two properties at Thetford Mines and one each at Black Lake and Vimy Ridge. Johnson's Company operated at Thetford Mines and at Black Lake. Bell Asbestos Mines, Limited, operated at Thetford Mines; Quebec Asbestos Corporation, Limited, at East Broughton; Canadian Johns-Manville Company, Limited, at Asbestos; and Nicolet Asbestos Mines, Limited, at St. Remi de Tingwick.

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.

Small deposits of chrysotile asbestos are known in other parts of Quebec and also in Ontario and British Columbia. Several have been worked from time to time. In 1941 trial shipments of chrysotile were made by Canadian Refractories Limited, from its property at Kilmar, Quebec. This asbestos has a very low content of iron and is entirely free from magnetite, and should be suitable for use in making insulation for electrical machinery.

No amosite or crocidolite has yet been found in Canada but there are numerous deposits of fibrous tremolite, fibrous asbestos and anthophyllite, which varieties are commercially termed amphibole asbestos. The fibres of these varieties are harsher and weaker than those of chrysotile and are in little present demand. None of these deposits is being worked, although formerly fibrous actinolite was quarried near the village of Actinolite, Hastings county, Ontario, for use in the making of roofing materials. Asbestos deposits reported as having been found in recent years in Manitoba and in northern and western Ontario are of the amphibole varieties. The amphibole fibres are too harsh and brittle to be spun but they have a higher resistance to acids than has chrysotile and it is possible that meterial from some of the deposits may be suitable for use in acid filters and for other purposes where long harsh fibres are required.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

Little data on world production in 1941 are available, but it is known that Canada maintained her position as the principal asbestos-producing country. Other countries producing relatively large quantities of asbestos are Russia, Rhodesia, Union of South Africa, Swaziland, the United States, and Cyprus. A new deposit of blue asbestos (crocidolite) is being developed in Australia and small shipments of an excellent grade of chrysotile have been made from India. It is reported that a deposit of chrysotile in Venezuela is being developed. The world's largest market for asbestos is in the United States, and Canada's proximity to this market confers very real advantages on the asbestos industry in this country. Another development favouring the Canadian industry is the increasing demand for short grades of fibre for use in newly developed asbestos-cement products, and in moulded plastic articles.

Most of the Canadian production of asbestos is exported in the unmanufactured state, i.e., either in the crude condition (long-fibred material only), in a partly opened state, or completely fluffed out and ready for manufacture. The great bulk of exports goes to the United States but substantial quantities are also exported to the United Kingdom and Australia. Since September 20, 1939, the Dominion Government has controlled the export of asbestos.

Market and Prices:

Asbestos finds use for a great variety of purposes but the principal asbestos products are, brake linings, clutch facings, packings, cloth, insulation, mill-board, siding, shingles, roofing, tile, and pipes.

Prices throughout 1941 remained the same as in 1940, 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, 1942.

BARITE IN 1941

Ores Mined and Producing Localities:

Barite is fairly widely distributed in Canada, the most important occurrences being in Nova Scotia, Ontario, and British Columbia. Most of the total recorded output about 50,000 tons since 1885 has come from Nova Scotia. Small tonnages have also been reported at intervals from Ontario and Quebec. Prior to 1941, the last important production was in 1917, when 3,500 tons was produced, all of it from mines in the Lake Ainslie district, Nova Scotia.

Important Developments:

The chief development in 1941 was the bringing into production of a large deposit of barite discovered in 1940 near Walton, Hants county, Nova Scotia. The discovery was made in the course of prospecting operations by Springer-Sturgeon Gold Mines Limited, 67 Yonge Street, Toronto, which company, on the basis of extensive diamond drilling, estimated 1,250,000 tons of ore reserves to a depth of 200 feet. Development of the deposit was started through a subsidiary, Canadian Industrial Minerals Limited, and a 150-ton grinding plant was erected on tidewater, 2½ miles distant. The mill came into operation in June, 1941, and has been turning out a 325-mesh product designed primarily for use in oil-drilling, and for which a ready market exists in Trinidad and South America. Shipments to the end of 1941 totalled 7,940 long tons, or almost double the Canadian production in 1908, the previous peak year. Most of the output was shipped to Trinidad.

The Walton barite is mostly off-colour material, much of it of a strong reddish shade, but a large tonnage appears to be exceptionally high in barium sulphate, with a specific gravity of 4.25 or higher. Such material, is not acceptable for the general ground barite trade, but meets oil-drilling requirements. The company is investigating possible methods of bleaching its product, and also outlets for the crude ore in the lithopone and barium chemicals trades. Estimates by the Canadian Geological Survey, based on a study of the deposit and of drill cores, show about 400,000 short tons of high-grade ore, 300,000 tons of "border-line" ore, and 4½ million cubic feet of low-grade material that would probably need beneficiation to be marketable. Based on these estimates, the Walton deposit is one of the largest known occurrences of barite.

In Quebec, a few tons of low-grade ore were shipped to Montreal for grinding from a property near Quyon, and from another near Buckingham.

In British Columbia, development was undertaken by R. A. Thrall, of Summit Lime Works, Lethbridge, Alberta, on a deposit near Parson, 25 miles south of Golden, and 230 tons of barite was shipped, most of it to the plant of Pulverized Products Limited, at Montreal, for grinding. A few tons of ground material was shipped to the Turner Valley oil field for use in drilling, and to the glass plant of Dominion Glass Company, at Redcliff, Alberta. The British Columbia Government aided in the building of a road to the property, which is reported capable of shipping up to 100 tons of crude ore a week. Price is quoted at $7 per ton f.o.b. mine, with $11 per ton freight cost to Montreal. Colour and grade are stated to be good, with an average content of 96 to 98 per cent barium sulphate.

Mr. M. Gorrie, Flagstone, British Columbia, owner of a small barite deposit 30 miles south of Elko, on the Crow's Nest branch of the Canadian Pacific railway, reported in January, 1942 that he had about 50 tons of ore at the mine ready for shipment. The barite is unusually white and pure, but the deposit is remote from rail and rather difficult of access.

Production and Trade:

Total production of barite in 1941 was 6,661 tons, valued at $73,168, compared with 330 tons, valued at $4,739 in 1940.

In 1938, the latest year for which fairly complete statistics are available, world production of barite was 960,700 tons. Germany has long been the leading producer, and supplied 50 per cent of the world total in 1938, followed by the United States, with about 30 per cent. The remainder has been obtained chiefly from the United Kingdom, Italy, Greece, France, and India. Operations recently undertaken in Cuba are expected to make that country of increasing importance as a producer, the Cuban output in 1940 being 16,000 tons.

Exports of barite in 1941, were not separately recorded. The material went mainly to Trinidad.

Imports of ground barite were 3,431 tons, valued at $81,620, compared with 2,622 tons valued at $64,922 in 1940, obtained chiefly from the United States.

Market and Prices:

Ground barite is used in industry mainly as an inert filler or loader in rubber, paper, oilcloth, textiles, leather, and plastics. In paints, it has long served as a pigment and as an extender. A more recent important use is as a weighting material in oil-drilling muds, to overcome gas pressures. Coarse, granular barite is finding increasing use as a batch ingredient for moulded flint glass. Large quantities of barite are used in the lithopone and barium chemicals trade. Barium metal finds only limited industrial uses: it is a very active deoxidizer, and is used in the form of wire coatings as a "getter" to remove traces of gas from radio, vacuum, and thermionic tubes. It also serves as a high-temperature lubricating film or coating on steel balls used for the rotating anodes of highly-evacuated small X-ray tubes, where oil cannot be used. Lead-calcium-barium alloys ("Frary" or "Ferry" metal) are used for bearings, and alloys of barium ("Baral" or "Barmag") with aluminium or magnesium, containing 25 to 50 per cent of barium, are now on the market. Nickel-barium alloys, with 0.2 per cent barium, are highly corrosion-resistant to hot gases and have been used in sparkplug electrodes.

Canada has been using about 2,500 tons of powdered barite a year, most of which, prior to the war, came from the United States and Germany. This relatively small tonnage gave little encouragement to the establishment of a domestic industry, particularly as the material in many favourably-situated deposits either requires beneficiation to meet trade specifications or is off-colour. Transportation and high freight rates to consuming centres have been handicaps in the case of certain other deposits carrying better grade material. Recovery of barite from mill tailings of plants treating sulphide ores, fluorspar, etc., is not economical.

Most of the domestic production of barite, which, until 1941 was small, has been custom-ground, chiefly by Pulverized Products Limited, 4820 Fourth Avenue, Rosemount, Montreal. The demand for ground barite was active in 1941, and is likely to be soon increased by the substitution of barite for zinc oxide and lithopone, due to recent priorities in the use of zinc.

Barite is a relatively low-priced commodity. Using the American trade as an index, market quotations in December, 1941 were as follows: crude ore, $6 to $8 per long ton, according to grade, f.o.b. mines; prime white, ground, bleached and floated, $23 to $25, f.o.b. Missouri. Canadian quotations were $7 to $10 per ton for good white crude, f.o.b. mines, depending on rail-haul; $40 to $44 for domestic ground; and $50 for prime white imported ground.

Tariff:

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 crude barite and $7.50 per ton on ground or otherwise manufactured material.

Witherite:

Commercial deposits of witherite, the only other ore of barium, are rare, and no occurrences of economic value are known in Canada. Most of the world supply has come from England, but war demands have seriously restricted supplies for American use, and additional sources are being sought on this continent. American imports of witherite in 1940 were 3,500 tons. Interest in witherite (barium carbonate) has been increasing, chiefly for use in the production of barium nitrate, used in priming mixtures for incendiary bombs. It is used in industry chiefly as an addition to heavy clay products and to mortar, in which it combines with soluble sulphates and prevents the formation of the unsightly white efflorescence known as "scumming". It is used also as a carburizing agent in the case-hardening of steel, as a water softener, and in certain kinds of glass.

The Bureau of Mines at Ottawa, would be glad to receive samples from Canadian sources, of mineral believed to be witherite, together with details of the locality of the occurrence, extent of deposit, etc.

United States quotations for ground, 90 per cent grade witherite in December, 1941 were $43 per ton: Canadian quotations were $55 to $70.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

BENTONITE IN 1941

Ores Mined and Producing Localities:

Bentonite, mainly of the highly-colloidal, "swelling" variety, is widely distributed over large areas of the Prairie Provinces, where it occurs at several horizons in the Upper Cretaceous sediments. The more important known deposits are exposed mainly in areas dissected by drainage channels where they show as beds in the slopes bordering valleys, and in the sides or on top of small buttes in typical "bad-land" topography. Thus, many of the chief exposures are found in the Red Deer Valley section of Alberta; over a wide area in southern Saskatchewan; and in the district around Morden, in southern Manitoba. One lower-lying bed occurs as a persistent parting in the No. 1 or main coal seam mined at a number of points in the Drumheller district, Alberta, as well as near Cluny, farther east. Other exposures exist in the Edmonton region, Alberta, and farther west, on McLeod river, near Edson. In British Columbia, a deposit of unusual thickness occurs in Tertiary beds near Merritt and at Princeton.

Several of the above occurrences have been mined on a small-scale, but the total production to date is comparatively small. Most of the output has been derived from the Drumheller area in the Red Deer Valley, Alberta, and from the Morden area, in Manitoba.

Operations in the Drumheller field were commenced in 1937, and most of the clay is used for oil-drilling in Turner Valley. Part of the output is processed in a plant in Calgary operated by Calgary Mud Company, 510 Lancaster Building, and part by Mineral Sales, Limited, 8th Avenue, West, Calgary, which in 1941 acquired the plant at Longview, Alberta, formerly operated by Messrs. Bryden and Nelson. The material processed in Calgary is marketed under the trade name "Altamud", and that processed at Longview is offered as "Viscolite". Total shipments by Drumheller and district producers to the end of 1941 amounted to about 4,500 tons, most of which was supplied by Gordon L. Kidd, of Drumheller to Calgary Mud Company, which shipped 935 tons in 1941. The remainder came from coal mines of Acme Coal Company, at East Coulee, and Wayne Coal Producers Association, at Wayne. The latter firm was inactive in 1941 and the former reported sales of 382 tons, at a price of $4.50 per ton f.o.b.

The bentonite deposits at Morden first attracted attention about 1934, and occasional small shipments were made, mostly to the foundry trade in Winnipeg. Pembina Mountain Clays, Limited, 915 Paris Building, Winnipeg, incorporated in 1940, has since erected a small drying and grinding plant in Winnipeg to supply foundry clay and the company is engaged also in the production of clay for the packing house and oil refining industries. The bentonite of the Morden area possesses high bleaching power in its natural state, without activation. It is planned to undertake activation in 1942 for the production of a clay of the Super Filtrol type. Sales in 1941 totalled 593 tons, 196 tons of which was foundry clay and 377 tons bleaching clay. Tests in the Bureau of Mines laboratories at Ottawa on Morden bentonite have shown that for foundry work the clay is equal, if not superior to the bentonite imported for this purpose from Wyoming in the United States. These results have been confirmed by similar tests made in England at Sheffield University.

Production and Trade:

Production of bentonite in Canada in 1941 was 2,172 tons, valued at $7,830, compared with 1,469 tons, valued at $4,488, in 1940.

No world figures of bentonite production are available. The United States supplies most of the material and its exports include ground natural clay for foundry and other industrial uses and activated clay for bleaching. American sales in 1940 reached a record of 251,000 short tons, valued at $1,919,461. About one-half of the output came from an area in adjoining sections of Wyoming and South Dakota, which furnishes a highly colloidal clay used largely for foundry work, oil drilling, water-sealing, etc.; other important producers are California, Mississippi, Texas, and Utah.

Canada exports little or no bentonite. Substantial quantities of activated clay of the Filtrol type are imported from the United States for bleaching in oil refineries and for packing-house products and possibly also some ground natural bentonite for similar use. Considerable quantities of American ground bentonite for foundry use and for other minor industrial purposes are also imported. Imports of activated clay, for oil refining, in 1941, were valued at $321,028, with no record of quantity.

Market and Prices:

About 38 per cent of the sales in the United States in 1940 was used for oil bleaching, mostly after acid activation; 18 per cent in drilling muds; and 30 per cent in foundry work. A large part of the clay used in the activated form is obtained from Mississippi.

Bentonite has a variety of minor industrial uses, most of which call for the colloidal, or "swelling", type, which is employed as an emulsifying agent in asphaltic and resinous compounds; in soaps and detergents; in various cosmetic and pharmaceutical preparations; as a suspending, spreading, and adhesive agent in horticultural sprays and insecticides; as a plasticizing ingredient in ceramic bodies, slips, and glazes, and in plasters; to improve the flow and workability of concrete; in cement manufacture; and in the clarifying of wines, vinegar, etc. Increasing amounts are being used for water sealing, to stop seepage through or around dam abutments, reservoir walls, the sides of irrigation ditches, and structural foundations, and as a coagulant in clarifying the water used in paper mills and sewage disposal plants, and to remove turbidity in domestic and industrial water supplies. Research on the production of a mica substitute from bentonite films was continued, but the product ("Alsifilm") is still in the development stage. Some micron-size material is used in paper coatings.

Canada probably possesses ample reserves of bentonite of foundry quality to supply domestic requirements, but freight rates to the main consuming centres have proved an obstacle to development in the face of low-priced American clay.

Wyoming dried and granulated clay sold in 1941 for $7.50 per ton, f.o.b. mines, in bulk, and air-floated 200-mesh material for $9.50 bagged, whereas similar material from Alberta has been quoted at $38. Selected, air-floated Wyoming clay was priced at $26 per ton f.o.b. Chicago. Freight rates from Wyoming points to Montreal are about $13.50 per ton. Imported activated (Filtrol-type) bentonite in 1941 cost $75 to $80 per ton, in carload lots, delivered eastern Canadian points, while American natural bleaching clay from Texas was quoted at $25 per ton laid down.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

BERYL IN 1941

Ores Mined and Producing Localities:

Beryl, a silicate of aluminium and beryllium, at present the only commercial source of beryllium, usually contains from 10 to 12 per cent of beryllium oxide which corresponds to 4 to 4.5 per cent of metallic beryllium. It occurrs in pegmatite dykes, mainly in the form of disseminated crystals, and the beryl sold is a by-product from the mining of these dykes for their feldspar, lithium minerals, or mica. World output is relatively small and comes mostly from the United States (South Dakota, Colorado, and New England), India, Argentina, Brazil, and South Africa. Known world reserves, however, are believed to be capable of meeting a considerable increase in the demand.

Known occurrences of beryl in Canada include a deposit in Lyndoch township, Renfrew county, Ontario, and several scattered occurrences in the Pointe du Bois district, southeastern Manitoba.

Canadian Beryllium Mines and Alloys, Limited, 901 Royal Bank Building, Toronto, has done some surface work on the deposit in Lyndoch township and has stock-piled a few tons of cobbed beryl crystals, but the mine was inactive during most of 1940 and throughout 1941. The pegmatite contains small amounts of columbite and certain other rare-element minerals. Some small shipments of feldspar have been made from the property.

In Manitoba, beryl occurs mainly as scattered crystals in certain pegmatite bodies that have been worked for either feldspar or lithium minerals in the Winnipeg River and Bird River areas. There has been no production aside from a small amount of clear, glassy material used for cutting into gem stones, for the Winnipeg jewellery trade. Mobirk Beryllium Mining, Limited, Victory Building, Toronto, incorporated in 1940 to develop five groups of claims in the Shatford, Bernic, and Cat Lake areas, reported in December, 1941 that it had placed parties in the field to commence operations. Plans call for the building up of a stock of beryl for the production of beryllium oxide in a plant to be located in Winnipeg.

Beryl-bearing pegmatites, containing lithium minerals, occur in an area lying about 20 miles northeast of the Yellowknife camp in the Northwest Territories. Occurrences of beryl are also known in the Rainy River and Patricia districts, Ontario, and in northern Quebec. None of these occurrences, however, is of particular economic interest at present.

Production and Trade:

There is no recorded Canadian production of beryl. The only known shipment consisted of about 2 tons, which was made about ten years ago and for experimental purposes only. There are no records of any Canadian imports of beryllium or its compounds.

There are no figures of world production of beryl. The United States is the chief consumer for use in the production of beryllium metal and alloys, and of beryllium oxide and other salts, and the consumption in that country is increasing steadily. The production, although small, is increasing, and sales in 1941 of the metal and of the alloys and compounds are estimated to have exceeded $1,000,000 in value Adequate supplies are available in the United States, and part of the imports are doubtless used to build up stocks.

Argentina and Brazil appear to be the most promising world sources of the mineral. Mines in Cordoba and San Luis provinces, Argentina, shipped 753 tons in 1939 and 520 tons in 1940. Brazil exported 1,47[illegible] tons of beryl in 1940, of which 418 tons went to the United States. Under an agreement concluded in 1941, the United States contracted to purchase the entire Brazilian production of beryl for the next two years.

Uses:

Beryllium-copper is still the leading alloy of beryllium in the United States, but increased interest is developing in the possibilities of light alloys of beryllium-aluminium for aircraft use. Several beryllium salts are on the market, the chief of which is the oxide, used as a super-refractory in crucibles and in insulators. It is used also as a filament coating in lamps; in fluorescent lighting tubes; for electrodes in electron tubes; as a cathode heating element in radio tubes; in electric unit heaters, where the resistance wire is embedded in the material; and as a lining in coreless induction furnaces to replace magnesia as a radiation shield around graphite crucibles. Ground beryl is used as a batch ingredient in sparkplugs and other ceramic specialties, to which it imparts high electrical and impact resistance and transverse strength. The present consumption for such uses is estimated at about 100 tons a year. Beryllium compounds give chrome-green glazes at cone 12.

Heavy beryllium-copper alloys continue to be used mainly in the general industrial field for small springs in business machines, pressure gauges, valves, electric contacts, etc., and in precision control instruments of various kinds. For such uses, the alloy is of value because of its exceptional resistance to fatigue and stability, coupled with resistance to corrosion, wear, and change of volume under load. Appreciable quantities of the alloy are also used in making beryllium-copper tools, which reduce fire hazard from sparking. A recent development is the use of beryllium-copper as the metal for cast-set bits and reaming shells for diamond drilling. The alloy used has a low melting point and has the trade name "Vankolite".

Two main classes of such alloys are on the market, mainly those containing 1.75 to 2.25 per cent of beryllium which are used for strong, heat-treated castings having tensile strengths up to 180,000 pounds a square inch, and those with only 0.05 to 0.5 per cent of beryllium, but with the addition of nickel, cobalt, or chromium. A typical cobalt-beryllium alloy contains 2.4 to 2.7 per cent cobalt and 0.38 to 0.5 per cent beryllium, whereas the chromium-beryllium series contain 0.35 to 0.5 per cent chromium and 0.07 to 0.12 per cent beryllium. These alloys have been developed in an effort to lower base prices and to so encourage the wider use of beryllium. Although not as strong or corrosion-resistant as the first class of alloys, these low-beryllium alloys have higher electrical conductivity and more uniform physical properties, one important use for them being in flash-welding.

The potential importance of beryllium-copper alloys for defence purposes has recently aroused considerable interest, and they are already specified for an increasing number of military uses. The alloy is claimed to exhibit remarkable resistance to wear and change in volume when subjected to rubbing loads under heavy pressures, and is used for non-magnetic ball bearings, tappet roller bearings, and bushings. Further recently developed uses are for fuse-springs in shells, and for solderless connectors and spring terminals in the automobile industry. Beryllium-nickel master alloys containing 12.5 per cent beryllium is being sold in powder or ingot form by Metal Hydrides, Incorporated, of Beverly, Massachusetts, a subsidiary of Ventures, Limited.

Recent tests show that pure beryllium is a remarkable conductor of sound - 2½ times that of steel. It is a good reflector of white light, has a permanent surface, a low density (1.84), and has suitable electrical and thermal conductivity properties, all of which suggest that it would be of value in the making of instrument mirrors.

A reported new use for beryllium acetate is as a coagulating, hardening bath for sodium alginate, a new form of textile fibre made from seaweed.

Market Conditions:

Beryllium Corporation of Pennsylvania, Reading, Pennsylvania, and Brush Beryllium Company, 3714 Chester Avenue, Cleveland, Ohio, remain the most important world consumers. Cooper-Wilford Beryllium Limited, of Newton Falls, Ohio, and 33rd and Arch Streets, Philadelphia, a company recently formed to engage in the production of light beryllium-aluminium alloys ("Beralite") for aircraft use, advised the Bureau of Mines early in 1941 that it might be in the market for supplies of beryl, and also that it was conducting research on flotation methods of concentrating low-grade beryl ores. A company is reported to have been organized in Argentina to produce mixed beryllium oxide-carbonate as a base material for the extraction of beryllium metal from domestic ores. This product, which is made by a newly-developed (Gourden) process, is stated to be of high purity and to contain 80 per cent of beryllium oxide, the difference being carbon dioxide.

