BUREAU OF MINES
DEPARTMENT OF MINES AND RESOURCES
OTTAWA, CANADA.

THE CANADIAN MINERAL INDUSTRY IN 1942.

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(By Staff, Bureau of Mines)
Department of Mines and Resources
Ottawa

Product	Author
I - METALS:	
Aluminium (not issued)	Buisson, A.
Antimony	Buisson, A.
Arsenic	Buisson, A.
Bismuth	Buisson, A.
Cadmium	Buisson, A.
Chromite	Eardley-Wilmot, V. L.
Cobalt	Buisson, A.
Copper	Buisson, A.
Gold	Buisson, A.
Indium	Buisson, A.
Iron Ore	Buisson, A.
Lead	Buisson, A.
Magnesium (see Magnesite)	Goudge, M. F.
Manganese	Eardley-Wilmot, V. L.
Mercury	Eardley-Wilmot, V. L.
Molybdenum	Eardley-Wilmot, V. L.
Nickel	Buisson, A.
Platinum	Buisson, A.
Radium and Uranium (not issued)	Spence, H. S.
Selenium	Buisson, A.
Silver	Buisson, A.
Tellurium	Buisson, A.
Tin	Buisson, A.
Titanium	Buisson, A.
Tungsten	Eardley-Wilmot, V. L.
Zinc	Buisson, A.
II - INDUSTRIAL MINERALS	
Asbestos	Goudge, M. F.
Barite	Spence, H. S.
Bentonite	Spence, H. S.
Beryl	Spence, H. S.
Bituminous Sand	Ells, S. C.
Brucite (see Magnesite)	Goudge, M. F.
Celestite	Spence, H. S.
Cement	Goudge, M. F.
Clay and Clay Products	Phillips, J. G.
Diatomite	Eardley-Wilmot, V. L.
Feldspar	Spence, H. S.
Fluorspar	Spence, H. S.
Garnet	Eardley-Wilmot, V. L.
Granite	Goudge, M. F.
Graphite	Spence, H. S.
Grindstones	Eardley-Wilmot, V. L.
Gypsum	Buisson, A.
Iron Oxides	Buisson, A.
Kaolin (see Clays)	Phillips, J. G.
Lime	Goudge, M. F.
Limestone (General)	Goudge, M. F.
Limestone (Structural)	Goudge, M. F.
Lithium Minerals	Spence, H. S.
Magnesite and Brucite	Goudge, M. F.

Product	Author
II - INDUSTRIAL MINERALS (cont'd):	
Magnesium Sulphate	Buisson, A.
Marble	Goudge, M. F.
Mica and Vermiculite	Spence, H. S.
Moulding Sands	Freeman, C. H.
Nepheline Syenite	Spence, H. S.
Phosphate	Spence, H. S.
Pyrites	Buisson, A.
Salt	Buisson, A.
Sand and Gravel	Picher, R. H.
Silica	Buisson, A.
Sodium Carbonate	Buisson, A.
Sodium Sulphate	Buisson, A.
Sulphur	Buisson, A.
Talc and Soapstone	Spence, H. S.
Vermiculite (see Mica)	Spence, H. S.
Volcanic Dust	Eardley-Wilmot, V. L.
Whiting	Goudge, M. F.
III- FUELS:	
Coal	Burrough, E. J.
Coke	Burrough, E. J.
Natural Gas	Madgwick, T. G.
Oil Shale	Swinnerton, A. A.
Peat	Leverin, H. A.
Petroleum	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, 1943.

ANTIMONY IN 1942

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 and of 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.

In Nova Scotia, the antimony property near West Gore, Hants county remained idle in 1942, and title to the West Gore antimony area has reverted to the Crown.

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 1942.

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 1942.

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 for further treatment, but no payment was received for the antimony. An antimony deposit at Gates Lake, in the vicinity of Lower Manitou Lake, Kenora district, and 50 miles north of Fort Frances, Ontario, was investigated in 1942 by F. Austin of Kirkland Lake.

In British Columbia, some diamond drilling was done by the Consolidated Mining and Smelting Company on the Snow group of claims at the south end of Stuart Lake, near Fort St. James. Some prospecting was also done near Watson Bar creek, a tributary of the Lillooet River, and about 30 miles north of Lillooet.

In Yukon some prospecting was done in 1942 by Walter McAlister on antimony showings in the Wheaton River area, about 35 miles southwest of Whitehorse. The area is described in Memoir No. 31, Wheaton District, Yukon (1912), and also in the Summary Report for 1915, of the Geological Survey.

The production of high-grade electrolytic antimony was commenced in 1938 at Trail, British Columbia. The antimony is recovered from flue dust, a by-product of Consolidated Mining and Smelting Company's silver refinery. 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. The Bunker Hill smelter, Bradley, Idaho, operates a 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 operates 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 1938 (1939-1942 figures not available), as published by the United States Bureau of Mines, amounted to about 38,000 tons. The production in 1937 was 42,100 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. World production at present is probably much in excess of 40,000 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 normal times in the United States, Great Britain, France, and Belgium from ores of foreign origin.

Canada's requirements are now supplied mainly from the electrolytic plant at Trail, British Columbia.

Market and Prices:

Antimony is an important war metal. 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 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 New York price of antimony metal (ordinary brand) in 1942 remained fixed at 14 cents a pound up to the middle of March, and at 16 cents for the rest of the year. The price for Chinese brand, duty paid, remained at 16.5 cents throughout the year. The price of antimony ore, c.i.f. New York in 1942, per unit of antimony contained was; for 50 to 55 per cent Sb., $2.10

to $2.20; for 55 to 60 per cent Sb., $2.20 to $2.30; and for 60 to 65 per cent Sb., $2.25 to $2.35. The slight fluctions in 1942 are due to the informal government control through the United States office of Price Administration.

Tariff:

The United States tariff on antimony is: antimony as regulus or metal, two cents per pound; needle or liquated antimony, 1/4 cent per pound.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

ARSENIC IN 1942

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. **Wampum Gold Mines are developing an arsenical-gold property at Douglas lake, Saskatchewan.**

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 the Cobalt area, northern Ontario, and the crude arsenic from the Beattie and O'Brien mines in western Quebec.

Production and Trade:

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

The world production is estimated by the U. S. Bureau of Mines at in excess of 80,000 tons, compared with 64,000 tons in 1939. Accurate production data are not available as some countries fail to record arsenic statistics and others give only sales or exports. The principal producing countries are: United States, Mexico, Sweden, France, Belgium, Australia, Japan, Brazil, and Canada.

Market and Prices:

Arsenic is used chiefly in the manufacture of insecticides. It is also used in the preparation of weed killers, sheep and cattle dip, wood preservatives, and in the manufacture of glass, minor uses being in pigments, tannery supplies, and pharmaceutical preparations. Arsenic salts are used to replace creosoting in the preservation of wood. The use of arsenic to manufacture chemical warfare materials has notably increased its consumption. Calcium arsenate and, to a much lesser extent, lead arsenate are the arsenicals ordinarily used in insecticides. Paris green, which is a copper acetoarsenite, is also used as an insecticide. Magnesium arsenate and manganese arsenate have also been used for this purpose. A considerable tonnage of white arsenic, in the form of crude arsenic or as sodium arsenite is used in the manufacture of weed killers. High-grade white arsenic is used in glass as a decolourizer, opacifier and refining agent. Small quantities of arsenic are used in the paint industry, as realgar or arsenic disulphide (As_2S_2) and as orpiment or arsenic trisulphide (As_2S_3).

Although the world consumption of white arsenic has varied greatly during the past ten years, the quoted price remained steady at 3½ cents a pound up to the middle of 1941. 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 normal demand, there seems to be little likelihood of any sustained increase in price.

The nominal price of arsenious oxide in New York remained at 3½ cents a pound in the first half of 1941 and at about 3¾ cents during the last half of the year. In 1942 the price remained fixed at 4 cents a pound. The Canadian price of white arsenic, as given by Canadian Chemistry & Process Industries, remained at 5½ to 6 cents a pound throughout 1942.

ISSUED BY THE BUREAU OF MINES,
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OTTAWA, MARCH, 1943.

BISMUTH IN 1942

Source of Supply:

Refined bismuth 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 Betts 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.

The American production includes metal recovered from the refining of Mexican lead bullion, and from the treatment of ores imported for smelting and refining from South America, Central America,and Australia, also a small quantity of lead-bismuth bullion imported from Canada.

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:

The demand for bismuth increased considerably during 1941 and 1942 owing to its greater use in metallurgical and pharmaceutical applications. 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" (55.5 per cent Bi), a non-shrinking 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. 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 price of bismuth in 1942 (London price in Canadian funds) remained at \$1.38 a pound. The price at New York remained fixed at \$1.25 a pound throughout 1942. 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.

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OTTAWA, MARCH, 1943.

CADMIUM IN 1942

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 1942 is estimated at 7,500 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 3,617 tons (about half of the world output), and sales were 3,684 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 mainly in electroplating and in the manufacture of alloys and compounds. The most common use of cadmium is as a protective coating for steel, and, to a much lesser extent, for copper alloys. The use of cadmium alloys in automobile bearings has created a strong demand for the metal. Cadmium is used also in the arts, paints, ceramics, 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 plating of aircraft, ordnance, automotive marine and electrical parts took increasing quantities of cadmium in 1942, at the expense of bearing alloys and pigments." (Eng. Min. Jnl., Feb. 1942)

The price of cadmium in 1942 (in Canadian funds) averaged \$1.18 a pound, compared with \$1.17 in 1941. The price of metallic cadmium, f.o.b. New York, in commercial sticks remained at 90 cents a pound, compared with 88.4 cents in 1941. 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.

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OTTAWA, MARCH, 1943.

CERIUM IN 1942

Source of Supply:

Cerium is obtained from monazite, a monoclinic phosphate of cerium metals, containing about 32 per cent cerium oxide (Ce_2O_3) and up to 18 per cent thoria (ThO_2). Monazite is distributed widely in igneous rocks throughout the world, especially in gneisses that have been intruded by pegmatites, but usually it forms only a small fraction of one per cent of the containing rock, and only the natural concentrations in stream gravels and beach sands have paid for exploration. The leading commercial sources of monazite sand are beach deposits in Brazil and India. In the United States there are commercial deposits in Carolina, Florida, and Idaho, and known occurrences in many other states. There are no known commercial deposits in Canada; there are a few known occurrences of monazite in Nova Scotia, Quebec, and British Columbia. It is usually found as small crystals in granites and pegmatites in the Canadian Shield. Small quantities occur in association with the black sands of the Quesnel River, Lillooet district, British Columbia. World production of monazite is approximately 5,000 tons a year.

Cerium is usually regarded as belonging to the general group of "rare earths", as it invariably occurs in nature associated with the other members (15 in all) of the group, and is very similar to the other rare-earth elements in many of its chemical properties.

Market Conditions, Uses and Prices:

Formerly the only commercial constituent of monazite was thoria, which was used in gas mantles, and monazite is still marketed on the basis of its thoria content, although commercial interest now centers on its content of ceria (Ce_2O_3) and other rare-earth oxides. Probably 50 per cent of monazite derivatives are consumed, chiefly as fluorides, in the cores of arc carbons to increase lighting intensity in searchlights, motion-picture projectors, and therapeutic lamps. About 25 per cent of the consumption of monazite derivatives is used in pyrophoric alloys or ferroceriums for use in sparking flints for lighters and the remainder is distributed among a large variety of uses, principally for making optical glassware.

Nominal prices for monazite as given by Metal and Mineral Markets, New York, remained at $60 per short ton, 8 per cent minimum thoria, throughout 1942. Published quotations are not available for most of the rare-earth products, although prices for small lots may be obtained on request from mineral dealers and chemical manufacturers. Prior to the war the leading producers of rare-earth products were located in Berlin, London, and Paris, for Europe, and Chicago for the United States.

In Canada, Shawinigan Chemicals, Limited, Shawinigan Falls, Quebec, has, since 1940, been producing cerium products from cerium chloride. The output is sold to Cerium Company, Limited of Montreal, for the manufacture of sparking flints.

(Part of the information for this review was abstracted from publications of the U. S. Bureau of Mines).

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OTTAWA, MARCH, 1943.

CHROMITE IN 1942

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 four producers operating in the Eastern Townships of Quebec, the chief of which was Chromite Limited at St.Cyr, 30 miles north of Sherbrooke; other shippers were Orel Pare, who worked the old Montreal pit, Coleraine township, range 11, lot 25, under contract for Union Carbide (U.S.A.); Bruce Fletcher and later Orford Mining Company, from a deposit northwest of Sherbrooke, and W. Roberge from the old Hall mine (Thetford quarry), 7 miles southeast of Black Lake.

Important Developments and Prospective Producing Localities:

The two outstanding developments during the year were the operations at Chromeraine on the old Reed-Belanger properties near Black Lake and the full-scale production by Chromite Limited near St. Cyr station (C.N.R.) in Cleveland township, range X, lots 7 and 8. During the last war the St. Cyr deposit, 5 miles east of Richmond, was known as the Sterrett mine and 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 was started early in 1942 and later the mill was increased to 150 tons. At the present output rate it is expected that before the end of 1943 the output during the last war will be exceeded.

In the Black Lake area, Wartime Metals Corporation extensively diamond drilled and investigated the underground workings of the Reed-Belanger deposit in Coleraine township, range X, lot 19, from which about 100,000 tons of concentrate and crude ore were sold during the last war. Over a million tons of milling grade ore, with some high-grade shoots were indicated. Buildings and a 600-ton a day concentrator were erected, and production of concentrates is expected about the middle of May, 1943. The property is now known as Chromeraine. Wartime Metals Corporation also holds the old Provincial mine, half a mile to the north. This property was examined and mapped by geologists of the Federal Department of Mines in 1942 and diamond drilling was recommended.

Many chromite deposits are known in the Black Lake-Thetford area and shipments to the Chromeraine mill are expected from a number of small or partly worked deposits. Several of these were prospected in 1942 and on some of them milling grade ore has been stockpiled. These include Union Carbide Company's Montreal pit, about 5 miles to the southeast, the second largest shipper during the year; Chrome Association Engineers (S.Bergeron) deposit in Block A, $2\frac{1}{2}$ miles to the northwest, under royalty agreement with Asbestos Corporation; the old Cariboo pit, a mile east of Chromeraine, which was diamond drilled and opened up by Asbestos Corporation. Another of this corporation's properties near Vimy Ridge village, 4 miles west of Black Lake, was worked by Joseph Parent. W. Roberge prospected the old Hall mine or Thetford quarry, $3\frac{1}{2}$ miles southeast of Chromeraine and shipped a few car lots of crude ore. The Stewart Chrome (Victory) mine, 4 miles east of Chromeraine was operated by W. Gregoire. H.T. Ward stockpiled a fair amount of milling ore from his deposit east of Nadeau Mountain and about $3\frac{1}{2}$ miles southwest of Chromeraine, but late in the year the property was taken over by J.M. Forbes and associates. British Canadian Asbestos stockpiled milling ore at its property close to the town of Black Lake. Prospecting was done on several other properties within 8 miles of Chromeraine.

In the outlying districts, the Orford Mining Company operating with Dominion Government assistance, took over, late in the summer, the H. Bruce Fletcher deposits in Orford township, range Xll, lot 7, about 15 miles northwest of Sherbrooke and worked No. 4 pit, which is 100 feet deep. A tunnel was driven under the pit and over a thousand tons of crude ore were shipped, but operations ceased late in the fall. In the Gaspé peninsula, Chromium Mining and Smelting Company is prospecting and diamond drilling chromite deposits in Weir township about 15 miles north of Port Daniel on the south Gaspé shore and also about 70 miles to the northwest in the Mount Albert district Courcelette township in north-central Gaspé. In the former, large boulders of chromite have been found and search for the ore in place is continuing. At Mount Albert small areas of high-grade lenses were discovered near the top of the mountain. Some work was done by Alchrome Prospecting Syndicate on a deposit in Awantjish township, range lV, lot 12, a few miles west of Lake Matapedia on north-central Gaspé.

In Ontario, Donaldson Chromium Prospecting Syndicate did some work on a serpentine zone in Rheaume township, concession Vl, lot 10, about 11 miles southeast of Cochrane, where small segregations of low-grade ore high in iron were prospected by pits, trenching, and diamond drilling. A deposit west of Shebandowan Lake, 55 miles west of Port Arthur, was sampled and diamond drilled but as samples and mill tests gave low results with high iron content further prospecting was not recommended.

In Manitoba, considerable interest has been aroused by the discovery, by geologists of the Federal Department of Mines and the University of Manitoba, of large chromite deposits north of the Bird River about 20 miles from the railway at Pointe du Bois in the south-eastern part of the province. In July 1942, the recognition of chromite in the gabbro and peridotite on the Page claim (being drilled for copper-nickel) suggested its occurrence in other areas of similar rocks, which was later confirmed. Many claims have been staked or acquired and are being drilled and prospected by Hudson Bay Exploration and Development, God's Lake Gold, Gunnar Gold, Central Manitoba, and others. The chromite occurs in alternate narrow bands of high-and low-grade ore. The main zone averages 7 feet in width and occurs in several separated groups, some of which have been traced for over 2000 feet. The run-of-mine ore ranges between 16 and 20 per cent Cr_2O_3, but is complex and high in iron. Several car lots were sent to the Bureau of Mines Laboratories, Ottawa, recently for concentration tests. Some difference was found in the character of the ores from the God's Lake and the Hudson Bay claims, the latter yielding a slightly better concentrate, but both contained a high proportion of iron, the best chrome-iron ratio being about 1.2 to 1. About a car lot of mixed concentrate from both properties was shipped to Saulte Ste Marie for test. Metallurgical research is being conducted at Ottawa to reduce the content of iron, but owing to its peculiar and intimate association with the chromite, satisfactory results are difficult to obtain at a reasonable cost.

In British Columbia, a number of chromite deposits were examined by geologists of the Federal and Provincial Departments of Mines. A few were prospected but no shipments were made and substantial production is not likely from any. Those north of Ashcroft in the south central part of the province are among the more promising; they include deposits on Cornwall Creek, Scottie Creek (Flint), and Ferguson Creek. Late in 1942, four lots totalling a little over a ton of 18 to 20 per cent Cr_2O_3 ore were shipped by D.B. Sterrett, to Ottawa for testing. The best results were obtained with the Ferguson Creek ore, though the chrome-iron ratio is below specifications. Among other deposits that were examined or prospected were: Castle Mountain deposits at Cascade near the United States boundary, from which about 700 tons of 38 per cent ore were shipped during the last war; and the Don claim at Rock Creek, Greenwood area, from which a composite bulk sample of about 32 per cent ore was sent to Ottawa for test early in 1943. A number of small chromite lenses were discovered recently by Government geologists on Shulaps Mountain and on Mission Mountain in the Bridge River district. Several claims on Mitchell Mountain in the Mason River area in the north central part of the province were examined by the geologists and small patches of fair-grade ore were disclosed.

Production and Trade:

Canadian production although rapidly increasing is far short of requirements, but output and trade figures for recent years are not available for publication owing to the war. From 1886, when records were first kept, until the end of 1942, Canada had produced about 185,500 tons of chromite, of which all except about 5,000 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.

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, and South Africa, the Philippines, Cuba, New Caledonia, Yugoslavia, Greece, and India each 50,000 tons or more. Turkey and Russia were the largest producers, but no records are available from Russia since 1937, when the output was about 200,000 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 is now believed to be in excess of 275,000 tons a year. 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 Chrome Mines Limited, the largest producer, obtains its ore 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.

Output from the Union of South Africa in 1939 was 167,000 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. Present production is believed to be more than double the pre-war output and the Union is now probably the leading producer of chromite.

The Philippine Islands has been an important producer of chromite since 1937. Prior to Japanese occupation the mineral was obtained principally from the Luzon zone in Zembales Province, where ore of a grade in excess of 51 per cent was 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.

The Cuban output is being shipped to the United States. The ore has a low chrome content and is used mainly in the refractory industry. Production has greatly increased.

New Caledonia has been shipping over 50,000 tons a year for a number of years. The mines are operated by British and American concerns. The Tiebaghi deposit is one of the richest in the world, the ore containing 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.

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. The Annam deposits in French Indo China, from which 52 per cent Cr_2O_3 concentrate can be made, are under Japanese control.

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 about 750,000 tons. Most of the output is from California, Rustless Mining Company at Pilliken, Eldorado county, being 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. Other deposits occur in Oregon and Washington. The Reconstruction Finance Corporation and private industry are providing a very large amount of capital for chromium projects. As a result of this along with drastic restrictions in the uses of chromite for non-essential purposes, output in the United States for war purposes in 1943 will probably be almost as large as its pre-war imports. It obtains its supplies mainly from Rhodesia, South Africa, Portuguese Africa, New Caledonia, and India, from which delivery is hazardous.

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, armour-piercing projectiles, and high-speed tool steels, and is used as a hard, toughening element in tank axles and frames, in aeroplane parts and other essential war materials. 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 from 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, often followed by leaching. 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.

Processes developed by the U.S. Bureau of Mines consist first of making a high purity sponge or powdered chromium by subjecting the ore to a chlorination process followed by a reduction of the chlorides; and second... of the conversion of the ore into soluble sodium chromate and subsequent electrolytical production of the metal from the chromium sulphate solution. Some success has been achieved by the "Sink and Float" method on low-grade ores crushed to a relatively coarse mesh.

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. Basic ceiling prices are for ores of the above grade and ratio, but because of the present emergency, ores as low as 40 per cent Cr_2O_3 and 2.1 ratio are acceptable at lower prices. When possible, lower grade ores are mixed with those of the highest grade, the proportion depending upon whether the ferrochrome produced is to be used for low-or for high-carbon steels. The maximum allowance for sulphur is 0.5 per cent and for phosphorus 0.2 per cent. Although lump ores are preferred, fines and concentrates are used in quantity; in some instances they are briquetted before use. The low iron content of the ore or concentrate is of the utmost importance.

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 as low as 8 per cent, but such low-grade ores are not being used at present as more effective plant operation is obtained with the higher grade ores still available. In any case, some of the highest grade ore must be added so as to raise the content of chrome and lower that of iron.

Specifications for refractory ore suitable for bricks vary somewhat and depend upon the kind of brick to be made. A Canadian manufacturer indicates maximal allowances of 25 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 12 mesh. Provided the impurities are within the above specifications, the Cr_2O_3 content may vary within certain limits, but it is generally over 40 per cent.

Standard grades of ferrochrome 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).

Market Conditions and Prices:

The principal Canadian buyers of chromite for metallurgical use are:- Chromium Mining and Smelting Corporation, Sault Ste. Marie, Ontario, and 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".

Canadian prices for high-grade ores are based upon the United States ceiling price, which is $43.50 per long ton at seaboard for ore containing 48 per cent Cr_2O_3 with a chromium-iron ratio of 3 to 1; plus or minus 90 cents per long ton unit of 22.4 pounds of contained Cr_2O_3 above or below 48 per cent; plus or minus $1.25 for each 0.1 chromium-iron ratio above or below 3 to 1, the limits being 3.5 to 1 and 2 to 1.

The price at a Canadian Mine at Black Lake in the Eastern Townships of Quebec would, for example, approximate this basic ceiling price; plus freight of \$2.28 from seaboard to Niagara Falls (near a Canadian consuming centre); plus exchange at 11 per cent to convert into Canadian funds; less \$5.12 freight from Black Lake to Niagara Falls. For a 46 per cent Cr_2O_3 ore with Cr-Fe ratio of 2.8 to 1, this price per long ton at Black Lake would thus amount to about \$43.50, less penalties of \$4.30, plus freight of \$2.28, plus \$4.56 exchange, less \$5.12 freight, or to about \$40.83 in Canadian funds.

Prices of other grade ores can be obtained from the Metals Controller, Ottawa.

United States prices of ferrochrome delivered on contracts 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, 67 to 72 per cent chromium and 2 per cent carbon, 19½ cents, and 0.1 per cent carbon, 22½ cents a pound of contained chromium.

Canada is now a large consumer of chromite and the requirements of the war industries are likely to increase. Domestic output has been insignificant in recent years, but will become fairly substantial when the Chromeraine and St. Cyr mills in the Eastern Townships of Quebec are in full production. Until metallurgical difficulties are overcome production cannot, however, be expected from the extensive low-grade deposits in theBird River area in southeastern Manitoba. The Canadian chromite supply situation is still far from satisfactory as 90 per cent of her imports are from long distances overseas and their movement constantly threatened by enemy action. Special attention is therefore required in the search for large and commercial grade chromite deposits.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

COBALT IN 1942

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.

Exploration work was done on the Kerr-Cobalt property in Otter township near Thessalon, Algoma district. The property is operated jointly by Kraft Prospecting Syndicate and Chrotung-co Prospecting Syndicate, under the direction of A. E. J. Jerome.

The many small leasers in the Cobalt camp, suffered a severe handicap when the Temiskaming Testing Laboratories, operated by the Ontario Department of Mines, was destroyed by fire in July 1941. The Laboratories have since been re-established in new quarters in the town of Cobalt, and operations were resumed in 1942. Leasers depend on the plant for the sampling, valuation, and frequently for the marketing of their ores.

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.

The only other custom mill in Cobalt is the old O'Brien 100-ton mill, now owned and operated by C. V. J. O'Shaugnessy.

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. Part of the Canadian production of cobalt ore in 1942 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, in 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 India, French Morocco, and Canada. 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 or stellite-type alloys, which contain 45 to 50 per cent cobalt, 30 to 37 per cent chromium, and 12 to 17 per cent tungsten. There are various modifications of this composition, but all contain high percentages of cobalt. Stellite 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 certain amount of cobalt is used in electro plating and as a catalyst. Cobalt oxide is used [redacted] in the ceramic industry owing to its fine colouring properties. Other compounds of cobalt are used as driers in paints and varnishes.

Consumption of cobalt, chiefly in the production of high-speed cutting tools and permanent magnets, increased substantially during the last two years.

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 remained at $2.11 a pound and for black oxide in 350-lb. lots, at $1.84 a pound, throughout the year. The nominal price for cobalt ore, 13 per cent grade, f.o.b. cars, Ontario remained at about $1.00 a pound of cobalt up to July and at $1.10 for the remainder of the year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, FEBRUARY, 1943.

COPPER IN 1942

Ores Mined and Producing Localities:

Canada's output of copper is obtained from the copper-nickel ores of Sudbury, Ontario; the copper-gold, copper-zinc, and the copper-pyrites ores of western Quebec; the copper-zinc ores of northern Manitoba; and the copper ores of British Columbia.

In British Columbia, Britannia Miming 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 shipped partly to the acid plant of Nichols Chemical Company at Barnet, B.C., and was partly exported. Development work below the 4,100-foot or bottom level, started in 1940, was continued in 1941 and 1942. The No. 7 shaft was raised from the 4,100-foot level to the 2,200-foot level and connections were made at several intermediate levels. The No. 8 shaft, which had been raised to the 3,900-foot level, is being sunk below the 4,100-foot level which is at the elevation of the mill bin and is connected with the Victoria shaft at a distance of 20,000 feet from the portal. A reduction of approximately 50 per cent in the scale of operations at Britannia mine became necessary in 1942, due to labor shortage. A contract was arranged late in 1942 with Wartime Metals Corporation under the terms of which all the products of Britannia is sold for its account and the company is guaranteed against loss.

Granby Consolidated Mining, Smelting & Power Company's production in 1942 approximated 86 per cent of its output in 1941. The copper concentrate was shipped to the Tacoma smelter of American Smelting & Refining Company at Tacoma, Washington. After November 1st all production was sold to the Canadian Government. Ore reserves again showed an increase in tonnage over the ore reserves at the beginning of the year. Anyox Metals, Limited, a subsidiary of Ventures, Limited, is conducting a diamond drilling campaign at the Hidden Creek and adjoining properties near Anyox.

The Tyee zinc-lead-copper property near Chemainus, Vancouver Island, was taken over in 1942 by Twin "J" Mines, Limited, a subsidiary of Jason Gold Mines Limited, and is being operated by the company under the supervision of Wartime Metals Corporation. The property is expected to be in production by the early summer of 1943. The concentrates (zinc, lead, and copper) are contracted to the Metals Reserve Company.

