Canada

The Canadian Mineral Industry 1953

Reviews by the Staff of the Mines Branch

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* Geological Survey of Canada

** Corundum, emery, garnet, grindstones, pumice, and grinding pebbles.

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PREFACE

This volume presents a series of reviews of the metals and minerals produced in Canada on a commercial scale during 1954, as well as certain others which, while not produced in Canada, are nevertheless important in the national economy.

Separates of these reviews, incorporating preliminary figures of production, consumption, etc., were issued during the early months of 1954. In the present volume, all figures are the final ones for the year.

Statistical data, except as noted, are from the Dominion Bureau of Statistics. Market quotations are mainly taken from standard marketing reports published in London, Montreal, and New York.

All reviews were prepared by officers of the Mines Branch, with the exception of that on uranium, which was written by Dr. A. H. Lang, of the Geological Survey of Canada.

The thanks of the Branch are due to all those who have contributed to the making of this publication, and especially to those mining operators and others connected with the industry whose co-operation throughout has been invaluable.

John Convey
Director, Mines Branch

INTRODUCTION

The Canadian mineral industry experienced its best year on record in 1953, both over-all production and value reaching new highs. The total value of $1,331,211,503 showed an increase of nearly four per cent over that of the previous year, attributable largely to an increase of $55,073,330 in the value of crude oil output. For the first time, oil led in value, replacing gold, which had headed the list for twenty-five years. Nickel was in second place, copper third, and gold fourth.

Although a decline in world prices reduced the value of mineral exports, these still accounted for nearly 30 per cent of Canada's export trade. Some uneasiness existed towards the close of the year in view of the proposal to increase United States import duties on lead and zinc.

The 32 per cent increase in crude oil production underlines the remarkable development of this part of the industry. Just prior to the Leduc discovery in 1947, domestic output was only about eight per cent of consumption, on balance: at the end of the 1953-54 fiscal year it had reached 43 per cent, despite the fact that the daily consumption rate had more than doubled. A major development in 1953 was the discovery of the Pembina field, 65 miles southwest of Edmonton, which promised to be the largest yet discovered in Canada.

The year marked the completion of two major oil transportation projects. The 718-mile Trans Mountain pipe line from Edmonton to Vancouver came into operation in October, and by the end of the year crude oil from the prairies was reaching the Sarnia, Ontario, refinery through the 643-mile extension of the Interprovincial pipe line from Superior, Wisconsin.

The most important development in connection with natural gas was the plan to build a pipe line from Alberta to Ontario and then on to Montreal. The line would be nearly 2,300 miles long, and would make gas available to a population of more than 4.5 millions.

Construction of the proposed Westcoast Transmission gas line from the Peace River area to Vancouver and the northwest United States awaited the granting of an import permit by the Federal Power Commission, Washington, D.C. Without this United States market, the line would not be economically feasible.

The coal industry, in order to meet competition from oil and gas, continued its program of improving both mining methods by increasing mechanization, and the quality of the product by modern methods of cleaning, drying, and the briquetting of fines.

Iron ore, nickel, and uranium provided the most outstanding developments in the metals group. The railroad being built from Sept Iles on the Gulf of St. Lawrence 360 miles north to the iron ore deposits of Quebec-Labrador was approaching completion and production seemed assured for midsummer, 1954. The new Lynn Lake, Manitoba, nickel operation of Sherritt Gordon Mines Limited came into operation late in 1953, and the company's Fort Saskatchewan refinery, which will produce nickel, copper, and cobalt, was expected to be in production by June 1954. The International Nickel Company of Canada Limited was rounding out a $150,000,000 program of underground development and expansion. Falconbridge Nickel Mines Limited also has been carrying out an extensive expansion program.

The main uranium development was the bringing into production of the Ace-Fay mine of the Crown-owned Eldorado Mining and Refining Limited, in the Beaverlodge area of northern Saskatchewan in April 1953, and the disclosure, by diamond drilling, of a large deposit on the property of Gunnar Mines Limited in the same general area. In Ontario, great activity developed over areas north of Lake Huron, Espanola, and Sudbury, and in the Timagami region.

In Quebec, prospecting and staking for uranium was largely confined to the extension of the Grenville geological subprovince. The Maniwaki and Fort Coulonge regions, and parts of the Abitibi, Ungava, Gaspé, and Eastern Townships regions all figured prominently in the search for uranium.

Canada was the fifth largest producer and consumer of copper in 1953, Ontario and Quebec being responsible for nearly three-quarters of the total output. During the year, International Nickel's new oxygen flash-smelting process came into operation at Copper Cliff. Towards the end of the year, Quebec's Chibougamau area entered the field, when Opemiska Copper Mines (Québec) Limited began the production of concentrates.

Although the lead output was 17 per cent higher than that of 1952, falling prices caused a 5.4 per cent drop in value. A like situation obtained in the case of zinc, and in consequence production was suspended at a number of British Columbia lea-zinc mines.

A development of considerable interest was the discovery late in the year of an important copper-zinc deposit near Manitouwadge Lake north of Lake Superior. In New Brunswick, efforts were mainly concentrated on exploration by drilling of the base metal deposits discovered in the Bathurst area late in 1952.

Gold production fell from 4,471,725 ounces in 1952 to 4,061,205 ounces in 1953. The decline was caused largely by a series of prolonged strikes at 13 producing mines in Ontario and Quebec, and the closing down of five mines in Ontario on account of depleted reserves

or high production costs was also a factor. There was little prospecting, and new developments were chiefly confined to properties adjacent to established mines. Early in October, the Federal Government announced legislation to continue the operation of the Emergency Gold Mining Assistance Act to the calendar year 1954.

Output of industrial minerals showed a substantial gain in value over 1952, asbestos being the chief contributor. Quebec continues to turn out over 95 per cent of the annual output. Ontario entered the field a few years ago, and has now been joined by British Columbia, where Cassiar Asbestos Corporation began the production of long-fibre material in July 1953.

The decline in the output of sulphur in all forms from 428,013 tons in 1952 to 349,945 tons in 1953 was attributable chiefly to a decrease in shipments of by-product pyrites by the major producers of western Quebec, as a result of prolonged strikes. The output will be substantially increased in 1954, when the new Port Robinson, Ontario, plant of Noranda Mines Limited is expected to begin turning out elemental sulphur, sulphur dioxide, and iron oxide sinter, the raw material for which will be pyrite from the company's Horne mine in Noranda, Quebec.

The general world sulphur situation improved greatly, and consumers generally were able to obtain their full requirements. With the bringing into production, late in 1953, of two new salt dome mines in Louisiana and Texas, further improvement seems assured for 1954.

METALLICS

ALUMINUM

Production of primary aluminum in Canada has been increasing steadily since 1946. The 1953 output of 548, 445 short tons was 9. 7 per cent greater than the previous record output of 499, 758 tons in 1952. Total deliveries (all forms) to the United States were increased to over 250, 000 tons--nearly double those of 1952. Great Britain was the second largest market, Canada the third, and the remaining shipments went to other nations of the free world.

The Aluminum Company of Canada, Ltd. (Alcan), Canada's only producer, has an alumina plant at Arvida and reduction plants at Arvida, Isle Maligne, Shawinigan Falls, and Beauharnois, all in the province of Quebec. Aluminum fabricating plants are located at Shawinigan Falls in Quebec and at Kingston, Toronto, and Etobicoke in Ontario. The total capacity of the reduction plants is about 550, 000 short tons of aluminum per year.

The completion of Alcan's two new hydro-electric installations on the Peribonka River in 1953 assures the full utilization of the aluminum smelting capacity in the Saguenay Valley and at Shawinigan Falls.

In British Columbia, construction of the Kitimat-Kemano project of Alcan is proceeding on schedule. On December 2, 1953, the driving of the 10-mile, 25-foot diameter tunnel to carry water through the coastal range to the Kemano powerhouse was completed. At the powerhouse within the base of the mountain, 2, 600 feet below lake level, 150, 000 H. P. turbines were being installed at the end of 1953. They will provide 450, 000 H. P., the first phase of an eventual 2, 200, 000 H. P. of installed capacity.

The smelter at Kitimat is nearing completion. The first pot lines are scheduled to commence aluminum reduction in mid - 1954. They will have an initial capacity of 91, 500 short tons of ingots annually. The plant is so designed that an additional 200, 000-ton capacity per year can be added when necessary at about one-third the cost per ton of capacity of the initial installations. Ultimate planned capacity for the smelter is 550, 000 short tons annually; such an output would increase present Canadian production by 100 per cent. It is expected that Canada's annual aluminum production will reach 600, 000 tons in 1954.

There is no bauxite, the ore of aluminum, in Canada, but owing to the proximity of low-cost power sites to water transportation, Canadian production is exceeded only by that of the United States. At present, the Canadian industry uses alumina from British Guiana bauxite for the most part, but a substantial amount of bauxite ore is also being shipped to Arvida from one of the Los Islands off French West Africa. New sources of bauxite are being developed in Jamaica, where Alumina Jamaica Limited, a subsidiary of Alcan, began shipments from its Kirkvine works in January, 1953. Expansion of the capacity of this plant from 65, 000 tons to more than 160, 000 tons annually was nearing com-

Production, Exports, and Imports, 1952-53

	1953		1952	
	Short Tons	$	Short Tons	$
Production				
Ingot	548,445		499,758	
Imports				
Bauxite				
British Guiana	2,036,159	10,782,604	2,078,223	9,713,157
Other countries	652,306	5,801,140	376,646	3,201,852
Total	2,688,465	16,583,744	2,454,869	12,915,009
Cryolite				
Greenland			2,202	361,525
Greenland, via U.S.A.	84	20,832	44	9,377
Total	84	20,832	2,246	370,902
Aluminum Products				
Semi-manufactured		4,157,969		2,820,042
Fully manufactured		12,283,851		6,403,419
Total		16,441,820		9,223,461
Exports				
Primary forms				
United States	233,468	80,288,113	116,007	37,249,238
United Kingdom	188,927	65,893,299	256,368	90,525,495
Other countries	37,297	14,384,272	40,215	14,968,732
Total	459,692	160,565,684	412,590	142,743,465
Semi-fabricated				
United States	10,836	5,569,555	9,648	4,352,618
India	2,179	1,079,138	1,620	768,351
Other countries	4,362	2,358,043	12,349	6,589,472
Total	17,377	9,006,736	23,617	11,710,441
Manufactured				
United States		2,176,012		2,686,862
Venezuela		1,232,530		2,297,510
Other countries		1,068,879		2,247,887
Total		4,477,421		7,232,259
Scrap				
United States	10,042	2,662,775	2,700	431,519
Other countries	3,412	1,143,217	793	220,247
Total	13,454	3,805,992	3,493	651,766
Domestic Consumption*	92,335		90,286	

*Producers' shipments of ingot.

pletion at the end of 1953. Shipments from this source to British Columbia will begin early in 1954, and are expected to be sufficient to supply the project at Kitimat.

WORLD PRODUCTION

Total world production of primary aluminum was estimated to be 2,644,000 short tons in 1953 compared with approximately 2,227,000 short tons in 1952. The United States and Canada, the two largest producers, accounted for about 68 per cent of the world total: Canada alone produced about 21 per cent.

USES

Among the many desirable characteristics of aluminum are its lightness, strength, corrosion-resistance, good electrical and thermal conductivity, workability, and appearance. Its most important quality is lightness. Volume for volume, aluminum weighs only about one-third as much as steel, copper, or zinc, and less than one-quarter as much as lead. With small additions of other metals its strength can be made to exceed that of mild steel. Because of these qualities, aluminum lends itself to effective and economical use in a wide variety of applications.

Aluminum is available from fabrication plants as castings, forgings, sheet, a variety of rolled and extruded shapes, tubes, rods, wire, foil, and powder.

PRICES

The Canadian price of aluminum ingot was 18 cents per lb. until the middle of February, 1953, and 19 cents from then until the end of the year. The price of aluminum ingot in the United States was 20 cents per lb. throughout January, 1953. It was then increased to 20 1/2 cents, where it remained until the end of July, when it was increased to 21 1/2 cents, remaining at this level until the end of the year.

ANTIMONY

No metallic antimony is produced in Canada, but antimonial lead and certain unrefined smelter products are produced by The Consolidated Mining and Smelting Company of Canada Limited at Trail, British Columbia. The total antimony content in 1953 amounted to 744 tons, compared with 1,165 tons in 1952.

The world supply of antimony in 1953 was more than adequate to meet industrial and defence requirements and the price of the metal declined from 38 cents a pound to 32 cents, according to the Engineering and Mining Journal.

Metallic antimony has not been produced in Canada since 1944, when Consolidated Mining and Smelting discontinued the operation of its refinery, which had been in use for the previous five years. For the past 10 years the company has been producing antimonial lead containing up to 25 per cent antimony from the lead concentrates from its Sullivan mine at Kimberley, British Columbia, and from lead-silver ores and concentrates containing antimony that are shipped to Trail for treatment by a number of domestic and foreign mines. The antimonial lead is recovered from the anode mud resulting from the electrolytic refining of lead bullion, which contains about 0.63 per cent antimony. In the recovery process, slags and flue dust containing a high percentage of antimony are accumulated and, since these materials cannot be readily treated at Trail, they are sold from time to time to foreign smelters.

In 1953, the principal producing countries on a mine basis were China (8,800 tons of contained antimony), Bolivia (6,376), Mexico (4,100), and Algeria (1,995). The United States is the principal consumer. In 1953 it used 14,300 tons of primary antimony, compared with 14,988 tons in 1952.

OCCURRENCES AND DEVELOPMENTS

A number of occurrences or deposits of antimony in Canada have been explored and partly developed, but results generally have not been encouraging. The more important or better known occurrences are listed below.

British Columbia

The Gray Rock lead-antimony deposit on Truax Creek, Bridge River area, was developed by underground workings during the period 1949-1952. Bralorne Mines Limited, which undertook much of this work, withdrew its interest in the property in 1953. Occurrences have been partly explored at the Stuart Lake mine, Fort St. James area, and at a property near Slocan City.

Production, Trade, and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production				
In antimonial lead	358		544	
In slag and flue dust	386		621	
Total	744	291,862	1,165	601,483
Imports				
Antimony metal				
From: United Kingdom ..	277	152,663	185	103,070
Belgium	269	107,060	271	176,358
Netherlands	154	51,915	-	-
Czechoslovakia ..	70	19,047	114	34,050
United States ...	29	14,357	244	179,313
Other countries ..	66	26,298	47	19,075
Total	865	371,340	861	511,866
Antimony oxides				
From: United Kingdom ..	37	18,256	69	43,577
United States	26	13,993	18	14,032
Other countries ..	1	524	-	-
Total	64	32,773	87	57,609
Antimony salts				
From: United States	13	15,137	14	15,788
West Germany ...	2	2,300	1	1,245
Total	15	17,437	15	17,033
Exports				
Antimony content of antimonial lead	188		412	
Consumption				
Antimony metal [a]	859		725	
Antimony contained in antimonial lead [b]	144		201	

a. Consumers' reported consumption.
b. Producers' domestic shipments.

Ontario

Antimony occurs in the ores of a number of gold and silver-cobalt mines, but not in sufficient amounts to make recovery worth while.

New Brunswick

At Lake George, Prince William parish, York county, quartz veins containing stibnite (antimony trisulphide) extend over a wide area, which has been developed by numerous shafts and surface workings. There was no activity in 1953.

USES AND CONSUMPTION

The metal is used chiefly to impart hardness and mechanical strength to lead. Electric storage batteries for cars and trucks, utilize large amounts of antimonial lead, the antimony content ranging from 4 to 12 per cent. It is also an important constituent in cable covering, solders, Babbitt metal, and type-metal alloys.

A new potential use for antimony has been reported in the electronics industry, where it has been shown that an aluminum-antimony alloy can be used to replace the germanium-silicon alloy currently used in the manufacture of small transistors or rectifiers for converting alternating current to direct current, and for detecting, transmitting, and amplifying radio signals.

Sulphides of antimony are used as pigments in paint and rubber manufacture. Antimony oxide is used for flame-proofing of paints, plastics, and textiles.

PRICES

The Canadian price of antimony is based on the United States price converted into Canadian funds. In the United States the price for domestic antimony, in lots of five tons or more, but less than carload lots, and boxed, was 37.93 cents a pound from January until November, when it declined to 31.97 cents a pound. The average price was 37.4 cents a pound.

The value of antimony contained in antimonial lead and unrefined smelter products produced in Canada in 1953 was estimated by the Dominion Bureau of Statistics to be 19.6 cents a pound.

ARSENIC

Production of arsenious oxide in Canada amounted to 702 tons valued at $56,150 in 1953 compared to 854 tons valued at $76,876 in 1952. Exports of refined white arsenic were 95 per cent higher than in the previous year and amounted to 288 tons valued at $24,928. Domestic consumption in 1952, the latest year for which figures are available, was 262 tons, of which 170 tons were used by the glass industry and 34 tons in the manufacture of white metal alloys.

Production, Trade, and Consumption of Arsenious Oxide

	1953		1952	
	Pounds	$	Pounds	$
Production	1,403,740	56,150	1,708,351	76,876
Exports[a]	576,500	24,928	294,800	16,906
Imports[b]	32,233	5,881	19,249	3,521
	1952		1951	
	Pounds		Pounds	
Consumption				
Glass industry	340,631		362,426	
White metal alloys	68,127		99,821	
Insecticides and miscellaneous	114,314		41,308	
Total	523,072		503,555	

a. Refined and crude white arsenic; excludes arsenic content of gold ores exported.
b. Arsenious oxide and arsenic sulphide.

CANADIAN SOURCES OF SUPPLY

O'Brien Gold Mines Limited, in western Quebec, recovers crude arsenic as a by-product in the treatment of its gold ore. The output is shipped to Deloro Smelting and Refining Company Limited, Deloro, Ontario, where it is refined into the white arsenic (As_2O_3) of commerce. Deloro, the only producer of refined white arsenic in recent years, is essentially a cobalt-silver refinery, but recovers some arsenic as a by-product in the treatment of silver-cobalt ores from northern Ontario and French Morocco, and from residues produced by Eldorado Mining and Refining Limited at Port Hope, Ontario. Roasting capacity is about 100 tons of refined white arsenic per month.

Beattie-Duquesne Mines Limited, Duparquet township, western Quebec, recovers crude arsenic from the roasting of arsenical gold ores in a Cottrell system. It stores the arsenic in crude form (about 77 per cent As_2O_3), but has not operated its refinery at Duparquet for many years.

The Bralorne, Hedley, and other mines in British Columbia ship arsenical gold concentrates to the smelter of American Smelting and Refining Company of Tacoma, Washington, but no payment is made for the contained arsenic and it is not included in Canadian production figures.

WORLD PRODUCTION

World output of arsenic is practically all obtained as a by-product from the treatment of precious and base-metal ores. United States is the leading producer and consumer of white arsenic; production ranged between 12, 795 and 18, 755 tons annually during the period 1947-1951. Other major producing countries include Mexico, Sweden, France, and West Germany. During the period 1945-51, total world production has ranged between 41, 000 tons (1946) and 56, 000 tons (1947), as reported by the Bureau of Mines, United States Department of the Interior. Small amounts are produced in a number of other countries.

USES

Most of the world production of arsenic is used in the manufacture of insecticides and weed killers; in Canada, however, it is used chiefly as a decolourizing agent in the manufacture of glass. Arsenic is also used in the manufacture of sheep dip, poisoned baits, acid-resistant copper, certain lead-base alloys, and wood preservatives: small amounts are used in pharmacy.

PRICES

Since the reduction in price of refined white arsenic from 6 1/2 cents to 5 1/2 cents a pound in August, 1952, the price of white arsenic in barrels, carload lots, has remained constant.

BISMUTH

Approximately 36 tons of metallic bismuth was produced in Canada in 1953, about half of the production in 1952. Peak output was in 1948, when 142 tons was produced. Almost all the output of bismuth metal was shipped to domestic consumers. Exports were confined to 46, 068 pounds of bismuth contained in bismuth oxychloride.

The metal is recovered in Canada from residues accumulated from the electrolytic refining of lead by The Consolidated Mining and Smelting Company of Canada Limited, Trail, British Columbia.

Bismuth oxychloride was produced by Molybia Corporation Limited from the LaCorne mine near Val d'Or, Quebec, which the company operated under a lease from the owner, Molybdenite Corporation of Canada Limited, from 1951 until June, 1953. The metal was recovered as a by-product in the purification of molybdenite concentrate by leaching with hydrochloric acid. The lessee ceased operations in June, 1953, because of the exhaustion of developed ore. Molybdenite Corporation then commenced a program of expansion, including the deepening of the shaft and the establishment of two new underground levels, as well as the remodelling and enlarging of the mill from a capacity of 250 tons to 500 tons a day. Two furnaces for the production of metallic bismuth were installed. Production was resumed in March, 1954.

