CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

MINES BRANCH

THE CANADIAN MINERAL INDUSTRY IN 1949

Review by the Staff of the Mines Branch

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PREFACE

This report contains reviews of each of the fifty-seven metals, fuels, and minerals that were produced in commercial quantities in Canada in 1949, preliminary mimeographed separates of which were made available to the public during the first half of 1950. A review of the mineral industry as a whole for 1949 is given in the introduction to the report.

The Branch is greatly indebted to operators of mines and quarries throughout Canada and to officers of the Dominion Bureau of Statistics who contributed much of the information contained in the report.

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Director, Mines Branch.

Ottawa, December, 1950.

INTRODUCTION

In the year covered by this report records were established in both the volume and value of Canada's mineral production. The new volume record was slightly above the previous peak of 1941 and 37 per cent above the 1935-39 average. Quantity records were attained in the outputs of iron ore, coal, natural gas, crude petroleum, cement, fluorspar, nepheline syenite, salt, and stone. The value of mineral production amounted to $901,010,026, a gain of close to $81,000,000 over 1948 the previous peak year. Metals were valued at $538,967,258, fuels at $183,654,473, clay products and other structural materials at $113,903,079, and the other non-metallics at $64,485,216. Aluminium production is not included as all of the metal is made from imported ore. The entry of Newfoundland into Confederation added to the Canadian supply a substantial production of iron ore, zinc, lead, copper, silver, and fluorspar valued at $27,583,615 in 1949.

The mineral industry as a whole had 116,500 people on its payrolls in 1949 and their salaries and wages amounted to $310,125,000. The metal mining industry had a payroll of 65,300, who were paid $187,408,000 in salaries and wages; the fuels a payroll of 28,600, with salaries and wages amounting to $72,700,000; and the non-metallic mineral industry a payroll of 22,600 who received $50,017,000 in salaries and wages.

Attention throughout the year continued to be centred largely on developments in the oil fields of Alberta where active exploration led to further important discoveries of petroleum and at the same time disclosed additional large reserves of natural gas, bringing the estimated total to 7 trillion cubic feet by the end of the year. Production of crude oil from the province reached an average daily rate of 55,000 barrels compared with a daily average of 29,750 barrels in 1948. Early in the year a company was formed to construct a pipeline from Edmonton to Superior, Wisconsin, with the intention of commencing the work early in 1950.

Developments in the Steep Rock and Michipicoten areas in Ontario pointed to a substantial increase in the output of iron ore from these areas within the next few years. In the Quebec-Labrador iron ore areas additional reserves were disclosed bringing total reserves to 357,000,000 tons by the end of 1949. Financial arrangements were made for bringing the deposits into production.

The large deposits of titanium ore at Allard Lake in Quebec were brought nearer to the producing stage. Work was under way on the 27-mile railway to connect the deposits with Havre St. Pierre, and on the construction of an electric smelting plant at Sorel, Quebec, to treat the ore.

A further outstanding development was the opening up of a new and important asbestos area in Munro township, Quebec, by Canadian Johns-Manville Company, Limited. Several deposits of the mineral were delimited by the end of 1949 and a 100-ton an hour mill to treat the ore was under construction.

Production of nickel, copper, lead, and zinc reached a peacetime total of 840,184 tons, being about 150,000 tons short of the peak reached in 1942. Exports of the four metals totalled 700,000 tons valued at $257,400,000. Sixty per cent of the tonnage was exported to the United States and about 30 per cent to Great Britain. Prices for copper, lead, and zinc remained at or near the peaks reached late in 1948 until the early spring of 1949. They then began to

decline and continued this downward trend until the late summer, following which there was a moderate recovery. At the end of the year, however, they were still well below the high levels of 1948.

Three new base metal properties entered production, namely Quemont and East Sullivan in Quebec, and Reeves MacDonald near Trail in British Columbia. In the latter province, The Consolidated Mining and Smelting Company of Canada, Limited commenced construction work on a new lead smelter so designed that it may be erected on the site of the existing plant without interrupting production. The company brought its second slag-fuming furnace into operation in August. The construction of Hudson Bay Mining and Smelting Company's new fuming plant and the addition to its zinc plant proceeded according to plan.

The 17 per cent increase in gold output compared with 1948 came mainly from Ontario, Quebec, and the Northwest Territories. Output, however, was more than 1,000,000 ounces below that of 1941, the peak year. Cost-aid assistance provided under the Emergency Gold Mining Assistance Act and the devaluation of the Canadian dollar in September 1949 were among the important contributions to the increased output.

Canada again contributed about half the world output of the platinum metals, the chief sources of the remainder being Russia, Transvaal, and Colombia.

Most of the silver output in 1949 was derived as a by-product from the treatment of base metal ores, but an increasing number of mines produced silver in ore or concentrates as their principal output. Production from the Cobalt-Gowganda area in Ontario increased and exploration was extensive.

Production and consumption of the industrial minerals continued at a high level. The construction industry absorbed record quantities of cement and stone and near-record quantities of other structural materials. Exports of non-metallic minerals and their products dropped to $73,700,000 from $94,900,000 in 1948, the decrease being partly the result of a prolonged strike by asbestos miners, and of Newfoundland no longer being in the category of an export market for coal and petroleum products.

Capital expenditures by the mineral industry in 1949 for new construction, and machinery and other equipment, are estimated at $133,000,000, a 27 per cent increase compared with 1948. The figures are exclusive of smelting and refining.

I. METALS

ALUMINIUM

Aluminium production in Canada in 1949 was 369,466 short tons, the largest peacetime output on record. Production would have been still larger had not a shortage of water for power-generating purposes early in 1949 necessitated the closing of some of the pot lines. All of the output is from imported ore.

The sole Canadian producer, Aluminum Company of Canada, Limited, has its alumina plant at Arvida, and reduction plants at Arvida, Ile 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 short tons of aluminium a year, or over 20 per cent of the estimated productive capacity of the world. In 1949 operations were concentrated at Arvida, Ile Maligne, and Shawinigan Falls. The company has fabricating plants at Kingston, Toronto, and Etobicoke in Ontario, and at Shawinigan Falls in Quebec. In addition, plants of other companies throughout Canada are engaged in the production of aluminium products.

In 1949 Aluminum Company of Canada, Limited investigated potential power and aluminium smelter sites in British Columbia and also negotiated with the Quebec Government for the development of increased hydro-electric power in the Arvida district to permit the using of reduction facilities now idle through lack of power.

The Canadian aluminium industry is exceeded in size only by that of the United States. The principal factor favouring the establishment of the industry in Canada is the abundant and low-cost hydro-electric power at points where the necessary raw materials can be cheaply and conveniently assembled. The chief imported raw materials are bauxite from British Guiana, coal and coke from the United States, and cryolite from Greenland and the United States. Fluorspar from the new Canadian province of Newfoundland is used for making synthetic cryolite, replacing much of the natural cryolite formerly imported.

Although Canada has no bauxite, low-grade potential ores of aluminium such as clay, shale, nepheline syenite, and anorthosite containing from 20 to 30 per cent alumina occur in many areas. The utilization of these low-grade raw materials has been the object of much research in various parts of the world, and various processes have been developed. The economic success of any of these processes will depend largely 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 from 55 to 60 per cent alumina and less than 7 per cent silica.

Domestic consumption of aluminium continues to grow, but by far the greater part of the production is exported in the forms of ingots, bars, blooms, rods, sheets, wire, cable, etc.

Uses and Price

Aluminium is finding an increasingly wide field of usefulness. It is available from fabricating plants in the form of castings, forgings, sheets, rolled and extruded shapes, tubes, rods, wire, foil, powder, and paste. In 1949 history was made in the utilization of aluminium with the construction over the Saguenay River, near Arvida, Quebec, of the first all-aluminium highway bridge. Aluminum Limited reports the sales distribution of aluminium in 1949 as follows: architectural and building uses, 28 per cent; transportation, 21 per cent; household supplies, 20 per cent; electrical industry, 16 per cent; canning and packaging, 7 per cent; chemical industries, 2 per cent; food and farming, 1 per cent; miscellaneous, 5 per cent.

The domestic base price of aluminium ingot 99·50 per cent minimum, for orders of 30,000 pounds or over, f.o.b. Arvida or Shawinigan, remained at 15½ cents per pound throughout 1949.

Production, Trade and Consumption

	1949		1948	
	Short tons	$	Short tons	$
Production, Ingot	369,466		367,079	
Imports: Bauxite				
From: British Guiana	1,725,104	8,961,371	1,820,237	7,070,960
United States	43,378	775,567	99,488	1,936,718
Netherlands Guiana	24,158	326,398	87,947	872,605
French Africa	.....	.....	822	3,718
Total	1,792,640	10,063,336	2,008,494	9,884,001
Imports: Cryolite				
From: Denmark	1,378	213,563	6,008	901,105
United States	150	30,353	683	130,708
Total	1,528	243,916	6,691	1,031,813
Imports: Aluminium Products				
Semi-manufactured	.....	2,091,073	.....	1,400,182
Fully manufactured	.....	5,753,790	.....	5,235,715
Total	.....	7,844,863	.....	6,635,897
Exports: Primary Forms				
To: United Kingdom	171,799	48,713,854	160,249	39,845,450
United States	69,690	19,023,928	77,775	19,067,488
Sweden	9,180	3,131,840	11,278	3,428,858
Switzerland	7,929	2,264,604	3,849	1,091,806
Australia	7,274	2,215,700	5,505	1,672,742
Brazil	6,863	1,978,156	6,164	1,696,838
Netherlands	5,256	1,631,619	10,559	3,239,877
Other countries	18,915	5,813,780	51,729	14,148,653
Total	296,906	84,773,481	327,108	84,191,712
Exports: Semi-fabricated				
To: India	3,227	1,551,545	1,036	604,275
United States	2,488	1,258,058	3,020	1,542,578
Brazil	1,164	548,028	373	207,863
Other countries	3,697	1,796,946	1,739	1,048,983
Total	10,576	5,154,577	6,168	3,403,699
Exports: Manufactured Products				
To: Venezuela	.....	1,097,047	.....	589,473
United States	.....	345,600	.....	265,786
Other countries	.....	1,522,754	.....	8,454,117
Total	.....	2,965,401	.....	9,309,376*
Exports: Scrap				
To: United States	4,028	1,005,291	22,282	4,998,886
Other countries	356	98,814	558	142,755
Total	4,384	1,104,105	22,840	5,141,641
Domestic Consumption: Ingot	58,800	.....	65,400	.....

*Includes wire and cable valued at $5,521,471. Exports of wire and cable in 1949 are included with semi-fabricated forms.

ANTIMONY

The world supply of antimony improved considerably in 1949. The continued drop in Chinese production was offset to a large extent by increased output from several of the other world sources.

There is no production of antimony metal in Canada. Since 1944, when its antimony refinery was dismantled, The Consolidated Mining and Smelting Company of Canada, Limited has been producing an antimony-lead alloy intermittently. In 1949 the company produced 569 tons of antimonial lead containing approximately 12 per cent antimony, and 504 tons containing approximately 5 per cent antimony.

Canadian requirements of antimony are met by imported metal, antimonial lead alloy, and domestic antimonial lead scrap largely in the form of old battery plates.

Canadian Occurrences

There are not many known occurrences of antimony in Canada. Some deposits have been developed at different times, several of which provided a small production during the latter part of the past century and the early part of the present. Antimony is found in Canada largely as the mineral stibnite (Sb_2S_3) and occurs in Newfoundland, Nova Scotia, New Brunswick, Quebec, British Columbia, and Yukon.

Newfoundland

Two occurrences of antimony have been reported, the most important being at Mortons Harbour on New World Island, the other being on Pond Island in Bay of Exploits, both on Notre Dame Bay. The stibnite at Mortons Harbour occurs in a vein along a sheared contact of a rhyolite dyke which intrudes chloritized andesitic lavas. The deposit was first worked prior to 1890 and activity continued for several years. Mining was resumed in 1906 when 100 tons of picked ore was shipped. The mine was again reopened during World War I. The Pond Island deposit is small and has never been developed.

Nova Scotia

The West Gore deposit in Hants county was worked for some years prior to 1917 and an antimony concentrate was produced carrying an appreciable amount of gold. Late in 1948 a company was formed to reopen the mine and to treat the dumps, which are reported to carry a small percentage of antimony and some gold. No work was done in 1949.

New Brunswick

Stibnite occurs in several quartz veins at Lake George and mining operations were carried on intermittently between 1868 and 1931. Ore was smelted during several of these periods and a small tonnage of metallic antimony was produced. The extensive ore dumps on the property are understood to contain considerable stibnite. Some exploratory work, including drilling, was done in 1947 and 1948, but further attempts to develop the deposit were discontinued.

In 1949 an occurrence of antimony was found in Petersville parish, Queens county, about 8 miles north of Welsford. Some trenching was done and further investigation of the deposit was planned.

Quebec

A small tonnage of ore was produced about 75 years ago from a deposit in South Ham township, Wolfe county.

British Columbia

Several occurrences have been worked in a limited way. In the Fort St. James area, the Stuart Lake mine was opened by a shaft about 1940 and a few tons of ore was shipped for test purposes. Test shipments have been made from several deposits in the Bridge River area. The Grayrock Mining Company, Limited (formerly Bellore Mines, Limited) acquired one of these properties at the head of Truax Creek. A road 11 miles in length from Minto to the property was completed in 1949 and some surface work was done. About 10 tons of 50 per cent antimony ore is reported to have been produced during the year.

The small amount of antimony that occurs associated with the lead-zinc-silver ore of the Sullivan mine, Kimberley, is ultimately recovered from the residues resulting as a by-product in the refining of lead at the Trail smelter of The Consolidated Mining and Smelting Company of Canada, Limited. Originally the antimony was recovered as refined metal, but is now recovered in the form of an antimonial lead alloy.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production (Antimony content of antimonial lead alloy)	79	61,020	155	113,173
Imports (Regulus)				
From: China	579	392,855	.....	.....
United States	420	310,817	474	299,572
Belgium	226	168,214	73	52,370
Others	67	36,416	.....	.....
Total	1,292	908,302	547	351,942
Exports (Content of antimonial lead)				
To: United States	.....	.....	325	.....
Brazil	.....	.....	89	.....
Total	.....	.....	414	.....

Normally the principal source of antimony is China, but the unsettled conditions in that country over the past decade have so restricted production that shipments have fallen to relatively small amounts. The current sources are Bolivia, Mexico, South Africa, United States, and Yugoslavia.

The United States is the chief consumer. Texas Mining and Smelting Company, Laredo, Texas, is the principal producer of refined anitmony in the United States and obtains its ores and concentrates almost exclusively from Mexico and Bolivia. Bradley Mining Company completed construction of a new smelter at Stibnite, Idaho, in 1949, for the treatment of local ore and concentrates. About 96 per cent of the United States domestic production of antimony is obtained in this State.

Uses and Consumption

Antimony is used chiefly as an alloying element with lead, to which it imparts hardness and mechanical strength. It expands on cooling, which makes it particularly useful in type-metal alloys. Antimonial lead is used for battery plates; for cable covering; and for sheet, pipe, etc., in the chemical and pulp

and paper industries. It is a component of most babbitt metals and is alloyed with lead and tin in the manufacture of solders, foil, collapsible tubes, and type metal.

Sulphides of antimony are used as pigments in paint manufacture and in the rubber industry. The oxides are used in the production of porcelain enamel frits. There are various other uses of antimony in the chemical industry.

Canadian consumption of antimony metal by specified industries in 1947 and 1948 was:

Industry	1948	1947
	Short tons	Short tons
White metal foundries	700	948
Electrical apparatus	56	213
Silverware industry	23	17
Brass foundries	13	11
Miscellaneous	20	.....
Total	812	1,189

Prices

The Canadian price of antimony declined from 41 cents at the beginning of 1949 to 32 cents at the end of the year.

The price of domestic antimony in the United States, according to Engineering and Mining Journal Metal and Mineral Markets, declined from 41·73 cents per pound at the beginning of 1949 to 35·28 cents at the end of the year.

ARSENIC (ARSENIOUS OXIDE)

Arsenical ores are widely distributed in Canada, but production of arsenic is limited to only a few localities where it is recovered as a by-product in the treatment of gold or silver-cobalt ores. In 1949, 263 tons of refined white arsenic (As_2O_3) valued at $26,332 was produced compared with 581 tons in 1948 valued at $82,909. In 1942, the peak year, 3,927 tons valued at $580,893 was produced.

Crude white arsenic was produced by two companies in 1949, namely, O'Brien Gold Mines, Limited, and Consolidated Beattie Mines, Limited, in Cadillac and Duparquet townships, respectively, in Quebec. The crude white arsenic is recovered as a by-product in the roasting treatment of gold ores. Approximately 1,600 tons was produced in 1949, but only the output of the O'Brien mine was shipped to Deloro Smelting and Refining Company, Limited, Deloro, Ontario, where it was refined to the white arsenic of commerce. The plant of Newcor Mining and Refining, Limited, Douglas Lake, Saskatchewan, was idle during 1949.

Gold-arsenic concentrates from British Columbia were shipped to the smelter at Tacoma, Washington, by Bralorne, Kelowna Exploration, Hedley Mascot, Polaris Taku, and other smaller gold mines, but as no payment is made for the recoverable arsenic this output is not included in the Canadian production figures.

Production and Trade

	1949		1948	
	Pounds	$	Pounds	$
Production (Refined arsenious oxide)				
Ontario	350,707	17,535	768,000	55,663
Quebec	175,938	8,797	394,000	27,246
Total	526,645	26,332	1,162,000	82,909
Exports[1]	12,400	1,030	170,800	6,582
Imports[2]	256,957	18,091	84,000	13,056

[1] Excluding those for which no payment is received.
[2] Including arsenic sulphide.

World production of arsenic is practically all obtained as a by-product from the treatment of gold, silver, copper, lead, zinc, cobalt, tungsten, and tin ores, the leading producing countries being Sweden, United States, Mexico, Australia, Italy, France, Japan, Germany, and Belgium.

Uses

Most of the world production of arsenic is used in the manufacture of insecticides and weed killers. Arsenic is also used as a clearing agent in making glass.

D.D.T. and 2-4-D have replaced arsenic to a considerable extent as an insecticide and weed killer, respectively. The medicinal use of arsenic has declined rapidly with the advent of penicillin.

A small amount of arsenic is used in lead cable sheathing to increase its resistance to soil corrosion. Other uses are in the preservation of wood; in the manufacture of pigments for metal finishing; and in the manufacture of dyestuffs, cattle dip, and bearing metals.

Consumers and Consumption

The more important Canadian consumers are: Niagara Brand Spray Company, Limited, Burlington, Ontario; The Steel Company of Canada, Limited, Hamilton, Ontario; Canada Metal Company, Limited, Toronto, Ontario; Mount Royal Metal Company, Limited, Sherwin-Williams Company of Canada, Limited, Dominion Glass Company, Limited, Consumers Glass Company, Limited, and Brandram-Henderson, Limited, all of Montreal, Quebec; and International Fibre Board Limited, Gatineau, Quebec.

Consumption of Arsenious Oxide in Canada

Industry	1948	1947
	Pounds	Pounds
Glass	432,711	432,449
Insecticides	15,390	117,051
White metal alloys	30,927	37,454
Miscellaneous	229,561	9,000
Total	708,589	595,954

Prices

The price of refined arsenious oxide (white arsenic, minimum 99 per cent As_2O_3) in barrels, carload lots, delivered, remained at 6 cents per pound until the end of September 1949, when it dropped to 5½ cents where it remained until the end of 1949.

BISMUTH

The Canadian output of metallic bismuth continued to decline and was almost 54 per cent lower than in 1948. The Consolidated Mining and Smelting Company of Canada, Limited, Trail, British Columbia, accounted for the entire production, which is derived from the residues resulting from the electrolytic refining of lead bullion.

Assomoly Registered, a company jointly owned by Molybdenite Corporation of Canada, Limited, and Associated Metals and Minerals, New York, installed and acid-leaching plant at the La Corne mine, La Corne township, Quebec. This plant can treat 3 tons daily of bismuth concentrates and low-grade molybdenite concentrates containing bismuth. The process consists of leaching the concentrates with hydrochloric acid and ferric chloride to dissolve out the bismuth as a chloride. The bismuth is subsequently precipitated as an oxychloride, in which form it is marketed. The plant operated on accumulated stocks during the autumn of 1949 and produced products having a bismuth content of 31,374 pounds. The La Corne mine was idle in 1949.

Occurrences

Occurrences of bismuth in Canada are rare, the most important being in the ore of the Sullivan mine of The Consolidated Mining and Smelting Company of Canada, Limited, Kimberley, British Columbia, where it occurs in very small amounts associated with the lead-zinc-silver minerals.

Small amounts of bismuth are associated with the silver-cobalt ores of the Cobalt district, Ontario.

Bismuth is associated with molybdenite in the La Corne mine from which Molybdenite Corporation of Canada, Limited produced a small tonnage of bismuth concentrates and, later, metallic bismuth during 1946 and 1947. The mine was closed late in 1947, but during 1949 stocks of concentrates on hand were treated for the recovery of bismuth as described above.

An occurrence of tetradymite (telluride of bismuth) was reported several years ago in the Glacier Gulch group, near Smithers, British Columbia.

World production of bismuth is in the neighbourhood of 1,200 metric tons a year and comes principally from the United States, Peru, Mexico, and Bolivia. Minor sources of supply are Argentina, Chile, Brazil, and Canada. United States production comes largely from the anode slimes produced in the Betts electrolytic process for refining lead bullion, the principal producers being: American Smelting and Refining Company, Omaha, Nebraska; Anaconda Copper Mining Company, Perth Amboy, New Jersey; and United States Smelting, Refining, and Mining Company, East Chicago, Indiana.

Uses and Consumption

Bismuth is a very brittle metal and consequently is not used alone, but its low melting point and tendency to expand on solidification render its alloys highly desirable for a number of applications. It is used with cadmium, tin, and lead in making low melting point alloys for sprinkler plugs and other fire-protection appliances, electrical fuses, low melting solders, dental amalgams, and tempering baths for small tools. Similar alloys are used for special airplane and automotive parts, for moulds in electro-forming, and in type metal. Bismuth is used in the production of radar equipment and in making optical glass.

Salts of bismuth are used extensively in medicinal compounds and pharmaceutical products. Due to their absorptive powers for X-rays, bismuth salts are used internally in X-ray examinations of the digestive tract.

Canada uses less than 50 tons of bismuth metal a year, the principal consumers being: Canada Metal Company, Limited, Toronto, Ont.; Mount Royal Metal Company, Limited, Montreal, Que.; Mallinckrodt Chemical Works, Limited, Ville La Salle, Que.; and Merck and Company, Limited, Montreal, Que.

Production and Trade

	1949		1948	
	Pounds	$	Pounds	$
Production:				
British Columbia (metal)	102,913	210,972	221,677	443,354
Quebec (in ore)	.....	.....	13,203	26,406
Ontario (in alloy)	.....	.....	5,362	10,724
Total	102,913	210,972	240,242	480,484
Exports (metal)	178,000	.....	158,000	.....
Imports (Bismuth-bearing ore, gross weight)				
From: United States	199,397	83,382	166,776	88,996
Australia	1,232	721	.....	.....
Bolivia	72,145	14,556	.....	.....
Total	272,774	98,659	166,776	88,996

Prices

The price of bismuth metal in Canada in 1949 remained at $2 a pound delivered Montreal.

In ton lots the f.o.b. New York price was $2 a pound throughout 1949.

CADMIUM

Production and exports of cadmium increased slightly compared with 1948, and the apparent Canadian consumption was also greater. The price of the metal remained unchanged throughout the year.

Production

About 79 per cent of Canada's output was produced at Trail, British Columbia, by The Consolidated Mining and Smelting Company of Canada, Limited, and the remainder by Hudson Bay Mining and Smelting Company, Limited, at Flin Flon, Manitoba. The metal occurs in close association with zinc and is recovered in the treatment of zinc concentrate at the Trail and Flin Flon plants from the residues that result from the purification of the zinc electrolyte. The rated capacity production of the Trail cadmium refinery is 700 tons a year, and of the Flin Flon refinery about 180 tons. At both refineries a high-grade cadmium product is made.

The Consolidated Mining and Smelting Company's Sullivan mine at Kimberley, British Columbia, supplies most of the lead and zinc concentrates treated at Trail. The zinc concentrate, amounting to about 750 tons a day, contains about 0·18 per cent cadmium. However, much of the company's cadmium production now comes from the treatment of zinc concentrate shipped to Trail by a number of Canadian and other mining companies, among the more important of which in 1949 were Zincton Mines, Limited, Britannia Mining and Smelting Company, Limited, Canadian Exploration Limited, Reeves MacDonald Mines, Limited, and Silver Standard Mines, Limited, all in British Columbia.

Hudson Bay Mining and Smelting Company's cadmium production came largely from its copper-zinc orebody at Flin Flon on the Saskatchewan-Manitoba boundary. The company also treated zinc concentrate containing cadmium from Sherritt Gordon Mines, Limited, and Cuprus Mines, Limited, both near Flin Flon.

Production, Trade, Consumption and Refinery Production in Principal Countries

	1949		1948	
	Pounds	$	Pounds	$
Production				
British Columbia	665,449	1,364,170	617,226	1,126,437
Saskatchewan	110,292	226,099	80,938	147,712
Manitoba	70,800	145,140	67,926	123,965
Total	846,541	1,735,409	766,090	1,398,114
Exports				
To: United Kingdom	442,664	1,047,509	589,094	1,379,730
United States	64,965	126,749	6,032	13,570
France	34,749	84,980	.....	.....
Sweden	48,568	100,899	.....	.....
Other countries	42,661	94,125	972	2,049
Total	633,607	1,454,262	596,098	1,395,349
Consumption (mainly in white metal alloys)	255,000	.....	185,000	.....

Refinery production by principal countries*	1949	1948
	Pounds	Pounds
United States	8,023,616	7,500,000
Canada	846,541	766,090
Tasmania	468,852	493,696
Great Britain	221,820	249,088

* Source: American Bureau of Metal Statistics.

Uses

The demand for cadmium has increased rapidly since the pure metal became available following development of the electrolytic process for refining zinc. Its chief use is in electroplating, where it is applied as a thin protective coating to other metals, principally iron and steel. Because of its relatively high cost compared with zinc this use is limited to such articles as bathroom, washing machine, and other household fittings, where a uniform attractive colour is

desired. Next in importance is its use in white metal alloys, especially where a hard, heat-resisting bearing alloy is required, as in high-speed internal combustion engines. The white metal alloy industry is the chief Canadian outlet. The addition of 0·7 to 1·0 per cent of cadmium strengthens copper without seriously reducing its electrical conductivity. Cadmium is used in making low melting point solders and fusible alloys for sprinkler apparatus, fire detector systems, and valve seats for high-pressure gas containers.

Nickel-cadmium automobile storage batteries with a cadmium content of about 7 pounds each have been in use for many years in Europe. This type of battery is said to have an operating life of from 15 to 20 years.

Cadmium sulphide and cadmium sulphoselenide (red lithopone) are standard agents for producing, respectively, bright yellow and red colours in paints, ceramic materials, inks, rubber, and leather. Cadmium nitrate is used in white fluorescent lamp coatings, and the oxide, hydrate, and chloride of cadmium are used in electroplating solution. Cadmium bromide, chloride, and iodide are used in the preparation of special photographic film.

Prices

The average Canadian price in 1949, estimated by the Dominion Bureau of Statistics, was $2.05 a pound.

The New York price of cadmium in the form of commercial sticks or bars remained at $2 a pound throughout the year. Patented shapes and anodes were 15 cents a pound higher.

CHROMITE

The Canadian output of chromite declined from 1,715 short tons in 1948 to 361 tons in 1949 and consisted mainly of shipments from small stockpiles of ore at the old Montreal pit of Union Carbide Company in the Black Lake area, Quebec. Imports, which enter Canada via the United States from Africa, Philippines, Russia, Turkey, etc., showed a decrease of approximately 3,000 tons to 66,246 tons in 1949. Production of ferrochromium decreased 8,000 tons to 22,000 tons, and exports decreased over 4,000 tons below the 1948 total to 18,149 tons.

Production, Trade, and Consumption

Chrome Ore	1949		1948	
	Short tons	$	Short tons	$
Production (shipments)	361	7,148	1,715	33,568
Imports				
From: United States[1]	23,386	757,195	31,133	1,206,837
Union of S. Africa	28,417	470,759	27,140	394,818
Rhodesia	7,040	269,614	4,733	184,111
Philippines	6,283	132,604	4,480	94,550
Turkey	560	25,628	1,232	46,429
Cuba	.....	.....	465	10,947
Other countries	560	8,282	.....	.....
Total	66,246	1,664,082	69,183	1,937,692
Consumption	64,000	.....	73,000	.....
Consumers' Stocks, Dec. 31	43,000	.....	33,000	.....

[1] Imported via the United States from Africa, Philippines, Russia, Turkey, Yugoslavia, Sierre Leone and India.

The old Montreal pit, which had operated over 50 years ago, was reopened by Union Carbide Company in 1941. It is operated for the company by Orel Paré.

Most of the deposits from which production was obtained in the past are between Quebec City and Sherbrooke in the Eastern Townships of Quebec, but all are inactive at present. The main sources of supply during the war were the Sterrett mine in Cleveland township, and the Reed-Belanger property in the Black Lake district, both of which operations ceased in 1944.

Fairly extensive deposits of low-grade chromite were discovered early in 1942 in southeastern Manitoba north of Oiseau (Bird) River. Various zones have been traced for lengths of several thousand feet. The chromite is high in iron and test work has been under way for some time at the Mines Branch, Ottawa, and elsewhere to raise the low chrome-iron ratio to within market requirements.

Although Canada's production of chromite is small, the availability of electric power at reasonable rates has enabled the establishment of an extensive ferro-alloy trade. One of the ferro-alloys produced in Canada for domestic consumption and export is ferrochromium which is made in carbon arc electric furnaces.

The following table shows the production, consumption, and exports of ferrochromium in Canada for 1948 and 1949 in short tons.

Chromium Alloys	1949	1948
	Short tons	Short tons
Production	22,000	30,000
Domestic Consumption	7,500	6,500
Exports of Ferrochrome		
To:		
United States	9,580	11,552
United Kingdom	5,828	8,692
Other countries	2,741	2,271
Total	18,149	22,515

World Production

World production of chromite of all grades varies from 1,100,000 tons to more than 2,000,000 tons annually and comes mainly from Russia, Union of South Africa, the Philippines, Southern Rhodesia, Turkey, and Cuba, with smaller tonnages from New Caledonia and India.

Southern Rhodesia, Turkey, and Russia are the main sources of metallurgical grade chromite. The Philippines, Cuba, and Southern Rhodesia supply mainly high-grade refractory ores. The Union of South Africa is the main supplier of chemical-grade ore.

Uses and Specifications

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

The chromium content, the ratio of chromium to iron in the ore or concentrate, the amount of non-chromium bearing material in the ore, and the physical character of the ore are the chief factors determining the grade and use of the material.

For standard metallurgical uses chromite should contain a minimum of 48 per cent chromic oxide (Cr_2O_3) with a chromium to iron ratio of 3 to 1 or more and the material should be in lumpy form.

For special types of chrome addition agents such as Chrome X, produced by Chromium Mining and Smelting Company, Limited, Sault Ste. Marie, Ontario, lower grade ores with a ratio 1·5 to 1 are being used.

Refractory chromite should contain 57 per cent or more of combined Cr_2O_3 and alumina (Al_2O_3) with approximately 40 per cent Cr_2O_3 and should be as low as possible in silica and iron. The ore should be hard and lumpy, not under 10-mesh, and the chromite should be present in an evenly, finely divided state rather than as coarse blobs with silicates.

There are no fixed limits for chemical grade ore except those imposed by price and the effect of grade on plant capacity. In contrast to metallurgical and refractory ore, concentrates and fines are preferred, and a low chromium to iron ratio is not harmful provided the chromium content is high. The silica content should be low.

Although the grades were named for the major uses, some interchange of grade is possible. Chemical ore has been used for metallurgical purposes, metallurgical concentrates and fines for chemical purposes, and metallurgical lump, for refractory purposes.

Chromite is used chiefly in the steel industry where it is mainly consumed in making ferrochromium for use in the manufacture of stainless and other alloy steels. Some chromite is used directly in the steel bath. Chromium increases hardness and shock resistance and imparts high tensile strength and ductility to steels. Other metallurgical uses include the manufacture of certain cast iron and non-ferrous alloys. The addition of chromium to cast iron reduces the grain size greatly, increases its resistance to wear and corrosion, and reduces oxidation at high temperatures. There is no completely satisfactory substitute for chromium in stainless and other alloy steels but some of the chromium can be replaced by molybdenum or manganese.

Chrome ore (refractory grade) is used in making refractory bricks and cements used largely in basic open-hearth furnaces, in arches of furnaces, etc. It is used with magnesia to make chrome-magnesia refractories.

Chemical grade ore is used for the production of chromium chemicals, which in turn are used in tanning leather, pigments, chromium plating, and other applications.

Prices

The Engineering and Mining Journal Metal and Mineral Markets Bulletin of December 29, 1949, quoted prices for chromite and allied products, as follows:

(*a*) *Chrome Ore,* per long ton, dry basis, f.o.b. cars, New York:

(1) Indian and Rhodesian

48 per cent Cr_2O_3, 3 to 1 ratio	$37.50
48 per cent Cr_2O_3, 2·8 to 1 ratio	$35.00
48 per cent Cr_2O_3, no ratio	$26.00

(2) South African (Transvaal)

48 per cent Cr_2O_3, no ratio	$26.00
44 per cent Cr_2O_3, no ratio	$18.00

(*b*) *Ferrochromium,* per pound of contained chromium containing 65 to 69 per cent chromium and high carbon (4 to 9 per cent carbon), in lump form, in carloads delivered to the eastern zone, 18·6 to 20·5 cents.

(*c*) *Chromium* (chrome metal), per pound on 97 per cent grade $1.12 for spot transactions and $1.07 on contract.

COBALT

Shipments of cobalt of Canadian origin in concentrates exported and in metal, alloy, oxides, and salts totalled 310 tons in 1949. This was a decline of 462 tons compared with shipments in 1948, but the latter included 323 tons of United States' stockpiled material accumulated and held in Canada during World War II. However, shipments do not represent actual production.

Much interest was shown in the Cobalt-Gowganda area of Ontario, where production increased and exploration was extensive. Silver-Miller Mines, Limited, at Brady Lake a few miles southeast of Cobalt, commenced milling in its new 50-ton per day concentrator in October 1949. This is the first new mill to be put into operation in the Cobalt area in recent years. Rich silver veins carrying cobalt were discovered on its property close to the Brady Lake fault. High-grade silver-cobalt veins were also discovered along the Brady Lake fault on the Cobalt Lode Silver Mines property adjoining Silver-Miller Mines on the south and east.

Cobalt occurs in minor amounts in the nickel-copper ores of the Sudbury district of Ontario and is recovered in the form of oxides and salts at the Port Colborne, Ontario, and Clydach, Wales, nickel refineries of The International Nickel Company of Canada, Limited. The cobalt is obtained from the residues of the electrolytic refining of nickel. Falconbridge Nickel Mines, Limited, with mines in the Sudbury area, plans to recover cobalt at its nickel refinery in Norway.

Production and Trade

(Tons of 2,000 pounds)

—	1949	1948
Shipments (from Canadian ores)[1]		
In concentrates exported	25	381
In metal, alloy, oxides, and salts produced	285	391
Total	310	772
Exports: *In concentrates*		
To: United States	6	381[2]
Other countries	19	.....
As metal, in oxides, and in salts[3]		
To: United Kingdom[4]	248	355
Other countries	0·5	1
Imports:		
As metal, in oxides, in alloys, or in concentrates	39	52

[1] Not necessarily mined in the years specified.

[2] Of which, 323 tons represent the United States' stockpile accumulated and held in Canada during World War II.

[3] Includes production from ores, concentrates, alloys, etc., of foreign origin.

[4] Does not include the cobalt contained in the nickel bottoms shipped to the nickel refinery at Swansea, Wales, where the cobalt is recovered as cobalt oxide.

The following table shows the cobalt contained in ore shipments from the Cobalt-Gowganda area in 1948 and 1949 in short tons.

Destination	1949	1948
Canadian refiners[1]	26	22
United States	6	64
United Kingdom	19	.....
Total	51	86

[1] Not included in official statistics until shipped from refineries as metal, oxides, or salts.

Statistics on Canadian production of cobalt, by years, do not give a true picture of actual annual production of new cobalt, mined or milled, because of the stockpiling policy of the mine operators, the cobalt refiners, and the purchasers of ores or concentrates. Production of the metal, or its content in compounds, from the Cobalt area does not show up until the finished product has been sold.

Deloro Smelting and Refining Company, Limited, Deloro, Ontario, the Canadian buyer of silver-cobalt ores and concentrates, recovers cobalt for making "stellite" and produces cobalt metal, oxides, and salts for domestic consumption and export.

Sudbury Area. The production of cobalt, in cobalt oxide form, at the Port Colborne nickel refinery of The International Nickel Company was begun in June 1947, and in 1949 amounted to 213 tons of contained cobalt. Anticipated annual production of this recovery plant is 250 tons of cobalt in oxide form. This production is in addition to the recovery of cobalt as cobalt oxide and salts at the Mond Nickel refinery in Swansea, Wales.

Falconbridge Nickel Mines plans to recover annually about 150 tons of cobalt in oxide form at its nickel refinery in Norway following alterations to the electrolytic plant. These alterations involve a changeover from sulphate to chloride solutions for the electrolytic refining of nickel.

Cobalt Area. During the two years prior to mill production in October 1949, Silver-Miller Mines had been a consistent shipper of high-grade silver ores containing better than 5 per cent cobalt.

Smaller shipments of cobalt-silver ore and concentrates were made from the Beaver and Temiskaming mines of Silanco Mining and Refining Company, Limited; by Mensilvo Mines, Limited, which operates a small concentrating mill for the recovery of cobalt; and by the operators holding the Cross Lake Lease on the O'Brien property near the north end of Cross Lake, the Kerr Lake Lease on the old workings at the bottom of Kerr Lake, and the O'Shaughnessy Lease on the O'Brien and adjoining Reinhardt properties at the southeast end of Cross Lake.

The Cobalt Chemical and Refining Company, Limited, a subsidiary of Silanco Mining and Refining Company, started production on a limited scale in November 1949, from its new smelter located about 5 miles south of Cobalt. This plant was designed to treat 10 to 15 tons of ore and concentrate a day from the mines in the Cobalt area. During 1949 about 75 tons of cobalt concentrate was shipped to the smelter by Silanco.

Gowganda Area. Siscoe Metals, Limited, operating the former Miller Lake-O'Brien mine near Gowganda, Ontario, about 45 miles north and west of Cobalt, was one of the major producers of silver and cobalt in 1949. Development work underground has proved up faulted extensions of formerly worked veins and located new sources of ore on the lower levels. The company's 100-ton mill, which has been in operation since 1948, was changed over from diesel to electric power early in 1949.

Castle-Trethewey Mines, Limited, adjoining the Miller Lake-O'Brien mine on the north and east, reopened its Capitol mine, which had been idle since 1931, to explore the same break being mined by Siscoe Metals on its lower levels from 1,000 to 1,200 feet. If development results are satisfactory the company plans to commence milling upon completion of mill rehabilitation.

World Production

Belgian Congo, Northern Rhodesia, French Morocco, United States, and Canada together contribute about 92 per cent of the annual world output of cobalt of approximately 6,000 metric tons. The Belgian Congo continues to

produce more than one-half of the world supply of cobalt, its sole producer being Union Minière du Haut Katanga. Peak production was reached by this company in 1948 with an output of 4,250 metric tons.

The United States is the largest consumer of cobalt but it produces only a small part of its requirements.

Uses

At least 75 per cent of the world production of cobalt is used in the metallurgical industry and most of the remainder in the ceramic industry. Its principal metallurgical use is in the making of permanent magnets and magnet alloy steels, followed by stellite alloys which contain 40 to 50 per cent cobalt, 30 to 37 per cent chromium, and 12 to 17 per cent tungsten. Stellite alloys are used in high-speed, high-temperature cutting-tools and die materials.