At Flin Flon, Manitoba, Hudson Bay Mining and Smelting Company, Limited, operated its mine, concentrator, copper smelter, and zinc plant at an increased capacity. Ore and waste pockets were completed at the 2,750-foot or bottom level station off the South Main shaft. The capacity of the copper smelter was further increased. A fifth copper roaster was installed and placed in operation and the reverberatory furnace was enlarged.

Hudson Bay Mining and Smelting Company proved by exploratory work an important copper-zinc ore body at Schist Lake. Emergency Metals, Limited (H.B. M & S. Co.) is equipping the Mandy mine with a 200-ton concentrating plant to treat the ore remaining, estimated at 180,000 tons, averaging 5 to 8% Cu, 20 to 30% Zn, and $5.00 in gold and silver per ton.

Sherritt Gordon Mines, Limited, has indicated by diamond drilling a large tonnage of low-grade copper ore in a section of its property north of the main orebody. The company's mine and mill were operated at capacity.

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

Falconbridge Nickel Mines Limited operated mine and smelter at Falconbridge to capacity. The expansion program, commenced in 1941, was completed near the end of June. Full advantage was taken of all units as they became available and new records were set in the tonnages of ore treated and metals produced. The capacity of the smelting plant was increased. Extensive exploration and development work was done on several levels, including the 1,750-foot level, and No. 5 shaft was extended to a depth of 3,150 feet. Despite the increased production, the total ore reserves again showed a moderate gain.

Ontario Nickel Corporation Limited actively developed the nickel-bearing property in MacLennan township, district of Sudbury, on which it holds an option to purchase. Considerable drifting, cross-cutting and raising was carried out. A power line was brought in from the Falconbridge line, a distance of 7½ miles, a substation erected and a full set of mining buildings were put up, including head-frame, compressor house, machine shop, office building, and cookery and living quarters. An average of thirty-five men were employed during 1942, commencing in April. Early in 1943 the Company was arranging to ship crude ore to one of the smelters.

Nickel Offsets, Limited, with a property in Foy township, west of Capreol, continued the extensive surface exploration and diamond drilling that was started in 1939. A shaft was sunk in 1941 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 that year. Further development work was carried on during 1942 on these three levels, with encouraging results. Sinking operations were resumed in December 1942, with an objective depth of 1,280 feet. Diamond drilling indicated ore averaging 1.9 per cent nickel and 1.5 per cent copper, and containing $2.00 a ton in precious metals, with mining widths up to 30 feet. The underground development has shown a substantially higher content of metals. It is planned to commence mining and shipping ore by late spring in 1943.

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

Clifton Consolidated Mines Limited took over the old Alexo property at Porquis Junction, Cochrane mining division.

Kam-Kotia Porcupine Mines, Limited, a project of Wartime Metals Corporation, is opening up the Jamieson copper property in Robb township, Cochrane district, 20 miles northeast of Timmins. This property was explored and developed by Hollinger Gold Mines, Limited, during the period 1926 to 1928. The work in 1942 included the completion of a 20-mile road from Timmins to the mine; construction of camp and mine buildings; erection of a 6-mile power line; and a small amount of diamond drilling to delimit the orebody. A 500-ton flotation mill is being installed and should be in operation early in the summer of 1943. Mining operations will be by open pit and electric shovel. Golden Gate Mines, Limited reports that it intends to continue diamond drilling the low-grade copper showing in the shore of Lake Shebandowan, Fort Frances mining division. The drilling consisted of four drill holes to a depth of 100 feet and showed bands of pyrrhotite. The surface zone is 300 feet wide, and contains about one per cent copper.

In Quebec, Noranda Mines, Limited operated its Horne mine, its concentrator, and its smelter at capacity. Exploration drifts were extended in a westerly direction from the new No. 6 shaft, from the 37th, 41st, 45th, and 49th (5,975-foot) levels. This work was supplemented by about 9,750 feet of lateral diamond drilling. Ore reserves are sufficient to maintain production for 15 years at the 1942 rate of production.

Waite Amulet Mines, Limited continued the exploration and development of its large high-grade orebody. Its concentrator, put in operation in 1939, was enlarged by additional copper cells and a 300-ton extension for treating zinc ores from the Waite mine, bringing the capacity to 1,800 tons a day.

Aldermac Copper Corporation, Limited, with mine and concentrator twelve miles west of Noranda, Quebec, operated throughout 1942. 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.

Tonnage treated by Normetal Mining Corporation, Normetal, Quebec, was up 22% over 1941. Shortage of labour hampered operations most of the year. The No. 3 shaft was sunk to 44 feet below the 2,750-foot level. Four new levels, at 150-foot intervals, below the 2,000-foot level will be developed during 1943. Shipments of copper and zinc concentrates were made regularly.

Refineries:

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. 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, 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 1939 (1940-42 not available), as reported by the American Bureau of Metal Statistics, was 2,385,400 tons. The United States copper supply in 1942 (Mining Congress, Feb. 1943) reached an all time high, exceeding the entire known world output in 1939. World consumption in 1938 (1939-42 not available), as given by the American Bureau of Metal Statistics, was 2,17[illegible],000 short tons.

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 (1941-42 not 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 wartime controlled price of electrolytic copper (London price in Canadian funds) remained at 10.086 cents a pound throughout the year. The New York price of domestic electrolytic copper averaged 11.775 cents a pound in 1942, compared with 11.795 cents in 1941. 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, 1943.

GOLD IN 1942

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 produces three-fifths of the total Canadian output. 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, and Crow River areas in Kenora district; Larder Lake and Matachewan areas in Timiskaming district; and a small production from the Goudreau area 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 Lakes 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.

About 55 per cent of Manitoba's gold comes 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. This is supplemented by the output from the mines near Goldfields, Lake Athabaska district.

Production of gold in the Northwest Territories 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, Oldham, 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 1942, development of new mines was greatly curtailed owing to the war. The shortage of certain materials and equipment and of labour resulted in the curtailment or cessation of exploration and development work at several new properties and at most of the established producing mines.

In Quebec, the Mic Mac gold-copper mine in Bousquet township, near Noranda, with a 500-ton mill started to produce in June. In Ontario, Renabie Mines Ltd. has been developing a promising property near Missanabie Lake, Sudbury district. In Manitoba, Howe Sound Exploration Company did 45,000 feet of diamond drilling on the property of Nor-Acme Gold Mines Ltd., near Snow Lake, the work having indicated a large deposit of gold ore of low to medium grades. Underground development is being postponed indefinitely. In Saskatchewan, Wampum Gold Mines, Ltd. is developing an important deposit of arsenical-gold ore at Douglas Lake, 3 miles west of Flin Flon.

Milling Operations:

A total of 130 gold mills with a combined rated capacity of 64,725 tons a day were in operation, their daily tonnage treated being about 80 per cent of the rated capacity. Of this total, 37 plants with a combined capacity of 6,760 tons ceased operations in the course of the year, and thus, by the end of the year, the number of mills in operation was reduced to 93 with a combined capacity of about 58,000 tons a day, compared with 127 mills rated at 62,800 tons in 1941. Only four new mills with a rated capacity of 950 tons were brought into production in 1942. Increases to plant capacity during the year took place at 12 plants and totalled 1,235 tons.

Data re operating milling plants is given in the following tabulation:-

Year	New Mills No.	New Mills Capacity Tons	Total Mills No.	Total Mills Capacity Tons	Increases No.	Increases Capacity Tons	Ceased Operating No.	Ceased Operating Capacity Tons
1942	4	950	130	64,725	12	1,235	37	6,760
1941	13	2,150	142	65,635	18	2,940	15	2,825
1940	12	1,605	143	62,485	60	5,690	15	1,175
1939	25	4,830	161	57,815	33	3,085	32	2,320

In Nova Scotia, 4 mills with a daily capacity of 280 tons were in operation. They were the Avon, Caribou Gold, Guysborough, and Queen. The Guysborough ceased operations in April.

In Quebec, 26 mills with a daily capacity of 15,115 tons were in operation, compared with 24 mills and 13,850 tons in 1941. Of this total 5 mills with a combined capacity of 1,475 tons ceased operating during the year. These were Arntfield, Cournor, Pandora, Powell-Rouyn, and Wood-Cadillac. Powell-Rouyn continued to ship crude ore to Noranda smelter. Mic Mac 500-ton mill went into production in June and West Malartic in May, 1942.

In Ontario, 60 mills with a daily capacity of 37,135 tons were in operation, compared with 72 mills and a capacity of 38,925 tons in 1941. Of the total, 10 mills with a combined capacity of 1,430 tons ceased operation during 1942. These were, Bankfield, Cline, DeSantis, Goldwood, Olive, Sand River, Sturgeon River, Tyranite, and Wendigo. The only new mill was the one on the Kenwest property near Big Manitou Lake.

In Manitoba, four mills with a combined capacity of 4,900 tons were in operation, namely Flin Flon, San Antonio, God's Lake, and Gunnar Gold. This last named was closed down permanently in September 1942. In Saskatchewan, the Box, Pamon, and Preview mills, with a combined capacity of 1,535 tons, operated for a part of the year and were then closed down. The small mill on the Monarch property at Amisk Lake, operated by Pamon Gold Mines Ltd., was destroyed by fire in January. The small mill of Preview Gold Mine Ltd. at Sulphide Lake, six miles north of Lac La Ronge ceased operations in September.

In British Columbia, 26 mills with a combined capacity of 5,025 tons were in operation in 1942, but 13 of these were closed down during the year, namely Alpine, Bayonne, Buccaneer, Buena Vista (750-ton), Central Zeballos, Euphrates, Homewood, Kootenay Belle (150-ton), Mount Zeballos, Muskateer, Polaris Taku (300-ton), Spud Valley, and Ymir Yankee Girl (155-ton). Most of these mills will probably resume operation after the war.

In the Northwest Territories, 6 mills with a combined capacity of 725 tons were in operation. They were the Con, Negus, Ptarmigan, Ruth, Slave Lake, and Thompson-Lundmark. The Ptarmigan, Ruth, and Slave Lake mills were closed before the end of the year. The Ruth property, situated in the Francois Lake area, 58 miles east of Yellowknife Settlement, and operated by the Consolidated Mining and Smelting Company of Canada, started milling operations in July, 1942, but after one month's operation the plant was closed. The property has been developed to a depth of 230 feet with two levels.

Production:

The Canadian production of gold in 1942 was 4,829,815 fine ounces valued at $185,947,877, compared with 5,345,179 fine ounces valued at $205,789,392 in 1941.

The value of Canada's gold production in 1942 was about 47 per cent of the value of all metals and 33 per cent of the value of the entire output of the Canadian mineral industry, compared with 52 per cent and 37 per cent respectively in 1941. The production by province, was as follows:

	1941		1942(a)		Increase or
	Fine ounces	Value	Fine ounces	Value	Decrease %
Nova Scotia	19,170	$ 738,045	12,950	$ 498,575	-32.4
Quebec	1,089,339	41,939,552	1,101,533	42,409,020	+ 1.1
Ontario	3,194,308	122,980,858	2,756,922	106,141,497	-13.7
Manitoba	150,553	5,796,290	138,606	5,338,641)	+ 8.1
Saskatchewan	138,015	5,313,578	173,361	6,674,398)	
Alberta	215	8,277	32	1,232	--
Brit. Columbia	608,203	23,415,816	470,254	18,104,779	-22.6
Northwest Terr.	74,417	2,865,054	97,039	3,736,002	+30.4
Yukon	70,959	2,731,922	79,058	3,043,733	+11.4
CANADA	5,345,179	$205,789,392	4,829,815	$185,947,877	- 9.6

(a) Preliminary figures subject to revision.

In Quebec, the larger output at the base metals mines and at some of the new gold mines offset the decrease in production at several of the older gold mines. The base metals mines contributed 26 per cent of the total output. In Ontario the decrease of 13.7 per cent was due in part to the discontinuation of operations at several properties. Output from the mines in the Kirkland Lake area decreased from a total of 744,000 ounces in 1941 to a total of 541,000 ounces in 1942. In the Porcupine area the output dropped from 287,200 ounces in 1941 to 249,500 ounces in 1942.

The production of Manitoba and Saskatchewan showed a total increase of 8 per cent due to enlarged operations at the base metal mines of Flin Flon and Sherritt-Gordon and to increased output at the San Antonio gold mine. In British Columbia the decrease was 22.6 per cent and was largely due to the closing of several properties.

World production of gold in 1942 is estimated at 37,600,000 fine ounces, compared with 40,827,000 fine ounces in 1941 (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 possibly Russia as a world producer of gold and contributes about 12 per cent of the total. 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 productionwas computed for 1940, 1941, and 1942 was $38.50 a fine ounce.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

INDIUM IN 1942

Source of Supply:

Many zinc ores contain indium, which is frequently associated with gallium. Indium also occurs in tin and tungsten ores and in some iron and manganese ores. Indium production in Canada was reported for the first time in 1942. It is being recovered in small quantities at Trail, British Columbia, from treatment of the residues obtained at the zinc refinery of Consolidated Mining and Smelting Company.

Refined indium has a silvery-white colour somewhat resembling that of platinum. It is ductile and slightly heavier than zinc. It has a low melting point (155°C.) and a relatively high boiling point (1450°C.).

Production

Canadian production figures are not available for publication. World production is still relatively small. Indium is being produced commercially in the United States, Germany, Belgium, and possibly in Japan and Russia.

In the United States indium is now recovered as a by-product of zinc and lead operations by American Metal Company, American Smelting and Refining Company, Anaconda Copper Mining Company, and National Zinc Company.

Markets and Prices

Indium is used for plating and as an alloy with other metals. It is deposited on and alloyed with cadmium-nickel and copper-lead on bearings for aeroplanes, automobiles, etc., and resist the corrosive action of lubricants containing organic acids. Coatings of indium-alloys appear to have a diversity of uses. They are easily polished and burnished. Indium is alloyed with gold and silver and with various base metals. It is used in dental alloys and in making low melting alloys. Augmented production of engine bearings and war restrictions on ordinary plating metals have stimulated interest in indium during the past two years.

The price of metallic indium was reduced in December 1940 from $15 to $12.50 a troy ounce, at which price it remained throughout 1941 and 1942.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

IRON ORE IN 1942

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 Unites States and in Newfoundland, no iron ore from domestic sources was produced in Canada from 1923 until 1939.

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.

New Development:

In Ontario, Algoma Ore Properties, Limited, a wholly owned subsidiary of Algoma Steel Corporation, Limited, encouraged by the bounty of two cents per iron unit provided by the Ontario Government, began in 1937 development work at its New Helen mine in the Michipicoten area, Ontario, and the first sinter was produced in July, 1939. Operations during the last two years consisted mainly in open cut mining.

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 daywas 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

The total shipments of sintered ore in 1942 were 481,800 tons. It was shipped via Michipicoten Harbour, 8 miles from the sintering plant, to the company's blast furnaces at Sault Ste. Marie, Ontario, and to United States ports on the Lower Lakes for use in United States blast furnaces. The manganese content is of special interest to users.

Exploratory work on the hematite property of Steep Rock Iron Mines Limited situated east of Atikokan, and about 135 miles west of Port Arthur, Ontario, 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. The size of the hematite bodies can be gauged from what has been reported, namely, that the probable average widths of A, B, and C bodies are 205,135, and 200 feet respectively, with explored lengths of over 3,000 feet in the case of A, which is still open at one end, and of 5,000 and 800 feet for B and C, each of which is open at both ends. Under the A orebody the greatest depth at which the ore has been found in a borehole is 1,400 feet below the surface of Steep Rock Lake, or 1,035 feet below the ledge; under the B zone ore was encountered 700 feet below lake level. High-grade ore occurs within these deposits and presumably makes up a considerable, but as yet very incompletely defined part of them.

In a paper entitled "Replacement Hematite Deposits, Steep

Rock Lake, Ontario" by H. M. Roberts and M. W. Bartley, and published in the January, 1943 issue of "Mining Technology", (A.I.M.M.) the following estimate of ore reserves is given.

> "Because considerable quantities of ore have been sampled accurately in close detail in the B ore body, it is now possible to estimate that 9,157,444 tons have thus far been proved, 8,400,600 tons of which can be mined in an open pit. On the B and A ore bodies together, 14,377,709 tons of probable ore are estimated, in addition to 1,525,320 tons of proved ore in the A ore body."

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 have been 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.

Michipicoten Iron Mines Ltd. was formed in 1943 to take over the iron properties owned jointly by Sherritt Gordon Mines Ltd. and Frobisher Exploration Co. Ltd. (a subsidiary of Ventures Limited). These properties, which consist of the Josephine, Ruth, and Lucy mines are about 20 miles from Michipicoten Harbour, Algoma district. Construction work was started at the Josephine mine in the fall of 1941, a transmission line was built to connect with the power line at Hawk Junction and the necessary electrically driven plant for development operations was installed. Shaft sinking was started February, 1942 and completed to a depth of 1,055 feet early in September. Six stations were cut, the lowest being at the 1,015 foot horizon. While shaft sinking was in progress the orebody that had been explored early in 1941 by surface diamond drilling was further explored by lateral diamond drilling at the first and second levels. A drill hole was then put through the orebody on the 6th or 865-foot level to ascertain water conditions, and lateral exploration was done on this level. The drainage of Parks Lake was then undertaken and by the end of October the main basin of the lake under which the orebody is located was dewatered. Some experimental shipments of lump ore have been made for test purposes.

The highest grade ore known is at the Josephine property, while large but lower grade ore deposits exist at the Ruth property about two miles away. The Lucy property has not yet been drilled. The Josephine mine is estimated to contain 1,271,000 tons of hematite averaging 51.3 per cent iron and 21 per cent silica, down to the 6th level. At the Ruth property drilling carried out since January 1942 shows an estimate of 11,200,000 tons of siderite, averaging 34.5 per cent iron. A pilot-plant has been in operation since the summer of 1942 for testing purposes. Consideration is being given to the erection, possibly in 1943, of the necessary mining, milling, and sintering plants for the production of about 500 tons of sinter a day.

During the past year Frobisher Exploration Company, Ltd., an exploration subsidiary of Ventures Limited and associated companies, continued investigation of Bessemer, Childs, and Rankin magnetite deposits in Mayo township, Hastings county. Extensive underground sampling and diamond drilling were carried out at the Bessemer mine, and the program of surface drilling on the Bessemer commenced in 1941 was continued. At the Radenhurst-Caldwell magnetite property near Flower Station, in Levant township, Lanark county, a program of shallow diamond drilling was carried out in 1942. This exploration indicated a substantial tonnage of low-grade ore and further drilling is planned in 1943. Large-scale magnetic concentration tests on the Bessemer ore were continued, and small-scale testing on the Radenhurst-Caldwell ore was commenced, at the Bureau of Mines Laboratory in Ottawa.

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 was carried on in 1942 under the direction of Hollinger Consolidated Gold Mines, Limited which has acquired a controlling interest in Labrador Mining and Exploration Company. Geological and exploration work were also undertaken on the Concession in a contiguous area in Quebec, which area embraces a total of approximately 20,000 square miles. The field work of 1942 by Hollinger confirmed the results of the work of earlier years. The exploitation of these deposits would necessitate the construction of a railway line from the St. Lawrence River at Seven Islands, which port is open to navigation throughout the year.

In British Columbia, the report on the proposed iron and steel works 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 has 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 acquired early in 1942 the old Anyox copper plant at Anyox and proposed erecting in British Columbia a plant for the production of iron and steel from scrap. No progress has been reported.

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

1942 by the large 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, 1943.

LEAD IN 1942

Ores Mined and Producing Localities:

Most of the lead produced in Canada comes from Consolidated Mining and Smelting Company's Sullivan silver-lead-zinc mine at Kimberley, British Columbia. Other 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 and from the lead-zinc-copper mine at Stirling, Cape Breton, Nova Scotia. The lead-zinc mine in Portneuf county, Quebec, resumed production in 1943 after a few years of idleness.

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 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 in 1942.

Reco Mountain Base Metals Mines Ltd., which is being financed by Gold Frontier Mines Ltd., took over in 1942 the Noble Five, Surprise, and Deadman mines, near Sandon, Slocan mining division. The properties are being explored by diamond drilling and underground development. The 100-ton mill of the Noble Five is being rehabilitated and prepared for operation in 1943.

The Whitewater mine and mill were taken over in the fall of 1942 by Kootenay Belle Gold Mines Ltd., and are being prepared for production early in 1943.

The Enterprise mine on Ten-Mile Creek, near Sandon was operated in the summer of 1942 by S. N. Ross, who installed a 50-ton flotation unit.

The Van Roy mine on Four-Mile Creek, near Silverton, was being prepared for operation in 1943, after lying idle for many years.

The Kootenay Florence mine at Ainsworth, on the west shore of Kootenay Lake, was taken over in 1943 by Wartime Metals Corporation and operated as the Kootenay Florence Project. The mill equipment and machinery of the Ymir Consolidated Mines Ltd. has been secured and will be installed in the old Kootenay Florence mill building. Production is expected to start in the spring of 1943.

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 remained idle 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, high-grade silver-lead properties near Mayo.

In Ontario, Lake Geneva Mining Company resumed operations in 1941 and operated during part of 1942, producing zinc and lead concentrates for the export market. An intensive exploration by diamond drilling was being carried on during the winter of 1942-43.

In Quebec, the Tetreault property near Notre Dame-des-Anges, Portneuf county, was taken over in 1942 by Siscoe Gold Mines Ltd., and operated under the supervision of the Wartime Metals Corporation. The lead and zinc concentrates produced are contracted to the Metals Reserve Company, of the United States.

In Nova Scotia the Stirling property, at Stirling, Cape Breton, remained idle in 1942. 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 1940-1942 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 were, in order of importance: United States, Mexico, Australia, Canada, Germany, Belgium, India (Burma), and Russia.

Markets and Prices:

The world consumption in 1938 (1939-1942 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. Lead is the only common metal classified in the least critical group. There are many purposes for which lead is normally used to a greater or lesser extent in competition with other materials now critical, for example, lead in plumbing, for sheet metal work on buildings, as bearing metal to replace tin, as chemical tank linings and pipes and as gaskets and washers to replace rubber, as collapsible tubes and foil to replace aluminium and tin, as die castings to replace zinc, as paint to replace zinc oxide and zinc chromate, in storage batteries to replace nickel and iron, as solder, and for various other purposes.

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) was 3.362 cents a pound throughout 1941 and 1942. The price at New York in 1942 was 6.50 cents throughout the year, compared with an average of 5.79 cents in 1941.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

MANGANESE IN 1942

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.

In New Brunswick during 1942, Nabco Manganese Mining Company operated the mine and concentrator on Gowland Mountain, near Elgin, southeast of Sussex. After shipping a number of car lots of concentrates the mine and mill closed down in August. One or two car lots of ore were shipped by the Turtle Creek Manganese Prospecting Syndicate from the Turtle Creek deposit 35 miles northeast of Sussex.

Prospective Producing Localities and Developments.

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 1942 was confined mainly to New Brunswick. The Sussex Manganese Mining Company deposit and equipment at Jordon Mountain, 7 miles north of Sussex, was taken over by the British Manganese Mining Company. The old workings were cleaned out and the mill erected by the Sussex Company in 1941 and was re-modelled. A few tons of ore from the dumps was shipped and some was put through the new mill early in 1943. The bulk of the ore is fine-grained, disseminated and brecciated and it is difficult to obtain high-grade concentrate by the ordinary gravity methods. British Manganese also acquired and opened up the Old Shepody Mountain deposit north of Hopewell Hill, about 40 miles east of the Jordan Mountain deposit. The old tunnel and adit, which were completely filled in, were cleaned out and the search for ore is continuing. Turtle Creek Manganese Prospecting Company, who took over the Turtle Creek deposit near Berryton from Mount Forest Manganese Mining Company, did some diamond drilling on the south side of the creek and also a considerable amount of prospecting. A few car lots of ore was shipped, but as insufficient ore was found by drilling, operations ceased and late in the year the property was acquired by G.F. Perry of Moncton, N.B. Some prospecting was done by Douglas Mountain Manganese on its deposit adjoining the Nabco property on Gowland Mountain.

At New Ross in Nova Scotia the Dominion Department of Mines, working in co-operation with the Provincial Government, did about 6,000 feet of diamond drilling to search for extensions of the veins in the Upper (Dean & Chapter) and the Lower (Dr. Cain) mines. Very little ore was located in the Upper mine, but some extension of the vein in the Lower mine was found, and although drill-core recovery was very incomplete examination of sludge samples indicated the possible existence of a fair tonnage of ore. However, work has been discontinued for the present. The Atlantic Manganese Company shipped a few car lots of very low-grade ore from the stockpile on the property.

Some prospecting was done by George McKay on a deposit near Bridgeville in Pictou county, where pyrolusite occurs on top of limonite under the limestone and on which some diamond drilling is planned. A deposit of concretionary nodules and plates of manganese ore in shale was prospected by Professor M. F. Bancroft along Bishop Creek near New Canaan. It was found that, the percentage of ore that can be hand sorted is too small to permit commercial operation.

In Quebec, no further work was done on the Magdalen Islands deposits in the Gulf of St. Lawrence half way between New Brunswick and Newfoundland, but a prospecting program has been outlined for 1943.

In Ontario, a deposit was prospected at Gargantua Harbour, Batchawana Bay, on the east shore of Lake Superior, Algoma district. Areas of banded and disseminated manganese ore were trenched and diamond drilled by Chromium Mining and Smelting Company. The general zone is about 400 feet wide and a mile long, but drilling showed it to contain low grade ore, except in a few places where the zone is narrow. Consequently, the company dropped its option in September, 1942.

In Manitoba, intermittent prospecting was continued on several bog and nodular manganese deposits, mainly in the vicinity of Riding and Porcupine Mountains, 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. Large or commercial deposits have not as yet been discovered. The development of and treatment experiments on the large deposits at Chamberlain in South Dakota have been followed with interest, as the ore is somewhat similar to that of the nodular material of Porcupine Mountain, but work on the Dakota deposits was halted recently owing to manpower and equipment shortages and because of the easing of the manganese situation.

In British Columbia, Newon Manganese Company, Toronto, prospected and did about 500 feet of short hole ("X-Ray") diamond drilling on the A.W. Haddock manganese claims at Chimney Creek bridge, 15 miles from Williams Lake in the southern Cariboo district. Surface showings were promising, but no ore of commercial grade or quantity were found by drilling and the option was dropped. Some prospecting was done by C. Fuller on a deposit in the Nazko valley about 65 miles west of Quesnel in the Cariboo, but there are no roads into the property and as it is a bog deposit production appears to be unlikely. Several other bog deposits occur in the Province, the best known being the A.J. Curle deposits about 7 miles northwest of Kaslo on the west side of Kootenay Lake and from which small shipments were made. No work was done on the rhodonite manganese deposits on the east side of Cowichan Lake on Vancouver Island, which were investigated in 1939 and from which about 1100 tons were shipped during 1919-1920.

In Newfoundland during the past three years intermittent prospecting was carried out on a siliceous manganese deposit at Brigus on Conception Bay and in the fall of 1942 Brigus Manganese Limited, Montreal, shipped about a ton of 33 per cent manganese ore to Ottawa for testing. The ore is apparently not amenable to the ordinary gravity and flotation methods, but a fairly good grade can be obtained from the coarsely crushed material by "Sink and Float" followed by roasting.

Production and Trade:

Canadian production and trade figures for 1941 and 1942 are not available for publication owing to the war.

Nearly 70 per cent of the imports of manganese ore in 1942 were from the Gold Coast, Africa, about 20 per cent from British India, and most of the remainder from the United States.

From 1886 to the end of 1942, a total of about 17,500 short tons of manganese ore was produced in Canada, close to half of it, between 1887 and 1890 inclusive. 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, a total of 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. During 1942 arrangements were made between the Allied Governments to distribute the manufacture of certain manganese ferro-alloys and for their exchange as partial substitution of ores being imported from far distances.

Estimates of world production are in the neighbourhood of 6,000,000 tons annually, those countries that probably produced 200,000 tons or over in 1941 in order of their output being Russia, British India, Gold Coast, Brazil, Union of South Africa, Egypt (Sinai), and Cuba.

Russia produces close to 3,000,000 tons annually, the output in 1941 being mainly from the Tshiaturi 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.

