CANADA
DEPARTMENT OF MINES AND RESOURCES
MINES AND GEOLOGY BRANCH
BUREAU OF MINES

THE CANADIAN MINERAL INDUSTRY IN 1945

Reviews by the Staff of the Bureau of Mines

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CONTENTS

II. INDUSTRIAL MINERALS (cont'd):

III. FUELS:

NOTE: The figures of production are as published by the Dominion Bureau of Statistics.

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

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

PREFACE

Mimeographed separates of all the metals and minerals reviewed for 1945 in this report have been available for distribution since August 1946. In the separates, preliminary figures for production, exports, and imports are given; whereas in the present report, final figures by the Dominion Bureau of Statistics for 1945 are used.

The increasing number of requests for these annual reviews, issued by the Bureau of Mines in Ottawa, is to a large extent indicative of the widening desire on the part of Canadians to keep fully abreast of developments in a leading primary industry of the Dominion. The rapid growth of mining in Canada during the past 25 years, its widespread and diversified operations, and its long-range possibilities for expansion, place the industry in the forefront as a contributor to the economic welfare of the country, and particularly to the expansion of Canada's export trade.

The reviews were prepared by Messrs. A. Buisson, E. J. Burrough, L. H. Cole, V. L. Eardley-Wilmot, W. M. Goodwin, M. F. Goudge, R. J. Jones, R. E. Neelands, R. H. Picher, P. V. Rosewarne, H. S. Spence, E. Swartzman, A. A. Swinnerton, and E. H. Wait, of the Bureau of Mines. The Bureau is indebted to all those who contributed data for use in the reviews, particularly operators of mines and quarries and officers of the Dominion Bureau of Statistics.

C. S. PARSONS,
Chief, Bureau of Mines.

OTTAWA, February, 1946.

I. METALS

ALUMINIUM

Although there is no bauxite (the ore of aluminium) in Canada, the Canadian aluminium industry is the second largest in the world, being exceeded only by that of the United States. The principal factor favouring the establishment of the industry in Canada is abundant and low-cost hydro-electric power at points where necessary raw materials can be cheaply and conveniently assembled.

Production is entirely by Aluminum Company of Canada, Limited, which has its alumina plant at Arvida and reduction plants at Arvida, Isle Maligne, Shawinigan Falls, La Tuque, and Beauharnois, all in the province of Quebec. These reduction plants have a total rated capacity of about 550,000 tons of aluminium a year, or over 20 per cent of the estimated productive capacity of the world.

Fabricating plants are located at Kingston, Toronto, and Etobicoke in Ontario, and at Shawinigan Falls in Quebec. These plants consume only a small part of the company's production and Aluminum Company of Canada is primarily a producer and exporter of aluminium ingot.

Developments in 1945 consisted mainly in adjusting production to meet the lesser peace-time demand. The reduction plants at Shawinigan Falls, La Tuque, and Beauharnois were closed and operations were concentrated at Arvida and Isle Maligne.

Principal Canadian Sources of Supply

The principal imported raw materials used in the Canadian aluminium industry are bauxite from British Guiana, coal and coke from the United States, fluorspar from Newfoundland, and cryolite from Greenland and the United States.

No bauxite occurs in Canada; but clay, shale, nepheline syenite, and anorthosite, containing from 20 to 30 per cent alumina, are found in many parts of the country. The utilization of these low-grade raw materials has been the object of much research and various processes have been developed. Three of these that are at present under trial on a commercial scale in the United States are:

1. The lime-sinter-soda leach process of Ancor Corporation, Harleyville, South Carolina, which uses clay and marl as its basic raw materials and has a Portland cement material as a marketable by-product.
2. The lime-soda-sinter process of Monolith Portland Cement Company, Laramie, Wyoming, which uses anorthosite and limestone as the basic raw materials, and also has a Portland cement material as a marketable by-product.
3. The ammonium sulphate digestion process of Columbia Metals Corporation, Salem, Oregon, using clay as the basic raw material, and having no marketable by-product.

In Europe, other processes have been developed to produce alumina from clay, colliery waste, low-grade bauxite, and various other materials.

The economic success of any of these processes will depend in large part upon local conditions, but it has yet to be proved that any of them can compete on an even basis with the Bayer process, the standard process for producing alumina, and which utilizes bauxite containing less than 7 per cent silica and from 55 to 60 per cent alumina. This process involves the digesting of bauxite in caustic soda solution under pressure and at elevated temperature to put the alumina into solution as sodium aluminate, leaving the impurities undissolved. The impurities, principally iron oxides and silica, are separated off and run to waste. The alumina is precipitated from the sodium aluminate solution in the form of aluminium hydrate, which after being filtered and washed is calcined to produce alumina for the electrolytic reduction process. The liquor from which the aluminium hydrate is precipitated contains the caustic soda and some dissolved alumina and is used again in the process for digesting more bauxite.

Production and Trade

Information on production is not available for publication.

Exports of aluminium and products in 1945 were valued at $133,566,994, of which, ingots, bars, and blooms comprised $121,778,512.

Imports of aluminium and products in 1945 were valued at $1,823,460. In addition, 3,983 tons of cryolite valued at $424,486, and 939,713 tons of bauxite valued at $7,262,766 were imported for the producton of aluminium.

Uses and Prices

Aluminium metal, being only one-third as heavy as steel, untarnishable, and also a good conductor of electricity, is finding an increasingly wide field of usefulness. It is available from fabricating plants in many forms, such as sheets, foil, castings, forgings, rolled and extruded shapes, tubes, rods, wire, powder, and paste. Because of its light weight and strength when alloyed, it is widely used in the making of aircraft and for many other purposes where lightness of the structural metal is particularly desirable. Large tonnages are used for making cable for transmission of electricity, and for making cooking utensils and containers for food and beverages. It is finding increasing use in architecture and in construction of transportation equipment such as railway cars, automobiles, and boats.

The price of aluminium ingot throughout 1945 was 15 cents per pound f.o.b. plant, but early in 1946 the price was reduced to 13½ cents per pound.

ANTIMONY

Antimony in the form of stibnite occurs in various parts of Canada, but, with the exception of small experimental shipments in 1939 and 1940 from the Fort St. James deposit in northern British Columbia, no antimony ore has been produced in Canada since 1917. Production of high-grade electrolytic antimony was commenced in Canada in 1938 at the plant of The Consolidated Mining and Smelting Company of Canada, Limited, at Trail, British Columbia, but was discontinued indefinitely in the spring of 1944. In place of refined antimony, this company is now producing an antimonial lead containing 25 per cent antimony which for most purposes is equally as suitable as metallic antimony.

The antimony contained in the antimonial lead produced at Traill is produced from antimonial fume residues which are a by-product of the lead-zinc operations. Antimony production is intermittent, depending upon the accumulation of the antimonial fume. The recorded production of antimony in 1945 comprised the antimony content of antimonial lead produced in the Trail plant.

During 1945, antimony was in short supply. In the first half of the year Canada was allocated 60 tons of antimony a month from the United States to supplement production of antimonial lead at Trail, which is sold to the producers of battery plates, solders, and babbitt metal; but in the second half of the year this allocation was reduced to 30 tons a month.

Because of the shortage of antimony in the United States and the increased demands in that country and the United Kingdom, coupled with a curtailment of supplies due to a decrease in shipments of antimony ores from Bolivia, the United States served notice that shipments to Canada would continue to be restricted to 30 tons a month during the first half of 1946. This was supplemented by a production of approximately 55 tons a month of contained antimony from the Trail plant during January, February, March, and April. Early in 1946 it was understood that The Consolidated Mining and Smelting Company would have to close their antimonial lead plant during May, June, and July, as the fumes from the antimonial lead smelter apparently have a deleterious effect on growing crops, and because the stock of antimonial fume had been exhausted. Later information was to the effect that sufficient residue to commence operations will not be accumulated before November 1946.

Production and Trade

Canada produced 834 short tons (content of antimonial lead) of antimony in 1945, valued on the basis of the price for antimony at $290,557, the comparative figures for 1944 being 969 tons valued at $281,000.

Imports of antimony in 1945 were: 1,034,792 pounds of antimony metal or regulus valued at $172,253; and 102,518 pounds of antimony salts valued at $36,728. Imports in 1944 were: 1,558,198 pounds of antimony metal or regulus valued at $237,334; and 68,765 pounds of antimony salts valued at $26,749. Imports of antimony oxide are not given separately.

Consumption of antimony in Canada amounted to about 1,400 short tons in 1945. Canadian requirements are predominantly for the metal or its alloys.

World production of antimony prior to the recent war averaged about 40,000 short tons a year. Most of the output comes from China, although Bolivia and Mexico are important producers, and smaller quantities are produced in Yugoslavia and several other countries. Most of the refined antimony is produced in the United States, Great Britain, France, and Belgium, from ores of foreign origin.

Uses

Antimony was an important war metal. Early in the war its uses were about equally divided between metal and trioxide; but by the end of 1944 the trend was toward a greatly increased use of oxide for use in flameproofing and fire-retarding paints. In peace time the oxide of antimony is used extensively as an opacifier in enamels.

The post-war demand for antimony will likely exceed that of the pre-war years because of the increasing requirements for storage batteries and other metal products, and of the new uses developed during the war.

Prices and Tariff

Prices in Canada for imported antimony metal of a purity of 99·6 per cent or higher were set by the Wartime Prices and Trade Board as shown below, in August 1944, and were still in force in March 1946.

Quantity (pounds)	Montreal, cents per pound	Toronto, cents per pound
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 purity not less than 99·0 per cent.

Quantity (pounds)	Montreal and Toronto, cents per pound
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 United States tariff on antimony is: antimony as regulus or metal, 2 cents per pound; needle or liquidated antimony, ¼ cent per pound.

ARSENIC

The world output of arsenic is practically all obtained as a by-product from the treatment of gold, silver, copper, lead, zinc, cobalt, tungsten, and tin ores. In Canada, arsenic is obtained as a by-product from the treatment of the silver-cobalt-arsenic ores of northern Ontario, and, to a lesser extent, of the gold arsenica 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 of arsenic in Canada in 1945 showed a decline of 22 per cent as compared with that of 1944, and 35 per cent as compared with 1943.

Principal Canadian Sources of Supply

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. The plant of O'Brien Gold Mines, Limited, consisting of a roasting unit and baghouse, was in continuous operation. The crude arsenic produced at the O'Brien plant is refined at the Deloro smelter.

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.

In Ontario, the gold ores of Little Long Lac, Hardrock, and MacLeod-Cockshutt mines, in Little Long Lac area, contain arsenic, but no attempt is being made to recover it.

In Saskatchewan, Newcor Mining and Refining Company has under construction a small smelter for treating the gold arsenical ores of its Douglas Lake property.

In British Columbia, the Bralorne, Hedley, and other mines export arsenical gold concentrates to the United States, but as no payment is made for the arsenic content, output is not included in the production figures. It is estimated that the quantity in 1945 was approximately 4,378,000 pounds.

Production and Trade

The recorded Canadian production of arsenic was 2,045,730 pounds valued at $130,909, compared with 2,627,022 pounds valued at $180,866 in 1944.

Exports as recorded by the Dominion Bureau of Statistics amounted to 6,070,140 pounds valued at $282,718, compared with recorded exports of 5,997,500 pounds valued at $306,891 in 1944. It should be noted, however, that actual payments received for the arsenic were much less than the figures shown for the respective years. This is explained by the fact that although no payment is received for the arsenic content of the aforementioned gold concentrates from British Columbia, what might be termed a "paper" value is reported. Thus, in 1945, "exports" to the United States amounted to 4,378,400 pounds, this being the estimated arsenic content of the gold concentrates from British Columbia that were shipped to the Tacoma smelter on the Pacific Coast, and for which no payment is received. On an arsenic content basis, shipments of arsenic to the United Kingdom in 1945 amounted to 1,404,400 pounds; and smaller quantities were shipped to Brazil, Argentina, Portugal, and Palestine.

Imports of compounds of arsenic in 1945 were: arsenic acid, 5,013,269 pounds valued at $185,133; arsenate of soda, 47,250 pounds valued at $16,980; and arsenate of lime, 31,398 pounds valued at $2,453; or a total of 5,521,917 pounds valued at $204,566. Imports in 1944 were: arsenic acid, 4,202,829 pounds valued at $156,652; arsenious oxide, 2,405 pounds valued at $1,749; and arsenate of soda, 86,475 pounds valued at $24,488; or a total of 4,291,309 pounds valued at $182,889.

Figures for the consumption in Canada of arsenic compounds (mainly arsenic acid, but including arsenious oxide and calcium arsenate) in 1944 and 1945 are not available. In 1943 it amounted to 4,807,049 pounds valued at $211,998, compared with 6,106,887 pounds valued at $273,919 in 1942.

The consumption of arsenic in the United States as given by the United States Bureau of Mines is as follows: "Roughly three-quarters of the consumption of white arsenic has been for preparation of agricultural insecticides, used mainly to combat the cotton boll weevil, the codling and gypsy moths that cause widespread damage to apples and pears, and as herbicides. Of the remainder, the glass industry is the largest user and may account for 5 to 10 per cent of the total use".

The world production is estimated by the U.S. Bureau of Mines to be in excess of 80,000 tons a year. The principal producing countries are: United States, Mexico, Sweden, France, Belgium, Australia, Japan, Brazil, and Canada.

Uses; 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, and as insecticides.

The New York price of white arsenic remained fixed at 4 cents a pound. The Canadian price, as given by Canadian Chemistry and Process Industries, remained at 7¾ to 8¼ cents a pound for the third consecutive year.

BISMUTH

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

Principal Canadian Sources of Supply

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, Deloro, formerly obtained a lead bullion that contained bismuth (and some gold and silver) from the treatment of the cobalt-silver ores of Cobalt and adjoining areas. This bullion was exported to the United States for refining.

Molybdenum Corporation of Canada, which operates a molybdenite mill and concentrator in LaCorne township, Abitibi county, Quebec, is modifying the flowsheet of its concentrator to recover the bismuth content of the molybdenite concentrate. By roasting and flotation, a bismuth concentrate running in excess of 20 per cent bismuth may be obtained. Such a concentrate, if obtainable, will be shipped to European markets with the molybdenite concentrate.

Production and Trade

Canada produced 189,815 pounds of bismuth valued at $260,047 in 1945, compared with 123,875 pounds valued at $154,844 in 1944. No separate records of exports of bismuth or bismuth salts are available for 1945. The only imports in 1945 were bismuth salts valued at $11,264. This compares with imports valued at $2,667 in 1944.

World production of bismuth is estimated at about 1,500 tons a year. The United States, Peru, Canada, and Mexico supply about 90 per cent of the output. For more than 50 years 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. Cerro de Pasco Copper

Corporation, New York, imports into the United States large quantities of bismuth and bismuth-lead alloy, mainly from Peru, and is the chief supplier of bismuth alloys.

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

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

Uses; Prices; Tariff

The demand for bismuth increased considerably during the war owing to its increased use for metallurgical and pharmaceutical purposes. Bismuth in peace time is used mostly in the manufacture of pharmaceutical products. A much larger portion than formerly is used in the making of so-called fusible or low-melting alloys. Fusible bismuth alloys usually include lead, tin, cadmium, mercury, or antimony. There are numerous alloys of bismuth that contain from 33 to 56 per cent bismuth.

The price (London price in Canadian funds) of bismuth in 1945 remained at $1.38 a pound. The price in New York remained at $1.25 a pound.

The American product is protected by a duty of 7½ per cent ad valorem.

CADMIUM

Cadmium is present in small amounts in most zinc and in some lead ores. Its production is limited entirely to the by-product recovery from electrolytic zinc and from the manufacture of lithopone.

Cadmium metal is produced by The 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. Both plants were in continuous operation during 1945.

Production and Trade

Canada produced 646,064 pounds of cadmium valued at $639,603 in 1945, compared with 526,970 pounds valued at $579,677 in 1944. Exports of refined metal in 1945 were 350,744 pounds valued at $385,369, compared with 383,324 pounds valued at $412,332 in 1944. These exports were nearly all to the United Kingdom. Canadian consumption is approximately 300,000 pounds a year and the cadmium is used mainly in the white metal alloys industry.

Consumption of cadmium in the United States in 1944, as given by the United States Bureau of Mines, was approximately as follows: electroplating, 62 per cent; alloys and solders, 13 per cent; pigments and chemicals, 3 per cent.

World production in 1945 is estimated at 5,800 short tons, the chief producing countries being, 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.

Uses; Prices; Tariff

Cadmium is used mainly in electroplating and in the manufacture of alloys and compounds, the most common use being as a protective coating for steel. To a much lesser extent it is used in 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. 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.

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.

The price (Canadian funds) of cadmium in 1945 averaged 99 cents a pound, compared with $1.10 in 1944. The price of metallic cadmium, f.o.b. New York, in commercial sticks remained at 90 cents a pound.

The American product is protected by a duty of 7½ cents a pound.

CHROMITE

Owing to the improvement in the chrome supply situation overseas, shipments were maintained throughout the year by only one producer, namely, Union Carbide Company, which obtains its chromite from the 'Montreal' pit in the Black Lake district, Quebec, operated for the company by Orel Paré. Chromite, Limited, near Richmond, Quebec, closed its mine in March after continuous production since the spring of 1942.

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.

Principal Canadian Sources of Supply

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, Quebec. The chromite occurs as fairly uniformly disseminated zones, scattered through which are plums of the massive mineral. The ore zone, which varies in width from 5 to 20 feet, has been traced on the surface for about 2,000 feet. The mine has been developed at five levels to a maximum length of 1,800 feet and to a depth of 550 feet. The ore, which averaged 18 per cent Cr_2O_3, was treated in a 150-ton mill.

The old Montreal pit was operated over 50 years ago and was reopened by Union Carbide Company in 1941, since when production has been continuous.

The Chromeraine mine, also in the Black Lake area, was operated in 1943 by Wartime Metals Corporation, but was closed in August 1944. The ore is chiefly low-grade, banded and disseminated chromite, averaging 8·0 per cent Cr_2O_3, with a small amount of the massive mineral. The zone has been traced intermittently for 2,000 feet, has an average width of 33 feet, and in places is 60 feet wide. A small amount of drilling has indicated that the ore extends to a depth of at least 440 feet.

Chromite Association did some prospecting in the Black Lake district in 1945.

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 comprised 2,005 tons of concentrates and 3,750 tons of lump ore with a total value of $160,752, compared with a total of 27,054 tons valued at $748,494 in 1944. The concentrates, valued at $85,934, were exported to the United States in 1945.

Imports of chrome ore amounted to 60,691 tons valued at $1,154,985, the sources being: Southern Rhodesia, 39·6 per cent; United States, 31 per cent; British India, 19·3 per cent; South Africa, 6·6 per cent; and the remainder from Turkey and Cuba. Imports of chrome ore in 1944 were 39,089 tons valued at $618,231 and were obtained mainly from Southern Rhodesia and British India.

The world annual production of chromite just prior to the war was about 1,300,000 tons. Russia, Turkey, Union of South Africa, the Philippines, and Southern Rhodesia were each producing 100,000 tons or more a year, and Cuba, Yugoslavia, Greece, New Caledonia, and India 50,000 tons or more each.

Uses

The uses of chromite are divided into three groups, namely metallurgical (by far the most important), refractory, and chemical.

In the metallurgical field, 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 stainless and the 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.

Chrome ore is used for making refractory bricks or materials used in basic open-hearth furnaces, in arches of furnaces, in parts of combustion chambers of high pressure steam boilers, etc. It is used with magnesia to make chrome-magnesia refractories, an important use in Canada being in the manufacture of brucite magnesia bricks that contain up to 30 per cent Cr_2O_3.

In the chemical industry, chromite is mainly used in fundamental salts, such as sodium and potassium bichromates, that are used in electroplating, tanning, dyeing, glassmaking, pigments, photography, bleaching, safety matches, antiseptics, some aniline dyes used in printing, etc. Finely powdered chrome oxide is used as a buffing compound for polishing stainless steels. During the war a large amount of chrome chemicals was used for military purposes.

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.

United States price of domestic and imported ores of 48 per cent Cr_2O_3 and 3 to 1 ratio is $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 chrome-iron ratio and upon the percentages of certain impurities.

COBALT

Since the completion, in February 1944, of the contract for the purchase of cobalt in ores by the United States Government for stockpiling, the market has been dull and after the end of the war shipments were drastically reduced. Before the end of the year all producers of cobalt ore, except Silanco Mining and Smelting Company, had discontinued production, and that company's operations were on a reduced scale. Concentrates were shipped mainly to Shepherd

Chemical Company, Cincinnati, Ohio, and partly to the smelter at Deloro, Ontario. Silanco Mining and Smelting Company, by far the largest producer, sold only half of its concentrate and built up the largest stockpile in the history of the Cobalt camp. The Temiskaming Testing Laboratories at Cobalt also accumulated a large stockpile from a number of small producers. The refinery at Deloro, the only one in Canada, treated cobalt residues, a by-product from Northern Rhodesian copper mines, for the British Government during the war. These residues are much higher grade than the domestic material and are comparatively simple to treat, and were the chief source of cobalt for the United Kingdom. No cobalt has been produced at Deloro from Canadian ores or concentrates since the summer of 1940. Large stocks of Canadian ore, held mainly for the United States Government, remain untreated at Deloro.

The increase in price of silver early in 1946 resulted in greatly increased interest in the Cobalt area. Silanco acquired many old silver properties containing cobalt and is erecting a 15-ton cobalt smelter and refinery alongside the Toronto and Northern Ontario Railway, south of Cobalt, which will probably be in operation by the summer of 1947.

The principal Canadian ores of cobalt are the steel-grey coloured minerals, cobaltite ($CoAsS$) and smaltite ($CoAs_2$), but it occurs also in varying amounts in nickel arsenides such as chloanthite. These minerals weather to erythrite, a pink powder of the arsenate, known as "cobalt bloom", which, on exposed surfaces, indicates the presence of cobalt. It occurs in minor amounts in some silver-bearing ores.

Principal Canadian Sources of Supply; Occurrences

Almost all the cobalt ore mined in Canada has come from the Cobalt area, which includes Gowganda and South Lorrain in northern Ontario. Most of the cobalt ores are associated with silver which is saved as a by-product. The Werner Lake property near the Manitoba boundary, 40 miles north of Minaki, Ontario, was not operated in 1945.

Most of Silanco Mining and Smelting Company's output came from the Agaunico and adjoining Ruethel mines north of Cobalt in Bucke township, concession 1, lot 15, and the remainder from the Beaver and Temiskaming mines. The ores from these mines are treated in a 100-ton mill on the old Colonial property in Coleman township. The company recently acquired about thirty-two of the old silver and cobalt producing properties in the district, six of which were reopened early in 1946. These included the Colonial mine which, at one time, was a substantial producer of cobalt. The Silanco contract of shipments to the refinery in Cincinnati expires in May 1946, and subsequent concentrates will be added to the present stockpile of about 2,000 tons for treatment in the new smelter. The company also plans to increase the capacity of its concentrator from 100 tons to 500 tons a day.

Production was also maintained from other cobalt properties containing a little silver, including the Lawson and University mines of La Rose-Rouyn Mines, Limited. A substantial percentage of cobalt was contained in shipments of silver ore from Genesee mine, operated by Ausic Mining & Reduction Company, and from Miller Lake O'Brien at Gowganda, and the O'Brien mines, both operated by Cross Lake Lease Syndicate. (The Miller Lake O'Brien mine was sold to Siscoe Gold Mines, Limited during the summer). Small amounts of cobalt were contained in shipments of silver ore from Kerr Lake mine, operated by J. H. Price; Foster mine operated by C. V. J. O'Shaughnessy; and the Nipissing mine operated by Nipissing Mining Company. Nearly all the above properties contain nickel and some copper.

A number of other properties were prospected mainly for silver. Silco Mines, Limited did some drifting on a vein of high-grade cobalt ore in the Gillies mine, Giroux Lake area.

Production and Trade

Canadian shipments of cobalt contained in hand-picked ore and concentrates amounted to 139,506 pounds, of which 117,823 pounds came from 477 tons of essentially cobalt ore and concentrate, and 21,683 pounds from 199 tons of essentially silver ore and concentrate. Over 70 per cent of the total cobalt contained in all shipments was from the Silanco operations. A total of 31,305 pounds of cobalt contained in the ores and concentrates was shipped to Deloro Smelting and Refining Company, Deloro, Ontario, for stockpiling and ultimate treatment, and the remainder was shipped to the United States. The Deloro plant produces cobalt metal, oxides, and amorphous sulphate, and manufactures stellite chiefly for the United Kingdom, but it also provides the Canadian requirements for these products.

All marketable cobalt products made at Deloro, none of which was of domestic origin, totalled about 650 tons of contained cobalt. Estimated Canadian consumption of these products, not including the cobalt used for stellite that was exported, was approximately 160 tons of contained cobalt.

According to customs returns, copper producers (mainly Rhokana Corporation) in Northern Rhodesia shipped 1,195 tons of residues containing nearly 500 tons of cobalt valued at $869,415 to Deloro for treatment. This compares with 1,838 tons valued at $1,327,755 in 1944. Imports of cobalt salts and oxides were 16,072 pounds valued at $22,390, compared with 1,720 pounds valued at $2,595 in 1944.

As reported by producers in the Cobalt area, exports of hand-picked ore and concentrate to Shepherd Chemical Company, Cincinnati, in 1945 amounted to 430 tons containing 109,123 pounds of contained cobalt valued at $90,026. Exports (cobalt content) of the metal, oxides, sulphate, and alloys, (all of which were made from Rhodesian residues) amounted to approximately 500 tons.

At the end of 1945, stocks of ore and concentrates at Silanco and at Temiskaming Laboratories at Cobalt totalled well over 2,000 tons. At Deloro, stocks of contained cobalt in Canadian concentrates held for the United States Government were about 330 tons; other Canadian concentrates and accumulated speiss residue, and the Rhodesian residues contained about 740 tons. Stocks (cobalt content) in the hands of producers of metal, oxides, and sulphate totalled about 108 tons.

Annual world output is estimated at approximately 6,000 tons, the principal producing countries being Belgian Congo, and Northern Rhodesia. The remainder comes from French Morocco, Canada, India, Spain, Australia, Brazil, Chile, United States, Burma, Japan, Russia, Finland, and Germany. The entire output from Belgian Congo has been shipped to the United States since the German invasion of Belgium in 1940. These shipments reached a peak of about 2,000 tons in 1943.

In Northern Rhodesia, the Rhokana mine is the principal source of cobalt for the British Empire. The copper sulphide ore containing up to 0·5 per cent cobalt is treated and some of the residues containing about 40 per cent cobalt and 15 per cent copper are shipped to Deloro, Ontario, Canada, for the extraction of cobalt.

In the United States cobalt is produced as a by-product from a few low-grade and complex ores. Production is maintained by Bethlehem Steel Company, Bethlehem, Pa., which treats the sulphides that occur with the magnetite and pyrite mined at Cornwall, Pa. St. Louis Smelting and Refining Company, now one of the largest producers, extracts cobalt from a complex copper-nickel-cobalt ore near Fredericton, Missouri.

Uses

Eighty per cent or more of the world production of cobalt is used in the metallurgical industry, and most of the remainder in the ceramic industry. The largest use is for stellite alloys which contain 40 to 45 per cent cobalt, 30 to 37 per cent chromium, and 12 to 17 per cent tungsten. Stellite is used mainly for cutting metals at high speed, for making magnets, and for the manufacture of valves for aeroplane engines. Cobalt is a major constituent in one type of alloy used for the rotor blades for the turbines in jet propulsion motors. Cobalt is used in electroplating; as a catalyst; and with other chemicals in nickel-plating solutions as an undercoating for chromium plating. Cobalt oxide has fine colouring properties and is used chiefly in the ceramic industry. Cobalt sulphate is used in the paint industry. Other compounds of cobalt are used as driers in paints and varnishes.

Prices

The present price per pound of contained cobalt in ore or concentrate, f.o.b. Cobalt, Ontario, is appreciably less than the U.S. Metal Reserve prices ($1.10 for 10 per cent or over cobalt content) which were rescinded in February 1944. The nominal New York price for cobalt metal in 550-pound barrels remained constant at $1.50 per pound; and for black oxide 70 to 71 per cent grade for metallurgical use, $1.26, and for the ceramic industry, $1.86 per pound.

COPPER

Canada continued to be one of the leading producers and exporters of copper. As the copper of the Canadian mines all occurs in association with precious metals and with other base metals that are normally in steady demand, the copper output is likely to continue at a fairly uniform rate, after the moderate recession that came at the end of the war.

Over 90 per cent of the copper exported in 1945 was in the refined state, and the larger part of this copper had been fabricated to at least a slight extent before export. An increasing portion of the output is being consumed within the Dominion. During the war most of the export was to Great Britain. The distribution abroad at the end of the year was again becoming diversified.

Contrary to expectations, the immediate post-war market for copper and other metals kept almost up to war-time peak. Besides the great need in Europe for the restoration of pre-war facilities, a rapid industrial expansion in the Far East is possible. Whether or not these potential markets can be established and maintained depends essentially upon the success or failure of international political collaboration and financial policies.

A great advance has been made during recent years in treating the ores of copper and in refining and rolling the metal within Canada, but much remains to be done in exporting manufactured products to give the Dominion the full advantage of its copper resources.

Principal Canadian Sources of Supply

The International Nickel Company of Canada, Limited continued to produce over half the Canadian output of refined copper. At the end of the year the output of the refinery at Copper Cliff had been reduced to two-thirds of the war-time peak in conformity with the reduced demand for nickel. All the company's mines in the Sudbury area were in operation, and the arrears of mine development is being caught up. Though the proven reserves of ore were seriously depleted during the war years, sufficient diamond drilling was done beneath the proven ore to indicate a large additional tonnage. By the end of 1945 the ore reserve position had been fully restored, with 217,373,000 tons reported. Sales of refined copper from the refinery at Copper Cliff were 107,862 tons. The refinery also produced 13,117 tons of copper derived from the Sherritt-Gordon mine in Manitoba and smelted at Flin Flon.

Falconbridge Nickel Mines, Limited regained possession of its refinery at Kristiansand, Norway, in May and during the summer resumed production at part capacity. The arrangement whereby International Nickel treated the Falconbridge matte was terminated shortly after the cessation of hostilities. The Falconbridge mine produced 717,105 tons of ore. The smelter treated 716,868 tons averaging 1·596 per cent nickel and 0·868 per cent copper. The resulting matte contained 5,271 tons of copper. In June one of the two blast furnaces was shut down on account of the insufficient supply of ore. Ore reserves at the end of the year were as follows:

	Tons	Nickel, per cent	Copper, per cent
Falconbridge mine	7,935,500	1·62	0·85
Other holdings in Sudbury district	5,746,500	1·87	1·04
	13,682,000	1·72	0·93

Noranda Mines, Limited, in Quebec, was again compelled to curtail production at its smelter, which draws its supply of ore and concentrate from the Horne, Waite-Amulet-Dufault, and Normetal mines, on account of labour shortage at the mines. The output of the associated company, Canadian Copper Refiners, Limited, at Montreal East, to be credited to these mines was 52,000 tons of refined copper. This refinery also treats blister copper from Flin Flon, the amount in 1945 being 40,000 tons. The manufacture of copper sulphate was commenced by Canadian Copper Refiners to supply the Canadian market. The production of selenium was absorbed by the commercial markets.

The Horne mine of Noranda Mines, Limited had a large tonnage of ore developed when the war started and an appreciable part of this had been drilled with ring blast-holes, ready for blasting. On account of the increasing shortage of labour, development work was curtailed and by the end of the war this reserve of drilled ore and much of the developed ore had been used up. Development work is again underway to recover the former position with regard to developed ore and to ore prepared for blasting. Deliveries from the Horne mine to the concentrator and smelter in 1945 follow:

	Tons	Copper, per cent	Gold, oz./ton	Silver, oz./ton
Direct smelting ore	436,222	2·896	0·150	0·465
Concentrating ore	857,003	1·926	0·153	0·324
Siliceous fluxing ore	37,309	0·237	0·056	0·193

The ore reserves of the Horne mine at the end of 1945 were:

	Tons	Copper, per cent	Gold, oz./ton
Sulphide ore over 4% copper	5,127,000	7·08	0·148
Sulphide ore under 4% copper	15,228,000	0·68	0·197
Siliceous fluxing ore	853,000	0·10	0·107

Waite Amulet Mines, Limited and the associated Amulet Dufault Mines, Limited again produced copper and zinc concentrates. The mill treated 517,000 tons of ore averaging 3·79 per cent copper, 5·64 per cent zinc, 0·032 ounce gold, and 1·55 ounces silver. Production of metals for the year was:

Copper	17,992 tons
Zinc	24,243 tons
Gold	9,517 ounces
Silver	472,829 ounces
Pyrite	49,846 tons

Operations were severely hampered by shortage of underground labour. Ore reserves are reported as 2,518,000 tons, of which 173,000 tons are in the Waite Amulet section, and 2,345,000 tons in the Amulet Dufault section.