In respect to the present and prospective market for beryl, the United States Bureau of Mines made the following comment (Minerals Yearbook, 1940): "A deterrent to more rapid expansion in the utilization of beryllium has been doubt among consumers of the metal and its alloys as to the adequacy of beryllium ore supplies. Actually, the offerings of beryl have greatly exceeded demand, and now both leading American beryllium companies are confident that as the industry grows ore supplies will grow proportionately. Although several substantial deposits have been reported that are alleged to contain enough beryl to permit being worked for beryl alone without depending on joint products (feldspar, gem materials, or other minerals) to carry the expense of mining, it is generally conceded that supplies must be drawn from various States and perhaps from South America and other foreign countries as well. Information available to the Bureau indicates that domestic production of beryl has ranged in recent years from less than 100 tons to a maximum of not more than 200 tons a year, whereas imports have been increasing. As a good deal of the apparent supply has gone to build up stocks, domestic consumption in making beryllium oxide and alloys has hitherto never exceeded about 300 tons". It would appear, therefore, that even a contingent increase in demand for beryllium products for war purposes is not likely to occasion any marked shortage of beryl or increase in the price of $30 to $35 per ton f.o.b. currently offered.

Prices:

Nominal quotations for standard beryl in 1941 remained substantially unchanged, at $30 to $35 a short ton, f.o.b. mines, of $40 to $45 at consuming plant, for 10 to 12 per cent BeO material. The blockade of Germany and Italy, however, diverted South American supplies to the United States, and with the surplus offerings resulting therefrom, sales were as low as $30 to $35 a ton ex dock, Atlantic ports. Special, glassy, crystalline beryl, which usually contains more beryllium oxide than normal standard grade and is preferred for ceramic use, commands a premium and sells as high as $50 a ton f.o.b. shipping point.

The price of beryllium-copper master alloy remained at $15 a pound in 1941, the base price of bar, strip, and sheet for fabrication being $1.05 a pound for metal with a beryllium content of 2 per cent. Rod sold at $1.23 a pound. One ton of beryl, worth about $50 a ton delivered, contains, on the average, enough beryllium metal to make about 3,000 pounds of beryllium-copper alloy.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

BITUMINOUS SAND IN 1941

Ores Mined and Producing Localities:

Deposits of bituminous sand occur along the Athabaska River between the twenty-third and twenty-sixth base lines, in the northern part of the province of Alberta, and extensive exposures may be seen along both sides of the river and certain of its tributaries. Detailed field investigations since 1913 by the Bureau of Mines have made it clear that these deposits constitute a vast reserve of bituminous material available for use as asphalt or for conversion by modern refining methods to more valuable petroleum products. Nothing commensurate with the immensity of this resource has yet been attempted in the way of production, but demonstration pavements have testified to the excellence of the sand as a paving material and much work has been done on the problem of the separation of the bitumen from the sand and on the production of higher grade products.

Since the provision of railway facilities to McMurray, serious efforts have been made for several years past to work the sand in the vicinity of McMurray where the more accessible and conveniently excavated sites are to be found.

Between 1927 and 1930, a total of 2,000 tons was shipped for laboratory investigations, and a further 3,000 tons was used in the construction of demonstration pavements and road surfaces. During 1931 to 1938 International Bitumen Company processed small amounts of bituminous sand at its plant at Bitumont, Alberta, producing asphalt for paving and roofing and 37,500 gallons of fuel oil. Fuel oil was disposed of to mining companies at Lake Athabaska. Roofing asphalt was shipped to Crown Point, Indiana; and Calgary, Alberta; paving asphalt to Edmonton and Banff, Alberta. The International Bitumen Company has not operated its plant since 1938.

During 1941 Abasand Oils, Limited completed its 400-ton a day separation and refining plant on Horse river near McMurray, and operated for six months until fire destroyed the separation plant and power plant. Commercial operation started on May 19th and continued until the fire on November 21st.

Production:

About 25,600 tons of sand were mined and processed and 753,270 gallons of crude produced. Refined products made during this period were 41,265 gallons gasoline, 70,770 gallons diesel fuel, 137,550 gallons fuel oil, 375,235 gallons of residuum and 319 tons of coke. No asphalt was made as the capacity of the plant was used in meeting orders for diesel fuel and fuel oil. Rebuilding of the burned units is well advanced and it is likely that operations will be resumed by the end of May, 1942. The units will have a capacity of 600 tons a day, which is 50 per cent larger than that of the former units.

Investigations:

Prior to 1934, the Bureau of Mines, Ottawa, conducted a comprehensive investigation of these asphaltic deposits. 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, have also been 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, 1942.

CELESTITE IN 1941

Ores Mined and Producing Localities:

Several occurrences of celestite (strontium sulphate) of possible economic interest are known in Canada, and in 1920-21, some ground material produced from a deposit in Bagot township, Ontario, was sold to the paint trade. The material from this deposit is coarsely-fibrous in character and is not very pure, containing about 18 per cent of barium sulphate. It is accordingly not favoured for chemical use, but is regarded as suitable for paints and general filler or loader use. The old pit was pumped out in 1941 and a few tons of ore were scaled down from a small drift. This, along with some stockpile material was shipped to Montreal for grinding. The product was used in the paint trade as a substitute for barite, but is reported to have found little favour, and no further work was done. Celestite of similar character and analysis occurs at some of the old fluorspar mines of the Madoc area in Ontario, and part of it might be recoverable from the waste dumps.

Celestite, analysing 98 to 99 per cent strontium sulphate occurs as a small vein of coarse platey crystals in Lansdowne township, Ontario and some of it was mined many years ago. Calcite appears to be the only associated mineral and recovery of a concentrate of high purity should be easily made by jigging and tabling. In the event of a war shortage of imported strontium compounds, this deposit probably offers the best possibility for supplying the deficiency, though the indicated tonnage is small. Celestite similar to this occurs in a small galena prospect shaft in Fitzroy township, in Ontario, analysis of selected material showing 93 per cent strontium sulphate. A moderate supply might be obtained from this source, but the ore would probably need to be concentrated. No important deposits of strontianite (strontium carbonate) are known in Canada.

Production and Trade:

There has been no recorded production of celestite in Canada for a number of years.

World production of strontium minerals is estimated at 5,000 to 7,000 tons a year. England is the principal source of supply, with Germany next. The United States produced about 350 tons in 1940, exclusive of celestite used for oil-drilling. Important deposits are reported to occur in India and Newfoundland, but there has been no production from these sources as yet.

Market and Trade:

Celestite is the principal source of strontium used in the manufacture of the various strontium salts, and strontianite a less common mineral, is used for the same purpose. The nitrate, carbonate, and hydrate are the most important of the strontium compounds used in industry and medicine. Strontium nitrate is employed mainly in pyrotechnics, for fireworks, railroad signal flares, and military flares and rockets, to which it imparts the characteristic strong red flame colour of the element. Other strontium compounds are employed in tracer bullets and shells. The hydrate is used chiefly in the refining of beet sugar by the Scheibler process. In North America, however, sugar is refined mainly by the Steffens, or lime, process. The carbonate is reported to be used to some extent as a batch ingredient in the manufacture of certain kinds of glass, glazes, and enamels, and as a fluxing and desulphurizing and dephosphorizing agent in iron and steel. Strontium chloride powder finds limited use in refrigerators working on the solid absorption principle. Ground celestite is used in fairly large quantities for purifying caustic soda in the rayon industry, and some impure material has been ground and employed as a barite substitute for weighting oil-drilling muds. Interest has also been shown in the possibilities of the carbonate and the sulphate in glass and white wares.

Strontium metal, made from either the natural sulphate or carbonate, is used in limited quantities in certain alloys, mainly of copper, tin, lead, zinc, and cadmium.

As yet, there is no serious shortage of strontium minerals in North American and supplies of ore from Great Britain are available. The United States small production was supplemented by imports amounting in 1940 to 2,750 tons, valued at $28,686, most of it from England. Early in 1941 it commenced to import from a new source in Mexico.

Trade in strontium minerals is mainly confined to a few importer-dealers, with sales based on individual contract. Price quotations in American trade journals in December 1941 for powdered celestite, 92 per cent grade, remained unchanged at $45 a ton; crude domestic ore sold at $15 to $20 a ton f.o.b. mines. Crude lump strontianite, 84 to 86 per cent grade, was quoted at $55 a ton, while the manufactured carbonate of 90 per cent purity sold at 15 to 18 cents a pound. Strontium nitrate, one of the chief commercial salts, remained at about 8 cents a pound.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, ONTARIO, MARCH, 1942.

CEMENT IN 1941

Ores Mined and Producing Localities:

Portland cement, the principal raw materials for which are limestone and clay, is manufactured in five provinces of Canada. In addition to the standard or ordinary variety of Portland cement, several other varieties, including high-early-strength, alkali-resistant, and white cement are now made in this country, the last named variety, however, being made from imported clinker.

Canada Cement Company, Limited, operates plants at Hull and Montreal East in Quebec; at Port Colborne and Belleville in Ontario; at Fort Whyte, Manitoba; and at Exshaw, Alberta. 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, making white cement, cement paints, etc., from imported clinker. British Columbia Cement Company, operates at Bamberton, British Columbia. The total rated daily-capacity of all plants at present is about 35,000 barrels, (a barrel of cement weighs 350 pounds net.) but this will be increased in 1942 when equipment now being installed is in operation.

When the change over from the "dry" to the "wet" process, now underway at the Exshaw plant of Canada Cement Company, is completed, all Canadian plants making cement from domestic raw materials will be using the wet process. Remarkable uniformity in the chemical and physical properties of the standard variety of cement is achieved throughout the country as the result of close technical control and improvements in plant equipment.

A new 325-foot kiln is being installed at the Montreal East plant of Canada Cement Company. A new pack house with a dust-collecting system, and storage silos having a capacity of 350,000 barrels of finished cement were built in 1941 at the Hull plant of this company.

Froth flotation is now used in a number of plants in the United States and other countries to remove certain materials, principally excess silica and mica, from limestone. The successful adaptation of this process to the beneficiation of cement raw materials has permitted the utilization of limestone deposits, which, though advantageously situated are not sufficiently pure in their natural state for cement manufacture.

Production and Trade:

Production of cement in 1941 was 8,368,711 barrels valued at $13,063,588, compared with 7,559,648 barrels valued at $11,775,345 in 1940. This marked gain in production was due mainly to the large increase in industrial construction in connection with war activities. Most of the cement produced is used within the Dominion, but there is also a small import and export trade.

Exports of cement during 1941 amounted to 310,870 barrels valued at $517,762, compared with 300,000 barrels, valued at $414,442 in 1940.

Imports of cement totalled 11,870 barrels valued at $59,162, compared with 13,214 barrels valued at $69,821 in 1940.

Market and Prices:

Cement is one of the most important of the structural materials and finds use in all construction work, such as bridges, dams, highways, foundations or buildings. In addition, 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, 1939, 1940, and 1941 were as follows:

	1937	1938	1939	1940	1941
Quebec	$1.37	$1.35	$1.33	$1.41	$1.43
Ontario	1.38	1.40	1.43	1.49	1.46
Manitoba	2.27	2.28	2.25	2.25	2.21
Alberta	1.99	2.01	1.97	2.01	2.00
British Columbia	1.81	1.87	1.91	1.94	1.97

The average selling price for Canada in 1941, was $1.56 a barrel.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

CLAYS AND CLAY PRODUCTS IN 1941

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, namely; production from domestic clays, which includes the production of building brick, structural tile, drain tile, roofing tile, stoneware, sewer pipe, pottery and refractories; and production from imported clays, which includes the manufacture of electrical porcelain, sanitary ware, sewer pipe, tableware, pottery, ceramic floor and wall tile, and various kinds of fireclay refractories. The gross value of ceramic products manufactured from Canadian clays (including sales of domestic clays) was $7,486,992 in 1941, compared with $6,344,547 in 1940. The total value of ceramic products manufactured from imported clays was $4,923,148 in 1941, compared with $4,356,406 in 1940.

Compared to world production, the value of clay products manufactured in Canada is small, and large quantities of the various kinds of ceramic products are imported annually. The total value of manufactured ceramic products imported into Canada in 1941, was $13,109,599, compared with $9,677,723 in 1940, and $6,992,382 in 1939.

Common Clays:

Common clays suitable for the production of building brick and tile are 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 $5,120,226 in 1941, compared with $4,359,505 in 1940.

Stoneware Clays:

The largest producing area in Canada of stoneware clay or semi-fireclays is in the vicinity of Eastend and Willows, Saskatchewan. Large quantities of the clays from the area are selectively mined and shipped to Medicine Hat, Alberta, where, owing to the availability of cheap gas fuel, they are used extensively in the manufacture of stoneware, sewer pipe, pottery, tableware, etc.

Stoneware clays and moderately refractory fireclays occur near Shubenacadie and Musquodoboit, Nova Scotia. Some of the Musquodoboit clay is used for the production of pottery, but it has not been extensively developed for ceramic use.

Stoneware clays or low grade fireclays occur near Williams Lake, and Chimney Creek Bridge in British Columbia; in the Cypress Hills of Alberta; and near Swan River, Manitoba, but as they are difficult of access, there has been little or no development.

The value of stoneware articles (sewer pipe, pottery, etc.) produced in Canada from domestic clays in 1941 is reported to have been $1,912,292, compared with $1,627,055 in 1940. Stoneware products are also manufactured by a few plants from imported clays. Production figures are not given.

Fireclays:

Two large plants and a few small plants manufacture fireclay refractories from domestic clay. At one plant, about 50 miles south of

(*) Note: Such ceramic products as glass, cement, and artificial abrasives are not included in this review.

Vancouver, a high grade, moderately plastic fireclay is extracted by underground mining from the clay beds in the Sumas Mountain, and the plant manufactures firebrick 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, Nova Scotia, for refractory purposes and some of the Musquodoboit clay is used for stove linings. Almost all other manufacturers of fireclay refractories (including high temperature cements, plastic refractories, etc.) use imported clay.

The value (sales) of the refractories produced in Canada from domestic clays in 1941 was $370,206, compared with $250,652 in 1940; the value of refractories produced from imported clays is reported to have been $893,544 in 1941, compared with $771,094 in 1940.

Imports of firebrick made from fireclay were:

	1940 Value	1941 Value
Brick, fire, other, valued at not less than $100 per M rectangular shaped; the dimensions of each not to exceed 125 cubic inches, for use exclusively in the construction or repair of a furnace, kiln, etc.	$ 96,157	$ 115,241
Brick, fire, n.o.p. for use exclusively in the construction or repair of a furnace, kiln, or other equipment of a manufacturing establishment.	$ 708,210	$2,010,306
Firebrick, n.o.p.	$1,263,645	$1,372,304

<u>China Clay (Kaolin), Ball Clay, Etc.</u>:

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. The large-scale operation of this deposit has been under consideration for a number of years and a company was organized a few years ago to extract the kaolinized material by underground mining, to refine it into high grade china clay, and to recover washed silica sand as a by-product. Following its reorganization as Canada China Clay and Silica Products, Limited, the company constructed a modern plant and is equipped to carry out the washing process in accordance with the most up-to-date and scientific methods. The project is of special interest in view of the hazards involved in obtaining shipments of china clay from the United Kingdom for the paper, rubber, ceramic and other industries. The Canadian production of grades of silica sand suitable for the glass trade has also assumed much greater importance, now that the Belgian source of supply has been cut off. Canadian Kaolin-Silica Products' property at Lac Remi, Quebec, which was operated chiefly for the production of high grade silica sand, has been idle since the destruction of the plant by fire a few years ago.

Several other interesting occurrences of kaolin, which is rather rare in Eastern Canada, have been discovered in Quebec in recent years. One of these, located on Thirty-One Mile Lake, near Point Comfort, Blake county, is being explored and some areas in the deposit yield china clay of a high grade in the crude state. The extent ~~of~~ and uniformity of the deposit is not as yet proved but its possibilities as a source of high-grade fireclay are receiving attention. Kaolin has also been discovered near Brebeuf; on Lake Labelle; and near Chateau Richer in Quebec, but there has been little exploratory work on the deposits.

Important deposits of high-grade, plastic, white-burning, and buff-burning clays occur on the Mattagami, Abitibi, and Missinaibi rivers in northern Ontario. Some of these can be classed as china clays, others as fireclays, and still others as ball clays. The deposits have attracted considerable interest in recent years but efforts to develop them have been handicapped owing to the distance of the deposits from industrial centres, and to the lack of transportation facilities.

In British Columbia, along the Fraser river, about 25 miles above Prince George, is an extensive clay deposit parts of which yield a high grade of china clay. As china clay from England is difficult to obtain on the West Coast owing to shipping risks, consideration is being given to the possibility of using material from this deposit as a source of china clay suitable for the pulp and paper trade.

In the manufacture of porcelain, sanitary ware, dinner ware, ceramic floor and wall tile, etc., china clay from England has been used almost entirely. Separate production figures are not published for these classes of ceramic ware as there are only one or two producers in each case. Canada also imports large quantities of china clay for use in the production of paper; in the rubber industry; and for other industrial purposes. Imports of china clay in 1941 were valued at $494,928 compared with $483,399 in 1940.

Ball clays of high bond strength occur in the "White Mud" beds of southern Saskatchewan but as yet they have not been developed.

Bleaching Clays:

Activated clays for oil bleaching are largely imported. The value of such clays imported into Canada by oil refineries in 1941 was $321,028, compared with $196,467 in 1940. Fuller's and infusorial earths are also imported for use in sugar refineries, vegetable oil mills, etc. Imports into Canada in 1941 of Fuller's Earth were valued at $60,193, compared with $44,540 in 1940. The imports in 1941 of infusorial earth were valued at $229,555, compared with $133,876 in 1940.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

DIATOMITE IN 1941

Material Mined and Producing Localities:

Diatomite consists of 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.

For many years the International Diatomite Limited, Tatamagouche, Nova Scotia, has been the principal producer but operations in the ponds near New Annan ceased in the fall of 1940 and only a few tons were sold from stock. The 1941 principal producers were G. Wightman, from a deposit on Digby Neck, Nova Scotia and to a lesser extent L. T. Fairey of Vancouver, from Quesnel in the Cariboo district of British Columbia.

A small amount of prospecting work was carried out on behalf of J. A. Morton of Montreal on deposits near Pocologan owned by W. M. Campbell of St. John, New Brunswick. A small amount of prospecting was done in the Gravenhurst area in Muskoka district, north of Toronto, Ontario.

Production and Trade:

Production in 1941 was 325 tons and sales 322 tons, valued at $9,835, compared with 248 tons valued at $7,947 in 1940.

Prior to the war diatomite was being produced by about thirty countries, but outside the North American continent statistics for the past three years are not available. The United States is by far the world's largest producer followed in order by Denmark, Germany, Japan, Algeria and Northern Ireland. The United States output which is of very high quality, was about 125,000 short tons in 1941.

No Canadian diatomite was exported in 1941. Although there is a large demand in England for insulation and filler material, the difficulty in shipping, high costs and relatively low price of the English and Irish diatomite prohibit the export of the home product to England. Imports into Canada were about 6,000 tons, almost all from California and a little from Oregon, United States, compared with 4,980 tons valued at $164,340 in 1940.

Consumption in Canada was approximately 6,350 tons, a 25 per cent increase over 1940. This was largely due to the increase in the use of diatomite bricks and mortars required for the insulation of the numerous furnaces now in operation in plants making war materials.

Uses:

About 75 per cent of the diatomite now being consumed in Canada is in the form of filter-aids, mainly in the refining of cane sugar, 20 per cent is used for insulation, and the remainder is absorbed as a filler, concrete admixture, silver polish bases, and in chemicals.

Market Conditions and Prices:

Deposits containing medium quality diatomite are very common in some parts of Canada. Owing, however, to United States 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.

Indications are that not more than 25 per cent of the calcined material produced from the best quality Canadian deposit so far discovered, can be made into an efficient filter-aid that can compete with the imported product. Therefore, unless the remaining 75 per cent or more of the non-filter grades produced can be sold, the cost of producing the filter-aid alone would be too high to be commercial. At present, the Canadian consumption of all non-filter grades is less than 800 tons annually, mainly in the form of diatomite insulation bricks, the greatly increased production of which by Canadian firms is necessary before the Canadian diatomite industry can be profitable.

The present price in Canada varies from $26.00 to $75.00 per ton for insulation and filtration; up to $200.00 in small lots for material suitable for polishes; imported insulation bricks vary from $85.00 to $140.00 per 1,000, according to grade and density.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

FELDSPAR IN 1941

Ores Mined and Producing Localities:

Feldspar has been mined in Canada since 1890. Most of the production has been of high-potash grade, and "No. 1 Canadian" has long been a standard in the ceramic industry as denoting prime quality for porcelain products. Some soda spar also is mined, and is sold for blending and for use in scouring preparations and soaps of the "Bon Ami" type.

Most of the production comes from adjacent sections of western Quebec and eastern Ontario, generally in the Ottawa region, with lesser amounts from mines in Ontario as far west as the Parry Sound and Sudbury districts. Formerly, a considerable part of the supply came from a number of small, scattered, and often intermittent operations, but in recent years most of it has come from a few of the larger deposits, the production being about equally divided between Ontario and Quebec.

In Ontario, the large quarry of Bathurst Feldspar Mines Limited, in Bathurst township, Lanark county, is the chief source of supply. Output from Murchison township, in Nipissing district, has been increasing. J. G. Gole Mining Company, of Toronto, the chief operator in Murchison township, reported shipments totalling 2,297 tons in 1941, of which 1,355 tons was potash spar and 942 tons soda spar. A few cars of potash and soda spar were shipped from near Burk's Falls, in Parry Sound district.

Nearly all of Quebec's production comes from the Lièvre River area, north of Buckingham, in Papineau county, the main source being the Wallingford mine, operated by Canadian Flint and Spar Company.

Production and Trade:

Canadian feldspar production in 1941 was 28,114 tons valued at $246,951, compared with 21,455 tons valued at $187,623 in 1940. The total Canadian production from 1890 to the end of 1941 amounts to 822,000 tons valued at $5,620,000.

World production of feldspar in 1937 (1938-41 not available) amounted to about 500,000 tons, including china stone, a variety of granite used in place of pure feldspar. Canada was sixth on the list, with about four per cent of the total.

Exports of feldspar in 1941 were 12,926 tons, valued at $86,867, compared with 14,255 tons valued at $95,846 in 1940.

Canada exports far more spar than it uses, the shipments going chiefly to Consolidated Feldspar Corporation and Genessee Feldspar Company, both at Rochester, New York.

Imports of ground spar, all from the United States, were 751 tons, valued at $12,614, compared with 740 tons valued at $13,661 in 1940. Imports of crude feldspar, used for blending and for the manufacture of cleansers, were 50 tons, valued at $252, compared with 50 tons, valued at $673 in 1940.