India produces over 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 Chief source of supply for the United States, the exports to that country being estimated at 380,000 long tons of 50 per cent manganese.

At Nsuta, Wasaw district, Gold Coast, is one of the largest known single manganese deposits. It 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.

The United States in 1941 took most of Brazil's total output of 426,151 long tons of ore averaging 42 per cent manganese. The principal deposit at Mato Grosso is estimated to have reserves of 25 million tons of 45 per cent or higher of manganese ore. Other large producing centres in Brazil are Minas Geraes and Bahia.

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 in 1941 were mainly to the United States and are estimated at 204,000 long tons.

In Cuba, the Cuban-American Manganese Corporation is the principal producer, its deposits being in Orient province. The plant was expanded in 1941 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 from Cuba to the United States in 1941 are believed to have been about 240,000 long tons.

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

In the United States about 50 per cent of the output of 76,000 long tons of high-grade ore in 1941 came from Montana and 30 per cent from Tennessee and Arkansas, the remainder being from thirteen other states. Between one and two million 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.

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.

During the past three 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 United States War Production Board is establishing three large and seven smaller concentration plants for the production of 600,000 tons of high-grade manganese ore a year from low-grade domestic ores. About two thirds of the output will come from plants in the Missouri River area in South Dakota, Boulder Dam in Nevada and the Cuyuna Range area in Minnesota.

Uses and Specifications:

It is estimated that over 90 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 fairly 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, 8 per cent silica, 0.15 per cent phosphorus, 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 unless they are briquetted. United States Metals Reserve Company buys ores down to a minimum of 35 per cent manganese and maxima of certain impurities, details of which are given below under "prices".

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 phosphorus were not too high. Unfortunately, steel requirements, except in some instances, connot 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. The Metals Reserve Company, the United States buying agency at Washington, D.C., is also a buyer of manganese ores.

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 75 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; 0.02 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 (80 per cent through 150-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. Research on the treatment of low-grade manganese ores is being carried out on a large scale in the United States and a considerable amount of literature on these investigations has already been published.

Prices:

Prices of ferro grade ore depend on manganese content and the amount of harmful impurities. Imported ore is usually quoted in cents per long ton unit of 22.4 pounds of contained manganese. United States prices for metallurgical ores are based on a standard duty free ore (Cuban and domestic) containing 48 per cent manganese, 6 per cent iron, 11 per cent silica and alumina combined, and 0.18 per cent phosphorus. The quotation for this grade is 85 cents per long unit of contained manganese at Gulf of Mexico ports, and 90 cents at New York and other Atlantic ports.

The price premiums and penalties for ores varying from the standard grade are as follows: Premium per long unit is $\frac{1}{2}$ cent for each per cent Mn above 48% and $\frac{1}{2}$ cent for each per cent iron below 6%. Penalties per long unit are one cent for each per cent Mn below 48% down to 44% and on an increased scale down to 20 cents for the minimum 35% Mn. Penalties are also deducted for the excess of impurities above the standard up to the maxima of 8% Fe ($3\frac{1}{2}$ cents); 15% $SiO_2 + Al_2O_3$ (7 cents) and 1 cent for each 0.03% P above 0.18% P.

Prices of chemical grade (battery grade) manganese ores early in 1943 were $55 per ton for Brazilian or Cuban ores (80 per cent minimum content of MnO_2) in car lots, f.o.b. New York, exclusive of duty. The delivered price in Canadian currency for finely ground battery grade ore in bags imported into Canada from Africa or Montana, U.S.A., was about $60 to $80 a ton depending on mesh and origin.

Imports from Canada into the United States of ores containing 10 per cent or more of manganese are subject to a duty of $\frac{1}{2}$ cent a pound of contained manganese, but are duty free if purchased and imported by the Metals Reserve Company.

Situation:

By far the greater part of the world output comes from Allied countries. This and the successful efforts of the United States in recovering manganese from its vast deposits of low-grade ore and that country's stockpiles sufficient for two years consumption are among the factors that have very considerably eased the Allied manganese situation. Canada's production is small and its imports are mainly from Africa and India. Many deposits have been found, but they are either too small or too low in grade for economic operation. Only production from deposits of substantial tonnage and satisfactory grade can successfully compete with the ores being imported from countries in which extensive high-grade deposits occur.

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

MERCURY IN 1942

Ores Mined and Producing Localities:

Cinnabar (HgS), the principal ore of mercury, is a heavy mineral (s.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 northwest 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 plant was erected and production was started in June, 1940. The present plant, consisting of Wedge roasters, kilns, and condensers, has been enlarged periodically and is over twenty times the capacity of the original. The grade of ore treated is about 0.3 per cent mercury. The deposit is on a steep mountain side and has been developed by adits at a number of different levels. 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. This mine is probably one of the largest single producers of mercury on the American continent and its output is far in excess of the domestic requirements. 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 about five flasks of mercury were produced in 1942. Copper Creek Mercury Mines (F.L. Gorse) operated the old Copper Creek deposits on the north shore of the west end of Kamloops Lake that was worked in 1894. A small tonnage of ore was treated in a retort and a few flasks of mercury were produced. Late in the year the Gould plant of Empire Mercury Mines north of Minto City in the Bridge River area was dismantled and shipped to Copper Creek and production on an increased scale is expected by midsummer of 1943. A few miles northwest of Copper Creek, G. F. Diskson and T. R. Hardie did some work on the Hardie Mountain deposits. A few tons of ore were roasted in a small retort and a few flasks of mercury were produced.

Prospective Producing Localities:

A number of mercury discoveries ave been made in the area 50 to 100 miles northwest of the Pinchi Lake mine and where extensive prospecting work is being maintained by Consolidated Mining & Smelting Company; Hollinger Exploration Company; Bralorne Mines Ltd., and others. The more important are those at the head of Silver Creek, 18 miles east of Takla Landing, where diamond drilling and stripping has given encouraging results and shaft sinking preparatory to underground development is underway. The installation of a treatment plant is expected in the near future. Bralorne Mines is developing a mercury property at Relay Creek, about 35 miles from the Bralorne Gold Mine in the Bridge River district and where the erection of a treatment plant is contemplated. Prospecting is active on several other cinnabar showings in the Bridge River and Yalakom River areas. New discoveries in the Poison Mountain area, west of Clinton and of Fraser River are also being prospected.

Most of the known mercury deposits in British Columbia were examined and reported upon in 1941 and in 1942 by officers of the Federal and Provincial Departments of Mines.

Production, Consumption and Trade:

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

World production just prior to the war was 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, Czechoslovakia, China, and Japan are also producers of mercury.

During the 1936-1938 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 came from the Monte Amiata mines in the province of Sienna and 40 per cent from the Idria mines in the Julian Alps. Since March, 1940, exports of mercury 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. Output at present, however, is stated to be about 7,000 flasks a month, working only 8 days a month. 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. Until the present war, Spanish and Italian mercury were both sold in London. In July, 1939, a cartel "Mercurio Europeo" which handled both Spanish and Italian mercury formed with an agent in London, but all former marketing arrangements have since become disorganized.

Statistical data of the United States after its entry into the war in December 1941 are not available. In that year it produced about 45,000 flasks of 76 pounds each, which was about 2½ times more than in 1939 and a record since 1883.

The large increase in the United States was the result of the difficulty of obtaining mercury from Europe and of the high price. About 200 mines were producing from 10 States, but 85 per cent of the output came from 33 mines. California contributed 57 per cent of output and was followed by Oregon and Nevada. H. W. Gould and Company of San Francisco, the principal producer in the United States, operates six mines in California and and Nevada and contributes about one-third of the total output. During 1941 this company's New Idria mine in San Benito county, California, was the largest producer in the United States 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 1942 came from new disclosures of ore in old mines, the average grade being slightly under 0.5 per cent mercury. Despite the increased output, large requirements of the United States cannot be met by domestic production and are being augmented largely by Canadian and Mexican mines.

In Mexico, development of old mines and discoveries of new ones has greatly increased production. Output in 1942 is reported to have been appreciably higher than in 1941 when 23,000 flasks were produced, this amount being 3 times greater than in 1939.

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 as a result 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 a 20-ton Gould furnace was recently installed and production on a small scale is expected early in 1943. England is now dependent upon the United States, Mexico, and Canada for a large part of its 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 ~~of~~ 0.30 an 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 gravity 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 and fluorescent 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, but for the latter and for non-essential uses consumption has been considerably restricted by order. In some instances substitutes have been developed, one of these being for anti-fouling paints, which until a year ago was a prime war requirement for mercury.

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 uses about 7 per cent of the total mercury consumed.

<u>Prices and Specifications:</u>

The New York prices for the iron flask of 76 pounds of mercury averaged $75.00 in 1938; prices at the end of January, 1943 were $196 to $198 in 100-flask lots. 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. Canadian imports into the United States are subject to a tariff of 25 cents per pound, or $19 a flask, in the United States currency.

Specifications call for a minimum of 99.5 per cent mercury and a maxima of 0.3 per cent antimony and 0.1 per cent arsenic.

<u>Situation:</u>

Because of the present substantial surplus production in Canada the larger Canadian buyers are not purchasing in less than 50 to 100-flask lots. Considerable difficulty is, therefore, experienced in disposing of small lots of a few flasks.

Owing to the greatly increased production of mercury from Canada, United States, and Mexico, the position of the Allied countries, which prior to the war were largely dependent on Spain and Italy for their supplies is now so much stronger that there is no longer an urgent need for an intensive search for new deposits. Only large deposits of economic grade ore are of interest at present. If such a deposit can be mined cheaply and on a large scale, ore grading as low as 0.25 per cent mercury or even slightly less could possibly be mined at a profit.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES & RESOURCES,
OTTAWA, MARCH, 1943.

MOLYBDENUM IN 1942

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 in 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.

Quyon Molybdenite Company, Quyon, Quebec, about 35 miles northwest of Ottawa, was by far the largest producer in 1942. The ore is treated in a 100-ton mill and the concentrate is roasted to produce molybdenum trioxide, which is sold to steel manufacturers. The company treated about 5 car lots of ore from Alice Arm, British Columbia, that had been lying in the old mill dump at Renfrew since 1917. About a car lot from Mount St. Patrick, Ontario and from Gayhurst township, Quebec, were also treated in the company's mill. The Government-sponsored Wartime Metals Corporation controls two molybdenite properties, one being the Molybdenite Corporaiion deposit in LaCorne township, 15 miles northwest of Val d'Or, Quebec, which is being operated by Siscoe Gold Mines Ltd. The pilot mill was remodoled and a few tons of concentrate were shipped to Quyon for roasting. A substantial tonnage of ore has been blocked out and plans are underway to erect a mill suitable for full-scale operations. The other Wartime Metals project is the Zenith Molybdenite property southwest of Renfrew, Ontario. A few hundred tons of ore obtained from underground development were hoisted and stockpiled, but operations ceased early in 1943. Farley Mining Company is operating a deposit that was prospected about 50 years, near Montcerf, north of Maniwaki, Quebec. A few car lots of ore and picked flake have been shipped from the property to Zenith and LaCorne for treatment. A car lot of ore was shipped to the United States by Edgemont Molybdenite Mines Ltd. from the property at Shutt in Raglan township south of Barry's Bay, Ontario. A car lot was shipped to the Quyon mill by T. Doyn from Bayhurst township, about 12 miles north of Megantic in the Eastern Townships of Quebec.

Developments during 1942 and Prospective Producing Localities:

Owing to the greatly increased demand for molybdenum, there was considerable development and prospecting activity on some of the 400 occurrences and deposits known throughout the Dominion, a few of which are mentioned below.

The outstanding development resulted from the discovery by Dome Exploration Company of a large body of good grade disseminated molybdenite on the south of the old St. Maurice Mines property on the Indian Peninsula, Kewagama Lake, Preissac township, in the Abitibi district, Quebec. it is being operated by Indian Molybdenum Limited. Tunneling and shaft sinking is in progress and a 500-ton treatment mill is being erected. Production is expected to start before mid-summer of 1943. Neighbouring claims are being prospected by various companies.

Bulk shipments for test were received at Ottawa from the La Pause Gold Mining Company, La Pause township, about 8 miles west of the Dome property; and from Vic-Ore Molybdenite Mines Limited (Goodrock Gold Mines) which is developing and drilling the old Bain deposits in Masham township, Quebec, 35 miles north of Ottawa, and is erecting a small treatment plant on the property. Prospecting is being carried out by Norwin Molybdenite Mines Limited at its property near Breckenridge, Quebec, 17 miles northwest of Ottawa and by National Molybdenum Mining Syndicate in Fiedmont township, Abitibi district, south of Barraute station, Quebec. Molybdenite showings in the vicinity of the LaCorne operations are also being prospected.

In Ontario, prospecting and sampling was carried out by a number of operators, some of which shipped small test pamples to Ottawa. These include Ajax Tungsten and Molybdenite Mines on the Puritan property north of Renfrew; Major Molybdenite Mines who diamond drilled on the old O'Brien showings on Mount St. Patrick, west of Renfrew; Lands and Mines Development Syndicate on the Baptiste Lake deposit near Highland Grove, west of Bancroft; C. W. Shosenberg and P. J. Dwyer west of Baptiste Lake, near Wilberforce and Tory Hill; Nakina Molybdenite Mines on the southwest shore of Burrows Lake, 14 miles northwest of Longlac station; Pilot Securities in Redvers township, north of Quibell station (C.N.R.), about 60 miles east of the Manitoba boundary. Diamond drilling and sampling were carried out by Wartime Metals Corporation at the East end of High Lake, Ewart township, 25 miles west of Kenora and close to the Manitoba boundary, but work had ceased by the end of the year. Other showings south and west of High Lake are being prospected by the owners of the claims. There was also some prospecting activity in the vicinity of Michipicoten Harbour in the Algoma district.

In British Columbia a promising deposit, at Timothy (Boss) Mountain in the southern Cariboo area, was diamond drilled and a fair tonnage of 1.0% MoS_2 ore was indicated. Consolidated Mining and Smelting Company, which owns the Timothy deposit, opened up the old Molly mine, south of Salmo and stockpiled a few hundred tons of ore. The Sapples property, a little north of the Molly, was operated for tungsten and molybdenum by Bralorne and a few tons were stockpiled. The Molly "B" property, one mile from Stewart on the Portland Canal was prospected by John Haahti and tests were carried out at Ottawa to separate the molybdenum from the tungsten minerals which occur together. British Columbia War Metals Board, Vancouver, made tests on samples from several localities including a copper-molybdenite ore from Texada Island off the east coast of Vancouver Island. Prospecting was carried out by C. C. Vandergrift on a deposit north of Rosebery near the north end of Slocan Lake. A number of other molybdenite properties in the Province were also prospected.

Present indications are that the Abitibi area in Quebec will become the principal source of production in Canada. The area is about 100 miles from the Ontario boundary and in general extends from Rouyn to Val d'Or. It is probably one of the most favourable localities for the discovery of other workable deposits.

Production and Trade:

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

Production was maintained throughout 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 to 1942 not available), was 16,500 tons of metallic molybdenum, of which 91 per cent came from the United States, In 1942, the United States produced concentrate estimated to contain about 21,000 tons of the metal, against 17,580 short tons in 1941. Climax Molybdenum Company, at Climax Colorado, the world's largest producer, is treating daily 18,000 tons or more of approximately 0.5 per cent MoS_2 ore and contributed about 67 per cent of the United States output in 1941. Most of the remainder was obtained as a by-product in the treatment of copper ores from New Mexico, Arizona, and Utah. Vanadium Corporation's Urad mine in Colorado was recently purchased by the Defence Plant Corporation and will be operated by Molybdenum Corporation of America; production is expected by the middle of 1943.

Production from Cananea, Mexico, is estimated at the equivalent of 750 tons of the metal a year; 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 1940 being about 500 short tons. It is reported that Germany has been obtaining 2000 tons of MoS_2 annually from Norwegian mines, but that the Knaben mine was bombed recently and the plant is reported to have been seriously damaged. Other producing countries were Mexico, Peru, French Morroco, Korea, Greece, Turkey, Yugoslavia and Australia.

Consumption and Uses:

Molybdenite concentrate is converted into an addition agent that is introduced into steel either as calcium molybdate or as ferro-molybdenum. During the past five years, however, 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 80 per cent of the Canadian consumption of molybdenum in 1942 was in the form of the oxide briquettes, which contain 52 per cent of molybdenum. In each of the past three years Canadian consumption has more than doubled.

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; in other cases molybdenum is being used successfully in combination with the tungsten. Owing to the difficulty of obtaining supplies of tungsten from outside sources, this substitution of molybdenum for tungsten has greatly increased and there is a corresponding increase in the demand for molybdenum. The use of molybdenum in cast iron has greatly 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 resistance and contacts and for heating elements contain molybdenum. The chemical applications continue to increase, one of which is the use of ammonium molybdate enamel to dull the bright surface of certain gun parts and to prevent rust. 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(49.5 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 Canadian concentrate is approximately 85 cents per pound of contained molybdenum sulphide in a concentrate of not less than 85 per cent MoS_2, delivered at mill.

United States specifications for concentrates dried at 212°F. are:-Minimum 85% MoS_2, and maxima in the following - copper 0.6%; iron 3.0%; combined phosphorus, antimony, and tin 0.2%.

The price per pound of contained molybdenum, f.o.b. Toronto in Canadian funds for the following compounds is approximately; Calcium molybdate (42% Mo), 99 cents; ferro-molybdenum (60% Mo), $1.23; and molybdic oxide (52% Mo), 99 cents. The calcium molybdate is sold in bags of about 12½ pounds containing exactly 5 pounds of molybdenum. The molybdic oxide briquettes weight 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 at present no plants in Canada for the conversion of molybdenite concentrate into suitable addition agents. Consequently, nearly all Canadian requirements of these agents are imported. It is likely that the steadily increasing consumption of molybdenum in Canada and the expected increase in production of concentrates will lead to the erection of a suitable conversion plant. The sale of domestic concentrates must be made through the Metals Controller, Ottawa.

In spite of the large output of molybdenum in the United States the demand is still very urgent. It should be pointed out, however, that although hundreds of occurrences are known in Canada - and many more are likely to be found - the great majority are so small and irregular that costs of production from them would be considerably higher than the present increased Canadian price of the mineral. It is expected that before the end of 1943 production from the Dome and LaCorne properties in the Abitibi region of Quebec will take care of at least half the domestic consumption of the metal.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES & RESOURCES,
OTTAWA, MARCH, 1943.

NICKEL IN 1942

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

Falconbridge Nickel Mines Limited operated its mine and smelter at Falconbridge to capacity. The expansion program, commenced in 1941, was completed near the end of June. Full advantage was taken of all units as they became available and new records were set in the tonnages of ore treated and metals produced. The capacity of the smelting plant was increased. Extensive exploration and development work was done on several levels, including the 1,750-foot level, and No. 5 shaft was extended to a depth of 3,150 feet. Despite the increased production, the total ore reserves again showed a moderate gain.

Ontario Nickel Corporation Limited actively developed the nickel-bearing property in MacLennan township, southeast of Capreol, district of Sudbury. Considerable drifting, crosscutting and raising were carried out. A power line was brought in from the Falconbridge line, a distance of 7½ miles, a substation erected and a full set of mining buildings were put up, including head-frame, compressor house, machine shop, office building, and cookery and living quarters. An average of thirty-five men were employed during 1942, commencing in April. Early in 1943 the Company was arranging to ship crude ore to one of the smelters.

Nickel Offsets, Limited, with a property in Foy township, west of Capreol, Sudbury district, continued the extensive surface exploration and diamond drilling that was started in 1939. A shaft was sunk in 1941 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 that year. Further development work was carried on during 1942 on these three levels, with encouraging results. Sinking operations were resumed in December 1942, with an objective depth of 1,280 feet. Diamond drilling indicated ore averaging 1.9 per cent nickel and 1.5 per cent copper, and containing $2.00 a ton in precious metals, with mining widths up to 30 feet. The underground development has shown a substantially higher content of metals. It is planned to commence mining and shipping ore by late spring in 1943.

Denison Nickel Mines Limited did not operate its property in Denison township, near Worthington, southwest of Sudbury, but hopes to re-open the mine in 1943.

Clifton Consolidated Mines Limited took over the old Alexo nickel-copper property at Porquis Junction, Cochrane mining division, and is expected to be shipping in 1943.

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, 1941, and 1942 not available) was 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 1942 was 35 cents per pound. The same price has ruled for more than 15 years.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

PLATINUM GROUP METALS IN 1942

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 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 is estimated to exceed 700,000 ounces. Canada has been the leading producer of platinum since 1934 when it displaced Russia; the other principal producers by order of importance being Russia, Colombia, 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 1942 are not available. The world consumption of platinum metals in 1939 was about equal to production (about 540,000 ozs.), 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 1942. Palladium ranks second in consumption and iridium third. Osmium, rhodium, and ruthenium are as yet consumed in relatively small quantities.

The market situation in 1942 is explained by Charles Engelhard, President of Baker and Company, Incorporated, in the following, part of which is abstracted from his annual review:

"The increased war needs of the United Nations, development of new industrial processes, scientific research for more dependable materials, all combined to make 1942 the biggest year in the history of the platinum metals industry.

It was necessary for the War Production Board (U.S.A.) in October, 1942, to restrict the use of platinum for jewelry so as to be able to meet the probable war needs of the United Nations.

The most important war-time uses of platinum are in the chemical, electro-chemical, and electrical fields, where high resistance to corrosion, erosion, and oxidation are essential. The largest single use is as a catalyst in the production of nitric and sulphuric acid for munitions plants - various electrical uses are second in importance and are followed closely by the glass and the electro-chemical uses. There are numerous new and interesting developments with platinum in the latter field. Other important uses for platinum, as well as palladium, are for catalytic operation in organic chemistry, such as the production of essential components of vitamins.

Many of the industrial fields have also shown heavy demand for platinum-clad materials.

In the dental field palladium as well as gold and platinum have extended their scope of usefulness.

Ample supplies of palladium exist to take care of jewelry requirements. For this purpose it is usually hardened with ruthenium and is similar in appearance to platinum.

It is likely that many of the war-developed industrial uses of platinum will remain when peace is achieved, and that palladium will continue to enjoy popularity as a jewelry metal. In this field it will supplement rather than supplant platinum, and probably also will continue to find, with platinum, increased industrial applications."

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.

With the exception of iridium, prices for the platinum group of metals remained virtually unchanged during 1942. The average price in New York (as given by M. & M. Markets of Eng. and Min. Journal) of refined platinum remained at $36.00 per ounce throughout 1941 and 1942. 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. Osmium was quoted at $45.00 to $48.00 throughout the year. Iridium was quoted at $275.00 per ounce early in 1941, then dropped to $175.00 in February and remained at that figure until the end of May, 1942, when the price was lowered by $10.00 to $165.00 at which price it remained for the remainder of the year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

SELENIUM IN 1942

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 600 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. About 100,000 pounds of selenium is now used annually for controlling the colour of glass, especially in the production of pink or ruby glass. It is finding a more extensive use 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 fire-proofing 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 1942. The Canadian price based on London quotations was 1.92 cents a pound throughout the year.

The Glass Industry Review givew the following quotations for selenium salts in 1942: barium selenite, $1.40 to $1.60 a pound, and sodium selenite, $1.50 to $1.65 a pound.

ISSUED BY THE BUREAU OF MINES
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

SILVER IN 1942

Ores Mined and Producing Localities:

Silver in 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 was from the portion of the Flin Flon deposits lying within that Province and from the "Box" gold property at Goldfields, which ceased operation in September, 1942, for the duration of the war.

In Manitoba, the production was 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. The Gunnar Gold Mine ceased operation in September, 1942, mainly due to the exhaustion of the known ore reserves.

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 has been mainly from the silver-lead ores of the Mayo district. These mines ceased operation in 1941 and the production reported in 1942 was from previous operations. All the equipment of the Treadwell-Yukon Company has been disposed of. 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, Ptarmigan, Thompson-Lundmark, and other properties in the Yellowknife and adjoining areas. The Ptarmigan was closed in October, 1942, for the duration of the war.

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, 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 1942 was 20,671,986 fine ounces, valued at $8,585,076, compared with 21,754,408 fine ounces valued at $8,323,454 in 1941.

World production of silver in 1941 (1942 figures not available), as estimated by the American Bureau of Metal Statistics, was 274,300,000 fine ounces, a new high, compared with 273,295,000 fine ounces in 1940.

Figures of production for Europe, Asia, Africa, and Australia are not available. The production in 1942 for the Western Hemisphere, which includes both North and South America and the West Indies, is estimated by Messrs. Handy and Harman at 183,600,000 ounces.

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

Market and Prices:

World consumption of silver in 1939 (1940-1942 figures not available) was estimated by Handy and Harman at 441,300,000 ounces.

Silver consumption in 1942 in the United States and Canada, as given in the "Annual Review of the Silver Markets" by Handy & Harman, was as follows:

> "The arts and industries used 115 million ounces in the United States and 4 million ounces in Canada. Of the Canadian total, about 40 per cent represents war and other essential uses. Nearly 60 per cent of the consumption in the United States is estimated to have gone into war production, or into uses classified as essential. This silver was used mostly in the production of photographic films, airplane engine bearings, solders and brazing alloys, electrical contacts, insignia, silver-plated eating utensils for the Forces and chemical equipment. Silver has also been used in the making of pharmaceutical products, surgical supplies, and dental alloys. There were insufficient supplies to fill more than a small part of the heavy (American) civilian demand for silverware and jewellery.
>
> "United States Government acquisitions of silver for 1942 are estimated at 63,400,000 ounces, by far the smallest annual total since the silver-buying programme was inaugurated. This total includes 14,400,000 ounces of foreign metal representing purchases made prior to November 28, 1941, when the buying by the United States Treasury ceased. The Treasury's silver holdings at December 31, 1942, are estimated at 3,343,000,000 ounces."

The average price of silver in 1942 (New York price in Canadian funds) was 42.166 cents per fine ounce, compared with 38.261 cents in 1941. The maximum price of fine silver in Canada was set in January, 1943, by the Wartime Prices and Trade Board, at 40 cents per ounce. The New York official price averaged 38.333 cents compared with 34.783 cents in 1941.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

TELLURIUM IN 1942

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. Ores containing tellurium occur in British Columbia, Saskatchewan, Manitoba, Ontario, and Quebec.

The electrolytic copper refineries operating in Canada have plants for the recovery of tellurium from their refinery sludges, and for the production of the refined metal. Ontario Refining Company at Copper Cliff, Ontario, started production in 1934, and , 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 150 short tons a year, or about double the pre-war figure, 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. When alloyed with lead, the tensile strength and toughness of the lead is increased greatly. Lead alloys containing from 0.1 to 0.5 per cent tellurium have been in use for some time in applications requiring resistance to vibration and corrosion. 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. A new use for tellurium is as a carbon stabilizer in cast iron when it is used in the form of a ferrotellurium.

A nominal price for tellurium of $1.75 per pound at New York prevailed throughout 1942.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, FEBRUARY, 1943.

TELLURIUM IN 1942

Sources 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 minor 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. Ores containing tellurium occur in British Columbia, Saskatchewan, Manitoba, Ontario and Quebec.

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Production and Trade

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

The world production is estimated at 190 short tons a year, or about double the prewar figure, and Canada and the United States continue to be the main sources of supply.

Markets 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. When alloyed with lead, the tensile strength and toughness of the lead is increased markedly. Lead alloys containing from 0.1 to 0.5 per cent tellurium have been in use for some time in applications requiring resistance to vibration and corrosion. 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 vibration and corrosion. It has also been used for improving the machining qualities of certain steels. Very finely powdered tellurium may be used as a rubber compounding material. Its presence is stated to shorten the time of curing and to greatly improve the resisting qualities of the product. A new use for tellurium is as a carbon stabilizer in malleable iron when it is used in the form of ferrotellurium.

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ISSUED BY THE BUREAU OF MINES
DEPARTMENT OF MINES AND RESOURCES
OTTAWA, [illegible], 1943

TIN IN 1942

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 was in commercial operation in April, 1942. The tin content of the ore is small and the recovery will be proportionately small.

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. Under wartime conditions, however, provided the deposit is reasonably large, it is worthy of attention, even though the grade of the material is lower than would ordinarily be regarded as suitable for commercial development. 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 was 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 terne-plate; pipe and tubing; type metal; bronze; galvanizing; and in bar tin.

