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CANADA

DEPARTMENT OF MINES AND RESOURCES

MINES AND GEOLOGY BRANCH

BUREAU OF MINES

THE CANADIAN MINERAL INDUSTRY IN 1944

Reviews by the Staff of the Bureau of Mines

Ottawa, 1945.

No.815

THE CANADIAN MINERAL INDUSTRY IN 1944

BUREAU OF MINES, MINES AND GEOLOGY BRANCH, DEPARTMENT OF MINES AND RESOURCES, OTTAWA

I. METALS:

Product	*Author*
Aluminium	Murray, G. H.
Antimony	Buisson, A.
Arsenic	Buisson, A.
Bismuth	Buisson, A.
Cadmium	Buisson, A.
Cerium	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	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	Spence, H. S.
Selenium	Buisson, A.
Silver	Buisson, A.
*Tantalite-Columbite	Spence, H. S.
Tellurium	Buisson, A.
Tin	Buisson, A.
Titanium	Buisson, A.
Tungsten	Eardley-Wilmot, V. L.
Zinc	Buisson, A.

II. INDUSTRIAL MINERALS:

Abrasives (Natural)	Eardley-Wilmot, V. L.
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.
Corundum	Eardley-Wilmot, V. L.
Diatomite	Eardley-Wilmot, V. L.
Feldspar	Spence, H. S.
Fluorspar	Spence, H. S.
Garnet (*see* Abrasives)	Eardley-Wilmot, V. L.
Granite	Buisson, A.
Graphite	Spence, H. S.
Grindstones (*see* Abrasives)	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.

II. INDUSTRIAL MINERALS *(cont'd)*:

Product	*Author*
Magnesite and Brucite	Goudge, M. F.
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.
Roofing Granules	Eardley-Wilmot, V. L.
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 (*see* Abrasives)	Eardley-Wilmot, V. L.
Whiting	Goudge, M. F.

III. FUELS:

Coal	Swartzman, E.
Coke	Burrough, E. J.
Natural Gas	Madgwick, T. G.
Oil Shale	Swinnerton, A. A.
Peat	Swinnerton, A. A.
Petroleum	Madgwick, T. G.

NOTE: The figures of production are as published by the Dominion Bureau of Statistics. The figures for 1944 are subject to revision.

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.

Asterisk (*) indicates review not issued for 1944.

Ottawa, July, 1945.

PREFACE

This is the first annual review of the Canadian mineral industry that the Bureau of Mines has issued in printed form since 1938, though mimeographed reviews were issued for each of the intervening years. Separate accounts are given of the more than seventy primary products credited to the industry in 1944, and, like the previous annual issues, that for 1944 gives the sources, localities, and quality and quantity of production of the various minerals. It deals also, with trade, prices, and other economic factors.

Since 1922, when the first annual review of the industry was issued by the Bureau, the list of minerals produced in Canada has steadily increased, until now, in a little over two decades, it is more than twice as long as it then was. In this interval, a number of metals and minerals have been added that were little used in Canada or elsewhere in 1922, for example, selenium, tellurium, bismuth, cadmium, indium, magnesium, bentonite and nepheline syenite. Canada has gained high-ranking world position in such important mineral products as gold, nickel, aluminium, asbestos, copper, zinc, lead, and platinum metals. The value of its mineral production rose from $184,300,000 in 1922 to $566,769,000 in 1942; in 1944 it declined to $485,924,000 under the influence of wartime scarcity of materials and manpower and of the government order limiting development work on new gold properties. Concurrent with this rise in production has been the increase in exports; in 1944, the total value of Canada's exports of aluminium, nickel, and copper was 10 per cent greater than that of the entire mineral output in 1922.

This great expansion of the Canadian mining industry and its significance in Canadian economy are not so well understood nor appreciated as they should be. The welfare of the industry should be of concern to all. Mineral resources are essential to the industrial expansion that contributes so largely to a country's prosperity in peacetime, and they are of exceptional importance in wartime. Canada is a leading producer of most of the principal metals and is an important producer of most of the non-metallic minerals, but its output of coal, crude petroleum, and iron ore is relatively small in comparison with domestic requirements. Imports of coal and petroleum, however, are obtained chiefly from nearby sources of supply in the United States, and imports of iron ore are obtained from that country and Newfoundland. Moreover, as a result of recent developments, the outlook for greatly increased domestic production of iron ore in 1945 and subsequent years is encouraging. As evidence of the importance of the mineral industry to Canadian economy, it may be noted that exports of mineral origin increased from a total value of $287,000,000 in 1939 to $1,138,000,000 in 1943, the figures for the latter year being higher than the value of exports originating from any other primary industry.

The Bureau of Mines is indebted to all those who contributed data for the reviews, particularly operators of mines and officers of the Dominion Bureau of Statistics.

OTTAWA, CANADA, JULY, 1945.

37709—71

ALUMINIUM [1]

The production of aluminium stands out as one of the greatest achievements of Canadian industry during the present war. A few years prior to the war Canada's annual output of primary aluminium was less than 27,000 metric tons. In 1939 the output increased to 70,000 metric tons, and in 1942 to 309,000 metric tons. By then, Canada was supplying approximately 40 per cent of all the aluminium used by the United Nations. The output reached a peak of 449,700 metric tons in 1943, which compares with a peak of only 10,900 metric tons in the first world war. In 1944 the output amounted to 418,045 metric tons. Aluminum Company of Canada, the only Canadian producer of aluminium, imports all of the ore (bauxite), the chief source of supply being deposits in British Guiana, South America. Though Canada has no bauxite it has an abundance of cheap electrical energy, a major requirement in the production of aluminium.

This expansion in the production of the metal involved the carrying out of a large-scale power development project on the Saguenay River; the development of new sources of supply of bauxite in British Guiana, and of fluorspar deposits in Newfoundland; the opening of a large, new transfer station in Trinidad to ensure the undelayed movement of bauxite to smelters in Canada; the construction of new, and the expansion of old smelters in various parts of Quebec; and the building of extensive new fabricating facilities for the manufacture of sheet, tubing, castings, and other products for use in airplane engines and bodies.

One of the first steps in the expansion program was the enlargement of the company's smelting facilities in Arvida, and Shawinigan Falls, Quebec. Some expansion had already taken place at Arvida in 1937 by the addition of two new pot lines. This had stepped-up production from 200,000 pounds of aluminium to 340,000 pounds a day. After Canada's entry into the war, however, expansion was rapid and construction was continued on a large scale until early in 1944. By that time, 25 pot lines were in operation, and production in Arvida had increased to 2,000,000 pounds of aluminium a day. This production, which was well over twice as much as the next largest smelter on the American Continent, absorbed all the power available on the Saguenay, and thus additional smelting facilities had to be provided in other localities. Four new pot lines were built at Shawinigan Falls, resulting in an increase of production there from 100,000 pounds of aluminium a day to 450,000 pounds. Two were built also at La Tuque and two at Beauharnois, both in Quebec.

Expansion of the company's fabricating facilities kept pace with the smelter expansion. During the early months of the war the fabricating plant in Toronto was used chiefly for the production of permanent mould, and sand and die castings. At the same time, a modern foundry was constructed at Etobicoke, a few miles from Toronto, and shortly afterwards nearly all the permanent mould castings and all the sand castings were being made in the Etobicoke plant. Most of these castings are designed for aircraft and are precision castings. Die castings, including fuse caps and bomb-release mechanisms, continued to be made in Toronto. The plant also turned out considerable strong aluminium alloy until the construction of the fabricating plant at Kingston made this unnecessary.

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1 This is the only review on Canada's aluminium industry that has been issued by the Department of Mines and Resources since the commencement of the war. Accordingly, it is mainly a review of the principal developments in the industry from 1939 to the end of May, 1945. The review was prepared from information supplied by the Office of the Metals Controller for Canada.

Production of foil was at first curtailed except for special condenser foil for military communication equipment. Later, production was greatly expanded to provide for detection bombs used in signalling surface ships. The reflectivity of the foil made it a highly suitable material for this use. In due course, thousands of pieces of "window type" foil were dropped from bombers as they flew across Germany. These strips floated for hours in the air and jammed radio-locating devices for miles around.

Aluminum Goods, Limited (subsidiary of Aluminum Company of Canada, Limited) which had been producing aluminium cooking utensils, turned its facilities to the production of aluminium gas tanks, steel smoke bombs, helmets, and other necessities of war. Further production expansion in this company's plant was impossible, and by arrangement with the Dominion Government a separate munitions division was started in an unused plant in Lambton, near Toronto.

The erection of the huge new plant at Kingston, however, was the most important expansion of the fabricating facilities. This plant is in reality two separate modern plants. One of these houses a sheet mill in which pure aluminium or high-strength alloys are rolled, and a tubing mill and extrusion plant used to turn out aircraft material. In the other plant, aluminium forgings are made. During the war this plant has turned out thousands of aircraft propellers and many hundreds of thousands of pounds of forgings for aircraft. In Kingston, Aluminum Company also has a modern laboratory where scientists of Aluminium Laboratories, Limited, a subsidiary organization, carry on research in many fields.

About 4 tons of bauxite are required to make one ton of aluminium, and although the company's bauxite mines at Mackenzie in British Guiana were being worked to capacity, more ore was needed. This led to the opening of new deposits farther up the Demarara River. To handle the increased flow of bauxite, additional facilities were required at Mackenzie, and a new powerhouse, a crushing and washing plant, three new dryers, and a machine shop were built.

Prior to the war, the fluorspar required for the production of aluminium was obtained from Europe, the United States, Mexico, and Newfoundland. Supplies from Europe were cut off early in the war, and the United States needed its own production. Accordingly, Aluminum Company proceeded with the development of further deposits in Newfoundland. Within a year all the required construction was completed and Newfoundland was supplying all the fluorspar needed to keep the aluminium smelters in full operation.

Production; Trade; Uses

Production of primary aluminium by years is given in the introductory paragraph. Aluminum Company's five smelters have a total daily capacity of 3,000,000 pounds of aluminium. The smelters at La Tuque and Beauharnois have been closed, however, and production at the others has been curtailed. During the peak years the average monthly production (short tons) of the fabricating plants was as follows:

Kingston	*Tons*
Forgings	250 to 500
Tubing	100
Extrusions	375 to 500
Sheet	500 to 750
Magnesium forgings	1

	Tons
Toronto	
Sheet	250
Foil	37 to 50
Die castings	25 to 30
Permanent mould castings	50 to 60
Magnesium castings	2½ to 5
Magnesium sheet	1

	Tons
Etobicoke	
Sand castings	40
Permanent mould castings	15 to 25

	Tons
Shawinigan Falls	
Wire, rod, bars, and cable	375

Canada's exports of aluminium in recent years are given below.

Year	*Exports** *(Short tons)*
1940	86,536
1941	192,757
1942	314,483
1943	375,383
1944	298,350
Total	1,267,509

*Figures do not include aluminium scrap.

During the five years ended December 31, 1944, only 6 per cent of the Canadian production was used within the country. The United Kingdom purchased approximately 55 per cent of the output; the United States, 32 per cent; Russia, 4.3 per cent; and Australia, 1.2 per cent. The remainder was exported to the other United Nations.

The principal war use of Canadian-produced aluminium has been in the making of aircraft. For example, at least 17,000 pounds of aluminium is used in the construction of a Lancaster bomber. Aluminium foil is used extensively in anti-Radar equipment, and aluminium powder is used in explosives. Early in the war, restrictions were placed on the civilian uses of aluminium, and later all civilian uses were prohibited. The restrictions were removed about a year ago, but were applied again recently on orders for aluminium foil. In peacetime, aluminium is used chiefly in the manufacture of wire and cable for high-power transmission lines, in the manufacture of cooking utensils, in the automotive industry, and for architectural purposes.

PREPARED BY G. H. MURRAY,
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OTTAWA, CANADA, JULY, 1945.

ANTIMONY IN 1944

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 antimony ore were produced intermittently in Yukon, British Columbia, Quebec, New Brunswick, and Nova Scotia, and there was also a small intermittent production of refined antimony in New Brunswick and Nova Scotia. The Canadian output of antimony for the first half of 1944 was derived mainly from the treatment of the antimonial residue produced as a by-product of silver refining at Trail, British Columbia. This plant closed down in the summer of 1944 for an indefinite period.

Production and Trade

Canadian production in 1944 was 969 short tons valued at $280,996, compared with 557 short tons valued at $189,408 in 1943. The imports of antimony in 1944 were: antimony metal or regulus, 1,558,198 pounds valued at $237,334; and antimony salts, 68,765 pounds valued at $26,749. The imports in 1943 were: antimony metal or regulus, 240,700 pounds valued at $38,755; and antimony salts, 10,990 pounds valued at $6,066. The imports of antimony oxide are not given separately.

The world production of antimony at present is probably in excess of 50,000 tons a year.

Prior to the war most of the production of antimony came form China, although Bolivia and Mexico were also important producers. Since 1938 there has been a marked increase in output from Bolivia, Mexico, and Yugoslavia, and, to a lesser extent, 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. Prior to the war most of the refined antimony was produced in the United States, Great Britain, France, and Belgium, from ores of foreign origin.

Canada's requirements has been supplied mainly from the plant at Trail, where the production of high-grade electrolytic antimony was commenced in 1938. Operations were carried on intermittently in accordance with the demand for antimony. 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 a 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. 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.

Uses and Prices

Antimony is an important war metal. It is used largely in alloys for storage-battery plates, bearing and babbitt metals, and solder, and it is also used in the manufacture of rubber goods, paints, and fixtures. The greatest single gain in use in 1944 was of antimony oxide in the flameproofing of textiles, principally duck for military purposes. The use of antimony in the manufacture of chemicals increased considerably during the past two years. The principal compound is the oxide of antimony, which is employed extensively as a pigment in sanitary enamelware and in nitrocellulose enamels. Demand for antimony in the post-war years will possibly exceed that of the pre-war level partly because of the large requirements for storage batteries and other metal products and partly because of the new applications developed during the war.

Prices in Canada for imported antimony metal of a purity of 99·6 per cent or higher (grade R.M.M.) as set in August 1944 by the Wartime Prices and Trade Board (Order No. A-1315) were as follows:—

Quantity lbs.	Montreal cents per lb.	Toronto cents per lb.
10,000 and over	17·90	17·60
10,000 - 2,000	18·65	18·35
2,000 - 1,000	20·65	20·35
Less than 1,000	21·15	20·85

Chinese grade with a purity of not less than 99·0 per cent:—

Quantity lbs.	Montreal and Toronto cents per lb.
10,000 and over	18·00
10,000 - 2,000	18·75
2,000 - 1,000	20·75
Less than 1,000	21·25

The New York price of antimony metal (ordinary brand) in 1944 remained fixed at 15·84 cents per pound throughout the year. The price for Chinese brand, duty paid, remained at 16·5 cents. The price of antimony ore, c.i.f. New York in 1944 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, $2.15 to $2.20; and for 60 to 65 per cent Sb, $2.20 to $2.30.

Tariff

The United States tariff on antimony is: antimony as regulus or metal, 2 cents per pound; needle or liquated antimony, ¼ cent per pound.

PREPARED BY A. BUISSON,
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OTTAWA, CANADA, MARCH, 1945.

1944 2999
43 3309

ARSENIC IN 1944

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, arsenie is obtained as a by-product of the treatment of the silver-cobalt-arsenic ores of northern Ontario, and, to a lesser extent, of the gold arsenical ores of the Beattie and O'Brien mines in Quebec. At these two properties, baghouses to extract crude arsenic from the fumes of roasting plants used in the recovery of gold from arsenical concentrate have been in operation for several years.

Production and Trade

The Canadian production of arsenic in 1944 was 2,627,022 pounds valued at $180,866, compared with 3,153,538 pounds valued at $254,009 in 1943. Exports of arsenic in 1944 were 5,997,500 pounds valued at $306,891, compared with 6,617,100 pounds valued at $353,484 in 1943. Imports in 1944 were: arsenious oxide 2,405 pounds valued at $1,749, and other compounds of arsenic 86,475 pounds valued at $24,488. The imports in 1943 were: arsenious oxide 400 pounds valued at $124; and other compounds of arsenic 97,425 pounds valued at $19,861.

The world production is estimated by the U.S. Bureau of Mines to be in excess of 80,000 tons a year. 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.

In Quebec, Beattie Gold Mines, Limited operated its roasting unit and baghouse for the recovery of crude arsenic from its arsenical concentrate. It also operated a small refinery for treatment of its crude arsenic. Operations ceased in the autumn of 1944 with the temporary closing of the 1800-ton mill. The plant at the O'Brien Gold Mines, Limited, consisting of a roasting unit and baghouse, was in continuous operation in 1944. The crude arsenic produced at the O'Brien plant is refined at the Deloro smelter.

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. The gold ores of Little Long Lac, Hardrock, and MacLeod-Cockshutt in Little Long Lac area, Thunder Bay district, Ontario, contain arsenic, but no attempt is being made to recover the product.

In Saskatchewan, the Douglas Lake mine was taken over in 1943 by Newcor Mining and Refining Company, which has under construction a small smelter for treating the gold arsenical ores of this property. Bralorne, Hedley, and other mines in British Columbia export arsenical gold concentrates to the United States.

Most of 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 from the O'Brien mine in western Quebec. A small quantity of refined arsenic was produced by Beattie Gold Mines, Limited.

Market, Uses, 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 decolorizer, 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).

The New York price remained fixed at 4 cents a pound. The Canadian price of white arsenic, as given by Canadian Chemistry and Process Industries, remained at 5½ to 6 cents a pound for the third consecutive year. As most of the white arsenic 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 a sustained increase in price.

PREPARED BY A. BUISSON,
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OTTAWA, CANADA, MARCH, 1945.

BISMUTH IN 1944

Refined bismuth is obtained in Canada mainly as a by-product from the treatment of the lead-zinc ores of British Columbia and partly as a by-product from the treatment of the silver-cobalt ores of northern Ontario. Most of the world's supply is obtained from the treatment of lead and copper refinery slimes and as a by-product of the mining of gold, tin, and tungsten ores.

Production and Trade

Canadian production of bismuth in 1944 was 123,875 pounds valued at $154,844, compared with 407,597 pounds valued at $562,484 in 1943. No separate records of exports of bismuth or bismuth salts are available. The only imports in 1944 were bismuth salts valued at $2,667, compared with $15,675 in 1943.

In British Columbia, Consolidated Mining and Smelting Company's plant for the electrolytic treatment of bismuth residue resulting from the electrolytic treatment of lead bullion has been operated intermittently since 1928, when it was erected. 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 cobalt-silver ores of Cobalt and adjoining areas. This bullion is exported to the United States for refining.

Statistics of the world production of bismuth are incomplete, but the present output is estimated at about 1,800 tons a year. The United States, Peru, Canada, and Mexico supply about 90 per cent of the world output. For more than half a century Bolivia was the principal source, but in recent years its production has decreased considerably.

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. The Cerro de Pasco Copper Corporation imports into the United States large quantities of bismuth and bismuth-lead alloy, mainly from Peru, and is the largest supplier of bismuth alloys.

The following are the principal producers of bismuth in the United States:—

Operators	Location
American Smelting and Refining Co.	Omaha, Nebraska
International Smelting and Refining Co.	E. Chicago, Indiana
United States Smelting, Refining and Mining Co.	E. Chicago, Indiana
Bunker Hill and Sullivan Mining and Concentrating Co.	Kellogg, Idaho.

Market and Prices

The demand for bismuth has increased considerably during the war owing to its increased use for metallurgical and pharmaceutical purposes. 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. Alloys containing bismuth are used to a greater extent than formerly in the aircraft, machine tool, munitions, and other industries. Additions of 0·1 to 1·5 per cent bismuth to stainless steel, copper and aluminium alloys improve machinability. There are numerous alloys of bismuth containing from 33 to 56 per cent bismuth.

The price of bismuth in 1944 (London price in Canadian funds) remained at $1.38 a pound. The price at New York remained fixed at $1.25 a pound throughout 1944. The American product is protected by a duty of 7½ per cent ad valorem.

PREPARED BY A. BUISSON,
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DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, CANADA, MARCH, 1945.

CADMIUM IN 1944

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 Trail, British Columbia, and by Hudson Bay Mining and Smelting Company at Flin Flon, Manitoba. The plant at Trail started to produce early in 1928 and like the plant at Flin Flon, 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.

Production and Trade

Canadian production of cadmium in 1944 was 526,970 pounds valued at $579,677, compared with 786,611 pounds valued at $904,602 in 1943. The exports of cadmium in 1944 were 383,324 pounds valued at $412,332, compared with 572,215 pounds valued at $626,379 in 1943.

The world production in 1944 is estimated at 5,500 short tons, the production in 1938, the latest year for which complete figures are available, being 4,200 short tons. The chief Allied producing countries are: the United States, Canada, Mexico, Belgium, Australia (Tasmania), Poland, Norway, England, Russia, and France. The Mexican output is contained in ores exported for treatment mainly to the United States.

Cadmium 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.

Uses 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 motor vehicle bearings and for solders has created a strong demand for the metal. Cadmium is used also in the arts, paints, ceramics, and dyeing, etc. In the United States, the consumption of cadmium is distributed approximately as follows: electroplating, 87 per cent; alloys and solders, 7·5 per cent; pigments and chemicals, 5·5 per cent. Cadmium 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.

Cadmium sulphide and cadmium sulphoselenide are standard agents for imparting bright resistant yellow and red colours respectively to paints, ceramics, inks, rubber, leather, and other products. Paper coated with cadmium sulphide acts as a mustard-gas detector. Cadmium nitrate is used in white fluorescent lamp coatings. The oxide, hydrate, and chloride are used in electroplating solution; the carbonate in ceramics; and the halides in photography.

The price of cadmium in 1944 (in Canadian funds) averaged $1.10 a pound, compared with $1.15 in 1943. The price of metallic cadmium, f.o.b. New York, in commercial sticks remained at 90 cents a pound throughout 1942, 1943, and 1944. 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.

PREPARED BY A. BUISSON,
BUREAU OF MINES,
DEPARTMENT OF MINES AND RESOURCES,
OTTAWA, CANADA, MARCH, 1945.

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CERIUM IN 1944

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 chief commercial sources of monazite sand are beach deposits in Brazil and India. There are a few occurrences of monazite in Nova Scotia, Quebec, and British Columbia, none of which is of commercial interest. It is usually found as small crystals in granites and pegmatites in the Canadian Shield and small quantities occur in association with the black sands of the Quesnel River, Lillooet district, British Columbia. In the United States there are commercial deposits in Carolina, Florida, and Idaho, and known occurrences in many other States.

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

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

Prior to the war the leading producers of rare-earth products for the European market were located in Berlin, London, and Paris, and those for the American market, in Chicago. In the United States the present supply of cerium products is provided by Cerium Metals Corporation, Niagara Falls, N.Y.

World production of monazite is approximately 5,000 tons a year.

Uses and Prices

Thoria, which was used in gas mantles, was formerly the only commercial constituent of monazite, and monazite is still marketed on the basis of its thoria content, although its content of ceria (Ce_2O_3) and of other rare-earth oxides is of chief interest at present. 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 (sparking) alloys or in ferroceriums for use in sparking flints for lighters. The remainder is used for a variety of purposes, but principally for making optical glassware. Cerium metal is used in the evacuation of radio tubes.

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 1944. No quotations are published for most of the rare-earth products, although prices for small lots may be obtained on request from mineral dealers and chemical manufacturers.

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CHROMITE IN 1944

The improvement in the Allied supply situation, which started in 1943, continued to such an extent in 1944 that the government-operated Chromeraine mine at Black Lake, Quebec, was closed in August. At the end of the year the only shippers were Chromite, Limited, near Richmond, Quebec, and Orel Paré, operating the 'Montreal' pit in the Black Lake district for Union Carbide Company. Chromite, Limited discontinued operations in the spring of 1945.

Pure chromite (FeO, Cr_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.

Sources of Production; Occurrences

Most of the deposits from which production has been obtained are between Quebec City and Sherbrooke in the Eastern Townships of Quebec.

Chromite, Limited obtained its output from the old Sterrett mine in Cleveland township. The chromite in the mine occurs as fairly uniformly disseminated zones, scattered through which are plums of the massive mineral. The ore zone has been traced on the surface for about 1,700 feet and varies in width from 5 to 20 feet. The mine has been developed at 5 levels to a depth of 500 feet.

The ore in the Chromeraine mine is chiefly low-grade, banded and disseminated chromite with a small amount of the massive mineral. The zone has been traced intermittently for 2,000 feet, has an average width of 30 feet, and in places is 60 feet wide. A small amount of diamond drilling has indicated that the ore extends to a depth of at least 440 feet. The ore was extracted by caving methods to a depth of 375 feet.

In Manitoba little prospecting was done on the large bodies of low-grade chromite deposits that were discovered early in 1942 north of Oiseau (Bird) River in the southeastern part of the province. Various zones have been traced for lengths of several thousand feet. The ore is high in iron and an economical method of bringing the chrome-iron ratio to within market requirements has not been devised.

Production and Trade

Shipments (mainly Cr_2O_3 concentrates) amounted to 27,054 tons valued at $748,494, as compared with 29,595 tons valued at $919,878 in 1943, the record year. From 1886 when records were first kept, until the end of 1944, Canada produced 244,000 tons of chromite, all except about 5,000 tons of which 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, and in the present war to the end of 1944 about 71,500 tons had been produced.

Canadian production of ferrochrome and other chrome addition agents was about 18,550 tons (70 per cent of which was exported), a decrease of 56 per cent compared with 1943.

Canadian consumption in 1944 was 46,517 tons of ore and concentrate, a decrease of 64 per cent compared with 1943.

About 78 per cent of the total imports of 41,520 tons valued at $643,560 came from Southern Rhodesia and Transvaal, and nearly all the rest from India. All of the exports, which amounted to 18,868 tons, were to the United States.

Production was started in the 100-ton mill of Chromite, Limited early in 1942 and its capacity was increased to 150 tons late that year. In 1944 about 37,000 tons of ore averaging 15 per cent Cr_2O_3 was treated, mostly from between the second and fifth levels south of the shaft. Over 12,000 tons of concentrate containing 48 per cent Cr_2O_3 was shipped to the United States. The development loan received from the Dominion Government in September, 1942, was all repaid by September, 1944, after which the mine was taken over by Basin Montana Tunnel Company, which had originally financed the operations. The contract for shipments to the United States Metals Reserve Company was not renewed and the mine was closed in the spring of 1945. Total shipments of concentrates and high-grade crude ore since the outbreak of the war were nearly 36,000 tons.

Wartime Metals Corporation operated the old Reed-Belanger deposits (Chromeraine project) 2 miles southwest of Black Lake. Production in the 600-ton mill was started in May, 1943, and in that year 77,500 tons of ore averaging about 8 per cent Cr_2O_3 was treated, in addition to which about 750 tons of custom ore averaging 18 per cent Cr_2O_3 was treated. In 1944, until operations ceased near the end of August, 87,500 tons was milled. No custom ore was received in 1944, but 2,400 tons of such ore that was received in 1943 was treated. About 11,000 tons of concentrate averaging 47 per cent Cr_2O_3 was shipped in 1944, compared with about 8,000 tons in 1943.

Orel Paré shipped about 4,000 tons of high-grade crude ore direct to a Canadian consumer from Union Carbide Company's 'Montreal' pit, 5 miles southeast of the Chromeraine project. The old workings were reopened in the fall of 1941 and since then regular monthly shipments have been maintained. The deposit was first opened 50 years ago, and 20,000 tons was shipped from it during the last war. From the fall of 1941 to the end of 1944 a total of about 14,000 tons of ore was shipped. About 500 tons of high-grade crude ore was shipped by Chrome Association, Limited from the old Greenshields mine, and three car lots were shipped by LaBonte and Metevier from the Hall mine, both in Coleraine township.

In the United States the output of the 80 producers in 1944 amounted to about 40,000 tons, compared with a peak output of 160,000 tons from 175 producers in 1943.

The world annual production of chromite just prior to the present war was about 1,300,000 tons. Russia, Turkey, Southern Rhodesia, and the Union of South Africa were each producing 200,000 tons or more a year, and the Phillippines, Cuba, New Caledonia, Yugoslavia, Greece, and India 50,000 tons or more each. Turkey is one of the most important sources of high-grade chromite.

Uses and Specifications

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 in other essential war materials. Large quantities of chromite, with certain specifications as to physical and chemical properties, are used in the making of refractories. Chromite is the source of such chemicals as sodium and potassium chromates.

Chromium Mining and Smelting Corporation, Sault Ste. Marie, Ontario, produces an addition agent known as Chrom-X.

Metallurgical chromite should contain a minimum of 48 per cent Cr_2O_3 and a chrome-iron ratio of not less than 3 to 1. 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 and in some instances they are briquetted before use. The low iron content of the ore or concentrate is of the utmost importance.

Specifications for refractory ore suitable for bricks depend upon the kind of brick to be made. The silica should be as low as possible. The chromite should 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). Canadian production of high-carbon ferro was suspended early in the year.

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".

United States prices of domestic and imported ores of 48 per cent Cr_2O_3 and 3 to 1 ratio are $43.50; ores of lower grade and ratio vary down to a minimum of $28 a long, dry ton at seaboard. Canadian prices of 47 to 48 per cent Cr_2O_3 concentrates are $25 to $40 a long ton, f.o.b. mines, depending upon the Cr-Fe ratio and percentage of certain impurities.

Reference

"Chromite Deposits of the Eastern Townships, Quebec", paper by C. H. Stockwell, Canadian Geological Survey, Canadian Mining and Metallurgical Bulletin, February, 1944, pages 71 to 86.

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COBALT IN 1944

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 area has been maintained in recent years by lessees working over old surface dumps and mining narrow surface veins and old underground workings. Cobalt ore has also been 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 has been no production from that province.

Production and Trade

Canadian production of cobalt in 1944 was 36,283 pounds valued at $34,106 compared with 175,961 pounds valued at $191,407 in 1943.

Imports of cobalt ore in 1944 were 1,838 tons valued at $1,327,775, compared with 1,118 tons valued at $785,721 in 1943. Imports of cobalt oxide were 1,720 pounds valued at $2,595, compared with 55 pounds valued at $130 in 1943.

The exports were as follows:

	1943		1944	
	Pounds	Value	Pounds	Value
Cobalt contained in ore	163,100	$ 188,510	25,900	$ 24,379
Cobalt, metallic	911,107	1,507,635	1,009,068	1,665,984
Cobalt alloys	214,202	1,021,663	176,589	789,202
Cobalt oxides and salts	67,040	135,630	462,656	829,469
Totals		2,853,438		3,309,034

The total annual world output is estimated to approximate 6,000 metric tons. The greater part of the Allied requirements is 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.

Silanco Mining and Smelting Company, which in August, 1943, took over the holdings of Cobalt Products, Limited at Cobalt, operated intermittently. The ore comes from various surface dumps and also from the underground workings of a few properties. The flotation concentrate, which contains from 8 to 12 per cent of cobalt, was sold directly to Deloro Smelting and Refining Company, Limited, Deloro, Ontario, agent for the United States Metals Reserve Company, until the end of February, 1944, and since then a few carloads have been shipped to Sheppard Chemical Company, Cincinnati, Ohio. The only custom mill in Cobalt is the old O'Brien 100-ton mill. owned and operated by C. V. J. O'Shaughnessy. The mill remained idle in 1944 owing to unfavourable market conditions. The Timiskaming Testing Laboratories at Cobalt are a great help to many small lessees in the Cobalt camp and adjoining areas who depend on the plant for the sampling, valuation, and frequently for the marketing of their ores.

The cobalt property at Werner Lake, 40 miles north of Minaki, Kenora district, owned by Kenora Prospectors and Miners, Limited, was idle throughout 1944.

A detailed investigation was made recently, by the University of British Columbia, of deposits of cobalt ore which have been known for years to exist on Nickel Plate Mountain and at the Little Gem mine. The conclusion was reached that from 50 to 100 tons of cobalt oxide could be produced for many years from ores of Nickel Plate Mountain as a by-product of their present operation. This could be done on an economic basis at present prices. An average concentrate from the Kelowna Exploration Company's mill averaged 0·88 per cent cobalt.

Deloro Smelting and Refining Company, Limited has the only plant in Canada that treats ores for the recovery of cobalt. The plant 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. The Canadian production of cobalt ore in 1943 was purchased by the company as agent for Metals Reserve Company and was stockpiled for this account. This arrangement was terminated in December, 1943.

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, Canonsburg, Pennsylvania, and Cleveland, Ohio.

Uses 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 increase 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 electroplating and as a catalyst. Cobalt oxide is used mainly in the ceramic industry owing to its fine colouring properties. Other compounds of cobalt are used as driers in paints and varnishes.

Consumption of cobalt, in the form of cobalt metal, oxide, salts, and driers, has increased substantially during the past three years.

The market for cobalt is uncertain at present and will remain so until the Metals Reserve Company in Washington decides on what is to be done with the surplus stocks that have been built up.

The price of cobalt has remained fairly steady in recent years. The nominal New York price for cobalt metal in 550-pound barrel remained at $1.50 a pound and for black oxide in 350-pound lots, at $1.85 a pound, throughout the year. The nominal price for cobalt ore, 10 per cent grade, f.o.b. cars, Ontario, remained at $1.10 a pound of cobalt.

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COPPER IN 1944

Canada is a leading producer and exporter of copper, and about 93 per cent of its total output is refined within the country. It has two copper refineries, one in Copper Cliff, Ontario, owned by International Nickel Company of Canada, Limited, which is the largest in the British Empire, and the other in Montreal East, owned by Noranda Mines, Limited. From the commencement of the war until the end of April, 1945, Canada produced a total of approximately 1,712,000 tons of copper, much the greater part of which was exported to the United Kingdom for war use. The Canadian output of copper is obtained chiefly from the copper-nickel ores of the Sudbury area in Ontario, the other principal sources of supply being the copper-gold, copper-zinc, and copper-pyrites ores of western Quebec; the copper-zinc ores of the Flin Flon and Sherridon areas of northern Manitoba; and the copper ores of British Columbia. Most of the copper ores mined in Canada occur in association with or contain important quantities of one or more of the other metals, chiefly gold, silver, nickel, and zinc.

Principal Sources of Supply: Exploratory Developments

The copper-nickel deposits of International Nickel Company in the Sudbury area have long been the chief source of supply of Canadian produced copper, the second largest source being the ore-bodies of Noranda Mines, Limited, Noranda, Quebec, and the third largest, the deposits of Hudson Bay Mining and Smelting Company that straddle the Manitoba-Saskatchewan boundary in the Flin Flon area. The remainder of the output is obtained mostly from the Normetal and Waite Amulet mines in western Quebec, the Sherritt Gordon mine in Manitoba, and the Britannia and Granby mines in British Columbia. The Aldermac copper mine in western Quebec was closed down in October, 1943, but in August, 1944 the company began to export a copper-lead concentrate from its property in the Eastern Townships of Quebec.

In Quebec, Noranda Mines, Limited, in the exploration of its lower (3,000-foot to 5,975-foot) levels by diamond drilling, outlined an ore-body 400 feet long by 70 feet wide averaging 0·124 ounce of gold a ton, and 0·84 per cent copper. Three diamond drill holes spaced 100 feet apart along the strike on the 5,975-foot or bottom level have proved the extension of the ore-body to approximately 500 feet below the level, the average grade being 0·16 ounce of gold a ton and 0·92 per cent copper. Exploration of this ore-body at greater depths will have to be deferred until a shaft has been sunk below the 5,975-foot level.

Owing to shortage of labour throughout the year, underground development at the Normetal mine, more particularly lateral work, was seriously curtailed. No. 3 shaft was deepened 450 feet down to the 3,200-foot level. From that elevation downward an internal shaft will probably be necessary.

Aldermac Copper Corporation, Limited, continued exploration and development work on its property at Moulton Hill, Ascot township, 4 miles from Sherbrooke.

In Ontario, International Nickel Company completed the No. 6 shaft at its Creighton mine in October, and throughout 1944 the company continued its lateral development work from the shaft. It commenced the preliminary work on extending the depth of the No. 2 shaft of its Garson mine, and in November the sinking of No. 7 shaft at its Stobie mine was completed. Development work at its Murray mine was carried on at a reduced rate in the last half of the year owing to the need for labour at the company's producing mines. During the summer of 1944 the company started work on the provision of a new mill tailings disposal area.

At the Falconbridge mine of Falconbridge Nickel Mines, Limited, extensive exploration and development was continued, and ore-zone development was commenced on the 2,625-foot and the 2,800-foot (bottom) levels off No. 5 shaft. Sinking of No. 1 shaft below the 2,100-foot level was started in February and at the end of 1944 the shaft had reached a point 2,691 feet below the collar. Three new stations had been cut at levels of 2,275, 2,450, and 2,625 feet.

Nickel Offsets, Limited, with a property in Foy township, west of Capreol, Sudbury district, continued the exploration and development work which had been started in 1939. Sinking of No. 2 shaft was discontinued in September at a depth of 188 feet, owing to the shortage of labour. No. 1 shaft is to be further deepened to 1,580 feet in 1945. Diamond drilling in 1944 amounted to 1,800 feet.

Dominion Nickel Mining Corporation continued the diamond drilling of its Whistle property in Norman township, Sudbury area, and further prospecting and drilling of the property is planned. Diamond drilling of the company's Tough claim down to 200 feet has disclosed a deposit containing 600,000 tons of 3 per cent nickel ore. North Range Nickel Mines, Limited plans to do extensive diamond drilling on a property adjoining the holdings of Nickel Offsets.

Shewan Copper Mining Corporation did further surface work on its nickel-copper claims on the north shore of Upper Shebandowan Lake in the Port Arthur mining division.

In Manitoba, Hudson Bay Mining and Smelting Company completed the sinking of its south main shaft to the new 3,250-foot level and did some lateral development work on that level. It deepened the winze at the north end of the mine to a depth of 137 feet below the 2,750-foot level. Diamond drilling by the company during the year totalled 41,300 feet.

Sherritt Gordon Mines, Limited suspended its development work during the summer months owing to the labour shortage. It did considerable diamond drilling, mostly in the eastern section of the property.

Diamond drilling by Cuprus Mines, Limited (subsidiary of Hudson Bay Mining and Smelting Company), mostly done in 1942, and a detailed geophysical survey made in 1943, indicated a mineralized zone 3,000 feet long containing a few lenticular copper-zinc deposits of good grade on the Thompson property near Schist Lake. It is expected that the surface plant for the sinking of a 600-foot exploratory shaft will be constructed during the summer of 1945, and that sinking of the shaft will be started.

In British Columbia, Britannia Mining and Smelting Company further curtailed exploratory and development work in its mines at Britannia Beach, and in its annual report the company states that the outlook for a satisfactory operation in 1945 is not good. Development work at the Copper Mountain property of Granby Consolidated Mining, Smelting, and Power Company was also curtailed owing to a shortage of labour. It consisted of exploratory drifting and raising.

In the Northwest Territories, American Metal Company of Canada, Limited (subsidiary of American Metal Company, Limited) had four prospecting parties and three diamond drills in the Coppermine River area.

Production and Trade

Canadian production of copper in 1944 was 273,535 tons valued at $65,257,172, compared with 287,595 tons valued at $67,170,601 in 1943. Exports of copper were valued at $40,543,943, compared with $30,816,449 in 1943. Imports of copper and its manufactures were valued at $642,116, compared with $911,508 in 1943. Imports of copper sulphate were 4,130 tons valued at $491,473, compared with 4,857 tons valued at $567,591 in 1943.

In Quebec, Noranda Mines, Limited operated its mine, concentrator, and smelter at a reduced rate. The smelter production amounted to 56,543 tons of anode copper. The estimated recovery from the Horne mine ore and concentrate was 28,290 tons, and the remainder was obtained from custom ores and slags. Ore reserves are sufficient to maintain production for about 15 years at the present rate of output.

The Noranda controlled copper refinery of Canada Copper Refiners, Limited, at Montreal East, was operated at a slightly reduced rate. It treats the anode copper from Noranda smelter and the blister copper from Hudson Bay Mining and Smelting Company's smelter at Flin Flon, Manitoba.

Waite Amulet Mines, Ltd. operated its mine and concentrator throughout the year. The mill, which has a nominal capacity of 1,800 tons a day, treated an average of 1,660 tons a day. About two-thirds of the tonnage treated was obtained from the Amulet Dufault property and the remainder from the Waite Amulet property. The mill feed assays averaged 3·67 per cent copper and 7·25 per cent zinc. A total of 608,574 tons was treated in 1944, from which were obtained 20,504 tons of copper, 37,088 tons of zinc, 12,104 ounces of gold, and 685,266 ounces of silver.

Normetal Mining Corporation operated its mine and mill 12 miles north of Dupuis, Abitibi county, at a further reduced rate. Its 780-ton mill treated an average of 530 tons a day, the lowest since 1940. The company shipped close to 26,000 tons of copper concentrate which averaged 22·65 per cent copper, and 16,528 tons of zinc concentrate which averaged 53·32 per cent zinc. Mill heads averaged 3·28 per cent copper and 6·22 per cent zinc, and contained small amounts of gold and silver. All of the copper concentrate was shipped to the Noranda smelter, and the zinc concentrate to smelters in the United States. Owing to the limited amount of lateral work, ore reserves, which amounted to 1,380,800 tons, decreased by 56,900 tons. Without allowance for dilution, these reserves have an average grade of 3·56 per cent copper, 6·77 per cent zinc, 0·032 ounce of gold, and 2·39 ounces of silver.

Aldermac Copper Corporation's property at Moulton Hill, near Sherbrooke, was equipped with a complete mining plant and a 250-ton concentrator, which was put into operation on July 15, 1944. The mill produces copper, lead, and zinc concentrates for shipment to the United States. A pyrites concentrate may also be produced. The ore contains appreciable amounts of gold and silver.

In Ontario, International Nickel Company operated its mines and plants at the maximum rate that available labour permitted. The copper refinery at Copper Cliff was operated close to capacity. It treats the output of blister copper produced at the nearby smelter, which is conveyed in molten form to the anode furnace. Refined copper is produced from reverberatory furnaces and from electric furnaces of the arc type.

Falconbridge Nickel Mines, Limited had the greatest production of nickel and copper in its history due to increased mechanization of operations to overcome labour shortage, and to improved metallurgy, the result of the additions to treatment plants completed in 1943. The ore reserves at Falconbridge, including those of the Levack and Mount Nickel properties, totalled 12,670,000 tons with an average grade of 1·72 per cent nickel and 0·93 per cent copper. The limited new deep development off No. 5 shaft has opened up what appears to be a substantial additional tonnage of good grade ore which is not included in the above statement.