Normetal Mining Corporation, Limited treated 204,000 tons of ore averaging 3·68 per cent copper, 7·00 per cent zinc, 0·0323 ounce gold, and 2·19 ounces silver. Payable metals in the copper concentrate shipped to Noranda were: 6,934 tons copper, 4,380 ounces gold, and 353,542 ounces silver. Ore reserves were maintained at 1,399,000 tons, with an average of 3·53 per cent copper, 7·04 per cent zinc, 0·032 ounce gold, and 2·53 ounces silver. No allowance is made in this for ore below the 2,750-foot level. Ore development on the 3,200-foot level was satisfactory.

Mic-Mac Mines, Limited, 25 miles east of Noranda, shipped copper-gold concentrate containing 433 tons of copper to the smelter.

Hudson Bay Mining and Smelting Company, Limited, at Flin Flon, Manitoba, continued to operate close to capacity. The importance of zinc, gold, and silver as by-products is likely to prevent any drastic reduction in output. The Flin Flon mine lies astride the Manitoba-Saskatchewan boundary and over half the output is now credited to Saskatchewan. Blister copper shipped to the refinery at Montreal East amounted to 40,000 tons. Gold, silver, and selenium were recovered as by-products.

The Flin Flon mine output was 1,823,000 tons of ore averaging 2·44 per cent copper, 4·83 per cent zinc, 0·091 ounce gold, and 1·29 ounces silver. The ore reserves at the end of the year were reported as 26,000,000 tons, averaging 2·99 per cent copper, 4·24 per cent zinc, 0·089 ounce gold, and 1·25 ounces silver. The mine is developed by levels down to 3,500 feet. Though development work was hampered by a shortage of underground labour, a substantial amount was done on levels from 2,750 to 3,500 feet.

At the property of Cuprus Mines, Limited, 8 miles east of Flin Flon, controlled by Hudson Bay Mining and Smelting Company, a mining plant was assembled preparatory to underground exploration.

Sherritt-Gordon Mines, Limited ships its copper concentrate to Hudson Bay Mining and Smelting Company's smelter at Flin Flon and its portion of the blister copper goes to International Nickel Company's copper refinery at Copper Cliff. During the year, 646,000 tons of ore was milled, averaging 2·26 per cent copper, 2·34 per cent zinc, 0·0181 ounce of gold, and 0·539 ounce silver a ton. From this there were produced 13,117 tons of copper and 18,722 tons of 50 per cent zinc concentrate. The copper ore reserves amount to 2,026,000 tons, averaging 2·65 per cent copper, 2·25 per cent zinc, 0·020 ounce gold, and 0·67 ounce silver.

Granby Consolidated Mining, Smelting and Power Company's Copper Mountain mine, Copper Mountain, B.C., was producing 3,000 tons of ore daily at the end of 1945, compared with 1,800 tons daily in August. The company's mill at Allenby treats 785,629 tons of ore averaging 1·074 per cent copper. The concentrate was shipped to the smelter at Tacoma, Washington. Production for 1945 was 7,014 tons of copper. Gold and silver production was valued at $201,179. Ore reserves at the end of the year were reported as 10,559,000 tons averaging about 1·25 per cent copper.

Britannia Mining and Smelting Company, Limited, despite the worst labour shortage during recent years, produced 6,125 tons of copper, 8,200 ounces of gold, and 47,600 ounces of silver, as well as 11,400 tons of 50 per cent pyrite concentrate and 500 tons of 55·4 per cent zinc concentrate. The zinc concentrate came from the new No. 8 orebody, and regular production can be expected when this part of the mine is in full operation. To help in alleviating the critical shortage of miners, underground training classes were started. The Labour-Management Committee functioned regularly throughout the year, with satisfactory results.

The Moulton Hill mine of Aldermac Mining Corporation, Ltd., near Sherbrooke, Quebec, was closed on June 30. During the first half of the year 40,468 tons of ore was treated to give concentrates of copper, lead, and zinc, which were shipped to the United States. The payable metal amounted to 367 tons of copper, 622 tons of lead, 1,444 tons of zinc, 2,206 ounces of gold, and 39,737 ounces of silver.

The principal discoveries were in Quebec. In February, drilling by Quemont Mining Corporation, Limited, under Osisko Lake, adjoining Noranda on the northeast, gave indications of gold-copper ore. Drilling during the remainder of the year outlined an important tonnage of ore. An old shaft south of the lake was re-equipped, and drifts on the 225- and 900-foot levels are being used for further drilling of the deposits. The Mining Corporation of Canada, Limited owns most of the issued shares of Quemont and is conducting the development. It has been announced that a 2,000-ton operation is contemplated.

Macdonald Mines, Limited, 5 miles northeast of Noranda, has located a large area of sulphides in which values in copper, zinc, and gold are reported. Drilling is being continued.

East Sullivan Mines, Limited, in the Val d'Or area, is developing a large deposit of sulphides in which payable values in copper and gold, as well as zinc values, are reported. Preparations are under way to start mining operations.

Production and Trade

The total copper production of Canada in 1945 was 237,457 tons valued at $59,322,261, compared with 273,535 tons valued at $65,257,172 in 1944. This decrease was partly due to the serious labour shortage throughout most of the year, but mainly to International Nickel Company's lowered output, compelled by the reduction in the market for nickel. By the end of the year copper was in strong demand, but there was little prospect of increasing the output.

Exports of copper were:

	1944		1945	
	Tons	Value	Tons	Value
In ore, matte, speiss	27,989	$ 3,918,495	19,295	$ 2,701,244
In ingots, bars, billets	135,233	29,049,257	129,349	32,098,264
In rods, sheets, tubing	18,063	4,193,044	7,281	1,956,339
Total copper exported	181,285	$37,160,796	155,925	$36,755,847

The copper "ore" was mainly concentrate from Britannia Mining and Smelting Company and from Granby Consolidated in British Columbia that was sent to Tacoma, Washington. The matte and speiss, comprising 5 per cent of the total, was sent to Great Britain and Norway with nickel for refining. Shipments of refined copper to Britain were reduced considerably. By December substantial shipments to continental Europe had been resumed. The larger part of the year's output was sent to the United States.

Imports of copper in any form, except as parts of manufactured goods, have been reduced to small proportions.

Canada used 82,317 tons of copper in 1945. A considerable part of this was exported in the manufactured state, as munitions of war in the first part of the year; and in such forms as bare and insulated wire, screening and brass products, throughout the year.

Uses and Prices

Electrical manufactures such as generators, motors, switchboards, and light bulbs provide the largest single market for copper. Next in importance comes copper wire installed in buildings, railway cars, ships, tramways, and similar uses. The automotive industry is another important outlet. An important part of the total is used as brass and bronze in a multitude of industrial and household forms.

The Canadian price remained pegged at 11·5 cents a pound for electrolytic copper sold within the Dominion. Restrictions on the prices paid for export copper were mainly removed by the end of the year so that exports were bringing a considerably higher price than domestic sales. Import quotas and other trade restrictions have been retained by most countries.

GOLD

The gold-quartz mines contributed 82 per cent of the total Canadian gold output in 1945; the base metals mines 16 per cent; and the alluvial placer operations 2 per cent. Production was 9 per cent lower than in 1944 and 50 per cent lower than in 1941, the peak year. Ontario produced close to 60 per cent of the total; Quebec, 25 per cent; British Columbia, 7 per cent; and Manitoba and Saskatchewan, 6 per cent.

There was a marked increase in exploration, mainly by diamond drilling, and in prospecting, particularly in the Yellowknife area, Northwest Territories, and in western Quebec and western Ontario. The results of much of this work have been encouraging. Claim staking was quite active in these areas. The removal of restrictions on development work resulted in increased underground development activity as labour and materials became available. Early in 1946 shaft sinking or preparation for it was proceeding at more than fifty new properties, mainly in Quebec and Ontario.

Principal Canadian Sources of Supply; Potential Producers

In Nova Scotia, the small output is from the gold quartz mines of Caribou, Goldenville, Oldham, and a few other areas.

In Quebec, the Noranda copper-gold mine is still the chief single producer of gold, though about 69 per cent of the output comes from gold-quartz mines, mainly in the Rouyn, Cadillac-Malartic, Bourlamaque-Siscoe, and Mud Lake areas.

In Ontario, with the exception of the gold obtained as a by-product in the refining of nickel and copper (69,079 ounces in 1945), virtually all the gold comes from gold-quartz mines, the Porcupine and Kirkland Lake areas being the principal producers. 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. Production was resumed at the Hard Rock mine in the Little Long Lac area in the latter part of 1945; and early in 1946 at the Jason mine, Patricia district; and at the Magnet and MacLeod Cockshutt mines in the Little Long Lac area.

In Manitoba, about 57 per cent of the output came from the gold-quartz mines of Rice Lake district and the remainder from the copper-zinc-gold ores of the Flin Flon and Sherritt-Gordon mines.

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

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

In British Columbia, most of the output comes from 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 the Zeballos River area on the west coast of Vancouver Island. The mines in Zeballos River area were 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 of Copper Mountain mine near Princeton. A relatively small output is obtained from placer operations. The Alpine and Bayonne mines in the Nelson area, the Polaris-Taku mine in the Atlin area, and the Privateer mine in the Zeballos area, have been reopened and will be in production in 1946.

In the Northwest Territories, production of gold was started in 1938, and is obtained from the Yellowknife River and adjoining areas north of Great Slave Lake. All producing mines in this area, except the Negus, which was in operation most of the year, were idle in 1945. Production at the Con mine in Yellowknife area will be resumed in 1946. In Yukon, the 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.

Several of the properties listed below can be regarded as prospective producers though few of them will be ready for production for a year or more. The others have varying possibilities as prospective producers.

	Area
Northwest Territories	
Giant Yellowknife	Yellowknife
Beaulieu Yellowknife	"
Crestaurum Yellowknife	"
British Columbia	
Granite-Poorman	Nelson
Whitesail Lake	Tweedsmuir Park
Manitoba	
Nor-Acme	Snow Lake
Snow Lake	"
Wekusko	Wekusko Lake
Ontario	
Renabie	Sudbury area, near Missinaibi Lake
Queenston	Kirkland Lake
Northland	" "
Hoyle	Porcupine
Gold Island Porcupine	"
Goldhawk Porcupine	"
Heath	Red Lake
Bayview Red Lake	"
Campbell Red Lake	"
Crowshore	Pickle Lake
Dickenson Red Lake	Red Lake
Quebec	
Buffadison	Louvicourt township
Vicour	" "
Louvicourt Goldfields	" "
Croinor Pershing	Pershing township
East Sullivan (gold-copper)	Bourlamaque "
East Amphi	Malartic "
Elder	Beauchastel and Duprat townships
Wasa Lake	Beauchastel township
Hosco	Joannes "
Joliet-Quebec (gold-copper)	Rouyn "
Quemont (gold-copper)	" "
Macdonald (gold-copper-zinc)	Dufresnoy "
National Malartic	Fournière "
Rouyn Merger	Rouyn "

The following are brief notes on developments at various gold prospects throughout Canada.

Quebec

Aubelle Mines, Limited, in Mud Lake area, completed a 500-foot shaft and started lateral development.

Aumaque Gold Mines, Limited, in Bourlamaque township, completed a 540-foot shaft and is doing lateral development work.

Anglo-Rouyn Mines, Limited, operating a gold-copper prospect in Rouyn township, completed a 3-compartment shaft to a depth of 585 feet and is doing lateral work on the bottom levels.

Bevcourt Gold Mines, Limited, in Louvicourt township, intends to sink to a depth of 750 feet to open up a mineralized zone said to be 2,000 feet long, as proved by drilling.

Buffadison Gold Mines, Limited, in Louvicourt township is preparing to sink a 1,000-foot shaft.

Croinor Pershing Mines, Limited, in Pershing township, is sinking to an initial depth of 250 feet.

Donalda Mines, Ltd., in Rouyn township, is sinking a 700-foot shaft.

Duquesne Gold Mining Company has completed a 775-foot shaft and reports encouraging results.

East Amphi Gold Mines, Limited, in Malartic township, has contracted for a 500-foot shaft and extensive diamond drilling in 1946.

East Sullivan Mines, Limited, operating a gold-copper-zinc property in Bourlamaque township, intends to sink a 500-foot shaft and is considering the erection of a large mill. Drilling has proved the existence of large bodies of gold-copper-zinc ore.

Eldora Gold Mines, Limited, in Rouyn township, has contracted for a 500-foot shaft. Elder Gold Mines, Limited, in Duprat and Beauchastel townships, is sinking an inclined shaft to 800 feet. Ore reserves are estimated at 1,500,000 tons of grade of $8 a ton.

Heva Cadillac Gold Mines, Limited, in Joannes township, intends to sink an incline shaft to a depth of 750 feet.

Hosco Gold Mines, Limited, in Joannes township, is sinking a 600-foot shaft. In 1945 it purchased the McWatters 175-ton mill.

Joliet-Quebec Mines, Limited, in Rouyn township, adjoining the Quemont property, completed sinking of a 600-foot shaft and has started lateral development. A large body of gold-copper ore is indicated by drilling.

Louvicourt Goldfields Corporation, in Louvicourt township, is to sink a 750-foot shaft to develop the large orebodies (2,500 to 3,000 tons per vertical foot) indicated by drilling.

Macdonald Mines, Limited, operating a gold-copper-zinc property in Dufresnoy township, has contracted for a 500-foot shaft to prove up the large sulphide deposit indicated by drilling.

New Bidlamaque Gold Mines, Limited, operating a gold-copper property in Bourlamaque township, is sinking a 400-foot shaft to explore the ore zones indicated by drilling.

Norbenite Malartic Mines, Limited, in Malartic township, plans to sink to 500 feet to prove a large mineralized zone indicated by drilling.

Pandora Cadillac Gold Mines, Limited, in Cadillac township, is deepening its 375-foot shaft to 1,025 feet.

Rouyn-Merger Gold Mines, in Rouyn township, is preparing to sink an incline shaft to a vertical depth of 1,300 feet.

Wasa Lake Gold Mines, Limited, in Beauchastel township, is sinking a 1,000-foot shaft. Property is to be equipped for an initial production of 1,000 tons of ore a day, and an eventual output of 1,500 tons a day. Drilling has indicated a combined tonnage of over 5,000 tons of ore per vertical foot.

Ontario

Amalgamated Larder Mines, Limited, Larder Lake area, is deepening its Cheminus shaft, which is 550 feet deep. Reserves are estimated at 322,000 tons, averaging 0·16 ounce gold per ton.

Aquarium Porcupine Gold Mines, in Night Hawk Lake area, is sinking to 600 feet.

Armistice Gold Mines, Limited, Larder Lake area, completed a 700-foot shaft and is doing lateral work.

Bayview Red Lake Gold Mines, Limited, in Red Lake area, is unwatering its old 500-foot shaft, which will be deepened to 1,000-feet.

Crowshore Patricia Gold Mines, Limited, in Pickle Lake area, has started the sinking of a 1,000-foot shaft.

Campbell Red Lake, in Red Lake area, is planning for a 700-foot shaft.

Dickenson Red Lake Mines, Limited, in Red Lake area, is preparing for the sinking of a 550-foot shaft.

Goldhawk Porcupine Mines, Limited, Night Hawk Lake area, is sinking to 650 feet.

Gold Arrow Mines, Limited, in Hislop township, Ramore area, is purchasing machinery for a 500-foot shaft.

Jasper Porcupine Mines, Limited, with property adjoining Delnite, in Deloro township, Porcupine area, is considering sinking a 1,000-foot shaft.

Laguerre Gold Mines, Limited, in Larder Lake area, is unwatering its shaft and proposes extending it 500 feet from its present depth of 280 feet.

Lingman Lake Gold Mines, Limited, in Lingman Lake area, Patricia district, is sinking a 500-foot shaft.

Malga Porcupine Gold Mines, Limited, in Shaw township, Porcupine area, has contracted for a 500-foot shaft.

Orlac Red Lake Mines, Limited, Red Lake area, proposes sinking a 535-foot shaft.

Porcupine Reef Gold Mines, Limited, in Whitney township, Porcupine area, proposes sinking to 1,000 feet.

Renabie Mines, Limited, in Missinaibi area, Sudbury district, will deepen its 280-foot shaft to a depth of 500 feet, and is expected to be producing by the latter part of 1946.

Starratt Olsen Gold Mines, Limited, in Red Lake area, is deepening its 330-foot shaft by about 500 feet.

Manitoba

Goldbeam Mines, Limited, at West Hawk Lake, near the Manitoba-Ontario boundary, is sinking a 500-foot shaft.

Howe Sound Exploration Company, Limited, operating its Nor-Acme property at Snow Lake, Herb Lake area, is doing extensive development work and plans to erect a concentrating plant with an initial capacity of 2,000 tons a day.

Ogama-Rockland Gold Mines, Limited, in Rice Lake area, is preparing to deepen its shaft to 500 feet.

Snow Lake Gold Mines, Limited, Snow Lake area, is doing development work.

Wekusko Consolidated Mines, Limited, operating the Ferro property at Wekusko Lake, plans to deepen its shaft from 170 feet to 550 feet.

British Columbia

Kenville Mines, Limited, operating the old Granite-Poorman property near Nelson, is carrying on an aggressive development campaign.

Cangold Mining and Exploration Company, Limited, operating the Sherwood property 36 miles west of Port Alberni, Vancouver Island, expects to be in production by the autumn of 1946.

Northwest Territories

Beaulieu Yellowknife Mines, Limited, 45 miles east of Yellowknife, proposes to sink a shaft to explore showings indicated by diamond drilling.

Cassidy Yellowknife Mines, Limited, in Yellowknife area, is preparing to sink to 200 feet.

Crestaurum Mines, Limited, in Yellowknife area, is preparing to sink to 500 feet.

Giant Yellowknife Gold Mines, near Yellowknife, completed in January 1946 its No. 1 shaft to a depth of 525 feet and is sinking No. 2 shaft. The proposed mill will have an initial capacity of 500 tons a day.

Roads to Mining Areas

In Quebec, the Provincial Government has let a contract for a 135-mile modern road into Chibougamau district, to be completed before the end of 1947. Promising gold and copper occurrences have been proved in this area and are awaiting vigorous development.

In Ontario, the Provincial Government has voted large sums for the building and development of mining roads. Among these is the proposed 90-mile road from the Canadian National Railway line into Red Lake. This road will prove a stepping stone to other mining areas in the territory north of Red Lake.

In Manitoba, construction by day labour has commenced on the northern section of a 36-mile all-weather road into the Snow Lake area northeast of Wekusko Lake. The cost of the road, up to an amount agreed upon, is to be borne by the Dominion Government and the Manitoba Government on a 50-50 basis.

In British Columbia, roads are being built into various mining fields. The Alaska Highway was taken over on April 1, 1946, from the United States Government for operation by the Dominion Government and the name was changed to Northwest Highway System. This highway will facilitate the approach to potential mining fields in northern British Columbia and Yukon.

A natural resources development, all-weather, 387-mile road is to be built from Grimshaw, Alberta, into the Yellowknife area. The Dominion Government is to bear not less than half and not more than two-thirds the cost of construction of the Alberta section and the whole cost of the 81-mile section in the Northwest Territories. Tenders have been called for both sections of the road and it is to be completed by the end of 1947.

Work is under way on a road between Fort Churchill on Great Bear Lake and the head of the rapids on Great Bear River, a distance of 35 miles. The cost of the road is being borne by the Dominion Government.

Production

The production and value of gold by provinces and territories in 1944 and 1945 are shown below:

	1944		1945	
	Fine ounces	Value	Fine ounces	Value
Nova Scotia	5,840	$ 224,840	3,291	$ 126,704
Quebec	746,784	28,751,184	661,608	25,471,908
Ontario	1,731,836	66,675,686	1,625,368	62,576,668
Manitoba	74,168	2,855,468	70,655	2,720,218
Saskatchewan	122,782	4,727,107	108,568	4,179,868
Alberta	51	1,963	7	269
British Columbia	196,857	7,578,994	186,854	7,193,879
Northwest Territories	20,775	799,838	8,655	333,218
Yukon	23,818	916,993	31,721	1,221,258
CANADA	2,922,911	$112,532,073	2,696,727	$103,823,990

In Quebec the base metals mines contributed about 31 per cent of the province's output; in Ontario, 4·3 per cent; in Manitoba and Saskatchewan, about 78 per cent; and in British Columbia, 8·1 per cent.

Data on operating gold milling plants are given below:

Year	New mills		Total mills		Increases		Ceased operating	
	No.	Capacity, tons	No.	Capacity, tons	No.	Capacity, tons	No.	Capacity, tons
1945	—	nil	67	49,540	—	nil	5	2,935
1944	—	nil	71	52,025	—	nil	5	2,315
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

World production of gold in 1944 (1945 not as yet available), excluding Russia, is estimated at 27,109,000 fine ounces. Canada is surpassed only by South Africa, and possibly by Russia, and contributes about 12 per cent of the total.

The average price at which Canada's gold production was computed for 1945 was $38.50 a fine ounce. The price of gold in Canadian funds has been $38.50 a fine ounce since October 1939.

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 Refiners, 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.

IRON ORE

Production of iron ore in Canada increased markedly in 1945 and is expected soon to equal the requirements of the Canadian iron and steel plants. Most of this ore is, however, exported to the United States in exchange for American ores that can be used to greater advantage in the Canadian furnaces. Dominion Steel and Coal Company, Sydney, Nova Scotia, continues to draw the bulk of its supply from its own mines at Wabana, Newfoundland. Preliminary development work on large deposits in the interior of Labrador and adjoining territory in Quebec, which were discovered in 1936, indicates a large tonnage of high-grade ore.

Principal Canadian Sources of Supply

Though deposits of iron are widespread throughout eastern Canada and British Columbia, few have been found of sufficient purity and size to meet the requirements of the modern industry; so few, in fact, that from 1923 until 1939 no iron ore was produced in this country. In 1939, the Helen mine in the Michipicoten area, north of Lake Superior, began to ship sinter. In 1944, the first small shipments of hematite were made from the Steep Rock mine, 150 miles west of Port Arthur. In 1945, the Josephine mine in the Michipicoten area commenced production of lump hematite. All these mines have substantial reserves of ore and give promise of steady production for many years to come.

Helen Mine. Algoma Ore Properties, Limited, a subsidiary of Algoma Steel Corporation, Limited, Sault Ste. Marie, Ontario, shipped 503,305 long tons of sinter from its Helen plant in 1945. The siderite calcined and roasted to make this sinter was derived mainly from the Victoria open-cut, a short distance east of the open-cut that has furnished the ore since 1939. Preparations are being made for underground mining beneath the original open-cut. This mining can be continued for many years in the massive orebody, estimated to contain 100,000,000 tons of ore.

Typical analyses of siderite and sinter are:

	Siderite %	Sinter %
Iron	35·00	51·50
Phosphorus	0·014	0·02
Sulphur	1·76	0·04
Manganese	2·04	3·00
Silica	6·46	9·50
Lime	2·45	3·60
Magnesia	5·41	7·96
Alumina	1·60	2·35
Loss on ignition	32·00	Nil

Concentration tests have been continued on the Goulais siliceous magnetite deposit, 50 miles northeast of Sault Ste. Marie, where 100,000,000 tons has been indicated by drilling.

Josephine Mine. The Josephine mine of Michipicoten Iron Mines, Limited came into production late in the year, and shipment of lump hematite was commenced in December. The mine is equipped for an output of 1,200 tons a day, of which about 150 tons is expected to be lump ore for use in the open-hearth. The remainder, after washing to remove silica, will be mixed with the siderite of the Helen mine to make sinter. Algoma Ore Properties will purchase the concentrate to be sintered and the company is sales agent for the lump ore. The mine is developed on several levels to a depth of 1,000 feet.

Typical analyses of the Josephine raw ore, prepared lump ore, and concentrate for sintering are as follows:

	Raw ore %	Lump ore %	Concentrate %
Iron	52·00	61·00	60·00
Phosphorus	0·04	....	....
Sulphur	2·12	0·05	0·08
Silica	15·00	3·00	5·00

Steep Rock. In spite of the difficulties inherent in a new operation, Steep Rock Iron Mines, Limited produced 504,000 tons of hematite in 1945, its first full season. Most of the ore was exported to the United States. Part of it was shipped through a port in Wisconsin and the remainder from the new ore dock of Canadian National Railways at Port Arthur. The ore was all derived from an open-cut on "B" orebody. The approximate average analysis of this deposit and of the three grades shipped in 1945 is as follows:

	"B" orebody	Shipping Grades		
		Steep Rock, 4 inch to 10 inch	Atikokan, 2 inch to 4 inch	Seine River, minus 2 inch
	%	%	%	%
Iron (dry basis)	60·80	59·97	60·38	59·09
Phosphorus	0·017	0·030	0·027	0·024
Sulphur	0·039	0·035	0·029	0·046
Silica	3·37	3·41	4·39	4·11
Natural iron	55·68	57·925	57·880	53·317
Loss on ignition	8·04	3·41	4·14	9·77

Pumping of the residue of water from the Middle Arm of Steep Rock Lake and stripping of overburden from "B" orebody proceeded throughout the year. It is expected that this will permit an increased output from this deposit during 1946. It is intended also to commence operations on "A" orebody, 2 miles to the north, during the coming season.

Labrador and Quebec. Development of the hematite deposits in the interior of Labrador, 300 miles north of the port of Seven Islands, and northward across the height-of-land in Quebec, was continued in 1945. Labrador Mining and Exploration Company included the following table in its annual report:

Labrador Iron Ore Deposits

(To end of 1945 field season)

	Fe+Mn	P	S	SiO_2	Long tons per vertical foot
Burnt Creek No. 4	58·7	0·075	0·009	7·91	19,000
Knob Lake	60·2	0·059	0·028	3·65	22,000
Ruth Lake No. 1	59·9	0·055	0·010	4·99	65,000
Ruth Lake No. 2	60·3	0·090	0·011	2·43	5,000
Ruth Lake No. 3	62·0	0·128	0·014	2·11	225,000
Ruth Lake No. 5	58·8	0·148	0·008	4·51	60,000
Ruth Lake No. 6	59·2	0·083	0·008	5·97	2,500
Ruth Lake Extension	63·6	0·035	0·030	4·94	84,000
Sawyer Lake	68·4	0·010	0·038	1·43	32,000
Wishart Lake No. 1	63·0	0·049	0·010	5·98	110,000
Wishart Lake No. 2	63·3	0·063	0·015	5·38	35,000
Average and total	62·1%	—	—	3·99%	659,500

Less work has been done on the known deposits northward across the border in Quebec, held by Hollinger North Shore Exploration Company. The grade is similar to the above and the tonnage now indicated is about the same as on the Labrador side. In all cases these measurements have been made on outcrops or with the aid of a little shallow trenching and the full size of the deposits has still to be determined.

The ore so far discovered is partly of Bessemer grade, and most of it will be "lump" ore when mined.

Both the exploration companies named above are controlled by Hollinger Consolidated Gold Mines. The M. A. Hanna Company of Cleveland, Ohio, has a minority interest in Labrador Mining and Exploration Company.

British Columbia. At the end of the year plans were completed for an electric iron smelting plant at Anyox. It is intended to rehabilitate the hydro-electric power plant of 15,000 horsepower capacity, to use charcoal made from local saw-mill waste, and to smelt magnetite from Texada Island, 500 miles to the south. The project is being financed jointly by B.C. Minerals and Resources Development Company and Privateer Mines, Limited.

Production and Trade

The following table may serve to illustrate the present trend and the future possibilities of the iron ore trade in Canada.

Canadian Iron Ore Production: Imports and Exports
(Short tons)

	Canadian Ore		Imports			Total ore used in Canada
	Used in Canada	Exports to United States	From United States	From Newfound-land	From other countries*	
1938	—	209	631,031	607,025	64,374	1,302,430
1939	113,058	10,540	1,205,261	524,849	34,734	1,877,902
1940	138,074	251,626	1,606,775	716,317	95,145	2,556,311
1941	233,969	282,068	2,212,437	962,259	79,959	3,488,624
1942	249,346	295,960	2,033,961	610,871	57,136	2,931,314
1943	266,617	374,677	2,978,388	911,450	16,587	4,173,042
1944	244,830	308,422	2,501,737	624,890	22	3,371,479
1945	363,949	771,495	2,988,484	736,665	14,701†	4,103,799

*Principally from Brazil in recent years.
†First post-war shipment from Sweden.

Prices

A general rise in price of 10 to 20 cents a gross ton was put into effect in the United States in December. This applies equally to the Canadian iron ores.

LEAD

About 95 per cent of the total Canadian output of lead in 1945 came from the Sullivan lead-zinc-silver mine of the Consolidated Mining and Smelting Company of Canada, Limited, at Kimberley, British Columbia. Lead production was higher than in 1944, but was lower than the average in the immediate pre-war years, the peak year being 1942.

Principal Canadian Sources of Supply

In British Columbia, the lead concentrate from the 8,000-ton concentrator of the Sullivan mine is smelted and refined at Consolidated Mining and Smelting Company's plants at Trail. There was a shortage of labour at the mine throughout the year, but, owing to the renewed attention given to underground development in 1944, mine production increased from 2,141,397 tons in that year to 2,435,877 tons in 1945. It is planned to give this development work special attention during the next few years, particularly on the lower levels. Sinking operations were commenced on the deepening of No. 1 shaft below the 3,350-foot level.

Western Exploration Company, at Silverton, produced zinc and lead concentrates for export up to June 1945, when milling operations were discontinued. The company did development work on its property the rest of the year.

Retallack Mines, Limited, at Retallack, ceased operations in September 1945.

Base Metals Mining Corporation operated its Monarch and Kicking Horse mines at Field on a salvage basis. Contracts for the sale of lead and zinc concentrates have been arranged up to June 1946.

The decision of the United States Government in September 1945 to raise the price of foreign silver from 45 cents to 71·11 cents an ounce should act as an incentive to reopen some of the silver-lead-zinc mines of British Columbia.

In Ontario, there was a small production of lead concentrate from Berens River Mines, Ltd., near the Manitoba boundary. Little new ore was disclosed by development work.

In Quebec, New Calumet Mines, Limited, a silver-lead-zinc property on Calumet Island, in Ottawa River, in Pontiac county, increased its mill tonnage from 400 to 600 tons a day. Lead concentrate containing about 3,800 tons of lead was produced for shipment to the United States.

Golden Manitou Mines, Limited, Bourlamaque township, Abitibi county, resumed production of lead concentrate in November on the receipt of necessary concentrating equipment, and shipped a small amount to the United States.

Aldermac Copper Corporation, Limited ceased operations at its property at Moulton Hill near Sherbrooke in July 1945, when its contract for the sale of lead and zinc concentrates terminated. There were no plans to reopen the mine.

Production and Trade

Canada produced 173,497 tons of lead valued at $17,349,723, compared with 152,291 tons valued at $13,706,199 in 1944. British Columbia contributed 97 per cent of the total output.

Exports were 107,292 tons of pig lead valued at $8,603,049, compared with 102,880 tons valued at $6,394,550 in 1944. Sixty-six per cent of the pig lead exported went to the United Kingdom, and 17 per cent to the United States. A total of 7,834 tons of lead in ores and concentrate valued at $573,690 was exported to the United States, compared with 9,500 tons valued at $650,433 in 1944. Imports of lead, largely from the United States in the form of lead tetra-ethyl compounds, were valued at $4,756,005, compared with $4,174,111 in 1944.

Domestic consumption of lead increased from an average of 35,000 tons a year prior to the war to an estimated consumption in 1945 of about 60,000 tons.

World production in 1939 on a smelter basis as published by American Bureau of Metal Statistics was 1,890,362 short tons. Complete figures for the war period are not available. The principal producing countries, in order of importance, were: United States, Australia, Mexico, Germany, Canada, Belgium, and Russia. The production in Belgium and Germany was mostly from imported ores. No lead ore deposit of major importance has been discovered in recent years.