The prices of tin in New York were fixed in August, 1941, at 52 cents a pound and remained at that level to the end of the year and throughout 1942.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

TITANIUM IN 1942

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 ferrotitanium, 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.

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, Australia, United States, and Canada. Brazil is the principal producer of rutile, and Norway is second in importance.

The United States has become virtually self-sufficient in supplies of ilmenite with the completion of the plan to exploit the Adirondack titaniferous iron ores. This deposit, known as the MacIntyre Development, is situated at Newcomb, Essex county, in northeastern New York State. Development of the property was started in 1941 by the Titanium Division of the National Lead Company, and the property was put into production in August, 1942. The program of operations called for a daily mine output of 5,500 long tons of ore analyzing 16 per cent TiO_2, from which were to be produced 800 long tons of ilmenite concentrate containing about 48 per cent TiO_2. Titanium ore is also produced in the United States in Arkansas, Carolina, Florida, and Virginia. The ilmenite concentrates shipped run from 42 to 54 per cent TiO_2, and rutile concentrates from 92 to 95 per cent TiO_2.

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 deoxidizer 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 carbontitanium 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, in steel manufacture, and in the ceramic industry.

During 1942 the situation remained unchanged with respect to the establishment, by Canadian Titanium Pigments Ltd., (630 Dorchester Street, W., Montreal), of a plant in Canada for manufacturing titanium pigments. The necessary supply of finished pigments is all imported from the United States, and the expanding demand was met in full. While supplies were allotted during the first four months of 1942, the pigments have been freely available to all industries from May onwards. 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.

The shipping situation curtailed supplies of ilmenite from India, but the situation in the United States was greatly relieved in 1942 by increased domestic production.

The New York quotation for ilmenite remained at \$28 to \$30 per gross ton of 60 per cent TiO_2, f.o.b. Atlantic seaboard. The price for rutile 94 per cent TiO_2 remained at 8 to 10 cents per pound 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 1942.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

TUNGSTEN IN 1942

Ores Mined and Producing Localities:

Wolframite, (FeMn)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. The lamps for this purpose are at present made only in California, but all duties into Canada on them have been removed. Full details regarding these lamps may be obtained from the Federal or Provincial Departments of Mines.

Production of concentrate in 1942, although over five times greater than in 1941, was still far short of domestic requirements. The two chief producers during 1942 were Consolidated Mining and Smelting Company's Red Rose property in central British Columbia, and Hollinger Consolidated Gold Mining Company at Timmins, Ontario. International Tungsten Mines Limited made shipments from its property on Outpost Island, Great Slave Lake, Northwest Territories; and small amounts of ore or crude concentrate were shipped to Ottawa for treatment from properties in every province, except Alberta and Prince Edward Island. The shipments were chiefly low-grade concentrate from the Indian Path property of Tungsten Mines Limited, in Nova Scotia.

Prospective Producing Localities and Important Developments:

In Nova Scotia, Tungsten Mines Limited (Ventures Limited) erected a 70-ton stamp flotation mill at the Indian Path mine, near Lunenburg and continued underground development to a depth of 230 feet. Several thousand tons of low-grade ore was treated and the crude concentrate was shipped to Ottawa for final treatment. Owing to the difficulty of obtaining a high-grade concentrate free from objectionable impurities, erratic distribution of scheelite lenses, and high production costs, the property was closed in December, 1942. The old Scheelite Mines property near Moose River, from which about 24 tons of concentrate was produced during the last war, was dewatered and opened up by the Dominion Government and the Provincial Department of Mines. It was disclosed that almost all the ore had been stoped and work was stopped after a car-lot of ore was salvaged and shipped to Ottawa for treatment. Some prospecting was done on the Hyland and other showings of scheelite along the Waverley anticline north and northeast of Halifax, but no new orebodies were found.

In New Brunswick, the Burnt Hill wolframite property in York County, from which about 14 tons of concentrate was shipped during the last war, was actively prospected, in 1941, by Consolidated Mining and Smelting Company, but operations ceased early in 1942, as it was found that production costs would be excessive, though the company estimated a fair tonnage of possible ore to a depth of 200 feet.

In Quebec, small amounts of scheelite occur at a number of gold producing mines, particularly in the general region east of Rouyn to Val d'Or. With Dominion Government financial assistance, the Quebec Department of Mines erected a small scheelite treatment plant at the Mine School west of Val d'Or, and late in the year started treating custom ore from the Lamaque, Sigma, Perron, Central Cadillac, McWatters, and Wood Cadillac mines, which ore had previously been shipped to Ottawa. The principal shipper to Val d'Or early in 1943 was Kerr-Addison Gold Mines on the Ontario side of the boundary. Sullivan Consolidated Mines, 3 miles northwest of Val d'Or is making a high-grade table concentrate from ore picked from the belt. Prospecting was continued on the Manley property in La Reine township and by Toburn Gold Mines on the Kayrand claims in Dalquier township northwest of Amos, but the company relinquished its option. Upstream Gold Mines (Donhurd) prospected claims in the vicinity of Dasserat Lake, 18 miles west of Rouyn; and prospecting was continued in the Marlow-Risborough area about 30 miles northeast of Megantic in the Eastern Townships.

In Ontario, scheelite is known to occur at at least 70 different properties throughout the province, but, with a few exceptions, the amounts are too small to be worthy of attention. The main producers are the large gold mines of the Porcupine area, principally the Hollinger mine, and properties in the Beardmore, Little Long Lac, Red Lake, and Larder Lake areas.

In the Hollinger mine, scheelite zones or bodies have been found in quartz in or close to the porphyry in at least 100 separate places from the surface down to the 5,150-foot level. The scheelite mill started to produce in March, 1942, and is treating 135 tons of ore daily. The company reports shipments of 67.6 tons of high-grade concentrate during 1942. Some custom ore was treated in the Hollinger mill from nearby Porcupine mines, including, Aunor, Mc Intyre, DeSantis and Dome, but Aunor is now the only steady shipper. Small regular shipments of ore were received at Ottawa from Preston East Dome. Delnite is tabling and jigging its flotation tailing and shipping the resulting low-grade concentrate (high in iron and arsenic) to Ottawa for cleaning tests.

In the Thunder Bay district east of Lake Nipigon, Little Long Lac Gold Mines at Geraldton stockpiled scheelite ore obtained from a picking belt over which an ultra-violet lamp is set up. A 20-ton scheelite mill was installed and treatment started in January, 1943. Leitch Gold Mines, 5 miles north of Beardmore, has also been lamp picking from a belt. The company shipped ore to Ottawa, but is now shipping to Little Long Lac mill. A similar type of scheelite occurs at Sand River Gold, which adjoins the Leitch, but the mine closed down in the summer of 1942 prior to which about a car lot of ore was shipped.

In the Red Lake area, about 50 miles from the Manitoba boundary, McKenzie Red Lake Gold Mines is stockpiling ore picked from a belt and is treating it in a small unit installed in the company's mill. Medium-grade concentrate is being shipped to Ottawa for reconcentration, but changes in the company's mill flow-sheet will be made as soon as the tests at Ottawa for the removal of the high sulphur have been completed. Some scheelite occurs in the McMarmac and other Red Lake mines.

In the Larder Lake district on the east side of Ontario near the Quebec boundary, Kerr-Addison Gold Mines recently found fairly large low-grade bodies of scheelite in the low gold-bearing tuffs and started small monthly shipments to Val d'Or mill in Quebec. A small shipment was made to Val d'Or from the adjoining Chesterville Larder Lake property. Late in December, 1942, a somewhat similar type and association of scheelite in tuffs was found in Upper Canada Mines, a few miles west of Kerr-Addison.

In the Patricia district, Dome Mines discovered good surface showings of scheelite on Eabamet Lake, Fort Hope area, but drilling failed to find commercial ore at depth, and exploratory work was discontinued. Pickle Crow Gold Mines is obtaining some scheelite from the belt, and is treating it in a small, especially designed unit at the mine, the product being a high-grade concentrate.

Scheelite occurrences were prospected in the Lakehead area, 8 miles north of Port Arthur; on Fenlon claims in the Algoma district west of Michipicoten Harbour; in Bears Passage area in Rainy River district; in Manitou Lake area south of Dryden in Kenora district; in the Rich Lake area west of Fort Hope in Patricia district; on the Fielding claims in the Sudbury ~~area~~ dist.; in the Sesikinika area, west of Kirkland Lake; at the Beaverhouse Lake Mines, north of Larder Lake; and in other widely scattered areas.

In Manitoba and Saskatchewan, prospecting was carried out on a number of scheelite occurrences on both sides of the boundary, south of Flin Flon, mainly in the vicinity of Phantom Lake, the most promising being the Mosher-Lundmark claims on the east side of the lake. About 20 miles to the east, Gold Hill Development is prospecting a deposit near Cranberry Portage. At Herb (Wekusko) Lake in north-central Manitoba, considerable prospecting was done by Tungold Mines (Jack Nutt), the principal showing being the old Apex claim on the east side of the lake from which a few tons of picked ore was shipped to Ottawa for tests in the fall of 1942. There was considerable prospecting activity on the Falcon-West Hawk Lake area in the southeast corner of Manitoba. Scheelite was discovered here in 1917, and about 4 tons of cobbed ore was shipped during the next year. Recent discoveries have extended the zone to a length of about 10 miles, along which the principal showings have been staked by Thor Gold and by J.A. Poirier. A ton or two of low-grade ore was shipped to Ottawa recently by N.S. Black from the north end of West Hawk Lake.

British Columbia is the leading Canadian producer of scheelite, the chief source of its output being the Red Rose mine on the Skeena River, near Hazelton. The discovery of large bodies of scheelite at the Emerald property, south of Nelson, is one of the outstanding Canadian developments in connection with strategic minerals. Close to 100 occurrences of scheelite have been found so far in the province.

Production of concentrate from its Red Rose property was started early in the year by Consolidated Mining and Smelting Company. The small mill was later enlarged to 75 tons a day and a 5,200-foot aerial tram line was installed to connect the mill with the top workings at 6,500-foot elevation. Scheelite and some ferberite occur in a quartz vein in a 400-foot thick diorite sill in contact with sediments. The company also operated the Tungsten Queen property in the Bridge River district and shipped ore to Kimberley for concentration. Late in the year, however, the property reverted to Ed. Phillips, who is again shipping high-grade massive white scheelite to Ottawa. Bralorne Mines is producing small quantities of scheelite concentrate from its gold property in the Bridge River area, a portion of which is being shipped to Ottawa for the removal of the sulphur. About a car lot of ore was shipped to Ottawa by J.W. Tillen from dumps of the Lucky Boy mine near Trout Lake, Lardeau area. About a ton of rough concentrate was shipped to Vancouver for re-concentration by Selkirks Tungsten-Tin Mines (Regal Silver) from its Woolsey property at Albert Canyon, northeast of Revelstoke. This property and the adjoining Snowflake were diamond drilled recently for tin and tungsten by the Department of Mines and Resources, Ottawa, but the results were inconclusive.

Scheelite was discovered early in 1942 in the old Iron Mountain or Emerald mine, 6 miles southeast of Salmo and not far from the United States boundary. The ore is rather finely disseminated in several separate contact metamorphic zones between granite and argillite and to a lesser extent between granite and limestone and also in narrow bands of lime-bearing silicates (garnet, epidote, diopside) known as 'Skarn'. Large tonnages averaging 1.0 per cent WO_3 or better, have been estimated in the main Emerald zone. The property has been extensively diamond drilled and is being developed by Wartime Metals Corporation, a Dominion Government Company, and the 300-ton a day mill, connected to the mine workings by a $1\frac{1}{8}$-mile aerial tram, is expected to be completed before midsummer of 1943. Several scheelite discoveries in the vicinity of the Emerald are being prospected.

None of the many recent discoveries in British Columbia has as yet given indications of being comparable in importance to the Emerald or to the Red Rose properties. A few other discoveries in the south part of the province, however, appear to be worthy of mention, among them being, United Victory on Boyd Creek, 10 miles north of Beaton, Lardeau district, which is being explored by Bralorne; the Stewart group, north of Ymir, Nelson district, which is under option to Consolidated Mining and Smelting Company of Canada Limited; Blue Eyes Group, north of Rossland, which is being prospected by Bayonne Consolidated; Last Chance Group on Swakum Mountain, Nicola district, which is under option to Pioneer. In the central and north part of the province, small-scale production is expected from Molly B at Stewart on the Portland Canal (provided metallurgical problems of separating the scheelite from the molybdenite, now being investigated at Ottawa, can be solved); Bear claim on Moroon Mountain near Terrace on Skeena River; and Wolframite group at Atlin.

In the Yellowknife-Gilmour Lake region, north of Great Slave Lake, Northwest Territories, more than 1,000 scheelite-bearing veins, mostly quartz, have been found by Dominion Government geologists and by private companies. Only a few of them, however, are sufficiently large to be of commercial importance. These include: the Storm group on the east side of Gordon Lake, 60 air miles northeast of Yellowknife, on which two shafts have been sunk by Consolidated Mining and Smelting Company; and the Storm group on the east side of Consolation lake. The latter is 45 miles southeast of the Gordon Lake Storm group, and is being worked by Tungsten Developers, which is treating the ore in a pilot mill and shipping the crude concentrate to Ottawa. Arctic Circle is developing three properties, namely, the Bren claim on Desperation lake, 8 miles east of Consolation Lake, the Victory claim, 4 miles north of Consolation Lake, and the A.S.C. group on the east side of Gilmour Lake. Goodrock Gold is prospecting 2 miles north of the Storm vein, on the east shore of Gordon Lake, where a 10-ton mill has been erected. Other properties from which a small output of scheelite is expected are:- Negus Mines, 2 miles south of Yellowknife; Consolidated Mining and Smelting Company's 'Con' mine, 2 miles southwest of Yellowknife; Dot and Eva group on west shore of Gilmour Lake, 2 miles south of Consolation Lake, being operated by A.M. Syndicate and is the original discovery of scheelite in the district early in 1940; De Steffany Tungsten Gold operating both the Dick group northwest of A.M. and the Moose claims on Hearne channel on Great Slave Lake, 32 miles to the southeast. The majority of these have sent samples ranging from 50 pounds to a ton to Ottawa for concentration tests.

The property of International Tungsten Mines on Outpost Island in Great Slave Lake has been developed down to the 425-foot level for the production of gold. The ore is a gold-copper-tungsten (scheelite and ferberite)-tin complex and difficulty is being encountered in producing a tungsten concentrate to meet specifications. During the past two years, a few car lots of low-grade concentrate produced in the company's mill, were shipped to the United States for tests and for chemical treatment. Several shipments were also made to Ottawa. An appreciable tonnage of tungsten ore is present, but production will depend largely upon the overcoming of metallurgical problems.

In Yukon, placer operations were continued on the Taylor, Seaholm, Lund, and Swanson claims on Haggart Creek and at Dublin Gulch in the Mayo district. Shipments of the gold clean-ups containing high percentages of scheelite and wolframite were made to Ottawa. Dominion Government geologists have estimated a fair tonnage of tungsten minerals in these gravels and have also found occurrences of scheelite in place in the metamorphosed limestone beds of Ray Gulch, Cement Creek, and Lynx Creek in the Mayo district. These new finds will be investigated during the summer of 1943.

<u>Production and Trade:</u>

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

World production of tungsten ore and concentrate in 1939 (figures since outbreak of the war are 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, Portugal, Bolivia, Korea, Japanese controlled areas in south China, and Argentina.

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 wolframite deposits are the largest in the world, and the principal deposits are [redacted] 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.

In Burma, 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. Burma, for the two years prior to the Japanese occupation, had been the world's largest producer. Exports were then 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.

The deposits of wolframite in Portugal are scattered, and production in 1940 was about 5,000 tons. Spain produced over 500 tons of wolframite in 1941, most of which came from the Province of Coruna.

In the United States, the third largest producer, the tungsten ores occur as scheelite and wolframite, its estimated output in 1941 being about 6,500 short tons of 60 per cent WO_3. This was exceeded in 1942. Shipments from the high-grade deposit at Yellow Pine, Idaho, discovered by the U.S. Bureau of Mines and Geological Survey, were started in August, 1941. Many new mills were completed, including the 1,300-ton concentrating and chemical plant of Union

Carbide Company at Bishop, California, which is taking custom ores and low-grade concentrate. Mills were completed recently at Atolia, California, and at Golconda, Nevada. Nevada-Massachusetts Company, Mill City, Nevada, has installed a 1,000-ton flotation plant that is making 68 to 75 per cent WO_3 concentrate from the tailing from its gravity mill and from storage. U.S. Vanadium is treating ore and low-grade concentrates from many sources in the Metals Reserve Company's plant at Salt Lake City, Utah. Prospecting was active throughout the year.

To conserve tungsten, the United States Government issued a General Preference Order in November, 1941, which 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, it is believed that 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 meet most of the United States minimum war requirements.

In Bolivia there was considerable activity on a number of small properties, as a result of a contract made by the United States Metals 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. A few hundred tons, mainly wolframite, is being exported from Peru.

Uses:

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 plate, armour-piercing projectiles, and other military equipment. Minor amounts of tungsten are used in steels for dies, valves, and valve seats for internal combustion engines, and for permanent magnets. Stellite, the best known non-ferrous alloy, contains 10 to 15 per cent tungsten with higher percentages of chromium and cobalt, 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. 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.

Recovery and Treatment:

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 stockpiled. 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.

Custom ores and crude concentrates are treated at the Ore Dressing plant of the Bureau of Mines, Booth Street, Ottawa; at the Quebec Department of Mines plant, Val d'Or, Quebec; and by War Metals Research Board, University of British Columbia, Vancouver.

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 as low as 3 per cent, but with an average of 10 per cent WO_3 is being treated in this manner. Prospective Canadian shippers of low-grade flotation concentrate (10% WO_3 or over) should obtain an export licence from the Metals Controller, Ottawa, and also communicate with U.S. Vanadium Corporation, Salt Lake City, Utah, agents for the Metals Reserve Company.

Specifications:

Tungsten ores are concentrated to 60 per cent or higher of tungsten trioxide (WO_3). For adding to steel, the ore is generally converted into ferro-tungsten, but sometimes into tungsten oxide, calcium tungstate, or tungsten powder. Canada has as yet no plants for the manufacture of ferro-tungsten or other tungsten addition agents and the only plant making tungsten steels is Atlas Steels, 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 maximum percentages of the following harmful impurities being; copper and phosphorus each 0.05; arsenic, antimony and tin each 0.10; bismuth and sulphur 0.50 each; molybdenum, 0.40; and manganese, 1.00. For wolframite (or ferberite), 1.50 per cent tin is allowed, and a little more arsenic and bismuth. The ores may be in lump, fine, or a mixture of both.

Prices:

Late in 1942, the Metals Reserve Company increased the purchase price in the United States of domestic concentrate from \$24 to \$30 per short ton unit (20 pounds) of contained WO_3 in the standard concentrate, less freight and penalties below 60 per cent WO_3 and above impurities specifications. The duty into the United States is \$7.93 a short ton 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 to \$2.75 a pound; and of 99.7 per cent purity, \$5.40 a pound.

The price in Canada of scheelite concentrate containing 70 per cent WO_3 (within specifications) is \$26.50 a short unit of WO_3, delivered at Welland, Ontario, equivalent to about \$1,855 a short ton of 70 per cent concentrate, delivered. All sales of Canadian concentrate must be made through the Metals Controller, Ottawa, who also buys wolframite concentrate for export.

Situation:

Tungsten is one of the most important of the war metals. At present, Canada's output is far short of requirements, but with recent developments, and with the bringing into production of the Emerald property in southern British Columbia, the output will be substantially increased by the end of 1943. The expanding war demands for tungsten, however, call for every effort on the part of the prospector and operator to discover and to increase production of the metal.

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DEPARTMENT OF MINES AND RESOURCES,
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ZINC IN 1942

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 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 re-treating the 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 in 1942.

Reco Mountain Base Metals Mines Ltd., which is being financed by Gold Frontier Mines Ltd., took over in 1942 the Noble Five, Surprise, and Deadman mines, near Sandon, Slocan mining division. The properties are being explored by diamond drilling and underground development. The 100-ton mill of the Noble Five is being rehabilitated and prepared for operation in 1943.

The Whitewater mine and mill were taken over in the fall of 1942 by Kootenay Belle Gold Mines Ltd., and are being prepared for production early in 1943.

The Enterprise mine on Ten-Mile Creek, near Sandon, was operated in the summer of 1942 by S.N. Ross, who installed a 50-ton flotation unit.

The Van Roi mine on Four-Mile Creek, near Silverton, was being prepared for operation in 1942, after lying idle for many years. The property is being operated by International Metals Inc., Ltd., and the old 100-ton mill is being renovated.

The Kootenay Florence mine at Ainsworth, on the west shore of Kootenay Lake, was taken over in 1943 by Wartime Metals Corporation and operated as the Kootenay Florence Project. The mill equipment and machinery of Ymir Consolidated Mines Ltd. has been secured and will be installed in the old Kootenay Florence mill building. Production is expected to start in the spring of 1943.

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 remained idle in 1942.

The Tyee zinc-lead-copper property, near Chemainus, Vancouver Island, was taken over in 1942 by Twin "J" Mines, Ltd., a subsidiary of Jason Gold Mines Ltd., and is being operated by the company under the supervision of Wartime Metals Corporation. The property is expected to be in production by the early summer of 1943. The concentrates (zinc, lead, and copper) are contracted to the Metals Reserve Company.

In Manitoba, the rate of output at the Flin Flon mine of Hudson Bay Mining and Smelting Company was appreciably higher than in 1941. 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 1941. The year's production of zinc was the highest on record. The Sherritt-Gordon copper-zinc mine and concentrator, about 50 miles northeast of Flin Flon, were operated at capacity throughout the year. Production from the West mine was on a slightly reduced scale from that of the previous year, while production from the East mine was resumed early in the Spring, and continued on a gradually increasing scale throughout the balance of the year. By the end of the year a substantial proportion of the output of this mine was coming from the zinc ore reserve.

In Ontario, Lake Geneva Mining Company, which resumed operations in 1941, operated its mill for part of 1942 and carried on much exploration work. Ontario Pyrites Company Ltd., a subsidiary of Ventures, Ltd., took over in 1942 the lead-zinc-copper property of Sudbury Basin Mine Ltd., located at Vermilion Lake, Sudbury district. The company had taken over in 1941 the adjoining property of Treadwell Yukon Mines Ltd. No work was done in 1942, nor is any contemplated in the near future.

In Quebec, Normetal Mining Corporation, with property north of Dupuis, Abitibi County, made shipments of lead and zinc concentrates to United States smelters throughout the year. New sales contracts made in June permitted the treatment of somewhat lower grade ores. Tonnage treated was down 10.5% as compared with 1941, due partly to shortage of labour during the latter part of the year and partly to delays caused by break-downs in the Diesel power plant, for which repair parts of good quality have been difficult to secure.

Waite Amulet Mines Ltd., continued the exploration and development of its various orebodies. The concentrator put in operation in 1939, was again enlarged by a 300-ton extension, bringing the capacity to 1,800 tons a day.

The Tetreault property near Notre Dame-des-Anges, Portneuf County, was taken over in 1942 by Siscoe Gold Mines Ltd., and operated under the supervision of Wartime Metals Corporation. The lead and zinc concentrates produced are contracted to the Metals Reserve Company, of the United States.

The Calumet Mine, on Calumet Island, Pontiac County and about 60 mines west of Ottawa, was under active exploration and development in 1942. The property is now operated by New Calumet Mines Ltd., under the direction of Frobisher Exploration Company. The 300-ton mill of Stirling mine, Cape Breton, has been purchased and is being installed. The property is expected to be in production about July 1943, and the zinc concentrate is contracted to Metals Reserve Company.

Golden Manitou Mines, Ltd., which took over in 1941 part of the holdings near Val D'Or of Quebec-Manitou Mines Limited, completed in 1942 the erection of a 600-ton mill for the production of zinc and gold concentrates. The mill capacity has since been further increased to 900 tons.

In Nova Scotia, the Stirling copper-lead-zinc property in Cape Breton has been idle since late in 1937. The 300-ton mill has been dismantled and shipped to the Calumet property, Pontiac County, Quebec.

__Production and Trade:__

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

The world production of zinc in 1939 (1940-1942 not available), as reported by the American Bureau of Metal Statistics, was 1,850,700 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 previous to the war held 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, treated large quantities of imported ore. Canada now probably occupies second position as a world producer.

World consumption in 1938 (1939-1942 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.

Market and Prices:

The basic uses of zinc under war conditions are no different from those in peacetime, but in all of its fields of use the wartime demand for the metal is exceptionally large and it is difficult for the industry to keep pace with the demand. 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.

About 55 per cent of the Canadian consumption of zinc is used in the war effort in the making of brass and bronze products; 18 per cent for galvanizing; 11 per cent for die casting; 10 per cent in zinc oxide; 3 per cent in dry batteries; and the remainder for miscellaneous purposes.

The average price of zinc for 1942, in Canadian funds based on London quotations, was 3.411 cents per pound, compared with 3.411 cents in 1941. The St. Louis price was 8.25 cents, compared with 7.474 cents in 1941.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

ASBESTOS IN 1942

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 limited field of usefulness are fibrous actinolite, fibrous tremolite, and anthophyllite.

The asbestos produced in Canada is practically all of the chrysotile variety and comes almost 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 ¼ to ½ inch in width, though veins exceeding 5 inches in width do occur. The fibres run crosswise of the vein 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.

In 1942 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 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 1942 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 actinolite and anthophyllite, which varieties are commercially termed amphibole asbestos. The fibres of these varieties are harsher and weaker than those of chrysotile and there is little demand for them at present. None of these deposits is being worked, although formerly fibrous actinolite was quarried near the village of Actinolite, Hastings county, Ontario, for use in 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 material 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.

Few figures on world production in 1942 are available, but it is known that Canada maintained its 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. Small shipments of asbestos are made from Australia (crocidolite), Bolivia (crocidolite), China (chrysotile), India (chrysotile), and Venezuela (chrysotile). 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. Late in 1942 some minor modifications were made in the classification of standard grades of Canadian asbestos and this revised classification has been adopted by the Quebec Asbestos Producers' Association.

Market and Prices:

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

Current prices f.o.b. Quebec mines, in U.S. funds, tax and bags included are as follows: No. 1 crude, $650 to $750 per ton; No. 2 crude, $165 to $385; spinning fibre, $124 to $233; shingle fibre, $62.50 to $85; paper fibre, $44 to $49; cement stock, $28.50 to $33; floats, $19.50 to $21; shorts, $12 to $16.50 per ton.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, JUNE, 1943.

BARITE IN 1942

Ores Mined and Producing Localities:

Canada's largest known reserves of barite are situated in Nova Scotia, which has produced most of the recorded output. Total production of the Dominion from 1885 to the end of 1942 amounted to only 65,000 tons.

In addition to the Nova Scotia occurrences, deposits are known in Ontario, Quebec, and British Columbia. Various attempts have been made over a period of years to develop a barite industry in Ontario, but with little success. Prior to 1941, little attention had been paid to occurrences in British Columbia, but a small tonnage was produced in that year and shipments increased considerably in 1942.

Important Developments:

The most important development in the history of the industry was the discovery in 1940 of a very large deposit near Walton, Hants county, Nova Scotia. Drilling has indicated reserves of $1\frac{1}{4}$ million tons of ore to a depth of 200 feet. The occurrence is being actively developed by Canadian Industrial Minerals Limited, a subsidiary of Springer-Sturgeon Gold Mines Limited, 67 Yonge Street, Toronto, which has installed a mill at tide-water, $2\frac{1}{2}$ miles distant and is turning out a 325-mesh product designed primarily for use in oil drilling for which a ready market exists in Trinidad and South America. Shipments of crude are also being made both for United States and domestic use in the manufacture of lithopone and barium chemicals. The Walton barite is mostly off-colour material, of a strong reddish shade and thus is not suitable for the general pigment and filler trade without bleaching. It is, however, high in barium sulphate, with a specific gravity of 4.25 or over, and is well adapted to oil drilling use. Shipments from this source totalled nearly 8,000 long tons in 1941 and in 1942 rose to close to 15,000 tons.