Many of the high-temperature alloys developed during World War II contain from 13 to 66 per cent cobalt. Capable of maintaining strength at high operating temperatures while resisting wear corrosion, these alloys are being used for various component parts of gas turbines, jet aircraft engines, and turbo-superchargers.

Cobalt is used in carbide-type alloys, welding rods, as a binder for tipping tools, in electroplating, and with other chemicals in nickelplating solutions such as for an undercoating for chromium plating.

Cobalt oxide is used chiefly in the ceramic industry because of its fine colouring properties and is one of the best known ground-coat frits for porcelain enamels.

There are no satisfactory substitutes for cobalt in its principal uses.

Prices and Tariffs

The price of contained cobalt in ore or concentrate, f.o.b. Cobalt, Ontario, in 1949 was 5·5 per cent per unit per pound. Deloro Smelting and Refining Company, Limited buys cobalt-silver ores from the Cobalt camp on the above basis and pays for the silver content of the ores or concentrates on a sliding scale based on the silver content. Treatment and refining charges are paid by the shipper from the above settlement.

The Engineering and Mining Journal Metal and Mineral Markets Bulletin of December 29, 1949, quoted the following prices for cobalt metal and cobalt compounds; cobalt metal, per pound, 97 to 99 per cent cobalt, $1.80 for 500 pounds (bbl.), $1.82 for 100 pounds (case), and $1.86 for under 100-pound lots; cobalt oxide, metallurgical grade, 72 per cent cobalt, per pound of cobalt contained, $1.95, f.o.b. Niagara Falls; ceramic grade, 70 to 71 per cent cobalt, per pound, $1.38 east of the Mississippi, and $1.40 west of the Mississippi; cobalt ore, per pound of cobalt contained, 60 to 80 cents, f.o.b. Cobalt, Ontario, dependent upon grade.

The duty on cobalt oxide, entering United States, was 10 cents a pound; sulphate, 5 cents a pound; linoleate, 10 cents a pound; and other salts and compounds, 30 per cent ad valorem. Cobalt ore, concentrates, and metal entered the United States duty free.

COPPER

Canada's copper output of 263,457 short tons in 1949 valued at $104,719,151 was 9 per cent higher in volume than that of 1948 but 2 per cent below it in value. For the first time it includes the output of Newfoundland. Forty-three per cent of the output came from Ontario, 26 per cent from Quebec, 20 per cent from Manitoba and Saskatchewan, 10 per cent from British Columbia, and the remainder from Newfoundland.

Production and Operations

All the copper produced from Canadian mines occurs in association with precious metals or with other base metals. This diversity of products tends to give stability to the mining operations.

Newfoundland

Buchans. The Buchans mine of American Smelting and Refining Company produces concentrates of copper, lead, and zinc. In 1949 the copper concentrate produced was 16,066 tons. The mill capacity is 1,300 tons a day. New orebodies were discovered in 1948 at some distance from the deposits that have been producing since 1928, and a new shaft (sunk 1,700 feet by the end of 1949 to exploit them) is expected to be in use by the end of 1950.

None of the numerous copper prospects in Newfoundland was active in 1949.

Quebec

Noranda. The Noranda smelter treated 1,056,780 tons of ore, concentrate, scrap copper, and other material to make 72,487 tons of anodes which were shipped to the company's copper refinery in Montreal East. Of the materials smelted, 454,929 tons was for other companies on a toll basis. New copper produced was 68,502 tons. The second reverberatory furnace was put into operation in August, after having been idle for 5 years, to treat the increased volume of custom ore. Substantial renewals and additions to the plant were made.

The Horne mine of Noranda furnished 1,257,202 tons of ore which yielded 25,948 tons of copper. The reserve is 17,507,000 tons of sulphide ore and 957,000 tons of siliceous fluxing ore. This does not include No. 5 pyrite orebody, known to contain 100,000,000 tons of material with low copper and gold values.

Noranda's Waite-Amulet mine and the adjoining Dufault property yielded 16,749 tons of copper from milling 453,175 tons of ore. The ore reserve is 1,050,184 tons, principally in lower "A" orebody (1,023,000 tons). An orebody discovered in 1949 was being developed through a new shaft.

Noranda has leased a part of the Joliet-Quebec property adjoining the Horne mine on the northwest and is preparing to mine a deposit of siliceous fluxing ore indicated by drilling to contain 900,000 tons.

Normetal. Normetal Mining Corporation, Limited increased its mill capacity to 800 tons daily. It milled 292,235 tons of ore and shipped 34,500 tons of copper concentrate to the Noranda smelter. The ore reserve is 1,452,800 tons. The internal shaft was sunk to a depth of 4,160 feet. Power is now obtained from the Quebec Hydroelectric Commission.

Quemont. Quemont Mining Corporation, Limited commenced to operate its concentrator in June and before the end of 1949 the plant had attained its rated capacity of 2,000 tons a day. Ore milled during 1949 was 346,014 tons from which 29,200 tons of copper concentrate was shipped to the adjoining Noranda smelter. The ore reserve is 9,229,500 tons. The main shaft was completed to a depth of 2,615 feet and preparation was made for exploring the deposits at lower levels.

East Sullivan. East Sullivan Mines, Limited commenced milling at the beginning of 1949 and the mill capacity of 2,500 tons a day was reached in June. The wide ore deposits permit rapid development and extraction of ore and low operating costs. The 768,746 tons of ore milled yielded 14,142 tons of copper from the Noranda smelter where the concentrate was smelted. The mine is partly developed to a depth of 1,000 feet. Preparations were under way to open six new levels in an additional depth of 900 feet. Ore reserve at the end of 1949 was 4,430,000 tons.

Gaspe Copper Mines Limited. Drilling during 1949 by this subsidiary of Noranda Mines disclosed 7,000,000 tons of ore, which brings the total indicated by drilling to 48,000,000 tons.

Northwestern Quebec

No work was done on the copper-gold deposits at Chibougamau and Opemiska in northwestern Quebec.

Ontario

With the exception of a small tonnage shipped to Noranda from the Bi-Ore property in the Mississauga Forest Reserve north of Lake Huron, all of Ontario's copper came from the nickel-copper mines of the Sudbury area.

International Nickel. The International Nickel Company of Canada, Limited operates five mines, from which 9,984,841 tons of ore was mined in 1949. Most of this ore was concentrated in a central flotation plant at Copper Cliff, the small remainder being smelted as lump ore at Coniston. A sixth mine is being developed at Creighton, not far from the present Creighton mine, to produce 6,000 tons daily of low-grade ore which will be concentrated in a new mill to be erected at the mine. The Copper Cliff concentrator gives two concentrates, one containing most of the copper and the other high in nickel, which are smelted separately. The blister copper is refined in the copper refinery at Copper Cliff, where blister copper from the Sherritt Gordon mine in Manitoba is also refined.

The company's five mines, namely Frood, Creighton, Levack, Murray, and Garson, are being made ready for expanded output in preparation for the cessation of mining in the large Frood-Stobie open pit, which will soon reach its maximum economical depth.

The company's ore reserve at the end of 1949 was 251,805,000 tons, the copper content being about the same as that of nickel.

Sales of refined copper were 110,937 tons. In addition, a moderate amount of copper in Monel metal, the natural alloy of copper and nickel, was produced.

Falconbridge. Falconbridge Nickel Mines, Limited has two mines and a smelter in the Sudbury area, and a refinery at Kristiansand in Norway. The company treated 941,929 tons of ore in 1949, of which 15,896 tons came from development faces in the new McKim mine and the remainder from the Falconbridge mine. As the smelter capacity is now considerably above that of the refinery, the latter is being expanded, and surplus matte is being stockpiled in the meantime.

The Falconbridge ore contains about twice as much nickel as copper. The ore reserve at the Falconbridge and McKim mines at the end of 1949 was 8,592,000 tons, and at the other properties in Sudbury area, 6,199,000 tons, or a total of 14,791,000 tons.

Manitoba and Saskatchewan

Hudson Bay. Hudson Bay Mining and Smelting Company, Limited operates the Flin Flon copper-zinc mine astride the Manitoba-Saskatchewan border, the Flin Flon smelter, two small mines in the vicinity, and a power plant on the Churchill River. The Flin Flon mine in 1949 furnished 1,885,107 tons of ore. The ore reserve is 20,157,000 tons. The Cuprus mine, 13 miles southeast of Flin Flon, produced 79,183 tons of ore. The ore reserve is 245,000 tons. The Schist Lake mine, 3½ miles southeast of Flin Flon, is under development. Its ore reserve of 270,000 tons is included in the reserve of the Flin Flon mine.

The Flin Flon smelter treated 359,026 tons of the company's copper concentrate and ore, and 60,958 tons of custom concentrate from the Sherritt Gordon mine. Ore from the Flin Flon deposits yielded 42,633 tons of blister copper that was shipped for refining to Canadian Copper Refiners, Limited at Montreal East.

Sherritt Gordon. Sherritt Gordon Mines, Limited is close to the end of its ore reserve at Sherridon, but is developing a new mine at Lynn Lake, 120 miles to the north, to which the equipment is being progressively transferred. In 1949 the ore milled was 432,524 tons. The copper concentrate was smelted at Flin Flon and the blister copper was refined at Copper Cliff to give 9,480 tons of refined copper. The ore reserve of 396,400 tons is expected to last through 1950 and into the first quarter of 1951 at a milling rate 20 per cent below that of 1949.

The nickel-copper ore at Lynn Lake occurs as a number of pipe-like deposits that are being developed underground. The ore reserve is 10,365,000 tons. A new extraction process using ammonia has been demonstrated in a pilot plant at Ottawa.

British Columbia

Granby. The Copper Mountain mine of Granby Consolidated Mining, Smelting and Power Company, Limited again increased its output and the ore was of higher grade than in 1948. The capacity of the mill at Allenby, 8 miles north of the mine, was increased in March 1949 to 5,500 tons a day. The mill treated 1,803,916 tons of ore, and the concentrate which was shipped to the smelter at Tacoma, Washington, yielded 17,847 tons of copper.

The ore reserve was maintained at 7,524,000 tons. It was again possible to mine some ore of lower grade that had been written off the reserve. The program of underground exploration that was commenced in 1949 is to be continued.

Britannia. Britannia Mining and Smelting Company, Limited operated its mill at 3,100 tons a day, treating 880,580 tons of ore. The 29,425 tons of copper concentrate and 719 tons of copper precipitate obtained from mine water were shipped to the smelter at Tacoma, and yielded 8,969 tons of copper.

A new orebody, low in copper and gold and with considerable zinc values and some silver, was developed in the upper part of the mine. This discovery has encouraged the continuance of exploration westward where zinc mineralization is known. Continued development of the No. 8 mine area was satisfactory.

Vananda. The mill of Vananda Mines (1948), Limited, on Texada Island, was again operated sporadically and the company made shipments of concentrate and hand-picked ore to Tacoma.

Approximately 101,443 tons of ingot copper was processed in Canada during 1949. Most of this was rolled into wire rods, a part of which was exported as noted above and the remainder was re-rolled into a great variety of wire products. Much of this wire was exported also. The remainder of the Canadian consumption was used chiefly to make brass and bronze.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production, all forms[1]				
Ontario	113,043	44,658,786	120,384	53,384,560
Quebec	67,822	27,092,363	48,813	21,819,473
Saskatchewan	34,960	13,964,980	31,074	13,890,237
British Columbia	27,055	10,783,314	21,501	9,590,326
Manitoba	16,960	6,774,871	18,960	8,475,160
Newfoundland[2]	3,617	1,444,837	.....	.....
Total	263,457	104,719,151	240,732	107,159,756
Production, refined[3]	226,083	.....	221,275	.....
Exports of ingots, bars, slabs, etc.				
To: United Kingdom	59,491	25,814,607	63,494	27,872,171
United States	50,211	20,364,107	18,086	8,042,218
France	7,402	3,267,767	14,097	5,964,180
Czechoslovakia	392	177,338	6,411	2,760,716
Switzerland	1,846	705,877	4,119	1,774,242
India	5,741	2,509,792	2,937	1,260,022
Other countries	2,077	875,266	7,025	3,009,101
Total	127,160	53,714,754	116,169	50,682,650
Exports of rods, strips, sheets, tubing				
To: United Kingdom	13,428	6,136,449	14,002	6,614,582
United States	8,841	3,988,922	1,459	745,683
Switzerland	1,455	700,349	3,656	1,705,439
Netherlands	4,288	1,940,273	2,821	1,327,489
Denmark	1,119	561,886	2,015	943,588
Other countries	2,398	1,411,138	4,686	2,671,428
Total	31,529	14,739,017	28,639	14,008,209
Exports in ore, matte, regulus				
To: United States	29,650	11,860,100	22,624	7,239,840
Norway	6,496	2,598,080	5,346	1,710,576
Other countries	912	364,960	586	187,424
Total	37,058	14,823,140	28,556	9,137,840
Consumption, refined	101,443	.....	107,353	.....

[1] Blister copper made from Canadian ore plus recoverable copper in concentrates, matte, etc., exported.
[2] Figures for full year 1949.
[3] Including any made from imported ore.

The American Bureau of Metal Statistics issued the following estimate of copper production in 1949 in most of the countries where the metal is produced or refined. The figures cover blister copper or refined copper only, copper exported in the form of concentrate being credited to the country where it is smelted.

Copper Output of Smelters and Refineries, 1949

(Tons of 2,000 pounds)

United States	961,464	Belgian Congo	155,864
Canada	224,408	Union of South Africa	32,561
Chile	386,617	Australia	11,235
Peru	23,183	Japan	81,611
Mexico	59,868	Finland	22,767
Germany (Federal Republic)	160,456	Turkey	12,010
Rhodesia	289,946	Yugoslavia	15,773

Uses and Price

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 an important outlet. A part of the total is used as brass and bronze in many industrial and household forms.

The price of copper at the beginning of 1949 was 23½ cents a pound at New York. It dropped rapidly and reached a low of 16½ cents in June, then rose to 18½ cents at the end of 1949.

GOLD

Canada continued to be the second largest producer of gold in 1949, being exceeded only by the Union of South Africa. Canadian production rose to 4,123,518 fine ounces, a 17 per cent increase over the 1948 output, due to a further improvement in the supply and quality of labour, the cost-aid assistance provided under the Emergency Gold Mining Assistance Act, and the devaluation of the Canadian dollar in terms of the United States dollar. However, production was still 1,221,661 ounces lower than in 1941, the peak year.

The increase in output of 593,910 fine ounces in 1949 came mainly from Ontario, the main producer, with an increase of 259,132 fine ounces, Quebec with an increase of 193,559 fine ounces, and the Northwest Territories with an increase of 75,868 fine ounces. The Kerr-Addison mine in the Larder Lake area of Ontario became Canada's largest gold producer, handling 4,200 tons of ore daily. Substantial increases in tonnage were also recorded by Giant Yellowknife in Northwest Territories and by Madsen Red Lake in Ontario. Several new mines entered production, including Campbell Red Lake in Ontario; Quemont, a gold and base metal producer, in Quebec; and the Nor-Acme gold mine in Manitoba.

Assistance payments for the calendar year 1948 under the Emergency Gold Mining Assistance Act amounted to $10,500,000 and it is estimated cost-aid assistance for the calendar year 1949 will total approximately $13,000,000. A Bill to amend the Act was passed by the House of Commons on December 3, 1949, providing for increased assistance where production from a mine in the designated year (under the Act the designated years are 1948, 1949, 1950) was less than that in the "Base" year. The Bill also provided for a reduction in the assistance payment to any mine during 1950 by an amount equal to $3.50 for each ounce of gold to which the rate of assistance applies in 1950. Devaluation of the Canadian dollar increased the value of gold in Canadian currency from $35 to $38.50 an ounce.

Canadian Production of Gold

(Fine Ounces)

Provinces	1949	1948	1941 (Peak year)
Ontario			
Auriferous quartz mines:			
Porcupine	1,047,949	998,838	1,440,590
Kirkland Lake	475,819	447,888	743,032
Larder Lake	314,434	204,144	205,766
Matachewan	49,526	48,994	69,870
Sudbury	32,725	23,974	12,197
Algoma	.....	165	11,560
Thunder Bay	117,863	112,351	242,478
Patricia	280,348	219,204	390,750
	2,318,664	2,055,558	3,116,243
Base Metal mines	35,845	39,819	78,065
Total	2,354,509	2,095,377	3,194,308
Quebec			
Auriferous quartz mines	703,677	604,260	812,704
Base metal mines	260,507	166,365	276,635
Total	964,184	770,625	1,089,339
British Columbia			
Auriferous quartz mines	260,088	253,870	510,161
Placer operations	14,497	18,133	35,020
Base metal mines	29,722	34,995	63,022
Total	304,307	306,998	608,203
Northwest Territories			
Auriferous quartz mines	177,493	101,625	74,417
Manitoba			
Auriferous quartz mines	106,755	63,074	80,330
Base metal mines	30,644	43,102	70,223
Total	137,399	106,176	150,553
Saskatchewan			
Placer operations	14	4	57
Base metal mines	94,194	87,923	137,958
Total	94,208	87,927	138,015
Yukon			
Placer operations	81,970	60,614	70,959
Newfoundland			
Base metal mines	9,269	.....	.....
Alberta			
Placer operations	115	78	215
Nova Scotia			
Auriferous quartz mines	64	188	19,170
CANADA—Total (ounces)	4,123,518	3,529,608	5,345,179
CANADA—Total $	148,446,648	123,536,280	205,789,392

Operations and Developments

British Columbia

Production decreased slightly in 1949 due to a lower recovery from dredging operations and to the suspension of operations at several mines. The large lode gold mines maintained a steady production.

Lode gold production came mainly from Bralorne Mines, Limited, in the Bridge River area; Kelowna Exploration Company, Limited, in the Osoyoos area; and Polaris-Taku Mining Company, Limited, in the Atlin area. This last company installed a small roaster in 1949 to handle about one half of its concentrate production, all of which it had previously shipped to a United States smelter for treatment. The remainder of the lode gold production came from the Pioneer mine in the Bridge River area; Cariboo Gold Quartz and Island Mountain mines in the Cariboo area; Hedley Mascot mine in the Osoyoos area, where operations were suspended in April 1949; and Sheep Creek and Kenville mines in the Nelson area.

The Privateer mine in the Clayoquot mining division, the famous Premier mine in the Portland Canal district, the Kootenay Central mine in the Rossland area, and the Alpine mine in the Nelson area, remained closed throughout 1949.

Most of the gold production from base metal mines came from Britannia Mining and Smelting Company, Limited, at Britannia Beach, and The Granby Consolidated Mining, Smelting and Power Company, Limited, at Copper Mountain.

Dredging operations accounted for an output of 14,497 fine ounces and were carried out by Atkinson Dredging Company, Limited, on the Similkameen River near Princeton; Tulameen Dredging Company on the Tulameen River near Princeton; Richmond Hill Mining Company, and Cariboo Metals near Likely; Moccasin Mines, Limited on McDame Creek; and Summit Mines, Limited, American Goldfields Incorporated, and Trebor Placer Exploration, Limited, all in the Quesnel-Wells area.

Saskatchewan

The gold output came from thatpart of the copper-zinc-gold mine of Hudson Bay Mining and Smelting Company, Limited at Flin Flon that lies within the province.

Manitoba

The large increase in gold output over that of 1948 resulted from the entry into production of the Nor-Acme mine in June 1949, a subsidiary of Howe Sound Exploration Company, Limited, in the Snow Lake area. Production from the mine for the remainder of the year totalled 37,000 fine ounces.

San Antonio Gold Mines, Limited produced approximately 50,000 ounces of gold from its mine at Bissett in the Rice Lake area.

Jeep Gold Mine, Limited, a subsidiary of San Antonio Gold Mines, Limited, in the Rice Lake area continued to ship gold ore to the San Antonio mill.

Ogama-Rockland Gold Mines, Limited, in the same area, produced approximately 16,000 ounces.

The gold output from base metal mining came from the Flin Flon mine of Hudson Bay Mining and Smelting Company, Limited, and from the Sherritt Gordon mine of Sherritt Gordon Mines, Limited, at Sherridon.

Ontario

The lode gold mines of the Porcupine, Kirkland Lake, and Larder Lake areas supplied most of the output; other important contributors being the lode gold mines of the Patricia, Thunder Bay, and Matachewan areas, and the nickel-copper mines of the Sudbury area.

The largest increase in production came from the Larder Lake area and was mainly accounted for by the substantial increase in output from the Kerr-Addison mine.

In the Porcupine area, the producers in order of output were: Hollinger, McIntyre, Dome, Aunor, Pamour, Preston East Dome, Hallnor, Delnite, Paymaster, Coniaurum, Buffalo Ankerite, Ross, Porcupine Reef, Broulan, Bonetal, and Hugh-Pam.

In the Kirkland Lake-Larder Lake area, the producers in order of output were: Kerr-Addison, Lake Shore, Wright-Hargreaves, Macassa, Sylvanite, Kirkland Lake Gold, Teck-Hughes, Upper Canada, Chesterville, Toburn, and Bidgood Kirkland. The Bidgood Kirkland mine was closed during 1949.

In the Patricia area the main producers in order of output were: Madsen Red Lake, Pickle Crow, Central Patricia, Cochenour Willans, McKenzie Red Lake, Campbell Red Lake, Starratt Olsen, Hasaga, New Dickenson, and New Jason.

The Campbell Red Lake mine commenced milling in 1949.

The New Jason mine resumed milling in August.

In the Thunder Bay area the chief producers were: MacLeod-Cockshutt, Leitch, Little Long Lac, Hard Rock, and Magnet.

Production also came from Matachewan Consolidated and Young-Davidson mines in the Matachewan area and from the Renabie mine in the Missanabie area.

Output from the nickel-copper mines of the Sudbury area totalled 35,845 fine ounces.

Quebec

The gold output continued to come from the Rouyn-Harricanaw belt of northwestern Quebec. The lode gold mines which accounted for production in 1949 in the order of output were: Lamaque, Malartic Goldfields, Sigma, East Malartic, Consolidated Beattie, Sullivan, Belleterre, Canadian Malartic, O'Brien, Stadacona, Senator-Rouyn, Perron, Barnat, Elder, Powell-Rouyn, Donalda, Consolidated Central Cadillac, Anglo-Rouyn, Louvicourt, Siscoe, Consolidated Duquesne, Hosco, Quesabe, and New Marlon.

The Quesabe, Anglo-Rouyn, and Consolidated Duquesne officially commenced production in 1949.

The New Marlon, Louvicourt, Siscoe, Hosco, and Consolidated Central Cadillac mines suspended operations during the year.

The remaining gold production came from the following base metal mines in order of output: Noranda, Quemont, East Sullivan, Golden Manitou, Waite Amulet, Normetal, New Calumet, and Anacon.

Nova Scotia

Production was the lowest in the history of the province.

Newfoundland

The output of 9,269 fine ounces came from the copper-lead-zinc mines of Buchans Mining Company, Limited, a subsidiary of American Smelting and Refining Company, in the central part of the Island.

Northwest Territories

Production was 75 per cent higher in 1949 as compared with 1948 and was well over double the 1941 production. Output came mainly from the Con, Negus, Rycon, and Giant Yellowknife mines.

Giant Yellowknife commenced operating its roaster and treated the stockpile of concentrates that had accumulated during 1948.

Discovery Yellowknife Mines, Limited, in the Quyta-Giauque Lake area, commenced to produce gold near the end of 1949.

Thompson-Lundmark Gold Mines, Limited discontinued production early in 1949.

Major development work was carried out by Akaitcho Yellowknife Gold Mines, Limited, on its property that adjoins Giant Yellowknife on the north; by Crestaurum Mines, Limited, in the Yellowknife area; and by Progress Diversified Minerals, Limited, in the Indin Lake Area.

Yukon

Production, which is derived from placer operations, came from the Dawson Mayo, and Whitehorse areas.

The Yukon Consolidated Gold Corporation, Limited, which operates dredges in the Dawson area, continued to be the largest producer in Yukon.

Yukon Gold Placers, Limited commenced operations on Thistle and Henderson Creeks. Operations were also carried out in the Dawson area by Clear Creek Placers, Limited, Yukon Explorations, Limited, and Miller Creek Placers.

Various individuals carried out smaller operations on Last Chance, Hunker, Goldbottom, Quartz, and Bonanza Creeks, and on Homestake Gulch.

In the Whitehorse area, the more important producers were Kluane Dredging Company, and Burwash Mining Company, Limited, on Burwash Creek.

A small production was reported from Dublin and Haggart Creeks in the Mayo area.

IRON ORE

Canada's production of iron ore increased markedly in 1949. The two iron mines in Ontario had greater outputs, and the entry of Newfoundland into Confederation brought the Wabana mines into Canada. Financial arrangements were concluded to provide a railway and other facilities for the Labrador-New Quebec hematite area. Most of the Canadian ore was exported. Imports from the United States remained at a high level, however, as it is economical to use a mixture of Ontario and Minnesota ores in the Ontario blast-furnaces. No progress was made toward developing the magnetite deposits of eastern Ontario. A small amount of magnetite was exported from British Columbia to an electric smelting plant in the State of Washington. Noranda Mines, Limited made further progress in its process to obtain sulphur and iron oxide sinter from pyrite concentrate.

Developments at Properties

Algoma Ore Properties Limited. This company is a subsidiary of Algoma Steel Corporation and conducts all that company's iron ore business. Its only producing property is the Helen mine in the Michipicoten district, 120 miles north of Sault Ste. Marie. The ore of the Britannia (formerly Bartlett) siderite deposit, which lies 9 miles to the northeast, is of good grade but the deposit is smaller than the Helen. The newly discovered Siderite Hill deposit 3 miles east of the Helen was drilled. It is similar in size to the Helen and the grade of the ore is somewhat higher. No further work was done on the Goulais magnetite deposit 60 miles north of Sault Ste. Marie, which contains 100 million tons of taconite-type ore.

The new undeground mine at the Helen was developed further on two levels to a depth of 600 feet. It is equipped to produce 4,500 long tons a day, using the block-caving method to mine the ore and a series of belt conveyers to bring it to the surface. At the end of 1949 the daily production from underground was 1,500 tons. The Victoria open pit, aided by substantial extensions of the Victoria orebody found recently, will furnish the balance to make 4,500 tons a day until the new underground mine is in full operation in 1950.

A fourth sinter machine was added to the sinter plant which now has a daily capacity of 3,400 tons. The output of sinter is now at the rate of one million tons a year, the company's objective for the Helen property. This capacity is dependent upon operating the plant throughout the year in place of 9 months as formerly.

The Siderite Hill ore was discovered by company men in 1948 in the course of a systematic examination of company lands held for many years. The main outcrop is on a hill that rises 300 feet above the surrounding ground. This will permit open pit mining of a considerable tonnage of ore. It is intended to develop this property as a separate operation with about the same output as the Helen.

Jones and Laughlin exercised its option on the Ruth and Lucy siderite properties northeast of the Helen, but no further development was done.

Steep Rock Iron Mines, Limited. The company's output of hematite continues to come from "B" Pit, now called the Errington mine. To prepare for the 1949 shipping season, over 3 million cubic yards of overburden was removed, one-third of it by hydraulic stripping and two-thirds with shovels and trucks. Shipments totalled 1,134,261 long tons, of which 1,096,763 tons was of standard grades and 37,498 tons was sulphurous ore used mainly for sintering.

As in 1948, there were only two standard shipping grades, Seine River for blast-furnace feed, and Steep Rock open-hearth lump. The Steep Rock grade is divided into lump ore, minus 10 plus 4 inches, and charge ore, minus 4 plus 1½ inches.

Drilling extended the known length of "B" orebody to 4,000 feet. The open pit now has a length of 3,000 feet and can be worked economically for several years more.

Preparations were being made to open an underground mine in "B" orebody, commencing in the spring of 1950. A vertical shaft is to be sunk to an initial depth of 1,200 feet in the hanging-wall at a distance of 2,000 feet from the open pit. From this shaft three levels beneath the open pit will be developed to make 5 million tons of ore available from each level.

The third level will be used for pumping in the first instance, and for production of ore later when deeper levels are developed. It is expected that the objective of one million tons a year from underground will be attained by 1955 when the open pit will probably be exhausted.

Financial arrangements for developing "A" orebody, now known as the Hogarth Mine, were completed late in 1949 and a contract was let for removing 45 to 50 million cubic yards of silt from the northern part of the lake bed. This contract is to be completed by the autumn of 1954. Meantime, the higher parts of the orebody will be exposed and production of ore is expected to commence in 1953. Full production of 2 million tons is anticipated in 1955. It is intended to mine about 20 million tons from the open pit before underground mining of this deposit commences. Less stripping of the rock walls per ton of ore will be required than at "B" pit, as the orebody is considerably wider. The grade is about the same, but the proportion of open-hearth lump ore is likely to be greater.

In January 1950, it was announced that Inland Steel Company of Chicago had leased 800 acres of ground on which "C" orebody is situated. Preliminary drilling of this locality some years ago indicated the possibility of a large deposit of ore. Drilling from the ice of the lake was commenced immediately.

Wabana Mines. The Wabana hematite mines of Dominion Steel and Coal Corporation, Limited have been in Canadian territory since Newfoundland joined Confederation on March 31, 1949. The official statistics show ore brought to Sydney, Nova Scotia, up to that date as imported. Since that date the statistics include the Wabana output in the Canadian production. In the summary below, figures for the full year are given.

The beds of hematite at Wabana constitute one of the world's large reserves of iron ore. The cost of mining and transportation is low and the four mines could produce a considerably larger tonnage than at present. The ore is rather

high in phosphorus and silica, however, and this restricts its more general use on this Continent. Large amounts have been sold in Great Britain and Germany, but present exchange difficulties have interfered somewhat with this trade.

Mechanization of the Wabana mines has proceeded rapidly during recent years and production methods have been improved.

Shipments during 1949 were:

	Long tons
Sydney, Nova Scotia	738,278
United Kingdom	711,305
United States	30,673
Total shipments in 1949	1,480,256
Total shipments in 1948	1,717,763

The company's records since mining was commenced in 1895 show the total shipments to the end of 1949 as follows:

	Long tons
Canada	26,117,172
Germany	12,776,367
United Kingdom	6,233,050
United States	2,485,175
Belgium	8,270
Total shipments	47,620,034

Labrador and New Quebec

Hollinger Consolidated Gold Mines, Limited, and M. A. Hanna Company, in partnership, continued to explore the important iron ore field in the central part of Labrador Peninsula. This increased moderately the reserve of ore to 357 million long tons, of which 241 million tons is in the Hollinger North Shore Exploration Company's concession in Quebec, and 116 million tons is in the concession of Labrador Mining and Exploration Company on the Newfoundland side of the border. The known ore is in thirty deposits in a length of 90 miles, but most of it is in the "main ore zones", 50 miles in length. The ore so far discovered has been found as outcrops, and it seems likely that additional deposits will be found as the search proceeds beneath the cover of drift in the intervening ground.

In the calculation of ore estimates three shipping grades have been considered, as follows:

Ore Estimate at End of 1949

(Dry analysis, per cent)

Type	Long tons	Iron	Manganese	Silica	Phosphorus	Sulphur
Bessemer	204,990,000	60·64	0·30	8·69	0·028	0·028
Non-Bessemer	108,878,000	57·71	0·55	7·99	0·112	0·109
Manganiferous	44,315,000	49·99	7·87	7·92	0·102	0·100

Late in 1949 it was announced that an agreement had been made with Iron Ore Company of Canada to finance the project to the point of production. This company represents six steel companies in the United States, including M. A. Hanna Company, which will market the 10 million tons a year considered to be the minimum payable tonnage. The requisite facilities include 350 miles of railway, rolling stock, port installations at Seven Islands on the Gulf of St. Lawrence, a hydro-electric plant to provide power for the mines, equipment for open pit mining, and townsites at the port and at the mines. The agreement is in the form of an option that can be exercised at any time up to the end of

1953, and the area optioned covers the larger part of the presently known ore deposits. Ample ore for use in Canada, Great Britain, and other countries has been reserved by the original owners (Hollinger and Hanna). The option requires that exploration on a substantial scale be continued by Iron Ore Company of Canada. This will leave the original exploration companies free to develop their extensive holdings outside the leased areas. Mining operations are to be conducted by a new company, Hollinger-Hanna Limited, in which the two parent companies share equally.

Railway location has been completed from Seven Islands to the mining area, and a winter road to give access to the right of way has been made for a part of the distance. Until the railway is constructed, the field will remain completely dependent upon transportation by air.

Production and Trade

From 1923 to 1938 there was no production of iron ore in Canada. The following table indicates how rapidly the output has increased since 1939.

Shipment of Canadian Iron Ore
(Thousands of long tons)

—	Helen sinter	Josephine lump	Steep Rock hematite	Wabana[1] hematite	Campbell River, B.C., magnetite	Canada Total
1939	109	.....	.....	.....	.....	109
1946	496	58	830	.....	.....	1,384
1947	508	.....	1,206	.....	.....	1,714
1948	507	.....	687	.....	.....	1,194
1949	662	.....	1,134	1,480	5	3,281

[1] Not included in Canada until 1949.

As noted in the following table, a large part of the ore from Ontario mines is exported to the United States where it is much in demand because of its high grade and its good furnace qualities. The larger part of the ore used in the blast furnaces of Ontario is imported from the United States. The furnaces at Sydney, Nova Scotia, use Wabana ore almost exclusively.

Production, Trade, and Consumption
(Thousands of long tons)

—	1949	1948
Production (shipments)	3,281*	1,194
Imports		
From: United States	2,099	3,028
Newfoundland	.....	733
Other countries	111	78
Total imports	2,210	3,839
Exports		
To: United States	1,612	956
United Kingdom	720	.....
Total exports	2,332	956
Indicated consumption in Canada	3,159	4,077
Imported ore as per cent of consumption	70	94

* Includes Newfoundland production for full year.

Ore imported from overseas is used at Sydney, Nova Scotia, mainly as open-hearth lump ore.

Canadian Imports of Iron Ore From Overseas

(Excluding Newfoundland)

(Long tons)

Year	Sweden	Brazil	Morocco	United Kingdom	Total
1948	.....	74,030	4,013	.....	78,043
1949	15,216	96,204	.....	10	111,430

Canadian Plants Using Iron Ore

The four companies listed below use almost all of the Canadian consumption of iron ore.

Blast Furnace, and Open-Hearth Plants in Canada

Company	Blast Furnaces		Open Hearths	
	Number	Annual capacity (net tons)	Number	Annual capacity (net tons)
Dominion Steel & Coal Corp., Ltd., Sydney, Nova Scotia	3	525,000	10	690,000
Algoma Steel Corporation, Ltd., Sault Ste. Marie, Ontario	5	1,035,000	12	610,000
Canadian Furnace, Ltd., Port Colborne, Ont.	2	221,760	.....	.....
The Steel Company of Canada, Ltd., Hamilton, Ontario	3	757,000	13	1,145,000
Totals	13	2,538,760	35	2,445,000

A small tonnage of lump ore is required by several other steel companies that make steel from scrap in small open-hearth furnaces and electric furnaces.

LEAD

Canada produced 159,775 tons of lead in 1949 valued at $50,488,879, compared with 167,251 tons valued at $60,344,146 in 1948. Ninety-one per cent of the production was refined lead produced at the smelter and refinery of The Consolidated Mining and Smelting Company of Canada, Limited, at Trail, British Columbia. Exports of both refined lead and concentrate were greater than in 1948 but there was a decrease in domestic consumption. The price of lead fluctuated widely during the year, the average Canadian price being 15·47 cents a pound compared with an all-time peak of 20·75 cents a pound at the end of 1948.

Production and Developments

British Columbia

Consolidated Mining and Smelting Company's Sullivan lead-zinc-silver mine at Kimberley, British Columbia, is Canada's principal source of lead. A total of 2,297,672 tons of ore was mined compared with 2,283,625 tons in 1948. The lead and zinc concentrates produced in the company's 8,600-ton a day concentrator near the mine are shipped to the Trail smelter. The large-scale development projects at the Sullivan that were commenced in 1947 were completed, including a new underground crushing plant, a 4-mile haulage-way to the mill, and a sink-float plant. Operation of the sink-float equipment was commenced in May and is proving satisfactory in eliminating coarse waste rock, which is returned to the mine for use as back fill on the lower levels. Plans have been made to mine a considerable portion of the ore remaining in the upper levels by open cut methods.

Production at Trail, most of which came from Sullivan ore, included 146,000 tons of refined lead. A second slag-fuming furnace was completed and placed in operation in August, making possible the treatment of all current blast furnace slag and zinc plant residues in addition to substantial stocks of these stockpiled materials. Construction work was begun on a new lead smelter so designed that it may be erected on the site of the existing lead plant without interrupting production.

The commercial production of indium as a by-product of the lead smelting operations was commenced. The volume of the company's receipts of custom ore and concentrate increased from 68,392 tons in 1948 to 134,510 tons in 1949. Most of the mines that ship to Trail are in British Columbia, but substantial shipments of lead concentrates were received from Quebec, Yukon, and South America.

Among the more important of the older silver-lead-zinc mines active in 1949 were: Base Metals Mining Corporation, Limited at Field; Zincton Mines Limited, Ainsmore Consolidated Mines, Limited, Violamac Mines, Limited, Santiago Mines, Limited, and Western Exploration Company, Limited, all in the Ainsworth-Slocan district; Highland Bell, Limited, at Beaverdell; and Silver Standard Mines, Limited, at New Hazelton.

Reeves MacDonald Mines, Limited, on the Pend d'Oreille River about 20 miles east of Trail, commenced production of lead and zinc concentrates in July. The company planned to increase the capacity of its new concentrator from 500 to 1,200 tons a day.

Canadian Exploration, Limited commenced producing lead and zinc concentrates from the Jersey zinc-lead deposit on its Emerald property near Salmo. It milled about 300 tons of this ore daily in its former tungsten concentrator following modification of the equipment.

Base Metals Mining Corporation reopened the Cork Province mine, near Kaslo, and made shipments from it.

Sheep Creek Gold Mines, Limited commenced production of lead and zinc concentrates in a new 50-ton mill at its Paradise mine near Invermere.

Following a shutdown of 16 months Silbak Premier Mines, Limited resumed production of gold-silver-lead concentrate at its Premier mine, near Stewart, in November.

Production was resumed in February at the Toric silver-lead mine, near Alice Arm, after a substantial rehabilitation development by Torbrit Silver Mines, Limited, a subsidiary of The Mining Corporation of Canada, Limited.

Underground development and exploration were carried out by the Consolidated Mining and Smelting Company with encouraging results on the copper-lead-zinc deposits at the Tulsequah Chief and Big Bull properties on the west

coast; on the lead-zinc deposits at the Bluebell property on the east side of Kootenay Lake; and on the H.B. property near Salmo. Production of lead-zinc oxide ore was expected to commence at the H.B. property in 1950.

Ontario

McWilliams-Beardmore Mines, Limited, which reopened the Silver Mountain zinc-lead-fluorspar mine, 37 miles west of Fort William, in 1948, commenced production of concentrates in a 15-ton pilot mill. Construction of a 150-ton concentrator was started in which it is expected fluorspar will be recovered as well as lead and zinc concentrates.

Rochette Gold Mines, Limited commenced production of lead and zinc concentrates from old surface dumps in a 35-ton mill at its property near Kingston and made preparations to resume underground operations.

Quebec

Lead concentrate was produced by New Calumet Mines, Limited, Pontiac county; Anacon Lead Mines, Limited, Portneuf county; and Golden Manitou Mines, Limited, Abitibi county. There was also a small production from Candego Mines, Limited, Gaspe county.

At New Calumet the mill capacity was increased from 550 to about 730 tons a day by the addition of a new ball mill and classifier. Production from 226,000 tons of ore included 8,000 tons of lead concentrate.

Golden Manitou Mines milled 358,980 tons of ore in its 1,000-ton a day concentrator to produce lead and zinc concentrates containing 1,080 tons of lead and 11,406 tons of zinc. The recovery of all metals was increased by the installation of additional flotation cells in the mill. Important new ore containing higher lead values was discovered at depth both east and west of the present mine workings.