Material for Canadian use is ground in mills operated by the following concerns:

Canadian Flint and Spar Company, Buckingham, Quebec.
Frontenac, Floor and Wall Tile Company, Kingston, Ont.
Bon Ami Company, Montreal East, Quebec.

The first two companies grind ceramic material while the Bon

Ami product is used in making scouring compounds. Canadian Flint & Spar Company expanded its grinding capacity in 1941 by the addition of a second Hardinge mill and air separator.

Owing to shortage of cargo space, shipments of crude and ground feldspar to Great Britain ceased in 1941. The first shipments from Canada to that country were made in 1940, following the cessation of Scandinavian supplies to the British market.

Market and Prices:

All of the feldspar used in industry is crushed or finely-ground material, usually prepared either in mills operated by producers of the crude mineral or in merchant mills supplied from independent mines. Some manufacturers of ceramic products mine and grind spar for their own use. Specially selected "dental spar", is used in the manufacture of artificial teeth.

By far the greater part of the feldspar production is used in the ceramic industries, of which the glass trade is the largest consumer, followed by pottery, enamel, and sanitary ware industries. In the United States, these industries used 98 per cent of total sales in 1940. Minor amounts are used in the manufacture of soaps and cleansers, abrasive wheels, and artificial teeth.

Domestic feldspar prices in 1941 were the same as in 1940. Crude No. 1 grade, both potash and soda spar, was quoted at $5.50 - $6.00, f.o.b. rail, for domestic mills and export. Ground spar, 200-mesh, sold at $16 - $18, and granular glass spar at $12, both f.o.b. mill.

Tariff:

Crude feldspar entering the United States pays a duty of 25 cents a long ton, the duty on ground feldspar being 15 per cent ad valorem.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

FLUORSPAR IN 1941

Ores Mined and Producing Localities:

Production of fluorspar in Canada has been relatively small, and intermittent, the total output from 1905 to the end of 1941 being approximately 60,000 tons, about half of which came from Ontario and the remainder from British Columbia. Most of the fluorspar mined in 1940 and 1941, came from the Madoc area, Hastings county, Ontario. No deposits of importance are known elsewhere in eastern Canada though there are scattered occurrences in Ontario and Quebec. In Nova Scotia, the mineral occurs in association with veins of barite in the Lake Ainslie district, Cape Breton, where a few hundred tons was produced in 1941. The Rock Candy deposit near Grand Forks, British Columbia, is the largest known occurrence of fluorspar in the Dominion.

Some fluorspar was mined in the Madoc district in the early years of the century, but the deposits first received serious attention during and immediately following the war of 1914-18, when a number of mines were opened, from which shipments totalling about 20,000 tons were made. From then until 1939, the output seldom exceeded 100 tons in any one year, and was obtained by pick-and-shovel methods at surface or by working over old waste dumps. With the outbreak of war, operations were resumed at several of the larger mines, following which shipments of about 8,000 tons, were made by the end of 1941.

Operations were started by Moira Fluorspar Mining Syndicate on the Noyes property in 1939 and a mill was built to beneficiate the ore, which, as in most of the other Madoc deposits, contains considerable calcite and barite. Some fluorspar was produced, but the venture was not a success and in 1940 the company transferred its operations to the nearby Perry mine. Work was suspended, however, before the mine came into production. In 1941, work was resumed on the Noyes mine by Gilman Exploration, Ltd., of Montreal, shipments of several hundred tons being made. In 1940 the Wallbridge mine was taken over by Dominion Fluorspar Company (Halliwell Gold Mines Ltd., of Montreal), which built a fair-sized plant, did some diamond drilling, and by the end of 1941 had shipped about 5,500 tons of ore. In 1940, Reliance Fluorspar Mining Syndicate of Toronto commenced operations on the Howard, or Hill, property, adjoining the Noyes mine, and continued work until September 1941, during which period it shipped 1,500 tons of ore. The company then moved its plant to the Perry mine, from which it shipped a few hundred tons before the end of the year. Charles Stoklosar, of Madoc, shipped a few hundred tons from material obtained at or near surface on several properties in the district.

The ores of the Madoc district and of the Lake Ainslie district, Nova Scotia, are intimate mixtures of fluorspar, calcite, and barite, and have proved difficult to beneficiate by concentration. In the Bureau of Mines laboratories at Ottawa it was found difficult to make a high-grade product without excessive loss in the middlings and tailings. Encouraging results were obtained, however, by the use of the Sink-and-Float method for the removal of limestone gangue in the coarse sizes. In concentrating these ores, the medium grade ($\frac{1}{2}$ inch to 1 inch), material is screened out and sweetened with clean, high-grade lump obtained by crude washing, cobbing, and picking of the screen oversize. The grade of the product has probably not averaged much above 60 to 65 per cent CaF_2. Such grade is accepted by the steel trade provided the barite content does not exceed 12 per cent (above which the sulphur introduced by this mineral becomes a factor), though shipments with a CaF_2 content of less than 85 per cent are penalized.

Nothing further was done in 1941 on the Clark fluorspar property in Cardiff township, Hastings county, Ontario, from which a small shipment of very pure spar was made in 1940, nor on the occurrence in Montbeillard township, Rouyn-Noranda district, Quebec, on which some work was done in 1940 by Cook Copper and Fluorite Corporation, Ltd.

The Rock Candy mine in British Columbia, operated by Consolidated Mining and Smelting Company between 1919 and 1929, has since been idle. Output reached an estimated total of 70,000 tons of ore, from which 30,000 tons of concentrate was recovered. Most of the production was used by the company to make hydrofluosilicic acid, for use in the electrolytic purification of lead at its Trail smelter. Sufficient by-product fluorine for this purpose is now recovered from the treatment of phosphate rock in the company's fertilizer plant at Trail. No information is available on ore reserves, but they are probably large.

Production and Trade:

Canadian fluorspar production and trade figures are not available for publication owing to the war.

World production of fluorspar has averaged about 500,000 short tons annually in recent years. United States and Germany together have supplied about 75 per cent of the total. The remainder has come mainly from France, the United Kingdom, Korea, Italy, Newfoundland, and the Union of South Africa. The United States produced 233,000 short tons in 1940, the highest since 1918 and an increase of close to 30 per cent as compared with 1939. Steps have been taken to increase production in Newfoundland, an important source of supply for the Canadian market. Canada in peacetime used from 12,000 to 15,000 tons of fluorspar a year, about half of it in the steel trade.

Market and Prices:

Fluorspar is a widely used mineral, but the steel industry is by far the largest consumer. Close to 73 per cent of output in the United States in 1940 was used in the steel industry; 15 per cent in the manufacture of hydrofluoric acid, and nine per cent in the enamel and glass trades. Fluorspar is used also in foundry work; in the making of cement, carbon electrodes, calcium carbide and cyanamid; in the reduction of aluminium, the refining of lead, and the treatment of various rare-metal ores; in the production of ferro-alloys; and as a binder in abrasives. Most of the hydrofluoric acid is used in the manufacture of artificial cryolite and of a wide range of organic and inorganic fluorine compounds. Its use in the making of organic refrigerants of the "Freon" (dichlorodifluoro-methane) type is increasing.

Clear, glassy, crystal fluorspar which is exceedingly rare and sells at about $1.00 an ounce, is used in optical instruments. Recently the tendency has been to supplant this material by artificial lithium fluoride, grown from a furnace melt, and now obtainable in crystals up to eight pounds in weight.

Standard fluxing gravel, or lump grade fluorspar for metallurgical use is usually sold on a specification of 85 per cent CaF_2, with not over 5 per cent silica. It should not contain more than 15 per cent of fines. American quotations in December 1941 for this grade were $23.00 per ton, f.o.b. mines, an increase of $1.00

to $3.00 a ton over 1940. Canadian (Madoc) fluorspar was reported to have sold in 1941 for $15.00 to $23.50 a ton, f.o.b. mines, for grades ranging from 60 to 80 per cent CaF_2. Glass and enamel grades call for not less than 95 per cent CaF_2, with a maximum of 3 per cent silica and 0.12 per cent iron (Fe_2O_3). The material must be in ground form in various mesh sizes, from coarse to extra fine. American quotations for this grade at the end of 1941 were $33.60 per ton, in bags, f.o.b. Illinois mines. Acid-grade spar, lump, gravel, and ground, has the strictest specification, minimum 98 per cent CaF_2, and not over 1 per cent silica. It sold in December, 1941 at $30.00 f.o.b. mines.

Tariff:

The duty on fluorspar entering the United States under the general tariff is $5.60 a long ton if it contains more than 97 per cent CaF_2; $8.40 a ton if it contains less than 97 per cent. Imports from Canada and the United Kingdom pay $4.20 a long ton ($3.75 a short ton) for above 97 per cent grade material. No duty is levied on fluorspar imported into Canada.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

GARNET IN 1941

Ores Mined and Producing Localities:

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 is a rather common mineral constituent of certain rocks distributed throughout the Dominion and it usually occurs as a garnetiferous-gneiss, large areas of which are known in parts of Ontario and Quebec. At present, however, little garnet is produced in the Dominion.

Operations in 1941 were intermittently carried out by the Canada Garnet Company near Labelle, Quebec and by a producer near River Valley, north of North Bay, Ontario.

Production:

A small tonnage of garnet rock was put through the Canada Garnet Company's mill and 60 tons valued at $423 was sold for sand blasting. About 42 tons were shipped from River Valley, Ontario. In 1940 about 88 tons valued at $629 was sold for sand blasting.

Between 90 and 95 per cent of the world output of garnet comes from the United States, Barton Mines Corporation, North Creek, New York, being by far the largest producer. Its product is regarded as the world standard abrasive garnet and its deposits are large. Total sales of the five active companies in the United States in 1941 amounted to 4500 tons, compared with 4716 tons, valued at $259,345 in 1940. A small amount of garnet inferior to that of the United States is produced in Spain. An effort is being made to develop a deposit in South Africa.

Attempts in the past to produce commercial garnet in Canada have failed owing to the small extent to which it is used; to the competition from high quality United States material; and to the fact that garnet possessing abrasive efficiency equal to that obtained in the United States has not as yet been found in sufficient quantities. Consumption in Canada has never been more than 150 tons of graded grain a year, all of which is supplied by the United States.

Aside from the United States, England is by far the leading consumer of garnet, but the amount used prior to the war was less than 800 tons a year.

Uses and Specifications:

Garnet, crushed and suitably graded as to size, is used for making abrasive-coated papers and cloth, which in turn are used mainly in the wood working (hard woods) and to a lesser extent in the shoe leather industries. As artificial abrasives rather than those made from garnet are used in the surfacing of metals, the marked increase in this work arising from the war effort has not affected activities in the garnet industry to any appreciable extent.

The specifications for garnet for use in the making of high quality abrasives are somewhat exacting. The individual crystals should be clear and free from embedded impurities and from minute fractures. They should be of a deep wine-red colour, and not smaller than pea size, walnut size or larger being preferable. The garnet should be tough, but should yield sharp and angular grains when crushed. The deposit should be extensive and the garnet content should not be less than 25 per cent. It should also be close to rail transportation and industrial centres. Few, if any, of the hundred or more garnet deposits so far examined in Canada fulfil all of these requirements. Minor uses for garnet or garnet rock, are for sand blasting and to a very small extent in the surfacing of plate glass.

Trade and Market Conditions:

Imports into Canada of prepared garnet grain suitable for "sand paper" manufacture are about 150 tons annually. Competition from United States producers and the high quality of their garnet have prevented exports of Canadian garnet to that country. Coated abrasive manufacturers in England would be glad to take Canadian garnet, provided it is up to the American standard and that a regular supply of this standard could be guaranteed over a long period, but they are not prepared to do so otherwise. Chalk flint, which is used to a large extent in England, is mined locally and, although it is not as good as garnet, it is much cheaper and could be substituted almost entirely, if necessary. As abrasives made from garnet are not used for war purposes, the British demand is not likely to increase as a result of the war. Competition from the artificial abrasives--silicon carbide, and oxide of alumina--is another serious factor in the marketing of garnet, the more so as the use of these abrasives has been extended recently to the wood working and leather industries, the two industries in which garnet abrasives were formerly used.

Prices:

The price in the United States of the best quality concentrate from which grain is prepared for abrasive papers and cloths ranges from $65 to $80 a ton f.o.b. mines and of graded grain, $90 a ton. Some sales of garnet fines for use in the surfacing of plate glass were made at about $26.00 a ton delivered, and garnet for use in sand-blasting sold at $20 to $30 a ton. Canadian prices of crushed garnet rock for sand blasting were about $7.00 a ton.

Crude garnet ore or ungraded mixed concentrate enters the United States duty free, the duty on grain graded into separate sizes and specially prepared garnet being one cent a pound.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

GRANITE IN 1941

(Building, Ornamental, and Crushed)

Source of Supply:

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 Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, and British Columbia. Large areas in Canada are underlain by granite, and the prospects of finding stone suitable for its various uses are good.

Producing Localities:

The industry in the Maritime Provinces was comparatively quiet. Few new deposits were opened and production came from the well-established firms.

Quebec furnishes most of the granite for building, the Stanstead, St. Samuel, Lake St. John, and Riviere-a-Pierre districts being the leading producers. The low ebb of building construction during the past few years has seriously affected this branch of the industry. The Silver Granite Company continued its operations in the Lake St. John district. Material from quarries in Quebec was made use of in the past few years in a number of Canada's public buildings, including the Supreme Court Building, Ottawa, the Ottawa Post Office, and several structures in British Columbia. It was also used in the construction of the T. Eaton Company's stores in Port Arthur and Edmonton.

A red granite of medium to coarse texture and of a uniform mixture has recently been developed near Coe Hill, Ontario, by Upper Canada Granite Quarries, Limited, and this deposit is being exploited with a view to supplying the domestic and export markets for monumental and building stock.

Prospecting for granite deposits suitable for building and monumental use has been active in Manitoba, and several deposits of red granite of various shades have been located, but so far little development has taken place.

Granite for monumental use is produced in the Maritime Provinces and in Quebec, Ontario, Manitoba, and British Columbia, and is finding a small but steadily increasing market. Early in 1939 an appreciable amount of foreign stone, principally of the black and red varieties, 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 should find a ready market for monumental use. Other deposits of 'black granite' in the Maritime Provinces, Quebec, Ontario, and Manitoba show promise of yielding stone of good quality.

Granite is used for building purposes mainly in large buildings, such as public and semi-public structures and institutions.

Production and Trade:

The Canadian production of granite in 1941 was 600,922 tons valued at $1,498,786, compared with 1,147,747 tons valued at $1,884,410 in 1940.

Exports were 2,751 tons valued at $27,079 (granite and marble unwrought), compared with 1,075 tons valued at $10,954 in 1940. Imports of granite were valued at $73,456 in 1941, compared with imports valued at $61,935 in 1940.

Markets:

Much of the granite produced in Canada is used for foundations for highways; for the permanent ballasting of railway roadbeds; for heavy aggregate in large concrete structures; for the filling of breakwaters; and for bridge piers. The market curtailment of such operations during the past several years has seriously affected production. Production is still far below the record years.

Some granite is being imported from the United States for monumental use, but these imports are likely in time to be replaced by Canadian material. The demand for stone for monumental use varies, and a variety which has enjoyed a steady market for a number of years may later be completely superseded by another variety. At present, the so-called 'black granite' and the 'grey' varieties seem to be in most demand for monuments, although the various shades of reds are still popular in many districts.

Now that shipments from the Scandinavian countries to the United States and to Camada have been discontinued, Canadian producers would be well advised to give careful study to the market possibilities of a monumental stock, especially for the black and red varieties.

In the building trade, coloured granites are being used to an increasing extent 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, 1942.

GRAPHITE IN 1941

Ores Mined and Producing Localities:

Graphite is widely distributed in the Archaean rocks of western Quebec and eastern Ontario, in which regions there was formerly a somewhat extensive graphite industry. With the exception of the Black Donald mine, in Ontario, these operations have long been idle and the plants for the most part have been dismantled. The Canadian deposits include bands or lenses of graphitic gneiss; belts of crystalline Grenville limestone carrying disseminated flake; and smaller, but often rich, pockety bodies or veins of coarsely crystalline graphite of plumbago character, usually also in limestone. Near St. John, in New Brunswick, bodies of amorphous graphite were worked many years ago on a small scale.

Black Donald Graphite Company, with mine and mill at Whitefish lake, 13 miles west of Calabogie, Renfrew county, Ontario, was again the only producer. The company has been in continuous operation for more than 30 years, mining a deposit of exceptional size and richness. The size of flake produced is too small for crucible use, but is well adapted for foundry facings and lubricants, for which purpose most of the output is sold. Most of the material treated in recent years has been rich mill tailings from early operations and discharged into Whitefish lake, from where they are being recovered by pumping. At the end of 1940 the company started a diamond drilling campaign in a search for new orebodies, as the ore in the old mine workings has been mostly removed, but no important indications of further reserves are reported. Most of the production in the past was used in the American and domestic foundry trade, but the output is now being reserved for Canadian use. A few tons of rich cobbed plumbago were mined in the Buckingham area during 1941 and shipped to the Black Donald Company for treatment.

Ore reserves at many of the old properties are believed to be considerable and could probably be used to meet domestic needs in an emergency, though this would entail the erection of new mills, or possibly of a central custom mill to treat the ore.

The Black Donald Company has advised the Bureau of Mines at Ottawa that it might be interested in obtaining supplies of high-grade milling ore from outside sources, and persons in a position to furnish such ore either on a direct-sale or contract basis are advised to submit proposals to the company. Canadian Foundry Supplies and Equipment, Limited, 4295 Richlieu Street, Montreal, will also take shipments of selected natural flake or plumbago-type graphite, provided the material does not require any further beneficiation.

Artificial graphite is made in Canada by Electro-Metallurgical Company of Canada, at Welland, Ontario, and by the Exolon Company at Thorold, Ontario. These companies supply the United States with part of its requirements.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

World production of natural graphite of all grades, and including flake, crystalline (plumbago) and amorphous, averaged about 140,000 short tons a year during the past decade. Madagascar, Germany, Austria, and Czechoslovakia are the principal producers of flake graphite; Ceylon of crystalline; and Mexico and Korea of the amorphous variety.

Market and Prices:

Graphite has many uses in industry, but it is employed principally in foundry facings, lubricants, crucibles, retorts and stoppers, pencils and crayons, paints, and stove polish. In the United States, these industries took 63 per cent of the total graphite sales in 1938, dry batteries, electrodes, and commutator brushes use important quantities, mostly amorphous or artificial.

AMerican importers, early in 1941 commenced to show concern over curtailment of shipments from Madagascar for the crucible trade, which consumes about 90 per cent of such imports. This involved the possibility that American crucible makers might be forced to revert to earlier practice and use Ceylon graphite, now largely discarded in favour of Madagascar flake. In an effort to forestall any serious shortage, steps were taken during the year, with Government support, to revive the defunct Alabama graphite industry, which had attained considerable temporary importance during the last war.

Canadian graphite requirements are principally for the foundry, dry battery, and paint trades. Foundry needs are met in part by domestic (Black Donald) production, and in part by imported Ceylon plumbago. The battery trade uses mainly Mexican amorphous, and paint requirements are filled largely by low-grade amorphous and flake. Owing to the fine grinding required to free the graphite, these Canadian deposits from which production was obtained several years ago yielded relatively little coarse flake of crucible grade, but with modern flotation methods of concentration, these ores could probably be readily treated to yield flake suitable for foundry work, when mesh-size is not important. Supplies of graphite are becoming difficult to obtain and the demand is increasing, and it may thus be necessary to reopen some of the old properties.

Graphite for United States consumption is mainly imported, the only domestic production of importance at present coming from near Morristown in northern New York State. Imports are handled chiefly through large importing houses which supply the trade, though some of the larger crucible and perhaps other firms likely import directly. As a result of the war demand, imports in 1940 showed a threefold increase over the average of the preceding five years.

According to American trade journals, prices at the end of 1941 were as follows: Ceylon lump, 10 to 12 cents a pound; carbon lump, 9 to 10 cents; chip, 7 to 8 cents; dust, 4 to 5 cents. Madagascar flake, 9 to 10 cents. All prices ex-dock New York, duty paid. The spot price of Mexican amorphous rose slightly to $10.60 a ton, with quotations f.o.b. New York at $14 to $25 a ton, according to grade.

Tariff:

The duty on graphite entering the United States under the general tariff, is 10 per cent ad valorem on natural amorphous and artificial grades, and of 30 per cent on crystalline lump, chip, and dust grades. The duty on imports from Canada and the United Kingdom is one-half of the above rates. The Canadian tariff is 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.

Graphite is classed as an essential mineral by the United States Government, and exports of graphite and graphite products have been subject to special export license since July 5, 1940.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

GRINDSTONES, PULPSTONES, and SCYTHESTONES IN 1941

Grindstones - The Read Stone Company, Sackville, New Brunswick, was the only producer of these stones in Canada and shipped from quarries near Stonehaven, on the Bay of Chaleur, New Brunswick. The total grindstone sales amounted to 170 tons valued at $8,500, as against 299 tons valued at $11,723 in 1940.

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. Because of the competition from the artificial grinding wheel and from foreign natural stones, production of grindstones from quarries continues to decline.

Pulpstones - There has been no output of pulpstones since the J.A. and C.H. McDonald Company ceased production four 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. There is also an increasing competition from Canadian-made artificial segmental pulpstones mainly of silicon carbide grit and at present about 560 of these stones are in use in the various Canadian pulp mills. The imported natural pulpstones come mainly from West Virginia, United States.

Scythestones - Over 42,000 of these small hand-operated stones, with a total weight of 18 tons and valued at $3,000 were sold in 1941 by the Read Stone Company, compared with 18 tons valued at $2,520 in 1940. These stones have for many years been obtained from the same quarry from which the company's grindstones are produced, but from finer textured beds of the sandstone.

The production of all grades of stone in 1941 was 188 tons valued at $11,500, compared with 317 tons valued at $14,243 in 1940.

Exports of these stones in 1941 were valued at $20,579 as against $4,149 in the previous year. Imports, which consisted chiefly of pulpstones, were valued at $102,768 as against $192,493 in 1940. Most of these come from the United States.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

GYPSUM IN 1941

Source of Supply:

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.

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

Producing Localities:

In Nova Scotia, Canadian Gypsum Company, operating at Wentworth, Hants county, about two miles from the town of Windsor, is the largest gypsum operator in the province. The stone is obtained from two separate quarries and the annual output is about 900,000 tons. Shipments of the crushed stone are made by steamer to the United States.

National Gypsum (Canada) Company carried on operation at Walton, Hants county, and also at Dingwall, Victoria county, in north-eastern Cape Breton. This is the largest operation of the company; shipments are made to the United States.

Connecticut Adamant Gypsum Company operating at Cheverie, Hants county, continued operations, the product being shipped to New Haven, Connecticut.