In British Columbia, development was commenced in 1941 by R.A. Thrall, Summit Lime Works, Lethbridge, Alberta, of a barite deposit near Parson, 25 miles south of Golden, with shipments totalling 230 tons. This was stepped up in 1942 to over 1,800 tons. Most of the material shipped has been crude ore, consigned to the plant of Pulverized Products Limited, Montreal, for grinding for the domestic trade, but a little crushed or ground barite is also produced for sale to a western glass plant and for use in oil drilling. Colour and grade are good, with an average barium sulphate content of 96 to 98 per cent. Price of crude has been quoted at $7 per ton f.o.b. mine, with $11 per ton freight cost to Montreal. A small quantity of high-grade barite also was taken in 1941 from a deposit 30 miles south of Elko, on the Crow's Nest branch of the Canadian Pacific railway.

Production and Trade:

Production of barite in 1942 was 16,667 tons, valued at $154,060, compared with 6,890 tons, valued at $74,416 in 1941. These are by far the largest annual production figures in the history of Canadian barite mining.

Prior to the war, world production of barite approximated one million tons a year, with Germany furnishing 50 per cent and the United States 30 per cent of the total. The remainder was obtained mainly from the United Kingdom, Italy, Greece, France, and India. Cuba has recently become a potentially important source of the mineral.

Exports of barite in 1941 and 1942 were not separately recorded. Ground material went mainly to Trinidad, and crude to the United States.

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

Market and Prices:

Ground barite is used 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 has 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.

No critical situation in respect to barite has developed as a result of war needs and ample reserves are available for Allied use. The United States has stepped up production to care for increased demands for defence purposes, mainly to replace imports for the manufacture of barium chemicals and for use in rubber and camouflage paints. Certain barium salts, chiefly the nitrate and peroxide, are used extensively in military pyrotechnics, and in the primer mixtures of incendiary bombs.

Canadian consumption of barite, estimated from import figures and sales of domestic material, is under 5,000 tons a year.

Barite is a relatively low-priced commodity. Canadian quotations have been \$7 to \$10 per ton for good white crude, f.o.b. mines, depending on rail-haul; \$40 to \$44 for domestic ground material; 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 (barium carbonate), 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 restricted supplies for American use and additional sources are being sought on this continent. American imports of witherite in 1940 were 3,500 tons and in the first nine months of 1941, 2,470 tons. Interest in witherite has been increasing, chiefly for the production of barium salts for military uses. 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". Artificial barium carbonate is being produced in Canada by Laprairie Company, Montreal, from Walton barite, this being the only important manufacture of barium salts in the Dominion. Witherite is also used as a carburizing agent in the case-hardening of steel, as a water softener, and in certain kinds of glass.

The Bureau of Mines, Ottawa, is interested in receiving 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, 1943.

BENTONITE IN 1942

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 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 come from the Drumheller area in the Red Deer Valley, Alberta, and from the Morden area, Manitoba.

Gordon L. Kidd of Drumheller, who commenced operations in 1937, reported shipments in 1942 of 734 tons, most of which went to Alberta Mud Company, 502 Lancaster Building, Calgary, for processing and use in oil drilling in the Turner Valley field. Aetna Coal Company, East Coulee, south of Drumheller, supplied 222 tons to Mineral Sales Limited, of Calgary, the material being shipped to Lethbridge and Okotoks, also for oil drilling use. Price of the crude clay was $4.50 to $6 per ton f.o.b. cars. Total production by Drumheller and district producers to the end of 1942 is about 5,500 tons.

In Manitoba, Pembina Mountain Clays Limited, 915 Paris Building Winnipeg, which commenced operations in 1940, continued development of its deposits near Morden in the southern part of the Province and reported 1,650 tons of clay mined. Part of this was processed in the company's plant at Winnipeg and marketed as foundry clay and bleaching clay, total sales being 660 tons. Most of the foundry clay has gone to local foundries, and the bleaching clay is used in oil refining and in the packing house trade. The bentonite of the Morden district possesses high bleaching power in the natural state, but the company installed an activation unit in 1942 and reported sales of 300 tons of activated clay. Tests in the Bureau of Mines Laboratories at Ottawa have shown that for foundry use Morden bentonite is equal, if not superior, to the bentonite imported for this purpose from the United States. Price of activated Morden clay in 1942 was $90 per ton; of unactivated $40; and of foundry clay $30, for less-than-carload lots.

Production and Trade:

Production of bentonite in Canada in 1942 was 1,057 tons, valued at $4,760, compared with 2,172 tons, valued at $7,830, in 1941.

No world figures of bentonite production are available. The United States supplies and uses most of the output; its exports have included ground natural clay for foundry and other uses, and activated clay for bleaching. Owing in large measure to increased demand by munitions plants; for use in oil refining; and in oil-well drilling muds, bentonite production in the United States in 1941 reached a record total of 354,000 short tons, an increase of 41 per cent over 1940, the previous record year. Value of the 1941 production was $2,451,900, as compared with $1,919,461 for 1940. Of the 1941 tonnage, 121,283 tons, or 34 per cent, went to the foundry trade; 118,625 tons, or 33 per cent, to oil refining use; and 58,468 tons, or 16 per cent, into drilling muds. About one-half of the output came from an area in adjacent sections of Wyoming and South Dakota, which furnishes a highly-colloidal, swelling type of bentonite used largely for foundry work, oil drilling, water-sealing, etc. The remainder came mainly from California, Mississippi, Texas, and Utah, a large proportion being of non-swelling type, employed chiefly for oil refining in the activated state.

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:

In addition to the three main uses mentioned above, bentonite has a variety of minor industrial uses, most of which call for the colloidal, or "swelling", type, 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; 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 has not progressed much beyond the laboratory stage, and the product ("Alsifilm") is still of problematic value. Some micron-size bentonite is used in paper coatings. A recent suggested use is for sealing leaks in gas mains and pipes and extinguishing the ignited gas flame.

Consumption for industrial detergents showed a marked increase in 1942, and the use of micron-sized material for pharmaceuticals also expanded. A recent, increasing use is for bonding ore briquettes in the smelting industry. A new method of incorporating bentonite in spent foundry sands in the form of a slurry instead of a powder is announced by a Canadian foundry and is stated to give improved results and to cut consumption and costs.

Bentonite prices in the United States have been showing a downward trend and the nation-wide average level in 1941 declined to $6.93 per ton f.o.b. mines, from $7.65 in 1940. Price average of the colloidal-type Wyoming material dropped from $10.65 to $9.39 in the same period. Trade journal quotations, however, have remained substantially unchanged. Wyoming dried and granulated clay sold in 1942 for $6.50 per ton, f.o.b. mines, in carload lots, and air-floated 200-mesh material for $9.50 bagged. Selected air-floated Wyoming clay was priced at $26 per ton, f.o.b. Chicago. Freight rates from Wyoming points to Montreal are about $14 per ton. Imported activated (Filtrol-type) bentonite has been costing $75 to $80 per ton, in carload lots, delivered eastern Canadian points, while American natural bleaching clay has sold for $25 per ton laid down.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

BERYL IN 1942

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, corresponding to 4 to 4.5 per cent of metallic beryllium. It occurs in pegmatite dykes, mainly in the form of disseminated crystals, and most of the comparatively small tonnage produced is a by-product from the mining of such dykes for their feldspar, lithium minerals, or mica. World output is relatively small and comes mostly from the United States, 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 southeastern Manitoba, Ontario, Quebec, and the Northwest Territories.

Canadian Beryllium Mines and Alloys, Limited, 901 Royal Bank Building, Toronto, is the only company that has given much active attention to the mining of beryl. Some years ago, it did considerable surface work on the deposit in Lyndoch township, and stockpiled a few tons of cobbed crystals and a considerable tonnage of rock that will require milling to recover the contained beryl. The mine has been inactive since 1940. The Lyndoch pegmatite shows evidence of extending for possibly two miles or more along the strike, and appears to be the most promising Canadian occurrence. The beryl, however, tends to occur in localized shoots or zones and more work is required in depth and beneath drift-covered areas before the commercial possibilities can be determined. Some small shipments of feldspar have been made from the property. Universal Light Metals Company, 28 James Street South, Hamilton, Ontario, reported early in 1943 that it was preparing to undertake exploration work on what may be an easterly extension of the Lyndoch deposit, about one-half mile distant from the existing workings.

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 commercial 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 having 9 tons of cobbed crystals stockpiled in 1942 on its Comet claim at Bernic Lake, but made no shipments. Winnipeg River Tin Mines, 403 Avenue Building, Winnipeg, reported 5 tons of cobbed beryl on its holdings in the same area, but it has made no shipments.

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, appears to be of particular economic interest.

Production and Trade:

There have been no recorded sales of beryl from Canadian sources. The only known shipment consisted of a few tons taken from the Lyndoch deposit about ten years ago and shipped for experimental purposes. No records of imports of beryllium or its compounds are available, and no beryl is known to be used or required for any purpose in Canada.

There are no figures of world production of beryl. The mineral, however, is produced on a very limited scale, and the estimated output in 1940 was only about 2,500 tons. Because of increased demand and higher prices, production may have risen slightly since then.

Brazil and Argentinaare the present leading sources of beryl and production in both countries has shown a marked increase. Brazilian exports rose from 276 metric tons in 1939 to 1,472 tons in 1940, while the Argentina production in the latter year was 520 tons. In 1941, a plant was installed in Argentina for the production of beryllium oxide-carbonate from domestic beryl, and the United States tariff on such compounds from Argentina was lowered from 25 per cent ad valorem to 12½ per cent. The American Government also concluded an agreement in 1941 to purchase the entire Brazilian production of beryl for the next two years. American imports of beryl from Brazil during the first nine months of 1941 totalled 942 short tons and from Argentina 693 short tons, at an average value of $47.48 per ton. Some beryl is produced in the United States, shipments in 1940 being 121 short tons, and in 1941 a record of 158 tons. The material came from South Dakota, Maine, New Hampshire, Wyoming, and Colorado, South Dakota being the leading source. India and South Africa also produce small quantities of beryl.

What is regarded as a potentially important source of beryllium is a recent discovery at Iron Mountain, New Mexico, of large deposits of the mineral helvite, a silicate-sulphide of beryllium, manganese, and iron. Helvite, a rare species, closely resembles garnet in outward appearance and is difficult to distinguish from that mineral. It contains about the same percentage of beryllium as beryl. Although the new Mexican helvite ore is rather lowgrade (about 0.4 per cent BeO), and will require concentration, the available tonnage is reported to be very large and if developments turn out as expected this source may provide the American beryllium industry with a substantial part of its requirements.

The United States is the chief consumer of beryl and is the leading producer of beryllium metal and alloys, as well as of beryllium oxide and other salts. American demand, which prior to 1941 was met by the available supply, commenced to increase strongly in that year, and sales of beryllium metal alloys, and compounds were estimated to have exceeded $1,000,000.

Germany and Italy, also, have been leading producers of the above commodities, with a lesser production credited to France and Japan, and the Axis Powers are estimated to have acquired over one-third of the beryl available in world markets in recent years. (U.S. Minerals Yearbook, 1941) Because of extended applications for military purposes, American consumption of beryl has shown a marked increase and demand is proving difficult to meet. Prices have recently been advanced to nearly treble the pre-war level, and beryl ores and its derivatives have been placed under strict allocation control by the United States Government.

Uses:

Beryllium is used chiefly in beryllium-copper alloys, fabricated into springs, diaphragms, and various mechanical parts subject to wear, vibration, or shock. Springs made of such alloys stand up under repeated compression better than any other known metal and are corrosion-resistant. For this reason they are being increasingly used in a wide range of aircraft instruments, such as altimeters and air-speed indicators, and in pressure gauges, electrical contacts, business machines, camera shutters, telephone jacks, and radio equipment. Beryllium hardens copper and increases its tensile properties without greatly decreasing electrical conductivity. The alloys usually contain about 2 per cent beryllium, though the content may range from as low as 0.1 per cent to 3.5 per cent and small additions of cobalt, chromium, or silver are sometimes made. Large and increasing quantities of beryllium-copper are being used in parts subject to wear in airplane engines. Being non-magnetic, and with structural properties comparable to alloy steels, the alloy is employed in parachute harness fasteners and release springs where it obviates magnetic disturbance of instruments.

Considerable quantities of beryllium-copper are also used in making tools for use where there is fire or explosion hazard from sparking, such as chemical and powder plants, munitions factories, or petroleum refineries. Formerly made entirely of berylliu-copper, such tools as hammers, wrenches, chisels, and crowbars for use in plants of this description are being faced or edged with the alloy to conserve supply. Beryllium-nickel-copper is more resistant to heat-checking than nickel cast iron, suggesting its use for brake blocks and clutch facings. Beryllium-nickel, with about 2 per cent beryllium, is being used in springs subject to corrosion and high temperatures, and in hypodermic needles and surgical instruments. Beryllium-nickel master alloy, containing 12.5 per cent beryllium, is being offered in powder or ingot form by Metal Hydrides, Incorporated, Beverly, Massachusetts.

One of the group of light metals and with a specific gravity (1.85) less than aluminium (2.70), beryllium early suggested a field of usefulness for lightweight beryllium-aluminium alloys for use in aircraft. At the outset such alloys proved to be brittle and not to have the desired properties, but this difficulty is being overcome and an alloy with 25 to 50 per cent beryllium, termed "beralite", is being offered by Cooper-Wilford Beryllium Limited, 33rd and Arch Streets, Philadelphia. The high cost of metallic beryllium has retarded development of beryllium-aluminium.

In such alloys, the beryllium must be added as pure metal, whereas in copper or nickel alloys it may be introduced in the oxide form, costing only one-third as much per pound.

In the ferro-alloy field, beryllium is stated to be in use in Germany in armour-plate and in tool steel containing 1 per cent beryllium, 12 per cent chromium, and 5 per cent nickel. Additions of 1 to 2 per cent of beryllium to various steels improve hardness, tensile strength, and acid resistance.

Beryllium metal has only limited uses notably in the windows of X-ray tubes, where it is used on account of its transparency to X-rays.

Various beryllium salts, principally the oxide and carbonate, are employed in industry. A growing use has developed for the oxide for the preparation of zinc-beryllium silicate, used as a coating for fluorescent lighting tubes and lamps and fluorescent screens. The oxide and carbonate, activated by uranium salts or rare earths, are utilized to some extent in luminescent paints. The oxide is a super-refractory, with a melting-point of 2.570°C., and is used in crucibles, insulators, electrodes, furnace linings, and as a filament coating in lamps. Beryllium acetate is used as a coagulating, hardening bath for sodium alginate, a new English textile made from seaweed.

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. Recent consumption for such uses is estimated at about 100 tons a year. Beryllium compounds give chrome-green glazes at cone 12.

Market Conditions:

The leading users of beryl on the American continent are Beryllium Corporation of Pennsylvania, Temple (Reading), Pennsylvania, and Brush Beryllium Company, 3714 Chester Avenue, Cleveland, Ohio, both of which are engaged in treating the mineral for the production of metal, alloys, and compounds. Beryllium oxide also is produced by Clifton Products Incorporated, Painesville, Ohio; and a plant for the manufacture of oxide and carbonate was being installed in 1941 at Harbor City, California, by the Calloy Company.

The demand for beryl has greatly increased to fill military needs for beryllium alloys, and severe shortages have developed. Efforts are being made by the United States Government to conserve stocks, direct supply into the most needed channels, and increase production by a substantial increase in price. Imports and purchases of beryl have been restricted to U.S. Government agencies or their authorized representatives. Contracts for sale and export of beryl from Canada for U.S. Government account may be negotiated through the Metals Controller; Ottawa. All such exports are subject to special export permit.

Prices:

Prior to 1941, nominal American quotations for beryl had remained steady at \$30 to \$35 per short ton, f.o.b. mines, or \$40 to \$45 at consumption point, for 10 to 12 per cent BeO material, though actual sales under contract averaged somewhat higher.

Quotations advanced through 1941 to $52 and $55 for the above grades,with actual sales reported at $60 to $72 in the latter part of the year. The upward trend continued during 1942 and in the latter part of the year the price was stabilized by the U.S. Government at $8.33 per unit of contained BeO, equivalent to $83 and $100 per ton for 10 per cent and 12 per cent grades, respectively, this price being for purchases for Government account.

The price of beryllium-copper master alloy, containing 4 per cent beryllium, has remained unchanged for some time at $15 per pound of contained Be, with the base price of bar, strip, and sheet, for fabrication, $1.05 per pound for metal with 2 per cent Be content. Rod sells at $1.23 per pound. Metallic beryllium and beryllium-aluminium are quoted at $45 to $50 per pound of contained Be. Calcined beryllium oxide sells at $4 per pound.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES
O T T A W A, MARCH, 1943.

BITUMINOUS SAND IN 1942

Source of Supply:

A deposit of bituminous sand occurs along Athabaska River between the twenty-third and twenty-sixth base lines. Intermittent exposures may be seen along both sides of the river and also along certain of its tributaries. Investigations by the Federal Bureau of Mines subsequent to 1913 have adduced much information and certain parts of the area appear to be promising from the standpoint of commercial development. It is clear however, that only after detailed exploration by the use of core drilling equipment, can the true value of individual areas be determined. Meanwhile it is assumed that the area as a whole, represents an important reserve of bituminous material from which various light and heavy petroleum products may be derived.

Production:

In connection with investigations by the Federal Bureau of Mines, some 5,000 tons of bituminous sand was mined and shipped during the period 1926-1930. A part of this material was used as a basis for laboratory studies but the greater part was successfully used in the construction of a variety of types of wearing surfaces.

During the period 1931-1938, International Bitumen Company processed a limited tonnage of bituminous sand at its plant at Bitumont, Alberta, with production of asphalts for paving and roofing and also 37,000 gallons of fuel oil. This plant has been dormant since 1938.

In 1941, Abasand Oils, Limited completed its revised separation and refining plant on Horse River near McMurray. The plant was operated from May 19th to November 21st when separation and power units were destroyed by fire. During the above period, production included 41,265 gallons of gasoline, 70,700 gallons of Diesel oil, 137,550 gallons of fuel oil, 375,235 gallons of residium, and 319 tons of coke. Following reconstruction in 1942, the Abasand plant was operated intermittently from June 10th to November 6th. During this period approximately 12,800 tons of sand were mined and approximately 385,000 gallons of crude produced. Refined products made during this period were 12,600 gallons of gasoline, 79,555 gallons of Diesel oil, 27,300 gallons of fuel oil, and 266,139 gallons of residuum. Operations indicated the desirability of further revisions of equipment and flow sheets and plans are now being prepared to carry these revisions into effect.

New Developments:

In July, 1942, under an agreement with the Dominion Government, Consolidated Mining and Smelting Company undertook to core drill certain of the more promising areas in the McMurray field and drilling was continued until the end of January, 1943. Arrangements have also been made with the Universal Oil Products Corporation and with the Standard Oil Development Company with a view to determining refining procedure and equipment best adapted to the final treatment of separated bitumen and also the type of products and percentages of same which may be most economically produced.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, FEBRUARY, 1943.

CELESTITE IN 1942

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 platy 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.

R8.12

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 4,724 tons of strontium minerals in 1941. 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 America and supplies of ore from Great Britain are available. The United States ~~small~~ production was supplemented by imports, most of it from England and 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 1942 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, 1943.

CEMENT IN 1942

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 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 Fort 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 is about 37,000 barrels, (a barrel of cement weighs 350 pounds net).

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.

Froth flotation is 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, were not sufficiently pure in their natural state for cement manufacture.

Production and Trade:

Production of cement in 1942 was 9,126,041 barrels valued at $14,365,237, compared with 8,368,711 barrels valued at $13,063,588 in 1941. 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.

Trade figures are not available for publication owing to the war.

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 the period 1937 to 1942 were as follows:

	1937	1938	1939	1940	1941	1942
Quebec	$1.37	$1.35	$1.33	$1.41	$1.43	$1.46
Ontario	1.38	1.40	1.43	1.49	1.46	1.43
Manitoba	2.27	2.28	2.25	2.25	2.21	2.10
Alberta	1.99	2.01	1.97	2.01	2.00	1.96
British Columbia	1.81	1.87	1.91	1.94	1.97	2.07

The average selling price for Canada in 1942, was $1.57 a barrel.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, JUNE, 1943.

CLAYS AND CLAY PRODUCTS IN 1942

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 $7,041,066 in 1942, compared with $7,575,336 in 1941. The total value of ceramic products manufactured from imported clays was $5,447,668 in 1942, compared with $5,371,853 in 1941.

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

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 $4,457,523 in 1942, compared with $5,191,388 in 1941.

Stoneware Clays

The largest production in Canada of stoneware clay or semi-fireclays comes from the Eastend and Willows area, 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 they are difficult of access and have not been developed.

The value of stoneware articles (sewer pipe, pottery, etc.) produced in Canada from domestic clays in 1942 is reported to have been $2,038,633, compared with $1,924,601 in 1941. 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 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.

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

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 1942 was $448,798, compared with $409,869 in 1941; the value of refractories produced from imported clays in 1942 was $1,478,149, compared with $991,116 in 1941.

China Clay, Ball Clay, Etc.

China clay (kaolin) has been produced commercially in Canada only from the vicinity of St. Remi d'Amherst, Papineau county, Quebec, where mining operations were carried on 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 is also of 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 have been discovered in Quebec in recent years. One of these, located on Thirty-One Mile Lake, Near Point Comfort, Hull county, is being explored and portions of the deposit yield china clay of a high grade in the crude state. The extent 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 Missinabi 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.

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 1942 was $348,068, compared with $321,028 in 1941. Fuller's and infusorial earths are also imported for use in sugar refineries, vegetable oil mills, etc.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, JUNE, 1943.

DIATOMITE IN 1942

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 fresh water 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 International Diatomite Limited, Tatamogouche, Nova Scotia, has been the principal producer, but operations in the ponds near New Annan ceased in the fall of 1940. The principal producers in 1942 were G. Wightman, from a deposit on Digby Neck, Nova Scotia; and to a lesser extent R.L. Marsh for L.T. Fairey of Vancouver, from lot 1122 on west bank of Fraser River north of Quesnel in the Cariboo district of British Columbia.

Northern Diatomite Company of Toronto started the erection of a treatment plant on its deposit south of Gravenhurst in the Muskoka district and production is expected by the summer of 1943. A little prospecting was done on a few other deposits, but production from any of them is doubtful.

Production and Trade:

Production in 1942 was 375 tons and sales 365 tons, valued at $9,027, compared with 344 tons valued at $9,935 in 1941.

Prior to the war diatomite was produced by about thirty countries, but outside the North American continent statistics for the past four years are not available. The United States is by far the world's largest producer and is followed in order by Denmark, Germany, Japan, Algeria, and Northern Ireland. The United States output, which is of very high quality, was about 145,000 short tons in 1942.

No Canadian diatomite was exported in 1942. 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 Canadian product to England. Imports into Canada were about 4,400 tons, mainly from California and a little from Oregon, U.S.A., compared with 6,965 tons valued at $229,555 in 1941.

Consumption in Canada was approximately 4,700 tons, a 35 per cent decrease as compared with 1941. This was due to a substantial decrease in the consumption for sugar filtration resulting from the restrictions on raw sugar entering Canada. There was a slight increase in the use of diatomite bricks and mortars required for insulation of the numerous furnaces in operation in plants making war materials.

Uses:

Normally 75 to 80 per cent of the diatomite consumed in Canada is in the form of filter-aids used mainly in the refining of cane sugar, but in 1942 only about 65 per cent was so used; 22 per cent was used for insulation; and the remainder, principally as a filler, and to a small extent in chemicals, silver polish bases, and as an admixture in concrete.

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 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 about 1,500 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 of Canadian diatomite for insulation varies from $17 to $30 and imported from $26 to $75 per ton for insulation and filtration; up to $200 in small lots for material suitable for polishes; imported insulation bricks vary from $85 to $140 per 1,000, according to grade and density.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

FELDSPAR IN 1942

Ores Mined and Producing Localities:

Most of the Canadian feldspar mined is of high-potash grade, though some operators also produce small amounts of high-soda spar. The latter type is rather uncommon as large deposits, but is sometimes found as zonal bodies in potash-feldspar pegmatites, especially along the walls.

Most of the recorded production has come from adjacent sections of western Quebec and eastern Ontario, in the general Ottawa region, with a small amount, also, from scattered properties in Ontario as far west as the Parry Sound and Sudbury districts. Manitoba also formerly had a small production from the Winnipeg River district, but operations ceased there about six years ago. 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 larger deposits, the production being about equally divided between Ontario and Quebec. In 1942, however, the Ontario output declined to only about 30 per cent of the total.

In Ontario, the large quarry of Bathurst Feldspar Mines Limited, in Bathurst township, Lanark county, has long been the chief producer: it was closed down about mid-year in 1942, having reached the limit of open-cast mining. Operated since 1935, the property is estimated to have produced a total of about 110,000 tons. Most of the remainder of the Ontario output in 1942 came from Murchison township, Nipissing District, where the J.G. Gole and W.B. Cameron properties together shipped about 1,300 tons. The former was taken over during the year by D.L. Ross and Company, and the latter by Keystone Contractors Limited.

In Quebec, the chief source of supply continued to be the large Wallingford mine of Canadian Flint and Spar Company in Derry township, Papineau county, in the Lièvre River section. This company also operated its New York mine in Buckingham township for part of the year, and commenced the development of a new property near St. Pierre de Wakefield in Wakefield township. United Mining Industries Limited of Montreal made shipments from a deposit in Buckingham township, west of the Lièvre River, part of which was dental spar. B. Winning of Notre Dame de la Salette also shipped a small tonnage of dental spar.

Production and Trade:

Canadian feldspar production in 1942 totalled 20,228 tons valued at $196,203, compared with 26,040 tons valued at $244,284 in 1941.

World production of feldspar, including china stone, a variety of granite used in place of pure feldspar, amounted to about half a million tons in 1937, the last year for which complete statistics are available, of which the United States furnished over 50 per cent. Canada was sixth on the list, with about 4 per cent of the total. In 1941, American production of crude spar was 338,000 long tons, a 16 per cent increase over 1940.

A considerable proportion of the Canadian output is exported, mainly to grinding plants of Consolidated Feldspar Corporation and Genesee Feldspar Company, at Rochester, New York.

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

Feldspar for domestic use is ground in mills operated by the following:

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

The first two companies grind material for ceramic uses, while the Bon Ami product is used in scouring compounds. Total domestic consumption of feldspar in 1940 was reported as 4,073 tons, valued at $83,838.

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.

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 the 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. A novel use recently proposed for feldspar is for smothering incendiary bombs, and has been patented by the United States Government. A low-fluxing, soda type of spar is preferred, free of material finer than 200-mesh, and is claimed to have extinguishing properties superior to common sand or any special mixtures recommended for such purpose.

Domestic feldspar prices in 1942 showed no change from previous years. Quotations for No. 1 grade crude continued at $5.50 to $6.00 per ton, f.o.b. rail, for domestic mills and export. Ground spar, 200-mesh, sold at $16 to $18, and granular glass spar at $12, both f.o.b. mill, in carload lots.

Tariff:

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

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

FLUORSPAR IN 1942

Ores Mined and Producing Localities:

Production of fluorspar in Canada has been small and intermittent, the total output from 1905 to the end of 1942 being approximately 65,000 tons, about half of which came from Ontario and the remainder from British Columbia. Most of the fluorspar mined during 1940 to 1942, inclusive, came from the Madoc area, Hastings county, Ontario. No deposits of major importance are known elsewhere in Eastern Canada though there are scattered occurrences in Ontario, Nova Scotia, 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 and 1942. 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 present 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. Since the outbreak of war operations have been resumed at several of the larger mines.

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, which continued operations through 1942 and produced most of the spar shipped from the district. In 1940, the Wallbridge mine was taken over by Dominion Fluorspar Company (Halliwell Gold Mines Limited), of Montreal, which built a plant, did some diamond-drilling, and by the end of 1941, when operations were suspended, had shipped several thousand tons. 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 when it transferred its plant to the Perry mine, which it continued to operate through 1942. Charles Stoklosar of Madoc, who prior to the war had produced most of the small tonnage shipped from the district, re-opened the old Blakely mine in 1942 and shipped a few hundred tons. Late in the year plans were announced for re-opening the old Keene mine. Most of the above developments in 1942 were undertaken with financial and other assistance by the Dominion Government, which has also set prices for the various grades produced (see below).