Anacon Lead Mines, Limited milled about 410 tons of ore a day and produced concentrate containing 1,187 tons of lead. The company planned to increase the mill capacity to 600 tons daily early in 1950. Exploration to the north of the old workings on the lower levels disclosed additional ore of better than average grade.

Candego Mines, Limited continued to develop the high-grade lead-zinc occurrences on its property in Gaspe peninsula. The mill was operated intermittently at an average of 10 tons a day until November, when the main power plant was destroyed by fire. The company shipped about 500 tons of bulk concentrate.

Ascot Metals Corporation, Limited acquired the Moulton Hill copper-lead-zinc mine near Sherbrooke and deepened the shaft to establish three new levels. The company planned to re-equip the mill and to commence production of concentrates in 1950.

New Brunswick

Preparations made in 1948 to develop the Elmtree lead-zinc deposit near Bathurst were discontinued.

Newfoundland

The Buchans copper-lead-zinc mine in the central part of the Island is the only base metal operation. It is operated by Buchans Mining Company, Limited, a subsidiary of American Smelting and Refining Company. Production from 334,000 tons of ore milled in the company's 1,300-ton concentrator included 32,085 tons of lead concentrate. Important new orebodies to the northwest of the older workings were outlined and a new shaft to develop this section of the property was started in June.

Yukon

United Keno Hill Mines, Limited continued to develop its rich silver-lead-zinc deposits in the Mayo district. The company's mill was destroyed by fire

in June but a new 250-ton mill was constructed and was placed in production in October. Concentrate and ore produced contained 2,665 tons of lead.

Northwest Territories

The Consolidated Mining and Smelting Company of Canada, Limited continued its exploratory drilling of the 500-square-mile concession which it holds jointly with Ventures, Limited, and Northern Lead Zinc, Limited at Pine Point, Great Slave Lake. The work indicated that commercial deposits of lead-zinc ore possibly extend over a wide area. In March 1949, a second concession was acquired consisting of 320 square miles adjoining the first concession on the east.

The zinc-lead-silver discovery made in 1948 near Indian Mountain Lake, north of Great Slave Lake, was drilled by Hollinger Consolidated Gold Mines, Limited, but the results were inconclusive and the option was dropped.

Production, Trade, and Consumption

	1949		1948	
	Short tons	$	Short tons	$
Production, all forms	159,775	50,488,879	167,251	60,344,146
Production, refined (a)	146,149	.....	160,025	.....
Exports, in ore				
To: United States	6,551	1,531,404	3,393	888,862
Belgium	13,340	3,209,967	2,214	674,630
Total	19,891	4,741,371	5,607	1,563,492
Exports, refined				
To: United States	61,869	19,441,226	53,036	17,241,784
United Kingdom	44,595	14,458,125	47,367	14,535,514
France	1,104	464,666	1,473	402,046
Netherlands	3,654	1,116,834	521	156,624
Other countries	4,218	1,663,680	1,365	422,546
Total	115,440	37,144,531	103,762	32,758,514
Exports, lead manufactures				
To: Portugal	.....	.....	.....	67,069
Venezuela	.....	24,729	.....	55,139
Iran	.....	164,501	.....	48,060
Colombia	.....	29,547	.....	9,854
United States	.....	1,860	.....	26,863
Other countries	.....	80,497	.....	154,760
Total	.....	301,134	.....	361,745
Imports of tetraethyl lead compounds—				
All from United States	8,586	6,356,843	7,286	5,131,472
Domestic consumption of refined lead				
Solders and alloys *(b)*	12,135	.....	15,642	.....
Wire coating and cable covering	12,622	.....	12,247	.....
Paints and pigments	5,026	.....	9,386	.....
Storage batteries *(c)*	18,095	.....	18,482	.....
Hot dipping and annealing	1,511	.....	1,774	.....
Foil and collapsible tubes	196	.....	400	.....
Ammunition	675	.....	342	.....
Miscellaneous	2,736	.....	1,269	.....
Total	52,996	.....	59,542	.....

(*a*) Includes lead recovered from imported ores and concentrates.
(*b*) Excluding lead in antimonial lead for storage batteries.
(*c*) Includes new lead and lead content of antimonial lead.

Production of refined new lead in 1948 and 1949 as compiled by the American Bureau of Metal Statistics was as follows:

Country	1949	1948
	Short tons	Short tons
United States	510,689	461,274
Canada	146,149	160,025
Mexico	252,739	214,431
Argentina	19,882	23,676
Peru	39,668	38,341
Belgium	87,417	72,427
France	59,103	38,375
Germany*	109,540	54,123
Italy	30,112	29,098
Spain	29,910	24,266
Japan	13,841	11,693
Australia	207,273	211,454
Tunis	21,581	20,008
Rhodesia	15,619	14,582

* 1948—Bizonal Area; 1949—Federal Republic.

United States produced approximately 511,000 tons of new lead from its domestic and foreign ores as well as 384,000 tons from scrap. It imported 275,000 tons of pig lead. Lead consumption was estimated at 868,000 tons or about 23 per cent less than in 1948. Much of the surplus was stockpiled by the Government. About one-third of the consumption went into storage batteries, the other principal outlets were cable covering and the manufacture of tetraethyl products.

In the United Kingdom, the second largest consumer of lead, 369,000 tons was used, of which cable covering, the principal outlet, accounted for 37 per cent.

Uses

Lead has a wide variety of industrial uses and it forms an essential component of a number of important chemical compounds and products. The principal uses vary in different countries but the overall peacetime uses in order of importance are for storage battery manufacture, cable covering, tetraethyl lead compound, bearing metal and solders, red lead and litharge, and white lead. Other uses include sheeting, ammunition, plumbing, caulking, foil for packaging, type metal, and chemical products.

From the viewpoint of world supply the large quantities of lead recovered as secondary metal from battery plates, cable sheathing, plumbing and caulking lead, etc., are of increasing importance.

Prices

The price of pig lead at Montreal was 20·75 cents a pound at the beginning of 1949. Between March and June it declined to 11·75 cents, after which it increased slightly and was 13·25 cents at the end of the year. The average Canadian price for 1949, estimated by the Dominion Bureau of Statistics, was 15·46 cents a pound for pig lead and 11·9 cents for lead contained in concentrates exported.

MAGNESIUM

No magnesium was produced in Canada during 1949. The electrolytic magnesium plant of Aluminum Company of Canada, Limited, at Arvida, Quebec, was not in operation. Dominion Magnesium, Limited, Haley, Ontario, shipped

from stock, and also made and shipped some magnesium alloys. In 1949 this company purchased the plant of Light Alloys, Limited, at Renfrew and also installed an extrusion press.

Developments in alloying, in fabrication, and in protecting the metal from corrosion continue and are improving the prospects for a greater use of magnesium in the near future. Among the new alloys now in use is a zirconium-zinc-magnesium alloy that has higher strength both under tension and compression, and is easier to fabricate than other magnesium alloys on the market. Work is also being done toward developing a cerium-magnesium alloy, and a lithium-magnesium alloy. Dow Chemical Company has evolved a process for plating magnesium with chromium to prevent corrosion. Additional applications of magnesium in aircraft manufacture were also a feature of 1949.

Magnesium foundries operating during 1949 were: Robert Mitchell Company, Limited, Montreal; Aluminum Company of Canada, Limited, Etobicoke, Ontario; Light Alloys, Limited, Renfrew, Ontario; Grenville Castings, Limited, Merrickville, Ontario; Canadian Magnesium Products, Limited, Preston, Ontario; and Western Magnesium, Limited, Vancouver.

Canadian Sources of Supply

The two sources of the magnesium made in Canada in recent years are dolomite and brucite.

Dolomite, the double carbonate of calcium and magnesium, is the raw material used by Dominion Magnesium, Limited, at Haley, in its thermal process of reduction with ferrosilicon. Dolomite is available in all provinces of Canada except Prince Edward Island.

Brucite, the hydroxide of magnesium, found in granules 1 to 4 mm. in diameter thickly disseminated throughout certain deposits of crystalline limestone in Quebec, Ontario, and British Columbia, has been the raw material used by Aluminum Company of Canada, Limited in its production of magnesium metal.

Production, Trade, Uses, and Prices

Data on production, exports, and imports are not available for publication.

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 have been developed such as for the cathodic protection of underground pipelines and also of domestic hot-water tanks from corrosion. It is used as a minor constituent of many aluminium-base alloys, and recently it was found that a small percentage of magnesium alloyed with grey cast iron will greatly improve the properties of the latter.

The price of 99·8 per cent magnesium in ingot form in carload lots f.o.b. Freeport, Texas, during 1949 was 20½ cents per pound, U.S. currency, and in lots of 100 pounds or more l.c.l., 22½ cents per pound.

MANGANESE

As known deposits of high-grade manganese ore in Canada are small and almost depleted, Canada is entirely dependent upon imports to meet its requirements. These imports in 1949 totalled 137,854 tons, a decrease of over 40 per cent below the 1948 total, and came mainly from Africa and India, with over 67 per cent entering Canada via United States.

Except for a small output of bog manganese from New Brunswick in 1947 all manganese properties in Canada have been inactive since 1943. Production in the peak year was only 1,800 tons.

Although Canada produces no manganese ore, its production of manganese addition agents has averaged about 80,000 tons annually in the past 3 years. Over 85 per cent of the output has been in the form of ferromanganese, mainly high carbon, and most of the remainder as silico-manganese.

Canadian Imports of Manganese Ore

Country from which shipped	1949		1948	
	Short tons	Value $	Short tons	Value $
United States*	93,570	3,153,662	169,746	4,882,357
Gold Coast	27,904	859,995	60,516	1,564,898
United Kingdom	33	2,094	36	2,564
India and others	16,347	459,771	.....	.....
Total	137,854	4,475,522	230,298	6,449,819

* None of which was of United States origin.

*Canadian Exports of Ferromanganese and Spiegeleisen**

Country of destination	1949	1948
	Short tons	Short tons
United States	64,588	72,462
Mexico	1,301	849
United Kingdom	894	1,222
Others	478	688
Total	67,261	75,221

* Exports of spiegeleisen did not exceed 900 tons in 1948 or 1949.

World Sources

Slightly less than half of the world production of manganese ore of approximately 4,000,000 metric tons a year is estimated to come from Russia. Other major sources of supply are the Gold Coast, India, the Union of South Africa, French Morocco, and Brazil.

Uses

Approximately 90 per cent of the ore produced is used in making addition agents for steel manufacturing. High-grade manganese dioxide (pyrolusite) is used in making dry cell batteries. In Canada, this industry consumes from 4,000 to 5,000 tons annually. Manganese in chemical compounds is used in the glass, enamel, paint, pigment, and rubber industries. It is also used in medicinal preparations, and in certain types of fertilizers.

Prices and Tariffs

At the end of 1949 the Engineering and Mining Journal Metal and Mineral Markets gave the following information on prices of manganese ore.

(1) On long-term contracts involving large tonnage prices were wholly nominal and a matter of negotiation.

(2) Nearby business on the basis of 48 per cent manganese 81·8 to 83·8 cents per long ton unit (22·4 pounds), c.i.f. United States ports (duty included).

(3) Chemical grades, per ton, coarse or fine with a minimum of 80 per cent MnO_2: Brazilian or Cuban, carloads, in barrels $60 and $65; Javan or Caucasian, 85 per cent minimum of MnO_2, $70 and $75; domestic, 70 to 72 per cent minimum MnO_2, $45 and $50 f.o.b. mines.

MERCURY

There has been no production of mercury in Canada since September 1944, as world prices for the metal have been too low to enable profitable operation. Shipments that have been made since 1944 have been from producers' stocks. All Canadian production in the past came from the Pinchi mine of The Consolidated Mining and Smelting Company of Canada, Limited, and the Takla mine of Bralorne Mines, Limited, both mines being in the Omineca mining division of British Columbia.

Canadian imports of mercury in 1949 declined to 4,816 flasks of 76 pounds, or to one-third of the total used in 1948 when two plants using mercury cells for the electrolytic production of caustic soda and chlorine were installed, one at Beauharnois, Quebec, and the other at Sarnia, Ontario. Once the cells are installed only minor amounts of mercury are required for replenishment purposes.

Trade and Consumption

	1949		1948	
	Pounds	$	Pounds	$
Imports				
From: United States	186,740	184,082	246,401	193,520
Mexico	71,700	62,449	16,110	11,457
Spain	19,560	19,476	540,360	394,433
Other countries	69	85	1,007	813
Total	278,069	266,092	803,878	600,223
Consumption				
Heavy chemicals	.....	.....	479,000	.....
Pharmaceuticals and fine chemicals	.....	.....	41,600	.....
Gold mining	.....	.....	6,000	
Electrical apparatus	.....	.....	13,100	.....
Miscellaneous	.....	.....	12,500	.....
Total	.....	.....	552,200	.....

World Production and Trade

Spain and Italy are the two chief producers of mercury, the two other major producers being United States and Mexico.

In Spain, the Almaden mine, the world's greatest mercury mine, is producing ore about five times as rich as that of its closest competitor, the Monte Amiata mine in Italy. After more than 20 centuries of exploitation it is reported to have reserves of about 6 per cent mercury, large enough to operate on its present scale of about 40,000 flasks a year for 200 years.

The Spanish-Italian quicksilver combine, Mercurio Europeo, which was formed in October 1928, was dissolved on January 1, 1950. The International Quicksilver Corporation, New York, former agents for the Mercurio Europeo,

announced that it will continue to represent the Spanish producers in the American market. The Leghorn Trading Company of New York has been appointed sole selling agents in the United States and Canada for the Italian quicksilver producers.

The following table shows the approximate production of mercury by the main producing countries for the years 1944-1949 in flasks of 76 pounds.

Country	1944	1945	1946	1947	1948	1949
Canada	9,682	.....	.....	.....	.....	.....
Italy	28,704	25,410	50,822	53,984	39,000	44,000
Mexico	26,063	16,443	11,660	9,700	4,786	.....
Spain	34,349	40,694	41,800	55,608	52,000	.....
United States	37,688	30,763	25,348	23,244	14,388	9,400

Uses and Prices

In addition to its extensive use in the electrolytic production of caustic soda and chlorine, large quantities of mercury are used in preparing pharmaceuticals and in electrical and industrial control instruments and meters. Mercury is consumed in considerable quantities in making agricultural disinfectants and fungicides, and in anti-fouling compounds such as oxides in the coating of ships' hulls, etc. It is used as a catalyst and in lesser amounts in dental preparations and as the fulminate in the manufacture of munitions and of blasting caps.

Increasing amounts of mercury are likely to be used in the new-type cell, developed during the war, for several types of military batteries and for hearing-aid use.

The price per flask (76 pounds) of mercury has declined steadily from a wartime peak of about $200 in 1942 to $71 on December 22, 1949, New York basis, as quoted by the Engineering and Mining Journal Metal and Mineral Markets. These prices included a $19 per flask United States' import duty for foreign-produced mercury.

MOLYBDENUM

There has been no production of molybdenite in Canada since the closing of the La Corne mine of Molybdenite Corporation of Canada, Limited, La Corne township, Quebec, in December 1947. During 1949 Assomoly Registered, a company formed jointly by Molybdenite Corporation and Associated Metals and Minerals of New York, treated part of the 265 tons of formerly 'rejected' concentrates from the La Corne mine, containing varying amounts of molybdenite and bismuth. This operation was discontinued late in 1949. Ore reserves at the mine at the time of closing were estimated by the company at approximately 130,000 tons.

There are at least four hundred known molybdenite deposits and occurrences distributed in all provinces except Alberta. Many of the occurrences consist of 'splashes' of high-grade molybdenite, but tonnages and continuity are lacking. Indian Molybdenum, Limited, a subsidiary of Dome Mines, Limited, in Preissac township, near La Corne, and Quyon Molybdenite Company, Limited, near Quyon, in Quebec, were both closed in 1944.

Canadian Imports and Consumption

As there are no Canadian plants for the conversion of molybdenite concentrates into the molybdenum addition agents (molybdic oxide, ferro-

molybdenum, calcium molybdate, etc.), Canada imports its requirements from United States through Climax Molybdenum Company for which Railway Power and Engineering Corporation is the Canadian agent, and through Molybdenum Corporation of America, New York.

The following table shows the imports of molybdenum addition agents into Canada, in tons of contained molybdenum for 1948 and 1949—

Product	1949	1948
Molybdic oxide (55·5 per cent Mo)	117	95
Ferromolybdenum (61·8 per cent Mo)	54	67
Calcium and sodium molybdate	5	5
Total	176	167

World Production

Data on world production of molybdenum, particularly on that of Russia, are incomplete, but from 80 to 90 per cent of total world production of about 12,000 metric tons annually comes from United States, the other chief sources of supply being Chile, Mexico, and Norway. United States production of molybdenum metal contained in concentrates in 1949 amounted to 12,500 short tons, compared with 13,353 tons in 1948. Of this, the Utah Copper Division of Kennecott Copper Corporation produced approximately 6,000 tons and Climax Molybdenum Company, Colorado, approximately 5,400 tons. Other large producers of copper in United States, Chile, and Mexico are recovering molybdenite from their copper flotation concentrates.

Uses and Specifications

In the manufacture of alloy steels molybdenum is added to the steel bath as molybdic oxide, ferromolybdenum, calcium molybdate, and molybdenum-bearing scrap. About 70 per cent of the molybdenum consumed is used as an alloying agent in steel manufacture and about 20 per cent in grey iron and malleable castings. Molybdenum and tungsten can be substituted for each other to impart strength and hardness to steel. Molybdenum intensifies the effect of other alloying metals in steel, such as nickel, chromium, and vanadium.

Most molybdenum alloy steels contain from 0·15 to 0·5 per cent molybdenum but in some instances this is considerably higher. High-speed tool steels contain up to 9 per cent molybdenum.

Increasing amounts of molybdenum ranging up to 25 per cent in content are being used in alloys in jet propulsion engines, turbo-superchargers, and gas turbines. For these uses it has been described as the best additive for high-temperature strength. It also increases the resistance of stainless steels to chemical action.

The use of molybdenum in various forms in chemical, electrical, and ceramic industries amounts to about 10 per cent of the total consumption. Molybdenum wire and sheet are used in the incandescent lamp and radio industries, and new alloys suitable for heating elements, electrical resistance, and contact points contain molybdenum. The salts of molybdenum are used in pigments, in vitreous enamels for coating steels and sheet iron, in welding rod coatings, in lithographing, and printing inks, and in many other applications.

Prices

On January 1, 1949, Climax Molybdenum Company increased the price of its molybdenum concentrate and addition agents to the following levels, f.o.b. Langeloth, Pa., or Climax, Colo.; concentrate, 90 cents per pound of MoS_2; ferromolybdenum $1.10 per pound of contained Mo; molybdic oxide briquettes, 95 cents per pound of contained Mo; and calcium molybdate, 96 cents. The above prices remained at these levels throughout 1949.

NICKEL

The Sudbury area of Ontario continues to supply over three-quarters of the world demand for nickel. The Canadian output for 1949, at 128,690 tons, was slightly less than the peacetime record of 1948, but the value was greater because of a slight rise in price. The seven mines of the Sudbury area are the only Canadian producers of nickel, with the exception of a small amount from silver-cobalt ore. However, a new nickel mine is being developed in northern Manitoba at Lynn Lake. As the market for nickel is expanding steadily, an active search has been under way for several years for new nickel deposits to augment the supply from the Sudbury field, which is now close to its maximum economic production. With the exception of Lynn Lake, no new deposits of payable size and grade have yet been found.

In 1949 the nickel production of New Caledonia was lower than in 1948, and amounted to 3,400 tons. Refining is done in France. Russia has a substantial production from the mine and smelter at Petsamo, formerly in Finland, and is reported to have nickel deposits elsewhere.

Canadian Nickel-Producing Mines

The nickel mines of the Sudbury area produces as by-products important amounts of copper, platinum metals, gold and silver, and minor quantities of selenium and tellurium. An increasing proportion of the sulphur in the ore is being recovered for industrial uses. Up to the present, attempts to make use of the iron in the ore have been unsuccessful. Two companies operate in the area, The International Nickel Company of Canada, Limited, and Falconbridge Nickel Mines, Limited.

International Nickel. During the past decade a large part of the ore mined by International Nickel has come from the Frood-Stobie open pit. As it is near the maximum economic depth, preparation of a large underground mine beneath the pit has been under way for some time and open pit mining soon will cease. At the Garson, Creighton, Murray, and Levack mines a program of shaft-sinking and underground development somewhat above the normal is under way to provide a larger tonnage of ore from these mines by the time operations in the Frood-Stobie open pit are ended.

Technological improvements in mining and milling for several years past have permitted profitable use of a progressively lower grade of ore. At Creighton a separate new mine of 6,000 tons daily capacity is being prepared to extract material that formerly was considered to be only mineralized rock. A concentrator being built at the mine is expected to be in operation in 1951.

The company's report for 1949 shows that 9,984,841 tons of ore was mined in 1949, which is slightly below the figures for the two preceding years. The ore reserve, at 251,805,000 tons, is slightly increased. During recent years copper and nickel have been extracted from the ore in about equal proportions.

The ore from the company's five mines is treated by flotation in the large concentrator at Copper Cliff, with the exception of a comparatively small tonnage of lump ore that is melted to matte in blast furnaces at Coniston, largely for the

production of Monel metal. The concentrator makes two products, a copper concentrate and a nickel-rich concentrate. The copper concentrate is treated in roasters, reverberatory furnaces, and converters to make blister copper which is refined in the adjoining copper refinery. The nickel-rich concentrate is roasted, then treated in reverberatory furnaces to give matte, which is cooled under controlled conditions so that particles of nickel and copper compounds crystallize separately. The matte is ground and the two are separated by flotation. The nickel concentrate is treated to give nickel oxide sinter, a new product that can be substituted economically for refined nickel for many uses. A part of the nickel oxide sinter is converted to refined nickel in the refinery at Port Colborne, Ontario. The copper concentrate joins the main copper circuit. Refinery sludges from the copper and nickel refineries are shipped to Great Britain for extraction of the precious metals.

A new plant is under construction at Copper Cliff that will supersede the roasters and reverberatories and will conserve the sulphur now wasted. The copper and nickel-rich cencentrates are to be flash-roasted in oxygen to give molten matte and concentrated sulphur dioxide gas. The gas will be compressed to the liquid state and in this form can be shipped economically for long distances to existing markets.

Falconbridge. Falconbridge Nickel Mines, Limited in 1949 treated 941,929 tons of ore, of which 15,896 tons came from development faces in the new McKim mine and the remainder from the Falconbridge mine. Of this ore, 597,165 tons (63·4 per cent) was concentrated by flotation, then roasted and sintered, and the remainder was smelted direct. Both blast furnaces were in operation throughout the year. The resulting matte was shipped to the company's refinery at Kristiansand, Norway, which is being enlarged and changed over to use a chloride electrolyte. Until these changes are completed the refinery capacity will remain less than smelter output, and meantime the surplus matte is being stockpiled. Preparation is under way to recover cobalt in addition to the usual products, electrolytic copper and nickel, platinum metals, gold, and silver.

The McKim mine is now partly developed on four levels, and is expected to reach its projected capacity of 500 tons a day in 1950. The Falconbridge internal shaft reached a depth of 4,000 feet. Ore reserves include only ore above the 2,800-foot level. Ore indicated below that level is higher in grade than on the upper levels and in similar volume. The company's other deposits of ore remain undeveloped.

The developed ore of the two mines is 8,592,000 tons. Indicated ore in the company's other properties is 6,199,000 tons, the total ore being 14,791,000 tons.

Prospective Producers and Prospects

Lynn Lake (Sherritt Gordon). A substantial amount of underground development was done at the Lynn Lake property of Sherritt Gordon Mines, Limited, 120 miles north of the railway terminus at Sherridon in northern Manitoba. "A" shaft was sunk to a depth of 1,000 feet and 3,200 feet of drifting and crosscutting was done at that level. "A" orebody was examined in detail to this depth and was drilled to a depth of 1,750 feet from the surface, with the result that over 2,000,000 tons was added to the indicated reserve of ore, which is now 10,365,000 tons. "C", "E", and "B" orebodies are to be examined similarly from this level. "El" orebody, 2½ miles south of "A", is to be developed from a second shaft to be sunk in 1950.

Development ore from "A" orebody has been concentrated in a pilot mill with good results. The concentrate was shipped to Ottawa for treatment by the company's ammonia process in a pilot plant, in which the extraction and the indicated costs have been better than anticipated. The pilot mill and the experimental extraction plant are to be operated during 1950. Equipment from

the worked-out East mine at Sherridon is to be brought to Lynn Lake, and eventually the milling equipment as well.

The Rexora property in northwestern Ontario was drilled by Falconbridge Nickel Mines, Limited, but the results were not satisfactory and the option was dropped.

The nickel-bearing deposits at Shebandowan, 75 miles west of Port Arthur, Ontario, at Rankin Inlet on the west coast of Hudson Bay, and near Hope, British Columbia, have remained inactive during the year.

Production and Trade

About 98 per cent of the Canadian production of nickel is exported, 68 per cent to the United States, 20 per cent to Great Britain, and the remainder to many other countries. The amount recorded as exported to Norway is for refining, and re-export, and not for industrial use in that country.

Production and Exports

Year	Production		Exports	
	Short tons	Value $	Short tons	Value $
1945	122,565	61,982,133	108,221	54,778,226
1948	131,740	86,904,235	131,840	73,801,871
1949	128,690	99,173,289	127,141	92,323,686

Exports of Nickel in Various Forms

Year	In Matte or Speiss		In Oxide		Refined Nickel	
	Short tons	Value $	Short tons	Value $	Short tons	Value $
1945	28,295	10,186,290	1,758	808,715	78,168	43,783,221
1948	50,801	24,320,922	9,792	5,020,167	71,247	44,460,782
1949	56,902	41,760,237	1,151	689,148	69,088	49,874,301

Nickel Exports

Destinations	1949		1948	
	Short tons	Value $	Short tons	Value $
Great Britain	28,265	20,545,673	25,555	12,626,831
Norway	11,848	8,673,249	8,968	4,239,082
United States	86,525	62,693,150	96,433	56,318,271
Australia	25	18,611	26	16,385
Belgium	54	44,100	245	168,983
Brazil	104	81,510	40	29,027
Chile	18	13,857	121	82,746
France	3	3,400	2	2,604
Japan	234	195,229	.....	.....
Sweden	.....	.....	336	239,264
Others	65	54,907	114	78,678
Total Exports	127,141	92,323,686	131,840	73,801,871

Uses and Prices

As most of the annual nickel output is used in the United States, it is instructive to note the following data published by the United States Bureau of Mines. It is probable that the small amount of nickel consumed by Canadian industries is used in somewhat similar proportions.

Uses of Nickel in United States in 1948

	Pounds of nickel	*Per cent*
Ferrous:		
Stainless steels	32,487,815	17·4
Other steels	43,564,600	23·3
Cast irons	8,431,667	4·5
Total Ferrous	84,484,082	45·2
Non-ferrous (comprises copper-nickel alloys, nickel-silver, brass, bronze, beryllium, magnesium and aluminium alloys, and Monel, Inconel and malleable nickel)	56,067,736	30·0
High-temperature and electrical resistance alloys	12,336,123	6·6
Electroplating:		
Anodes	28,425,717	15·2
Solutions	1,327,396	0·7
Catalysts	1,190,851	0·6
Ceramics	370,708	0·2
Others	2,913,905	1·5
	187,116,518	100·0

World consumption of nickel was about 15 per cent lower in 1949 than in 1948, but it had recovered to the 1948 rate by the end of 1949. As noted in the above table, almost half the nickel used goes into alloys with iron, that is stainless steel for corrosion resistance, alloy steels for strength, and alloy cast irons for both corrosion resistance and strength. Alloys of nickel with the other base metals are next in order, and electroplating takes about one-sixth of the output.

The price of electrolytic nickel in the United States was stable during 1949 at 40 cents a pound, including import duty of 1¼ cents a pound, for carload lots f.o.b. refinery, Port Colborne, Ont. At the time of devaluation of the British pound in September, the exchange rate for the American dollar was set at $1.10 Canadian. The Canadian price of nickel was raised on September 20, 1949, from 39·75 cents to 42·50 cents a pound, where it remained to the end of 1949.

PLATINUM GROUP METALS

Canada is credited with about half the annual world supply of platinum metals. Canadian production in 1949 amounted to 336,017 ounces, an increase of 25 per cent over the 1948 output. With the exception of 101 ounces recovered with placer gold in British Columbia, it came as a by-product of nickel-copper mining in the Sudbury district of Ontario. Prices of platinum, ruthenium, and iridium declined in 1949.

The other half of the world supply of platinum metals comes from Russia, Transvaal, and Colombia. Russia's output is not known, but it is estimated at about half that of Canada. Facilities for treating ore from the extensive deposits at Rustenburg in South Africa were increased in 1949 and the Transvaal is now a substantial producer. Colombia has for many years produced 30,000 to 40,000 ounces of the crude platinum metals annually that are refined in the United States.

Production, Exports, and Imports

The annual Canadian output of platinum metals, as recorded by the Dominion Bureau of Statistics, does not correspond with the annual amount recovered from ore treated. The reason is that the anode residues containing these metals are gathered at irregular intervals and the accumulations of these residues at the refineries are shipped to the precious metals refinery in Acton near London, England, at similarly irregular intervals. The only practicable way to record the output is to estimate the precious metals content of the shipments to Acton.

	1949		1948	
	Fine ounces	$	Fine ounces	$
Production				
Platinum	153,784	11,603,002	121,404	10,622,850
Palladium, rhodium, ruthenium, iridium, and osmium	182,233	8,289,915	148,343	6,295,132
Total	336,017	19,892,917	269,747	16,917,982
Exports of platinum group metals in concentrates and other forms except scrap:				
To: United Kingdom	.....	11,964,741	.....	11,155,831
United States	.....	6,020,638	.....	5,620,889
Other countries	.....	30,644	.....	13
Total	.....	18,016,023	.....	16,776,733
Imports of platinum group metals, all forms:				
From: United Kingdom	.....	10,618,744	.....	10,672,941
United States	.....	504,428	.....	121,480
Other countries	.....	1,068	.....	.....
Total	.....	11,124,240	.....	10,794,421

As United States is the principal consumer of platinum metals, an idea of the relative amounts used annually can be gained from statistics published by the United States Bureau of Mines. By industries the amounts in ounces sold in 1949 were:

Industry	Platinum	Palladium	Others	Total	Per cent of total
Chemical	31,918	9,580	4,806	46,304	17
Electrical	28,618	53,943	2,108	84,669	31
Dental and medical	7,492	13,704	120	21,316	8
Jewellery and decorative	74,938	29,536	9,997	114,471	42
Miscellaneous	4,018	95	2,241	6,354	2
Total	146,984	106,858	19,272	273,114	100

In the Sudbury area there are seven nickel-copper mines from which the platinum metals are derived as a by-product. Five of the mines belong to The International Nickel Company of Canada, Limited, which has smelters at Copper

Cliff and Coniston in the Sudbury field, a copper refinery at Copper Cliff, and nickel refineries at Port Colborne, Ontario, and at Clydach in Wales. The platinum metals, along with gold and silver, are collected in the refinery residues that are shipped to Acton for treatment. The refined platinum metals from Acton are sold in world markets, but are in the main sent back to this Continent for use in United States.

The Falconbridge and McKim mines of Falconbridge Nickel Mines, Limited supply a smelter at Falconbridge. Matte from this smelter is shipped to the company's refinery at Kristiansand in Norway, where the platinum metals are recovered as anode residues and refined.

From the records of ore treated in the smelters and of platinum metals produced for several years past, it can be deduced that the average recovery from a ton of ore is 0·033 ounce, an amount that can be extracted profitably only because it is concentrated automatically and without extra cost in the refinery sludges.

The platinum placers of the Tulameen River in British Columbia, the nickel-copper-platinum deposits near Hope, British Columbia, and the nickel-copper-palladium-platinum deposits at Shebandowan Lake, Ontario, remained inactive. Substantial nickel-copper deposits containing small amounts of the platinum metals were being developed at Lynn Lake in northern Manitoba.

Uses

The six platinum metals fall naturally into two categories. Platinum, osmium, and iridium have atomic weights around 190, and specific gravities of 21 to 22. Palladium, rhodium, and ruthenium have atomic weights of about 100 and specific gravities of 11 to 12. The particular qualities that make them useful may be stated as follows:

High Melting Point. Ranges from 1554° C. for palladium to 2700° C. for osmium.

Corrosion Resistance. The resistance of platinum to common reagents except chlorine is well known. The metals and their alloys are mostly resistant to tarnishing. Silver is electroplated with an extremely thin coating of rhodium to make it non-tarnishing. A reflector of rhodium in optical instruments can be used at high temperatures.

Ductility. Used mainly in wrought forms. Platinum and palladium are extremely ductile. Rhodium and iridium are worked with difficulty, ruthenium with still more difficulty, and osmium is almost completely non-ductile.

Alloys. The metals are used mainly as alloys. Rhodium, iridium, ruthenium, palladium, copper, gold, and nickel are the elements most commonly added to platinum, seldom over 25 per cent and often 10 per cent or less. Iridium and ruthenium increase the strength and hardness of platinum at room temperatures. Rhodium gives alloys resistance to oxidation at high temperatures.

Catalysts. Platinum in particular is a useful catalyst. Eighty-mesh gauze of 10 per cent platinum-rhodium alloy is used commonly for nitrogen fixation. A unit containing 90 troy ounces of gauze, operating at about 1000° C. can give 40 tons of nitric acid in 24 hours with a conversion efficiency of 96 per cent. Production of high octane gasoline is aided by a platinum catalyst in a recently developed process.

Prices

The price of platinum and ruthenium dropped steadily from $93 per troy ounce in January 1949 to $69 in June, where it remained until the end of 1949. The price of iridium, which was $110 at the beginning of 1949, dropped to $105

in January, to $100 in June; and remained at $100 for the rest of 1949. Palladium and rhodium were priced at $24 and $125 respectively. The nominal quotation of $100 for osmium pertained throughout 1949.

SELENIUM AND TELLURIUM

Selenium and tellurium are combined for the purpose of this review as they are closely associated and are both produced in Canada as by-products of copper refining at the same plants. Relatively small amounts of the metals or their compounds and products are required by industry, but selenium is of much greater economic and industrial importance than is tellurium.

The metals are recovered from the residues (tank slimes) that result from the electrolytic refining of copper, the two Canadian producers being The International Nickel Company of Canada, Limited, at Copper Cliff, near Sudbury, Ontario, and Canadian Copper Refiners, Limited (a subsidiary of Noranda Mines, Limited), at Montreal East, Quebec. At Copper Cliff the metals produced originate in International Nickel's extensive copper-nickel deposits near Sudbury. The Copper Cliff refinery has a demonstrated capacity production of 270,000 pounds of selenium a year. At Montreal East selenium and tellurium are recovered from the refining of copper anodes made at Noranda, Quebec, from copper ores of that area, and from blister copper produced by Hudson Bay Mining and Smelting Company, Limited, at Flin Flon on the boundary between Manitoba and Saskatchewan. The Montreal East refinery, with an annual rated capacity of 450,000 pounds of selenium, is the largest selenium plant in the world.

Production and Trade

	1949		1948	
	Pounds	$	Pounds	$
Production, Selenium				
Quebec	99,709	204,403	119,487	238,974
Manitoba and Saskatchewan	131,674	269,932	162,418	324,836
Ontario	86,842	178,026	108,989	217,978
Total	318,225	652,361	390,894	781,788
Exports, Selenium and Salts				
To: United States	170,780	314,579	264,197	469,058
United Kingdom	137,328	230,158	156,110	304,058
France	29,066	70,401	.....	.....
To: Other countries	6,610	12,420	27,578	54,765
Total	343,784	627,558	447,885	827,881
Production, Tellurium				
Quebec	.....	.....	.....	.....
Manitoba and Saskatchewan	2,966	5,339	2,686	4,701
Ontario	8,726	15,707	8,739	15,293
Total	11,692	21,046	11,425	19,994

The exports of tellurium are not reported separately but most of Canada's production is exported.

The United States is the principal world producer of both metals. They are also produced in Russia, Sweden, and Germany.

Uses

No figures are available to show the comparative amounts of selenium or tellurium used in various industries. The principal outlets for selenium appear to be in the manufacture of glass, rubber, and rectifiers. In glass manufacture selenium neutralizes the green colour caused by iron impurities and is used to make red and ruby glass for signal lenses. Small additions of selenium to rubber promote resistance to heat, oxidation, and abrasion. Increasing amounts of the metal are being used to make electrical dry-plate rectifiers, for which use a very high-grade selenium free from impurities is required.

A unique characteristic of selenium is that its conductivity increases on exposure to light. This property is used to make photo-electric or light-sensitive cells for automatically operating lamps, alarms, swinging doors, etc., and in television and sound film. The total amount of selenium required for these uses is very limited.

It is used as an antioxidant in lubricating oil; for fat hardening; as a catalyst in the petroleum industry; in the hydrogenation of coal; for treating skin diseases; and for making certain inks and insecticides.

Selenium dioxide is used to make a number of selenium compounds, particularly accelerators for vulcanizing rubber. Ferroselenium (about 50 per cent selenium) is used as a master alloy for addition to steels to improve machinability. Selenium oxychloride is used as a solvent; sodium selenate in the preparation of an insecticide; sodium selenite in glass manufacture; and sodium sulphoselenite to produce brown tones in photographic toning baths. Cadmium sulphoselenite pigments are used to prepare a stable door paint with colours ranging from orange to maroon.

Tellurium is used to improve the durability of rubber; to increase the hardness of metals; in zinc refining; in the ceramic and glass industries, where it imparts a bluish to brownish effect in the products; and in toning silver prints.

Prices

Black powdered selenium, 99·5 per cent pure, sold for $2 a pound at New York, and tellurium $1.75 a pound. These prices remained unchanged throughout 1949.

SILVER

Canada's production of 17,641,493 ounces of silver in 1949 was 1,531,511 ounces greater than in 1948. Most of it was derived as a by-product from the treatment of base metal ores, but an increasing number of mines produced silver in ore or concentrates as their principal output. Much interest was centred in the Cobalt-Gowganda area of Ontario, formerly one of the world's principal silver-producing areas, where production increased and exploration was extensive.

The price of silver at New York increased slightly and the devaluation of the Canadian dollar in September 1949 added about 7½ cents an ounce to the price received by Canadian producers.

Domestic consumption and exports were greater than in 1948.

Production and Developments

British Columbia

The Sullivan lead-zinc-silver mine at Kimberley, owned by The Consolidated Mining and Smelting Company of Canada, Limited, is Canada's principal source of silver. The ore is concentrated near the mine and the lead and zinc concentrates are shipped 200 miles by rail to the company's smelter

and refineries at Trail where the metals are recovered. Most of the silver in the ore goes into the lead concentrates and is recovered from the tank slimes resulting from the electrolytic refining of lead. A substantial amount of the company's silver output of 8,325,300 ounces came from a number of smaller mines which ship silver-lead-zinc ores or concentrates to the Trail smelter. The volume of this custom material treated at Trail has grown appreciably in recent years and in addition to Canadian ores and concentrates, the smelter in 1949 treated concentrates from United States, Peru, Bolivia, and other countries.

Torbrit Silver Mines, Limited, the second largest silver producer in the province, produced 1,119,900 ounces in bullion from its mine near Alice Arm on the west coast. Following extensive rehabilitation of the Toric mine, which had been idle since 1930, Torbrit commenced to produce in its new 300-ton mill in February.

Highland Bell, Limited, at Beaverdell, shipped 6,500 tons of silver-lead ore to Trail containing about 840,000 ounces of silver. It made plans to build a 40-ton mill at this property in 1950 and to ship concentrate instead of hand-picked ore.

Silver Standard Mines, Limited, near Hazelton, which entered production in 1948, produced concentrates containing about 300,000 ounces of silver.

Violamac Mines, Limited, and Western Exploration Company, Limited, (Enterprise and Standard mines), were the principal producers of silver in the Slocan district.

Other important producers were the Granby Consolidated Mining, Smelting and Power Company, Limited (255,750 ounces), near Princeton, and Britannia Mining and Smelting Company, Limited (70,500 ounces), at Howe Sound. Both of these companies export copper concentrate containing precious metals to the United States.