During the recent war, because of the disruption of European markets, large tonnages of foreign ore were available to the United States, and, due partly to war needs, consumption of lead in that country expanded considerably. To meet its requirements the United States will likely find it necessary to import large tonnages of lead from countries which formerly exported their surplus output chiefly to Europe. At the same time there will likely be a greater need than ever in Europe for Canadian, Mexican, and Australian lead, and thus a world shortage of the metal during the next few years seems probable.

Uses

Lead has a wide variety of uses and the demand for it is more stable than for most non-ferrous metals. The principal peace-time uses of lead in order of importance are for storage batteries, cable coverings, white lead, red lead, litharge, ammunition, and lead-tetra-ethyl. Other uses include lead for collapsible tubes, sheet, solder, babbitt, type metal, caulking lead, and bronze. In Europe the use of lead in paint, pipe, and solder is relatively more important than in North America, and a correspondingly smaller proportion is used in storage batteries. The comparatively recent and increasing use of lead-tetra-ethyl for tempering gasoline may become of important significance in world markets. The lead content of the tetra-ethyl compound is not recoverable.

Prices

During the first seven months of the year, nearly all lead surplus to domestic requirements was sold to the United Kingdom at a price well below open market prices. After the expiry of the war-time contract on August 7, lead was sold to the United Kingdom at 5·90 cents (Canadian funds) and to the United States and other countries at 5·90 cents (United States funds) a pound. The average price received for lead during 1945 is estimated at 5·00 cents a pound. About 3½ cents a pound was received for lead exported in lead concentrate.

The average price of pig lead in New York was 6·50 cents a pound, and in London £25 a long ton.

MAGNESIUM

Production of magnesium in Canada, in common with that in other countries, showed a marked decrease after the war. The only Canadian producer, Dominion Magnesium, Limited, at Haleys (near Renfrew), Ontario, ceased operations in August after accumulating a large stock of metal and alloys. Shortly after the end of the war in Europe the plant was purchased from the Canadian Government by the operating company, and extensive changes in equipment were under way at the close of the year. The magnesium powder plant of the Consolidated Mining and Smelting Company of Canada, Limited, at Trail, British Columbia, in which magnesium powder was made from purchased ingots, was also closed after the war. Magnesium foundries were operated in 1945 by Aluminum Company of Canada, Limited, at Toronto and Etobicoke; by Robert Mitchell Company, Limited, at Montreal; and by Light Alloys, Limited, at Renfrew.

Principal Canadian Sources of Supply

Sources of magnesium metal in Canada are dolomite, brucite, serpentine, and sea-water.

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

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.

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.

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, 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: (1) reduction of magnesia with carbon (in use in the United States); (2) reduction of magnesia with calcium carbide (in use in the United Kingdom); and (3) reduction of calcined dolomite with ferrosilicon (in use in Canada, the United States, and Italy).

Production and Trade

The field of usefulness for magnesium is steadily expanding. It was formerly used almost exclusively in pyrotechnics; but it is now an important structural material, being used alloyed with various proportions of other metals in the form of castings, extruded shapes, forgings, and sheets; other uses, such as for the cathodic protection of underground pipelines from corrosion, are proposed. It is also used as a minor constituent of many aluminium-base alloys.

The price quoted by Engineering and Mining Journal during 1945 for magnesium in ingot form in carload lots was 20½ cents per pound, U.S. currency, f.o.b. New York.

MANGANESE

All manganese properties in Canada were inactive in 1944 and 1945. The small Canadian production in the past came mainly from deposits in the Maritime Provinces. 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 disclosed during the operation of the iron deposits of Steep Rock Iron Mines, Limited, west of Port Arthur, Ontario, to warrant its recovery as a by-product. Consumption is steadily increasing, however, but adequate supplies of high quality ore can now be obtained from foreign deposits, the output from which was restricted during the war.

Much the greater part of the imports of manganese ore in 1945, totalling 198,277 tons, came from Africa, mainly from the Gold Coast. In 1944, imports were 80,000 tons and were mainly from India. Consumption in 1945 was 105,640 tons, a 29 per cent increase over that of 1944. Stocks of ore at the end of 1945 were nearly 7,000 tons.

Canadian production of manganese ferro-alloys, of which 47 per cent was ferro-manganese, and 40 per cent silico-manganese, totalled 66,626 short tons, an increase of 25 per cent over 1944. Exports, which were mainly to the United Kingdom, were 17,488 short tons, an increase of nearly 50 per cent. Stocks of manganese alloys at the end of 1945 were about 10,000 short tons.

World production of manganese ore is estimated to be between five and six million tons annually, the leading producing countries being Russia, British India, Gold Coast, United States, Union of South Africa, Brazil, and Cuba. Prior to the last war, Russia was the source of nearly half the world production, the principal deposits being in the Republics of Georgia and Ukraine. During the last quarter of 1945 Russia was the largest individual shipper of manganese ore to the United States.

MERCURY

No mercury has been produced in Canada since the summer of 1944, all shipments in 1945 being from stock. Accordingly, this review is confined mainly to those developments bearing on the Canadian situation that were not dealt with in the review on mercury by the Bureau of Mines for 1944, to which those wishing more detailed information on sources of production, occurrences, uses, etc., are referred.

All of the Canadian production has come from Consolidated Mining and Smelting Company's Pinchi mine and from the Takla property of Bralorne Mines, Limited, both of which mines are in the Omineca mining division, British Columbia. The Pinchi mine was the largest single producer of mercury in the Western Hemisphere.

Production and Trade

During the time the two aforementioned mines were in operation Canada produced a total of 56,641 flasks (2,076 tons) of mercury. Shipments from stock in 1945 were 4,779 flasks. Exports were 3,473 flasks, which went to the United States, India, Australia, and Brazil. Imports were 356 flasks, mainly from Mexico. Consumption was 1,325 flasks, a decrease of 50 per cent as compared with each of the two previous years. Producers and consumers stocks at the end of 1945 were 3,728 flasks, which is less than half the stocks at the end of 1944.

In the United States, consumption in 1945 reached a record of 64,000 flasks, and imports in July alone amounted to 20,000 flasks. Following the defeat of Japan, however, consumption decreased to about 3,000 flasks a month. Much of the mercury (in the form of oxide) was used in the manufacture of dry cell batteries for use in the Tropics, mainly in small portable radios. Contracts for the batteries were cancelled following the defeat of Japan and manufacturers are now preparing to make the batteries for civilian use, particularly for various makes of hearing aids. The battery is not being made in Canada.

World production just prior to the war was estimated at about 6,000 tons a year. Producers of over 1,000 flasks annually, besides Canada, during the war years were: Italy, Spain, United States, Mexico, Russia, China, Chile, Czechoslovakia, and Union of South Africa.

Production in the United States in 1945 was 30,600 flasks and was 40 per cent below the 1943 output of 52,000 flasks, the highest since 1881. Production during the last quarter of 1945 was well below the pre-war average. Nearly 75 per cent of the 1945 output came from California, where the New Idria Mine in San Benito county is by far the largest United States producer.

Prices

The United States controlled price early in 1944 was $176 per flask. This dropped to $96 by midsummer, rose to $140 in December, and to $160 in February 1945. This rise was traceable to the sudden demand for battery use. Large quantities of mercury then became available from Spain and the price dropped to $96 in September. United States ceiling price restrictions were suspended in late August. The Government purchase of surplus mercury stocks caused an upward swing at the end of the year to $108. The price in March 1946 was $105. In 1938 the average price was $75 per flask.

Outlook

If the expected large-scale production of the mercury dry cell for civilian use materializes the demand for the metal will increase, but production from Spain and Italy will soon be back to normal, and imports from Europe and other countries will not be restricted. These circumstances, together with a price of only half that obtained in 1943, do not encourage the reopening of Canadian mercury mines.

MOLYBDENUM

During 1945, production was maintained only from the LaCorne mine in LaCorne township, Quebec. From July 1942 to July 1945, the mine was operated by Wartime Metals Corporation, after which the property and all assets were taken over by the original owners, Molybdenite Corporation of Canada, who carried on without interruption with Wartime Metals personnel. Since July, concentrates have been sold in the open market, prior to which they were shipped through the Metals Controller and under contract to Climax Molybdenum Company, Langeloth, Pennsylvania, for conversion into oxide or ferromolybdenum and equivalent amounts of these products were shipped by that company to Railway and Power Engineering Company, Toronto, the distributor for Canada.

As there are no plants in Canada to convert the concentrate into addition agents, there is no sale for concentrate in Canada. Sales to the United States are likely to be barred because of tariffs, large productive capacity, and surplus stocks in that country. A considerable European demand for concentrate may develop, however, in connection with the manufacture of structural and engineering molybdenum steels and with other new fields of use, such as electronics. However, Canadian concentrate must meet strong competition from United States sources.

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 contact 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.

Principal Canadian Sources of Supply; Occurrences

The LaCorne mine, source of the output in 1945, is being developed to a depth of 500 feet on four levels. Two distinct types of ore occur. The east-west veins, which were first worked, are quartz veins; the north-south veins, which are richer and wider, are characterized by the presence of red feldspar. A zone of good grade ore averaging 0·8 per cent MoS_2 was struck at the bottom of the shaft. About 300 tons of ore averaging 0·65 per cent MoS_2 is being milled daily. The company is erecting a plant to extract the bismuth from the concentrate and is considering the installation of a plant to convert the concentrate into oxide.

Indian Molybdenum, Limited (Dome Mines, Limited) closed its property in Preissac township, Quebec, in April 1944, and Quyon Molybdenite Company's mine near Quyon, Quebec, was also closed early in 1944.

At least 400 molybdenite deposits and occurrences are known in Canada, distributed in all the 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 80,575 tons of ore treated, 560 tons of high-grade concentrate was produced. Shipments amounted to 489 tons of concentrate containing 419 tons of MoS_2 (251 tons of molybdenum) valued at $411,663. Prior to the closing of the contract with Climax Molybdenum Company in July, about 433 tons of concentrate was shipped to the United States for conversion into oxides and ferromolybdenum, after which 55 tons was shipped to France. In 1944, concentrate and molybdenum trioxide containing 561 tons of molybdenum were shipped.

A total of 203 tons of concentrate, containing 175 tons of MoS_2, was on hand at the LaCorne mine at the end of 1945.

Consumption of molybdenum closely follows that of alloy steel production. In 1945 it amounted to 397 tons of contained molybdenum (86 per cent as molybdenum trioxide briquettes and nearly 14 per cent as ferromolybdenum). Only about one ton of molybdenum was contained in the calcium and sodium molybdates consumed. Monthly consumption for the first four months averaged 67 tons of molybdenum, after which it decreased rapidly and was only 15 tons in December 1945. Consumption of molybdenum in 1944 was close to 540 tons. Molybdenum is used by about forty Canadian iron and steel manufacturers, but most of it is consumed by five companies.

Canada imports all the molybdenum addition agents it uses from the United States through Climax Molybdenum Company, the distributor for Canada being Railway and Power Engineering Company, Toronto. Its stocks at the end of 1945 amounted to 122 tons of molybdenum contained in ferro and oxide, mainly ferro. Consumers stocks at the end of 1945 probably amounted to at least 70 tons of contained molybdenum.

Just prior to the war, 90 per cent of the world production, estimated at 19,000 short tons of metallic molybdenum annually, came from the United States. During 1945, Climax Molybdenum Company, Climax, Colorado, the world's largest producer, reduced its mine output to 5,000 tons of ore daily or to one-third of the maximum, the grade being about 0·6 per cent MoS_2. The company contributed about 56 per cent of the estimated total American output of 16,000 tons of contained molybdenum in 1945. This total compares with 19,340 tons in 1944, and with 30,833 tons in 1943, the peak year. The remainder of the 1945 output was obtained mainly as a by-product from the operation of some of the large copper producers.

Other producing countries in order of their present importance are: Mexico, Chile, Norway, Peru, French Morocco, Turkey, and Australia. There is production also from Russia, Korea, Manchuria, Burma, China, Finland, Rumania, France, Japan, and Sweden, but the amounts are not known.

Uses; Specifications

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 that weigh 5 pounds each, and contain 2½ pounds of molybdenum.

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. For high-speed tool-steels as much as 9 per cent is added.

Molybdenum alloys are used widely for the hard-wearing and other important parts of airplanes. They are used in the automobile industry; 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, in welding rod coatings, 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

There is no Canadian market for concentrates as there are no conversion plants, and since July 1945 the only shipments have been to Europe at a price of 42½ cents per pound.

The price per pound of contained molybdenum, f.o.b. Toronto, in Canadian funds, for the following imported compounds is approximately: calcium molybdate (42 per cent Mo), 90 cents; ferromolybdenum (60 per cent Mo), $1.13; and molybdic oxide (52 per cent Mo), 90 cents. Calcium molybdate is sold in bags of about 12½ pounds containing exactly 5 pounds of molybdenum.

Tariff

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

NICKEL

The end of the war and the rapid curtailment of munitions manufacture cut off sharply the war-time uses of nickel. Following V-J Day, the production of The International Nickel Company of Canada, Limited was reduced to the level it was estimated would be needed to meet the normal requirements, considering that two of the chief former users, Germany and Japan, would be out of the market for some time to come.

The Canadian production of 122,000 tons came almost entirely from the Sudbury area. The output from other parts of the world remained at about 20 per cent of the world total, including a generous estimate for the Russian output. Although the known ore reserves of the Canadian mines have been seriously diminished, additional ore indicated by diamond drilling will more than restore the former position.

Principal Canadian Sources of Supply

International Nickel Company of Canada, Limited and Falconbridge Nickel Mines, Limited continued to furnish all the Canadian output with the exception of a little recovered as a by-product from the treatment of silver-cobalt ores.

Until August, International Nickel operated its mines and plants to full capacity of available labour. From August onward, a planned curtailment of production was put in force at all the mines, reduction plants, and refineries, with a view to adjusting the supply of nickel to the current demand. This reduction in the output of ore enabled more attention to be paid to mine development, which had to be curtailed during the war. The company's Petsamo property in Finland was taken over by the Russian Government and, during the year, payment of $20,000,000 in compensation was arranged. Work was continued at Creighton mine on the lower levels of No. 6 shaft, which was completed in 1943. Extension of Frood No. 4 shaft was started during the latter part of the year to develop ore below the 3,400-foot level. Preparations were completed for deepening Garson No. 2 shaft, and sinking operations, commenced in April, are still (March 1946) in progress. Underground exploration of the Murray mine was continued, and concreting of the shaft stations, commenced in 1944, was completed. Development operations at the Stobie mine, adjoining Frood, which were suspended in June on account of the labour shortage, were resumed in November. All these underground operations have in view the development of ore that has been indicated by diamond drilling.

The arrangement whereby International Nickel treated Falconbridge Nickel Company's matte was terminated shortly after the cessation of hostilities, and this matte is now being shipped to the Falconbridge refinery in Norway.

There were no other producers of nickel in Canada during the year; but an interesting nickel prospect was found in northern Manitoba. Following a geophysical survey of a mineralized area 100 miles north of Sherridon, diamond drilling by Sherritt-Gordon Mines, Limited disclosed a wide body of sulphides containing 1 to 2 per cent combined nickel and copper. Although this is not of ore grade, it has provided the incentive for further drilling.

Production and Trade

Unlike the decline in production during 1944, which was the result of labour shortage, the reduction in 1945 was planned to suit the smaller peace-time market.

Production of Nickel in Canada (all forms)

	Tons	Value
1944	137,299	$69,204,152
1945	122,565	61,982,133

As the stocks of nickel all the way from refineries to final users had been reduced to unduly small amounts during the war years, an appreciable tonnage was required to restore the inventories to normal. This is reflected in the export figures for the year. Until the end of the year little nickel had been exported to European countries, except to Great Britain, Russia, and Norway.

Exports of Nickel from Canada

	In matte or speiss	In oxides or salts	Refined	Total
1944: Tons	33,848	1,242	97,509	132,599
Value	$12,185,370	$574,857	$55,640,407	$68,400,634
1945: Tons	28,295	1,758	78,168	108,221
Value	$10,186,290	$808,715	$43,783,221	$54,778,226

The fact that substantial shipments were continued to Russia (9,384 tons in 1944 and 3,240 tons in 1945) seems to indicate that Russian production is not yet sufficient for its needs. The development of the Petsamo mine, formerly in Finland, should in due course augment substantially the Russian production of nickel.

Uses; Price

Though the drastic reduction in munitions manufacture compelled a moderate reduction in the amount of nickel consumed at the end of the year, the many new uses found for nickel during the war, as in radar, and in jet-propelled planes, as well as extended uses for stainless and other nickel-bearing steels, are expected to provide an expanding market.

Nickel on this continent remained at a quoted price of 35 cents per pound throughout the war and for several years previous.

PLATINUM GROUP METALS

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, all the Canadian output of platinum and its allied metals is obtained in the form of residue from the treatment of the Sudbury nickel-copper matte. Canada has been the leading producer of the platinum metals for several years.

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.

Late in 1945, Falconbridge Nickel Company resumed the export of nickel-copper matte, obtained at its smelter at Falconbridge, to its copper-nickel refinery in Kristiansand, Norway. This refinery is equipped to produce refined gold, silver, platinum, and palladium, in addition to refined nickel and copper. During the war Falconbridge matte was treated at the plants of International Nickel Company at Copper Cliff, Ontario.

Production and Trade

Canada produced 208,234 fine ounces of platinum valued at $8,017,010 in 1945, compared with 157,523 fine ounces valued at $6,064,635 in 1944. Production of palladium and other associated metals of the platinum group was 458,674 fine ounces valued at $18,671,074, compared with 42,229 fine ounces valued at $1,960,-085 in 1944. It should be noted that, for 1945, the production figures for the platinum group represent the metal content of concentrates produced from nickel-copper ores. For earlier years, the figures refer to refined metals recovered and the contents of concentrates sold.

Exports of platinum group metals in all forms were valued at $13,297,000, compared with $6,776,508 in 1944. Imports of platinum products were valued at $4,083,300, compared with $99,381 in 1944.

World annual production of platinum and its allied metals is estimated at 500,000 ounces, with a peak of 773,000 ounces in 1942. 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 worthwhile estimate can be made of world production and consumption of the platinum group of metals for 1945. The world consumption, however, was probably about equal to production.

Market

The market situation in 1945 is explained by Charles Englehard, President of Baker and Company, Incorporated, in the following, which is abstracted from his annual review:

"Shortly after the war ended, the United States and other governments (including Canada), removed all remaining restrictions on the use of platinum metals for jewelry and other peacetime uses. This was followed by a heavy demand for platinum by manufacturers of civilian goods (particularly jewelry manufacturers). Supplies of platinum in the hands of the trade were not adequate to meet this pent-up demand.

"The merit and value of the platinum metals for industrial purposes is demonstrated by the following figures, compiled by the United States Bureau of Mines, showing the uses in the United States of the platinum metals during the first six months of 1945:

Electrical and chemical industries	212,500	ounces
Dental and medical purposes	37,000	"
Jewelry	37,000	"
	286,500	"

"Palladium made great gains during the war as a precious metal for fine jewelry.

"Platinum metals contributed greatly to the winning of the war through their widespread use in military equipment and in the production of war goods.

"The uses of platinum metals in civilian goods are expected to be more diversified than in the pre-war period.

"The important improvements contributed by these metals are better quality in chemical products at lower costs; appliances and equipment that give better service with less maintenance; and greater precision and reliability in measuring instruments and automatic controllers or recorders. Current research and development are aimed at the continued improvement of platinum alloys and the expansion of the platinum metals in world markets."

Prices

Except for iridium, the prices per fine ounce for the platinum group of metals remained stable. Platinum was $35, palladium $24, osmium $50, rhodium $125, and ruthenium $35 an ounce. Iridium sold at $120 from January to August, and at $90 to $100 from September to December.

SELENIUM

Selenium is fairly widely distributed, but in no case does it occur in quantity large enough to be mined for itself alone. It is not widely used in industry though new uses are being steadily developed. Canada and the United States are the principal sources of supply.

Principal Canadian Sources of Supply

In Canada selenium 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. The plant at Montreal East is the largest producer of selenium in the world.

A plant* for the manufacture of selenium compounds was erected in 1944 at Montreal East by Canadian Copper Refiners, Limited. The compounds being made in addition to refined selenium are double distilled selenium, C.P. selenium, commercial selenium dioxide, sodium selenite, and sodium selenate.

Production and Trade

Canadian production of selenium was 379,187 pounds valued at $728,039, compared with 298,592 pounds valued at $537,466 in 1944 and with a peak output of 495,365 pounds in 1942. Quebec is the source of about 50 per cent of the total output, Ontario about 22 per cent, and Manitoba and Saskatchewan the remainder.

Exports of selenium and selenium salts were 442,084 pounds valued at $843,404, compared with 250,404 pounds valued at $445,768 in 1944.

World production of selenium is believed to approximate 700 short tons a year.

Uses; Price

Selenium is marketed as a black to steel-grey amorphous powder, but cakes and sticks are also obtainable. Among the other products marketed are ferroselenium, sodium selenite, selenious acid, and selenium dioxide. The most important outlets for selenium prior to the war were in the glass, rubber, and paint industries. The greatest single development in the utilization of selenium since 1939 has been its use in electrical rectifiers that played such an important rôle in connection with radar and with generators for aeroplants and army field equipment. Considerable quantities are being used as accelerators in the vulcanization of synthetic rubber. Selenium is used to develop free machining qualities in stainless metal and as an ingredient of austenitic chromium steels. For the latter purpose it is supplied in bars of selenium-bearing stainless metal. 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.

SILVER

Silver in Canada is obtained mainly as a by-product from the treatment of base metal ores. The remainder comes from the silver ores of Ontario and British Columbia; from the gold-quartz ores; and to a small extent from gold alluvial deposits.

*For details of the plant and of the uses of its products see April 1946 issue of the Canadian Mining and Metallurgical Bulletin, pages 143 to 190 inclusive.

Principal Canadian Sources of Supply

About 45 per cent 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 of The Consolidated Mining and Smelting Company of Canada, Limited, 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 that part of the Flin Flon deposits of Hudson Bay Mining and Smelting Company, Limited, lying within that province; and in Manitoba, the production was from the copper-zinc ores of the Flin Flon and Sherritt-Gordon mines and to a lesser extent from San Antonio and other gold mines.

In Ontario, the principal (53 per cent in 1945) source of silver is the copper-nickel ores of the Sudbury area, though the output of the metal from this source showed a general downward trend from 1941 to 1945, inclusive. A considerable quantity is also recovered in the refining of bullion from gold mines in the province; and a decreasing amount is obtained from silver-cobalt ores.

In Quebec, the output is obtained from the copper-gold ores of Noranda Mines, Limited; the copper-zinc ores of Waite Amulet Mines, Limited, and of Normetal Mining Corporation, Limited; and from many gold mines of western Quebec.

In the Northwest Territories, practically all of the 2,033 ounces produced in 1945 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.

In Yukon, production came from gold placer operations mainly in the Klondike area, the output in 1945 being 25,158 ounces, compared with 32,066 ounces in 1944. Until 1941, when operations ceased, most of the output came from the silver-lead ores of the Mayo area.

Deloro Smelting and Refining Company, Limited, Deloro, Ontario, continues to be the only plant that treats high-grade silver-cobalt ores from Cobalt and adjoining areas. The company operates its silver furnaces only when it receives enough ore to make the run worthwhile.

Silanco Mining and Smelting Corporation, the largest producer of cobalt ore in the cobalt area, is erecting a 15-ton smelter and refinery about 6 miles south of Cobalt to treat cobalt and silver ores of the district.

Several companies in the United States are equipped to treat cobalt-silver ores, and prior to the late war they obtained most of their ore from the Cobalt area. They were unable to accept such ores during the war, but are likely to resume their contacts with Canadian markets.

Production and Trade

Canada produced 12,942,906 fine ounces of silver valued at $6,083,166 in 1945, compared with 13,627,109 fine ounces valued at $5,859,656 in 1944. The output has been decreasing steadily since 1940, when it reached 23,833,800 ounces. The maximum production was in 1910 and amounted to 32,869,264 ounces.

British Columbia was in the lead with a production of 5,620,323 ounces valued at $2,641,552 in 1945; and was followed by Ontario, with 3,185,369 ounces valued at $1,497,123; Quebec, with 2,149,570 ounces valued at $1,010,570; Manitoba and Saskatchewan, with a total of 1,960,340 ounces valued at $921,360; and Yukon and Northwest Territories, with a total of 27,191 ounces valued at $12,780.

Exports of silver were: silver contained in ore, concentrates, etc., 2,232,405 fine ounces valued at $1,153,796, compared with 2,389,739 fine ounces valued at $1,170,475 in 1944; and silver bullion (Canadian), 2,723,698 fine ounces valued at

$1,443,814, compared with 3,577,243 fine ounces valued at $1,762,944 in 1944. Imports of manufactures of silver were valued at $57,423, compared with $36,349 in 1944.

Silver consumption in Canada, as reported by The Wartime Prices and Trade Board, totalled 8,300,300 ounces, compared with 7,595,600 ounces in 1944 and with 7,991,500 ounces in 1943. Of the total consumption in 1945, 3,628,600 ounces was used for sterling; 2,015,000 ounces for coinage; 1,041,800 ounces for making silver nitrate; 961,300 ounces for making anodes; and 653,500 ounces for making alloys, wire, and for miscellaneous purposes.

Plants in Canada for the production of refined (fine) silver are operated by the following:

Operators	Location of plant
Royal Canadian Mint	Ottawa, Ontario
Deloro Smelting and Refining Company	Deloro, Ontario
The International Nickel Company of Canada, Limited	Copper Cliff, Ontario
Hollinger Consolidated Gold Mines, Limited	Timmins, Ontario
The Consolidated Mining and Smelting Company of Canada, Limited	Trail, B.C.
Canadian Copper Refiners, Limited	Montreal East, Quebec

Market and Prices

The average estimated price (Canadian funds) of silver in 1945 was 47 cents a fine ounce, compared with 43 cents in 1944.

Canada, until the end of 1945, was the only country that had maintained a ceiling price on silver based on the pre-war price of the metal. Throughout 1945 the silver-using industries continued to be supplied with metal on a basis of 40 cents an ounce, the approximate equivalent in Canadian funds of the 35⅜ cents foreign silver price that had prevailed in the United States until August 31, 1942. Canadian mine production in 1945 was made available, first to the home trade, and then to the Royal Canadian Mint. Only after these requirements had been met was permission given to export the excess production under Government licence for sale abroad at prices above the 40-cent ceiling. In September 1945, the United States Office of Price Administration raised the ceiling price of foreign silver from 45 cents a fine ounce to 71·111 cents. In December 1945, the Wartime Prices and Trade Board undertook to modify the existing arrangements in Canada. Under the new plan the Royal Canadian Mint was authorized by the Minister of Finance to purchase silver, starting January 1946, at specified prices. The Mint was instructed to buy half its current requirements from the pool of Canadian production available for domestic use at the domestic ceiling price (40 cents Canadian funds) and the balance at the export price (78 cents Canadian funds), up to the point where its purchases at the domestic ceiling price during the first half of 1946 amount to 250,000 ounces, from which time it will buy all its further current requirements, if any, from the pool at the export price, until June 30, 1946. The plan was for the same process to be repeated in the second half of 1946, unless conditions necessitate a change.

Under present conditions the small silver producers in the Cobalt area, Ontario, and in British Columbia are permitted to export their output, thus obtaining the foreign silver price. The small silver producers in the Cobalt area, that have their ores treated at Deloro, have been paid since January 1946 on the basis of the export price, less the usual smelter charge.

TELLURIUM

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.

Production and Trade

Canada produced 484 pounds of tellurium valued at $929, compared with 10,661 pounds valued at $18,657 in 1944. Exports of tellurium are not recorded separately.

World production is estimated at 150 short tons a year, or about double the pre-war figure.

Uses; Price*

Very finely powdered tellurium is used as rubber-compounding material, this being the most important use of tellurium at present. Small quantities are used as a colouring agent in the ceramic industry. When alloyed with lead the tensile strength and toughness of the lead are 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. Tellurium is used for improving the machining qualities of certain steels.

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

TIN

Cassiterite (SnO_2), the only important ore of tin, is a widely distributed mineral, but in only a few countries are the deposits sufficiently large for commercial development. Stannite, a sulphide of copper, iron, and tin, is of little importance as an ore.

Canada's production of tin is obtained from the small cassiterite content of the lead-zinc-silver ore of the Sullivan mine of The Consolidated Mining and Smelting Company of Canada, Limited, at Kimberley, British Columbia.

The tin supply situation remained critical throughout the world during 1945, and though there was an increase in the number of mines in production in Malaya, the chief source of supply, in the first quarter of 1946, most operations remained on a restricted scale. In February 1946, according to "Metal and Mineral Markets" (published by Engineering and Mining Journal), a British Mission, which started to investigate the tin situation after Malaya was recaptured by the Allies, estimated total 1946 production (tin content) there at 12,500 tons. This compares with an average pre-war output of approximately 75,000 tons.

An autonomous international body, known as the Combined Tin Committee, functions to assure co-operation in the distribution of tin during the period of world short supply. The Committee includes representatives of the United States, United Kingdom, Netherlands, France, and Belgium.

The tin produced at Kimberley and the small domestic recovery of secondary tin are far from sufficient to meet Canadian requirements.

Principal Canadian Sources of Supply; Occurrences

Consolidated Mining and Smelting Company's tin concentration plant at Kimberley has been in operation since March 1, 1941, and its plant for the production of refined tin, also at Kimberley, since April 1942.

During recent years numerous tin-bearing occurrences were disclosed in Yukon and in the Northwest Territories. Although none of these appears to be of near future economic interest, geological conditions in the regions concerned warrant considerable prospecting attention. Known cassiterite occurrences elsewhere in Canada are not of present economic interest.

*For details regarding the uses of tellurium see the April 1946 issue of The Canadian Mining and Metallurgical Bulletin, pages 188 to 190, inclusive.

Production and Trade

Canada produced 425 tons of tin valued at $492,990 in 1945, compared with 258 tons valued at $299,643 in 1944.

Imports of tin in the form of blocks, pigs, tin foil, and collapsible tubes in 1945 were valued at $5,122,147, compared with $2,178,118 in 1944.

World mine production of tin in 1944 (1945 not available) was estimated by the International Tin Research and Development Council, The Hague, to be 109,000 long tons, compared with a peak output of 245,500 long tons in 1941.

Uses; Price

Tin is used chiefly in the manufacture of tin plate, mainly for use in making tin cans and containers of all kinds. To conserve supplies, the use of tin in solders and in babbitt metal has been restricted in recent years and there has been wide use of low-tin or virtually tin-free solders. Smaller quantities of tin are used in foil, terneplate, type metal, bronze, and galvanizing.

The price of tin in New York was fixed at 52 cents a pound in August 1941, and this price prevailed to the end of 1945.

TITANIUM

Titanium-bearing ores found in Canada are of two classes:

Ilmenite, containing 30 to 40 per cent TiO_2 occurs in three localities in Quebec. In one of these, St. Urbain, on the St. Lawrence, 60 miles below Quebec City, a part of the ore contains free TiO_2 as rutile mixed with the ilmenite, and its content of TiO_2 reaches 50 per cent and more. The other two deposits are at Ivry, 65 miles north of Montreal, and Allard Lake, 12 miles north of Havre St. Pierre on the Gulf of St. Lawrence.

Titaniferous magnetite, the second class of titanium-bearing ore, is composed of the two minerals, ilmenite and magnetite, mixed intimately in varying proportions, with a content of 5 per cent or more TiO_2. This ore is more abundant and occurs more widely in Canada than does ilmenite. It is not used in this country at present as a source of titanium. Large deposits occur at Mine Centre in northwestern Ontario; in the southern part of Hastings county, north of Belleville, Ontario; at Desgrosbois, 65 miles north of Montreal; and on the Saguenay River, near Arvida, Quebec.

Deposits of magnetic beach sands containing titanium occur at a number of places on the north shore of the Gulf of St. Lawrence. An interesting bed of such sand that has been consolidated into solid ore occurs at Burmis, Alberta, just east of the Crowsnest Pass.