Nickel Offsets, Limited, Foy township, commenced to ship assorted ore to International Nickel Company's smelter in Copper Cliff in September, 1943, and continued to do so until February, 1944, during which period a total of 10,311 tons, averaging 3·50 per cent copper, 4·3 per cent nickel, 10·14 per cent cobalt, and 0·18 ounce of platinum, was shipped. Further mining of ore from the property awaits the erection of a concentrator, plans for which are under consideration.

Harlin Nickel Mines, Limited made steady shipments of crude ore from its Alexo property at Porquis Junction to International Nickel Company's smelter at Copper Cliff until August, 1944, when operations were discontinued.

Kam-Kotia Porcupine Mines, Limited, a project of Wartime Metals Corporation, operated the Jamieson copper property in Robb township, 20 miles north of Timmins. This property was explored and developed by Hollinger Gold Mines, Limited, during the period 1926 to 1928. A 500-ton flotation mill was put into operation early in September, 1943, but operations ceased in December, 1944, following the cancellation of the contract with Metals Reserve Company. Operations were carried on by Hollinger Consolidated Mines, Limited under the general supervision of Wartime Metals Corporation. The copper concentrate was shipped to Noranda smelter.

In Manitoba, Hudson Bay Mining and Smelting Company operated its mine, concentrator, copper smelter, and zinc plant at Flin Flon close to capacity. Although the tonnage treated was lower than in 1943, the output of copper and zinc was exceeded only by that of 1943. Production of gold, silver, and cadmium was lower, however, than for several years. The concentrator, which has a rated capacity of 6,000 tons a day, treated an average of 5,540 tons a day. A total of 43,241 tons of blister copper was produced, compared with 46,180 tons in 1943.

Emergency Metals, Limited, which was organized as a war measure by Hudson Bay Mining and Smelting Company to mine the remainder of the ore at the Mandy mine, continued in operation until the end of 1944, by which time the known ore reserves were depleted. The ore was treated in a 200-ton mill which entered production in April, 1943.

Sherritt Gordon Mines, Limited milled a total of 731,783 tons of ore, about 65 per cent of which came from the eight upper levels of its West mine and the remainder from its East mine. From the concentrates, 12,270 tons of copper and 11,960 tons of zinc were recovered. Reserves of copper ore amounted to 2,175,000 tons averaging 2·59 per cent copper and 2·2 per cent zinc, and the reserves of zinc ore to 113,000 tons averaging 9·04 per cent zinc and 0·95 per cent copper.

In British Columbia, Britannia Mining and Smelting Company operated its mines and concentrator at Britannia Beach at about 50 per cent of normal capacity. The copper concentrate was shipped to American Smelting and Refining Company's smelter at Tacoma, Washington. A contract entered into in 1942 with Wartime Metals Corporation was cancelled in December, 1944. Part of the pyrite concentrate was shipped to the acid plant of Nichols Chemical Company, Barnet, British Columbia, and the remainder was exported to the United States.

Granby Consolidated Mining, Smelting and Power Company operated its mine at Copper Mountain and its concentrator at Allenby at a reduced rate. Shipments were maintained for the first nine months of 1944 on a basis of 4,500 tons of ore per operating day, but by December 31, it was necessary to reduce the shipments to a basis of 3,000 tons. Diamond drills were substituted for percussion drills in the primary breaking of the ore. The ore reserves total 12,235,000 tons, averaging 1·2 per cent copper, which is sufficient for about seven years of capacity operation. Shipments from the mine from the beginning of operations, covering a period of 13 years, amount to 15,055,000 tons, containing an average of 1·3 per cent copper. Concentrates produced by the company were sold in 1944 to United States Commercial Company under contracts which have been extended to March 31, 1945, and were shipped and refined at the smelter of American Smelting and Refining Company, Tacoma, Washington.

The Tyee property, near Chemainus, Vancouver Island, was operated by Twin "J" Mines, Limited, under the supervision of Wartime Meals Corporation. Production was started in July, 1943, and was discontinued on May 18, 1944, as Metals Reserve Company had given notice that its contract would cease to be effective for delivery of copper and zinc concentrates after July 11, 1944. The company's 150-ton mill, which entered production in 1943, produced zinc, lead, and copper concentrates.

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 have been 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. These agreements were terminated at the end of 1944. Part of the present Canadian output is used in Canada to meet present commitments, and most of the remainder is exported to the United States. Producers on the Pacific coast are continuing to export their product for treatment in the United States under private contracts. Concentrates shipped there, chiefly from British Columbia, are treated in bond.

Uses and Prices

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 wartime controlled price of electrolytic copper (London price in Canadian funds) remained at 11·75 cents a pound throughout the year. The New York price of domestic electrolytic copper remained at 11·775 cents a pound in 1942, 1943, and 1944.

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OTTAWA, CANADA, APRIL, 1945.

GOLD IN 1944

The chief sources of gold in Canada are the gold-quartz mines, which in 1944 contributed 83 per cent of the total. The base metals mines contributed 16 per cent, and the alluvial placer operations, 1 per cent. The total Canadian production in 1944 was 21 per cent lower than that of 1943 and 40 per cent lower than the high mark of 1941.

Ontario produced close to 60 per cent 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; and Larder Lake and Matachewan areas in Timiskaming district.

Quebec's chief single producer is still the Noranda gold-copper mine. About 70 per cent of the output, however, comes from gold-quartz mines in the Bourlamaque, Siscoe, Malartic, and Cadillac areas in Abitibi county, and the Arntfield, Duparquet, Rouyn, and Mud Lake areas in Témiscamingue county.

The chief sources of gold in British Columbia are the gold-quartz mines of the Bridge River area, Lillooet mining division; the Salmon River area, Portland Canal mining division; Wells camp, Cariboo mining division; Hedley camp, Osoyoos mining division; the Sheep Creek, and other adjoining areas, Nelson mining division; and of Zeballos River, on the west coast of Vancouver Island. The mines in Zeballos River area are idle owing to war conditions. 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 output is obtained from placer operations.

About 55 per cent of Manitoba's gold came from the gold-quartz mines of Rice Lake district in eastern Manitoba, the source of the remainder being the copper-zinc-gold ores of the Flin Flon and Sherritt Gordon mines.

In Saskatchewan, the production was entirely from that portion of Hudson Bay Mining and Smelting Company's Flin Flon mine lying within the province.

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. All the producing mines in this area, except the Negus which was in operation most of the year, were idle in 1944.

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 output of placer gold is reported annually.

Important Developments

Development work at the producing mines was greatly curtailed owing to conditions arising from the war. There was a marked increase in prospecting, however, and in exploration, mainly by diamond drilling. This activity was particularly noticeable in the Yellowknife district, Northwest Territories, and in the mining areas of western Quebec. The results, to date, of much of this work have been encouraging. Claim staking has been quite active also in these areas.

All restrictions on development work at gold properties have been removed and this action is expected to result in increased underground development activity as soon as labour and materials become available. Among the prospective producers are the following new properties:—

	Area
Northwest Territories	
Giant Yellowknife	Yellowknife
British Columbia	
Whitesail Lake	Tweedsmuir Park, north-central British Columbia
Manitoba	
Snow Lake	Snow Lake
Ontario	
Renabie	Sudbury area, near Missinaibi Lake
Queenston	Kirkland Lake
Northland	Kirkland Lake
Hoyle	Porcupine
Gold Island Porcupine	Porcupine
Goldhawk Porcupine	Porcupine
Heath	Red Lake
Quebec	
Croinor Pershing	Pershing township
Hosco	Joannes township
Elder	Beauchastel township
Wasa Lake	Beauchastel township
Louvicourt Goldfields	Louvicourt township
Rouyn Merger	Rouyn township
National Malartic	Fournière township

This list does not include several other properties in western Quebec. Several of the properties listed above have been sufficiently explored to prove the existence of ore-bodies large enough to justify the erection of milling plants.

Production

The Canadian production of gold in 1944 was 2,922,911 fine ounces valued at $112,532,073, compared with 3,651,301 ounces valued at $140,575,088 in 1943 and 4,841,306 ounces valued at $186,390,281 in 1942.

The production by provinces was:—

	1943		1944	
	Fine Ounces	*Value*	*Fine Ounces*	*Value*
Nova Scotia	4,129	$ 158,967	5,840	$ 224,840
Quebec	922,533	35,517,521	746,784	28,751,184
Ontario	2,117,215	81,512,777	1,731,836	66,675,686
Manitoba	91,775	3,533,337	74,168	2,855,468
Saskatchewan	174,090	6,702,465	122,782	4,727,107
Alberta	21	808	51	1,963
British Columbia	241,346	9,291,821	196,857	7,578,994
Northwest Territories	59,032	2,272,732	20,775	799,838
Yukon	41,160	1,584,660	23,818	916,993
CANADA	3,651,301	140,575,088	2,922,911	112,532,073

In Quebec the base metals mines contributed about 30 per cent of the province's production; in Ontario, the contribution was 3·3 per cent; in Manitoba and Saskatchewan it was about 80 per cent; and in British Columbia, 9·1 per cent.

Data on operating gold milling plants are given in the following tabulation:

Year	*New Mills*		*Total Mills*		*Increases*		*Ceased Operating*	
	No.	*Capacity Tons*	*No.*	*Capacity Tons*	*No.*	*Capacity Tons*	*No.*	*Capacity Tons*
1944	—	nil	71	52,025	—	nil	4	2,230
1943	—	nil	85	57,510	—	nil	16	5,845
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

Treatment Plants

Plants for the production of fine gold are operated by:

The Royal Canadian Mint, Ottawa, Ontario.
Hollinger Consolidated Gold Mines, Limited, Timmins, Ont.
Canadian Copper Refineries, Limited, Montreal, Quebec.
Consolidated Mining and Smelting Company, Trail, B.C.
International Nickel Company of Canada, Copper Cliff, Ont.

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.

World production of gold in 1944 (excluding Russia) is estimated at 27,500,000 fine ounces. Canada is surpassed only by South Africa, and possibly Russia, as a producer and contributes about 12 per cent of the total.

The average price at which Canada's gold production was computed for 1944 was $38.50 a fine ounce. This price has prevailed since October, 1939.

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OTTAWA CANADA, JUNE, 1945.

INDIUM IN 1944

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. 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

Indium production in Canada was reported for the first time in 1942, when it was recovered in small quantities at Trail, British Columbia, from treatment of the residues obtained at the zinc refinery of Consolidated Mining and Smelting Company. No production was reported in 1943 and 1944.

World production is still relatively small, though production in the United States increased considerably during the past three years. It is recovered in that country as a by-product of zinc and lead operations mainly by Anaconda Copper Mining Company, and to a small extent by American Metal Company, American Smelting and Refining Company, Eagle-Picher Mining and Smelting Company, and National Zinc Company.

Uses 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 resists the corrosive action of lubricants containing organic acids. Electro-deposition of indium on lead followed by heat-treatment has proved useful for bearings. Indium plate will probably be used in surfacing various other types of rubbing surfaces. 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 in recent years, but there has been only a moderate expansion in the use of the metal for war purposes.

Early in 1944 the price of indium dropped to $7.50 a troy ounce, which price prevailed throughout the year. Production of indium has been increasing, however, and stocks of the once "precious" metal have been accumulating. Competition for business has weakened the price structure to the point where quotation in quantity basis appears to be largely a matter of negotiation, and by March 1945 wholesale lots were sold as low as $4 an ounce, U.S. funds.

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OTTAWA, CANADA, MARCH, 1945.

IRON ORE IN 1944

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

Dominion Steel and Coal Corporation, Limited, Sydney, Nova Scotia, obtains its iron ore from its own mines at Wabana, Newfoundland. Steel Company of Canada, Limited, Hamilton, Ontario, and Canadian Furnace, Limited, Port Colborne, Ontario, obtain their iron ore 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, Michipicoten area, Ontario.

Sources of Production; Developments

All but a small part of the iron ore produced in Canada in 1944 came from the New Helen mine of Algoma Ore Properties, Limited in the Michipicoten area, Ontario, and the remainder came from the hematite property of Steep Rock Iron Mines, Limited, near Atikokan, about 135 miles west of Port Arthur, Ontario. In 1943 a production of 125,000 tons of beneficiated magnetite was obtained from the Austin Brook mine near Bathurst, New Brunswick, but the property was idle in 1944.

Algoma Ore Properties, Limited (wholly owned subsidiary of Algoma Steel Corporation, Limited) began to develop the New Helen mine in 1937 and the first sinter was produced in July, 1939.

Large-scale tests on the treatment of ore from Algoma Properties' Goulais Iron Range, 50 miles northeast of Sault Ste. Marie, indicate that a product containing 65 per cent iron can be obtained, and further tests are being made. Based on the results of an extensive diamond-drilling program, the deposit is estimated to contain about 100,000,000 tons of siliceous magnetite. The active development of the Goulais Iron Range is not contemplated in the near future.

Directors of Steep Rock Iron Mines, Limited approved a three-year production program in the latter part of 1944 that calls for a total iron ore output of 5,000,000 tons from its hematite deposits in the Steep Rock Lake area, north of Atikokan, Ontario, during the shipping seasons of 1945 to 1947, inclusive. All mining is in the "B" ore-body, and open pit mining is planned to a maximum depth of 550 feet below bedrock. Exploratory work on the property in previous years had indicated that the deposits, which were discovered in the winter of 1937-38 under the bed of Steeprock Lake by diamond drilling through the ice, are large. High-grade ore presumably makes up a considerable, but as yet very incompletely defined, part of them. The company reports that the property has 17,244,000 long tons of "proven ore" and 14,336,000 long tons of "probable ore", making a total of 31,580,000 long tons. Most of this ore is available for open pit mining. No estimate has been prepared of "possible ore".

Diversion of the Seine River was completed in 1943, and included about 20 miles of road building; the excavation of over 1,200,000 cubic yards of earth and of 500,000 cubic yards of rock; the lowering of Finlayson Lake by a tunnel; the construction of a spillway and control works in Raft Lake; the construction of coffer-dams to isolate the eastern part of Steep Rock Lake; and the construction of a power line, the installation of pumps and barges, and works in preparation for pumping Steep Rock Lake. This pumping was commenced on December 10, 1943 and water was sufficiently down for the company to commence the production of iron ore by August, 1944. The first shipment from the Steep Rock mine left Atikokan on October 3, 1944 for delivery via Fort Frances to Superior, Wisconsin, for loading into Great Lakes boats. Difficulty was experienced, however, with viscous mud in the vicinity of the "B" ore-body which caused a curtailment of mining operations, but in the spring of 1945 the thickness of this mud had been reduced sufficiently by removal to overcome its tendency to flow over the site of the projected workings on the ore-body. Regular shipments to Lower Lake points via Duluth were commenced early in May, 1945. On June 22 advice was received to the effect that work on the ore docks at Port Arthur was by then sufficiently advanced to enable shipments of one of the three grades of ore through that port and that the docks would be ready for autumn use by September 1, 1945.

In 1944, the company erected a crusher and a screening plant capable of handling 700 tons an hour. In the screening plant the ore is separated into three sizes, namely 4 to 10-inch lump ore for open-hearth use; 1 to 4-inch charge ore for open-hearth use; and minus 1-inch blast furnace ore. The three sizes fall into separate sections of the bin below, where they are loaded into railway cars on the 3-mile spur (Canadian National railway) from Atikokan, and are hauled to the loading docks on the Great Lakes.

Michipicoten Iron Mines, Limited, which was formed in 1943 to take over the Josephine, Ruth, and Lucy iron properties, continued underground work in the Josephine mine throughout 1944. The three properties are owned jointly by Sherritt Gordon Mines, Limited and Frobisher Exploration Company, Limited (Ventures, Limited), and are about 20 miles from Michipicoten Harbour, Algoma district, Ontario. In 1941, a transmission line was built to connect the Josephine mine with the power line at Hawk Junction, and the necessary electrically driven plant for development operations was installed. Shaft sinking was started in February, 1942, and was completed to a depth of 1,055 feet early in September of that year. Six stations were cut, the lowest being at the 1,015-foot level. While shaft sinking was in progress the ore-body was further explored by lateral diamond drilling at the first and second levels. The drainage of Parks Lake was then undertaken.

The underground work in the Josephine mine in 1944 was confined mainly to the three lowest (fourth, fifth, and sixth) levels, and most of it was on the fourth and sixth levels. The ore reserves were increased by 1,174,000 gross tons and now total 3,840,000 gross tons, averaging about 52 per cent iron, 15 per cent silica, 2·12 per cent sulphur, 0·04 per cent phosphorus, and 0·43 per cent manganese. Considerable headway was made toward equipping the Josephine mine for production on a scale of 375,000 gross tons of ore a year. This work involves the erection of a crushing plant, including a primary crusher underground, a concentrator for the production of open-hearth lump ore, and a jig plant for the production of hematite concentrate. The plant was expected to be ready for operation by the end of April, 1945

A contract for sale of the output from the Josephine mine has been made with Algoma Ore Properties, Limited (Algoma Steel Corporation). The contract is for a period of seven years from April, 1945 and it calls for the delivery of a minimum of 75,000 gross tons of open-hearth lump ore and 194,000 gross tons of hematite concentrate a year. The concentrate will be mixed and sintered with the siderite ore from the New Helen mine in Algoma Ore Properties sintering plant at Wawa, Ontario.

The Ruth property, which is 2 miles from the Josephine, remained idle in 1944. It was drilled extensively in 1942 and in the first three months of 1943, the indicated ore reserves to a depth of 800 feet being 28,600,000 long tons of siderite averaging 31·26 per cent iron, 13·15 per cent silica, and 5·14 per cent sulphur. These reserves include 16,840,000 tons of low-silica siderite averaging 34·54 per cent iron and 6·81 per cent silica. The remainder averages 26·57 per cent iron and 21·46 per cent silica.

On the Lucy property in the same area, a small amount of assessment work was done.

No further work was reported on the magnetite deposits in Hastings county, Ontario. Some exploratory work was done on a few of these deposits in 1941, 1942, and 1943.

At Sarpedon Lake in Quetico Park, Rainy River district, Sarpedon Iron Mines, Limited has been diamond drilling an iron formation in search of ore under the lake. Most of the exposed iron formation in the area is magnetite-bearing. It is hoped, however, that large concentrations of hematite will be found.

No work in 1944 was reported on the Gunflint iron range at Round Lake, southwest of Port Arthur, nor on the Matawin iron range south of Shebandowan. In 1943 Gunflint Iron Mines, Limited did some diamond drilling on hematite deposits on these ranges.

Since 1936, Labrador Mining and Exploration Company, the control of which was acquired in 1943 by Hollinger Consolidated Gold Mines, Limited, has been making extensive surveys and doing exploratory work on iron deposits near Sawyer Lake and vicinity, along the Quebec-Labrador boundary. Work on the Labrador side is being done by Labrador Mining and Exploration, and that on the Quebec side by Hollinger North Shore Exploration Company. To date, 24 iron deposits have been found, 15 in Quebec and 9 in Labrador. In addition, 3 outcrops have been reported in Labrador. The Sawyer Lake deposit is the only one on which much exploration has been done, but it is proposed to conduct an extensive diamond-drilling program on the various deposits when conditions become favourable.

The following tabulation gives an idea of the great possibilities of the region:

Name of Deposit	Per cent Fe + Mn	Apparent width Feet	Apparent length Feet
Labrador			
Sawyer Lake	68·4	150	2,200
Ruth Lake No. 1	57·9	100	3,300
Ruth Lake No. 2	59·3	175	300
Ruth Lake No. 3	61·7	400	1,230
Wishart Lake	61·6	100	2,400
Fleming Lake No. 1	67·9	40	750
Fleming Lake No. 4	59·6	3	600
Timmins Bay	69·4	40	1,000
Ruth Lake Extension	64·9	175	1,250

No details are available on the deposits in Quebec, though one deposit with a known width at some places of 350 feet and a known length of 3,900 feet has been disclosed. Outcrops to the south indicate the possible extension of this body for a distance of over 2 miles.

The Sawyer Lake area is about 325 miles from the St. Lawrence River at Seven Islands, which port is open to navigation throughout the year. Ample power will be available from the nearby Grand Falls on Hamilton River, where surveys have shown a potential minimum of 1,250,000 h.p. Hollinger has completed negotiations with M. A. Hanna Company of Cleveland, Ohio, for participation in the future exploration and development of the iron deposits both in Quebec and in Labrador.

Production and Trade; Prices

Canadian production of iron ore in 1944 was 553,252 tons valued at $1,909,608, compared with 641,294 tons valued at $2,032,240 in 1943. Consumption of iron ore in 1944 totalled 3,478,800 short tons, of which 266,149 tons came from Canadian mines.

Exports of iron ore were 308,424 tons valued at $1,153,166, compared with 374,677 tons valued at $1,450,985 in 1943. Imports were 3,126,649 tons valued at $7,393,926, compared with 3,906,425 tons valued at $9,056,389 in 1943.

Shipments of sintered ore from the New Helen mine in 1944 amounted to 474,405 gross tons, and total shipments to the end of 1944 amounted to 2,328,900 gross tons. The ore was shipped via Michipicoten Harbour, 8 miles from the sintering plant, partly to the company's blast furnaces at Sault Ste. Marie, Ontario, and partly to United States ports on the Lower Lakes for use in United States blast furnaces. The manganese content is of special interest to users. The 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. To fit it for commercial use in blast furnaces, a sintering plant capable of treating 3,000 tons of ore a day was built, the analysis of the sinter produced being approximately as follows:

	Per cent		Per cent
Iron	51·50	Alumina	2·35
Phosphorus	0·02	Lime	3·60
Silica	9·50	Magnesia	7·96
Manganese	3·00	Sulphur	0·04

It is expected that production from the property of Steep Rock Iron Mines, Limited will have an average grade (dry analysis) of:

	Per cent
Iron	60·48
Silica	3·40
Phosphorus	0·023
Sulphur	0·043
Loss by ignition	8·5

The moisture content is estimated to be 7 per cent. The natural iron content (averaging 56·54 per cent) is 4·54 per cent higher than the average of ore shipped from the Lake Superior ranges in the United States. The low silica content of 3·42 per cent will permit the use of the ore to "sweeten" other ores, and the extremely low phosphorus content of 0·017 per cent is well below the Bessemer limit. Though these qualities make Steep Rock ore a premium product, probably its most valuable quality is its physical structure, which should make it a good open-hearth lump ore, producing little minus 100-mesh fines and reducing the percentage of scrap normally required.

There are no official Canadian price quotations for iron ore. Prices, f.o.b. Lake Erie ports, a 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 was 7¼ to 7¾ cents a long ton unit.

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LEAD IN 1944

Lead production in Canada is obtained from the various silver-lead-zinc mines of British Columbia and to a smaller extent from the few zinc-lead mines in Quebec and Ontario. The Sullivan mine at Kimberley, British Columbia, operated by Consolidated Mining and Smelting Company of Canada, is the principal source of production. Canada exports the greater part of its output of lead.

Production and Trade

Canadian production of lead in 1944 was 152,291 tons valued at $13,706,199 compared with 222,030 tons valued at $16,670,041 in 1943. British Columbia contributed 97½ per cent of the total output, and the remainder was obtained from Quebec and Ontario.

Exports were: 102,880 tons of pig lead valued at $6,394,550, compared with 154,348 tons valued at $9,222,104 in 1943; and 9,500 tons of lead in ores and concentrates valued at $650,433, compared with 5,735 tons valued at $425,306 in 1943. Imports of lead were valued at $4,174,111 compared with $4,128,077 in 1943.

In British Columbia the lead and zinc concentrates produced in the 8,000-ton concentrator of the Sullivan mine are shipped by rail 185 miles to the company's smelter and refinery at Trail. A total of 2,141,400 tons of ore was milled in 1944, a decrease of about 15 per cent compared with 1943. The grade of ore treated was also lower, due largely to the cleaning out of stope bottoms in preparation for filling, and to the curtailment of development work in the early years of the war so that greater attention could be given to production.

Western Exploration Company at Silverton produced zinc and lead concentrates for export.

Reco Mountain Base Metal Mines, Limited, near Sandon, operated the renovated Noble Five concentrator until May, when the plant was destroyed by fire.

Retallack Mines, Limited, at Retallack, completed the renovation of its 300-ton mill in April. A contract for sale of the zinc concentrate, made in December, 1943, with United States Commercial Company, a United States Government subsidiary company, was replaced in April, 1944, by a contract for the sale of lead and zinc concentrates to American Smelting and Refining Company in the United States.

The Kootenay Florence mine at Ainsworth was operated by Wartime Metals Corporation as the Kootenay Florence Project from early in 1943 until May, 1944, when the contract for sales to Metals Reserve Company (United States) was cancelled.

Base Metal Corporation's power house was destroyed by fire in January and as a result there was no production from the company's Kicking Horse zinc-lead mine at Field from then until June 12. The mine was in continuous production during the remainder of the year, and until near the end of November, when a small crew was placed in the Monarch zinc-lead mine, also at Field, to complete salvage operations. The company's concentrator treated an average of 122 tons a day during the period of regular operation, compared with a daily average of 169 tons in 1943. Development work was carried on at the Kicking Horse mine during the time that production was suspended.

The Tyee zinc-lead-copper property, near Chemainus, Vancouver Island, was in production until May when the contract with Metals Reserve Company was cancelled. The property was acquired in 1942 by Twin "J" Mines, Limited, and was operated by the company under the supervision of Wartime Metals Corporation. Zinc, lead, and copper concentrates were produced in the 125-ton mill. The Reeves McDonald zinc-lead mine on the Pend-d'Oreille River remained idle in 1943.

Several small lead-zinc properties, mainly in the Ainsworth-Slocan area shipped crude ore to the Trail smelter.

In Ontario, Lake Geneva Mining Company's property in Hess township, Sudbury district, was operated by Wartime Metals Corporation. The sales contract with Metals Reserve Company was cancelled, effective April 30, and operations ceased near the end of May, following which the plant was dismantled and sold.

In Quebec, New Calumet Mines, Limited, with mine and 500-ton concentrator at Calumet Island, Pontiac county, operated at capacity. The lead and zinc concentrates are shipped to American smelters designated by Metals Reserve Company, with which New Calumet has a contract.

The Tetreault property near Notre-Dame-des-Anges, Portneuf county, was operated by Siscoe Gold Mines, Limited, under the general supervision of Wartime Metals Corporation until May, when activities were discontinued. The lead and zinc concentrates were sold under contract to Metals Reserve Company.

Aldermac Copper Corporation, Limited equipped its property at Moulton Hill, 4 miles from Sherbrooke, with a complete mining plant and a 250-ton concentrator, which was put into operation on July 15. The mill produces lead, copper, and zinc concentrates for shipment to the United States. In due course, a pyrites concentrate may also be produced. The ore contains appreciable amounts of gold and silver.

World production in 1939 (figures for the war period not available), as published by the American Bureau of Metal Statistics, was 1,899,000 short tons. The principal producing countries were, in order of importance: United States, Mexico, Australia, Canada, Germany, Belgium, India (Burma), and Russia. The production in Germany and Belgium was mostly from imported ores.

Uses and Prices

The world consumption in 1938 (1939-1944 not available), as given by the American Bureau of Metal Statistics, was 1,638,100 metric tons. The Canadian consumption of lead prior to the war was between 35,000 and 40,000 short tons a year.

Lead is used chiefly in the lead pigment, cable covering, storage battery, building, and ammunitions industries, and in the manufacture of tetraethyl lead for gasoline. So far in the present war it has been 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. 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, and as chemical tank linings and pipes.

Tetraethyl lead, which has become an important outlet for lead, plays an indispensable rôle in the production of 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.

The average price of pig lead (quotations on the London market, converted to Canadian funds) was 4·5 cents a pound throughout 1944. The price at New York was 6·50 cents throughout 1944.

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OTTAWA, CANADA, JUNE, 1945.

MAGNESIUM IN 1944

Magnesium, industry's lightest metal, is available from many sources in Canada and elsewhere. The present source of the metal produced in Canada is dolomite. Other potential sources are magnesite, brucite, serpentine, and sea-water.

Dolomite, the double carbonate of calcium and magnesium, and which contains 13 per cent of magnesium, is found in all provinces of Canada except Prince Edward Island. It is particularly abundant in Ontario and Manitoba.

Magnesite, the carbonate of magnesium, containing 28·7 per cent magnesium, and hydromagnesite, containing 26·5 per cent of magnesium, are available in British Columbia. Deposits of magnesitic dolomite consisting of an intimate mixture of magnesite and dolomite occur in Argenteuil county, Quebec, where they are being worked for the production of basic refractories. The magnesite deposits in British Columbia are undeveloped, but magnesium has been made from them on an experimental scale. Magnesitic dolomite possesses no advantages over dolomite or magnesite as a source of magnesium.

Brucite, in the form of granules 1 to 4 mm. in diameter thickly disseminated throughout crystalline limestone and forming 20 to 35 per cent of the volume of the rock, occurs in large deposits in Ontario and Quebec. Brucite is the hydroxide of magnesium and contains 41·6 per cent of magnesium. The Canadian deposits are the largest known in the world. The brucite is being recovered in the form of granules of magnesia from one of these deposits near Wakefield, Quebec, and though the granular magnesia so obtained is being used principally for the manufacture of basic refractories and as an ingredient in chemical fertilizers, it is a very suitable raw material for the production of magnesium metal.

Serpentine, the silicate of magnesium, contains 25·8 per cent of magnesium, and occurs in many deposits throughout Canada. It is also available in huge waste dumps aggregating probably 100,000,000 tons in the asbestos-producing region of Quebec. The average magnesium content of these dumps is about 23 per cent. A process has been worked out for the recovery of magnesium from serpentine.

Sea-water, although it contains only 0.13 per cent magnesium, is a source of the metal in England and the United States. Dolomitic lime is used to precipitate the magnesia from the sea-water in the form of hydroxide, and the magnesia from both is recovered in the process.

Underground brines containing $MgCl_2$ and residual brines from salt-making operations, containing $MgCl_2$, are used in the United States as sources of magnesia and magnesium, but brines containing sufficient $MgCl_2$ to render them of value are not available in Canada.

Processes for the production of the metal from the various raw materials may be divided into two groups, namely, electrolytic, and thermal. The electrolytic process provides most of the magnesium made, except in Canada where a thermal reduction process is used. The three thermal reduction processes in use throughout the world involve reduction of magnesia with carbon (in use in the United States); reduction of magnesia with calcium carbide (in use in the United Kingdom); and reduction of calcined dolomite with ferrosilicon (in use in Canada, the United States, and Italy).

The ferrosilicon reduction process in use in Canada involves the grinding and mixing together of ferrosilicon, calcined dolomite, and a catalyst, briquetting the mixture, and charging the briquettes to externally heated retorts operating under a vacuum. The magnesium vapour is condensed on the sides of a water-cooled condenser and is removed as a ring or crown of pure, solid metal. These crowns are re-melted and cast into ingots, with or without alloying elements.

Production and Trade

Dominion Magnesium, Limited, Haleys, Ontario, which began production in August, 1942, is the only producer of magnesium in Canada. The plant is operated by a private company under supervision of Wartime Metals Corporation, a Crown company. Production in 1944 amounted to 5,290 tons valued at $2,575,695, compared with 3,577 tons valued at $2,074,652 in 1943.

No data are available for publication on exports and imports of magnesium, but most of the production is exported.

The three magnesium foundries in Canada are located at Toronto, Montreal, and at Renfrew, Ontario. They are operated respectively by Aluminum Company of Canada, Limited, Robert Mitchell Company, Limited, and Light Alloys, Limited. A plant for the making of magnesium powder is operated at Trail, British Columbia, by Consolidated Mining and Smelting Company of Canada, Limited.

Uses and Prices

The field of usefulness of magnesium is steadily expanding. Magnesium was formerly used almost exclusively in pyrotechnics, but it is used also as a structural metal, particularly in the form of castings and extruded shapes. For structural use it is alloyed with various portions of other elements. It is used as a constituent in many aluminium-base alloys.

The price quoted by Engineering and Mining Journal for magnesium in ingot form in carload lots during 1944 was 20½ cents per pound, U.S. currency, f.o.b. New York.

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OTTAWA, CANADA, JUNE, 1945.

MANGANESE IN 1944

All manganese properties in Canada were inactive in 1944. The small Canadian production in the past has come from deposits in the Maritime Provinces.

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, the most common and most important, contains, when pure, 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 precarboniferous rocks.

Sources of Production: Occurrences

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 a small amount of high quality ore has been mined in only a few localities.

Since the outbreak of the 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. No new deposits have been found, however, and attempts to operate some of the better grade old properties were discontinued after a few months' work. Production ceased in the fall of 1943, in which year a carlot was shipped from Jordan Mountain, north of Sussex, New Brunswick. From 1939 until the fall of 1943 there was a small production in New Brunswick also from Gowland Mountain near Elgin, southeast of Sussex; Turtle Creek, near Berryton, and at Quaco Head, near St. Martin on the south coast.

In Nova Scotia, the principal output came from New Ross, 45 miles west of Halifax, and there was a small output from East Mountain, east of Truro.

Large boulders of float ore assaying as high as 54 per cent manganese occur on the Steep Rock iron deposit, 140 miles west of Port Arthur. They are believed to have come from the limestone in the hanging wall of "B" ore-body. Samples were shipped to Ottawa in August for concentration tests and fair results were achieved by means of the sink-and-float process and then removing excess of silica by flotation.

Production and Trade

From 1886 to the end of 1943, a total of about 18,600 short tons of manganese ore was produced in Canada, close to half of it from 1887 to 1890 inclusive. More than 20,000 tons is known to have been produced, however, between 1862, when the mining of manganese was started, and 1886. During the war period, 1915 to 1918 inclusive, a total of 1,784 tons was shipped, the largest output being 957 tons in 1916. From 1939 to the end of 1944, a total of 1,067 tons valued at $13,698 was shipped.

Approximately 45 per cent of the imports of manganese ore in 1944 totalling 79,906 short tons, valued at $2,213,396, came from India; about 40 per cent from the Gold Coast; and the remainder from Egypt, Chile, and the United States. This was an increase of 56 per cent over the tonnage imported in 1943. Consumption was 81,824 tons, a 36 per cent increase over that of 1943.

Canadian production of manganese ferro-alloys, mainly silico-manganese, was 44,334 tons, an increase of nearly 36 per cent over 1943. Exports of these alloys were 10,500 tons, a decrease of nearly 35 per cent.

World production of manganese ore is between six and seven million tons annually, the leading producing countries being Russia, British India, Gold Coast, United States, Union of South Africa, Brazil, and Cuba.

Russia in 1941 is reported to have produced close to 6,000,000 tons, [redacted], the output being mainly from the Tchiaturi deposits in Georgia. There are also deposits in the Urals and near Nikopol, north of the Crimea. India produces over 1,000,000 tons of metallurgical grade ore a year, mainly from the Central Provinces, the principal district being Balaghat. Much of the ore is exported to Great Britain. India is also the chief source of supply for Canada and the United States. At Nsuta, Wasaw district, Gold Coast, is one of the largest known single manganese deposits. The ore is of excellent metallurgical grade (48 to 52 per cent Mn). About 40 per cent of the Canadian imports of manganese ore in 1944 were from Gold Coast. The principal deposit in Brazil is at Mato Grosso. South Africa's production comes mostly from the Portmasburg area, Griqualand West, Cape Province. Early in the war South Africa was producing nearly half a million tons a year, but its output has decreased about 75 per cent. In Cuba, the principal deposits are at Isabelita in Orient Province. Egypt, prior to the war, was producing about 150,000 tons of 30 per cent ore annually from the Sinai Peninsula.

The United States produced 243,000 tons of metallurgical ore (over 35 per cent Mn), an increase of 18 per cent over its 1943 output. Nearly 57 per cent of the output came from Anaconda Copper Mining Company, Anaconda, Montana, where carbonate ores are nodulized. Large tonnages were produced also at Butte, Montana; at Waynesboro, Virginia; and at Las Vegas, Nevada. The output of ferruginous manganese ore (10 to 35 per cent Mn) in the United States in 1944 was about 500,000 tons. Most of the low-grade ore comes from Cuyana range in the Lake Superior district, Minnesota. During the war years many deposits of medium- and low-grade manganese ores were developed in the United States and processes for their beneficiation were worked out. As a result, supplies have been adequate, and the leaching and nodulizing plant at Las Vegas, which treated 1,000 tons daily, and was costly to operate, was shut down in September, 1944. Electrolytic manganese is made at Knoxville, Tennessee, and at Boulder City, Nevada.

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 ferromanganese, 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. About 13 pounds of manganese is used in each ton of steel. Ferromanganese, containing 75 to 82 per cent manganese and 5 to 7 per cent carbon, is by far the most important addition agent, and the highest "ferro" grade ore is used to make it. Such ore should contain at least 48 per cent of manganese and not more than 6 per cent iron, 10 per cent silica and alumina, and 0·18 per cent phosphorus; 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 4 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. It takes about two tons of 48 per cent ore to make one ton of standard ferro.

The Canadian market for metallurgical ore is confined mainly to two manufacturers of manganese ferro-alloys; namely, Electro-Metallurgical Company, Welland, and Canadian Furnace, Limited, Port Colborne, both in Ontario.

Chemical grade ores are used mainly in the manufacture of dry batteries. Specifications call for high-grade pyrolusite because of its high available oxygen, which acts as a depolarizer. The ore should contain not less than 75 per cent manganese dioxide (MnO_2). Most of the ore is ground to 200 mesh, but some coarse ground ore of 8 to 12 mesh is also used. Canadian requirements of chemical ore range from 3,000 to 4,000 tons a year, most of it being ore from the Gold Coast. Nearly all of it is used by three manufacturers of dry batteries in Ontario, namely: Canadian National Carbon Company, Toronto; Burgess Battery Company, Niagara Falls; and General Dry Batteries of Canada, Limited, Toronto. Chemical ore is used also as colouring agents in the glass, ceramic, and paint industries; as pigments and dyeing materials; as salts in photography, fertilizers, disinfectants, bleachers; and for other minor purposes.

Prices

Prices of ferro-grade ore depend upon the 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 (based on a standard duty-free ore containing 48 per cent manganese and within the specifications outlined), are 85 cents per long unit of contained manganese at Gulf of Mexico ports, and 90 cents at New York and other Atlantic ports. The premiums and penalties for ores varying from the standard grade can be obtained from the Metals Controller, Ottawa. The prices paid in 1944 by the Government and Canadian consumers for approximately 48 per cent manganese ore were $46 for Indian ore at Welland and $37 per long ton for Gold Coast ore at Canadian ports.

The delivered prices of chemical grade (battery grade) manganese ores in Canadian currency for finely ground battery grade ore in bags imported into Canada from Africa or Montana, U.S.A., was $60 to $85 a short ton depending upon mesh and origin.

Outlook

Known deposits of high-grade manganese ore in Canada are small, and are almost exhausted. No commercial grade deposits have been found and future production appears to be unlikely unless sufficient manganese is discovered during the operation of the Steep Rock iron deposits to warrant its recovery as a by-product.

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MERCURY IN 1944

At the outbreak of the war the Allies were seriously deficient in mercury, as the bulk of world output came from Italy and Spain. Prices rose to nearly three times the pre-war level, but within two years, owing to the greatly increased production from the United States and from the Pinchi mine in British Columbia, supplies became sufficient to enable the export of mercury to the other Allied countries. Early in 1944 many of the activities in the United States and some in Canada were suspended as the supply was much greater than the demand, and prices declined. The Pinchi mine was closed down in July and at present (April, 1945) no mercury is being produced in Canada. Late in the summer, however, a complete reversal took place, mainly due to unforeseen requirements for a new application, and prices increased appreciably. Towards the close of the year, stocks in the United States were at their lowest level and some of the mines in that country were reopened.

Cinnabar (HgS), the principal ore of mercury, is a heavy (s.g.=8·1) mineral 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.

Sources of Production: Occurrences

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 ore-bodies are on a steep mountainside and consist of large cinnabar-bearing areas in veins and as impregnations, mainly in dolomitized and brecciated limestone along zones of fracturing and shearing. The deposit was discovered in the summer of 1937 and was optioned late in 1938 to Consolidated Mining and Smelting Company. Production was started in June, 1940. The mine has been developed by a glory hole and by levels for 400 feet above the main 200-foot haulage level from which a 200-foot deep shaft was sunk early in 1944, giving a vertical distance of about 800 feet. Exploration and diamond drilling revealed ore all the way down to the bottom of the shaft, and at this depth the grade is better than the average (0·4 per cent mercury) of the milling ore. A number of cinnabar claims were staked and prospected in 1942 and 1943 along the so-called "Pinchi fault", which runs in a northwesterly direction for at least 100 miles from Pinchi Lake. Of chief importance is the Takla property, east of the headwater of Silver Creek, 85 miles northwest of the Pinchi mine.

During the period 1939 to 1943 some prospecting was also carried out and a few flasks were produced from deposits north of Kamloops Lake; from the Yalakom River, 30 miles northwest of Lillooet; from Relay Creek and 16 miles north of Minto City, both north of Bridge River. Part of the Empire Mercury Mines plant, north of Minto City, was removed to Copper Creek, Kamloops Lake, in the autumn of 1942, but apparently was not re-erected.

Production and Trade

Canadian production in 1944 was 9,683 flasks (of 76 pounds each) valued at $1,210,375, as compared with 22,240 flasks valued at $4,559,200 in 1943. Since the outbreak of the war Canada has produced 54,641 flasks or about 2,076 tons.

Exports amounted to 4,682 flasks, a decrease of 70 per cent compared with 1943. They were valued at $959,810 and were shipped to India, United States, and Australia. Imports were 466 flasks valued at $44,182, and were nearly all from Mexico. Producers and consumers stocks at the end of the year were 8,315 flasks.

The plant at the Pinchi mine, consisting of Wedge roasters, kilns, and condensers, is capable of treating about 1,200 tons of ore daily, but was treating only 400 tons daily before it was closed down in July because of the lack of a market and of an accumulation of stocks. The Pinchi mine was the largest single producer of mercury in the Western hemisphere, its output during its four years of operation being over 2,000 tons of refined mercury.

The Takla property was operated by Bralorne Mines, Limited, and production from the 100-ton plant was started in November, 1943. As the deposit is in comparatively flat country the mine is developed by shaft, mainly from the 100-foot level. Operations ceased in September, 1944, after the Metal Reserve Company (U.S.) cancelled the contract. Production during the period amounted to about 66 tons of mercury.