In order to carry out the above program, the company obtained funds from the United States Export-Import Bank and negotiated a contract with the Defense Materials Procurement Agency, Washington, D.C., whereby the United States has agreed to purchase 3,000 tons of molybdenite and 225 tons of bismuth metal over a six-year period.

Since 1946 there has been a gradual increase in world production, which in 1953 was reported by the United States Bureau of Mines to have been about 2,090 tons. The principal producing countries were Mexico, Peru, South Korea, Yugoslavia, Bolivia, and Japan. United States production figures are not published.

Production, Trade, and Consumption

	1953		1952	
	Pounds	$	Pounds	$
Production				
British Columbia[a]	71,298	160,421	142,246	320,053
Quebec[b]	46,068	49,136	20,127	27,171
Total	117,366	209,557	162,373	347,224
Exports				
Metal	-		33,646	
Oxychloride (bismuth content)	46,068		20,127	
Total	46,068		53,773	
Consumption[c]				
Metal	67,268		106,896	

a. Refined bismuth produced.
b. Producer's shipments (bismuth content of bismuth oxychloride).
c. Producer's shipments to Canadian consumers.

CANADIAN OCCURRENCES

Bismuth has been found in association with molybdenite at a number of places in western Quebec, but not in sufficient quantities to justify recovery.

An occurrence of cosalite (lead-bismuth sulphide) in Marlow township, Frontenac county, Quebec, was investigated by Lachance Mines Limited in 1951 and 1952, but the property was reported to be idle in 1953.

USES

The metal is used to alloy with other metals such as lead, tin, zinc, etc., for purposes where a low melting point is required, such as links in sprinkler heads. A newly developed use is in the manufacture of permanent magnets having a very high energy potential. These are produced by sintering a mixture of finely pulverized bismuth and manganese in the correct proportions.

Bismuth salts are used extensively in pharmaceutical products, the main compounds being bismuth subcarbonate, bismuth subgallate, bismuth nitrate, and bismuth subsilicate. The use of bismuth for pharmaceutical purposes has, however, decreased somewhat in the past few years owing to replacements by antibiotics and kaolin-base preparations.

TARIFFS AND PRICES

There is no Canadian tariff on metallic bismuth.

United States imposes a duty of 1.875 cents a pound on bismuth metal and 35 per cent ad valorem on bismuth salts and compounds.

The Engineering and Mining Journal quoted the price of bismuth in 10-ton lots as $2.25 a pound in New York throughout the year. The Canadian price is based on the United States price.

CADMIUM

Most zinc and some lead ores contain cadmium in very small amounts; occasionally sufficient cadmium is present to be recovered profitably as a by-product. In Canada, the metal is recovered from cadmium-rich precipitates that result from the purification of the zinc

electrolyte in the electrolytic process for making refined zinc used by The Consolidated Mining and Smelting Company of Canada, Limited (Cominco) at Trail, British Columbia, and by Hudson Bay Mining and Smelting Company, Limited at Flin Flon, Manitoba. The cadmium refinery at Trail has a rated production capacity of 700 tons a year and the Flin Flon refinery 180 tons. In actual practice the output of both refineries is about half their rated capacity: the cadmium produced is of the highest purity.

Most of the output of cadmium at Trail comes from zinc concentrate produced from lead-zinc ores mined and milled at Cominco's Sullivan mine, Kimberley, British Columbia. Zinc concentrates containing cadmium were shipped to Trail from a number of other mines in 1953; the more important were Cominco's Bluebell and Tulsequah mines in British Columbia; United Keno Hill Mines Limited in the Yukon; and Canadian Exploration Limited in British Columbia.

Hudson Bay's cadmium production came from its copper-zinc mine at Flin Flon on the Manitoba-Saskatchewan boundary, and from several small subsidiary mines near Flin Flon.

A considerable amount of cadmium is contained in zinc concentrates exported from Canada. The cadmium content of these concentrates is, in most cases, not reported separately and the amount recovered therefrom by foreign plants or smelters is not known.

USES

Cadmium is used chiefly as an electro-deposited protective coating for iron and steel products. For this purpose, it is superior to zinc, as it has a higher resistance to atmospheric corrosion and, moreover, can be deposited more uniformly in the recessed portions of intricately shaped parts. In 1953, nearly 95 per cent of the total Canadian consumption was used by the electro-plating industry.

The next most important use is as a component of bearing alloys for internal combustion engines designed for use at high speeds and temperatures. The metal is also used in making low-melting-point solders and fusible alloys. Salts and compounds of cadmium are used in the manufacture of brilliant red and yellow pigments, in making photographic films, in engraving and lithographing, and in the making of vinyl plastics.

Nickel-cadmium storage batteries are in common use in Europe. They are said to have a longer life than the lead-acid type, but their use in North America has not been extensive.

PRICES

The New York price of cadmium in commercial sticks remained at $2.00 a pound throughout the year. Cadmium in special shapes

designed for platers was $2.15 a pound. The average Canadian price estimated by the Dominion Bureau of Statistics was $2.00 a pound.

The United States tariff on cadmium is 3 3/4 cents a pound.

Production, Trade, and Consumption

	1953		1952	
	Pounds	$	Pounds	$
Production, all forms				
British Columbia and Yukon	960,288	1,920,576	834,235	1,835,317
Saskatchewan and Manitoba	157,997	315,994	114,352	251,574
Total	1,118,285	2,236,570	948,587	2,086,891
Production, refined	977,226		819,822	
Exports				
To: United States	611,341	1,042,442	15,126	22,936
United Kingdom	357,562	648,217	593,906	1,447,280
Other countries	660	1,330	11,312	32,366
Total	969,563	1,691,989	620,344	1,502,582
Consumption				
Plating	226,631		224,667	
Other	12,615		7,836	
Total	239,246		232,503	
Refinery production principal countries[a]				
United States	9,682,197		8,387,824	
Canada	1,118,285		948,587	
Italy	350,363		293,443	
Australia	505,041		506,980	
United Kingdom[b]	379,555		335,081	

a. American Bureau of Metal Statistics, except for Canada.
b. United States Mineral Trade Notes.

CALCIUM

Calcium is produced in Canada by Dominion Magnesium Limited at Haley, Ontario. This company is now the world's largest producer of calcium and the only commercial source of the metal in Canada.

Until 1939, France was the chief producer of calcium metal; there was no commercial production on this continent. In that year, Electro Metallurgical Company, a unit of Union Carbide and Carbon Corporation, brought its plant into production at Sault Ste. Marie, Michigan. Canadian production by Dominion Magnesium Limited was commenced in 1945.

The metal may be made in a number of ways, but the electrolytic deposition of calcium from a molten chloride bath was the first process to be used and is the one employed by Electro Metallurgical Company. Dominion Magnesium Limited uses the distillation method, a process similar to that employed in making magnesium by the Pidgeon process. It consists in the reduction of hydrated lime and aluminum powder in high-temperature vacuum retorts. The lime is mixed with the aluminum in the required proportions and briquetted. The briquettes or pellets are charged into tubular retorts of chrome-nickel steel. The retorts are heated and evacuated. The reaction that takes place results in an interchange, the aluminum combining with the oxygen of the lime, and the free calcium distilling off and condensing in crystalline form on a removable condenser, the end of which projects from the furnace. The over-all recovery by this method is about 75 per cent. The purity of the metal is dependent upon the purity of the raw material. Commercial calcium as now produced contains less than 2 per cent magnesium; special grades produced by redistillation are available, containing less than 0.5 per cent magnesium. The metal is melted and cast into ingots and billets, the latter weighing approximately 100 pounds.

Calcium, an alkaline earth metal, is the fifth most abundant element in the earth's crust. It is an active reducing agent and reacts readily at elevated temperatures with practically all the elements except the inert gases. In its commercial form freshly cut calcium is silvery white. Such surfaces, when exposed to moisture-bearing atmospheres, develop thin films of bluish-gray oxide which protect the metal against further attack. When exposed to moist air there does not appear to be sufficient heating tendency to create a fire hazard. Unlike sodium or other alkali metals, calcium may be allowed to come in contact with the skin without danger; it may, in general, be handled like magnesium and aluminum.

Calcium is ductile and malleable. It can be machined in a lathe, drilled, threaded, sawed, extruded, pressed, hammered into plates, and drawn into wire. Its commercial forms include chunks, bars, shavings, rods, and, very recently, powders.

USES

Its uses include: (a) the high-temperature reduction of refractory oxides of such metals as uranium, titanium, zirconium, vanadium, thorium, and chromium; (b) applications in organic reactions as a reducing, condensing, or polymerizing agent; (c) deoxidizing and desulphurizing of steels and other alloys; and (d) inclusion as an alloying agent with aluminum, lead, magnesium, tin, zinc, and nickel.

An important use for calcium in the commercial field is in lead sheathing and lead-sheathed cables. The alloys for cable sheathing contain up to 0.25 per cent calcium.

PRODUCTION, TRADE, PRICES

Information on Canadian production, exports, and imports of calcium metal is not available for publication.

Dominion Magnesium Limited quoted prices per pound during 1953, f.o.b. Haley, Ontario, as follows:

Commercial grade 98-99%

Ingots 1,000-29,999 lbs.	- $1.28
Ingots less than 1,000 lbs.	- $1.43

Low-nitrogen grade 99-99.5%

Billets 1,000-29,999 lbs.	- $1.83
Billets less than 1,000 lbs.	- $2.08

CHROMITE

No shipments of chromite from Canadian mines have been made since 1949. During World War II production came from the area between Quebec City and Sherbrooke in the Eastern Townships of Quebec.

There are no known deposits of commercial-grade chromite ores in Canada. The Bird River deposits in the Lac du Bonnet district in southeastern Manitoba are considered large, but are low-grade, having a chromium-iron ratio of about 1.4 to 1. Test work has been carried out by Hudson Bay Mining and Smelting Company, Limited and the

Mines Branch, Ottawa, in an effort to raise this low ratio to market specifications.

Imports used in the production of ferrochrome decreased considerably in 1953 because of a decline in demand by the United Kingdom

The United States, which consumes about half of the world production of chromite and produces only a small fraction of its requirements, has taken steps to increase its domestic production by means of financial advances and long-term purchase contracts.

Trade and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Imports, chromite				
From: Union of S. Africa	48,408	685,776	33,469	327,072
United States*	32,059	1,423,080	58,965	2,845,234
Philippine Islands	19,040	251,925	6,720	84,825
Southern Rhodesia	16,345	537,498	18,898	770,107
Turkey	2,240	108,270	16,731	754,645
Cuba	-	-	13,560	364,977
Total	118,092	3,006,549	148,343	5,146,860
Exports, ferrochrome				
To: United States	28,469	7,879,061	28,030	5,699,497
United Kingdom	5,263	2,078,802	16,046	6,578,476
Other countries	92	20,998	214	48,433
Total	33,824	9,978,861	44,290	12,326,406
Consumption, chromite	93,552		148,908	

* Country of origin not known.

WORLD MINE PRODUCTION

It is estimated that of the 3,200,000 metric tons of chromite produced during 1952, Turkey and Soviet Russia together accounted for about 40 per cent of the total. Most of the production from Turkey is a very high (52 per cent Cr_2O_3) metallurgical-grade ore.

South Africa, with its large reserves of medium-grade ore in the Transvaal, ranks third. Most of the output is of chemical grade, of which South Africa is the only producer. Southern Rhodesia competes with Turkey as the major source of metallurgical-grade ore.

The Philippines, with very large reserves of ore of metallurgical and refractory grades, occupies fourth position.

In North America, Cuba is the most important producer. Its output includes both refractory and metallurgical grades.

CONSUMPTION AND USES

World consumption of chromium is about three and one-half times the combined consumption of nickel, tungsten, molybdenum, and cobalt.

Approximately one-half of all chromite consumed is metallurgical grade; 35 per cent is refractory grade; and 15 per cent chemical grade. The specifications and uses for each are as follows:

(1) Metallurgical-grade Chromite

For use in the manufacture of ferrochrome, chromite should contain 45 to 50 per cent Cr_2O_3, with a chromium-iron ratio varying from 2.8 to 1 to 3 to 1. The material should be in lump form, as it is used in electric furnaces, and should contain as little silica as possible.

Ferrochrome is mainly consumed as low-carbon and high-carbon ferrochrome, both of which contain from 67 to 71 per cent chromium. Low-carbon ferrochrome is used in stainless and in heat-resistant steels because of its low carbon content. These steels are widely used in the chemical and petrochemical industries. High-carbon ferrochrome is used in the production of other chromium-bearing steels and alloy cast-irons. Chromium in these steels greatly increases corrosion resistance to oxidation; in cast-iron, chromium increases hardness, strength, and resistance to oxidation.

Chromium metal is used in the production of high-temperature, corrosion-resistant alloys as well as in chromium bronzes, hard-facing alloys, welding-electrode tips, and certain high-strength aluminum alloys. High-temperature alloys contain from 18 to 28 per cent chromium together with varying amounts of cobalt, tungsten, molybdenum, nickel, titanium, and columbium. The main uses of high-temperature alloys are in the jet and gas turbine engine industry for such parts as nozzle guide vanes and turbine blades. They are also used in heat exchangers, boiler super-heaters, and superchargers.

Chromium plating is used to improve the outward appearance of steels, but such finishes require only small quantities of chromium. Many articles such as dies, gauges, and punches are plated with a thicker layer to obtain hardness and wear resistance.

(2) Refractory-grade Chromite

For the manufacture of refractories, alumina (Al_2O_3) substitutes for some of the chromic oxide (Cr_2O_3) and specifications call for a 57 per cent minimum of combined Cr_2O_3 and Al_2O_3 with as little iron and silica as possible, usually around 10 and 5 per cent, respectively. The chromium-iron ratio is of no consequence in this grade but the ore must be hard and lumpy, not under 10-mesh. Fine ore is suitable for the manufacture of brick cement or in the chrome-magnesite brick industry.

Refractory-grade chromite is manufactured into bricks for use as a neutral lining for furnaces. Because of its high melting point and chemical inactivity, chromite is widely used in contact with acid or basic fluxes. Hence it is common practice to use chromite bricks near the slag line in open-hearth furnaces, separating the silica bricks of the roof and the top of the sides from the dolomite or magnesite bricks of the hearth and sides below the slag line. Other chrome refractories are used for patching brickwork and in ramming mixtures for furnace bottoms.

(3) Chemical-grade Chromite

For chemical consumption the specifications are not so rigid as in the metallurgical and refractory grades. Standard chemical ores contain 44 per cent Cr_2O_3, and iron is not a problem within reasonable limits. The ore should not contain more than 15 per cent Al_2O_3, 20 per cent FeO, 3 per cent SiO_2, and the sulphur must be low. The chromium-iron ratio is usually about 1.5 to 1. Fines are preferred because the ore is ground in processing to sodium and potassium chromates or bichromates.

Sodium bichromate or its derivatives are widely used in the tanning of leather, as pigments in the paint and dye industries, in the surface treatment of metals, and as a source of electrolytic chromium metal.

CANADIAN CONSUMERS OF CHROMITE

Canadian consumption of chromite, mainly in the production of ferrochrome, was much lower during 1953 than 1952. Canadian production of ferrochrome at capacity levels is dependent upon exports mainly to United States and the United Kingdom. Exports to United States were high early in 1953 but slackened about mid-year. Export trade with the United Kingdom declined because of a large inventory of chromium alloys in that country and because of the desire to conserve dollars.

Chromite is consumed in Canada by the Electro Metallurgical Company at Welland, Ontario, where high- and low-carbon chromium alloys are produced in a modern plant using electric furnaces. Exothermic chromium alloys are produced by Chromium Mining and Smelting Corporation, Limited, at Sault Ste. Marie, Ontario, in electric furnaces.

Canadian Refractories Limited produces chrome refractories for furnace linings in its plant at Kilmar, Quebec.

PRICES

According to E. and M. J. Metal and Mineral Markets of December 31, 1953 the United States prices were as follows:

Chrome ore - per long ton, dry basis, subject to penalties if guarantees are not met, f. o. b. cars N. Y., etc.,:

Rhodesian	
48 per cent Cr_2O_3, 3 to 1 ratio, lump, long-term contracts	$44 to $46
48 per cent Cr_2O_3, 2.8 to 1 ratio, lump, long-term contracts	$40 to $42
48 per cent Cr_2O_3, no ratio, long-term contracts	$32 to $34
South African (Transvaal)	
48 per cent Cr_2O_3, no ratio	$33 to $34
44 per cent Cr_2O_3, no ratio	$23 to $24
Turkish	
48 per cent Cr_2O_3, 3 to 1 ratio, nominal	$53 to $54
Pakistan (Baluchistan)	
48 per cent Cr_2O_3, 3 to 1 ratio	$51 to $52

Ferrochrome - per lb. of Cr:
High-carbon (4 to 9 per cent C) 65 to 69 per cent Cr, lump, carloads, f. o. b. destination continental U. S. A., 24 3/4 cents, low-carbon, 34 1/2 cents.

Chromium (Chrome metal)
per lb., 97 per cent, spot - $1.23
" " " " ", contract - $1.18

Electrolytic chromium - 99 per cent min., f. o. b. Niagara Falls, N. Y., $3 to $4.50 per lb. depending upon mesh.

TARIFFS

Canadian

Chrome ore - free

Chromium metal - in lumps, powder, ingots, blocks, or bars, and scrap alloy metal containing chromium, when imported by manufacturers for use exclusively for alloying purposes in their own factories - free.

Ferrochrome

British preferential	- free
Most favoured nation	- 5 per cent ad valorem
General	- 5 per cent ad valorem

United States

Chrome ore - free

Chromium (chrome metal) - 12 1/2 per cent ad valorem

Chromium nickel and chromium vanadium - 12 1/2 per cent ad valorem

Ferrochrome
3 per cent or more carbon on Cr. content - 5/8 cent per lb.
less than 3 per cent carbon on Cr. content - 12 1/2 per cent ad valorem

COBALT

Shipments of cobalt from Canadian mines during 1953 increased to 1,602,545 pounds from 1,422,000 in 1952. The increase was chiefly due to a greater output from the Cobalt-Gowganda area of Ontario.

The improved world supply situation made it unnecessary for the International Materials Conference to recommend the allocation of cobalt for the first quarter of 1953, and the Manganese-Nickel-Cobalt Committee of that organization disbanded at the close of the year, following the improvement in the supply of nickel.

Demand for cobalt remained high, mainly owing to its increased use in high-temperature and magnet alloys and in cemented carbides. The increase in demand caused the world price of the metal to rise to $2.60 (U.S.) per pound during November, in contrast to the lower price trend of other metals.

CANADIAN PRODUCTION

Mine production of cobalt in Canada is derived from the following sources:

(a) Cobalt and silver ores* from the Cobalt-Gowganda area of Ontario.

(b) Nickel-copper ores from the Sudbury district of Ontario (as a by-product).

(c) Uranium-radium ores of Great Bear Lake, Northwest Territories (as a by-product); occasional shipments of hand-cobbed cobalt ores are also made from this source.

* Usually an ore or concentrate containing more than 10 per cent cobalt is classified as a cobalt ore, and under 10 per cent as a silver ore -- depending on purchase tariffs prevailing at the time of shipment.

Production of electrolytic cobalt metal was commenced in mid-1952 from the nickel-copper matte exported by Falconbridge Nickel Mines Limited to its nickel refinery at Kristiansand, Norway. Production during 1952 approached capacity level.

Great Bear Lake Area

Concentrates shipped from the Crown-owned mine of Eldorado Mining and Refining Limited at Port Radium, Great Bear Lake, contain small amounts of cobalt. A speiss produced from the company's Port Hope refinery residues contains about 12 per cent cobalt and is sold to Deloro.

Other Developments

About 300,000 pounds of cobalt metal will be produced annually at the refinery of Sherritt Gordon Mines, Limited, which is under construction at Fort Saskatchewan near Edmonton, Alberta. Shipment of nickel concentrates from the mine at Lynn Lake, Manitoba, to the refinery was scheduled to begin early in January, 1954; first production of nickel and cobalt is expected about the end of March, 1954.

The property of Western Nickel Mines Limited, seven miles from Choate, which is 95 miles east of Vancouver, on the Canadian Pacific Railway, is being prepared for large-scale mining which is expected to commence early in 1955. Concentrates will be shipped to the Fort Saskatchewan refinery, where the contained cobalt will be recovered.