The ores of the Madoc district and of the Lake Ainslie area, Nova Scotia, are intimate mixtures of fluorspar, calcite, and barite, and have proved difficult to concentrate without excessive loss of fluorspar in the middlings and tailings. In practice, run-of-mine Madoc ore is screened to remove fines, which constitute the bulk of the shipping product and these are sweetened with clean lump spar recovered by passing the coarse material over picking belts. Grade of product does not average much above 60 to 65 per cent CaF_2. Although this is considerably below the standard trade specification of 85 per cent for metallurgical fluorspar it is accepted by the steel trade under price penalty, provided the barite content does not exceed 12 per cent. Barite is objectionable on account of its sulphur content.

Small pockety deposits of fluorspar also occur in Ontario in Cardiff township, Haliburton county, where a few tons of high-grade picked spar was produced at the Clark property in 1942.

The Rock Candy mine in British Columbia was operated by Consolidated Mining and Smelting Company between 1919 and 1929 but 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. In the latter part of 1942, interest developed in a fluorspar occurrence near Birch Island, North Thompson River, where drilling operations are being undertaken by G.B. Webster, 11 King Street West, Toronto. The deposit consists of a fine-grained, intimate mixture of fluorspar and celestite, containing considerable pyrite. Test shipments were made in 1942 to the Bureau of Mines, Ottawa to determine whether recovery could be made of both the fluorspar and the celestite.

<u>Production and Trade:</u>

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

World production of fluorspar has averaged about half a million short tons annually in recent years, the United States and Germany supplying about 75 per cent of the total. The remainder has come mainly from Russia, the United Kingdom, Newfoundland, France, Korea, Italy, and the Union of South Africa. The United States produced a record total of 320,000 short tons in 1941, an increase of 37 per cent over 1940. The Newfoundland production has been increasing steadily and now supplies a large part of the Canadian demand. Canada in peacetime used from 12,000 to 15,000 tons of fluorspar a year, about half of it in the steel trade. The expansion in the production of aluminium will materially step up the demand for acid-grade spar.

Market and Prices:

Fluorspar has a number of industrial uses, but the steel trade is by far the largest consumer. In 1941, close to 70 per cent of total fluorspar sales in the United States went to the steel industry, 17 per cent to manufacturers of hydrofluoric acid (employed in making artificial cryolite and aluminium fluoride, both raw material for the aluminium industry), and 10 per cent to the glass and enamel trades. Minor uses are 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. Its use in the making of organic refrigerants of the "Freon" (dichlorodifluoro-methane) type is increasing.

Clear, glassy, crystal fluorspar, which is very 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. Domestic production has been considerably under 85 per cent CaF_2, with shipments lower even than 60 per cent, but marketing of such grades is subject to individual purchase agreement. The price of domestic metallurgical grade fluorspar for Canadian consumption was set in 1942 by the Metals Controller on the following basis: $24 in U.S. funds, per short ton, f.o.b. Kentucky-Illinois mines, plus 11 per cent exchange, plus 10 per cent war exchange tax, plus freight from above field to Canadian consuming point, less freight from Canadian mine to same point, less 25 cents for each per cent CaF_2 below 85 per cent. As an example, this would work out at $36.36 per short ton for standard 85 per cent grade, f.o.b. Madoc, for shipment to Sault Ste. Marie, Ontario, or $32.38 for shipment to Hamilton, Ontario.

Glass and enamel grades call for not less than 95 per cent CaF_2, with a maximum of 2½-3 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 throughout 1942 were $34 per ton, in bulk, 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 one per cent silica. It sold in January 1942, at $32, f.o.b. mines, rising to $35 in June-December. There is little or no production of such grades in Canada so that no price stabilization has been placed in effect regarding them.

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, 1943.

GARNET IN 1942

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, the amount of garnet produced in the Dominion is negligible.

Operations in 1942 were carried out intermittently by the Canada Garnet Company near Labelle, Quebec and by a producer near River Valley, north of North Bay, Ontario.

Production:

There was no production in 1942 by the Canada Garnet Company; but about 18 tons were shipped from River Valley, Ontario. In 1941 about 76 tons valued at $583 was sold, mainly 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 the output is 12 to 15 tons of concentrate daily from very large deposits containing 5 to 12 per cent garnet. Total sales of the four active companies in the United States in 1942 amounted to about 5,000 tons, compared with 5,501 tons, valued at $371,752 in 1941. A small amount of garnet inferior to that of the United States is produced in Spain.

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 225 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 fulfill 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:

Canadian consumption of prepared garnet grain suitable for "sand paper" manufacture has decreased and is now less than 200 tons annually. Competition from United States producers and the high quality of their garnet have prevented exports of Canadian garnet to that country. If it were not for shipping restrictions, coated abrasive manufacturers in England would be willing 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 so 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 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 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, 1943.

GRANITE IN 1942

(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. No 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 was being exploited with a view to supplying the domestic and export markets for monumental and building stock. It has been closed for the duration.

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 1942 was 1,351,815 tons valued at $1,940,304, compared with 600,922 tons valued at $1,498,786 in 1941, and 1,147,747 tons valued at $1,884,410 in 1940.

Trade figures are not available for publication owing to the war.

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 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 Canada 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, JUNE, 1943.

GRAPHITE IN 1942

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 or dismantled. The Canadian deposits include bands ~~of~~ 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 tailing from early operations which was discharged into Whitefish Lake from where it is recovered by pumping. Mining on the property was suspended several years ago, the main orebody being considered worked out. In 1942 a geological investigation of the deposit, together with a diamond-drilling program, was undertaken by Frobisher Exploration Company, (Ventures Limited), and a substantial tonnage of new ore was proved. Black Donald Graphite Company continued in operation until the end of the year when it was taken over by Ventures which intends to proceed with new underground development under the name of Black Donald Graphite Limited. Most of the production in the past consisted of various grades and mesh sizes of milled products and went to the American and domestic foundry trade. Since the outbreak of war much of it has been reserved for the greatly increased domestic demand.

During 1942, as the result of a threatened shortage of crucible flake graphite, the United States Government became interested in the possibility of a supply of such material from Canada. Prospecting for new deposits was encouraged, and a number of new occurrences were brought to governmental attention, on some of which surface stripping was done by established mining companies with a view to possible development. Various properties, including old, defunct mines, were examined by the Bureau of Mines and the Metals Controller's Office, Ottawa, in company with representatives of the U.S. War Production Board, and several sample shipments were tested in the Bureau of Mines laboratories. The threatened emergency was averted by the British occupation of Madagascar and it was not found necessary to take further steps to encourage interest in the development of a Canadian supply. Ore reserves at many of the old properties are believed to be considerable and could probably be used in an emergency, though this would entail the erection of new mills, or possibly of a central custom mill, to treat the ore.

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 prior to the war. Madagascar, Germany, Austria, and Czechoslovakia were then the principal producers of flake graphite; Ceylon of crystalline; and Mexico and Korea of the amorphous variety. Substantial reserves exist in the United States, but proved uneconomical to work in peacetime. Development was undertaken in 1942, under Government auspices, of deposits in Pennsylvania, Alabama, and Texas, to provide a domestic supply of crucible flake.

Market and Prices:

Graphite has many uses in industry, but 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.

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, the ores of many of the earlier-worked Canadian deposits yielded a relatively small proportion by high-value coarse crucible flake. In the interval, also, crucible graphite specifications have become much stricter and in addition to size of flake and carbon content, have stipulations regarding fusibility of ash, break-down, and volume. In general a No. 1 crucible flake should be coarser than 50-mesh, with about 40 per cent standing on a 35-mesh screen and 40 per cent on a 28-mesh screen. Carbon content should be 85 per cent or better.

The better grades of graphite for United States consumption are mainly imported. The only domestic production of flake of importance in recent years has come from near Morristown, in northern New York State, the material being a fine flake employed mainly for foundry use. Minor amounts have been furnished by Texas, Alabama, and Montana. Low-grade amorphous graphite for paint use is mined in Nevada and Michigan, and anthracite-graphite (so-called "sea coal"), used in foundry work, is produced in Rhode Island.

American imports are handled chiefly through large importing houses, which supply the trade and often process the material, though some of the larger crucible and other firms may import directly. In order to conserve supply, all stocks and imports of "strategic" graphite, which includes crystalline graphite in flake, lump, or chip form and coarser than 50-mesh, were placed under strict control and allocation by the United States Government in 1942.

Despite feared shortages American graphite prices have remained substantially at pre-war levels. No. 1 crucible flake was set, under agreement during 1942, at 13 cents per pound, and No. 2 crucible flake (minus 50 plus 70-mesh) at 11 cents. Ceylon crucible lump sold at 10 to 11 cents; carbon lump, 9 to 10 cents; chip, 7 to 8 cents; dust, 4 to 5 cents: all prices ex dock New York, duty paid. Mexican amorphous was quoted at $14 to $25 a ton, according to grade, f.o.b. New York.

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 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), $7\frac{1}{2}$ per cent ad valorem; general, 10 per cent; on ground and manufactures of, including foundry facings, but not crucibles, British, 15 per cent; intermediate, $22\frac{1}{2}$ 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 licence since July 5, 1940.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

GRINDSTONES, PULPSTONES, AND SCYTHESTONES IN 1942

Material suitable for these stones occurs in certain sandstone beds in Nova Scotia, New Brunswick, and on the British Columbia Coast. Many years ago the output was considerable, but most of the known beds have been depleted and the demand for natural stones has fallen off.

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 200 tons valued at $8,000, as against 203 tons valued at $9,125 in 1941.

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 five 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 35,000 of these small hand-operated stones, with a total weight of 16 tons and valued at $2,000, were sold in 1942 by the Read Stone Company, compared with 18 tons valued at $3,000 in 1941. 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 1942 was 216 tons valued at $10,000, compared with 221 tons valued at $12,125 in 1941.

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

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

GYPSUM IN 1942

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 the gypsum production during 1942 was considerably curtailed due to the difficulty in securing boats for shipment. There was an approximate reduction of 70 per cent in tonnage shipped as compared to that of the previous year, with a decrease of 56 per cent in the tonnage quarried. The various operators have maintained their storage sheds or stockpiles at aapacity during the past few years and at the end of 1942 the tonnage of gypsum on hand in the province exceeded the total output of the season.

Canadian Gypsum Company, operating at Wentworth, Hants county, about two miles from the to n of Windsor, is the largest gypsum operator in the province. The stone is obtained from two separate quarries and 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 northeastern Cape Breton. This is the largest operation of the company; shipments are made to the United States.

Connecticut Adamant Gypsum Company, Cheverie, Hants county, suspended operations during 1942 and 3,800 tons from stock was 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, N. S., and the products are 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, suspended operations at Baddeck Bay, Cape Breton. When operating, 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 of Canadian Gypsum Company 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 operators are Canadian Gypsum Company, with property and plant at Hagersville, and Gypsum Lime and Alabastine (Canada) Limited, of Caledonia, both in Haldimand county.

The markets in the Prairie Provinces were supplied by three operating plants, two of which are in Winnipeg, and one in Calgary.

Gypsum Lime and Alabastine (Canada) Limited, operate a plant in Winnipeg and one in Calgary, while Western Gypsum Products Limited operate in Winnipeg. Deposits in northern Alberta, although distant from markets and railway, are of good grade.

In British Columbia, production from the deposits at Falkland was maintained to supply the plant at New Westminster of Gypsum Lime and Alabastine (Canada) Limited. 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 1942 was 580,575 tons valued at $1,180,565, compared with the record production of 1,593,406 tons valued at $2,248,428 in 1941.

The severe drop in output in 1942 is ascribed mainly to lack of shipping facilities for handling the Nova Scotia production which is mostly exported by sea to the United States.

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

The world production of gypsum in 1941 was estimated at 10 million tons. Canada probably occupies third place among the 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 wallboard, 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 for the manufacture ofsulphuric acid, ammonium sulphate, cement and special plasters is increasing, and, normally, there is a good opportunity for the Canadian material in this market. Canada has extensive deposits, favourably situated for commercial development, 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 Canadian production was exported principally for use as a fertilizer for the peanut crop, but it is possible that an industry will eventually be started in this country in which the anhydrite may be used for the manufacture of sulphur or sulphur compounds and of special plasters, similar to those being marketed in England.

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. 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 remained at $2.50 to $3.50 per ton f.o.b. mine throughout 1942.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

IRON OXIDES (MINERAL PIGMENTS) IN 1942

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 in 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 1942 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. The calcined and air-floated mineral products, produced to rigid specifications, are very essential for use in the National Defence industries. Construction of an additional calcining unit, of a new design was begun in the fall of 1942 and is expected to be in production by May 1943.

Deposits at Almaville, Laviolette county, and at Les Forges, St. Maurice county, were operated by Charles D. Girardin of Yamachiche. Mauricy Oxide Company of Grand'Mere operated its property at St. Adelphe, Champlain county, and Thos. H. Argall of Trois Rivieres operated hisproperty near Pointe-du-Lac, St. Maurice county. Among the other deposits worked in the past in Quebec are those near St. Anne de Beaupre, Montmorency county; 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.

In British Columbia, a small production of iron oxide from Alta Lake, New Westminster district, and from oxide beds in the Windermere district, 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 1942 totalled 9,160 tons valued at $150,845, compared with 10,045 tons valued at $142,069 in 1941. Shipments by producers in the Province of Quebec totalled 8,722 tons valued at $146,245, compared with 9,770 tons valued at $139,185 in 1941. The Canadian production from 1940 to date remained constant at about 10,000 tons a year.

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

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 consumption of iron oxide by the illuminating gas industry in 1941 was 8,575 tons, while the amount consumed in the paint industry was 1,600 tons.

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 price of red iron oxide in 1942 as given by Canadian Chemistry and Process Industries, was 2 to 7 cents a pound.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

LIME IN 1942

Source of Supply:

Lime is manufactured in every province except Prince Edward Island, though the Saskatchewan production is intermittent and small. 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 nearly one-half of the total output, Quebec being next with slightly more than one-third of the total.

The steadily increasing demand for lime by the war industries has raised production above all previous records, and most of the forty-eight plants throughout the country operated at capacity during 1942. A new source of hydrated lime became available in 1942 with the coming into operation of the magnesia plant of the Aluminum Company of Canada, Limited at Wakefield, Quebec. At this plant hydrated lime is produced as a co-product of magnesia. The large rotary-kiln lime plant of Shawinigan Chemicals Limited at Shawinigan Falls, Quebec was enlarged in 1942 by the addition of two kilns.

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 1942 amounted to 884,830 tons valued at $6,530,389, compared with 860,885 tons valued at $6,357,941 in 1941. Of this production lime sold for building purposes in 1942 amounted to 56,348 tons valued at $606,944, compared with 67,862 tons valued at $735,213 in 1941.

Trade figures are not available for publication owing to the war.

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 and is one of the great basic raw materials for the chemical industry. Of the current production more than 93 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 1942.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, JUNE, 1943.

LIMESTONE (GENERAL) IN 1942

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 1942 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 1942 production of limestone for general use, exclusive of that used for building stone, lime, and cement is estimated at 6,282,050 tons valued at $5,675,571, compared with 7,115,907 tons valued at $5,779,872 in 1941. The production for all purposes in 1942 is estimated at 10,030,635 tons, compared with 10,768,030 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 for use as blast furnace flux, 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 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.

Pure dolomite is now an important source of magnesia and magnesium metal. In the calcined state it is used for precipitating magnesia from sea water and from magnesium chloride brines, the magnesia content of the dolomite itself being recovered at the same time. It is also the raw material in several processes in which the magnesia of the dolomite alone is recovered. The magnesia so obtained may be used for the making of magnesium metal as well as for various other purposes for which magnesia is used. Magnesium metal is also recovered directly from calcined dolomite by reduction with ferrosilicon.

A use for limestone that is 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, JUNE, 1943.

LIMESTONE (STRUCTURAL) IN 1942

Ores 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, two quarries near Queenston in the Niagara peninsula yield 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 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, 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 1942. Although building construction is 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 1942 was 18,327 tons valued at $207,372, compared with 35,142 tons valued at $277,855 in 1941. 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.

Trade figures are not available for publication owing to the war.

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, JUNE, 1943.

LITHIUM MINERALS IN 1942

Source of Supply:

Lithium minerals were mined in Canada on a small scale in the past, but there is no production at present. The last recorded shipment was made in 1937, and was valued at $1,694.

Amblygonite, spodumene, and lepidolite are the chief lithium minerals of commerce and their ores usually contain respectively, about 8, 6, and 4 per cent of lithium oxide. The known Canadian occurrences of these minerals of present economic interest are confined to Manitoba where there is a considerable development of lithium-bearing pegmatites, notably in the Pointe du Bois area in the southeastern part of the Province. This district has furnished all of the small Canadian production, amounting to a few hundred tons, the material shipped being mainly spodumene. Lithium Corporation of Canada, 403 Avenue Bldg., Winnipeg, is the company that has been most actively interested in promoting development of deposits in the above section and it has carried out considerable work on its holdings, mainly on those at Bernic Lake. It mined and stockpiled about 50 tons of mixed ore in 1941, but was inactive during 1942. The material taken out in 1941 comprised about equal amounts of cobbed amblygonite and spodumene and included also a few tons of triphylite, a phosphate of lithium and iron, containing theoretically about 9 per cent of lithium oxide. Other occurrences of lithium minerals in Manitoba include those at the Silver Leaf property on Winnipeg River; the Irgan claim, at Cat Lake, north of Oiseau River; Falcon Lake, 85 miles east of Winnipeg, near the Ontario-Manitoba boundary; and on the Kobar claims, near Mile 81 on the Hudson Bay railway. In most of these occurrences spodumene is the chief lithium mineral and it is usually mixed with considerable quartz, necessitating concentration to make a commercial shipping product.

Platy books of lepidolite occur in small amounts in a pegmatite in Wakefield township, Gatineau county, Quebec and spodumene is reported to occur in Lacorne township, Abitibi county, about 10 miles from 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 about 20 miles northeast of Yellowknife, Northwest Territories.

Production and Trade:

No production of lithium minerals in Canada was reported in 1942.

Figures of world production, exports and imports are not published. The United States, Southwest Africa, Sweden, Portugal, Spain, Germany, and Argentina are the chief producers, output in the United States being probably over 50 per cent of the total. Production of lithium minerals in the United States comes mainly from the Black Hills region in South Dakota, although some lepidolite formerly was obtained from California and New Mexico. A considerable quantity of lithia is recovered in the form of lithium-sodium phosphate from the brine of Searle's Lake, California and this source now furnishes nearly 50 per cent of the American supply of lithia. Production of lithium minerals (including the last-mentioned) in the United States in 1941 was close to 4,000 tons or about double the output in each of the two preceding years.

Lithium minerals have been offered in the crude lump form, of variable purity. Recently, attention has been given to the concentration of the ores, principally spodumene, in an effort to provide higher-grade material and to increase the supply. Spodumene-feldspar-quartz mixtures have proved amenable to flotation, and two flotation plants were under erection in the United States in 1942, one at Tinton, South Dakota, and the other at King's Mountain, North Carolina.

Uses:

The high-litia 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. In recent years spodumene, the most abundant of the lithium minerals, has been receiving increasing attention as a ceramic raw material. Spodumene is rather refractory, but spodumene-feldspar mixtures have lower melting points than has feldspar alone. The objectionable high thermal expansion of spodumene can 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 appears to have possibilities for use in pottery bodies, glazes and enamels, replacing more costly prepared lithium carbonate, provided that it can be obtained in standard grade of the required purity. Lepidolite is highly effective as a fluxing addition in high-talc bodies; amblygonite is of value for use in opaque glasses.

Lithium and its compounds have risen from a position of only minor importance a few years ago to one of considerable significance, to fill war needs, and military uses in 1942 were greater than industrial requirements. The chloride is one of the most hygroscopic inorganic compounds known and is being used to an increasing extent as a drying agent in air-conditioning units. Initially developed for industrial and domestic use, such units are being employed to dry the air for blast furnaces, giving 10 per cent greater efficiency. It and the fluoride and carbonate 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 stearate is employed in aviation greases. Lithium hydride serves as a convenient means of transporting and storing hydrogen gas; the nitride serves in the same way for ammonia.

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 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.

Lithium, in the vapour form, also furnishes a neutralizing atmosphere for furnaces used in the heat-treating and annealing 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.

Market Conditions:

No plants for the chemical treatment of lithium ores exist in Canada and consequently, any production must find an export market. Most of the ore marketed prior to the war was treated by a few large chemical firms specializing in the business, the principal plants being in the United States, Great Britain, Germany, and France. Such firms usually purchase their requirements under individual contract and there is thus little in the way of an open market, price quotations given in trade journals being merely nominal. Some of the larger consumers own and operate their own mines. Leading buyers, consumers, and manufacturers in the United States, as given in a December, 1942, publication of the U.S. Bureau of Mines, include the following firms:

Maywood Chemical Company, Maywood, N.J.

Foote Mineral Company, 16th and Summer Street, Philadelphia, Pa.

Harshaw Chemical Company, 1945 East 97th Street, Cleveland, Ohio.

Mallinckrodt Chemical Works, 2nd and Mallinckrodt Street, St. Louis, Mo.

Lithaloys Corporation, 444 Madison Avenue, New York, N.Y.

Metalloys Corporation, 730 Rand Tower, Minneapolis, Minn.

Lithium Corporation of America, Raymond and Commerce Bldg., Newark, N.J.

Corning Glass Works, Corning, N.Y. (Lepidolite).

B.F. Drakenfeld and Company, 45 Park Place, New York, N.Y. (Lepidolite).

To conserve supply for defence needs, the United States Government in September, 1942, placed lithium compounds under allocation control and a similar order was extended to lithium ores in December. These orders prohibit sale, purchase, and delivery of such commodities without specific authorization of the War Production Board.

Prices:

Prices of lithium minerals in 1942 showed no change from the previous year. Amblygonite continued to sell at \$40 per ton, f.o.b. American mines, for material containing 8 to 9 per cent Li_2O; spodumene, 6 per cent grade, at \$30; and lepidolite, at \$25. Prices of the various master alloys of lithium ranged from 50 cents to \$8 a pound, in ton lots, and of lithium metal, 98 to 99 per cent, \$15 per pound, in 100-pound lots.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

MAGNESITE AND BRUCITE IN 1942

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 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.

Brucite (magnesium hydroxide) in the form of granules thickly disseminated through a matrix of crystalline limestone occurs in large deposits at Rutherglen, Ontario, and at Bryson and Wakefield in the province of Quebec. By a process developed in the Bureau of Mines laboratories, Ottawa, it is possible to recover these brucite granules in the form of magnesia of a high degree of purity and to have hydrated lime as a co-product. A plant using this process is now in operation near Wakefield, Quebec. The granular magnesia produced is at present used mostly for making basic refractories, and for making a special grade of paper.

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.

Brucite is much less common than magnesite. The only deposits being worked commercially are in Canada and the United States. The magnesia obtained by calcining brucite may be used for the same purposes as that obtained from magnesite and also has some special applications of its own.

Competing with magnesite and brucite as sources of magnesia products are dolomite 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. The extraction of magnesia from sea-water is being done on a very large scale in 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 continued 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, JUNE, 1943.

MAGNESIUM SULPHATE IN 1942

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 have been made from one of the lakes in Saskatchewan.

The largest production has come from the deposits in 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. The material produced is of high grade. Operations ceased in the fall of 1942. 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 1942 was 1,140 tons valued at $37,760, compared with 265 tons valued at $7,343 in 1941.

Canadian Trade figures are not available for publication owing to the war.

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 weighing 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 in 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, due to the discontinuance of supplies from European countries, hitherto the main sources of supply. Quotations 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 throughout the year.

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, 1943.

MARBLE IN 1942

Sources of Supply:

Marble quarries are operated in 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 in beds up to 40 inches thick is quarried at St. Albert, near Ottawa, by Silvertone Black Quarries, Limited. 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 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 1942 amounted to 14,615 tons valued at $91,143, compared with 17,649 tons valued at $120,081 in 1941.

Trade figures are not available for publication owing to the war.

Market Conditions:

The Canadian market calls for interior decorative marble almost entirely, and very little is used for the exteriors of buildings. A considerable quantity is, however, used for tombstones.

In recent years there has been an increasing demand for marble in the form of terrazzo for flooring, and many inquiries have reached the Bureau of Mines, Ottawa, as to where marbles of various colours can be obtained.

There is a wide range in the price of marble depending on quality and rareness of colouring, but these prices are as a rule governed by those of European marbles of similar kind, most of which, in peacetime, enjoy a world-wide market whereas the markets for marble produced on this continent are mostly domestic.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, JUNE, 1943.

MICA IN 1942

Ores Mined and Producing Localities:-

Canada is one of the two main world sources of phlogopite, or amber mica, the other being the island of Madagascar. Muscovite, or white mica, is of fairly common occurrence in Canada, but in general, deposits of this type have proved of small economic importance, owing either to the poor grade of material or to the small amount of mica present, and, until recently, production of muscovite was negligible. The discovery of an important muscovite-bearing field near Mattawa, Ontario, in 1941-42 has materially altered this situation and active development is proceeding. Substantial quantities of high-quality mica, much of it recovered in sheets of phenomenal dimensions, were taken out in this area in 1942 and the district shows promise of becoming an important producer. Muscovite of "ruby" quality was recently found in Bergeronnes township, Saguenay county, Quebec, from where there was a small production in 1942.

Phlogopite:

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, 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 centred on deposits in Quebec.

Leading producers of phlogopite in Quebec in 1942 were Messrs. Blackburn Bros., operating the old Nellis mine, in Hull township; A. and W.M. Wallingford, working various scattered properties in Quebec and Ontario and salvaging waste dump mica; St. Lawrence Mining Corporation, Kilmar, in Argenteuil county; Papineau Mica Mines and White Mica Mining Syndicate, in Wells township, Papineau county; A.P. Blood, near Farrelton, Denholm township, Gatineau county; and St. Lawrence Mica Corporation, Petit Pre, near Quebec City.

In Ontario, production came mainly from mines operated by Kingston Mica Mining Company near Godfrey, in Bedford township; Amber Ridge Mica Company and Perth Mica Company in North Burgess township; and from dump-turning operations and old stock shipments of Loughborough Mining Company (General Electric Company), in Loughborough township.

The above operations accounted for most of the output, the remainder being derived from a number of small and mostly intermittent operations, mainly in Quebec. Scrap mica continued to be recovered from old waste dumps from which some merchantable sheet was also salvaged and shipments were on an unusually large scale. The scrap was mostly exported to grinding plants of United States Mica Manufacturing Company at East Rutherford, New Jersey, and Chicago, Illinois. Domestic and export demand for ground phlogopite was active and the grinding plant of Messrs. Blackburn Bros. was in capacity operation throughout the year. Late in the season this plant was moved from its old location in Templeton township to the company's present main site of operations at Cantley, Hull township.

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 splitting, 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. The 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 been used in low-voltage domestic heater appliances.

<u>Muscovite:</u>

The discovery of important deposits of high-grade muscovite during the winter of 1941-42 in the Eau Claire district near Mattawa, Nipissing District, Ontario, led to active prospecting and development in the area and a substantial production was achieved. Mica-rich pegmatites are numerous in the field, and some of them, as on the original Purdy discovery, contain crystals of extraordinary size and measuring as much as 5 by 8 feet across, they yield sound, clear sheets of "strategic" quality up to 60 by 30 inches and representing probably the largest merchantable mica on record.

Most of the output came from the property operated by Purdy and Macdonald during the first nine months of the year and later taken over by Purdy Mica Mines Limited, a subsidiary of Inspiration Mining and Development Company, of Amos, Quebec. The latter was active during the summer prospecting and developing its own holdings from which a quantity of mica was taken and which were later incorporated into its subsidiary. The company has installed a well-equipped mica shop at Mattawa to which the mine-run material is taken for preparation for market. Mica Consolidated Mines Limited, Victory Bldg., Toronto, also developed claims in the same area and reported a small production, its mica being prepared in a shop located in the nearby village of Bonfield. This company converts its best mica into condenser films for the domestic market and early in 1943 was installing presses for the production of punched sizes. A number of other properties have been staked in the area, but have not yet been developed to the production stage.