Principal Canadian Sources of Supply

Small shipments of ilmenite were made formerly from the Ivry deposit, but during recent years the only production has been from the St. Urbain deposits. The largest potential source of ilmenite is the recently discovered Allard Lake ilmenite deposits, from which experimental shipments only have been made. These deposits are very large, though their full extent is not yet known. The ore as exposed in hills and ridges contains several million tons above the ground level. It averages about 35 per cent TiO_2, 37 per cent iron, and 3 per cent silica. Its convenient location near an ocean port will permit large-scale development when there are sufficient market outlets.

Production and Trade

During recent years there has been a small annual production of ilmenite from St. Urbain for export to the United States. The output in 1945 was 14,147 tons valued at $67,575, compared with 33,973 tons valued at $165,195 in 1944.

No ilmenite is used in Canada at present.

Uses and Specifications

The two principal uses for ilmenite are as an alloying agent in steels, and as pigment. At Niagara Falls, N.Y., ferro-titanium and ferro-carbon-titanium alloys are made from it for use in improving the quality of steel. By far the larger part of the ilmenite consumed in the world, however, is used to make the pigment, titanium white. New uses for this pigment are being found constantly and the demand continues to increase rapidly. There were reports during the year of a Canadian plant to make titanium white, but no definite action was taken.

To the present the substantial amounts of titanium white used in Canada have been imported from the United States. A part of the ore for the United States plants is produced in the southern states. Normally, much of the ore for these plants was Travancore sand from India, which is particularly well suited to the process at present in use. When this became unobtainable during the war the McIntyre titaniferous magnetite deposit in New York state was opened and operated on a large scale, but this property has been closed.

TUNGSTEN

The supply of tungsten has been in excess of the demand for the past two years, although it was critically short during the war up to the autumn of 1943. Canadian production ceased at the end of 1943, since when only the small amounts on hand at the mines have been shipped. Canada's requirements can be adequately supplied from the Emerald property in southern British Columbia if an urgent demand again arises.

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.

Principal Canadian Sources of Supply; Occurrences

During 1941 and 1942, scheelite was obtained from many deposits throughout Canada, most of them small. The three largest producers were the Red Rose mine south of Hazelton, northern British Columbia, the Emerald mine near Salmo, southern British Columbia, and Hollinger Consolidated Gold Mines, Limited, Timmins, Ontario.

Production and Trade

As noted, there was no production in 1945. Shipments consisted of 1,153 pounds of concentrate (containing 792 pounds of WO_3) that was produced at the treatment plant of the Bureau of Mines, Ottawa, in 1943, from some ores from Ontario and British Columbia. The WO_3 content was valued at $1,045. Shipments in 1944 were mine stocks amounting to 443·4 tons containing 142·5 tons WO_3 valued at $245,780.

Details of the total war shipments from the larger producers are given in the Bureau of Mines review for 1944 (Report No. 815).

Canada has no plants for the manufacture of ferrotungsten. Tungsten steels are made in two plants. Atlas Steels, Limited, Welland, Ontario, the principal producer, uses ferrotungsten as well as high-grade scheelite concentrate which is added directly to the steel bath. This is possible because of the comparative ease with which calcium forms as slag. Federal Foundries and Steel Company, Limited, London, Ontario, uses a small quantity of scheelite concentrate for making tungsten steels.

Canadian consumption amounted to 245 tons of tungsten metal contained in ferrotungsten and scheelite. This was slightly more than in 1944, but only a quarter of the 1942 consumption. There were no imports of ferrotungsten or scheelite in 1945; stocks at the end of 1945 were 279 tons of contained tungsten.

Information on world production in recent years is incomplete. 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, 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 occurs mainly as wolframite. Most of the mines are in Kiangsi Province, where the largest deposits occur. 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 1945 was 5,807 tons of 60 per cent WO_3, compared with 10,259 tons in 1944, and with the record of 12,055 tons in 1943. Over 90 per cent of the 1945 output came from California, Idaho, and Nevada. Imports amounted to 8,875 tons, 50 per cent of which was from Bolivia, and 30 per cent from Brazil.

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 have been 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 scheelite concentrate containing 70 per cent WO_3 (within specifications), delivered at Welland, Ontario. At the end of 1945, prices were $17.50 per unit of WO_3 for scheelite and $1.54 per pound of contained tungsten in ferrotungsten.

ZINC

British Columbia produced 57 per cent of the Canadian output of zinc in 1945, Manitoba and Saskatchewan 21 per cent, and Quebec about 21 per cent. Seventy per cent of the output was high-grade electrolytic zinc produced at Trail, British Columbia, and at Flin Flon, Manitoba, and the remainder was shipped as concentrate to smelters in the United States. About 85 per cent of the production was exported.

The decrease in production, compared with 1944, is partly attributed to shortage of labour, and partly to an apparent surplus of zinc and a correspondingly weak demand for concentrate by United States smelters after the end of the war.

Principal Canadian Sources of Supply

In British Columbia, the lead and zinc concentrates produced by The Consolidated Mining and Smelting Company of Canada, Limited, in the 8,000-ton concentrator near its Sullivan mine at Kimberley, are smelted and refined at Trail. Despite a shortage of labour, production at the mine showed an increase of about 13 per cent compared with 1944, and amounted to 2,435,877 tons of ore. Zinc output amounted to 135,887 tons, compared with 122,518 tons in 1944. Development and exploration work, which had been curtailed during the war years prior to 1944, was actively resumed, and, with the inclusion of low-grade ore now found to be minable, ore reserves were increased. Deepening of No. 1 shaft at the Sullivan mine below the 3,350-foot level was commenced and will continue during 1946.

A number of smaller operators, mostly in the Ainsworth-Slocan area, produced zinc concentrate containing a total of about 10,000 tons of zinc. Among these were:

Western Exploration Company at Silverton, which ceased milling in June when its sales contract terminated, but continued underground development to the end of the year.

Retallack Mines, Limited at Retallack, which ceased operations in September.

Zincton Mines, Limited, which continued operations at the Lucky Jim zinc mine until June 1, when its sales contract ended. Its mill was reopened in October on a reduced scale and the concentrate was shipped to Trail.

Base Metals Mining Corporation, Limited, which operated its Monarch and Kicking Horse properties on a salvage basis. Contracts for the sale of the company's lead and zinc concentrates have been arranged up to June 1946.

Britannia Mining and Smelting Company, Limited, on Howe Sound, recovered a small tonnage of zinc concentrate in opening up its No. 8 orebody. Zinc as well as copper concentrate will be produced when regular mining of the orebody is under way.

In Manitoba, Hudson Bay Mining and Smelting Company, Limited operated its copper-zinc mine and smelter at Flin Flon on the Manitoba-Saskatchewan boundary at a reduced rate because of shortage of labour. The concentrator produced 140,868 tons of zinc concentrate and 358,111 tons of copper concentrate. The average percentage recovery of zinc in the zinc concentrate was the highest recorded. The zinc plant treated 146,210 tons of zinc concentrate and produced 47,468 tons of slab zinc.

Cuprus Mines, Limited (subsidiary of Hudson Bay Mining and Smelting Company) prepared its copper-zinc deposit at Schist Lake for underground development. A power line was constructed to the property and a mining plant was installed to sink a 600-foot exploration shaft.

Sherritt-Gordon Mines, Limited, at Sherridon, operated on a slightly reduced scale. It milled 646,092 tons of copper-zinc ore and produced 18,723 tons of zinc concentrate averaging 49 per cent zinc.

In Quebec, four mining companies produced zinc concentrate which was exported to smelters in the United States, there being no plant for smelting and refining zinc in eastern Canada.

Waite Amulet Mines, Limited, near Noranda, operated its 1,800-ton concentrator below capacity. It milled 517,213 tons of gold-copper zinc ore containing an average of 5·64 per cent zinc, from which 24,242 tons of zinc was produced.

Golden Manitou Mines, Limited, near Val d'Or, treated an average of 776 tons a day in its 1,000-ton concentrator. Concentrate shipped contained 13,492 tons of zinc. The company has a contract to ship all of its zinc concentrate to the American Zinc Company of Illinois until January 1, 1948.

Normetal Mining Corporation, Limited, in Abitibi county, 70 miles north of Noranda operated its 780-ton concentrator below capacity. It milled 204,057 tons of ore with an average grade of 7 per cent zinc and 3·68 per cent copper. The zinc concentrate contained 10,429 tons of zinc.

New Calumet Mines, Limited, on Calumet Island in the Ottawa River, produced concentrate containing about 14,000 tons of zinc, 3,800 tons of lead, and some gold and silver. It increased the ore handled in its concentrator from 400 tons a day to 600 tons a day. The MacDonald or No. 2 shaft area was opened up for production.

Quemont Mining Corporation, Limited, which adjoins Noranda on the north, disclosed important deposits of gold-copper-zinc ore at depth. It carried out an extensive drilling program and commenced underground development from old workings.

East Sullivan Mines, Limited, near Val d'Or, outlined a large gold-copper-zinc orebody by drilling. It plans to sink a shaft and to do underground development to confirm the drilling results.

Aldermac Copper Corporation, Limited closed its lead-zinc property at Moulton Hill, near Sherbrooke, in July as its contract for the sale of concentrate to United States Commercial Company expired at the end of June.

Production and Trade

Canada produced 258,607 tons of zinc valued at $33,308,556, compared with 275,412 tons valued at $23,685,405 in 1944. The production (which includes the zinc content of concentrates) by provinces was: British Columbia, 147,396 tons; Saskatchewan, 37,707 tons; Manitoba, 17,430 tons; Ontario, 120 tons; and Quebec, 55,954 tons.

Canada exported 220,625 tons of zinc valued at $20,240,769, compared with 213,861 tons valued at $15,015,516 in 1944. The exports consisted of 91,780 tons of zinc contained in ore and concentrates, compared with 113,303 tons in 1944; 121,960 tons of metallic zinc, compared with 95,985 tons; and 6,886 tons of zinc scrap, compared with 4,572 tons in 1944. Fifty-three per cent of the metallic zinc was exported to the United Kingdom, 35 per cent to the United States, and 7 per cent to France. All of the zinc concentrate exported went to the United States.

Imports of zinc products of all kinds, including oxide and chemicals, were valued at $2,257,745, compared with $2,454,539 in 1944. Practically all of the imported zinc products originated in the United States, the exception being lithopone, 54 per cent of which, with a value of $553,202, was imported from the United Kingdom.

Prior to the war, Canada used an average of 20,000 tons of zinc a year. Owing to war-time requirements, particularly for brass and other copper-zinc alloys, domestic consumption increased to 80,000 tons in 1943, but declined to 62,000 tons in 1945. In August 1945, all restrictions on the purchase of zinc, which were imposed in 1942, were removed.

World production of zinc on a smelter basis in 1939 amounted to 1,851,370 short tons according to the American Bureau of Metal Statistics. The principal producing countries in order of importance were: United States, Germany, Belgium, Canada, Poland, and Russia. Belgian, and to a large extent German production was derived from imported ores.

Uses

Zinc is one of the most important of the non-ferrous metals and has a wide range of industrial uses. In the war its largest use was in the manufacture of brass and of other copper base alloys used mainly for shell cartridges. In peacetime the galvanizing industry, where the metal is used as a protective coating for iron and steel, is the principal consumer. In zinc die-casting, zinc comprises

96 per cent of the metal used. In the form of rolled sheets zinc has many uses, such as weather stripping, roofing sheet, fruit jar sealer rings, dry-cell cups, and electrical equipment. Zinc is used in boiler and hull plates, as zinc dust in precipitation of gold, in the desilverization of lead, in wire for brake linings, and in socketting for wire cable.

Zinc oxide is used in compounding rubber; in the manufacture of paint, ceramics, linoleum, matches, inks, and of many other commodities.

Prices

The average price of Canadian zinc sold in 1945, as determined by the Dominion Bureau of Statistics, was 6·44 cents a pound.

The war-time contract whereby the two producers of refined zinc shipped all metal surplus to domestic requirements to the United Kingdom expired in August 1945. Spelter sold under this agreement averaged 4·90 cents a pound. Early in the year the United Kingdom requirements eased sufficiently to permit substantial export of spelter to the United States. The St. Louis price for high-grade electroytic zinc was 9·25 cents (United States funds) a pound. This netted Canadian sellers an average of 8·3 cents (Canadian funds) a pound after deduction for duty and freight charges.

The zinc content of concentrate sold to United States smelters had an estimated export value of slightly over 3 cents a pound.

II. INDUSTRIAL MINERALS

ABRASIVES (NATURAL)

Brief reviews only are given below of garnet, pulpstones, grindstones, scythestones, and volcanic dust, as the production of natural abrasives in Canada has been small for many years. Corundum is reviewed separately.

Garnet

Niagara Garnet Company remodelled its small concentrator at Sturgeon Falls, Ontario, and installed machinery for making flour grades. About 100 tons of 50 per cent garnet ore was shipped to the concentrator from a deposit near River Valley, in Dana township, about 25 miles to the northwest. The concentrates were pulverized and converted into seven grades of flour ranging from 45 micron down to 3 micron in size. The flours are being stored for ultimate shipment to optical companies for use in lens grinding and polishing. About half a ton of mixed flour grades is being produced daily.

Canada Garnet, Limited did not mine or treat any garnet at its property south of Labelle, 100 miles north of Montreal.

Over 85 per cent of the world output of garnet comes from North Creek, New York, and the product is regarded as the world standard garnet. Production in 1945 was 6,300 tons, a 34 per cent increase over the previous year.

Concentration of garnet is improved by using the sink-float process as a rougher to eliminate the coarse tails, and the concentrate is improved by subjecting it to a heat-treatment process.

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. Garnet is used to minor extent for sandblasting, and for surfacing plate glass. Garnet superfine (flour) grades are being used as a partial substitute for corundum flour, which is used for polishing optical lenses, for which purpose several hundred tons of garnet were used in the United States in 1945.

Canadian consumption of garnet grain suitable for "sandpaper" manufacture has been less than 200 tons a year. At present, however, none is being used commercially 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, and flours from 6 cents a pound for 275 mesh, to 65 cents a pound for 5 and 10 micron.

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 1945, but a total of 225 tons of grindstones valued at $10,870 was shipped by Read Stone Company, Sackville, and by Bay of Chaleur Grindstone Company from quarries near Stonehaven on the Bay of Chaleur, northern New Brunswick. In 1944, about 225 tons of grindstones valued at $12,000 was produced.

Pulpstones were last produced in 1937, by J. A. and C. H. McDonald Company from Gabriola Island, near Nanaimo on Vancouver Island. 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. There is also an increasing competition from Canadian-made artificial segmental pulpstones, mainly of silicon carbide grit, and about 645 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 the 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 of iron, sodium, magnesium, calcium, etc.

Deposits of volcanic dust occur in Saskatchewan, Alberta, and British Columbia. There was no production in 1944 and 1945. In 1943, 60 tons was shipped from Rockglen, 125 miles southeast of Swift Current, Saskatchewan. A lease was taken out recently on the Duncairn deposit near Swift Current and samples of cleanser material were distributed.

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 largest consumer of volcanic dust and pumice, and has an annual output of about 90,000 tons valued at over $700,000. The material is used mainly in scouring and cleansing compounds and as a concrete admixture and concrete aggregate. To a minor extent it is used for insulation; in glass bevelling; for polishing aluminium; in the manufacture of fire-proof walls; in acoustic plaster; in building tiles; as a filler in paint and in asphalt; and as glazes in ceramics.

ASBESTOS

The asbestos industry operated at capacity during 1945 and production was only slightly under that of the record of 477,846 tons in 1941. Export controls, which had been in force since September 20, 1939, were removed in October and large sales were made to western European countries, where stocks were almost completely lacking. Construction of a 750-ton mill was undertaken by Flintkote Mines, Limited, a subsidiary of Flintkote Company of Canada, Limited. This mill, which is 2½ miles east of Thetford Mines, will be in operation early in 1946 and will turn out a complete line of asbestos fibres.

The outlook for the asbestos industry is good. Development of new asbestos products has been rapid in recent years, and of particular significance are the developments in asbestos-cement products which require the short grades of fibre that formerly were difficult to market.

Principal Canadian Sources of Supply

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 of 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, and the great open pit at Asbestos is the largest asbestos quarry in the world.

Small deposits of chrysotile asbestos are known in other parts of Quebec, in Ontario, and in 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 therefore is particularly suitable for making insulation for electrical machinery.

No amosite or crocidolite has been found in Canada, but there are numerous deposits of fibrous tremolite, actinolite, and anthophyllite. These varieties are commercially termed amphibole asbestos. Their fibres are harsher and weaker than those of chrysotile and cannot be spun, but they have a higher resistance to acids than has the chrysotile fibre, and are usually used in preference to the latter for filtering acid materials. Fibre from certain of the tremolite deposits in Ontario and Quebec has proved to be suitable for this use and small shipments were made in 1944 and 1945 from a property near Calabogie, Ontario, and in 1944 from another near Val d'Or, Quebec. A number of years ago fibrous actinolite was quarried near the village of Actinolite, Hastings county, Ontario, for use in coating roofing materials.

Asbestos deposits reported as discovered in recent years in Manitoba, British Columbia, and in northern and western Ontario are of the amphibole varieties.

In 1945, 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 Mines, Limited, at St. Remi de Tingwick.

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 $\frac{1}{4}$ to $\frac{1}{2}$ 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.

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 and developing levels preparatory to recovering rock by block-caving operations.

During the late war the Germans produced amphibole asbestos synthetically from mixtures of precipitated silica, calcium fluoride, magnesium fluoride, and ammonium fluoride. The resultant fibres were very short and the product cost several times as much as natural asbestos.

Production and Trade

The production of asbestos in 1945 amounted to 466,897 tons valued at $22,805,157, compared with 419,265 tons valued at $20,619,516 in 1944.

Exports of asbestos in 1945 were: crude asbestos, 863 tons valued at $366,563, compared with 1,541 tons valued at $649,564 in 1944; milled fibres, 209,765 tons valued at $15,857,555, compared with 171,668 tons valued at $13,634,772 in 1944; asbestos waste, refuse or shorts, 229,929 tons valued at $5,618,124, compared with 212,728 tons valued at $4,361,358 in 1944; asbestos manufactures, including asbestos roofing, valued at $341,648, compared with exports valued at $184,189 in 1944.

As may be seen from the above data 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 (crudy fibre), or completely fluffed out and ready for manufacture. The great bulk of exports goes to the United States, but substantial quantities are exported to the United Kingdom and Australia, and shipments to Europe were resumed again late in the year.

Imports in 1945 consisted of: 107·5 tons of asbestos packing valued at $101,615; brake linings for automobiles, etc., valued at $316,461; asbestos brake linings and clutch facings not otherwise provided for, valued at $32,005; asbestos in any form other than crude, and all manufactures of, not otherwise provided for, $1,385,224. The last classification includes some asbestos from South Africa of a kind not produced in Canada and required for certain manufactures. Comparative data for 1944 are: 110·8 tons of packing valued at $100,260; brake linings for automobiles valued at $423,171; clutch facings for automobiles valued at $350,779; brake linings and clutch facings, not otherwise provided for, $39,919; asbestos in any form other than crude and all manufactures not specifically designated $963,387.

Canada continues to be the principal asbestos producer. Other countries producing relatively large quantities are Russia, Rhodesia, Union of South Africa, Swaziland, the United States, and Cyprus. Small shipments 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 industry.

Uses; Prices

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 1945 remained the same as in 1944; 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.

BARITE

Production of barite in Canada, which in 1944 showed a fivefold gain over 1943, continued to rise in 1945. Sales by primary producers comprised crude ore and ground material. In contrast with the long period of virtual stagnation, production is now well established. Domestic needs are relatively small, but important export outlets have developed in the past few years in the United States, notably for use in oil-well drilling and in the manufacture of lithopone and of barium chemicals. Barite shortages in the United Kingdom, Belgium, and the Netherlands, have also recently occasioned interest regarding a Canadian supply, and this may lead to the establishment of outlets in Europe.

Principal Canadian Sources of Supply

Production continued to be confined to Nova Scotia, which supplied 77 per cent of the total, and to British Columbia, in both of which provinces increases were recorded.

In Nova Scotia, Canadian Industrial Minerals, Limited, the only producer in eastern Canada, continued to expand its important operation at Walton, Hants county, and reported slightly higher shipments than in 1944. Further prospecting by geophysical methods is reported to have indicated continuation of the orebody for 500 feet beyond the 600-foot length already disclosed by open-cut mining, thus confirming the results shown by drilling. Estimated reserves now stand at nearly 2,500,000 short tons, about 30 per cent of which may require beneficiation to bring up to shipping grade. Open quarry operation was continued throughout 1945, and the pit level was carried to 80 feet below surface, but it is planned to commence underground mining in 1946. With this in view, a shaft was sunk to a depth of 40 feet and collared before the close of the year, and provision was being made to bring in electric power. Preparations were being made to improve the efficiency of the washing plant, and this is expected to result in saving considerable fine barite that has been going to waste. Tests by the Bureau of Mines, Ottawa, have shown that a substantial recovery of such fine barite in the form of a 95 per cent, or better, concentrate can be made by screening, washing, and tabling, thus reducing present tailing losses by about one-third.

Maritime Exploration, Limited, Halifax, did some drilling on a barite prospect near Brookfield, Colchester county, but apparently there was insufficient ore to warrant development.

In Ontario, Woodhall Mines, Limited did no further work on the old Premier Langmuir property on Nighthawk River, Langmuir township, which it leased in 1944 from Canada Baryte Mines. The Woodhall Company plans to resume operation in 1946.

In British Columbia, R. A. Thrall, Morris Bldg., Lethbridge, Alberta, who had been shipping crude barite for several years from a deposit near Parson, 25 miles south of Golden, incorporated his business in the name of Mountain Minerals, Limited. Seventy per cent of the production from British Columbia came from the Parson property and 30 per cent from a new deposit that the company opened near Brisco in the Windermere valley, about 25 miles south of Parson.

Tests by the Bureau of Mines, Ottawa, on the fluorite-barite-calcite ores of the Madoc area, Ontario, and of the Lake Ainslie area, Nova Scotia, have indicated the possibility of recovering a marketable barite product from them by flotation, but no plans for treating these ores commercially have been made.

Production and Trade

According to figures supplied to the Bureau of Mines by producers, total production of barite in Canada in 1945 was 139,622 short tons valued at $1,270,-138, compared with 118,719 tons valued at $1,023,696 in 1944. Of the 1945 total, 77,525 tons valued at $408,610 was crude ore shipped by primary producers and 62,097 tons valued at $861,528 was ground material milled at the source. Nova Scotia supplied 108,434 tons, and British Columbia 31,188 tons. Of the Nova Scotia production, 46,337 tons was shipped as crude ore, and 62,097 tons as ground material. All of the crude and 98 per cent of the ground material was exported. All of the production from British Columbia was shipped as crude ore from the source. Most of it (28,503 tons) was consigned to Vancouver for use as permanent ballast in maintenance ships; 1,673 tons was shipped to Pulverized Products, Limited, Montreal, for grinding and sale to the domestic pigment and other trades; and 1,012 tons was ground at Summit Lime Works, Crow's Nest, B.C., for use in western glass works and in oil-well drilling.

Exports of barite (not shown separately in trade statistics), approximated 107,000 short tons, of which about 43 per cent was crude ore and 57 per cent ground material. Exports in 1944 totalled about 104,000 tons, of which 64 per cent was crude ore and 36 per cent ground material. The crude is consigned to the United States for use in the manufacture of lithopone and of barium chemicals, and most of the ground product goes to Trinidad, Venezuela, and Colombia for use in oil-well drilling.

Imports of ground barite, all from the United States, totalled 1,150 tons valued at $32,531, compared with 1,824 tons valued at $47,913 in 1944.

Consumption of ground and crushed barite in Canada in 1944 (figures for 1945 not available), as reported to the Dominion Bureau of Statistics by users, was 2,799 tons. This was distributed among the following trades: paint, 1,971 tons; rubber, 288 tons; glass, 294 tons; wallpaper, 20 tons; miscellaneous, 226 tons. Shipments from Canadian mines for domestic use in 1945 totalled 2,991 tons. This, plus imports of 1,150 tons, gives an apparent total consumption of 4,141 tons. This amount is exclusive of material sold for ballast and for oil-well drilling.

The world pre-war output was close to 1,000,000 tons annually, of which Germany supplied about 50 per cent and the United States, 30 per cent. The remainder came mainly from the United Kingdom, Italy, Greece, France, and India. Production in the United States in 1945 amounted to 690,152 tons, compared with 515,136 tons in 1944. Primary barite production in the United States comprises mainly crude lump and pebble ore, mined chiefly in Missouri and Georgia.

Uses; Specifications

See the Bureau of Mines review on barite for 1944 (Report No. 815).

Prices and Tariffs

The average unit price of domestic crude barite sold by primary producers in 1945 for use in the manufacture of lithopone, chemicals, fillers, pigments, and glass, was $7 to $7.35 per short ton f.o.b. mine. Crude lump sold for ballast purposes was valued at $3 per ton. Ground, off-colour barite exported for oil-well drilling use sold for $15.80 per ton f.o.b. Atlantic ports, and ground white for the pigment and filler trade averaged $33 per ton f.o.b. mill.

In the United States, Georgia crude was quoted at $8.50 to $9 per long ton, f.o.b. mines, and Missouri crude at $8.25 to $8.50. Missouri prime white, water-ground, floated and bleached, sold for $22.85 per ton, f.o.b. works.

In the American market, crude barite is usually sold on a penalty-premium basis, a content of 94 per cent $BaSO_4$ and less than 1 per cent iron (Fe_2O_3) being considered standard. A premium or penalty of 25 cents per ton is set for each per cent of barium sulphate above or below 94 per cent, and a similar premium or penalty for each 0·1 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. Canadian imports are free of duty under the British preferential tariff, and there is no duty on barite used in drilling mud, or in the manufacture thereof. Otherwise, imports from countries other than the United Kingdom are subject to a duty of 25 per cent.

Witherite

Witherite (natural barium carbonate) is the only other barium mineral of commerce. Commercial deposits are rare and most of the world supply is derived from England.

BENTONITE

The known deposits of bentonite in Canada are confined to the Prairie Provinces and British Columbia. Manitoba and Alberta have furnished most of the production. 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, has deposits of non-swelling material that is of value for bleaching purposes in the natural state and is amenable to activation. It is also suitable for foundry use.

Principal Canadian Sources of Supply

Most of the output came from the Morden area in Manitoba, 91 per cent of the crude clay shipped having been mined there. Production from the area is mostly shipped after drying to Pembina Mountain Clays, Limited, Winnipeg, for activation. This company added a grinding unit to its Morden plant for the production of foundry clay and of bleaching grades not requiring activation, and intends to erect a new activating plant to provide for greatly increased production.

In Alberta, the output came from the Drumheller area, which to the end of 1945 had supplied about 7,500 tons. The material was mined by Gordon L. Kidd, and by Aetna Coal Company, East Coulee. It was shipped to Alberta

Mud Company, 502 Lancaster Bldg., Calgary, and to Western Clay and Chemical Supply Company, 320 First Avenue West, Calgary, for processing and use in oil-well drilling in the Turner Valley field.

In British Columbia, there was no production of bentonite. Deposits occur at Princeton and near Merritt, and, prior to 1945, Francis Glover, 969 Jarvis Street, Vancouver, made occasional small shipments from deposits at Princeton, mostly to Vancouver for grinding and local use.

Production and Trade

Canada produced approximately 4,400 tons of crude bentonite in 1945, of which about 4,000 tons came from Manitoba and the remainder from Alberta. The value of products, including natural crude clay and activated material shipped by primary producers, was $171,780. These figures compare with 3,500 tons valued at $163,174 in 1944. Output from Manitoba to the end of 1945 amounted to 11,000 tons.

Imports (all from the United States) of activated clay in 1945 were valued at $347,823, compared with $366,719 in 1944. Considerable amounts of natural ground bentonite, mainly for foundry use, are also imported from the United States.

Canada used a total of about 16,200 tons of domestic and imported natural and activated bentonite in 1945, the industries being: bleaching of lubricating oils and gasoline, 55 per cent; foundries, 33 per cent; oil-well drilling, 9 per cent; miscellaneous, 3 per cent.

The United States produces and uses most of the world output and exports substantial amounts of ground natural clay and activated material. Its production in 1944 (1945 not available) reached a peak of 546,768 short tons valued at $3,605,988.

Production of highly colloidal (swelling) type bentonite comes mainly from Wyoming and South Dakota, and of the non-swelling type mainly from Mississippi and California.

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 of packing-house products; and to control the viscosity of oil-well drilling muds. These three uses accounted for 81 per cent of the 546,768 tons produced in the United States in 1944. 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.

Recent work by the Department of Chemistry, McGill University, Montreal, has shown that activated bentonite is an efficient catalyst for the de-alkylation in the vapour phase of a number of organic compounds derived from petroleum.

Prices

The price of bentonite varies within very wide limits, depending upon the nature of the material and the degree of processing it has been given. Alberta crude clay sold in 1945 for $4 to $4.50 per short ton, f.o.b. mines; the material processed for oil drilling use was priced at $35 per ton, bagged, f.o.b. plant. Activated bentonite for bleaching use cost $66 to $68 per ton in carload lots, delivered eastern Canadian points. The average consumer price for Wyoming standard 200-mesh bentonite in 1945 was about $8.20 per ton, bagged, in carload lots, f.o.b. plant. Special grades were quoted at $11 to $80.

BITUMINOUS SAND

Deposits of bituminous sand occur along the 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 subsequent to 1913 indicated that the bituminous sand in certain parts might be suitable for commercial development, but that a true value of individual areas could be determined only after detailed exploration by core-drilling equipment. 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. In 1942, 1943, and 1944, a total of 111 holes were drilled in the Wheeler Island area, the Steepbank River area, and the Horse River Reserve near Fort McMurray. Drilling was continued in 1945 under the supervision of engineers of the Mines and Geology Branch. As a result, 75 holes were drilled in the Steepbank River area, aggregating 17,738 feet, and 26 holes were drilled in the Muskeg River area, about 35 miles north of Fort McMurray, aggregating 3,172 feet.

Production

It has been estimated that approximately 50,000 tons of bituminous sand was mined for all purposes during the 30-year period prior to the end of 1944. Some of this material was for experimental work, but the greater part of it was treated to remove the bitumen, which in turn was processed into gasoline, diesel fuel oil, and residual fuel oils.

During 1945 about 14,800 tons of bituminous sand was mined, from which 10,950 barrels of bitumen was obtained. The bitumen was refined into gasoline, diesel oil, and residual fuel oil, and some asphalt was recovered. In June 1945, a fire in the separation plant of Abasand Oils, Limited, near Fort McMurray, destroyed the separation plant, the warehouse, and the machine shops. The company has indicated its intention to replace the burned structures as soon as possible.

Under an arrangement with Oil Sands, Limited, another separation plant is being erected under the auspices of the Alberta Provincial Government at Bitumont, about 50 miles down the Athabaska River from Fort McMurray.

CEMENT

In 1945, the last of the Canadian cement manufacturing plants was changed over from the dry to the wet process of manufacture, so that now the entire Canadian industry is using the same process, and remarkable uniformity in chemical and physical properties of the standard variety of cement is obtained throughout the Dominion.

In the latter half of 1945 a great deal of building repairs and construction that had been deferred during the war years was undertaken. This increased the demand for cement over and above that in the preceding year and a substantial gain in production was achieved. The quantities of cement imported and exported increased also. An increased demand for cement in 1946 is anticipated because of the large amount of heavy construction and road building in prospect.

Principal Canadian Sources of Supply

Raw materials for the making of cement, namely, limestone and clay, are widely distributed in Canada, and cement 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 white cement, however. is made from imported clinker.

Four companies constitute the Canadian cement industry. These are:

Canada Cement Company, Limited, which has manufacturing plants at Hull and Montreal East in Quebec; at Port Colborne and Belleville in Ontario; at Fort Whyte, Manitoba; and at Exshaw, Alberta. This company also operates grinding plants at Chatham, New Brunswick, and at Halifax, Nova Scotia, where cement is made from clinker brought from Montreal East.

St. Mary's Cement Company, Limited, which operates a plant at St. Mary's, Ontario.

Medusa Products Company of Canada, Limited, which has a grinding plant at Paris, Ontario, where white cement and cement paints are prepared from clinker imported from the United States.

British Columbia Cement Company, which operates a plant 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).

Production and Trade

Production of cement was 8,471,679 barrels valued at $14,246,480, compared with 7,190,851 barrels valued at $11,621,372 in 1944.