World production just prior to the war was estimated to be slightly in excess of 5,500 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 75 per cent of the world output, and the United States contributed about 11 per cent. The pre-war output from Russia, then the fourth largest producer, was about 300 metric tons a year. Production from Mexico in 1944 was reported to be about 900 tons. Czechoslovakia, China, Japan, Chile, and Peru are also producers of mercury. In the Union of South Africa, production was started at Monarch Kop in 1940 and its output has increased substantially each year since then. In 1944 it was nearly 1,200 flasks (45·3 tons).

Production in the United States in 1944 was about 37,500 flasks, compared with 51,929 in 1943, which was the highest since 1881. California contributed about 75 per cent of the output. The New Idria mine in San Benito county, California, continued to be the leading producing mine.

Uses

Canada uses about 3,000 flasks of mercury a year, about 75 per cent of it for medicinal and pharmaceutical purposes, and in heavy chemical industries. The consumption of mercury in Canadian gold mines, which is now about 7 per cent of the total, has decreased owing to wider use of cyanidation and to improvements in the recovery of the mercury after amalgamation.

In the United States the main cause for the recent marked increase in consumption was the large demand for mercury for use in the Ruben dry battery. This small cell, about $\frac{3}{8}$-inch high, containing mercuric oxide and layers of zinc and paper in the form of a spiral, will last five times as long as the standard flash lamp battery. It is being used widely in all branches of the armed forces; in small portable radios (walkie-talkie), etc.; and large peacetime markets are forecast. Other uses for mercury are: as a catalyst or in the electrolytic preparation of chlorine, caustic soda, acetic acid, and acetone. 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 used in the manufacture of mercury salts, thermometers, medical supplies, mirrors, mercury vapour, and fluorescent lamps; in the manufacture of electrical and chemical apparatus; for automatic electrical contacts; in electric rectifiers; as cathodes in electrolytic chemical processes; in the manufacture of felt; in boiler compounds; in especially designed mercury boilers to replace steam in power production; in cosmetics; and for anti-fouling paint.

Prices and Tariffs

In the first quarter of 1944 the controlled United States price of mercury was $176 per flask, but by July the price had dropped to $96. It rose to $140 in December and to $170 in February, 1945. In 1938 the average price was $75.

Imports of mercury into Canada from the United States are not subject to duty, but are subject to 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 per flask in 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.

Outlook

Apart from direct war uses, it is possible that the demand for mercury will continue to rise, due to its new use in the manufacture of miniature dry batteries. In the event of an increased demand for this and other uses, Canada's output could be readily maintained at the record rate of 1943, when 22,240 flasks were produced, and, if necessary, this rate could be substantially increased.

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MOLYBDENUM IN 1944

Molybdenum concentrates produced in Canada are shipped to Climax Molybdenum Company, Langeloth, Pennsylvania, for conversion into oxide or ferromolybdenum, and equivalent amounts of these products are shipped by that company to Railway and Power Company, Montreal, the distributor for Canada. The supply situation had improved to such an extent that in April, 1944, it was decided to discontinue operations at the Indian Molybdenum mine (Dome Mines, Limited) in Preissac township, Quebec, as the output from the LaCorne mine in LaCorne township, Quebec, would be sufficient to meet the Canadian requirements. In May, 1944, operations at the Quyon Molybdenite property near Quyon, Quebec, were also discontinued.

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, Quebec, and in British Columbia, molybdenite usually occurs in quartz or in quartz veins, along the contacts of, or intruded into 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 be readily distinguished in the field by the olive grey-green smear it leaves when rubbed on glazed white porcelain or enamel. Graphite, for which it is often mistaken, leaves a grey-black smear.

Sources of Production; Occurrences

All of the production in 1944 came from the LaCorne and Indian Molybdenum mines in the Abitibi area and the Quyon Molybdenite mine near Quyon, Quebec, 35 miles northwest of Ottawa.

Two distinct types of ore occur in the LaCorne mine: the east-west veins, which were first worked, being quartz veins; and the north-south veins, which are richer and wider, being characterized by the presence of red feldspar. The mine is being developed to a depth of 375 feet on three levels. On the bottom level, which was opened in 1944, north-south veins of the same grade and widths as on the levels above were encountered.

Indian Molybdenum, Limited, obtained its ore from a large body of disseminated molybdenite in Preissac township, 20 air miles northwest of the LaCorne mine. The molybdenite is similar to the LaCorne ore. Development by means of a flatly inclined shaft of 200 feet vertical depth showed that the ore averages about 0·45 per cent MoS_2, which is considerably lower than was estimated through diamond drilling.

At least 400 molybdenite deposits and occurrences are known in Canada, distributed in all provinces except Alberta. Present indications, however, are that the Abitibi area in Quebec will continue to be the principal source of production. 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 areas for the discovery of other workable deposits.

Production and Trade

From the 187,130 tons of ore treated in 1944 by the three producers, about 1,097 tons of high-grade concentrate was produced and 1,064 tons of concentrate and molybdenum trioxide were shipped, the 561 tons of contained molybdenum being valued at $1,079,698. In 1943, 192 tons of contained molybdenum was shipped.

Wartime Metals Corporation took over the LaCorne property in July, 1942, and made arrangements for Siscoe Gold Mines, Limited, to operate the mine. Production at the enlarged mill was started in May, 1943, and by the end of December, 1944, nearly 150,000 tons of ore containing between 0·6 and 0·7 per cent MoS_2 had been treated, the average during 1944 being about 270 tons daily. The mine is producing over 30 tons of molybdenum (contained in high-grade concentrates) a month.

Indian Molybdenum's 600-ton mill entered production in September, 1943, and by April 30, 1944, when it was closed, it had treated a total of about 93,000 tons of ore.

Quyon Molybdenite Company treated about 150 tons of ore daily, which averaged 0·2 per cent MoS_2. The concentrate was converted to molybdic oxide in a small roasting plant on the property, and was then briquetted and shipped to steel manufacturers in Canada. During the last war this mine was the world's largest producer of molybdenum and it contributed nearly 80 per cent of Canada's output before 1939. The company was acquired by J. J. Gray, of Toronto, in May, 1944.

Prior to the war, 91 per cent of the world production, estimated at 16,500 tons of metallic molybdenum, came from the United States. Climax Molybdenum Company, Climax, Colorado, the world's largest producer, reduced its tonnage and is treating about 10,000 tons of ore daily containing about 0·5 per cent MoS_2. The company probably contributed about 60 per cent of United States total output of contained molybdenum in 1944. This total amounted to 19,267 tons, compared withh 30,833 tons in 1943. Most of the remainder is obtained as a by-product of some of the large copper producers in Utah, New Mexico, and Arizona. Other producing countries are Norway, Mexico, Chile, Peru, French Morocco, Korea, Greece, Turkey, Yugoslavia, Australia, and recently Manchuria.

Uses and Specifications, Tariff

About 30 Canadian consumers, mainly iron and steel companies, used nearly 540 tons of contained molybdenum in 1944, almost 89 per cent as molybdic oxide, nearly 11 per cent as ferromolybdenum, and the remainder as calcium molybdate. About 90 per cent of the molybdenum, however, is consumed by five steel companies. Consumption in 1943 was nearly 600 tons of contained molybdenum, compared with 72 tons in 1939. Stocks of the metal contained in products at the end of the year were nearly 300 tons.

Molybdenite concentrate is converted into an addition agent that is introduced into steel as molybdenum trioxide, ferromolybdenum, or to a small extent as calcium molybdate. The oxide is usually moulded into briquettes.

Molybdenum has a widening range of uses, but by far the greater part of the output is used in steel to intensify the effect of other alloying metals, particularly nickel, chromium, and vanadium. These steels usually contain from 0·15 to 0·4 per cent molybdenum, but in some instances the percentage is considerably higher.

Molybdenum alloys are used widely 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 in the manufacture of shell steels; in armour plating; and in high-grade structural die and stainless steels, and to some extent in high-speed tool-steels. Molybdenum is used in cast iron and in permanent magnets. 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 uses continue to increase and the salts are used in pigments, in vitreous enamels for coating steels and sheet iron, and for analytical work.

United States specifications for concentrate dried at 212° F. are: MoS_2, minimum 85 per cent; copper, maximum 0·6 per cent; iron, maximum 3·0 per cent; combined phosphorus, antimony, and tin, maxima 0·2 per cent.

Prices

The Metals Controller's contract to purchase all domestic molybdenum products at a bonus price of not less than 85 cents a pound of contained sulphide in concentrate, f.o.b. Ottawa, was terminated on December 31, 1943, owing to changed conditions. New producers will have to sell in the open market at the normal price which is about 50 cents (Canadian funds).

The price a pound of contained molybdenum, f.o.b. Toronto, in Canadian funds, for the following imported compounds is approximately: Calcium molybdate (42 per cent Mo), 98 cents; ferromolybdenum (60 per cent Mo), $1.15; and molybdic oxide (52 per cent Mo), 98 cents. The calcium molybdate is sold in bags of about 12½ pounds containing exactly 5 pounds of molybdenum. The molybdic oxide briquettes weigh 5 pounds each and contain 2½ pounds of molybdenum.

Canadian ore and concentrate shipped to the United States is subject to a duty of 17½ cents a pound of contained molybdenum.

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NICKEL IN 1944

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, Ontario. Some nickel is also recovered as a by-product from the treatment of the cobalt-silver ores of Cobalt and of other areas in northern Ontario.

The Canadian output is all smelted at the Copper Cliff smelter of International Nickel Company and the Falconbridge smelter of Falconbridge Nickel Mines, Limited. The only nickel refinery in Canada is at Port Colborne, Ontario, and is operated by International Nickel. That company ships some of its nickel matte to its plants at Huntington, West Virginia, and Clydoch, Wales. Prior to the war Falconbridge Mines, Limited shipped its matte to its refinery at Kristiansand, Norway, but during the war this matte was refined in Canada by International Nickel Company.

Principal Canadian Sources of Supply: Occurrences

The mines of International Nickel Company of Canada, Limited, in the Sudbury area, are by far the most important world source of nickel, and the Falconbridge mine of Falconbridge Nickel Mines, Limited is the only other important Canadian source.

Nickel Offsets, Limited, with a property in Foy township, west of Capreol, Sudbury district, continued the exploration and development work which was started in 1939. Further mining of ore awaits the erection of a concentrator, plans for which are under consideration.

Dominion Nickel Mining Corporation continued to diamond drill the Whistle property and other holdings in Norman township, Sudbury district. Further prospecting is planned for 1945. Diamond drilling on the Tough claim has disclosed down to 200 feet an ore-body containing 600,000 tons of 3 per cent nickel.

North Range Nickel Mines, Limited plans to do extensive diamond drilling on an area adjoining the property of Nickel Offsets, Limited, in Foy township, Sudbury district.

Shewan Copper Mining Corporation did further surface work on its nickel-copper claims on the north shore of Upper Shebandowan Lake, Port Arthur mining division.

Denison Nickel Mines, Limited did not operate its property in Denison township, near Worthington, southwest of Sudbury.

In Manitoba, Red Cloud Mining and Smelting Company undertook early in 1944 to diamond drill its claims in Oiseau (Bird) River area, Lac du Bonnet mining division, and to make a magnetic survey of the claims in a search of copper-nickel and chromite occurrences. Prospecting in 1943, by H. Johnson, northwest of Cat Lake in southeastern Manitoba resulted in the discovery of a low-grade copper-nickel sulphide zone apparently of large extent. No further development was reported in 1944.

In British Columbia the property of Pacific Nickel Mines, Limited near Choate, Yale mining division, remained inactive. The company has reported reserves of 1,183,500 tons averaging 1·39 per cent nickel and 0·50 per cent copper.

Production and Trade

Canadian production of nickel in 1944 was 137,299 tons valued at $69,204,152, compared with 144,009 tons valued at $71,675,322 in 1943. The output in 1943 was the highest on record.

Exports of nickel were as follows:—

—	1943		1944	
	Tons	Value	Tons	Value
		$		$
Nickel, fine	95,240	53,438,303	97,509	55,640,407
Nickel in matte, etc.	36,415	13,109,436	33,848	12,185,370
Nickel in oxide	3,892	1,798,607	1,242	574,857
	135,547	68,346,346	132,599	68,400,634

Imports of nickel and its products were valued at $918,931, compared with $1,167,458 in 1943.

The International Nickel Company of Canada, Limited operated its mines and plants during 1944 at the maximum capacity that available labour would permit. The production of nickel was lower than 1943 due, as mentioned above, to the shortage of labour. Lateral development was carried on throughout the year at the No. 6 shaft of the Creighton mine which was completed in October, 1944, and it commenced the preliminary work in extending the depth of No. 2 shaft at its Garson mine. In November it completed the sinking of No. 7 shaft at its Stobie mine. At its Murray mine, development work was carried on at a reduced rate in the latter part of the year, owing to need for labour in the company's producing mines. Work was started during the summer to provide a new mill tailings disposal area. In its annual report for 1944 the company states that "due to its effort to speed victory, our Company during the war has diminished its ore reserves and has had to handle enormous tonnages of low grade ore to supply the requirements of the United Nations. The inability to expand ore reserves by continous mine exploration is due to our labour shortage. During the five years since the war started nearly one million feet of diamond drilling have been completed and when the ore which has been discovered by this diamond drilling is proven (by development) the additional tonnage determined may be as great as the loss in ore reserves caused by the extraordinary ore consumption during the war."

Falconbridge Nickel operated its mine and smelter at Falconbridge throughout 1944. The company's output reached a peak of 12,050 tons of nickel and of 6,380 tons of copper, due largely to increased mechanization to overcome labour shortage and to the additions to treatment plants completed in 1943. The company continued its extensive development and exploratory work and commenced the development of the ore on the bottom level off No. 5 shaft. It started to sink No. 1 shaft below the 2,100-foot level in February and at the end of 1944 the shaft had reached a point 2,691 feet below the collar. Three stations had been cut at levels of 2,275, 2,450 and 2,625 feet. In its annual report the company states that "With the war in Europe nearing its end there has been already in 1945 a slackening of demand. The market for copper has definitely worsened in price. As to nickel, while sales continue normally the contracts at present in force contain cancellation clauses with short notice. It follows that the situation will remain uncertain until civilian markets are reopened."

The company's ore reserves, as given in the annual report, totalled 12,670,000 tons with an average grade of 1·72 per cent nickel and 0·93 per cent copper. The limited new deep development off No. 5 shaft has opened up what appears to be a substantial additional tonnage of good grade ore which is not included in the above statement.

Harlin Nickel Mines, Limited operates the Alexo nickel-copper property at Porquis Junction, Cochrane mining division, where production was started in

June, 1943. Steady shipments of crude ore to International Nickel Company's smelter at Copper Cliff were maintained until August, 1944, when operations ceased.

The world production of nickel in 1944 was probably in excess of 150,000 short tons, the chief producing countries being Canada, New Caledonia, Greece, India, Norway, and Russia.

Market and Prices

New applications of nickel for the production of a great diversity of special-quality nickel steels and alloys developed in the pre-war years and the increasing acceptance of these new applications in industry had by 1939 built up a total world consumption of nickel estimated by the International Nickel Company at 128,000 short tons for that year. One of the most highly essential of the war metals, demands for war and other purposes have greatly exceeded the increased emergency production of the war years, and close control has been necessary to conserve available supplies for high priority requirements.

The quoted spot price of nickel in the United States has continued unchanged at 35 cents a pound since 1928.

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OTTAWA, CANADA, MAY, 1945.

PLATINUM GROUP METALS IN 1944

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 its 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.

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

Production and Trade

The Canadian production of platinum in 1944 was 157,523 fine ounces valued at $6,064,635, compared with 219,713 fine ounces valued at $8,458,951 in 1943. The production of palladium and other associated metals of the platinum group was 42,229 fine ounces valued at $1,960,085, compared with 126,004 fine ounces valued at $5,233,068 in 1943.

Exports of platinum group metals in all forms were valued at $6,776,508, compared with $7,738,998 in 1943. Imports of platinum products in 1944 were valued at $99,381, compared with $454,946 in 1943.

World production of platinum and its allied metals in 1944 is estimated at 570,000 ounces. Canada has been the leading producer of platinum since 1934 when it displaced Russia; the other principal producers in order of importance being Russia, South Africa, and Colombia. 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 to restrictions on the publication of statistics, no worth-while estimate can be made of world production and consumption of the platinum group of metals for 1944. The world consumption, however, was probably about equal to production.

Market and Prices

The market situation in 1944 is explained by Charles Engelhard, President of Baker and Company, Incorporated, in the following, which is abstracted from his annual review:

There was no sign in 1944 of any easing in demand for platinum for military equipment and war industries which continued to require very large amounts of platinum and platinum alloys. To conserve platinum for these uses regulations are in effect to prohibit the use of platinum in the manufacture of jewelry, which was one of the principal pre-war applications.

Platinum and platinum alloys are used in numerous electrical and electronic devices such as magnetos, automatic controllers, radios, and other apparatus used in warfare. They are vital in producing many materials including explosives, electro-chemicals and special glass products.

During 1944 there has been a substantial increase in demand for palladium, which is in sufficient supply, for industrial, jewelry and dental purposes. It is being consumed in electrical equipment for small contacts, and as a catalyst in a growing number of hydrogenation processes. It has achieved wider public recognition as a precious metal suited for jewelry. The pen and pencil trade has also become an important consumer of palladium.

Rhodium, ruthenium and iridium continued to be used mainly for alloying purposes. Rhodium can be used with very satisfactory results as a hardener for either platinum or palladium, thus assisting iridium which is subject to conservation regulations, as is also rhodium.

Except for iridium, prices for the platinum group have remained stable during 1944. Platinum was $35 an ounce, palladium $24 an ounce, rhodium $125 an ounce, and ruthenium $35 an ounce. Iridium sold at $165 an ounce up to July 1944, and since then has been quoted at $120 an ounce.

With regard to the outlook, Mr. Engelhard stated that

No early change is expected in the current demand for platinum and platinum alloys for military equipment and war industries. It appears that much of what is being learned during the war concerning the uses and advantages of platinum metals will be applicable to post-war products and processes, which supports a confident view of the long-term possibilities of the platinum industry.

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SELENIUM IN 1944

Selenium is fairly widely distributed, but is not abundant in nature. It occurs in association with sulphur and frequently accompanies the sulphides of heavy metals in the form of selenides. In no case does it occur in quantity large enough to be mined for itself alone.

Commercial selenium is recovered 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 the copper refinery of International Nickel Company of Canada at Copper Cliff, Ontario. The only other producer in Canada is Canadian Copper Refiners, Limited, with refinery at Montreal East, Quebec, where production was commenced in November, 1934. 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 mine on the boundary line between Manitoba and Saskatchewan.

Production and Trade

Canadian production of selenium in 1944 was 298,592 pounds valued at $537,466, compared with 374,013 pounds valued at $654,523 in 1943. The maximum production of 495,365 pounds was reached in 1942. Quebec is the source of about 58 per cent of the total output of the metal, Ontario about 18 per cent, and Manitoba and Saskatchewan the remainder.

Exports of selenium and selenium salts in 1944 were 250,404 pounds valued at $445,768, compared with 211,530 pounds valued at $380,493 in 1943.

World production of selenium is believed to approximate 600 to 700 short tons a year, the United States and Canada being the principal sources of supply. Small quantities are produced by several countries, including Russia, Rhodesia, and Mexico.

A plant for the manufacture of selenium compounds was erected in 1944 at Montreal East by Canadian Copper Refiners, Limited.

Uses 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.

The greatest single development in the utilization of selenium since the commencement of war has been its use in electrical rectifiers that have played such an important rôle in connection with radar and with generators for aeroplanes and army field equipment. Considerable quantities are being used as accelerators in the vulcanization of synthetic rubber. It is also being used to develop free machining qualities in stainless metal. Selenium is used as an ingredient of austenitic chromium steels. For this purpose it is supplied in bars of selenium-bearing stainless metal. The Battelle Institute has discovered that selenium is useful in producing good ruby glass; is a quality-improver in lubricating oil; and is a potent ingredient of anti-fouling paints for ship bottoms.

Since August, 1938, the nominal price for selenium, black powdered, 99·5 per cent pure at New York has been $1.75 a pound. "Glass Industry" gives the following quotations for selenium salts in 1943: (1944 not available) barium selenite, $1.40 to $1.60 a pound, and sodium selenite, $1.50 to $1.65 a pound.

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SILVER IN 1944

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.

Production and Trade

The Canadian production of silver in 1944 was 13,627,109 fine ounces valued at $5,859,657, compared with 17,344,569 fine ounces valued at $7,849,111 in 1943. The output has been steadily decreasing for several years.

Exports of silver were: silver contained in ore, concentrates, etc., 2,389,739 fine ounces valued at $1,170,475, compared with 2,253,018 fine ounces valued at $1,040,297 in 1943; and silver bullion (Canadian), 3,577,243 fine ounces valued at $1,762,944, compared with 9,198,617 fine ounces valued at $4, 517,756 in 1943. Imports of manufactures of silver were valued at $36,349, compared with $31,681 in 1943.

About half of the silver produced in Canada comes from British Columbia, by far the largest source of production in the Dominion being the Sullivan lead-zinc-silver mine at Kimberley. 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 mainly from the portion of the Flin Flon deposits lying within that province; and 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, and other gold mines.

In Ontario, production from the mines of Cobalt and adjoining areas has been decreasing for several years, and it is the activities in connection with the production of cobalt ore that have helped to keep many small enterprises in operation in these areas. The increased production of silver from the nickel-copper mines of the Sudbury area in the past 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.

In Quebec, the rapid expansion of mining in the western portion of the province in recent years has resulted in a marked increase in the production of silver, which in 1944 totalled 2,558,300 ounces. It is obtained from the copper-gold ores of Noranda, the copper-zinc ores of Waite-Amulet and Normetal, and 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. Gold placer mining contributes about 20,000 ounces a year.

In the Northwest Territories, practically all of the small output in 1944 came from the radium-silver ores of Eldorado mine in the vicinity of Echo Bay, Great Bear Lake, and from the Negus gold mine in the Yellowknife area.

Plants for the production of 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.

Market and Prices

In the "Annual Review of the Silver Markets", Handy and Harman summarize the consumption of silver in 1944 as follows:

England's industrial consumption of silver, restricted entirely to war purposes is estimated at 14,000,000 to 18,000,000 ounces. In Mexico the arts used about 6,500,000 ounces, part of which went into native handicraft articles. Canadian arts and industries absorbed an estimated 5,000,000 ounces. This was a 25 per cent increase in 1943 and established a new high record. In the case of the United States the estimated consumption for the arts and industries was 125,000,000 ounces, an increase of 4 per cent over 1943; of this amount war and other essential purposes accounted for about 65 per cent.

In 1944 the Canadian Government purchased 4,000,000 ounces of silver for coinage purposes from Dominion producers, and an additional 400,000 ounces were made available through recovery from unrefined gold deposited at the Royal Canadian Mint, Ottawa.

The average estimated price (Canadian funds) of silver in 1944 was 43 cents per fine ounce, compared with 45·3 cents in 1943. The maximum domestic price of refined silver in Canada was set in January, 1943, by the Wartime Prices and Trade Board, at 40 cents per ounce. This price was later on readjusted by the Metals Controller, Department of Munitions and Supply. The New York official price was 44·75 cents throughout 1944.

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TELLURIUM IN 1944

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 varieties 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 sludges, and for the production of the refined metal. Tellurium was first produced in Canada in 1934 at Copper Cliff, Ontario by International Nickel Company of Canada, Limited. The only other producer, Canadian Copper Refiners, Limited, started production in 1935 at its plant in Montreal East, Quebec. 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, Noranda, Quebec, and the blister copper of Hudson Bay Mining and Smelting Company, Flin Flon, Manitoba. There has been no recovery in Canada from the sludge of sulphuric acid chambers.

Production and Trade

Canadian production of tellurium in 1944 was 10,661 pounds valued at $18,657, compared with 8,600 pounds valued at $15,050 in 1943 and 11,084 pounds valued at $17,735 in 1942. Exports of tellurium are not recorded separately.

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.

Uses and Prices

Metallic tellurium, until a few years ago, was of little industrial importance. Formerly it was used to a small extent in some radio work and 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 is 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 in which case it is used in the form of a ferrotellurium.

A nominal price for tellurium of $1.75 per pound at New York has prevailed since 1938 and throughout 1944.

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TIN IN 1944

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.

In British Columbia 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 production of tin. 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. Cassiterite occurs also in many other places in Canada, but no commercial deposits have 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. During the past few years it has become apparent that the gold-bearing placers in many creeks in the Mayo district contain some crystalline cassiterite. Some evidence has been gathered showing the likelihood of there being from 200 to 300 tons of tin available as cassiterite in the placers of Dublin Gulch and Haggart Creek. In August, 1943, a lode source of this tin was found on the north side of Dublin Gulch assaying from $\frac{3}{4}$ to $1\frac{1}{2}$ per cent tin across an approximate width of 3 feet.

The tin concentration plant of Consolidated Mining and Smelting Company at Kimberley commenced operation on March 1, 1941, and has been functioning very satisfactorily. The plant for the production of refined tin also at Kimberley was brought into commercial operation in April, 1942. The tin content of the ore is small and the recovery is proportionately small.

Production and Trade

Production of tin in 1944 was 516,626 pounds valued at $299,643, compared with 776,937 pounds valued at $450,623 in 1943. Imports of tin in the form of blocks, pigs, tin foil, and collapsible tubes in 1944 were valued at $2,178,118, compared with $1,766,334 in 1943.

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 3,000 tons a year and are now much larger. These requirements were formerly obtained mostly from smelters in the Straits Settlements. The position of the Allied countries in respect to tin became critical with the capture by Japan of these smelters and of the Malayan tin mines, and the civilian use of the metal has been greatly curtailed. The search for commercial deposits of tin in Canada was continued and some occurrences of possible economic interest were found by a Geological Survey party in the Yellowknife area, Northwest Territories. Elsewhere, the results were not encouraging.

The world smelter production of tin in 1939 (data for war years incomplete) was 175,500 long tons.

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 at Texas City, Texas. This Government-sponsored smelter was built by Tin Processing Corporation of New York and had originally a capacity of 50,000 long tons of concentrate or 18,000 long tons of tin a year. Built to treat the portion of Bolivian ores made available to the United States (50,000 long tons of concentrate), it was ready for operation in April, 1942. Subsequent enlargements raised the capacity of the smelter to 90,000 long tons a year. In 1944 it was producing at the rate of 30,000 long tons of metal a year. 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 babbitt 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 price of tin in New York was fixed in August, 1941, at 52 cents a pound and there has been no change since then.

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TITANIUM IN 1944

All known occurrences of titanium in Canada of possible economic interest are in Quebec and Ontario. Ilmenite or titanic iron ($FeTiO_3$), in commercial quantities and containing from 18 to 25 per cent of titanium is found at St. Urbain in Charlevoix 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 (magnetite containing 3 to 15 per cent titanium) deposits 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 Vermilion Lake in western Ontario.

The Canadian output 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

The production of titanium ore (ilmenite) in 1944 was 33,973 tons valued at $165,195, compared with 69,437 tons valued at $308,290 in 1943. Imports of titanium, which are in form of the oxide, are not recorded separately.

The world production of titanium ore is estimated at about 300,000 tons of ilmenite and 9,000 tons of rutile. India is the principal producer of ilmenite, the other important producers being Norway, Malaya, Portugal, Australia, United States, and Canada. The principal producers of rutile are Brazil, New South Wales (Australia), and the United States.

The United States became 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 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 analysing 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.

The situation with respect to titanium dioxide pigments has remained unchanged during 1944. All of Canada's requirements were imported from the United States and the expanding demand continued to be met.

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 ferro-carbontitanium f.o.b. plant remained at \$142.50 a ton, and metallic titanium at \$5 to \$5.50 a pound throughout 1944.

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TUNGSTEN IN 1944

The supply of tungsten, which was critically short during 1943, is now in excess of the demand. Consequently, the output of Canadian concentrates ceased at the end of 1943, but stocks at the mines were shipped during 1944. In the first quarter of 1945 consumption increased for a special war use, but by the end of April orders were cancelled, and at the present rate of consumption Canada has nearly two years' supply of tungsten. Resumption of mining operations thus appears unlikely, but if an urgent demand again arises, Canada's requirements can be adequately supplied from the Emerald property in southern British Columbia.

Wolframite, (Fe, Mn)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, fairly soft, 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 and in certain contact metamorphic deposits. It can be detected readily in the dark by its brilliant, pale bluish-white fluorescence under ultra-violet light and purple filter.

Sources of Production; Occurrences

Intensive prospecting in 1941 and 1942 by means of the ultra-violet lamp revealed several hundred occurrences of scheelite distributed in every province except Alberta, the majority as well as the largest deposits being in British Columbia. All, except three or four, of the deposits are small and in many of them the scheelite is associated with gold ores and was recovered as a by-product of gold mining operations.

In Nova Scotia, the production came from the Indian Path mine near Lunenburg on the south coast, and from the Moose River property, 35 miles northeast of Halifax.

The production from Quebec was hand-picked ore from a number of gold mining operations.

In Ontario, over 90 per cent of the output came from Hollinger Consolidated Gold Mines, Timmins, and most of the remainder came from Little Long Lac and Kerr Addison gold mines. Fairly massive scheelite occurs in the Hollinger mine in zones or bodies in quartz close to the porphyry, from the surface down to the 5,150-foot level.

In British Columbia, which was the leading producer of scheelite, the chief source of output was Consolidated Mining and Smelting Company's Red Rose mine, south of Hazelton. The remainder of the production came from the Emerald deposit, 6 miles southeast of Salmo in southern British Columbia, and from several producers in the Bridge River area. The Emerald ore is rather finely disseminated, usually in impure limestone with garnetite, and occurs in several contact metamorphic zones, mainly between granite and argillite.

In the Yukon, the output came from placer operations, and in the Northwest Territories it came mainly from Outpost Island in Great Slave Lake.

Production and Trade

As noted, there was no production in 1944. Shipments consisted of concentrates on hand at mines and mills and comprised, in the main, the 1943 output from the Emerald property. The shipments amounted to 443·4 tons of high-and low-grade concentrates which contained 142·5 tons of WO_3 (114 tons of tungsten) valued at $245,780. They included 310 tons of low-grade concentrate (48 tons of WO_3) that was shipped to the United States for treatment.

Shipments in 1943 reached a record of 754 tons of concentrate (327 tons of tungsten) valued at $1,083,538, and from the start of the war to the end of 1944 they amounted to 1,510 tons of concentrate containing 742 tons of WO_3 (594 tons of tungsten) valued at $1,786,525. Most of this was 70 to 75 per cent WO_3 concentrate which was shipped to Atlas Steels, Limited, Welland, Ontario. The remainder consisted of low-grade (10 to 15 per cent WO_3) concentrate and was shipped to the United States for further treatment. All concentrates in stock at January 1, 1944, have now been shipped with the exception of about 33 tons of very low-grade material at the Val d'Or plant. Stocks at Welland and in storage at Niagara Falls at end of 1944 amounted to 515 tons of contained tungsten.

Consumption was about 232 tons of tungsten contained in scheelite and ferrotungsten, compared with 390 tons in 1943. No tungsten ore was imported in 1944.

In Nova Scotia, production of tungsten ore was discontinued late in 1942.

In Quebec, the output was shipped to the Val d'Or plant of the Quebec Department of Mines for treatment until November, 1943, when this service was discontinued.

In Ontario, the scheelite mill at the Hollinger mine entered production early in 1942 and was closed in September, 1943, during which period it produced about 275 tons of high-grade concentrate, which contained about 195 tons of WO_3. The ore averaged 0·37 per cent WO_3.

In British Columbia, production at the Red Rose property was started in January, 1942, and was discontinued in October, 1943, during which period 600 tons of high- (73·8 per cent) and low- (14 per cent) grade concentrates (344 tons of WO_3) were shipped, the average grade of the ore treated being 1·64 per cent WO_3.

The Emerald deposit was discovered early in 1942 and production from the 300-ton mill was started in July, 1943. The property, which was operated by a Crown company, was closed in October, 1943, as a result of the marked improvement in the tungsten situation. During the short period of operations high- (72 per cent) and low- (15 per cent) grade concentrates containing 137 tons of WO_3 were produced, the average grade of ore treated being 1·7 per cent WO_3. Estimates of reserves are 250,000 tons of 1·25 per cent WO_3 ore, apart from the ore in numerous minor bodies. The output from properties in the Bridge River area amounted to about 12 tons of WO_3.

The total output from the Yukon and the Northwest Territories amounted to about 21 tons of contained WO_3.

From 1939 to May, 1944, when shipments ceased, the Bureau of Mines, Ottawa, received about 210 tons of ore from about 60 producers across the Dominion for treatment. From this ore about 63 tons of concentrate which contained 40 tons of WO_3 was recovered and shipped.

Canada has no plants for the manufacture of ferrotungsten or other tungsten addition agents and the only company making tungsten steels is Atlas Steels, Welland, Ontario. Only scheelite is used by the company at present, and the high-grade (not less than 70 cent cent WO_3) concentrate is added directly to the steel bath. This is possible because of the comparative ease with which the calcium forms a slag.

World production of tungsten ore and concentrate in 1939, on a basis of 60 per cent WO_3, was about 40,000 metric tons, and the principal producers were China, Burma, United States, Bolivia, Malaya, Portugal, Spain, Korea, Japanese-controlled areas in south China, Australia, Argentina, Brazil, and South Africa. China was the chief source of tungsten for 20 years prior to

1939, the record production being 16,257 metric tons of 60 per cent WO_3 in 1937. The ore mainly occurs as wolframite. Most of the mines in Kiangsi Province, where the largest deposits occur, are still under Chinese control. In Burma, the Mawchi tin-tungsten mine, 170 miles northeast of Rangoon, was the principal producer. Bolivia is the principal producer in South America. In Europe the most extensive tungsten deposits occur in Trasos-Montes in northeastern Portugal.

In the United States, output in 1944 is estimated at 10,500 tons of 60 per cent WO_3, compared with the record of 12,045 tons in 1943. Most of the output came from Idaho, California, and Nevada. Approximately half the United States 1944 production came from the Bradley Mining Company's operations at Yellow Pine, near Stibnite, Idaho. The tungsten plant at Salt Lake City, operated by the U.S. Vanadium Corporation for the Metal Reserve Company, closed down in April, 1944. Most of the Canadian low-grade concentrate was shipped in the past to this plant for chemical treatment. Most of the ore mined in the United States is scheelite which occurs mainly in contact metamorphic deposits of tactite or skarn (garnet-epidote-diopside-calcite-quartz-complex) and is somewhat similar to the deposits in southern British Columbia.

Uses

As an alloying metal in steel, tungsten (usually as ferrotungsten, but sometimes as calcium tungstate or scheelite concentrate) is used essentially to impart hardness and toughness, which are maintained even when the steel is heated to a high temperature. Almost 80 per cent of the consumption of tungsten in the United States is used for the production of high-speed steels for cutting tools, in which the tungsten content is 15 to 20 per cent. Alloy steels containing tungsten are being used extensively in making armour plate, armour-piercing projectiles, and other military equipment. The use of tungsten in hard facing compounds is growing. 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 2 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.

Prices

Until production ceased late in 1943, all sales of Canadian concentrate were made through the Metals Controller, Ottawa, at a price of $26.50 a short unit (20 pounds) of WO_3 for concentrate containing 70 per cent WO_3 (within specifications), delivered at Welland, Ontario. Since then the price has fluctuated downward and is unstable.

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OTTAWA, CANADA, MAY, 1945.

ZINC IN 1944

Close to 55 per cent of the zinc produced in Canada in 1944 came from Consolidated Mining and Smelting Company's Sullivan silver-lead-zinc mine near Kimberley, British Columbia. The remainder was from Hudson Bay Mining and Smelting Company's copper-zinc deposits at Flin Flon, which straddle the Manitoba-Saskatchewan boundary; 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; the Normetal and Waite-Amulet copper-zinc mines in western Quebec; and the Tetreault and New Calumet lead-zinc mines in Quebec. About 77 per cent of the Canadian production of zinc in 1944 was exported, mostly in the refined form.

Production and Trade

Canadian production of zinc in 1944 was 275,412 tons valued at $23,685,405, compared with 305,377 tons valued at $24,430,174 in 1943. The production in 1944 by provinces was: British Columbia, 145,076 tons; Quebec, 68,786 tons; Saskatchewan, 43,364 tons; Manitoba, 22,165 tons; and Ontario, 1,143 tons.

The exports in 1944 were 213,861 tons (zinc content) valued at $15,015,516, compared with 242,736 tons (zinc content) valued at $16,516,365 in 1943. Exports in 1944 consisted of: zinc contained in ore, 113,303 tons; metallic zinc, 95,985 tons; and zinc in scrap, etc., 4,572 tons. The exports in 1943 were: zinc in ore, 111,275 tons; metallic zinc, 129,315 tons; and zinc in scrap, 2,146 tons. Imports of zinc products of all kinds, including oxide and chemicals, were valued at $2,454,539, compared with $4,116,156 in 1943.

In British Columbia, the zinc and lead concentrates produced by Consolidated Mining and Smelting Company of Canada in the 8,000-ton concentrator of the Sullivan mine at Kimberley are shipped by rail 185 milles to the company's smelter and refinery at Trail. A total of 2,141,400 tons of ore was milled in 1944, a decrease of about 15 per cent compared with 1943. The grade of ore treated was also lower, due largely to the cleaning out of stope bottoms in preparation for filling, and to the retarded state of development work. This work, which had been curtailed so that greater attention could be given to production, was expanded.

Western Exploration Company at Silverton produced zinc and lead concentrates for export.

Reco Mountain Base Metal Mines, Limited, near Sandon, which started milling operations at the renovated Noble Five concentrator in September, 1943, discontinued operations in May, 1944, when the plant was destroyed by fire.

Retallack Mines, Limited, at Retallack, completed the renovation of its 300-ton mill in April. Its contract for the sale of the zinc concentrate, made in December, 1943, with United States Commercial Company, a United States Government subsidiary company, was replaced in April, 1944, by a contract for the sale of zinc and lead concentrates to American Smelting and Refining Company in the United States.

The Kootenay Florence lead-zinc mine at Ainsworth was taken over in 1943 by Wartime Metals Corporation, and was operated as the Kootenay Florence Project from early in 1943 until May, 1944, when the contract for sales to the Metals Reserve Company (United States) was cancelled.

Zincton Mines, Limited operated the Lucky Jim zinc mine and its 350-ton concentrator at Zincton at a reduced rate.

Base Metal Corporation's power house was destroyed by fire in January and as a result there was no production from the company's Kicking Horse zinc-lead mine at Field from then until June 12. The mine was in continuous production during the remainder of the year, and until near the end of November, when a small crew was placed in the Monarch zinc-lead mine, also at Field, to complete salvage operations. The company's concentrator treated an average of 122 tons a day during the period of regular operation, compared with a daily average of 169 tons in 1943. Development work was carried on at the Kicking Horse mine during the time that production was suspended.

The Tyee zinc-lead-copper property, near Chemainus, Vancouver Island, was in production until May when the contract with Metals Reserve Company was cancelled. The property was acquired in 1942 by Twin "J" Mines, Limited, and was operated by the company under the supervision of Wartime Metals Corporation. Zinc, lead, and copper concentrates were produced in the 125-ton mill. The Reeves McDonald zinc-lead mine on the Pend-d'Oreille River remained idle in 1943.

Several small lead-zinc properties, mainly in the Ainsworth-Slocan area shipped crude ore to the Trail smelter.

In Manitoba, Hudson Bay Mining and Smelting Company at Flin Flon operated at capacity. The output of zinc was higher than in past years with the exception of 1943. The concentrator, which has a rated capacity of 6,000 tons a day, treated an average of 5,540 tons of ore a day. A total of 51,229 tons of slab zinc was produced, compared with 54,249 tons in 1943. Major development and exploration work was limited by the labour shortage, the principal work accomplished being the completion of the south main shaft to the 3,500-foot level. A total of 41,300 feet of diamond drilling was also done.

Sherritt Gordon Mines, Limited, Sherridon, obtained about 65 per cent of its copper-zinc from its West mine (down to the 8th level), and 35 per cent from its East mine. A total of 731,783 tons of ore was milled from which 11,960 tons of zinc was obtained. The zinc ore reserves were 113,000 tons averaging 9·04 per cent zinc and 0·95 per cent copper, and the copper ore reserves were 2,175,000 tons averaging 2·59 per cent copper and 2·20 per cent zinc. The company did considerable diamond drilling, mostly in the eastern section of the property.

Cuprus Mines, Limited (Hudson Bay Mining and Smelting Company) completed plans for the sinking of a 600-foot exploration shaft on its Thompson copper-zinc property near Schist Lake. Diamond drilling in 1942 and a geophysical survey in 1943 indicated a mineralized zone 3,000 feet long which contains a few lenticular copper-zinc bodies of good grade.

In Ontario, Lake Geneva Mining Company's property in Hess township, Sudbury district, was operated by Wartime Metals Corporation. The contract with Metals Reserve Company for the sale of its zinc concentrates was cancelled, effective April 30, and operations ceased near the end of May, and the plant was dismantled and sold.

In Quebec, New Calumet Mines, Limited, with mine and 500-ton concentrator at Calumet Island, Pontiac county, operated at capacity. Shipments of zinc and lead concentrates are made to American smelters designated by Metals Reserve Company with which New Calumet has a contract.

Operations at the Tetreault property near Notre-Dame-des-Anges, Portneuf county, were discontinued in May. The property was operated by Siscoe Gold Mines, Limited as the "Tetreault Project" under the general supervision of Wartime Metals Corporation. The zinc and lead concentrates were sold under contract to Metals Reserve Company.

Aldermac Copper Corporation, Limited equipped its property at Moulton Hill, 4 miles from Sherbrooke, with a complete mining plant and a 250-ton concentrator, which was put into operation on July 15. The mill produces zinc, copper, and lead concentrates for shipment to the United States. In due course, a pyrites concentrate may also be produced. The ore contains appreciable amounts of gold and silver.

Waite Amulet Mines, Limited treated an average of 1,660 tons of ore a day in its 1,800-ton mill. About two-thirds of the tonnage treated was obtained from the Amulet Dufault property and the remainder from the Waite Amulet property. The mill feed contained an average of 7·25 per cent zinc and 3·67 per cent copper, and from it 37,088 tons of zinc, 20,504 tons of copper, 12,104 ounces of gold, and 685,266 ounces of silver were obtained. Exploration work was mainly in the form of exploratory diamond drilling.