In Quebec, the Simard mine near Les Escoumains, in Bergeronnes township, Saguenay county, which carries a good quality of ruby muscovite, was taken over in the latter part of 1942 by Mica Laurentien, Limited, a subsidiary of Sullivan Consolidated Mines Limited, 1604 Aldred Bldg., Montreal, which is proceeding with development and has made some shipments.

Considerable prospecting for muscovite mica of "strategic" quality was conducted in Ontario and Quebec and numerous samples were submitted to the Bureau of Mines and to the Metals Controller's Office, Ottawa. Most of this material, however, was too heavily spotted or stained or otherwise inferior to be considered of "strategic" quality. Some interest also was shown in deposits in British Columbia, but most of these are at such high altitudes or are so far distant from transporation as to be of doubtful economic value.

A small tonnage of muscovite of scrap and schist grade is ground in British Columbia by two mills in Vancouver. The schist material comes from a deposit at Baker Inlet near Prince Rupert, operated by P.M. Ray, 23 Besner Block, Prince Rupert, and is shipped to Messrs. Fairey and Company, 661 Taylor Street, Vancouver, for grinding. This company also ground scrap-grade mica from near Oliver during 1942, material from this source also being ground by G.W. Richmond, 3239 West King Edward Avenue, Vancouver. Most of the ground product finds a market with local roofing manufacturers, and some is exported to the west coast of the United States.

Production and Trade:

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

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:

Phlogopite. A threatened shortage of phlogopite due to possible cutting off of Madagascar supplies following Japan's entry into the war was largely relieved by the

British occupation of the island in 1942, and substantial shipments of Madagascar block and splittings reached the United States during the year. Thus, an expected urgent demand for larger supplies from Canada failed to materialize and although Canadian production was increased considerably above that of recent years, with more operators active, the market in the main was quiet. Demand for block in the medium sizes, 2 by 3 to 3 by 5 inches, was fair, but was dull for splittings and the 1 by 1 and 1 by 2 inch sizes. The threatened shortage of heat-resistant phlogopite for aviation sparkplug use was averted in part through the receipt of Madagascar supplies and in part through the lowering of specifications, the last factor making available for sparkplug use considerably more Canadian material than had hitherto been thought possible. Consequently, for the present at least, current production and supply of sparkplug grade mica are considered adequate to meet the expected demand.

Muscovite. Muscovite mica of "strategic" quality continued to be the chief concern and the United States Government was active in efforts to increase a domestic supply by assistance to operators and by substantially raising price levels. A Government agency, Colonial Mica Corporation, 92 Liberty Street, New York, acting for Metals Reserve Company was set up to purchase and stock-pile suitable mica and its field extended also to Canada, where substantial purchases of the production from the Eau Claire field in Ontario, were made, as well as from the Saguenay district, in Quebec. This agency offers a ready outlet for Canadian muscovite of "strategic" quality in unlimited quantity and is the only authorized American purchaser and importer of Canadian "strategic" muscovite. It is not at present interested in buying phlogopite mica. In co-operation with Colonial Mica Corporation and for U.S. Government account, the Metals Controller, Ottawa, has set up a fund for the purchase of "strategic" muscovite and is prepared to accept shipments from smaller operators under individual agreement. There are, however, no restrictions governing open sale of such mica to domestic buyers.

"Strategic" muscovite is defined as follows: "Block and punch mica of better than heavy-stained quality, free of mineral inclusions (black or red spots, stains, or streaks), cracks, pinholes, cross-grains, reeves and ribs, and relatively free of clay staining. It must be hard, clear, and reasonably flat, and capable of being evenly and easily split into laminations or sheets of uniform thickness over the entire area, yielding sheets of at least 1 by 1 inch in size". The heaviest demand at present is for sheets measuring 1½ by 2 inches, 2 by 2 inches, and 2 by 3 inches. Although colour is some criterion of value, so-called "ruby" being regarded as the best quality, it is not necessarily a deciding factor, and green, smoky, "rum", and other shades find 'strategic' uses. 'Strategic' mica demands much skill and care in its preparation to obtain maximum recovery from the rough, mine-run crystals or "books" and to ensure that the finished product measures up to required specifications. The latter are exacting, whereas in the case of phlogopite practically any material is acceptable provided it is free from such gross physical imperfections as mineral inclusions, cracks, holes, and poor splitting properties.

Muscovite and phlogopite sheet mica are used almost entirely for electrical insulation. They are cut or punched into a great variety of shapes and sizes and in the form of splittings are 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, and the former, in the shape of washers, for the barrel, and as thin sheets (so-called "cigarette mica") for the spindle-wrapping and radio shield. Large quantities of muscovite are used in the form of thin sheets for radio condenser films. For all such uses muscovite must be of the best quality, free from spotting or heavy staining. Spotted and stained muscovite ("electric" mica) is used mainly in domestic heater appliances, such as toasters, and flat-irons, and inferior, ribbed material is punched into washers and discs for various insulating purposes. Because of the restrictions on the manufacture of a wide range of electrical equipment an abundant supply of low-grade muscovite is available and such material is difficult to market.

Fine flake or powdered mica made mainly from muscovite, and also from phlogopite and even biotite, has become an important industrial product, particularly in the United States, where a number of plants are engaged in its manufacture by wet and dry systems of grinding. The raw material is variously mine and shop waste or scrap, small sheets and flakes recovered from clay-washing plants, and schist rock mined for the purpose. In a few cases pegmatites also are mined as a source of grinding mica. 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 gives promise of 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. It is also employed as a mould and core wash (trade-name "Micawash") in foundry work where it is claimed to improve the surface of all types of castings, and also as a cleansing flux in the melting of various metals.

Prices:

Mica prices in general 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.

Phlogopite: According to dealers' reports, general price averages for phlogopite in 1942 showed little change from those of the previous year, quotations being approximately as shown below, according to quality:

Knife-trimmed Block or Sheet		Splittings	
Size, inches	Per pound	Size, inches	Per pound
1 x 1 and 1 x 2	$0.25 to $0.30	1 x 1	$0.65
1 x 3 and 2 x 2	0.45 to 0.50	1 x 2	0.75
2 x 3	0.70 to 0.80	1 x 3	0.90
2 x 4	0.95 to 1.00		
3 x 5	1.50 to 2.00		
4 x 6	1.75 to 2.50		
5 x 8	2.75 to 3.25		

Ground phlogopite continued to sell as follows, according to fineness: 20 mesh, $25 per ton; 60 mesh, $35; 120 mesh, $55; 150 mesh, $65; all prices f.o.b. Ottawa, in ton lots, bags extra. Scrap phlogopite, for export, sold for $10 to $11 per short ton, in carload lots.

Muscovite: There is comparatively little domestic demand for block muscovite, most of the consumption being in the form of splittings for micanite manufacture, prepared films for condensers, and punched discs, segments, and washers, most of which are imported. There are thus no established quotations for trimmed sheet muscovite, and little is handled by Canadian mica dealers. Consequent on the important production developing in the Eau Claire field, Colonial Mica Corporation, acting for the United States Government, set up a scale of prices during the year for Canadian muscovite of 'strategic' quality and made substantial purchases on this basis. The material is required to be prepared in "full trim" form, and is purchased subject to inspection and appraisal for quality and perfection of trim. The price schedule is as follows, per pound, in Canadian funds, f.o.b. shipping point:

Size, inches	No 1. Clear	No 2. Slightly Stained	No 3. Stained
1 x 1	$0.825	$0.58	$0.33
1 x 2	1.10	0.77	0.44
1½x 2	1.925	1.35	0.77
2 x 2	3.025	2.12	1.21
2 x 3	3.85	2.695	1.54
3 x 3	4.40	3.08	1.76
3 x 4	5.225	3.66	2.09
3 x 5	6.05	4.235	2.42
4 x 6	6.875	4.818	2.75
6 x 8	7.975	5.588	3.19
8 x 10	11.00	7.70	4.40
10 x 12	13.20	9.24	5.28

Small amounts of heavily stained and spotted block muscovite are used in peacetime by manufacturers of domestic heater appliances and repair shops, but owing to present manufacturing restrictions, the demand for such material is slight and is met by available supply, with prices offering little encouragement for mining for this quality alone.

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.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

MOULDING SAND (NATURAL BONDED) IN 1942

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 1942 was 37,032 tons valued at $42,185, compared with 38,309 tons valued at $40,066 in 1941, and 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.

Data on the consumption of moulding sand, core sand, and other foundry sand are incomplete, but it is likely that, at present, consumption greatly exceeds 200,000 tons a year.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

NEPHELINE SYENITE IN 1942

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, with albite and microcline feldspar. It often contains 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 known occurrences of commercial nepheline syenite in Canada lie mainly in Ontario, the developed deposits being in Peterborough, Hastings, and Haliburton counties. The large operation of American Nepheline Corporation (Ventures Limited) on Blue Mountain, near Lakefield, Peterborough county, has accounted for most of the production. Small tonnages have also been produced intermittently from deposits near Bancroft, in Dungannon township, Hastings county, and near Gooderham, in Glamorgan township, Haliburton county. The rock of the Blue Mountain occurrence is massive and medium-textured, whereas most of the production from the Bancroft and Gooderham areas has consisted of coarse pegmatitic material.

Output of American Nepheline Corporation's quarry is treated in part at the company's mill at Lakefield, which supplies the domestic trade, but most of it is shipped crude to its plant at Rochester, New York. Production from other sources has gone in the crude state to various feldspar-grinding mills in the United States. Completion of a flotation unit to remove minor impurities other than iron-bearing minerals was planned during the year at the Rochester mill.

American Nepheline Corporation was in full operation and reported about 55,000 tons of rock mined. Of this, 35,000 tons was exported and 6,000 tons milled at its Lakefield plant. Part of the cleaned product from the latter has in recent years been shipped to the mill of Frontenac Floor and Wall Tile Company, at Kingston, Ontario, to be finely ground on a custom basis for various ceramic uses, but most of such grinding is now done at Rochester, the finished product being granted re-entry into Canada duty-free. Canadian Flint and Spar Company, Victoria Bldg., Ottawa, mined about 800 tons of pegmatitic syenite from its property in Dungannon township, for export to the United States. Port Coldwell Mining Syndicate, 11 King Street West, Toronto, announced plans for exploiting nepheline syenite occurrences near Port Coldwell on the north shore of Lake Superior, where large deposits are known to exist.

Production and Trade:

Nepheline syenite production in 1942 was valued at $196,270, compared with $227,583 in 1941. These figures cover chiefly crude rock consigned to American mills, but include also finished products made in Canada both for domestic consumption and for export.

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

Except for 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 material and it is also employed by a number of American plants. Some American feldspar grinding establishments use the syenite for blending with their granular glass spar. 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 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.

Interest has been shown in the possibility of employing nepheline syenite as a source of alumina for the aluminium industry to replace bauxite,all of which is imported.. Frobisher Exploration Company, Limited (Ventures) conducted an intensive geological and diamond drilling program in 1941 on the nepheline syenite occurrences of the Bancroft area, Ontario and test work has been proceeding in the laboratories of the Bureau of Mines, Ottawa, on methods of treating the rock for recovery of the contained alumina, potash, and soda.

The fine dust product resulting from the processing of Lakefield syenite is used as a substitute for pumice, for grinding and polishing, and in the cleanser, enamelware, and heavy clay industries.

Glass-grade nepheline syenite for sale in Canada remained at the 1941 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 unchanted, 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 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.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

PHOSPHATE IN 1942

Ores Mined and Producing Localities:

Phosphate occurs in Canada (1) 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 (2) 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.

Mining of apatite has for many years been on a comparatively insignificant scale, the 1941 production of 2,500 tons being the largest recorded since the closing down of most of the larger mines at the beginning of the century. Since then most of the small output has been mainly by-product material recovered during mica-mining operations, with occasional small tonnages produced by intermittent operators. Chief purchaser has been the Electric Reduction Company, Buckingham, Quebec, for use in the production of elemental phosphorus and various phosphorus compounds. More recently, Canadian Refractories Limited, Kilmar, Quebec, have reported being in the market for small tonnages.

As offered for sale, the apatite usually consists of cobbed, picked lump, the grade of which may run from 65 to 80 per cent tricalcic phosphate. A slight revival of interest in the possibilities of straight apatite mining was evidenced in 1941-42, and several of the old and larger mines in the Lievre River section, Papineau county, Quebec, north of Buckingham, were re-opened and yielded most of the material sold. Small plants were installed at some of these properties and a shipping product was made that consisted of a composite of screened fines and cobbed lump of around 60 to 70 per cent grade. Chief operators in Quebec in 1942 were Barry Lake Mining Company, 11 Rue des Remparts, Quebec, working the High Rock mine; Commercial Mineral Poducts Company, 680 Sherbrooke Street West, Montreal, working the Old Union and Little Union properties, all the above in West Portland township; and Robert Bigelow, of Buckingham, who re-opened the old Brazeau mine in Bowman township near Val des Bois, with shipments totalling 500 tons, the largest unit production. In Ontario, Canadian Phosphate Mining Company Limited, 125 Holland Avenue, Ottawa, took over the old McLaren Mine in Bedford township near Westport and did considerable work, including diamond-drilling, with shipments of about 200 tons.

Tests were made in the laboratories of the Bureau of Mines, Ottawa, on beneficiating apatite by flotation and encouraging results were obtained. For use in the production of phosphorus, the principal domestic outlet for the material, flotation concentrates would require to be briquetted or sintered, as fines are objected to.

Canadian apatite deposits, though doubtlss still containing considerable reserves, tend to be erratic and pockoty, and are incapable of supplying more than a small fraction of domestic requirements for phosphate rock, which are of the order of a quarter of a million tons annually. Total production since the inception of mining around 1870 is estimated to have been about 350,000 tons.

Production and Trade:

Apatite production in 1942 was 1,892 tons, valued at $16,776, compared with 2,487 tons, valued at $33,376, in 1941. All of the output was used in Canada, mainly for the manufacture of phosphorus. Grade ranged from 60 to 80 per cent. Purchase price basis was $16 per short ton for 80 per cent material, with a penalty or premium of 20 cents per unit below or above that figure. The average price of imported Florida phosphate, laid down, during the year was $18 per long ton for 75 per cent grade.

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

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 1941 being more than 4½ million tons. 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.

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. 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 a 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.

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 slime 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.

The use of flotation for cleaning the sedimentary phosphate of the Southern States has shown continued expansion and has become established practice. Electrostatic methods for recleaning flotation concentrate have given good results.

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.

Of the 4 million tons of phosphate produced in the United States in 1940, 19 per cent was exported. Production rose to nearly $4\frac{3}{4}$ million tons in 1941, 60 per cent of which was used for the manufacture of superphosphate, and 14 per cent for the making of phosphoric acid, phosphorus salts and compounds, and ferrophosphorus. Compounds included baking powder, cleanser and laundering preparations, and a wide variety of chemicals employed in industry.

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 have been showing a steady expansion, and now consume over 650,000 tons of phosphate annually.

Tariff:

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; superphosphate intended for blending with other fertilizer ingredients, however, enters Canada free under all tariffs.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

PYRITES IN 1942

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.

In Quebec, Aldermac Copper Corporation's mine and concentrator, twelve miles west of Noranda, were in continuous operation in 1942. 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, Québec, 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, all of the pyrites used in the Freeman flash-roasting plant in the mill of St. Lawrence Paper Mills Company is 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, and part was exported to plants in the United States. A considerable tonnage of pyrites from previous years operations has accumulated at Britannia Beach and is awaiting more favourable market conditions.

Northern Pyrites, Limited completed in 1940 a program of development work that was 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 tide-water 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 1942.

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 or 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, 1943.

SALT IN 1942

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 ix recovered by mining rock salt and by evaporation from brine produced by leaching the waste material in the mine.

Producing and Prospective 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, obtain their salt from Sandwich, Ontario.

In Nova Scotia, Malagash Salt Company produced about 8 per cent less salt than in the previous year. 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 in 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.

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.

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.

In Manitoba, the plant of Canadian Industries Limited, Neepawa, operated continuously, and the company has a new plant installed in 1941, 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 company is in a position to place all grades of salt on the market. To provide for contingencies, a second production well was drilled in 1941 and made ready for production when needed.

Production and Trade:

The production of salt in 1942 was 658,458 tons valued at $3,922,566, compared with 560,845 tons valued at $3,196,165 in 1941.

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

No salt deposits in the United States are known to be nearer than about 200 miles from the Atlantic coast, so that such industries as fish curing and others in coastal areas usually find it easier to use salt imported mainly from the West Indies (26,000 tons imported in 1941). The submarine menace has made it increasingly impracticable to use this market, so that the seaboard consumers have had to obtain their supplies from sources within the United States and from Canada, which fact explains the noticeable increase in Canadian exports of salt.

Market and Prices:

The market for salt in Canada is steadily increasing. 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.

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 $3.53 per barrel; while industrial fine, in bulk car lots f.o.b. plant per ton, were $6.53 and industrial coarse were $10.63 per ton.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

SAND AND GRAVEL IN 1942

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 1942 amounted to 23,548,852 tons valued at $7,742,947, compared with 31,604,806 tons valued at $10,375,723 for 1941. Following are the output and value by provinces for these two years:

NAME	1941 QUANTITY tons	1941 VALUE $	1942 QUANTITY tons	1942 VALUE $
Nova Scotia	749,441	332,531	618,539	265,810
New Brunswick	962,483	423,772	1,087,834	582,564
Quebec	11,681,390	2,673,300	9,852,069	2,398,657
Ontario	11,569,382	4,524,463	6,234,871	2,464,941
Manitoba	1,503,901	429,996	1,379,373	432,901
Saskatchewan	1,220,801	406,835	1,339,718	485,367
Alberta	956,484	433,504	537,713	225,445
British Columbia	2,960,924	1,151,322	2,498,735	887,262
Total	31,604,806	10,375,723	23,548,852	7,742,947

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 1941 and 1942. 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.	
	1941	1942	1941	1942	1941	1942	1941	1942
Sand	1.15	1.15	1.00	1.00	1.00	1.00	1.00	1.00
Gravel	1.10	1.10	1.53	1.56	1.00	1.00	1.00	1.00
Crushed Stone.	.82	.93	1.61	1.67	-	-	1.13	1.10

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

SILICA IN 1942

Source of Supply:

The materials produced are quartz for smelter flux and ferrosilicon; quartzite for ferrosilicon 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 ferrosilicon 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.

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.

Important Developments and Producing Localities:

In Nova Scotia the deposit of silica sand near River Denys, Inverness county, was not operated during 1942. 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 operated only intermittently. When operating it produces sand of different grades for steel foundries, the glass industry, and for sand blasting etc.

The whole plant of the Canadian Kaolin Silica Products, Ltd., at Lac Remi, was destroyed by fire in April, 1940, 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.

Canada China Clay Company, with property and plants at St. Remi d'Amherst, did not operate its own mine, but obtained its material from the adjoining property of Canadian Kaolin Silica Products Ltd. China clay and silica sand are being produced in two separate treatment plants.

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 ferrosilicon 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 ferrosilicon finds a market both in Canada and abroad.

In Ontario a deposit of sandstone, situated about 2 miles west of Joyceville, a village on Ontario Highway No. 15, eleven miles north of Kingston, is operated by A. D. Bartlett of Kingston for the purpose of supplying silica for cement manufacture at the rate of from 50 to 60 tons of quarried rock per day. 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. Kingston Silica Mines Limited, R.R.1, Kingston, has been formed to operate this property. The company is expected to start early in 1943 on the construction of the necessary buildings and the installation of equipment.

An appreciable amount of ferrosilicon of low silicon contemt 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 ferrosilicon 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 present 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.

West of Winnipeg the needs for silica are met almost entirely by imported material.

<u>Production and Trade:</u>

The production of quartz and silica sand in 1942 was 1,646,679 tons valued at $1,832,370, compared with 2,052,878 tons valued at $1,266,187 in 1941. Silica brick produced in 1942 were 4,120 M valued at $255,700, compared with 4,111 M valued at $238,433 in 1941.

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

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.

Quotations as given by "Canadian Chemistry and Process Industries" are: silica sand, various grades, in car lots $9 to $9.50 a ton; silica, quartz, 99 per cent, 110-220 grade, in car lots, $14 to $20 per ton.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

SODIUM CARBONATE (NATURAL) IN 1942

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 1942 was 256 tons valued at $2,048, compared with 186 tons valued at $1,488 in 1941.

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

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 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.

Most of the major consuming industries are requiring more soda ash to cope with higher operating schedules. New munition plants and increased requirements of the aluminium industry, because of vastly expanded production and utilization of low-grade ores, are contributing to the increased consumption of soda ash.

The consumption of "soda ash" by the chemicals and allied industries in 1940 (1941-1942 are not available), totalled 19,361 tons valued at $553,707. The consumption was distributed as follows: acids, alkalis, and salts, 10,840 tons; soaps and washing compounds, 5,820 tons; boiler compounds, 1,450 tons; and miscellaneous chemical industries, 1,251 tons. 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 1942 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, 1943.

SODIUM SULPHATE (NATURAL) IN 1942
(Glauber's Salt and Salt Cake)

Source of Supply and Producing Localities:

Sodium sulphate occurs as crystals or in the form of highly concentrated brines in many lakes throughout Western Canada. 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".

Production in 1942 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 Alkali lease on the deposit at Alsask Lake, and has erected a 250-ton plant which went into operation in the spring of 1942. 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 operated its dehydrating plant at Sybouts Lake, 9 miles south of Gladmar. The plant erected and put into production early in the autumn of 1941, was later destroyed by fire, but plans were made for the building of a new plant which was put in operation early in 1942.

Mr. D. C. Hart of Regina has been experimenting on methods of dehydrating and obtaining a product suitable to the textile trade. He has under construction a plant for test purpose on a lake in the vicinity of Horizon. This plant is expected to be in operation sometime in 1943.

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 ($Na_2SO_4CaSO_4$) 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.

Investigations 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 has been increasing each year.

Production and Trade:

The production of natural sodium sulphate in 1942 amounted to 128,912 tons valued at $1,064,266, compared with 115,601 tons valued at $931,554 in 1941, and 94,260 tons valued at $829,589 in 1940. Production increased over 11 per cent compared with that of 1941, and 36 per cent compared with 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 and 1942. Canadian trade figures are not available for publication owing to the war.

Market Conditions and Prices:

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.

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, 1943.

SULPHUR IN 1942

Source of Supply:

Deposits of native 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. International Nickel Company of Canada erected in 1930 at Copper Cliff, Ontario, a sulphuric acid plant employing the contact process in the manufacture of acid from converter gas, for the recovery of portions of its smelter gases. A plant has been in operation since 1925 at the Coniston smelter of the same company. A plant using the contact process was erected in 1929 at Tadanac (Trail), British Columbia by Consolidated Mining and Smelting Company. At the plant of International Nickel Company, high-grade sulphuric acid is produced and is marketed in several industries, while at the Trail plant, the acid made is used chiefly for the manufacture of fertilizers.

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 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, and part was exported to plants in the United States. A considerable tonnage of pyrites from previous years operations has accumulated at Britannia Beach and is awaiting more favourable market conditions.

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 Freemam 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 concentrate in the United States. At the plant of Noranda Mines Ltd. pyrites concentrate, a by-product of the milling of copper-gold ores, was marketed for the manufacture of acid.

Production and Trade:

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

World production of sulphur in 1940, (1941-1942 not available), including elemental sulphur recovered in the treatment of pyrites and as a by-product from the treatment of industrial gases, is estimated by the U. S. Bureau of Mines at 3,600,000 long tons.

The United States is the main source of the world production of crude sulphur. The output in 1941 amounted to 3,139,000 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 was 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.

"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 solwed 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 involves the solution of the aluminium-bearing mineral in sulphuric acid."

According to "Metal and Mineral Markets", New York, the price of sulphur in 1942 remained unchanged at $16 a long ton, f.p.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, 1943.

TALC AND SOAPSTONE IN 1942

Ores Mined and Producing Localities:

The entire talc and soapstone production of Canada has for some years past come from Ontario and Quebec. More than 90 per cent of the total output of talc to the end of 1942, however, came from the Madoc area, Hastings county, Ontario, which supplies ground talc of good white colour, while Quebec produces mainly a grey, off-colour grade. Quebec is the only producer of cut soapstone blocks and bricks, and of sawed crayons.

Development of the Madoc deposits commenced about 1900 and total output to date is estimated to have been about 400,000 tons. Since 1937, Canada Talc Limited, operating the Conley mine, has furnished most of the supply, having taken over the mine and mill of the G. H. Gillespie Company, the pioneer operator, in that year. Production is at the rate of about 15,000 tons a year. There have been various other small, intermittent operations in the area but these have accounted for only a small tonnage. In 1941, Trent Mining Syndicate commenced development on a property adjoining the Conley mine and erected a small mill, but was inactive during most of 1942. W. C. Spry (Victory Talc) continued to grind a small tonnage of off-colour talc in the mill of Canada Slate Products about a mile north of Madoc, the crude rock being obtained from a deposit near Ompah, Frontenac county, 65 miles distant. The Ompah talc is finely schistose, cream-coloured, and quite distinct in character from that of the Madoc district.

Quebec has been producing cut soapstone since 1922, mainly in the form of blocks and bricks for the alkali recovery furnaces of domestic kraft mills. The sawing of crayons was commenced a few years ago. The industry is centred in the Thetford Mines district, Eastern Townships, where Broughton Soapstone and Quarry Company is the principal operator. This company operates two soapstone quarries near Leeds station in Broughton township and in addition to turning out cut stone and crayons produces most of the ground talc made in the Province. Other smaller operators in the same district are Charles Fortin, of Robertson, and L. C. Pharo, of Thetford Mines, working in Thetford and Leeds townships, respectively. Some of the sawing 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. Total sales of cut stone from the district in 1942 were about 3,000 tons and of ground talc about 8,500 tons. 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 Brome county, close to the Vermont boundary. The company began to produce in 1938 and in 1941 reported sales of about 1,500 tons of ground talc of various grades. Total production of ground talc in the Province in 1942 was nearly 14,000 tons.

In British Columbia the deposits near McGillivray, on the Pacific Great Eastern railway and at Kapoor near Victoria have been idle since 1935. Crude talc from these occurrences was formerly 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 mica, slag, etc., mainly for local roofing firms and partly for export to Tacoma, Washington.

In 1941, Messrs. Pulverized Products Limited, Montreal, reported having commenced production 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, including soapstone, in 1942 totalled 15,634 tons, valued at $168,392, compared with 18,171 tons, valued at $204,884, in 1941. Sales of soapstone were valued at $121,766, compared with $155,925 in 1941; the 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 $290,158, compared with $360,809, in 1941.

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

Pre-war world production of talc, including ground material, cut soapstone, steatite, and pyrophyllite (a mineral closely resembling talc and used for many similar industrial purposes) amounted to about half a million tons a year. Of this total, the United States produced over half. American output rose 48 per cent in 1941 over the previous year, making a record of 416,369 short tons, valued at $4,701,892, as compared with 281,375 tons, valued at $3,008,320, in 1940. These figures are exclusive of cut dimension soapstone. Manchuria, with an output of around 100,000 tons, was the second-largest producer and was followed by France and Italy, each with about 50,000 tons, Norway, British India, Canada, and Germany (including Austria).

Market Conditions and Prices:

World consumption of talc has shown a steady increase in recent years, as is seen in the large increase noted above in American sales in 1941. Since the outbreak of war demand for Canadian talc has increased and is used in part to supply British deficiencies caused by the shutting off of French and Italian imports. Exports to Great Britain could be increased materially if more cargo space were available. British importers report satisfaction with the grade of shipments for general purpose use. Madoc talc, although of prime white colour, contains a considerable amount of gritty, carbonate impurity, and 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 lower in carbonates and are 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.