Windsor Plaster Company quarried stone from the old Mosher quarry on the property of Windsor Gypsum Company. The gypsum is treated in the company's manufacturing plant at Windsor, and the products sold, in the form of selenite hardwall, bondwall, Kayo bug killer, dental plaster and plaster of Paris, to markets in Eastern Canada and Newfoundland.

Gypsum Lime and Alabastine (Canada), Limited continued operations at Baddeck Bay, Cape Breton, during the summer months. Shipments are made by boat to the company's plant at Montreal. Victoria Gypsum Company carried on operations at Little Narrows, Victoria county.

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

Extensive deposits of gypsum are known to occur in northern Ontario, but, so far, these have not been developed. In southern Ontario, the gypsum industry was active in the district south of Hamilton, and supplied all grades of plaster and plaster products to the markets in Ontario and Quebec.

The markets in the Prairie Provinces were supplied by the four operating plants, two of which are in Winnipeg, Manitoba, and two in Alberta.

Deposits in northern Alberta, although distant from markets and railway, are of good grade.

In British Columbia, production from the deposits at Falkland were maintained to supply the plant at New Westminster. Several other deposits are known to occur in British Columbia. A large tonnage of by-product gypsum is obtained from the production of phosphate fertilizers at the plant of Consolidated Mining and Smelting Company at Tadanac, and efforts to find an outlet for this material are being continued.

Production and Trade:

The production of gypsum in 1941 was 1,590,321 tons valued at $2,947,361, compared with 1,448,788 tons valued at $2,065,933 in 1940. This production constitutes an all-time record for Canada.

Exports of gypsum were: 1,238,464 tons valued at $1,260,740, compared with 1,313,360 tons valued at $1,372,386 in 1940. Imports were: 2,194 tons valued at $69,759, compared with 1,844 tons valued at $56,278 in 1940.

The world production of gypsum is estimated at between 9 and 10 million metric tons. Canada probably occupies third rank among the world's producers.

Markets:

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 portion 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.

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 the Canadian material in this market. Canada is fortunate in having extensive deposits, favourably situated for commercial exploitation, the material from which has been proved by tests carried out by the Department of Mines and Resources to be of excellent grade. Prior to 1937 the small production in Canada was exported principally for use as a fertilizer for the peanut crop, but it is possible that an industry will be started in this country in which the anhydrite may be used for the manufacture of sulphur or sulphur compounds as well as of special plasters, similar to those now being marketed in England.

The gypsum industry, which is entirely dependent on the building industry, has not shown as rapid a rate of increase as some of the other industries. Nevertheless, the improvement in recent years has been quite marked.

The use of gypsum products in the building trades has made rapid progress 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 probable that production of gypsum for domestic use will continue to decline during the war, but as most of the crude gypsum 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 upon 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. The price of crude gypsum as quoted by the Canadian Chemistry and Process Industries is $2.50 to $3.50 per ton f.o.b. mine.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

IRON OXIDES (MINERAL PIGMENTS) IN 1941

Ores Mined and Producing Localities:

Ochreous iron oxide, which is sold uncalcined and used chiefly in the purification of illuminating gas, comprises the bulk of the minerals produced under this category. The calcined form of ochreous iron oxide is used 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 the raw and the calcined state for use as pigments in paints.

The Canadian iron oxide industry is small and the quantity produced shows little change from year to year. Present producing localities have met the requirements of the domestic pigment trade for the cheaper grades for many years. The production for some time past has come mostly from deposits near Trois Rivieres, Quebec. In 1941, Sherwin-Williams Company of Canada operated deposits at Red Mill and near Champlain in Champlain county. It was the only producer of calcined iron oxides, the others having marketed only air-dried products. Deposits at Almaville, Laviolette county, and at Les Forges, St. Maurice county, were operated by Charles D. Girardin of Yamachiche. The deposits at St. Adelphi, Champlain county, and the mine and plant of Eugene McNicoll, at Lacoste, Labelle county, were idle throughout 1941. A small tonnage of air-dried products was shipped by J. E. Chapman for experimental purposes from an ochre deposit at Cheneville, Papineau county, in 1940, but no shipments were reported in 1941. Among the other deposits worked in the past in Quebec are those near St. Anne de Beaupre, Montmorency county; at Les Forges, near Trois Rivieres; in Lynch township, Labelle county; and at St. Raymond, Portneuf county. The erection of a sulphur plant at Aldermac mine, west of Rouyn, in Quebec, from which iron oxide was to be produced as a by-product, has been deferred owing to the war.

A small production of iron oxide from Alta Lake, New Westminster district, and from oxide beds in the Windermere district, British Columbia, has been reported since 1923. The oxide is used chiefly for gas purification.

Other deposits could be worked in Quebec and Ontario, if the demand warranted their development. In Nova Scotia, beds of ochre and umber were operated to a small extent in the past. In Alberta and Saskatchewan, several deposits of ochre are known, some having commercial possibilities, but as they are difficult of access and as the market is limited, they have had little development. Large deposits near Grand Rapids and Cedar Lake in northern Manitoba remain undeveloped for similar reasons.

Production, Trade, and Prices:

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 1941 totalled 10,045 tons valued at $142,069, compared with 9,979 tons valued at $111,874 in 1940. Shipments by producers in the Province of Quebec totalled 9,770 tons valued at $139,1[illegible], compared with 9,073 tons valued at $107,845 in 1940. The Canadian production from 1930 to 1938 remained constant at 5,000 to 6,000 tons a year.

Exports of mineral pigments in 1941 were 3,787 tons, valued at $229,731, compared with 4,913 tons valued at $342,988 in 1940.

Imports of all kinds of ochres, siennas, and umbers totalled 1,552 tons, valued at $71,216, compared with 1,817 tons valued at $70,339 in 1940. There were also imports of prepared oxides, fillers, and related products, some of which were probably not ochres, valued at $1,510,385, compared with $1,037,951 in 1940. During the past two years the imports have been mainly from the United States.

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

The price in New York of iron oxide, standard No. 1 quality, Spanish red, remained normally at 3 to 5 cents per pound throughout 1941. The average Canadian selling price of crude ochre was $3.38 a ton, and that of calcined oxides about $45.00 a ton, f.o.b. plant.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

LIME IN 1941

Source of Supply:

Lime is manufactured in every province except Prince Edward Island, though the Saskatchewan production is intermittent and very small. Fifty-nine plants were in operation during 1941. 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, the leading lime-producing province, supplies over one-half of the total output, Quebec being next with slightly more than one-quarter of the total.

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 this purpose have increased very considerably within the past two years and, with the present high degree of activity in the construction industry, are expected to increase further in 1942.

Much attention has been devoted recently to methods of hydrating the magnesia when preparing hydrate from dolomitic lime, and hydrators operating on the principle of the autoclave are now in use for this purpose. The practice of passing hydrated lime through tube mills is employed in some plants in the United States with the object of increasing the plasticity. Recent research in the United States on stabilization of clay-soil roads with hydrated lime has shown that on certain clays better results are obtained with lime than with other stabilizing materials.

There are many prospective lime-producing localities in Canada because of the abundance of suitable limestone throughout the country. With the northward development of the mining industry, considerable interest is being manifested in making lime from limestone deposits in the far north.

Production and Trade:

Lime production in 1941 amounted to 862,845 tons valued at $6,397,047, compared with 716,730 tons valued at $5,194,555 in 1940.

There is very little foreign trade in lime because lime is made in nearly all countries. Exports in 1941 amounted to 12,979 tons valued at $113,964, compared with 23,617 tons valued at $121,340 exported in 1940. The greater part of these exports go to the United States, but small shipments are made to Newfoundland, South America, and the West Indies.

Imports, which are all from the United States, amounted in 1941 to 4,438 tons valued at $26,761, compared with 4,126 tons valued at $23,352 in 1940.

Market and Prices:

Lime is marketed in the form of quicklime and in the hydrated state, the latter being 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 of the great basic raw materials for the chemical industry, and of the current production more than 85 per cent is used in chemical processes, thus the old conception of lime as being primarily a structural material is no longer true.

Prices of the various lime products vary over a wide range depending on the geographical position of the plants and on difference in quality of the lime. No significant change occurred in prices of lime during 1941.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

LIMESTONE (GENERAL) IN 1941

Sources of Supply:

Limestone, because 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, but by far the greater part of the production comes from Ontario and Quebec. The 1941 production of limestone for all purposes, including the manufacture of lime and cement, constituted about 90 per cent of the total production of Canadian stone.

Limestone is available in great bedded formations and in massive highly metamorphosed deposits--the former being much more common and yielding most of the production. At present, almost all Canadian limestone is won by open pit methods, though 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, particularly for the production of high-grade stone for chemical use, as the readily accessible parts of deposits become worked out.

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.

Production and Trade:

The 1941 production of limestone for general use, exclusive of that used for building stone, lime, and cement is estimated at 6,810,000 tons valued at $5,869,000, compared with a production of 6,108,591 tons valued at $5,126,075 in 1940. The production for all purposes in 1941 is estimated at 10,450,000 tons, compared with 9,183,860 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 furnace flux, and from the United States alone for road metal, and for use in some pulp mills in Ontario near the International Boundary. Comparatively small tonnages are exported to the United States for use in agriculture and in sugar refineries. No separate record is maintained of the trade in limestone.

Markets:

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 of the products are processed but little if at all from the condition in which the rock is obtained from the quarry, 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. Argillaceous dolomite is used in the manufacture of rock wool. This industry is steadily expanding in Canada and in 1941 its output was valued at well over $1,000,000. Pure dolomite is assuming a position of importance as a raw material for the manufacture of magnesium metal. A process has been developed to extract magnesium directly from calcined dolomite, and a plant employing this process is now under construction in Ontario. Calcined dolomite is also used in other countries to precipitate magnesia from sea water and magnesium chloride brines--the magnesia so obtained being used either for the manufacture of magnesium metal or for refractory materials. 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 many 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, 1942.

LIMESTONE (STRUCTURAL) IN 1941

Orcs Mined and Producing Localities:

Limestone in blocks of large dimensions for sawing into building stone is quarried in Quebec, Ontario, and Manitoba. In Quebec, quarries at St. Marc des Carrieres, Portneuf county, produce grey limestone, and several in and near Montreal yield 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. At Longford Mills, near Orillia, buff, silver-grey, and brown limestone for use both as marble and as building stone is available, but has not been quarried for the past several years. The Manitoba quarries are near Tyndall and yield mottled buff, mottled grey 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 Quebec; and at Ottawa, Kingston, Erin, and Wiarton in Ontario. Rubble is their chief product.

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

There were no developments of importance in 1941. Although building construction is very active owing to defence needs, most of the buildings are of the factory type and require little cut stone; thus, the building-stone industry is relatively inactive and a number of the quarries are either shut down or operated only for a short time each year.

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

Production and Trade:

The production of limestone for structural purposes in 1941 was 23,269 tons valued at $272,520, compared with 28,376 tons valued at $263,068 in 1940. This production was largely from quarries in Ontario and Quebec. The value 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.

Exports of building limestone are small and are not separately recorded; exports of building stone of all kinds except granite and marble had a value of only $6,326 in 1941, compared with $1,016 in 1940.

Imports of all varieties of building stone, excepting marble and granite, during 1941 were valued at $13,036, compared with $29,749 in 1940. This imported stone is mostly limestone.

Prices:

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.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

LITHIUM MINERALS IN 1941

Source of Supply:

Amblygonite, spodumene, and lepidolite, the chief lithium minerals of commerce, contain respectively about 8, 6, and 4 per cent of lithium. The known Canadian occurrences of present economic interest are confined to Manitoba. A number of lithium-bearing pegmatites have been found in the Pointe du Bois area, in the south-eastern part of the province, since 1925, when the original discovery was made on the Silver Leaf property in that area, and exploratory work on certain of these deposits has disclosed appreciable tonnages of the above three minerals. A few hundred tons, mostly from the Silver Leaf mine and from the Buck claims at Bernic lake, have been shipped to the United States. Lithium Corporation of Canada, 403 Avenue Building, Winnipeg, the only active operator, has confined its work principally to its Bernic Lake deposits, where it stock-piled some amblygonite during the year. Spodumene is the principal mineral on the company's property at Cat lake; the other known occurrences of the mineral in Manitoba being near Falcon lake, 185 miles east of Winnipeg, and on the Kobar claims, near Mile 81 on the Hudson Bay Railway. Recent and projected road construction will provide improved transportation facilities for several of the more important lithium properties adjacent to the Winnipeg river.

Platey books of lepidolite occur in small amounts in a pegmatite in Wakefield township, Hull county, Quebec, and spodumene is reported to occur in Lacorne township, Abitibi county, about 10 miles from the Barraute station on the Canadian National Railway. Spodumene-bearing pegmatites containing beryl, tantalite, and other minerals typical of lithium mineralization, have been reported in an area lying about 20 miles northeast of Yellowknife in the Northwest Territories.

Production and Trade:

No production of lithium minerals was reported in 1941. The last shipment was made in 1937 and came from the Bernic lake deposit in Manitoba, the value of the shipment being $1,694. Figures of world production, exports and imports are not published. Most of the world supply comes from deposits in the United States, Southwest Africa, and Argentina. Production of lithium minerals in the United States comes mainly from the Black Hills region in South Dakota. Known reserves of lithium in that country are believed to be sufficient to meet the relatively small requirements. Shipments from Southwest Africa have been increasing in recent years, with exports of 611 long tons of lepidolite and 179 tons of amblygonite in 1940, all of which went to Great Britain. There was also a production of 40 tons of petalite, a lithium-aluminium silicate of lower lithia content than spodumene. The output of amblygonite from Southwest Africa in the first six months of 1941 amounted to 100 tons. Production in Argentina consists mainly of spodumene.

World reserves of lithium minerals are large and widely distributed and production could be greatly increased if necessary. Up to the present, however, world consumption has not exceeded a few thousand tons a year.

Uses:

The high-lithia minerals, amblygonite and spodumene, are used chiefly in the production of lithium chemicals and metal, the principal use of lepidolite being as a batch constituent in the making of opal and heat-resistant glass. The use of amblygonite, spodumene, and lepidolite in the ceramic industry is based on the powerful fluxing effect of the lithia they contain, as compared with the soda or potash of feldspar. In the ceramic industry, recent attention has been given chiefly to spodumene, the most abundant of the lithium minerals. Spodumene is rather refractory, but spodumene feldspar mixtures have lower melting points than has feldspar alone. The objectionable high thermal expansion of spodumene may be overcome by calcining and conversion to the stable "beta" form as is done in the so-called decrepitation process for the recovery of spodumene in the form of fine powder from rock consisting of intimate mixtures of spodumene and quartz or spodumene and feldspar. The mineral is believed to have possibilities for use in pottery bodies, glazes, and enamels in replacing more costly prepared lithium carbonate, provided that it can be obtained in standard grade of the required purity. Lepidolite has proved highly effective as a fluxing addition in high-talc bodies; and amblygonite is of value for use in opaque glasses.

The treatment of lithium ores for the production of salts and metal has long been confined to a few companies with plants in the United States, England, Germany, and France. The use of lithium chloride, one of the most hygroscopic of the inorganic compounds, as a drying agent in air-conditioning has been increasing in importance. It, and the fluoride, are used as a flux in coatings for aluminium welding rods. Lithium hydroxide is used in Edison storage batteries, mainly for use in mine locomotives. A method of making single crystals of lithium fluoride up to eight pounds in weight from a molten bath has been perfected. The fluoride has valuable optical properties and is replacing fluorspar for general use in instruments.

Lithium is the lightest of all the metals, having a specific gravity of only 0.53. A wide range of master alloys of lithium with calcium silicon, brass, copper, manganese, zinc, lead, tin, magnesium, and aluminium, has been developed in the United States. The lithium content of the base metal varieties ranges from 0.5 per cent to 10 per cent, and rises to as high as 50 per cent in the light calcium and silicon series. The component metals are produced by electrolysis, and the alloys are made in an electric vacuum furnace. The alloys are furnished in lumps, slabs, cubes, or plates, and are being used to an increasing extent as de-oxidizing, de-gasifying, and de-sulphurizing agents in copper, brasses, bronzes, etc., and for the hardening of lead and aluminium. Alloys of lithium with zinc, aluminium, and magnesium are strong and are highly resistant to corrosion. It is stated that the addition of one-third of a pound of lithium per ton imparts ductility to alloy steels.

In the use of lithium as a neutralizing medium for furnace atmospheres in the heat treating of steel and non-ferrous alloys, the desired effect is achieved by placing a lithium cartridge in an evaporation chamber through which the spent gases pass to the muffle where the work is being treated. It is claimed that this method dispenses with carburizing, decarburizing, or scaling of the finished work, and that it is applicable in the melting of non-ferrous alloys in crucibles, in which it prevents drossing, and in the heating prior to forging or pressing. Lithium hydride is being used as a convenient means of transporting hydrogen gas by air to remote localities and for its safe storage; the nitride offers similar possibilities for ammonia.

Prices:

Prices of the master alloys range from 50 cents to $8.00 a pound in ton lots. Amblygonite continued to sell at about $40.00 a ton, f.o.b. American mines, for material with a lithia content of from eight to nine per cent. Crude lump lepidolite, at $24.00 to $25.00 a ton, f.o.b., showed little change from 1940, and spodumene, six per cent grade, remained at $30.00 a ton.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

MAGNESITE AND BRUCITE IN 1941

Ores Mined and Producing Localities:

Magnesitic dolomite consisting of an intimate mixture of magnesite and dolomite is quarried at Kilmar and at Harrington East, in Argenteuil county, Quebec, and is processed for use as refractory materials. 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.

Large deposits of magnesite containing considerable silica and alumina occur in British Columbia near Marysville, between Cranbrook and Kimberley. They are owned by Consolidated Mining and Smelting Company of Canada, Limited and experimental work to remove the silica and alumina by flotation 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 the Yukon, but either because of their limited extent or remoteness from transportation, they are not of commercial importance at present.

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.

Deposits of brucite (magnesium hydroxide) recently discovered by the Bureau of Mines, Ottawa, at Rutherglen, Ontario, and at Bryson and Wakefield, Quebec, have added greatly to the known reserves of magnesium minerals of economic importance. The brucite occurs as granules thickly disseminated through a matrix of crystalline limestone. 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 difficult to obtain during wartime, and a domestic source is of prime importance. A plant is now under construction near Wakefield, Quebec to produce magnesia from the deposits in that area and is expected to be in operation early in 1942.

Production and Trade

Canadian production and trade figures are not available for publication owing to the war.

Markets and Prices

Magnesite is available in many countries. Russia is probably the world's greatest producer of magnesite, but almost all is for domestic use.

Magnesite is usually calcined before shipment and the resultant magnesia is used for the making of refractory products to withstand extremely high temperatures, for making oxychloride cement, and for magnesium metal. It is also 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 in Europe, England, and the United States.

Competing with magnesite as sources of magnesia products are dolomite, brucite, and sea-water. Dolomite, in addition to its use as a refractory material has long been the principal source of basic magnesium carbonate and pure magnesium oxide, 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 is now being done on a very large scale in both England and the United States, the material so obtained being used for making magnesium metal as well as for various industrial and pharmaceutical purposes.

Prices of calcined magnesite in 1941 f.o.b. Montreal or Toronto as quoted by Canadian Chemistry and Process Industries 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, 1942.

MAGNESIUM SULPHATE IN 1941

Source of Supply and Producing Localities:

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 a considerable production from several of the "lakes" in British Columbia, and experimental shipments were made from one of the lakes in Saskatchewan.

The largest production has come from the deposits at Basque, British Columbia, the material from which is refined at Ashcroft, 15 miles south of the deposit. The refinery, now owned by Ashcroft Salts Company, Limited, has a capacity of 10 tons of salt a day. It was operated until the early summer of 1939, when it closed down pending improved marketing conditions, and was again brought into production in 1941. The material produced was of high grade; four samples, representative of the different crystal sizes prepared all ran over 99.5 per cent $MgSO_4.7H_2O$. There are a number of other occurrences in British Columbia, near Clinton, north of Kamloops, and 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, 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.

Production and Trade:

The Canadian production of magnesium sulphate in 1941 was 265 tons valued at $7,343, there being no production in 1940.

The imports in 1941 were 2,729 tons valued at $109,022, compared with 2,211 tons valued at $86,090 in 1940.

Market Conditions and Prices:

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

Prices for Epsom salts remained steady for the greater part of the year, due to the discontinuance of supplies from European countries, hitherto the main sources of supply. 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.

Tariffs:

When magnesium sulphate is not being made in Canada, imports are dutiable at the rate of 17½ per cent, otherwise the duty is 20 per cent. The tariff on the material entering the United States is 3/4 of a cent per pound, or $15.00 per ton.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

MARBLE IN 1941

Source of Supply:

Marble quarries are operated in the provinces of Quebec, Ontario, Manitoba, and British Columbia. The products include squared blocks for sawing into slabs and for making monuments, and broken marble for rubble and for making terrazzo, stucco dash, whiting substitute, marble flour and artificial stone. Waste from some of the quarries is sold for chemical uses and for road metal.

In Quebec, several varieties of clouded grey marble and also a black marble are quarried at Philipsburg by Missisquoi Stone and Marble Company, Limited. Some brown marble used for counters and wainscoting is obtained from the building stone quarries in the Trenton limestones at St. Marc des Carrieres, Portneuf county. Dolomitic white marble is quarried and crushed by White Grit Company at Portage de Fort, Pontiac county, and by Canada Marble and Lime Company at l'Annonciation, Labelle county, for the making of terrazzo chips, stucco dash, poultry grit, artificial stone, and for chemical and ceramic uses. A small quantity of dark red marble has been quarried at Cap St. Martin near Montreal, chiefly for making tombstones.

In Ontario, black marble is quarried at St. Albert, near Ottawa, by Silvertone Black Marble Quarries, Limited. Recently a 40-inch bed of marble was uncovered in this quarry which, because of its soundness and uniformity, is suitable for making large monolithic pillars. White marble is quarried at Marmora by Bonter Marble and Calcium Company, Limited, and at Haliburton by Bolender Brothers for making terrazzo chips, poultry grit, stucco dash, and artificial stone. Buff, red, white, green, and black marbles are quarried north of Madoc by Karl Stocklosar and by Connolly Marble, Mosaic and Tile Company, Limited for use as terrazzo.

In Manitoba, a number of highly coloured marbles are available, but there is only a small production to supply terrazzo chips and building rubble.

In Alberta, a deposit of calcareous tufa near Radnor station on the Canadian Pacific railway has been quarried for terrazzo and a small quantity has also been marketed in block form.

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

Many known deposits of beautifully coloured marbles have never been fully investigated, chiefly because the present demand in Canada for marble of any one colour, other than for a staple variety such as white, is comparatively small.

The war has adversely affected the Canadian marble industry, for though construction activity is again at a high level, most of the buildings erected are of the industrial type in which little or no standing marble is used.