Normetal Mining Corporation operated its mine and mill 12 miles north of Dupuis, Abitibi county, at a further reduced rate, the 780-ton mill averaging 530 tons a day, the lowest since 1940. All of the zinc concentrate was shipped to smelters in the United States. These shipments amounted to 16,528 tons and averaged 53·32 per cent zinc. Shipments of copper concentrate to the Noranda smelter amounted to 25,996 tons and averaged 22·65 per cent copper. Mill heads averaged 6·22 per cent zinc and 3·28 per cent copper with a low content of gold and silver. Owing to the limited amount of lateral work done, the known reserves declined 56,900 tons to 1,380,800 tons, with an average grade before dilution of 6·77 per cent zinc, 3·56 per cent copper, 0·032 ounce of gold, and 2·39 ounces of silver. Owing to shortage of labour, development, more particularly lateral work, was seriously curtailed. No. 3 shaft was deepened 450 feet down to the 3,200-foot level. From this elevation downward an internal shaft will probably be necessary.

Golden Manitou Mines, Limited operated its mine and 1,000-ton concentrator near Val d'Or. Its contract with the United States Government agencies for zinc concentrates expired January 1, 1945, but it made a new contract with American Zinc Company of Illinois for a period of 3 years. The company reports ore reserves above the 960-foot level of 983,100 tons averaging 7·74 per cent zinc, 0·045 ounce of gold, and 3·06 ounces of silver. Ore of good grade not included in the above estimate has been proved by diamond drilling down to a depth of 1,500 feet.

Hollinger North Shore Exploration Company (Hollinger Consolidated Gold Mines) investigated occurrences of zinc that were disclosed in 1943 on its concession near the Quebec-Labrador boundary. Limited exploratory work on an outcrop indicated a width of 13 feet of zinc ore and a length, determined by trenching, of 660 feet, the grade being 6·75 per cent zinc, 1·32 per cent copper, and $2.00 in precious metals. Prior to the war, United States, Canada, Australia, Germany, Poland, Mexico, and Russia, in the order named, were the principal producers of zinc from ores of domestic origin.

Uses and Prices

The basic uses of zinc under war conditions are the same as those in peacetime, but in all fields of use the wartime demand for the metal is exceptionally large. 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. A large percentage of the Canadian consumption of zinc is used in the war effort in the making of brass and bronze products, for galvanizing, for die casting, in zinc oxide, in dry batteries; and for miscellaneous purposes.

The average price of zinc in 1944, in Canadian funds (based on London quotations), was 4·3 cents per pound, compared with 4·0 cents in 1943. The St. Louis' price was 8·25 cents throughout 1944. This price has prevailed since 1942.

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NATURAL ABRASIVES IN 1944

As the production of natural abrasives in Canada has been very small for many years, only brief reviews of the following are given below; garnet, pulpstones, grindstones, and scythestones, volcanic dust (pumice). Corundum is reviewed separately, as the demand has increased considerably and the Canadian corundum industry was revived in 1944.

Garnet

Niagara Garnet Company shipped about 100 tons of garnet rock to a small mill at Sturgeon Falls, Ontario, from a deposit in Dana township, concession III, lots 1 and 2, 4 miles north of River Valley Station (41 miles northwest of North Bay). About 10 tons of ore from this rock was treated, and 3 tons of concentrate valued at $90 was shipped to the company's head office in Niagara Falls, New York, for further treatment.

Canada Garnet, Limited mined a few tons at its property south of Labelle, 100 miles north of Montreal, and shipped a car lot to the Quebec Bureau of Mines' treatment plant at Val d'Or, where 2 tons of concentrate was made. Samples were sent to foundries for sandblasting tests. Tests were made by the Bureau of Mines, Ottawa, on concentrate submitted by the company to determine the efficiency of the garnet for sandblasting on metal and stone, compared with that of silica sand and artificial abrasives in general use. Results did not indicate any advantage in its use.

A. G. Chew, of Sudbury, prospected a garnet zone in Loughrin township, concession IV, lot 14, about 24 miles east of Sudbury, and shipped 4 tons of ore to the United States for experimental purposes.

About 85 per cent of the world output of garnet comes from the United States, mainly from North Creek, New York, and the product is regarded as the world standard abrasive garnet. Production in 1944 dropped over 20 per cent below the 1943 output of 5,935 tons, valued at $429,120.

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. The specifications for garnet for this use are somewhat exacting. Few, if any, of the hundred or more garnet deposits so far examined in Canada fulfil all of the requirements. Minor uses for garnet are for sandblasting; for surfacing plate glass, and garnet superfine (flour) grades are now being used as a partial substitute for corundum flour used for optical lens polishing.

Canadian consumption of garnet grain suitable for "sandpaper" manufacture is less than 200 tons annually and none is at present commercially used for sandblasting. Competition from the artificial abrasives (silicon carbide and oxide of alumina) is a serious factor in the marketing of garnet.

Prices of ungraded concentrate suitable for sandpaper range from $60 to $85 a ton.

Grindstones, Pulpstones, and Scythestones

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

No pulpstones or scythestones were produced in 1944, but 225 tons of grindstones valued at $12,000 were shipped by the Read Stone Company, Sackville, from quarries near Stonehaven on the Bay of Chaleur, northern New Brunswick. In 1943 that company produced about 162 tons of grindstones and 2 tons of scythestones having a total value of $6,225.

Pulpstones were last produced in 1937 by the J. A. and C. H. McDonald Company from Gabriola Island, near Nanaimo on Vancouver Island, British Columbia. Good pulpstones are in demand, particularly for use in the large magazine grinders, but known Canadian deposits containing thick beds of sandstone of the proper quality appear to have been worked out and production has ceased. There is also an increasing competition from Canadian-made artificial segmental pulpstones, mainly of silicon carbide grit, and about 650 of these stones are in use and in stock in the various Canadian pulp mills. The imported natural pulpstones come mainly from West Virginia.

Volcanic Dust

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

Deposits of volcanic dust are found in Saskatchewan, Alberta, and British Columbia. There has been intermittant production from Waldeck, near Swift Current, and at Rockglen, 125 miles southeast of Swift Current, in Saskatchewan, and from near Williams Lake in British Columbia. There was no production in 1944, but in 1943 about 60 tons was shipped from the Rockglen deposit for insulation purposes.

Imports are grouped with a number of similar products (pumice, pumice stone, lava, and calcareous tufa), the value of which totalled $27,880 in 1944. Most of the pumice dust was used in scouring powders.

The United States is the world's largest consumer of volcanic dust and pumice and has an annual output of over 125,000 tons. Consumption is mainly for scouring and cleansing compounds and as a concrete admixture and concrete aggregate. Minor uses are for insulation, glass bevelling, polishing aluminium, in the manufacture of fire-proof walls, building tiles, and as glazes in ceramics.

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ASBESTOS IN 1944

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

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.

Small deposits of chrysotile asbestos are known in other parts of Quebec and also in Ontario and British Columbia, and several of them have been worked from time to time. The asbestos from some of these deposits 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 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 the making of roofing materials. Asbestos deposits reported as having been found in recent years in Manitoba and in northern and western Ontario are of the amphibole varieties. The amphibole fibres are too harsh and brittle to be spun, but they have a higher resistance to acids than has chrysotile, and it is possible that material from some of the deposits is suitable for use in acid filters and for other purposes where long harsh fibres are required. Small, trial shipments for testing for this use were made from a property near Calabogie, Ontario, and from another near Val d'Or, Quebec, in 1944.

Production and Trade

The production of asbestos in 1944 amounted to 419,265 tons valued at $20,619,516, compared with 476,196 tons valued at $23,169,505 in 1943.

Exports of asbestos in 1944 were as follows: crude asbestos 1,541 tons valued at $649,564; milled fibres 181,668 tons valued at $13,634,772; asbestos waste, refuse or shorts 212,728 tons valued at $5,361,358; asbestos manufactures including asbestos roofing valued at $184,189. Comparative data for 1943 are: crude asbestos 1,990 tons valued at $859,511; milled fibres 210,837 tons valued at $15,673,929; asbestos waste, refuse or shorts 230,172 tons valued at $5,848,031; asbestos manufactures valued at $139,209.

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.

Imports in 1944 consisted of 110·8 tons of asbestos packing valued at $100,260; brake linings for automobiles valued at $523,171; clutch facings for automobiles valued at $35,779; brake linings and facings not otherwise provided for, valued at $39,919; asbestos manufactures not specifically designated, valued at $963,387. These latter products included some asbestos from South Africa of a kind not produced in Canada and required for certain manufactures. Comparative data for 1943 are: 139·9 tons of asbestos packing valued at $100,260; brake linings for automobiles valued at $405,220; clutch facings for automobiles valued at $347,844; brake linings and facings not otherwise provided for, valued at $37,439; asbestos manufactures not specifically designated, valued at $1,368,216.

Production has been continuous from the Thetford area since 1878 and reserves of asbestos-bearing rock are huge. 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 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 1944 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. Late in 1945 Flintkote Mines, Limited (subsidiary of Flintkote Company of Canada, Limited) expects to have a new asbestos property in operation 2½ miles east of Thetford Mines.

The asbestos-bearing rock is mined in open pits and underground. The block-caving method of underground mining is coming into general use. This method was put into operation at the King mine of Asbestos Corporation in 1934. Johnson's Company is now using the same method, and Bell Asbestos Mines and Canadian Johns-Manville are sinking shafts preparatory to recovering rock by block-caving operations.

Few figures on recent world production of asbestos are available, but Canada continues to be the principal producer. 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 is a great advantage to the Canadian asbestos industry.

Uses, Prices, and Outlook

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

Prices throughout 1944 remained the same as in 1943; f.o.b. Quebec mines, in U.S. funds, tax and bags included, they were as follows: No. 1 crude, $650 to $750 per ton; No. 2 crude, $165 to $385; spinning fibres, $124 to $233; magnesia insulation and compressed sheet fibres, $124 to $146.50; shingle fibres, $62.50 to $85; paper fibres, $44 to $49; cement stock, $28.50 to $33; floats, $19.50 to $21; shorts, $14.50 to $26.50 per ton.

The post-war outlook for the asbestos industry appears to be good. Throughout the war Canadian producers were able to sell their entire output in spite of the loss of overseas markets, and with the coming of peace these overseas markets will again be open to Canadian fibre. Development of new asbestos products has been rapid in recent years. Of particular significance are the developments in asbestos-cement products which require the short grades of fibre, the marketing of which formerly constituted a problem. In 1944 an asbestos fabric reinforced with glass fibre was developed which has greater strength than the straight asbestos cloth and is being used for covering.

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BARITE IN 1944

Production of barite in Canada in 1944 was nearly five times greater than in 1943, the previous record year, and exceeded by a considerable margin the entire output from 1885 to the end of 1943. Sales by primary producers comprised both crude ore and ground material.

For the first time in years crude barite was in demand for export. Shortages in the United States of crude lump for barium chemicals and lithopone, and of drilling, glass, and pigment grades, served to direct attention to Canada as a source of supply. The shortages were first in evidence in 1943 and were accentuated throughout 1944 by increased military demands for barite for use in camouflage paints and by the labour scarcity. As a result, contracts were negotiated by the U.S. War Production Board in 1944 for shipments of 60,000 tons of Nova Scotia barite to American consumers, 50,000 tons of which was to be crude ore and 10,000 tons ground material, the order to be completed by February, 1945. A substantial domestic market for crude ore also developed for use as permanent ballast in maintenance ships being built in West Coast yards, and nearly 12,000 tons was supplied for this purpose. Most of the ground barite produced was exported for use in oil well drilling in Trinidad, Venezuela, and other South American countries. In April, the U.S. War Production Board placed barite in the group of minerals the supply of which was insufficient to satisfy war plus essential industrial demands, and it was moved up into Group I and continued there for the remainder of the year.

Principal Canadian Sources of Production; Occurrences

For the past several years the production of barite in Canada has been confined to Nova Scotia and British Columbia, the source of supply in Nova Scotia being the deposit of Canadian Industrial Minerals, Limited, at Walton, in Hants county. In British Columbia, output in 1944 came from a property at Parson, 25 miles south of Golden, that was operated by R. A. Thrall.

The fluorspar ores of the Madoc area, Ontario, and of a deposit at Lake Ainslie in Nova Scotia, contain important amounts of barite. The latter deposit was operated in 1942 and 1943 and a small tonnage of hand-picked barite has been stockpiled. Tests by the Bureau of Mines, Ottawa, on ores from the Madoc and Lake Ainslie areas indicate the possibility of recovering a marketable barite product from them by flotation. Canadian Industrial Minerals, Limited did some exploratory work on the Lake Ainslie property in 1944, and on another barite deposit near Brookfield, Colchester county, Nova Scotia, under option agreements.

Production and Trade

Total production of barite in Canada in 1944 was 118,719 short tons valued at $1,023,696, compared with 24,474 tons valued at $279,253 in 1943. Of this total, 79,200 tons valued at $507,316 was crude ore shipped by primary producers, and 39,519 tons valued at $516,380, ground material milled at the source. Sales of crude to the domestic market for grinding, ballast purposes, and other uses, totalled 13,358 tons valued at $47,109 at the mine. The low average unit value of $3.52 per ton shown by the last figures was due to the large proportion of ballast material included, which sold at $3 per ton f.o.b. mine.

Exports of barite are not shown separately in trade statistics, but approximated 104,000 short tons, of which about 66,000 tons was crude ore, and 38,000 tons was ground material. The total compares with approximately 20,000 tons, all ground barite, exported in 1943. The exports in 1944 included crude ore consigned to the United States, and ground barite for oil-well drilling that was shipped mainly to the United States, Trinidad, and Venezuela.

Imports of ground barite, all from the United States, totalled 1,824 tons valued at $47,913, compared with 1,686 tons valued at $43,239 in 1943.

In Nova Scotia, Canadian Industrial Minerals, Limited, continued to expand its important operation at Walton and reported shipments totalling 106,105 short tons, of which 66,861 tons was crude and 39,244 tons ground material. The deposit has been shown by drilling to be one of the world's largest known barite occurrences, with indicated reserves of some three million tons. The ore is mostly off-colour material, being heavily stained by iron, and is thus not suitable for the general pigment and filler trades. It is high in barium sulphate, however, with a correspondingly high specific gravity, and is thus well adapted for use in drilling mud, for which purpose most of the ground material is sold. It also meets the requirements of the lithopone and barium chemicals industries, and most of the crude shipped in 1944 was consigned to American manufacturers of these products under contracts negotiated by the U.S. War Production Board.

During the year, extensive stripping of overburden was undertaken, and this work exposed ore mineable by opencast methods over an area 600 feet long by 200 feet wide. The length stripped is only about half that of the ore-body as indicated by diamond drilling. Plant additions in 1944 at the mill, located at tidewater, and 2½ miles from the mine, included an 800 tons per day washing installation for crude ore; conveyer equipment for loading crude on to vessels; a 10,000-ton crude storage building; and cement silo storage of 5,000-ton capacity for ground material. Barite is being mined and shipped at the rate of 500 tons a day, and mill capacity has been raised to 400 tons daily of ground material by the addition of a second Raymond grinding unit.

In British Columbia, production was also increased at the aforementioned property at Parson and shipments totalled about 12,500 tons, compared with 2,000 tons in 1943. The bulk of the sales consisted of crude ore consigned to Vancouver for ballast use, and shipments of about 600 tons were also made to the plant of Pulverized Products, Limited, 4820 Fourth Avenue, Rosemount, Montreal, for grinding. A few hundred tons from the property was ground at the plant of Summit Lime Works, Crow's Nest, B.C., for use in glass manufacture and drilling mud.

In Ontario, Woodhall Mines, Limited, 347 Bay Street, Toronto, did some work on the old property of Canada Baryte Mines on Nighthawk River, Langmuir township, and produced a small amount of crude, but no shipments were made.

World production of barite prior to the war was close to one million tons a year, of which Germany supplied 50 per cent and the United States 30 per cent. The remainder came mainly from the United Kingdom, Italy, Greece, France, and India.

Due to increased demand for well-drilling use and for the manufacture of lithopone and barium chemicals, production of primary barite in the United States in 1944 showed a 25 per cent increase over the 1943 figure of 410,633 tons, reaching 516,582 tons, an all-time high, Of the 1944 total, Missouri furnished 28 per cent, Georgia 21 per cent, and Tennessee, 8 per cent, the remainder coming from Arkansas, California, Nevada, North Carolina, and South Carolina. The Arkansas production consists of flotation concentrates; that of the other States is crude lump and pebble. Output of ground and crushed barite in 1944 totalled 346,000 tons, a 60 per cent increase over 1943.

British production also showed a marked increase and was estimated at around 100,000 long tons.

Uses, Specifications

Crude lump barite is used in the manufacture of lithopone, an important white pigment and filler material, and in a wide range of barium chemicals. For these trades, barite is required to contain 95 to 96 per cent $BaSO_4$, and not more than 3 per cent SiO_2 and 1 per cent Fe_2O_3. The ore should be furnished crushed to 1½-inch size. There is little manufacture of the above products in Canada, but they are produced on a large scale in the United States, where, in 1944, 34 per cent of the total barite used was employed for such purposes.

For most other industrial uses barite is employed in finely ground form, 325 mesh being the general specification. The material should be of good white colour, the best grades being obtained by wet-grinding, bleaching with acid, and water-floating. Some off-colour material is used for less exacting purposes. Content of $BaSO_4$ is usually required to be not less than 95 per cent. Chief uses for ground barite are as a heavy, inert filler or loader in rubber, asbestos products, paper, linoleum and oilcloth, textiles, leather, and plastics. It is one of the leading pigments and extenders in paints, and in recent years has become of increasing importance as a heavy weighting medium in oil-well drilling muds, to overcome gas pressures. Colour is immaterial in barite for the last-named use, the requirements for which are a minimum specific gravity of 4·25 (corresponding to a $BaSO_4$ content of 93 per cent) and absence of soluble salts. The glass trade also uses considerable barite as a batch fluxing ingredient for moulded flint glass. For this purpose, it should contain not less than 96 per cent $BaSO_4$, under 3 per cent moisture, and not more than 0·4 per cent iron oxide (Fe_2O_3), with a fineness in the range of 20 to 100 mesh.

According to the Dominion Bureau of Statistics, consumption of ground and crushed barite in Canada in 1943, as reported by users, was 3,732 tons, distributed among the following trades: paint, 2,760 tons; rubber, 434 tons; glass, 290 tons; linoleum, 109 tons; wallpaper, 15 tons; miscellaneous, 124 tons. Shipments from Canadian mines for domestic use totalled 2,569 tons, which, plus imports of 1,686 tons, and less changes in consumers' stocks of 203 tons, showed an apparent total consumption of 4,052 tons.

Distribution of the 510,000 tons of primary barite consumed in 1944 in the United States was as follows: oil-well drilling, 54 per cent; barium chemicals and lithopone, 34 per cent; fillers, loaders, and pigments, 7 per cent; glass, 5 per cent.

Barium carbonate is the principal intermediate salt used in the manufacture of other barium chemicals. It is also employed to prevent the unsightly white efflorescence ("scumming") in bricks and other heavy clay products, and for case-hardening of steel. Important military uses for it, and for the nitrate, are in making green flares, tracers, incendiary bombs, shell primers, etc. Blanc fixe, or precipitated barium sulphate, is used in white paints, rubber, linoleum, and oilcloth. Barium chloride is used to purify salt brines for the manufacture of chlorine and sodium hydroxide; in making coatings for photographic paper; as a flux in the production of magnesium alloys; as an extender in titanium pigments; in colour lakes; in finishing white leather; and in the purification of beet sugar. Barium hydroxide, also, is used in the refining of sugar and of animal or vegetable oils; and the peroxide, in making hydrogen peroxide.

Barium metal has only limited industrial applications. It is used as a wire coating to remove traces of gas in radio, vacuum, and thermionic tubes, and to coat steel balls in the rotating anodes of X-ray tubes. Alloys of barium with lead and calcium ("Frary" metal) are used for bearings; and nickel-barium alloys for corrosion-resistant sparkplug electrodes. Nickel coated with barium oxide can replace tungsten to advantage for the cathodes of the smaller types of electron tubes, giving a high yield of electrons per watt of heating energy.

Of interest is the announcement made in 1944 by the Laprairie Company, 906 University Tower Building, Montreal, of a method of employing the intermediate compound, barium sulphide or "black ash", made by roasting barite with coal, as a substitute for barium carbonate to prevent scumming in bricks. The black ash is introduced into the pugging water in solution, and is stated to be three times as effective as the same weight of carbonate.

Prices

Canadian quotations in 1944 for crude barite remained unchanged at around $7 per short ton, f.o.b. mines. Domestic ground white barite for pigment and filler use sold at $32 to $40 per ton, f.o.b. works, according to quality, whereas prime white imported was quoted at $50, and off-colour at $46. Ground off-colour domestic averaged around $12.80 per short ton, f.o.b. Atlantic port.

In the United States, Georgia crude was quoted at $8.50 to $9 per long ton, f.o.b. mines. Missouri crude, which in the first quarter sold at $6.75 to $7.50, according to grade, rose to $8.25 to $8.50 in the latter part of the year. In the American market, crude barite is usually sold on a penalty-premium basis, a content of 95 per cent $BaSO_4$ and 1 per cent Fe_2O_3 being considered standard. A premium or penalty of 25 cents per short ton is set for each per cent of barium sulphate above or below 95 per cent, and a similar premium or penalty for each $0 \cdot 1$ per cent of Fe_2O_3 below or above 1 per cent.

The United States imposes a duty of $4 per ton on crude barite, and $7.50 per ton on ground or otherwise manufactured material. Barite enters Canada free under the British preferential tariff: imports from other countries pay 25 per cent ad valorem.

Witherite

Witherite (natural barium carbonate) is the only other barium mineral of commerce. Commercial deposits are rare and no occurrences of economic interest are known in Canada. Most of the world supply is derived from England. American imports in recent years have been averaging around 3,000 to 3,500 tons a year. Witherite is used chiefly as a "scumming" preventive in bricks and mortar. It is also a valuable base compound for the production of other barium salts, and is used in certain types of glass; for water softening; and for case-hardening of steel. American quotations in 1944 for ground, 300-mesh witherite of 90 per cent $BaCO_3$ grade were $43 per ton, unchanged from 1943.

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OTTAWA, CANADA, APRIL, 1945.

BENTONITE IN 1944

Bentonite, a type of clay derived from volcanic ash, is widely distributed in the Prairie Provinces, and occurs also in British Columbia. It has been produced intermittently on a small scale since around 1926, total output to the end of 1944 being estimated at about 15,000 tons. Of this, 48 per cent came from Manitoba, 46 per cent from Alberta, and 6 per cent from British Columbia. Small trial lots, not shown in statistical records, have also been produced in Saskatchewan.

Bentonites from different localities may vary rather widely in their nature and physical properties, and these determine the particular industrial uses of the material. Most Canadian bentonites are of the highly colloidal, swelling type, suitable for foundry use and for oil-well drilling. Manitoba, however, possesses deposits of non-swelling material that is of value for bleaching purposes in the natural state as well as being amenable to activation. It is also well suited for foundry use.

Sources of Production; Occurrences

Manitoba became the leading Canadian producer of bentonite in 1943 and retained that position in 1944, in which year it was the source of 85 per cent of the output. Twelve per cent of the 1944 production came from Alberta, and the remainder from British Columbia.

In Alberta, most of the production has come from Drumheller, in the Red Deer Valley area, where Gordon L. Kidd has been conducting operations since 1937. Aetna Coal Company, East Coulee, in the same region, also produces a small tonnage from its coal-mining operations. In southern Saskatchewan there are numerous occurrences of bentonite in the Willowbunch-St. Victor-Eastend region. Small trial shipments have been made from some of these, but so far there has been little active development. In southern British Columbia, bentonite occurs in beds up to 8 feet in thickness near Merritt and Princeton. Occasional small shipments have been made from the Princeton deposit, most of which have gone to Vancouver for grinding and local use.

Production and Trade

Production of bentonite in Canada in 1944, including natural crude clay and activated material shipped by primary producers, was valued at $163,174 compared with $116,932 in 1943, an increase of nearly 40 per cent. Shipments totalled approximately 3,500 tons.

Manitoba's production, most of which was activated material, was valued at $160,268 in 1944, compared with $110,428 in 1943, and represented 98 per cent of the total value of output. The crude clay is mined near Morden, in the southern part of the province, and is shipped to Winnipeg for processing in a small pilot plant built several years ago by Pembina Mountain Clays, Limited, 915 Paris Building, Winnipeg. Sales in 1944 amounted to about 3,000 tons. The company also has an interest in a bentonite deposit at Rockglen, Saskatchewan, but has done no development work on it. From 1937, when development of the deposit at Morden was first undertaken, to the end of 1944, the production of bentonite from the area is estimated to have totalled about 7,000 tons.

In 1943, International Clay Products, Estevan, Saskatchewan, shipped 445 tons of clay from a bed that underlies the local lignite deposits. This clay is not a true bentonite, but it has properties that make it satisfactory for use in oil-well drilling, particularly in brine formations, and the above shipment was used for this purpose in the southern part of the province. There was no production in 1944.

Shipments from the Red Deer Valley area, Alberta, in 1944 amounted to 433 tons valued at about $5 a ton f. o. b. rail at Drumheller. The material was shipped to Alberta Mud Company, 502 Lancaster Building, Calgary, for processing and use in oil-well drilling in the Turner Valley field. From 1937 to the end of 1944, production from the Red Deer Valley area totalled about 7,000 tons.

In 1944, there was a reported production of 114 tons of bentonite from the Princeton deposit in British Columbia. This was shipped to Gypsum, Lime and Alabastine, Canada, Limited, New Westminster. Total production from the deposit from 1926 to the end of 1944 is estimated at 1,000 tons. The deposit is controlled by Francis Glover, 969 Jervis Street, Vancouver.

Canada exports little or no bentonite. Substantial quantities of activated clay of the "Filtrol" type are imported from the United States for bleaching purposes in oil refineries and packing houses, and possibly also some ground natural bentonite for similar use. Imports of activated clay in 1944 were valued at $366,719, compared with $295,066 in 1943. Considerable amounts of natural ground bentonite for foundry use and for other minor industrial purposes are also imported from the United States, but are not shown separately in trade statistics.

The United States produces and uses most of the world output, and under peacetime conditions also exports substantial amounts of ground natural clay and of activated material. Production in that country established a record in 1943, when shipments totalled 480,202 tons valued at almost $3,000,000, an increase of 28 per cent in quantity and 18 per cent in value over 1942. Demand for foundry and drilling use continued strong throughout 1944, and all producers were working at capacity. The 1944 production has not been reported, but in the Western States it is estimated to be up about 12 per cent over 1943, and in the Southern, about 14 per cent.

Uses

Bentonite is used chiefly as a bonding ingredient in foundry sands; for the bleaching, or decolorizing, and filtering of mineral and vegetable oils and packing house products; and to control the viscosity of oil-well drilling muds. These three uses accounted for 85 per cent of the 480,000 tons produced in the United States in 1943, distribution being as follows: foundries, 38 per cent; bleaching, 33 per cent; drilling, 14 per cent. Most of the output of Pembina Mountain Clays, Limited, Winnipeg, is used in bleaching petroleum products, though sales are also made to linseed oil plants, packing houses, and to firms engaged in reclaiming crankcase oil.

The colloidal, or swelling, type of bentonite has a wide range of minor uses, including fillers, concrete admixture, and for preventing seepage around dams, irrigation ditches, reservoirs, and structural foundations. It is used 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.

The estimated consumption of bentonite in Canada in 1943, including both domestic and imported natural and activated material, totalled about 12,270 tons. Distribution, by industries, was as follows: bleaching of lubricating oils and gasoline, 49 per cent; steel, iron, and brass foundries, 39 per cent; polishes and cleansers, 7 per cent; pulp and paper, 2 per cent; miscellaneous, 3 per cent. In addition, 1,078 tons of crude bentonite was purchased from producers in Alberta for use in oil-well drilling in Turner Valley, making a total indicated consumption of 13,348 tons.

For activating use, the non-swelling type of clay is specified, the main supply of which is furnished by Mississippi. Some of the Mississippi production is also used in foundries.

Prices

Prices in 1944 remained substantially unchanged. Wyoming standard 200-mesh bentonite, bagged, sold at $9.50 per ton, f.o.b. plant, and crushed at $7, in bulk. Special grades were quoted at $11 to $16.50. In 1943, the average unit value of production in the United States was $6.24 per ton, and $8.73 for the Wyoming field. Canadian trade journal quotations in 1944 for standard Wyoming-type clay were $27 to $30.

Alberta drilling bentonite was priced at $38 per ton, bagged, f.o.b. Calgary, and $40 in Turner Valley; in December, the price was reduced to $35, ex-Turner Valley. Crude sold at around $5 per ton, f.o.b. mine. Activated bentonite, for bleaching use, cost $66 to $68 per ton, in carload lots, delivered eastern Canadian points.

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OTTAWA, CANADA, MARCH, 1945.

BERYL IN 1944

Beryl, a silicate of aluminium and beryllium, is the commonest beryllium mineral, and is the only present commercial source of the element. It generally contains from 10 to 12 per cent of beryllium oxide, corresponding to from 4 to 4·5 per cent of beryllium. The occurrence of beryl is restricted to pegmatite dykes, in which it is usually found as disseminated crystals, sometimes of very large size. Only rarely, however, is the beryl content of pegmatites sufficient to enable the deposits to be worked for this mineral alone, and a large part of the comparatively small world production has been obtained as a by-product from the mining of feldspar, mica, or lithium minerals.

Canada produces no beryl and very little beryl is used or required by domestic industries. Most of the world supply in recent years has come from Brazil, Argentina, India, the United States, and South Africa.

Principal Canadian Occurrences

The most noteworthy occurrences of beryl in Canada are in Ontario, southeastern Manitoba, and the Northwest Territories.

In Ontario, intermittent work was done prior to 1941 on a beryl pegmatite in Lyndoch township, Renfrew county. A few tons of clean cobbed crystals were obtained, and about 200 tons of milling grade rock was stockpiled. Most of the work on the property was done by the present owners, Canadian Beryllium Mines and Alloys, Limited, 901 Royal Bank Building, Toronto, who, however, have reported no sales. A detailed examination of the main, easterly workings, made in 1943 by the Bureau of Mines, Ottawa, and the Metals Controller's Office, indicated an average content of 0·188 per cent beryl in the total rock excavated, with a maximum for the richest quarry sections of 1·24 per cent. Grade of selected clean beryl crystals was 10·41 per cent BeO.

In Manitoba, a little work was done several years ago on beryl showings in pegmatites opened originally for feldspar and lithium minerals in the Winnipeg River and Oiseau (Bird) River areas, but no shipments were reported.

In the Northwest Territories, exploration in the area north and east of the Yellowknife gold camp has disclosed numerous occurrences of beryl in pegmatites which also contain lithium minerals and tantalite-columbite. Some of these are considered to be of possible economic interest.

In Quebec, scattered occurrences of beryl are known in Lacorne and Preissac townships, Abitibi county, often associated with molybdenite. None of these, however, is believed to be of economic importance.

Uses and Markets

Beryllium is used chiefly in the form of beryllium-copper alloys, the most important of which contains about 2 per cent beryllium. A beryllium-aluminium alloy containing 5 per cent beryllium is used as a deoxidizer in making aluminium-magnesium products. Straight beryllium metal has only limited applications, notably for the windows of X-ray tubes, where it is used for its transparency to the rays.

Various beryllium salts, principally the oxide and carbonate, are used in industry. A growing demand has developed for the oxide for the preparation of zinc-beryllium silicate, used as a coating for fluorescent lighting tubes and lamps, and for fluorescent screens. The oxide and carbonate, activated by uranium salts or rare earths, act as "phosphors" and are utilized in luminescent paints. The oxide is a super-refractory, with a melting-point of 2,570°C., or 520 degrees above that of alundum, 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 specialities, to which it imparts high electrical and impact resistance and transverse strength. Some is also used in cooking utensil enamels. Consumption for such uses in the United States is estimated at about 100 tons a year.

Most of the present world production of beryl is marketed in the United States, where the following companies engaged in the primary production of beryllium metal, alloys, and compounds are the chief purchasers: Beryllium Corporation of Pennsylvania, Temple (Reading), Pennsylvania; Brush Beryllium Company, 3714 Chester Avenue, Cleveland, Ohio; and Clifton Products Incorporated, Painesville, Ohio. All of these companies considerably expanded their production facilities in 1944, under Government subsidy.

Prices

War demands occasioned a sharp increase in the price of beryl during the 1940-1944 period. Metals Reserve Company quotations rose progressively from the pre-war figure of $30 to $35 per short ton, f.o.b. mines, for ore with 10 to 12 per cent BeO content, respectively, to $145 per ton for 10 per cent grade, or $14.50 per unit of contained BeO, in 1944. Completion of an adequate United States Government stockpile reserve, and return of purchase to consumers at the end of 1944, is expected to result in a material lowering of the above price in 1945.

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OTTAWA, CANADA, JUNE, 1945.

BITUMINOUS SAND IN 1944

Deposits of bituminous sand occur along Athabaska River in Alberta between the twenty-third and twenty-sixth base lines. Intermittent exposures can be seen along both sides of the river and along certain of its tributaries. Investigations by the Bureau of Mines, Ottawa, subsequent to 1913, indicated that the bituminous sand in certain parts of the area is suitable for 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 tentatively assumed that the deposits in the area, as a whole, comprise an important reserve of bituminous material from which various light and heavy petroleum products may be derived.

In 1942, as part of a war program for investigation of petroleum resources in Canada, exploratory core drilling was undertaken by the Mines and Geology Branch at the request of the Oil Controller. The initial work was in the Wheeler Island and Steepbank River areas respectively, 54 and 20 miles north of Fort McMurray, and was under immediate supervision of engineers of Consolidated Mining and Smelting Company of Canada, Limited. In all, 21 holes (11 in Wheeler Island area and 10 in Steepbank River area) aggregating 3,021 feet were drilled. Drilling was continued in 1943 and 1944 under direction of engineers of the Mines and Geology Branch. Forty-eight holes aggregating 6,601 feet were drilled in the Horse River Reserve near Fort McMurray, and 42 holes aggregating 7,495 feet were drilled in the Steepbank area. Assays of cores obtained will serve as a basis for the evaluation of the bituminous sand within the areas drilled. The drilling is still in progress. A marked advance in drilling technique was effected in 1943 by the introduction of diamond-drilling equipment in place of augers previously used.

Production

In the aforementioned investigations by the Bureau of Mines, about 5,000 tons of bituminous sand was mined and shipped during the period 1926-1930. Part of this material was used as a basis for laboratory studies, but most of it 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 of 37,000 gallons of fuel oil. Operation of the plant was discontinued in 1938, but was resumed by Oil Sands, Limited, late in the summer of 1943. The separation unit was operated during part of October, 1943, when about 750 tons of bituminous sand was treated, from which approximately 750 barrels of bitumen was obtained. There was no production in 1944.

In 1941, Abasand Oils, Limited completed its remodelled separation and refining plant on Horse River near Fort McMurray. The plant was operated from May 19 to November 21, when separation and power units were destroyed by fire. During that period, production included 41,265 gallons of gasoline, 70,700 gallons of Diesel oil, 137,550 gallons of fuel oil, 375,235 gallons of residuum, and 319 tons of coke. Following reconstruction in 1942, the Abasand plant was operated intermittently from June 10 to November 6, during which period approximately 12,800 tons of sand was mined and approximately 385,000 gallons of crude was produced. Refined products made 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.

Recent Developments

On April 1, 1943, an agreement was entered into between the Dominion Government and Abasand Oils, Limited, whereby finances were provided for the rehabilitation and enlargement of existing separation and refining units. In June, 1944, the various plant units had been largely reconstructed, and subsequently a series of test runs was initiated. The throughput capacity of the new installations is adequate for pilot-plant purposes. It is hoped that the operation of the separation plant may indicate an efficient method for the recovery of bitumen from the sands.

During the test runs conducted in 1944, 5,684 tons of bituminous sand was mined and fed into the separation plant from which the output of bitumen was 4,354 barrels. Due to delays in obtaining the necessary refining equipment the alterations to the refinery were not completed until late in the year. In a test run of six days during December the diluted crude oil charged to the refinery consisted of 3,787 barrels of bitumen and 2,808 barrels of process diluent oil. The run indicated that the refinery could readily handle 600 barrels of bitumen daily.

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OTTAWA, CANADA, MAY, 1945.

CEMENT IN 1944

Portland cement, the principal raw materials for which are limestone and clay, is manufactured in Quebec, Ontario, Manitoba, Alberta, and British Columbia. 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. The last named, however, is made from imported clinker.

Canada Cement Company, Limited operates plants at Hull and Montreal East in Quebec; at Port Colborne and Belleville in Ontario; at Fort Whyte, Manitoba; and at Exshaw, Alberta. St. Mary's Cement Company, Limited operates a plant at St. Mary's, Ontario. Medusa Products Company of Canada, Limited has a plant at Paris, Ontario, making white cement, cement paints, etc., from imported clinker. British Columbia Cement Company operates at Bamberton, British Columbia. The total rated daily capacity of all plants is about 37,000 barrels (a barrel of cement weighs 350 pounds net).

All Canadian plants, except one that makes cement from domestic raw materials, are 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.

Production and Trade

Production of cement in 1944 was 7,190,851 barrels valued at $11,621,372, compared with 7,302,289 barrels valued at $11,599,033 in 1943.

Exports of Portland cement in 1944 amounted to 736,572 cwt. valued at $377,434, compared with 604,103 cwt. valued at $344,004 in 1943. As in 1943, the countries taking the major part of these exports were Trinidad and Newfoundland.

Imports of Portland cement in 1944 amounted to 49,014 cwt. valued at $76,838, compared with 65,018 cwt. valued at $83,975 in 1943. In addition to the finished cement, 34,551 cwt. of white Portland cement clinker valued at $21,130 for grinding in Canada was imported in 1944, compared with 23,723 cwt. valued at $13,861 in 1943.

Prices and Outlook

The average selling prices of cement per barrel, f.o.b. plant, in the several producing provinces during the period 1937 to 1944 were as follows:

	1937	1938	1939	1940	1941	1942	1943	1944
Quebec	$1.37	$1.35	$1.35	$1.41	$1.43	$1.46	$1.44	$1.46
Ontario	1.38	1.40	1.43	1.49	1.46	1.43	1.46	1.46
Manitoba	2.27	2.28	2.25	2.23	2.21	2.10	1.89	1.96
Alberta	1.99	2.01	1.97	2.01	2.00	1.96	1.94	1.96
British Columbia	1.81	1.87	1.91	1.94	1.97	2.07	2.14	2.12

Cement is one of the most important of the structural materials and is used in all construction work, such as bridges, canals, 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.

Cement played an important part in the wartime construction program, and production was greatly increased, but with the completion of the program the demand has lessened. However, the post-war outlook for cement is good, and a large increase in demand is expected when restrictions on non-military construction are lifted and the long-planned program of highway building and general construction is begun.

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OTTAWA, CANADA, JUNE, 1945.

CLAY AND CLAY PRODUCTS IN 1944

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

The industrial clays of Canada may be classified as common clays, stoneware clays, fireclays, china clays, and ball 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 $6,970,274 in 1944, compared with $6,608,193 in 1943. The total value of ceramic products manufactured from imported clays was $4,376,713 in 1944, compared with $4,385,416 in 1943.

Large quantities of the various ceramic products are imported annually.

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 $4,438,501 in 1944, compared with $4,055,419 in 1943.

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 are 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 1944 is reported to have been $1,803,276, compared with $1,817,990 in 1943. 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, firebrick and other refractory materials are manufactured from a high-grade, moderately plastic fireclay that is extracted by underground mining from the clay beds in

Sumas Mountain. Another plant at Claybank, Saskatchewan, utilizes the highly plastic refractory clays obtained by selective mining of the "White Mud" beds in the southern part of the province.

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 clay in 1944 was $386,088, compared with $449,273 in 1943; the value of refractories produced from imported clays in 1944 was $827,291, compared with $975,742 in 1943.

China Clay, Ball Clay, Etc.

China clay (kaolin) has been produced commercially in Canada only from the vicinity of St. Rémi 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 equipped to carry out the washing process in accordance with the most up-to-date and scientific methods. The plant has been producing glass sand regularly. Canadian Kaolin-Silica Products' property at Lac Rémi, 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 deposits of kaolin have been discovered in Quebec in recent years, among these being a deposit at Thirtyone Mile Lake, near Point Comfort, Hull county; near Brébeuf; at Lake Labelle; and near Chateau Richer.

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

In British Columbia, along the Fraser River, about 25 miles above Prince George, is an extensive clay deposit, parts of which yield a high grade of china clay. As china clay from England is difficult to obtain on the West coast, owing to shipping risks, consideration has been 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 and ball clay from England or the United States is used. 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 they have not been developed to any extent.

Bleaching Clays

Activated clays for oil bleaching are largely imported. The value of such clays imported into Canada by oil refineries in 1944 was $366,719, compared with $295,066 in 1943. Fuller's and infusorial earths are also imported for use in sugar refineries, vegetable oil mills, etc. It has been reported that certain western bentonitic materials have been used in Canada for oil bleaching purposes.

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OTTAWA, CANADA, JUNE, 1945.

CORUNDUM IN 1944

As a result of circumstances arising from the war, there was a revival of activity in the production of corundum in Canada in 1944. It was the first recorded output of the mineral in the Dominion since 1921, and the five car lots of concentrate produced were obtained from the treatment of tailings at the Craigmont property in Renfrew county, Ontario. The concentrate was shipped to American Abrasive Company's plant in Westfield, Massachusetts, for grinding and for the preparation of fine powders and flour. Wartime Metals Corporation of Montreal arranged to treat the tailings at the request of the United States Government, which has been encountering difficulties in obtaining supplies from the Transvaal in South Africa in sufficient quantities to meet the requirements. The 125,000 tons of tailings available at the Craigmont property are estimated to have a corundum content of about 3 per cent. A 200-ton gravity mill equipped with a magnetic separator was erected by Wartime Metals Corporation close to the site of the old Craig mill early in 1944 and shipments of concentrate to Westfield were commenced in the autumn of that year.

Corundum (Al_2O_3), the oxide of aluminium, usually occurs as bronze-coloured barrel-shaped crystals. It is fairly heavy, and has a hardness (Mohs' scale) of 9, being the hardest known mineral next to diamond (hardness 10).