Exports of Portland cement increased to 281,944 barrels valued at $535,012 from 210,448 barrels valued at $377,434 in 1944. The greater part of the exports went to Newfoundland, Trinidad, and Jamaica.

Imports of Portland cement rose to 32,653 barrels valued at $141,539 from 14,000 barrels valued at $76,838 in 1944. All of these imports were from the United States. (In addition to the finished cement, 54,549 cwt. of white Portland cement clinker valued at $35,023 was imported from the United States for grinding in Canada, compared with 34,551 cwt. valued at $12,130 in 1944.)

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. The cement products industry, making building blocks, bricks, pipe, artificial stone, garden furniture, etc., uses cement as its principal raw material.

Prices

The average selling prices of cement per barrel f.o.b. plant in the several producing provinces during the period 1937 to 1945 were as follows:

	1937	1938	1939	1940	1941	1942	1943	1944	1945
Quebec	$1.37	$1.35	$1.35	$1.41	$1.43	$1.46	$1.44	$1.46	$1.54
Ontario	1.38	1.40	1.43	1.40	1.40	1.43	1.46	1.46	1.55
Manitoba	2.27	2.28	2.25	2.23	2.21	2.10	1.89	1.96	2.11
Alberta	1.99	2.01	1.97	2.01	2.00	1.96	1.94	1.96	2.01
British Columbia	1.81	1.87	1.91	1.94	1.97	2.07	2.14	2.12	2.12

CLAY AND CLAY PRODUCTS

(Such ceramic products as glass, cement, and artificial abrasives are not included in this review; but vitreous enamelling is included.)

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.

During the war some plants were forced to shut down or to curtail their production on account of the serious labour and material shortages, but all the ceramic industries towards the end of 1945 were embarked on a large reconstruction program. Many of the smaller plants probably will not reopen, owing to the lack of capital and the rapid rate of deterioration of existing equipment such as kilns and clay machines.

Modernization of the clay industry, with more attention to quality control, technical knowledge of raw materials, modern methods, standardization, and sales promotion is an expected development during the reconstruction period.

The ceramic products manufactured from Canadian clays, including the sales of domestic clays, were valued at $8,305,295 in 1945, compared with $6,997,425 in 1944, and with the peak value of approximately $14,000,000 in 1929. Ceramic imports reached a value of $10,891,847 in 1945, and exports a value of $627,248. The imports consisted principally of china clay, firebrick, china tableware, porcelain, and earthenware.

Common Clays

The largest production of building brick and tile is centred in southern Ontario. This is due to the proximity of markets. Common clays suitable for the production of building brick and tile are found in all the provinces of Canada. There are ninety-eight brick and tile plants in Canada which are in production or plan to operate in the near future. The capacities of these plants range from 600 tons to 125,000 tons a year.

Of interest is the purchase of a brick manufacturing plant near Estevan, Saskatchewan, by the Provincial Government, called the Saskatchewan Clay Production Corporation.

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.

Stoneware articles (sewer pipe, pottery, etc.) are manufactured in thirty-eight plants, including eight plants that manufacture sewer pipe. Included are a number of small operators engaged in the manufacture of pottery.

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 "Whitemud" beds in the southern part of the province.

Some of the refractory clays from Shubenacadie are mined and used by the steel plant at Sydney, Nova Scotia.

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, but operations are at a standstill. Other deposits in Quebec are at Thirtyonemile Lake, near Point Comfort, Hull county; near Brébeuf; at Lake Labelle; and at Chateau

Richer; but are not being developed to any appreciable extent. Efforts to develop deposits on the Mattagami, Abitibi, and Missinaibi Rivers in northern Ontario have been handicapped owing to the distance of the deposits from industrial centres, and railways.

China clay and ball clay from England or the United States is used in the manufacture of porcelain, sanitary ware, dinner ware, ceramic floor and wall tile, etc.

Vitreous Enamelling

About thirty plants are engaged in the Canadian production of vitreous enamelled products. These plants are located in eastern Canada and produce refrigerators, stoves, ranges, furnaces, washing machines, signs, etc. The Ferro Enamels (Canada), Limited, Ottawa, is the leading supplier of porcelain enamel frits used by the manufacturers to cover metal sheets and casings, and of pottery glaze frits.

CORUNDUM

The Canadian corundum industry had been dormant since 1921, the activity during 1944 and 1945 being the result of circumstances arising from the war. Owing to the difficulty of obtaining 'flour' corundum used for polishing high precision lenses for military optical instruments from the Transvaal, in South Africa, the only source of supply, Wartime Metals Corporation (a Crown company) erected a 200-ton gravity mill to treat tailing at the Craigmont property, Renfrew county, Ontario. This project was undertaken at the request of the United States Government, and shipments of concentrate to American Abrasive Company's plant at Westfield, Mass., for grinding and for the preparation of fine powders were started in the autumn of 1944. Shipments have been maintained steadily at the rate of nearly 110 tons monthly. By the end of 1945 a total of 75,000 tons of tailing had been treated and it was estimated that the treatment of the remaining 50,000 tons would be completed by September 1946. The tailing has a corundum content of about 3 per cent. Since November 1945, the Craigmont operations have been handled by the Department of Reconstruction and Supply, Ottawa.

In March 1946, U. S. Conservation Order M. 89, covering corundum, was revoked and supplies of all corundum products can be obtained without difficulty. Under these circumstances, when the treatment of Craigmont tailing is completed, it is likely that Canadian corundum operations will again be dormant for an indefinite period.

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).

Principal Canadian Sources of Supply; 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 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. The corundum content of a deposit in the French River area northeast of Georgian Bay is much below commercial grade.

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 19,000 tons of concentrate valued at $2,024,000 was shipped. A total of about 26,000 tons of mill tailing was re-treated during 1920 and 1921, from which 600 tons of concentrate valued at $80,500 was shipped.

Production and Trade

During 1945, nearly 65,000 tons of tailings was treated and 1,317 tons of concentrate averaging 66·5 per cent corundum having a nominal value of $130,393 was shipped to Westfield, Massachusetts, for conversion into flour grades. No crude ore has been treated and mining is not contemplated.

Canada imports only small quantities of corundum. The imports include 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 production in 1945 was about 5,144 tons, a 32 per cent increase over that of 1944. The output is exported, mainly to the United States.

Uses

Prior to the war, corundum was used chiefly for the abrasive grit in grinding wheels required for special types of work. In the United States, which is by far the leading consumer, a start was made shortly after the end of the war to revert to the use of corundum for the manufacture of precision grinding wheels. Most of it is used, however, as flour for the polishing of lenses, and the coarse grain for snagging wheels.

The price of Canadian concentrate is nominal and is Government-controlled at about $100 per ton. The prices of corundum and other ores imported into the United States were frozen as of August 20, 1943. South African 'crystal' corundum was $107 and 'boulder' was $74 per short ton delivered to the Westfield plant. U.S. prices of prepared grain and flour corundum vary considerably according to mesh size. These prices are 8¾ cents per pound for 8 to 60 mesh and 9¾ cents for 70 to 275 mesh; flours range from 30 cents for 850 mesh to 70 cents for 2600 mesh.

DIATOMITE

Owing to the new use of diatomite as a fertilizer dusting agent, a record was set in the Canadian consumption in 1945, and both in 1944 and in 1945 the amount used was more than double that of 1943. Almost all the Canadian requirements are imported, as present production is insignificant. Tests, which were started in 1944 to determine the suitability of Canadian material for this new use, are continuing.

Diatomite consists of the microscopically small remains of siliceous shells of diatoms, a form of algæ 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.

Principal Canadian Sources of Supply; Occurrences

There are more than 400 known deposits of diatomite in Canada. They 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 parts of 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 are 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 the aforementioned areas, the two present 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.

The Nova Scotia Department of Mines is investigating and testing the Nova Scotia deposits. The Resources Development Board, Fredericton, is investigating the southern New Brunswick diatomite deposits in the vicinity of Saint John, and material has been submitted to fertilizer manufacturing plants for testing.

Production and Trade

Production in 1945 was 50 tons; and sales 46 tons, valued at $1,248. This does not include a carlot of Quesnel, B.C., diatomite that was shipped for fertilizer testing, and also some from New Brunswick for the same purpose. In 1944, sales were 13 tons valued at $437.

Imports were 13,217 tons valued at $362,882, all of which came from the United States. The imports included about 200 tons of diatomite brick. In 1944, imports were 11,664 tons valued at $335,939.

Consumption in Canada was approximately 13,260 tons, of which about 7,800 tons was used as a fertilizer dusting agent.

Prior to the war, diatomite was produced in about thirty countries. The United States, with about twenty operators, is by far the largest producer, its estimated output in 1945 being about 180,000 tons. Of interest is the recent formation of Great Lakes Carbon Corporation as a trading company for Dicalite Company. The latter company is the second largest diatomite producer and has been operating deposits at Walteria, California, and at Terrebonne, Oregon. This corporation (Dicalite Division) has also acquired the properties at Basalt, Nevada, and at Kittitas, Washington, and now has four diatomite properties operating in four States. Most of the material being used by Canadian fertilizer manufacturers comes from the Kittitas deposit.

Diatomite production in Ireland, England, and Australia has increased appreciably in the past few years. The fresh water deposits in Canada are similar to those in Germany, and it is of interest to mention that the German crude peaty material is burnt in long open-sheds by self-calcination, the heat from which dries wet lumps placed on shelves inside the roof and above the burning heaps. German production was between 20,000 and 50,000 tons annually.

Uses; Specifications

Prior to 1944, 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. In 1945, however, only about 32 per cent was so used, and about 60 per cent was consumed as a dusting agent in ammonium nitrate fertilizers that are made 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 the nitrate 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 as a filler in the paint, chemical, paper, rubber, soap, and textile industries; also in silver polish bases, and as an admixture in concrete. A small amount of lime-diatomite insulation bricks is made by one company in Toronto, which uses some of the Nova Scotia material.

During the war one of the chief uses of diatomite was in pressure filters for the filtration of portable water, mainly for use in the Pacific. This use is now being applied in industrial plants and the diatomite is superior to sand filters for the removal of disease-producing organisms. It was used also in the war for blocks and pipe insulation in combination with asbestos in the naval construction program; in fireproof structural sheets for minimizing fire hazards on warships; and in paints for army equipment.

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 the success of the tests being made on the diatomites from Quesnel, British Columbia, Digby, Nova Scotia, and Saint John, New Brunswick. Preliminary reports on the Quesnel material by one fertilizer company are quite encouraging. Production of ammonium nitrate fertilizer is expected to continue increasing, as much of it is exported to Europe.

Prices

The price of diatomite used in Canada for insulation varies from $23 to $40 a ton; for filtration from $26 to $75 a ton; for fertilizer grades, $28 to $42 a 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.

FELDSPAR

All of the feldspar mined in Canada in 1945 came from Quebec and Ontario. Total production increased about 19 per cent over 1944. Quebec continued to increase its lead, with 88 per cent of the total, compared with 76 per cent in 1944. There were no important new developments in the industry, and the bulk of the output continued to come from established mines.

Principal Canadian Sources of Supply

Throughout the life of the feldspar industry, mining has centred in adjacent sections of western Quebec and eastern Ontario, the general Ottawa region being the source of most of the production. Manitoba produced a few thousand tons between 1933 and 1939, but has reported no further shipments since. In 1945, most of the output came from seven major producing properties, five of which are in Quebec, and two in Ontario.

In Quebec, most of the production came from four mines operated by Canadian Flint and Spar Company in Derry, Buckingham, West Portland, and Templeton townships in Papineau county. The company commenced to ship from its newly acquired Hart property west of Lièvre River, on which active development is proceeding. The only other important producer was United Mining Industries, Limited, which worked two mines in Buckingham township. The company worked mainly on its new McClement property east of the town of Buckingham, to which most of its equipment was moved. Both companies shipped a small tonnage of dental spar in addition to their regular ceramic grade.

In Ontario, most of the output came from operations of Bathurst Feldspar Mines in Bathurst township, Lanark county, and from Canspar Mines, Limited, in Dickens township, Nipissing district. Early in the year, the latter company moved its site of operations from its former property near Madawaska, in Murchison township, to a new location on the west side of Aylen Lake in Dickens township. Small shipments were also reported from the Bancroft area, Hastings county, and from a reopened old property in Conger township, Parry Sound district.

Production and Trade

Production of feldspar in 1945 totalled 30,246 tons valued at $282,656, compared with 23,509 tons valued at $227,632 in 1944. Of the total in 1945, Quebec supplied 26,389 tons, and Ontario 3,857 tons, compared with 17,842 tons and 5,667 tons, respectively, in 1944.

Exports, comprising mainly ceramic grades of crude, but including also a small amount of ground feldspar and high-value dental crude, totalled 16,888 short tons valued at $125,028, compared with 13,081 tons valued at $102,918 in 1944. The quantity was 60 per cent of the total reported production for 1945. Most of the material was consigned to grinding plants in the United States, where the chief importers were Consolidated Feldspar Corporation, and Genesee Feldspar Company, in Rochester, N.Y., and Shenango Pottery Company, Newcastle, Pa.

Imports of ground feldspar, all from the United States, were 826 tons valued at $15,052, compared with 546 tons valued at $10,658 in 1944. The material included spar for pottery use and for the manufacture of cleansers.

As reported by the Dominion Bureau of Statistics, consumption of feldspar in Canada in 1945 totalled 12,994 short tons, compared with 11,173 tons in 1944. Distribution by industries was as follows: cleansers, 4,847 tons; glass, 2,740 tons; enamelling, 2,684 tons; pottery products, 2,347 tons; abrasives, 60 tons; miscellaneous, 266 tons. Enamelling use showed the largest increase, the amount being nearly double that used in 1944. Quebec used about 53 per cent of the total consumption, Ontario, 45 per cent, and Alberta, 3 per cent.

Feldspar for domestic use was ground in mills operated by Canadian Flint and Spar Company, Buckingham, Quebec, and by Bon Ami, Limited, 13719 Notre Dame Street East, Montreal. The former company produces ground spar for ceramic and cleanser use; and Bon Ami Company's product is used only in cleanser compounds of its own manufacture. Frontenac Floor and Wall Tile Company's mill at Kingston, Ontario, was in operation for only a short period in 1945.

World production of feldspar in 1937, the latest year for which complete statistics are available, totalled about 500,000 tons, of which the United States supplied over 50 per cent. Canada was in fifth position, being exceeded by Sweden, Norway, and Czechoslovakia. In 1944, production of crude spar in the United States had risen to a record of 327,408 long tons, and ground feldspar sales established a record of 343,201 short tons. The leading producing states were North Carolina, which furnished 38 per cent of the total crude sold, South Dakota, New Hampshire, Virginia, Wyoming, Colorado, and Connecticut. The production in 1945 is estimated at about 350,000 tons.

Canadian production has always greatly exceeded domestic consumption, leaving a considerable surplus for export. Canadian spar has a high reputation for quality with the pottery trade in the United States, and American grinding mills are generally ready to take all the crude that is offered. This market currently shows signs of expansion, owing to the progressive depletion of reserves in the eastern and southern States; and, with the anticipated increased demand in the reconstruction period, Canadian producers should have no difficulty in disposing of much larger tonnages.

Uses; Specifications

All of the feldspar used in industry is ground material which is usually prepared either in mills run in conjunction with mining operations, or in merchant mills that obtain their supplies 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—98 per cent in the United States in 1944—is for pottery, glass, enamelware, and other ceramic uses. 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. Small tonnages of specially selected crude ("dental spar") are used in the manufacture of artificial teeth, and such material commands a large premium.

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, all of the feldspar supplied to grinding mills consisted of crude lump produced by picking and cobbing methods. As a result of threatened shortages in the Eastern United States, attention in that country has been given in the past few years to the milling and concentrating of sub-grade rock to fill grinders' requirements.

Prices and Tariffs

Prices of Canadian crude feldspar of ceramic grade in 1945 ranged from $6.50 to $7.50 a ton, according to quality, f.o.b. rail, for export or shipment to domestic mills. Selected crude dental spar sold for $48.50 a ton, f.o.b., in carload lots for United States delivery, but the declared unit value of small-tonnage lots, bagged, for export to Mediterranean countries ranged as high as $110 a ton. Domestic ground spar was quoted at $12.50 a ton for granular glass grade, $16.50 to $20 for 200-mesh pottery grade, 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.

FLUORSPAR

Canada depends largely upon imports to meet the needs of industry for fluorspar. Since 1929, virtually all of the Canadian production has come from the Madoc area in Hastings county, Ontario, and there has been a small production from the Lake Ainslie area in Nova Scotia.

There were no noteworthy changes in the industry in 1945. Practically all of the production came from the Madoc area, and shipments from the area continued at substantially the same level as in 1944. The Dominion Government, through the Mines and Geology Branch, Department of Mines and Resources, continued the general supervision of operations in the Madoc field as an aid to producers in maintaining output. This program, which included also diamond drilling, loans against production, and other forms of assistance, was initiated in 1942, and 86 per cent of the total reported shipments to the end of 1945 came from operators so assisted.

Canadian Sources of Production

In 1945, four mines were in active production in the Madoc area, namely: the Bailey (Millwood Fluorspar Mines, Limited); Rogers (Reliance Fluorspar Mining Syndicate); Blakeley (Charles Stoklosar); and Lee Junior (Bassett Fluorspar Mines, Limited). The first two accounted for 90 per cent of the total shipments of 7,400 tons. Millwood Fluorspar Mines proceeded actively with development on the Bailey property, which adjoins the Keene mine that was formerly worked by the same company and was closed in the latter part of 1944. Total fluorspar shipments from the Madoc field in the four-year period 1942-1945 amounted to 28,812 tons.

Most of the mine shipments from the Madoc field 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 customarily has ranged from 60 to 65 per cent CaF_2, calcite and barite being the chief impurities. No commercial beneficiation of Madoc fluorspar has ever been practised. During 1945, milling tests were continued in the laboratories of the Bureau of Mines, Ottawa, on trial shipments of Madoc ore in an effort to reduce the objectionably high barite content. Similar work on fluorspar ores from the Lake Ainslie district having the same general characteristics showed that, by blending ore which did not prove amenable to concentration with that from another property, satisfactory recovery of fluorspar and barite in the form of marketable products can be made.

Fluorspar, associated with calcite and apatite, occurs as the filling of veins and pockets in pegmatite bodies in the Wilberforce-Harcourt district, about 50 miles north of Madoc, where some surface work and diamond drilling was done on several properties in 1943. Tops Mining Syndicate, the only operator in 1945, did a little more work on its holdings near Harcourt, but made no shipments.

Dominion Magnesium, Limited opened a few shallow pits and also did some diamond drilling on several of the showings near Cobden in Ross township, Renfrew county, to determine whether the deposits might serve to supply the fluorspar requirements of the company's magnesium plant at nearby Haley. Concentration tests are reported to have yielded a product of 95 per cent grade.

No further work was done in 1945 on the fluorspar deposits near Sand Creek, Pontiac county, Quebec. In 1944, Twin Valley Prospecting Syndicate, Ottawa, shipped about 20 tons of clean, picked spar from the deposits to Dominion Magnesium, Limited. The grade is reported to have run 92 to 98 per cent CaF_2.

There was no reported production of fluorspar in Nova Scotia in 1945. Shipments totalling nearly 1,500 tons were made from two properties in the Lake Ainslie district, between 1941 and 1943. The material was considerably below metallurgical grade, and further development will probably depend upon treatment of the ores to produce fluorspar and barite concentrates.

In British Columbia, there has been no production of fluorspar since 1929. Output came from the Rock Candy mine of Consolidated Mining and Smelting Company, near Grand Forks, from which 42,000 tons of concentrate was produced between 1919 and 1929.

Production and Trade

Canada produced 7,369 short tons of fluorspar valued at $233,708 in 1945, compared with 6,924 tons valued at $217,701 in 1944. It imported 20,512 tons valued at $530,670, compared with 37,101 tons valued at $840,309 in 1944. Sixty-five per cent of the 1945 imports came from Newfoundland and was consigned to Arvida, Quebec, for use in the production of aluminium; 26 per cent was obtained from Mexico; and 9 per cent from the United States. Mexican material (average unit value $26 per ton) is assumed to have been all metallurgical grade spar; and that from the United States (average unit value $30.50) probably included substantial amounts of acid and ceramic grades, neither of which is produced in Canada.

Consumption of fluorspar in Canada in 1945 is estimated at 36,840 short tons, compared with 57,632 tons in 1944 and with a peak of 64,922 tons in 1943. Fifty-two per cent of the total in 1945 was used in the steel trade; 35 per cent by smelters of non-ferrous metals; and 10 per cent in the heavy chemicals industry. The remainder was used in enamels and glazes, ferro-alloys, white metal alloys, glass, etc. Ontario was the largest consumer (43 per cent), and was followed by Quebec (36 per cent), and Nova Scotia (20 per cent).

Consumption of fluorspar in the United States in 1945 totalled 356,925 short tons, of which 56 per cent was used in the steel trade, 31 per cent in the manufacture of acid, and 9 per cent in the glass industry.

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. Military requirements occasioned a large increase in American production during the war, and mine shipments reached a record of 413,781 short tons in 1944, well over double the 1939 figure. Production in the United States in 1945 declined to 324,260 tons. The United States Government stockpile objective of 200,000 short tons of fluorspar was fully reached in 1945.

Uses; Specifications

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. Fluorspar is used in small amounts in numerous other metallurgical industries.

The next largest use is in the manufacture of hydrofluoric acid, which is used mainly in making artificial cryolite and aluminium fluoride for the aluminium industry. Third in importance is the use of fluorspar as a fluxing and opacifying ingredient in glass and enamels. Of interest also is the use of the fluorine compound, uranium hexafluoride, for the gaseous diffusion separation of the uranium isotopes U235 and U238 in the development of atomic energy.

Standard fluxing gravel or lump grade for metallurgical use is usually sold on a specification of a minimum of 85 per cent CaF_2, and not over 5 per cent silica or 0·3 per cent sulphur. Fines should not exceed 15 per cent. Canadian shipments have been much below this 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 2·5 to 3 per cent SiO_2 and 0·12 per cent Fe_2O_3. The material must be 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. It must be in powder form. Most of the material supplied to the acid and ceramic trades is a flotation concentrate.

Prices

Canadian trade journal quotations for metallurgical gravel, 85 per cent grade, fluorspar in 1945 were $40 per ton, f.o.b. Toronto, and for ground, 97 per cent grade, $66 to $69.

In the United States, under an OPA ruling of August 1943, the maximum price for metallurgical grade spar f.o.b. at consumer's plant was based on the effective CaF_2 content plus either, (a) rail freight from shipping point to consumer's plant, or (b) rail freight from Rosiclare, Illinois, to such plant, whichever is the lower. The base price was set as follows: 70 per cent effective units, $33 per short ton; 65 to 70 per cent, $32; 60 to 65 per cent, $31; under 60 per cent, $30. "Effective units" are computed as the CaF_2 content less $2\frac{1}{2}$ times the percentage of contained silica. This price ruling remained in effect throughout 1945.

Effective April 1, 1944, export permit requirements on fluorspar shipments were lifted on material consigned to the United States and to any part of the British Empire.

Tariff

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. Fluorspar enters Canada duty free.

GRANITE

(*Building, Ornamental, and Crushed*)

Large areas in Canada are underlain by granite and other related crystalline igneous rocks, and in a number of localities quarries in such rocks have been opened up for the production of building stone, monumental stock, riprap, etc. More than 90 per cent of the Canadian output of granite in 1945 was supplied by Quebec and Ontario, and the remainder came from Nova Scotia, New Brunswick, Manitoba, and British Columbia.

Prior to the war most of the Canadian production of granite was used for riprap and crushed stone and in the construction of public and semi-public buildings, and smaller quantities for monumental stock; but during the war there was little demand for dimensioned stone for building, so that many of the quarries producing only this type of stone were forced to close. There was sufficient demand, however, for monumental stock for the domestic market and for export to enable a number of the firms to keep their dressing sheds in operation on a small scale, and some of the larger quarries favourably situated were able to supply any demand for riprap that arose. With the prospects of extensive building construction, these companies can turn again to the production of building stone with little loss of time.

Many of the Canadian granites are suitable for monumental use, and prior to the war much of this material was used within a limited radius of the various quarries; but appreciable quantities of special monumental stock such as the 'reds' and 'black granites' were imported from the Scandinavian countries, notably Finland and Sweden. When shipments were cut off, Canada and the United States had to depend upon their own quarries. In Canada a number of quarries produce granite of pleasing characteristics for monumental use and in the past few years there has been a small but steady increase in the domestic demand for such stone. Moreover, numerous requests from the United States for samples have been received by Canadian firms, and exports to that country have shown an appreciable increase.

Principal Canadian Sources of Supply

Quebec continued to furnish most of the granite used for building, road foundation, and other heavy construction, the leading producing areas being Stanstead, Stanstead county; St. Samuel, Frontenac county; Rivière-à-Pierre, Portneuf county; and Lake St. John district. Granite for monumental use is produced in the Maritime Provinces, and in Quebec, Ontario, Manitoba, and British Columbia. 'Black granite' is produced mainly in the vicinity of Lake St. John and from quarries along the north shore of Lake Superior. Other deposits of 'black granite' in the Maritime Provinces, Quebec, Ontario, and Manitoba show promise of yielding stone of good quality.

In Nova Scotia and New Brunswick, the industry was again comparatively quiet. Production in Nova Scotia came from well established firms in the Shelburne and Nictaux West areas and most of the material was monumental stock. In New Brunswick, the granite quarry at Hampstead was in production, and two firms at St. George produced for the monumental trade. A few tons of 'black granite' was produced from the quarry at Lake Digdequash.

In Quebec, grey granite comprises over half of the total output of the province and is quarried mainly in the Stanstead district. At St. Gédéon and at St. Joseph d'Alma in the Lake St. John district, Le Granit National Ltée. produces 'black granite' which finds a ready market for monumental use and for building trim. Brodies, Limited, Montreal, has its new cutting shed, erected to replace the shed destroyed by fire, in full operation. The company obtains its granite from Graniteville, Stanstead county; from Guenette, Labelle county; and from Mount Johnson near Iberville. Stanstead Granite Quarries Company, of Beebe, obtained its grey granite stock from quarries at Graniteville; its rough monumental stock was purchased from various other localities. Prospecting for some of the coloured granites that are in demand for monumental use was active in the province. Granite of deep red colour and pleasing texture is being developed in several districts, notably near Grenville, in Grenville county, and in the vicinity of Donnacona, Portneuf county.

In Ontario, the Ontario Rock Company, Toronto, quarried a trap rock at Havelock, Peterborough county, which is used mainly for road foundations, railroad ballast, and concrete aggregate.

In Manitoba and British Columbia, there were no new developments of special importance.

Production and Trade

Canada produced an estimated total of 220,500 tons of granite valued at $1,158,800 in 1945, compared with 269,964 tons valued at $1,303,790 in 1944.

Exports of granite and marble (granite is not recorded separately) unwrought, in 1945, was 3,835 tons valued at $46,606, compared with 3,871 tons valued at $42,567 in 1944. The export possibilities of monumental stock are worthy of careful study by Canadian producers especially for the black and red varieties, and in view of the aforementioned interest being shown by American consumers. Many Canadian granites are suitable for all the purposes for which granite is used.

Imports of granite in 1945 were valued at $75,783, compared with $78,920 in 1944. Small amounts of granite were imported from the United States, mainly for monumental use.

GRAPHITE

Production of graphite in Canada in 1945, as for many years past, was confined to the Black Donald mine near Calabogie, Renfrew county, Ontario, which produces a variety of grades of mill products for different industrial uses. Shipments were about the same as in 1944.

Supply of flake and crystalline grades continued the improvement shown in 1944. In November 1944, the United States War Production Board Order controlling the allocation of graphite was amended to remove crucible graphite from the strategic class, leaving only Ceylon amorphous grade of 95 per cent carbon content on the restricted list. In view of the favourable stock position of Madagascar flake, this quality was restored to open purchase at the end of March 1945.

Principal Canadian Sources of Supply

Flake graphite is widely distributed in many parts of the Canadian Shield, chiefly in gneisses and crystalline limestone. Production has been confined to adjacent sections of western Quebec and eastern Ontario, in the general Ottawa region, where about 12 mines and mills were operated at various times in the early years of the industry. Occurrences of flake graphite in Manitoba and British Columbia have attracted little interest as yet. Bodies of amorphous graphite occur near Saint John, New Brunswick, and were worked on a small scale many years ago.

Frobisher Exploration Company took over the Black Donald property in 1943 and has since been operating it under the name of Black Donald Graphite, Limited. Most of the production in recent years has come from the re-treatment of old mill tailings pumped from the lake alongside the workings. This procedure was continued in 1945, though ore obtained by robbing old pillars in the No. 2 shaft and salvaged from surface dumps was also put through the mill. Dewatering of the No. 3 or Ross shaft was started during the summer. The shaft was re-collared and a station was cut 290 feet from the surface. Lateral work on this level was planned early in 1946 to tap the new orebody indicated by drilling. Changes in milling procedure effected a considerably improved recovery of flake. Estimated reserves at the end of 1945 comprised 8,000 tons of old tailings and 35,000 tons of ore.

Production and Trade

According to figures supplied to the Bureau of Mines, Ottawa, sales of finished products by Black Donald Graphite, Limited in 1945 totalled 1,910 short tons valued at $179,001, compared with 1,582 tons valued at $171,166 in 1944. Sixty-seven per cent was exported, and 33 per cent was sold in Canada. A total of 3,963 tons of tailings with an average carbon content of 22·5 per cent was treated, and 2,850 tons of ore with an average carbon content of 15·5 per cent was milled. Mill recovery of raw graphite was 1,319 tons.

Exports of milled and finished concentrates were 1,142 tons valued at $124,295, compared with 576 tons valued at $87,774 in 1944. Ninety-seven per cent of the material was shipped to the United States.

Imports of unmanufactured graphite were valued at $66,869, compared with $48,095 in 1944. Eighty-three per cent of the total imported in 1945 was Mexican amorphous, the remainder being from the United States. Manufactures of graphite imported, exclusive of crucibles, were valued at $277,242, of which 94 per cent came from the United States; similar imports in 1944 had a value of $261,205. Imports of graphite crucibles were valued at $115,256, compared with $128,738 in 1944; 58 per cent, by value, came from the United States, and 42 per cent from the United Kingdom.

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.

Canada and the United States 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, upon imports of flake from Madagascar, and of plumbago from Ceylon. Production of all types and grades of natural graphite in the United States in 1944 totalled 5,408 short tons, compared with 9,939 tons in 1943. Production in 1945 is reported to have shown a further considerable drop. Texas and Alabama have furnished most of the recent supply.

Uses; Specifications

Graphite has many uses 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. Black Donald flake is too small for crucible use, and finished products consist mainly of amorphous foundry grades, but include also a proportion of high-grade flake and dust sold for use in lubricants, packings, and polishes. Prepared facings for the domestic foundry trade are made also.

Canadian graphite requirements are principally for the foundry, dry battery, packings, lubricants, and paint trades. Foundry needs are met in part by domestic 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 chiefly in foundry facings, lubricants, and pencils.

Of interest is the recent announcement that considerable quantities of specially refined graphite are being used in the construction of the so-called "atomic piles" for the production of atomic energy. In these piles, the graphite serves as a moderator to promote the capture of neutrons released by nuclear fission of uranium, which, in the form of slugs or rods, is inserted as a lattice within a large mass of graphite blocks. Additional amounts of graphite are used as a shield surrounding the piles and serve to reflect escaping neutrons back into the latter.

Prices; Tariffs

Prices of domestic flake graphite in the United States in 1945 ranged from 14 cents per pound for best crucible grade down to 5 cents per pound for the lowest (No. 4) grade. Crude Ceylon lump, chip, and dust ranged from 15 cents to 5 cents per pound, according to carbon content. Madagascar crucible flake, under allocation control during the first quarter of the year, remained at 10 to 11 cents per pound. Mexican amorphous continued to sell at $20 per ton, f.o.b. Sonora, for crude lump, and 4 to 6 cents per pound for powdered.

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), 7½ per cent ad valorem; general, 10 per cent; on ground and manufactures of, including foundry facings, but not crucibles, British, 15 per cent; intermediate, 22½ per cent; general, 25 per cent. Graphite crucibles enter Canada free under the British preferential tariff; under other tariffs the duty is 15 per cent ad valorem.