Silbak Premier Mines, Limited, in the Portland Canal district, resumed production in November after a shutdown of 15 months. The mine has been an important producer of gold, silver, and lead for many years.

Yukon

United Keno Hill Mines, Limited, the only metal mine in operation, produced lead concentrate and crude ore containing 1,403,360 ounces of silver. Operations were hampered by the loss of the company's mill by fire in June 1949, but a new 250-ton mill was constructed and was put into operation in October 1949. Most of the ore produced came from the Hector mine but high-grade zones were partly developed in several other mines on the property.

Manitoba and Saskatchewan

Hudson Bay Mining and Smelting Company, Limited shipped blister copper containing 1,868,507 ounces of silver produced from its copper-zinc deposit at Flin Flon on the Manitoba-Saskatchewan boundary.

Other silver output came from Sherritt Gordon Mines, Limited (172,000 ounces), at Sherridon, and Cuprus Mines, Limited, a subsidiary of Hudson Bay Mining and Smelting Company, and from the Snow Lake and San Antonio gold mines.

Ontario

The International Nickel Company of Canada, Limited, the largest producer of silver in the province, recovered about 1,100,000 ounces from its copper-nickel deposits in the Sudbury area.

There was a marked revival of production and exploration in the Cobalt-Gowganda district. Total shipments in 1949 contained 1,124,000 ounces of silver.

Silver Miller Mines, Limited, at Brady Lake a few miles southeast of Cobalt, commenced milling in October 1949 and produced concentrates containing 164,000 ounces of silver by the end of December 1949. In 1948 and prior to mill production in 1949 this company shipped high-grade ore containing over 500,000 ounces of silver.

Cobalt Lode Silver Mines, Limited discovered a high-grade silver vein at its property south of the Silver-Miller mine.

In the Gowganda area Siscoe Metals, Limited produced concentrates containing over 600,000 ounces of silver from the former Miller Lake O'Brien mine. Development work on the property outlined additional sources of ore.

Castle Trethewey Mines, Limited, adjoining the Miller Lake O'Brien property on the north reopened its mine which had been idle since 1931. Production will not be resumed until the completion of extensive rehabilitation of the mine and the remodelling of the mill.

Ontario's forty-six gold mines in operation in 1949 produced 408,152 ounces of silver as a by-product. Hollinger Consolidated Gold Mines, Limited was the chief producer with a silver output of 87,203 ounces from its Hollinger and Ross mines.

Quebec

Noranda Mines, Limited produced copper anodes containing 1,779,000 ounces of silver at its smelter at Noranda. Of this production, 524,315 ounces came from Noranda's Horne mine, and the remainder mostly from copper concentrates produced by Waite Amulet Mines, Limited, Quemont Mining Corporation, Limited, East Sullivan Mines, Limited, and Normetal Mining Corporation, Limited, all copper-zinc mines in western Quebec that shipped copper concentrates containing gold and silver to the Noranda smelter.

Golden Manitou Mines, Limited, near Val d'Or, shipped lead concentrate and gold precipitate containing 760,000 ounces of silver to the United States.

New Calumet Mines, Limited, on Calumet Island in the Ottawa River, produced lead concentrate containing 619,000 ounces of silver, and Anacon Lead Mines Limited, Portneuf county, produced lead concentrate containing 145,000 ounces of silver. Both companies shipped their lead concentrates to the Trail smelter.

The twenty-four gold mines in production in Quebec in 1949 are estimated to have produced 150,000 ounces of by-product silver.

Ascot Metals Corporation, Limited reopened the Moulton Hill copper-lead-zinc mine near Sherbrooke and expected to commence production in 1950. Gold and silver are important constituents of the ore.

At Bachelor Lake, 160 miles northeast of Noranda, Dome Exploration (Quebec), Limited continued to explore its silver-zinc-lead deposit discovered in 1947.

Close drilling indicated 790 tons per vertical foot over a length of 375 feet and a width of 21 feet. A discovery of ore of similar nature was made on the property toward the end of 1949.

Newfoundland

Buchans Mining Company, Limited, a subsidiary of American Smelting and Refining Company, shipped copper, lead, and zinc concentrates that contained about 585,000 ounces of silver. Buchans is the only producing metalliferous mine.

Production, Trade, and Consumption

	1949		1948	
	Fine ounces	$	Fine ounces	$
Production, by Provinces				
British Columbia	7,573,506	5,623,328	6,717,908	5,038,431
Quebec	3,250,578	2,413,554	2,376,754	1,782,566
Ontario	2,562,859	1,902,923	3,210,107	2,407,580
Yukon	1,562,730	1,160,327	1,718,618	1,288,964
Saskatchewan	1,482,009	1,100,392	1,323,900	992,925
Newfoundland (a)	585,026	434,382	.....	.....
Manitoba	554,266	411,542	737,298	552,974
Other provinces	70,519	52,360	25,397	19,047
Total	17,641,493	13,098,808	16,109,982	12,082,487
Production, by Sources				
Base metal ores	15,980,762	.....	14,113,904	.....
Gold ores	680,401	.....	1,002,525	.....
Silver-cobalt and silver ores	960,527	.....	979,108	.....
Placer gold operations	19,803	.....	14,445	.....
Total	17,641,493	.....	16,109,982	.....
Imports of Unmanufactured Silver				
From: United States	927,803	681,716	637,597	468,410
Mexico	401,819	288,886	.....	.....
United Kingdom	3,091	2,212	80,220	60,050
Total	1,332,713	972,814	717,817	528,460
Imports of Silver Manufactures				
From: United States	.....	66,172	.....	72,869
United Kingdom	.....	467,994	.....	411,210
Other countries	.....	75,716	.....	51,663
Total	.....	609,882	.....	535,742
Exports of Silver Bullion				
To: United States	6,207,090	4,564,237	5,434,299	4,026,118
Other countries	4,822	4,050	65	56
Total	6,211,912	4,568,287	5,434,364	4,026,174
Exports, In Ore and Concentrates (b)				
To: United States	3,714,787	2,772,698	2,945,149	2,178,323
Belgium	339,827	232,486	349,542	255,630
Total	4,054,614	3,005,184	3,294,691	2,433,953
Exports of Silver Manufactures				
To: United States	.....	259,886	.....	608,545
Other countries	.....	17,922	.....	37,491
Total	.....	277,808	.....	646,036

Production, Trade, and Consumption (Cont'd)

	1949	1948
	Fine ounces	Fine ounces
Consumption, by Uses		
Coins and War Service Medals (c)	5,200,000	2,185,067
Sterling	2,857,245	1,730,735
Anodes	2,463,095	1,365,093
Silver nitrate	968,841	956,062
Brazing alloys	46,034	41,069
Wire and sheet	.....	28,800
Lead-silver alloys	2,393	4,641
Miscellaneous	195,832	247,561
Total	11,733,440	6,559,028

(a) Total Newfoundland production for 1949.
(b) Newfoundland exports for last 9 months only.
(c) 1,700,000 ounces of silver is reported to have been used in 1949 to strike Canadian war service medals.

World production of silver comes mostly from the Western Hemisphere; Australia and Belgian Congo being the only other important sources. According to the American Bureau of Metal Statistics, production from the principal silver-producing countries in 1948 and 1949 was:

Country	1949	1948
	Ounces	Ounces
Canada	17,641,493	16,109,982
United States	34,559,000	36,111,000
Mexico	49,453,741	45,800,000
Bolivia	7,000,000	7,562,000
Peru	10,609,404	9,288,500
Australia	8,494,000	10,057,519
Belgian Congo	4,549,225	3,805,500

Silver consumption in the United States, the largest consuming country, was estimated at 103,000,000 ounces in 1949, (including 13,000,000 ounces for coinage) about 24 per cent less than in 1948.

Uses

A large amount of the world silver output is minted into coins. Ornaments, jewellery, and sterling ware are other long-established outlets. Much silver is used in the electroplating industry.

Silver is used either pure or alloyed in the electrical field, especially where a very low resistance conductor is required. Various silver alloys are used in certain types of bearings, brazing solders, and in dentistry.

Silver nitrate is used chiefly in the preparation of light sensitive emulsions for use on photographic film.

Prices

Canadian prices were based on New York quotations which ranged from a high of 73·25 cents an ounce to a low of 70 cents in 1949. Following the

devaluation of Canadian currency in September 1949, the Canadian price increased to 80·85 cents an ounce where it remained the rest of the year. The average price of refined bar silver in Canada in 1949 was 75·32 cents an ounce compared with 74·70 cents in 1948.

TIN

The world production of tin metal improved so materially during 1949 that, on November 15, the Combined Tin Committee, which had been responsible for the international allocation of tin, recommended to their respective governments that the Committee be dissolved. The London Metal Exchange was opened and resumed dealings in tin on November 15, 1949, and on the same day the United Kingdom Ministry of Supply revoked the order controlling the use of tin. In the United States practically all restrictions relating to tin were removed on December 1, 1949. The estimated world production of tin metal for 1949 was 168,800 long tons, an increase of 11,300 tons over 1948 and of 6,700 long tons over 1938.

The Canadian output, which amounts to about 7 per cent of domestic requirements, was 276 long tons valued at $633,047 in 1949, compared with 309 long tons valued at $688,565 in 1948. The source of this output is the very small amount of cassiterite that occurs in the silver-lead-zinc ore of the Sullivan mine of The Consolidated Mining and Smelting Company of Canada, Limited, at Kimberley, British Columbia. The company has recovered a part of this tin as a by-product from the concentration of the Sullivan ore since 1941 and up to the end of 1949 had produced 2,805 long tons of tin. The tin concentrate is smelted in an electric furnace.

Malayan production was approximately 10,000 tons higher than in 1948, and that from Indonesia, Belgian Congo, and Nigeria showed little change. Output from Bolivia dropped slightly, and the production from Siam was almost double that of 1948.

Canadian Occurrences

No economic deposits of tin have been found in Canada, but there are minor occurrences, principally of cassiterite (SnO_2), the most important tin mineral, in a number of localities. Occurrences are known in the New Ross area, Lunenburg county, Nova Scotia; in the Sudbury and Thunder Bay districts of Ontario; in the Lac du Bonnet district of southeastern Manitoba; in southern British Columbia; in the Mayo district, Yukon; and in the Yellowknife district, Northwest Territories. Most of the showings are found in pegmatite dykes, exceptions being the placer gravels on numerous creeks in Yukon, and the association of cassiterite and sometimes stannite ($Cu_2S.FeS.SnS_2$) with certain base metal ores in southern British Columbia. A small lode deposit has been reported on Dublin Gulch in the Mayo area, Yukon.

Uses; Types Made

Tin is used chiefly in the manufacture of tin plate and solder, other uses being in the manufacture of babbitt metal and bronze; in tinning; as foil and collapsible tubes; in chemicals; and as an addition agent to the bath in hot zinc galvanizing. By far the largest consumption is in the manufacture of tin plate. This industry was established in Canada in 1940, and now has a productive capacity of about 300,000 long tons of tin plate a year, or over 6 million base boxes.

Two types of tin plate are made, standard hot-dipped and electrolytic. The demand for electrolytic plate is increasing and more than 25 per cent of the tin plate produced in Canada in 1949 was of this type. Standard hot-

dipped tin plate is made by feeding sheets cut from strips of cold rolled steel plate through a bath of molten tin. The electrolytic is produced by passing a continuous strip through an acid or alkaline tin-plating bath which comprises one of the numerous units of a machine 300 to 400 feet in length. The essential units in this continuous line operation are the welding unit to join a new coil, the cleaning cell, the electrolytic pickling cell, a brushing unit, the plating bath, the re-flow unit in which the strip is heated by electric conduction to a temperature just sufficient to melt the deposited tin and allow it to flow and assume a bright metallic surface, a chromic acid spray, an oil dispersion chamber to provide a microscopic oil coating on the finished plate, and a cutter to cut the strip into standard size sheets. Automatic pin-hole detectors and sheet thickness gauges are also in the line at certain points. The speed of the strip varies according to the thickness of coating required and may be as high as 600 feet per minute or higher. In one of the recently constructed American plants a speed of 2,500 feet a minute is reported.

The tin coating by this process is much thinner than for hot-dipped plate. The usual grades of electrolytic are 0·25 pound and 0·50 pound per base box as compared with 1·25 and 1·50 pound per base box for hot-dipped. In general, the significant savings in the electrolytic process compared with hot-dipped are in the weight of tin and in the efficiency of its application. The savings in labour costs are largely offset by higher maintenance charges and the depreciation of equipment.

The pre-war grades of solder and babbitt are again coming into general use. In the manufacture of tin foil and collapsible tubes aluminium has replaced tin to a great extent.

Imports of Tin and Allied Products

	1949		1948	
	Long tons	$	Long tons	$
Tin in blocks, pigs, or bars				
From: United Kingdom	71	158,024	10	22,200
British Malaya	2,096	4,833,743	2,559	5,519,472
Hong Kong	423	809,905	35	79,213
Belgium	805	1,466,404	650	1,473,889
Netherlands	.....	.....	233	591,748
United States	247	521,197	111	211,813
Bolivia	34	72,436	.....	.....
Total	3,676	7,861,709	3,598	7,898,335
Tin plate				
From: United Kingdom	199	67,935	613	215,495
United States	22,828	3,745,344	42,991	6,303,906
Total	23,027	3,813,279	43,604	6,519,401
	Pounds	$	Pounds	$
Tin foil				
From: United Kingdom	92	58	.....	.....
United States	5,696	5,492	2,681	1,919
Total	5,788	5,550	2,681	1,919
Babbitt metal				
From: United Kingdom	64,700	17,812	15,700	13,158
United States	23,700	11,884	30,700	12,331
Total	88,400	29,696	46,400	25,489

Consumption

Consumption of tin in Canada by industrial uses for 1949 and 1948 was as follows:

	1949 Long tons	1948 Long tons
Tin plate and tinning	2,823	2,181
Solder	966	1,241
Babbitt metal	247	220
Brass and bronze	195	281
Tin foil and collapsible tubes	31	45
Miscellaneous	56	78
Total	4,318	4,046

Prices

The Canadian price of tin f.o.b. Montreal or Toronto declined from $1.05 per pound at the beginning of 1949 to 89 cents per pound at the end of 1949. The price of tin in New York fell from $1.03 to 78 cents in the same period.

TITANIUM

Preparation was continued in 1949 for the large-scale mining of the ilmenite deposits at Allard Lake in Quebec, and the smelting of the ilmenite at Sorel in that province. Output totalled 540 tons of ilmenite and came from St. Urbain in Quebec. The experimental work on the production of titanium metal by Dominion Magnesium, Limited was continued. All titanium products used in Canada were imported.

Ilmenite, which contains 30 to 40 per cent TiO_2, is one of the two classes of titanium-bearing ores occurring in Canada. The other is titaniferous magnetite, which is composed of ilmenite and magnetite, mixed intimately in varying proportions, with a content of 5 per cent or more of titanium dioxide (TiO_2).

At St. Urbain, on the St. Lawrence, 60 miles below Quebec City, a part of the ore contains free titanium dioxide as rutile mixed with the ilmenite, and its content of TiO_2 reaches 50 per cent and more. Ilmenite also occurs at Ivry in Quebec.

Titaniferous magnetite occurs more widely in Canada than does ilmenite, but is not used in this country at present as a source of titanium. Large deposits occur at Mine Centre in northwestern Ontario, and smaller deposits in the southern part of Hastings county, north of Belleville, Ontario; at Degrosbois, 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. A bed of such sand that has been consolidated into solid material occurs at Burmis, Alberta, just east of Crowsnest Pass.

No rutile, the natural oxide of titanium, is produced in Canada.

Production of Ilmenite

	Short tons	Value $
1947	7,104	36,036
1948	4,441	21,091
1949	540	2,892

Production in recent years has been continued to the St. Urbain deposits which are scattered through a small area about 9 miles north of Baie St. Paul.

They have been worked intermittently to supply the small annual demand for export. During the war, when the interruption of supplies of titanium ore from India put the pigment plants in the United States in short supply, and concentrate from the McIntyre deposits in the Adirondacks was not yet available, there was a substantial production from St. Urbain.

Small shipments of ilmenite were made in the past from the Ivry deposits, 65 miles north of Montreal.

Quebec Iron and Titanium Corporation, Limited, formed jointly by Kennecott Copper Corporation and New Jersey Zinc Company, has under construction at Sorel, Quebec, an electric furnace smelting plant to treat ilmenite from the large deposit at Allard Lake. Shipments on a large scale to the new plant are expected to commence in 1950. Power is to be obtained from La Trenche plant of Shawinigan Water and Power Company, now under construction on the upper St. Maurice River. The contract is for 150,000 h.p., and the first block of power is expected to be available early in 1951. The electric furnace reduces most of the iron of the ore to low-carbon pig iron and the titanium is concentrated in the slag which contains about 70 per cent titanium dioxide. The plant is designed to treat 1,500 tons of ore a day, which will yield 500 tons of iron and 700 tons of titanium dioxide concentrate. The concentrate will be used to produce refined titanium dioxide for pigments and other purposes. Provision has been made for expanding the plant when conditions warrant.

The deposit of ilmenite at Allard Lake was discovered in 1946 by the prospectors of Kennecott Copper Corporation and is held by a subsidiary, Allard Lake (Quebec) Mines, Limited. It is probably the largest known deposit of ilmenite in the world, with about 200 million tons indicated by drilling, averaging about 35 per cent TiO_2 and 40 per cent iron. The deposit is 22 miles north of Havre St. Pierre, a port on the Gulf of St. Lawrence, 570 miles northeast of Montreal. A railway 27 miles in length is under construction from the port to the orebody.

Imports

All titanium products used in Canada are imported, mainly from the United States during recent years.

*Imports of Titanium Dioxide and of Pigments containing not less than 14 per cent Titanium**

	Short tons	Value $
1948	19,646	4,610,340
1949	20,793	5,157,539

*Includes a comparatively small amount of antimony pigments.

Uses and Specifications

Titanium is used at present mainly as titanium dioxide in pigments. A smaller amount is used in the iron and steel industry as ferrotitanium and ferrocarbontitanium. Production of metallic titanium has not been established experimentally.

Titanium White used in Canadian Paint Industry

	Short tons
1947	4,117
1948	5,766
1949	5,894

The paint industry uses, in addition to titanium white, a considerably larger amount of mixed pigments containing titanium, also imported from the United States.

Titanium white has many other uses, such as: to make paper opaque; to make rubber white; in ceramic glazes; for printing inks; in linoleum; in cosmetics; and to de-lustre artificial silk. Thus the total annual imports are much larger than are recorded in the table above.

Titanium is used in many other forms. Ferrotitanium and ferrocarbon-titanium, imported from the United States, are used under special circumstances to purify steel.

Ferrotitanium Used in Canadian Steel Industry

	Short tons
1948	442
1949	142

Titanium-bearing steel has come into use as a base for white glazes. Titanium carbide is used as the hard ingredient of the "carbide" high-speed cutting-tools, usually mixed with tungsten carbide. Titanium dioxide, made artificially or in the natural form of rutile, is used commonly as a coating for welding rods. Titanium tetrachloride was used extensively during the war for smoke screens. A small amount is used for purifying alloys of aluminium.

Increasing amounts of titanium dioxide are being used to produce metallic titanium, using the process established by the United States Bureau of Mines. The metal is made by changing the titanium dioxide into titanium tetrachloride and then reducing it to the metal by the use of metallic magnesium.

Titanium metal melts at about 1800° Centigrade, can be rolled, drawn, and forged, and has a specific gravity of 4·5 (iron is 7·8). It has excellent corrosion resistance, except for certain acids, and shows no tarnish after 30 days' exposure to salt spray. The tensile strength of the annealed metal is 82,000 pounds per square inch. Cold-worked to 50 per cent reduction, the tensile strength is 126,000 pounds per square inch. These properties suggest important uses for the metal when the cost of producing it has been reduced sufficiently.

Prices

Prices (nominal) f.o.b. Atlantic ports at the end of 1949 were:

Ilmenite, 56 to 69 per cent TiO_2, $14 to $16 per long ton.
Rutile, 94 per cent TiO_2 minimum, 4 to 5 cents per pound, nominal.
Titanium metal, 96 to 98 per cent, $5 per pound.

TUNGSTEN

No tungsten ore or concentrates were produced in Canada in 1949. Tungsten operations at the Emerald mine of Canadian Explorations, Limited, near Salmo in southern British Columbia, the only source of tungsten ore in Canada in recent years, were suspended in December 1948, following the decision of the company to mine a lead-zinc deposit on the same property and to change the mill flow-sheet to make lead and zinc concentrates. The main deposit in the Emerald mine is estimated to contain about 200,000 tons of 1 per cent WO_3 ore.

Consumption of the metal in ferrotungsten and scheelite in steel furnaces in Canada decreased from 341 short tons in 1948 to 169 short tons in 1949 due in part to the curtailment of shipments of scheelite from the Emerald mine.

Shipments, Trade, and Consumption of Tungsten Ores and Products

	1949		1948	
	Short tons	$	Short tons	$
Shipments of scheelite				
WO_3 content	42[1]	.....	523[2]	1,004,124
Imports of ferrotungsten[3]				
From: United Kingdom	11	32,060	122	400,611
United States	140	257,673	71	206,311
Sweden	.....	.....	.....	.....
Total	151	289,733	193	606,922
Imports of scheelite (from Spain)	28	3,463	83	126,519
Consumption				
In ferrotungsten and scheelite in steel furnaces	169	.....	341	.....

[1] From Emerald Mine stocks.
[2] From 71,000 tons of ore treated at the Emerald property.
[3] Ferrotungsten is approximately 79 per cent tungsten.

Scheelite and ferberite occur in the properties of Philmore Yellowknife Gold Mines, Limited, at Great Slave Lake, and of Reno Gold Mines, Limited, at Canadian Creek, in Yukon. Although these companies were active in recent years there was no production in 1949.

No ferrotungsten is made in Canada. Alloy steels containing tungsten are made by Atlas Steels, Limited, Welland, Ontario, from ferrotungsten or high-grade scheelite concentrates. High-grade scheelite is added directly to the steel bath because of the comparative ease with which calcium enters the slag.

World Production

World production of tungsten has declined from a wartime peak of about 61,000 tons of concentrate containing 60 per cent WO_3 to between 20,000 and 30,000 tons annually.

China is the chief producer of tungsten ore, contributing approximately 30 per cent of the total annual output of the world. The tungsten occurs as wolframite and the deposits, which are among the most extensive in the world, are mainly in the Nanling belt in Krangsei, Kwangtung, and Hunan provinces. Only a few of the better known deposits have been thoroughly explored.

Korea, Portugal, United States, and Bolivia produce major amounts of tungsten ore, and production from Brazil has been increasing in recent years. The Belgian Congo and Tasmania supply smaller amounts of tungsten concentrates for export.

Uses

Tungsten is used mainly in the production of tool and die steels to impart hardness and toughness, which properties the steels retain even at high temperatures. High-speed cutting-tools contain 12 to 20 per cent tungsten, and steels for hot working dies, chisels, and punches contain from 1·5 to 2·5 per cent tungsten. Most of these tungsten alloy steels also contain varying amounts of chromium, vanadium, and carbon. Other tungsten alloy steels are used in valve

seats for internal combustion engines, in steels for gun riflings and linings, and in making permanent magnets. In the last use, however, tungsten is being replaced by cheaper chromium steels of the more expensive but magnetically stronger cobalt alloys.

Stellite, a non-ferrous alloy, contains 10 to 15 per cent tungsten with higher percentages of chromium and cobalt. Tungsten carbide is used widely as an extra hard cutting-tool and as inserts in detachable bits for mining and excavation work.

Pure tungsten, drawn through tungsten carbide dies, is used as lamp filaments, one ton being sufficient for the manufacture of 10 million electric lamps. Pure tungsten is used also in radio tubes, contact points, and in other phases of electronics. Minor amounts of tungsten are consumed in the form of tungsten salts (tungstates) which are used in X-ray screens, for fireproofing and waterproofing fabrics, etc.

Prices

The Engineering and Mining Journal Metal and Mineral Markets, December 29, 1949, gave the following quotations on tungsten ore, per short ton unit of WO_3, for ore of known good analysis: Chinese, duty paid New York, $18.50 and $19.00; Bolivian, Brazilian, etc., duty paid $18.50 and $19.00; and domestic scheelite delivered to buyer's plant, $28.50 per ton (nominal), basis of 60 per cent WO_3.

ZINC

Production of refined zinc and of zinc contained in concentrates for export was higher than in 1948 and a record output value was reached for the third successive year. Electrolytic zinc made by The Consolidated Mining and Smelting Company of Canada, Limited, at Trail, British Columbia, the largest Canadian producer, and by Hudson Bay Mining and Smelting Company, Limited, at Flin Flon, Manitoba, comprised about 68 per cent of the total volume of output. The remainder, most of which was exported, was largely contained in concentrates produced in Quebec and Newfoundland.

The price of zinc fluctuated widely during 1949, ranging from $9\frac{1}{4}$ to $17\frac{3}{4}$ cents a pound. The average price was 12·46 cents a pound.

Production and Developments

British Columbia

Consolidated Mining and Smelting Company produced 157,204 tons of slab zinc, compared with 146,378 tons in 1948. A second slag-fuming furnace, completed and put into operation in August 1949, has made possible the treatment of all blast-furnace slag and zinc plant residues as well as substantial amounts of these stockpiled materials. The company's Sullivan mine and mill at Kimberley, which supply most of the zinc and lead concentrates treated at Trail, operated continuously throughout 1949 on a 5-day week basis. Ore mined totalled 2,297,672 tons, compared with 2,283,625 tons in 1948. The completion of the underground crushing plant, the low-level haulageway, and the sink-float plant commenced in 1947 provides for an increased ore output per operating day and the treatment of lower grade ore.

In addition to concentrates from its Sullivan mine, the company treated substantial amounts of ores and concentrates from a large number of mines in Canada and abroad. The more important Canadian shippers of zinc concentrate in 1949 were: Britannia Mining and Smelting Company, Limited, Howe Sound; Zincton Mines, Limited, Zincton; Canadian Exploration, Limited, Salmo; Base

Metals Mining Corporation, Limited, Field; Reeves MacDonald Mines, Limited, Salmo; Western Exploration Company, Limited, Silverton; and Silver Standard Mines, Limited, Hazelton, all in British Columbia; and New Calumet Mines, Limited, Bryson, Quebec.

At Britannia, exploration to the west of the known ore zones resulted in the discovery of an orebody containing important values in zinc.

Reeves MacDonald commenced production of zinc and lead concentrates in a new 500-ton a day concentrator in July. The capacity of this plant was expected to be increased to over 1,000 tons in 1950.

Canadian Exploration began production of zinc and lead concentrates from its Jersey deposit in March 1949.

Sheep Creek Gold Mines, Limited commenced production of zinc and lead concentrates in a new 50-ton mill at its Paradise mine near Invermere. An orebody was discovered at this company's Zincton mine near Kaslo.

Consolidated Mining and Smelting Company continued its underground exploration and development of the copper-lead-zinc deposits at the Tulsequah Chief and Big Bull properties in the Taku River area, of the zinc-lead deposits at the Bluebell property east of Kootenay Lake, and of the H.B. property near Salmo. Production of zinc-lead oxide ore at the H.B. property is expected to commence in 1950.

Manitoba and Saskatchewan

Hudson Bay Mining and Smelting Company at Flin Flon on the Manitoba-Saskatchewan boundary mined 1,885,107 tons of ore, compared with 1,865,137 tons in 1948. In addition to 133,737 tons of its own zinc concentrate the company treated zinc concentrates from the Sherritt Gordon mine and Cuprus mine in its leaching plant. It produced a total of 49,174 tons of slab zinc, which was slightly less than the amount in 1948. The tonnage of high quality (four-nines plus-grade) zinc and the average purity of all zinc produced were the highest for any year to date. The construction of the new fuming plant and the addition to the zinc plant, which were commenced in 1948, proceeded according to plan. The completion of these projects will enable the recovery of much of the zinc in stocked zinc plant residues (830,000 tons) and of the zinc in the reverberatory slag. The company's new Schist Lake mine, 3½ miles southeast of Flin Flon was not operated. Installation of the surface plant at this property was completed.

Production at Sherritt Gordon Mines, Limited, 40 miles northeast of Flin Flon, was curtailed slightly due to the approaching exhaustion of the orebody. Production from 432,524 tons of ore milled included 10,128 tons of zinc concentrate averaging 50 per cent zinc.

Cuprus Mines, Limited (a subsidiary of Hudson Bay Mining and Smelting Company), about 13 miles southeast of Flin Flon, which commenced production in October 1948, milled 83,500 tons of ore. Production included about 8,350 tons of zinc concentrate.

Ontario

McWilliams-Beardmore Mines, Limited, which reopened the Silver Mountain zinc-lead-fluorspar mine 37 miles west of Fort William in 1948, produced a small quantity of bulk concentrate in a 15-ton pilot mill. It commenced the construction of a 150-ton concentrator in which it is expected fluorspar will be recovered as well as zinc and lead concentrates.

Rochette Gold Mines, Limited produced lead and zinc concentrates in a 35-ton mill from old surface dumps at its property near Kingston. It made preparations to resume mining operations.

Quebec

Zinc concentrates were produced at the copper-zinc mines of Waite Amulet Mines, Limited, Normetal Mining Corporation, Limited, Quemont Mining Corporation, Limited, and East Sullivan Mines, Limited; and at the zinc-lead mines of Golden Manitou Mines, Limited, New Calumet Mines, Limited, and Anacon Lead Mines, Limited.

Wait Amulet, 6 miles northwest of Noranda, milled 453,174 tons of ore and shipped concentrates, the production from which included 20,281 tons of zinc. Most of the ore mined came from the Lower "A" orebody on the Amulet Dufault section of the property, but the life of both "C" and "F" shaft deposits was lengthened by the finding of more ore. A new shaft was commenced to develop the East Waite orebody discovered by drilling in 1948.

At Normetal in Desmeloizes township certain changes made in the mill were partly responsible for a 23·4 per cent increase in the tonnage treated, which amounted to 292,235 tons. Production included 34,562 tons of zinc concentrate. Power was delivered by the Quebec Hydro-Electric Commission in April over a newly constructed transmission line from Noranda. The new No. 4 internal shaft was deepened 900 feet to the 4,160-foot level.

Quemont Mining Corporation, near Noranda, commenced milling in its 2,000-ton concentrator in June 1949. Production from 346,000 tons of ore milled included 1,430 tons of zinc concentrate. Most of this concentrate was stockpiled owing to a strike at zinc plants in United States.

East Sullivan Mines near Val d'Or brought its 2,500-ton concentrator into production in January 1949. The company treated 768,746 tons of ore and production included 5,238 tons of zinc. The construction of a plant to recover iron pyrite was commenced.

Golden Manitou Mines, Limited, 9 miles east of Val d'Or, milled 358,980 tons of ore. Production included 18,775 tons of zinc concentrate containing 11,351 tons of zinc. Lead concentrate and silver-gold precipitate were also produced and exported. Three new orebodies, one high in silver, and two with good values in zinc, were outlined by drilling at a depth of 1,200 to 1,400 feet.

New Calumet mine on the Ottawa River, 50 miles west of Ottawa, milled 226,000 tons. Production included about 24,000 tons of zinc concentrate. The mill capacity was increased from 550 tons to about 730 tons a day by the addition of a new ball mill and classifier.

Anacon Lead Mines, Limited continued the rehabilitation and underground exploration at the former Tetreault property 50 miles west of Quebec City, which it reopened in 1948. The mill treated an average of 410 tons of ore a day and produced concentrate containing 6,450 tons of zinc. Development on the lower levels to the north of the older workings disclosed additional ore of good grade.

The Moulton Hill copper-lead-zinc mine, which was developed to the production stage by Aldermac Copper Corporation, Limited, in 1944 and 1945, was reopened by Ascot Metals Corporation, Limited, in July 1949. The shaft was deepened to a vertical depth of 600 feet and the establishment of three new levels was commenced. The company plans to re-equip the mill and to commence the production of concentrates in 1950.

Candego Mines, Limited, in Gaspe Peninsula, operated its 90-ton mill intermittently until November 1949, when operations were suspended because of a fire in the power plant. It shipped about 500 tons of zinc-lead concentrate.

Bachelor Lake Dome Exploration (Canada), Limited continued the exploration of its silver-zinc-lead deposit at Bachelor Lake, 160 miles northeast of Noranda. Close drilling indicated 790 tons per vertical foot over a length of 375 feet and a width of 21 feet. A second discovery was made on the property towards the end of 1949.

New Brunswick

The development of the Elmtree lead-zinc deposits near Bathurst by Coulee Lead Zinc Mines, Limited, was discontinued.

Newfoundland

The Buchans zinc-lead-copper mine of Buchans Mining Company, Limited, a subsidiary of American Smelting and Refining Company, in the central part of the Island, operated throughout the year. A total of 334,000 tons of ore was milled in the 1,300-ton concentrator and production included 71,325 tons of zinc concentrate. New orebodies northwest of the mine were located by drilling and a new shaft to develop this section of the property was collared in June 1949.

Yukon

United Keno Hill Mines, Limited continued to develop its rich silver-lead-zinc deposits in the Mayo district. A new 250-ton mill equipped to recover zinc and lead concentrates was constructed and was put into operation in October to replace the company's former 125-ton bulk concentrate mill which was destroyed by fire in June 1949. Good progress was made on the construction of the Federal Government road between Whitehorse and Mayo which, when completed in 1950, will eliminate about 500 miles of river transportation.

Northwest Territories

Consolidated Mining and Smelting Company continued exploratory drilling on the 500-square-mile concession it holds jointly with Ventures Limited and Northern Lead Zinc, Limited, at Pine Point, Great Slave Lake. The work indicated that commercial deposits of lead-zinc ore possibly extend over a wide area. In March 1949 a second concession consisting of 320 square miles to the east of the first concession was acquired.

The zinc-lead-silver discovery made in 1948 at Indian Mountain Lake, north of McLeod Bay, Great Slave Lake, was drilled by Hollinger Consolidated Gold Mines, Limited. The results were inconclusive and exploration by Hollinger was discontinued.

World Production

According to the American Bureau of Statistics world production of slab zinc in specified countries in 1948 and 1949 was as follows:

Country	1949	1948
	Short tons	Short tons
United States	816,453	787,764
Canada	206,045	196,575
United Kingdom	71,798	80,621
Australia	90,536	91,607
Rhodesia	25,592	24,830
France	67,148	61,803
Belgium	194,631	169,468
Spain	21,530	23,338
Mexico	58,162	55,732
Norway	45,240	46,298
Italy	29,384	29,495
Germany*	95,812	45,589
Netherlands	17,212	14,978
Japan	35,622	23,342
Total	1,775,165	1,651,440

* 1948—Bizonal Area; 1949—Federal Republic.

Production, Trade, and Consumption

	1949		1948	
	Short tons	$	Short tons	$
Production, all forms (a)				
British Columbia (inc. Yukon)	144,518	38,288,581	135,155	37,654,210
Manitoba and Saskatchewan	49,174	13,028,163	51,130	14,244,651
Quebec	62,661	16,601,312	47,879	13,339,095
Newfoundland *(b)*	31,909	8,454,091	.....	.....
Total	288,262	76,372,147	234,164	65,237,956
Production, refined metal *(c)*	206,045	.....	196,575	.....
Exports of refined metal				
To: United States	108,068	26,227,108	75,408	20,173,019
United Kingdom	52,692	13,994,579	55,433	12,623,151
France	3,417	1,164,780	8,709	2,455,059
India	1,934	512,220	1,724	483,275
Other countries	2,196	584,295	3,613	951,446
Total	168,307	42,482,982	144,887	36,685,950
Exports, in ore (d)				
To: United States	59,298	8,562,595	54,227	4,752,238
Belgium	23,069	1,912,484	.....	.....
United Kingdom	15,445	1,409,055	.....	.....
Other countries	8,872	681,797	.....	.....
Total	106,684	12,565 931	54,227	4,752,238
Exports of scrap, dross, and ashes				
To: United States	2,695	388,979	6,848	826,239
Belgium	3,032	205,555	.....	.....
Other countries	297	59,222	371	72,822
Total	6,024	653,756	7,219	899,061
Exports of zinc manufactures	.....	162,203	.....	159,232
Imports of zinc and zinc products				
From: United States	.....	4,055,837	.....	4,923,683
United Kingdom	.....	441,236	.....	458,681
Other countries	.....	43,657	.....	109,323
Total	.....	4,540,730	.....	5,491,687
Consumption of refined zinc				
Galvanizing	25,789	.....	22,888	.....
Zinc oxides and dust	5,856	.....	7,580	.....
Brass and copper products	4,196	.....	4,664	.....
Diecasting alloys	3,176	.....	3,395	.....
Dry batteries	1,323	.....	1,794	.....
Secondary smelters *(e)*	4,794	.....	6,054	.....
Miscellaneous	535	.....	524	.....
Total	45,669	.....	46,899	.....

(a) Includes zinc estimated recoverable from concentrate exported.
(b) Includes total 1949 production from Newfoundland.
(c) Includes zinc recovered from imported concentrates.
(d) Exports from Newfoundland included for last 9 months.
(e) Most of the virgin zinc consumed in secondary smelting plants goes into alloys which are subsequently diecast, and into brass. They are not included in brass, and diecasting alloys above, the amounts not being available separately.

Uses

Zinc has a wide range of industrial uses. In the United States 50 per cent of the consumption of 703,000 tons in 1949 was used in galvanizing; 28 per cent in diecasting and zinc base alloys; 12 per cent for brass products; and 8 per cent in rolled zinc fabrications. In the United Kingdom, the second largest consumer of zinc, 320,000 tons was used. Galvanizing and brass products each accounted for about 30 per cent of the United Kingdom's consumption.

The metal is marketed to industry in grades, varying according to their respective content of lead, iron, cadmium, and other impurities. In North America, the principal grades produced are "Special High Grade" used chiefly for diecasting; "Regular High Grade" used for brass manufacture and rolled zinc fabrications; and "Prime Western" used for galvanizing. In Canada zinc is refined only by the electrolytic process, by which "Special" and most of the "Regular High Grade" zinc are produced. To fill orders for "Prime Western", Canadian producers debase their products to meet specifications.

In galvanizing, zinc is applied to iron or steel as a thin coating to prevent rusting. It has an affinity for iron and the coating is usually applied by hot-dipping. However, for some purposes such as wire screening, the coating is applied by electroplating. Zinc base alloys, prepared from high-grade electrolytic zinc to which is added 3 to 4 per cent aluminium, up to 3·5 per cent copper, and 0·02 to 0·1 per cent magnesium, are used extensively for diecasting complex shapes, especially for automobile accessories.

Brass, a copper-zinc alloy containing up to 50 per cent zinc, has many diversified uses in industry and the arts. Rolled zinc is used for fabrications exposed to corrosion such as weather stripping, fruit jar sealer rings, battery cups, boiler and hull plates, and brake linings. Zinc dust is used to make zinc salts and compounds; for purifying fats; manufacture of dyes; and to precipitate gold and silver from cyanide solution. Zinc oxide is used in compounding rubber and in the manufacture of paint, ceramic materials, inks, matches, and many other commodities. Among the more important of the zinc compounds and products are lithopone, zinc carbonates, zinc chloride, zinc stearate, zinc sulphate, and zinc sulphide.

Prices

The price of ordinary electrolytic zinc in Canada declined from 17·75 cents a pound in January 1949 to 10 cents a pound between March and June 1949. It was 11·75 cents a pound at the end of the year. The United States' price of "Prime Western" zinc was 9·75 cents a pound in December 1949, 1·25 cents less than the corresponding Canadian price due to the devaluation of the Canadian dollar.

The average Canadian price in 1949 was estimated by the Dominion Bureau of Statistics to be 12·46 cents a pound for slab zinc and 5·9 cents a pound for zinc contained in concentrates exported.

II. INDUSTRIAL MINERALS

ABRASIVES (NATURAL)

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

Corundum

There has been no production of corundum in Canada since completion of the treatment of the old tailings at the Craigmont property, Renfrew county, Ontario, in October 1946. During the two years of operation approximately 2,600 tons of concentrate containing 1,726 tons of fine corundum was shipped to America Abrasive Company, Westfield, Massachusetts, the only handler of corundum on the Continent, for use in polishing precision lenses for military optical instruments.