Domestic Refinery Production

The Deloro smelter operated continuously during the year at almost full capacity of 60 tons of metal or equivalent per month. Smelter capacity was for the most part engaged in treatment of Moroccan ores and the World War II stockpile of Canadian concentrates for account of the United States government. The smelter also handled Canadian requirements of cobalt metal, oxides, and salts by treatment of the Cobalt-Gowganda silver ores, Eldorado speiss, and metallic scrap.

Construction and rehabilitation of the smelter of Cobalt Chemicals Limited, a few miles south of Cobalt, continued during the year; it is expected to commence production during the first quarter of 1954 with a capacity of 15 tons of raw materials per day. The smelter will be operated under the management of Quebec Metallurgical Industries Limited, a subsidiary of Ventures Limited and Frobisher Limited.

The ban on the export of cobalt ores and concentrates, dating from the beginning of 1951, was lifted at the beginning of 1953.

WORLD MINE PRODUCTION

The world mine production of cobalt during 1952 amounted to 10,000 metric tons of contained cobalt, of which the copper ores of the

Union Minière du Haut Katanga, Belgian Congo, accounted for 6,831 metric tons. The cobalt-nickel-gold-arsenic ores of La Société Minière de Bou-Azzer et du Graara, French Morocco, was the next largest producer with 1,000 metric tons, followed by Canada, Northern Rhodesia, and the United States.

The United States in 1954 may reach second place as a producer if success is attained in solving corrosion problems at the Garfield, Utah, and Fredericktown, Missouri, chemical refineries, which will treat concentrates from the cobalt-copper ores of the Calera Mining Company at Cobalt, Idaho, and the iron concentrate containing cobalt, nickel, and copper of the National Lead Company at Fredericktown, Missouri, respectively.

CONSUMPTION AND USES

Cobalt metal, which constitutes about 90 per cent of the total consumption, is marketed in the form of rondelles, granules, shot, and powder. The remaining ten per cent is made up of black and grey oxide; inorganic salts such as the acetate, carbonate, sulphate, etc.; and organic compounds such as linoleates, naphthenates, and resinates. These last find extensive use in the paint industry as driers.

The largest single use for cobalt is in the high-temperature cobalt-base alloys that are used in the jet and gas turbine engine industry and in guided missiles for such parts as nozzle guide vanes and turbine rotor blades. The metal is an important constituent of permanent-magnet alloys, cemented carbides, hard-facing rods, and high-speed steel. A radioisotope, Cobalt 60, is widely used by industry for radiographic examinations, and also forms the basis for the 'Cobalt Bomb', which is used in the treatment of cancer.

Cobalt oxide finds its largest use in ground coat frits to promote adherence between fired enamel and the metal base to which it is applied. The inorganic salts are used in electroplating and are added to animal feeds.

The more important Canadian consumers of cobalt are; Deloro Smelting and Refining Company Limited; Canadian General Electric Company, Limited; Nuodex Products of Canada, Limited, Toronto (driers); Ferro Enamels (Canada), Limited, Oakville, Ont.; Atlas Steels, Limited, Welland, Ont.; Dominion Glass Company, Limited, Montreal; and Canadian Hanson and Van Winkle Company, Limited, Toronto, (electro-plating).

PRICES

The prices for cobalt ores and concentrates eligible under the Canadian Government's premium price plan are given above.

The commercial prices of cobalt at the end of 1953, according

to E. and M. J. Metal and Mineral Markets were as follows:

(1) Cobalt metal, $2.60 per pound in the form of rondelles or granules in 500- to 600-pound containers, ex docks or store New York or Niagara Falls, N.Y. In 100-pound containers the price is $2.62 per pound, and in less than 100-pound containers, $2.67 per pound.

(2) Cobalt metal fines, $2.60 per pound of cobalt contained f.o.b. New York or Niagara Falls, N.Y., standard package of 650 pounds.

(3) Cobalt oxide, ceramic grade, 72 1/2 to 73 1/2 per cent cobalt, $1.96 per pound east, and $1.98 1/2 per pound west of Mississippi. Quotations are for oxide packed in 350-pound containers.

The prices in Canada by Deloro Smelting and Refining Company Limited are comparable to the above prices with due regard to the premium on the Canadian dollar.

TARIFFS

(a) Canada

ore	- free
cobalt oxide	
British preferential	- free
Most favoured nation	- 10% ad valorem
General	- 10% ad valorem

(b) United States

ore and metal	- free
cobalt linoleate	- 5 cents per lb.
cobalt oxide	- 5 cents per lb.
cobalt sulphate	- 2 1/2 cents per lb.
other cobalt compounds and salts	- 30% ad valorem

COPPER

Production of copper in all forms totalled 253,252 tons valued at $150,953,742 compared with 258,038 tons valued at $146,679,040 in 1952. Ontario contributed 51 1/2 per cent of the tonnage, practically all of which came from the copper-nickel ores of the Sudbury area. Quebec was second with 21 1/2 per cent. Newfoundland, Nova Scotia, Manitoba, Saskatchewan, and British Columbia also contributed to the

output. There were 20 principal producing mines located in these provinces.

The output of refined copper, all of it from the refineries of The International Nickel Company of Canada, Limited, at Copper Cliff, Ontario, and of Canadian Copper Refiners Limited at Montreal East, Quebec, was 236,966 tons compared with 196,320 tons in 1952.

Canada stood fifth as a producer of copper, following the United States, Northern Rhodesia, Chile, and Russia. In 1953, Canada ranked sixth as a consumer, being led by the United States with 1,443,700 tons; the United Kingdom, with 359,600 tons; Russia, with 334,500 tons; West Germany, with 237,300 tons; and France, with 118,400 tons.

The allocation control on copper, established in 1951 by the International Materials Conference, was discontinued February 15, 1953. World supply and demand for the metal were generally in balance. Large stocks of copper were retained by the Government of Chile for sale at a price in excess of the average world price of about 30 cents a pound.

PRODUCTION

Newfoundland

Buchans Mining Company Limited in central Newfoundland milled 346,000 tons of zinc-lead-copper ore from which 11,800 tons of copper concentrate containing about 2,900 tons of copper was produced and shipped to a smelter in the United States. The Lucky Strike, Oriental, and Old Buchans deposits continued to be operated but the newer Rothermere mine was the main source of ore supply.

Nova Scotia

Mindamar Metals Corporation Limited. Ore milled from the company's Stirling mine in Cape Breton Island amounted to 188,647 tons from which 7,654 tons of lead-copper concentrates containing 1,903 tons of lead and 821 tons of copper were produced. No. 2 shaft was deepened to 1,172 feet and two new levels developed below the 700-foot horizon. Ore reserves were estimated at 248,245 tons averaging 6.5 per cent zinc, 1.4 per cent lead, and 0.7 per cent copper.

Quebec-Abitibi County

Noranda Mines Limited. Operations at the mine and smelter were suspended on August 22 by a strike*. Production of ore from the Horne mine was 890,488 tons, from which 15,395 tons of copper and 132,045 ounces of gold were produced. The smelter treated 822,016 tons of ores and concentrates, including material from other copper, gold, and silver mines, that yielded 47,003 tons of anode copper containing 243,720 ounces of gold and 1,584,940 ounces of silver. The copper and precious metals were recovered at the electrolytic copper

* This strike was not ended until February, 1954.

Production, Trade, and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production, all forms [a]				
Ontario	130,583	77,587,439	125,343	70,973,056
Quebec	54,920	32,886,057	68,846	39,297,212
Saskatchewan	30,588	18,316,355	30,344	17,320,154
British Columbia	24,148	14,371,494	20,786	11,828,103
Manitoba	9,411	5,635,573	9,374	5,350,804
Newfoundland	2,814	1,684,862	2,959	1,689,079
Nova Scotia	788	471,962	383	218,663
Northwest Territories	-	-	3	1,969
Total	253,252	150,953,742	258,038	146,679,040
Production, refined [b]	235,786		196,320	
Exports				
In ingots, bars, slabs, etc.				
To: United States	74,655	45,450,580	52,630	33,248,986
United Kingdom	51,384	31,607,540	41,643	24,258,670
France	2,940	1,917,674	8,537	6,449,920
Brazil	2,345	1,520,688	2,835	1,855,978
Other countries	670	443,439	8,030	5,592,763
Total	131,994	80,939,921	113,675	71,406,317
In rods, strips, sheets,and tubing				
To: United States	3,100	1,994,453	10,878	7,911,943
Switzerland	2,313	1,477,089	2,492	2,019,252
New Zealand	220	230,816	1,328	1,057,816
Ireland	134	94,432	594	388,475
Denmark	112	73,527	1,652	1,552,882
Australia	84	60,203	2,857	1,999,288
Other countries	892	936,478	3,026	2,637,191
Total	6,855	4,866,998	22,827	17,566,847
In ore and matte				
To: United States	35,716	19,286,856	24,640	11,018,784
Norway	9,063	4,893,966	8,180	3,609,527
West Germany	2,926	1,579,959	471	254,205
Japan	2,332	1,259,037	18	9,693
United Kingdom	1,121	605,667	1,126	495,055
Other countries	-	-	2	560
Total	51,158	27,625,485	34,437	15,387,824
Consumption				
Refined	108,526		130,347	

a. Production in all forms consists of blister copper made from Canadian ore plus recoverable copper in concentrates, matte, etc., exported.
b. Production from Canadian ore, foreign ore, and scrap.

refinery of Noranda's subsidiary, Canadian Copper Refiners Limited, Montreal East. Ore reserves at the Horne mine were reported to be 14,856,000 tons.

Waite Amulet Mines, Limited and Amulet Dufault mines delivered to the Waite Amulet mill 372,780 tons of copper-zinc ore, from which concentrate containing 15,332 tons of copper was produced. The East Waite mine, which was brought into production in 1952, supplied 62 per cent of the mill feed. The mines were closed on October 21, owing to a strike*. Total ore reserves were estimated at 1,622,000 tons.

Quemont Mining Corporation, Limited treated 631,578 tons of copper-zinc ore, which yielded 52,250 tons of copper concentrate containing 9,418 tons of copper. Two new orebodies totalling 416,000 tons, with higher than average grade copper values, were located during the year in the lower levels of the mine. Ore reserves were 9,528,000 tons averaging 1.47 per cent copper, 2.76 per cent zinc, and 0.16 ounces per ton of gold. The mine was closed on October 2 by a strike*.

Normetal Mining Corporation Limited treated 290,849 tons of ore and produced 28,067 tons of copper concentrate containing 5,878 tons of copper. The No. 4 shaft was deepened 668 feet and 3 new levels established, the deepest being 4,160 feet below the surface. Ore reserves were 2,416,100 tons averaging 2.61 per cent copper and 8.14 per cent zinc. The mine was closed by a strike on October 17*.

East Sullivan Mines Limited milled 909,140 tons of ore, from which copper concentrates containing 11,392 tons of copper were produced. The mine workings were deepened to 2,800 feet and four new levels established. Ore reserves were reported to be less than at the end of 1952, when 4,330,000 tons were indicated.

Golden Manitou Mines Limited is essentially a producer of zinc and lead concentrates, but a small quantity of copper (108 tons in 1953) is recovered from the lead concentrate. No development was carried out during the year on the copper orebody that occurs about 800 feet north of the zinc-lead production zones.

Southern Quebec

Ascot Metals Corporation Limited suspended operations at its Moulton Hill mine, near Sherbrooke, in July, but continued mining zinc-lead-copper ore from its Suffield property, nine miles south of the city. Bulk lead-copper concentrates containing 1,201 tons of copper were shipped. Ore reserves at the Suffield were in the neighbourhood of 460,000 tons, averaging 5.38 per cent zinc, 0.81 per cent copper, and 0.64 per cent lead.

* These strikes were not ended until February, 1954.

Production from the Weedon mine, 40 miles northeast of Sherbrooke, which was resumed in November, 1952, resulted in an output of copper concentrates containing about 1,425 tons of copper. Zinc and pyrite concentrates were also produced from ore remaining in the old workings.

Quebec Copper Corporation Limited, a subsidiary of East Sullivan Mines Limited, commenced production in a new 700-ton capacity mill in February 1954, on the old Huntingdon property near Eastman. A shaft was completed to a depth of 1,160 feet and 3 levels established between a depth of 500 feet and 850 feet. Ore reserves were estimated at 600,000 tons averaging 2 per cent copper.

Opemiska Copper Mines (Quebec) Limited completed construction of a 400-ton mill and commenced production of copper concentrates in December from its property in Levy township, 25 miles west of Chibougamau Lake. One new ore zone was discovered during the year. Indicated ore reserves were 1,054,000 tons averaging 4.82 per cent copper.

Ontario

The International Nickel Company of Canada, Limited. A record output of 13,095 tons was mined from the company's five underground mines--Creighton, Frood-Stobie, Levack, Garson, and Murray--and from the Frood open-pit section of the Frood-Stobie mine, all in the Sudbury area. Eighty per cent of the ore came from underground operations. Output of refined copper at 117,174 tons was almost the same as in 1952.

The major program of expanding underground operations, commenced during World War II, was continued. The capacity of the Creighton concentrator was increased from 10,000 tons to 12,000 tons a day.

At the Copper Cliff smelter a new unit was put into operation for treating all the company's copper concentrate by the oxygen-flash-smelting process. The smelter gas from this process, rich in sulphur dioxide, was delivered to the adjacent plant of Canadian Industries Limited for the production of liquid sulphur dioxide.

Ore reserves at the end of 1953 were 261,541,259 tons, containing 7,795,326 tons of combined nickel-copper. Extensive exploration was carried out on the company's properties in the Sudbury area, also on deposits at Mystery Lake, Manitoba, and in the Northwest Territories.

Falconbridge Nickel Mines Limited continued the expansion program of the past several years. Smelter capacity was increased by the addition of a new blast furnace and other facilities.

Preparations for production were carried out at the East

Falconbridge mine adjoining the Falconbridge main mine 8 miles northeast of Sudbury, at the Hardy mine near the town of Levack and at the Mount Nickel mine, 5 miles north of Sudbury, all of which are expected to be in production in 1954. Reserves of developed and indicated ore were 34,571,100 tons averaging 1.57 per cent nickel and 0.83 per cent copper.

East Rim Nickel Mines Limited. Late in the year, a new 600-ton concentrator, producing high-grade magnetic concentrate and copper-nickel flotation concentrate for shipment to the Falconbridge smelter, was put in operation on this property, located about 5 miles north of Falconbridge. Prior to milling, the company made daily shipments of ore to Falconbridge.

Other Production in Ontario

Milnet Mines Limited, about 18 miles north of Falconbridge, made daily shipments of about 500 tons of nickel-copper ore to Falconbridge Nickel Mines Limited.

Nickel Offsets Limited, about 12 miles northeast of Renack, constructed a 300-ton mill and commenced production of copper-nickel concentrates. New Ryan Lake Mines Limited near Matachewan continued production of copper concentrates in its 150-ton mill.

Manitoba and Saskatchewan

Hudson Bay Mining and Smelting Company, Limited, operates a copper-zinc mine, copper smelter, and zinc plant at Flin Flon, close to the Saskatchewan boundary. The orebody lies in both provinces, but the major production has been from Saskatchewan for a number of years past.

Of the 1,497,093 tons of ore mined, 1,478,095 tons were concentrated and the remainder smelted directly. At the smelter, 437,062 tons were treated, comprising concentrates from the Flin Flon and Cuprus concentrators, direct smelting ore, and zinc plant residues. Blister copper containing 40,152 tons of copper, plus gold, silver, and selenium was produced and shipped for electrolytic refining.

At the Cuprus mine (a company subsidiary), 7 1/2 miles southeast of Flin Flon, 86,549 tons of copper-zinc ore were mined and 20,442 tons of copper concentrates averaging 11 per cent copper were produced and shipped to the Flin Flon smelter.

Hudson Bay's ore reserves, including the properties close to Flin Flon now under development, were 17,638,000 tons averaging 3.25 per cent copper and 3.9 per cent zinc at the end of 1953.

Sherritt Gordon Mines Limited. The milling of ore on a preliminary basis was commenced in October in the company's reconstructed concentrator at Lynn Lake, Manitoba. Mill feed came from the "A"

orebody while the "EL" orebody was developed for stoping operations. Copper and nickel concentrates were stored or shipped to custom smelters pending completion of Sherritt Gordon's chemical-metallurgical plant at Fort Saskatchewan, Alberta, where it was expected that both refined nickel and copper would ultimately be produced. The ore reserves at the Lynn Lake property were estimated at 14,055,000 tons averaging 0.618 per cent copper and 1.223 per cent nickel. The railway from Sheridon to Lynn Lake, 147 miles in length, was completed in November, 1953.

British Columbia

The Granby Consolidated Mining, Smelting and Power Company, Limited. Operations at the company's Copper Mountain copper-gold-silver mine, 12 miles south of Princeton, and its concentrator at Allenby, 8 miles north of the mine, resulted in the treatment of 1,810,378 tons of ore averaging 0.88 per cent copper. Concentrates containing 12,466 tons of salable copper were produced, compared with 12,351 tons in 1952. Ore reserves at the end of the year were 2,948,000 tons averaging 0.93 per cent copper.

Britannia Mining and Smelting Company Limited during 1953 treated 839,389 tons of ore from its property on Howe Sound. Emphasis was placed on the mining of deposits containing a relatively high-copper-low-zinc ratio. Copper concentrates amounting to 28,355 tons containing 8,580 tons of copper were produced and there was also a small copper production from precipitates recovered from mine water. Considerable exploration was carried out on the company's extensive property.

Tulsequah Mines Limited, a subsidiary of The Consolidated Mining and Smelting Company of Canada Limited, operates the Tulsequah Chief and Big Bull zinc-copper-lead mines in the Atlin district. An expansion of mill capacity to 500 tons a day made possible the milling of 173,115 tons of ore, compared with 96,059 tons in 1952. About 2,071 tons of contained copper was produced.

Other Production

Consolidated Mining and Smelting exported about 2,800 tons of copper matte containing 50 per cent copper which it recovered in the refining of lead at Trail.

EXPLORATION AND DEVELOPMENT

Newfoundland

Investigations of a number of copper occurrences, principally by Falconbridge Nickel Mines Limited in the Notre Dame Bay area, were carried out.

New Brunswick

Brunswick Mining and Smelting Corporation Limited. Two massive zinc-lead orebodies estimated to contain about 46 million tons averaging 5.25 per cent zinc, 1.84 per cent lead, and 0.46 per cent copper were outlined to a depth of 1,000 feet on the company's properties southwest of Bathurst. Adjoining one of these orebodies, the Austin Brook, a zone was found containing 3,630,000 tons with an average grade of 1.01 per cent copper. Initial developments to bring the properties into production were carried out.

Southern Quebec

Eastern Metals Corporation Limited sank a 490-foot shaft and explored a nickel zone and adjacent copper zone on three levels on its property in Montmagny county. Preliminary estimates of reserves indicated 500,000 tons averaging 2 per cent copper in the south zone. An associate company, Eastern Smelting and Refining Company Limited, was formed in May, 1953, to construct and operate a smelter at Chicoutimi for the treating of nickel and copper concentrates. The plans were in a preliminary stage at the end of the year.

Quebec-Chibougamau Area

Campbell Chibougamau Mines Limited sank a four-compartment production shaft to a depth of 1,230 feet and established seven levels on property leased from Merrill Island Mining Corporation Limited and adjoining one of its own properties. The foundations for a 1,700-ton a day concentrator were poured. Production of concentrates was expected to commence in May, 1955. Ore reserves, including the leased property, are estimated at 3,050,000 tons averaging 2.6 per cent copper and 0.08 ounces of gold per ton. A contract was negotiated with the United States Government for the sale of 31,500 tons of copper over a two-year period following the commencement of production.

Considerable prospecting activity and exploration of known copper occurrences took place in the area during 1953.

Quebec-Gaspé Area

Gaspé Copper Mines Limited, a subsidiary of Noranda Mines Limited, continued mine development and plant construction at its property in the central part of the peninsula. The concentrator is designed to treat 6,500 tons of ore a day, and production of anode copper is expected to commence in March 1955. Ore reserves of 67 million tons averaging 1.3 per cent copper have been indicated by drilling.

Ontario

Ontario Pyrites Company Limited continued the exploration and development of its Errington and Vermilion Lake properties 18

miles west of Sudbury. Reserves of over 10 million tons averaging 1.15 per cent copper, 0.81 per cent lead, and 3.5 per cent zinc have been indicated.

Manitoba and Saskatchewan

Hudson Bay Mining and Smelting Company, Limited, continued underground development at its Schist Lake copper-zinc mine, 3 1/2 miles south of Flin Flon, and at its North Star copper mine, 12 miles east of Flin Flon. About 6,600 tons of development ore from these properties was treated at Flin Flon. Underground exploration was started at the Birch Lake Copper mine, 9 1/2 miles southwest of Flin Flon, and at the Coronation property, 13 1/2 miles southwest of Flin Flon, two new orebodies with an indicated reserve of 545,000 tons averaging 5.37 per cent copper to a depth of 600 feet were outlined by drilling.