Sources of Production: Occurrences

All of the Canadian production of corundum has come from a corundum-bearing belt of nepheline syenite that passes in a northeast direction through the southeast, northern, and central parts respectively, of Haliburton, Hastings, and Renfrew counties in Ontario, and about 82 per cent of the total output to date has come from the Craigmont property, the chief source of the remainder being the Burgess deposits, about 5 miles to the west. The belt is about 100 miles long and 6 miles wide and is the most northerly of three belts of syenites in which corundum is known to occur. The middle belt is in Methuen and Burleigh townships, Peterborough county, and the southern belt, 65 miles to the east, is in Frontenac county. A deposit of corundum in the French River area northeast of Georgian Bay was prospected in 1943, the results of which work indicated that the corundum content is much below commercial grade.

Production and Trade

As noted above, Canada produced a few carloads of corundum in 1944, but from 1901 when production was commenced until about 1915 the Dominion was the leading producer of the mineral, and from 1901 to 1918 inclusive, a total of 370,000 tons of ore was treated. From this, 19,000 tons of concentrate valued at $2,024,000 was shipped. The ore came mainly from numerous open cuts on the present Craigmont property, some of which are over 600 feet long and 250 feet wide. The workings, known as the Craig and Klondike cuts, are on the south and west slopes of Robillard Mountain. During the early part of this continuous period of operation the ore milled had a corundum content of 10 per cent, but that milled near the end of the operations had a content of only 4 per cent. A total of about 26,000 tons of mill tailings was re-treated during 1920 and 1921, from which 600 tons of concentrate valued at $80,500 was shipped.

Canada imported only a small quantity of corundum in 1944. The imports included a small amount of flour corundum that was prepared at Westfield, Mass. Certain physical and structural qualities of the minute grains of natural corundum make it preferable to those of the artificial abrasive for the purposes for which it is used.

Most of the world production of the mineral during the past 25 years has come from the Transvaal, Union of South Africa, from which an output of from 4,000 to 7,000 tons a year has been obtained since 1940, though production has been declining since 1942, the peak year. All of the output is exported, mainly to the United States. Production from Russia in recent years is said to have been large, but no statistics are available. Production from India and Madagascar has been intermittent. In the United States there was no production of corundum in 1944, but the erection of a mill is planned on a deposit in Gallatin county, Montana, from which a small annual output was maintained between 1902 and 1905. During 1943 and 1944 a careful re-examination was made of the known corundum deposits in the United States, most of which were last worked 40 to 50 years ago. As a result of these investigations some corundum was produced near Clover in South Carolina in 1943, but operations were discontinued in the same year.

In the Transvaal, most of the output has been in the form of "Crystal" that occurs as loose crystals of corundum in shallow alluvial deposits or "paddocks" that are formed by the disintegration of corundiferous rock. The crystals are mined intermittently, mainly from small open cuts, by a large number of "diggers", and are washed on screens that are revolved by hand. The deposits are small and are unevenly distributed over a wide area in the Zoutpansberg and Pietersburg districts of northern and eastern Transvaal. In the spring of 1944 a modernly equipped mill was erected at Pietersburg for the concentration of reef corundum, or plumasite, that occurs in veins or feldspathic dykes, somewhat similar to the Craigmont deposit in Canada. The mill is in steady production and the concentrate is exported.

Uses and Specifications

Until recently, corundum was used chiefly for the abrasive grit in grinding wheels required for special types of work. At present, however, most of the corundum used in the United States, which is by far the leading consumer, is in the form of very fine powder or flour for use in the grinding and polishing of high precision lenses for naval and military optical instruments. The coarse corundum grain is used mainly in the manufacture of wheels for snagging the forgings and castings for tanks and other military equipment.

Canadian concentrates should have a corundum content of at least 65 per cent, and preferably 70 per cent, or higher, and they should be as free as possible of magnetic material. South African corundum is marketed in the United States in accordance with Government (Transvaal) grading regulations, based on the alumina content and on screen-sized limits.

Outlook

The aforementioned "crystal" corundum of the Transvaal is produced at a much lower cost than it would be possible to produce corundum from any of the deposits on the North American continent. Apparently, however, supplies of this "crystal" corundum are becoming exhausted, or the widely scattered deposits are difficult to operate on an efficient basis. In any event, nearly 30 per cent of the total output of corundum from South Africa in 1944 was in the form of concentrate obtained from the treatment of reef corundum, or plumasite, whereas "crystal" corundum accounted for only 40 per cent of the output as compared with more than 90 per cent in 1940. If this is indicative of an eventual changeover to the production of concentrate the prospects for the successful development of Canadian deposits will be enhanced. In the post war years, however, natural corundum will again be in competition with artificial abrasives, the civilian uses of which are now restricted.

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OTTAWA, CANADA, MARCH, 1945.

DIATOMITE IN 1944

Production of diatomite in Canada has been insignificant and almost all the requirements are imported. Although deposits are numerous and widespread, they are, with few exceptions, small and the material is not suitable as a filter-aid, until recently the principal use. Owing, however, to the use of diatomite as a fertilizer dusting agent, a recent development, Canadian consumption in 1944 was more than double that of 1943, and tests are under way to determine the suitability of Canadian material for this new use.

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 (geologically) fresh water origin, which is the most common in Canada, usually occurs as a grey or brown mud or peat, whereas the diatomite of Tertiary age is in dry and compact beds, and is very light in weight and white to cream in colour.

Sources of Production; Occurrences

There are more than 400 known deposits of diatomite in Canada. These deposits are in the swamps and in the lake bottoms of northern Nova Scotia; in southern New Brunswick; in the Muskoka district, Ontario; and in various localities in British Columbia. The Tertiary fresh water deposits near Quesnel in the Cariboo district, British Columbia, are by far the largest known in Canada. They extend for many miles along the Fraser River, are compact, and up to 40 feet thick. At Digby Neck, Nova Scotia, is the largest known Recent fresh water (swamp) deposit in Canada. All of the Canadian production of diatomite since 1939 has come from these and from the Fraser River localities, the two producers being G. Wightman, who operates the deposit at Digby Neck, and L. T. Fairey, of Vancouver, who has been obtaining his output from Lot 1122, on the west bank of the Fraser River, north of Quesnel. There has been no activity of consequence on the deposits in the Muskoka area for some time.

Production and Trade

Production in 1944 was 39 tons; and sales 13 tons valued at $437, compared with sales of 98 tons valued at $3,331 in 1943. Imports into Canada were 11,664 tons valued at $335,939, of which 73 per cent came from California, 23 per cent from Washington, and 4 per cent from Oregon. In 1943, imports were 5,623 tons valued at $184,012. Consumption in Canada was approximately 11,680 tons compared with about 5,700 tons in 1943.

Prior to the war diatomite was produced in about 30 countries, and at present the United States, with about 20 operators, is by far the largest producer, having increased its output in 1944 to nearly 160,000 tons.

Uses and Specifications

Until recently between 70 and 80 per cent of the diatomite consumed in Canada was used in the form of filter-aids, mainly in the refining of cane sugar, but in 1944 only about 38 per cent was so used, and over 54 per cent was consumed as a dusting agent in ammonium nitrate fertilizers that are made for the Government by three companies, one in Welland, Ontario, one in Calgary, Alberta, and the other in Trail, British Columbia. The diatomite thus used is highly porous and when added to the nitrate it absorbs moisture which prevents it from caking and ensures even spreading. Specifications call for uncalcined material of 325 mesh and less than 5 per cent moisture. The remainder of the diatomite consumed was used chiefly for insulation and as a filler in the paint, chemical, paper, rubber, soap, and textile industries, and in silver polish bases.

Amongst war uses are: for blocks and pipe insulation in combination with asbestos in the naval construction program; in fireproof structural sheets for minimizing fire hazards on warships; in pressure filters for the filtration of potable water; and in paints for Army equipment.

Market Conditions and Prices

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. Thus, the future for Canadian production appears to depend upon whether the tests being made by the British Columbia Department of Mines will prove that the diatomite in the vicinity of Quesnel can be used as a dusting agent in ammonium nitrate fertilizer. Consumption for this purpose in 1944 was 6,315 tons, and all of the requirements are at present being imported from a deposit near Kittitas, Washington. Production of this fertilizer for use in Europe is expected to increase. No other known deposit in Canada contains the type of diatomite that would meet the specification calling for uncalcined material.

The price of diatomite used in Canada for insulation varies from $25 to $40 per ton, for filtration from $26 to $75 per ton; for fertilizer grades, $28 to $42 per ton; for material suitable for polishes the price for small lots ranged up to $200 a ton. Imported insulation bricks vary in price from $85 to $140 per 1,000, according to grade and density.

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OTTAWA, CANADA, MAY, 1945.

FELDSPAR IN 1944

Most of the feldspar mined in Canada is of high-potash grade, though some operators also ship small amounts of soda spar. The latter type is rather uncommon as large deposits, but is sometimes encountered as zonal bodies along the walls of potash feldspar pegmatites. Canada has large reserves of feldspar, and production could be increased to meet any likely demand.

There were no important new developments in 1944, and production continued at about the same level as during the preceding four-year period. As in former years about half the output went to the domestic market, and the other half was exported to the United States.

Sources of Production

In recent years, the entire production of feldspar has come from adjacent sections of western Quebec and eastern Ontario, in the general Ottawa region. Until 1942, mine output was about equally divided between the two provinces, but in that year Quebec gained a substantial lead and has since supplied 70 to 80 per cent of the total. In 1944, there were eight major producing mines, five in Quebec, and three in Ontario.

In Quebec, most of the production came from three properties operated by Canadian Flint and Spar Company in Derry and Buckingham townships, in the Lièvre River section, and in Templeton township, all in Papineau county. The only other important producer was United Mining Industries, Limited, operating two properties in Buckingham and West Portland townships, respectively, in the same area. Both of these companies shipped a small tonnage of dental spar in addition to their regular ceramic grade.

In Ontario, the bulk of the output came from operations of Bathurst Feldspar Mines, in Bathurst township, Lanark county; and Madawaska Feldspar Company, Keystone Contractors, Limited, and Canspar Mines, Limited, in Murchison township, Nipissing District. Keystone Contractors worked its property until midyear, when it was taken over by Canspar Mines, a subsidiary of Lapa Cadillac Gold Mines, Limited.

Production and Trade

Mine shipments of crude feldspar in 1944 totalled 23,509 tons valued at $227,632, compared with 23,858 tons valued at $237,771 in 1943. Of the total, Quebec supplied 17,842 tons and Ontario 5,667 tons. These amounts compare with 17,199 tons and 6,659 tons for the two provinces, respectively, in 1943.

Exports of crude spar amounted to 13,081 tons valued at $102,918, compared with 12,724 tons valued at $96,453 in 1943. Most of the material was consigned to grinding plants of Consolidated Feldspar Corporation and of Genesee Feldspar Company, at Rochester, N.Y., and to Shenango Pottery Company, New Castle, Pennsylvania. Exports also included a small tonnage of dental spar.

Imports of ground spar, all from the United States, were 546 tons valued at $10,658, compared with 526 tons valued at $12,886 in 1943. The material included spar for pottery purposes and for use in cleansers.

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

Canadian Flint and Spar Company, Buckingham, Quebec.
Frontenac Floor and Wall Tile Company, Kingston, Ontario.
Bon Ami, Limited, 13,719 Notre Dame Street East, Montreal, Quebec.

The first two companies ground material mainly for ceramic purposes; the Bon Ami product is employed solely in cleanser compounds. Production of ground feldspar in 1944 totalled 10,902 tons, compared with 12,290 tons in 1943.

World production of crude feldspar in 1937, the latest year for which complete statistics are available, totalled about half a million tons, of which the United States furnished over 50 per cent. In 1941, production in that country achieved a record of 338,860 long tons, valued at $1,519,456, but declined slightly in subsequent years, the estimate for 1944 being 325,000 tons. The leading producing States are North Carolina, South Dakota, New Hampshire, Colorado, and Virginia. The production of ground spar in the United States in 1944 was about the same as in 1943, when shipments totalled 335,810 short tons. In 1937, Canada was fifth on the list of world producers, following Sweden, Norway, and Czechoslovakia.

Uses

Domestic requirements for feldspar are relatively small, and a considerable part of the annual output of crude spar is exported to grinding mills in the United States. In 1943, domestic consumption of ground feldspar was 13,178 tons, distribution by industries being: cleansers, 45 per cent; pottery, 22 per cent; glass, 20 per cent; enamel, 13 per cent.

All of the feldspar used in industry consists of ground material, usually prepared either in mills run in conjunction with mining operations or in merchant mills supplied from independent mines. Some manufacturers of ceramic products mine or buy crude spar and grind it for their own use. By far the greater part of the production (over 95 per cent in the United States in 1943) is employed for ceramic purposes, including pottery, glass, and enamelware. The remainder is used mainly in scouring soaps and cleansers, and for bonding of fired abrasive wheels and other shapes. Some coarsely crushed spar, usually made from impure waste or quarry fines, is sold for stucco dash, artificial stone, chicken grit, etc.

Most of the feldspar used is of the high-potash type, but a certain amount of high-soda spar also is in demand for blending purposes and for use in low-fired enamels and glazes. Practically all colours of feldspar are equally acceptable for ceramic uses, but for cleanser purposes, pale shades of white to buff are demanded. Nepheline syenite and aplite (an impure feldspathic rock) are to some extent competitive with feldspar for certain ceramic uses, notably in the glass trade.

Until recently, the universal practice has been that all of the feldspar supplied to grinding mills has consisted of crude lump produced by picking and cobbing methods. As a result of threatened shortages in the eastern United States attention has been given in the past few years to the milling and concentrating of sub-grade rock to fill grinders' requirements. The Golding-Keene Company installed a concentrator at Keene, New Hampshire, a few years ago, and in 1943 a 30-ton pilot mill was placed in operation at Erwin, Tennessee, by Consolidated Feldspar Corporation. In 1944, the same company started construction of a 200-ton mill at Kona, North Carolina, which is expected to come into production early in 1945. All the above mills employ flotation methods. Recently, also, there has been a small recovery of by-product feldspar from American mills engaged in concentrating the lithium mineral spodumene from pegmatite, and at Monterey, California, the Del Monte Properties Company lowers the feldspar content of its glass sand by flotation.

Prices

Prices of Canadian crude feldspar in 1944 ranged from $6 to $7.50 a ton, according to grade, f.o.b. rail for export or shipment to domestic mills. Selected crude dental grade sold for $45 to $53 a ton in carload lots, for United States sale. Domestic ground spar was quoted at $12.50 a ton for granular glass grade, and $16.50 to $20 for 200-mesh pottery grades, all in carload lots, f.o.b. mill.

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

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OTTAWA, CANADA, MARCH, 1945.

FLUORSPAR IN 1944

Commercial deposits of fluorspar in Canada occur only in a few areas, and 55 per cent of the total output of 96,000 tons to the end of 1944 was obtained from the Madoc area, Hastings county, Ontario, and 44 per cent from British Columbia. In general, mining of fluorspar has been intermittent and on a small scale, with periods of greater activity during the first world war and the present war. At no time, however, has production been sufficient to meet domestic requirements, and Canada depends largely upon imports to meet the needs of industry. Indicating Canada's dependence on foreign sources of supply, in the 5-year period 1940-1944 reported consumption of fluorspar, largely for military purposes, totalled 227,484 tons. Of this, only 34,296 tons (13 per cent) was derived from domestic mines, 219,171 tons (87 per cent) being imported. In 1944, about 85 per cent of the tonnage imported was obtained from Newfoundland, 14 per cent came from the United States, and the remainder from Mexico.

To assist in meeting war shortages, the Dominion Government in 1942 initiated a program of assistance to fluorspar producers by means of loans, (under arrangements involving the advisory supervision of operations), diamond drilling, geological examination of properties, and in other ways. Of the total output, amounting to almost 25,000 tons in the three years ended 1944, nearly 72 per cent was produced by four operators who were assisted under this program. Most of the mine shipments have comprised material considerably below standard metallurgical specifications and have consisted of screened fines sweetened with clean, picked lump. Average grade of such combined product has ranged from 60 to 65 per cent CaF_2, calcite and barite being the chief impurities. A number of milling tests were run in the laboratories of the Bureau of Mines, Ottawa, in 1944 on trial shipments from various properties in an effort to reduce the objectionably high barite content of most Canadian fluorspar ores.

Sources of Production; Occurrences

Most of the domestic supply of fluorspar during the present war has come from the Madoc area, Ontario, where the mineral has been mined intermittently for about 40 years. Since 1939, most of the output has come from the Noyes, Perry, Keene, Wallbridge, Blakeley, Rogers, and Bailey mines. The Rogers mine, last actively operated in 1914, was reopened late in 1943, when operations at the Perry mine were abandoned. On the Bailey property a new vein was opened up in August, 1944, following the cessation of operations at the Keene mine.

The fluorspar bodies in the Madoc area consist of a series of impersistent shallow veins that fill fractures in limestone, and the vein zone extends for several miles adjacent to a major fault. At a few mines the veins extend downward into underlying granite. Much of the ore consists of an interbanded association of fluorspar, calcite, and barite, which presents serious concentrating difficulties.

Some interest has been shown in recent years in fluorspar occurrences in the Wilberforce-Harcourt district, Haliburton county, about 50 miles north of Madoc, where diamond drilling and some surface work were done on several properties in 1943. The ore is an intimate mixture of fluorspar and calcite. It usually also contains considerable apatite, and some mica and other silicate minerals. The work did not disclose any important ore-bodies, and there was little further activity in 1944. W. E. Clark (Tops Mining Syndicate) produced a few tons of high-grade picked spar from his holdings near Harcourt.

In the latter part of 1944 a deposit of fluorspar, essentially similar in character to that of the Haliburton area, was discovered near Cobden, in Renfrew county. The property is owned by Eric Johnston, of Cobden. Some surface work was done by Dominion Magnesium, Limited to determine whether the deposit might supply the fluorspar requirements of the company's magnesium plant at nearby Haley, but no report on the results is available.

Scattered occurrences of fluorspar are known in Quebec, but few of these appear to be of economic importance. In 1943 and 1944, some work was done by Twin Valley Prospecting Syndicate, of Ottawa, on fluorspar showings near Sand Creek, north of Otter Lake, Pontiac county. About 20 tons of clean, picked spar was shipped in 1944 to the plant of Dominion Magnesium, Haley, Ontario. Grade is reported to have run 92 to 98 per cent CaF_2. This represents the first recorded production of fluorspar in the province.

In Nova Scotia, there is considerable fluorspar in some of the barite veins near Trout River, Inverness county, where work was done in 1942 and 1943 on the MacKay property. In 1944 the Provincial Department of Mines continued a program of diamond drilling and geological investigation on the property, which was also examined and sampled by Canadian Industrial Minerals, Limited. A shipment of the ore was sent to the Bureau of Mines, Ottawa, to determine whether recovery can be made of fluorspar and barite products.

In British Columbia, Consolidated Mining and Smelting Company operated a large deposit of fluorspar between 1919 and 1929 at its Rock Candy mine, near Grand Forks, and produced about 70,000 tons of ore, from which 42,000 tons of concentrate was recovered. The mine has since been idle and there has been no further production of fluorspar in the province. In the latter part of 1942, interest developed in a fluorspar occurrence near Birch Island, North Thomson River, where drilling operations have been undertaken by Globe Investment Company, 11 King Street West, Toronto. The deposit consists of a fine-grained, intimate mixture of fluorspar, celestite, and feldspar, with considerable pyrite. Preliminary results of tests on trial shipments by the Bureau of Mines, Ottawa, indicate that the ore is amenable to flotation.

Production and Trade

Canada produced 6,924 tons of fluorspar valued at $217,701 in 1944, compared with 11,210 tons valued at $318,424 in 1943.

Imports were 37,101 tons valued at $840,309, compared with 77,436 tons valued at $1,738,669 in 1943. Most of the material came from Newfoundland, and was consigned to Arvida, Quebec, for use in the production of aluminium.

In 1944, the six following producers, all in the Madoc area reported shipments: Reliance Fluorspar Mining Syndicate (Rogers mine); Millwood Fluorspar Mines (Keene and Bailey mines); Charles Stoklosar (Blakeley mine); Bassett Fluorspar Mining Syndicate (Lee Junior mine); Detomac Mines (McIlroy mine); and Fluoroc Mines (Howard mine). Nearly 60 per cent of the total output from the above seven mines came from the Rogers property, 14 per cent from the Bailey, 10 per cent from the Keene, and 9 per cent from the Blakeley. The Reliance, Millwood, and Fluoroc were Government-assisted projects.

Production of fluorspar from the Madoc area during the five years 1940 to 1944, inclusive, amounted to about 32,000 tons, or 94 per cent of the total domestic output.

World production of fluorspar prior to the war averaged about 500,000 short tons annually, of which the United States and Germany supplied about 75 per cent. The remainder came mainly from Russia, the United Kingdom, Newfoundland, France, Korea, Italy, and the Union of South Africa.

The United Kingdom is the leading Empire source of fluorspar. Newfoundland, which is next on the list, has large reserves and has greatly expanded shipments in recent years.

Uses

Consumption of fluorspar in Canada in 1944 was 56,900 tons, of which 60 per cent was used by non-ferrous smelters, including aluminium and magnesium plants; 33 per cent by the steel trade; and 5 per cent by the heavy chemicals industry.

Fluorspar has a variety of industrial uses, in most of which it serves as a powerful fluxing agent. The steel industry is by far the largest consumer. In basic open-hearth and electric furnace charges, fluorspar is an essential ingredient, imparting fluidity to the slag and permitting the use of larger quantities of lime, the agent most effective in removing sulphur, phosphorus, and other impurities. About 6 pounds of spar is required per ton of steel made in the open-hearth, and 20 pounds per ton for that made in the electric furnace. Fluorspar is used in small amounts in numerous other metallurgical industries, including foundries and various metal-refining operations. A small addition of fluorspar is made to the ferrosilicon-calcined dolomite briquettes used in the production of magnesium by the Pidgeon process, where it serves as a catalyst and improves recovery.

The next largest use for the mineral is in the manufacture of hydrofluoric acid, which is used mainly in making artificial cryolite and aluminium fluoride for the aluminium industry. The anhydrous acid is used in making organic ("Freon") refrigerants, a recently expanded use for which as an aerosol insecticide carrier in the newly developed "mosquito bombs" is of timely interest in view of the highly effective use that is being made of these "bombs" against malarial mosquitoes in the Pacific war theatre. The acid is being used to an increasing extent as an improved catalyst, in place of sulphuric acid, for the alkylation of olefins in the production of 100-octane aviation gasoline. Next in importance is the use of fluorspar as a fluxing and opacifying ingredient in glass and enamels.

Specifications; Tariff

Standard fluxing gravel or lump grade for metallurgical use is usually sold on a specification of a minimum 85 per cent CaF_2, and not over 5 per cent silica or 0·3 per cent sulphur. It should not contain more than 15 per cent of fines. Owing to recent shortages, however, sales in the United States are being made on the basis of 78 per cent CaF_2, with a minimum of 55 "effective units", and up to 1 per cent sulphur. Effective units are computed as being the CaF_2 percentage less $2\frac{1}{2}$ times the silica content. Canadian shipments have been running much below even this reduced standard, and in some cases consumers sweeten the material with higher grade imported spar.

Glass and enamel grades call for not less than 95 per cent CaF_2, with a maximum of $2\frac{1}{2}$ to 3 per cent SiO_2 and 0·12 per cent Fe_2O_3. The material must be in ground form, in mesh sizes ranging from coarse to extra fine.

Acid-grade spar has the most rigid specification, namely a minimum of 98 per cent CaF_2 and not over 1 per cent SiO_2. Like the ceramic grade, it must be in powder form, and most of the material supplied to the acid and ceramic trades is a flotation concentrate.

Prices

By arrangement with consumers, the price of domestic metallurgical fluorspar was set in 1942 by the Metals Controller on the following basis: $24 in U.S. funds a 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 a 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. Although maximum prices in the Illinois-Kentucky field were revised in July, 1943, there was no change in the above arrangement in 1944 as a result of the increases.

In 1942, fluorspar was placed on the list of minerals requiring a permit for exportation from Canada, but this restriction was withdrawn, effective April 1, 1944, in respect to shipments to the United States and to any part of the British Empire.

The duty on metallurgical grade fluorspar entering the United States is $5·625 a ton, and on acid and ceramic grades, $3.75 a ton. There is no duty on fluorspar imported into Canada.

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OTTAWA, CANADA, APRIL, 1945.

GRANITE IN 1944

(Building, Ornamental, and Crushed)

The stone quarried consists of granite and related crystalline igneous rocks used for building, decorative, ornamental, or constructional purposes. Producing properties are 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.

Granite for monumental use is produced in the Maritime Provinces and in Quebec, Ontario, Manitoba, and British Columbia. Prior to the war an appreciable amount of foreign stone, principally of the black and red varieties, was imported, mainly from Finland and Sweden. 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.

Production and Trade

The Canadian production of granite in 1944 was 269,879 tons valued at $1,300,989, compared with 780,422 tons valued at $1,522,072 in 1943; and 1,366,425 tons valued at $1,946,249 in 1942. The large output in 1942 and 1943 was mainly attributed to the large power plant development at Shipshaw, Quebec.

Exports of granite and marble unwrought in 1944 were 3,871 tons valued at $42,567, compared with 3,762 tons valued at $47,258 in 1943.

Imports of granite in 1944 were valued at $78,920, compared with $69,569 in 1943. The annual value of the imports prior to the war was approximately $100,000.

The industry in the Maritime Provinces was comparatively quiet in 1944. No new deposits were opened and production came from the well-established firms. In Nova Scotia, granite both for building and monumental purposes has been quarried and processed in the province for many years. Light, medium, and dark grey granites were produced in 1944 at Shelburne by W. T. Dauphinee and A. R. Bower, and at Nictaux West by E. A. Rice and O. A. Rice. A black granite for monumental purposes was also quarried at Birchtown, Shelburne county, by W. T. Dauphinee.

In New Brunswick, B. Mooney & Sons, Realty, of Saint John, operated the quarry on Spoon Island, near Hamstead, Queens county, and produced granite for monumental and structural uses. Some black granite was produced from a quarry at Digdequash Lake, Charlotte county. The Milne Coutts and the S. Pinney's quarries near St. George, Charlotte county, were also operated on a small scale.

Quebec continued to furnish most of the granite for building, the leading producing areas being Stanstead, Stanstead county; St. Samuel, Frontenac county; Rivière-à-Pierre, Portneuf county; and Lake St. John district. Le Granit National Ltée operated its quarries at St. Gédéon and St. Joseph d'Alma, Lake St. John district. Brodies, Limited, of Montreal, operated its dressing plant at Iberville, and obtained its granite from Graniteville, Stanstead county, from Guenette, Labelle county, and to a small extent, from Mt. Johnson, near Iberville. Stanstead Granite Quarries Company of Beebe operated its quarries at Graniteville. Le Granit National, Ltée produced black granite from its quarry at St. Joseph d'Alma, Saguenay county. Grey granite which constitutes over 60 per cent of the total production in Quebec is quarried mainly in the Stanstead area. Some black or dark grey granite is quarried at St. Gédéon, Roberval county, at Mt. Johnson, Iberville county, and at St. Joseph d'Alma, Saguenay county.

In Ontario, the Ontario Rock Company of Toronto operated a quarry at Havelock, Peterborough county; and Building Products, Limited, of Montreal, quarried some stone from near Madoc, Hastings county. A red granite of medium to coarse texture and of uniform mixture was being developed prior to the war near Coe Hill, Wollaston township, Hastings county. The property, which is owned by Upper Canada Granite Quarries, Limited, 1406 Concourse Building, Toronto, was being developed to supply the domestic and export markets for monumental and building stones. It has been idle during the war.

Prospecting for granite deposits suitable for building and monumental use has been active in Manitoba and several deposits of red granite of various shaaes have been located, but there has been little development in recent years.

In British Columbia, granite was produced on a small scale by several operators in 1944, mostly by municipalities and the railway companies. The principal operators were: Coast Quarries, Limited, operating at Granite Falls, Burrard Inlet; B. C. Monumental Works operating at Granite near Vancouver; Vancouver Granite Company on Kelson Island, Vancouver mining division; and Vernon Granite and Marble Company, Vernon.

Uses

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 break-waters; and for bridge piers. Granite from quarries in Quebec has been used in the construction of public buildings in different parts of Canada, in competition with local stone. Most operations in which granite is used have been greatly curtailed during the war.

Some granite is being imported from the United States for monumental use, but Canadian granite is being used to an increasing extent for this purpose. 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. Canadian producers should 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 the industry is likely to prosper.

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OTTAWA, CANADA, MAY, 1945.

GRAPHITE IN 1944

Production of graphite in Canada in 1944 continued to be confined to the old-established Black Donald mine near Calabogie, in Renfrew county, Ontario, which produces a variety of grades of mill products for different industrial uses.

There were no important changes in the general graphite situation in 1944. Supply for Allied Nations' requirements maintained the over-all improvement shown in the previous year, and the concern felt in the earlier stages of the war over possible shortages, particularly of crucible grades, was much less in evidence.

Sources of Production; Developments

Flake graphite is widely distributed in many parts of the Canadian Precambrian Shield, chiefly in gneisses and crystalline limestones. Production has been confined to adjacent sections of western Quebec and eastern Ontario, in the general Ottawa region. Occurrences of flake graphite are known also in Manitoba and British Columbia, but so far these have attracted little interest. Bodies of amorphous graphite occur near Saint John, New Brunswick, and were worked on a small scale many years ago.

In 1942, Frobisher Exploration Company (a subsidiary of Ventures, Limited) undertook a geological investigation of the Black Donald property and conducted a diamond-drilling program, as a result of which a substantial tonnage of new ore was located. Frobisher Exploration took over the property in 1943, and has since been operating it under the name of Black Donald Graphite, Limited. A new power plant on the Madawaska River was completed at the end of 1943 to replace the old one washed out earlier in the year, and various additions and changes were made in the mill circuit.

Production and Trade

Canadian production of graphite in the form of finished mill products totalled 1,582 tons valued at $171,166, with sales valued at about $125,000. Output consisted mainly of foundry grades, but included also some 300 tons of high-grade lubricating flake. In 1943, production was 1,903 tons valued at $197,431.

Exports of milled and finished concentrates were 576 tons valued at $87,774, compared with 611 tons valued at $80,961 in 1943. Most of the material went to the United States.

Imports of unmanufactured graphite, most of which was Mexican amorphous, were valued at $48,095; of manufactured, at $261,205; and of graphite crucibles, at $128,738. These values compare with $23,773, $286,583, and $191,296, respectively, in 1943.

There was a fairly active production of graphite in the general Ottawa region about 30 years ago. About a dozen mills were in operation at various times and produced small tonnages of refined flake, the maximum output being in 1916, when shipments totalled nearly 4,000 tons. Total estimated production to the end of 1944 is approximately 70,000 tons. The Black Donald mine is the only survivor of these various operations. Under various ownerships, this mine has a record of 36 years of operation. The main ore-body was considered to have been worked out several years ago, and mining operations were suspended. Production was maintained, however, through the re-treatment of old mill tailings recovered from the lake by pumping, a procedure still followed in 1944, when some ore derived from reopened shallow workings also was put through the mill. The capacity of the mill was increased in 1944. About 6,500 tons of mill-feed was treated, of which 75 per cent was old tailings, and 25 per cent newly mined ore. Running on ore, mill capacity was 25 tons a day, and on tailings, a little over 30 tons, with a recovery of about 5 tons of finished product. Grade of tailings averaged about 15 per cent carbon, and of ore, 30 to 35 per cent. It is intended to dewater and recondition the old main Ross shaft in 1945, from which levels will be run to tap the new ore-body indicated by drilling, and which is estimated to contain several years' supply of ore.

Artificial graphite is made in Canada by Electro-Metallurgical Company of Canada, Welland, Ontario, and by Exolon Company, Thorold, Ontario. These companies export part of their production to the United States.

Prior to the war, world production of natural graphite of all types, and including flake, crystalline (plumbago), and amorphous, averaged about 140,000 short tons a year. Madagascar, Germany, Austria, and Czechoslovakia were the principal sources of flake; Ceylon, of plumbago; and Mexico and Korea, of amorphous.

The United States and Canada possess important graphite reserves, but are deficient in the types of graphite required for the most exacting uses, notably for crucible manufacture. Deposits are comparatively low grade for the most part, and production costs are high. Consequently, the United States depends, for most of its requirements of high-grade graphite, on imports of flake from Madagascar and of plumbago from Ceylon. Production of all types and grades in the United States in 1943 totalled just under 10,000 tons.

In 1943, shipments of graphite from Ceylon amounted to 20,501 tons, a decline of 25 per cent from the 1942 figure. For the past several years all graphite from Ceylon and Madagascar has been purchased by the British Ministry of Supply, under allocation agreement with the United States Government for Allied Nations' use.

Uses; Specifications

Graphite has many uses in industry, but is employed principally in foundry facings, lubricants, crucibles, retorts and stoppers, packings, pencils and crayons, paints, and stove polish. Important quantities, mostly amorphous or artificial, are used in dry batteries, electrodes, and commutator brushes.

The flake of the Black Donald deposit is too small for crucible use, but the products made are high in carbon and are well suited for lubricants, packings, polishes, and foundry requirements, for which purposes most of the output is sold. Prepared facings for the domestic foundry trade also are made.

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

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 over.

Prices; Tariff

Trade quotations showed little change in 1944 from those of the previous year. All Ceylon and Madagascar graphite continued to be purchased and sold to consumers at fixed prices by Metals Reserve Company, which also had set prices on United States flake.

The duty on graphite entering the United States under the general tariff is 5 per cent ad valorem on natural amorphous and artificial grades, and 15 per cent on crystalline lump, chip, and dust grades. 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.

Exports of Canadian graphite and graphite products have been subject to special export licence since January, 1941.

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OTTAWA, CANADA, JUNE, 1945.

GYPSUM IN 1944

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 chief producer of gypsum in Canada and is followed by Ontario, New Brunswick, Manitoba, and British Columbia.

Production and Trade

The production of gypsum in 1944 was 596,164 tons valued at $1,511,978, compared with 446,848 tons valued at $1,381,468 in 1943 and the record production of 1,593,406 tons valued at $2,248,428 in 1941. The decline in output can be traced largely to a shortage of cargo space for the export of Nova Scotia's production to the United States.

The world production of gypsum is estimated at 8,000,000 tons. Canada probably occupies third place among the producers.

Imports of gypsum and plaster of Paris in 1944 were 2,110 tons valued at $82,403, compared with 6,691 tons valued at $76,850 in 1943. Imports in 1943 included 5,000 tons of crude gypsum valued at $12,490.

Exports of gypsum, plaster of Paris, ground, and prepared wall plaster, in 1944, were 387,392 tons valued at $443,385, compared with 185,688 tons valued at $221,866 in 1943.

In Nova Scotia, Canadian Gypsum Company, Limited, operating at Wentworth, Hants county, about 2 miles from Windsor, is the largest gypsum operator in the province. During the summer it ships part of the crushed stone by steamer to the United States and part by rail to its large storage plant at Deep Brook, Digby county. In the winter, when Wentworth is closed to navigation, the crushed stone from the storage plant is shipped by steamer to the United States. The company operated for seven months during 1944 at about one-quarter capacity.

National Gypsum (Canada) Company continued its operations at Dingwall and Walton. Windsor Plaster Company quarried stone from the old Mosher quarry on the property of Windsor Gypsum Company and also from the Vienot quarry at Brooklyn. Connecticut Adamant Gypsum Company reports a small shipment from its stockpile at Cheverie, Hants county. Victoria Gypsum made a small shipment from storage at Little Narrows. The Baddeck quarry of Gypsum, Lime and Alabastine, Canada, Limited remained idle owing to high freight rates and scarcity of labour. The production of gypsum in Nova Scotia increased from 255,700 tons in 1943 to 401,284 tons in 1944. A maximum output of 1,395,200 tons was obtained in 1941.

In New Brunswick, the gypsum quarries and plant of Canadian Gypsum Company at Hillsborough were operated at capacity and all grades of plaster and wall boards were produced for the markets in Eastern Canada. No shipments of crude gypsum were made to the United States due to the difficulty of obtaining vessels. The total output in 1944 was 42,040 tons, being 16 per cent in excess of the 1943 production.

In Ontario, gypsum is mined at Caledonia by Gypsum, Lime and Alabastine, Canada, Limited, and at Hagersville by Canadian Gypsum Company, Limited, both centres being in Haldimand county. All grades of plaster and plaster products are manufactured for markets in Ontario and Quebec. So far the extensive deposits of gypsum known to occur in northern Ontario have not been developed. The Ontario output of gypsum in 1944 was 90,288 tons, compared with 92,400 tons in 1943. The maximum output occurred in 1922 and amounted to 110,200 tons.

In Manitoba, Gypsum, Lime and Alabastine, Canada, Limited and Western Gypsum Products, Limited operated their quarries at Gypsumville and at Amaranth respectively, and their plants in Winnipeg throughout the year. Western Gypsum Products, Limited of Winnipeg is building a new gypsum mill and wall board plant at Calgary. Products include wall board, sheeting, building tile, plasters, etc., from gypsum mined at Mayook, B.C. The total production of gypsum was 38,330 tons compared with 37,989 in 1943.

In British Columbia, Gypsum, Lime and Alabastine, Canada, Limited, continued the production from its deposits at Falkland to supply its plant at Port Mann, near New Westminster and at Calgary, Alberta. 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. The total production of gypsum was 24,222 tons, compared with 24,412 in 1943.

Markets and Uses

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 is used in the manufacture of wallboard, gypsum blocks, insulating material, acoustic plaster, etc.

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. 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. The manufacture of gypsum boards, for which there has been a large demand in recent years, has partly compensated for the decrease in use for residential building purposes.

Consumption of gypsum in Canada in the gypsum products industries, including wallboard, and hard wall plasters is approximately 180,000 tons a year, mostly as calcined gypsum. The Canadian cement industry consumes annually 50,000 tons of crude gypsum.

The use of anhydrite for the manufacture of sulphuric 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.

Prices

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 1944.

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OTTAWA, CANADA, MARCH, 1945.

IRON OXIDES (MINERAL PIGMENTS) IN 1944

Ochreous iron oxide, which is sold uncalcined and is 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.

Principal Canadian Source of Supply

The production for some time past has come mostly from deposits near Trois Rivières, Quebec, but there are other deposits in different parts of Canada that could be operated were the demand sufficient to warrant doing so.

In the past, deposits in Quebec were operated near Ste. Anne de Beaupré, Montmorency county; in Lynch township, Labelle county; and at St. Raymond, Portneuf county.

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

In Alberta and Saskatchewan, several deposits of ochre are known, some of which have commercial possibilities, but they are difficult of access and the market is limited and they have received little active attention. The most promising known deposit in Saskatchewan is located at Loon Lake, 32 miles from St. Walburg (station on C.N.R. line) and 77 miles northwest of North Battleford. These occurrences are being investigated by the Saskatchewan Department of Natural Resources. Large deposits near Grand Rapids and Cedar Lake in northern Manitoba remain undeveloped for similar reasons. In Nova Scotia, beds of ochre and umber were operated to a small extent in the past.

Production and Trade

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 1944 totalled 8,599 tons valued at $150,250, compared with 8,401 tons valued at $135,893 in 1943. Shipments were mainly from Quebec.

Sherwin-Williams Company of Canada operated its deposits and plants at Red Mill, Champlain county, Quebec, and a few miles east of Trois Rivières. It is the only Canadian producer of calcined iron oxides, the others marketing only air-dried products. Its calcined and air-floated mineral products produced to rigid specifications are in use in the war industries. This plant, which produces most of the Canadian iron oxide was operated at capacity throughout 1944.

Several small deposits are worked intermittently at Almaville, St. Louis, and St. Adelphe in Champlain county, and at Les Forges, and near Pointe-du-Lac, St. Maurice county.

Exports of iron oxides in 1944 were 2,026 tons valued at $120,327, compared with 1,830 tons valued at $131,830 in 1943. The exports of mineral pigments n.o.p. were 627 tons valued at $121,622, compared with 82 tons valued at $13,393 in 1943.

Imports of all kinds of ochres, siennas, and umbers totalled 1,430 tons valued at $70,168, compared with 1,125 tons valued at $76,644 in 1943.

Uses and Prices

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 1943 (figures for 1944 not available) was 6,568 tons, and the amount consumed in the paint industry was 2,321 tons.

The Canadian price of red iron oxide, as given by Canadian Chemistry and Process Industries, remained at 2 to 7 cents a pound throughout 1944.

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OTTAWA, CANADA, MAY, 1945.

LIME IN 1944

Lime is manufactured in every province except Prince Edward Island, though the production in Saskatchewan 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 producer, supplies nearly one-half of the total output, Quebec being next with about 42 per cent.

There are many prospective lime-producing localities in Canada because of the abundance of limestone throughout the country; but in the more industrialized areas, particularly in Ontario and Quebec, large unworked deposits of pure high-calcium limestone that will yield a white lime suitable for chemical purposes are becoming scarce. With the northward development of the mining industry, interest is being manifested in making lime from limestone deposits in the more northerly parts of the country.

The demand for lime by war industries raised production above all previous records in 1943, and the decrease in output in 1944 was caused mainly by labour and fuel shortages and by the difficulty of getting replacement parts. Prior to the war a program of modernization was under way at most of the larger lime plants and this program will be proceeded with at an accelerated pace as soon as equipment becomes available.

Production and Trade

Production of quicklime and hydrated lime during 1944 amounted to 885,214 tons valued at $6,926,844, compared with 907,768 tons valued at $6,832,992 in 1943. Of these quantities somewhat less than half was used by companies producing lime principally for their own consumption. The output in 1943 comprised 766,147 tons of quicklime valued at $5,990,088, and 141,621 tons of hydrated lime valued at $842,904.

Exports of lime in 1944 amounted to 15,450 tons valued at $136,797, compared with 15,391 tons valued at $133,320 in 1943. These exports were chiefly to the United States, but other countries to which exports were made were Newfoundland, Jamaica, Greenland, and St. Pierre and Miquelon.

Imports of lime in 1944 amounted to 6,698 tons valued at $34,917, compared with 9,077 tons valued at $64,303 in 1943. These imports were all from the United States.

Forty-five plants were in operation during 1944. Pacific Lime Company, Limited put an oil-burning rotary kiln into production at its plant at Blubber Bay, Texada Island, British Columbia. A new source of hydrated lime that became available during the war was that from the brucite-magnesia plant at Wakefield, Quebec, operated by Aluminum Company of Canada, Limited. At this plant hydrated lime is obtained as a co-product in the production of magnesia from brucitic limestone.

Prices and Outlook

Prices of the various lime products vary over a wide range, depending upon the geographical position of the plants and upon difference in quality of the lime. No significant change occurred in prices of lime during 1944.