Several known deposits of corundum occur in the nepheline-syenite belt, which is 100 miles long and 6 miles wide, in Haliburton, Hastings, and Renfrew counties in eastern Ontario. However, they are small and scattered, and of an erratic nature.

Production and Trade

Canada in 1949 imported approximately 126 tons of corundum from fine to coarse grain, most of which was used in the manufacture of grinding wheels and the remainder in grinding and polishing lenses. These imports entered Canada via United States from the Transvaal, Union of South Africa, the chief world producer for the past 30 years. The ores vary from 20 to 50 per cent corundum and until 1946 most of the output was crystal. Concentrates were first produced in 1944 and accounted for 78 per cent of the entire output of 2,716 tons in 1949.

Uses and Prices

Very coarse grain corundum is used in making snagging wheels, and finer grain corundum is used mainly in grinding wheels for precision work in the metal trades. The finest grades (flour grades) of corundum are used for polishing high precision lenses.

Quotations on crude corundum imported into United States were not given in domestic trade journals but were estimated to have varied from $90 to $110 per ton, according to grade. Prices of prepared corundum grain varied considerably according to mesh size and at the end of 1949, according to Engineering and Mining Journal Metal and Mineral Markets, were: natural, per pound, size 8 to 60 inclusive, 8¾ cents; 70 to 275, 9¾ cents; 500, 30 cents; 850 to 1000 45 cents; 1200 to 1600, 65 cents; and 2600, 70 cents.

Garnet

The small output of garnet in Canada in 1949 was produced by Niagara Garnet Company, Limited, Sturgeon Falls, Ontario, which intermittently operates a garnet deposit near River Valley in Dana township, Ontario, and ships rough concentrates to its mill at Sturgeon Falls for finishing. About 40 tons of ore was treated, and from the 10 tons of concentrate produced approximately 2 tons of flour grades were made but were not shipped in 1949.

The garnet is of good grade and occurs in crystals from the size of marbles up to crystals 4 inches in diameter. The garnet ore is crushed and concentrated to about 95 per cent garnet grain. This is then finely pulverized into flour grades for use in the grinding of lenses and the surfacing of plate glass and is shipped to the United States. No grain garnet is produced, however, for the sandpaper trade.

Canada Garnet, Limited, with a property near Labelle, Quebec, made a trial shipment of a garnetiferous gneiss to the plant of the Suzorite Company, Limited, at Cornwall, Ontario, for concentration tests. The results of this test work were not known, but providing good garnet grain from the gneiss constitutes a difficult concentration problem.

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 United States in 1949 amounted to about 8,000 tons of all grades.

Consumption and Uses

Canadian consumption of garnet grain for the manufacture of sandpapers amounts to about 350 tons per year, the two Canadian manufacturers of sandpapers being Canadian Durex Abrasives, Limited, Brantford, and Canada Sandpapers, Limited, Preston, both in Ontario. Competition from artificial abrasives such as silicon carbide and oxide of alumina is a serious factor in the marketing of garnet.

Prices

The cost of ungraded garnet concentrates suitable for sandpaper, according to Engineering and Mining Journal Metal and Mineral Markets, was $85 per ton f.o.b. New York at the end of 1949. Prices of other garnet products ranged up to $150 per ton, with the superfine powders in 5- to 10-micron size used for lense polishing selling for about $200 per ton.

Grindstones, Pulpstones, and Scythestones

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

Read Stone Company, Limited, Sackville, New Brunswick, and Bay of Chaleur Grindstone Company of Clifton, New Brunswick, are the two Canadian grindstone producers. In 1949, 195 tons of grindstones valued at $12,450 were shipped, compared with 220 tons valued at $20,100 in 1948. Read Stone Company, by far the larger operator, ships its material from quarries near Stonehaven, New Brunswick. Bay of Chaleur Company obtains its material from along the Bay of Chaleur at low tide near Grand Anse, New Brunswick.

Good pulpstones are in demand, particularly for use in large magazine grinders, but known Canadian deposits containing thick beds of sandstone of the proper quality appear to be worked out. Natural sandstone pulpstones were last produced in Canada in 1937 from a deposit on Gabriola Island opposite Nanaimo on Vancouver Island, British Columbia. Canadian demand for pulpstones for several years past has been partly supplied by artificial abrasive (mainly of silicon carbide grit) segmental pulpstones, by far the most of which are made by Norton Company of Canada, Limited, in its Hamilton, Ontario, plant. The pulpstones supplied to the Canadian pulp and paper trade by Carborundum Company are made in its United States plant and imported into

Canada. About 900 artificial pulpstones were in use and about 300 in stock in Canadian pulp mills at the end of 1949. A small number of pulpstones made of artificial abrasive material were exported.

Volcanic Dust

Deposits of volcanic dust occur in Saskatchewan, Alberta, and British Columbia, but there has been no production in recent years. Test shipments were made in 1947 from a deposit near Nanton, Alberta.

Volcanic dust is used in Canada mainly for making scouring and cleaning aids. Light-weight building blocks composed of pumice aggregate and cement mixture are made by several companies in British Columbia. The pumice aggregates are imported from Oregon and Washington States at a price of $6 to $9 f.o.b. Vancouver plants.

Imports are grouped with a number of similar products (pumice, pumice stone, lava, and calcareous tufa) and in 1949 were valued at $105,977, compared with $108,684 in 1948. Approximately 90 per cent of the imports came from the United States and the remainder from Italy.

At the end of 1949, according to the Engineering and Mining Journal Metal and Mining Markets the price of pumice stone per pound, f.o.b. New York or Chicago, packed in barrels, was 3 to 5 cents for powdered, and 5½ to 8 cents for lump. These prices varied widely and were dependent upon availability of supply, the use to which it was put, and the quantities required.

ASBESTOS

The year 1949 was eventful for the Canadian asbestos industry. Extensive exploration programs carried out in various parts of the country proved up a number of important new orebodies. Modernization of established mills and haulage systems continued. Further progress was made in the changeover from open-pit mining to underground mining by the method known as block-caving, by producers in the Thetford Mines and Asbestos districts of Quebec. Recovery of short fibre from old refuse dumps was started. But for a prolonged strike that affected most of the producers, the Canadian production would undoubtedly have reached a record. At the close of the year demand for fibre of all grades was greater than ever before.

The outstanding development was the opening up of a new and important asbestos-bearing area near the village of Matheson in Munro township, northern Ontario, by Canadian Johns-Manville Company, Limited. This is about midway between the gold-mining centres of Timmins and Kirkland Lake. By the end of 1949 several deposits had been delimited, the largest of which is 2,200 feet long, 800 feet wide, and proved to a depth of over 780 feet. A mill to treat 100 tons of ore per hour was under construction and the first unit of 50 tons per hour capacity was to be in operation early in 1950. The asbestos is a harsh variety of chrysotile of the cross-fibre type and occurs in veins up to one inch wide. It is well suited to the production of asbestos-cement products. Active prospecting is being done by a number of other companies in this new field.

In the old established producing area of Quebec, new deposits were also proved up by drilling. These included the new orebody at the Vimy Ridge property of Asbestos Corporation, the new property of Bell Asbestos Mines in Thetford township, and the extension of Johnson's Company orebody at Black Lake. A new company, United Asbestos Corporation, Limited, continued work on its property under the bed of Black Lake.

In British Columbia, Acme Asbestos Cement, Limited did exploratory work on its chrysotile property on Sproat Mountain, near Revelstoke.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production (Shipments)				
Crude	652	420,188	977	594,594
Milled fibres	194,583	24,463,703	241,953	25,943,710
Shorts and refuse	379,671	14,862,181	473,839	15,693,171
Total production	574,906	39,746,072	716,769	42,231,475
Exports of Crude				
To: United States	459	277,584	644	363,924
Other countries	172	138,661	228	193,203
Total	631	416,245	872	557,127
Exports of Milled Fibres				
To: United States	126,338	14,939,832	168,211	17,089,931
United Kingdom	18,957	2,282,956	24,365	2,716,452
France	8,505	1,427,182	10,623	1,493,736
Australia	5,513	696,558	6,726	711,091
Belgium	5,625	827,274	6,048	782,086
South America	5,487	884,568	10,129	1,415,576
Other countries	11,216	1,710,466	10,975	1,343,382
Total	181,641	22,768,836	237,077	25,552,254
Exports of Shorts and Refuse				
To: United States	334,656	12,936,464	430,894	14,529,902
United Kingdom	9,790	395,854	13,799	478,540
Other countries	8,272	416,343	7,800	281,233
Total	352,718	13,748,661	452,493	15,289,675
Exports of Manufactures (Brake Linings, Clutch Facings, Roofing, Packing, etc.)				
To: United States	.....	66,321	.....	110,091
French Africa	.....	36,182	.....	116,962
South America	.....	123,495	.....	135,589
Netherlands	.....	2,411	.....	26,960
Other countries	.....	136,198	.....	190,557
Total	.....	364,607	.....	580,159
Imports				
Packing	128	145,695	89	108,092
Brake linings for motor vehicles	.....	439,616	.....	649,896
Clutch facings for motor vehicles	.....	221,208	.....	218,202
Brake linings and clutch facings, other	.....	60,641	.....	83,724
Miscellaneous manufactures	.....	1,729,200	.....	2,692,065
Total	.....	2,596,360*	.....	3,751,979

* Eighty per cent from the United States.

The above production was of the chrysotile variety and came from the Eastern Townships of Quebec, where the producing centres are Asbestos, Thetford Mines, Black Lake, East Broughton, Vimy Ridge, and St. Remi de Tingwick.

There were seven 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, at Thetford Mines; Quebec Asbestos Corporation, Limited, at East Broughton; Canadian Johns-Manville Company, Limited, at Asbestos; Nicolet Asbestos Mines, Limited, at St. Remi de Tingwick; and Flinkote Mines, Limited, 2½ miles east of Thetford Mines. A number of other companies did exploration or development work searching for new deposits in the Eastern Townships of Quebec.

The asbestos-bearing rock is mined both in open pits and underground. However, the block-caving method of underground mining is coming into general use by all companies and within relatively few years all production will be by that method.

Production in the Thetford area has been continuous since 1878 and reserves of asbestos-bearing rock are huge. Core drilling to depths of from 1,200 to 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 less than one-half inch in width, though in rare instances, veins exceeding 5 inches in width are found. The fibres run crosswise of the vein and thus the width of the vein determines the length of the fibre. Slip-fibre, occurring in fault veins, is obtained largely in the East Broughton area.

Canada accounts for about 70 per cent of the world output of asbestos. 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, Bolivia, China, India, and Venezuela. The largest market for asbestos is in the United States.

Small deposits of chrysotile asbestos are known in other parts of Quebec, in Ontario, and in British Columbia, and several have been worked from time to time. The fibre from some of these deposits has a very low iron content and is free from magnetite, and is thus 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. The fibres are harsher, longer, and weaker than those of chrysotile and cannot be spun, but they have a higher resistance to acids than has chrysotile fibre, and are usually used in preference to the latter for the filtering of acid solutions. Fibre from certain of the tremolite deposits in Ontario and Quebec has proved suitable for this use and small-scale development work is proceeding on a deposit of fibrous tremolite near Calabogie, Ontario, and near St. Luc de Matane, Quebec.

Uses and Prices

Asbestos has a great variety of uses, the principal products being: cloth, brake linings, clutch facings, packings, insulation, millboard, sidings, shingles, roofing, tile, and pipes. Short fibre is also finding important new uses in the plastics industry.

Effective January 1, 1949, and continuing throughout the year, according to the Engineering and Mining Journal Metal and Mineral Markets, quotations in United States funds for fibre per short ton, f.o.b. Quebec mines, bags included, were: crude No. 1, $960 to $1,050; crude No. 2 and sundry crudes, $492 to $550; spinning fibres, $232 to $475; shingle stock, $95.50 to $141; paper stock, $78.50 to $88; shorts, $27 to $52; waste $56.

BARITE

Production of crude and ground barite in Canada in 1949 totalled 47,138 short tons, a decrease of 50 per cent below the 1948 output. Exports also declined 50 per cent to 49,456 short tons, due mainly to a curtailment of oil-drilling programs in Central and South American countries.

Canada's leading producer, Canadian Industrial Minerals, Limited, with mine and mill at Walton, Hants county, Nova Scotia, accounted for over 96 per cent of the total production. Mountain Minerals, Limited, with mine at Parson, British Columbia, furnished the remainder.

There are also numerous small, undeveloped deposits of barite in the general Ottawa region of Ontario and Quebec and in several districts of northern Ontario, Nova Scotia, Manitoba, and British Columbia.

Production, Trade, and Consumption

	1949		1948	
	Short tons	$	Short tons	$
Production (mine shipments)				
Crude	10,238	74,366	44,726	381,092
Ground	36,900	483,296	51,021	692,288
Total	47,138	557,662	95,747	1,073,380
Imports (ground)				
All from United States	939	32,269	1,263	39,613
Exports				
Crude	39,726	.....	38,596	.....
Ground	9,730	.....	57,191	.....
Total	49,456	.....	95,787	.....
Consumption				
Paints	1,331	.....	1,330	.....
Rubber goods	659	.....	359	.....
Glass	380	.....	380	.....
Miscellaneous	1,075	.....	500	.....
Total	3,445	.....	2,569	.....

Nova Scotia

Canadian Industrial Minerals, Limited continued production of barite of high $BaSO_4$ content for direct shipment in crude and ground form. Development work in 1949 included removal of overburden along the strike of the orebody to the east, completion of No. 3 ore pass system at the 270-foot level, and some lateral development at the 350-foot horizon.

Maritime Barytes, Limited, with two properties near Brookfield, Colchester county, announced completion of plans for the erection of a mill designed to treat ore containing both siderite and barite.

Ontario

Woodhall Mines, Limited, with mine and mill in Langmuir township, Porcupine area, the only operators in Ontario in recent years, reported no production in 1949.

British Columbia

Mountain Minerals, Limited continued production from its property at Parson, the bulk of the product being shipped to eastern Canada for grinding.

World Production

The United States is by far the largest producer of barite and in 1948, according to the United States Bureau of Mines, contributed approximately 58 per cent of the estimated world production of 1,207,000 metric tons. Other leading producers include the United Kingdom (100,000 tons), Italy (55,000 tons), India, Greece, Brazil, Argentina, and Spain. Canadian production reached a peak of 127,000 tons in 1945.

Uses, Specifications

Ground barite is used principally as a pigment and filler in paints, as a filler in rubber goods, in moulded flint glass, in chemicals, and in drilling mud.

For drilling mud, barite is combined with bentonite and other materials to form a heavy suspension used in drilling oil and gas wells to overcome gas pressures, and to remove cuttings from the drilling face. For this purpose barite with a minimum $BaSO_4$ content of 95 per cent, minimum specific gravity of 4·2, and an absence of soluble salts is required. The size required is about 98 per cent minus 325-mesh.

As a filler for the rubber and paint trades barite should contain not less than 95 per cent $BaSO_4$, grind to a pure white colour, and be free from carbonaceous impurities.

For the chemical trade barite should have a minimum of 95 per cent $BaSO_4$, maximum of about 3 per cent silica, and 1 per cent Fe_2O_3. Colour is not important.

For the glass trade, barite should be relatively pure, particularly as regards Fe_2O_3 which should not exceed 0·04 per cent.

Barite is used as a filler in a number of commodities including paper, linoleum, textiles, asbestos products, and artificial ivory. It is used also in materials to provide protection against X-rays, in glass to improve brilliancy and cutting properties, and as a heavy medium in sink and float processes, particularly coal washing.

Barium chemicals find wide application in industry. Barium carbonate is used to reduce "dry house" scum on bricks; in pharmaceuticals; as a flux in the enamelling and ceramic trades; and in heat-treatment compounds. The chloride is used as a pigment in lithographic inks; for the purification of salt brine and water treatment; as a mordant in dyeing textiles, and in many other applications. Other compounds include the hydrate, phosphate, oxide, sulphide, stearate, and chlorate.

Prices and Tariffs

Final 1949 quotations on barite as published in Engineering and Mining Journal Metal and Mineral Markets were as follows: Georgia, crude $11.50 to $12; Missouri, crude ore, minimum 94 per cent $BaSO_4$, less than 1 per cent iron, $9.50; and 93 per cent $BaSO_4$, $9 to $9.25 per long ton, f.o.b. mines.

The average declared value of crude off-colour exports for 1949 was $7.50, and of ground barite $11.45 per short ton, f.o.b. Atlantic ports. Crude white sold for about $10 per short ton at rail.

Barite enters Canada free under the British Preferential Tariff and at 25 per cent ad valorem under other schedules. Barite used in drilling mud is not dutiable. The duty on crude or unmanufactured barite entering United States is $3.50 per ton, and on ground or otherwise manufactured, $7.50 per ton.

BENTONITE

Mine shipments of bentonite in Canada in 1949 increased 3½ per cent in tonnage over 1948. All production continued to come from Manitoba and Alberta, where the bentonite occurs interbedded with clay, shale, and sometimes with coal seams.

Alberta shipments of mine crude to processing plants decreased 12 per cent in tonnage compared with 1948, owing to the increased use of drilling-mud bentonites imported from the United States.

Occurrences

The principal known occurrences of bentonite in Canada are in the Prairie Provinces and British Columbia.

Large deposits of non-swelling bentonite that are valuable for bleaching purposes both in the natural and activated states, and for foundry use, occur in the Pembina Valley area of southern Manitoba.

Large deposits of bentonite, both swelling and non-swelling, occur in the Wood Mountain and Cypress Hills areas in southern Saskatchewan. Laboratory tests have proved some of these deposits to have a high efficiency, when activated, for refining and decolorizing oils. Work in 1949 by the Saskatchewan Government has shown that their low capacity yield is the main disadvantage to the use of these bentonites in drilling fluids. Chemical beneficiation to increase the yield value is being studied with the hope of at least providing suitable muds for local use.

In Alberta, large deposits, both swelling and non-swelling, occur in the central and southeastern sections of the province.

In British Columbia large deposits of bentonite, mostly of the non-swelling variety, occur at Princeton and near Merritt.

Production and Imports

	1949		1948	
	Short tons	$	Short tons	$
Mine shipments of crude				
Manitoba	15,000	.....	14,140	.....
Alberta	2,021	.....	2,300	.....
Total	17,021	.....	16,440	.....
Production of processed bentonite[1]	8,271	430,735	7,897	415,408
Imports of activated clay[2] (All from United States)	.....	265,793	.....	272,586

[1] Includes ground natural bentonite and activated material.

[2] Considerable unrecorded amounts of ground bentonite are imported from the United States for foundry use and for use as oil-well drilling muds.

Operations in Manitoba are confined to those of Pembina Mountain Clays, Limited, 915 Paris Building, Winnipeg, which ships the dried ground clay from the Morden area to its plant in Winnipeg for activation. All of the Canadian production of activated clay comes from this area. Output of crude bentonite to the end of 1949 is estimated at 55,000 tons.

There has been no production to date from the aforementioned deposits in Saskatchewan, with the exception of a few trial shipments.

Alberta's output was from operations centred in the Drumheller area. The following reported shipments for 1949: Gordon L. Kidd, and Aetna Coal Company, Drumheller; and Western Gem and Jewel Collieries, Limited, Cambria. Production to the end of 1949, amounting to approximately 15,000 tons, was of the highly colloidal swelling variety.

There has been no production from the Merritt area in British Columbia for several years, but small, intermittent shipments have been made from the Princeton deposit by Francis Glover, 1029 Marine Building, Vancouver. Most of this material went to Vancouver for grinding and local use in the refining of lubricating oils.

Uses

Bentonite is used chiefly in the refining of mineral and vegetable oils; as a bonding ingredient in foundry sands; and to control the viscosity of oil-well drilling muds.

To a minor extent it is used as a filler in paper, rubber, and other products; as a detergent in soaps and cleaners; as a coagulant for clarifying wines, honey, and turbid waters; as a stabilizer in various hydraulic cements and emulsions; as a carrier for insecticides, fungicides, and herbicides; and in toiletries, and medicinal preparations. It is used for grouting dams and irrigation ditches and to prevent seepage around foundations of buildings. Bentonite is also used in bonding and plasticizing ceramic bodies and ore briquettes for smelting. Treated bentonite is used as a dessicant to prevent atmospheric moisture from entering packaged goods, and for coating small seeds to increase their bulk and facilitate sowing.

Most of the Manitoba output undergoes activation and is used in bleaching and refining petroleum products. Alberta bentonite is used mainly as a drilling mud in oil-well drilling in the province. Smaller amounts from Alberta have been used by the gold and coal mining industries in exploratory drilling, in foundry work, and for grouting and lining the dams, and irrigation canals on the prairies.

Alberta bentonite is shipped for drying and grinding to Alberta Mud Company, Limited, 609 Herald Building, and to Western Industries, Limited, 200 Lancaster Building, both in Calgary.

As reported by the Dominion Bureau of Statistics, Canada in 1948 (1949 figures are not available) used 19,188 short tons of domestic and imported natural and activated bentonite, compared with 16,358 short tons in 1947. Consumption by industries in 1948 (1947 in brackets) was: steel furnaces, 4,490 tons (3,095); iron foundries, 1,800 tons[1] (1,800); petroleum refining, 9,111 tons (8,252); oil-well drilling, 2,500 tons[1] (2,000); soaps, 858 tons (794); pulp and paper, 229 tons (220); miscellaneous, 200 tons (197).

Prices and Tariffs

Activated bentonite for bleaching and refining oils was approximately $72 per ton in bulk carload lots delivered eastern Canadian points in 1949. Alberta crude bentonite sold for $5 to $5.75 per short ton, f.o.b. mine. The processed bentonite for oil drilling use was unchanged at $35 per ton f.o.b. plant.

There were no changes in the prices of Wyoming, South Dakota, and Mississippi bentonite. Wyoming and South Dakota standard 200-mesh bentonite sold for $11.50 per ton, bagged in carload lots, f.o.b. plant. Dried, crushed material sold for $9 per ton, bulk, in carload lots. Special grades in dust form were quoted as high as $80 per ton. Natural ground, Mississippi bentonite was quoted at $13.50 per ton, bagged lots, f.o.b. plant.

[1] Partly estimated.

The duty on unmanufactured bentonite entering the United States is 75 cents per ton, and on manufactured, $1·625 per ton. Bentonite, not further manufactured than ground enters Canada duty free. Activated bentonite, for oil refining use, imported into Canada, pays 10 per cent ad valorem.

CEMENT

Production of Portland cement in Canada in 1949 reached a peak of 15,916,564 barrels but it was not sufficient to meet the continued high demand from the construction industry. Several major engineering developments absorbed large quantities. Despite an increase in output of 1·8 million barrels over 1948, a total of 2,284,001 barrels was imported, chiefly from the United States. Shipments from the United Kingdom reached a peak and amounted to over 20 per cent of the total imports.

Cement is produced in five of the ten provinces: Quebec, Ontario, Manitoba, Alberta, and British Columbia. The raw materials required in its manufacture are widely distributed across Canada enabling the industry to establish production facilities near marketing areas.

The three companies engaged in the production of cement in Canada have a total daily capacity of approximately 47,000 barrels. Canada Cement Company, Limited, the largest producer, operates manufacturing plants at Exshaw, Alberta; Fort Whyte, Manitoba; Hull and Montreal East, in Quebec; and at Port Colborne and Belleville, Ontario. The company ships bulk cement from Montreal East to its bagging plants in Chatham, New Brunswick, and in Halifax, Nova Scotia, for bagging and distribution to the Maritime Provinces and Newfoundland. Other distributing plants are in Quebec City, and in Toronto and Windsor in Ontario.

St. Mary's Cement Company, Limited produces cement in its plant at St. Mary's, Ontario, and British Columbia Cement Company, Limited operates a plant at Bamberton, British Columbia.

New kilns were completed and put into operation at the Belleville plant of Canada Cement Company and at the plant of St. Mary's Cement Company.

A fourth company, Medusa Products Company of Canada, Limited, imports clinker for grinding to produce white cement and other cement products at its plant in Paris, Ontario.

Production and Trade

	1949		1948	
	Barrels of 350 lb.	$	Barrels of 350 lb.	$
Production	15,916,564	32,901,936	14,127,123	28,264,987
Exports				
Newfoundland	879*	2,652*	29,687	77,627
Venezuela	15,634	41,056	23,625	64,784
Other countries	2,699	8,025	19,687	58,164
Total	19,212	51,733	72,999	200,575
Imports				
United States	1,649,266	5,278,986	981,620	3,547,860
Belgium	167,275	433,102	119,792	349,815
United Kingdom	450,779	1,098,001	18,201	91,748
Other countries	16,681	67,850	1,058	5,750
Total	2,284,001	6,877,939	1,120,671	3,995,173

* January to March inclusive.

Apart from the above imports of finished cement, 44,044 barrels of clinker valued at $131,927 was imported in 1949 from United States for additional processing in Canada.

Uses and Prices

Increasing amounts of cement are being used in the cement products industry, the value of cement used by this industry in 1948 being $6,138,541 compared with $891,870 in 1939. The gross selling value of the industry's products increased from $3,716,692 in 1939 to $26,186,413 in 1948. The articles manufactured include concrete pipe, laundry tubs, burial vaults, concrete and cinder block, artificial stone, concrete brick, and ready mix concrete.

Portland cement increased in price in 1949. Average prices (1948 prices in brackets) f.o.b. cars at the following cities (as compiled by the Dominion Bureau of Statistics) were per barrel of 350 pounds: Montreal, $2.19 ($2.11); Toronto, $2.68 ($2.58); Winnipeg, $2.48 ($2.47); Regina, $3.54 ($3.46); and Vancouver, $3.15 ($3.10).

CLAYS AND CLAY PRODUCTS

With the exception of art pottery and refractories made from domestic fireclays, sales of clay products in 1949 showed an increase over 1948. To meet the heavy demand there was a further expansion in the production capacity of certain kinds of ceramic products and a number of new plants were being established.

The abrupt decrease in demand for Canadian-made art pottery resulted mainly from the effects of foreign competition assisted partly by the devaluation of the pound sterling. Chiefly because of this competition, two large potteries in western Canada were forced to suspend operations.

The decrease in production of refractories from domestic fireclays was the result largely of the destruction by fire of the plant of one of the largest producers. However, this plant has been rebuilt and full-scale production is expected in 1950.

Production and Trade

——	1949	1948
	$	$
Production		
From: Canadian clays[1]	17,981,709	17,629,048
Imported clays[2]	14,457,000	12,363,734
Imports		
Clays		
From: United States	1,730,126	1,887,400
United Kingdom	494,037	475,443
Total	2,224,163	2,362,843
Clay Products		
From: United States	16,608,513	14,913,340
United Kingdom	13,076,975	12,716,811
Other countries	923,047	695,952
Total	30,608,535	28,326,103

[1] Products comprise building brick, structural tile, drain tile, roofing tile, sewer pipe, stoneware, pottery, and refractories.
[2] Products comprise electrical porcelain, sanitary ware, sewer pipe, tableware, pottery, ceramic floor and wall tile, thermal insulating materials, and various kinds of refractories.

Production and Trade—concluded

—	1949	1948
	$	$
Exports		
Clays		
To: United States	16,726	15,518
Other countries	783	3,138
Total	17,509	18,656
Clay Products		
To: United States	363,955	324,137
Sweden	275,934	378,579
Other countries	1,071,874	786,760
Total	1,711,763	1,489,476

Common Clays

Common clays or shales suitable for the production of building brick and tile occur in all of the provinces of Canada, but materials suitable for making high quality brick and other clay products are not plentiful. This has presented difficulties in attempts to establish new plants in various parts of the country. However, good brick clays or shales occur near Toronto, Hamilton, Montreal, and in the eastern and western coastal areas, and in these localities production of good quality brick and structural tile is on a large scale. Good quality structural clay products are also produced in certain areas of the Prairie Provinces. The value of building brick, structural tile, drain tile, etc., produced in Canada in 1949 from domestic clays was $14,379,869 compared with $13,148,071 in 1948.

There has been a high demand for light-weight concrete aggregate. "Haydite" (shale bloated by heat treatment) is produced regularly in a large plant near Toronto, but the demand exceeds the amount of available material suitable for making light-weight structural units.

Stoneware Clays

The largest production of stoneware clays in Canada is in southern Saskatchewan, particularly in the vicinity of Eastend. The clay is selectively mined and is shipped to Medicine Hat, Alberta, where, owing to the availability of cheap natural gas, it is used extensively to make a wide variety of stoneware articles, sewer pipe, pottery, etc.

The stoneware clays or semi-fireclays that occur associated with the fireclays in the Sumas Mountain, south of Vancouver, are utilized on a rather large scale for making sewer pipe, flue liners, and other stoneware products.

Deposits of stoneware clays and moderately refractory fireclays that occur near Shubenacadie and Musquodoboit, Nova Scotia, have been used for the production of pottery, certain stoneware products, and low-grade refractories, but have not been developed extensively for ceramic use. Deposits of stoneware clays or semi-fireclays occur also near Williams Lake and Chimney Creek Bridge in British Columbia, and near Swan River, Manitoba, but they are difficult of access and have not been developed.

In Ontario and Quebec, stoneware clays where needed must be imported.

The value of stoneware articles (sewer pipe, artware, etc.) produced in Canada from domestic clays was approximately $2,121,201 in 1949, compared with $2,684,704 in 1948. The value of such products made from imported clays in 1948 was $703,706.

Fireclays

Two large plants and several small plants make fireclay refractories from domestic clay. Firebrick and other refractory materials are made on a large scale at a plant about 50 miles south of Vancouver, from the high-grade, moderately plastic fireclay that is extracted by underground mining from the clay beds in the Sumas Mountain. Other smaller enterprises have been established in this area in recent years for the manufacture of refractories or allied products from material obtained from the Sumas Mountain deposits. Some of this material is exported to northwestern United States for use in making refractories. A 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. Small amounts of the most refractory clays in the deposits near Shubenacadie, Nova Scotia, have been used for refractory purposes by the steel plant at Sydney in that province, and some of the Musquodoboit clay has been used for the production of stove linings.

Other production of fireclay refractories (firebrick, high-temperature cements, plastic refractories, etc.) in Canada, particularly in eastern Canada, is from imported clays.

The rather extensive deposits of plastic fireclays that occur in the Mattagami, Missinaibi, and Abitibi Rivers in northern Ontario have received little active development attention owing to their remoteness and to certain difficulties attending efforts to extract uniform high-quality material.

Suitable deposits of such alumina or alumina-silica minerals as bauxite, sillimanite, kyanite, and andalusite, valuable raw materials for the production of super-duty refractories, have not been found in commercial quantities in Canada.

Fireclays imported by rail or water transportation from the United States enter Canada duty free if not further processed than ground.

The value of refractories produced in Canada from domestic clays in 1949 was approximately $444,667, compared with $689,644 in 1948. The value of refractories made from imported clays in 1948 was $1,279,138.

China Clay and Ball Clay

China clay (kaolin) has been produced commercially in Canada only in the vicinity of St. Remi d'Amherst, Papineau county, Quebec, where a large plant was established several years ago to refine the kaolinized material found there into high-grade china clay, and to recover washed silica sand as a by-product. However, this project was abandoned in 1948 because of mining and operational difficulties.

None of the several other smaller deposits of kaolin occurring in Quebec has been developed. One of these is near Point Comfort, Thirty-one Mile Lake, Hull county, the others being near Brebeuf, Lake Labelle, and Chateau Richer.

The clay deposits in northern Ontario (see "Fireclays" above) contain material that may be classified as crude china clay, and in British Columbia, parts of the extensive clay deposits that occur along the Fraser River, about 25 miles above Prince George, yield high-grade kaolin. However, their distance from industrial centres has prevented their development.

The Saskatchewan Government has undertaken an extensive program of exploration and development of the ball clay resources of the southern part of the province largely in the hope that markets for western ball clays may be expanded in eastern Canada and the United States.

China clay imported from England or the United States is used to make electrical and other porcelains, sanitary ware, tableware, ceramic floor, and wall tile, etc. The value of such clay products made in Canada in 1948 was $9,381,990. Large quantities of china clay are also imported for use in the paper and rubber industries. Imports of china clay in 1949 were valued at $1,270,022, of which imports valued at $803,719 came from the United States and at $466,303 from the United Kingdom.

DIATOMITE

Although there are more than 400 known occurrences of diatomite in Canada production is small and is far short of consumption. Canada imports practically all its requirements from the United States. Output comes from Nova Scotia and British Columbia and in 1949 amounted to 60 tons, whereas consumption totalled 16,237 tons compared with 17,260 tons in 1948. Diatomite increased in price in 1949.

Production, Trade, and Consumption

	1949		1948	
	Short tons	$	Short tons	$
Production (sales)	60	1,703	46	1,487
Imports				
From: United States	16,913	551,825	17,196	511,679
United Kingdom	1	129	4	436
Total	16,914	551,954	17,200	512,115
Consumption				
Fertilizer dusting	6,944		7,670	
Filtration	6,722		5,000	
Fillers	2,292		4,360	
Insulation	189		180	
Concrete admixture	80		50	
Chemicals and miscellaneous	10			
Total	16,237		17,260	

Diatomite consists of microscopically small, siliceous, skeleton remains of diatoms, a form of algæ that at one time lived in water.

The material of recent (geologically) freshwater origin, the most common type in Canada, usually occurs as a grey to brown to black mud or peat and is found in the swamps and lake bottoms of northern Nova Scotia, in southern New Brunswick, in British Columbia, and in the Muskoka area of Ontario.

The material of Tertiary age occurs in dry, compact beds and is very light in weight with relatively low moisture content. It is white to cream in colour. The Tertiary freshwater deposits near Quesnel in the Cariboo area of British Columbia are by far the largest known in Canada. They extend for many miles along the Fraser River, are compact, and, in places, are up to 40 feet thick. Transportation difficulties and costs have hindered their exploitation. Small

amounts of this diatomite have been marketed for insulation purposes, and tests were being conducted on the suitability of this material for coating nitraprills.

The largest known recent freshwater (swamp) deposit in Canada occurs at Digby Neck, Nova Scotia. The Nova Scotia Department of Mines has almost completed an investigation started in 1946 of some of the diatomite deposits of the province, particularly those along Digby Neck. Tests were conducted on the Digby Neck diatomite during 1949 by the Nova Scotia Research Foundation, Halifax, in co-operation with the Mines Branch, Ottawa.

United States with an annual output in excess of 200,000 tons is the world's leading producer and consumer of diatomite. Most of the output is produced by two companies: Johns-Manville Corporation (Celite Division) from deposits at Lompoc, California; and the Dicalite Company from deposits at Walteria, California, Terrebonne, Oregon, Basalt, Nevada, and at Kittitas and Quincy, in Washington.

Other important producers include Denmark (Moler), Germany (kieselguhr), Algeria, Japan, and France.

Uses

Diatomite is used as a fertilizer dusting agent in making ammonium nitrate fertilizers by The Consolidated Mining and Smelting Company of Canada, Limited, in its plants at Warfield, British Columbia, and at Calgary, Alberta, and by North American Cyanamid, Limited, in its plant at Welland, Ontario. For this purpose, the diatomite is highly porous, and when added to the nitrate, it absorbs moisture and prevents the nitraprills from caking and sticking together. Specifications call for uncalcined material of 95 per cent minus 325-mesh with a less than 5 per cent moisture content.

Diatomite is used for filtration purposes in many industries across Canada, the most important of which include sugar refining, liquor distilling, dry cleaning, and syrup-making. Most of the remainder is used as fillers in the paint, paper, rubber, soap, textile, and chemical industries.

Some diatomite is consumed in the manufacture of lime-diatomite insulation bricks by a Toronto firm which uses Nova Scotia calcined diatomite. Minor amounts of diatomite are consumed in concrete admixtures, insecticide carriers, insulation materials, silver polish, etc.

Prices

The cost of diatomite varies widely and is dependent on the use to which it is put and the quantity in which it is purchased. The 1949 price quotations, f.o.b. Montreal or Toronto, list the following in dollars:

Filtration Grades

100-lb. lots	cwt., $3.85-$6
1,000-lb. lots	ton, $100-$160
Carload lots	ton, $34-$80

Filler Grades

100-lb. lots	cwt., $2.75-$3.30
1,000-lb. lots	ton, $77-$104.50
Carload lots	ton, $34-$46

The cost of diatomite for other purposes varies widely, but in large quantity purchasing may range from $40 to $60 f.o.b. plants. Material suitable for metal

polishes purchased in small lots may range up to $200 per ton. Imported diatomite insulation bricks vary in price from $140 to $300 per 1,000 according to grade and density.

FELDSPAR

Feldspar production in Canada in 1949 decreased 33 per cent to 36,948 short tons from the all-time high of nearly 55,000 tons in 1948. Approximately 86 per cent of the total output came from Quebec, and the remainder from Ontario.

Exports, all crude and almost entirely to United States, declined 49 per cent to 17,570 short tons, about one-half of the total output. Imports increased slightly to 228 short tons.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production				
Quebec	31,848	384,892	42,800	464,926
Ontario	5,100	43,610	12,051	99,511
Total	36,948	428,502	54,851	564,437
Imports				
All from United States	228	4,555	207	4,640
Exports				
To: United States	17,527	108,323	31,459	223,345
Other countries	43	3,592	8	600
Total	17,570	111,915	31,467	223,945

Quebec

Most of the output was produced by Canadian Flint and Spar Company, Limited, Ottawa, Ontario, with mines in Derry, West Portland, Buckingham, and Templeton townships in Papineau county.

The company's grinding mill at Buckingham operated throughout the year producing for the domestic trade. Bon Ami, Limited, Montreal, continued to grind feldspar for its own use.

Other leading producers included E. Wallingford, Templeton township, and William and O. A. Wallingford, Hull and Templeton townships in the Gatineau area. Minor tonnages were produced from other mines in the same area.

Ontario

Canadian Flint and Spar in Bedford township, Frontenac county, and Bathurst Feldspar Mines, Limited, in Bathurst township, Frontenac county,

were the principal producers. W. Cameron and L. Aleck, who operated in Murchison township, Renfrew county, also contributed to the total output.

Consumption and Uses

Consumption of feldspar in Canada in 1948 totalled 15,153 short tons. Distribution by industries was: clay products, 7,000 tons (estimated); cleansers, 3,667 tons; glass, 2,744 tons; enamelling, 1,700 tons (estimated); and abrasives, 42 tons.

The most important specification for feldspar is its iron content and that of other colouring oxides. For whiteware, porcelain, glass, etc., the iron (Fe_2O_3) content should not exceed 0·06 per cent. Users of dental spar may tolerate up to 0·10 per cent.

Potash microcline of high purity represents the highest quality of feldspar. Feldspar comprising mixtures of potash and soda spar (albite) are subject to lower grading. For ceramic use, colour is not important. For cleansers, however, for which both potash and soda spar are accepted, the material should be of good white colour.

Markets, Prices, Tariffs

Canadian Flint and Spar Company, Limited is the principal purchaser of crude feldspar of all grades in Canada. Bon Ami, Limited purchases white spar for cleanser use. Buyers of ceramic grade spar in United States include Consolidated Feldspar Corporation, Rochester, New York; Genesee Feldspar Company Incorporated, Rochester, New York; and Shenango Pottery Company, New Castle, Pennsylvania. Buyers of dental grade spar include Myerson Tooth Corporation, Cambridge, Massachusetts, Universal Dental Company, Philadelphia, Pa., and Dentist's Supply Company, New York.

Prices for No. 1 crude feldspar in 1949 ranged up to $8.50 per short ton f.o.b. rail, and for special high quality ceramic (crude) up to $13. The average declared unit value of crude shipped to United States was $6.18 per ton. Final 1949 quotations for ground pottery grade, in bags, were: car lots $22; less than car lots $24 per short ton f.o.b. Toronto or Montreal.

The duty on crude feldspar entering United States was 25 cents per long ton and on ground feldspar, 15 per cent ad valorem.

FLUORSPAR

Production of fluorspar in Canada reached a new high of 64,477 tons in 1949 with a value of $1,592,908. This compares with 11,340 tons valued at $344,834 in 1948, the increase being due to the entry of Newfoundland into Confederation.