British Columbia

At the property of Granduc Mines Limited about 25 miles northwest of Stewart in northern British Columbia, being developed jointly by Granby and Newmont Mining Corporation, an orebody about 900 feet long and 25 feet wide averaging two per cent copper was disclosed. Late in the year a second copper orebody was located 500 feet east and roughly parallel to the first, but with an indicated width of 116 feet. Further exploration was planned in the hope of outlining sufficient ore to justify the construction of low-cost transportation facilities.

Considerable exploration was carried out in areas containing copper occurrences, particularly in the northern part of Vancouver Island. However, no discoveries of importance were reported.

Northwest Territories

Rankin Inlet Nickel Mines Limited in November commenced sinking a 350-foot shaft on its nickel-copper deposit at Rankin Inlet on the northwest coast of Hudson Bay. Exploration on two levels was planned for 1954. Ore reserves indicated by drilling were 435,000 tons averaging 3.29 per cent nickel and 0.91 per cent copper.

Yukon Territory

Exploration of the Wellgreen property in the Kluane Lake district by Hudson Bay Exploration and Development Company, Limited continued both underground from a 1,200-foot adit and by drilling from the surface. Ore reserves of 257,000 tons averaging 1.83 per cent nickel, 1.14 per cent copper, with small amounts of platinum, palladium and cobalt, were indicated.

USES

About 50 per cent of the world consumption of refined copper was used in the electrical industry for conductors such as wire, cable,

etc. A large part of the remainder was consumed in brass, bronze, and other copper alloys. The use of copper tubing for interior water supply systems continued to increase.

PRICES AND TARIFFS

The Canadian price of electrolytic copper was 29.5 cents a pound in January and February. It increased to over 30 cents a pound in March and April then declined to 29.5 cents where it remained until late in December. The last quotation for 1953, on December 31, was 28.18 cents a pound.

In the United States, the price of domestically produced copper was fixed at 24.2 cents a pound until late in February. After the control was lifted, the price of copper increased steadily to over 30 cents a pound in April. It subsequently declined to 29.4 cents but rose to 29.7 cents a pound at the end of the year.

There is no tariff on imports of copper ores or concentrates into Canada. Copper in bars, rods, wire, and alloys is subject to varying tariff rates. In the United States the tariff of 2 cents a pound on the copper content of imports was suspended from February 16, 1953, until June 30, 1954, and subsequently extended to June 30, 1955.

GOLD

Canada's gold production in 1953 was 4,055,723 fine ounces valued at $139,597,985, a decline of about 9 per cent from the 1952 production of 4,471,725 ounces at $153,246,016. Output decreased in every major producing area except Yellowknife in the Northwest Territories. This was due to strikes, which from July 11, 1953, to the end of the year suspended operations at 13 gold producers in Ontario and Quebec for varying periods of time, and to the closing of 5 mines in Ontario owing to high costs or depleted ore reserves. There was very little prospecting for gold, and new development was limited to properties adjacent to established mines. No new mines were brought into production.

For many years, gold has been Canada's leading mineral in value. In 1953 petroleum was in first place, nickel second, copper third, and gold fourth. In world output, Canada retained second place, South Africa leading with close to 12 million ounces.

The Government announced in a press release on October 7, 1953, that legislation would be introduced to extend the operation of the Emergency Gold Mining Assistance Act to the calendar year 1954. The Act was amended so as to redefine the "rate of assistance" factor

In the field of iron ore development, 1953 was again an exceedingly active year. In Labrador-New Quebec, all grading was completed on the 360-mile railway which will connect Sept Iles to Knob Lake, and the track was laid to Mile 330 at Menihek. Ruth Lake No. 3 deposit in Labrador was partly readied for mining operations, which will commence in 1954. At Marmora, in southeastern Ontario, stripping continued at a very rapid rate and construction of a concentrator and a pelletizing plant at Marmora and of terminal facilities and a dock near Picton on Lake Ontario was commenced. In the Steep Rock area, Caland Ore Company, Limited, announced its intentions of developing "C" orebody, with underground production scheduled to commence in 1960. The International Nickel Company of Canada Limited announced plans for the construction of a plant to produce one million tons of high-grade, by-product iron ore from low-grade pyrrhotite. Noranda Mines Limited also announced plans to construct at Port Davidson, Ontario, a plant that will turn out by-product iron sinter.

The outlook for 1954 with respect both to iron ore output from producing mines and exploration activity by producing and non-producing companies is excellent. In contrast to the period 1925-1938, when no iron ore was produced, the production of iron ore is rapidly becoming one of Canada's major mineral industries.

Iron Ore Production (Shipments) in Canada
By Properties*
(Long Tons)

	1953	1952	1951
Steep Rock (direct-shipping ore) ..	1,301,377	1,274,666	1,325,889
Wabana (direct-shipping ore) . . .	2,399,821	1,477,153	1,540,176
Helen and Victoria (sinter)	1,166,832	1,145,830	1,211,234
Quinsam Lake (magnetic concentrates) . .	553,591	551,812	101,371
Texada Island (magnetic concentrates) . .	333,077	209,016	-

* Shipment figures based on company data.

Most of Ontario's output of iron ore was exported to the United States, where it is in demand because of its high grade and good furnace qualities. In turn, most of the ore used in Ontario blast furnaces is imported from the United States. Most of British Columbia's output of magnetite concentrates was exported to Japan, there being no market for it in Canada. Wabana iron ore supplied the iron and steel plant at Sydney, Nova Scotia, and the remainder was exported to the United Kingdom and to West Germany.

Ore imported from Brazil and Liberia in 1953 was used as open-hearth lump ore at various plants.

Production, Trade, and Consumption

		1953		1952	
		Long Tons	$	Long Tons	$
Production (shipments		5,812,337	44,102,944	4,707,008	33,744,311
Imports					
From:	United States	3,579,295	25,705,847	3,666,729	24,196,991
	Brazil	114,458	2,116,129	142,665	2,306,293
	Liberia	27,293	371,734	1,005	15,581
	United Kingdom			10	586
	Total	3,721,046	28,193,710	3,810,409	26,519,451
Exports					
To:	United States	1,843,542	14,126,702	1,795,113	11,395,824
	United Kingdom	1,076,124	6,541,794	629,468	3,680,527
	Japan	855,398	7,041,088	709,206	5,546,177
	West Germany	528,485	3,133,407	301,033	1,710,944
	Total	4,303,549	30,842,991	3,434,820	22,333,472
Indicated consumption[a]		5,222,015		5,082,597	
Domestic production as a percentage of indicated consumption		111.1		92.6	

a. Indicated Consumption = Production (shipments) + imports - exports.

PRODUCING MINES

Newfoundland

Dominion Wabana Ore Limited. Production of iron ore (hematite) from Wabana Mines, Bell Island, Conception Bay, amounted to 2,403,405 tons during 1953. This included 2,286,665 tons from all underground mines and 116,740 tons from contract mining on the surface. Dominion Wabana hopes to increase its daily output to 10,000 tons during the early part of 1954. Shipments of ore during 1953 amounted to an all-time record of 2,399,821 tons compared with 1,477,153 tons during 1952. The destination of 1953 shipments was; United Kingdom, 1,138,963 tons; Sydney, N.S., 759,338 tons; and Germany, 501,520 tons.

Quebec

Quebec Iron and Titanium Corporation. Production of

ilmenite ore during 1953 at the Allard Lake operations, according to the company, was 158,211 short tons. Shipments of ilmenite ore to the company's experimental smelting operation at Sorel were 125,234 short tons, of which the average content was approximately 35 per cent titanium dioxide (TiO_2) and 40 per cent iron. Ilmenite ore treated at Sorel totalled 332,349 short tons. Output of by-product iron amounted to 107,463 short tons and shipments were 95,707 short tons. Production of by-product iron ingots, iron in the form of pigs, and steel ingots, during 1952 amounted to 7,224, 5,275, and 23,386 short tons, respectively.

Ontario

Algoma Ore Properties, Limited. The company's production comes from the Helen and Victoria underground mines in the Michipicoten area. During 1953, shipments of sinter from the sintering plant at Jamestown totalled 1,166,832 tons compared with 1,145,830 tons in 1952. Of this amount, 391,381 tons were shipped by rail to Algoma Steel Corporation at Sault Ste. Marie and 775,451 tons by vessel to lower lake ports. Estimated production for 1954 is about 1,500,000 tons.

Steep Rock Iron Mines Limited. Shipments of iron ore during 1953 totalled 1,301,377 tons, of which 640,062 tons came from the Errington open pit, 19,148 tons from the Errington underground development, and 642,167 tons from the newly opened Hogarth open pit. Operations at the Errington open pit ceased on December 5th; this pit yielded a total of 9,165,844 tons of ore during its life. Production in 1954 is scheduled for 2,000,000 tons and will come from the Errington underground and Hogarth open pit.

British Columbia

The Argonaut Mining Co. Ltd. continued the mining of magnetite from its Iron Hill mine at Quinsam Lake throughout 1953. Mine production totalled 1,321,876 tons of ore averaging about 35.9 per cent iron. Export shipments totalled 553,531 tons of magnetite concentrates averaging about 55.9 per cent iron, and domestic shipments totalled 60 tons. Export shipments from this open-cut hillside mine go mostly to Japan.

Texada Mines Limited continued mining and milling magnetite ore throughout 1953, the bulk of the production coming from the Prescott and Lake open pits from which the first output came in 1952. Towards the end of the year a new pit, the Paxton, was opened up. The total amount of ore mined in 1953 was 514,936 tons, of which 43 per cent came from each of the older pits, and 14 per cent from the Paxton. Although underground mining is contemplated for the Prescott orebody, none took place during 1953. The mill treated 515,257 tons. The total amount of iron concentrates produced and shipped to Japan during the year was 333,077 tons.

DEVELOPMENT

Labrador-New Quebec

Iron Ore Company of Canada's construction program continued at an accelerated rate throughout 1953, with all major projects being on schedule at the end of the year. The first ore will be mined and shipped before the end of the 1954 season. All grading on the railroad was completed by the end of 1953. The track was laid to Menihek (mile 330) and it is expected that the steel will reach the mining area in the first quarter of 1954. The railroad has been ballasted to Mile 230 and ballasting on the northern portion will commence early in 1954.

The construction of the tide-water ore docks at Sept Iles is almost completed and the machinery for ore handling is in the process of installation. All facilities at the Sept Iles terminal yards and docks will be completed in 1954.

Ontario

Bethlehem Mines Corporation, as lessee of the magnetite deposits at Marmora, Ontario, of its wholly-owned subsidiary, Marmoraton Mining Company, continued the stripping of the limestone capping that overlies the iron ore deposits. At the open-pit operation, permanent repair shops, warehouses, change room, and offices have been completed and construction was commenced on crushing, concentrating, and pelletizing facilities. Production is expected to commence in 1954, with an ultimate goal of 500,000 tons of agglomerated concentrates per year.

Caland Ore Company, Limited, during 1953, announced its intention of developing "C" orebody in the eastern section of the Steep Rock Lake area. A contract for the dredging of the silt from Falls Bay of Steep Rock Lake has been let to Construction Aggregates Corporation of Chicago. Dredging is scheduled to begin in the spring of 1955 and to be completed by January 1, 1960. Mining will be by underground methods and the first production is scheduled for 1960. Full production of about 3 million tons will not be reached until several years later.

EXPLORATION

The year 1953 was probably one of the most active in the history of iron ore exploration in Canada in respect to both the number of participating companies and the field work carried out by these companies. The following listings indicate very generally the geographical areas in which individual company effort was concentrated.

In the southwestern part of Labrador, Newfoundland, Canadian Javelin Foundries and Machine Works Limited, both in its own name and in the name of Newfoundland and Labrador Corporation, holds concession areas on which it carried out exploration during 1953.

In Quebec, the following companies hold concessions or claims in the "Labrador Trough". In some instances active exploration programmes were conducted during 1953.

Iron Ore Company of Canada
Quebec Labrador Development Company Limited
Great Mountain Iron Corporation
Fort Chimo Mines Limited
Fenimore Iron Mines Limited
Norancon Exploration Quebec Ltd.
Atlantic Iron Ore Limited
International Iron Ore Company Limited

In other parts of northeastern Quebec, such as the Marybelle Lake, Lake Allard, Matonipi Lake, and Mount Wright areas the following companies carried on active exploration:

Hollinger (Quebec) Exploration Company Limited
Canadian Cliffs, Limited
M. J. O'Brien Limited
United States Steel Corporation
Quebec Cobalt and Exploration Limited
Gravimetric Surveys Limited
Bellechasse Mining Corporation Limited

In southwestern Quebec, Chemical Lime Limited and Gravimetric Surveys Limited were active during the year.

In Ontario, in both the southeastern and northwestern sections, the following companies were active:

United States Steel Corporation
Nipiron Mines Limited
The Steel Company of Canada Limited
Canada Iron Mining Limited
Trent River Iron Limited
Algoma Ore Properties, Limited
Dominion Gulf Company
Jalore Mining Company, Limited
Canadian Cliffs, Limited
North Range Mining Company Limited
Head of the Lakes Iron Limited
McMarmac Red Lake Gold Mines Limited
Calmor Mines Limited

In the Northwest Territories, Seven Islands Mining and Exploration Corporation, Limited was active on the Nastapoka Islands and Belcher Island Iron Mines Limited on the Belcher Islands.

In British Columbia, Quatsino Copper-Gold Mines, Limited holds a magnetite property on Vancouver Island but no work was carried out during 1953.

PRICES AND TARIFFS

Prices of Canadian iron ores are, in general, negotiated by contract. They are dependent on quality, quantity, commissions, delivery, and other factors, and they may be subject to penalties or premiums, according to the content of impurities, etc.

Neither Canada nor the United States maintains tariffs on iron ore.

LEAD

Canada produced 193, 706 tons of lead valued at $50, 076, 822 compared with 168, 842 tons valued at $54, 671, 021 in 1952. The production came chiefly from British Columbia, Newfoundland, and Yukon. Production of refined lead by The Consolidated Mining and Smelting Company of Canada Limited (Cominco) which operates Canada's only lead smelter at Trail, British Columbia, was 165, 752 tons compared with 182, 942 tons in 1952. The export of lead contained in concentrates showed a substantial increase due mainly to shipments to foreign plants rather than to the Trail smelter. Considerably less lead ore was imported from foreign countries than in 1952. There was an increase in the value of imports of lead and lead products, over 90 per cent of the latter being tetraethyl lead, used to improve the quality of gasoline. The construction of a plant to produce tetraethyl compounds in Canada was under consideration.

Owing largely to increased output of batteries and cable covering, domestic consumption of lead was almost 5, 000 tons higher than in 1952. The price of lead in Canada ranged from 11. 75 cents a pound to 14. 25 cents a pound during 1953.

GENERAL DEVELOPMENTS

British Columbia

The Sullivan zinc-lead- silver mine at Kimberley, owned by Cominco, is Canada's principal source of lead. There were 2, 643, 251 tons of ore mined in 1953 compared with 2, 699, 533 tons in 1952. Thirty per cent of the ore was mined in open-pit operations. In the Sullivan concentrator 144, 573 tons of lead concentrate and 226, 772 tons of zinc concentrate were produced. The metals contained in these concentrates included 103, 893 tons of lead and 114, 905 tons of zinc. About 4, 000 tons a day of coarse waste rock was removed from the mill feed in a sink-float plant and returned to the mine for use as backfill.

Production, Trade, and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production, all forms				
British Columbia . .	148,818	38,472,263	129,385	41,894,771
Newfoundland	17,702	4,576,214	18,059	5,847,571
Yukon	15,795	4,083,449	9,184	2,973,883
Quebec	9,237	2,387,930	10,520	3,406,353
Nova Scotia	1,826	472,074	778	252,021
Ontario	328	84,892	902	291,979
Northwest Territories	-	-	14	4,443
Total . . .	193,706	50,076,822	168,842	54,671,021
Production, refined (includes lead from imported ores) . . .	165,752		182,943	
Exports, ore or concentrate				
To: United States . .	40,617	9,986,518	9,718	2,669,903
Belgium	11,457	2,605,704	9,035	2,752,561
W. Germany . .	9,609	2,192,522	5,214	1,475,176
Total . . .	61,683	14,784,744	23,967	6,897,640
Exports, refined lead including scrap				
To: United Kingdom	51,156	10,022,265	26,657	8,788,073
United States . .	50,094	12,550,205	105,755	33,119,977
Brazil	1,061	245,913	1,240	482,228
Belgium	336	68,909	280	67,529
Other countries	755	163,363	1,021	320,328
Total . . .	103,402	23,050,655	134,953	42,778,135
Imports, lead and lead products				
Tetraethyl compounds		10,456,800		9,270,084
Pigs and blocks . .		62,427		127,066
Manufactures n. o. p.		255,067		214,325
Litharge		274,654		231,159
Capsules		97,384		141,186
Miscellaneous . . .		116,804		138,801
Total . . .		11,263,136		10,122,621

	1953		1952	
Domestic Consumption refined lead	Short Tons	$	Short Tons	$
Ammunition	3,784		3,006	
Foils and collapsible tubes	1		3	
Heat treating	372		363	
Oxides, paints, and pigments	6,602		7,439	
Solders	2,867		2,462	
Babbitt	344		273	
Type metal	156		204	
Antimonial lead[a]	4,169		2,585	
Cable covering	17,635		15,959	
Pipes, sheets, traps, and bends	4,995		4,005	
Block, for caulking, etc.	3,597		3,744	
Batteries[b]	12,589		11,527	
Miscellaneous	1,248		1,869	
Total	58,359		53,439	

a. Lead content of antimonial lead.
b. Amount of pig lead consumed in battery makers' own plants. Does not include content of antimonial lead.

Production at Cominco's Bluebell lead-zinc mine at Riondell on the east side of Kootenay Lake was increased to 750 tons per operating day. Construction of a 1,000-ton mill at the company's H. B. zinc-lead mine near Salmo was completed but the commencement of production was deferred.

Sil-Van Consolidated Mining and Milling Company Limited commenced production of lead and zinc concentrates in a 150-ton mill in June at its property near Smithers.

Giant Mascot Mines Limited deepened its underground workings and increased production to about 500 tons of ore a day at its lead property near Spillimacheen.

Canadian Exploration Limited completed a large-scale development program, including the use of trackless mining and about 7,000 feet of conveyor-belt ore transport systems, at its Jersey zinc-lead mine near Salmo. Owing to the decline in metal prices, the daily tonnage milled was reduced in December from 1,800 tons to 1,000 tons.

Other producers of lead concentrate included: Tulsequah Mines Limited, a subsidiary of Cominco, Taku River area; Violamac Mines Limited and Carnegie Mines Limited, near Sandon; Sunshine Lardeau Mines Limited, near Camborne; Silver Standard Mines Limited, near Hazelton; and Yale Lead and Zinc Mines Limited at Ainsworth.

Because of prevailing prices, production was suspended at a number of lead-zinc mines, the most important being Reeves MacDonald Mines Limited, which discontinued operation of its 1,200-ton concentrator in April, and at the Zincton and Paradise mines of Sheep Creek Gold Mines Limited; the Cork Province, Monarch, and Kicking Horse mines of Base Metals Mining Corporation Limited; and the Premier and Indian mines of Silbak Premier Mines, Limited. Britannia Mining and Smelting Company Limited discontinued the production of lead concentrates early in 1953.

The modernizing of Cominco's lead smelter at Trail neared completion. New charging, sintering, and gas-handling equipment was installed.

Ontario

A small amount of lead concentrate was produced by Matachewan Consolidated Mines Limited from the Matarrow lead mine in the Matachewan area. The operation was uneconomic and the mine was closed in January, 1953.

Jardun Mines Limited prepared its property near Sault Ste. Marie for production of zinc and lead concentrates on a basis of milling 100 tons of ore daily.

Quebec

Lead concentrates were produced by New Calumet Mines Limited, Pontiac county; Anacon Lead Mines Limited and United Montauban Mines Limited, Portneuf county; Golden Manitou Mines Limited, Abitibi county; and by Consolidated Candego Mines Limited, North Gaspé county. Ascot Metals Corporation Limited produced a bulk copper-lead concentrate from its Suffield and Moulton Hill mines near Sherbrooke. The Moulton Hill mine was closed in July.

United Montauban Mines Limited commenced production of zinc and lead concentrates in a new 500-ton mill in August.