GYPSUM

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. Gypsum is found in every province with the exception of Prince Edward Island. The crude rock, crushed to a size convenient for handling, is produced mainly for export, and the processed material for domestic sale.

Prior to the war an average of about 80 per cent of the total Canadian production of gypsum was exported. This percentage dropped rapidly during the war due to lack of shipping, and in 1943 exports amounted to only 43 per cent, the lowest recorded. It increased to 58 per cent in 1945.

Associated with many of the Canadian gypsum deposits are extensive beds of anhydrite, the anhydrous calcium sulphate ($CaSO_4$), that are favourably situated for commercial development, and the material from which has been proved by the Bureau of Mines, Ottawa, to be of excellent grade. In the past a small annual tonnage of this material was exported to the United States for use as a fertilizer for the peanut crop. There was no recorded production in 1945 for this purpose.

Principal Canadian Sources of Supply

In Nova Scotia, most of the material quarried is being shipped by boat in the crude state to the ports on the north Atlantic seaboard of the United States. Prior to the war an appreciable tonnage was also shipped to the United Kingdom, and when shipping is again available this trade will probably be resumed. Canadian Gypsum Company, Limited, operating at Wentworth, Hants county, about 2 miles from Windsor, is the largest producer. 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 intends to build a storage plant and shipping pier at Hantsport, which will enable the loading of large steamers practically throughout the year. National Gypsum (Canada) Company continued its operations at Dingwall and Walton and enlarged its plant and other facilities at Dingwall for a much greater production. Windsor Plaster Company quarried rock for use in its calcining mill at Windsor. Connecticut Adamant Plaster Company mined and shipped crude gypsum to the United States. Victoria Gypsum Company at Little Narrows, and Gypsum, Lime and Alabastine, Canada, Limited, at Baddeck, were idle.

In New Brunswick, Canadian Gypsum Company at Hillsborough produced all grades of plaster and wallboards for the markets of eastern Canada.

In Quebec, Gypsum, Lime and Alabastine, Canada, Limited expects to increase the gypsum board capacity of its plant in Montreal by 20 to 25 per cent by the addition of a new boiler unit in 1945.

In Ontario, Gypsum, Lime and Alabastine, Canada, Limited, with quarries at Caledonia, and Canadian Gypsum Company, Limited, with quarries at Hagersville, both in Haldimand county, manufacture all grades of plaster and plaster products for markets in Ontario and Quebec. Canadian Gypsum Company, in Toronto, plans to start construction of a new and modern plant with increased capacity early in 1946 to replace the plant destroyed by fire early in 1945. The extensive deposits of gypsum in northern Ontario have not been developed.

In Manitoba, Gypsum, Lime and Alabastine, Canada, Limited and Western Gypsum Products, Limited operated their quarries at Gypsumville and Amaranth, respectively, and their plant at Winnipeg throughout the year.

Western Gypsum Products, Limited had a new gypsum plant under construction in Calgary, for the manufacture of various types of wallboard, sheeting, building tile, plasters, etc., from gypsum rock obtained from Mayook in the Cranbrook district in British Columbia.

In British Columbia, Gypsum, Lime and Alabastine, Canada, Limited continued production from its deposits at Falkland to supply its plants at Port Mann, near New Westminster, and at Calgary. When in full production the plant at Port Mann, which replaces the plant destroyed by fire in 1944, will help ease the shortages of building material. The new plant has a much greater capacity than the one it replaces. It will handle the requirements of the British Columbia markets and will be able to export to markets served through Pacific ports. Several other deposits are known to occur in British Columbia. Efforts to find an outlet for the large tonnage of by-product gypsum obtained from the production of phosphate fertilizers at the plant of The Consolidated Mining and Smelting Company of Canada, Limited, at Tadanac are being continued.

Production and Trade

Canada produced 839,781 tons of gypsum valued at $1,783,290 in 1945, compared with 596,164 tons valued at $1,511,978 in 1944, and with the record output of 1,593,406 tons valued at $2,248,428 in 1941.

Exports of gypsum, plaster of Paris, and ground and prepared wall plaster were 559,079 tons valued at $590,683, compared with 387,392 tons valued at $443,385 in 1944. Imports of gypsum and plaster of Paris were 3,772 tons valued at $111,327, compared with 2,110 tons valued at $82,403 in 1944.

World production under normal conditions is estimated at 8,000,000 tons annually. Canada is probably in third place.

Uses; Prices

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. 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.

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 are usually made early each year. The nominal price of crude gypsum as quoted by Canadian Chemical and Process Industries remained at $2.50 to $3.50 per ton f.o.b. quarry or mine.

IRON OXIDES (MINERAL PIGMENTS)

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 Canadian iron oxide industry is small and the quantity produced shows little substantial 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 Sources 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 Nova Scotia, beds of ochre and umber were operated on a small scale in the past.

In Quebec, Sherwin-Williams Company of Canada operated its deposits and plants at Red Mill, Champlain county, a few miles east of Trois Rivières. It is the only Canadian producer of calcined iron oxides; the others market only air-dried products. Its calcined and air-floated mineral products are produced to rigid specifications. This plant produces most of the Canadian iron oxide and was operated at capacity throughout 1945. 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. 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 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. Large deposits near Grand Rapids and Cedar Lake in northern Manitoba remain undeveloped for similar reasons.

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

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 1945 totalled 10,314 tons valued at $172,053, compared with 8,599 tons valued at $150,250 in 1944. The 1945 production was made up of 9,917 tons from Quebec and 397 tons from British Columbia.

Exports of iron oxides in 1945 were 2,447 tons valued at $96,490, compared with 2,026 tons valued at $120,327 in 1944. Exports of mineral pigments n.o.p. (mostly zinc oxide) were 6,078 tons valued at $1,012,524, compared with 627 tons valued at $121,622 in 1944.

Imports of all kinds of ochres, siennas, and umbers totalled 1,900 tons valued at $97,164, compared with 1,430 tons valued at $70,168 in 1944.

Uses; Prices

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. 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 1944 (figures for 1945 not available) was 9,194 tons. The amount consumed in the paint industry was 2,614 tons of iron oxide, and 648 tons of ochre, siennas, and umbers. Besides their chief uses in the illuminating gas industry and in the paint industry, iron oxide pigments are used as colouring agents and fillers in the manufacture of imitation leather, shade cloth, shingle stain, and paper and cardboard fillers. Siennas and umbers are used in wood stains and wood fillers. Ochre is used as a pigment for linoleum and oilcloth, as a pigment in wood stains and wood fillers, and in colouring cement, stuccos, and mortar.

The Canadian price of red iron oxide, as given by Canadian Chemistry and Process Industries, remained at 2 to 7 cents a pound throughout 1945, whereas yellow, brown, and black iron oxides remained between 5 and 12 cents a pound.

LIME

Production of lime for the second successive year was down a small amount from the record of 907,768 tons in 1943, owing to shortages of fuel and labour and other factors, but not to a decreased demand. The demand for lime is likely to continue strong for a number of years because of new lime-using industries that will shortly be coming into production. To meet this demand several of the larger companies are planning to increase production either by building new kilns or by changing the design of existing kilns. Several new plants are also in prospect. Approximately 85 per cent of the Canadian lime originates in Ontario and Quebec.

Dolomite Refractories, Limited built a new plant at Dundas, Ontario, that will be producing dead-burned dolomite for use in the steel industry. It consists of one vertical, mixed-feed kiln having a rated capacity of 40 tons a day.

Principal Canadian Sources of Supply

Lime is manufactured in every province except Prince Edward Island, though production in Saskatchewan is intermittent and small.

In Nova Scotia, dolomitic lime is made for use in the steel industry. Until recently, high-calcium lime was also produced, but the plant ceased operation during the war owing to the difficulty of obtaining labour and supplies.

In New Brunswick, Ontario, and Manitoba, high-calcium and dolomitic limes are produced.

In Quebec, Alberta, and British Columbia, only high-calcium lime is produced.

There are many prospective lime-producing localities in Canada as limestone is abundant throughout the country; but in the more highly industrialized areas, particularly in Ontario and Quebec, unworked, easily accessible deposits of pure high-calcium limestone that will yield a white lime suitable for chemical requirements are becoming scarce.

Production and Trade

Total production of lime in 1945 amounted to 832,253 tons valued at $6,525,038, compared with 885,142 tons valued at $6,926,844 in 1944. Of the 1945 total, 708,173 tons valued at $5,579,868 was quicklime, and 124,080 tons valued at $945,170 was hydrated lime. This compares with the 1944 production of 738,202 tons of quicklime valued at $5,948,079, and 146,940 tons of hydrated lime valued at $978,765. The values do not include the cost of the containers. About 50 per cent of the quicklime and 2½ per cent of the hydrated lime produced in 1944 was used by companies producing lime primarily for their own consumption.

Exports of lime in 1945 amounted to 21,001 tons valued at $237,456, compared with 15,451 tons valued at $136,797 in 1944. Most of these exports went to the United States, but exports were also made to Newfoundland, Jamaica, Greenland, and St. Pierre and Miquelon.

Imports of quicklime in 1945 amounted to 6,354 tons valued at $35,766, compared with 6,697 tons valued at $34,917 in 1944. Imports of hydrated lime are recorded with other products and are not separately available.

Quicklime is marketed in the lump, pebble, crushed, and pulverized forms. The lump and pebble lime is sold either in bulk or packed in barrels. The crushed and pulverized lime is packed in air-tight, multi-wall paper bags.

Hydrated lime, a specially prepared, dry slaked lime in the form of a powder of such fineness that usually over 95 per cent will pass a 325-mesh sieve, is marketed in 50-pound, multi-wall paper bags.

Uses; Prices

Lime is one of the great basic raw materials of the modern chemical industry and over 90 per cent of the present Canadian production is used for chemical and metallurgical purposes. Hydrated lime finds wide use in agriculture as the principal ingredient of certain spray mixtures and dusting powders, and also for the sweetening of acid farmland. Hydrated lime and quicklime are important materials in the construction industry.

Prices of the various lime products vary over a wide range depending upon the geographical position of the plants and upon differences in the quality of the lime. The average price of quicklime f.o.b. plants, but exclusive of containers, is $8 per ton, and that of hydrated lime on the same basis, $6.70 per ton, but the latter figure includes considerable by-product material sold below the ordinary market price.

LIMESTONE (GENERAL)

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 the 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 those consisting almost entirely of calcium carbonate, through magnesian limestone, to those consisting of dolomite, the double carbonate of calcium and magnesium. Siliceous and argillaceous varieties of the above types also occur, as well as large deposits of the rare brucitic limestone and magnesitic dolomite, both of which latter types are being worked.

Abundant as is limestone in Canada, easily accessible unworked deposits of the pure high-calcium variety, so largely used by chemical and metallurgical industries, are becoming scarce within economic shipping range of the more highly industrialized areas, and recourse will have to be had in the future either to underground mining, or to beneficiation of surface deposits in order to remove undesirable impurities. At several Portland cement plants in various parts of the world impure limestone is being beneficiated by means of flotation.

Production and Trade

The production of limestone in 1945 for general use, exclusive of that used for lime and cement, is estimated at 5,820,000 tons valued at $6,250,000, compared with 5,565,286 tons valued at $5,528,459 in 1944. The production for all purposes in 1945 is estimated at 9,500,000 tons.

Limestone, being widely distributed and a low-cost commodity, is, as a rule, not transported for long distances and rarely figures in international trade, but for certain consuming centres in Canada it is obtained from the United States and Newfoundland. The stone so obtained is used for blast furnace flux, road metal, and for the manufacture of pulp. 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 1945 by six Canadian plants is estimated at $1,746,000, compared with $1,617,420 in 1944. Imports from the United States were valued at $460,677 in 1945. Five new plants, two in British Columbia, and one each in Nova Scotia, Quebec, and Ontario, were being built in 1945, and one in Ontario previously destroyed by fire is being rebuilt.

Pure dolomite has become an important source of magnesia, and during the latter years of World War II was an important source of magnesium metal. Magnesia and basic magnesium carbonate are made from calcined dolomite by the Pattinson process. Magnesium can be 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, which in turn is converted into 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.

Dead-burned dolomite is widely used as refractory material in basic open-hearth furnaces in the steel industry. The first Canadian plant to produce dead-burned dolomite was built at Dundas, Ontario, in 1945.

Magnesitic dolomite is processed at Kilmar, Quebec, for the production of refractory products. Brucitic limestone is processed at Wakefield, Quebec, for the production of magnesia and hydrated lime.

The use of limestone in agriculture is capable of very extensive development. Though the necessity for applying limestone or lime to agricultural land to remedy deficiencies of calcium and magnesium, to neutralize soil acidity, and to maintain or increase soil fertility has been emphasized for many years, the quantity so used in Canada is still relatively small, whereas the agricultural use of limestone could well constitute one of its most important uses both from the economic and tonnage viewpoints.

LIMESTONE (STRUCTURAL)

Quarries for the production of limestone for building purposes are worked in Quebec, Ontario, and Manitoba. Modern requirements of the building-stone industry call for blocks of stone of large dimensions from which are sawn slabs and blocks of the exact size required for constructing the building. Although limestone is abundant in Canada the heavily bedded variety of desirable texture, free from cracks and other defects, and capable of being carved and otherwise worked, is not plentiful.

During the war the construction of buildings of the type requiring cut stone was drastically curtailed and the production of building stone declined almost to the vanishing point, and such shipments as were made were from stock. Stocks are now depleted and with the construction of many buildings planned for the coming years the outlook for the industry engaged in the production of structural limestone is distinctly promising.

In Quebec, the quarries yielding heavily bedded building stone 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, heavily bedded silver-grey limestone is quarried from extensive deposits near Queenston in the Niagara Peninsula, and smaller quantities of buff, and of variegated buff and grey limestone are also obtained. At Longford Mills, near Orillia, buff, silver-grey, and brown limestone, suitable for use as building stone and as marble, is available, but the quarries have been inactive during the past several years.

The Manitoba quarries are near Tyndall. They yield, mottled buff, mottled grey, and mottled variegated limestone suitable for exteriors of buildings and for use as interior decorative stone. There has been very little production in recent years.

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

Production and Trade

The production of limestone for structural purposes in 1945 is estimated at 22,600 tons valued at $391,000, compared with 12,228 tons valued at $225,186 in 1944. 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 $7,331 in 1945 and of $5,713 in 1944. Imports of all varieties of building stone except marble and granite in 1945 had a value of $48,997, compared with $15,120 in 1944.

Prices

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

MAGNESITE AND BRUCITE

Magnesitic dolomite, a rock composed of an intimate mixture of magnesite and dolomite is quarried at Kilmar and at nearby Harrington East, Argenteuil county, Quebec, by Canadian Refractories, Limited, and is processed for use as refractory products and to a minor extent for use as a fertilizer material.

Brucitic limestone composed of granules of brucite (magnesium hydroxide) thickly distributed through a matrix of calcite, is quarried near Wakefield, Quebec, by Aluminum Company of Canada, Limited and is processed for the recovery of magnesia for refractory and fertilizer use, and of hydrated lime for use in construction and for chemical purposes.

In May 1945, Canadian Refractories, Limited, the principal Canadian producer of basic refractory products, was taken over by Harbison Walker Refractories Company of Pittsburgh, U.S.A., and an extensive program of enlargement and modernization of production facilities at the Canadian company's plant is under way. This includes the installation of a sink-float plant, and a 245-foot rotary kiln.

In February 1945, Canadian Refractories formed a subsidiary company, Dolomite Refractories, Limited, at Dundas, Ontario, to produce dead-burned dolomite for use in steel plants; and a large vertical, mixed-feed kiln having a rated capacity of 40 tons of dead-burned dolomite a day was erected and will be in production early in 1946.

Magnesite deposits occur also in British Columbia and in Yukon. The most important of these is at Marysville, British Columbia, between Cranbrook and Kimberley. They are owned by The Consolidated Mining and Smelting Company of Canada, Limited. Considerable silica and alumina occur as impurities in this magnesite. The company has devised a flotation method to remove the greater part of these impurities, but there has been no commercial production. Other magnesite deposits in British Columbia and Yukon are either of limited extent or are so far from transportation that they are not of commercial importance at present.

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

In addition to those near Wakefield, there are large deposits of brucitic limestone at Bryson, Quebec, and at Rutherglen, Ontario, and there is a small deposit on Redonda Island in British Columbia.

Production and Trade

In 1945, the value of the products made from magnesitic dolomite and brucite magnesia was $1,251,000, compared with $1,139,281 in 1944 and with $1,260,056 in 1943, the peak year.

Exports of basic refractory materials made from magnesite and brucite in 1945 amounted to 1,550 tons valued at $82,483, compared with 1,013 tons valued at $31,583 in 1944. In addition a considerable tonnage of magnesia is exported.

Imports of magnesia products in 1945 had a value of $938,227, compared with $1,622,697 in 1944. The items were: dead-burned and caustic-calcined magnesite valued at $279,910, compared with $466,314 in 1944; magnesite brick valued at $305,141, compared with $718,481 in 1944; magnesia alba and levis, $57,056, compared with $219,116 in 1944; magnesia pipe covering, $155,504, compared with $71,138 in 1944; magnesium carbonate, $38,921, compared with $38,853 in 1944; magnesium sulphate, $101,695, compared with $108,795 in 1944.

Uses

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

Products made from brucitic limestone include granular magnesia of high quality for use after dead-burning for making refractory products; lower grade magnesia for fertilizer use; and hydrated lime. The granular magnesia has been ground and marketed for the making of magnesium bisulphite liquor used for making special grades of paper. Experiments have shown that, with or without further processing, it can be used for oxychloride cement and for various other purposes for which magnesia made from magnesite can be used. Experiments have also shown the brucite magnesia to be particularly well suited to the production of magnesium metal.

MARBLE

The marble industry in Canada, in common with that in all belligerent countries, was relatively inactive during the war because most of the buildings erected were of the strictly utilitarian type in which very little marble was used. With the resumption of construction of the ornamental type of buildings the demand for marble is increasing and preparations were made late in 1945 for the reopening in 1946 of quarries that have been closed for several years. Foreign marble, which has always largely dominated the Canadian market, is now obtainable only with difficulty and at higher prices than formerly because of depleted European stocks, damage to quarries and equipment during the war, and because of labour trouble. Thus the outlook for increased production of domestic marble in the near future is good.

Principal Canadian Sources of Supply

Canada is well supplied with deposits of marble, and quarries are operated in Quebec, Ontario, Manitoba, and British Columbia. The products in recent years have been terrazzo chips, stucco dash, poultry grit, marble flour, whiting substitute, rubble, and material for making artificial stone, but some squared blocks for sawing into slabs for interior decorative use have also been produced.

In Quebec, clouded grey marbles and also a black marble are obtained in the quarries of Missisquoi Stone and Marble Company, Limited at Philipsburg near the foot of Lake Champlain. Brown marble for counters and wainscoting is obtained from the building-stone quarries in the Trenton limestone at St. Marc des Carrières, Portneuf county. Red and green marble for use as terrazzo is quarried by MAB, Ltée. at St. Joseph de Beauce. Orford Marble Company, Limited, a new company, commenced preparations for quarrying a variegated red, green, and grey serpentinous marble near North Stukely, Shefford county, late in 1945. The product at present is stucco dash, but it is intended to produce block marble at this quarry in the near future. White dolomite is quarried and crushed by Canadian Dolomite Company, Limited, at Portage du Fort, Pontiac county, for terrazzo chips, stucco dash, artificial stone, and various minor products.

In Ontario, black marble in beds up to 40 inches thick is produced by Silvertone Black Marble Quarries, Limited, Ottawa, at St. Albert, 30 miles southeast of 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. White Star Mine (Bolender Bros.) produces terrazzo and poultry grit at Marmora.

In Manitoba, a number of highly coloured marbles are available along the Flin Flon and Hudson Bay railroads, and also at Fisher Branch and other places, but there is no activity at present.

In British Columbia, there are many deposits of marble, but there is only a small production of white by Marble and Associated Products from a quarry near Victoria, and by Beale Limestone Quarries on Texada Island.

Production and Trade

Estimated production of marble in 1945 was 20,000 tons valued at $165,000, compared with 11,829 tons valued at $85,374 in 1944.

Exports of marble are recorded with exports of granite, and the exports of both during 1945 amounted to 3,835 tons valued at $48,606, compared with 3,871 tons valued at $42,567 in 1944.

Imports of marble in 1945 had a value of $122,994, compared with $77,402 in 1944. Imports are largely in the form of unpolished slabs and sawn stock, the finishing being done in marble mills throughout Canada. In addition, mosaic flooring materials consisting in large part of marble were imported to the value of $63,006 in 1945, compared with imports of similar materials valued at $64,904 in 1944.

Prices

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

MICA

The total value of mica production in Canada in 1945 was nearly $608,000 lower than that of 1944, the peak year, though the total quantity rose over 5 per cent. Exports declined in quantity and value for all classes of products. Exports of trimmed sheet, which in 1944 were 4 per cent by quantity, of the total, and 70 per cent of the value, dropped to only slightly over 1 per cent and 49 per cent, respectively. Exports of splittings were only 2 per cent of the quantity shipped in 1944, and of ground mica, 59 per cent.

Reduced requirements for war purposes and a general improvement in the supply situation contributed to the large decline in the demand for Canadian mica. There was a decrease in the production of trimmed sheet, the result chiefly of the closing of the important muscovite operation of Purdy Mica Mines Limited, at Eau Claire, Ontario, on April 1, 1945. Sales by this company in 1944 were over 42 per cent by quantity, and 75 per cent by value, of the total trimmed sheet sold in that year. With cessation of its operations, production of mica in Canada reverted almost entirely to the phlogopite variety. The deposits at the Purdy property were of phenomenal richness and made an important contribution to the war effort. It is doubtful, however, whether muscovite can be produced profitably in Canada in peace time in competition with that from countries having much cheaper labour, and in any event, output is likely to be small. Canadian producers of phlogopite may experience strong competition in the immediate future from Madagascar, the only other important world source of this type of mica. Production in Madagascar in 1945 was at a record level and supplies are likely to increase.

Principal Canadian Sources of Supply

Most of the Canadian phlogopite mica comes from adjacent sections of western Quebec and eastern Ontario, in the general Ottawa region, and the greater part of the output, in the form of block and splittings, is sold by producers and dealers having trimming establishments in or near Ottawa. In recent years direct mine shipments of semi-rough mica have also been made by a few operators to the United States for the production there of punched shapes, notably aeroplane sparkplug nose washers. With the gradual substitution of ceramic-type plugs, such exports have declined materially. The making of thin splittings is, for the most part, farmed out in small rural communities in the Ottawa district on a piece-work basis.

In Quebec, most of the production continued to come from the Nellis mine at Cantley in Hull township, and from the Phosphate King mine near Perkins in Templeton township, both of which are operated by Blackburn Bros., Blackburn Building, Ottawa. The company prepared the output in its shops in Perkins and in Ottawa, and continued the production of ground mica at its mill at Cantley. It is the only Canadian producer of this mica. Perkins Mills Mica Company, Montreal, worked the old Jackson Rae mine in Templeton township part of the year and later moved to Lake Terror in West Portland township. The mica was trimmed in a shop opened by the company at Masson. Pink Lake Mica Company, Toronto, reopened the old Kent mine at Pink Lake, in Hull township, but reported no shipments. A number of small operators produced sheet mica, but a large part of such sales probably consisted of material from old waste dumps or was from stocks mined in former years. Shipments of reclaimed, small-sized waste for mechanical splittings were 26 per cent less than in 1944. Scrap phlogopite shipments from Quebec were about 40 per cent of total exports of this type scrap. Siscoe Gold Mines, Limited reported plans for developing a large deposit of rock ("Suzorite") comprised largely of coarse flake phlogopite in Suzor township, Laviolette county, with the intention of going into production of ground mica for roofing and other uses. Towards the end of 1945, New Calumet Mines, Limited, Calumet Island, was considering the installation of a mill unit for recovery, cleaning, and grinding of the considerable amount of flake mica in the tailings from its zinc-lead operation. These two developments, if proceeded with, will aid considerably in maintaining the supply of phlogopite for grinding use, as stocks of mine scrap are low through progressive workings of old waste dumps.

In Ontario, most of the ouput came from the old Lacey mine of Loughborough Mining Company, Frontenac county, which was reopened under lease, in 1944 by Sydenham Mining Company. Loughborough Mining Company shipped substantial amounts of scrap mica recovered from old waste dumps at its Lacey mine. Kingston Mica Mining Company, which during the war shipped rifted rough sheet to the United States for trimming and punch use, closed its property near Godfrey, in Bedford township, Frontenac county, early in 1945, but continued to ship scrap. The mica is of good heat-resistant quality and a large part of the output was used in aviation sparkplugs. In the winter of 1944-45, straight mining for scrap-grade mica was conducted on an old property near Wilberforce in Haliburton county, and one carload was reported to have been shipped. Scrap phlogopite shipments from Ontario were about 60 per cent of the total exports in 1945 of this material. A few other small operators produced phlogopite.

The contract of Purdy Mica Mines, Limited, with Colonial Mica Corporation, the official U.S. Government purchasing agency, was terminated at the end of 1944, and the Purdy output of sheet muscovite was sold openly thereafter on the standard Indian system of sizing. Further drilling was done on the property after the cessation of mining, and the company's large shop at North Bay continued in operation until remaining stocks of rough mica were cleaned up, after which the company disposed of its shop and mine equipment. About 150,000 pounds of rough, mine-run mica was reported mined during the 3 months of operation. Scrap shipments, all of which was exported, totalled about 200 tons. No sheet muscovite is known to have been produced from other sources in Canada, but about 25 tons of scrap grade was mined for export at an old feldspar property near Wanup, Sudbury district, Ontario.

In British Columbia, shipments of mica schist continued to be made from the Albreda area to Vancouver for the production of roofing flake. About 500 tons was mined. Ground muscovite (or sericite) made from schist rock is produced by Fairey and Company, 661 Taylor Street, Vancouver. The finer mesh sizes of phlogopite are exported to the United States for use in plastic and ceramic types of electrical insulation, and other grades are mostly sold for use in the domestic roofing, building, and rubber trades. The ground muscovite is sold to roofing manufacturers in Vancouver and Victoria.

Production and Trade

Canada produced 7,044,221 pounds of mica valued at $233,270, compared with 6,684,846 pounds valued at $841,026 in 1944. Sales of trimmed muscovite by Purdy Mica Mines, Limited, and comprising practically the entire output of this type of mica, were 19,533 pounds valued at $72,329, compared with 219,523 pounds valued at $572,292 in 1944.

Most of Canada's output of mica is exported, principally to the United States and to Great Britain. Exports of mica totalled 6,079,800 pounds valued at $302,109, of which 5,205,600 pounds valued at $44,255 was scrap and ground mica. About 90 per cent of the scrap exports is estimated to have been phlogopite, and 10 per cent muscovite. Exports comprised 67,600 pounds of trimmed sheet valued at $146,026, compared with 282,100 pounds valued at $572,541 in 1944; 1,500 pounds of phlogopite splittings valued at $1,200, compared with 75,800 pounds valued at $56,211; 801,400 pounds of semi-rough phlogopite, mainly for mechanical splittings, valued at $107,740, compared with 955,600 pounds valued at $133,149; 352,000 pounds of ground phlogopite valued at $11,055, compared with 600,900 pounds valued at $18,340; and 4,853,600 pounds of scrap valued at $33,200, compared with 4,879,200 pounds valued at $36,072. Most of the scrap phlogopite exported is shipped to dry grinding plants of United States Mica Manufacturing Company at East Rutherford, New Jersey, and at Forest Park, Chicago. Scrap muscovite has been shipped in recent years mainly to Concord Mica Corporation, Concord, New Hampshire, for the production of wet-ground mica.

Canada imported mica and manufactures of, to the value of $236,597, compared with $185,986 in 1944. Imports of unmanufactured mica consist largely of muscovite splittings from India for the manufacture of mica plate, and muscovite sheet or block for capacitor films, domestic heater elements, and stoves. There are substantial imports of wet-ground muscovite for use in the manufacture of wallpaper.

Canada and Madagascar are the two chief sources of phlogopite, but small amounts are obtained from Ceylon, Korea, Mexico, Tanganyika, Portuguese East Africa, and the Northern Territory of Australia. Many countries produce small quantities of muscovite mica, though India has long been the chief source. 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, produced in Madras. Brazil is next to India as a source of "ruby" muscovite. The United States is third, the chief producing States being North Carolina, South Dakota, New Hampshire, and Connecticut. Argentina is an important producer and exporter of muscovite, but a large part of the output is green, spotted mica.

Markets and Uses

Mica is outstanding as an insulating material in all forms of electrical equipment and appliances, and almost all the 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. The recent development of the ceramic type of sparkplug has largely eliminated the use of mica for aviation sparkplugs.

Large quantities of muscovite are used in the form of thin sheets for radio and magneto condenser films, and for the bridges and supports in radio tubes. Heavily spotted and stained muscovite ("electric" mica) is used mainly in domestic appliances. Fine flake or powdered mica, made mainly from muscovite, but also from phlogopite and even biotite, is used mostly in the roofing and rubber trades.

Prices

Dealers' quotations for the various trade sizes of phlogopite were approximately as shown below, according to quality as based on colour, hardness, and splitting properties:

Size (Inches)	*Knife-trimmed Block or Sheet* Per Pound
1 x 1 and 1 x 2	$0.35 to $0.50
1 x 3	0.50 " 0.60
2 x 3	0.70 " 0.80
2 x 4	0.95 " 1.00
3 x 5	1.50 " 2.00
4 x 6	1.75 " 2.50
5 x 8	2.75 " 3.25

	Splittings Per Pound
1 x 1	$0.75
1 x 2	0.85

(Splittings prices in U.S. funds).

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 $13.35 per short ton in carload lots, compared with $12.80 per ton in 1944; and scrap muscovite exports, $16.70 per ton, compared with $17.75.

Purdy Mica Mines, Limited used the Indian system of grading and established a new scale of prices for its muscovites. In the standard grades Nos. 1 to 6, quotations ranged from $8.94 to $0.84 per pound for clear quality; $5.88 to $0.54 for slightly spotted; and $3.48 to $0.25 for more heavily spotted. Special large sizes were quoted at $35.34 to $11.06 for clear; $26.72 to $7.58 for slightly spotted; and $10.00 to $3.96 for more heavily spotted.

Montana cleaned and screened crude vermiculite continued to be quoted at $12 a short ton, f.o.b. mine, and North Carolina crude remained at $9.50 a ton.

MOULDING SAND (NATURAL BONDED)

Moulding sands are mixtures of sand and clay that, when moist, can be formed into moulds from which metal castings can be made. When suitable mixtures occur they are designated natural bonded moulding sands. Synthetic or 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.

Principal Canadian Sources of Supply

Every province, except Prince Edward Island, produces natural bonded moulding sand; by far the greater part (generally over 90 per cent) of the output being 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.

A complete moulding sand research laboratory forms part of a well-equipped experimental foundry for the casting of all metals that was installed recently in the Physical Metallurgy Research Laboratories of the Bureau of Mines, Ottawa. In the moulding sand laboratory, comparative tests are being made on moulding and core sands for individual foundries. Tests' results are designed to indicate which sand is the most economical from the viewpoint of binder consumption, cleaning castings, etc. The characteristics of various core binders are being studied. Cores for steel castings is a special project. Test castings are made and various core mixtures are tried out for resistance to "burn in".

Production and Trade

The Canadian production (preliminary estimate) of moulding sand in 1945 was 34,311 tons valued at $66,972, compared with 30,988 tons valued at $64,335 in 1944. 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 domestic production. Moulding sands, core sands, and other sands and gravels enter Canada duty free.

NEPHELINE SYENITE

Canada and Russia are the only important producers of nepheline syenite. Practically all of the Canadian production is used in the ceramic industry, most of it going to the glass trade.

Nepheline syenite, a quartz-free rock, consists essentially of nephelite, with ablite and microcline feldspar. It often contains small amounts of iron-bearing minerals, chiefly magnetite, hematite, and biotite mica, together with such accessory minerals as corundum, zircon, muscovite, calcite, scapolite, etc. It is relatively high (24 per cent in average Canadian commercial rock) in alumina compared with straight feldspar (17 to 20 per cent) and it is thus used as a feldspar substitute in a number of ceramic industries, more especially in the glass trade. Early in the war, American Nepeheline Corporation worked out commercial methods of treating Canadian syenite in the laboratories of the Bureau of Mines, Ottawa, with the intention of using it, if necessary, to replace bauxite as a source of pure alumina for the production of aluminium, but it was decided to apply the process to other more adaptable raw materials in the United States.