Production and Trade:

Production of marble in 1941 amounted to 17,570 tons valued at $129,210, compared with 13,739 tons valued at $75,409 in 1940.

Exports of marble are recorded with exports of granite, and the exports of the two during 1941 amounted to 2,751 tons valued at $27,079, compared with 1,075 tons valued at $10,954 in 1940.

Imports of marble during 1941 had a value of $43,295, compared with $84,005 in 1940. Current imports of marble are largely in the form of unpolished slabs and in the form of sawn stock for tombstones, the finishing being done in the marble mills throughout Canada. Most of the imports of marble blocks are from the United States.

Market Conditions:

The Canadian market calls for interior decorative marble almost entirely, and very little is used for tombstones. In recent years there has been an increasing demand for marble in the form of terrazzo for flooring, and many inquiries have reached the Bureau of Mines, Ottawa, as to where marbles of various colours can be obtained.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

MICA IN 1941

Ores Mined and Producing Localities:

Canada has the distinction of being one of the two main world sources of phlogopite or amber mica, the other being the French possession Madagascar.

Muscovite, or white mica, is of fairly common occurrence in Canada, but in general, deposits of this type of mica have proved of small economic importance owing either to the poor grade of material or to the small amount of mica present, and production of muscovite has been negligible.

Most of the production of phlogopite has been derived from a comparatively restricted area in adjacent parts of Ontario and Quebec, in the general Ottawa region, and extending roughly from Kingston, on Lake Ontario, northeastward into Gatineau and Papineau counties, Quebec. In Quebec, the mica-bearing series extends for some distance west and east of the main productive district, into Pontiac and Argenteuil counties, respectively, and there are also several scattered occurrences as far east as Quebec City. In Ontario, similar outlying deposits extend westwardly into Hastings and Haliburton counties. In recent years, most of the productive activity has been centered on deposits in Quebec.

Leading producers of amber mica in 1941 were Messrs. Blackburn Brothers, who operate the old Nellis mine, in Hull township, Quebec; St. Lawrence Mica Corporation, with a mine at Petit Pré, near Quebec City; E. Wallingford, at Perkins, Templeton township, Quebec; and Kingston Mica Mining Company, which operates the Thirty Island Lake mine in Bedford township, near Godfrey, Ontario. These properties accounted for most of the output, the remainder being derived from a number of small and mostly intermittent operations, most of them in Quebec. Late in the year, Messrs. Blackburn Brothers took over the old Phosphate King mine, in Templeton township, Quebec, and proceeded with plans for development of the property. Scrap mica continued to be recovered from old waste dumps, from which some merchantable sheet was also salvaged. The scrap is mostly exported to a grinding plant of United States Mica Manufacturing Company, at East Rutherford, New Jersey, and Chicago, Illinois.

The larger Canadian producers operate their own mica shops, but there are also 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. In smaller rural communities, much of the work, particularly splittings, is farmed out, the labour being performed mostly by girls on piecework.

Black mica (biotite or lepidomelane) occurs in considerable quantity in Faraday township, near Bancroft, in Hastings county, Ontario, and the deposits were worked some years ago to supply a grinding mill, now inactive, at Bancroft. This mica occurs in very large sheets, but is mostly of poor splitting quality and too high in iron for general electrical use, though some has found employment in low-voltage domestic heater appliances.

Although muscovite, or "white" mica, is widely distributed in the Precambrian rocks of eastern Canada and in certain areas of western Ontario, Manitoba, and British Columbia, production has been negligible. In general, it has been found that the proportion of sound, merchantable sheet in the pegmatites is too low for the profitable mining of this mineral alone. During the past three years, there has been much prospecting and some mining activity on scattered muscovite occurrences in Quebec, mainly in the Lake St. John-Saguenay region. Only a small production, mostly of very small punch sizes, resulted from most of this work; some of the output was shipped to a punching plant at St. Césaire, near Granby.

An outstanding recent development has been the discovery in Bergeronnes township, east of the Saguenay river, of a deposit of high-grade "ruby" muscovite, comparable in quality to the best Indian or Brazilian mica. This property which is owned by Eugene Simard, of Grandes Bergeronnes, came into production on a small scale in 1940, but was reported inactive in 1941. Some muscovite was also taken from the old Maisonneuve mine, in Berthier county, north of Joliette in 1940. Samples of large sheets of a good grade of stained muscovite, said to have come from a remote locality on the Peribonka river, 100 miles north of Lake St. John, have been received by the Bureau of Mines, and similar samples have also been received from a deposit near Wabowden, on the Hudson Bay railway in Manitoba. No developments have been reported, however, in either instance. There were reports of plans to develop further certain of the muscovite occurrences in the Tetè Jaune-Big Bend region, in British Columbia, but there is no record of any production. A few small sales of muscovite were made in 1941 from deposits in the Mattawa, Lakefield, Kaladar, and Parry Sound districts, Ontario.

In recent years, a small production of fine flake muscovite, or sericite, has been obtained from a deposit at Baker Inlet, near Prince Rupert, British Columbia. This material, which amounted to 100 tons in 1941, is shipped to Vancouver for grinding. The property is owned and operated by P. M. Ray, 23 Besner Block, Prince Rupert. The ground material is stated to sell for $32.50 per ton, f.o.b. Vancouver, and is consumed mainly in the local roofing tráde. Ground muscovite, made from imported Indian and domestic British Columbia scrap, is also produced by G. W. Richmond, 3239 West King Edward Avenue, Vancouver, for local roofing use and for export. In 1941 Messrs. Fairey and Company, 661 Taylor Street, Vancouver, who grind the fine flake muscovite from Baker Inlet, took about 100 tons of grinding scrap from a deposit near Oliver, B. C.

The mica-grinding plant of Messrs. Blackburn Bros., Blackburn Building, Ottawa, in Templeton township, Quebec, continued to produce various mesh sizes of ground amber mica from mine and shop scrap, the demand being reported active and the volume of sales nearly double the 1940 figure.

Of possible economic interest is a sample of extremely friable sericite schist received by the Bureau of Mines during the year, and said to come from a large deposit in Palmerston township, Frontenac county, Ontario. A grinding test showed that a few passes through rolls sufficed to reduce the material to a snow-white powder nearly 60 per cent finer than 270-mesh, the particles having a fibrous character. This suggests possible outlets for the ground product in the paint and filler trades. Sericite commonly grinds much more readily than mica, and accordingly can be sold at a much lower price. Lacking the sheen of mica, it is reported to be preferred for varnishes and certain other protective coatings. Of immediate defence interest is the announcement that sericite can be used to replace a substantial part of the zinc oxide used in rubber, where it serves not alone as a filler but also as an activator and accelerator, and it is claimed to have already proved its value in cable insulation. Other suggested uses are in foundry facings, partings, and core washes, either alone or combined with graphite.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

Production records date back to 1886, and show annual outputs ranging in value from $30,000 in the earlier years to as high as $375,000 (in 1920). While sales have comprised mainly sheet or block mica in the various trade sizes, including a fair proportion of splittings, they have also included a considerable amount of waste grinding scrap, the value of which in some years has represented over 50 per cent of the total and has averaged around 20 per cent.

Latest available statistics indicate that in 1938 total recorded world production of mica of all classes and grades was about 31,000 long tons, but of this total, over 22,000 tons was low-priced grinding scrap. The remainder comprised both sheet or block mica in various styles of trimming and splittings. Most of this was muscovite, as only Canada and Madagascar, which together produced a little more than 1,000 tons, are producers of phlogopite. India has for many years been the world's chief source of mica, both block and splittings, and in 1938 exported almost 9,000 tons. Brazil recently has been making rapid headway as a second important source of high-grade muscovite; exports from that country in 1940 totalled 1,117 metric tons, or nearly three times the 1939 figure. Canada's share of the world production, though relatively small, is important, as for certain uses, notably for heater plate, commutator insulation, and heavy-duty aviation sparkplugs, amber mica has definite superiority over muscovite.

Market Conditions:

In 1940-1941, as a result of curtailment of mica exports from Madagascar, a strong export market developed for Canadian phlogopite--both knife-trimmed block and splittings--and dealers reported a heavier volume of sales than for some years past, with supplies lagging considerably behind orders. Although this situation has brought about a marked revival of interest in mica mining, most of such interest has been shown by small operators lacking the necessary capital for sustained and serious development, and although the number of producers has shown a marked increase, little important new mining has been undertaken, the bulk of the output continuing to come from a few older established mines.

Demand has been particularly strong for hard, heat-resistant grades of block, suitable for heavy-duty aviation sparkplugs, but deposits carrying this class of mica are relatively rare and production is limited to only a few mines. Efforts to stimulate output of sparkplug mica have been made under the joint co-operation of the Bureau of Mines and the Metals Controller, and a large number of phlogopite samples from various deposits have been tested in the laboratories of the Bureau for heat-resistance. Of the samples tested, however, it was found that only 15 per cent measured up to standard sparkplug quality; 40 per cent were sub-standard but perhaps usable in an emergency; whereas 45 per cent were definitely useless.

Sheet mica is marketed in various classes, depending upon 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, and 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, in which respect phlogopite tends to be variable, particularly in cases where it has undergone some degree of natural alteration (hydration).

Of all industrial minerals, mica, in the sheet form, through the various stages of its mining, preparation for market, grading, etc., involves the greatest expenditure of labour and time per unit of quantity production, and it is by far the most costly of these minerals. From mining to preparation in the form of trimmed or split sheets, each piece entails an individual hand operation. Mechanical preparation has made little progress, and most of the production is still handled by primitive hand-and-knife methods. The making of splittings by hand in particular, is a slow and costly operation as an expert worker can split only about one pound an hour, at a labour cost of 15 - 20 cents. As a result, 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.

Sheet mica is used almost entirely for electrical insulation. It is cut or punched into a great 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, is used as stove windows, and in lighting equipment, and there is a limited demand for special large-sized, flawless sheet for use in marine compass dials, boiler gauges and in the inconoscopes of television transmitters. Muscovite and phlogopite are essential in the manufacture of aviation sparkplugs, the latter for the nose-washers at the base of the plug, which are required to possess high heat-resistance. Recent research has been directed toward the perfecting of a ceramic type of plug, some of which are already in use and in time this type of plug may replace the mica plug. It is claimed that their cost is only one quarter that of mica plugs; that they absorb no moisture, and thus prevent condensation in the combustion chamber, with consequent risk of shorting in cold weather; and that they are not subject to penetration and corrosion by the lead oxide derived from high-rating aviation fuel.

Much has been heard in the past few years of a new synthetic material, "Alsifilm", made from a colloidal dispersion of bentonite clay, and designed to replace mica for use in electrical insulation. It is claimed that this product possesses most of the desirable properties of mica, and that it can be made in sheets of any desired size and thickness by a process similar to that followed in the making of paper, and at very low cost. Considerable research has been proceeding on the development of the product, which, if perfected, would vitally affect the mica industry, but so far it has not attained commercial significance.

Mica is a comparatively unimportant mineral from the view point of tonnage produced. Sheet mica is, however, a vital mineral in industry, particularly in all forms of electrical equipment. It is one of the few industrial minerals that are listed by the United States government as "strategic" minerals. Although already drawn on extensively, Canadian reserves of amber mica are still adequate to furnish important supplies, and any appreciable advance in price would probably result in a general revival of mining and increased production.

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 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 resistance to weathering and to corrosion by fumes and liquids. A new use that promises large outlets for coarser grades is as an addition to oil-well drilling muds, to prevent circulation loss of water into uncased and porous formations. Large amounts of wet-ground muscovite mica are used in the manufacture of wall-paper, and some is used in the ceramic type of insulating material termed "Mycalex". Progress is reported in the development of resin-bonded natural flake and 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. Mica powder has been suggested as a substitute for wax in paint and varnish removers, in which it serves to seal surfaces and retard evaporation.

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 been made known by the United States Bureau of Mines. The Bureau has also investigated 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 pulverizes mica, a particularly difficult mineral to grind, as readily as does ball-milling, and it may provide a cheaper means of producing ground mica than the machines now used. It has also proved successful in promoting the recovery of vermiculite by agglomerate tabling.

Prices:

Mica prices are difficult to determine owing to the lack of reliable market quotations and to the prevailing system of trade discounts. 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, and to the practice by consumers of laying in stocks well ahead of current requirements. According to dealers' reports, general retail price averages for phlogopite in 1941 advanced slightly from those of 1940, quotations being approximately as given below. These prices, however, are not an 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

Size	Per Pound
1 x 1 inches	$ 0.30
1 x 2 "	0.40
1 x 3 "	0.65
2 x 3 "	0.95
2 x 4 "	1.35
3 x 5 "	2.25
4 x 6 "	2.50
5 x 8 "	3.50

Splittings

Size	Per Pound
1 x 1 inches	$ 0.65
1 x 2 "	0.7
1 x 3 "	0.75

Ground mica (phlogopite) continued to sell as follows, according to fineness: 20 mesh, $25 per ton; 60 mesh, $30; 120 mesh, $55; 150 mesh, $65; all prices f.o.b. Ottawa, in ton lots, bags extra.

There is very little trade in sheet muscovite mica in Canada, though some of the smaller electric appliance manufacturers and repair shops purchase odd lots of domestic material. Consequently no indication of prices can be given. Most of the Canadian requirements are met by direct imports of Indian sheet and splittings. With possible curtailment of Indian supplies, however, a more ready market for domestic muscovite may develop, and the Mica Company of Canada, Lois Street, Hull, Quebec, has advised the Bureau of Mines that they would be interested in receiving samples for appraisal and possible quotations.

Tariff:

Canada's exports of mica to the United States are dutiable under the following classification: Untrimmed small sheet, phlogopite, yielding rectangular pieces not over 1 x 2 inches, 10 per cent ad valorem. Mica unmanufactured, valued at not over 15 cents per pound, 4 cents per pound; valued at over 15 cents per pound, 4 cents per pound plus 25 per cent ad valorem. Mica, cut or stamped to dimensions, shape, or form, 40 per cent ad valorem. Mica films and splittings, not cut or stamped to dimensions, not over twelve ten-thousandths of an inch in thickness, 25 per cent ad valorem; over twelve ten-thousandths of an inch in thickness, 40 per cent ad valorem. Mica films and splittings cut or stamped to dimensions, 45 per cent ad valorem. Mica plate and built-up mica, and manufactures of, 40 per cent ad valorem. Phlogopite waste or scrap, valued at not over 5 cents per pound, 15 per cent ad valorem. Mica waste and scrap valued at over 5 cents and not over 15 cents per pound, 4 cents per pound plus 25 per cent. Mica, ground or pulverized, 15 per cent ad valorem.

Imports of mica and manufactures of, into Canada, are dutiable at 15 per cent ad valorem under the British Preferential tariff; under the Intermediate tariff, at 25 per cent; and under the General tariff, at 27½ per cent. Such importations from the United States, however, are dutiable at 20 per cent, under the 1938 Trade Agreement.

Both phlogopite and muscovite mica are regarded as "strategic" war minerals, and have been included among the minerals dealt with in the "Prospectors' Guide", issued by the Mines and Geology Branch, Department of Mines and Resources, Ottawa, in 1942. Copies of this publication may be obtained by applying to the Director of the Branch.

VERMICULITE:

Vermiculite, an altered variety of phlogopite or biotite mica, which swells enormously when heated, yielding an exceedingly light-weight and bulky, cork-like material, is now widely utilized in the heat-treated, expanded form as a valuable heat and acoustical insulation product. Most of the world production comes from the United States, and large quantities of the crude mineral are imported into Canada for processing. No authenticated occurrences are known in Canada, though there have been unconfirmed reports of deposits in the Albreda district, British Columbia. The crude material sold in 1941 at $9.50 to $12 per ton f.o.b. mines in North Carolina and Montana, respectively, while the expanded product retailed at around $1 per 24-pound bag of 4 cubic feet at eastern Canadian points.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

MOULDING SAND (NATURAL BONDED) IN 1941

Ores Mined and Producing Localities:

Every province except New Brunswick and Prince Edward Island produces natural bonded moulding sand. One deposit in New Brunswick was 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 greater part of the output has come from the Niagara peninsula, Ontario. Occasionally new deposits have been opened up, mostly in Ontario and in the western provinces.

The results of a general investigation of moulding sands in Canada were published in 1936 by the Bureau of Mines, Ottawa, in the form of report No. 767, "Natural Bonded Moulding Sands of Canada." This report directs 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.

Production and Trade:

The Canadian production in 1941 was 33,830 tons valued at $33,979, compared with 29,602 tons valued at $30,538 in 1940.

Silica sands without clay bond, used in steel foundries and the glass industry, are not included in the production figures. 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 part time operators such as farmers for local foundries.

The industry is seasonal in nature as foundrymen usually obtain their supplies in the summer and autumn.

Imports are not recorded separately and are mostly from the United States. Moulding sands and other sands and gravels enter Canada duty free.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

NEPHELINE SYENITE IN 1941

Ores Mined and Producing Localities:

Nepheline syenite is a quartz-free crystalline rock consisting essentially of the mineral nephelite, a silicate of alumina, potash, and soda, and albite and microcline feldspar. It often contains also varying amounts of iron-bearing minerals in the form chiefly of black mica and magnetite, together with such accessory minerals as zircon, corundum, calcite, scapolite, etc. It has no free silica and is high in alumina (20 to 30 per cent in average commercial rock) as compared with straight feldspar (17 to 20 per cent) and it has thus found favour with the ceramic industries, particularly in the glass trade. For ceramic use the crude rock must be freed of its iron-bearing constituents, removal of which can often be readily effected by a relatively cheap process of magnetic separation at about 20-mesh size.

The possibility of using various forms of rock as substitutes for straight feldspar in the ceramic industries has received increasing attention in recent years and greater use is now made of semi-kaolinized granite (Cornwall or Carolina stone), aplite, pinite, alaskite, etc. Some of these rocks may contain too much iron in the form of finely divided and unremovable impurities to be used for whitewares or white glass, but they are suitable for coloured glass; if coarse enough to be freed, the impurities can be removed by magnetic or other means, leaving a product sufficiently low in iron to be used for general ceramic work. Even straight feldspar is now often freed of such impurities as mica, garnet, etc., by magnetic means and separators have been installed in a number of American mills for this purpose.

The known occurrences of nepheline syenite in Canada lie mainly in Ontario, the most extensively developed deposits being in Peterborough, Hastings, and Haliburton counties. Production began in 1936 with the opening of a quarry by Canadian Nepheline, Limited at the west end of Blue Mountain in Methuen township, Peterborough county. This company at the same time erected a small plant at Lakefield, the nearest rail point 27 miles distant, for crushing and cleaning the rock. Production for supplying the domestic glass trade has been continuous since then. In 1937-38 production of crude rock was greatly expanded by the formation of a subsidiary, American Nepheline Corporation, which erected a large crushing and processing plant at Rochester, New York, to take care of United States requirements. Present capacity of the Lakefield mill is 45 tons of finished product a day, and the Rochester plant is designed for about 200 tons of feed a day. The main product made in both plants is a granular, minus 20-mesh material, containing about 24 per cent of alumina, and only 0.07 per cent of ferric oxide (Fe_2O_3). The Lakefield mill supplies cleaned material to the mill of Frontenac Floor and Wall Tile Company, Kingston, Ontario, for fine grinding for general ceramic use, and similar fine syenite is being produced at the Rochester plant. In 1940, Canadian Nephaline Limited was merged with American Nepheline Corporation, and is now the latter company's Canadian branch.

American Nepheline Corporation reported its Canadian production of processed material in 1941 as being close to 8,000 tons, most of which was glass grade. Part of the shipments were used in Canada and the remainder in the United States, production at the company's Rochester plant having been temporarily curtailed pending the installation of flotation methods designed to further improve the grade of product. Small quantities of 200-mesh material were sold in Canada for use in the general ceramic trade. Canadian sales also included some Grade B (dust) syenite, outlets for which have been found as a substitute for pumice for grinding and polishing, and in the enamelware, cleanser, and heavy clay industries. Shipments of crude rock to the company's Rochester mill totalled nearly 32,000 tons, a 30 per cent increase over 1940; sales of processed material amounted to about 25,000 tons, of which 15,500 tons was standard glass grade material, 6,000 tons, finely-ground pottery grade, and the remainder Grade B, which was sold to the enamel and coloured glass trades.

A second important nepheline syenite area lies in the Bancroft-Gooderham district, Hastings and Haliburton counties, about 30 miles northeast of the Methuen deposit. Production began in 1937 and has since been continued intermittently by several operators, the total output to the end of 1941 being about 20,000 tons. The principal operators have been Gooderham-Nepheline, with a quarry at Gooderham, in Glamorgan township; New England Nepheline Company, an affiliate of Golding-Keene Company, Keene, New Hampshire; Superior Nepheline Mines, Limited (formerly Temagami Development Company), 38 King Street West, Toronto, and Canadian Flint and Spar Company, 207 Victoria Building, Ottawa. Operations of the last three have all been in Dungannon township, east of Bancroft. Output of Gooderham-Nepheline and of Superior Nepheline Mines quarries has gone chiefly to the grinding plant of United Feldspar Corporation at West Paris, Maine; that of the New England Nepheline Company to the Golding-Keene mill at Keene, New Hampshire; and that of Canadian Flint and Spar Company to the mill of Consolidated Feldspar Corporation, Rochester, New York. Superior Nepheline Mines, Limited, erected a crushing and picking plant at its quarry in 1940.

The rock produced in Methuen township is a medium-grained and uniform-textured syenite, whereas most of the output from the Gooderham-Bancroft district has consisted of coarse pegmatitic material. It has been used after processing at destination for removal of iron-bearing constituents, chiefly black mica, for blending with feldspar to raise the alumina content. It is far less uniform in its alumina content than the Methuen rock and is thus no longer in favour. The Gooderham quarry has been inactive since 1938, and during 1941 the Bancroft properties were also idle. The nepheline of these pegmatites is mainly in the form of large crystals, and if means could be found to separate it from the associated coarse feldspars, scapolite, sodalite, and other minerals present, a nepheline product of high purity would be available.

Frobisher Exploration Company, Limited, a subsidiary of Ventures Limited (which holds the controlling interest in American Nepheline Corporation), conducted an intensively geological and diamond drilling program in 1941 on the nepheline syenite occurrences in the Bancroft area. In connection with this work, a process was developed in the laboratories of the Bureau of Mines, Ottawa, for the production of alumina from the nepheline syenite deposits, having as by-products, potash and soda ash. Canada has been obtaining its bauxite, the ore of aluminium, from the Guianas in South America, and in the event that these supplies are cut off, the nepheline syenite could be used to replace the bauxite as a source of aluminium. Nepheline Products, Limited, with office at Lakefield, Ontario, was incorporated in 1941 as a subsidiary of Ventures Limited to attend to outlets for nepheline syenite other than in the ceramic trade.