New Brunswick

Brunswick Mining and Smelting Corporation Limited continued diamond-drill exploration of its Austin Brook zinc-lead deposit

17 miles southwest of Bathurst, discovered in 1952. Overburden was stripped from a section of the ore zone to permit the mining of a small amount of ore for metallurgical-treatment investigations. In September the company acquired the Anacon-Leadridge property, about five miles north of the Austin Brook deposit, where a similar type of orebody was delineated. The two deposits are estimated to contain about 46 million tons to a depth of 1,000 feet, averaging 5.25 per cent zinc, 1.84 per cent lead, and appreciable amounts of silver, copper, and tin, as well as considerable pyrite.

Keymet Mines Limited commenced construction of a 200-ton mill at its zinc-lead property 15 miles north of Bathurst, at which production of zinc and lead concentrates was expected to commence early in 1954.

Nova Scotia

Mindamar Metals Corporation Limited continued the operation of the Stirling mine, Cape Breton Island, at which production was resumed in 1952. It produced zinc concentrate and copper-lead concentrate containing about 1,900 tons of lead.

Newfoundland

Buchans Mining Company Limited operated its 1,350-ton mill at an average of 950 tons a day, producing zinc, lead, and copper concentrates in which there was a total lead content of about 20,000 tons.

Yukon

United Keno Hill Mines Limited, the principal operator, increased production of lead and zinc concentrates from its property in the Mayo district, particularly from newly developed levels at the Hector mine. A new deeper level was established at the adjoining Calumet mine.

The 220-ton mill constructed jointly by Mackeno Mines Limited, Yukeno Mines Limited, and Bibis Yukon Mines Limited, also in the Mayo district, commenced production of lead and zinc concentrates in April. Most of the ore treated came from the Mackeno mine, but a small amount of ore was milled for Bellekeno Mines Limited on a custom basis.

Northwest Territories

Pine Point Mines Limited, a subsidiary of Cominco and Ventures Limited, discontinued in September an exploratory diamond-drilling program it has been carrying out for several years at its zinc-lead deposit at Pine Point, Great Slave Lake. Several million tons of ore averaging 10 per cent combined metals have been blocked out on the property, a large part of which may be mined by open-pit methods.

USES

Lead is used principally in storage battery manufacture, cable covering, and in tetraethyl lead compounds for improving the quality of gasoline. It is also used for acid tank lining, ammunition, bearing metal, Babbitt metal, solder, litharge, red lead, and white lead.

The industrial application of atomic energy will involve a potential new use for sizable amounts of lead for the protection of personnel against radiation.

The lead content of storage batteries and many other lead manufactures can be recovered when the article or application ceases to be serviceable. Hence the use of secondary lead is a very important factor in the over-all consumption.

PRICES

The Canadian price of lead fluctuated between 14, 25 cents a pound and 11. 75 cents a pound. It was 13. 00 cents a pound at the end of the year. The average price, estimated by the Dominion Bureau of Statistics, was 13. 15 cents a pound.

MAGNESIUM

During 1953, magnesium was produced by two companies -- Dominion Magnesium Limited, at Haley, Ontario, and Aluminum Company of Canada Ltd. (Alcan), at Arvida, Quebec.

Dominion Magnesium uses the thermal ferrosilicon process to produce the metal from dolomite quarried at the plant. The potential capacity of the plant, if devoted entirely to magnesium production, is 6, 000 tons a year, but some calcium also is produced. A new foundry was opened at Haley in September, 1952, for the production of magnesium castings. During 1953, Dominion Magnesium completed a million-dollar plant at Beauharnois, Quebec, to produce ferrosilicon for the Haley plant. The silica comes from a deposit at Lac Bouchette, a few miles south of Lake St. John.

At Arvida, Alcan produces magnesium by means of the electrolytic process: the plant has a capacity of 4, 000 metric tons a year. The raw material is brucite, obtained from brucitic limestone from the company's mine near Wakefield, Quebec.

The following magnesium foundries for the production of magnesium castings are established in Canada:

Robert Mitchell Company, Ltd., Montreal, Que.
Aluminum Company of Canada, Ltd., Etobicoke, Ont.
Canadian Magnesium Products Ltd., Preston, Ont.
Grenville Castings Ltd., Merrickville, Ont.
Barber Die Castings, Ltd., Hamilton, Ont.
Light Alloys Ltd., Renfrew and Haley, Ont.
Western Magnesium Ltd., Vancouver, B.C.

Dominion Magnesium has a 2,400-ton extrusion press and a 500-ton vertical forming press at its Haley foundry.

SOURCES OF MAGNESIUM

The principal ores of magnesium are dolomite, magnesite, and carnallite. Magnesium also occurs as magnesium chloride in some natural salt brines. These were the main source of magnesium produced in the United States prior to World War II. Another important source is sea-water, which contains approximately 0.5 per cent of magnesium chloride. This was the source of most of the magnesium produced in the United States during the last war.

PRODUCTION

The Second World War greatly stimulated the demand for magnesium, which was needed for the manufacture of incendiary bombs and parachute flares, and especially for aircraft components and air-borne equipment. Its restriction to war uses, however, meant that relatively few consumers in other industries became familiar with its working properties until hostilities ended.

As more magnesium became available for civil use, and technical improvements were made in the alloying and fabricating of the metal, consumption has increased. However, the slackening of stockpiling in the United States, the largest producer and consumer, led to a decline in production during 1953.

Principal Producers of Magnesium, 1950-53 *
(short tons)

Year	United States	Canada	France	Italy	United Kingdom**
1950	15,726	1,770	492	134	5,309
1951	40,881	***	962	746	8,814
1952	105,821	***	1,202	1,076	5,192
1953	93,075	***	1,098	1,595	5,951

* American Bureau of Metal Statistics
** Includes secondary products
*** Not published

USES

The light weight of magnesium, combined with good strength and stability, account for the use of large quantities of the metal in a

wide variety of applications. The aircraft industry is by far the largest user for structural purposes. Large quantities of cast magnesium alloys are being employed in jet engines, but the most significant development in this field is the increased use of wrought magnesium products in the airframe itself.

Its use in materials handling equipment, portable tools, ladders, the transportation industries generally, and in die-castings for automotive and other purposes is steadily expanding. When alloyed with aluminum to the extent of about one per cent, magnesium imparts increased strength without increasing weight, and such alloys are finding increasing use in many fields.

The electro-chemical properties of magnesium are of value in providing anodic protection against corrosion of iron and steel, and large quantities are used for this purpose. The chemical and metallurgical industries are using increasing amounts of magnesium for deoxidizing and desulphurizing metals, the production of malleable cast-iron, the manufacture of silicones, and many other purposes.

PRICES

Prices quoted by one major producer during 1953 were 32-34 cents per pound for pure 20-lb. ingots and 35-37 cents for standard alloys. Effective January 1, 1954, these prices were dropped to 31 cents and 32.5 cents respectively.

MANGANESE

Canada produces no manganese ore, the known deposits being considered either too small or too low-grade for commercial exploitation. Canada is, therefore, entirely dependent upon imports of the ore for its steel industry, as is, in fact, every large steel-producing nation in the free world to a considerable extent.

Approximately 95 per cent of the world output of manganese ore is used in the manufacture of manganese alloys for the steel industry. An average of 13 pounds of manganese must be added to produce a ton of steel ingot, this amount being necessary to deoxidize, clean, and combine with sulphur to permit the successful rolling and fabrication of the steel. As an alloying element, manganese improves the strength and toughness of structural steels and cast-irons.

Although Canada produces no manganese ore, the availability of abundant and cheap power has made possible the establishment of a modern ferromanganese plant at Welland, Ontario, in which high- and low-carbon ferromanganese and silicomanganese are manufactured in electric furnaces. The plant is operated by Electro Metallurgical

Company, a division of Union Carbide Canada Limited. Canadian Furnace Company Limited at Port Colborne, Ontario, produces silvery pig-iron from low-grade manganiferous ores.

The volume of imports of manganese ore, exports of ferromanganese, and consumption of metallurgical-grade ore in Canada in 1953 showed a considerable decrease because of the loss of export trade with United States, where substantial additions were made to ferromanganese production capacity during 1952 and early in 1953.

CANADIAN OCCURRENCES

Small tonnages of manganese ore have been produced from time to time from several of the bog manganese deposits in New Brunswick. During 1953 some exploration was carried out in the Tetagouche Falls and Woodstock areas of the province. Other bog deposits occur in Nova Scotia, Manitoba, and British Columbia but they are of low and variable grade and lack sufficient tonnage and continuity to make them attractive economically.

Labrador Mining and Exploration Company Limited has developed 13,321,000 long tons of manganiferous iron ore averaging 49.93 per cent iron and 7.45 per cent manganese, and Hollinger North Shore Exploration Company Limited has developed 40,045,000 long tons averaging 50.25 per cent iron and 7.70 per cent manganese at their respective iron ore properties in Labrador and Quebec.

WORLD PRODUCTION

The estimated world mine production of manganese ore during 1952 was 7,700,000 metric tons, of which Soviet Russia accounted for an estimated 2,500,000 metric tons, or 32 per cent of the total.

The free world supply of manganese comes mainly from the Gold Coast, Union of South Africa, India, and French Morocco. The Indian output is generally consigned to United States, while the North African production supplies European markets. The output of the Gold Coast and the Union of South Africa goes to both markets. Production from the Gold Coast, Union of South Africa, and India is mostly metallurgical-grade but the Gold Coast also ships a large amount of battery-grade. Of importance is the growing production in Brazil, Cuba, Turkey, Mexico, Egypt, and Japan.

The United States imports about 90 per cent of its manganese ore requirements. To encourage increased domestic production, the government, in 1951, introduced an incentive price purchase plan for domestic ores. Deliveries under the plan up to the end of 1953 amounted to 3,864,962 long ton units. The government is also encouraging the production of manganese ores from nearby sources, notably from the Amapa deposits in Brazil, in an effort to shorten supply lines in the event of emergency. Government procurement agencies have

Trade and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Imports of manganese ore				
From: United States[a] ...	31,709	1,190,745	74,393	3,194,832
Belgium[a]	12,340	635,852	-	-
India	11,043	372,228	13,954	402,217
Gold Coast ...	10,035	453,462	63,112	2,741,404
Turkey	-	-	25,688	1,257,255
Union of S. Africa	1,500	56,148	7,520	355,311
United Kingdom .	55	11,428	50	6,130
Other countries .	-	-	9,688	316,573
Total	66,682	2,719,863	194,405	8,273,722
Exports of ferromanganese				
To: United States ..	399	104,013	29,501	5,515,812
Mexico	127	26,529	823	157,243
Venezuela ...	123	26,780	72	15,531
Colombia	34	7,150	49	10,801
Spain	-	-	830	180,059
Other countries .	-	-	15	3,777
Total	683	164,472	31,290	5,883,223
Consumption of ore				
Metallurgical-grade	62,462		165,847[b]	
Battery grade ..	3,188		3,650	
Total	65,650		169,497[b]	

a. Country of origin not known
b. Revised

also entered into agreements with commercial interests for the recovery of ferromanganese from open-hearth slags.

CONSUMPTION, USES, AND SPECIFICATIONS

As noted, 95 per cent of the output of manganese ore is consumed by the iron and steel industry. The dry-cell battery industry accounts for three per cent, and the chemical industry for the remainder.

Metallurgical-grade Manganese

Most of the manganese consumed by the steel industry is in the form of high-carbon ferromanganese and the remainder as low- and medium-carbon ferro-manganese, silicomanganese, spiegeleisen,

manganese metal, and ore in the order given.

Electrolytic manganese metal is used in place of low-carbon ferromanganese to reduce the carbon content in stainless steels, thus eliminating the need of a carbon stabilizer.

General specifications for metallurgical-grade manganese ore are as follows: minimum of 48 per cent manganese; maxima of 7 per cent iron, 8 per cent silica, 0.15 per cent phosphorus, 6 per cent alumina, and one per cent zinc. The ore should be in hard lumps less than 4 inches, and not more than 12 per cent should pass a 20-mesh screen.

Battery-grade Manganese

Manganese ore for dry-cell use must be a manganese dioxide (pyrolusite) ore of not less than 75 per cent MnO_2 and not more than 1.5 per cent iron, and should be very low in such metals as arsenic, copper, zinc, nickel, and cobalt.

Chemical-grade Manganese

Ore for chemical use should contain at least 35 per cent manganese and is used to make manganese sulphate fertilizer and various salts for use in the glass, dye, paint, varnish, and photographic industries.

Canadian Consumers

Metallurgical ore consumers are Electro Metallurgical Company at Welland, and Canadian Furnace Company Limited at Port Colborne, both in Ontario.

Battery-grade ore consumers are National Carbon Limited, and General Dry Batteries of Canada Limited, both of Toronto; Burgess Battery Company, Limited in Niagara Falls, Ontario, and Ray-O-Vac (Canada) Limited in Winnipeg.

Electrolytic manganese metal imported from the United States is consumed by Atlas Steels, Limited, Welland, Ontario, in the manufacture of low-carbon stainless steel. It is also used by the aluminum and magnesium alloy industry.

PRICES

The E. and M.J. Metal and Mineral Markets Bulletin of December 31, 1953, quoted the following United States prices for manganese ore and compounds:

Metallurgical Grade

Indian ore - Nominal at $1.08 to $1.10 per long ton unit of Mn, c.i.f. United States ports, duty extra, basis 46 - 48% Mn, nearby positions.

West Africa and other sources - On long-term contracts, 46 - 48% Mn, quotations nominal at 90 cents, c.i.f. United States ports, duty extra.

Chemical Grade

Brazilian or Cuban, per long ton, coarse or fine, minimum 80% MnO_2, carloads, in barrels, $65 to $75.

Domestic, per long ton, coarse or fine 70 - 72% MnO_2, $45 to $50, f.o.b. mines.

Addition Agents

Ferromanganese. Per net ton, 74 - 76% Mn, f.o.b. Clairton, Sheridan, and Johnstown, Pa., $200; 76 - 80% Mn, f.o.b. Niagara Falls, N.Y., and Alloy, West Virginia, 13.15 cents per lb. of contained Mn.

Silicomanganese. Per lb., carload lots, f.o.b. shipping point, freight allowed, 65 - 68% Mn.

Maximum 1 1/2%	C, 18 - 20%	Si - 11.4 cents
" 2%	C, 15 - 17 1/2%	Si - 11.2 cents
" 3%	C, 12 - 14 1/2%	Si - 10.9 cents

The above prices, subject to the exchange rate on the Canadian dollar, are indicative of Canadian prices.

TARIFFS

Canada

	British Preferential	Most Favoured Nation	General
Manganese ore	free	free	free
Ferromanganese (per lb. of contained Mn)	free	1¢	1 1/4¢
Silicomanganese (per lb. of contained Mn)	free	1 1/2¢	1 3/4¢

United States

Manganese ore
Over 10% but less than 35% Mn.
On Mn content - 1/4 cent per lb.
- Cuba free

35% Mn and over
Battery and Chemical grades
On Mn content - 1/4 cent per lb.
- Cuba free

Metallurgical grades
On Mn content - 1/4 cent per lb.
- Cuba free

Manganese Alloys
  Ferromanganese
    30% or more Mn.
      Containing not over 1% carbon
        On Mn content - 15/16 cents per lb. and 7 1/2% ad valorem.
      Containing over 1% and less than 4% carbon
        On Mn content - 15/16 cents per lb.
      Containing not less than 4% carbon
        On Mn content - 5/8 cents per lb.

Manganese silicon (including silicon manganese)
        On Mn content - 15/16 cents per lb. and 7 1/2% ad valorem.

Spiegeleisen containing not more than 1% carbon and manganese boron.
        On Mn content - 15/16 cents per lb. and 7 1/2% ad valorem.

Manganese metal
        On Mn content - 1 7/8 cents per lb. + 15% ad valorem.

MERCURY

There has been no production of mercury in Canada since September, 1944, and all shipments since then have been from producers' stocks. The only known Canadian deposits of cinnabar (HgS), the principal ore of mercury, are in the Omineca Mining Division of northern British Columbia, where The Consolidated Mining and Smelting Company of Canada Limited accounted for nearly all of Canada's production of mercury during the war years 1940-1944, the source being its Pinchi Lake mine. Bralorne Mines Limited produced the remainder from its Takla mine, 85 miles northwest of Pinchi Lake. Output from these mines reached a peak of 22,240 flasks (a flask contains 76 lbs.) during 1943, and was discontinued in September, 1944, when it became cheaper to obtain mercury from Italy and Spain. The deposits in British Columbia average about 0.5 per cent of mercury and are capable of supplying Canadian requirements for many years, if necessary.

WORLD PRODUCTION AND TRADE

Spain and Italy are the principal producers of mercury, their combined resources being sufficient to meet world requirements. Yugoslavia, the United States, and Mexico also produce important quantities.

In Spain, the Almaden mine, with ore grading five to six per cent of mercury, is the richest in the world. Capacity of this mine will be doubled when installation of new equipment, under way in 1953, is complete.

Exports, Imports, and Consumption

	1953		1952	
	Pounds	$	Pounds	$
Exports				
To: United States	7,018	18,857	1,500	4,935
Imports				
From: United States[a]	140,926	318,245	136,349	370,901
Mexico	27,873	56,434	1,520	3,943
Netherlands	22,770	52,370	-	-
Portugal	3,982	6,815	6,570	13,181
Other countries	861	2,176	-	-
Total . . .	196,412	436,040	144,439	388,025
Consumption				
Heavy chemicals	138,928[b]		229,900	
Pharmaceuticals and fine chemicals	47,728		26,600	
Electrical apparatus	9,196		8,132	
Gold mines	6,000[c]		6,000[c]	
Miscellaneous	10,000[c]		10,000[c]	
Total . . .	211,852		280,632	

a. Country of origin not necessarily United States.
b. The decrease was due to a decline in the requirements of chlorine and caustic soda manufacturers.
c. Estimated.

Most of the Italian production comes from the Monte Amiata mine in Tuscany, the reserves averaging about 1.3 per cent of mercury. Control of the Idria mine in the Trieste area passed from Italy to Yugoslavia at the end of World War II. This mine ranked next to the Almaden mine in production before World War II and largely accounts for Yugoslavia's rise as an important producer.

World consumption of mercury in recent years has averaged about 150,000 flasks per year, with a peak of 270,000 flasks in 1942.

USES

In addition to its uses in the chemical, pharmaceutical, and electrical industries, mercury is used in the manufacture of agricultural disinfectants and fungicides, and of anti-fouling compounds for ships' hulls. In the gold-mining industry it is used in the extraction of the metal by amalgamation. Mercury is also used in dental preparations, in making detonators, as a catalyst, and in general laboratory work.

PRICES

Canadian prices are based largely on United States prices. According to the E. and M. J. Metal and Mineral Markets, the price of mercury in the United States declined steadily from a high average monthly price of $212.962 per flask in January to a low of $183.423 per flask in October, and increased slightly to $185.923 in December. These prices include U. S. import duty of $19 per flask. There is no Canadian import duty.

MOLYBDENUM

Shipments of molybdenite from Canadian production dropped from 253 tons of contained molybdenite (MoS_2) in 1952 to 162 tons in 1953, the reason being that the sole producer, Molybdenite Corporation of Canada Limited, ceased production at mid-year to permit the expansion of its mine and mill facilities. Production was expected to resume in March, 1954.

Increased supplies and lower prices of tungsten ores relieved the pressure on molybdenum supplies, which had become critically short following the commencement of the Korean war. The improved position during 1953 made it possible for the International Materials Conference to discontinue recommending the allocation of molybdenum to the countries of the free world. In Canada and the United States the allocation of domestic supplies was discontinued by the Non-Ferrous Metals Division, Department of Defence Production, and by the National Production Authority, respectively. Prices for molybdenum ore, metal, and primary products remained constant in contrast to the general lowering of metal prices.

Occurrences of molybdenite are common in Canada, but only a few have been developed successfully, as the tonnages available are limited. Canada's production comes from the mine of Molybdenite Corporation of Canada Limited about 25 miles north of Val D'Or in western Quebec. This property was operated during World War II by a Crown company, Wartime Metals Corporation, which constructed a 275-ton mill on it. Production from May, 1943, until July, 1945, amounted to 2,739,539 pounds of concentrate averaging 87 per cent MoS_2 and containing 1,429,711 pounds of molybdenum. As there are no Canadian plants equipped to convert molybdenite into primary products, the concentrates were shipped to Langeloth, Pennsylvania, for treatment and returned to Canadian consumers. The property was returned to the present operating company on July 15, 1945 and continued in production until December, 1947, when operations were suspended. The company resumed test milling early in 1951 and succeeded in producing a concentrate relatively free of bismuth and containing over 90 per cent MoS_2. By the end of 1951 it had increased the milling rate to about 280 tons per day.