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

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sold either in bulk or packed in barrels; crushed lime (1-inch and under) and pulverized lime are sold in air-tight, multi-wall paper bags. In these various forms lime has many uses in chemical and metallurgical processes, in agriculture, in construction, and for various other purposes. It is one of the great basic raw materials of the chemical industry and over 90 per cent of the present production is used in chemical processes.

The post war outlook for the lime industry, because of its close connection with the rapidly expanding chemical and metallurgical industries, appears to be bright. New chemical uses for lime are continually appearing, and the demand for mason's lime, which has been small in recent years, should increase with the resumption of peacetime building activities.

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OTTAWA, CANADA, JUNE, 1945.

LIMESTONE (GENERAL) IN 1944

Limestone is the most widely used of all rocks because of the great variety and importance of its industrial uses and because of its widespread occurrence. 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 present production of limestone for all purposes, including the manufacture of lime and cement, constitutes 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. In chemical composition the deposits range from pure high-calcium limestone through magnesian limestone to dolomite. Large deposits of brucitic limestone and magnesitic dolomite are being worked.

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 impure limestone by flotation. This method of purifying limestone is now in use at several Portland cement plants in various parts of the world, and it is likely to be more widely used in the future as it permits utilization of certain deposits which, though advantageously situated, contain impurities that hitherto spoiled the usefulness of the deposit.

Production and Trade

The 1944 production of limestone for general use, exclusive of that used for lime and cement, is estimated at 5,560,989 tons valued at $5,525,421, compared with 6,265,181 tons valued at $6,105,749 in 1943. The production for all purposes in 1944 is estimated at 9,900,000 tons.

Limestone is widely distributed and is quarried on a large scale in all industrial countries. Rarely is there much international trade in it, but limestone for use in certain large consuming centres in Canada can be obtained more cheaply from abroad and 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.

Uses

For industrial 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. For certain uses (in the wood pulp industry, for example) the limestone as quarried requires little or no processing, but most 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. Most of the limestone used in chemical and metallurgical industries is of the high-calcium variety, but dolomite is rapidly increasing in importance as an industrial raw material.

Argillaceous dolomite is used for the manufacture of rock wool, a widely used insulating material. The value of rock wool and slag wool produced in 1944 by five Canadian plants in Ontario and Quebec was $1,617,420 compared with $1,721,141 in 1943. The decreased production was caused mostly by shortages in labour and materials. Two new plants, one in Saskatchewan and one in

New Brunswick, were built during 1944 but did not come into production until 1945.

Pure dolomite is now an important source of magnesia and magnesium metal. The metal is recovered directly from calcined dolomite by reduction with ferrosilicon, and indirectly by reacting calcined dolomite with sea-water or with magnesium chloride brine, thereby forming magnesium hydroxide that is converted into the chloride, from which after dehydration, magnesium is recovered by electrolysis. High-calcium lime can be used in place of dolomitic lime for precipitating magnesium hydroxide from sea-water and brine, but where the dolomitic lime is used the yield of magnesia is increased by the magnesia content of the latter. Dolomite is the raw material from which basic magnesium carbonate and magnesia are made by the Pattinson process. Deadburned dolomite is widely used as a refractory material in the steel industry.

Magnesitic dolomite is used in Quebec for the production of refractory products; brucitic limestone is processed for the production of magnesia and hydrated lime.

The use of limestone in agriculture is capable of extensive development. Though the necessity of applying limestone or lime to agricultural land to maintain or increase soil fertility has been emphasized for many years, the quantity so used in Canada is small.

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OTTAWA, CANADA, JUNE, 1945.

LIMESTONE (STRUCTURAL) IN 1944

Limestone in blocks or large dimensions for sawing into building stone is quarried in Quebec, Ontario, and Manitoba. The quarry centres in Quebec for this heavily bedded limestone are at St. Marc des Carrières in Portneuf county, and in the vicinity of Montreal. At both localities a grey limestone is obtained. In Ontario, silver-grey limestone and smaller quantities of buff, and of variegated buff and grey limestone, are quarried near Queenston in the Niagara Peninsula. At Longford Mills, near Orillia, buff, silver-grey, and brown limestone suitable for building stone and marble 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. They have been inactive for the past several years.

In addition to the large quarries, the products of which normally have a wide shipping range, small quarries producing building stone for local use are worked near Quebec City, Montreal, and Hull in the province of Quebec; and at Ottawa, Kingston, and Wiarton in Ontario. Rubble is their chief product.

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

Production and Trade

The production of limestone for structural purposes in 1944 was 12,180 tons valued at $192,870, compared with 9,328 tons valued at $180,057 in 1943. This production was almost entirely 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.

There is little trade in building stone at present between Canada and other countries. Exports of limestone for building purposes are small and are not separately recorded, but exports of all varieties of building stone except marble and granite had a value of only $5,713 in 1944, and of $7,864 in 1943. Imports of all varieties of building stone except marble and granite in 1944 had a value of $15,120 compared with $4,000 in 1943.

The small production reflects the wartime curtailment in construction of buildings of the type requiring cut-stone. Most of the quarries were inactive during 1944 and a part of the shipments made were from stock. The rise in imports was occasioned in part by the difficulty of securing labour for the short periods of quarry operation necessary to supply the small demand for stone not already in stock. As a result, many of the quarries remained closed and the small demand was supplied by imported stone.

Prices and Outlook

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 a cubic foot, depending on the size of block and grade of stone.

There is likely to be a good demand for structural limestone when construction for civilian requirements gets under way, because the construction of a great many necessary buildings for which Canadian limestone is specified has been deferred until after the war.

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OTTAWA, CANADA, JUNE, 1945.

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LITHIUM IN 1944

Amblygonite, spodumene, and lepidolite are the chief lithium minerals of commerce: their ores contain, respectively, about 8, 6, and 4 per cent of lithium oxide. Spodumene is in greatest supply, and is the base raw material for the manufacture of many lithium salts, lithium metal, and alloys. Amblygonite has similar uses, but is scarcer and more expensive. Lepidolite, or lithia mica, is employed mainly in the natural state as a batch ingredient in glass. The occurrence of all three minerals is confined to pegmatite dykes of a definite type, which usually have a localized, regional distribution and often carry, also, important amounts of beryl and tantalite-columbite. In some cases, such dykes have been worked for the recovery of all of these minerals.

There has been no recorded production of lithium minerals in Canada since 1937, when 32 tons of amblygonite and spodumene valued at about $1,700 was shipped, and little if any lithium ore is known to be used or required for any purpose in the Dominion. Thus, an outside market would have to be found for any production. Considerable development work has been done in recent years, however, on deposits in the Pointe du Bois area in southeastern Manitoba; and in the three years ended 1944 increased interest was shown in the commercial possibilities of lithium deposits in other sections of that province, though activities have been confined to exploratory drilling. Some attention has been given, also, to lithium-bearing deposits in the Yellowknife-Beaulieu area in the Northwest Territories.

Lithium ores and compounds early became of strategic importance in the present war, and to conserve supply for defence needs the United States Government placed both under allocation control in 1942. Government assistance also was given to the establishment of two spodumene mills, one in North Carolina, and the other in South Dakota. These measures resulted in a considerable easing of the general supply situation in 1944.

Sources of Production: Occurrences

All of the small Canadian production of lithium minerals has come from the Pointe du Bois area in Manitoba. Lithium Corporation of Canada, 409 Avenue Building, Winnipeg, is the company that has been most actively interested in furthering the development of the lithium-bearing pegmatites in the area, 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 1942-1944. 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 on the Silver Leaf property, on Winnipeg River; on the Irgon and Page-Johnson claims, at Cat Lake, north of Oiseau River; on the Picard and Scott claims, near East Braintree, 84 miles east of Winnipeg, near the Ontario-Manitoba boundary; and on the Kobar claims, near Mile 81 on the Hudson Bay Railway. Spodumene is the chief lithium mineral in most of these occurrences, and it is usually mixed with considerable quartz, necessitating concentration to make a commercial shipping product.

Sherritt-Gordon Mines, Limited in 1942 drilled about 20 holes on the Kobar group of claims at Crowduck Lake in the Herb Lake area, the deepest of which cut the deposit at a depth of 175 feet. Spodumene-bearing pegmatite was found to extend over a length of at least 900 feet, with an average width of 18 feet, and with a spodumene content of nearly 14 per cent. The indicated amount of spodumene present in the section drilled was 1,400 tons per vertical foot. In 1943, Sherritt-Gordon drilled the Scott (Atyfor) claim near East Braintree. The results indicated a number of irregular tongues or lenses of spodumene-bearing pegmatite. The two best holes showed, respectively, 18 per cent spodumene over a width of 40 feet, and 22 per cent over 39 feet. Further prospecting in the Cat Lake area in 1943 disclosed extensive surface showings of spodumene-pegmatite over considerable distances beyond the previously known Irgon deposit, with estimated contents of 25 to 30 per cent sopdumene over widths of 25 to 30 feet in many sections. In 1944, Hudson Bay Exploration and Development Company drilled six holes on the Eagle No. 1 claim in the Cat Lake section; and Consolidated Mining and Smelting Company also made examinations of showings in the same area and at Bernic Lake. Further discoveries of spodumene were reported during the year on the Spot group of claims near Maskwa Lake, west of Cat Lake, where spodumene contents of around 40 per cent were indicated.

Recent exploration by the Canadian Geological Survey, and by private interests, in the Yellowknife-Beaulieu River area, N.W.T., has disclosed extensive and widespread lithium mineralization. Many of the pegmatites contain also tantalite-columbite, beryl, and cassiterite. Several groups of claims were taken up in 1943 and 1944, on some of which mining for tantalite is planned in 1945. The region, however, is probably too distant to be of immediate economic interest as a source of lithium minerals.

In Quebec, several spodumene-bearing pegmatite dykes have been reported in Lacorne and Barraute townships, Abitibi county, and in 1944 Ventures, Limited did some exploration on a group of claims in Lacorne adjoining the molybdenum mine of Wartime Metals Corporation.

In western Ontario, Consolidated Mining and Smelting Company is reported to have done some work in 1944 on an occurrence of spodumene on Maligne River, in Quetico Provincial Park, Rainy River district. The spodumene is stated to occur in crystals up to 10 inches across, and to make up about 20 per cent of a 30-foot pegmatite dyke.

Production and Trade

Total production in Canada during the active period 1925 to 1937, inclusive, is estimated at about 250 tons, and comprised lepidolite, spodumene, and amblygonite. Most of the material was exported to the United States.

The United States and Southwest Africa have been the two leading producers of lithium ores in recent years, with the former probably supplying well over 50 per cent of the annual total, and possessing the largest reserves. Production consists mainly of spodumene and amblygonite, and in the United States has come chiefly from the Black Hills region in South Dakota. An additional important source of lithia in the United States is lithium-sodium phosphate, recovered from the brine of Searle's Lake, at Trona, California, which at present furnishes nearly 50 per cent of the total American lithia production. Shipments of lithium ores and compounds in the United States in 1944 reached an all-time high of 13,319 tons, a 63 per cent increase over the previous year.

There are no plants in Canada for the chemical treatment of lithium ores. Most of the world production 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 purchased their requirements under individual contract, and there has thus been 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.

Uses

The high-lithia minerals amblygonite and spodumene are used mainly in the production of lithium chemicals and metal. Lepidolite is used chiefly as a batch constituent in the making of opal and heat-resistant glass, and increasing amounts are now employed in borosilicate glass for electronic tubes and boiler gauges. Spodumene has been receiving increasing attention as a ceramic raw material. It is rather refractory, but spodumene-feldspar mixtures have lower melting points than has feldspar alone. The mineral appears to have possibilities for use in pottery bodies, glazes and enamels, where it would replace 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 attained major wartime importance in the electro-chemical, aircraft, and foundry industries, and military uses now exceed 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. Originally developed for industrial and domestic use, such units are being employed to dry the air for blast furnaces, giving 10 per cent greater efficiency. The chloride, 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 30 pounds in weight from a molten bath has been perfected. The material has valuable optical properties for achromatic lens combinations and ultraviolet and infrared spectroscopy, and is replacing optical-grade fluorspar for general use in instruments. Lithium stearate has become established as a water-resistant grease that works well under extreme ranges of temperature and is used extensively as an aircraft lubricant. It is also employed in waxes and polishes. Lithium hydride provides a convenient and safe means of transporting and storing hydrogen gas, and this has become a commodity of primary military importance. Lithium nitride serves a similar purpose in the case of ammonia. The carbonate is being used to an increasing extent to improve gloss in ceramic glazes and enamels; in optical and low-expansion glasses; and to decrease scaling and decarburization in steel heat-treating furnaces.

Lithium is the lightest of 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 alloys are being used to an increasing extent as de-oxidizing, degasifying, and desulphurizing agents in copper, brasses, bronzes, etc.; as scavengers for cast iron and in the refining of high-carbon steel; and for the hardening of lead and aluminium. Alloys of lithium with zinc, aluminium, and magnesium are strong and highly resistant to corrosion.

Prices

Prices of lithium minerals in 1944 showed little change from those of the previous year. Amblygonite, 8 to 9 per cent Li_2O, was quoted at $40 to $50 per ton; spodumene, 6 per cent grade, at $5 to $6 per unit for mill concentrates; and lepidolite, 3 per cent Li_2O at $25 per ton, all f.o.b. mines. Lithium metal was unchanged at $15 per pound.

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OTTAWA, MARCH, 1945.

MAGNESITE AND BRUCITE IN 1944

Magnesite is found in Quebec and British Columbia. In Quebec the magnesite occurs intimately associated with dolomite and the rock is properly termed "magnesitic dolomite". It is quarried at Kilmar and at Harrington East, Argenteuil county, and is processed for use as refractory materials.

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. A number of other deposits of magnesite are known in British Columbia and Yukon, but either because of their limited extent or distance 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 of them 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 Quebec. By a process developed in the Bureau of Mines laboratories, Ottawa, these brucite granules are recovered in the form of magnesia of a high degree of purity, and hydrated lime is obtained as a co-product in a plant near Wakefield. The deposits are the largest known in the world.

Production and Trade

In 1944 the value of products made from magnesitic dolomite and brucite was $1,139,281, compared with $1,260,056 in 1943.

Exports of basic refractory materials made from magnesite and brucite in 1944 amounted to 1,013 tons valued at $31,583, compared with 9,006 tons valued at $110,976 in 1943.

Imports of magnesia products in 1944 had a value of $1,513,902 and consisted of the following items: dead-burned and caustic-calcined magnesite, $466,-314; magnesite brick, $718,481; magnesia, $219,116; magnesia pipe covering, $71,138; and magnesium carbonate, $38,853. In 1943 the total value of these products was $1,746,060.

Products from magnesitic dolomite include dead-burned or grain material, bricks and shapes (burned and unburned), caustic-calcined magnesitic dolomite, and finely ground refractory cements.

The magnesia obtained from brucitic limestone is in granular condition. The greater part of the production is dead-burned and made into the same types of refractory products as is the magnesitic dolomite, but important quantities are also marketed in the lightly calcined state for use as an ingredient in chemical fertilizers, and also for making paper.

Products made in Canada from imported magnesite and magnesia include fused magnesia (artificial periclase), optical periclase, and "85 per cent magnesia" pipe covering.

Uses and Prices

Prices of calcined magnesite in 1944, f.o.b. Montreal or Toronto, as quoted by Canadian Chemistry and Process Industries, were $70 to $90 a ton.

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 the production of magnesium. It is the basis for a number of magnesium salts and has many minor uses.

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

Dolomite and sea-water compete with magnesite and brucite as sources of magnesia products. 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 in recent years it has become a source of magnesium metal.

Sea-water has become an important source of magnesia in England and the United States for use in making magnesium and for various industrial and pharmaceutical purposes.

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OTTAWA, CANADA, JUNE, 1945.

MAGNESIUM SULPHATE IN 1944

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. Experimental shipments have been made also from one of the lakes in Saskatchewan.

Canada's output of magnesium sulphate has come chiefly from a deposit in Basque, British Columbia, production from which was discontinued in the autumn of 1942. The salt was refined at Ashcroft, 15 miles south of the deposit, and the grade of the product was high. The refinery, now owned by Ashcroft Salts Company, Limited, had a capacity of 10 tons of salt a day. 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 sulphates, which at certain times of the year crystallizes into a bedded deposit with layers of both salts.

Production and Trade

There was no production of magnesium sulphate in Canada in 1943 and 1944. In 1942 is was 1,140 tons valued at $38,760.

Imports of magnesium sulphate in 1944 were 2,684 tons valued at $108,795, compared with 3,379 tons valued at $137,372 in 1943. The imports were mainly from the United States.

Uses, Prices, Tariffs

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

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 $63 to $65 per short ton in bags, whereas the B.P. material was quoted at $3.60 per barrel throughout the years 1943 and 1944.

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 ¾ cent per pound, or $15 per ton.

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OTTAWA, CANADA, APRIL, 1945.

MARBLE IN 1944

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

In Quebec, several varieties of clouded grey marble and also a black marble are available in the quarries of Missisquoi Stone and Marble Company, Limited at Philipsburg. Brown marble used for counters and wainscoting is obtained from the building-stone quarries in the Trenton limestone at St. Marc des Carrières, Portneuf county. White dolomite is quarried and crushed by Canadian Dolomite Company, Limited at Portage du Fort, Pontiac county, for making artificial stone, terrazzo chips, stucco dash, and various minor products.

In Ontario, black marble in beds up to 40 inches thick is quarried at St. Albert, near Ottawa, by Silvertone Black Marble Quarries, Limited, Ottawa. 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 of red and buff marble by Winnitoba Marble Quarries, Winnipeg, from its quarry at Fisher Branch to supply building rubble and terrazzo chips.

In British Columbia there are many deposits of marble, but there is at present only a small production of white marble, by Marble and Associated Products, Victoria, from a quarry at Malahat, and by Beale Quarries Limited, Van Anda, Texada Island.

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

Production and Trade

Production of marble in 1944 amounted to 11,829 tons valued at $85,374 compared with 11,848 tons valued at $68,022 in 1943.

Exports of marble are recorded with exports of granite and the exports of the two during 1944 amounted to 3,871 tons valued at $42,567, compared with 3,762 tons valued at $47,258 in 1943.

Imports of marble in 1944 had a value of $77,402, compared with $50,630 in 1943. Imports are largely in the form of unpolished slabs and sawn stock, the finishing being done in marble mills throughout Canada. In addition, there were imports in 1944 of mosaic flooring materials, which consisted in large part of marble valued at $64,904, compared with imports of similar materials valued at $23,680 in 1943.

Prices and Outlook

There is a wide range in the price of marble depending on the quality and rareness of colouring.

The war has adversely affected the marble industry because most of the wartime buildings have been of the industrial type in which little or no standing marble has been used. Few of the quarries were in active operation in 1944 and such shipments of block or slab marble as were made were from stock. There has, however, been an increase in the demand for terrazzo material, most of which previously originated in Europe. Several of the Canadian quarry operators have added equipment for the production of both terrazzo chips and poultry grit from waste marble, and a good range of colours is now available in domestic terrazzo chips. In view of the large accumulation of building construction to be proceeded with after the war it is expected that a good demand for Canadian marble will materialize in the near future.

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OTTAWA, CANADA, JUNE, 1945.

MICA IN 1944

Canada is one of the two leading world sources of phlogopite, or amber mica, the other most important producer being Madagascar. Numerous occurrences of muscovite, or white mica, also are known in Canada, but only since the discovery in 1942 of exceptionally rich deposits in the Eau Claire area, Ontario, has there been a substantial production of this variety. Preliminary figures indicate that in 1944 the value of muscovite shipments from this field amounted to about 70 per cent of the total Canadian production of all classes and qualities of mica, and exceeded the entire value of the country's output in 1943. In 1943, also, the deposits furnished about 8 per cent of the total Canadian and American production of strategic muscovite, supply of which was drawn from many hundreds of mines.

Although Canada has a substantial export trade in sheet mica, it also imports considerable quantities of muscovite splittings, block, and manufactured mica, the value of which in 1944 was $185,986.

The general supply situation in respect to mica of all classes showed a considerable and progressive improvement during 1944, particularly in reference to strategic qualities of muscovite and phlogopite required for capacitor and aviation sparkplug use.

In 1942, Colonial Mica Corporation, the United States Government mica purchasing agency, was empowered to extend its muscovite buying program to Canada. It established a special schedule of prices, entered into contracts, and in 1943 opened a Canadian office at North Bay, Ontario, and appointed a resident agent. During 1944, Colonial extended assistance to Canadian producers of both strategic-quality muscovite and phlogopite in the form of loans of drill-compressor units and other equipment on a rental basis, and similar assistance was also given mica operators by the Department of Mines and Resources, Ottawa, in 1943 and 1944. Colonial terminated its Canadian buying program on December 31, 1944, leaving producers of all types and qualities of mica free to sell in the open market.

Of technical interest was the development in 1943 of improved instruments for readily determining the power factor and the electrical conductivity of sheet mica. Appraisal solely by visual means caused the rejection of important amounts of sound mica. The new instruments are, respectively, the direct-reading Q-meter and the point-electrode conductivity tester, both developed by the Bell Telephone Laboratories. They are not intended to supplant visual inspection, but by their use it is expected that important amounts of mica of a quality hitherto rejected on account of appearance will become available for capacitor and other more exacting electrical needs. Instruments of the above type are now available in the Bureau of Mines, Ottawa, for the testing of mica samples.

Also of technical interest is the development in the United States of a mechanical device for trimming mica by means of a fine-toothed band saw, inclined at an angle to a base plate against which the mica is held, thus yielding a bevel or bias cut. This machine was installed in a few commercial mica shops in 1944. Methods of making thin mica splittings by other than hand-knife means also have been under investigation in the United States by the National Bureau of Standards, and a recent circular of the Bureau describes two mechanical devices designed for the purpose.

Sources of Production

Phlogopite.—Most of the phlogopite mined in Canada has come from a belt of pyroxenite rocks that extends from Kingston to Ottawa, in Ontario, and thence northward into Quebec, between the Gatineau and Lièvre Rivers. The productive belt is from 60 to 70 miles wide and about 200 miles long. Scattered, outlying mica deposits occur also in Pontiac and Argenteuil counties, Quebec, and as far east as Quebec City; and in Ontario, similar deposits have been mined to the west in Hastings and Haliburton counties.

In Quebec, the Nellis mine at Cantley, in Hull township, and the Phosphate King mine, in Templeton township, both of which are operated by Blackburn Bros., Blackburn Building, Ottawa, continued to be the chief sources of production in that province. Consideration was being given by New Calumet Mines, Limited, to the possibility of recovering a marketable flake mica product from mill tailings at this company's lead-zinc property on Calumet Island, Pontiac county. It is estimated that about 10 tons a day of plus 65-mesh mica can be recovered by screening the tailings discharge from 450 tons of ore milled. Tests were run in the Bureau of Mines, Ottawa, to remove impurities from the crude tailing by tabling, followed by wet-grinding in a ball mill. Samples of the resulting 200-mesh product were submitted to various consuming industries, but no decision was made by the company in regard to entering into production.

In Ontario, the chief operator in 1944 continued to be Kingston Mica Mining Company, with mine near Godfrey, in Bedford township, Frontenac county. The output of this property is exported in the form of rifted rough sheet to the United States for trimming and punch use, and is of special heat-resistant, sparkplug quality. Canadian deposits yielding this class of phlogopite are comparatively few, the chief other sources being the Ericson mine, in Denholm township, Quebec, and a property at Petit Pré, near Quebec City. The last-named mine has been idle since 1942.

At mid-year, operations were undertaken by Sydenham Mining Company to unwater and reopen the old Lacey mine of the General Electric Company, near Sydenham, in Frontenac county. Assistance for this work, in the form of a loan of equipment, was given by Colonial Mica Corporation. Considerable progress was made, and several consignments of rough, mine-run mica were shipped to the United States for trimming and punch use.

In 1944, Micaspar Industries, Limited of Hamilton did some work on the old Richardson mine, in Loughborough township, and erected a small grinding plant. The plant was operated for only a short time, producing a few tons of ground mica, part of which was made from scrap off the property and part from purchased muscovite waste.

Muscovite.—Muscovite, the occurrence of which in commercial sheet form is confined to granite pegmatite dykes, is far more widely distributed in Canada than phlogopite, and deposits are known in many sections of Quebec and Ontario, as well as in Manitoba and British Columbia, and in the Baffin Island section of the Eastern Arctic. Spasmodic attempts at development of certain of these occurrences have been made, but it was not until the discovery in 1942 of deposits in the Eau Claire region that serious production of muscovite was undertaken. Following the original discovery of the Eau Claire deposits on what is now the Purdy Company's property, several groups of claims were staked on adjacent ground by various syndicates, but none of these contain encouraging amounts of mica, and the quality, in general, is too low for profitable mining.

In Quebec, there are deposits of ruby muscovite mica of strategic quality in Petain township, Abitibi county, and in Bergeronnes township, Saguenay county, the production from which has been small.

In British Columbia, production consists only of schist or other micaceous rock, the sources of the output in 1944 being a deposit near Oliver, operated by R. C. McKay, and a deposit in the Albreda area that was opened by George Campbell. A number of pegmatitic occurrences of sheet muscovite are known in British Columbia, most of which lie in the Tête Jaune, Big Bend, and Fort Grahame areas. Small quantities of mica were taken from some of these deposits years ago, but for the most part the occurrences lie at high altitudes, above timber line, and they could be worked only for brief periods during the summer months.

Production and Trade

General.—According to Dominion Bureau of Statistics preliminary report of mineral production, the total mica output in Canada in 1944 amounted to 6,684,846 pounds valued at $841,026, compared with 8,050,692 pounds valued at $553,856 in 1943. The increase in value is due to greatly expanded sales of high-priced muscovite from Eau Claire, Ontario.

Ontario and Quebec continued to furnish practically all of the production, comprising sheet or block, splittings, ground, and scrap. The output in Ontario declined about 18 per cent in quantity, but increased nearly 110 per cent in value, while the output in Quebec decreased 50 per cent in quantity and 35 per cent in value. The above percentages of quantity, however, do not afford a true index of the sheet mica industry, since they include a large amount of scrap or waste sold for grinding use. For example, over 70 per cent of the total quantity of mica exported in 1944 was grinding scrap, having only 4 per cent of the total export value. In addition, nearly 9 per cent of the exports comprised ground mica having 2 per cent of the value.

As a large part of the output is exported, export figures afford a fair index of the industry by types of products. The total quantity of mica exported amounted to 6,793,600 pounds valued at $816,313. About 14 per cent of the exports by quantity, and 17 per cent by value, was rough phlogopite that was shipped to the United States and Mexico for trimming, splitting, or punching; 5 per cent by quantity, and 70 per cent by value, was trimmed block muscovite and phlogopite; 1 per cent by quantity, and 7 per cent by value, was phlogopite splittings; and 9 per cent by quantity, and 2 per cent by value, was ground phlogopite.

Scrap mica, which was all consigned to American grinding plants, comprised 71 per cent of the quantity, and 4 per cent of the value. About 28 per cent of the exports of scrap was muscovite, having 34 per cent of the declared value, and 72 per cent was phlogopite, with 66 per cent of the value. Most of the scrap phlogopite is shipped to United States Mica Manufacturing Company, East Rutherford, New Jersey, and Forest Park, Chicago. In 1944, most of the scrap muscovite from the Purdy mine was shipped to Concord Mica Corporation, Concord, New Hampshire. Average calculated unit value of the muscovite scrap was $17.75 per ton, and of the phlogopite scrap, $12.80 per ton.

About 500,000 pounds of the rough phlogopite, valued at nearly $85,000, that was exported, comprised small sizes and was mostly recovered from old waste dumps. It was shipped to the United States for making heavy, random-thickness splittings by mechanical means.

Sheet mica exported in the form of rough, mine-run material, trimmed block, and splittings, amounted to 1,313,500 pounds valued at $761,901. Of this, 80 per cent by quantity and 90 per cent by value was consigned to the United States; 6 per cent by both quantity and value went to the United Kingdom; and 13 per cent by quantity and 3 per cent by value was shipped to Mexico for making into splittings.

Phlogopite.—Commencing with 1886, when records were first kept, to the end of 1944, total value of Canada's mica output, the bulk of which consisted of phlogopite, has amounted to over $10,000,000.

In general, Canadian phlogopite deposits tend to be of an erratic, impersistent, and pockety character, and this factor makes underground mining difficult and expensive and for the most part precludes any sustained, systematic attempt to develop ore-bodies. Only in comparatively few instances have workings been carried to depths greater than 100 feet, a great part of the production having been derived from a large number of small, scattered, and intermittently operated surface pits. Reserves, however, are probably sufficient to maintain output at present levels for a considerable period.

The larger producers of phlogopite operate their own mica shops, and sell direct to the trade, but a substantial volume of business is done also by dealers who purchase small lots of mine-run or trimmed block from small operators and grade, trim, or split the material for sale. Most of the splitting work is farmed out in small rural communities and is done on a piecework basis.

In Quebec, Blackburn Bros. ships the rough mica from its Nellis and Phosphate King mines to its trimming shop at Ottawa. Blackburn Bros. also produce substantial amounts of ground phlogopite in various mesh sizes at the Nellis mine. Other leading shippers of sheet phlogopite in Quebec in 1944 included E. Wallingford, Perkins, and W. Wallingford, Gatineau Point, both of whom operated in Templeton township; A. P. Blood, who worked the Ericson property near Farrelton, in Denholm township; and L. Joanisse, at St. Michel, in Wentworth township. Numerous small operators sold minor amounts of rough and trimmed sheet and scrap mica, much of which was from stock or was recovered from old waste dumps. Most of such random production is sold in Canada, W. C. Cross, 205 Bridge Street, Hull, Quebec, and Mica Company of Canada, Lois Street, Hull, being the chief purchasers.

In Ontario, substantial shipments of small-sized phlogopite were made from stock by Loughborough Mining Company (General Electric Company) to Mexico, to be made into splittings for U.S. Government account. The company also continued to ship considerable quantities of scrap mica, recovered from old waste dumps on its Lacey property. Shipments of scrap and of trimmed sheet from stock were also made by W. W. Lee, of Perth Road. S. Orser (Bancroft Mica and Stone Products) mined and shipped a few tons of black, iron-rich biotite mica (lepidomelane), in the form of large, rough crystals, from an extensive deposit of such material near Bancroft, in Hastings county. Most of this mica is sold for grinding, but the crystals yield a small proportion of sound sheet suitable for use in low-voltage domestic heater appliances.

Madagascar, the other chief source of phlogopite, started to produce on an important scale around 1920, and since then has had an annual output of sheet mica about equal to that of Canada. Ceylon, Korea, Tanganyika, and Portuguese East Africa have also furnished small amounts of phlogopite, and a few years ago development of deposits in Mexico was commenced. Recently, the discovery of occurrences in the Northern Territory of Australia was reported.

Muscovite.—In Ontario, Purdy Mica Mines was the only operator of consequence in 1944, and was in steady production throughout the year. Shipments of sheet mica totalled 219,518 pounds valued at $572,290, compared with 84,546 pounds valued at $200,215 in 1943. As in 1943, the greater part of the output was sold to Colonial Mica Corporation, under contract agreement. The Purdy Company continued development at its No. 1, No. 2, and Croteau pits, and also opened a new (No. 3) pit. It also did considerable work on a number of other dykes adjacent to these openings. A force of about 40 men was employed in these operations. The company's large mica shop, which was opened at North Bay in 1943, was in full operation, with a total payroll of about 150. The original shop, established at Mattawa, was closed down in October and the equipment was transferred to North Bay. Total rough, mine-run mica reported as mined in 1944 amounted to 642 tons. An exceptional feature of the Eau Claire mica is the large size of trimmed sheet recovered, some of the crystals or books having dimensions as great as 5 by 8 feet.

The only other operator in the Eau Claire field in 1944 was Mattarig Mica Mining Syndicate, which did a little surface work but produced very little mica.

In Effingham township, Addington county, Marston Minerals, Limited, of Rochester, N.Y., produced about 20 tons of mine-run mica from the old Orser property near Mazinaw Lake. Algonquin Mica Mining Syndicate, of Toronto, made small trial shipments from the old Low property at Aylen Lake, Dickens township, Nipissing district.

In Quebec, H. Sigouin, of Bourmont, produced a small amount of ruby muscovite of strategic quality from a deposit in Petain township, Abitibi county, equipment being supplied by Colonial Mica Corporation. From occurrences of this type of mica in Bergeronnes township, Saguenay county, a few sales were made from stock.

The only production of mica in British Columbia consists of schist or other micaceous rock, mined on a small scale to supply grinding plants operated in Vancouver by Fairey and Company, 601 Taylor Street, and Geo. W. Richmond, 4190 Blenheim Street. Total quantity shipped during the year was about 500 tons.

Muscovite mica is widely distributed, and many countries produce small quantities. India has long been the chief source of supply, and production there since 1942 has exceeded all previous records. Indian "ruby" muscovite, obtained from Bihar Province, is the world standard for exacting electrical uses, particularly for magneto and radio condenser films. India also supplies green muscovite, which is produced in Madras. In 1942 and 1943, the United States obtained about 70 per cent of its imports of strategic mica from India, where more than 100,000 persons were employed in the industry.

Brazil also produces muscovite of ruby quality, and is second to India as a source of supply. Brazilian mica exports in 1943 totalled $1\frac{3}{4}$ million pounds.

The United States holds third position as a producer of muscovite, the chief producing States being North Carolina, South Dakota, New Hampshire, and Connecticut. American production has increased substantially during the present war, largely as a result of assistance furnished to operators by the Government, coupled with enhanced prices offered for official purchase.

Colonial Mica Corporation at the end of 1944 discontinued the purchase of domestic smaller sizes of all types of muscovite, as well as of any mica except ruby quality, production of which comes largely from the New England States. This action is expected to result in a large overall decline in mica production in 1945, particularly in the important North Carolina field, where the bulk of the output consists of green mica.

Argentina also is an important producer and exporter of muscovite, but a large part of the output is green, spotted mica, and is not of strategic quality. Smaller supplies of muscovite are obtained from a number of other countries.

As to Canada's ability to maintain the profitable production of muscovite in the post-war years, when prices are likely to be appreciably lower than at present, it may be noted that the records of Purdy Mica Mines show that, after writing off trimming and other charges, little profit has been derived from the handling of mica in the smaller range of sizes.

Markets and Uses

Mica possesses a combination of properties that make it of outstanding value as an insulating material in all forms of electrical equipment and appliances, and almost the entire production of sheet muscovite and phlogopite is used in the electrical industry. 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 iconoscopes of television transmitters. Muscovite and phlogopite are essential in the manufacture of aviation sparkplugs: muscovite, in the shape of washers, for the barrel, and as thin sheets (so-called "cigarette mica") for the spindle-wrapping and radio shield; and phlogopite for the nose-washers at the base of the plug, which are required to possess high heat-resistance.

Large quantities of muscovite are used in the form of thin sheets for radio and magneto condenser films, and for the bridges in radio tubes, requirements for both of which uses constitute the most pressing need at present. For such uses, muscovite of the best quality, free from spotting or heavy staining, has been specified. It has recently been found, however, that stained and even heavy-stained material gives satisfactory performance in radio tubes, sparkplugs, magneto coil insulation, and low-tension primary condensers, and substitution in these fields is now conserving large amounts of better-quality mica for condenser use.

Heavily spotted and stained muscovite ("electric" mica) is used mainly in domestic appliances, such as toasters and flat-irons; and inferior, ribbed material is punched into washers and disks for various insulating purposes. Because of war 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 at remunerative prices.

Fine flake or powdered mica, made mainly from muscovite, but 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 also 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. Other uses are in weather and corrosion-resistant paints; in resin varnishes for coating foodstuff cans; as a decorative medium in wallpaper and for Christmas-tree "snow"; in the ceramic type of insulation termed "Mycalex" and "Mykroy"; and in a wide range of resin-bonded, moulded insulation and plastics. Ground mica is also employed as a mould and core wash in foundry work. Important new outlets for coarser grades are developing for use in oil drilling, to prevent circulation loss of water into uncased and porous formations.

Vermiculite, a variety of mica which has the unique property of swelling enormously into exceedingly light-weight, accordion-like form when heated, is used extensively for thermal and acoustic insulation. The expanded product, also termed "Zonolite", has a specific gravity of only 6 to 8 pounds per cubic foot, is comparatively refractory, and has low thermal and sound conductivity. In the form of loose-fill, it is a valuable insulator in the walls and roofs of dwellings, industrial buildings, furnaces, ovens, and refrigerators, in which fields it competes with rock and glass wool. Combined with various bonding materials, it is fabricated into pipe covering, insulating blocks, plasters, tiles, and structural roof slabs, and it is also widely employed as a light-weight aggregate in concrete, including cast slabs for pre-fabricated houses. Such slabs are also being used for the decks, roofs, and fire-walls of ships and buildings subject to bombing attack. Plastic insulation made with vermiculite is used as a heat insulator on the outside of boilers and refinery columns, and as a sound-proofing agent in automobiles and aircraft.

Most of the world supply of vermiculite is produced and used in the United States, where production in 1943 totalled 46,645 tons valued at $471,595. Montana, Wyoming, and North Carolina furnish most of the output. Deposits also exist in the Transvaal and Tanganyika in Africa, and in Australia. There are no known occurrences in Canada, but three plants are engaged in processing raw material imported from the United States, to supply the domestic building trades. Imports of crude vermiculite in 1944 were valued at $21,166, compared with $18,482 in 1943.

Much attention has been given to the possibility of developing satisfactory substitutes for mica, but so far efforts in this direction have not been encouraging. Even if found usable, such substitutes would require fundamental changes in design of equipment, which would have to be made progressively over an extended period. At present, therefore, there is little likelihood of any lessening in the use of mica by the electrical industry.

As noted above, Canada exports most of its output of mica mainly to the United States and Great Britain. Mica Company of Canada, Lois Street, Hull, Quebec, is the principal user of splittings, for the manufacture of mica plate, and also deals in cut and punched block mica. The larger electrical manufacturing companies have their own sources of supply, but smaller concerns and repair shops purchase limited amounts of domestic mica from producers or dealers. Ground mica, made chiefly by Messrs. Blackburn Bros., Blackburn Bldg., Ottawa, is marketed in 20-, 60-, and 150-mesh sizes. Part of the production supplies the domestic roofing, rubber, and plastic trades, and part is exported.

Prices

Phlogopite.—Dealers' quotations for the various trade sizes in 1944 were approximately as shown below, according to quality as based on colour, hardness, and splitting properties:

Knife-trimmed Block or Sheet		Splittings	
Size, Inches	Per Pound	Size, Inches	Per Pound
1 x 1 and 1 x 2	$0·35 to $0·50	1 x 1	$0·75
1 x 3	0·50 to 0·60	1 x 2	0·85
2 x 3	0·70 to 0·80		
2 x 4	0·95 to 1·00		
3 x 5	1·50 to 2·00	(Splittings prices in U.S. funds)	
4 x 6	1·75 to 2·50		
5 x 8	2·75 to 3·25		

Ground phlogopite sold as follows, according to fineness: 20 mesh, $30 per ton; 60 mesh, $40; 150 mesh, $65; all prices f.o.b. Ottawa, in ton lots, bags extra. Scrap phlogopite, for export, had an average declared value of $12.80 per short ton, in carload lots.

Muscovite.—Most of the small domestic consumption of muscovite is in the form of splittings for micanite manufacture, prepared films for condensers, and punched disks, segments, and washers, nearly all of which are imported. There are thus no established trade quotations for trimmed sheet muscovite, and little is handled by Canadian mica dealers. The scale of prices set up by Colonial Mica Corporation for Canadian muscovite in 1943 remained in effect throughout 1944 and was as follows, quotations being in Canadian funds, f.o.b. shipping point:—

Size of Grade Inches	No. 1 quality $	No. 2 quality $	No. 3 quality $
1 x 1	1·54	0·66	0·33
1¼ x 1¼	2·09	0·88	0·44
1½ x 2	2·75	1·485	0·77
2 x 2	4·125	2·31	1·21
2 x 3	5·225	2·97	1·54
3 x 3	5·775	3·41	1·76
3 x 4	6·16	3·96	2·09
3 x 5	6·60	4·62	2·42
4 x 6	7·70	5·17	2·75
6 x 8	8·80	6·05	3·19
8 x 10	11·00	8·25	4·40
10 x 12	13·20	9·90	5·28

Prices set for "thins" (under 7 mils) ranged from $0.50 to $2.50 per pound, according to size and quality.

The above schedule of sizes was set up specifically to meet Canadian conditions, more especially the output of the Purdy mine, and does not conform to any regular trade standards. With the termination of Colonial Mica Corporation's buying program in Canada on December 31, 1944, Purdy Mica Mines went over to the Indian standard system of grading, and established a new scale of prices for subsequent sales.

Montana cleaned and screened crude vermiculite was quoted in 1944 at $12 a short ton, f.o.b. mine, and North Carolina crude at $9.50. The expanded product weighs only 6 pounds per cubic foot, as compared with 60 pounds for the natural mineral. It is usually marketed in 24-pound bags, and American quotations averaged $75 to $80 a ton f.o.b. plant. Value of sales in the United States in 1943 is estimated at about $3,250,000.

Tariffs

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 by 2 inches, 10 per cent ad valorem. Mica unmanufactured, valued at not over 15 cents per pound, 4 cents a 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 a pound, 15 per cent ad valorem. Mica waste and scrap valued at over 5 cents and not over 15 cents a pound, 4 cents a pound plus 25 per cent. Mica, ground or pulverized, 15 per cent ad valorem.

Permit licences are required for the export of all mica and mica products, with the exception of scrap and waste shipped to the United States. These are obtainable from the Export Permit Branch, Department of Trade and Commerce, Ottawa.

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

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OTTAWA, CANADA, APRIL, 1945.

MOULDING SAND (NATURAL BONDED) IN 1944

Moulding sands are mixtures of sand and clay which, when moist, can be formed into moulds from which metal castings can be made. When suitable mixtures occur they are called natural bonded moulding sands. (Mechanically prepared moulding sand is made by the addition of bonding clay to silica).

In Canada, natural bonded moulding sands usually occur in shallow beds, sometimes of fairly uniform thickness over a considerable area, but in most cases of irregular thickness. These beds are always near the surface. The best natural bonded moulding sands are composed of fairly pure silica sand and plastic refractory clay. The clay bonding content varies approximately from 3 per cent to 30 per cent.