Production and Trade:

Nepheline syenite production in 1941 was valued at $227,583, compared with $113,245 in 1940. These figures represent mostly crude rock consigned to American mills, but include also finished products made in Canada for domestic consumption and for export.

Exports in 1941 (all to the United States) totalled 29,385 tons, valued at $109,936, compared with 23,812 tons, valued at $111,357 in 1940.

Aside from Russia, the output of which is unknown, Canada is the only producer of nepheline syenite. Russia recovers large tonnages of apatite (phosphate) from apatite-nephelite rock, large bodies of which occur in the Kola Peninsula. Much research has been carried out in that country on the commercial use of the by-product nephelite. It is believed, however, that this material is not comparable in quality to the Canadian product, though it is probably suitable for dark glass. It has also been investigated as a possible raw material for the manufacture of aluminium. Despite the active search for commercial-grade nepheline in the United States, most of the recorded occurrences contain too much finely divided and inseparable iron to be suitable for the manufacture of white glass.

Market Conditions and Prices:

Nepheline syenite continues to be used chiefly in the glass trade, where it is preferred to straight feldspar because of its higher content of alumina. Most Canadian glass plants now use the syenite 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 higher content of alkalis reduces the temperature of melting with resultant saving of fuel and longer tank life. Research has been proceeding steadily on applications for nepheline syenite in other branches of ceramics, and it has been found of advantage owing to its higher fluxing action, as a body ingredient in a variety of products, including pottery, semivitreous ware, sanitary and electrical porcelain, floor and wall tile, and structural clay products, as well as in enamels. Increased vitrification, translucency, and mechanical strength, improved glaze fit, and reduced absorption, warpage, thermal expansion, and crazing, are among the desirable properties claimed for the various types of ware made from it.

Glass grade nepheline syenite for sale in Canada remained at the 1940 price of $11.75 per ton, bulk, in carload lots, f.o.b. Lakefield, with ground, 200-mesh, ceramic grade quoted at $16.50. Grade B (dust) sold for $13.00, l.c.l. American prices also remained unchanged, at $12.00 for glass grade, and $15.50 for ceramic grade, all bulk, in carload lots, f.o.b. Rochester, New York.

Tariff:

Crude nepheline syenite enters the United States free of duty, provided that total imports of both crude and ground material do not exceed 50,000 long tons in any calendar year. Ground material pays 15 per cent ad valorem. During 1940, the United States Customs Court ruled that ground syenite was entitled to free entry under the classification of "manufactured sand", but this ruling was later contested by the United States Treasury Department and the 15 per cent figure was restored pending a new hearing.

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PHOSPHATE IN 1941

Ores Mined and Producing Localities:

Phosphate occurs in Canada in two forms, namely, as apatite, found associated with phlogopite mica in irregular pockety bodies in Precambrian crystalline pyroxenite rock of adjacent sections of southwestern Quebec and eastern Ontario, and as bedded, sedimentary phosphate rock of Carboniferous and Permo-Jurassic age that extends along the Rocky Mountains divide, or Alberta-British Columbia boundary, from the Crowsnest area in the south as far north as Jasper.

The western sedimentary phosphate is rather low-grade and is not considered to be of economic interest under present conditions. Operations by Consolidated Mining and Smelting Company about ten years ago in the Crowsnest-Michel area resulted in the shipment of 5,000 tons of the rock to Trail, British Columbia, for the manufacture of fertilizer, but attempts to concentrate it proved unsuccessful and the company has since drawn its supplies from Garrison, Montana. Eastern Canadian plants requiring phosphate for fertilizer or for other purposes, use mainly Florida rock, which in 1941 cost about $17.50 per ton, delivered, for 75 per cent grade.

Large-scale mining of apatite in Ontario and Quebec, an industry of some importance between 1870 and 1894, virtually came to an end in the latter year, following the discovery of the huge deposits of sedimentary phosphate in the Southern States, and production has since been intermittent and small. Total output from the two provinces is estimated at about 350,000 tons. Much of the apatite reported as sold since about 1900 has been by-product material recovered in the mining of mica. It has been clean, cobbed mineral containing about 80 per cent of tricalcium phosphate and most of it has been purchased by Electric Reduction Company, Buckingham, Quebec, for use in the production of elemental phosphorus and various phosphorus products. More recently, Canadian Refractories Limited, Kilmar, Quebec, reported being in the market for small annual tonnages.

Because of the rather erratic nature of Canadian apatite bodies, the high loss of fines in cobbing clean lump material, and the cost of mining as compared with the low production cost of sedimentary rock, there has been little incentive until recently to attempt to revive the mining of apatite deposits. However, the increase in the laid-down cost of imported phosphate has caused attention to be directed to several of the old mines in the Lièvre River area, Papineau county, Quebec, and shipments totalling close to 2,500 tons were made from properties in the area in 1941.

Production and Trade:

Apatite production in 1941 was 2,487 tons, valued at $33,376, compared with 358 tons, valued at $4,039 in 1940. Almost all of the output in 1941 came from Quebec, and quantity and value were the highest since 1899. The unit price was also higher than for most of this 42-year period.

Production, as in past years, included a small amount of picked lump, sold by a number of small operators, the grade of which ranged from 80 to 84 per cent. Most of the material shipped, however, consisted of a composite of lump and fines of about 7[illegible] per cent grade, and was produced mainly by Commercial Mineral Products Company, 680 Sherbrooke Street West, Montreal, which operated the old Emerald and Little Union mines in Buckingham township and the Old Union mine in West Portland township, Quebec. The shipping product was made by screening mine-run material on 3/8 inch and fines were improved by adding clean cobbed lump. The process involves considerable wastage of free apatite contained in minus one inch, -- plus 3/8 inch sizes. Tests have been made in the laboratories of the Bureau of Mines at Ottawa on the recovery of this material by selective screening, but gave poor results. Flotation might be used in treating Canadian apatite ores, both for improving the recovery and raising the grade of product, but this would entail the briquetting or sintering of the concentrate, since fines are objected to in the treatment in the electric furnace for making phosphorus, which is the principal domestic outlet for the material. Barry Lake Mining Company, 11 Rue des Remparts, Quebec, took over the old High Rock mine in West Portland township, and installed equipment preparatory to placing the property in production. Several hundred tons was shipped from the old North Star mine in East Portland township, one of the larger of the early producers.

World production of phosphate is about 11 million long tons annually. By far the greater part of it consists of sedimentary rock, but the Russian output of apatite, produced as concentrate from nepheline-apatite rock amounts to about 1,000,000 tons a year. Sweden and Canada are the only other producers of apatite for which figures are available. Sweden produced 6,267 tons in 1939, and as a war measure, was reported in 1940 to be undertaking the recovery of apatite from iron-ore tailings, under Government subsidy. Japan is reported to be considering the development of extensive apatite deposits in French Indo-China; and the Brazilian Government has begun the production of superphosphate from domestic apatite. In the United States, apatite is recovered as a concentrate from the treatment of nelsonite in Virginia, and some by-product mineral has also been produced from magnetite-apatite ore in New York State.

The United States is the leading producer of sedimentary phosphate, its output in 1940 being more than 4,000,000 tons of which 750,000 tons was exported. Shipments from Tunisia and Morocco in 1939 totalled over 3,000,000 tons; from Egypt and Algeria, about 500,000 tons each; and from the Pacific islands of Nauru, Ocean, and Christmas, a total of close to 1,500,000 tons. Except for Russia, European countries are deficient in phosphate deposits.

Imports of phosphate rock into Canada in 1941 totalled 237,029 tons, valued at $863,833, compared with 165,858 tons, valued at $663,554, in 1940, almost all of which came from the United States. Canada also imported 57,060 tons of superphosphate, valued at $649,011 in 1941, compared with 99,686 tons, valued at $982,337 in 1940.

Market Conditions and Prices:

Increasing 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 by Government and by private agencies has been devoted to the problems involved and to the development of new fields of utilization of elemental phosphorus. This work is expected to bring about a large expansion in the industry in phosphorus chemicals. Higher-strength superphosphates are 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 has 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 substantial saving in freight costs.

Research is in progress on methods of rendering raw phosphate available as plant food by volatilizing the combined fluorine from fused rock, the fluorine being the compound that inhibits solubility in the soil. Removal of contained fluorine from acid phosphate is required before the phosphate can be used in stock feeds and food products generally. Defluorination of fertilizer superphosphate, particularly of processed fertilizers diluted with calcareous materials, is also desirable to prevent reversion to the citrate-insoluble form during curing and storage. At the fertilizer plant of Consolidated Mining and Smelting Company, Trail, British Columbia, the fluorine so removed is recovered for use in the manufacture of hydrofluosilicic acid, used in the electrolytic refining of lead, thus dispensing with the use of fluorspar as a source of fluorine.

About 85 per cent of the United States production of phosphate is used in the fertilizer industry; 10 per cent in the making of baking powder and cleanser and laundering preparations; and the remainder in the chemical trade at large. Although most of the world production of phosphate will continue to be used in the making of fertilizers, the use of phosphorus and its compounds is showing a marked increase. One of these chemicals, trisodium phosphate, is already being employed extensively as a detergent in laundry work; as a general cleanser; for preventing scale or scum in boiler-feed and washing waters; and in the tanning, photographic, sugar, and other industries. The removal of injurious fluorine, the cause of "mottled" teeth, from potable waters, is accomplished by filtering through a bed of tricalcium phosphate. Sodium pyrophosphate and tetraphosphate are proving of value for deflocculating and lowering the viscosity of the muds used in oil drilling. Sodium metaphosphate is a strong "wetting" agent, and is highly efficient in the flotation of certain non-metallic minerals, and also in laundry practice. Alkaline earth phosphate binders are proving of value for refractory materials. Research is proceeding on the use of phosphate in glass batches and various ceramic products. In the United States, non-fertilizer uses for phosphate have been showing a steady expansion and these uses now consume about 500,000 tons of phosphate annually.

The use of electric furnace and blast furnace smelting for the treatment of phosphate rock has made available for concentration large tonnages of low-grade slimes made in the washing of sedimentary phosphate, material that it would not be economical to treat by the acid method of superphosphate manufacture. The slime product is sintered or nodulized before smelting.

Prices paid for apatite for Canadian consumption rose from $12 per short ton for 80 per cent grade, with 15 cents plus or minus per ton-unit above or below this figure, during the first six months, to $16 per ton, with 20 cents per ton unit bonus or penalty, in the last quarter.

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.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

PYRITES IN 1941

Ores Mined and Producing Localities:

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 several years.

Aldermac Copper Corporation's mine and concentrator twelve miles west of Noranda, Quebec, were in continuous operation in 1941. The copper concentrate is shipped for treatment to the Noranda smelter, while the high grade iron pyrites concentrate is shipped partly to chemical plants in the United States and partly to Three Rivers, Quebec, for use by St. Lawrence Paper Mills Company. At the Noranda mine, Noranda, Quebec, pyrites concentrate a by-product of the milling of copper-gold ores, was marketed for the manufacture of acid.

At Three Rivers, Quebec, all of the pyrites used in the Freeman flash-roasting plant in the mill of St. Lawrence Paper Mills Company is now being obtained from the Aldermac mine. The Freeman plant supplies all of the sulphur dioxide and part of the steam required for the operation of the company's sulphite plant.

In British Columbia, part of the large output of pyrites from the Britannia mine at Britannia Beach was consigned to the acid plant of Nichols Chemical Company at Barnet, British Columbia. As in previous years, however, much of the output was stored, awaiting more favourable market conditions.

Northern Pyrites, Limited completed in 1940 a program of development work that has been in progress for four years on its Ecstall pyrites property, located on Ecstall river about sixty miles south of Prince Rupert. A large plant as well as a railway to tidewater is required before active production can commence, but in the meantime, the company is awaiting more favourable market conditions. The Granby Company did considerable exploratory diamond drilling on the Ecstall property several years ago. According to reports, the orebodies contain 5,000,000 tons of ore averaging 49 per cent sulphur, 42 per cent iron, 2.3 per cent zinc, less than one per cent copper, and about $1.00 a ton in gold and silver. No work was done in 1941.

Production and Trade:

Canadian production and trade figures are not available for publication owing to the war.

Market and Prices:

Although the Freeman process of flash roasting, designed for by-product flotation fines that are obtained 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 meet any Canadian demand.

There is apparently no standard price in Canada for sulphur in pyrites. Most contracts are believed to be based on a price of 5 cents or better per unit (22.4 pounds) of sulphur per long ton, f.o.b. cars at point of production.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

SALT IN 1941

Source of Supply:

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. Salt is being 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 the waste material in the mine.

Producing Localities:

In Ontario, production was steady throughout the year, and all of the well-established plants were in operation. 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, Malagash Salt Company produced about 25 per cent less salt than in the previous year. A fire destroyed its power plant early in December, 1940, in consequence of which a complete shut-down of underground development was necessary. A new and permanent power plant has been erected. 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. Detailed studies have been started with a view to improving the grade of fishing salt obtained from this deposit and encouraging results are being obtained.

At Neepawa, Manitoba, the plant of Canadian Industries, Limited operated continuously, and the company has installed a new plant utilizing vacuum evaporation with modern equipment to produce all grades of salt.

At Waterways, Alberta, Industrial Minerals, Limited, controlled by Dominion Tar and Chemical Company of Montreal, operated continuously throughout the year. The direct-fired pans of the original plant have been replaced by one set of quadruple effect vacuum pans, complete with modern accessories. Two grainers have been added so that the coarser grades of salt can be produced. Other new equipment includes an Oliver filter with the necessary heaters and exhauster; one block press; weighing and bagging equipment for 100-pound bags, down to 3-1/2 pound packets; as well as packaging and wrapping machinery for the 2-pound cartons of table salt. With this new plant the company is in a position to place all grades of salt on the market. To provide for contingencies, a second production well was drilled and was made ready for production when needed.

In New Brunswick, a salt basin was discovered in 1921, as a 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 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. It was 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 1939 still another drill hole passed through the same salt formation, the thickness, however, being only about 100 feet, indicating that the northern edge of the basin is being approached. Six drill holes have penetrated the salt so that a deposit of salt over 1-1/2 miles wide and four or more miles long is already indicated, 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. The possibility of developing this deposit for the production of salt is being seriously considered.

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, and one bed more than 480 feet in thickness contained over 90 per cent sodium chloride. The apparent great thickness of the salt may be due to the steep dip of the beds.

Production and Trade:

The production of salt in 1941 was 560,827 tons, valued at $3,008,281, compared with 464,714 tons, valued at $2,823,269 in 1940.

Exports of salt in 1941 were 12,525 tons, valued at $121,784, compared with 6,349 tons valued at $61,922 in 1940. Imports of salt were 81,433 tons, valued at $449,904, compared with 112,511 tons, valued at $557,768 in 1940, and 117,628 tons valued at $507,368 in 1939. The greater part of this salt comes into Canada free of duty for use in the fisheries on the Atlantic and Pacific coasts.

The world production of salt is steadily increasing and in 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 stood thirteenth on the world list and was the third largest producer in the British Empire, being exceeded only by Great Britain and India. Canada produces only slightly over one per cent of the world production and over 7 per cent of that of the British Empire.

The market for salt in Canada is steadily increasing, and the industry is in a sound condition. Domestic production, except for small exports, is sold principally to the dairy, meat curing, and canning industries; to fisheries; to highway and transport departments for soil stabilization; to 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 in the past few years. The development of soil stabilized bases for runways at Canadian air fields continued, and several air fields have been 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, as it has been found that even in the coldest weather the sand in piles which have been so treated remains loose and free flowing, thus allowing easy distribution on the icy roadway.

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

According to the Canadian Chemistry and Process Industries (Toronto), prices for the several grades of salt remained stationary throughout the year. Quotations for specially purified (99.9 per cent NaCl) salt in 280-pound barrels f.o.b. plant were $3.10 per barrel, while industrial fine in bulk car lots f.o.b. plant per ton were $6.32, and industrial coarse per ton were $10.00.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

SAND AND GRAVEL IN 1941

Deposits of gravel and sand are numerous throughout eastern Canada, with the exception of Prince Edward Island, where gravels are scarce. Owing to the widespread occurrence of gravels and sands and to 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 small number of large plants. Some grades of sand particularly suitable for certain industries command a much higher price than does ordinary sand.

The total production of sand and gravel for 1941 amounted to 31,914,550 tons valued at $11,839,623, compared with 31,375,415 tons valued at $11,759,245 for 1940. Following are the output and value by Provinces for these two years:

	1940		1941	
	Quantity Tons	Value $	Quantity Tons	Value $
Nova Scotia......	1,440,140	867,490	726,488	302,327
New Brunswick....	944,033	278,710	1,171,486	439,828
Quebec............	12,177,624	3,127,931	11,216,000	2,908,000
Ontario	9,678,745	4,025,026	9,239,737	3,812,120
Manitoba	1,851,645	839,993	1,931,799	757,870
Saskatchewan	1,472,885	741,353	728,246	433,550
Alberta	1,722,465	1,069,667	1,110,523	614,350
British Columbia.	2,087,878	809,075	2,750,271	1,071,578
	31,375,415	11,759,245	28,874,550	10,339,623

Road improvement, concrete works and railway ballast absorb by far the greater part of the gravel and sand used. Gravel in particular has proved a good material for building all-weather roads at low cost and its use has steadily increased with the growth of motor traffic.

A considerable tonnage of sand and gravel is also used in the mines for re-filling underground workings. Some mines use 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 two 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 program 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 and the proportion thus processed is 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, free from dust, loam, organic matter or clay, and contain 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, all of which require special grades of sand.

War conditions did not materially affect the total consumption of sand and gravel, as the extra amount absorbed by war services is partly if not wholly offset by a decreased activity in ordinary industry due to the war.

Prices of sand, gravel and crushed stone in the four largest cities in Canada were as follows, at the end of 1940 and 1941. Prices per ton or cubic yard, as indicated below, are for carlots, f.o.b. cars:

	Montreal		Toronto		Winnipeg		Vancouver	
	per ton		per ton		per cu.yd.		per cu. yd.	
	1940	1941	1940	1941	1940	1941	1940	1941
Sand	1.15	1.15	.93	1.00	1.00	1.00	1.00	1.00
Gravel	1.10	1.10	1.43	1.53	1.00	1.00	1.00	1.00
Crushed Stone	.75	.82	1.35	1.61	-	-	1.13	1.13

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

SILICA IN 1941

Source of Supply:

The materials produced 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 steel foundries; and silex, the finely pulverized silica used in the ceramic and paint industries.

Quartz, quartzite, or sandstone in sizes from ½ inch to 6 inches is used in the manufacture of ferro-silicon and pure silicon, and quartz and quartzite are used also 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 use for which it is required. In the manufacture of glass, for instance, 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 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, and then either air- or water-floated to recover the fine flour. The ceramic industry requires that it be 150 mesh or finer, whereas in the paint industry, air-floated material 250 mesh or finer is required.

Important Developments and Producing Localities:

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 Quebec.

The deposit of silica sand near River Denys, Inverness county, Nova Scotia, was not operated during the past year. The sand is of good quality and is suitable for a number of uses. It should find a ready market in the Maritime Provinces especially in the steel foundries.

In Quebec, the plant of the Ottawa Silica and Sandstone Company, was idle most of the year. When operating it produces sand of different grades for steel foundries, the glass industry, and for sand blasting, etc. This company has also a plant for the production of rock wool. In April, 1940, a fire destroyed the whole plant of the Canadian Kaolin Silica Products, Ltd., at Lac Remi, Quebec, and to date no move has been made to rebuild. As this company was supplying a large part of the Canadian production of silica sand, much hardship has been placed on the consumers, who in consequence have to obtain the greater part of their requirements from the United States.

Canadian China Clay Company, at St. Remi d'Amherst, Quebec, has sunk a shaft to a depth of over 300 feet and has carried out extensive development on its 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. Machinery was installed and production operations were started during the summer. China clay and silica sand are being produced and it is hoped that this source of supply will meet some, at least, of the requirements of the silica industry.

A deposit of sandstone, situated about 2 miles west of Joyceville, a village on Ontario Highway No. 15 eleven miles north of Kingston, Ontario, was opened up by A. D. Bartlett of Kingston for the purpose of supplying silica for cement manufacture. A steady production of from 50 to 60 tons of quarried rock per day is shipped from this property for this purpose. The sandstone is loosely compacted and breaks down readily to a sand of a uniform grade suitable for use in steel foundries and for sand blasting. Canadian Flint and Spar Company, operating a crushing plant at Buckingham, produced a small tonnage of high-grade quartz sand, which was used as an abrasive.

Canadian Carborundum Company, at St. Canute, Quebec, produced silica sand almost entirely for the manufacture of carborundum at its plant at Shawinigan Falls. 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, 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 to pass a 3-inch screen and be retained on a 5/8 inch screen. 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, Ontario, and one at Arvida, Quebec, produce this grade.

In the use of silica as a flux, smelter operators 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 upon the market for the finished products.

The demand for high-grade silica sand was steady and large quantities are still imported. Canadian producers have a good chance to enter this market at the present time provided they can guarantee the grade of the material and regularity of shipments. 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 must guarantee regularity of shipments, if they hope to gain control of these markets. The use of Canadian sand for sand blasting is increasing.

Interest is active throughout Canada in the search for deposits of high-grade silica strategically situated for supplying the increasing demand, especially that in central Ontario and in Western Canada. West of Winnipeg the needs for silica are met almost entirely by imported material.

Production and Trade:

The production of quartz and silica sand in 1941 was 2,026,299 tons valued at $1,526,765, compared with 1,858,259 tons valued at $1,203,527 in 1940. The 4,145 M silica brick produced in 1941 were valued at $240,411, compared with 3,438 M valued at $182,786 in 1940.

Exports of silica in the form of quartzite in 1941 amounted to 105,077 tons valued at $190,933, compared with 106,203 tons valued at $195,163 in 1940.

The total of the various grades of silica, (ganister, flint, silex and silica sand) imported in 1941 amounted to 427,930 tons with a value of $936,798, compared with 283,851 tons valued at $630,679 in 1940. Imports of silica brick in 1941 were valued at $746,768, compared with $472,215 in 1940.

Market and Prices:

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 largest 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, 1942.

SODIUM CARBONATE (NATURAL) IN 1941

Source of Supply:

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 British Columbia, chiefly in the Clinton Mining Division, near 70-mile House, about 20 miles northeast of Clinton, and in the neighbourhood of Kamloops. Since 1921 there has been a small intermittent production from several of these deposits, the product being marketed in Vancouver for use in the manufacture of soap.

Production and Trade:

Production in 1941 was 186 tons valued at $1,488, compared with 220 tons valued at $1,760 in 1940.

Imports of soda ash or barilla in 1941 were 38,944 tons valued at $816,067 ($20.96 per ton), compared with 4,647 tons valued at $110,285 ($23.70 per ton) in 1940, and 1,573 tons valued at $45,377 ($28.90 per ton) in 1939.