During 1952, underground development on the 270-, 375-, and 500-foot levels together with diamond drilling indicated further ore at greater depth. Plans were made to suspend production during 1953 to permit the opening up of two new levels at the 625- and 750-foot horizons and the preparation of the mine for production at the rate of 500 tons per day with a milling rate of about 350 tons per day.

To finance this expansion a contract was entered into with the United States Government, through its Defense Materials Procurement Agency, whereby the United States Export-Import Bank agreed to advance $540,000 towards the expansion program in return for an option on 6,000,000 pounds of molybdenite and upwards of 450,000 pounds of bismuth metal over a period of six years. The price to be paid for the molybdenite is in excess of the world market price.

Production, Imports, Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production (shipments)				
Contained MoS_2	162	215,527	253	409,831
Imports				
Molybdic Oxide				
From: United States	178	372,185	260	537,356
United Kingdom	1	2,333	-	-
Total	179	374,518	260	537,356
Calcium Molybdate (grouped with vanadium oxide and tungsten oxide for alloy steel manufacture)				
From: United States	99	101,433	84	270,444
Ferromolybdenum[a]	101	165,501	220	354,212
Consumption (Mo content)				
Molybdic oxide	200		239	
Ferromolybdenum	56		111	
Calcium molybdate	18[b]		4	
Total	274		354	

a. Not recorded separately in the official trade statistics of Canada. Figures are from the United States Export Statistics.
b. 1953 - Includes sodium molybdate, molybdenum metal powder, and molybdenum wire.

Quebec Metallurgical Industries Limited carried out exploratory work on a molybdenite property near Quyon, Quebec, during the year.

WORLD MINE PRODUCTION

The world mine production of molybdenum in ores and concentrates during 1952 amounted to 22,200 metric tons, of which the United States accounted for 19,622 metric tons. The remainder came from Chile, Canada, Norway, and Japan. Production from United States alone in 1953 is expected to amount to approximately 26,000 metric tons.

The United States has two large producers: Climax Molybdenum Company at Climax, Colorado, which is the largest single source of molybdenite in the world, and Kennecott Copper Corporation, which recovers molybdenite as a by-product in the concentration of its Utah, New Mexico, and Nevada copper ores. On behalf of the Defense Materials Procurement Agency, Climax has under way an expansion program that will effect a considerable increase in output during 1954.

Production in United States also comes from the molybdenite mine of Molybdenum Corporation of America at Questa, New Mexico; the copper mines of Miami Copper Company at Miami, Arizona; and the tungsten mine of United States Vanadium Corporation at Bishop, California.

In Chile, the second largest producing country, molybdenite is recovered as a by-product in the milling of copper ores of Braden Copper Company, a subsidiary of Kennecott Copper Corporation.

CONSUMPTION AND USES

About 90 per cent of all molybdenum produced is used as an additive in the form of ferromolybdenum, molybdic oxide, or calcium molybdate in making steel and cast-iron. For the production of low-molybdenum steels, molybdic oxide is the form most generally used. Ferromolybdenum is used where a higher molybdenum content is required, as in cast-iron and steel foundries.

Much of the molybdenum used in alloy steels goes into the making of gears and axles for the automobile, railroad, and shipbuilding industries, shafts for mining and industrial machinery, and castings for pumps and valves. Varying amounts of molybdenum are used in high-speed tool steels, high-temperature alloys, and stainless steels.

Molybdenum wire and sheet are used in the electric lamp, radio valve, rectifier, and resistance wire industries. Molybdenum is used in conjunction with cobalt as a catalyst in hydroforming, desulphurization, and hydrogenation. Molybdenum salts are used in

pigments, mordants, and welding rod coatings: they have a limited use in the chemical field. Pure molybdenite is finding increasing use as a lubricant.

The more important Canadian consumers of molybdenum primary products are Atlas Steels, Limited; Algoma Steel Corporation; The Steel Company of Canada, Limited; Sorel Industries, Limited; Shawinigan Chemicals, Limited; Welland Electric and Steel Foundry, Ltd.; Dominion Engineering Works, Ltd., and Dominion Colour Corp. Ltd.

PRICES

According to E. and M. J. Metal and Mineral Markets, December 31, 1953, prices of molybdenum in United States were as follows:-

Molybdenum metal

99% purity, per lb.	$ 3.00

Ferromolybdenum

f. o. b. shipping point, per lb. of contained Mo	
55-65% Mo, powdered	$ 1.41
all other sizes	$ 1.32

Calcium molybdate ($CaO\ MoO_3$)

f. o. b. shipping point, per lb. of contained Mo	$ 1.15

Molybdic trioxide (MoO_3)

f. o. b. shipping point, per lb. of contained Mo	
bagged	$ 1.13
canned	$ 1.14

Molybdenite

f. o. b. mines, per lb. of contained MoS_2 in a 90% concentrate	$ 0.60

TARIFFS

Canada

	British Preferential	Most Favoured Nation	General
Calcium molybdate	free	free	5% ad val.
Molybdic oxide	"	"	"
Ferromolybdenum	"	5% ad val.	"
Molybdenum ore and concentrate	"	free	free

United States

(a) Molybdenum ore and concentrate, 35 cents per lb. on Mo. content.
(b) Calcium molybdate, ferromolybdenum, metallic molybdenum, molybdenum powder, and all other alloys and compounds of molybdenum, 25 cents per lb. on Mo content and 7 1/2% ad valorem.
(c) Material containing over 50% molybdenum: bars, ingots, scrap, and shot, 25% ad valorem; other forms - 30% ad valorem.

NICKEL

Production of nickel in all forms was 287,385,777 pounds, valued at $160,430,098, compared with 281,117,072 pounds, valued at $151,349,438, in 1952. Nickel was first in point of value in metallic mineral production and was exceeded only by petroleum in the over-all mineral production for 1953. Except for a small output from three new operations in the Sudbury area and a small recovery in the treatment of silver-cobalt ores from the Cobalt area, Ontario, all Canadian production was from the mines of The International Nickel Company of Canada, Limited and Falconbridge Nickel Mines Limited.

Canadian production in 1953 accounted for about 80 per cent of the free-world output of nickel. Although the demand for nickel in 1953 continued at a high level, there was a substantial relaxation in government restrictions. Allocations by the International Materials Conference were discontinued at the end of the third quarter, and in August the Organization for European Economic Co-operation released member countries from their agreement to restrict the use of nickel. In October, controls on the civilian use of nickel were revoked in the United States, although safeguards were provided to assure adequate supplies to meet military and atomic energy requirements. All use and purchase controls were revoked in Canada and similar restrictions on nickel in the United Kingdom were removed in the last quarter of the year.

The concentrator of Sherritt Gordon Mines Limited at Lynn Lake, Manitoba, was completed and the railway extension from Sher-

ridon was opened for traffic late in the year. The refinery at Fort Saskatchewan, Alberta, was nearing completion at the year's end. The expansion programs in the Sudbury district were continued and active development and exploration were carried out in various parts of Canada.

The Nicaro operation in Oriente Province, Cuba, produced 14,000 tons of nickel. Work on the Riddle plant in Oregon, United States, was begun in September and is expected to produce between 7,000 and 9,000 tons of contained nickel in the form of an iron-nickel alloy. The National Lead Company's plant at Fredericktown, Missouri, is expected to be in production in 1954 with an annual output of about 900 tons.

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Production, all forms	143,693	160,430,098	140,559	151,349,438
Exports				
Matte or speiss	63,909	70,312,715	63,753	70,248,850
Oxide	1,299	1,328,992	1,211	1,060,737
Refined nickel	79,909	90,900,597	77,058	79,672,175
Total	145,117	162,542,304	142,022	150,981,762
Exports by destination				
To: United States	95,751	108,116,943	95,292	99,849,500
United Kingdom	32,592	35,841,974	30,951	33,744,999
Norway[a]	16,365	18,001,280	15,193	16,692,071
Brazil	114	169,206	122	134,441
Chile	54	62,912	43	46,690
Other countries	241	349,989	421	514,061
Total	145,117	162,542,304	142,022	150,981,762

a. For refining and re-export only.

ACTIVITIES AT PRODUCING MINES

The International Nickel Company of Canada, Limited continued its extensive program of underground development and expansion of operations. A new metallurgical process was announced whereby high-grade iron ore will be recovered as a by-product in the treatment of a certain portion of the ore mined. The process will increase the output of nickel and will ultimately result in a production of 1,000,000 tons of iron ore annually. In December, the monthly nickel-production capacity was increased by 1,000 tons. This additional output will bring the company's annual rate of nickel production to approximately 137,500 tons. The total ore mined in 1953 was over 13,667,000 tons.

Falconbridge Nickel Mines Limited continued extensive development and expansion in all phases of operations. An increase of 45,745 tons in ore treated was reported, and in addition 122,882 tons of custom ores were treated in the company's plant. Although no new mines entered production in 1953, the Mount Nickel and Hardy mines shipped their first development ore.

Shaft sinking advanced 469 feet at the East mine, about a mile east of Falconbridge, 327 feet at the Mount Nickel mine, a few miles north of Sudbury and 286 feet and 56 feet at the No. 1 and No. 2 shafts, respectively, of Fecunis Lake mine, on the northwestern rim of the Sudbury Basin.

Extensive drilling, crosscutting, and raising were carried out in the East, Mount Nickel, Hardy, Boundary, and Fecunis Lake mines. The first three of these mines are expected to go into production in 1954. The Hardy and Boundary mines are adjoining in Levack township.

A 15-foot blast furnace with ancillary equipment was added to the Falconbridge nickel smelter.

East Rim Nickel Mines Limited in MacLennan township on the east rim of the Sudbury Basin continued shipping development ore to the Falconbridge concentrator until late in the year, when the company's own 500-ton daily capacity mill came into production. Falconbridge has undertaken to purchase a given quantity of concentrates, and to accept shipments at a rate which, if met, will complete the contract in about three years.

Milnet Mines Limited is located in Parkin township, 22 miles northeast of Sudbury. During 1953 the company carried out 2,783 linear feet of advance, plus 1,091 equivalent feet of slashing in crosscutting, drifting, and raising. Average monthly shipments of 12,500 dry tons of crushed ore were trucked to Falconbridge for treatment. Shipments are not expected to continue beyond 1954.

Nickel Offsets Limited, comprising 51 patented claims, is in Foy and Bowell townships, about 20 miles north of Chelmsford. A 300-ton capacity mill was completed and put into operation in September. It is currently treating approximately 225 tons a day. Concentrates are shipped daily to Falconbridge, a distance of 40 miles. Diamond drilling and underground development of the property was continued.

DEVELOPMENT AND EXPLORATION

Eastern Ontario

The Bonter property, lot 27, concession V, Marmora town-

ship, Hastings county, was diamond drilled by Ontario Nickel Mines Limited.

Sudbury Area, Ontario

A number of properties were explored in the Sudbury Basin area.

Western Ontario

In the Kenora district, Quebec Nickel Corporation, Limited, continued exploration and diamond drilling on its 200 odd claims in the Werner Lake-Gordon Lake-Rex Lake area. Substantial tonnages of sub-marginal and marginal nickel-copper ore were indicated.

Further diamond drilling and sampling was carried out on the nickel-copper prospect near Emo in the Rainy River district, which is owned jointly by Ventures Limited and Falconbridge Nickel Mines Limited.

Eastern Quebec

Eastern Metals Corporation Limited continued the development of its nickel-zinc-copper deposit in Rolette township, Montmagny county, Quebec. Work on the three-compartment shaft was continued and lateral exploration was carried out on the 450-foot level.

Quebec Nickel Corporation Limited carried out a geophysical survey on a number of claims in Rolette township in the vicinity of the Eastern Metals property.

Manitoba

The developments connected with the Lynn Lake mine of Sherritt Gordon Mines Limited were completed. Some delays in the construction of the refinery at Fort Saskatchewan were experienced, and full-scale operation of the mine and concentrator was held over until early in 1954. The first shipment of nickel concentrate was made in January, In the initial stages, the copper concentrates will be shipped to The International Nickel Company's smelter at Copper Cliff, Ontario.

In the Mystery Lake area in central Manitoba, further exploration was carried on by Canadian Nickel Company Limited (subsidiary of The International Nickel Company of Canada, Limited) and Mystery Lake Mines Limited. Huge tonnages of low-grade nickel-bearing material have been indicated by diamond drilling.

In the Lac du Bonnet Mining Division, southeastern Manitoba, Maskwa Nickel Chrome Mines Limited carried out development and extensions to the diamond drilling program on several nickel deposits.

British Columbia

Work was started on a new tunnel 1,000 feet below the old adit at the mine of Western Nickel Mines Limited, near Choate. Plans were formulated for bringing this mine into production within the next year or two.

Yukon

Hudson Bay Exploration and Development Company Limited conducted further exploration and diamond drilling on the nickel-copper deposit in the Kluane Lake district. Another discovery of nickel-copper was made by Prospectors Airways Limited about 40 miles southwest of the Hudson Bay property.

Northwest Territories

Rankin Inlet Nickel Mines Limited shipped a complete mining outfit to its property near Rankin Inlet on the west shore of Hudson Bay, Keewatin district. Shaft sinking was started and plans call for the building of a 300-ton concentrator by early 1955.

USES

From 40 to 50 per cent of the nickel consumed is used in the manufacture of stainless and other alloy steels, and cast-iron. Monel metal, Inconel, nickel-silver, brass, bronze, and malleable nickel account for from 25 to 30 per cent. Electro-plating uses about 18 per cent and the balance is used in high-temperature and electrical-resistance alloys, catalysts, ceramics, and miscellaneous applications.

PRICES AND TARIFFS

The Canadian price of nickel was 54 cents per pound for most of January, 1953. In the latter part of January it was increased to 57 cents, where it remained for the rest of the year.

The United States price was 56.5 cents per pound in January 1953. In the latter part of that month it was increased to 60 cents, where it remained for the balance of the year.

The United States tariff on refined nickel is 1 1/4 cents per lb. Nickel oxide and nickel ore and matte enter United States duty free.

PLATINUM METALS

Canada's production of the platinum metals during 1953 was 303,563 ounces of which 137,545 was platinum. This was an increase of 8.5 per cent over the 1952 production. Canada maintained her first-place position by producing about one-half of the world output of these metals.

Other important producing countries are South Africa, whose output may in a few years surpass that of Canada; Russia, which is believed to be producing 100,000 ounces per year and is now selling on the world market; Colombia, with a production rate of about 30,000 ounces per year; and the U.S.A., which turns out slightly more than 25,000 ounces annually, and is the world's largest consumer.

The most important source of platinum is the Canadian nickel industry, from which practically all of the Canadian production is derived. The chief producers are The International Nickel Company of Canada Limited and Falconbridge Nickel Mines Limited. International Nickel recovers the platinum metals, together with gold and silver, as anode residues, which are shipped to the company's precious metals refinery at Acton, near London, England, for treatment. Falconbridge Nickel ships the matte from its smelter at Falconbridge to its refinery at Kristiansand, Norway, where the precious metals are recovered from anode residues. The refined platinum metals are sold on world markets, the greater portion being sent back to this continent for use in the United States. A large part of the shipments to the United States is routed via Canada, which explains the substantial Canadian imports of these metals.

CONSUMPTION

The Canadian consumption of platinum metals is relatively small. The United States is the principal consumer and an idea of the relative amounts used annually can be gained from the following table:

Platinum Metals (Ounces) Used in the United States, 1953
(From U.S. Bureau of Mines)

	Platinum	Palladium	Other Platinum Metals	Total	P.C. of Total Amount Used
Electrical	67,850	152,136	5,073	225,059	42.2
Chemical	160,622	24,961	9,752	195,335	36.6
Jewellery and decorative	31,496	27,583	5,641	64,720	12.2
Dental and medical . .	14,451	26,024	318	40,793	7.6
Miscellaneous	2,161	821	4,409	7,391	1.4
Total . . .	276,580	231,525	25,193	533,298	100.0

USES

The platinum group metals have extremely wide and important applications today in the fields of electricity and electronics, communications, transportation, medicine, dentistry, food, clothing, and shelter. Common applications of the metals are in the manufacture of rayon, glass fibre, nitrates for fertilizers, high-octane gas, vitamins for health, electrodes for aircraft spark plugs, and contacts for the millions of relays required in the telephone system.

Production and Trade

	1953		1952	
	Ounces	$	Ounces	$
Production[a]				
Platinum	137,545	12,550,981	122,317	10,916,792
Palladium, rhodium, ruthenium, iridium, osmium	166,018	7,495,409	157,407	7,559,109
Total . . .	303,563	20,046,390	279,724	18,475,901
Exports				
Platinum metals in concentrates[b]		14,756,828		17,386,276
Platinum metals, refined and semi-processed[c] . .				
To: United States . . .		10,921,621		12,919,157
Other countries . .		600,507		223,679
Platinum, old and scrap				
To: United Kingdom . .		10,940		4,900
United States . . .		-		92,767
Total . . .		11,533,068		13,240,503
Imports				
Platinum and platinum metals, refined and semi-processed[d]				
From: United Kingdom		16,076,843		17,073,798
United States . .		1,054,033		1,135,765
Other countries		202,798		76,116
Total . . .		17,333,674		18,285,679

a. 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 at Acton, near London, England, also at irregular intervals.

b. Shipped to England for refining. Canada does not produce any refined platinum or platinum group metals.

c. These exports are actually imports from the United Kingdom, but were originally derived from the concentrates shipped there from Canada for refining.

d. See preceding note for origin.

The numerous electrical applications of the platinum metals are based upon their resistance to oxidation, sulphidation, spark erosion, and high temperatures, and to their good mechanical properties. Because of their high catalytic activity, resistance to corrosion, and resistance to oxidation at high temperatures, the metals are used extensively in the chemical industry.

Platinum is favoured by jewellers because of its fine appearance, high density, workability, and non-tarnishing quality. Palladium, also used in jewellery, has the beautiful white colour that is so desirable in setting diamonds; it has also the strength to secure the gems and its relative lightness enables elimination of excessive weight. Mirrors for projectors are made by electroplating rhodium on other metals. The brilliant rhodium finish is applied to numerous consumer articles. Ruthenium, iridium, and osmium are mainly used as alloy hardeners for pen-tippings, alloys, and similar purposes. Osmium, the heaviest known substance, has a melting point of 2700°C, and possesses a great capacity to absorb hydrogen.

PRICES

Over the years there have been great variations in prices. During World War II, the price of platinum was controlled at $35.00 per ounce. The current market price is $90.00 to $95.00; in the summer of 1952 it went above $100.00. Since July, 1953, a ceiling price of $93.00 per ounce has applied to platinum in the United States.

Palladium is less costly at $22.00 to $24.00 per ounce, while iridium commands the top price of the group, $170.00 to $200.00 per ounce.

According to the E. and M.J. Metal and Mineral Markets, United States prices per ounce were as follows throughout 1953:-

Platinum	-	$ 90 to $ 95
Palladium	-	$ 22 to $ 24
Osmium	-	$140 to $200
Rhodium	-	$125
Ruthenium	-	$ 75 to $ 93
Iridium	-	$170 to $200

SELENIUM

Selenium is recovered chiefly as a by-product from the treatment of copper sulphide ores. In Canada it is recovered from the

anode slimes accumulated in the electrolytic refining of copper by Canadian Copper Refiners Limited, a subsidiary of Noranda Mines Limited, at Montreal East, Quebec, and by The International Nickel Company of Canada Limited at Copper Cliff, Ontario.

Selenium of high purity continued to be in short supply in 1953 because of the increasingly heavy demand for it in the manufacture of rectifiers. The price of high-purity selenium increased from $3.50 to $4.75 a pound.

Canadian Copper Refiners operates the largest selenium plant in the world, and in addition to very high-purity selenium in metallic or powdered form produces a wide range of selenium compounds. The selenium is recovered as a by-product in the refining of copper anodes produced at the Noranda smelter, Noranda, Quebec, from copper ores mined in the Noranda area, and from blister copper produced by Hudson Bay Mining and Smelting Company, Limited, at Flin Flon, Manitoba.

Selenium is recovered at the Copper Cliff refinery in the form of black, free-flowing powder averaging 99.5 per cent selenium. It originates in International Nickel Company's extensive copper-nickel deposits of the Sudbury area, Ontario.

United States and Canada are the principal producers. Small quantities are produced in Australia, Japan, and several European countries.

The United States and the United Kingdom were studying the possibility of increasing the production of secondary selenium from discarded rectifiers.