In the past, Canada depended chiefly upon imports to meet its requirements, as is shown by the fact that 82 per cent of the average consumption of 21,800 tons during the 30-year period ended 1948 was imported. With the entry of Newfoundland, Canada has sufficient ore reserves for years to come and is now the second largest producer of fluorspar in the British Empire. In addition, exports may be expected to increase in the near future.

Fluorspar production in Newfoundland began in 1932, and since then nearly 500,000 tons of ore valued at over $8,500,000 have been shipped.

Production, Trade, and Consumption

	1949		1948	
	Short tons	$	Short tons	$
Production (shipments)				
Newfoundland	58,077	1,405,033	(1)	(1)
Ontario	6,400	187,875	11,340	344,834
Total	64,477	1,592,908	11,340	344,834
Imports				
From: Newfoundland	(1)	(1)	41,405	927,566
United States	1,522	59,146	1,475	47,152
Mexico	988	22,504	6,044	130,472
Total	2,510	81,650	48,924	1,105,190
Exports				
To: United States	15,344	.....	.....	.....
Total	15,344	.....	.....	.....
Consumption				
Non-ferrous smelters	.....	.....	29,585	.....
Steel furnaces	.....	.....	20,651	.....
Heavy chemicals	.....	.....	3,011	.....
Glass	.....	.....	569	.....
Enamelling and glazing	.....	.....	250[2]	.....
Miscellaneous	.....	.....	50[2]	.....
Total	.....	.....	54,116	.....

[1] Newfoundland, for convenience, regarded as part of Canada for full year.
[2] Estimated

Ontario

All the output in 1949 came from the Madoc area in Hastings county, which supplied about 66 per cent of the Canadian fluorspar production from 1905 to the end of 1948. Production in 1949 came from the Rogers mine, operated by Reliance Fluorspar Mining Syndicate, Limited, and the Bailey mine, operated by Millwood Fluorspar Mines, Limited.

Fission Mines, Limited resumed its program of surface exploration and drilling on its property in Cardiff township, near Wilberforce, which was discontinued in 1947.

Cardiff Fluorite Mines, Limited continued its exploration work of tunnelling, drifting, and drilling on its property near Wilberforce during the first part of 1949, and reports that the mill and inclined shaft site have been chosen, work on the shaft to commence early in 1950.

Newfoundland

All the commercial fluorspar veins occur in the vicinity of St. Lawrence, a town on the southeast coast of Newfoundland, most of the veins being within 6 miles of St. Lawrence Harbour. St. Lawrence Corporation, Limited, and Newfoundland Fluorspar, Limited, are the two producers. Both companies maintained production at a substantial level despite curtailment of operations in the latter part of the year owing to a shortage of hydro-electric power caused by an abnormally dry summer.

Production of St. Lawrence Corporation came from its Iron Springs mine, one of the 'higher grade' veins located 2½ miles southwest of St. Lawrence. By means of a combination gravity and flotation mill, the company turns out one of the highest grade concentrates in the world. The flotation concentrates average over 98 per cent calcium fluoride (CaF_2) with less than 1 per cent silica and less that 0·01 per cent sulphur. Production in 1949 totalled 21,375 tons of concentrates, consisting of 7,125 metallurgical and 14,250 acid grade, compared with 27,542 tons in 1948, consisting of 13,494 metallurgical and 14,048 acid grade. Shipments amounted to 24,304 tons compared with 21,372 tons in 1948, and consisted of 8,960 metallurgical to the steel plants of Canada, and 15,344 acid grade to the United States. The acid grade flotation concentrates were shipped to a subsidiary, St. Lawrence Fluorspar Incorporated, at Wilmington, Delaware, where they were dried before reshipping to the chemical and ceramic industries.

Production of Newfoundland Fluorspar, Limited, a subsidiary of Aluminum Company of Canada, Limited, is derived from the Director mine, located 1½ miles west of St. Lawrence. The vein averages 15 to 25 feet in width and has an average calcium fluoride content of 75 per cent. Production in 1949 amounted to 32,002 tons of hand-picked, crushed ore, having an average calcium fluoride content of 75 per cent. Shipments totalled 33,773 tons, of which 31,064 tons went to Arvida, Quebec, and the remainder to the steel and chemical industries of Canada. At Arvida the ore is improved by flotation, and, with the exception of a few shipments to other consumers, is used in the manufacture of aluminium by the electrolytic process.

No serious estimate of Newfoundland's ore reserves can be made, but they are probably in excess of 20,000,000 tons. Over twenty-four veins have been located to date, none of which has been completely traced longitudinally or vertically. However, fluorite mineralization is known to extend for as much as 3 miles longitudinally, and at depths of over 500 feet no siginficant changes are noted in grade and width.

The fluorspar veins in Newfoundland are fissure fillings in a granite intrusive believed to be of Devonian age, and are typically epithermal, commonly consisting of finely banded fluorite along the walls and coarsely crystalline fluorite in the open centres of the veins and in vugs, all more or less brecciated and containing varying amounts of granite breccia. The gangue in the veins consists principally of brecciated granite, fine-grained quartz, and calcite. The veins are steeply dipping, ranging from vertical to 65 degrees with a few minor exceptions, and vary in width from a few inches to more than 50 feet. The 'higher grade' veins average between 4 and 5 feet in width, have a CaF_2 content of at least 95 per cent, and a silica content of 1 to 4 per cent, whereas the 'lower grade' veins average between 15 and 20 feet in width, have a CaF_2 content of about 75 per cent, and a silica content of 10 to 15 per cent.

Other Canadian Occurrences

Fluorspar deposits occur also in Ross township, Renfrew county, Ontario; in Huddersfield township, Pontiac county, Quebec; in the Lake Ainslie district, Cape Breton Island, Nova Scotia; and at the Rock Candy mine of The Consolidated Mining and Smelting Company of Canada, Limited, near Grand Forks, British Columbia.

Uses and Specifications

The chief use of fluorspar in Canada is in the manufacture of aluminium fluoride, used in the aluminium industry. The aluminium fluoride is added directly to the pots as a make-up to the electrolyte.

The next largest use is as a powerful fluxing agent in the steel industry, and is used in small amounts in numerous other metallurgical industries,

including foundries and various metal-refining operations. About 6 pounds of spar is required per ton of steel made in the open-hearth, and 20 pounds per ton for that made in the electric furnace.

The next largest use is in the manufacture of heavy chemicals.

The ceramic industry is next, and uses fluorspar as a fluxing and opacifying ingredient in glass and enamels.

In the United States the steel industry is the largest consumer of fluorspar. The next largest use is in the manufacture of hydrofluoric acid. The anhydrous acid is used mainly in the production of the organic 'Freons' used as refrigerants and as propellants for the aerosol fumigators, and in the production of 100-octane gasoline. Smaller amounts are used to prepare elemental fluorine, and numerous fluorine compounds.

In the United States it is possible that more fluorspar will be employed eventually in making hydrofluoric acid than is normally used in the manufacture of steel. The synthetic organic chemical industry in particular, with its diversity of compounds and extensive applications, offers unlimited opportunities for the development of organic fluorine compounds. A thermally stable fluorine compound, uranium hexafluoride, requiring elemental fluorine in its synthesis, is used for the gaseous diffusion separation of uranium isotopes U_{235} and U_{238}.

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.

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

Acid-grade spar has the most rigid specifications, namely a minimum of 98 per cent CaF_2 and not over 1 per cent SiO_2. Like the ceramic grade, it is used mainly in powder form.

Prices

Prices received for fluorspar vary widely, and the following quotations can serve only as a general guide to prices obtained by producers and dealers in Canada for their own product. The value of the various grades of fluorspar can be ascertained only by direct negotiations between buyers and sellers.

Canadian Chemistry and Process Industries quotations for metallurgical gravel, 85 per cent grade fluorspar in 1949 remained at $40 per ton, carlots, f.o.b. Toronto, and for acid ground, 97 per cent grade, in bags, $66 to $69. Quotations on ceramic ground, 95 per cent grade, in bags, opened in May 1949, at $3.63 to $3.83 per 100 pounds, and increased to $4.05 to $4.20 by the end of 1949.

In the United States, Engineering and Mining Journal quotations indicated that prices for metallurgical grade remained unchanged during 1949. Based on effective units of CaF_2, and f.o.b. Kentucky-Illinois mines, prices were as follows: 70 per cent and over, $37 per ton; 65 to 70 per cent, $36; 60 to 65 per cent, $35; under 60 per cent, $34; and pellets under 60 per cent, $30. "Effective units" are computed as the actual CaF_2 content less $2\frac{1}{2}$ times the percentage of contained silica. Acid grade fluorspar, 97 per cent CaF_2, bulk, dropped from $45 to $43.50 in the latter part of 1949. Foreign fluorspar, metallurgical grade, duty paid, was quoted at $39 to $40 per net ton, Atlantic seaboard.

Tariffs

The duty on fluorspar entering the United States is $3.75 per short ton if it contains more than 97 per cent CaF_2 and $5.625 per short ton if it contains 97 per cent or less. Fluorspar enters Canada duty free.

GRANITE

Production of granite in 1949 showed a substantial increase both in tonnage and value compared with that of 1948. About 95 per cent of the tonnage produced is used as rubble and riprap, roofing granules, concrete aggregate, road metal, etc., but the value of such material is very small. However, several large commercial buildings were erected with part granite facing and this, coupled with a continued high demand for monumental stone, was mainly responsible for the increase in the value of the production.

The term "granite" as applied to commercial stone includes practically all igneous rocks, as well as metamorphic rocks of igneous origin, that may be quarried for use as building, monumental, or crushed stone. A large part of Canada is underlain by such rocks, but, to be economically productive, granite must have certain qualities such as strength, uniformity, colour, etc., and the deposits must be near transportation facilities and markets.

Quebec, the leading Canadian producer of granite, has a flourishing industry because it has large areas of granite rocks close to populated centres and to transportation. Ontario, British Columbia, Nova Scotia, New Brunswick, and Manitoba produce small amounts of building and monumental stone. Newfoundland has large areas underlain by igneous rocks, and as the province is well servised by sea transport, the active development of some of these areas could result in the building up of an export market. Alberta and Saskatchewan have no deposits near populated areas or transportation facilities.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production of monumental and building granite				
Dressed	21,801	1,764,721	17,273	1,921,481
Rough	20,388	326,231	17,619	282,557
	42,189	2,090,952	34,892	2,204,038
Production of rubble and riprap, roofing granules, concrete aggregate, road metal, etc.	2,280,028	3,063,786	1,008,036	1,575,398
Total	2,322,217	5,154,738	1,042,928	3,779,436
Exports of granite and marble (unwrought)				
To: United States	5,568	125,144	5,123	99,242
Jamaica	.....	.....	1	192
Total	5,568	125,144	5,124	99,434
Imports of granite				
From: Sweden (mostly rough)	.....	87,107	.....	94,138
United States (about one-half rough)	.....	110,141	.....	99,362
Finland (all rough)	.....	32,783	.....	24,674
Other countries	.....	1,649	.....	2,121
Total	.....	231,680	.....	220,295

In Quebec, grey granite is the principal rock quarried and comes from many districts, including Rivière-à-Pierre, St. Samuel, St. Sebastien, St. Gerard, Stanhope, Scotstown, and Stanstead. Black granite is produced at St. Joseph d'Alma in the Lake St. John district and in the Noranda area; dark bluish grey granite in the Mount Johnson area about 40 miles east of Montreal; and red granites in the Grenville, Guenette, and Lake St. John districts.

In Nova Scotia, grey granite is produced in the Nictaux and Shelburne areas, and black granite in the Shelburne area.

New Brunswick has deposits of red, black, and grey granites of good quality. Red granite is produced in the St. George and Bathurst districts; and grey and bluish grey granite in the Hampstead area.

In Ontario, some development work has been done on the black granite at River Valley and there are occurrences of black and red granite in northwestern Ontario from which some red was produced during 1949.

Manitoba produces small amounts of red, grey, and black granite from quarries near the Manitoba-Ontario boundary for the Winnipeg market.

British Columbia has widespread occurrences of granite in varied colour, one of the best known building stones being the andesite from Haddington Island. Grey granite was obtained from Nelson Island.

Uses

Granite is usually quarried in Canada for use as building or monumental stone and, in both cases, there is a large amount of waste in the quarries. Some of the large irregular blocks are used as riprap to strengthen breakwaters and causeways against heavy washes or currents, whereas some of the smaller pieces are crushed for concrete aggregate or are used as poultry grit, paving blocks, or curbstones. However, these uses for granite waste are extremely limited compared to the amount of granite produced. Granite as a building stone is used chiefly for ornamental purposes forming the outside facing of the lower portion of many buildings.

Some of the granite produced in Canada has good export possibilities, especially the red and black varieties which are much in demand as a monumental stone in United States.

GRAPHITE

Production of graphite in Canada continued to come from the sole Canadian producer, Black Donald Graphite Company, Limited, subsidiary of Frobisher Limited, which operates the Black Donald mine near Calabogie, Renfrew county, Ontario. Shipments of finished products in 1949 (1948 figures in brackets) of which 82 per cent was exported to United States, consisted of 1,623 (2,035) short tons of amorphous foundry grade; 188 (124) short tons of dust grades; and 336 (380) short tons of high-grade lubricating and pencil flake.

Total unmanufactured imports, mostly amorphous grades from Mexico, increased slightly in value, and imports of ground and manufactured graphite decreased 12 per cent in value compared with 1948. Canada's entire requirements of crucibles are imported.

With the flooding of the area about the Black Donald mine which will follow completion of power developments on the Madawaska River, Canada faces the prospect of having no production of natural graphite. However, artificial graphite made from anthracite or petroleum coke, and which is employed as an alternative to natural amorphous in many applications, is produced by Electro-Metallurgical Company of Canada, Limited, Welland, Ontario.

Production in Canada, mostly of small flake and amorphous, has come in the past from widely scattered deposits in the crystalline limestones and gneisses of

the general Ottawa region in adjacent sections of eastern Ontario and western Quebec. Other deposits are known to occur in New Brunswick, British Columbia, Manitoba, Labrador, and the Northwest Territories.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Shipments, by types				
Amorphous foundry grades	1,623	130,913	2,035	165,059
Dust grades	188	23,186	124	15,722
High-grade lubricating and pencil flake	336	58,397	380	59,150
Total	2,147	212,496	2,539	239,931
	Per cent		Per cent	
Shipments, by destination				
United States	82·3	.....	77·0	.....
Europe	1·1	.....	1·0	.....
Domestic market	16·6	.....	22·0	.....
Imports, unmanufactured				
From: Mexico	.....	55,099	.....	45,063
United States[1]	.....	19,931	.....	25,714
Ceylon	.....	8,271	.....	11,122
Total	.....	83,301	.....	81,899
Imports, ground and manufactured[2]				
From: United States	.....	286,536	.....	321,958
United Kingdom	.....	825	.....	4,552
Mexico	.....	5,906	.....	7,169
Total	.....	293,267	.....	333,679
Imports of crucibles				
From: United Kingdom	.....	67,859	.....	59,265
United States	.....	60,200	.....	57,517
France	.....	637	.....	217
Total	.....	128,696	.....	116,999

[1] Mainly re-exported foreign graphite.
[2] Excluding crucibles.

Principal world sources of graphite are Madagascar (large flake), Ceylon (plumbago or crystalline varieties), and Mexico (amorphous).

Uses

The iron and steel industry accounts for approximately 80 per cent of the consumption of graphite for use as crucibles and other refractories and for foundry facings. Other consumers include manufacturers of heavy chemicals, electrical apparatus, paints, and polishes.

For crucible manufacture only the highest quality plumbago and flake is acceptable. For lubricants small flake is preferable, but natural amorphous of good quality and artificial graphite are also used. Lower grade amorphous and dust is used for foundry facings and core washes. Lower grade graphite of all varieties is used in paints, and high-grade amorphous graphite is required for 'lead' pencils and dry batteries.

Graphite is used in the preparation of colloidal graphite, as a structural material in the form of carbon-graphite parts used extensively for bearings, bushings, etc.; and for the impregnation of wearing-metal surfaces.

Artificial graphite is used principally in making heavy electrodes, and for dry batteries, lubricants, commutator brushes, and colloidal graphite.

Prices and Tariffs

Final 1949 quotations, as published in the Engineering and Mining Journal Metal and Mineral Markets, were: Madagascar, c.i.f. New York, "Standard grades 85-87 per cent C", $210 per ton; special mesh, $265 to $300; special grade 99 per cent C, $700. Sales of the better grades of graphite are usually made against the exacting requirements of consumers; published quotations are largely nominal. Amorphous graphite, Mexican f.o.b. point of shipment, per metric ton, $9 to $16, depending upon grade.

Canadian quotations as published by Canadian Chemistry and Process Industries at the end of 1949 were: graphite, various grades, 6 to 60 cents per pound; plumbago (s.t. extra), 5½ to 10½ cents per pound.

The average price received by Canadian exporters of natural graphite in 1949 was 4½ cents per pound f.o.b. shipping point.

The Canadian tariff is as follows:

	British Per cent	*Intermediate* Per cent	*General* Per cent
Graphite not ground or otherwise manufactured	Free	7½	10
Ground and manufactures of, including foundry facings but not crucibles	15	22½	25
Crucibles	Free	15	15

GYPSUM AND ANHYDRITE

Output of gypsum was slightly lower in 1949 than in 1948, the record year, due to a decline in exports from Nova Scotia.

Canada has good gypsum deposits in all provinces except Saskatchewan and Prince Edward Island; but production is confined to five provinces. Over 80 per cent of the Canadian output of crude gypsum comes from Nova Scotia.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production				
Nova Scotia	2,555,795	2,766,005	2,795,848	3,028,646
New Brunswick	80,436	371,529	61,534	338,405
Ontario	203,187	871,467	182,303	770,004
Manitoba	94,918	797,723	94,698	836,483
British Columbia	79,913	616,966	82,426	574,707
Total	3,014,249	5,423,690	3,216,809	5,548,245
Exports of crude and ground gypsum and plaster of Paris and wall plaster				
To: United States	2,544,708	2,640,071	2,589,602	2,677,672
Newfoundland	.....	.....	31,581	38,674
Puerto Rico	.....	.....	7,382	12,918
Other countries	47	1,104	242	9,199
Total	2,544,755	2,641,175	2,628,807	2,738,463
Imports of gypsum, plaster of Paris, and wall plaster				
From: United States	9,143	201,500	10,831	217,415
United Kingdom	154	5,119	153	5,968
Total	9,297	206,619	10,984	223,383

Newfoundland

There are good gypsum deposits at various points on the west coast of the Island but no development of these has been undertaken.

Nova Scotia

Although deposits of gypsum occur in many parts of the province, production is limited to Hants county on the mainland and to Victoria county, Cape Breton Island. Most of the output is exported to United States for processing but some of this is done in Nova Scotia and Quebec.

Canadian Gypsum Company, Limited, a subsidiary of United States Gypsum Company, at Wentworth, Hants county, is the largest Canadian operator. The rock from the company's large quarries is taken by rail 15 miles to Hantsport, from where it is shipped in company freighters to various United States Gypsum Company plants on the Atlantic seaboard. Other operations in Hants county include quarrying at Walton and Cheverie for export to United States, and near Windsor for use in the mill of Windsor Plaster Company, Limited, the only plaster mill in the province.

In Victoria county, National Gypsum Company (Canada), Limited and Victoria Gypsum Company, Limited operate quarries at Dingwall and at Little Narrows respectively. The former company exports rock to its own plants in eastern United States, and the latter supplies private buyers in Canada, United States, West Indies, and South America.

New Brunswick

Canadian Gypsum Company produces all grades of plaster and wallboard for the markets of eastern Canada, also high-grade plasters that are used extensively throughout Canada. In both cases the rock is quarried near the company's plant at Hillsborough.

Quebec

Gypsum Lime and Alabastine, Canada, Limited produces all grades of plaster and wall board at its Montreal East plant from rock obtained at Dingwall, Nova Scotia.

Ontario

Gypsum Lime and Alabastine, Canada, Limited, at Caledonia, and Canadian Gypsum, at Hagersville, manufacture a wide variety of gypsum plasters and wallboards from gypsum rock obtained by underground mining methods from gypsum beds underlying the respective plants.

Manitoba

Gypsum Lime and Alabastine, Canada, Limited and Western Gypsum Products, Limited produce gypsum plasters and wallboard at Winnipeg. The former company obtains gypsum rock from its own quarry at Gypsumville and the latter from a mine at Amaranth, both in Manitoba.

Alberta

No gypsum rock is produced. Gypsum Lime and Alabastine, Canada, Limited and Western Gypsum Products operate plants in Calgary, the former producing gypsum plasters from gypsum rock obtained from its Falkland quarry in British Columbia, and the latter, gypsum plaster, wallboard, and gypsum tile from gypsum rock from the Amaranth mine, Manitoba.

British Columbia

Gypsum Lime and Alabastine, Canada, Limited produces gypsum plasters and wallboard at its New Westminster plant from gypsum rock from its Falkland quarry. Columbia Gypsum Products, Incorporated continued to develop the gypsum deposits in the Windermere and Canal Flat areas.

Uses

Gypsum. Gypsum is the principal component of plasters and wallboards. When heated at a low temperature, gypsum gives off three-quarters of its water of crystallization. The resulting product, known as plaster of Paris, will quickly set to a hard porous mass when water is added. Plaster of Paris as such has only limited uses as in moulding work where quick setting is required, or in ceramic work where its porous properties are essential. To make plasters and wallboards, certain materials are added to the plaster of Paris as retarders and fillers. This gives the final products a longer period of set and greater strength than the original plaster of Paris. Special products are made also from calcined gypsum, such as acoustic boards, partition tile, fire-resisting walls, insulating tile, etc. Gypsum is added in small quantities to Portland cement, where it acts as a retarder in the time of set of the cement.

Gypsum in the ground form was formerly used in large quantities as a fertilizer on many types of soil. This use, however, now appears to be limited mainly to black alkali soils.

Anhydrite. Compared with gypsum, anhydrite has few uses. Production is usually limited to quarries where the removal of anhydrite beds is essential to the continued production of gypsum. The material is used as a soil conditioner on peanut crops in the United States.

Prices

The nominal price of crude gypsum in 1949, as quoted by Canadian Chemical and Process Industries, was $3 to $3.50 per ton f.o.b. quarry or mine. However, large contracts with seaboard quarries were at prices much below these figures.

IRON OXIDES (OCHRES)

Canadian production of iron oxides (ochres), which has ranged from a peak of 19,128 tons in 1920 to a low of 4,357 in 1933, in 1949 totalled 13,625 tons. Production comes mainly from the Trois-Rivières area of Quebec and is comprised chiefly of ochreous iron oxide sold uncalcined for use in the purification of illuminating gas. Small amounts are exported. A minor output of crude iron oxide is derived from deposits in British Columbia.

Sherwin-Williams Company of Canada, Limited, the only Canadian producer of calcined iron oxides, operates deposits and a plant at Red Mill, a few miles east of Trois-Rivières, Quebec.

The several other known deposits of ochre in Canada remained undeveloped.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production (sales)				
Quebec	10,873	184,586	12,095	193,619
British Columbia	2,752	23,301	1,086	9,772
Total	13,625	207,887	13,181	203,391
Imports (ochres, siennas, umbers)				
From: United States	1,505	79,000	1,423	67,905
United Kingdom	75	6,171	39	3,367
Total	1,580	85,171	1,462	71,272

Production and Trade—concluded

	1949		1948	
	Short tons	$	Short tons	$
Exports				
To: United States	2,559	185,289	4,466	182,321
Italy	237	39,629	56	9,985
Netherlands	179	27,769	142	21,851
Brazil	103	21,750	95	15,683
Other countries	310	49,765	491	82,745
Total	3,388	324,202	5,250	312,585

Quebec

Output in 1949 consisted of 9,236 tons of crude oxide valued at $40,520, and 1,637 tons of calcined oxide valued at $144,066.

Shipments of crude iron oxide were made by four operators from deposits at Marchand, Pointe-du-Lac, and Les Vieilles Forges, St. Maurice county; at St. Raymond, Portneuf county; and at St. Louis de France, and Almaville, Champlain county.

Sherwin-Williams produced calcined, milled, and air-floated products for use in mineral pigments and polishing rouge, at its plant at Red Mill, Champlain county.

Manitoba

The large deposits near Grand Rapids and Cedar Lake remained undeveloped owing to a lack of markets.

Saskatchewan

The principal deposit of possible economic interest is at Loon Lake, 32 miles from St. Walburg on the Canadian National railway, and 77 miles northwest of North Battleford.

British Columbia

A small production of iron oxide comes from the Morning Star mine of British Columbia Electric Company at Alta Lake, New Westminster district.

Uses

Canadian consumption of iron oxide by the illuminating gas industry in 1948 was 8,853 tons valued at $72,622. The paint industry consumed 2,210 tons of calcined iron oxide valued at $301,183 and 308 tons of ochres, siennas, and umbers valued at $47,781.

Iron oxide pigments are used also as colouring agents and fillers in making imitation leather, shade cloth, shingle stain, paper and cardboard. Siennas and umbers are used in wood stains and wood fillers. The natural ochre is used as a pigment for linoleum and oilcloth, in wood stains and wood fillers, and in colouring cement, stuccos, and mortar.

Prices

The Canadian price of red iron oxide, f.o.b. Toronto or Montreal, as given by Canadian Chemistry and Process Industries, varied from 2 to 11 cents a pound throughout 1949, while yellow, brown, and black iron oxides remained between 5 and 12 cents a pound.

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LIME

Production of lime in Canada in 1949 continued at a high level amounting to 1,018,823 tons valued at $11,309,820. The continued strong demand came from the chemical, metallurgical, and construction industries. Ontario accounted for 52 per cent of the total output and Quebec for 32 per cent. British Columbia, Manitoba, Alberta, New Brunswick, and Newfoundland produced the remainder.

There are in Canada approximately 45 plants burning lime in 150 kilns varying in size from the small pot-type to the large rotary kiln. In 1949 some plants produced solely to meet their own requirements.

Trade is confined almost entirely to shipments of lime across the International Boundary in local areas where economic factors favour export or import of relatively small quantities.

Production, Trade, and Consumption

	1949		1948	
	Short tons	$	Short tons	$
Production				
Quicklime	798,187	8,971,040	850,043	8,709,834
Hydrated lime	220,636	2,338,780	203,541	1,945,228
Total	1,018,823	11,309,820	1,053,584	10,655,062
Imports (quicklime)				
From: United States	16,408	173,350	23,878	219,485
United Kingdom	91	3,094	.....	.....
Total	16,499	176,444	23,878	219,485
Exports				
To: United States	30,132	497,308	31,741	460,352
Other countries	56	1,349	613	10,757
Total	30,188	498,657	32,354	471,109
*Consumption, showing purpose for which *used or sold*				
Pulp and paper mills	202,614	2,439,950	230,717	2,577,266
Metallurgical	139,234	1,068,074	143,709	964,308
Building trades	174,075	2,630,405	141,388	1,916,400
Sugar refineries	16,847	155,371	19,317	144,977
Glass works	13,940	141,449	14,451	138,023
Agriculture	15,274	202,053	12,249	124,136
Sand-lime brick	10,269	102,514	9,634	85,296
Other industrial uses	439,919	4,530,743	464,010	4,474,234
Various non-industrial uses	6,651	39,261	18,109	230,422
Total	1,018,823	11,309,820	1,053,584	10,655,062

* About 45 per cent of the total is consumed by producers themselves.

With the exception of Prince Edward Island, deposits of limestone suitable for the production of lime occur in every province including Newfoundland. However, the concentration of industry in Ontario and Quebec has resulted in the development of important centres of lime production in these two provinces. This concentration of demand has encouraged development of larger and more efficient kilns with relatively lower production costs.

High-calcium lime is produced in British Columbia, Alberta, Quebec, and Newfoundland; both dolomitic and calcium limes are available in Ontario, Manitoba, and New Brunswick.

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

Quicklime is marketed as lump, pebble, crushed, or pulverized lime. The lump and pebble types are sold either in bulk or in multi-wall paper bags.

Hydrated lime, a specially-prepared dry slaked lime, is marketed as a powder in 50-pound multi-wall paper bags. It is usually of a fineness exceeding 95 per cent minus 325-mesh.

Uses and Prices

Lime has become one of the great basic raw materials of the modern chemical and metallurgical industries. Approximately 84 per cent of all lime, both quick and hydrated, made in Canada is used to meet the requirements of these and other manufacturing industries.

Large quantities of both quick and hydrated lime are also used by the building trades, in agriculture, and in the pulp and paper industry, which in 1948 consumed 22 per cent of all lime produced in Canada.

In agriculture, the hydrate is used not only as a soil sweetener but also as an important ingredient in spray mixtures, and in dusting compounds.

Prices of lime products vary widely and are dependent on the geographical location of the plants and variations in the quality of lime. The average price in 1949 of quicklime f.o.b. plants but exclusive of containers was $11.20 per ton.

LIMESTONE (GENERAL)

Quarry production in Canada in 1949 exclusive of stone for the cement and lime industries amounted to 10,951,312 tons valued at $13,876,845, as compared with 10,003,142 tons valued at $12,523,275 in 1948. The over-all production in 1949 amounted to 16,674,227 tons.

Limestone is widely distributed in Canada with deposits occurring in all provinces except Prince Edward Island, but including Newfoundland. Limestone accounts for 90 per cent of all stone quarried in Canada.

Occurrences in Canada are largely in extensive bedded formations that yield most of the Canadian output. However, there are many occurrences of non-bedded, highly metamorphosed deposits. In composition the limestones range from high-calcium through magnesian limestones to dolomite, with occurrences of both the argillaceous and siliceous varieties. There are also deposits of brucitic limestone and magnesitic dolomites.

It has become apparent with Canada's increased industrial activity that, in spite of the wide distribution of deposits, there is a growing scarcity of high quality, high-calcium limestone suitable for chemical and metallurgical use, and economically accessible to industrial areas. It may, therefore, be necessary to resort to underground mining or beneficiation of lower grade deposits to obtain future supplies. Impure stone is beneficiated by flotation at certain Portland cement plants in other countries.

There is little trade in limestone between Canada and other countries as the material is a low-cost commodity widely distributed. In certain consuming centres, however, it is imported for use as blast-furnace flux, road metal, and for pulp manufacture. A small quantity is exported to the United States for use in sugar refineries, for flux, and wood pulp processing, and for agricultural purposes. Trade figures for limestone are not recorded separately.

Uses

To meet the various industrial requirements limestone is marketed in many forms, ranging from dimensional blocks for constructional use to finely pulverized material for use as a mineral filler. For most uses, such as railway ballast, road metal, concrete aggregate, and as a flux in metallurgical plants, it is processed by crushing and screening, but for certain uses such as for the pulp industry it is used in lump form. Considerable stone is used in the manufacture of Portland cement, and of lime, and by the chemical industry which requires high-calcium stone.

Argillaceous dolomite is used in making rock wool. Output from the thirteen mineral wool plants engaged in the production of glass wool in 1949 was valued at $9,013,000.

Magnesium metal was extracted from dolomite both in Canada and elsewhere during the recent war. Magnesia and magnesium carbonate are prepared from calcined dolomite by the Pattinson Process.

Dead-burned dolomite for use by the steel industry as a refractory in basic open-hearth furnaces is produced in a plant at Dundas, Ontario.

Magnesitic dolomite is processed into basic refractories at Kilmar, Quebec. At Wakefield, Quebec, a brucitic limestone is processed for the recovery of magnesia, hydrated lime, and fertilizer material. The magnesia from this plant is used in basic refractories, and has been used as a source of magnesium metal.

The necessity of adding lime either as limestone or as hydrated lime to overcome soil deficiency and to neutralize acidity has long been recognized. Consumption in Canada for this use, however, remains relatively small. Addition to soil per acre of cultivated land in Canada in 1947 (the most recent statistics available) amounted to only 7·6 pounds of CaO.

LIMESTONE (STRUCTURAL)

Production of limestone in Canada for use as dimension stone in 1949 was 56,871 tons valued at $1,412,851, a slight increase in both quantity and value compared with 1948. Dimension limestone production continued to be confined to Manitoba, Ontario, and Quebec. Output in 1949 increased in Manitoba and Quebec, but decreased in Ontario.

Most stone is marketed as sawn slabs or mill blocks for cutting either at the dressing works of producers or at those of cut-stone contractors, to the accurately dimensioned pieces used in the larger types of buildings. To be acceptable for this purpose stone must be heavily bedded, free from cracks and other defects, and easily worked. As occurrences of this type are not plentiful in Canada in the desired textures, imports from the United States are consequently large. Imports from the United Kingdom increased during 1949.

Several small quarries, especially in Quebec, continued to supply hand-trimmed stone for use as sills, lintels, and for facing to meet the high demand resulting from the intensive building program.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production of limestone for building purposes				
Quebec	24,645	971,451	23,279	949,362
Ontario	22,861	281,580	29,261	285,318
Manitoba	9,365	159,820	1,800	100,000
Total	56,871	1,412,851	54,340	1,334,680
Imports of building stone (except marble and granite)				
From: United States	15,085	213,475	34,388	370,085
United Kingdom	1,739	30,209	662	11,498
Other countries	37	1,283	240	5,696
Total	16,861	244,967	35,290	387,279
Exports of building stone unwrought (except marble and granite)				
To: United States	130	3,713	49	1,078
Other countries	.....	.....	1	90
Total	130	3,713	50	1,168

[1] The value of production refers only to stone marketed as mill blocks or in finished condition by the quarry and does not include the value of work done on the stone by cut-stone contractors.

In Quebec, the major producing areas are at St. Marc des Carrieres, Portneuf county, and in the vicinity of Montreal. Both supply a grey stone.

In Ontario, heavily bedded deposits of silver grey limestone are quarried at Queenston, mainly, and at Thorold in the Niagara district. Variegated buff and grey stone are also obtained from these deposits. The quarries at Langford Mills, Rama township, north of Orillia, which formerly yielded buff, silver-grey, and brown limestone for building purposes, remained inactive.

Hand-trimmed stone for local demand is quarried intermittently at a number of small quarries in Ontario and Quebec.

Limestone suitable both for building exteriors and interiors is obtained from quarries near Tyndall in Manitoba where characteristic grey, mottled buff, and variegated stone is produced.

Prices

Mill blocks vary in price with quarry location, size of block, and grade of stone, and range upwards from approximately $1 a cubic foot at quarry.

MAGNESITE AND BRUCITE

The value of brucite granules and dead-burned magnesitic dolomite in 1949 amounted to $1,536,200, compared with $1,724,489 in 1948. Most of this material is used for refractories.

Magnesitic dolomite, or dolomitic magnesite as it is now called, is a rock composed of intimately intermixed magnesite and dolomite. It occurs in Canada only in Argenteuil county, Quebec, where, at Kilmar, it is mined by Canadian

Refractories, Limited and converted into refractory products. Rock from the stopes is crushed and then passed through a heavy-media separation plant to remove waste material before it is ground and dead-burned in a rotary kiln.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production; Magnesitic dolomite brucite	.....	1,536,200	.....	1,724,489
Imports				
Dead-burned and caustic-calcined magnesite				
From: United States	3,603	250,272	7,018	485,215
United Kingdom	1,038	127,025	518	67,316
Other countries	42	5,262	177	19,543
Total	4,683	382,559	7,713	572,074
Magnesite fire brick				
From: United States	.....	486,671	.....	430,768
Other countries	.....	.....	.....	653
Total	.....	486,671	.....	431,421
Magnesia alba and levis				
From: United States	365	78,927	433	92,574
United Kingdom	64	21,204	60	29,488
Total	429	100,131	493	122,062
Magnesia pipe covering				
From: United States	.....	76,505	.....	128,081
United Kingdom	.....	88,247	.....	257,271
Total	.....	164,752	.....	385,352
Magnesium carbonate				
From: United States	113	13,471	163	22,251
United Kingdom	874	112,935	532	69,038
France	1	802	.....	.....
Total	988	127,208	695	91,289
Magnesium sulphate				
From: United States	2,196	99,649	2,742	114,501
Germany	427	11,232	.....	.....
United Kingdom	160	10,000	55	4,291
Total	2,783	120,881	2,797	118,792
Exports				
Basic refractories, dead-burned				
To: United States	1,618	63,701	2,383	95,616
Brazil	401	21,775	1,480	84,993
Argentina	.....	.....	220	8,028
Other countries	18	2,383	274	15,034
Total	2,037	87,859	4,357	203,671

Brucitic limestone, a rock composed of granules of brucite (magnesium hydroxide) thickly distributed throughout a matrix of calcite, is quarried near Wakefield, Quebec, by Aluminum Company of Canada, Limited, and is processed

for the recovery of magnesia and lime. Most of the output of magnesia is sold in granular form for use in making basic refractories, for fertilizer, and for general chemical purposes. Hydrated lime produced during the process of recovering the magnesia is marketed chiefly for use in the construction industry and for agricultural and chemical purposes.

Brucitic limestone occurs in a number of large deposits in the Wakefield and Bryson areas, Quebec; at Rutherglen, Ontario; and on West Redonda Island, British Columbia. Small deposits occur at a number of other places in Ontario and Quebec.

Magnesite occurs in British Columbia and in Yukon. The most important of these deposits, at Marysville, British Columbia, near Cranbrook, is owned by The Consolidated Mining and Smelting Company of Canada, Limited, but there has been no production. The magnesite contains considerable silica and alumina, most of which can be removed by a flotation process devised by the company. Other known deposits of magnesite in British Columbia and Yukon are either too small or too far from transportation to be of economic interest at present.

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

Uses

Magnesitic dolomite is used to make basic refractories. These include dead-burned grain material, bricks and shapes, and finely ground refractory cements.

Brucitic limestone yields magnesia for making both burned and chemically bonded basic refractory bricks, and shapes; for use in fertilizers; for magnesium oxysulphate products; and for a number of other uses. It has been used for making magnesium metal, for magnesium bisulphite liquor needed in producing special grades of paper, and on an experimental scale for making magnesium oxychloride cement.

MARBLE

Production of marble in Canada in 1949 amounted to 52,152 tons valued at $446,905, compared with 68,347 tons valued at $528,529 in 1948. This decline in production was due to a decrease in the Ontario output.

Production and Trade

Although mill blocks for sawing into ornamental slabs are quarried in Canada, production consisted chiefly of either crushed or ground marble marketed as terrazzo chips, poultry grit, whiting substitute, stucco dash, marble flour, and as aggregate for the manufacture of artificial stone. Ontario accounted for approximately 73 per cent of the total output in 1948, the remainder coming from Quebec with the exception of a small tonnage from British Columbia.

Province	1949		1948	
	Tons	$	Tons	$
Quebec	18,721	267,272	18,075	259,720
Ontario	33,131	174,083	49,847	260,809
British Columbia	300	5,550	425	8,000
Total	52,152	446,905	68,347	528,529

Most of the marble imported into Canada is in the form of mill blocks or slabs. These are dressed by domestic marble works to meet consumers' specifications. Imports of marble increased 14 per cent in 1949 compared with 1948 due almost entirely to a higher demand for ornamental marble for churches and for sawn slabs from European countries. There was a small export of terrazzo chips to the United States.

Imports of Marble, 1949

By Countries of Origin

Type of Marble	United States	Belgium	Italy	France	Other countries	Total
	$	$	$	$	$	$
Rough	24,880	3,308	37,748	1,213	2,661	69,810
Sawn	30,259	2,091	52,178	.....	.....	84,528
Tombstones	64,341	.....	2,506	.....	.....	66,847
Manufactured	12,576	3,716	11,343	.....	527	28,162
Ornamental for churches	778	4,960	39,090	20,793	.....	65,621
Total	132,834	14,075	142,865	22,006	3,188	314,968
Mosaic flooring materials[1]	162,767	28,973	8,978	14,002	56,643	271,363

[1]Consist largely of marble.

Imports during 1948 including mosaic flooring materials valued at $276,893 amounted to $472,221.

Operations

Quebec

Missisquoi Stone and Marble Company, Limited operates the largest marble quarry in Canada at Phillipsburg, near the foot of Lake Champlain, and produces a clouded grey marble.

Orford Marble Company, Limited produces terrazzo chips from quarries near North Stukely in Shefford county. In 1949 there was a small production of mill blocks which were shipped to dressing plants. The deposit is of the serpentine variety in red, green, and grey.