Principal Canadian Sources of Supply

The developed deposits of nepheline syenite in Canada are confined to Peterborough, Hastings, and Haliburton counties in Ontario. The other known 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. The large operation of American Nepheline, Limited, at Blue Mountain, 26 miles northeast of 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 from near Gooderham in Haliburton county, and the material was shipped in the crude state to grinding mills in the United States. The Blue Mountain deposit is massive and medium-textured, whereas most of the production from the Bancroft and Gooderham areas has consisted of coarse pegmatite material.

The Blue Mountain deposit has been developed as a large side-hill quarry operation extending for a length of some 2,000 feet and with a face of 60 feet, which is taken down in three lifts. At maximum (summer) capacity, about 500 tons of rock a day is broken with a force of 30 to 35 men. Rock is loaded by power shovel and is trucked to the quarry crusher plant, where it is reduced to shipping size (about 6 inches). In summer, the rock is trucked 5 miles to a loading dock at the east end of Stony Lake, where it is dumped direct into 300-ton scows for transport to railhead at Lakefield. A large storage pile is maintained at the Lakefield dock from which winter rail loadings are made. Rock for the Lakefield mill is trucked the 26 miles from the quarry. The plant has a daily capacity of 40 tons of finished product.

At the end of 1945, preparations were under way for developing a glory-hole method of quarry operation at Blue Mountain on top of the ridge. An adit was driven 250 feet into the side of the ridge to the east of the present workings, from which a raise will be carried 150 feet to surface. Rock will be dumped down the raise to an underground primary crusher discharging to a proposed new mill at the quarry. This mill, erection of which will depend upon the success of beneficiation tests, would turn out finished material for the glass and other trades, supplementing production from the plant at Rochester, New York, and would replace the mill at Lakefield.

Production and Trade

Production of nepheline syenite in Canada in 1945 totalled 61,345 short tons, of which about 11,000 tons was milled and cleaned by magnetic separation at the Lakefield plant of American Nepheline, Limited, with the production of approximately 8,600 tons of finished products. Mine production in 1944 was about 58,000 tons. Exports of crude rock shipped to the Rochester (N.Y.) mill of American Nepheline Corporation was 52,663 short tons valued at $172,750, compared with 35,310 tons valued at $123,905 in 1944. Domestic sales of glass-grade material were 8,360 tons, compared with 7,386 tons in 1944; of 200-mesh pottery grade, 156 tons compared with 317 tons; and of B-grade powder sold as a pumice substitute and for cleanser, enamels, and heavy clay products use, 166 tons compared with 186 tons. Sales of products made at the company's Rochester mill comprised 20,447 tons of glass-grade material, 9,926 tons of 200-mesh pottery grade, and 1,091 tons of B-grade powder, or a total of 31,464 tons.

Uses

Nepheline syenite continues to be used chiefly for the manufacture of container glass and for this purpose is marketed in the form of a granular 28-mesh product, replacing granular glass-spar (feldspar). Most Canadian glass companies and a number of large American plants have been using the material for several years. 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 melting temperature, with resultant fuel economy and longer tank life. Use of syenite has also been expanding in other branches of ceramics, and ground to 200 mesh, it is used in a variety of products. It is also claimed to be superior to feldspar for the manufacture of artificial teeth.

For all ceramic purposes the crude rock must be freed of its iron-bearing impurities. Iron (Fe_2O_3) content of the Canadian finished product averages about 0·08 per cent. The Bureau of Mines, Ottawa, has been doing test work on the separation of small amounts of corundum and mica in the Blue Mountain rock, with possible recovery of these minerals as by-products. Flotation treatment of the rock has been practised at Rochester for some time.

Prices and Tariffs

Granular glass-grade nepheline syenite in 1945 was quoted at $12 per ton, in carload lots, f.o.b. mill; and 200-mesh ceramic grade at about $16. B-grade dust sold at $13, l.c.l.

Crude nepheline syenite enters the United States free of duty; finished products pay 15 per cent ad valorem.

PHOSPHATE

Canada produces minor amounts of apatite, a phosphate mineral, from pyroxenitic rocks of the Ottawa region in Quebec and Ontario. In such rocks, apatite is frequently associated with phlogopite mica and sometimes phosphate is produced as a by-product of mica mining. Mining for straight apatite was most active between 1878 and 1894, when there was a considerable phosphate industry, centred mainly in the Lièvre River-Templeton area, Quebec. Substantial reserves probably exist in some of the larger deposits, but the bodies tend to be erratic and pockety, and are incapable of supplying more than a small fraction of the domestic requirements, which in 1945 totalled over 300,000 short tons.

Sedimentary phosphate rock occurs along the Rocky Mountain Divide, notably in the vicinity of Crow's Nest, but the material is considered too low grade to be of present economic interest.

Principal Canadian Sources of Supply

All the shipments in 1945 were from the Brazeau mine, operated by R. Bigelow; the High Rock mine, operated by O. C. Cote; and the Phosphate King mine near Perkins, operated by Messrs. Blackburn Bros. The three properties are in Papineau county.

In Ontario, Ontario Phosphate Industries, Limited continued development work on its MacLaren property in Bedford township until the end of September, but made no shipments. Previous development work and that in 1945 included a diamond-drilling program; the sinking of a 3-compartment shaft to a depth of 150 feet; and about 500 feet of drifting and cross-cutting.

Production and Trade

Shipments of apatite totalled 299 tons valued at $4,356, delivered, compared with 482 tons valued at $6,716 in 1944. Sales comprised mainly crude ore and some cobbed and screened material; grade ranged from 62 to 86 per cent B.P.L. For many years Electric Reduction Company, Buckingham, has purchased most of the apatite produced and uses it in the production of elemental phosphorus and of various phosphorus compounds. Such apatite is only a small part of the company's phosphate requirements, which are mostly met by rock from Florida.

Imports of sedimentary phosphate in 1945 totalled 317,695 short tons valued at $1,450,580, compared with 388,247 tons valued at $1,710,378 in 1944. Ninety-five per cent came from the United States (Florida and Montana), 4 per cent from North Africa, and the remainder from Netherlands West Indies (Curaçao). The last material is rock low in fluorine that is imported for use in stock feeds.

Russia is the leading producer of apatite. Total estimated world production of phosphate in 1940 was nearly 10,000,000 metric tons, of which the United States furnished over 4,000,000 tons. American production reached nearly 5,500,000 metric tons in 1944.

Uses

Phosphate is used chiefly for the manufacture of fertilizer. Ordinary superphosphate, made by treatment of phosphate rock with sulphuric acid, is the chief product made, but triple superphosphate, ammonium phosphate, and other compounds of higher P_2O_5 content are produced on an important scale. Production of phosphoric acid by furnace treatment of rock has been increasing steadily, and permits the use of low-grade material that it would be uneconomic to acidulate. Thermal defluorination of phosphate rock and of superphosphate has also shown a marked increase in order to meet deficiencies of bone-meal and other fluorine-free phosphatic materials for stock-feed use. Phosphate rock is the sole commercial source of phosphorus.

Consumption of phosphate rock in Canada in 1945, as reported by users, was 394,048 tons, of which 93 per cent went to the fertilizer trade, and 6·8 per cent into the production of phosphorus and phosphorus compounds. Consumption by provinces was: British Columbia, 59 per cent; Quebec, 24 per cent; and Ontario, 17 per cent. All of the fertilizer rock is used in three superphosphate plants of Canadian Industries, Limited, at Belœil, Quebec; Hamilton, Ontario; and New Westminster, British Columbia; and in the plant of Consolidated Mining and Smelting Company of Canada, Limited, Trail, British Columbia. Eastern plants use mainly rock from Florida and North Africa, and the Trail plant gets its supply from deposits in Montana.

Prices

Overall average price of the United States production in the first half of 1945 was $4.02 per ton. Average declared spot value of the phosphate rock imported into Canada in 1945 was $4.55 per short ton. The price paid in 1945 for Canadian apatite delivered at plant 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.

PYRITES AND SULPHUR

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 published statistics on recent pyrites production refer to by-product iron pyrites recovered in the concentrating of copper and copper-zinc ores.

Deposits of native sulphur of commercial grade have not been found in Canada, but sulphur occurs in combination with copper, lead, zinc, nickel, or iron in many base metal sulphide orebodies in various parts of the country. In the smelting of these ores sulphur dioxide gas is produced, and prior to 1925 this gas was a total waste as no facilities were available for the recovery from it of sulphur or of sulphur compounds. In practice this gas can be used directly for the manufacture of liquid sulphur dioxide or for the production of elemental sulphur. Sulphur used in the making of sulphuric acid is recovered in the form of sulphur dioxide from salvaged smelter gas by The Consolidated Mining and Smelting Company of Canada, Limited, at Trail, British Columbia, and by Canadian Industries, Limited, at Copper Cliff, Ontario. There has been no production of elemental sulphur in Canada since July 1943.

Principal Canadian Sources of Supply

In Quebec, Noranda Mines, Limited, Noranda, recovers the pyrites from the cyanide mill tailings and sells it to pulp and paper mills at Trois Rivières and at Hull, Quebec, and to chemical plants in Canada and the United States. Waite Amulet Mines, Limited has been producing a pyrites concentrate since March 1944, which it ships mainly to the United States.

In British Columbia, most of the large output of pyrites from the Britannia mine of Britannia Mining and Smelting Company, Limited, at Britannia Beach was sold to Nichols Chemical Company's acid plant at Barnet, B.C., and the remainder was exported to Compagnie des Boleo in Mexico. The pyrites averaged over 50 per cent in sulphur. A considerable tonnage from operations in previous years has accumulated 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. Reserves are estimated at 5,000,000 tons with a sulphur content of 45 per cent.

By July 1943, the demand for sulphuric acid for fertilizer manufacture had become so great that the production of elemental sulphur at Trail, which was commenced in 1936, was discontinued. The sulphuric acid is made in a plant, using the contact process, that was erected by Consolidated Mining and Smelting Company in 1929. Canadian Industries, Limited, also, uses the contact process in its acid plant at Copper Cliff, the production of sulphuric acid being from converter gas that is withdrawn from the flues by arrangement with The International Nickel Company of Canada, Limited. The acid is marketed in several industries.

Production and Trade

Canada produced 250,114 tons of sulphur (sulphur content of pyrites shipped, plus sulphur content of sulphuric acid made from smelter gases) valued at $1,881,321 in 1945, compared with 248,088 tons valued at $1,755,739 in 1944. A total of 228,618 tons of pyrites concentrates was produced, compared with 254,134 tons in 1944; the amount shipped being 227,733 tons compared with 250,071 tons in 1944.

The sulphur content of pyrites exported in 1945 was 75,479 tons valued at $315,232, compared with 90,836 tons valued at $353,441 in 1944. A total of 11,203 tons of sulphuric acid valued at $252,857 was exported, compared with 18,960 tons valued at $269,133 in 1944.

Imports of sulphur in all forms (crude, brimstone, etc.) were 248,846 tons valued at $4,063,324, compared with 235,955 tons valued at $3,875,649 in 1944. Imports of sulphuric acid were 149 tons valued at $17,454, compared with 189 tons valued at $24,542 in 1944.

The consumption of sulphur in certain Canadian industries in 1944 (1945 not available) as given by the Dominion Bureau of Statistics was:

	Short tons
Pulp and paper	195,203
Heavy chemicals	68,549
Explosives	1,753
Rubber goods	1,259
Insecticides	1,228
Miscellaneous	1,895
Total	269,887

The United States is the major world source of crude sulphur and its output in 1944 (1945 not available) amounted to 3,218,200 tons.

ROOFING GRANULES

During the past decade the roofing granule industry in Canada has increased over fourfold and the growth has been particularly rapid in the past 3 years. Canadian-made granules are obtained from seven deposits, three of which are in Ontario and four 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 part of the improved shingle has an inner coating, usually of natural granules, upon which another coating of the required coloured granules is spread.

It is estimated that the output of granule roofings in 1946 will be about 15 per cent greater than in 1945, largely as a result of the intensified home-building activity. The search for suitable rocks in Canada has recently increased, and, as 62 per cent of the granules used are imported, several companies are contemplating their manufacture from Canadian material.

Principal Canadian Sources of Supply

In Ontario, three deposits are being quarried for granules in the vicinity of Madoc, 100 air miles east and north of Toronto. These are: a grey rhyolite deposit 5 miles northeast of Madoc; a black amphibole rhyolite, 4 miles northwest; and a greenish grey basalt, 20 miles west, near Havelock. Building Products Company, the leading Canadian manufacturer, crushes and screens the rock from these quarries at a mill near Madoc, and artificially colours the granules at a plant at Havelock, the only granule-colouring plant in Canada.

In British Columbia, G. W. Richmond is quarrying a dark grey slate at McNab Creek, Howe Sound, and a greenish siliceous rock at Bridal Falls, near Chilliwack. At Kapoor on southern Vancouver Island, O. M. Brown is mining a grey-black slate, and from an adjacent deposit, hard greenish rock. These two operators have crushing and screening plants in Vancouver and Victoria respectively, where natural granules are produced and sold to roofing companies in the two cities.

Small quantites of granules that were made from slate deposits at Madoc 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 been used also to a small extent. Tests were made recently on the slate that occurs near Kentville, Nova Scotia.

Some of the leading manufacturers of granule roofings, as well as individuals, have been making tests and searching certain areas in Canada for rocks suitable for making the best type of granules, but the specifications (*see* below) are rigid. Apart from slates, there appear to be few such rocks in areas where they can be economically mined, crushed, and shipped to producing plants.

In 1945, granule-coated roofings and sidings were manufactured by ten companies, which have a total of 14 plants located at Saint 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 many patents. A few of the methods employed consist of: heating, which darkens the 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 formulæ used by individual companies are closely guarded secrets.

Production and Trade

Consumption of roofing granules in Canada amounted to 77,559 tons valued at $1,617,558, an increase of 30 per cent compared with 1944. In 1934 only 18,115 tons valued at $288,644 was consumed. About 51 per cent of the total consumption in 1945 was comprised of natural coloured granules and the remainder consisted of artificially coloured granules. The distribution of natural and artificially coloured granules of all types is: reds, 32 per cent; greens, 27 per cent; greys and blacks, 33 per cent; blue, 3 per cent; buffs and browns, 3 per cent; white, 2·0 per cent.

Imports of all types and colours amounted to 48,452 tons valued at $990,976, or 62 per cent of the total tonnage consumed. Imports in 1945 came from four leading producers in the United States. Quarries and plants producing slate granules that are used in Canada are located at: Delta, Pennsylvania; Whitsford, Maryland; Fairmont, Georgia; Granville, New York; and Poultney, Vermont. Natural blue-black granules are obtained from Delta and Whitsford; natural green from Fairmont; natural red from Granville; and natural green and red as well as all artificial colours from Poultney. Rock bases come from Charmian near Gladhill (basaltic greenstone and purple rhyolite) and from Watsontown (buff shale), Pennsylvania; Copley, Ohio (artificially coloured quartzite), and Pacific, Missouri (natural buff quartz gravel). Artificially coloured trap rocks come from Wausau and Kremlin, Wisconsin, and from Bound Brook, New Jersey. A small amount of ceramic (red brick and white porcelain) granules comes from Danville, Illinois.

The United States is the 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 was 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, they called for flat granules, and nearly all were made from slate. The present trend, however, is toward more solid angular fragments, and the use of true slate is decreasing, though, in 1945, 36 per cent of the total used in Canada was slate granules (21 per cent natural and 15 per cent artificially coloured). Rocks suitable for granules should be fairly hard, of low porosity, fine-grained, opaque, possess a high melting point and break well. They should be composed mainly of silica or silicates and should be free from metallic minerals, flaky minerals, minerals with fibrous partings, and the 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 should be as dark (blue-black) as possible, or else greens and reds. All granules are oiled to improve adhesion to the asphalt and to intensify the colour, but for the latter, the effect is not permanent. Two mesh grades of granules are used, namely 'coarse' (10 to 28 mesh), and to a much smaller extent 'fine' (28 to 35 mesh).

Prices

Prices vary considerably depending upon the type of granule, and upon whether the colour is natural or artificial. Imported granules range in price from $16 to $20 a ton, f.o.b. eastern Canadian plants for natural rocks and slates; from $20 to $26 for artificially coloured reds and greens; from $36 to $40 for blues; and from $22 to $25 for buffs and browns.

SALT

In Canada salt occurs in the form of brine springs, or in bedded deposits, in every province with the exception of Quebec.

Salt is obtained by the following three main methods, only the last two of which are used in Canada: by the evaporation of sea water by solar heat; by the artificial evaporation of brines obtained from brine springs or of brines formed by allowing fresh water to come into contact with salt deposits at depth; and by actual mining of rock salt deposits. The first method is used in warm countries where there is continuous sunshine over long periods and little rainfall. The large and flaky crystals produced by this slow method admirably meets the requirements of some of the salt-consuming industries, but it is altogether unsuitable for others.

With one exception, noted elsewhere, all the salt produced in Canada is obtained by artificial evaporation, as nearly all the deposits occur at great depths.

The crystal grain is comparatively fine and because of this is not acceptable to consumers such as the fish-packing industry, which requires a coarse-grained salt.

Malagash Salt Company, Malagash, Nova Scotia, is the only Canadian company that actually mines salt.

Most of the Canadian production is, therefore, of the finer grades and the present producing plants are mostly in Ontario and in the central western provinces. The fishing industries, which prefer a coarse salt, are mainly on the Atlantic and Pacific seaboards, and a large part of their requirements has in the past been supplied by solar salt from the West Indies and California.

Thus, the geographical distribution of the Canadian deposits, together with the necessity of using artificial evaporation methods of recovery, prohibits any one company from producing grades to suit all consumers. Accordingly, the importation of the coarser grades not now produced in Canada will have to continue until methods are developed to produce these grades by evaporation or other processes.

Principal Canadian Sources of Supply; Occurrences

Production in 1945 was obtained from Nova Scotia, Ontario, Manitoba, and Alberta. Over 85 per cent of the total came from Ontario, and each of the other three provinces produced about 5 per cent.

In Nova Scotia the only producer is the Malagash Salt Company, which has been in steady production since 1918. A 25-ton pilot plant for the purification of salt by means of flotation and fusion has been erected by the Federal Government in conjunction with the Nova Scotia Department of Mines and the company. The plant has been running for several months and the salt is being tested by several of the large fishery companies with decidedly promising results. In order to bring about a lowering of costs, tests are being made at the Bureau of Mines, Ottawa, on a rotary type of furnace to replace the reverberatory type now being used.

The salt beds at Malagash occur in strata of the Windsor series. The top of the salt formation was encountered 85 feet below the surface and operations have extended to a vertical depth of 1,128 feet. They reach out horizontally for 1,300 feet north and south and 1,400 feet east and west. In addition to the three main seams of white salt, there are parallel zones of discoloured salt from which the salt can be recovered only by leaching.

At Nappan, near Amherst, Cumberland county, Maritimes Industries, Limited, a subsidiary of Standard Chemical Company, Limited, in the autumn of 1945 began the drilling of its first well on a salt structure that had been investigated by Imperial Oil, Limited, and later by the Department of Mines, Nova Scotia. The company obtained surface rights and intends to erect a plant with a capacity of 120 tons of high-grade salt a day, suitable for meat packing, fish packing, table, dairy, and other uses.

A hole drilled to about 7,000 feet, by Lion Oil Refining Company of Arkansas, in the summer of 1944 near Mabou, Inverness county, Cape Breton, proved the existence of several beds of rock salt, but no further work has been undertaken. The largest bed penetrated has a thickness of 155 feet. The company holds a large acreage in Inverness county for the purpose of geological investigation.

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, the Department of Lands and Mines did some exploratory drilling southeast of Weldon, in the winter of 1944-45, on what is believed to be the southern limb of a huge salt basin that was disclosed in 1921, first, in the vicinity of Gautreau, south of Moncton, on the east side of Petitcodiac River, and, afterwards, near Weldon, on the west side. In one of the holes, 115 feet of rock salt was encountered. Drilling by New Brunswick Gas and Oilfields, Limited, at Weldon, prior to the war showed that the part of the basin on the west side of the river also contains huge tonnages of salt.

In the spring of 1945, the Department of Lands and Mines drilled for salt in the vicinity of the Plumweseep springs. The deepest hole reached a depth of 488 feet without encountering salt. There are several such springs in New Brunswick.

In Ontario, the six plants were in steady operation, the centres of production being Amherstburg, Sandwich, Sarnia, and Goderich. 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, manufactures soda ash from saturated brine and also recovers calcium chloride from its process as a by-product.

In Manitoba, Neepawa Salt Company (subsidiary of Canadian Industries, Limited), Neepawa, was in continuous operation. This plant, erected in 1941, utilizes vacuum pan evaporation and produces all grades of evaporated salt. The brine is obtained from wells 1,500 feet deep.

In Alberta, Industrial Minerals, Limited, Waterways, operated continuously. An addition to the plant will bring its capacity up to 100 tons a day. The company is in a position to place all grades of evaporated salt on the market. To provide for contingencies, it drilled a second well in 1941 which was made ready for production when needed. The Waterways field is estimated to contain 500,000 tons of salt (98·3 to 99·6 per cent purity) per acre.

A discovery of salt was made early in 1945, in a well drilled 14 miles south of Vermilion, Alberta. The top of the salt formation was encountered at 3,481 feet and the formation extends to a depth of 3,903 feet. A 110-foot section through the centre of the salt formation was not cored, but 312 feet were proved and the portion not cored can be reasonably assumed to be salt. Thus there is a probable thickness of salt of various degrees of purity of 422 feet. This discovery is of great interest as it is in the more settled part of the province and is reasonably close to natural gas wells. With such a thickness it is likely that the same deposits will be found in wells that may be drilled closer to the railway.

Production and Trade

The production (sales) of salt in 1945 was 673,076 tons valued at $4,054,720, compared with 695,217 tons valued at $4,074,021 in 1944. The slight decline was probably mainly in the amount of salt used in the chemical industries, which showed a large and steady increase during the war. This decline has probably been partly offset by the continued demand in the meat-packing and dairy industries.

Exports were 5,314 tons valued at $105,494, compared with 3,182 tons valued at $80,672 in 1944. Imports were 137,167 tons valued at $805,002, compared with 147,282 tons valued at $846,057 in 1944. The apparent Canadian consumption was 809,857 tons valued at $4,724,591, compared with 839,317 tons valued at $4,840,406 in 1944.

No statistics of world consumption have been available since 1938.

World production of salt in 1938, the last year for which complete data are available, was computed at 32,000,000 long tons by the Imperial Institute, London. Of this quantity, the British Empire accounted for 5,200,000 long tons or 16·2 per cent, the order of output of the largest producers being the United Kingdom, India, and Canada. The leading producers among the foreign countries were: the United States, Russia, China, Germany, France, Italy, Poland, Rumania, and Manchuria.

Prices

According to Canadian Chemistry and Process Industries, the quoted prices on various grades of salt remained unchanged throughout 1945, as follows:

Specially purified salt, 99·9 per cent, f.o.b. plant	100 lb.	$ 0.94
Fine industrial salt, bulk carlots f.o.b. plant	ton	$ 6.53
Coarse industrial salt, bulk carlots f.o.b. plant	ton	$10.63

SAND AND GRAVEL

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

Production of sand and gravel in 1945 amounted to 29,750,703 tons valued at $10,568,363, compared with 28,399,986 tons valued at $10,280,119 for 1944. The output and value by provinces was:

Province	1944 Tons	1944 Value	1945 Tons	1945 Value
Nova Scotia	911,970	$ 411,041	1,308,848	$ 555,809
New Brunswick	1,960,382	958,524	1,627,371	686,267
Quebec	8,541,400	2,140,856	8,971,960	2,279,537
Ontario	9,529,803	4,417,427	10,466,891	4,466,862
Manitoba	1,102,448	296,086	1,497,062	516,380
Saskatchewan	1,163,097	533,175	1,237,595	563,276
Alberta	833,524	328,151	919,736	433,436
British Columbia	4,357,362	1,194,859	3,721,240	1,066,796
	28,399,986	$10,280,119	29,750,703	$10,568,363

Uses

Road improvement, concrete works, and railway ballast absorb by far the greater part of the gravel and sand used. Gravel in particular has proved a good material for building all-weather roads at low cost and its use has steadily increased with the growth of motor traffic. A considerable tonnage of sand and gravel is used in the mines for re-filling underground workings. Some mines use several thousand tons a day.

Most of the gravel used for roads 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. Road pits may remain idle for two years or more. The amount of gravel produced from year to year thus fluctuates, depending upon the program of road construction and improvement. Intermittent operation also applies to railway pits, which may remain idle for several years.

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

Most of the sand is used in the building industry for concrete work, cement and lime mortar, or wall plaster. It must be free from dust, loam, organic matter, or clay, and contain little silt, and is usually obtainable from local deposits. Other important uses of sand are: moulding in foundries, filtering of water supply, and glassmaking, all of which require special grades of sand.

War conditions did not materially affect the total consumption of sand and gravel, as the extra amount absorbed by war services was partly, if not wholly offset by decreased activity in industries that ordinarily use large quantities.

Prices

Prices of sand, gravel, and crushed stone in the four largest cities in Canada were as shown below at the end of 1945. Prices per ton or cubic yard, as indicated below, are for carlots, f.o.b. cars.

		Prices 1945
Sand		
Montreal,	per ton	$1.20
Toronto,	" "	1.00
Winnipeg,	" cu. yd	1.00
Vancouver,	" " "	1.00
Gravel		
Montreal,	per ton	1.10
Toronto,	" "	1.58
Winnipeg,	" cu. yd	1.00
Vancouver,	" " "	1.00
Crushed Stone		
Montreal,	per ton	0.97
Toronto,	" "	1.70
Winnipeg,	" cu. yd	....
Vancouver,	" " "	1.10

SILICA

The silica materials produced in Canada are quartz, quartzite, sandstone, silica sand, and silex.

Quartz usually occurs in massive form without crystal faces. In the crystal form, most of the commercial supply for the world is obtained from Brazil. When flawless, transparent, and possessing the necessary piezoelectric properties, quartz crystals are of great strategic importance. They are also cut and ground for lenses, prisms, etc.

Quartzite is a firm, compact metamorphosed sandstone, made up chiefly of grains of quartz sand united by a siliceous cement.

Sandstone must be of a high purity when the silica content is the prime essential for its employment in industry.

Silica sand is disintegrated quartz, and for commercial use much of it is obtained by the mechanical disintegration of pure grades of sandstone, and in special cases of quartz, after which the crushed material is washed and screened into grades suitable for the several industries.

Principal Canadian Sources of Supply

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 (natural) is obtained from Nova Scotia, Quebec, and Manitoba.

In Nova Scotia, quartzite is regularly quarried from a deposit at Leitches Creek, about 25 miles from Sydney, for use in the manufacture of silica brick for the Sydney steel plant. A 50-ton sample from a huge deposit of high-grade white silica rock in Yarmouth county was tested at the steel plant at Sydney, as a result of which a 1,000-ton test lot was removed from the deposit late in 1945. Silica sand from a high-grade deposit at Diogenes Brook, Inverness county, is also used in the plant at Sydney. The Bureau of Mines, Ottawa, has a research investigation under way on white silica sands from extensive beaches and dunes at Barrington Bay and at Port Mouton, on the southwest shore of Nova Scotia, to determine whether some method of beneficiation can be found to remove the objectionable impurities and to make a product suitable for the manufacture of glass.

In Quebec, a number of silica plants were in operation and several deposits were actively prospected.

Canada China Clay and Silica Company, Limited, with a plant near St. Remi d'Amherst, obtained its silica sand from a nearby quarry in Amherst township, Papineau county. The grinding plant has a capacity of 250 tons a day and the product is sold to manufacturers of glass and silicon carbide, as well as for use as moulding sand and sandblasting. It finds a ready market in the Montreal district.

Industrial Silica Corporation (266 St. James St., Montreal) operated a quarry on a deposit of vein quartz at Lac Bouchette, Roberval county, and the material produced was shipped to St. Lawrence Alloys and Metals, Beauharnois, and to Dominion Steel and Coal Company, Sydney, Nova Scotia.

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. The fines were shipped to Canada Cement Company, Montreal.

Consumers Industrial Minerals, Limited, a new company formed to produce silica sand from a deposit of quartzite near St. Julienne, plans to enlarge its small crushing and screening plant.

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 Quebec and Ontario. The silicon and ferrosilicon are marketed in Canada and abroad. J. Montpetit produced sandstone at Melocheville for the same use.

Near Buckingham there was a small production of quartzite for manufacture into grinding pebbles. Canadian Flint and Spar Company, which has a quarry and grinding plant at Buckingham, produced small quantities of high-grade silica sands for special uses and prepared silica flour for use in the pottery industry. Crude quartz produced in this area is used as flux in the electrochemical plant of Electric Reduction Company, Buckingham.

SODIUM SULPHATE (NATURAL)

Sodium sulphate occurs as crystals or in the form of highly concentrated brines in many lakes and deposits throughout western Canada. From these, hydrated sodium sulphate, known as Glauber's salt, and anhydrous sodium sulphate, known to the trade as 'salt cake', are produced in Canada.

Investigations of the sodium sulphate deposits in western Canada were made by the Mines Branch, predecessor organization of the Bureau of Mines, Ottawa, in 1921, and over 120,000,000 tons of hydrous salts were proved in the few deposits examined in detail. The material is in the form of the hydrous salt (mirabilite or Glauber's salt) which contains 55·9 per cent of water of crystallization that is removed before marketing. For the small amount of the hydrous product that is marketed as such, clean crystals are harvested and stockpiled, after which they are screened to various sizes, bagged and shipped.

Anhydrous sodium sulphate is also obtained as a by-product from the manufacture of hydrochloric acid and as a by-product from the viscose industry. The latter source of supply is likely to increase rapidly as the demand for the other products of the viscose industry expands. Thus, unless the anhydrous material from western Canada can be made of such a high degree of purity that consumers will be willing to pay a premium based on the sodium sulphate content, it will likely be unable to compete in the export market with the by-product material.

Principal Canadian Sources of Supply

The production of natural sodium sulphate in 1945 came from Saskatchewan, where the principal producers are: 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. The last-named company plans to double the capacity of its plant, construction to start in the spring of 1946. There was considerable activity throughout the year at a number of other deposits in Saskatchewan and several small experimental plants were erected.

In New Brunswick, many millions of tons of sodium sulphate seem to be indicated in a rock salt deposit at Weldon, the boundaries of which have not been fully determined. Preliminary research by the Bureau of Mines, Ottawa, showed that it is feasible to recover the sodium sulphate, but further detailed work is required to determine the commercial possibilities and the method of recovery.

Production and Trade

Canada produced 93,068 tons of sodium sulphate valued at $884,322 in 1945, compared with 102,421 tons valued at $987,842 in 1944. The operating plants in Saskatchewan are capable of meeting any likely demand. The material from western Canada is shipped to the pulp mills on the Pacific coast of Canada and to those in eastern Canada; to The International Nickel Company of Canada, Limited, at Copper Cliff, Ontario (for use in the separation of nickel and copper); and to a number of pulp mill centres in the United States.

Shipments to the United States showed a marked increase during the war, but competition with the increased production of the by-product material may adversely affect this trade.

Imports of sodium sulphate, including Glauber's salt, salt cake, and nitre cake (sodium bisulphate), were 15,451 tons valued at $108,285, compared with 22,044 tons valued at $242,095 in 1944.

Uses; Prices

Glauber's salt is used widely in the chemical industries and the demand is increasing. Sodium sulphate is used chiefly in the sulphate process for the manufacture of kraft pulp; and large amounts are used at Copper Cliff. It is used in the glass, dye, and textile industries, and to a smaller extent for medicinal purposes, and for tanning.

The price of natural sodium sulphate from the deposits in western Canada in 1945 was quoted at $8.50 per short ton in carload lots, f.o.b. plant. The delivered price at pulp mills, which are mostly distant from producing centres, is considerably higher.