USES

The most important use for selenium, arising out of its electro-positive characteristics, is in the manufacture of dry-plate rectifiers for converting alternating current to direct current. There was an increasing demand for selenium rectifiers for such purposes as storage battery charging and electro-plating; in the electronics field the demand for miniature selenium rectifiers has continued to expand rapidly, especially for use in radios, television sets, and signal equipment.

A unique property of the metal is that it increases in electrical conductivity on exposure to light. This property is applied in the manufacture of photo-electric cells for automatically operated swinging doors, alarms, signal lights, etc., in television and sound film equipment, and in photographic exposure meters.

Selenium is also used in glass manufacture as a decolourizing agent, and, in larger amounts, to produce a red or ruby colour. Small

Production, Trade, and Consumption

	1953		1952	
	Pounds	$	Pounds	$
Production				
Quebec	113,533	476,839	78,830	256,198
Manitoba and Saskatchewan	56,115	235,683	81,622	265,272
Ontario	92,698	389,332	81,578	265,129
Total	262,346	1,101,854	242,030	786,599
Exports, metals and salts				
To: United Kingdom	147,814	627,899	133,369	490,629
United States	102,722	428,121	109,840	395,836
Italy	1,458	1,929	-	-
India	1,426	7,425	600	7,066
West Germany	200	1,450	-	-
Other countries	-	-	312	1,170
Total	253,620	1,066,824	244,121	894,701
Consumption by industries				
Glass	2,470		2,660	
Electronics	1,850		300	
Rubber	2,783		4,805	
Agriculture	80		23	
Alloy steel	7,282		3,979	
Total	14,465		11,767	

additions of selenium to rubber promote resistance to heat, oxidation, and abrasion.

Ferroselenium, or iron selenide (about 50 per cent selenium), is used as a master alloy for addition to steel to improve its machining qualities.

PRICES

There are no Canadian quotations for selenium.

The United States price for black powdered selenium, 99.5 per cent, was $3.00 to $3.50 a pound in January and February, and $4.25 to $4.75 for the balance of 1953. High-purity (rectifier grade) selenium was quoted at $6.00 a pound early in 1954.

SILVER

Canadian production of silver during 1953 reached 28, 299, 335 ounces, more than in any other year since 1930, and close to the all-time high recorded in 1910 during the peak of production from Cobalt, Ontario, when 32, 869, 264 ounces were produced. Most of the output comes from the treatment of base-metal ores, though some 11 per cent of the 1953 production was from the cobalt-silver mines of Ontario and about 2 per cent was recovered as a by-product of gold mining.

During the past several years, the production of silver has been rising with the increase in the output of base metals. Although in 1953 some 17 British Columbia lead-zinc mines were closed down owing to the lower price of zinc, there was an increase in the province's production of silver of over 1 1/2 million ounces and, in the whole of Canada, of 3 million ounces over the preceding year.

Canada is the world's third largest producer, following Mexico and the United States.

	1953	1952
	(millions of ounces)	
Mexico . . .	47.9	50.4
United States	35.0	40.2
Canada . . .	28.3	25.2

Other producers are Peru, Australia, Bolivia, and Japan.

Canada produces much more silver than she can consume, while the United States uses more than double her own output. Consumption in the arts and industries in Canada amounted to about 4, 700, 000 ounces during 1953. For coinage purposes, the Royal Canadian Mint used 3, 900, 000 ounces.

OPERATIONS AND DEVELOPMENTS

British Columbia

Canada's largest silver producer is the Sullivan lead-zinc-silver mine at Kimberley, owned and operated by The Consolidated Mining and Smelting Company of Canada, Limited. The ore is concentrated near the mine and the concentrates are shipped to Trail, where the silver is recovered from the tank slimes resulting from the electrolytic refining of lead. The total output of refined silver from this source was 16, 144, 791 ounces, most of which came from the treatment of custom ores and concentrates shipped to Trail by a large number of mining companies in Canada and other countries.

Production, Imports, and Exports

	1953		1952	
	Ounces	$	Ounces	$
Production by provinces				
British Columbia	9,308,874	7,820,385	7,784,964	6,502,002
Yukon	6,639,127	5,577,530	4,028,551	3,364,646
Ontario	5,154,619	4,330,395	6,491,124	5,421,387
Quebec	4,571,373	3,840,410	4,536,247	3,788,673
Saskatchewan and Manitoba	1,687,130	1,417,358	1,591,663	1,329,357
Newfoundland	648,389	544,712	638,524	533,295
Other provinces and Northwest Territories	289,823	243,481	151,154	126,243
Total	28,299,335	23,774,271	25,222,227	21,065,603
Production by sources				
Base-metal ores	24,313,892		19,670,011	
Gold ores	619,855		688,489	
Silver-cobalt and silver ores	3,350,220		4,845,148	
Placer gold operations	15,368		18,579	
Total	28,299,335		25,222,227	
Imports, unmanufactured				
From: United States	287,497	231,165	145,898	128,210
Imports, manufactured				
From: United Kingdom		531,065		394,510
United States		156,392		139,504*
Denmark		25,207		18,402
West Germany		8,236		7,669
Switzerland		6,139		4,252
Other countries		16,422		23,114
Total		743,461		587,451*
Exports, ore and concentrates				
To: United States	5,381,280	4,364,535	3,304,865	2,637,553
Belgium	182,554	148,773	140,538	113,946
West Germany	122,684	100,044	96,623	75,295
Other countries	-	-	4,422	3,582
Total	5,686,518	4,613,352	3,546,448	2,830,376
Exports, bullion				
To: United States	14,632,914	12,231,882	14,928,413	12,617,692
Other countries	-	-	102	111
Total	14,632,914	12,231,882	14,928,515	12,617,803
Exports, manufactured				
To: United States		68,946		81,908
Other countries		3,761		5,381
Total		72,707		87,289

* Revised

Torbrit Silver Mines Limited, near Alice Arm in the Cassiar district, was the province's second largest silver producer with an output of 1,176,759 ounces. The mine was shut down by a strike for nearly five months during 1953.

Other important producers were Silver Standard Mines Limited, near Hazelton; Highland-Bell Limited, Beaverdell; and Violamac Mines Limited and Western Exploration Company Limited in the Slocan district.

Saskatchewan and Manitoba

Hudson Bay Mining and Smelting Company Limited at Flin Flon, on the boundary between Manitoba and Saskatchewan, produces silver as a by-product from its copper-zinc operations. During 1953, this company shipped about 40,000 tons of blister copper containing 1,692,483 ounces of silver. It treated 416,667 tons of copper concentrate, residues, and ores from its Flin Flon mine and also 20,442 tons of copper concentrate containing precious metals from its subsidiary, Cuprus Mines, located 7 1/2 miles northeast of Flin Flon.

The output of the two producing gold mines in Manitoba, San Antonio Gold Mines Limited and Nor-Acme Gold Mines Limited, included some by-product silver.

Ontario

Owing to the Government's incentive price plan on purchases of cobalt ores, the Cobalt-Gowganda mines continued at a relatively high rate of production during the year. Silver content of silver ore shipments made during 1953, via the Temiskaming Testing Laboratories, amounted to 2,717,341 ounces, while the silver content of the cobalt ore shipments was 262,585 ounces. The high-grade silver ore shipments went primarily to the smelter of Deloro Smelting and Refining Company Limited, as did the high-grade cobalt ore shipments. In addition to this, some silver and cobalt ores were shipped to the U.S.A. for refining. Some low-grade silver concentrate was shipped to the smelter at Noranda, Quebec.

The principal silver producers in the Cobalt-Gowganda area were Castle-Trethewey Mines, Limited, Sisco Metals of Ontario Limited, Lost Lake Mines Limited, Silver-Miller Mines, Limited, and Cobalt Consolidated Mining Corporation Limited.

An amalgamation took place during the year whereby the Cobalt Consolidated Mining Corporation Limited took over the following companies:- Silanco Mining and Refining Company, Limited, Cobalt Lode Silver Mines, Limited, Penn Cobalt Silver Mines, Gilgreen Mines Limited, and Hellens Mining and Reduction Company Limited.

The International Nickel Company of Canada, Limited, sold 1,106,733 ounces of silver which it recovered from the treatment of its copper-nickel ores in the Sudbury district.

The 38 Ontario gold mines operating in 1953 recovered 353,532 ounces of silver as a by-product.

Quebec

In Quebec, silver is recovered mainly as a by-product of base-metal mining, with gold mining making a smaller contribution. The principal producer was Noranda Mines Limited, which had an output from its copper smelter of 49,937 tons of copper anodes containing 1,584,940 ounces of silver. Of this amount 404,230 ounces is estimated to have come from the company's Horne mine at Noranda. The remainder came from copper concentrates shipped to the Noranda smelter by Waite Amulet Mines, Limited, Normetal Mining Corporation Limited, Quemont Mining Corporation Limited, and East Sullivan Mines, Limited, all in Abitibi county, and from silver concentrate shipped from mines in the Cobalt and Gowganda areas of Ontario.

Other silver production in the province came from the zinc-lead or zinc-lead-copper ores of New Calumet Mines Limited, Anacon Lead Mines Limited, Golden Manitou Mines Limited, Ascot Metals Corporation Limited, Consolidated Candego Mines Limited, Barvue Mines Limited, United Montauban Mines Limited, and from the 16 gold mines operating in 1953.

New Brunswick

Exploration work continued on the large zinc-lead-copper deposit of Brunswick Mining and Smelting Corporation Limited, which averages about 2 ounces of silver per ton. Other companies with properties in the northern part of the province carried on exploration on similar types of orebodies.

Nova Scotia

Mindamar Metals Corporation Limited produced zinc, lead, and copper concentrates containing about 235,000 ounces of silver at its property on Cape Breton Island.

Newfoundland

Buchans Mining Company Limited shipped copper, lead, and zinc concentrates containing about 650,000 ounces of silver.

Yukon

United Keno Hill Mines Limited, in the Mayo district, produced lead and zinc concentrates and silver precipitates containing over 6 million ounces of silver. Most of the production came from new deeper levels developed at the Hector mine, with additional tonnage from the adjoining Calumet mine, where a winze was deepened to establish a new level. A new 150-ton mill, constructed jointly by Mackeno Mines Limited, Yukeno Mines Limited, and Bibis Yukon Mines Limited on property adjoining that of United Keno Hill Mines Limited, commenced in April to produce lead and zinc concentrates

rich in silver. Most of the ore treated in this mill was supplied by the Mackeno mine, while some ore from the Yukeno and Bellekeno mines was also milled.

CANADIAN SILVER REFINERIES

Plants for the production of fine silver are listed below:-

Quebec

Canadian Copper Refineries Limited, Montreal East.

Ontario

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

British Columbia

The Consolidated Mining and Smelting Company of Canada Limited, Trail.

USES

The four major uses for silver are in coinage; in the manufacture of plate, ornaments, and jewellery; in the photographic industry; and in electro-plating. The use of the metal for coinage has tended to decline in recent years, while the industrial and ornamental uses tend to increase. It is also used, chiefly as an alloying metal, in the manufacture of industrial and scientific equipment; in nickel-steel alloys for wear resistance and thermal conductivity; in silver-brazing alloys; and in making special solders.

In 1953, the United States used some 95 million ounces in the arts and industries--well above double its output. Less than half of this was used for plate and plated ware.

The metal is usually marketed 'pure' (99.99 per cent Ag), or as sterling silver (925 parts silver and 75 parts alloy per thousand). The pure metal may be bought in 1,000-ounce bars or in granulated or powdered form: sterling is usually sold as sheet or wire.

The table below shows the principal uses in Canada for 1952 and 1953:

Canadian Silver Consumption, by Uses

	1953	1952
	ounces	
Coinage	3,855,243	4,245,889
Plate	1,788,323	1,156,206
Silver nitrate	1,282,257	1,082,761
Electro-plating	1,131,634	1,116,538
Wire and rod	284,206	263,351
Grain silver	66,000	62,000
Brazing alloys	32,251)	51,459
Lead-silver alloys	8,535)	
Miscellaneous	69,992	53,669
Total	8,518,441	8,031,873

Coinage leads, for 1953, with 45.25 per cent of the total, followed by sterling, 20.99 per cent; silver nitrate (the greater part used in the photographic industry), 15.05 per cent; and electro-plating, 13.28 per cent.

PRICES

The Canadian price of silver ranged from 80.88 cents per ounce in January, 1953, to a high of 85.25 cents in May. The average price for the year, according to the Dominion Bureau of Statistics, was 84 cents per ounce.

TELLURIUM

Tellurium, like selenium, occurs in extremely small concentrations in certain copper, lead, and gold ores. It usually occurs in much smaller amounts than selenium, and when minerals containing the two metals are associated the relative proportions may be as low as one part of tellurium to thirty parts of selenium. In Canada, tellurium is recovered from the anode slimes resulting from the electrolytic refining of copper.

The two Canadian producers are Canadian Copper Refiners Limited (a subsidiary of Noranda Mines, Limited), Montreal East, Quebec, and The International Nickel Company of Canada, Limited, Copper Cliff, Ontario. The Montreal East plant refines copper anodes produced at the Noranda smelter, Noranda, Quebec, from ores of

Noranda's Horne mine and from other copper mines in the area. Blister copper produced at the copper smelter of Hudson Bay Mining and Smelting Company Limited, Flin Flon, Manitoba, is also usually shipped to Canadian Copper Refiners for electrolytic refining and the recovery of the contained precious and other metals.

Production

	1953		1952	
	Pounds	$	Pounds	$
Quebec	8,770	15,347	-	-
Manitoba and Saskatchewan	2,635	4,611	325	552
Ontario	5,025	8,800	5,710	9,707
Total	16,430	28,758	6,035	10,259

The market is limited and the greater part of the Canadian output is exported to the United Kingdom or United States.

USES

A principal use is as an additive to lead and copper. In the former case, it improves the ductility, and in the latter it increases the hardness and improves the machining qualities without impairing the electrical conductivity.

Early in 1954, The American Institute of Electrical Engineers reported the development of a new lead-tellurium alloy containing an unspecified amount of tellurium for use in sheathing electric power cables.

Tellurium is used in small amounts as a chill inducer to prevent shrinkage in iron castings. It is also used to improve the durability of rubber; to impart bluish or brownish tints in the ceramic and glass industries; and in toning baths in photography.

PRICES

The Canadian price during 1953 was $1.75 per pound.

TIN

Canadian production of tin amounted to 488 long tons valued at $581,746 in 1953 compared with 95 long tons valued at $253,581 in 1952. Canadian output is in the form of concentrates derived from the tailings in the concentration of lead-zinc-silver ore from the Sullivan mine of The Consolidated Mining and Smelting Company of Canada Limited, Kimberley, British Columbia.

Between the end of March and the end of July the world price of tin fell from $1.21 1/2 per pound to 78 1/4 cents. This caused a serious economic crisis in Malaya and other tin-producing countries. Many mines were closed down and production was curtailed in Malaya, Indonesia, and Bolivia, the three largest producers. World production of tin in concentrates for 1953 is estimated at 177,000 long tons compared with 171,000 long tons in 1952. Price and end-use controls on tin were removed in the United States during February, 1953.

Particular significance is attached to the agreement reached by the United Nations Conference on Tin at Geneva, Switzerland, in December. If ratified by the 24 countries specified in the draft agreement, this will establish an International Tin Council with headquarters in London and provide for price stabilization of tin. The stabilization measures proposed call for an initial floor price of £ 640 per long ton, equivalent to 80 cents a pound; an initial ceiling price of £ 880 per long ton, equivalent to $1.10 a pound; the setting up of a buffer stock of tin up to 25,000 long tons, to be contributed by producing countries (75 per cent of buffer stock in metal and 25 per cent in cash for purchase of metal); the administration of the buffer stock by a manager authorized to sell tin when the price exceeds £ 800 per long ton (equivalent to $1.00 a pound) and to buy when it falls below £ 720 per long ton (equivalent to 90 cents a pound); establishment of export controls under certain conditions.

CANADIAN OCCURRENCES

No tin deposits of economic grade have so far been discovered in Canada, but numerous minor occurrences are found in widely separated parts of the country. These are in the New Ross area, Lunenburg county, Nova Scotia; in the Bathurst area, New Brunswick; in the Sudbury and Thunder Bay districts, Ontario; in the Lac du Bonnet district, southeastern Manitoba; in southern British Columbia; in the Mayo district, Yukon; and in the Yellowknife area, Northwest Territories. With the exception of some placer tin (cassiterite, SnO_2) in some creeks in Yukon, the Canadian occurrences are either associated with base metal ores or in pegmatite dykes.

USES AND CONSUMPTION

More than 80 per cent of the tin consumed in Canada is used for tin plate and solder, the former accounting for about 50 per cent. Tin is also used as a constituent of Babbitt metal, bronze, and type metal; in tinning; and in chemicals. For foil and collapsible tubes it has been replaced to a large extent by aluminum.

Production of electrolytic tin plate increased during the year, accounting for well over 60 per cent of the total tin plate output. The fabrication of differential electrolytic tin plate in Canada was still on an experimental basis, the service qualities of the product were still to be tested, and the commercial production was small. Canada was the third largest producer of tin plate in 1953.

Production, Trade, Consumption

	1953		1952	
	Long Tons	$	Long Tons	$
Production	488	581,746	95	253,581
Imports				
Blocks, pigs, bars				
From: Malaya	1,459	3,407,141	2,165	5,822,781
Belgium	984	2,144,617	735	1,966,570
Netherlands	643	1,570,715	459	1,222,182
United Kingdom	575	1,059,452	237	644,323
United States	41	81,605	313	830,714
Italy	-	-	40	108,815
Total	3,702	8,263,530	3,949	10,595,385
Tin plate				
From: United States	5,406	1,007,450	896	158,185
United Kingdom	1,036	206,952	391	134,858
Total	6,442	1,214,402	1,287	293,043
	pounds		pounds	
Tin-foil				
From: United States	16,565	17,022	2,585	3,702
United Kingdom	-	-	194	167
Total	16,565	17,022	2,779	3,869
Babbitt Metal				
From: United States	41,700	16,759	37,500	22,636
United Kingdom	6,700	4,799	3,200	2,084
Total	48,400	21,558	40,700	24,720

	Long Tons	
Consumption		
Tin plate and tinning	1,965	2,517
Solder	1,325	1,080
Babbitt metal	244	212
Brass and bronze	237	225
Tin-foil and collapsible tubes	36	31
Miscellaneous	96	125
Total	3,903	4,190

PRICES

According to E. and M. J. Metal and Mineral Markets the price of tin in the United States declined from a high of $1.21 per lb. in January, 1953, to a low of 77 3/4 cents in August. The price subsequently increased and was 84 3/4 cents per lb. at the end of the year.

TARIFFS

Canadian

Tin in blocks, pigs, or bars for use in Canadian manufacture, tin strip waste, and tin foil enter Canada duty free.

Tin in blocks, pigs, and bars, not for specific use in Canadian manufacture, bears the following duty -

British preferential	-	free
Most favoured nation	-	5% ad valorem
General	-	5% ad valorem

TITANIUM

Canada possesses one of the world's largest deposits of ilmenite at Allard Lake in eastern Quebec. Shipments of ilmenite from these deposits in 1953 to the experimental plant of Quebec Iron and Titanium Corporation at Sorel, Quebec, totalled 125,234 tons[1] compared to 266,410 tons in 1952. Shipments from Sorel during 1953 were 140,992 tons of titanium dioxide concentrate (electric smelter slag) containing approximately 100,527 tons of titanium dioxide. Shipments of ore from the St. Urbain area of Quebec totalled 4,731 tons.

Titanium research in all fields from ore to metal continued at the Mines Branch, Ottawa, and some research was carried on by the Ontario Research Foundation. In industry, Shawinigan Water and Power Company Limited, Dominion Magnesium Limited, Quebec Metallurgical Industries Limited, Thompson Products Limited, and Atlas Steels Limited were engaged in various forms of titanium research.

Ilmenite ($FeTiO_3$), rutile (TiO_2), and sphene ($CaTiSiO_5$ - also called titanite) are the most abundant of the different titanium minerals. The principal ores are titaniferous magnetite, titaniferous hematite, ilmenite, and rutile. Rutile contains up to 60 per cent titanium and is the more desirable ore, but ilmenite, which may contain about 32 per cent titanium (52.7 per cent TiO_2), is cheaper and more plentiful. For industrial purposes the only distinction between ilmenite and titaniferous magnetite is in the titanium content. Ore classed as ilmenite generally carries 18 to 24 per cent and upwards of titanium with from 1.6 to 2.6 times as much iron, while titaniferous magnetite

(1) Short tons used throughout.

seldom carried more than 15 per cent titanium and the ratio of iron to titanium usually runs from 4:1 to 6:1.