Sources of Supply

Every province except Prince Edward Island produces natural bonded moulding sand. At one time that province produced small quantities for local use. By far the greater part of the output, generally over 90 per cent, comes from the Niagara Peninsula in Ontario. Occasionally, new deposits have been opened up, mostly in Ontario and in the Prairie Provinces.

The results of a general investigation of moulding sands in Canada were published in 1936 by the Bureau of Mines, Ottawa, in Report No. 767 (No. 768, French edition), "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 possibility of replacing imported material with Canadian sands.

Production and Trade

The Canadian production in 1944 was 30,988 tons valued at $64,335, compared with 42,029 tons valued at $75,891 in 1943. 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. Silica sands without clay bond, used mainly in steel foundries, are not included in the above production figures.

Imports are not recorded separately, but are mostly from the United States. They greatly exceed production. Moulding sands, core sands, and other sands and gravels enter Canada duty free.

Consumption of moulding sand, core sand, silica, and other foundry sands for nine basic Canadian industries in 1943 approximated 250,000 tons.

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OTTAWA, CANADA, MAY, 1945.

NEPHELINE SYENITE IN 1944

Nepheline syenite is a quartz-free crystalline rock consisting essentially of the feldspathoid mineral nephelite (a silicate of alumina, potash, and soda) with albite and microcline feldspars. It often contains varying amounts of iron-bearing minerals, chiefly 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 in the ceramic industries, particularly in the glass trade.

Canada and Russia are the only countries that are known to produce nepheline syenite on a commercial scale. Canadian reserves are large, and production can be increased greatly if necessary.

Sources of Production

The developed occurrences of nepheline syenite in Canada are confined to Ontario, where deposits have been worked in Peterborough, Hastings, and Haliburton counties. The large operation of American Nepheline Corporation at Blue Mountain, near Lakefield, in Peterborough county, has accounted for most of the output and has been the only producer since 1942. Prior to that year small tonnages were produced intermittently from deposits near Bancroft, in Hastings county, and near Gooderham, in Haliburton county, and the material was shipped in the crude state to grinding mills in the United States. 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. Other known, but undeveloped, occurrences in Ontario are in the French River area, Georgian Bay district, and at Port Coldwell, Thunder Bay district, on the north shore of Lake Superior. In Quebec, nephelite is a constituent of syenites of the Montreal, Labelle-Annonciation, and other areas. In British Columbia, there are extensive bodies in the Ice River district, near Field.

Production and Trade

Production of nepheline syenite in Canada in 1944 totalled 47,625 tons valued at $217,989, compared with 49,901 tons valued at $292,010 in 1943. These figures comprise crude rock shipped to the United States for processing, and finished products made in Canada for domestic consumption and export. Domestic sales of glass-grade material were 7,386 tons, and of 200-mesh pottery grade, 317 tons. In addition, 186 tons of fine, dust-grade product was disposed of as a pumice substitute, and to the cleanser, enamelware, and heavy clay industries.

Exports, almost all crude rock, totalled 35,310 tons valued at $123,905, compared with 36,240 tons valued at $129,826 in 1943.

Production in Canada was commenced in 1936, when Canadian Nepheline, Limited opened a small quarry at Blue Mountain near Lakefield, Ontario, and installed a concentrating mill at Lakefield designed to supply the domestic glass trade. The operation was greatly expanded in 1938 by the formation of a subsidiary, American Nepheline Corporation (Ventures, Limited), which erected a 200-ton processing plant at Rochester, New York, to which substantial amounts of crude rock have been shipped for treatment for the American trade. In 1940, American Nepheline Corporation took over the parent company and in 1944 quarried 58,000 tons of crude rock. It produced 25,000 tons of finished material in its Rochester, N.Y., mill, and 7,500 tons in its Lakefield plant.

Very large tonnages of nepheline syenite are milled in Russia for the recovery of the contained phosphate (apatite), with the production of by-product nephelite. Deposits of commercial grade are reported to occur in British India, but have not as yet been developed. A number of occurrences are known in the United States, but most of the material contains too much inseparable, finely divided iron to be suitable for use in higher grade ceramic products.

Markets and Uses

Nepheline syenite is essentially a substitute for feldspar and 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 companies, and several large American plants, now use the material. Some feldspar grinding plants in the United States use the syenite for blending with their granular glass spar. In the glass batch, 3 tons of syenite will replace 4 tons of feldspar, 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, semi-vitreous ware, sanitary and electrical porcelain, floor and wall tile, and structural clay products, as well as in enamels. Increased vitrification, translucency, and mechanical strength, improved glaze-fit, and reduced absorption, warpage, thermal expansion, and crazing, are among the desirable properties claimed for the various types of ware made from it. 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.

Because of its relatively high alumina content, nepheline syenite has attracted attention as a possible source of pure alumina for the production of aluminium, to replace bauxite, and commercial methods of treatment have been worked out. At present, however, the process is being used on other more adaptable raw materials.

Prices and Tariff

Glass-grade nepheline syenite for sale in Canada remained at $11.75 per ton, bulk, in carload lots, f.o.b. Lakefield, and ground, 200-mesh, ceramic grade was quoted at $16.50. Grade B (dust) sold for $13 l.c.l. American prices also remained unchanged at $12 for glass grade, and $15.50 for ceramic grade, all bulk, in carload lots, f.o.b. Rochester, New York. 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. The duty on ground material is 15 per cent ad valorem.

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OTTAWA, CANADA, MARCH, 1945.

PHOSPHATE IN 1944

All of the small output of phosphate in Canada consists of apatite, a common associate of the phlogopite mica mined in the Precambrian crystalline pyroxenites of southwestern Quebec and eastern Ontario. Apatite was mined on a considerable scale prior to 1900, but since then a large part of the comparatively small output has represented by-product material derived from operations for mica. During the present war there has been a slight renewal of interest in mining for straight apatite, and small tonnages have been produced from several of the larger old mines in Quebec that have been reopened. The largest output from these recent operations was obtained in 1941, when a total of 2,500 tons was produced. Though small, this tonnage exceeded the production in any other year since 1900. Total production since the inception of mining in 1870 is estimated at about 350,000 tons. Although there are probably substantial reserves of apatite in the above region, the deposits tend to be erratic and pockety, and are incapable of supplying more than a small fraction of the domestic requirements.

Sources of Production

In Quebec, most of the apatite has come from mines in territory contiguous to the Lièvre River in Papineau county, and mainly from Buckingham, Portland, Bowman, and Templeton townships.

In Ontario, the apatite-bearing belt extends in a southwesterly direction through the Rideau Lakes section, chiefly in Lanark, Leeds, and Frontenac counties. Ontario Phosphate Company conducted a diamond-drilling program in 1944 on the old MacLaren property, in Bedford township, near Westport, sank a 3-compartment shaft to a depth of 175 feet, and opened a level at 150 feet, to tap ore indicated by drilling. In August, the company was reorganized as Ontario Phosphate Industries, Limited (Temple Building, Toronto).

The sedimentary phosphate rock which occurs along the Rocky Mountains divide, notably in the Crowsnest area, is rather low grade and is not considered to be of present economic interest.

Production and Trade

Shipments of apatite in 1944 totalled 482 tons valued at $6,716, compared with 1,451 tons valued at $18,385 in 1943. Practically all of the production came from a property in Bowman township, operated by Robert Bigelow; the old High Rock mine in West Portland township, operated by O. C. Coté; and the old Phosphate King mine in Templeton township, operated by Blackburn Bros.; all of these properties being in Quebec. For many years Electric Reduction Company, Buckingham, Quebec, has purchased most of the apatite produced, for use in the production of elemental phosphorus and various phosphorus compounds. Canadian Refractories, Ltd., Kilmar, Quebec, also purchases small tonnages.

Production of superphosphate by eastern Canadian plants in 1944 is estimated to have reached nearly 200,000 tons, or over double the pre-war output. This quantity supplied about 60 per cent of the domestic demand and the remainder was imported, mainly from the United States.

Imports of sedimentary phosphate rock totalled 388,247 tons valued at $1,710,378, compared with 260,846 tons valued at $1,085,080 in 1943. Most of the material came from Florida and Montana. Imports included, also, a small tonnage of rock brought in ballast from Morocco, and a shipment of low-fluorine phosphate from Curaçao, imported by the Feeds Administration for use in stock feeds.

By far the greater part of the world production consists of sedimentary rock, of which the United States is the leading producer, its output in 1944 being estimated at about 5½ million tons.

Uses

Most of the phosphate mined throughout the world is used for the manufacture of fertilizers. Ordinary superphosphate is the chief product made, but triple superphosphate, ammonium phosphate, and other compounds are produced on an important scale.

Phosphate rock is the sole commercial source of phosphorus. As the element, and as a component in a wide variety of salts and compounds, phosphorus is used extensively in many industries.

Actual consumption of phosphate rock in Canada in 1943, as reported by users, was 277,979 tons, of which 81 per cent went to the fertilizer trade, and 18 per cent into the production of phosphorus and phosphorus compounds. All of the fertilizer rock is used in three superphosphate plants of Canadian Industries, Limited, located at Belœil, Quebec; Hamilton, Ontario; and New Westminster, British Columbia; and in the plant of Consolidated Mining and Smelting Company, Trail, British Columbia.

Prices and Tariffs

Cost of American-produced phosphate rock of 75 per cent grade, laid down at eastern Canadian points, in 1944 ranged from $14 to $19 per long ton. The price paid for Canadian apatite was $16 per short ton, for material of 80 per cent grade, with a penalty or premium of 20 cents per unit below or above that figure.

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 United States Government on exports of either crude phosphate rock or superphosphate. Superphosphate intended for blending with other fertilizer ingredients, however, enters Canada free under all tariffs.

PREPARED BY HUGH S. SPENCE,
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OTTAWA, CANADA, MARCH 1945.

PYRITES IN 1944

Pyrites is produced in Canada as a by-product in the treatment of copper-pyrites ores at the Waite-Amulet and Noranda mines in Quebec, and at the Britannia mine in British Columbia. No lump pyrites has been produced in Canada for several years, and statistics published regarding recent pyrites production refer to by-product iron pyrites recovered in the concentrating of copper and copper-zinc ores.

Production and Trade

Canadian sulphur production is computed as the sulphur in iron pyrites shipped, plus the sulphur recovered from non-ferrous smelter gases. The estimated sulphur recovered from all sources (sulphur in pyrites, and sulphur recovered from smelter gases) in 1944 was 248,088 tons valued at $1,755,739, compared with 257,515 tons valued at $1,753,425 in 1943.

Exports of pyrites (sulphur content) in 1944 were 90,836 tons valued at $353,441, compared with 104,509 tons valued at $409,597. No exports of elemental sulphur are recorded.

Imports of sulphur in all forms (crude, brimstone, etc.) in 1944 were 235,955 tons valued at $3,875,649, compared with 218,527 tons valued at $3,524,006 in 1943.

Imports of sulphuric acid were 190 tons valued at $24,542, compared with 220 tons valued at $28,095 in 1943.

Noranda Mines, Limited, Noranda, Quebec, produced 187,500 tons of pyrites in 1944. The pyrites is recovered from the cyanide mill tailings and is sold to chemical plants in Canada and the United States.

Waite Amulet Mines, Limited put into operation in March, 1944, a pyrite concentrating unit that had produced by the year end a total of 48,924 tons of pyrites concentrate containing 23,526 tons of sulphur. This was shipped mainly to the United States.

Aldermac Copper Corporation is operating a new property at Moulton Hill, 4 miles from Sherbrooke. This property is equipped with a 250-ton concentrator which started operations in June, 1944, and produces copper, lead, and zinc concentrates for shipment to the United States. A pyrites concentrate may also be produced in the future. The company made shipments to St. Lawrence Paper Mills, Trois Rivières, from its stockpile at the Aldermac property in the Rouyn area. The Aldermac mine and mill ceased operations in August, 1943.

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 operations in previous years has accumulated at Britannia Beach for disposal when market conditions are more favourable.

The property of Northern Pyrites, Limited, at Ecstall River, about 60 miles south of Prince Rupert, remained idle in 1944. Exploitation of the ore-bodies with estimated reserves of 5,000,000 tons of 45 per cent sulphur awaits an improvement in market conditions.

Market and Prices

The Freeman process of flash-roasting, designed for by-product flotation fines that are obtained from the treatment of copper ore, has established a market for this class of ore. Ample supplies of pyrites fines are already available at strategic points to meet any Canadian demand.

Pyrites is used in the making of sulphate pulp by E. B. Eddy Company, Hull, and by St. Lawrence Paper Mills Company, Trois Rivières, Quebec. A considerable tonnage is used in the making of sulphuric acid at the chemical plants of Nichols Chemical Company at Valleyfield, Quebec, Sulphide, Ontario, and Barnet, British Columbia.

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.

PREPARED BY A. BUISSON,
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OTTAWA, CANADA, APRIL, 1945.

ROOFING GRANULES IN 1944

The roofing granule industry in Canada has shown a steady annual increase and is now several times larger than it was a decade ago. The output of Canadian material is obtained from 4 deposits: 2 in Ontario, and 2 in British Columbia.

The granules consist of small broken particles of rock or slate, in their natural state, or artificially coloured, that are affixed to asphalt sheeting. The underside of the sheeting is coated with a film of talc or fine mica, and is then cut into shapes for roofing shingles or for sidings (resembling rows of bricks separated by mortar). The exposed portion of a recently improved shingle has an inner coating, usually of natural slate granules, upon which another coating of the required coloured granules is spread.

Sources of Supply

In Ontario, the granule material is obtained from two deposits of grey and black rhyolite or trap rocks 20 miles apart, one about 7 miles northeast of Madoc, and the other, 2 miles east of Havelock. Building Products Company, the leading Canadian manufacturer of roofing granules, crushes and screens the rock at a mill near Madoc, and artificially colours the granules at a plant at Havelock.

In British Columbia, dark grey and greenish slates are quarried by O. M. Brown at Kapoor in the southern part of Vancouver Island, and by G. Richmond at Howe Sound, about 25 miles north of Vancouver.

In the past, small quantities of granules were made from slate deposits at Madoc, but they proved to be too soft and their colour was too light a grey to be suitable for use. Red and green slates from the dumps of the old slate quarries near Granby and Richmond in the Eastern Townships of Quebec have also been used to a small extent.

Leading manufacturers of roofing granules have been making a search in certain areas in Canada for rocks suitable for making the best type of granules, but the specifications (*see* below) are rigid, and there appear to be few such rocks in areas where they can be economically mined, crushed, and shipped to producing plants.

In 1944, granule-coated roofings and sidings were manufactured by 9 companies, which have a total of 13 plants located at St. John, New Brunswick; Asbestos, Montreal, and Lennoxville in Quebec; Toronto, Hamilton, Brantford, and London in Ontario; Winnipeg, Manitoba; and Vancouver and Victoria in British Columbia.

Processes for colouring granules are covered by a great many patents. A few of the methods employed consist of: heating, which darkens the (usually red) colour; adding oxides of iron and chromium and then burning; addition of sodium silicate, clay, and the required pigment; addition of zinc oxide, clay, and liquid phosphoric acid, heating, and then adding the pigment. Many combinations are employed and generally the formulae used by individual companies are closely-guarded secrets.

Production and Trade

Nearly 60,000 tons of all types of granules, valued at a little over $1,000,000, were used by Canadian manufacturers in 1944, and it may be noted in comparison that an investigation made in 1934 indicated that 18,115 tons of granules, valued at $288,644, were consumed in that year. Nearly all producers reported a considerable increase in 1944 over their 1943 consumption. About 52 per cent of the total were natural colours, and the remainder consisted of artificially-coloured granules. The distribution of colours of all types of granules were: reds, 31.4 per cent; greens, 30.0 per cent; greys and blacks, 31.3 per cent; blues, 2.5 per cent; buffs and browns, 2.8 per cent; white, 2.0 per cent. Imports of all types and colours amounted to 37,650 tons valued at about $774,000, or 63.4 per cent of the total tonnage consumed.

Canadian imports came from four leading producers in the United States that have plants and quarries at Poultney and Castletown in Vermont (red and green slates); Charmain (greenstone, purple rhyolite and quartzite), and Delta (black slate) in Pennsylvania; Copley in Ohio (quartz conglomerate pebbles); Fairmount in Georgia (green slate); Wausau in Wisconsin (quartz); and elsewhere.

The United States is the world's leading consumer of granule roofings, and in 1944 produced about 990,000 tons of granules valued at $12,530,000, an increase of nearly 13 per cent over the 1943 output. About 64 per cent of the total tonnage were artificially-coloured granules.

Specifications

Specifications for the types of rock that make the best granules are somewhat exacting and samples must pass severe tests. At one time, requirements called for flat granules and nearly all were made from slate, but the trend is now toward more solid angular fragments, and the use of true slate is decreasing. Rocks suitable for granules should be fairly hard, of low porosity, very fine-grained, possess a high melting point, and break well. The composition should be mainly of silica or silicates and the rocks should be free from metallic minerals, flaky minerals, minerals with fibrous partings, and carbonates. They should withstand weathering action over long periods, and prevent "blistering" of the underlying asphalt caused by a combination of the penetration of water and actinic rays of the sun. Coloured rocks are generally preferred, and the colours (reds and greens) are often intensified artificially, but the granules must have the physical properties that will enable them to maintain the colour permanently. Slates suitable for granules should be hard, and their colour as dark (blue-black) as possible, or else greens and reds. Granules made from ceramics (tiles, scrap porcelain, and brick) and slag are used to a small extent in Canada. Natural colours are often intensified by oiling, but the effect is not permanent.

Two mesh grades of granules are used, namely, "coarse" (10 to 30 mesh) and to a smaller extent "fine" (20 to 35 mesh).

Prices

Prices vary considerably depending upon the type of granule, and whether natural or artificially coloured. Imported granules per ton, f. o. b. eastern Canadian plants, range from $16 to $23 for natural rocks and slates; artificially-coloured reds and greens, $21 to $40; blues, $35 to $50; buffs and browns, $23 to $36. Canadian-made granules range from $10 to $20.

Outlook

All producers estimate an increase in output for 1945. The search for suitable rocks in Canada has recently increased and several companies are contemplating the manufacture of granules from Canadian material. Because of the intensified home-building activity, the outlook for the Canadian granule industry appears to be bright.

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OTTAWA, CANADA, JUNE, 1945.

SALT IN 1944

Common salt (sodium chloride) is obtained in solution in a brine from which the salt is extracted by evaporation and in lump or solid form by direct mining. Salt is produced in southern Ontario, at Malagash, Nova Scotia, at Neepawa, Manitoba, and at Waterways, Alberta. In Ontario, Manitoba, and Alberta the salt is obtained from brine wells. The Malagash salt is recovered by mining rock salt and by evaporation from brine produced by leaching the waste material in the mine.

Sources of Production

In Nova Scotia, the salt beds at Malagash occur in strata of the Windsor Series and operations have extended to a vertical depth of 1,128 feet and reach out horizontally for 1,300 feet north and south and 1,400 feet east and west. In addition to the two main white seams of salt there are parallel zones of reddish coloured salt.

At Nappan, near Amherst, Cumberland county, a well was drilled in 1931 by Imperial Oil, Limited, in a search for oil and gas. The hole reached a total depth of 4,134 feet and bottomed in anhydrite. The hole penetrated 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, for a length of 20 feet, and this was followed by many other salt horizons interbedded in gypsum, anhydrite, and sand. At 2,990 feet, there followed a thickness of 500 feet of salt. The geological structures in this area were worked out in detail by Imperial Oil, Limited. To obtain further information on this structure the Nova Scotia Department of Mines undertook a drilling campaign in 1943. No. 1 hole, drilled one mile west of Amherst, intersected 26 feet of salt between 779 feet and 805 feet. No. 2 hole drilled 650 feet north of No. 1 intersected salt at 888 feet and was still in salt at 1,114 feet (giving 226 feet of salt), when drilling was discontinued. The results of the drilling gave ample evidence of huge deposits of salt in the district. Maritime Industries, Limited, a subsidiary of Standard Chemical Company, Limited, was organized early in 1945 to establish a plant near Amherst for the production of salt from the salt beds in this area.

Lion Oil Refining Company, of Arkansas State, U.S.A., did some drilling for oil during the summer of 1944 near Mabou, Inverness county, Cape Breton. One hole drilled to about 7,000 feet proved the existence of several beds of rock salt. The company holds a large acreage in Inverness county and was carrying on geological investigations in this area.

Salt occurrences consisting wholly of brine springs and seepages have been known for many years in Cape Breton and other districts in Nova Scotia, but none of these springs is known to contain brine of a high degree of salinity.

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 that side of the river. The top of the rock salt is 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 was being approached. Six drill holes have penetrated the salt so that a deposit over $1\frac{1}{2}$ miles wide and about 4 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.

An important discovery of salt was made early in 1945, 14 miles south of Vermilion, Alberta. The strike was made at a depth of 3,400 feet, and the bed has a thickness of 400 feet. The Waterways salt bed is at a depth of 700 feet with a thickness of 200 feet. Natural gas, which is available at Vermilion, will prove of importance in the development of this new bed.

Production and Trade

The production of salt (sales) in 1944 was 695,217 tons valued at $4,074,021, compared with 687,686 tons valued at $4,379,378 in 1943. Exports were 3,182 tons valued at $80,672, compared with 8,061 tons valued at $118,174 in 1943. Imports were 147,282 tons valued at $846,057, compared with 84,788 tons valued at $589,108 in 1943.

In Nova Scotia, a 25-ton pilot plant for the flotation and fusing of the salt is being erected by the Federal Government in conjunction with the Nova Scotia Department of Mines and the Malagash Salt Company. The plant was completed and equipped by the end of the year, with the exception of the furnace installation.

In Ontario, all of the well-established plants were in steady operation. The centres of production are Amherstburg, Goderich, Sarnia, Sandwich, and Windsor. The caustic soda-chlorine plants of Canadian Industries, Limited, at Cornwall, Ontario, and at Shawinigan Falls, Quebec, obtain their salt from Sandwich. Brunner, Mond, Canada, Limited, at Amherstburg, manufacture soda ash from natural brine and also recover calcium chloride as a by-product.

In Manitoba, the plant of Neepawa Salt Company, subsidiary of Canadian Industries, Limited, Neepawa, operated continuously. The company's plant, erected in 1941, utilizes vacuum evaporation and is equipped to produce all grades of salt. The brine is obtained from wells 1,500 feet deep.

At Waterways, Alberta, Industrial Minerals, Limited, controlled by Dominion Tar and Chemical Company of Montreal, operated continuously. The company is in a position to place all grades of salt on the market. To provide for contingencies, a second well was drilled in 1941 and was made ready for production when needed. The Waterways field is estimated to contain 500,000 tons of salt of 98·3 to 99·6 per cent purity an acre. An addition to the plant at Waterways will be completed by the end of 1945 and will double the capacity of the plant, bringing it up to 100 tons a day.

In the United States there are no known salt deposits nearer than about 200 miles from the Atlantic coast, so that such industries as fish curing and others in coastal areas usually find it more convenient to use salt imported mainly from the West Indies, and to a small extent from Canada.

Uses and Prices

The market for salt in Canada is steadily increasing. Domestic production is used principally in the chemical, dairying, meat curing, and canning industries; by fisheries; by highway and transport departments for use as a soil stabilizer; by the pulp and paper industry; and as table salt.

The use of salt in soil stabilization for the foundations of highways and for a surface veneer for gravel roads is standard practice. Salt has been used extensively also in the development of soil-stabilized bases for runways at Canadian air fields. Sand piled each autumn at regular intervals along main highways remains loose and free-flowing, even in the coldest weather, when mixed with salt, thus allowing easy distribution on the icy roadway. Large quantities of salt are now used on the highways. The consumption of salt in Canada in certain specified industries, as given by the Dominion Bureau of Statistics, in 1942 (1943 and 1944 not yet available) was as follows:

	Tons
Acids, alkalis, and salts industry	306,500
Meat industry	56,300
Fish industry	22,500
Pulp and paper industry	14,300
Leather tanneries	8,200
Bread and bakery industry	7,700
Fruit and vegetable industry	6,600
Miscellaneous uses	39,000

According to Canadian Chemistry and Process Industries (Toronto), prices for the several grades of salt were as follows in 1944: specially purified (99·9 per cent NaCl), 94 cents per 100-pound lot; industrial fine, in bulk car lots f.o.b. plant, $6.53 per ton; and industrial coarse, $10.63 per ton.

PREPARED BY A. BUISSON,
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OTTAWA, CANADA, APRIL 1945.

SAND AND GRAVEL IN 1944

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.

Production

The total production of sand and gravel for 1944 amounted to 24,921,950 tons valued at $9,375,388, compared with 25,744,469 tons valued at $9,005,857 for 1943.

Output by Provinces, 1943 and 1944

Province	1943 Tons	1943 Value	1944 Tons	1944 Value
Nova Scotia	917,376	$ 585,007	1,654,136	$ 1,162,850
New Brunswick	719,531	372,936	670,256	374,506
Quebec	10,601,376	2,362,635	9,818,406	2,283,699
Ontario	8,285,309	3,620,852	8,175,400	3,739,011
Manitoba	1,046,673	293,938	945,073	292,550
Saskatchewan	1,288,263	583,687	1,101,165	481,776
Alberta	628,157	309,389	590,634	291,409
British Columbia	2,257,784	877,413	1,966,880	749,587
Total	25,744,469	$ 9,005,857	24,921,950	$ 9,375,388

Uses

By far the greater part of the output of gravel and sand is used in road improvement, concrete works, and railway ballast. Gravel in particular has proved a good material in the building of 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 used in the mines for refilling 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 stockpiles, for two years' requirements. Gravel in road pits may remain unused for two years or more, and the amount of gravel produced from year to year thus fluctuates, depending upon the program of road construction and improvement. Gravel in railway pits may remain unused 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 free from dust, loam, organic matter, or clay, and must contain only a little silt. It is usually obtainable from local deposits.

Much sand is used also for moulding in foundries, filtering of water supply, and in making glass, all of which require special grades of sand.

Prices

Prices of sand, gravel, and crushed stone in the four largest cities in Canada were as follows, at the end of 1943 and 1944. Prices, per ton or cubic yard, as indicated below, are for carlots, f.o.b. cars:

	Montreal per ton		Toronto per ton		Winnipeg per cu. yd.		Vancouver per cu. yd.	
	1943	1944	1943	1944	1943	1944	1943	1944
Sand	$1.15	$1.20	$1.01	$1.04	$1.00	$1.00	$1.00	$1.00
Gravel	1.10	1.10	1.55	1.55	1.00	1.00	1.00	1.00
Crushed stone	0.98	0.97	1.67	1.72	....	....	1.10	1.10

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OTTAWA, CANADA, MAY, 1945.

SILICA IN 1944

The materials produced in Canada are quartz, quartzite, sandstones, and silica sand.

Quartz is one of the most common and useful of minerals. It usually occurs in massive form without crystal faces and varies in texture from coarse to fine grained. It is generally white and opaque to semi-translucent. Quartz also occurs as crystals, the supply of which is obtained mainly from Brazil. When flawless, transparent, and possessing the necessary piezoelectric properties, quartz crystals are of great strategic importance. They are cut and ground for lenses, prisms, etc.

Quartzite is a firm, compact rock, made up chiefly of grains of quartz sand united by a siliceous cement. It is, in general, a metamorphosed sandstone.

Sandstone is a rock composed essentially of grains of quartz, bonded together by some substance acting as a cementing material. Only sandstone of high purity can be used when the silica content is the prime essential for its employment in industry.

Silica sand is disintegrated quartz, obtained when rocks have been subjected to mechanical disintegration and chemical decomposition.

Quartz is mined in Quebec and Ontario; quartzite is quarried in Nova Scotia, Quebec, Ontario, Manitoba, and British Columbia; sandstone is quarried in Quebec and Ontario; and silica sand is obtained from Nova Scotia, Quebec, and Manitoba.

Production and Trade

The production of quartz and silica sand in 1944 was 1,740,262 tons valued at $1,658,409, compared with 1,776,749 tons valued at $1,608,448 in 1943. Production of silica brick in 1944 amounted to 3,997M valued at $312,092, compared with 4,165M valued at $295,505 in 1943.

Imports of the various grades of silica amounted to 468,200 tons valued at $1,477,540, compared with 521,580 tons valued at $1,978,671 in 1943. These imports included 457,603 tons of silica sand valued at $914,390, compared with 509,043 tons valued at $1,011,117 in 1943; and 8,774 tons of silex or crystallized quartz valued at $530,200, compared with 11,410 tons valued at $945,967 in 1943.

Exports consisted of 126,608 tons of quartzite valued at $260,181, compared with 68,555 tons valued at $124,345 in 1943.

In Nova Scotia a considerable tonnage of white quartzite was quarried at Leitches Creek by John S. Nairn, contractor, to supply the requirements of the steel plant at Sydney for the manufacture of silica brick. Archie Stevens of Glace Bay quarried silica sand from the Diogenes Brook deposit 3 miles north of the highway at Melford, Inverness county. The sand was quarried under contract for use in the steel plant at Sydney. The overburden is removed by power shovel and the sand is trucked 11 miles to the railway at River Denys station.

In Quebec, Ottawa Silica and Sandstone Company operated its plant at Templeton. It produces sand of different grades for steel foundries, for the glass industry, and for sandblasting, and other purposes.

Canada China Clay and Silica Company, Limited, with plants near St. Remi d'Amherst, obtains its silica sand from a nearby quarry in Amherst township, Papineau county. The grinding plant has a capacity of 250 tons per day and the product is sold to manufacturers of glass, ferrosilicon, and silicon carbide, and is used for numerous purposes including moulding sand and sandblasting.

Canadian Flint and Spar Company produced high-grade quartz sand, which was sold for abrasive and ceramic uses. The company operates a quarry and grinding plant at Buckingham. Crude quartz produced by it and by other operators in the area was used as flux in the electro-chemical plant of Electric Reduction Company, Buckingham.

United Mining Industries, Limited of Buckingham produced crude quartz which was sold to firms in Buckingham.

Canadian Carborundum Company produced silica sand at St. Canut, Two Mountains county, for use in the manufacture of carborundum at its plant at Shawinigan Falls.

St. Lawrence Alloys and Metals, Limited produced sandstone from Melocheville, Beauharnois county for use in the production of ferrosilicon of several grades and of metallic silicon in electric furnaces at Beauharnois. The company also used high-grade quartz from localities in Quebec and Ontario. The silicon and ferrosilicon produced are marketed in Canada and abroad.

Industrial Silica Corporation (266 St. James Street, Montreal) operated a quarry at Lac Bouchette, Roberval county, from March to August, and the crude quartz produced was shipped to the plant of St. Lawrence Alloys and Metals at Beauharnois.

In Ontario, Kingston Silica Mines, Limited operated a deposit of sandstone near Joyceville, 11 miles north of Kingston. The sandstone is used to supply silica for the manufacture of cement and for other purposes. It is loosely compacted and breaks down readily to a sand of a uniform grade suitable for use in steel foundries and for sandblasting. Further additions to the plant were being made early in 1945.

Dominion Mines and Quarries, Limited operated its quarry at Killarney, on the north shore of Georgian Bay. The crushed quartzite was shipped to producers of ferro alloys at Welland, Ontario, and Niagara Falls, New York.

Manitoulin Quartzite Company was formed in 1944 by Keystone Contractors, Limited to acquire and operate a quarry at Sheguiandah, Manitoulin Island. A considerable tonnage of crude quartzite was shipped by boat to Niagara Falls, New York, and to Toledo, Ohio.

Madawaska Feldspar Company with quarry in Murchison township, Nipissing district, was in operation most of 1944, and shipped crude quartz to St. Lawrence Alloys and Metals at Beauharnois, Quebec.

The British Columbia War Metals Research Board, in co-operation with the British Columbia Department of Mines (and in 1944 under the auspices of the British Columbia Industrial and Scientific Research Council), has been engaged since 1940 in research work in connection with the recovery of silica sand for foundry use from impure sands available in British Columbia.

Market, Specifications, and Prices

The demand for high-grade silica sand was steady and large quantities are still imported. 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 in order to take advantage of these markets. The use of Canadian sand for sandblasting is increasing.

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. In special cases it can be prepared from a friable quartz and from vein quartz.

Silica, known as "potters' flint" for use in the ceramic industry must be 150 mesh or finer, whereas in the paint industry, air-floated material 250 mesh or finer is required.

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 recoverable amounts of the precious metals. The silica requirements for the manufacture of ferrosilicon and silica brick depend upon the market for the finished products.

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.

The price per ton of the several grades of silica varies greatly depending on its purity and on the purpose for which it is to be used. Silica generally is a low-priced commodity, and therefore the location of a deposit with respect to markets is of great importance. The largest markets for silica are in 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. West of Winnipeg the needs of silica are met almost entirely by imported material.

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OTTAWA, CANADA, MAY, 1945.

SODIUM CARBONATE (NATURAL) IN 1944

Deposits of natural sodium carbonate, in the form of "Natron" (sodium carbonate with 10 molecules of water) and also of brine, occur in a number of "lakes" throughout the central part of British Columbia, chiefly in the Clinton mining division, about 20 miles northwest of Clinton, and in the neighbourhood of Kamloops.

Production and Trade

These deposits are far from the main eastern Canadian markets for sodium carbonate, and production is restricted to the requirements of consumers within economic rail-haul. Over the period since 1921, output from several of the deposits has been small and intermittent, amounting to 44 tons valued at $488 in 1944, compared with 468 tons valued at $5,148 in 1943, and shipped to Vancouver for soap manufacture.

Eastern Canadian consumers of soda ash obtain their supplies from chemically prepared material made from salt by the Solvay or ammonia process in Ontario and the United States.

Imports of soda ash or barilla in 1944 were 20,141 tons valued at $583,653, compared with 70,557 tons valued at $1,213,818 in 1943.

Uses and Prices

Sodium carbonate, or soda ash, has many industrial uses, notably 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. Technological advances are continuing to increase the consumption of soda ash in the glass industry. Another major use of sodium carbonate is in the production of sodium hydroxide or caustic soda. A recent development is its use in the manufacture of "synthetic salt cake" (anhydrous sodium sulphate). Substantial quantities of soda ash are also used in the smelting of iron ores.

The special wartime demands of new munitions plants, of expansion in aluminium production, of increased utilization of low-graded ores, and of the higher operating schedules of the major consuming industries have contributed to a greatly increased consumption of soda ash during the war. The total Canadian consumption amounted to 89,400 tons in 1942, the latest year for which figures are available. The 1944 consumption appears to have been somewhat lower.

Consumption of Soda Ash in Specified Canadian Industries, 1942

(As published by the Dominion Bureau of Statistics)

	Tons	Value
Chemical and allied products (acids, salts, explosives, soaps, etc.)	30,391	$ 900,378
Manufacture of non-metallic minerals (incl. coke, gas, petroleum and glass)	54,539	1,471,513
Pulp and paper industry	3,476	120,465
Dyeing, cleaning, etc.	536	28,724
Textiles	287	11,027
Sugar refinery	189	8,762

The price of "soda ash" in 1944, as quoted in Canadian Chemistry and Process Industries, was $2.00 per bag of 100 pounds throughout the year.

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OTTAWA, CANADA, MARCH, 1945.

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SODIUM SULPHATE (NATURAL) IN 1944

(*Glauber's Salt and Salt Cake*)

Sodium sulphate occurs as crystals or in the form of highly concentrated brines in many lakes throughout Western Canada. Hydrated sodium sulphate, known as Glauber's salt, and anhydrous sodium sulphate, known to the trade as "salt cake", are produced in Canada.

Production has been mainly from Saskatchewan. A small tonnage of crude has been harvested intermittently in Alberta for local consumption as cattle lick, although sodium sulphate is the chief salt in a number of salt deposits in that province. Undeveloped deep-seated beds of sodium sulphate occur in southern New Brunswick.

Production and Trade

The production of natural sodium sulphate in 1944 amounted to 102,421 tons valued at $987,842, compared with 107,121 tons valued at $1,025,151 in 1943. The decrease is attributed to the shortage of labour. 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.

Production in 1944 was entirely from Saskatchewan. 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 a day. The company also operated up to April, 1944, the deposit at Alsask Lake or Hardene where a 250-ton plant has been in operation since 1942. Midwest Chemicals, Limited, of Palo, with property at the central portion of Whiteshore Lake, operated throughout the year. Horseshoe Lake Mining Company operated, throughout 1944, its plant at Ormiston. Sybouts Sodium Sulphate Company operated its dehydrating plant at Sybouts Lake, 9 miles south of Gladmar. Chaplin Sodium Sulphate, Ltd., formed to develop Lake Chaplin sodium sulphate deposits. Dr. D. C. Hart of Regina, who has been operating a test plant, produced in a small way at Cabri and Snake Hole Lakes.

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. These deposits were described in Report No. 646, issued in 1926 and entitled "Sodium Sulphate Deposits of Western Canada."

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

Export figures of sodium sulphate are not available. Shipments from the deposits in Western Canada to the United States have shown a marked increase since the commencement of the war. Imports of sodium sulphate, including

Glauber's salt (hydrated sodium sulphate), salt cake (anhydrous sodium sulphate), and nitre cake (sodium bisulphate), in 1944 were 22,044 tons valued at $242,095, compared with 13,231 tons valued at $191,283 in 1943.

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 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 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.

Markets, Uses, and Prices

The material from Western Canada is shipped to the Pacific coast of Canada and the United States; east to Ontario, Quebec, and the Maritimes; and south to the middle western States and to Louisiana.

Glauber's salt is used widely in the chemical industries, and the demand is increasing. Sodium sulphate is used extensively in the pulp and paper (70,100 tons in 1942), glass, dye, and textile industries and to a smaller extent for medicinal purposes and for tanning. It is also used extensively (21,500 tons in 1942) in the form of nitre cake in the smelting of nickel-copper ores for the separation of these two metals.

The price for natural anhydrous sodium sulphate from the deposits in Western Canada ranges from $9 to $10 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.

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OTTAWA, CANADA, APRIL, 1945.

SULPHUR IN 1944

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 ore-bodies in various parts of the country. In the smelting of these ores sulphur dioxide gas is produced, but prior to 1925 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. Sulphur used in the making of sulphuric acid is recovered from salvaged smelter gas in Ontario and British Columbia. Sulphuric acid is also made from pyrites by Nichols Chemical Company at its plants in Quebec, Ontario, and British Columbia.

International Nickel Company's sulphuric acid plant at Copper Cliff, Ontario, which was erected in 1930, employs 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. These plants have been enlarged during the war and were operated at capacity during 1944. A plant using the contact process was erected in 1929 at Trail, British Columbia, by Consolidated Mining and Smelting Company.

The high-grade sulphuric acid produced in the plant at Copper Cliff is marketed in several industries, and the acid made in the Trail plant is used chiefly for the manufacture of fertilizers. This plant commenced producing elemental sulphur from the smelter gases in 1936. This operation was continued until July, 1943, when the demand for sulphuric acid for fertilizer manufacture became so great that the production of elemental sulphur had to be discontinued. The lower tonnage of lead and zinc concentrates from the Sullivan mine at Kimberley tended to reduce sulphuric acid production in 1944, and it was necessary to ship and roast a large tonnage of Sullivan iron tailings to supply some of the acid required for fertilizers. Chemical and fertilizer production in 1944 broke all previous records. Sulphuric acid output in terms of 100 per cent acid was 331,700 tons, and fertilizer output was 327,200 tons.

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, at the plant of Noranda Mines, Limited, pyrites concentrate, a by-product of the milling of copper-gold ores, was marketed for the manufacture of acid used partly by the chemical industry and partly in the manufacture of pulp and paper by the sulphite process. Sulphuric acid is produced by Nichols Chemical Company at its plants at Valleyfield, Quebec, at Sulphide, Ontario, and at Barnet, British Columbia. The company obtains its sulphur from the roasting of pyrites.

Production and Trade

Canada's production in 1944 of sulphur, including elemental sulphur and the sulphur content of sulphuric acid and of pyrites, was 248,088 tons valued at $1,755,739, compared with 257,515 tons valued at $1,753,425 in 1943.

Exports were: pyrites (sulphur content) 90,836 tons valued at $353,441, compared with 104,509 tons valued at $409,597 in 1943; sulphuric acid 18,960 tons valued at $269,133, compared with 31,414 tons valued at $481,749 in 1943. No exports of elemental sulphur are recorded.

Imports of sulphur in all forms (crude, brimstone, etc.) were 235,955 tons valued at $3,875,649, compared with 218,527 tons valued at $3,524,006 in 1943. Imports of sulphuric acid were 190 tons valued at $24,542, compared with 220 tons valued at $28,095 in 1943.

World production of elemental sulphur is estimated by the U.S. Bureau of Mines at over 4,300,000 long tons.

The United States is the main source of the world production of crude sulphur. The output in 1942 amounted to 3,460,700 long tons, chiefly from the states of Texas and Louisiana.

Market and Prices

Sulphur is used in Canada chiefly in the production of sulphite pulp (211,500 tons in 1942) and for use in the making of artificial silk. It is used to a large extent also in the manufacture of sulphuric acid, explosives, and rubber, and in the production of fertilizers.

Sulphur is one of the essential raw materials for war, such as, in the form of sulphuric acid for making explosives. The rayon industry consumes large quantities of sulphur. The expansion of the pulp and paper industry has also created increased demand for sulphur. With the construction of new sulphuric plants in Canada and the United States the consumption of sulphur was increased gradually throughout the war period.

The consumption of sulphur in certain Canadian industries in 1942, as given by the Dominion Bureau of Statistics, was as follows:

	Short Tons
Pulp and paper	206,785
Heavy chemicals	69,236
Explosives	1,806
Rubber goods	1,412
Textiles	1,200
Insecticides	1,246
Fertilizers	1,290
Miscellaneous	2,005
Total	284,980

The consumption of sulphuric acid, 66° Be., by industries in 1942 was:

	Short Tons
Fertilizers	310,000
Explosives	110,000
Heavy chemicals	70,000
Smelters and refineries	75,000
Petroleum refineries	20,000
Coke and gas	31,000
Iron and steel	12,000
Textiles	10,000
Miscellaneous	15,000
Exports	31,000
Total	684,000

The sulphuric acid producers are:

Canadian Industries, Ltd., with plants at Copper Cliff and Hamilton, Ontario; and New Westminster, British Columbia.

Consolidated Mining and Smelting Co. of Canada, with plant at Trail, British Columbia.

Dominion Steel and Coal Corp., Ltd., with plant at Sydney, Nova Scotia.

Nichols Chemical Co., Ltd., with plants at Sulphide, Ontario, Valleyfield, Quebec, and Barnet, British Columbia.