Market and Prices:

Sodium carbonate, or "soda ash", has many industrial uses, such as in the manufacture of glass and soap, in the purification of oils and of bauxite for the production of aluminium, and in the flotation of minerals. Owing to technical advances, the use of soda ash in the glass industry (the greatest consumer of sodium carbonate) continued to grow. The next largest use of sodium carbonate is in the production of sodium hydroxide or caustic soda. An interesting new use for sodium carbonate is in the manufacture of "synthetic salt cake" (anhydrous sodium sulphate). Considerable quantities of soda ash are also consumed in the smelting of iron ores. The treatment of metallic minerals by flotation in Canada in 1941 required about 4,000 tons of soda ash. As the present known Canadian deposits are far from the main markets, the output is restricted to the requirements of consumers within economic rail haul from the deposits. Eastern consumers of soda ash obtain their supplies from the chemically prepared material made from salt by the Solvay or ammonia process in Ontario and in the United States.

The price of soda ash in 1941 as given by the Canadian Chemistry and Process Industries remained at $2.00 per bag of 100 lbs. throughout the year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

SODIUM SULPHATE (NATURAL) IN 1941
(Glauber's Salt and Salt Cake)

Source of Supply and Producing Localities:

The material produced in Canada is both hydrated sodium sulphate known as Glauber's Salt and 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 in 1941 was mainly from Saskatchewan, but a small tonnage of the crude salts was harvested in Alberta for local consumption for cattle licks. The principal producers were: Natural Sodium Products, Limited, with plants at Bishopric and Hardene; Horseshoe Lake Mining Company, Ormiston; Midwest Chemical Company, Palo; and Sybouts Sodium Sulphate Company, Gladmar; all of which are in Saskatchewan. Small tonnages were also produced from several other properties.

Natural Sodium Products' plant at Bishopric operated throughout the year and has a capacity of about 500 tons daily. The company also acquired the Hockley leases on the deposit at Alsask lake, formerly operated by Sodium Corporation Limited and has a plant under construction. The Canadian National Railway has completed the construction of a spur track from near Hardene to serve this new plant. Midwest Chemicals Limited, at the central portion of Whiteshore lake, operated throughout the year and the Canadian National Railway constructed a spur track in the autumn of 1941 to serve the company's plant. Horseshoe Lake Mining Company operated its plant at Ormiston.

Sybouts Sodium Sulphate Company completed its dehydrating plant at Sybouts lake, 9 miles south of Gladmar, Saskatchewan, and started operations early in the autumn. The plant was later destroyed by fire, but plans were made for the building of a new plant which will likely be in operation early in 1942.

No production is reported from British Columbia. Sodium sulphate is the chief salt in a number of deposits in that province, and several of them have been prospected to determine their extent.

A discovery made in New Brunswick during 1937 may yet prove of importance as a source of sodium sulphate. New Brunswick Gas and Oilfields, Limited, in drilling for gas at Weldon, has proved large thicknesses of rock salt (sodium chloride). Two holes drilled 3,500 feet apart, from which cores were obtained, show 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 content of this bed ranges from 25 per cent to 30 per cent. Glauberite and sodium chloride are present in other holes drilled in 1939, thus further extending the salts basin. Many millions of tons of sodium sulphate seem to be indicated in this deposit, the boundaries of which have not yet been fully determined. The Bureau of Mines, Ottawa, did much research work on the material recovered in these cores, and indicated a method of recovery of the sodium sulphate. Further detailed work is required to determine the commercial possibilities of the deposit.

The industry in western Canada appears to be well established and steady progress is being made. The material is shipped to the Pacific coast in Canada and the United States; east to Ontario, Quebec and the Maritimes; and south to the Middle Western States and to Louisiana.

Investigation of the sodium sulphate deposits in western Canada was started by the Bureau of Mines, Ottawa, 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, and is increasing each year.

Production and Trade:

The production of natural sodium sulphate in 1941 amounted to 115,601 tons valued at $931,554, compared with 94,260 tons valued at $829,589 in 1940. Production from the deposits of western Canada increased over 22 per cent compared with that of 1940. The increase can be traced to the increased activity in the nickel and the pulp and paper industries and to the greater demand for the material in the United States due to the cutting off of imports from Europe. The operating plants in western Canada are capable of producing over 900 tons of dried salts a day, and if necessary the tonnage could be greatly increased.

Complete figures for the world production of salt cake are not available, and it is difficult to compare the returns from different countries as the production comes from chemical plants and from natural deposits. Germany, prior to the war, was probably the largest producer of total salt cake and Canada was among the first ten producers. Canada is, however, one of the largest producers of salt cake from natural deposits.

Shipments from the deposits in western Canada to the United States showed a marked increase in 1941, but export figures are not available. Imports of sodium sulphate, including Glauber's salt, salt cake, and the acid sodium sulphate (nitre cake), amounted to 8,729 tons valued at $134,196, compared with 9,498 tons valued at $135,480 in 1940.

Market Conditions and Prices:

In the chemical industries, glauber's salt is used widely and the demand is increasing. Sodium sulphate is used extensively in the pulp and paper (53,500 tons in 1940), glass, dye, and textile industries and to a smaller extent for medicinal and tanning purposes. It is also used extensively in the nickel-copper smelting industry for the separation of these two metals.

Markets for the products from these deposits are likely to expand, as supplies from Europe are no longer available and as the by-product material from the manufacture of hydrochloric acid is decreasing in volume each year owing to the manufacture of hydrochloric acid synthetically.

The price for natural anhydrous sodium sulphate from the deposits in western Canada ranged from $8.00 to $8.50 per short ton f.o.b. plant. The delivered price is considerably higher, owing to the high freight rates to the consuming plants, which are mostly in eastern Canada.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

SULPHUR IN 1941

Source of Supply:

Deposits of elemental sulphur of commercial grade have not been found in Canada, but sulphur occurs in combination with copper, lead, zinc, nickel, or iron in many base metal sulphide orebodies in various parts of the country. In the smelting of these ores sulphur dioxide gas is produced, but until recent years this gas was a total waste as no facilities were available for the recovery from it of sulphur, or sulphur compounds.

In practice, this gas can be used directly for the manufacture of sulphuric acid; the production of liquid sulphur dioxide; or for the production of elemental sulphur. A few years ago, International Nickel Company of Canada erected a plant at Copper Cliff, Ontario for the recovery of portions of its smelter gases for use in the manufacture of sulphuric acid. Later a similar plant was erected at Tadanac (Trail), British Columbia by Consolidated Mining amd Smelting Company. At the former plant high grade sulphuric acid is produced and is marketed in several industries, while at the latter, the acid made is used chiefly for the manufacture of fertilizers. Part of it is used elsewhere in the plant and some of it is marketed. Since the summer of 1936, the plant at Tadanac has also been producing elemental sulphur from the smelter gases. No plant in Canada is producing liquid sulphur dioxide from smelter gases, although this has been done experimentally.

In Quebec, Aldermac Copper Corporation, with a mine and concentrator 12 miles west of Noranda, produces a copper concentrate and a high-grade pyrites concentrate from massive sulphide ores. The former is shipped to the Noranda smelter for treatment, while part of the latter is exported to chemical plants in the United States and part of it is shipped to Three Rivers, Quebec, for use by St. Lawrence Paper Mills Company for use in its Freeman flash-roasting plant. Construction by Aldermac Copper Corporation of a plant to produce sulphur and iron oxide has been suspended owing to the existing favourable market for its pyrites concentrates in the United States.

At the Noranda mine pyrites concentrate, a by-product of the milling of copper-gold ores, was marketed for the manufacture of acid.

Production amd Trade:

Canadian production and trade figures are not available for publication owing to the war.

The United States are the main source of the world production of sulphur. The output in 1941 amounted to 3,150,000 tons, chiefly from the states of Texas and Louisiana.

Market and Prices:

Sulphur is used in Canada chiefly in the production of sulphide pulp and for use in the making of artificial silk and newsprint. It is used to a large extent also in the manufacture of sulphuric acid, explosives, and rubber, and in the production of fertilizers. With the construction of new sulphuric plants in Canada and the United States, the consumption of sulphur was increased in 1941 and will be further increased in 1942.

The following abstracts have been taken from the review on sulphur published in the February, 1942, issue of the Mining Congress Journal.

While sulphur is a vitally essential raw material for war, it is no more so than steel, gasoline, rubber, fertilizers, paper and the other countless things which war consumes and sulphur helps to make. The increase in sulphur consumption in the United States from 1940 was about 30 per cent, while industrial activity was 27 per cent.

Sulphuric acid is still used to concentrate nitric acid, but it is no longer used in large amounts to produce nitric acid. Nearly the same quantity of sulphuric acid as before must, however, pass through the munitions plants to make one ton of explosive, and it then emerges as a large volume of dilute by-product acid. The spent acid disposal problem is being solved by purification and concentration of the acid for use in part by the munition plants and in part for use in other industries.

The remarkable growth of the rayon industry continues, and of all the rayon processes the viscose process consumes the largest quantity of sulphur. The expansion of the pulp and paper industry has also created increased demand for sulphur.

Sulphur and sulphuric acid are serving well in the problem of substitute materials. Salt and sulphuric acid are being used for making hydrochloric acid, thus releasing large quantities of chlorine which is used for the same purpose. A number of the proposals for aluminium production from clay involve the solution of the aluminium-bearing mineral in sulphuric acid.

According to Metal and Mineral Markets, New York, the price of sulphur in 1941 remained unchanged at $16 a long ton, f.o.b. mines. The prices at consumers' plants in Canada vary from $22 to $25 according to location, the difference being due to transportation costs.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

TALC AND SOAPSTONE IN 1941

Ores Mined and Producing Localities:

Active production of ground talc in Canada was begun in 1906 from deposits in the Madoc area, Ontario, and these deposits have since been the main source of supply. Canada Talc, Limited is the chief producer in the area, having taken over the holdings of G. H. Gillespie Company, the pioneer operator, in 1937. There have been various other small operations in the area. In 1941, Trent Mining Syndicate began to develop a property adjoining that of Canada Talc, Limited, where surface showings indicate an easterly extension of the same vein system, and at the end of the year was proceeding with the erection of a small mill. R. W. Bonter and associates of Trenton ground a small tonnage of slightly off-colour talc in the mill of Canadian Slate Products, a mile and a half north of Madoc; the crude was brought in by truck from a deposit near Ompah, Frontenac county, 65 miles distant. The talc from Ompah is finely-schistose, cream-coloured, and distinct in character from the white foliated talc of the Madoc district.

In British Columbia, the deposits near McGillivray, on the Pacific Great Eastern railway, and at Kapoor, near Victoria, have been idle since 1935. The crude was shipped to a grinding plant at Vancouver, for local roofing use. Some ground soapstone is prepared in a small mill in Vancouver by G. W. Richmond, 3239 West King Edward Avenue, from crude imported from the State of Washington. The mill also grinds miqa, slag, etc., mainly for local roofing firms and partly for export to Tacoma, Washington.

Quebec has been producing soapstone in small quantities since 1922 and the industry has been supplying mainly blocks and bricks for alkali recovery furnaces of domestic kraft mills. Some cut furnace stone has been exported. In recent years the sawing of crayons has been undertaken. Broughton Soapstone and Quarry Company, the principal operator, has developed a large quarry near Leeds station on the Quebec Central railway, in Broughton township. This company produces cut furnace stone and crayons and has a grinding mill in which quarry and sawing waste, as well as a more highly talcose rock occurring in a band cutting its main soapstone body, are pulverized. The company took over the Louis Cyr holdings at St. Pierre de Broughton in 1940. Other operators in the same area are Charles Fortin, of Robertson, and L. C. Pharo, of Thetford Mines. L. C. Pharo installed a small grinding unit on his property in Thetford township in 1938. Some of the dust from these operations is sold to domestic roofing firms, and a considerable tonnage of quarry and sawing waste is shipped to the grinding plant of Pulverized Products, Limited, 4820 Fourth Avenue, Rosemount, Montreal. Baker Mining and Milling Company, 4010 St. Catherine Street West, Montreal, the only other operator in Quebec, has a mine and mill near Highwater in Potton township, Brome county, close to the Vermont boundary. The company began to produce in 1938, and in 1941 reported sales of about 2,000 tons of ground talc of various grades. Pulverized Products, Limited and Broughton Soapstone and Quarry Company produce most of Quebec's output of ground talc, their total shipments in 1941 being about 7,000 tons. The latter company recently erected a building for the air-drying of crude with a capacity of 3,000 tons, and also enlarged its bagged storage space to 2,000 tons. Pulverized Products expanded its grinding capacity in 1941 by the addition of a Williams hammer-mill, screens, air separator, and dust collector, the equipment being used in the production of coarser (200-mesh and roofing) talc. Both companies employ Raymond-type equipment for producing fine 325-mesh grades.

It was announced toward the end of 1941 that consideration was being given to the development of a talc deposit that occurs as a band in an old copper mine near Eastman, in Bolton township, Brome county. Tests on samples of this talc in the laboratories of the

Bureau of Mines, Ottawa, showed it to be of grey, off-colour grade and rather heavily contaminated by magnetite, sulphides, and carbonates. Pulverized Products reported having commenced production in 1941 of a new trade talc substitute, "Asbestolite", made from a pale yellow serpentine encountered in mining magnesite in the Kilmar district, Quebec. The ground product is stated to be fibrous somewhat like the talc of the Gouverneur district, New York; it is said to be much more bulky, however, and to have greater suspending power in paints.

Production and Trade:

Production of ground talc in 1941 totalled 17,841 tons. valued at $195,074, compared with 15,166 tons. valued at $154,733 in 1940. The output of soapstone was valued at $155,925, compared with $74,905 in 1940; these figures include sawn furnace stone, crayons, quarry and sawing waste sold for grinding, and possibly also some sawdust from the cutting plants. Total value of all classes of products sold as talc and soapstone was $350,999, compared with $229,639 in 1940, an increase of $131,400 or 57 per cent.

Exports of talc products, mainly ground material, but including also crayons, totalled 19,411 tons valued at $263,568, compared with 10,232 tons, valued at $142,577, in 1940, and 7,185 tons. valued at $74,560, in 1939.

Imports of talc totalled 4,805 tons valued at $93,455, compared with 3,719 tons valued at $66,238, in 1940. Practically all of it came from the United States.

World production of talc, including cut soapstone, steatite, and pyrophyllite (a mineral closely resembling talc and used for many similar industrial purposes) amounts to about 500,000 tons a year. The United States produces more than 50 per cent of the total, its output in 1940 being 281,000 short tons. Prior to the war it was followed by Manchuria, with an output of about 100,000 tons a year. France and Italy each produce about 50,000 tons; Norway, 25,000 tons; and British India, 20,000 tons a year. World consumption of talc has increased more than 40 per cent in the past decade.

Market Conditions and Prices:

The talc market was particularly active as a result of the heavy demand from Great Britain for rubber grades to fill the deficiency caused by the cutting off of Italian, French, and Norwegian supplies. Operators found it difficult to keep pace with this demand, and larger quantities could have been shipped had adequate cargo space been available. British importers reported that the grade of shipments was satisfactory for general-purpose use, and the Canadian material appears to be well established in the British market. Madoc talc, although of prime white colour, contains a considerable amount of gritty, carbonate impurity, and so cannot be substituted for the higher grades of French and Italian talcs used in the cosmetic and pharmaceutical trades. The Quebec talcs, though off-colour, are usually much lower in carbonates and have proved acceptable for rubber, paper, and paint use, and for rice polishing. Some objection has been voiced regarding their suitability for cable insulation, owing to a small content of manganese. It is reported that a portion of the shipments to Great Britain is used for the smothering of incendiary bombs, talc being considered superior to ordinary sand for this purpose; this report, however, lacks confirmation.

Talc has a great variety of uses. Much of the greater part of the output, however, is used in the paint, ceramics, roofing, paper, and rubber trades, the remainder being used chiefly in cosmetics and pharmaceuticals, foundry facings, bleaching fillers for textiles, insecticides, plasters, and in rice polishing. Compact, massive talc is used mainly for sawing into steel-makers' crayons and so-called "lava" shapes for refractory and electrical insulators. Such shapes are in active demand for use in short-wave radio equipment. In the United States, which is the principal outlet for ground talc (including soapstone and pyrophyllite), the percentages of consumption were as follows in 1940: paint industry, 24 per cent; ceramic industry, 18 per cent; the roofing, paper and rubber trades, 12 per cent, 11 per cent, and 10 per cent, respectively; cosmetics, 3 per cent; and foundry facings, 2 per cent. The ceramic uses of talc and pyrophyllite are rapidly increasing, to prevent crazing in floor and wall tile, in electrical and other porcelains, in porcelain enamels, dinnerware bodies, and in refractories. For rubber, talc is employed mainly for the dusting of moulds and finished products. It is of value also as a body reinforcing ingredient to impart toughness and to increase tensile strength, particularly in cable insulation.

Many grades of ground talc are marketed and the price range is wide. Value is dependent upon purity (governing freedom from gritty or iron-bearing substances, slip, and colour), particle shape, and fineness of grinding, the specifications for which vary in the different consuming industries. Roofing and foundry talcs are the cheapest grades, these trades being satisfied with coarser grey or off-colour material, often soapstone powder or sawing dust, which sells at about $5 to $7 a ton f.o.b. rail. Better-class grey talcs, suitable for rubber and paper use, sold in 1941 for $7 to $15 a ton f.o.b., according to grade and fineness. White, foliated Madoc talc was quoted at $18 to $30 a ton for the two best grades, and $8 to $12 for coarser mesh sizes. American talcs include high-grade, white Californian material, selling at $17 to $20; fibrous New York "Asbestine", "Tremoline", and "Loomite" grades quoted at $12 to $15; and the lower-grade, grey Georgia and Vermont products, which sell at $6 to $10: all prices f.o.b. mines. Lava steatite and crayon talc sells at from $100 to $150 a ton, whereas the coarser roofing grades, often largely talc-coated, gritty, air-separator rejects, may sell as low as $4.

The Dominion Bureau of Statistics reports consumption of talc in Canada in 1939 at about 8,500 tons, of which the roofing trade took 3,170 tons; paints, 2,350 tons; pulp and paper, 1,125 tons; and rubber, 707 tons. The remainder was used mainly in soaps and cleansers, toilet preparations, and electrical apparatus.

Tariff:

Canadian ground talc or soapstone exported to the United States is dutiable at 17½ per cent ad valorem on material valued at not over $14 a long ton. On material valued at over $14 a ton, the duty is 35 per cent. Crude material pays one-quarter cent a pound, whereas cut soapstone or talc, in the form of bricks, crayons, blanks, etc., is dutiable at one cent a pound. Talc, ground or unground, enters Canada under the British Preferential tariff at 15 per cent ad valorem, and under the Intermediate and General tariff at 25 per cent: imports from the United States, however, are dutiable at 20 per cent.

PYROPHYLLITE Pyrophyllite (hydrous silicate of alumina) closely resembles talc in appearance and physical characteristics. It is difficult to distinguish from talc, even by microscopic means, and often requires chemical analysis for its identification. In the ground state it can be employed for many of the industrial uses of talc. Commercial deposits are relatively scarce. Most of the recorded world production comes from North Carolina, where the industry has expanded rapidly in recent years. A large part of the American output goes to the ceramic trade, the remainder being sold for fillers in various products. When fired, pyrophyllite does not flux, as does talc, and it is of value in a wide range of high-grade ceramic products, including refractories. A furnace-patching product made with pyrophyllite is marketed under the name "Pyroplastic".

Important deposits are known in Newfoundland, from which some shipments were made a few years ago to the grinding mill of Clinchfield Sand and Feldspar Corporation, Baltimore, Maryland. In Canada, some rather low-grade, sericitic pyrophyllite occurs at Kyuquot Sound on the west coast of Vancouver Island; a small quantity was shipped from these deposits about 30 years ago for use in refractories and cleanser products. None of the occurrences of pyrophyllite in Quebec recorded in early reports of the Geological Survey have been developed and little is known of their extent or economic possibilities. One such deposit in Stanstead township, near Lake Memphremagog, was investigated in 1941 by the Bureau of Mines, but the material proved to be sericite.

In 1941, pyrophyllite was quoted at $8.00 to $13.00 a ton, f.o.b. North Carolina mills, for 200-mesh and 325-mesh material, respectively.

Note: Copies of publication No. 803, "Talc, Steatite, and Soapstone: Pyrophyllite", published by the Bureau of Mines, Ottawa, in 1940, may be obtained from The Director, Mines and Geology Branch, Department of Mines and Resources, Ottawa.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

VOLCANIC DUST IN 1941

Source of Supply:

Deposits of volcanic dust (pumice dust) are found in Saskatchewan, Alberta, and British Columbia. There has been intermittent production from Waldeck, near Swift Current, Saskatchewan, and from near Williams lake in British Columbia.

In Saskatchewan, deposits occur also five miles north of Braddock; west of Beverley; and near St. Victor, all of which are grey to buff in colour. Some stripping and prospecting was done during 1940 on a deposit of white volcanic dust overlain by bentonite 5 miles west of Rockglen, and laboratory experiments were carried out during 1940-41 by the University of Saskatchewan on the Rockglen and several of the other deposits of volcanic dust.

In British Columbia there are several deposits, 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 north of Quesnel lake in the Cariboo district but there has been no production.

Production and Trade:

There has been no production of volcanic dust since 1934. The production in that year amounted to 31 tons valued at $310, all of which came from Waldeck, Saskatchewan.

Imports, which are grouped with a number of similar products—pumice, pumice stone, lava, and calcareous tufa—were valued at $40,910 in 1941, compared with $35,631 in 1940.

In the United States, shipments of volcanic dust and pumice in 1940 (figures for 1941 not available) were $82,407 tons, valued at $449,914, about twenty companies being engaged in production.

Market Conditions:

The material is used mainly as the abrasive base in scouring and cleansing compounds, and a small amount is used in acoustic plaster and in concrete admixture. About 60 per cent of the United States output is used for cleansing and scouring compounds; 27 per cent for light-weight concrete and aggregate; 4 per cent for acoustic plaster; and the remainder for asphalt filler, stucco, filtering and insulating media, paint filler, insecticide, floor sweep, dusting the inside of tires, and in abrasive uses, such as glass bevelling, or in the polishing of aluminium. Some of the United States volcanic dust produced in the United States in 1939 was used in the manufacture of fire-proof 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 suitability for such use has been indicated by laboratory and industrial applications. In this connection it has been used successfully in some glazes, replacing feldspar.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

WHITING SUBSTITUTE IN 1941

Sources of Supply:

Whiting substitute, as the name implies, is a material that may be used in place of chalk whiting, all of which originates in England or in Europe. It may be made from white limestone or white marble, marl, lime, or the waste calcium carbonate sludge resulting from the manufacture of caustic soda.

The principal differences between whiting made from chalk, and whiting substitute made from marble or limestone are that the latter is usually whiter, has a low capacity for absorbing oil, and the individual particles are sub-angular rather than rounded.