Canadian Dolomite Company, Limited, at Portage du Fort, Pontiac county, quarries a white dolomite that is crushed for terrazzo chips, stucco dash, aggregate in artificial stone, and various other products.

The building stone quarries at St. Marc des Carrieres, Portneuf county, produce a brown marble from the Trenton limestone to supply an intermittent demand. The marble is dressed for store counters and wainscoting.

Ontario

Silvertone Black Marble Quarries, Limited quarries black marble at St. Albert, 30 miles southeast of Ottawa, for terrazzo chips, and as mill blocks.

Stocklosar Marble Quarries produces red, pink, buff, green, black, and white terrazzo chips from deposits near Madoc.

Verona Rock Products, Limited, Verona, about 20 miles northwest of Kingston, produces poultry grit, and stucco dash from white limestone.

Bolenders, Limited produces poultry grit, stucco dash, and plaster aggregate from a deposit 8 miles north of Haliburton at Eagle Lake.

Manitoba

There are a number of undeveloped occurrences of highly coloured marbles along the Hudson Bay and the Flin Flon branches of the Canadian National Railway, and at Fisher Branch, about 100 miles north of Winnipeg.

British Columbia

Production is limited to a small tonnage of white marble by Marble and Associated Products from a quarry near Victoria. It is used mainly for stucco dash, and in ground form as whiting substitute in making putty.

There are several undeveloped deposits in the province.

Price

The price of marble varies widely according to quality and to variety of colour.

MICA

Production of mica of all classes in Canada in 1949 declined 56 per cent in volume below the 1948 output. Approximately 82 per cent was phlogopite and the remainder, muscovite. Production came from Ontario, Quebec, and British Columbia.

Exports of all classes decreased 58 per cent in value, whereas imports increased 39 per cent compared with 1948.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production (primary sales)				
Trimmed	47,882	31,731	75,024	17,210
Splittings	8,550	7,470	17,514	14,028
Sold for mechanical splitting	8,019	1,762	317,005	67,635
Rough, mine-run or rifted	10,091	1,214	21,918	2,693
Unclassified	43,069	3,172	.....	.....
Ground or powdered	1,854,844	49,907	3,748,268	84,224
Scrap	1,518,101	13,302	3,722,574	34,158
Total	3,490,556	108,458	7,902,303	219,948
Imports (including manufactures)				
From: United States	.....	351,872	.....	241,850
India	.....	182,830	.....	148,230
Other countries	.....	32,767	.....	17,122
Total	.....	567,469	.....	407,202
Exports (all to United States)				
Trimmed	97,900	26,571	8,400	3,835
Splittings	.....	.....	11,300	8,272
Rough	78,000	12,983	354,300	75,205
Ground	460,000	17,086	2,122,000	45,185
Scrap	678,300	3,526	1,998,000	16,002
Exports (mica manufactures)				
To: United States	.....	1,747	.....	220
Brazil	.....	1,271	.....	1,461
Other countries	.....	408	.....	181
Total	.....	63,592	.....	150,361
Consumption				
Electric apparatus	.....	.....	402,877	547,942
Mica manufactures	.....	.....	100,007	88,630
Roofing	.....	.....	1,742,000	34,395
Wallpaper	.....	.....	230,000	18,707
Paints	.....	.....	582,417	35,716
Rubber	.....	.....	435,308	31,003

Quebec

Quebec produced 21 per cent of the trimmed mica; all of the small sheet for mechanical splittings; 6 per cent of the scrap; 29 per cent of the ground mica; the total output of 8,550 pounds of splittings; and 43,069 pounds of unclassified material.

Blackburn Brothers, Ottawa, turned waste dumps at the Nellis mine near Cantley and in addition, produced ground mica at their mill at Cantley, Hull township. Other producers included E. Wallingford at Perkins, and J. R. Gauthier at Buckingham.

The large deposit of suzorite in Suzor township, Laviolette county, owned by Suzorite Company, Limited, Cornwall, Ontario, was not operated in 1949.

Ontario

Ontario produced 79 per cent of the trimmed mica including a high proportion of dark phlogopite or lepidomelane; 59 per cent of the scrap; and 45 per cent of the ground mica.

Ontario Mica Mines Limited produced most of the phlogopite sheet from the old Orser mine near Godfrey in Frontenac county. This company and the Loughborough Mining Company which turned old waste dumps at the Lacey mine, near Sydenham, produced most of the scrap. Bancroft Mica and Stone Products Mining Syndicate, Limited, at Selby, produced large amounts of dark phlogopite or lepidomelane. Muscovite, both sheet and scrap, was produced by North Bay Mica Company, Limited, North Bay, which operated the Purdy mine at Eau Clair near Mattawa, famous during World War II for its production of sheet of exceptional size.

Suzorite Company, Limited produced ground mica at its plant at Cornwall, Ontario.

British Columbia

Of the total Canadian output, British Columbia furnished 35 per cent of the scrap and 26 per cent of the ground mica.

Production is confined to the Albreda district where fine flake for grinding purposes is recovered from schist rock.

Ground mica is produced by Fairey and Company, Vancouver, and by George W. Richmond of Vancouver.

Uses

Mica is used in three principal forms namely: natural sheet, used mainly for electrical insulation; splittings, used in making built-up sheet; and ground mica, used mainly in the roofing, paint, and rubber trades. Vermiculite, which is not known to occur commercially in Canada, and which expands many times on heating, is used mainly for heat-insulating materials.

The quality of sheet mica depends upon its colour, splitting qualities, and freedom from cracks, blow holes, gas bubbles, ripples, rulings, mineral inclusions, hardness, and other physical characteristics. In general the lighter coloured phlogopite and clear muscovite are found to have the highest electrical qualities and therefore bring the highest prices.

Splittings, comprising films as thin as one-thousandth of an inch or less, are used in various pressed and moulded forms including sheet, cloth (mica with cloth backing), paper, tape or binding insulation, tubes, washers, and many other shapes. They are manufactured from both muscovite and phlogopite according to use. Micanite is the general term used for all bonded mica sheet.

Ground mica of all classes is used extensively, as an extender and pigment in paint, as a filler and dusting agent in roofing materials, and in rubber: in mould washes for foundry work, lubricants, wallpaper, pipe enamel, annealing, tinsel powder, and in high-frequency insulators.

Mica buyers in Canada include: Blackburn Brothers, Blackburn Building, Ottawa; Walter C. Cross, 209 Bridge Street, Hull, Quebec; and Mica Company of Canada, 2 Lois Street, Hull, Quebec.

Prices

The following is a guide to prices offered by Ottawa region dealers for trimmed sheet mica.

Size (inches)	*Per Pound*
1 x 1 and 1 x 2	$ 0.27
1 x 3	0.60
2 x 3	0.90–1.00
2 x 4	1.40
3 x 5	1.75
4 x 6	2.00
5 x 8	3.00

Grinding scrap sold in 1949 from $11 to $20 per short ton delivered, according to quality.

According to the Engineering and Mining Journal Metal and Mineral Markets' quotations at the end of 1949, Madagascar sheet mica first quality high-heat duty paid New York, per pound, grade 7 (below 1 square inch) sold at 50 cents; grade 6 (1 to 1½), 71 cents; grade 5 (3 to 6), $1.07; grade 4 (6 to 10), $1.20; grade 3 (10 to 14), $1.60; lepidolite (lithia mica), per ton (2,000 pounds) 4 per cent lithia, powdered, carload lots, $80.

Canadian Chemistry and Process Industries, November 1949, quotes the following prices: mica, ground, 20-, 40-, and 80-mesh roofing grade, f.o.b. Hull, Quebec, $60; 80-mesh lubricating grade, $80; and biotite No. 160-mesh, f.o.b. Toronto, ton lots, 100 pounds $7.95 to $8.50.

Under United States Import Duties, 1948, as amended, the duty on mica, unmanufactured, valued at not over 15 cents a pound, is 4 cents a pound; at over 15 cents a pound, 2 cents a pound plus 15 per cent ad valorem; cut or stamped to dimension, shape, or form, 40 per cent ad valorem; films and splittings not cut or stamped to dimensions, not over 0·0012 inch thick, 12½ per cent ad valorem; over 0·0012 inch thick, 20 per cent ad valorem; cut or stamped to dimension, 45 per cent ad valorem; untrimmed phlogopite from which no rectangular piece exceeding 2 inches by 1 inch may be cut, 5 per cent ad valorem; waste and scrap valued at not more than 5 cents a pound, 15 per cent ad valorem; 5 to 15 cents a pound, 4 cents a pound; over 15 cents a pound, 4 cents a pound plus 25 per cent ad valorem; ground or pulverized, 15 per cent ad valorem; and built-up mica sheet, and other manufactured forms, 25 per cent ad valorem.

NEPHELINE SYENITE

Total shipments of nepheline syenite in Canada in 1949 increased to 78,783 short tons, compared with 74,386 short tons in 1948. The output of processed material available mainly in 28-mesh glass grade and 200-mesh pottery grade increased almost 70 per cent. Total Canadian production came from American Nepheline, Limited, sole producer in the Western Hemisphere, from extensive deposits on Blue Mountain, Peterborough county, Ontario.

Development work at the property during 1949 included the opening of two new working-faces at the Cabin Ridge open pit and preparation for the opening of two additional faces. The underground haulage tunnel was extended and raises were driven from the tunnel to connect with the east and west stope storage areas.

The company has announced plans for the removal of its fine-grinding plant from Rochester, New York, to Canada during 1950.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production of crude (Ore transported to storage)	89,731	.....	94,200	.....
Shipments				
Ground, glass grade	26,931	341,128	16,587	219,532
" pottery grade	6,413	106,422	4,546	73,155
" miscellaneous	2,705	4,396	80	800
Total ground	36,049	451,946	21,213	293,487
Crude	42,734	171,056	53,173	212,975
Total shipments	78,783	623,002	74,386	506,462
Exports of crude and processed materials				
To: United States	55,217	344,927	60,537	314,826
United Kingdom	444	9,550	286	5,701
Netherlands	1,271	26,671	22	526
Other countries	359	5,806	262	6,465
Total	57,291	386,954	61,107	327,518

Known deposits occur in Ontario near Bancroft, Hastings county; Gooderham, Haliburton county; in the French River area, Georgian Bay district; and at Port Coldwell, Thunder Bay district; in the Montreal, Labelle-Annonciation, and other areas in Quebec; and in the Ice River district, near Field, in British Columbia.

Canada and Russia are the only important producers of nepheline syenite, Canada being the sole source of high-grade ceramic material.

Uses

Nepheline syenite is used exclusively for ceramic purposes, its principal value being in its material lowering of firing temperatures. It is valued as an addition in the glass batch because of its high alumina content (23 per cent in Lakefield nepheline syenite) to which a lowering of annealing temperatures, reduced coefficient of expansion, increased tensile strength, hardness, and brilliancy, are attributed.

Although only recently made available to the trade in quantity it has found application in glass manufacture mainly and in many types of wares including whitewares, such as sanitary, porcelain, semi-vitreous dinnerware, hotel china, dental porcelain, floor and wall tile, porcelain balls and liners, and kitchenware. It is also used in porcelain enamels, and as a bond in refractory cements.

B-grade dust, a by-product, finds a limited market for cleansers, enamels, and certain other clay products.

Nepheline syenite is sold in two sizes: 28-mesh, glass grade; and 200-mesh, pottery grade.

Prices and Tariffs

The price of processed nepheline syenite remained unchanged during 1949 at $14 a short ton for 28-mesh glass grade, and $18 for 200-mesh pottery grade, bulk carload lots, f.o.b. rail. B-grade dust was quoted unchanged at $10. The declared value of crushed crude exports was $4 a ton. Nepheline syenite, all classes, entered United States free of duty.

PHOSPHATE

With the exception of 20 tons from the Lièvre River district of Quebec, there was no production of phosphate in Canada in 1949. The last recorded production amounted to 57 tons in 1946. Phosphate mining in Canada virtually ceased about 50 years ago following the development of extensive sedimentary deposits in the United States which have since been a low-cost source of supply. Imports of phosphate rock, most of which were from the United States, increased to 620,808 short tons, compared with 482,008 short tons in 1948.

Quebec Smelting and Refining, Limited, Montreal, with options on several properties near Notre Dame de la Salette, north of Buckingham, Quebec, carried out extensive drilling in 1949 and has announced plans for further drilling in 1950.

Canadian reserves of apatite, of which no estimate is available, occur in numerous scattered deposits in the general Ottawa region of Ontario and Quebec. Production in the past reached a maximum of about 30,000 tons a year, almost 90 per cent of which came from Quebec.

World production of phosphte in 1949 was estimated at 19,000,000 metric tons, 50 per cent of which came from the United States.

Trade and Consumption

	1949		1948	
	Short tons	$	Short tons	$
Imports, Phosphate rock				
From: United States	610,112	3,738,472	476,968	2,842,200
Netherlands—Antilles	10,696	141,051	5,040	68,968
Total	620,808	3,879,523	482,008	2,911,168
Imports, Superphosphate				
From: United States	154,736	2,511,016	119,383	1,861,922
Netherlands	12,836	182,351	.....	.....
Total	167,572	2,693,367	119,383	1,861,922
Imports, Phosphoric acid				
From: United States	246	26,312	167	20,651
United Kingdom	.....	.....	9	4,601
Total	246	26,312	176	25,252
Consumption				
Fertilizers	.....	.....	372,976	.....
Phosphorus and compounds	.....	.....	28,280	.....
Steel furnaces	.....	.....	1,500*	
Miscellaneous	.....	.....	10,000*	
Total	.....	.....	412,756	.....

* Estimated.

Uses

Phosphate rock is used chiefly for making commercial fertilizer mostly in the form of superphosphate made by the treatment of the raw material with sulphuric acid. In United States, furnacing processes developed in recent years

(mostly by T.V.A.) have given rise to the production of phosphatic fertilizer of the slag type. Finely ground phosphate rock, untreated, is also applied directly to the soil on a minor scale.

Phosphorus and a large number of phosphorus compounds are used for a variety of purposes including the manufacture of detergents, water softeners, leavening agents, flame retardants, pigments, opacifiers, food preservatives, pharmaceutical preparations, food supplements, and many others. Ferrophosphorus (iron phosphide) is used in iron and steel castings to increase fluidity, in rolled sheet to prevent sticking, and in other metallurgical applications. Elemental phosphorus (yellow and white) is used for the manufacture of phosphorus alloys and compounds, rodent poisons, pyrotechnics, etc.

To be acceptable for acid treatment, phosphate ore or concentrates must be virtually free from common impurities such as iron oxides, calcite, and ferromagnesium minerals. The grade should approach 80 per cent tri-calcium phosphate. For furnace treatment these impurities are not objectionable within reasonable limits, but purchasers prefer rock containing a minimum of 70 per cent tri-calcium phosphate.

Prices and Tariff

Prices for crude ore, which remained unchanged throughout 1949, were quoted in United States trade journals as follows: Florida—pebble phosphate 77 to 78 per cent B.P.L. (bone phosphate of lime) $7.31; 68 to 66 per cent, $4.61 per long ton f.o.b. mines.

The price offered by eastern consumers for domestic phosphate was $14.80 per short ton for 80 per cent B.P.L. f.o.b. works with a penalty or bonus of 19 cents per unit below or above that figure.

Phosphate rock is not dutiable under the Canadian tariff.

PYRITES AND SULPHUR

All pyrites produced in Canada is obtained as a by-product from the concentration of base metal sulphide ores, and none is mined as a primary material. The sulphur content of these pyrites concentrates ranges from 47 to 50 per cent. Pyrites in this form is sold for making sulphuric acid at plants in British Columbia, Ontario, and Quebec, and is exported to the United States, Japan, and Mexico for the same purpose.

Companies marketing pyrites concentrates in 1949 were: Noranda Mines, Limited, Waite Amulet Mines, Limited, and Quemont Mining Corporation, Limited, all in the Noranda area, Quebec; and Britannia Mining and Smelting Company, Limited, Britannia Beach, British Columbia.

In addition to these sources there are large deposits of pyrites in Canada, notably in British Columbia, on the Ecstall River near its junction with the Skeena River, 45 miles from Port Essington; in Ontario in the Algoma district, and also 7 miles west of Sioux Lookout. None of these, however, has been actively developed.

About 55 per cent of the sulphuric acid produced in Canada is made from the sulphur content of gases from the smelters of The Consolidated Mining and Smelting Company of Canada, Limited, at Trail, British Columbia, and of The International Nickel Company of Canada, Limited, at Copper Cliff, Ontario, At Trail the acid is made in the company's plant and at Copper Cliff it is made by Canadian Industries, Limited. Liquefied sulphur dioxide has been produced experimentally from the gases at Copper Cliff.

Native sulphur is not known to occur in commercial quantities in Canada. In the past it was produced from smelter gases by The Consolidated Mining and

Smelting Company, but at present all the sulphur in the gases is required by the company to make sulphuric acid for use in the manufacture of fertilizers.

Noranda Mines, Limited continued large-scale experimental work on the production of sulphur and iron from pyrites. Sufficient pyrites is available in the Noranda district to permit of the production of 200,000 tons of sulphur annually for many years.

The natural gas available in southern Alberta, some of which contains nearly 9 per cent of hydrogen sulphide is another large potential source of sulphur. Efforts are being made to develop a process to recover elemental sulphur from this gas.

Deposits of anhydrite and gypsum in Nova Scotia and New Brunswick, and elsewhere in Canada constitute a huge potential source of sulphur and its compounds. The adaptation of a process in successful operation in Germany, England, and France that produces sulphuric acid and portland cement from anhydrite or gypsum and clay is being investigated in New Brunswick.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production of Sulphur				
Sulphur equivalent in pyrites shipped	117,581	596,154	87,126	412,988
Sulphur equivalent recovered from smelter gases	144,290	1,442,900	142,337	1,423,370
Total	261,871	2,039,054	229,463	1,836,358
Imports				
Crude, roll, and flour sulphur, all from United States	280,557	5,213,921	354,622	5,528,740
Exports, in pyrites				
To: United States	60,291	255,815	47,051	180,357
Japan	28,360	118,476	.....	.....
Mexico	1,902	8,185	3,192	15,353
Total	90,553	382,476	50,243	195,710

Uses

Sulphur in the elemental form or as sulphuric acid has many important uses in industry. Consumption of sulphur and its compounds by industries in Canada during 1947 and 1948 is given in short tons in the following table:

Industry	1948	1947
Pulp and paper	260,912	253,423
Heavy chemicals	205,172*	228,710*
Rubber goods	2,154	2,165
Insecticides	1,293	1,545
Explosives	1,759	1,496
Miscellaneous	1,143	924
Total	472,433	488,263

* Includes sulphur equivalent recovered from smelter gases.

Prices

Prices of sulphur remained unchanged during 1949. The price for the domestic market in United States at the close of 1949 was $18 per long ton f.o.b Texas mines.

The price of Spanish pyrites at United States east coast ports was 14 to 16 cents per long ton unit of sulphur c.i.f., guaranteed 48 per cent sulphur.

ROOFING GRANULES

Most of the roofing granule production in Canada comes from deposits in Ontario, the remainder being from Quebec and British Columbia. Since production accounts for less than one-third of consumption, it is heavily supplemented by imports. The 1949 output of roofing granules was slightly lower than in 1948, whereas consumption increased from 113,085 short tons to 115,992 short tons in 1949. Imports rose from 64 per cent of the consumption in 1948 to 68 per cent in 1949 and came entirely from United States. Users continued to show increasing preference for artificially coloured granules over the natural material.

Consumption and Trade

	1949		1948	
	Short tons	$	Short tons	$
Consumption				
Natural	38,486	722,216	40,366	722,868
Artificially coloured	77,506	2,029,470	72,719	1,748,291
Total	115,992	2,751,686	113,085	2,471,159
Consumption by colours				
Grey and black	34,549	647,328	35,177	627,057
Red	25,080	582,415	27,383	608,812
Green	35,862	862,473	32,433	721,701
Blue	9,724	335,815	6,856	225,993
Buff and browns	5,863	160,900	6,017	149,649
White and grey-white	4,914	162,755	5,219	137,938
Total	115,992	2,751,686	113,085	2,471,150
Imports				
From: United States	78,749	1,898,889	72,219	1,612,639
United Kingdom	.....	.....	3	318
Total	78,749	1,898,889	72,222	1,612,957

About 33 per cent of the 1949 consumption was slate.

Developments

Quebec

Suzorite Company, Limited produces natural granules used for undercoating from suzorite rock in its plant at Cornwall, Ontario. This rock is quarried near McCarthy in Suzor township about 160 miles east of Senneterre, and is moved by rail to the Cornwall plant. It consists of mica (50 per cent), feldspar, apatite, and pyroxenite. After removing the mica the remainder is crushed and screened to granule size and shipped to the consumer.

Wendell Mineral Products, Limited, Montreal, sampled and surveyed a grey rhyolite deposit in Duverny township near Landrienne, east of Amos. The company planned to erect a crushing and colouring plant for the production of roofing granules.

Ontario

Building Products Company, Limited, the chief Canadian producer, operates quarries near Madoc. It quarries a black amphibole rhyolite deposit 4 miles northeast of Madoc, and a pink rhyolite deposit east of Madoc near Moira Lake. The rock from these quarries is crushed and screened in a mill at Madoc. The company also receives the undersize from the quarry of Ontario Rock Products, Limited, near Havelock, and crushes and screens this material to granule size at its Havelock plant near the green-grey basalt quarry of Ontario Rock Products, Limited. The granules made in both plants are artificially coloured at the Havelock plant, the only roofing granule colouring plant in Canada.

British Columbia

G. W. Richmond quarries a dark grey slate at McNab Creek, Howe Sound, and a green siliceous rock at Bridal Falls near Chilliwack. He produces natural granules in his Vancouver plant for shipment to local roofing manufacturers. The two quarries on southern Vancouver Island did not operate in 1949.

Granule-coated roofings and sidings were manufactured in 1949 by ten companies which have a total of fourteen plants across Canada, at Asbestos, Montreal, and Lennoxville, in Quebec; Toronto, Hamilton, Brantford, and London, in Ontario; Winnipeg, in Manitoba; and Vancouver, and Victoria in British Columbia.

Specifications and Colouring

Specifications for rock types suitable for the manufacture of roofing granules are very rigid and few types are able to meet all specifications. Rocks suitable for granules should be fairly hard, and tough enough to withstand breakage and dusting through handling with mechanical equipment; should be fine-grained with low porosity to withstand weathering effects from freezing and thawing and should contain no "foreign materials" such as carbonates, feldspars, mica, sulphides, fibrous minerals, etc., that would deteriorate through natural weathering agencies or through poor adhesion to the asphalt. They should be opaque to the transmission of the actinic rays of the sun and not allow the passage of ultra-violet, or infra-red rays, to the underlying asphalt; should "break well"; and should be uniformly-textured to take "artificial colouring" well so that no blotchy effect is apparent in the shingles on a roof, light coloured rock being preferable to dark coloured.

Specifications of granules used for under coats are almost as rigid as those for the top-coat granules. However, most of these are black slates and are not artificially coloured. They are generally much cheaper than the artificially coloured top-coat granules.

The deposits of rock must contain sufficient tonnage of uniform characteristics within economical haulage distance of the colouring plant to support many years of production. The plant site should be close to rail haulage facilities and not too distant from the roofing manufacturing plants.

Two mesh grades of granules are used by manufacturers of roofings and sidings, most of the granules being "medium coarse" (between — 10 + 35 mesh), and the remainder, "fines" (— 28 + 60 mesh).

Processes for colouring granules are covered by many patents. The two processes in most widespread use are: the sodium silicate process in which the granules are thoroughly coated with sodium silicate, clay, the required pigment,

and a little titanium oxide, and heated to the required temperature in a rotary kiln; and the phosphoric acid process in which the granules are thoroughly mixed with zinc oxide, clay, and liquid phosphoric acid, and then heated with the addition of the required pigment.

Slates on heating will, on occasion, take a deeper, darker colour and become harder. Sometimes oxides of iron and chromium are thoroughly mixed with the granules which are then "burned" to produce satisfactory shades of reds and greens. The methods and mixes employed by any manufacturer of artificially coloured granules are closely held secrets. Information on patents or processes may be obtained by reference to patent files.

Prices

Prices of granules depend upon the type of granule and upon whether the colour is natural or artificial. In 1949 imported granules averaged $18.75 a ton f.o.b., eastern Canadian plants, for natural rocks or slates. Artificially coloured granules averaged per ton; reds, $23.21; green, $24.72; blue, $34.53; buff or brown, $27.45; and white or grey-white, $33.33. The average value of all types per ton was $23.72 compared with $24.26 for 1948.

SALT (SODIUM CHLORIDE)

Production of salt in 1949 remained at about the same level as in 1948 but there was considerable expansion within the industry. The new plant of Prairie Salt Company, Limited, at Unity, Saskatchewan, came into production about the middle of 1949 and construction of the new caustic soda-chlorine plant of Dominion Alkali and Chemical Company, Limited, subsidiary of Dominion Tar and Chemical Company, Limited, at Beauharnois, was completed.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production (by types)				
Fine vacuum salt	265,959	4,149,240	282,711	3,464,190
Coarse grainer salt	11,437	264,035	19,419	376,277
Mines rock salt	43,303	380,695	25,908	266,285
[1]Salt produced for chemical purposes	428,316	772,755	413,223	729,276
Total	749,015	5,566,725	741,261	4,836,028
Production (by provinces)				
Ontario	607,206	3,477,583	619,598	3,265,654
Nova Scotia	86,612	1,030,126	61,799	700,164
Alberta	28,359	547,304	34,613	449,780
Manitoba	18,734	367,186	25,251	420,430
Saskatchewan	8,104	144,526	.....	.....
Total	749,015	5,566,725	741,261	4,836,028
Imports				
From: United States	153,151	951,558	155,142	833,935
Bahamas	41,955	331,463	22,227	139,462
Jamaica	18,220	85,468	3,476	14,329
Portugal	11,166	56,796	.....	.....
Other countries	12,195	142,587	5,226	91,104
Total	236,687	1,567,872	186,071	1,078,830

Production and Trade—concluded

	1949		1948	
	Short tons	$	Short tons	$
Exports				
To: United States	2,600	32,462	1,463	18,636
New Zealand	182	6,951	905	30,314
Hawaii	220	5,595	144	2,836
[2]Newfoundland	86	1,282	2,562	50,314
Other countries	386	16,725	556	25,004
Total	3,474	63,015	5,630	127,104
Apparent Consumption	982,228	7,071,582	921,702	5,787,754

[1] Mainly in brine, and used by the producers in the manufacture of chemicals.
[2] First three months, 1949; full year 1948.

Imports of salt in the coarse grades increased greatly, the chief reason being the entry of Newfoundland into Confederation, which consumes large quantities of coarse salt in the fishing industry, most of which has to be imported from the West Indies.

Salt beds or brines occur in all provinces, but huge, proven rock salt deposits underlie parts of Nova Scotia, New Brunswick, Ontario, Saskatchewan, and Alberta.

Canada's imports of salt are chiefly of grain sizes and of purities not obtainable in the country. The salt obtained from direct mining of rock salt beds usually contains many of the impurities of the original beds, and although all grain sizes required can be obtained by this method, the purity may not be sufficiently high to satisfy all uses. The salt from vacuum pan evaporation is of high purity but only fine grain sizes are produced. Geographical location of deposits in relation to markets also has a bearing on imports. British Columbia, for instance, imports salt from California because the long rail haul from the nearest domestic sources of supply prohibits competition at present with ocean transportation.

Nova Scotia

In Nova Scotia, Malagash Salt Company, Limited operates a salt mine at Malagash, Cumberland county. The mined rock salt is crushed, screened, and sold as fishery, refrigerator, hay, and dairy salts, for ice removal on highways and railways, and for dust laying. Maritime Industries, Limited, subsidiary of Standard Chemical Company, Limited, at Nappan, near Amherst, Cumberland county, obtains its salt from the vacuum pan evaporation of salt brine from wells drilled into massive beds of salt that come within 860 feet of the surface at this point.

Quebec

No salt is produced in Quebec. Salt used by chlorine-caustic soda plants in the province is obtained from Ontario and United States. The new plant of Dominion Alkali and Chemical Company, Beauharnois, was completed.

Ontario

Ontario's large production of salt is used mainly to supply its expanding chemical industries. The salt is obtained from wells drilled into salt beds that lie from 800 to 1,500 feet below the surface at Goderich, Sarnia, Warwick, and Sandwich in southwestern Ontario.

Goderich Salt Company, Limited, subsidiary of Standard Chemical Company, Limited, and Purity Flour Mills, Limited, are the two producers in Goderich.

Dominion Salt Company, Limited operates the plant at Sarnia. Salt from this plant will be used in the caustic soda-chlorine plant at Beauharnois. Salt for the caustic soda-chlorine plant of the Dow Chemical Company of Canada Limited, Sarnia, is obtained from brine wells on the company's property. The chemicals from the plant are being used chiefly in the company's plants in Sarnia.

At Sandwich, Canadian Industries, Limited produces salt from vacuum evaporators and from open-type grainers. The brine from these salt wells is used in the company's caustic soda-chlorine plant at Sandwich, and salt from this plant is shipped to other chlorine-caustic soda plants of Canadian Industries, Limited, at Cornwall, Ontario, and Shawinigan Falls, Quebec.

Several miles south of Sandwich, Brunner-Mond Canada, Limited has brine-producing wells from which the brine is pumped to the plant at Amherstburg, where it is one of the basic raw materials in the manufacture of soda ash.

Warwick Pure Salt Campany, Limited produces coarse salt from open pan evaporation of brine obtained from wells on its property near the village of Warwick.

Prairie Provinces

Canadian Industries, Limited, with plant at Neepawa, is the only producer of salt in Manitoba. Erected in 1941, the plant utilizes vacuum pan evaporation to produce all grades of evaporated salt. The brine, obtained from wells over 1,000 feet deep, is a nearly saturated natural brine occurring in porous sedimentary rocks. There are no proven bedded deposits of rock salt in this area.

In Saskatchewan, Dominion Tar and Chemical Company, Limited, through its subsidiary Prairie Salt Company, Limited, opened its new salt plant at Unity. This plant obtains salt brine from beds of salts over 3,500 feet below the surface.

Industrial Minerals, Limited, subsidiary of Dominion Tar and Chemical Company, at Waterways, produces evaporated salt for household and dairy uses. The plant of Alberta Salt Company, Limited, at Lindbergh, obtains brine from salt beds lying over 2,800 feet below the surface. Natural gas obtained from strata above the salt beds is used for fuel in the evaporation of the brines.

The extensive oil-well drilling in the West has made more information available on the extent and size of the salt beds in Alberta and Saskatchewan.

Uses and Prices

Salt is used chiefly in the chemical industries, and extensively for household and food purposes. The coarse grades of salt are used in the curing of fish, for ice and dust control on highways, and in refrigeration.

According to Canadian Chemistry and Process Industries certain grades of salt increased in price during 1949.

	Prices	
	December 1948	*November 1949*
Specially purified salt, per 100 lb., 99 per cent f.o.b. plant	$ 1.10	$ 1.10
Fine industrial salt per ton bulk, carlots, f.o.b. plant	$ 6.00-$ 7.80	$ 7.00-$ 8.80
Coarse industrial salt per ton bulk, carlots, f.o.b. plant	$13.00-$14.80	$15.40-$17.20

SAND AND GRAVEL

The output of sand and gravel in Canada in 1949 amounted to 63,356,308 tons valued at $31,181,541, compared with the peak production of 68,670,863 tons valued at $30,629,596 in 1948. The demand for sand and gravel continued

strong in the building industry during 1949, but in some provinces less gravel went into the building or improvement of roads.

Production

—	1949		1948	
	Quantity	Value	Quantity	Value
	Tons	$	Tons	$
Newfoundland	1,416,202	999,598	.....	.....
Nova Scotia	1,933,652	1,738,114	1,636,808	1,706,838
New Brunswick	3,142,633	1,106,479	3,347,817	1,231,256
Quebec	19,179,692	7,326,456	28,102,377	9,535,944
Ontario	22,320,753	11,214,136	20,588,496	10,468,216
Manitoba	2,260,196	696,783	2,498,277	754,196
Saskatchewan	1,930,959	1,795,766	1,846,336	917,243
Alberta	2,448,814	1,553,589	3,592,275	2,219,497
British Columbia	8,723,407	4,750,620	7,058,477	3,796,406
Total	63,356,308	31,181,541	68,670,863	30,629,596

Uses

Concrete, road building, and concrete construction absorb most of the gravel and sand output. Gravel has proved a good material for low cost, all-weather road surfaces. The development of improved methods of processing the material and of compacting the understructure of the pavements has led to its extensive use for both wearing and base courses on paved rural highways.

Most of the gravel used for road work comes from pits worked exclusively for that purpose. The pits are operated to supply the immediate need and to build up a reserve of processed gravel, in the form of stockpiles large enough for 1 or 2 years' requirements, after which the processing equipment is moved somewhere else. These road pits may remain idle for 2 years or more.

A large part of the gravel now used is crushed, screened, and washed, and the use of gravel thus processed is increasing steadily. Most provinces use crushed instead of pit-run gravel for surfacing their main highways because the angular aggregate produced by crushing can be more densely compacted and imparts greater stability to the road surface under traffic.

Pit-run gravel is gradually being replaced by processed gravel or crushed stone as ballast on main railway lines. The crushed gravel or stone is either bought from commercial plants or processed by contract in pits or quarries owned by the railway companies. In the latter case the pits or quarries are operated not only for the immediate need, but for several years' requirements in the form of stockpiles, after which the pits or quarries remain idle for some years.

A large tonnage of sand and gravel is also used for refilling the worked-out parts of mines.

Large commercial plants are equipped for producing crushed, screened, and washed gravel, a product that can compete with most types of crushed stone.

The amount of sand consumed follows roughly the trend of building activity, as the larger part of the sand excavated is used in the building industry, such as concrete work, cement and lime mortar, and wall plaster. For these purposes the sand must be free from dust, loam, organic matter, or clay. When demand is high a large proportion of these materials is obtained from rivers or lakes either with dredging boats or portable dredging equipment installed at the shore.

Other important uses of sand are for moulding in foundries, filtering of water supply, and glassmaking, all of which require special grades of sand. Some large foundries buy ordinary sand and process and blend it to the required grade.

Prices

Prices for carlots, f.o.b. cars, at the end of 1949, as reported by the "Engineering and Contract Record," were as follows:

(In dollars per short ton)

—	Montreal	Toronto	Winnipeg	Vancouver[1]
Sand	2·00	2·90	3·60[2]	2·15
Gravel, ¾ inch	2·50	3·45	3·72	2·15
Crushed stone, ¾ inch	1·10	3·45	3·72[2]	2·33

[1] Prices subject to 3 per cent Provincial Government tax.
[2] Per cubic yard.

SILICA MINERALS

Canadian production of quartz and silica sand in 1949 was lower than in 1948. However, imports of silica sand continued high for use in the glass, silicon carbide, sodium silicate, and steel foundry industries. The cost to consumers was again raised by the increase in railway freight rates and by some increases in plant prices.

A new plant for the production of silicon carbide was opened at Cap-de-la-Madeleine in Quebec and plans were announced for the opening of another such plant at Trois Rivières, Quebec, and of a sheet glass plant at Toronto. These plants will be large users of silica sands. Sampling and drilling of deposits were carried out in several provinces.

Quartzites and sandstones are the important rock deposits from which silica and silica sands are obtained. Nova Scotia, Quebec, and Ontario have important beds of quartzite that have been developed to some extent. Every province has sandstone deposits but few of those exposed are suitable as sources of high quality silica sands. Consequently, exploration and development work is required to find areas of high-grade sandstone.

Production and Trade

The following table shows Canadian production, exports, and imports of silica in 1948 and 1949.

—	1949		1948	
	Short tons	$	Short tons	$
Production of quartz and silica sand	1,722,476	1,588,531	2,017,262	2,082,573
Production of silica brick (thousands of bricks)	3,663	453,797	3,234	367,742
Imports of silica sand				
From: United Kingdom	174	839	270	1,352
Belgium	5,219	7,086	.....	.....
Norway	.....	.....	600	540
United States	505,723	1,354,514	583,149	1,444,732
Total	511,116	1,362,439	584,019	1,446,624
Exports of quartzite				
All to United States	144,302	326,091	228,100	494,284

Nova Scotia

Dominion Steel and Coal Corporation, Limited obtained quartzite from Chegoggin Point, Yarmouth county, for use in its silica brick plant at Sydney, Nova Scotia.

Quebec

Canadian Carborundum Company, Limited produces silica sand at St. Canut in Two Mountains county for use in its Shawinigan Falls abrasive plant.

St. Lawrence Alloys and Metals, Limited produces various grades of silica at its crushing and screening plant in Melocheville from a quarry in Potsdam sandstone. The coarser grades are used in the company's own silicon and ferrosilicon plant at Beauharnois.

Ontario

Kingston Silica Mines, Limited produces silica sands from an outcrop of Potsdam sandstone near Joyceville, 11 miles north of Kingston. The sand is sold for the manufacture of artificial abrasives, and as steel foundry sand.

Dominion Mines and Quarries, Limited, Killarney, and Canadian Silica Corporation, Limited, Sheguindah, Manitoulin Island, produce quartzite from large outcrops of Lorrain quartzite. This quartzite is used in Canada and United States as a raw material to manufacture silicon and ferrosilicon alloys.

Algoma Steel Corporation, Limited, Sault Ste. Marie, obtains quartzite from Wright Brothers, Bellevue, 20 miles to the north, for use in the company's silica brick plant.

Prairie Provinces

Some interest was shown in the sand deposits of Manitoba and Saskatchewan in 1949 but there was no production.

Other Centres of Production

Production of silica for use as a flux by base metal smelters at Noranda, Quebec; Sudbury, Ontario; Flin Flon, Manitoba; and Trail, British Columbia, is carried on near these centres and accounts for an appreciable part of the total silica production.

Uses; Specifications

Silica sand is generally prepared from friable sandstone or quartzite by crushing, washing, drying, and screening to recover material varying in grade according to consumption requirements. Natural silica sands are usually too impure to warrant removal of the impurities, although in certain cases this might prove satisfactory, depending upon the ease of separation of the various minerals in the sand, and the size of the silica sand grains. In the manufacture of container glass, for instance, the sand used should range between 28 and 150 mesh, and the iron (Fe_2O_3) content should be less than 0·04 per cent.

Silica sand for use in the artificial abrasives or sodium silicate industries varies slightly in screen size but in general has to be as pure as glass sands.

Silica sand for steel foundry use generally contains a greater percentage of impurities than do glass sands and varies greatly in screen size depending upon type of castings and the foundry practice of the firm. These sands usually contain no material coarser than 20 mesh nor finer than 200 mesh, but percentage of fines to coarse must be varied greatly to produce all the types of foundry sand required by Canadian manufacturers.

Sand-blast sand is usually composed of the coarsest grains produced from a sand plant and might vary from 8 mesh to 48 mesh in closely sized ranges. The physical properties of these sands, including shape of grains, friability, and hardness, are of great importance.

Sandstone in run-of-the-mine size is used by the cement manufacturers to increase the silica ratio of their original mixes.

Silica ground to 150 mesh or finer is known as "potter's flint" in the ceramic industry. This material must be prepared from very pure quartz or high-grade silica sand. Fine silica is also required in the paint, soap, building products, and general chemical industries.

Smelter operators endeavour to obtain their silica for use as a flux from the nearest source, and in many cases use a siliceous ore containing recoverable amounts of the precious or base metals.

Quartz, quartzite, or sandstone in sizes from 6 inches to ½ inch is used in the manufacture of ferrosilicon and metallic silicon.

Quartzite of high purity and crushed to about 8 mesh is used to manufacture silica brick.

In producing silica for the above uses, regularity of shipments and meeting of rigid specifications are important factors.

Quartz in crystal form without flaws, transparent, and possessing the necessary piezo-electric properties, is valuable in radio-frequency control apparatus. Crystals may also be cut and ground for lenses and prisms, or fused to make clear fused quartz equipment. No commercial deposits of quartz with the properties for these uses have been found in Canada, the only present world sources of supply being Brazil and Madagascar.