According to "Metal and Mineral Markets", New York, the price of sulphur in 1944 remained unchanged at $16 a long ton, f.o.b. mines. The prices at consumers' plants in Canada vary from $20 to $32 according to location, the difference being due to transportation costs. The average for the Dominion in 1943 was about $27.

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TALC AND SOAPSTONE IN 1944

The Canadian production of talc and soapstone comprises ground products made from both these raw materials, sawn soapstone furnace blocks and bricks, and talc crayons. The combined quantity of such materials produced during the five-year period 1940-1944 has averaged about 30,000 tons annually, and since the inception of mining in 1886 has totalled slightly over 600,000 tons valued at nearly six million dollars.

Ontario supplies all of the prime white powdered talc produced, Quebec furnishing off-colour ground talc (in part made from soapstone waste), sawn dimension soapstone, and talc crayons. In recent years, the total output of ground talc of all grades has been about equally divided between these two provinces, with annual shipments averaging between 12,000 and 15,000 tons each.

Canada is self-sufficient in respect to most of the grades of ground talc needed for its industrial requirements, and there is a considerable surplus for export. It also produces most of the sawn dimension soapstone and talc crayons used, but is dependent on imports, obtained mainly from the United States, for certain special qualities of ground talc demanded by the ceramic, paint, and cosmetic trades. Imports of such talc in 1942 and 1943 amounted to approximately one-third of the total domestic consumption of about 15,000 tons.

Following the outbreak of war, a substantial demand for Canadian talc developed in the British market, to supply deficiencies caused by the cutting off of imports from France, Italy, and Norway. In 1943, all forms of talc, soapstone, and pyrophyllite were placed under strict control and allocation by the British Government, with all purchases and imports to be made for Ministry of Supply account. Canadian producers who previously had sold through a single representative in the United Kingdom were, however, exempted from this order. At the same time, cargo space allotment was placed in the hands of the Ministry of War Transport. A Talc Importers' Association was organized to provide for sale and distribution to approved consumers, and set prices were established. (Details of the above regulations were published in the November 6, 1943 issue of the *Commercial Intelligence Journal*, Department of Trade and Commerce, Ottawa, and copies of the Statutory Rules and Regulations governing the control are available in that Department.)

With the exception of shipments to the United States, exports of talc (including steatite, soapstone, and pyrophyllite) from Canada during the war have been subject to export permit control. In April, 1944, following the establishment of the British control system, exports to British Empire destinations were exempted from export permit licence.

Sources of Production

In Ontario, all the output comes from the Madoc area, in Hastings county, where production commenced some 40 years ago.

In Quebec, the entire production is obtained from the Eastern Townships, mainly from the Thetford Mines area, and there are also a mine and mill at Highwater, close to the Vermont boundary. All of Canada's output of sawn soapstone blocks comes from the Thetford Mines area.

Owing to the critical need for additional sources of massive, steatitic talc (*see* below), investigations were made during 1943 and 1944 by Wartime Metals Corporation, a Crown company, of an occurrence of such material near Red

Earth Creek in Kootenay National Park, British Columbia, but it was decided that the recovery of usable material was too low to justify further work. Samples of yellow steatite from a deposit at the base of Mt. Whymper, several miles south of the above occurrence, were forwarded to the United States for test, but the material proved to be too badly flawed to be usable.

Production and Trade

Production of talc and soapstone in Canada in 1944 totalled 32,597 tons valued at $357,249, compared with 26,164 tons valued at $266,685 in 1943. The material comprised ground material made by primary producers, sawn soapstone blocks and bricks and talc crayons; and sawing and quarry waste that was sold to other firms for grinding. The production in Ontario consists entirely of ground material, and is classed for statistical purposes as talc; that of Quebec, which includes ground and sawn stone, and grinding waste, is classed as soapstone, although the ground product is marketed as talc. In statistical records, also, the output from Quebec is not classified by products, and includes ground material made only by mine operators.

Estimated total production of ground material marketed as talc in 1944, and including that made by secondary grinders, was 31,886 tons valued at $314,385, compared with 24,281 tons valued at $261,893 in 1943. Sales of sawn soapstone furnace blocks in 1944 totalled 1,487 tons, or 16,466 cubic feet, valued at $40,036, and of talc crayons and slices, 151 tons valued at $37,760. These figures compare with 1,293 tons of soapstone blocks valued at $35,439, and 99 tons of crayons valued at $19,357 sold in 1943.

In Ontario, production of ground talc in 1944 amounted to 13,584 tons valued at $153,122, an increase of nearly 14 per cent in quantity and 17 per cent in value over the 1943 figures. The talc of the Madoc area has foliated to massive, compact texture, and is of good white colour, but contains considerable carbonate. It occurs as veins cutting crystalline dolomitic limestone. Recent tests by the Bureau of Mines, Ottawa, have shown that the carbonate content can be reduced by flotation to below the tolerance demanded for even the most exacting uses, including the manufacture of steatite insulators. A paper entitled "Canadian Talc for Use in Steatite Insulators", giving the results of the above tests, was published in the Bulletin of the American Ceramic Society (vol. 22, No. 8, August, 1943). As yet, however, no commercial use has been made of beneficiation in the production of talc in Canada. Total production of talc from the Madoc area to the end of 1944 amounted to approximately 415,000 tons. Since 1937, Canada Talc, Limited, which operates the Conley and Henderson mines, has been the only important producer. In 1944, the company started the construction of a new grinding mill to replace its original plant. Rated capacity will be 5 to 8 tons an hour, depending upon the class and fineness of the products to be made.

In Quebec, the estimated production of ground talc by primary producers was 14,967 tons valued at $121,130, compared with 12,099 tons valued at $127,343 in 1943. The talc produced in Quebec also is of the foliated type, but it occurs in bands in highly metamorphosed basic rocks, mainly serpentine and pyroxenite, and is often associated with bodies of soapstone, an impure talcose rock. It contains considerable iron, present mainly in chlorite, and varies rather widely in carbonate content. It yields a slightly off-colour, grey powder.

Broughton Soapstone and Quarry Company, with mines and mill near Leeds station, in Broughton township, is the principal operator in Quebec, and produces ground talc, sawn soapstone blocks and bricks, and talc crayons. Similar products are made by L. C. Pharo, of Thetford Mines, who operates in Leeds township. Soapstone blocks are also produced by Charles Fortin, of Robertson, in Thetford townshp. Baker Mining and Milling Company, 4010 St. Catherine Street West, Montreal, operates a mine and grinding mill near Highwater, in Brome county.

In recent years, there have been small sales of custom-ground pale yellow serpentine, found in the mining of magnesite in the Kilmar district, Quebec, and classed as a talc substitute. The ground product is stated to be fibrous, resembling the tremolitic talc of the Gouverneur district, New York, and to be well adapted for use in paint.

Some of the sawing dust from the operations in the Thetford Mines area 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.

In British Columbia, the production of talc near McGillivray, on the Pacific Great Eastern railway, and at Kapoor, near Victoria, was discontinued in 1935. The material was shipped to Vancouver for grinding and local use in roofing products. Some ground soapstone is prepared in a small mill in Vancouver by George W. Richmond, 3239 West King Edward Avenue, from crude imported from the State of Washington. This plant also grinds mica, slag, etc., for local roofing use and for export.

Exports of talc totalled 11,920 tons valued at $157,178, compared with 11,364 tons valued at $146,516 in 1943. The bulk of the shipments went to the United States (58 per cent) and the United Kingdom (41 per cent). Imports remained substantially unchanged at 6,094 tons valued at $130,603, compared with 6,450 tons valued at $130,813 in 1943.

Prior to the war the world production of talc, including ground material, cut soapstone, steatite, and pyrophyllite amounted to about half a million tons a year, more than half of which was produced in the United States. Manchuria, with an output of about 100,000 tons, was the second largest producer, followed by France and Italy, each with about 50,000 tons, Norway, British India, Canada, and Germany (including Austria).

Sales in the United States in 1944 totalled 398,863 short tons valued at $5,017,462, a slight decrease from the figure of 412,868 tons valued at $5,121,414 reached in 1943. The above totals include talc, pyrophyllite, and soapstone, in the crude, ground, and sawn or manufactured form, but are exclusive of sales of cut dimension soapstone. Eastern States, notably New York, North Carolina, Vermont, and Georgia, furnished 81 per cent of total sales in 1943. Production in New York was over double that of any other State. California rose from fourth to third place among the producing States.

Uses

Ground talc has a wide variety of uses, but much the greater part of the output is employed in the paint, roofing, paper, rubber, and ceramic industries. It is used, also, in foundry facings, bleaching fillers for textiles, cosmetics and pharmaceuticals, soaps and cleansers, insecticides, polishes, plastics, and for rice polishing. Talc is also reported to be of value as a fertilizer.

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.

The Canadian consumption of ground talc in 1943, as reported by users, totalled 17,201 tons, distribution, by industries, being as follows: paints, 34 per cent; roofing products, 23 per cent; rubber, 11 per cent; pulp and paper, 9 per cent; cosmetic and pharmaceutical preparations, 7 per cent; insecticides, 5 per cent; soaps and cleansers, 3 per cent; miscellaneous, 8 per cent. Consumption of soapstone furnace blocks by Canadian pulp and paper mills in the same year was 1,076 tons, equivalent to 11,956 cubic feet.

Steatite is the mineralogical name given to compact, massive talc, having no visible grain, that can be sawn, turned, drilled, and otherwise machined into any desired form. Such material has been widely used for the production of fired shapes, used mainly as electrical insulators. There is now a large demand for steatite for use as grid spacers in high-frequency ship and tank radio transmitters, and for the cores, bushings, resistors, etc., in radio, radar, and other electronic equipment. It is used to an important extent also for carbon black and other gas burner tips. An alternative trade name for steatite is "lava talc". Because of the small amount of natural steatite available, its high cost, and excessive machining and firing losses, the aforementioned articles are now made largely by die-pressing powdered talc. Suitable talc for the purpose is required to be high-grade material, low in lime and iron, and such talc is commonly termed steatite, or steatitic talc, irrespective of its texture. There is still a limited demand, however, for sawn steatite shapes, and suitable crude is in short supply; the chief sources are British India, Sardinia, Maryland, Montana, and California. Specifications call for compact texture, good structural strength, freedom from hair-cracks and parting lines and from gritty impurities, and a low content of lime and iron. In general, grade and suitability are determined by machinability and firing behaviour, followed by tests for electronic performance. Chemical analysis is of secondary importance.

Soapstone, a soft greenish rock containing a high percentage of talc, is used extensively in the form of sawn blocks and bricks for lining the alkali recovery furnaces and kilns of kraft pulp and paper mills. It is also used for brick and slab liners for fireboxes, stoves, and ovens, and for switchboard panels, laboratory benches, etc. Considerable quantities of soapstone quarry and sawing waste are ground and marketed as low-grade talc to the rubber, roofing, foundry, and other trades.

Compact, massive talc, sawn into square pencils and slices, is an important material for steelmakers' crayons. Recent shortages of suitable raw material have led to the introduction of extruded crayons compounded of ground talc with a suitable binder.

Prices and Tariffs

Ground talc has a wide price range. Value is dependent upon purity (determined by 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, the users 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 roofing, rubber, and paper use, sold in 1944 for $8 to $11.75 a ton, according to fineness. White talc from Madoc, Ontario, was quoted at $8 to $10 for the coarser grades, $12 to $18 for finer mesh sizes, and $44 for minus 400-mesh material.

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, and at 35 per cent on material valued at over $14 a ton. The duty on crude material is 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 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. 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.

Commercial deposits are relatively scarce. Most of the recorded world production comes from North Carolina, where the industry has expanded rapidly in recent years. Sales of pyrophyllite in the United States in 1944 comprised 5,683 tons of crude valued at $52,343, and 60,560 tons of ground valued at $504,739, a total of 66,243 tons valued at $557,082. A new important use for the mineral is as a carrier in DDT personnel insecticidal dusts, and in agricultural insecticides generally.

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.

Important deposits are known in Newfoundland, and are owned and operated by Industrial Minerals Company of Newfoundland, Limited, Box 435, St. John's, which shipped about 500 tons of ground material in 1942 and 1943. In 1944, shipments declined to 140 tons.

In 1944, pyrophyllite was quoted at $10 to $13 a ton, f.o.b. North Carolina mills, for 200-mesh and 325-mesh material, respectively.

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WHITING SUBSTITUTE IN 1944

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 continental Europe. It may be made from white limestone or white marble, marl, lime, or from 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. The marbles at present used contain very little magnesium carbonate, though in the past a whiting substitute made from white dolomite was produced in Eastern Canada for making putty, and there seems to be no good reason why a dolomitic whiting substitute would not be equally as suitable as calcite for numerous purposes.

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 subangular 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 have been built to make whiting substitute from marl, and both were in operation in 1944. The output of one plant was utilized entirely as a filler for newsprint.

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 made in Canada.

Production and Trade

Producers of whiting substitute are: Pulverized Products, Limited, Montreal; Claxton Manufacturing Company, Toronto; White Valley Chemicals, Limited, Bobcaygeon, Ontario (operated by Chem-Ore Mines, Limited, Toronto); Marlhill Mines, Limited, Marlbank, Ontario; Gypsum Lime and Alabastine, Canada, Limited, Winnipeg; and Beale Quarries, Limited, Van Anda, Texada Island, British Columbia.

No separate record is kept of production of whiting substitute, but the industry has experienced a steady growth in recent years because improvements in grinding equipment and the maintenance of close technical control have enabled 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, though there are some uses for which chalk whiting is necessary and other materials cannot be substituted.

There is little or no whiting substitute exported from Canada. Imports of whiting, crude chalk, and prepared chalk were valued at $334,744 in 1944 compared with $303,190 in 1943.

Uses 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 to $15 f.o.b. plants.

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OTTAWA, CANADA, JUNE, 1945.

COAL IN 1944

The production of coal in Canada is confined mainly 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. Approximately 34 per cent of the coal produced in Canada in 1944 came from Nova Scotia, and 44 per cent from Alberta.

Nova Scotia produces medium and high volatile coking and non-coking bituminous coal from Cape Breton Island, largely in the Sydney area and from the mainland collieries in the Cumberland and Pictou areas. New Brunswick produces at Minto and adjoining area 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. Lignite is also available in northern Ontario, but the field has never been commercially exploited.

Alberta produces almost all ranks of coal, including a small tonnage of semi-anthracite coal. Coking bituminous coal ranging from high volatile to low volatile is produced in the Crowsnest, Nordegg, and Mountain Park fields, and the Lethbridge, Coalspur, and other areas of the foothills yield lower rank bituminous coals that are practically non-coking. The coal mined in the central area of the province such as in the Drumheller and Edmonton fields is lower in rank and is classed as sub-bituminous, whereas that mined in the Pakowki area is lignite and that in the Tofield, Redcliff, and several other areas is on the border of sub-bituminous and lignite. The Cascade area was the only field that produced semi-anthracite coal in 1944.

British Columbia produces bituminous coal of varying types from low to high volatile from Vancouver Island, and from the Crowsnest, Telkwa, and Nicola areas on the mainland, whereas sub-bituminous coal is mined mainly in the Princeton field.

Production and Trade

The production of coal in Canada in 1944 amounted to 17,118,008 tons valued at $71,214,303, compared with 17,859,057 tons valued at $62,877,549 in 1943. The minimum output during the past 15 years was 11,738,000 tons in 1932, and the maximum output was 18,865,030 tons in 1942.

*Production of Coal by Provinces**

Province	1944 Tons	1943 Tons
Nova Scotia	5,808,792	6,103,085
New Brunswick	347,032	372,873
Manitoba	....	999
Saskatchewan	1,390,155	1,665,972
Alberta	7,437,781	7,676,726
British Columbia	2,134,248	2,039,402
Canada	17,118,008	17,859,057

Production of Coal in Canada by Kinds

	1944 Tons	1943 Tons
Bituminous	11,838,000	11,985,000
Sub-bituminous	730,000	792,000
Lignite	4,550,000	5,082,000
	17,118,000	17,859,000

* Data are those given in Preliminary Report of Mineral Production, 1944, by Dominion Bureau of Statistics.

The total imports of coal into Canada amounted to 28,926,925 tons, compared with 28,852,654 tons in 1943. Anthracite importations amounted to 4,413,227 tons, compared with 4,458,519 tons in 1943. Bituminous coal importations amounted to 24,513,527 tons, compared with 24,393,798 tons for 1943.

Coal exports from Canada amounted to 1,010,240 tons, compared with 1,110,101 tons for 1943.

The Canadian consumption of coal in 1944 was practically 45 million tons in comparison with 29·4 million tons in 1939.

New Developments, Markets and Uses

The coal production from Nova Scotia augmented by a relatively 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, however, has caused an almost complete stoppage of the movement of coal into Quebec and Ontario from this area. In the Sydney area a new mine, Dominion No. 26, operating on the Harbour seam was opened.

In New Brunswick, production had a setback because of a serious forest fire which destroyed the tipples and shafts of several operations. Some operators did not reopen, but others rebuilt and were in production before the end of the year. Labour shortage caused the temporary cessation of operations in some of the Minto mines.

The development of markets in Ontario for Alberta coal was discontinued in 1942 due to the increased demands in the western provinces. However, in October, 1944, the market was reopened for stoker and nut sizes, and approximately 7,000 tons of these sizes were distributed during the last quarter. In order to provide a reserve of production to meet emergencies, the Emergency Coal Production Board in 1943 initiated and financed the opening of six stripping operations in Alberta. Of these, five remained in operation during 1944 and shipped approximately 160,000 tons of coal. The Board was also instrumental in the reopening of a large stripping operation in southern British Columbia, and this mine continued to operate during 1944. In addition, several bituminous coal operators in the Mountain Park area mined by stripping fairly large tonnages of bituminous coking coal.

During the year, several coal dealers in Quebec and Ontario introduced the process developed in the Department of Mines and Resources for the improvement of blower coal by chemical treatment, and prepared some 40,000 tons of coal for distribution.

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OTTAWA, CANADA, MARCH, 1945.

COKE IN 1944

Most of the production of coke in Canada is obtained from standard by-product coke oven plants that process large tonnages of coal for the production of metallurgical coke for industrial use. A portion of this coke, together with the surplus coke produced by the gas industry is sold as domestic fuel. During the war the abnormal conditions prevailing have resulted in a considerable increase in the production of metallurgical coke. The increased capacity has been obtained by the construction of a new plant and also by an increase in the coal tonnage processed in existing plants, which in some cases has exceeded the rated capacity of the particular plant. The transfer of the coke production from plants normally producing domestic coke to industrial uses has also assisted in meeting the requirements for metallurgical coke.

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 7 by-product coke plants, 2 beehive plants, 3 Curran-Knowles installations, 7 continuous vertical retort plants, and 8 installations of horizontal D retorts.

Of the coal consumed for the production of coke in Canada approximately 80 per cent is processed in the five leading plants in Ontario and Eastern Canada. These operations include the plant of the Dominion Steel and Coal Corporation at Sydney, Nova Scotia, which has an annual rated capacity of 950,000 tons of coal; the Montreal Coke and Manufacturing Company's plant at Ville La Salle in the province of Quebec, which produces metallurgical and domestic coke, and also supplies the gas requirements for the city of Montreal, and has an annual capacity of 565,000 tons of coal; Algoma Steel Corporation's metallurgical coke plant at Sault Ste. Marie, Ontario, which has been expanded to a rated capacity of 1,780,000 tons a year; the Hamilton By-product Coke Ovens, Ltd. (together with its subsidiary operations, the Ontario Coke Ovens Division) with a rated capacity of 795,000 tons of coal a year; and the coke ovens of Steel Company of Canada at Hamilton, Ontario, which have a rated capacity of 641,000 tons of coal a year.

The manufacture of beehive coke at two plants in Western Canada was continued at capacity and represented approximately 5 per cent of the coke marketed in Canada.

The construction for the Algoma Steel Corporation at Sault Ste. Marie of 86 ovens of a battery of Koppers under jet type ovens, designed for an annual capacity of 765,000 tons of coal, was completed, and the ovens were brought into operation. This was the chief construction project.

Production and Trade

The total production of coke from coal in 1944 was 4,001,560 tons, compared with 3,548,700 tons in 1943. Production by provinces was reported as follows:

Provinces	1944 Tons	1943 Tons	Per Cent Increases
Eastern Provinces	1,093,940	1,068,310	+ 2·4
Ontario	2,609,370	2,178,300	+ 19·8
Western Provinces	298,250	302,090	— 1·2
Canada	4,001,560	3,548,700	+ 12·8

Coal processed for the manufacture of coke amounted to 5,391,036 tons, of which 1,299,268 tons were of Canadian origin and 4,091,768 tons were imported. Petroleum coke produced at the oil refineries amounted to 80,868 tons, compared with 84,575 tons in 1943.

The imports of coke for 1944 were 813,460 tons, compared with 941,066 tons in 1943. Exports of coke for 1944 were 42,588 tons, compared with 48,256 tons in 1943.

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OTTAWA, CANADA, APRIL, 1945.

NATURAL GAS IN 1944

Natural gas occurs in most provinces. It is produced commercially in abundance in Alberta and Ontario, and in smaller quantities in New Brunswick, Saskatchewan, and Quebec.

Principal Canadian Sources of Supply: Occurrences

Natural gas occurs in sedimentary rocks, either in limestones, usually dolomitic and cavernous, or in sands and sandstones. The principal Canadian sources are in rocks of Palæozoic age, the chief sources of supply being the Turner Valley field in Alberta, fields in Kent and Haldimand counties in Ontario, and the Stony Creek field in New Brunswick. Natural gas is also produced in Alberta and Saskatchewan in considerable quantity from Cretaceous sandstones. The foregoing productive areas have been generally defined for some time. No outstanding new finds contributed to the production in 1944, but at the close of the year what appears to be an important discovery was made at Jumping Pound, 20 miles west of Calgary, in Alberta.

Production and Trade

The total production of natural gas in Canada during 1944 amounted to 45,956,800 M cubic feet valued at $11,905,600. The production* by provinces was as follows:—

	1943		1944	
	Amount M cu. ft.	Value $	Amount M cu. ft.	Value $
New Brunswick	675,029	327,787	652,000	313,000
Ontario	7,914,408	6,543,913	7,800,000	5,148,000
Saskatchewan	116,201	45,568	112,800	44,000
Alberta	35,569,078	6,241,815	37,392,000	6,400,000
N.W.T.	1,500	335	....	....
CANADA	44,276,216	$13,159,418	45,956,800	$11,905,600

In New Brunswick, the Stony Creek field continued to supply Moncton and Hillsborough and certain localities in Albert and Westmorland counties with natural gas. Three new wells were drilled, two were deepened, and four were abandoned. Total new production measured in terms of initial production amounted to 1,636 M cubic feet. Total production was 653,306 M cubic feet and sales 626,688 M cubic feet. The geophysical survey of 1943 was continued into 1944.

In Quebec, natural gas is produced in small quantities at several shallow wells along the St. Lawrence River and is used locally.

In Ontario, drilling was principally active in Haldimand county, where new wells were brought into production in Walpole, Oneida, and South Cayuga townships, and in Norfolk county, notably in Townsend township. These wells were mostly in proven territory. New ground was developed in Zone township Kent county, where a number of producing wells were completed just north of the old Bothwell oilfield. Very little drilling in unproved areas occurred elsewhere and no results were recorded.

In Saskatchewan, the eastern part of the Lloydminster field supplied the town of Lloydminster from 5 wells. In the Kamsack area 7 wells were drilled, 2 of which got production. Kamsack Gas and Oil Company replaced its 2-inch line with a 5-inch line, which was connected to 11 shallow wells. Three other

* Figures from the Dominion Bureau of Statistics, those for 1944 being preliminary.

small wells supplied the needs of farmers. Other wells were being drilled in both these areas. Geological and geophysical work was again being done and drilling was done in many localities.

In Alberta, the Turner Valley field furnished fuel for the operations in the field itself; to the cities and districts of Calgary and Lethbridge; and raw material to the nitrogen plant in Calgary. For several years the drilling of gas wells in this field has been unnecessary, as the gas is largely derived from the production of petroleum in which the gas plays a vital rôle. The gas/oil ratio of many of these oil wells, particularly in the southern part of the field, where effective measures of conservation were applied too late in their life, has risen so much that in some cases they have had to be reclassified as gas wells, thus augmenting the reserve of gas.

*Production of Alberta, by Fields**

	1943 M cu. ft.	1944 M cu. ft.
Turner Valley		
Shallow wells	45,789	42,840
Limestone gas wells	16,344,113	11,396,668
Limestone oil wells	27,850,290	29,947,394
Less gas repressured by British American Oil	....	9,374
	44,240,192	41,377,528
Foremost	298,782	38,228
Viking	1,742,686	1,858,585
Kinsella	4,582,218	5,172,263
Medicine Hat	2,998,155	3,227,006
Redcliff	682,158	822,282
Other fields	564,509	768,389
	55,108,700	53,264,281

* Information from Petroleum and Natural Gas Conservation Board.

These figures are considerably larger than those of the Dominion Bureau of Statistics, which are for consumption only. Production, therefore, still remained much in excess of consumption, although the waste of gas in Turner Valley was further reduced by over 12 per cent. Ever since Royalite No. 4 well demonstrated the existence of a big gas field in Turner Valley the need for preventing this waste has been recognized, but technical and economic difficulties arose. Steady progress has been made in recent years, however. The Provincial Government, during the year, established the Natural Gas Utilities Board to put into effect recommendations made in the report of Thomas R. Weymouth in 1943. At the end of 1943, Madison Natural Gas Company was formed and this company, together with British American Oil Company, has been entrusted by the Board with the execution of the plan, which involves dismantling one of the existing natural gasoline plants and portioning the supply of gas among the remaining plants. It is hoped that when the scheme is fully working, the only gas wasted will be small quantities from oil wells producing intermittently. All gas produced and not required is to be returned underground either to the Turner Valley gas-cap or to the Bow Island field. Three wells are to be used as input wells in the south end of Turner Valley and four in the north. It is estimated that the scheme will add 60 per cent to the life of the field as a gas producer. The experiments in repressuring through Foundation well in the south end were discontinued at the beginning of the year and a start was made on the new scheme in December using the Carleton and Pacalta wells which were repressured 1 and 2 days respectively.

Two important outlets exist for natural gas from Turner Valley, apart from its use as fuel. The plant of Alberta Nitrogen Company near Calgary, built by the Consolidated Mining and Smelting Company of Canada to make military explosives and using natural gas and electric power, was found to have a capacity in excess of the demand for explosives, and owing to a shortage of commercial fertilizer, this has resulted in its being used in part for the manufacture of fertilizers for home and foreign markets. The other outlet is as a source of iso-butane, which is processed in the alkylation plant together with butylene obtained from Imperial Oil and British American refineries. The iso-butane is recovered in the absorption plants with most of the normal butane, but the proportion of the latter is insufficient to render an isomerization plant economical and it goes into the motor gasoline.

The gas fields at Viking, 80 miles southeast of Edmonton, and at Kinsella farther east, supply the Edmonton area, the Kinsella field being the principal source of supply. Two wells were completed in the field in 1944 and in December 17 wells were producing at Viking and 14 at Kinsella. In December 39 gas wells were producing in the Medicine Hat field and 13 in the Redcliff field.

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OTTAWA, MAY, 1945.

OIL SHALE IN 1944

There are large deposits of oil shale 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 been actively developed on a commercial scale.

Production and Trade

No production has been reported for a number of years and no oil shale is being imported into Canada.

Experimental plants were erected in 1928-30 near Rosevale, New Brunswick, and New Glasgow, Nova Scotia, to treat local shales but they operated only for short periods.

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 was: Scotland, 1,551,346 tons; Esthonia, 1,450,885 tons; and Manchuria, approximately 3,000,000 tons. In 1939 South Africa is reported to have produced 3,000,000 gallons of shale oil. In Australia the Federal and New South Wales Governments are reported to be giving considerable assistance to the shale oil industry, the production in 1942 being 1,600,000 gallons of shale oil.

Technological Developments

A large amount of investigational work has been carried out by the Bureau of Mines, Ottawa, including 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 process designed for the distillation of oil shale.

In 1942, the Mines and Geology Branch, Department of Mines and Resources, Ottawa, drilled some of the oil shale deposits in New Brunswick to determine their possibilities as a source of oil and lubricants under war conditions. A total of 43 holes were drilled in oil shale deposits in the Rosevale area and in the vicinity of Taylor Village, New Brunswick; 36 holes were also drilled in deposits at Albert Mines, New Brunswick. The conclusion was reached after assaying more than 3,300 samples, that the over-all grade of the shales in the areas mentioned is too low to be of economic interest even under present conditions.

Owing to the depletion of petroleum reserves, interest has been renewed in oil shale in the United States. It is announced that the U.S. Bureau of Mines is building an oil shale research and development laboratory at the University of Wyoming at Laramie. A site has also been selected, in Colorado, for an oil shale demonstration plant to cost $1,500,000.

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OTTAWA, CANADA, APRIL, 1945.

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PEAT IN 1944

Peat is the name given to the material 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. Peat is found in every province of the Dominion and, generally speaking, occurs in two distinct forms—humified, or fuel peat, and unhumified, or moss peat.

Peat Moss

Peat moss is the dead moss of the sphagnum plant. Its chief value lies in its ability to absorb and hold up to 25 times its own weight of liquids and gases. It is used as a bedding litter for animals and as a filler for fertilizers. Because of its elasticity and low heat conductivity, it is also used for insulating and sound-proofing and as a packing material.

Production and Trade

Prior to the war, peat moss was obtained from bogs in Quebec, Ontario, Alberta, and British Columbia. Most of the operations were on a relatively small scale and the annual production amounted to only a few thousand tons.

When supplies from Europe to this country and the United States were cut off as a result of the war, active attention was given to the development of deposits in Canada, with the result that in 1944 a total of 32 plants were in operation having a total production of 63,149 tons valued at $1,554,606. The corresponding figures for 1943 were 64,360 tons valued at $1,461,422.

In British Columbia, 13 companies produced 35,940 tons from bogs near New Westminster, the largest producers being Western Peat Company, Limited, Industrial Peat, Limited, and Alouette Peat Products, Limited.

In Ontario, 6 companies produced 9,800 tons, the largest producers being Erie Peat Company, Welland, and Canadian Industries, Limited, Erieau.

In Quebec, 11 companies produced 14,078 tons, the two largest producers being Premier Peat Company, Isle Verte, and Canada Peat Company, Rivière du Loup.

In New Brunswick, production came from Fafard Peat Moss Company, Pokemouche. Western Peat Company is still developing its property at Shippigan and has not yet started production.

In Manitoba, production came from the property operated by Winnipeg Supply and Fuel Company near Whitemouth.

The Canadian production of peat moss is practically all exported to the United States for use as horticultural moss, poultry and stable litter.

Large quantities of peat were produced in Denmark, Sweden, Holland

NOTE:- The production figures used in this review are preliminary and subject to revision.

Peat Fuel

Small amounts of peat fuel have been produced intermittently in Ontario and Quebec. In 1944, machine peat fuel was produced by four operators in Quebec. The total production in Canada was 624 tons valued at $5,242, the greater part of which came from the property at St. Bonaventure, Yamaska county, Quebec. In Ontario a small amount of peat fuel was made at Gads Hill near Stratford.

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OTTAWA, CANADA, JUNE, 1945.

CRUDE PETROLEUM IN 1944

Crude petroleum is produced in Canada from wells in Alberta, the Northwest Territories, Ontario, and New Brunswick. The total production in 1944 was in excess of 10,000,000 barrels, 89 per cent of which came from Alberta. The Turner Valley field in that province contributed 82·5 per cent of the total Canadian output as compared with 95 per cent in 1943. This percentage decrease can be traced partly to more than a twofold increase from other fields in Alberta, and partly to a marked increase in production in the Norman field, Northwest Territories. By far the greater part of Canada's requirements of crude petroleum is imported.

In 1944 there was a record amount of exploration and drilling in Alberta and Saskatchewan in search of new sources of petroleum. No discoveries of oil were made in Saskatchewan, but in Alberta several new producers were added to the list.

Sources of Production: Developments

The Rundle (Madison) limestone of Palæozoic age is the source of almost the entire production of petroleum in the Turner Valley field. Until June, 1936, production in the field came almost entirely from the wells in the gas cap and was termed "naphtha", an unstable natural gasoline. Since then, however, development has been diverted toward the western deep-lying belt of the limestone, the existence of which had already been indicated by marginal wells. Production comes from the same porous horizons that yield the naphtha in the gas cap, and the gravity of the oil increases progressively down the dip slope from 45° A.P.I. to 38° A.P.I., beyond which lies edge water. (By way of explanation it should be noted that the specific gravity of a heavy crude oil is about 10° A.P.I.; thus, as the specific gravity decreases, the degrees A.P.I. increase. The letters A.P.I. following the degrees mean that the specific gravity is measured in terms of the American Petroleum Institute scale.)

In 1944 drilling in Turner Valley was largely in the central part of the field, which had formerly attracted little attention owing to its supposed indifferent yield. There was a steady development of the northern section of the field. In the central region drilling was encouraged by financial aid from Wartime Oils, Limited, a Crown company, formed in 1943, which lends money to the operators on the basis of a small royalty and low interest, to be repaid out of production. Twenty producing wells were completed under this scheme in 1944, three of which were better than average producers. Twenty-one other wells were also completed in Turner Valley, two of which are near the southern end and fourteen are north of Sheep River. Neither the northern nor the southern limit of the field has been fully defined as yet by drilling.

Activities in the northern end of Turner Valley were stimulated through the finding of oil in wells on the east side at depths below the known water level on the west side. All wells flow naturally, and, with one exception that turned out to be a water flow, those that have ceased to be oil wells have passed into the category of gas wells.

The pipe-line charge for pumping oil from Turner Valley to the Imperial Oil Refinery at Calgary was reduced on May 1, 1944, from 9½ cents a barrel to 7½ cents, thus bringing the price of 41° A.P.I. crude up to $1.68 a barrel, in tanks at the well. The differential of 2 cents per degree A.P.I. above and below 41° A.P.I. remained unchanged.

South of Conrad on the Canadian Pacific Railway an oil of 25·4° A.P.I. gravity was discovered in the Ellis sand at 3,050 feet. This area is 7 miles west of the old Skiff field, where heavier oil was struck in 1927. The old Red Coulee field 7 miles west of Coutts on the International boundary, which produced 329,000 barrels in the past 15 years, was abandoned in 1944.

Extensive test drilling, usually following geological and geophysical surveys, was continued on the southern plains of Alberta. Results of special interest were obtained at a well in the Princess field, 120 miles east of Calgary. First developed in 1939, this well yielded a total of 30,000 barrels of 27° A.P.I. oil in 1941 and 1942 from just above the Palæozoic rocks. Production proved difficult, however, owing to high pressure gas and to water. The well was "spudded in" the latter part of July, 1944, and rich lubricating oil was encountered at 3,983 feet in the Jefferson lime of Middle Devonian. It was completed in September and produced over 12,000 barrels by the end of the year. It is the first discovery of Devonian oil in commercial quantity in the plains of Alberta.

A number of test wells were being drilled along the Foothills from near the International boundary to Folding Mountain near Jasper. Near Lundbreck a hole had reached a depth of 9,857 feet, probably a world's record for cable tools. A hole in the Wildcat Hills west of Calgary was abandoned at 11,155 feet, after striking water in the Rundle limestone; another at Coalspur had reached 10,355 feet and was still being deepened. A third well started at Ram River after No. 2 had obtained a small production from the Devonian limestone had reached a depth of over 5,000 feet.

The most notable event in the Foothills, however, was the striking, in December, at Jumping Pound, 20 miles west of Calgary, of wet gas comparable to that of the Turner Valley field. This well, a sequel to that drilled to 12,056 feet towards the close of 1943, which struck salt water in the Rundle and was abandoned, reached the limestone at 9,618 feet and a porous zone from 9,636 to 9,860 feet. This zone is believed to correspond to the lower porous zone of Turner Valley. The flow of gas was large and the liquid product ranged from a crude resembling that found in Turner Valley to water-white naphtha. Full testing was not possible before the close of the year.

The total footage drilled in Alberta was 597,828 compared with 487,923 in 1943.

A photographic aerial reconnaissance of the Foothills, begun late in July as a joint project of a number of large interests, was intended to cover 9,000 square miles from the International boundary, omitting areas already covered by the Geological Survey of Canada. Many geological and several geophysical parties were also active in Alberta during 1944.

Prospecting for oil in Saskatchewan continued to be active and the structural and deep test drilling proceeded in association with widespread geological and geophysical surveys. The deep tests at Wilcox, Radville, and Buffalo failed to find gas or oil in commercial quantity, and two other holes were started, one near Elbow, and the other at Swift Current. Three wells, that were drilled south of Unity, had shows of oil, and two of them were completed as gas wells. Several holes were being drilled near Lloydminster, and drilling was done at Yorkton, Torch River, Kisby, Simpson, Maple Creek, and Dysart.

Although the drilling of wells under the Canol project in the Northwest Territories was discontinued, exploratory drilling was maintained by Imperial Oil, Limited. At the end of 1944 there were 58 wells in the Norman field producing or capable of producing oil, 54 of which were drilled as part of the Canol project. The size of the field as determined by the drilling is 5,000 acres, and recoverable reserves are estimated to range from 30 million to 60 million barrels. The productive formation, a reef limestone, is reached at depths of 1,050 to 1,150 feet in the shallower wells on the right bank of the Mackenzie River, and at 1,706 feet in one of the wells on Bear Island.

In Ontario, most of the production was again obtained from the Petrolia, Oil Springs, Bothwell, and Mosa fields, with lesser amounts from West Dover, Warwick, Dunwick, Thamesville, and several other townships. Drilling in Kent county was extended into Lake Erie.

On Gaspe Peninsula, Quebec, no further drilling was done in No. 1 well of Continental Petroleums, Limited. In its No. 2 well, 4½ miles to the west, drilling had reached a depth of over 2,000 feet.

In Prince Edward Island the deep test well that was started from a pier in Hillsborough Bay in 1943 had reached a depth of 11,868 feet.

In New Brunswick the geophysical work in the Stoney Creek area was continued. A large acreage was being held in the province for prospecting.

In Nova Scotia two wells in the Mabou area, Cape Breton, were abandoned; and a well at Kennetcook in the Windsor area had reached a depth of 3,000 feet.

Production and Trade

Production of crude petroleum by provinces in 1943 and 1944 is shown below. The figures are from the Dominion Bureau of Statistics, those for 1944 being preliminary.

Production by Provinces

—	1943		1944	
	Barrels	Value	Barrels	Value
New Brunswick	24,530	$ 34,342	22,000	$ 30,800
Ontario	132,492	311,356	132,800	316,000
Alberta	9,601,530	15,724,518	8,952,000	14,592,000
Northwest Territories	293,750	400,201	964,300	1,311,500
	10,052,302	$16,470,417	10,071,100	$16,250,300

Production in Alberta by fields in 1943 and 1944 is given below. The figures are from the Petroleum and Natural Gas Conservation Board, Alberta, and the totals differ slightly from those of the Dominion Bureau of Statistics.

Production in Alberta

—	1943	1944
	bbl.	bbl.
Turner Valley—		
Palæozoic limestone oil wells	8,940,198	7,837,492
Palæozoic limestone gas wells	46,465	37,427
Shallow oil wells (Cretaceous)	4,865	3,209
Natural gasoline	461,169	448,186
	9,452,697	8,326,314

—	1943	1944
Other Fields—		
Armelgra	46	....
Conrad	....	24,733
Del Bonita	1,882	2,948
Dina	200	....
Lloydminster	2,640	6,296
Moose Dome	2,205	628
Princess	340	13,815
Ram River	....	207
Red Coulee	8,928	3,835
Taber	88,735	148,638
Tilley	5,065	3,137
Twin River	....	6,418
Vermilion	93,258	234,603
Wainwright	18,136	17,154
	221,851	462,412
Bitumen produced at McMurray	?	4,345
(Turner Valley total)	9,452,697	8,326,314
Total for Alberta	9,674,548	8,793,071

Production in the Turner Valley field came from a total of 257 oil wells and from 49 gas wells. Most of the output is crude oil obtained from the oil wells, and there is a small output of naphtha from gas wells. Considerable natural gasoline is recovered from the gas treated in absorption plants.

Outside Turner Valley, 11 fields in Alberta were producing or were capable of producing in 1944, the largest of these being the Vermilion field 120 miles east of Edmonton.

Production in the Vermilion field in 1944 was 150 per cent greater than in 1943. This increase can be traced partly to the completion of the new plant, which, by an electrical method, removes the water and salt from the oil. The treated oil is used as a fuel in the locomotives of the Canadian National Railway Nineteen wells were brought into production in the field in 1944. Farther east, at Lloydminster, on the border of Saskatchewan, a plant was built to treat a somewhat similar crude.

In the Taber field in the southern part of Alberta, the productive area was further outlined and 3 or 4 miles to the west another pool appears to have been discovered. The oil has a gravity of 19° A.P.I. and is virtually free from water. Its flash point is too low for direct use as fuel and it is shipped partly by tank car to Calgary, and partly by truck to local refineries. From July to the end of 1944 more than 24,000 barrels were produced from two wells at Conrad, 20 miles south of the Taber field, and the oil was shipped to Regina.

Delivery of crude from the Norman field in the Northwest Territories to the refinery at Whitehorse, Yukon, was started on April 16 and on April 30 the refinery went into operation. Its throughput capacity is 3,500 barrels of crude a day, and its products were 100 octane gasoline, motor gasoline, fuel gasoline, Diesel X fuel oil, and road oil. The refinery, like the pipe-line and the Canol wells, was an undertaking of purely military character. The throughput capacity and the products of the refinery at Norman remained the same as in 1943. The price of ethyl gasoline at Norman was reduced to 35 cents a gallon, and that of aviation gasoline to 68 cents.

Canada in 1944 imported 57,041,285 barrels of crude petroleum for refining, compared with imports of 49,700,143 barrels in 1943. This represented much the greater part of the total value of imports of petroleum and its products in the two years, the total for 1944 being $100,997,763 as compared with $94,843,848 in 1943. In 1943 the United States supplied 81 per cent of the imports of crude oil; Venezuela, 10·8 per cent; and Colombia, 8·2 per cent. In 1944, however, the United States supplied only 60·4 per cent; whereas Venezuela supplied 21·2 per cent, and Colombia, 17·2. The remainder came from Ecuador and the Dutch West Indies.

Exports of petroleum and its products from Canada in 1944 were valued at $12,117,533, as compared with $8,652,465 in 1943 and with $848,558 in 1939.

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