The products made from white marble or white limestone are pulverized to various degrees of fineness ranging from 200 to 400 mesh, and the raw material used contains very little magnesium carbonate, though in the past a whiting substitute made from white dolomite was produced in eastern Canada for making putty.

Marl suitable for making whiting substitute should be white or nearly so, be nearly free from grit and clayey material, and have a very low content of organic matter. This last-named constituent, which is present to some extent in all deposits of marl, renders the product unsuitable for use as a filler in products such as putty and paint where it will come in contact with oils. The oil-absorptive capacity of whiting substitute made from marl is usually greater than that of whiting, but in other respects the physical characteristics of the two products are much the same.

Calcium 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 several years. Its use up to the present has been as a filler in newsprint, book, and magazine 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.

Production and Trade:

Producers of whiting substitute are Pulverized Products, Limited, Montreal; Claxton Manufacturing Company, Toronto; White Valley Chemicals, Limited, Toronto; Gypsum, Lime and Alabastine, Canada, Limited, Winnipeg; and Beale Quarries, Limited, Van Anda, Texada Island, British Columbia.

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, and in the present situation when all European sources of whiting are cut off from the Canadian market because of the war, the domestic industry is largely supplying the Canadian market.

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.

Market and Prices:

Whiting substitute made in Canada is used mostly in the manufacture of oilcloth, linoleum, in certain kinds of rubber products, in putty, in explosives, and as a filler in newsprint, book, and magazine paper. 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.

Prices per ton, bagged and in carload lots range from $8.00 to $15.00 per ton f.o.b. plants.

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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

COAL IN 1941

The principal coal producing Provinces of Canada are Nova Scotia and Alberta, the combined production from these areas representing approximately 80 per cent of the total production of Canada.

The coal production from the Nova Scotia mines, augmented by a small tonnage from New Brunswick, provides not only for the local requirements of the railways of the area, steel industry and domestic consumption, but also for much of the fuel requirements of the Province of Quebec and to a lesser degree the Province of Ontario. The Western and Prairie Provinces produce all ranks of coal from semi-anthracite to lignite; the appreciable tonnage of Alberta coal is principally bituminous in rank as is also that from British Columbia. The Provinces of Saskatchewan and Manitoba produce lignites only.

From the Alberta coal field bituminous and domestic coals are moved eastward to the markets at Winnipeg and in Ontario.

The movement of coal from Nova Scotia on the St. Lawrence route has been largely curtailed during the year owing to the considerable increase in the local requirements of wartime industry and transportation.

The Dominion Steel & Coal Corporation at Sydney, Nova Scotia, produced coal for its industrial and coking requirements and also supplied railway and other markets notwithstanding a period of restricted output from some of its larger mines.

The briquetting of coal was expanded during the year following the installation of equipment by the Vancouver Island Coals, Ltd., at Union Bay, and by the West Canadian Collieries Limited at Blairmore, Alberta, the latter company introducing a new type of equipment suitable for the production, from bituminous coals, of binderless briquettes.

The large scale investigational work on the production of fuel from Northern Ontario lignite was continued during the year with a view to marketing this fuel in its most suitable form.

The production of coal in Canada amounted to 18,155,447 tons, valued at $57,995,503, compared with 17,566,884 tons valued at $54,675,844 in 1940.

Production of Coal in Canada by Provinces

Province	1941 Tons	1940 Tons	Per Cent Increase or Decrease	
Nova Scotia	7,386,975	7,848,921	5.9	Minus
Alberta	6,969,846	6,203,839	12.3	
British Columbia	2,020,842	1,867,846	8.2	
Saskatchewan	1,319,899	1,097,517	20.0	
New Brunswick	523,299	547,064	4.5	Minus
Manitoba	1,246	1,697	26.5	"
Canada	18,222,107	17,566,884	3.7	

Production of Coal in Canada By Kinds

	1941 Tons	1940 Tons	Per Cent Increase or Decrease	
Bituminous	13,602,473	13,333,037	2.1	
Subbituminous	585,453	598,686	2.2	Minus
Lignite	4,034,181	3,635,161	10.9	

The imports of coal into Canada totalled 21,808,861 tons compared with 17,546,107 tons in 1940. The anthracite importations totalled 3,940,859 tons. Bituminous coal importations consisted of 17,867,068 tons compared with 13,578,705 tons in 1940 and were mainly from the United States.

Coal exports from Canada amounted to 531,449 tons, compared with 504,898 tons for 1940.

Canadian coal moved under Federal Government assistance amounted in 1941 to 3,318,968 tons at a cost of $4,489,229, or $1.35 per ton, compared with 3,008,289 tons at a cost of $4,315,590 or $1.43 per ton in 1940.

Assistance to the movement of coal, generally in the form of reduced freight rates, is provided by the Federal Government thereby enabling Canadian coals to compete on even terms in markets from which it would otherwise be excluded by competition from imported coals. The total cost to the Government in subventions from 1928 when this assistance came into effect, up to the end of 1941, on the movement of 25,963,161 tons, amounted to $28,205,133 or $1.09 per ton.

The licensing under the Wartime Prices and Trade Board was continued, all engaged in the production and marketing of coal or coke having to obtain a licence and to keep the Board informed on the movement and disposal of fuel.

The work undertaken in the Fuel Research Laboratories of the Bureau of Mines, Department of Mines and Resources, during the year included the continuation of the programme for the Physical and Chemical Survey of Canadian Coals, carbonization investigations for the improvement for the manufacture of coke and by-products, and assistance to the Department of Munitions and Supply in the choice of solid fuels for wartime establishments.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

COKE IN 1941

Coke was produced for metallurgical and domestic use from Canadian and imported coal in diversified types of carbonizing equipment, which included seven by-product coke plants, two beehive plants, two Curran-Knowles installations, seven continuous vertical retort plants and eight installations of horizontal "D" retorts. Of these several coke and gas plants distributed throughout Canada, the operations of five of the by-product coke plants account for about 85 per cent of the entire consumption of the coal used in the production of coke in Canada.

The continued heavy demand for coke by wartime industries has encouraged the maximum production of by-product coke to maintain supplies for the new demands made upon the industry and for the normal requirements for domestic fuel and other uses.

The Province of Ontario produces about 60 per cent of the coke manufactured in Canada; the principal operations being reported together with their rated coal capacity in the following table:

Company	Location	Annual Rated Capacity
Algoma Steel Corporation	Sault Ste. Marie	1,015,000
Hamilton By-Product Coke Ovens	Hamilton, Ontario	415,000
Steel Company of Canada	" "	641,000
Consumers' Gas Company	Toronto, "	302,000

The coal supply for these plants is drawn from imported stocks owing to the unfavourable location of suitable bituminous coal of Canadian origin.

Two large by-product plants in Eastern Canada are situated, one at Sydney, N.S., operated by the Dominion Steel & Coal Corporation Limited, principally for the production of blast furnace coke, and the other at Ville La Salle, Quebec, operated by the Montreal Coke & Manufacturing Company, mainly for the production of domestic fuel. About 75 per cent of the potential capacity of these plants, 1,273,000 tons of coal per annum, can be supplied from Canadian mines.

Beehive coke is manufactured in two plants in Western Canada (Coleman, Alberta, and Michel, B.C.), and the Curran-Knowles battery of ovens of the Crow's Nest Pass Coal Company at Michel, B.C., was reported to be in successful operation.

The total production of coke from coal in 1941 was 3,150,094 tons, compared with 3,015,394 tons in 1940, and 2,410,095 tons in 1939. Production by Provinces was reported as follows:

Province	1941	1940	Per Cent Increase
	Tons	Tons	
Eastern Provinces	1,029,009	1,040,999	1.1 Decrease
Ontario	1,836,117	1,732,305	6.0
Western Provinces	284,968	242,092	18.0
Total for Canada	3,150,094	3,015,394	

The coal processed for the manufacture of metallurgical and domestic coke amounted to 4,360,579 tons of which 1,495,305 tons was of Canadian origin and 2,865,274 tons was imported. A small amount of petroleum coke was produced at the oil refineries amounting to 71,921 tons, compared with 66,820 tons in 1940. The imports of coke in 1941 were 719,338 tons compared with 614,417 tons in 1940.

Further expansion of the coking industry in Canada will require the construction of more oven capacity.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
Ottawa, March, 1942

NATURAL GAS IN 1941

Source of Supply:

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, and Quebec.

In Alberta, most of the production comes from the Turner Valley Field, which supplies the cities of Calgary and Lethbridge and the adjacent districts. The Edmonton area is supplied from the Viking Field about 80 miles south east of the city, supplemented by the Kinsella Field to which the pipe line was extended in the fall of 1940, although discovered in 1929. Five wells were drilled there during 1941. Medicine Hat is supplied from the field of the same name, Wainwright from the Fabyan Field, and Brooks from its own field. A gas well was completed in the Suffield area during the year. By the extension of gathering lines in Turner Valley the gas from more wells in that field was made available at the absorption plants.

In Saskatchewan, the eastern part of the Lloydminster Field supplies the town of the same name, and plans are under way to pipe gas from this field to Saskatoon. Part of this acreage has been unitized and preparations were made to drill at least three wells at Lloydminster and one at Muddy Lake, south of Vera. At least three favourable areas have been defined by seismic survey in that general vicinity. In the Kamsack area five wells were drilled and others are to be drilled in 1942. Three of those drilled were the largest in volume so far of the 33 drilled to date. A pipe line has been laid to the town of Kamsack. Much seismic work was done in the Southern part of the Province and some test drilling in the South east. The Little Pine Pete Well, NW¼ sec. 29, township 46, range 20, west of the 3rd Meridian had reached a depth of 2,135 feet after passing numerous shows of gas and oil; it was to be continued. A deep test a mile north of No.1 Well at Bishopric was over 1,000 feet deep and was being continued.

In Ontario, natural gas is produced commercially only in South-western part of the Province. The principal fields are Tilbury, Haldimand, Dawn, De Clute, Brownsville, Dover, Norfolk, Welland, Onondaga, and Malahide. In the Malahide field in Elgin county, some new producers were drilled and the Watford Field in WarwickTTownship was extended south and east into Adelaide Township. Apart from this new work was mostly filling in old areas. Some gravimetric survey work was done.

In Quebec, natural gas is produced in small quantities 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 with natural gas. Eight wells were either drilled or deepened for production, a total footage of 6,121 feet and yielding an initial flush production at the rate of 8.7 M M. cubic feet per day. Jointly for gas and oil, two holes were being drilled to prove possible extension to the field and a third to explore at Irving Settlement, Baltimore. In these three hbles 11,912 feet was drilled.

Production:

The total production of natural gas in Canada during 1941 was 39,213,386 M cubic feet valued at $12,356,067 compared with 41,232,125 M cubic feet valued at $13,000,593 in 1940.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

OIL SHALE IN 1941

Ores Mined and Producing Localities

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.

Important Developments

There were no new developments in 1941 and there have been no changes for a number of years.

Prospective Producing Localities

The prospective producing localities are Albert county in New Brunswick and Pictou county in Nova Scotia.

Production and Trade

There has been no production reported for a number of years.

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. Activity has been confined chiefly to field exploration and to laboratory investigation. Laboratory work by the Bureau of Mines of 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. No oil shale is being imported into Canada.

For many years the large-scale production of oil shale was confined to Scotland, but deposits in Manchuria and Esthonia are now being developed on a large scale. The production of these countries in 1937 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. No recent figures are available for production in Esthonia, Manchuria, France or other European countries and statistics of the Scottish Shale Industry are not being published for the war period.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1942.

PEAT IN 1941

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 was formed, and on the nature of the vegetation which contributed to its formation. Many species of plants are found in peat bogs, the most abundant being 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 in a bog is named according to the plants that predominate in its formation. Peat is found in every province of the Dominion.

PEAT FUEL

Small amounts of peat fuel have been produced intermittently from bogs in Quebec and Ontario for several years. In 1941 the production came from bogs at Gad's Hill, Grand Valley, and Linwood in Ontario; and development work was underway on a bog at St. Arsene in Quebec. At the St. Arsene and Gad's Hill bogs the peat is put through macerators before being placed on the drying racks.

Sales of peat fuel in 1941 were 506 tons valued at $2,350 compared with 30 tons valued at $75 in 1940. The average annual output between 1932 and 1936 was about 1,800 tons.

Imports and exports of peat fuel are not separately recorded.

PEAT MOSS

During recent years peat moss from the bogs at Isle Verte, Riviere Ouelle, and Waterville, Quebec; at Grand Valley, and Clinton, Ontario; at Cowan, Manitoba; at Melfort, Saskatchewan; at Edmonton West, Alberta; and near New Westminster, British Columbia, has been used as litter in bedding for animals; as a soil conditioner for market gardens and horticulture; as filler for fertilizers; as insulating material in the building trade; and as packing material. The production of insulating moss comes chiefly from bogs at Isle Verte and Edmonton West, and there is a small, intermittent production from bogs at Clinton, Ontario, and Melfort, Saskatchewan. The fabricating plants at Isle Verte, Edmonton West, and New Westminster produce a material known as "Spagmoss", "Mosstex" and "Westpeco". Mosstex is also produced as boards; and Westpeco as pads for the shipment of vegetables. Litter is produced at Isle Verte, Riviere Ouelle, and New Westminster. Humus, used for agriculture and as fertilizer filler, is produced at Alfred, Scarboro Junction, Erie, Brampton, and Grand Valley in Ontario, and at St. Stephen, New Brunswick.

Prior to the war, the United States obtained most of its requirements of peat moss from Europe, and as these supplies are no longer available, a market has been opened up in that country for at least 72,000 tons of peat moss a year. This outlet is capable of expansion and provides a real opportunity for Canadian producers to increase their sales. Several new deposits were developed in Canada in 1941 for the production of baled peat moss.

Five new plants, three in Quebec and two in Ontario, each equipped with two mechanically operated presses, were brought into production in 1941. Those in Quebec are: Canada Peat Limited, at Riviere du Loup; La Tourbiere Yamaska, at St. Guillaume, D'Upton, Yamaska county; and Premier Peat Moss Corporation, which built a new plant to replace one destroyed by fire at Isle Verte. Those in Ontario are: Erie Peat Company's plant at Welland and the Kennedy Stinson plant at Alfred. The plant of Canadian Humus Products in Beverly township, Wentworth county, Ontario, was producing at capacity throughout the summer of 1941, the product being a limey, humified peat "Hu-Mar".

Development work was done on several deposits throughout Canada that have been acquired by established companies and by newly formed companies. Included in those acquired are the Caribou bog in Kings county and the Big Plain bog on Chignecto Isthmus in Nova Scotia, and the Jolicure bogs near Midgic, Westmoreland county, the Shippigan and Pokemouche bogs in Gloucester county, and the Escuminac and Eel River bogs in Northumberland and Kent counties, New Brunswick.

In Quebec, work began on preparing the surface and on draining the St. Anaclet bog one mile south of Father Point, and on the erection of a baling plant.

In Ontario, Grand Valley Peat Moss Company completed the drainage system of the Luther bog in Dufferin county, acquired the field equipment for transporting sods on the bog and cut and stored twenty stacks of sods in the field. The company is preparing to build a baling plant. Arctic Peat Moss Company was reported to be draining the Fort Frances bog in New Ontario.

In British Columbia, the large plant in course of construction on the Byrnes bog near New Westminster will supply peat moss for use in the United States in the production of magnesium.

The Newington bog, north of Cornwall, Ontario, is being developed for the production of dry humus, and the Victoria Road bog, for peat moss and dry humus.

The production of peat moss in 1940 (figures for 1941 not yet available) was 17,186 tons valued at $282,543.

Imports of peat moss during 1941 were 14.3 tons valued at $925, compared with 11 tons valued at $677 in 1940; and cleaned, sized and ground mosses and grasses 415 tons, valued at $71,130, compared with 770 tons valued at $103,231 in 1940.

Imports of peat moss into the United States from Canada in 1940 (1941 figures not yet available) were 13,122 tons valued at $305,544, compared with 6,922 tons valued at $147,342 in 1939 (Mineral Yearbook, 1940, p. 932).

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DEPARTMENT OF MINES AND RESOURCES,
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PETROLEUM IN 1941

Source of Supply:

Crude petroleum is produced in Canada from wells in Alberta, Ontario, New Brunswick, and the Northwest Territories. Though the annual output is increasing, exceeding 10,000,000 barrels for the first time in 1941, it is still considerably less than one-fifth of Canada's requirements.

In Alberta, the Turner Valley field, southwest of Calgary, is the source of 97 per cent of Canada's output of crude petroleum. The remainder of the crude production in the province comes from several wells in the Plains areas.

The largest exploratory and development program in the history of the industry in Alberta was undertaken in 1941 in an effort to increase production.

Interest in Turner Valley was centred chiefly in the north end of the field, the proven productive area of which was extended northerly about two miles by drilling operations during the year. With this extension, the Turner Valley field now has a total length of twenty miles. Until June, 1936, it had produced mainly gas and naphtha, but in that year, drilling toward the western flank of the structure resulted in a rapid increase in the production of high grade crude, ranging in gravity from 40° to 45° API. During 1941 a total of 42 wells was brought into steady production, 15 of which are in the northern extension, four of them as far north as Township 21. At the close of the year, 176 crude oil wells were in production in Turner Valley and 29 wells were being drilled for oil, 17 of which are in township 21, two in township 22, one (on the Sarcee Indian Reserve) in Township 23, and nine in the southern part of the field. Drilling in Turner Valley totalled 376,676 feet in 1941, compared with 296,832 feet in 1940.

The wells in the north end of Turner Valley are very productive in comparison with the moderately productive wells in the south end and with the less productive wells in the central area. The porosity in part of the central area has been confined mainly to a zone in the upper part of the Palaeozoic limestone, while in the north and south ends there are two porous zones. In portions of the central area even the one porous zone is comparatively tight and some non-productive wells have been drilled in what would ordinarily be considered as proven territory. In some of the other wells, small yields were obtained by extensive acidization. The limits of the north end of the field are not as yet defined, the present known width being about half a mile across the strike. Because of the large yields from the more northerly wells, an extensive program of wildcat drilling along the assumed strike of the field has been undertaken for twelve miles north of the most northerly producing well.

There was considerable activity also in other portions of the Alberta Foothills. A second well was being drilled in the Grease Creek area, which is about midway between the Bow and Red Deer rivers, the first well having been abandoned because of mechanical difficulties. Some shows of oil are reported in a well being drilled in the Ram River area on the continuation of the Clearwater limestone outlier; and in the Moose Mountain area a test well was drilled to a depth of 5,200 feet and while some shows of gas were encountered, the well was non-commercial. Northwest of Lundbreck, in the Crowsnest Pass area, the Maxmont well had reached a depth of 9,080 feet at the end of 1941, a record depth for cable tool drilling in Canada; some shows of oil were encountered.

In the Plains of Alberta, the Vermilion area is the largest producer of crude oil, being followed in order in 1941 by the Princess, Wainwright, Red Coulée, Taber, Del Bonita, Dina, and Lloydminster areas. Seven wells were drilled near Borradaile, in the Vermilion area, making a total of 16 wells drilled in this area by the end of the year. The first Vermilion well was placed on the pump in May, 1940, and seven others are now being pumped. The wells in the area are on the Battleview anticline; and the oil is treated to remove silt and a small amount of emulsion. It is being used as locomotive fuel by the Canadian National Railway.

Most of the year's drilling in the Princess, or Steveville area, 100 miles east of Calgary, was done by Standard Oil Company of British Columbia. Commercial yields of oil have been found in only two wells, namely, Princess No. 2, where the oil occurs in the upper part of the Palaeozoic limestone, and Princess No. 6, in the Sunburst sandstone at the base of the Lower Cretaceous.

In the Brooks-Tilley area, southwest of Steveville, a well was completed early in 1942 without production, but operations in the area are continuing. The results of extensive seismic work carried out in 1941 are being used to determine well locations.

Two test wells drilled in the Blood Indian Reserve, southwest of Lethbridge, encountered water with only shows of oil and gas. The structure was determined by seismograph.

Drilling of the Guardian well at Pouce Coupé was continued in 1941, and at the end of the year was in Palaeozoic strata. About 80 miles to the west, Pine River No. 1 well at the mouth of Commotion Creek in the Foothills belt had reached a depth of more than 5,500 feet.

In Saskatchewan, a comprehensive geophysical and geological survey was continued in the southern part of the Province preparatory to the selection of sites for deep test holes.

In Ontario, crude oil continues to be produced at Petrolia, Oil Springs, Bothwell, and in the townships of Dawn, Warwick, West Dover, and Mosa in the southwestern part of the Province.

In New Brunswick, the production comes from the Stoney Creek field about nine miles southwest of Moncton. Two holes, started to test the extension of the field, had reached depths of 3,933 feet and 4,312 feet and an exploratory hole at Irving Settlement, Baltimore, was at a depth of 3,667 feet at the end of the year.

In Quebec, a deep test well was started late in the year in the eastern part of Gaspé peninsula.

In the Northwest Territories production comes from three wells near Norman on the Mackenzie river, about 50 miles west of Great Bear Lake. The products of the refinery at Norman include high octane aviation gasoline, motor gasoline, and light and heavy Diesel oil.

<u>Production</u>:

Canada produced 10,124,613 barrels of crude petroleum valued at $14,194,766 in 1941, both figures being higher than in any past year, the output in 1940 being 8,590,978 barrels, valued at $11,160,213.

PRODUCTION BY PROVINCES IN 1940 and 1941 (1)

	1940 bbls.	1941 bbls.
New Brunswick	22,167	22,322
Ontario	187,644	160,000
Alberta	8,362,203	9,928,162
N. W. T.	18,633	14,119
Saskatchewan	331	----
TOTALS	8,590,978	10,124,613

(1) - Figures from Dominion Bureau of Statistics. These are based on sales and hence do not exactly correspond with actual production.

PRODUCTION IN ALBERTA (2)

	Wells No.	1940 bbls.	Wells No.	1941 bbls.
Turner Valley:				
Palaeozoic Limestone oil wells		8,142,626	176	9,504,111
Palaeozoic Limestone gas wells		30,390		27,096
Shallow oil wells (Cretaceous)		7,309	3	6,014
Natural gasoline		247,172	50	293,122
TOTALS		8,454,497	229	9,830,343
Other Fields:				
Del Bonita	2	3,444	2	4,393
Dina	2	4,746	2	2,894
Lloydminster	2	1,648	1	416
Princess	1	351	2	19,587
Red Coulee	7	12,177	7	11,626
Taber	0	----	1	5,600
Vermilion	3	10,817	7	21,851
Wainwright	4	7,527	6	11,933
TOTALS	21	40,710	28	78,300
TOTALS for Alberta		8,495,207	257	9,908,643

(2) - Information from Petroleum and Natural Gas Conservation Board, Alberta.

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