Prices

The price per ton of the several grades of silica varies greatly, depending upon its purity and the purpose for which it is to be used. Silica generally is a low-priced commodity, and therefore the location of a deposit with respect to markets is of great importance. The largest markets for silica are in Quebec and Ontario and new deposits, to be of interest to these markets, should be within economic reach of the southwestern Ontario, Toronto, or Montreal areas. In western Canada the main markets are in Alberta and Manitoba. West of Winnipeg the silica needs are almost entirely imported.

The prices, according to Canadian Chemistry and Process Industries, increased slightly during 1949, chiefly in the coarser grades.

Silica Sand

—	Various grades		Silica, quartz, 99% silica soft	
	Toronto, carload lots	Toronto, L.C.L.	110-200 grade	Decomposed 325 mesh
	Ton	Ton	Carlots, per ton	Carlots, per ton
Dec. 1948.....	$10.50–$11.00	$16.00	$14.00–$20.00	$30.00–$35.00
Nov. 1949.....	$11.00–$12.00	$16.00–$17.00	$21.00–$33.00	$30.00–$35.00

SODIUM SULPHATE (NATURAL)

Production of sodium sulphate in Canada decreased from 153,698 short tons in 1948 to 120,259 short tons in 1949, owing to the decline in paper production in Canada and to the saturation of the United States market by "salt cake" from chemical industries. Exports were 28 per cent and imports 55 per cent lower than in 1948.

The output comes from Saskatchewan, in which province mainly, but also in Alberta, large reserves of sodium sulphate occur in beds and in highly concentrated brines in alkali lakes.

The price of sodium sulphate showed a slight decrease in 1949 and potential plant capacity was in excess of market demands.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production (shipments)	120,259	1,614,731	153,698	2,136,276
Imports				
From: United States	5,584	110,094	13,866	292,440
Germany	705	15,587	.....	.....
Total	6,289	125,681	13,866	292,440
Exports to United States	21,388	300,472	29,612	468,561

The principal producers of natural sodium sulphate in 1949 were: Natural Sodium Products, Limited, which operated its plant at Bishopric but not at Alsask in 1949; Horseshoe Lake Mining Company, Limited, at Ormiston; Midwest Chemicals, Limited, at Palo; Sybouts Sulphate Company, Gladmar; and Saskatchewan Minerals, Sodium Sulphate Division, at Chaplin Lake.

Production methods of the various companies vary considerably, but the general trend is towards the production of a higher grade product. To accomplish this the crystallizing pond has come into general use.

In some lakes the sodium sulphate occurs as an actual bed in a dried-up lake or under a saturated brine; in others, as a brine with little or no actual crystal beds. In the late summer months the brine in all lakes is usually almost saturated, and at this time the brine is pumped from the lake into an enclosed pond. After more evaporation and cooler weather the sodium sulphate crystallizes out and the excess brine is returned to the main lake. The crystal or Glauber's salt is collected and stockpiled. The salt is then fed to a dehydrating plant to remove the water of crystallization, which amounts to over 50 per cent of the weight of the crystal. The dehydrating plants usually consist of a simple rotary kiln and a crushing and screening plant. The finished salt commonly known as "salt cake" is shipped in bulk. The product from this crystallizing pond method is usually purer than that produced from the mining of the salt beds with all their included silt and other salts.

Uses and Prices

Sodium sulphate is used chiefly in the sulphate process in making kraft pulp. It is used in the glass, dye, chemical, and textile industries, and to a lesser extent, for medicinal purposes, and for tanning.

The price of natural sodium sulphate from the deposits in Saskatchewan was quoted by Canadian Chemistry and Process Industries in November 1949, at $13.50 per short ton in carload lots, f.o.b. plant, compared to $15.50 in the same period of 1948.

TALC AND SOAPSTONE

Sales of talc and soapstone in Canada during 1949 totalled 26,922 short tons, a decrease of 1,848 tons below the 1948 output. The production continued to come from the Eastern Townships of Quebec, and from the Madoc area of Ontario.

Talc and soapstone deposits occur also in the Rainy River district in southwestern Ontario; in several localities along the Alberta-British Columbia boundary including the Windermere mining division, and adjacent sections of Alberta; on Vancouver Island; and in the southern reaches of the Fraser River watershed.

Approximately 16 per cent of the output was exported. Canada produces its entire requirements of sawn dimension soapstone and talc crayons, but imports, mainly from United States and Italy, certain special qualities of ground talc demanded by the ceramic, paint, and cosmetic trades. Imports in 1949 declined 7 per cent compared to the 1948 total.

Production, Trade, and Consumption

	1949		1948	
	Short tons	$	Short tons	$
Production (Sales)				
Ground	26,563	301,655	28,445	292,288
Sawn soapstone blocks and talc crayons	359	19,138	325	17,535
Total	26,922	320,793	28,770	309,823
Imports				
From: United States	6,633	200,046	7,051	183,489
Italy	599	26,768	742	29,749
Other countries	37	1,594	5	200
Total	7,269	228,408	7,798	213,438
Exports				
To: United States	4,144	52,153	5,032	62,533
Australia	29	1,485	19	905
Other countries	49	877	1	36
Total	4,222	54,515	5,052	63,474
Consumption				
Roofing	.....	.....	7,696	.....
Paints	.....	.....	6,041	.....
Rubber	.....	.....	3,125	.....
Insecticides	.....	.....	2,461	.....
Pulp and paper	.....	.....	3,722	.....
Toilet preparations	.....	.....	1,242	.....
Clay products	.....	.....	1,127	.....
Other uses	.....	.....	1,368	.....
Total	.....	.....	26,782	.....

Quebec

Broughton Soapstone and Quarry Company, Limited continued to produce ground talc, sawn soapstone blocks, bricks and crayons, from three quarries in the vicinity of Broughton Station. Baker Mining and Milling Company,

Limited, with mine and mill near Highwater, produced ground talc from underground mining operations. Eastern Townships talc is adapted for use as filler material where colour is of secondary importance.

Ontario

Canada Talc, Limited, Madoc, the only other Canadian producer, continued production of prime white talc suitable for ceramic and general filler use.

British Columbia

Ground talc is produced by Geo. W. Richmond and Company for the local roofing trade from imported materials.

Uses

Specifications for talc and related minerals vary widely according to use, but, in general the lower grades are used in the roofing, rubber, and insecticide trades and as a dusting agent for wire nails, etc. For paint use, the principal factors are colour, particle shape, packing index, and oil absorption. The ceramic trade demands prime white colour; the paper industry, high brightness, high retention, low abrasiveness, and freedom from chemically active substances; and the lubricant trade, freedom from grit, high slip, and softness. For the cosmetic and pharmaceutical trade only talc of extreme purity is acceptable.

Steatite, the massive, compact form of talc, is used in making ceramic insulators. High-grade talc is used for talcum powder, soaps, and other toilet and pharmaceutical preparations.

Miscellaneous uses of talc include cleansers, plaster, polishes, and plastics. Talc is used also as a filler for pipeline enamel and other asphaltic coatings.

Purchasers of crude talc for grinding purposes include Industrial Fillers, Limited, Montreal, and George W. Richmond and Company, Vancouver.

Prices and Tariffs

Final 1949 quotations on talc as given in Canadian Chemistry and Process Industries remained unchanged from 1948 at $9.50 to $44 per short ton f.o.b. Madoc, Ontario, according to size and quality. Imported Italian sold from 4 to 5 cents per pound, whereas finely ground, off-colour material for filler use, sold up to $10.50 per ton delivered Eastern centres. The average declared unit value of exports for 1949 was $12.92 per short ton, a 4 per cent increase over the corresponding figure for 1948.

Talc, steatite, and soapstone entering the United States from Canada is dutiable at the following rates: ground, value not over $12.50 per ton, 10 per cent ad valorem; over $12.50 per ton, 35 per cent; crude $2.50 per short ton; and sawn soapstone in the form of blocks, bricks, and crayons, one cent per pound.

Talc enters Canada under the British Preferential Tariff at 15 per cent ad valorem. Imports from the United States are dutiable at 20 per cent.

PYROPHYLLITE

Pyrophyllite, a mineral similar to talc but with alumina substituted for magnesia, is adaptable generally to the same uses as talc. Pyrophyllite is produced intermittently in Newfoundland from a large deposit near Manuels, Conception Bay.

WHITING SUBSTITUTE

Whiting substitute, often referred to in Canada as domestic whiting and as marble flour, is produced by pulverizing white limestone, marble, calcite, or marl. Production in 1949 came entirely from marble and limestone. Marl, however, formed a source of supply for two Ontario plants for several years.

Whiting substitute is prepared by pulverizing calcium carbonate in the form of either white marble or white limestone to a fineness of from 200 to 400 mesh. A by-product precipitated chalk prepared by recovery of residues from the manufacture of caustic soda by the lime-soda ash process is classed as a whiting substitute in some areas outside Canada. Its use, however, is restricted, as it usually contains free alkali.

Production and Trade

Production in 1948 and 1949 is shown in the following table:

Stone processed for whiting	1949		1948	
	Short tons	$	Short tons	$
Marble	8,130	97,560	9,995	120,440
Limestone	7,527	38,603	7,997	51,469
Total	15,657	136,163	17,992	171,909

Canadian producers of whiting comprise: Industrial Fillers, Limited, Montreal, Quebec; Marlhill Mines, Limited, Thorold, Ontario; Gypsum Lime and Alabastine (Canada), Limited, Winnipeg, Manitoba; and Beale Quarries, Limited, Vananda, Texada Island, British Columbia.

Little or no whiting substitute is exported.

Although whiting substitute is used for a variety of purposes, imported chalk whitening is necessary for certain uses. Imports of whiting, gilders whiting, Paris white, and crude and prepared chalk amounted to $436,006 in 1949, compared with $403,637 in 1948. Imports from United States totalled $359,196; from the United Kingdom, $55,461; and from other European countries, $21,349.

Uses, Specifications, and Prices

New uses are increasing the demand for mineral fillers. Whiting substitute is used in making linoleum, oil cloth, moulded articles, cleaning compounds, polish, and certain rubber products; in putty and explosives; and as a filler in newsprint and other paper. Calcite of high purity and pulverized to minus 325 mesh is used as an extender in the paint industry. This form of whiting is characterized by its superior whiteness.

Marl as raw material used in making whiting substitute must be free from grit and clayey materials, have a low content of organic material, and should be white. Organic material renders whiting from this source unsuitable as a filler in putty and paint. Apart from the much greater oil-absorptive capacity of whiting substitute made from marl, the physical characteristics of both types are generally the same.

III. FUELS

COAL

Coal production in Canada in 1949 reached a new peak of 19,120,046 short tons, an increase of 3·6 per cent over that of 1948, and of 8·7 per cent over the 1940-48 average. Alberta contributed 45 per cent of the output and Nova Scotia, 32 per cent, the remainder being from British Columbia, Saskatchewan, and New Brunswick. Canadian consumption of coal was 39,938,000 tons, approximately 7,400,000 tons less than in 1948. About 55 per cent of this was imported, compared with 64 per cent in 1948.

Developments

The development of new and improved types of cutters, loaders, and conveyers to suit varying conditions continued to speed up the mechanization of coal mines. Experimental work in Nova Scotia on the application of a "continuous miner" to longwall mining proceeded satisfactorily. The continuous miner, as designed for this type of operation, cuts or rips the coal from the face without the aid of explosives, and takes it to conveyers that load the coal into cars. This activity in mechanized mining coupled with increased competition with imported fuels has made it necessary to extend and improve coal preparation facilities in order to produce better quality coals. Thus, improvements to coal washeries were made or planned; cleaning plants were established; and improved sizing equipment was installed at mines in all coal-producing provinces where no cleaning equipment was used in the past.

Strip coal mining is conducted in all coal-producing provinces, the total strip-mined coal in 1949 amounting to 5,414,634 tons or 28·3 per cent of the Canadian output of coal in that year, compared with 4,945,838 tons or 27 per cent of the output in 1948. In Saskatchewan about 98 per cent of the coal mined was produced by strip methods.

A plant was completed for the production of briquettes from medium volatile coal in the Alberta Mountain Park area, as was a smaller plant for semi-anthracite in the Cascade area. Experimental work was conducted at the Mines Branch, Ottawa, on development of a process for briquetting wet coal fines for the production of railway fuel and such briquettes may possibly be produced commercially in the near future. Further interest was shown in briquetting mixtures of imported anthracite fines and Canadian coking coals, and mixtures of subbituminous non-coking coals with bituminous coking coal.

Use of the process developed in the Mines Branch for the improvement of blower coal by chemical treatment was continued in Quebec and Ontario, but to a decreasing extent owing to increased imports of Welsh anthracite and continued replacements with oil-burning equipment.

Oil developments in Alberta did not materially affect sales of coal in 1949 as is evident from the fact that a total of 493,700 tons of prepared stoker coal was shipped from Alberta, compared with 516,402 tons in 1948. Although shipments to Saskatchewan and within Alberta decreased by only one-half per cent, shipments to other provinces increased by about 26 per cent. Consumption of prepared Alberta stoker coal by the railways decreased by about 67 per cent. Shipments of prepared stoker coal from Saskatchewan mines increased from 629,710 tons in 1948 to 757,267 tons in 1949, and the shipment of prepared stoker sizes from mines in British Columbia remained unchanged at about 43,500 tons.

Production of Coal by Provinces[1]

(Tons of 2,000 pounds)

Province	1949				1948			
	Bituminous[2]	Sub-bituminous	Lignite	Total	Bituminous	Sub-bituminous	Lignite	Total
Nova Scotia	6,181,779	.....	.....	6,181,779	6,430,991	.....	.....	6,430,991
New Brunswick	540,806	.....	.....	540,806	522,136	.....	.....	522,136
Saskatchewan	.....	.....	1,870,487	1,870,487	.....	.....	1,589,172	1,589,172
Alberta	5,493,962[2]	3,122,893	.....	8,616,855	4,934,458[2]	3,188,797	.....	8,123,255
British Columbia	1,906,963	.....	.....	1,906,963	1,780,334	.....	.....	1,780,334
Yukon	3,156	.....	.....	3,156	3,801	.....	.....	3,801
Tons	14,126,666	3,122,893	1,870,487	19,120,046	13,671,720	3,188,797	1,589,172	18,449,689
Canada, Total ..... $	91,710,666	15,670,525	3,533,930	110,915,121	87,926,877	15,736,826	3,020,305	106,684,008

[1] Coals classed according to A.S.T.M Classification of Coal by Rank—A.S.T.M. Designation: D388-38.
[2] Includes semi-anthracites from the Cascade area. (1948 production: 337,503 tons; 1949 production 304,743 tons).

Imports of Coal for Consumption

(Tons of 2,000 pounds)

Country of origin	1949			1948		
	Anthracite	Bituminous	Total	Anthracite	Bituminous	Total
From:						
United States..	3,618,490	18,072,272*	21,690,762	5,082,483	25,528,028	30,610,511
United Kingdom....	326,645	4,812	331,457	162,354	196	162,550
Other countries....	.....	17	17	.....	14	14
Total.....	3,945,135	18,077,101	22,022,236	5,244,837	25,528,238	30,773,075

* Includes some briquettes and lignite.

Exports of Coal

(Tons of 2,000 pounds)

Destination	1949	1948
Newfoundland	43,111*	402,777
St. Pierre and Miquelon	9,162	13,636
United States	319,360	324,109
Argentina	.....	51,527
Japan	1,570	481,102
Brazil	38,958	.....
Fiji	18,194	.....
Other countries	1,688	111
Total	432,043	1,273,262

* For first three months only.

Production in Nova Scotia was 0·4 per cent higher than the 1940-1948 average. Medium- and high-volatile bituminous coking coals are produced in the Sydney, Cumberland, and Pictou areas, and some non-coking bituminous coal is mined in the Inverness area. The production from Nova Scotia and New Brunswick is used mainly to supply the requirements of the railways of the area, the steel and paper industries, the local domestic market, and for the production of electric power. During 1949 shipments of coal from Nova Scotia to various centres in central Canada were resumed and on an increasing scale.

Production in New Brunswick in 1949 (of which 57 per cent was strip-mined) was 27 per cent higher than the 1940-1948 average.

In Ontario, lignite of a lower grade than that found in Saskatchewan occurs in the Onakawana area, but there has been no commercial production. Approximately 187,000 tons of Alberta coal was shipped into Ontario compared with 282,600 tons in 1948. Of this, about 86,000 tons were bituminous, 94,000 tons subbituminous, and 7,000 tons semi-anthracitic coal. Most of the shipments were non-coking coals and were largely for domestic use.

Production in Saskatchewan was a record and was about 13 per cent higher than the 1940-1948 average. Only lignite is produced, most of the production being from the Bienfait division of the Souris area, the other main producing fields being the Estevan and Roche Percée divisions of that area.

Alberta produces almost all ranks of coal, including a small tonnage of semi-anthracite. 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 non-coking coal is produced. The coal in the Drumheller, Edmonton, Brooks, Camrose, Castor, and Carbon area is classed as subbituminous, and that in the Tofield, Redcliff, and several other areas is on the border of subbituminous and lignite. The Cascade area was the only field that produced semi-anthracite in 1949. Of the total production about 64 per cent was bituminous, and 36 per cent subbituminous and lignite, but mainly the former. The total production was about 6 per cent higher than the 1940-1948 average. Exclusive of 1946, 1949 saw the highest coal production in the history of coal mining in the province. About 35 per cent of the bituminous coal, and about 33 per cent of the subbituminous coal was strip-mined, that is, a total of 34 per cent of all the coal mined in the province.

Production in British Columbia was 7 per cent higher than in 1948, and was 0·3 per cent higher than the 1940-1948 average. Bituminous coking coal ranging from high- to low-volatile is mined on Vancouver Island, and in the Crowsnest, Telkwa, and Nicola areas on the mainland. Lesser quantities of subbituminous coal are produced mainly in the Princeton field. About 17 per cent of all the coal produced in the province was strip-mined.

Consumption of briquettes in Canada increased from 601,208 in 1948 to 671,927 tons in 1949. These consisted of: 46,320 tons made from carbonized Saskatchewan lignite; 460,644 tons made from low-volatile bituminous and semi-anthracitic coals from the Nordegg and Cascade areas in Alberta, and from medium-volatile bituminous coal from the Crowsnest area of Alberta; and 164,963 tons imported from the United States and prepared from low-volatile bituminous coals and anthracite, alone, and mixed.

COKE

Production of coke from bituminous coal in 1949 was 3,864,603 tons compared with 3,945,776 tons in 1948. Coal processed for the manufacture of coke amounted to 5,174,146 tons, of which 1,290,749 tons was of Canadian origin and 3,883,397 tons was imported from United States. Petroleum coke produced at the refineries amounted to 117,369 tons compared with 87,438 tons in 1948.

Imports of coke totalled 716,160 tons, a decrease of over 135,000 tons from 1948, whereas exports increased from 199,825 tons in 1948 to 294,753 tons in 1949.

Most of the coke produced for the Canadian market is obtained from standard by-product coke ovens which process coal in large tonnages for use in the production of steel and non-ferrous metals or for domestic use. The retort coke, which is produced as a by-product of the gas industry, forms a small part of the total coke production and is used mainly to make carburetted water gas for distribution as city gas. The residual stocks of retort coke of about 20,000 tons a year are sold as domestic coke. Manufactured gas for large urban areas comes mainly from by-product coke ovens, which also produce domestic coke prepared and sized in accordance with market requirements.

The increasing demand for metallurgical coke has resulted in the construction of new batteries of coke ovens in Nova Scotia and British Columbia

and in plans for the expansion of other coke oven plants. The new battery of ovens of the Dominion Steel and Coal Corporation, Limited, at Sydney, Nova Scotia, were in full operation for most of the year. The 17 new ovens installed in the plant of Montreal Coke and Manufacturing Company, Limited, are being used for the production of foundry coke.

Production and Trade

	1949		1948	
	Short tons	$	Short tons	$
Production, from bituminous coal[1]				
Ontario	2,467,081	34,228,730	2,621,405	36,959,687
Nova Scotia, New Brunswick, and Quebec	1,060,007	15,332,632	1,058,351	14,640,521
Manitoba, Saskatchewan, Alberta, and British Columbia	337,515	3,805,603	266,020	3,063,243
Total	3,864,603	53,366,965	3,945,776	54,663,451
Production of pitch coke	16,975	329,163	17,600	313,677
Bituminous coal used to make coke				
Imported	3,883,397	39,224,125	4,077,123	40,818,855
Canadian	1,290,749	9,510,721	1,158,803	8,285,164
Total	5,174,146	48,734,846	5,235,926	49,104,019
Production of petroleum coke	117,369	1,118,234	87,438	1,101,832
Imports, all types, from United States	716,160	12,301,451	851,791	14,584,678
Exports, all types				
To: United States	290,399	4,542,429	189,989	2,882,148
Other countries	4,354	191,316	9,836	186,028
Total	294,753	4,733,745	199,825	3,068,176

[1] Excluding pitch coke.

Coke is produced from the several types of carbonization equipment in use throughout Canada. These include seven by-product coke oven plants, two beehive plants, one Curran-Knowles installation, seven continuous vertical retort plants, and eight installations of horizontal "D" retorts.

Approximately 80 per cent of the coal used in the production of coke in Canada is processed by five companies at plants in eastern Canada, namely: Dominion Steel and Coal Corporation at Sydney, Nova Scotia, with an annual rated capacity of 813,000 tons of coal; Montreal Coke and Manufacturing Company with a plant at Ville La Salle in Quebec with an annual rated capacity of 656,000 tons of coal, which normally produces domestic coke and also supplies Montreal with gas; Algoma Steel Corporation, Limited, with a metallurgical coke plant at Sault Ste. Marie, Ontario, which has an annual rated capacity of 1,761,000 tons of coal; Hamilton By-Product Coke Ovens, Limited, at Hamilton, Ontario, with a rated capacity of 415,000 tons of coal a year; and the coke ovens of Steel Company of Canada, Limited, at Hamilton, Ontario, with a rated capacity of 641,000 tons of coal a year.

The manufacture of beehive coke was continued by two companies in western Canada, namely: International Coal and Coke Company, Limited, and The Crow's Nest Pass Coal Company, Limited, in their respective plants at Coleman, Alberta, and at Michel, British Columbia. This production is approximately 4 per cent of the coke marketed in Canada.

NATURAL GAS

Developments in natural gas in Alberta in 1949 closely paralleled those in oil and estimates made by the Department of Mines and Technical Surveys placed reserves at about 7 trillion cubic feet at the end of the year. An outstanding completion in 1949 was the Walter Marr well, southeast of Pincher Creek, the largest gas well ever drilled in Canada. In addition, a large number of gas wells several of which had flows between 20,000 and 30,000 M cubic feet a day were discovered during oil-drilling operations. The discoveries, however, were either abandoned or capped until such time as a market was available, the market in the immediate vicinity of the gas fields being fully supplied. There was thus no incentive to drill for gas only. However, the number of discoveries made incidental to the search for oil was indicative of the large reserves that may be expected when exploration is directed towards the discovery of gas.

The question of gas export from Alberta has been under discussion for the past two years. Late in 1948 the Dinning Commission was appointed to investigate the proven and potential gas reserves of Alberta, the present consumption of gas, and future requirements. Two companies who plan to export gas from Alberta received incorporation charters from the Federal Government.

Production

Natural gas production in Canada in 1949 totalled 60,457,177 M cubic feet, of which Alberta accounted for 51,179,779 M cubic feet. Production increased in Ontario and Saskatchewan but decreased in New Brunswick and Northwest Territories. Production by provinces is shown in the following table.

Provinces and Fields	1949		1948	
	M cu. ft.	$	M cu. ft.	$
Alberta				
Turner Valley	.....	.....	28,410,306	.....
Viking-Kinsella	.....	.....	12,736,227	.....
Medicine Hat	.....	.....	3,544,804	.....
Redcliff	.....	.....	1,418,255	.....
Leduc	.....	.....	907,395	.....
Other fields	.....	.....	1,948,230	.....
Total	51,179,779	2,558,989*	48,965,217	8,324,087
Ontario				
Tilbury, Romney, Raleigh	.....	.....	2,210,665	.....
Lincoln, Haldimand, Wentworth	.....	.....	1,772,101	.....
Zone	.....	.....	1,488,010	.....
Other fields	.....	.....	3,119,653	.....
Total	8,024,213	8,826,634	8,590,429	6,958,247
Saskatchewan	812,916	81,292	477,271	47,727
New Brunswick				
Stoney Creek	375,035	146,864	420,352	287,446
Northwest Territories	65,234	6,523	150,000	15,000
Canada, Total	60,457,177	11,620,302	58,603,269	15,632,507

* Value of Alberta production for 1948 and earlier years was calculated from the average price paid by absorption plants, distributors, and utilities' consumers. The value of production for 1949 is based on a well-head valuation of 5 cents per M cubic feet.

Alberta

Almost 50 per cent of the production of natural gas came from Turner Valley, which is still the major source of supply for Calgary and other towns on the Calgary pipeline which use natural gas as their chief fuel. Turner Valley has produced gas since 1922 from a foothills-type structure.

A structure in the foothills similar to Turner Valley was discovered in 1948 by Canadian Gulf Oil Company's Pincher Creek No. 1 well, southwest of Pincher Creek in the Crowsnest Pass area. Two follow-up wells were drilled, of which one was a dry hole. The other, the Canadian Gulf Walter Marr No. 1, was drilled to a depth of 12,768 feet. This well had a calculated initial flow of gas of 83,000 M cubic feet a day with a distillate content of 3,000 barrels a day of light crude (52 degrees A.P.I.) from limestone of Mississippian age. The Walter Marr well is about 7 miles northwest of Pincher Creek discovery well, indicating the possibility of an enormous gas supply in this area.

In the plains of Alberta the large number of gas wells discovered in 1949 were made mostly in sands of Lower Cretaceous and in the Viking sand, which is the producing sand in the large Viking-Kinsella gas field. Two discoveries were made in the Viking sand a short distance outside the limits of the Viking-Kinsella field. In east central Alberta another large discovery from several Lower Cretaceous sands was made near Ashmont. One of the wells in the Battleview area, south of the Vermilion field, was reconditioned in the Colony sand at the top of the Lower Cretaceous and obtained gas at the rate of 68,000 M cubic feet a day. Two potential gas wells were completed in the vicinity of Castor. In the Hanna area, where gas had already been found, two additional wells made large discoveries of gas. Several wells near Stettler, including some of those completed as oil wells had large flows of gas.

In the area north of Edmonton, where drilling has been concentrated, a number of discoveries were made which gave flows up to 20,000 M cubic feet a day. Among these were discoveries near Picardville, Calahoo, Lily, Cardiff, and Boyle. Although isolated discoveries, they indicate the presence of gas sands and possible large reserves in this area. Farther north, near Lac la Biche, two wells encountered large gas flows in the Lower Cretaceous which caused the wells to "blow out". Gas was also discovered in the Devonian in one of these wells. Further additions were made to the Pouce Coupe gas field on the Alberta-British Columbia border, where four wells have been brought into production during the past 2 years. On test, Peace River No. 8 had interesting showings in Triassic beds.

In most oil fields natural gas is produced with the oil. During 1949 the Leduc field produced 5,323,020 M cubic feet of gas, mostly from the D3 zone. To conserve this gas Imperial Oil, Limited commenced construction of gas-gathering lines, a compressor plant, and processing plant to recover gasoline, propane, and butane. The cost of the plant, which will have a capacity of about 24,000 M cubic feet of gas a day, was estimated at $6,500,000. It is expected that 1¼ gallons per 1,000 cubic feet of gas will be recovered, of which half will be gasoline, half propane and butane. The gas after treatment will be available for sale or for return to the reservoir to maintain pressure. It is doubtful whether such methods will be applicable to the Redwater or Golden Spike fields, where the gas-oil ratio is much lower.

Ontario

Production in 1949 decreased from 8,590,429 M cubic feet in 1948 to 8,024,213 M, and was insufficient to meet the demand. Some gas was imported from the United States during the summer months and stored underground for use during peak winter periods and it was hoped that the quantity imported

would be increased materially. In addition, about 9 miles of pipeline was built connecting the Kimball field with the Dawn storage pool, so that surplus gas produced during the off-peak season would be made available for winter use.

Approximately three hundred and sixty-two wells were completed in Ontario during 1949. Of these, thirteen were oil wells, one hundred and fifty-seven were gas wells, and one hundred and ninety-two were dry holes. Five small gas pools were discovered, three in the Mosa field, one in the Camden field, and one near Payne, a short distance northwest of the Kimball field. Imperial-Payne was the most important single well with an initial open-flow of 40,000 M cubic feet a day. This was the largest gas well so far obtained in Ontario and production was thought to be from reef formation in rocks of Silurian age.

In an effort to divert a maximum volume of gas from domestic to industrial use the Ontario Fuel Controller issued an order lifting all restrictions on natural gas burners ordered taken out in 1942. About ten thousand domestic consumers who were required to convert from natural gas were thus allowed to re-install gas burners although new consumers were not permitted to install gas appliances. The time required to place the ten thousand burners back in service was estimated at approximately 2 years.

PEAT

Production of peat moss in Canada in 1949 amounted to 80,249 short tons, a decrease of 11 per cent in output, compared with 1948. Forty companies contributed to the output, over 80 per cent of which came from two areas; the Fraser River delta in British Columbia, and the Rivière du Loup area, Quebec. The reduced production was due largely to the heavy rains in the Fraser River delta in August 1948, which prevented the harvesting of the 1948 output.

Most of the production is exported to United States for use as horticultural moss, and as poultry and stable litter.

Production

Province	1949			1948		
	Producers	Short tons	$	Producers	Short tons	$
British Columbia	16	44,581	1,508,093	16	51,496	1,928,651
Quebec	16	21,168	445,636	16	24,622	434,125
Ontario	4	7,381	210,008	4	7,261	189,447
New Brunswick	3	5,752	156,400	3	4,482	136,001
Manitoba	1	1,367	56,712	1	1,939	79,654
Total	40	80,249	2,376,849	40	89,800	2,767,878

Peat moss is the dead fibrous moss that has been excavated from peat bogs, dried, shredded, and pressed into bales or smaller packages. Its value is dependent upon its highly absorptive nature, and its main uses are for stable bedding, poultry litter, and for soil conditioning.

Peat is widely distributed throughout Canada. In its natural state it consists of about 90 per cent water and 10 per cent vegetable matter in various stages of decomposition and disintegration. It generally occurs in two distinct forms, slightly humified sphagnum or moss peat, and well humified grass or sedge peat, better known as fuel peat. Small amounts of peat fuel have been produced intermittently in Ontario and Quebec. In 1949 there was a small output at Gads Hill Station near Stratford, Ontario.

Peat for Agricultural Use

A co-operative investigation was started in 1947 by the Department of Agriculture, and the former Department of Mines and Resources (now the Department of Mines and Technical Surveys) Ottawa, to test the value of humified peat as a source of organic matter for depleted and exhausted soils. In November 1948, about 3,000 tons of humified peat was excavated from a bog near Farnham, Quebec, and trucked to eight selected orchards in the Eastern Townships in that province. After being allowed to dry and disintegrate throughout the winter and spring of 1949, this material, alone, and mixed with various fertilizers, was added to certain selected plots to effect a comparison of the yield from treated and untreated trees. Results to date in this long-term investigation indicate that soil to which humified peat has been added shows improved growth.

Price

The price of peat moss varied from $18 to $32 a ton in 1949 according to location. The average price for the Canadian production (less containers) was approximately $28 a ton.

CRUDE PETROLEUM

Developments in Alberta in 1949 brought further significant changes to Canada's oil picture. Canadian production of crude petroleum was 73 per cent higher than in 1948, with a value increase of 63 per cent. Production in Alberta was almost double that of 1948 and at the end of 1949 was at a rate of approximately 60,000 barrels daily with an estimated potential output of approximately 125,000 barrels. Prairie requirements were met and surpassed. When the construction of the proposed pipeline from the Edmonton area to Superior, Wisconsin, is completed, supplies of oil will be made available to eastern Canada. Refining capacity in western Canada was being expanded to a total of 80,000 barrels daily and the expansion program included the construction of a number of units and of several new refineries. In 1949 refinery capacity was increased by an estimated 11 per cent.

Extensive exploratory drilling in Alberta resulted in numerous important discoveries, the two outstanding being the Golden Spike field, 20 miles southwest of Edmonton, and the Normandville well, 300 miles to the northwest, which opened up wide possibilities of future discoveries in the extensive areas northward from Peace River. The continued success achieved in oil-drilling operations raised the proven reserves of petroleum to more than 1,000,000,000 barrels valued at approximately $3,000,000,000 at the well head.

Production of oil increased in Ontario but decreased in New Brunswick, Saskatchewan, and Northwest Territories.

New Brunswick

Two exploratory wells were being drilled at the end of 1949.

Quebec

The search for oil in Gaspe continued and three wells were drilled.

Ontario

Production increased 84,000 barrels over the 1948 output owing to a further development of the Becher field near Sarnia by Imperial Oil, Limited. This field was discovered in 1946. With a present daily production exceeding 550 barrels it accounts for more than one-half of Ontario's total output. Production of oil continues to come from the old shallow fields such as Oil Springs, Petrolia, and Thamesville-Bothwell. No new oil pools were discovered during 1949.

Production of Crude Petroleum in Canada

(In barrels of 35 imperial gallons)

Field	1949	1948
Alberta		
Leduc	9,688,784	4,657,371
Redwater	4,793,491	36,875
Turner Valley:		
Crude oil	3,826,543	4,432,084
Natural gasoline	477,446	468,655
Lloydminster	716,941	648,055
Taber	150,746	201,527
Conrad	139,728	179,627
Princess	121,227	186,393
Vermilion	86,933	112,331
Golden Spike	85,081	.....
Joseph Lake	35,858	.....
Whitemud	26,506	.....
Stettler	15,725	.....
Normandville	5,891	.....
Miscellaneous	75,492	50,665
Alberta total	20,246,392	10,973,583
Saskatchewan (Lloydminster)	782,188	849,166
Ontario	260,670	176,989
Northwest Territories	155,528	350,541
New Brunswick	19,544	21,372
Total (bbl.)	21,464,322	12,371,651
Total value $	61,590,000	37,693,000

Alberta

The great increase in yield came from the Leduc and Redwater fields now recognized to have been major discoveries for the years 1947 and 1948, respectively, for the North American Continent. When Prairie requirements were met in mid-1949, prorationing was instituted pending the construction of the proposed 1,150-mile pipeline from Edmonton to Superior, Wisconsin, by Interprovincial Pipe Line Company Limited. From Superior the oil will be taken by lake tankers to the head of the Great Lakes for delivery to eastern Canadian refineries, particularly to Sarnia and Petrolia in Ontario.

The cost is estimated at $90,000,000. The first section from Edmonton to Regina is expected to be in operation by the autumn of 1950 and to have an initial capacity of 95,000 barrels a day. Completion of the line is expected in 1951. It is estimated that 52,000 barrels a day will be shipped by tanker to eastern Canadian refineries from Superior.

Redwater. The Redwater field showed a greater expansion in 1949 than did Leduc and throughout the year produced at the average rate of 13,000 barrels a day. In the month of July, production averaged 21,000 barrels a day. Only three wells were producing at the beginning of 1949. However, by the end of the year two hundred and ninety wells had been drilled in an area of about 14 miles long by 4 miles wide and the field was still not delimited.

Leduc. This field expanded steadily with the drilling of one hundred and seventy-eight wells, which brought the field total to three hundred and fifty-two. Important developments included an extension of the D2 producing zone to the southwest of previous production and the establishment of a connection with the D3 reef zones in the Woodbend and Leduc areas. Imperial Oil, Limited commenced construction of gas-gathering lines, a compressor plant, and a processing plant to recover gasoline, propane, and butane from the gas produced with the oil.

Lloydminster. Production of heavy crude oil from the Lloydminster area was greatly curtailed and amounted to only about 30 per cent of potential capacity. New refinery units equipped to put out a wider range of products were under construction in Lloydminster and Calgary and will provide a larger market for the oil. An addition to this heavy crude area was made in the vicinity of Maidstone, Saskatchewan, east of Lloydminster.

Discoveries

The Golden Spike and Normandville discoveries proved to be the two outstanding events in petroleum exploration in 1949. Oil in the Golden Spike field was discovered in March 1949, 20 miles southwest of Edmonton and 4 miles west of the Woodbend field found in 1948. The first well, Imperial Schoepp No. 1, at Golden Spike drilled the exceptional thickness of 544 feet of oil-saturated pay zone and was completed in April with a rated capacity of 10,000 barrels a day. A second well completed in December has an oil zone 560 feet thick. The size of the field is not yet known.

The Normandville well was discovered in September 1949, 30 miles south of Peace River town and 300 miles northwest of Edmonton, at a depth of 6,730 feet in a 25-foot saturated limestone zone. On restricted test the well flowed 189 barrels of 39 gravity oil in 7½ hours. This discovery was of particular significance in that it opened up the possibility of Devonian oil production in the Peace River district and in the extensive areas to the north which are underlain by Upper Devonian sediments. As a result millions of acres have already been acquired by the oil companies under exploratory permit from the Alberta Government.

There were a number of other discoveries of significance, brief accounts of which follow:

Bon Accord, 18 miles north of Edmonton and 12 miles southwest of Redwater, was indicated as an oil field in February 1949, by a well that was completed at a depth of 4,630 feet. It was plugged back to the productive zone and after acidization on production test it made 165 barrels of oil in 4½ hours.

A well drilled near Barrhead, 55 miles northwest of Edmonton, was completed at a depth of 6,414 feet and plugged back to 4,117 feet. Oil occurs in the Mississippian limestone of similar age to the productive limestone of Turner Valley. The well on test produced 36 barrels an hour of 23 gravity oil which is heavier than the oil found at Leduc. A subsequent well, O'Meara Barrhead, was completed in December 1949, with an oil flow at the rate of 30 barrels an hour. It also had a gas flow at the rate of about 2 to 3 million cubic feet a day. Some water occurs with the oil.

At Joseph Lake, 18 miles southeast of Edmonton, oil was discovered in April by Superior Oils in a sand the equivalent of the producing gas sand of the great Viking-Kinsella gas field, 100 miles east of Edmonton. The first well at Joseph Lake had a rated oil capacity of 528 barrels a day from a depth of 3,262 feet.

Oil in the Whitemud field, 7 miles east of Woodbend field and 6 miles south of Edmonton, was discovered by Imperial Oil, Limited in April 1949. The

well was drilled to a depth of 6,259 feet and was plugged back to a sand of the Lower Cretaceous formation at a depth of 4,055 to 4,064 feet. On test the well yielded 177 barrels of oil in 18 hours.

In the Stettler field, 100 miles northeast of Calgary and about the same distance southeast of Edmonton, the discovery well, Ellis No. 1, was completed by Canadian Gulf Company, Limited in June 1949. There are two oil zones in the Devonian similar to those at Leduc and with a combined thickness of 100 feet. The well on test had a rated capacity of 3,000 barrels a day from a total depth of 5,385 feet.

The Campbell well, 8 miles northwest of Edmonton, was completed in August 1949, by Redwater Leaseholds Limited at a depth of 5,008 feet but plugged back to a Lower Cretaceous oil sand at 4,356 feet. The well was put on the pump and produced as much as 80 barrels a day of 35 gravity oil.

A well at Volmer, 15 miles northwest of Edmonton, was completed in September by R. W. Development Company as a follow-up of a promising but unproductive well drilled previously by Imperial Oil, Limited. The oil comes from a Lower Cretaceous sand at a depth of 3,670 to 3,676 feet and the well is pumped.

The Simmons extension, 3 miles south of the south end of the Redwater field and on the south side of North Saskatchewan River, was found by a well drilled by Imperial Oil, Limited. In the Simmons well there is 170 feet of saturated oil zone above the water line which was found in the drill stem test between depths of 3,272 to 3,282 feet. On test the well yielded at the rate of 1,557 barrels a day.

The Excelsior field, 12 miles north of Edmonton, was discovered by a well completed in November 1949 by Imperial Oil, Limited. There are 40 feet of oil-saturated Devonian Limestones equivalent to the upper producing zone in the Leduc field. On test the well flowed at the rate of 792 barrels a day.