TALC AND SOAPSTONE

Talc and soapstone production in Canada comprises ground products made from both these raw materials, sawn soapstone furnace blocks and bricks, and talc crayons. For a number of years there has been a steady production of these three classes of material centred in the Eastern Townships, Quebec, and of ground talc in the Madox area, Hastings county, Ontario. The average output in the period 1941-1945, inclusive, was about 30,000 tons a year. Very little talc has been produced elsewhere in Canada. The ground talc produced in Quebec consists of grey, slightly off-colour material, classed for statistical purposes as soapstone; that from Ontario is of prime white grade. Production is about equally divided between the two provinces.

Canada is self-sufficient in most of the grades of ground talc, and there is a considerable surplus available for export. It also produces most of the domestic requirements of sawn dimension soapstone and talc crayons, but imports, mainly from the United States, certain special qualities of ground talc demanded by the ceramic, paint, and cosmetic trades. Imports of such talc in 1944 and 1945 amounted to approximately 6,000 short tons.

Principal Canadian Sources of Supply

In Ontario, production of prime white foliated talc from the Madoc area during the forty years since operations were commenced is estimated at about 430,000 tons. Since 1937, Canada Talc, Limited, which operated the adjoining Conley and Henderson mines (now combined into a single operation), has been the only important producer. The company's new grinding mill, with a capacity of about 5 tons of finished products, came into operation early in 1945. About 75 per cent of the mill feed is from the Conley workings and 25 per cent from the Henderson property. Coarse rejects are screened and de-dusted for the production of granular grades.

The Madoc talc occurs in a series of closely spaced veins traversing white Grenville crystalline dolomitic limestone and varies from coarsely foliated, to massive, compact material. 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, but no commercial use of beneficiation has been made.

In Quebec, Broughton Soapstone and Quarry Company, with mines, mill, and sawing plant near Leeds station in Broughton township, is the principal operator, and produced ground talc, sawn soapstone blocks and bricks, and talc crayons. Similar products are made by L. C. Pharo Company of Thetford Mines, at Pontbriand and at Kinnear's Mills in Thetford and Leeds townships respectively. Soapstone blocks are produced by Charles Fortin of Robertsonville, Thetford township. Some of the sawing dust from these operations is sold to domestic roofing firms, and a considerable tonnage of quarry and sawing waste is shipped to the grinding plant of Pulverized Products, Limited, 4820 Fourth Avenue, Rosemount, Montreal.

Baker Mining and Milling Company operates a mine and grinding plant near Highwater, Brome county.

The Quebec talc and soapstone bodies occur in highly metamorphosed basic rocks, mainly serpentine and pyroxenite. The talcose material is rather high in iron due to the presence of residual chlorite, and there is often considerable carbonate present. It yields a slightly off-colour, grey powder.

In British Columbia, some ground soapstone for local roofing and building use is produced in Vancouver from imported crude waste by Geo. W. Richmond and Company, 4190 Blenheim Street.

Production and Trade

Canada produced 27,088 tons of talc and soapstone valued at $294,888 in 1945, compared with 32,597 tons valued at $357,249 in 1944. These figures cover ground material made by primary producers, sawn soapstone blocks and bricks, talc crayons, and sawing and quarry waste sold to other firms for grinding. Production of ground talc and soapstone, including material made from powdered waste, was 24,531 tons valued at $232,711, of which 53 per cent by quantity and 61 per cent by value was produced in Ontario, and the remainder in Quebec. Shipments of soapstone blocks totalled 1,255 tons valued at $32,966; and of talc crayons and pieces, 130 tons valued at $31,258. In 1944, output of ground material was 31,886 tons valued at $314,385; of soapstone blocks, 1,487 tons valued at $40,036; and of crayons and pieces, 151 tons valued at $37,760.

Exports of talc totalled 7,363 tons valued at $100,114, compared with 11,920 tons valued at $157,178 in 1944. Shipments comprised mainly ground material, and went chiefly to the United States (82 per cent) and to the United Kingdom (12 per cent).

Imports of ground talc in 1945 were 6,388 tons valued at $131,863, compared with 6,094 tons valued at $130,603 in 1944. They consisted mainly of fibrous, tremolitic talc produced in the Gouverneur region, New York, and used mainly in paints; and of ceramic and cosmetic grades from California.

Prior to the war, the world production of talc, including ground material, cut soapstone, steatite, and pyrophyllite, amounted to about 500,000 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 next largest producer and was followed by France and Italy, each with about 50,000 tons, Norway, British India, Canada, and Germany (including Austria).

Uses

Ground talc is used chiefly 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.

Canada used 21,000 tons of ground talc and soapstone in 1945, the distribution by industries being: roofing, 6,168 tons; paints, 6,100 tons; rubber goods, 2,656 tons; pulp and paper, 1,528 tons; medicinal and toilet preparations, 1,400 tons; insecticides, 943 tons; clay products, 753 tons; soaps and scouring powders, 631 tons; linoleum, 250 tons; electrical apparatus, 199 tons; textiles, 112 tons; iron and steel, 110 tons; miscellaneous, 150 tons.

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 is used for the production of fired shapes, which in turn are used mainly as electrical insulators. It is used to an important extent also for burner tips. 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 from high-talc ceramic bodies. Suitable talc for the purpose must 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 relatively scarce; the chief sources being British India, Sardinia, Maryland, Montana, and California.

Soapstone 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 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 used as low-grade talc in 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

The market value of ground talc varies widely and 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 $6 to $7 a ton f.o.b. rail. Domestic grey talc, suitable for roofing, rubber, and paper use, sold in 1945 for $6 to $10 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. Imported European cosmetic talcs have cost as high as $80 per ton, delivered.

Average value of domestic soapstone blocks in 1945 was about $2.25 a cubic foot, or $25 a ton; and of sawn crayons, $1.20 a gross, or $275 to $300 a ton. Soapstone waste for grinding sold at $2 a ton f.o.b. rail.

Tariffs

Canadian ground talc or soapstone exported to the United States is dutiable at 17½ per cent ad valorem on material valued at not over $14 a long ton, and at 35 per cent on material valued at over $14 a ton. The duty on crude material is ¼ 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 25 per cent; imports from the United States are dutiable at 10 per cent.

Pyrophyllite

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.

WHITING SUBSTITUTE

Whiting substitute, also referred to as domestic whiting and as marble flour, is finely pulverized white limestone, or white marble, or marl. It may be made also from lime or from the waste calcium carbonate sludge resulting from the manufacture of caustic soda.

White marble and white limestone when used for whiting substitute are pulverized to degrees of fineness ranging from 200 to 400 mesh. Only marble and limestone containing very little magnesium carbonate are used for making whiting substitute. In Canada, most of it is made from white marble; though, in Ontario, two plants have been built to make it from marl.

By-product precipitated chalk, made from waste sludge resulting from the manufacture of caustic soda from 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 its manufacture are available, but it is not made in Canada.

Production and Trade

There is no separate record of production, but the industry has shown 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.

Producers of whiting substitute are: Pulverized Products, Limited, Montreal, Quebec; 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, Manitoba; and Beale Quarries, Limited, Van Anda, Texada Island, British Columbia.

Little or no whiting substitute is exported. Imports of whiting, crude chalk, and prepared chalk were valued at $330,593 in 1945, compared with $334,744 in 1944.

Uses; Specifications; 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. The output of one of the aforementioned plants in Ontario is used entirely as a filler in newsprint.

Marl suitable for making whiting substitute should be white or nearly so, nearly free from grit and clayey material; and be very low in organic matter. Organic matter is present to some extent in all deposits of marl and renders the product unsuitable for use as a filler in products such as putty and paint where it will come into contact with oils. The oil-absorptive capacity of whiting substitute made from marl is usually greater than that of whiting, but otherwise the physical properties are much the same.

Prices per ton, bagged, and in carload lots range from $8 to $15 f.o.b. plants.

III. FUELS

COAL

The production of coal in Canada is confined to the western and eastern provinces. Ontario and Quebec have no commercial coal mines, and the previous small production of lignite in Manitoba apparently ceased in 1943. Approximately 31 per cent of the coal produced in Canada was mined in Nova Scotia, and about 47 per cent came from Alberta.

Principal Canadian Sources of Supply

In Nova Scotia, medium and high volatile coking and non-coking bituminous coals are produced in the Sydney, Cumberland, and Pictou areas. Production in 1945 was 12 per cent lower than in 1944.

In New Brunswick, a relatively small tonnage of bituminous coal is mined in the Minto field, where production in 1945 was slightly higher than in 1944, owing mainly to the continued increased production from open-pit mines.

In Saskatchewan, only lignite is produced, the main producing fields being the Bienfait, Estevan, and Roche Percée divisions of Souris area, though most of the coal is obtained in the Bienfait division. Production in 1945 was greater than in 1944 and was close to the record set in 1943.

Lignite is available also in the Onakawana area in northern Ontario, but there has been no production. Further experimental work was conducted in the field on the possibilities of utilizing a high-pressure steam-drying process for the production of a suitable domestic fuel, and during the winter of 1945-46 small quantities of this fuel were distributed in northern Ontario for the purpose of obtaining the opinions of consumers as to the suitability or otherwise of the fuel.

Alberta produces almost all ranks of coal, including a small tonnage of semi-anthracite coal. Coking bituminous coal ranging from high- to low-volatile is produced in the Crowsnest, Nordegg, and Mountain Park fields. In the Lethbridge, Coalspur, Saunders, and several other areas of the foothills a lower rank bituminous coal that is practically non-coking is produced. The coal mined in the Drumheller and Edmonton fields is lower in rank and is classed as sub-bituminous; 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 1945. The increase of 300,000 tons in the production of coal in Alberta in 1945 as compared to 1944 can be traced almost entirely to the development of various open-pit operations by the Emergency Coal Production Board in the Camrose, Castor, Brooks, and Taber sub-bituminous areas. Total production was close to that of 1942, the record year.

In British Columbia, bituminous coal ranging from low- to high-volatile is obtained from Vancouver Island, and from the Crowsnest, Telkwa, and Nicola areas on the mainland. Lesser quantities of sub-bituminous coal are mined mainly in the Princeton field. Total production for the province was 20 per cent lower than in 1944 and was about the same as the output of 1939.

Production and Trade

Canada produced 16,506,713 tons of coal valued at $67,588,402 in 1945, compared with 17,026,499 tons valued at $70,433,169 in 1944. The minimum output during the past 15 years was 11,738,913 tons in 1932, and the maximum output was 18,865,030 tons in 1942.

Production of Coal by Provinces
(Finally revised figures)

Province	1944 Tons	1945 Tons
Nova Scotia	5,808,792	5,112,615
New Brunswick	347,032	361,184
Manitoba	....	....
Saskatchewan	1,390,155	1,532,995
Alberta	7,437,781	7,800,151
British Columbia	2,134,248	1,699,768
Canada	17,118,008	16,506,713

*Production of Coal in Canada by Kinds**

	1944 Tons	1945 Tons
Bituminous	11,838,000	11,774,200
Sub-bituminous	730,000	3,199,600
Lignite	4,550,000	1,532,900
	17,118,000	16,506,700

Total imports of coal into Canada amounted to 25,061,556 tons, compared with 28,723,854 tons in 1944. Imports of anthracites amounted to 3,411,424 tons, compared with 4,413,227 in 1944. Imports of British anthracite decreased from 218,511 tons in 1944 to 28,382 tons in 1945, the latter being mainly buckwheat size. Imports of bituminous coal, all of which came from the United States, amounted to 21,176,811 tons, compared with 24,513,527 tons in 1944.

Exports of coal from Canada amounted to 840,708 tons (823,710 tons bituminous and 16,998 tons lignite), compared with 1,010,240 tons in 1944.

The Canadian consumption of coal in 1945 was 40,350,000 tons, compared with almost 45,000,000 tons in 1944 and 29,400,000 tons in 1939.

Markets and Uses

The coal production from Nova Scotia, augmented by a relatively small tonnage from New Brunswick, provided, prior to 1940, 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 war-time expansion of industry and transportation caused an almost complete cessation of the movement of coal into Quebec and Ontario from this area, and, since the end of the war, other factors have prevented the return of Nova Scotia coal to these markets.

In New Brunswick, the operators and the Provincial Government, with the aid of other agencies, have been investigating the resources and mining methods, production, and markets of their coal with a view to the establishment of washeries and possibly other processing equipment to beneficiate the coal as a means of retaining and possibly expanding present markets.

The development of markets in Ontario for Alberta coal was discontinued in 1942, but was reopened in October 1944 because of the fuel shortage, and in 1945 a total of 235,227 tons, consisting of 31,804 tons of bituminous coal and 203,423 tons of sub-bituminous coal, were brought in, mainly for domestic consumption.

*There is a serious discrepancy between the 1944 and 1945 values for sub-bituminous coals and lignite. This is due to the fact that the 1944 values are based on the old coal classification, whereas the 1945 values are based on the new system of classification, which raises the rank of the bulk of the Alberta lignites to the sub-bituminous class, and some of the former sub-bituminous coals to the bituminous class.

A large part of the sub-bituminous coal came from one or more of the five stripping operations initiated and financed by the Emergency Coal Production Board in 1943 in order to provide a reserve of production to meet emergencies. Production of the five emergency operations increased from 175,126 tons in 1944 to 534,819 tons in 1945. It is understood that most of these emergency strip mines are to be closed in 1946.

Owing to the shortage of various fuels during the war, briquettes made from coal were used to an increasing extent in Canada. During 1945 a total of 304,175 tons of briquettes, of which 53,901 tons was made from carbonized lignite, and the remainder from low-volatile bituminous coal, was produced in western Canada, and 142,435 tons of briquettes, made from low- and high-volatile bituminous coals and anthracite, was imported from the United States.

The process developed in the Department of Mines and Resources for the improvement of blower coal by chemical treatment was in continued use during 1945 in Quebec and Ontario, and 165,500 tons of coal was prepared for distribution.

COKE

Most of the coke produced in Canada is from standard by-product coke oven plants which process large tonnages of coal for the manufacture of metallurgical coke for use in the production of steel and non-ferrous metals. The domestic fuel market is also supplied with by-product coke, together with the surplus retort coke produced by the gas industry. The demand for metallurgical coke during the war months of 1945, necessitated the maintenance of the maximum output from all by-product plants. It is expected that coke will regain the domestic markets it formerly held in competition with fuel oil, city gas, and other smokeless fuels.

Principal Canadian Sources of Supply

Coke was produced from the several types of carbonization equipment in use throughout the Dominion. These include 7 by-product coke oven plants, 2 beehive plants, 3 Curran-Knowles installations, 7 continuous vertical retort plants, and 8 installations of horizontal "D" retorts.

Approximately 80 per cent of the coal used in the production of coke in Canada is processed in the five principal plants in Ontario and eastern Canada. These include: Dominion Steel and Coal Corporation's plant, Sydney, Nova Scotia, which has an annual rated capacity of 950,000 tons of coal; Montreal Coke and Manufacturing Company's plant at Ville La Salle in the province of Quebec, which normally produces domestic coke and also supplies Montreal with gas, and has an annual rated capacity of 565,000 tons of coal; Algoma Steel Corporation's metallurgical coke plant at Sault Ste. Marie, Ontario, which has an annual rated capacity of 1,780,000 tons of coal; Hamilton By-Product Coke Ovens, Limited, which, together with its subsidiary operations, Ontario Coke Ovens Division, has a rated capacity of 795,000 tons of coal a year; and the coke ovens of Steel Company of Canada, Hamilton, Ontario, which have a rated capacity of 641,000 tons of coal a year.

The manufacture of beehive coke was continued in two plants in western Canada, this production being approximately 5 per cent of the coke marketed in Canada.

During the war two major construction operations were undertaken. These were: the extension of Algoma Steel Corporation's coke oven plant at Sault Ste. Marie, with the installation of 86 Koppers under-jet ovens, designed for an annual capacity of 765,000 tons of coal; and the construction of three batteries, each of 18 Curran-Knowles ovens, for Ontario Coke Ovens Division. This plant was constructed primarily to augment the city gas supply of the Hamilton area.

Production and Trade

Total production of coke from bituminous coal in 1945 was 3,862,451 tons, compared with 4,017,696 tons in 1944. Production by provinces was reported as follows:

Provinces	1944 Tons	1945 Tons
Eastern provinces	1,093,939	1,069,586
Ontario	2,626,186	2,529,347
Western provinces	297,571	263,518
	4,017,696	3,862,451

Coal processed for the manufacture of coke amounted to 4,979,029 tons, of which 1,208,102 tons was of Canadian origin and 3,970,927 tons was imported from the United States. Petroleum coke produced at the refineries amounted to 67,889 tons, compared with 80,868 tons in 1944.

Imports of coke were 1,250,548 tons, compared with 813,460 tons in 1944. Exports were 38,665 tons, compared with 42,588 in 1944.

NATURAL GAS

Natural gas is produced commercially in Alberta, Ontario, New Brunswick, and Saskatchewan. A few shallow wells in Manitoba and Quebec produce small quantities for individual owner consumption. Alberta produces about 82 per cent of the total Canadian output. Natural gas production in Canada during 1945 increased nearly 6 million M cubic feet from the previous year, the value being greater than in 1944 by $1,400,000.

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 quantities from Cretaceous sandstones. The areal limits of the foregoing productive areas have been generally defined for some time.

In Alberta, an important development towards the close of the year was the extension of the Kinsella gas field by Imperial Oil, Limited. The first two wells brought in are 6 to 8 miles east of producing wells in the established area. Six new wells were completed up to February 1946 by the company's subsidiary, Royalite Oil Company, Limited, and approximately 60,000 acres east of the Kinsella field have been proved productive. With this extension of the area the Viking-Kinsella field becomes one of the largest and most important gas reserves in Alberta. The Medicine Hat-Redcliff gas field, the oldest in Alberta, was considerably expanded by outpost drilling, and the proven area is among the largest in Alberta.

A determined program of exploratory work was carried out in various locations in the province. Thirteen oil and gas reservations totalling 1,270,000 acres were taken up, and there were applications awaiting attention covering another 1,500,000 acres. Imperial Oil, Limited, the principal producer and distributor in the Viking-Kinsella field, plans to install a transmission pipeline to Red Deer and to supply this and the intermediate towns of Lacombe, Panoka, Wetaskiwin, and Camrose with natural gas. This field has been supplying Edmonton and intermediate towns with their gas requirements for many years. The Princess-Steveville-Denhart area, about 160 miles due south of Kinsella, is probably the largest untapped gas reserve of the southern plains, though production depths are likely to be greater than in other fields. Sixty miles southeast of Princess is the Medicine Hat-Redcliff gas field which was considerably extended by further drilling in 1945.

In Saskatchewan, thirty-three wells were drilled, ten of which were completed as commerical gas producers. The natural gas output comes from the Lloydminster, Kamsack, and Unity fields, the largest production being from the Lloydminster field, which straddles the Alberta-Saskatchewan boundary, and where three new wells were brought in. A large gas field was being developed in the Vera-Unity area, 66 miles southeast of Lloydminster, and Bata Petroleums, Limited, the leading operator, commenced a 40-well program. Ten wells were drilled, seven of which were producers. An initial pipeline was laid to the town of Unity, and gas was turned into the distribution system in November. The ten new gas wells in the Vera-Unity and Lloydminster fields have a potential of 120 million cubic feet per day at a pressure of 400 to 720 pounds per square inch. It is planned to add to the gas reserves in the two fields during 1946 and eventually to build up sufficient reserves to supply the cities of North Battleford and Saskatoon, and towns within a reasonable distance from a pipeline. The gas fields of Lloydminster and Unity together are reported to already have sufficient reserves to supply Saskatoon with natural gas. A pipeline to serve Saskatoon is expected to reach the city toward the end of 1946. Drilling was also undertaken at Torch River, north of Nipawin; at Morse, Pennant, and Maple Creek in the southwest part of the province; at Simpson, midway between Regina and Saskatoon; and at Aberdeen, northeast of Saskatoon. Some of this drilling was in progress at the end of the year. At Kamsack, the small gas field near the Manitoba boundary, five wells were being drilled to augment the existing supply.

In Ontario, further development of a gas field discovered in 1944 near the old Bothwell oil field was undertaken. Two gas wells were brought in 1 mile from the shore in the bed of Lake Erie at the south end of the Tilbury-Romney gas area; and in the older gas fields further wells were brought into production. To offset the gas shortage in southwestern Ontario, Union Gas Company of Canada, Limited, the leading producer and distributor, made application to the United States Federal Power Commission to import 5,500,000 M cubic feet of natural gas a year from Texas, with the intention of storing it in off-peak months in dry wells in Lambton county. If the application is accepted, the company hopes to renew service to many of its customers.

In New Brunswick, the Stony Creek field continued to supply Moncton and Hillsborough and certain localities in Albert and Westmorland counties. Four new wells were drilled and two were deepened. Total new production, measured in terms of initial production, amounted to 3,120 M cubic feet per day. No wildcat drilling took place, but geophysical surveys were in progress over parts of Albert county throughout the year.

Production and Trade

Production of natural gas in Canada by provinces in 1944 and 1945 was as follows:

	1944		1945	
	Amount M cu. ft.	Value $	Amount M cu. ft.	Value $
New Brunswick	702,464	341,636	653,230	317,568
Ontario	7,082,508	4,694,097	7,199,970	4,837,586
Saskatchewan	119,116	46,656	163,824	58,165
Alberta	37,161,570	6,339,817	40,393,061	7,095,910
N.W.T.	1,500	335	1,500	335
CANADA	45,067,158	$11,422,541	48,411,585	$12,309,564

Markets

The large reserves of natural gas being built up in Alberta are a potential source of supply for industries which may be established to process natural gas for the production of gasoline and other by-products. Already in the United States a plant is being built for this purpose, and the time appears to be approaching when gasoline will be synthesized from natural gas at costs competitive with those for producing gasoline from crude oil. Another potential outlet for natural gas in Canada is its use in the manufacture of liquid gas for general cooking and heating. In the United States, where such use is large and is increasing, it is claimed that the new fuel gives twice the heat of natural gas. The liquid gas, a mixture of pentane and butane, is bottled under pressure, and, when used, pressure is released and the gas is burned in the gaseous form. This mixture of gases has a thermal value of approximately 3,000 B.T.U. per cubic foot, compared with about 1,000 B.T.U. per cubic foot for natural gas. The low cost of the liquid gas per gallon, and convenient tank truck delivery service have been prime reasons for its increasing use in those areas not served by natural gas pipelines.

Some of the natural gas from Turner Valley is used in the plant of Alberta Nitrogen Products, Limited, near Calgary, which produces commercial fertilizers from ammonium nitrate. Natural gas was used during the war as a source of iso-butane, which was processed in the alkylation plant at Calgary. This plant is to continue operations. Natural gas played an important rôle during the war in the making of 100-octane aviation gasoline, synthetic rubber, and other essential war products.

PEAT

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 upon the nature of the vegetation that 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 Canada, and generally occurs in two distinct forms, namely, unhumified, or moss peat, and humified, or fuel 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 twenty-five times its own weight of liquids and gases. It is used as a bedding litter for animals, for horticultural purposes, and as a filler for fertilizers. Because of its elasticity and low heat conductivity, it is used also for insulating and sound-proofing and as a packing material.

Principal Canadian Sources of Supply

Prior to 1939, 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.

Production and Trade

In 1945, thirty-two plants were in operation with a total production of peat moss 83,963 tons valued at $2,011,139. In 1944, production was 80,446 tons valued at $1,869,553. These figures may be subject to correction due to a possible duplication in the returns from British Columbia arising from the inclusion of some resale figures. Exports were 76,409 tons valued at $2,625,514, compared with 63,949 tons valued at $2,105,370 in 1944.

In British Columbia, thirteen companies produced 49,694 tons valued at $1,374,082, the largest producers being Western Peat Company, Limited, and B.C. Peat Company, Limited.

In Ontario, five companies produced 13,546 tons valued at $255,334, the largest producer being the Erie Peat Company, Welland.

In Quebec, eleven companies produced 16,641 tons valued at $375,642, the largest producer being Premier Peat Company, Limited, Isle Verte.

In New Brunswick, the only producer was Fafard Peat Moss Company, Pokemouche.

In Manitoba, the main production came from the property near Whitemouth, operated by Winnipeg Supply and Fuel, Limited. A small quantity was produced by McCabe Bros.

The Canadian production of peat moss is practically all exported to the United States for use as horticultural moss, and poultry and stable litter.

Large quantities of peat were produced in Denmark, Sweden, Holland, Germany, and Russia prior to the war, but no recent production figures are available.

Price

Price of peat moss varies from $18.50 to $45.50 a ton according to location, the average price for the Canadian production in 1945 being about $25.50 a ton.

Peat Fuel

Small amounts of peat fuel have been produced intermittently in Ontario and Quebec. In 1945, a small quantity was made at Gads Hill, near Stratford, Ontario.

CRUDE PETROLEUM

Crude petroleum is produced in Canada from wells in Alberta, the Northwest Territories, Saskatchewan, Ontario, and New Brunswick. Production in 1945 was lower than it has been since 1939 and was 15 per cent less than in 1944. Production from Alberta continued to decline, the newer fields failing to offset the 11 per cent decline in Turner Valley. This field is the oldest in Alberta, and has been producing oil for 31 years. Production from the field has been decreasing since 1942, the peak year. Alberta contributed nearly 94 per cent of the Canadian production, close to 87 per cent of which came from Turner Valley. The discontinuance of the Canol project at the end of March resulted in a marked curtailment in production from the Northwest Territories. By far the greater part of Canada's requirements of crude petroleum is imported.

In western Canada, the petroleum industry was greatly affected by the cessation of war-time activities. Especially in the Prairie Provinces, large quantities of aviation gasoline were used by the Empire Air Training Scheme. The demand for gasoline for this purpose began to decline some months before V-E Day and came to an end early in September. The Alaska Highway project was a large user of motor fuel. One of the two alkylation plants built during the war to convert iso-butane into iso-octane was closed near the end of 1945. The other plant, at Calgary, will continue to operate, however, and excess over aviation needs will be used for blending with motor gasoline.

Exploration and drilling in the west continued on much the same level as in 1944. Large sums are spent each year in search of new fields to supplement the declining yield from older sources. The Alberta Petroleum Association reported that more than $900,000 a month was expended in oil exploration in Alberta in 1945, most of it by outside oil interests. Results generally were inconclusive and disappointing. Of interest was the successful completion of the first commercial oil well in Saskatchewan. The well is in the Lloydminster area, where a few other wells have since been successfully completed.

Principal Canadian Sources of Supply

In Alberta, the Rundle (Madison) limestone of Palæozoic age is the source of almost the entire production of petroleum in Turner Valley. Until June 1936, production in the field came almost entirely from the wells in the gas cap and was termed "naphtha", an unstabilized 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, as the specific gravity decreases, the degrees A.P.I. increase.)

Eighteen new wells were reported as completed and on steady production in Turner Valley, where drilling was confined mainly to the central and northern parts of the field. Only two producers were completed in the south, one of which at the extreme southern end of the field, was an average producer. Efforts to determine how far the productive area in the north extends towards Whiskey Creek, 4 miles beyond existing wells, were confined to two deep tests, neither of which had proved productive by the end of the year, and the northernmost has been abandoned. The southern limits of the Turner Valley field are already fairly definitely known. The drilling program financed by loans from Wartime Oils, Limited to test the central west flank of Turner Valley was concluded in August, when a total of twenty-one wells had been completed, nearly all of which are producers.

Elsewhere in Alberta there were no outstanding developments, aside from the notable increases in production from the Conrad, Princess, Lloydminster, and Vermilion fields which partly offset the decline in Turner Valley. At Conrad, fourteen new wells were completed, oil of 25°A.P.I. to 26°A.P.I. gravity coming from the Ellis sand at about 3,000 feet. The field is a stratigraphic sand trap on the northeast flank of the Sweetgrass Arch. Seven wells were drilled at Princess as a sequel to the obtaining of production from the Devonian in 1944. Four of these are oil wells, one is a gas well, one was unproductive, and the other was plugged back to become a gas well.

Salt water was encountered in the well drilled at Jumping Pound, west of Calgary, about 4,000 feet southwest of the well that struck a large flow of wet gas towards the close of 1944. A well halfway between the two was to be started early in 1946. The deep test well at Brazeau, farther north in the Foothills, reached the top of the possibly productive Rundle limestone at 9,498 feet, but the Lower Cretaceous formation was repeated by faulting before the main porous zones in the limestone were reached. The well was being deepened. The deep test at Coalspur was finally abandoned in the limestone after collapse of the casing. The cable-drilled hole near Lundbreck was deepened to 9,879 feet, a possible record for that kind of drilling.

In the plains of southern Alberta, four wells were drilled in a new area west of Taber, and oil was found in the top of the limestone in a well 10 miles northwest of Coutts. Another well only a quarter of a mile northeast proved dry. Some concealed structures that were tested after careful geophysical and geological study proved to be more complex than was expected and, consequently, are not of economic value. This kind of exploration was extended to the Northwest Territories and to the Peace River Block, and fifteen seismic and several gravimetric parties were in the field during the summer. Three seismic crews also operated in Saskatchewan.

Drilling in Alberta reached a total of 543,437 feet, compared with 597,828 feet in 1944. In Turner Valley the total was 159,049 feet in 1945.

In Northwest Territories eight test-holes were drilled and another was completed in the Mackenzie River area adjoining the Norman Wells field, all of which proved dry. Drilling and production in connection with the Canol Project ceased early in March, and the pumping of crude oil through the pipeline and operation of the Whitehorse refinery was discontinued about April 1. Stocks of oil remaining at Norman Wells refinery were transferred to Imperial Oil, Limited, and operation of the wells to supply local demands was unnecessary until late summer.

In Saskatchewan, the aforementioned first oil well came into production in April and was followed by one in May, another in July, and by three in December. The oil is obtained from Lower Cretaceous sand at depths ranging from 1,880 to 2,000 feet, and has a gravity of 12° A.P.I. Production from the six wells amounted to 16,507 barrels of clean oil, which, as in the case of that from the Alberta side of the Lloydminster field, was used as fuel by the Canadian National Railways.

Production in Ontario was 8·5 per cent less than in 1944, owing mainly to shortage of labour. It came chiefly from the Petrolia, Oil Springs, Bothwell, and Thamesville fields, and from Mosa township in the order named. Production from the old Dutton field, as a result of rejuvenation of the wells in 1943, increased from about 300 barrels a year prior to the war to an estimated output of 1,700 barrels in 1945. In a systematic search that was begun for small pools in southwestern Ontario, a number of holes were drilled, one of which in Chatham township reached the Precambrian at 3,680 feet. In it were traces of oil, principally around 1,700 feet.

In Quebec, drilling continued in Gaspe Peninsula at No. 2 well of Continental Petroleums, Limited. Peninsular Oil Corporation, Limited was starting a hole near the town of Gaspe, and Gaspe Oil Ventures, Limited expect to drill a test well 12 miles from Gaspe Harbour in 1946.

In New Brunswick, there was no wildcat drilling, but geophysical surveys were in progress over parts of Albert county throughout the year. In the Stony Creek field, new oil production in 1945 amounted to 70 barrels a day.

In Nova Scotia, the Sun Oil Company's well on the Minudie anticline, south of Amherst, was abandoned owing to mechanical difficulties at 6,506 feet in Mississippian salt formation. A second well was being drilled at Nappan. Nova Scotia Gas and Oil Company's well at Kennetcook, Hants county, had reached a depth of 700 feet at the end of 1945.

In Prince Edward Island, the test well of Island Development Company, 8 miles offshore from Charlottetown, in Hillsborough Bay, was abandoned in a salt formation of Mississippian age at a depth of 14,696 feet.

Production and Trade

The production of crude petroleum in 1944 and 1945 was as follows:

	1944		1945	
	Barrels	Value	Barrels	Value
Alberta	8,727,366	$14,468,061	7,979,786	$13,169,692
Northwest Territories	1,223,675	632,587	345,171	136,303
Saskatchewan	....	....	14,374	15,362
Ontario	125,067	296,420	113,325	268,478
New Brunswick	23,296	32,832	30,140	42,413
Totals	10,099,404	$15,429,900	8,482,796	$13,632,248

Canada in 1945 imported 56,798,371 barrels of crude petroleum for refining, valued at $72,310,214, compared with imports of 57,041,285 barrels in 1944 valued at $71,935,000. The United States supplied 56 per cent of the total imports; Venezuela, 27 per cent; Colombia, 14 per cent; and Ecuador, 3 per cent.

Exports of petroleum and its products from Canada in 1945 were valued at $11,252,448, as against $8,056,674 in 1944.