Talc has a great variety of uses. Much 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, platters, 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. Steatite insulators, which were formerly made from sawn shapes are in such heavy demand for short-wave radio equipment for war purposes that the supply of suitable raw material is far short of requirements and they are now largely made from ceramic bodies. For such purpose the talc employed is required to be low in iron and lime and comparatively few natural talcs meet these specifications. Tests were carried out during the year in the Bureau of Mines laboratories at Ottawa on the possibility of beneficiating Madoc talc by flotation methods in order to reduce the lime content to the required tolerance and encouraging results were obtained. Ceramic tests on the cleaned product also indicated that it possesses favourable properties for insulator use. In order to meet the critical shortage of steatite talc and to conserve supply, the United States Government in October placed the material under strict allocation and control, restricting its use to approved national needs. Permitted uses included insulators, sparkplugs, steatite porcelain, electrical and heat insulators, electric light bulbs, and preparation of foods and pharmaceuticals. As defined by the Order (amended in February, 1943,), steatite talc covers natural magnesium silicate suitable for use in steatite products, and containing not over 1.5 per cent lime, 1.5 per cent ferric oxide, and 4 per cent alumina.

As an indication of consumption trends for ground talc (including also soapstone and pyrophyllite), United States sales in 1941 went to the following industries: paint, 29 per cent; ceramics, 19 per cent; roofing, 10 per cent; paper, 9 per cent; rubber, 14 per cent; cosmetics, 5 per cent; and foundry facings, 2 per cent.

Ceramic uses for talc have shown the most noteworthy increase and it is now a standard ingredient in floor and wall tile, electrical and other porcelains, porcelain enamels, dinnerware bodies, and 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 lime and 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. Domestic grey talc, suitable for rubber and paper use, sold in 1942 for an average of $7 to $8 per ton. White, Madoc talc was quoted at $7 to $10 for the coarser grades, $11 to $28 for finer mesh sizes, and $44 for minus 400-mesh material.

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 $11: all prices f.o.b. mines. Lava steatite and crayon talc sells at from $100 to $150 a ton.

The Dominion Bureau of Statistics reports the consumption of talc in Canada in 1940 at slightly over 11,000 short tons, of which the roofing trade took 4,822 tons; paints, 2,683 tons; pulp and paper, 1,168 tons; rubber, 855 tons; cosmetics, 455 tons; and soaps and cleansers, 435 tons.

Tariff:

Canadian ground talc or soapstone exported to the United States is dutiable at $17\frac{1}{2}$ 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.

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. The occurrences are at present owned and operated by Industrial Minerals Company of Newfoundland Limited, Box 435, St. John's, which in 1942 installed a grinding plant with a capacity of 25 tons a day and shipped about 500 tons of ground material to Great Britain. 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 reported occurrences of pyrophyllite in Quebec 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 1942, pyrophyllite was quoted at $8 to $13 a ton, f.o.b. North Carolina mills, for 200-mesh and 325-mesh material, respectively.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES & RESOURCES,
OTTAWA, MARCH, 1943.

VOLCANIC DUST IN 1942

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. Although a number of deposits of fair size and grade have been found and tested, mining activity has been insignificant in recent years.

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, when production amounted to 31 tons valued at $620. One ton came from Waldeck, Saskatchewan, and 30 tons from Williams Lake, British Columbia.

Imports are grouped with a number of similar products -- pumice, pumice stone, lava; and calcareous tufa, the value of which total approximately $40,000 annually.

In the United States, shipments of volcanic dust and pumice in 1941 (figures for 1942 not available) were 117,310 tons, valued at $669,514, about twenty-four companies being engaged in production. This output was 42 per cent greater in amount and 49 per cent higher in value than in 1940 and was an all-time high in quantity and value.

Market Conditions and Uses:

The war cut off supplies of high quality Italian pumice, but suitable material is being produced in California.

In the past, about 60 per cent of the United States output was used as the abrasive base in scouring and cleansing compounds and to a lesser extent for glass bevelling, polishing aluminium, etc., but in 1941 about 43 per cent was used for these purposes and 48 per cent as a concrete admixture and concrete aggregate. The value of the latter, however, was only 11 per cent of the total against nearly 60 per cent for abrasive purposes: 4 per cent for acoustic plaster; and the remainder for asphalt filler, stucco, filtering and insulating media, paint filler, insecticide, floor sweep, and dusting the inside of tires. Some of the United States volcanic dust was also 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, after electromagnetic treatment, in the place of feldspar in ceramic bodies whose colour has secondary importance. The mechanical strength of pumicite bodies is said to be higher, but shrinkage somewhat higher, than that of feldspar bodies.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

WHITING SUBSTITUTE IN 1942

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 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.

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. Most of the whiting substitute made in Canada is made from white marble.

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. Two plants are engaged in making whiting substitute from marl.

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; Marlhill Mines, Limited, Marlbank, Ontario; Gypsum, Lime and Alabastine, Canada, Limited, Winnipeg; and Beale Quarries, Limited, Van Anda, Texada Island, British Columbia.

The industry has experienced a steady growth in recent years because improvements in grinding equipment and the maintenance of close technical control have enabled products to be marketed that are very consistent in chemical and physical properties. Many manufacturers now use the domestic products with entire satisfaction in place of imported whiting and with all European sources of whiting cut off because of the war, the domestic industry is largely supplying the Canadian market.

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.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

COAL IN 1942

Source of Supply

The production of coal in Canada is confined to the western and eastern provinces. Ontario and Quebec have no commercial coal mines and the production of coal in Manitoba is limited to a small tonnage of lignite.

Nova Scotia produces bituminous coal from Cape Breton Island and the mainland collieries in the Cumberland and Pictou areas. New Brunswick produces at Minto a small portion of the bituminous coal of Eastern Canada. Lignite is produced in Saskatchewan, the main producing areas being the Bienfait and Estevan divisions.

Alberta produces all ranks of coal including a small tonnage of anthracitic coal. Bituminous coal is produced in the Crowsnest field and the mining areas of the foothills. The coal mined in the central area of the province is lower in rank and is classed as sub-bituminous and domestic or lignitic.

British Columbia produces bituminous and sub-bituminous coal from Vancouver Island, the Crowsnest area, which is adjacent to the Alberta field, and also from the inland area located near the towns of Princetown and Merritt.

The major portion of the coal produced in Canada is mined in Nova Scotia and Alberta, the production from each of these areas being approximately 40 per cent of the total production for Canada.

New Developments

The coal production from Nova Scotia, augmented by a small tonnage from New Brunswick, provides, in peacetime, not only for the requirements of the railways of the area, the steel industry and the domestic market, but also for much of the fuel requirements of the Province of Quebec and to a lesser degree Ontario. The increasing wartime expansion of industry and transportation during 1942 however, considerably reduced the movement of coal from this area.

The development of markets in Ontario for Alberta coal has also been discontinued due to the increased demand in the western provinces.

The output from most of the Canadian collieries for 1942 has been increased and development work undertaken to increase production and in a measure offset the adverse effect of the reduction in manpower. A major development of the year was the construction of the Elk Colliery near Fernie, B. C. to replace the operations of the Coal Creek Colliery which are to be abandoned.

Production and Trade

Production of coal in Canada amounted to 18,707,110 tons valued at $62,175,909, compared with 18,225,921 tons valued at $58,059,630 in 1941. The maximum output was reached in 1942. The minimum during the last 15 years was 11,739,000 tons in 1932.

Production of Coal in Canada by Provinces

Province	1942 Tons	1941 Tons	Per Cent Increase or Decrease
Nova Scotia	7,189,200	7,387,700	- 2.7
Alberta	7,665,000	6,970,000	+ 9.0
British Columbia	2,153,200	2,020,800	+ 6.5
Saskatchewan	1,270,400	1,322,800	- 4.4
New Brunswick	428,000	523,400	- 18.0
Manitoba	1,300	1,200	+ 8.3
Canada	18,707,100	18,225,900	+ 2.6

Production of Coal in Canada by Kinds

	1942 Tons	1941 Tons	Per Cent Increase or Decrease
Bituminous	13,541,000	13,603,300	- 0.5
Sub-bituminous	726,300	585,500	+ 24.0
Lignite	4,439,800	4,037,100	+ 10.0

The imports of coal into Canada totalled 25,609,267 tons, compared with 21,808,861 tons in 1941. Anthracite importations amounted to 4,802,023 tons, compared with 3,940,859 tons in 1941. Bituminous coal importations amounted to 20,807,005 tons, compared with 17,867,068 tons for 1941.

Coal exports from Canada amounted to 815,585 tons, compared with 531,449 tons for 1941.

The present Canadian consumption of coal is in excess of 40 million tons a year, compared with 29.4 million tons in 1939, the last year for which detail information is available.

The world production of all grades of coal in 1938 (1939-42 not available) was 1,469 million metric tons. United States of America contributed 24 per cent, Germany 28 per cent, Great Britain 16 per cent, Russia 6 per cent, and France 6 per cent.

Canadian coal moved under Federal Government assistance amounted to 2,698,390 tons at a cost of $4,420,380, compared with 3,318,968 tons at a cost of $4,489,229 in 1941.

The total cost to the Government in subvention from 1928 when this assistance came into effect, up to the end of 1942, on the movement of 28,661,551 tons, amounted to $32,625,513 or $1.14 per ton.

It should be noted that, along with the regular subvention paid on coal which is in a competitive market, it was also found necessary to establish subvention rates to cover other situations. Any tonnages moved under these special allowances are included in above figures.

The Emergency Coal Production Board was set up in November, 1942, to investigate the coal mining industry in general and formulate plans whereby the maximum amount of coal should be mined in the coming year. This Board is providing subsidy payments to those mines which it has been proved can increase their production substantially if given the necessary assistance. In other cases, the Board is prepared to subsidize efficient mines which are finding increased costs and labor difficulties overwhelming and can prove that they must close down unless they can be aided financially.

The Coal Administration has further paid subsidy to operators to cover the increased cost of cost-of-living bonus. Payments began in June, 1942, and covered periods extending back to September, 1941.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

COKE IN 1942

Source of Supply

Coke from Canadian and imported coals was produced to the capacity of the several types of carbonizing equipment located throughout Canada. These plants 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.

By-product coke ovens produce most of the coke made in Canada and of the coal consumed for the production of coke in Canada 85 per cent is processed in five by-product coke plants.

The Province of Ontario produces approximately 60 per cent of the coke manufactured in Canada; the principal operations are reported in the following table together with the rated capacity of the plants:

Company	Location	Annual Rated Capacity
Algoma Steel Corporation	Sault Ste. Marie, Ontario	1,015,000
Hamilton By-Product Coke Ovens	Hamilton, Ontario	415,000
Steel Company of Canada	" "	641,000
Consumers' Gas Company	Toronto "	302,000

Two large by-product plants are situated in Eastern Canada, one at Sydney, Nova Scotia, operated by the Dominion Steel & Coal Corporation, Limited, principally for the production of blast furnace coke used by the Company, and the other plant at Ville LaSalle, Quebec, operated by the Montreal Coke & Manufacturing Company which was operated for the production of metallurgical coke. About 75 per cent of the capacity of these plants is supplied with coal from Canadian mines.

Beehive coke is manufactured in two plants in Western Canada situated at Coleman, Alberta, and Michel, British Columbia.

Expansion of the industry has been undertaken at Michel, B.C., with the installation of ten Curran-Knowles ovens as an extension to the existing battery, and also at Hamilton, Ontario, where a new battery of these ovens was under construction. These plants are to be completed early in 1943.

Production and Trade

The total production of coke from coal in 1942 was 3,274,600 tons, compared with 3,150,100 tons in 1941. Production by Provinces was reported as follows:

Province	1942	1941	Per Cent Increase
Eastern Provinces	1,123,570	1,029,010	0.4
Ontario	1,849,330	1,836,120	0.7
Western Provinces	301,700	284,970	6.0
Total for Canada	3,274,600	3,150,100	4.0

Coal processed for the manufacture of coke amounted to 4,537,524 tons, of which 1,554,064 tons were of Canadian origin, and 2,983,460 tons were imported. A small amount of petroleum coke was produced at the oil refineries amounting to 73,732 tons, compared with 71,921 tons in 1941.

The imports of coke for 1942 were 720,113 tons, compared with 614,417 tons in 1941.

Exports of coke in 1942 were 44,764 tons, compared with 40,167 tons in 1941.

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

NATURAL GAS IN 1942

Source of Supply:

Natural gas has been found in most of the provinces of Canada. It is produced commercially in abundance 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 fuel for the field itself, and then feeds the pipe line to the cities and districts of Calgary and Lethbridge. It has not been necessary to drill gas wells for some years, and production is now largely derived from the oil wells in which the gas plays a vital role in the production of oil. The gas/oil ratio of many of these, particularly in the southern part of the field, where conservation measures had not been fully developed until after the wells had been some time in production, has risen so that in some cases wells have had to be re-classified as gas wells, thus adding to the reserve of gas. Production of gas is still much in excess of consumption, although the large amount wasted was reduced by nearly one third in 1942. With further improvements in conservation, particularly should the experiment in re-cycling gas, started in December, prove successful, the waste is likely to continue to decline. Although the use of gas for fuel increased considerably owing to war demand, the more efficient operation of Turner Valley oil wells enabled the average daily production to be reduced.

The Edmonton area is supplied from the gas field at Viking, about 80 miles south east of the city, supplemented by that at Kinsella farther east. The latter field was discovered in 1929, and was first connected by an extension of the pipe line in the fall of 1940. The duplicate 12-3/4" line from Viking to Edmonton was not completed for lack of pipe. During 1942 three wells were drilled at Kinsella, and at the close of the year six wells were producing and the field thus became the principal producer. Medicine Hat and the adjacent town of Redcliff are supplied from the Medicine Hat field, where one well was drilled. The Vermilion field became an important producer of natural gas in 1942, the quantity produced being about the same as that of the Fabyan field, which supplies Wainwright. The output from the Brooks and Foremost fields was obtained from several small producers.

In Saskatchewan, the eastern part of the Lloydminster field supplies the town of the same name. In the Kamsack area, two new wells were drilled, one well was deepened to 1,210 feet, and another from 1575 feet to 1753 feet. A total of 36 wells have been drilled in this field, mostly to depths around 200 feet, and they yield from 15M to 250M cubic feet at a closed-in pressure of 36 pounds. Much geophysical and geological work was done during 1942 and previously, principally in the area running diagonally from the southeast corner of the province in a north-westerly direction to about 50 miles north of Lloydminster, the purpose being the discovery of either gas or oil. Deep tests have, however, so far failed to disclose accumulations of gas in commercial quantities.

In Ontario, natural gas is produced commercially only in the south-western part of the Province, the principal fields being Tilbury, Haldimand, Dawn, De Clute, Brownsville, Dover, Norfolk, Welland, Onondaga, and Malahide.

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 Moncton and Hillsborough with natural gas. Two new wells were drilled and five were deepened, one of which was abandoned owing to mechanical difficulties, and another showed no increase. The total new production, measured in terms of initial flush production, amounted to 21,862 M cubic feet. The total production for the year was 619,221 M cubic feet, sales being 581,073 M cubic feet. A geophysical traverse was run across the field from well 47 to well 128, and continued to Albert Mine. The results show the desirability of further work of this nature.

Production:

The total production of natural gas in Canada during 1942 amounted to 42,719,100 M cubic feet valued at $12,201,510. The production by provinces was as follows:

	1942		1941	
	Amount M cu.ft.	Value $	Amount M cu.ft.	Value $
New Brunswick	610,000	298,900	653,542	317,437
Ontario	11,000,000	6,600,000	11,828,703	7,140,130
Saskatchewan	107,600	32,280	106,168	31,850
Alberta	31,000,000	5,270,000	30,905,440	5,175,364
Northwest Territories	1,500	330	1,500	335
	42,719,100	12,201,510	43,495,353	12,665,116

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943.

OIL SHALE IN 1942

Deposits and Producing Localities

Large deposits of oil shale are known to exist in different parts of Canada, the 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.

Developments

As a war project, the Mines and Geology Branch, Department of Mines and Resources, Ottawa, on the request of the Oil Controller, drilled some of the oil shale occurrences in New Brunswick with a view to the evaluation of them as a source of oil and lubricants under war conditions. In one of the projects, forty-three holes were drilled in oil shale deposits in the Rosevale area and in the vicinity of Taylor Village, New Brunswick, but the results were disappointing. Thirty-six holes were also drilled in deposits at Albert Mines, New Brunswick, and the results indicate that upwards of 20,000,000 tons of low-grade material is available, the average grade being estimated at 12 to 14 gallons a ton.

Prospective Producing Localities

The prospective producing locality is Albert county in New Brunswick.

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 were being developed in 1938 on a large scale. The production of these countries in 1938 (1939-42 not available) was: Scotland, 1,551,346 tons; Esthonia, 1,450,885 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.

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PEAT IN 1942

General Statement

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 1942 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 1942 were 210 tons valued at $1,370, compared with 355 tons valued at $2,155 in 1941. 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

Prior to the war peat moss from the bogs at Isle Verte, Riviere Ouelle, and Waterville, Quebec; at Grand Valley and Clinton, Ontario; near Melfort, Saskatchewan; at Edmonton West, Albérta; and near New Westminster and at Pitt Meadows, British Columbia, has been used as litter in beddings for animals; as soil conditioner for market gardens and horticulture; as filler for fertilizer, as insulating and sound proofing material in the building trade; and as packing material. The production of insulating moss comes chiefly from the bogs at Isle Verte and there is also a small production near Clinton. The fabrication plants at Isle Verte, Edmonton, and New Westminster produce materials known as "Sphagmoss", "Moss-tex", and "Westpeco". "Moss-tex" is also produced as insulating board and recently as pads used for shipment of vegetables, and "Westpeco" is produced in similar pads. Litter and agricultural moss is produced at Isle Verte, Riviere Ouelle, and at New Westminster, and fertilizer fillers are produced at Alfred, Scarboro Junction, Erieau, Brampton, and Grand Valley.

The requirements of peat moss in the United States were met prior to the war by importation from Europe and as these supplies are no longer available, a market has been opened for at least 72,000 tons of peat moss a year. This outlet is capable of expansion and provides a real opportunity for the Canadian producers to increase their sales. Advantage has been taken of this situation and Canada is becoming an important producer of peat moss. Several new plants went into production in 1941. Most of these are fairly large with two baling presses. In Quebec, a plant was erected at Riviere du Loup, and one at Isle Verte. In Ontario, the Alfred plant was enlarged, a plant was erected at Welland, and also a plant producing "Humar" (a mixture of marl and humus matter) was erected by Canadian Humus Products Ltd., in Beverly township, Wentworth county. In

British Columbia a plant was erected at New Westminster.

During 1942 the following new plants went into production: Fafard Peat Moss Company, Pokemouche bog, Shippigan, New Brunswick; Father Point peat bog, at Father Point, Quebec; Polar Bear Peat Moss Products Ltd., Pine River bog, Rainy River, and Arctic Peat Moss Corporation, Ltd., Crozier bog, Fort Frances, Ontario; Winnipeg Supply and Fuel Co. and McCabe Bros. Grain Company, both plants on the Shelley bog, Whitemouth; Lac du Bonnet bog near Lac du Bonnet Village, Manitoba, Industrial Peat Limited, and B. C. Peat Company, both on the Byrne bog, New Westminster, B.C. Of these, Industrial Peat Limited has erected a large plant, and is one of the largest producers of peat moss. The capacities of the other plants range from 1,000 to 200,000 bales of moss a year.

Development work has begun on several deposits throughout Canada, some of which have been acquired by established and by newly formed companies. Included in these are the large bogs at Shippigan, Gloucester county, New Brunswick; at Les Escumains, in Saguenay county; at Isle Coudres, in Charlevoix county, Quebec; and at Lac du Bonnet, Manitoba.

The production of peat moss in 1942 was 44,916 tons valued at $1,049,029, compared with 27,803 tons valued at $644,253 in 1941.

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

ISSUED BY THE BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, MARCH, 1943

PETROLEUM IN 1942.

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 well over 10,000,000 barrels, it is still far short of Canada's requirements.

About 97 per cent of the oil produced in Canada in 1942 came from the Turner Valley field of Alberta, where the Madison Limestone is the chief source formation, a very small amount being obtained from sands in the overlying Cretaceous rocks. The oil from the Madison Limestone is obtained from oil and gas wells, and to this is added the natural gasoline recovered in absorption plants from the gas from these wells.

Until June 1936, except for a few wells yielding a heavier product from near the lower margin of the gas-cap, production from Turner Valley was almost entirely obtained from gas wells in the form of "naphtha", an unstabilized natural gasoline. Since then, development has been almost entirely toward production from the liquid-phase zone of the limestone lying on the western flank of the gas-cap. The oil ranges in gravity from 38° just above the still deeper-lying water zone to 45° adjacent to the gas-cap.

Interest in Turner Valley during 1942 was centred chiefly in the north end of the field where an ambitious program of drilling was started towards the end of 1941 to prove its extension northwards as far as the Sarcee Indian Reserve. Twenty-nine wells were brought into steady production in Turner Valley. The distribution of developments along the 20 miles of the field now proved to be oil-bearing was somewhat as follows: In range 2 west of the 5th Meridian, in township 18, one well came into production, one was still drilling and drilling of one was resumed; in township 19, eight wells were brought into production; in Range 3 west of the 5th Meridian, in township 19, three wells entered production and one was still drilling; in township 20, three wells were brought into production, eight were still drilling, and one was abandoned owing to water; in township 21 fourteen wells were brought into production, nine were still drilling, three were suspended, and two were abandoned owing to depth; in Range 4 west of the 5th Meridian, in township 21 one well was drilling and two were abandoned; in township 22, one was suspended and seven were abandoned; in township 23, one was suspended and one abandoned. A total of 352,339 feet of drilling was done.

Thus, much of the drilling to extend the field northwards proved ineffective, the structure being more complex than was expected; and the limestone is deep-seated north of Whiskey Creek along the zone explored. Some narrowing of the productive gap in the centre of the field was achieved by wells in townships 19 and 20 near Sheep River, although in general this part is less productive. In a sense the gap is bridged by the former highly productive pool in the gas cap associated with Royalite 4.

It is a remarkable fact that of the 214 wells completed since the crude oil development began in 1936, and ignoring those unsuccessfully drilled in the attempt to extend the field northward, only 13 were completed as gas wells or had to be abandoned, and one was abandoned after productive life because of inability to cope with water. Water drive must be too slow in Turner Valley to play an important role in oil production; the recession of the upper limit of the liquid-phase zone consequent on production is noticeable, however, and occasionally as the gas/oil ratio of marginal wells rises above 30,000, such wells pass into the category of gas wells. Eight more wells were ready for reclassification at the end of the year, all in the older, southern area. With the experience gained in that area in conservation, the northern end should be saved from premature decline in oil production, due to condensation in the formation. Thus 192 of the 214 wells are still in production, to which should be added the two Model wells drilled earlier.

An important investigation was started in December, 1942, in an effort to inject gas into the more depleted part of the Turner Valley field. This took the form of returning gas from the Frontier and Sundance Wells, later to be supplemented by that from the Prairie Well, to Foundation Well. Successful repressuring of the limestone would greatly augment the ultimate recover of oil per acre.

During the year, the method of conservation in Turner Valley was changed for one devised by Prof. G.G. Brown of Michigan University under which the allowables of the wells are based on reservoir displacement at the rate of 25 barrels of reservoir fluid per acre per day. With this [redacted] and earlier efforts, the over-all gas/oil ratio of Turner Valley has steadily declined since July 1941.

In November, a deep test was started to explore the possibility of the Devonian limestone carrying oil in commercial quantity. It is located in the central part of the field in legal sub-division 2-25-19-3-5, and had reached a depth of 3,576 feet by the end of the year. It is being financed by 14 companies operating in the field. The Devonian limestone is believed to lie about 2,000 feet below the Madison in the more westerly part of the field, having been cut off by the 'sole fault' farther east. Should the Devonian limestone prove productive it will prolong the life of the Turner Valley field considerably.

Other parts of the Albertan Foothills received much drilling attention. A test outside Jasper Park at Solomon Creek had reached 4,774 feet at the close of the year; another at Jumping Pound, west of Calgary, was at 5,131 feet. Later in the year a well was located on a large structure west of Nanton in Sullivan Creek. Ram River Well No. 2 was completed at 4,340 feet, but had not been tested. The test on Forget-me-not Ridge, legal sub-division 8-17-22-6-5, reached 2,800 feet, and that in the Willow Creek area, legal sub-division 2-17-13-3-5, was at 840 feet.

Drilling was particularly active in the Plains of Alberta at Vermilion, where fifteen wells were completed and three abandoned. Better facilities were being planned for the dehydration of the oil, which forms an excellent fuel oil for the locomotives of the C. N. R., and the drilling of more wells was planned. Owing to difficulties in the disposal of the oil in the meantime it was not possible to test the production fully, but during the year 63,793 barrels was produced from 18 wells.

In the southern part of Alberta, a well drilled at Taber into the Madison Limestone and plugged to the overlying Sunburst Sand proved to be the largest producer in Alberta outside Turner Valley, its initial production being 330 barrels per day (18.3° API). In the last quarter of the year it produced 18,854 barrels.

An 80-barrel well (24° API) was completed at Tilley, southeast of Brooks early in April and produced 5,718 barrels. Other tests in the vicinity proved failures. In general the area in southeastern Alberta stretching from the Bow River northwards to Monitor, which was the scene of much drilling following geophysical and geological surveys, did not meet expectations. Structures were tested near Grantham, Monogram, Rolling Hills, Jenner, Oyen, and more to the west at Eyremore and Castor.

A new producer was drilled at Wainwright and a test was begun at Del Bonita.

In the Pouce Coupé district, a hole spudded in May had reached a depth of 2,129 feet. The test at Commotion Creek on the British Columbia side was abandoned at 6,940 feet.

In Saskatchewan, geophysical and geological exploration continued and deep tests followed. One, 6 miles west of Radville reached 7,958 feet, but was abandoned because of mechanical trouble. Another in southeastern Saskatchewan reached 3,344 feet and one at legal sub-division 2-30-26-2 was abandoned at 1,699 feet owing to drilling difficulties. The hole at legal sub-division 6-21-11-29-3, which had been standing for several years, was deepened from 2,690 to 3,253 feet in an attempt to reach the limestone, and one started near Muddy Lake had reached 400 feet.

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 Quebec, the deep test in the eastern part of Gaspé peninsula was abadoned at 4,770 feet.

In New Brunswick, geophysical work was done across the Stoney Creek field and extended to Albert Mines. One new well was drilled, having an initial production of 60 barrels a day; two old wells were shot.

In the Northwest Territories an important development in 1942 was the exploratory drilling undertaken at Norman Wells to meet the expanding requirements of the region. More than 20[redacted] holes were drilled; and the production of crude oil in 1942 exceeded 82,000 barrels, compared with 23,776 barrels in 1941. Most of the mining enterprises in the Northwest Territories used power generated by Diesel engines efore [redacted] 1939. In that year a refinery with a capacity of 840 barrels a day was built. It was brought into production in 1940 and produces aviation gasoline, motor gasoline, and light and heavy Diesel oil.

Production

Canada produced in 1942, 10,410,080 barrels of crude petroleum valued at $16,020,280, both figures being higher than in any past year, the output in 1941 being 10,133,838 barrels valued at $14,415,096.

Production by Provinces in 1941 and 1942 (1)

	1941 bbls.	1942 bbls.
New Brunswick	31,359	27,760
Ontario	160,238	150,000
Alberta	9,918,577	10,150,000
Northwest Territories	23,664	82,320
Totals	10,133,838	10,410,080

(1) Figures from the Dominion Bureau of Statistics. These are based on sales and hence do not exactly correspond with actual production.

Production in Alberta (2)

	1941 bbls.	1942 bbls.
Turner Valley		
Palaeozoic Limestone oil wells	9,504,111	9,668,263
Palaeozoic Limestone gas wells	27,096	27,650
Shallow oil wells (Creteceous)	6,014	5,806
Natural gasoline	293,122	302,216
Totals	9,830,343	10,003,935
Other Fields		
Del Bonita	4,393	1,653
Dina	2,894	2,780
Lloydminster	416	477
Princess	19,587	10,478
Red Coulee	11,626	10,107
Taber	5,600	29,819
Tilley	-	5,718
Vermilion	21,851	63,793
Wainwright	11,933	14,510
Totals	78,300	139,355
Crude oil produced McMurray	19,519	10,041
Totals for Alberta	9,928,162	10,153,311

(2) Information from Petroleum and Natural Gas Conservation Board, Alberta.

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