PRODUCTION

Quebec Iron and Titanium Corporation

The mining of ilmenite ore at Allard Lake was at a reduced rate in 1953. Shipments to the company's experimental smelting plant at Sorel, amounting to 125,234 tons, were less than one-half of those in 1952, and had an average content of approximately 35 per cent TiO_2 and 40 per cent Fe. At Sorel, the company operated its five electric-arc ore-reduction furances at various power input capacities on a variable schedule. Maintenance of the reduction furnace roofs continued to be a major difficulty in bringing the furnaces up to their rated capacity.

The greater part of the titanium dioxide concentrate was shipped to the United States for the manufacture of titanium dioxide pigment. Trial lots of the slag were also shipped to various chemical industries for experimental work on conversion into titanium tetrachloride, an essential raw material in the titanium metal industry. Constant research on every phase of the process was carried on throughout the year by the Sorel research group of Quebec Iron and Titanium Corporation, in collaboration with the research groups of the parent companies, Kennecott Copper Corporation and New Jersey Zinc Company.

No further exploration was carried out on the company's ore deposits in the Allard Lake area, and ore reserves remain in the general neighbourhood of 125,000,000 to 150,000,000 tons of ilmenite.

Baie St. Paul Titanic Iron Ore Company Limited
American Titanic Iron Company Limited

The above companies in the St. Urbain area of Quebec shipped 4,658 tons of ilmenite during the year compared with 51 tons in 1952.

EXPLORATION

Very little exploration for new deposits or of previously known and explored deposits took place during 1953. Pershing Amalgamated Mines Limited carried out a diamond drilling program at its Desgrosbois, Quebec, titaniferous magnetite deposit. Titanium Development Corporation had ore dressing tests conducted on material from its ilmenite property near Ivry, Quebec. Laurentian Titanium Mines Limited did some surface and geophysical work on a titaniferous iron prospect in Wexford and Chertsey townships, Terrebonne and Montcalm counties, Quebec. Canadian Javelin Foundries and Machine Works Limited carried out some exploration of the St. Charles titaniferous magnetite deposits in the townships of Taché and Bourget,

Production and Trade

	1953		1952	
Production (shipments)	Short Tons	$	Short Tons	$
Ilmenite				
Allard Lake area . . .	125, 234		266, 410	
St. Urbain area . . .	4, 731	31,472	51	459
Total	129, 965		266, 461	
TiO_2 concentrate				
From Allard Lake ilmenite, smelted at Sorel	140, 992		42, 141	
Titanium dioxide content of above	100, 527	4, 206,496	30, 805	1, 238, 103
Imports				
Titanium dioxide and pigments containing not less than 14 per cent titanium				
From: United States	23, 970	5, 646,914	21, 469	5, 365, 582
United Kingdom	7, 930	2, 819,931	2, 736	1, 090, 786
Total	31, 900	8, 466,845	24, 205	6, 456, 368

Chicoutimi county, Quebec. Hollinger (Quebec) Exploration Company Limited carried out preliminary exploration on 74 claims covering a large iron-titanium deposit at Marybelle Lake, Saguenay county, Quebec, about 75 miles north of Mingan, Quebec.

OTHER OCCURRENCES

In the St. Urbain area of Quebec, there are at least five known ilmenite deposits -- the Coulombe, Furnace, General Electric, Bignell, and Joseph Bouchard (Glen). Titaniferous magnetite occurs in Quebec in the St. Marguerite area, near the Bay of Seven Islands, in the Natashquan black sands, and in the Chibougamau district. It occurs also at Mine Centre, Ontario; near Burmis, Alberta; and near St. Georges, Newfoundland. Titanium-bearing minerals have been reported near White Bay in northeast Newfoundland and in the Ramsay Brook district about 35 miles south of Campbellton, New Brunswick.

WORLD PRODUCTION*

World production of rutile concentrates totalled about 52, 000 tons in 1952. Australia's (the largest producer) came from black sands on the east coast; United States production (second largest) from black sands along Florida's east coast. Smaller amounts come from Brazil, French Cameroons, French Equatorial Africa, India, Norway, and Senegal.

* Statistics from United States Bureau of Mines.

World production of ilmenite concentrates for 1952 is estimated at about 984,000 tons. Chief producers were: United States with an output of 528,584 tons and India, Norway, Canada, and Malaya in that order. United States production in 1953 is estimated at 481,000 tons. About one-half of this production comes from the Tahawus mine in New York State. Output in India is derived principally from black sands in Travancore. Norway's output comes principally from deposits south of Stavanger. Ilmenite is also produced from black sands in Australia and Malaya, and in Brazil, Egypt, Portugal, Senegal, and Spain.

USES

Titanium dioxide (titanium white), the most important compound of titanium, has wide use as a pigment and in the manufacture of ceramics, cosmetics, food products, paper, and rayon. A small amount of titanium is used in the iron and steel industry as ferrotitanium and ferrocarbontitanium to purify and harden steel. The production of titanium metal from titanium dioxide is increasing rapidly, but the amount of titanium dioxide consumed in this manner is very small compared to that consumed in the pigment industry. The general use of titanium metal awaits the development of an inexpensive method of extracting it from its ores.

Titanium dioxide in the natural form of rutile is used commonly as a coating for welding rods. Crystals of titanium dioxide made artificially have a very high index of refraction and are being used for certain purposes in place of diamonds. Small amounts of titanium tetrachloride are used for purifying alloys of aluminum. Titanium carbide is one of the ingredients of "carbide" high-speed cutting tools, in which it is usually mixed with tungsten carbide.

Because of its high strength-weight ratio, titanium metal has a special application in supersonic aircraft, and about three-quarters of the present production is going into air compressors for jet aircraft engines. Its qualities make it a desirable material for airframe construction of supersonic aeroplanes. It is used also in alloys of stainless and heat-resisting steels where the size of the product is small. Certain alloys with cobalt and nickel are used as filaments in vacuum tubes.

TARIFFS

Neither Canada nor the United States maintained tariffs on titanium ores during 1953.

PRICES

According to E. and M.J. Metal and Mineral Markets, market quotations in the United States throughout 1953 were as follows:

Ilmenite: 56 to 59 per cent TiO_2, f.o.b. Atlantic seaboard, $18 to $20 per long ton throughout the year.

Rutile: minimum 94 per cent concentrate, 7 to 8 1/2 cents per lb. throughout the first quarter of 1953, decreasing to 5 1/2 to 6 1/2 cents in the second quarter, and further decreasing to 5 to 6 per lb. for the balance of the year.

Canadian prices are largely based on those quoted in E. and M. J. Metal and Mineral Markets.

TUNGSTEN

The United Kingdom price quotation, which at the time of writing best reflects the world market, dropped in successive steps from 360 shillings per long ton unit of WO_3 for scheelite ore at the beginning of 1953 to from 140-150 shillings at the end of the year. These prices compare with 485 shillings at the beginning of 1952, when the supply position commenced to improve.

The main reasons for the depressed state of the world tungsten ore market are the following:

(a) The increase in production in the United States where, during the latter part of 1953, production exceeded consumption. This resulted from government action whereby domestic production, since mid-1951, is purchased at a guaranteed price of $63 per short ton unit of WO_3. Purchase of 3,000,000 units has been authorized, of which only 599,893 had been delivered by the end of 1953.

(b) The large increase in production available from Korean mines and from mines that came into production during the period of higher prices.

(c) The gradual withdrawal of the British Government as a major purchaser of tungsten ores.

PRODUCTION AND TRADE

Shipments of tungsten concentrates from Canadian mines increased to 1,221 short tons of WO_3 valued at $5,688,128 during 1953. Canadian producers maintained output at a high rate during 1953 under long-term contracts at prices in excess of world market prices.

Canadian Exploration Limited, under an agreement with the Canadian Government, undertook the rehabilitation of the Emerald mine near Salmo, British Columbia, and its operation for Government account. The mine and mill went into production during the latter part of November, 1951. With the discovery of further scheelite orebodies, the company made arrangements with the Government to purchase the new mill and to double its capacity to about 500 tons per

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Production (shipments)				
WO_3	1,221	5,688,128	747	4,488,237
Imports				
Scheelite[a]				
From: Bolivia	55	90,467	-	-
Thailand[b]	49	138,432	-	-
Southern Rhodesia	12	33,985	-	-
Australia	11	21,766	-	-
Brazil	-	-	1	6,190
United States	-	-	28	243,527
Total	127	284,650	29	249,717
Ferrotungsten[c]				
From: United States	16	77,551	190	1,407,586
United Kingdom	9	47,938	23	114,813
Portugal	6	32,753	33	284,415
Total	31	158,242	246	1,806,814
Exports				
Scheelite (W content)				
To: United States	639		383	
United Kingdom	211		157	
Total	850		540	
Consumption				
Scheelite	27		90	
Ferrotungsten	40		165	
Tungsten metal, carbide, and sodium tungstate	63		44	
Total	130		299	

a. WO_3 content not known.
b. In 1952, 2,724 short tons of low-grade scheelite, valued at $98,401, were imported from Thailand.
c. Tungsten content not known.

day. Owing to the easing of the tungsten situation, the Government decided to sell back to the company its remaining ore reserves; this arrangement became effective on October 1, 1952, leaving the company in full control.

Production on company account during the year ended August 31, 1953, amounted to 82,944 short ton units of WO_3, of which 51,588 were in the form of a 52.03 per cent WO_3 table concentrate, and 31,356 were in a 26.76 per cent WO_3 flotation concentrate.

Western Tungsten Copper Mines Limited operated the Red Rose mine, south of Hazelton, British Columbia, which is held on a lease from The Consolidated Mining and Smelting Company of Canada Limited. Production of 24,417 units of contained tungsten was derived from 37,283 tons of ore milled. The scheelite concentrate was exported to the United Kingdom and the United States under long-term contracts. A copper concentrate containing silver and gold was sold to the American Smelting and Refining Company at Tacoma, Washington.

Columbia Lead and Zinc Mines Limited began milling operations on scheelite ore in the late spring of 1953. The mine is about 20 miles east of Revelstoke, British Columbia. However, owing to the market price and the grade of the product, the mill operated for a short period only, at the end of which the property was closed.

DOMESTIC REFINERY PRODUCTION

Tungsten ores are not refined into primary products such as ferrotungsten in Canada. However, a new electric smelting plant began operations during December 1952 for the production of tungsten carbide and tungsten powder directly from low-grade tungsten concentrates. The plant is operated by a division of Kennametal Incorporated at Port Coquitlam, British Columbia.

WORLD MINE PRODUCTION

The world mine production of tungsten ores during 1952 amounted to 55,400 metric tons of concentrates containing 60 per cent WO_3, of which it is estimated that China produced 20,000 metric tons. Other relatively large producers were the United States, Portugal, Bolivia, Republic of Korea, Spain, and Australia. Canadian production during 1952 followed that of at least five other countries.

OTHER DEVELOPMENTS

During the fall of 1953, the Minister of Mines and Technical Surveys announced that an interesting occurrence of scheelite had been discovered in Newfoundland by a field party of the Geological Survey of Canada. The discovery was made in the Gander Bay area in the vicinity of Comfort Cove, and the quartz vein in which the scheelite occurs was traced for three-quarters of a mile.

Burnt Hill Tungsten Mines Limited continued development work on its property in York County, New Brunswick, at the junction of the Miramichi River and Burnt Hill Creek. Some wolframite has been disclosed and the company plans to commence milling in 1954.

USES

Tungsten is utilized as scheelite, ferrotungsten, pure metal, powder, wire, rod, sheet, and various chemical compounds such as the metatungstates. The greatest single use of tungsten is in the steel industry, where it is used in the form of scheelite or as ferrotungsten for the production of high-speed steel. The type most widely used, commonly known as the 18-4-1 type, contains 18 per cent tungsten, 4 per cent chromium, and 1 per cent vanadium.

Tungsten carbide is used for tipping tools, such as milling cutters, reamers, punches, and drills; for dies in wire and tube drawing; for wear-resistant parts such as gauges, valve seats, and valve guides; and as cores in armour-piercing shells.

In the non-ferrous or super-alloy field, tungsten is alloyed with cobalt, chromium, nickel, molybdenum, titanium, and columbium in varying amounts to produce a series of hard-facing, heat-resisting, and corrosion-resisting alloys. The main use of the high-temperature alloys is in turbo-jet engines for such parts as nozzle guide vanes, turbine blades, combustion chamber liners, and tail cones. They are also used in heat exchangers, boiler superheaters, and superchargers.

The pure metal is used in ignition and other contact points in the automotive industry. It is used for the production of incandescent lamp filaments, and certain types of bronze.

Stellite, a non-ferrous alloy, containing from 5 to 20 per cent tungsten with chromium and cobalt, is used in the production of welding rods for hard facing and in the manufacture of high-speed cutting tools.

The commercial applications of chemical compounds of tungsten are numerous. Some of the more important are:- flame-proofing combustible materials, in the dyeing industry, as catalysts and tanning agents, and in making X-ray screens.

The more important consumers of tungsten in Canada are: Atlas Steels Limited; Canadian General Electric Company Limited; Shawinigan Chemicals Limited; A. C. Wickman (Canada) Limited; Kennametal of Canada Limited; Deloro Smelting and Refining Company Limited; Wheel Trueing Tool Company of Canada Limited; Boyles Bros. Drilling Company Limited; J.K. Smit and Sons of Canada Limited; Johnson, Matthey and Mallory Limited; Canadian Westinghouse Company Limited; and Dominion Colour Corporation Limited.

Atlas Steels Limited, by far the largest consumer, uses approximately 80 per cent of the total in the form of ferrotungsten and scheelite.

PRICES

According to E. and M. J. Metal and Mineral Markets, December 31, 1953, United States prices of tungsten were as follows:-

Tungsten ore - per short ton unit of WO_3, concentrates of known good analysis, basis 60 per cent:

Foreign ore - c.i.f. U.S. ports, duty extra.
Wolfram - $24 to $25
Scheelite - $30 to $32

Domestic ore
Western high grade - $63 per unit f.o.b. mine
North Carolina high grade - $63 per unit f.o.b. mine

Tungsten metal
per lb., 98.8 per cent, minimum 1,000 lb. lots, $5.35.
per lb., 99.9 per cent plus, hydrogen-reduced, $6.40.

Ferrotungsten
per lb. of W contained, 75 to 85 per cent W, $4.10 in lots of 10,000 lbs. or more.

According to the same source, the London market quoted the following nominal prices per long ton unit of WO_3 wolfram, 170 shillings; scheelite, 155 shillings.

TARIFFS

Canada

	British preferential	Most favoured nation	General
Tungsten ore	free	free	free
Tungsten metal	"	"	"
Tungsten oxide	"	"	5% ad valorem
Ferrotungsten	"	5% ad valorem	5% ad valorem

United States

Tungsten ore and concentrates
On tungsten content - 50 cents per lb.

Tungsten metal
Tungsten carbide, and combinations containing tungsten carbide in lumps, grains, or powder
On tungsten content - 42 cents per lb. plus 25 per cent ad valorem.

Tungstic acid and other forms of tungsten

On tungsten content - 42 cents per lb. plus 20 per cent ad valorem.

Ferrotungsten

On tungsten content - 42 cents per lb. plus 12 1/2 per cent ad valorem.

URANIUM

Important advances were made in the Canadian uranium industry in 1953, by increased production, interesting developments at several properties, and further discoveries. Production figures are not available for publication.

Radioactive discoveries were reported from 239 new properties, bringing the total to 884. Some properties contain many individual occurrences and thus the total number of known occurrences is several thousand. A few of these are essentially thorium occurrences, but most are uranium. At the end of the year, 228 individuals and companies held permits from the Atomic Energy Control Board for work beyond the stage of ordinary prospecting; some of these had explored more than one property. Eighty-three of the permit holders were inactive during the year, and some reported only a little work. However, many companies carried on extensive exploration programs, some with very encouraging results.

There has been no change in the guaranteed price schedule since the announcement some time ago that it was extended to April 1, 1962. However, this schedule is based on the assumption that the product sold to the Crown-owned Eldorado Mining and Refining Limited would be in the form of concentrates or raw ore containing 10 per cent or more uranium oxide (U_3O_8) which would require much further treatment. In a recent statement, W. J. Bennett, President of Eldorado and of Atomic Energy of Canada Limited, pointed out that the authorities concerned have always been prepared to consider a special price to meet special situations. He noted two conditions under which special prices would be considered: (1) a property with a proven tonnage of substantial dimensions but in such a location and having a grade such that production would not be worth while under the present price; (2) a property capable of producing a high-grade mill product, but only after large expenditures for plant.

SASKATCHEWAN

Saskatchewan continued to hold the lead in uranium developments, the most important being the entry of Eldorado's Ace-Fay mine into production in April and the disclosure by diamond drilling of a

large deposit on the property of Gunnar Gold Mines Limited. As a result of additional pitchblende discoveries, the Beaverlodge uranium region now extends from the Alberta boundary eastwards for about 80 miles along the north side of Lake Athabasca.

Beaverlodge Region

Eldorado Operations. The extensive preparations for production at the Ace-Fay mine were completed by the spring of 1953. They included sinking the five-compartment Fay shaft to a depth of 1,175 feet, driving a 4,000-foot haulage-way from the 6th level of the Ace shaft to the 6th level of the Fay; stope preparation and other development work; installation of a 2,000-tons-a-day underground crushing plant; building a carbonate leaching plant with an initial capacity of 500 tons a day; and building a large, combined, office, warehouse, machine shop, assay office, and hoist house at the Fay shaft-head.

Some time ago Eldorado announced it would eventually accept custom ore at the Ace-Fay plant, but that details would have to be settled later. Provision for custom ore was made by excavating underground storage bins between the 1st level and the surface, near the Fay shaft, and by providing special crushing and sampling equipment. No custom ore was bought in 1953.

Work was continued on the RA group of claims, where an adit driven a few years ago revealed ore of fair grade which the company plans to mine and truck a distance of 3 miles to the Ace-Fay plant. To facilitate this an adit was begun from the shore of Beaverlodge Lake in 1952, and was connected with the former workings in the autumn of 1953.

The company did further work on the Bolger group, which is east of Ace Lake and includes about 2 miles of the St. Louis fault. Eldorado has a leasing agreement with Radiore Uranium Mines Limited, which holds claims immediately to the south, to explore part of the Radiore ground as well as the Bolger group. Diamond drilling from the surface was continued in 1953 and important intersections were obtained in three holes near the Radiore boundary. To explore these discoveries further Eldorado decided to sink a three-compartment shaft, called the Verna shaft. It is to be sunk to a depth of 940 feet and the site is 1 1/4 miles east of the Ace shaft. To reach this site, extension of the road to the Ace shaft around the east side of Ace Lake was begun in the autumn of 1953 and is now finished. Buildings and a headframe have been installed and shaft sinking began in November.

Private Properties. Private companies explored nine properties in the Beaverlodge region by adits or shafts during 1953, and 47 by diamond drilling. Several others did surface trenching and prospecting.

On the property of Gunnar Gold Mines Limited, a large amount of drilling was done on a 75-foot grid system on a discovery

made in 1952. About the middle of 1953 the company announced the deposit was estimated to have a value of more than $65,000,000 and subsequent drilling has added substantially to the estimate. Preliminary tests are reported to have shown that the ore is amenable to acid leaching, and plans are being made for a plant that may have a capacity of 1,250 tons a day, with production expected to begin in 1955. Initial mining will be by open-pit methods.

Large amounts of underground exploration were done on the Eagle-Ace and A.B.C. properties of Nesbitt-LaBine Uranium Mines Limited and on the Smitty zone of Rix-Athabasca Uranium Mines Limited, and smaller amounts on the claims of Beaverlodge Uranium Mines Limited, Beta Gamma Mines Limited, Meta Uranium Mines Limited, National Explorations Limited, Pitch-Ore Uranium Mines Limited, and Strike Uranium Mines Limited. Exploration has shown the presence of material of ore grade and at certain of the properties this is present in considerable amounts. Several of these companies will probably be shippers when Eldorado begins to buy custom ore. Further work on some of the properties explored underground will possibly indicate larger tonnages that would warrant separate mills, but the immediate outlook is for shipping to Eldorado, and in some cases the amounts of ore in sight are relatively small.

Mention has been made of encouraging results obtained by Eldorado near its boundary with Radiore Uranium Mines Limited. Another company, Lorado Uranium Mines Limited, which has been drilling a discovery near the south shore of Beaverlodge Lake, has also announced promising results. The company intends to drive an adit to permit further exploration. Several other properties within 20 miles of Goldfields were tested by trenching or drilling, with some encouraging results. Brief notes on recent discoveries farther afield follow.

In 1953 radioactive deposits were found in four separate areas between the Alberta boundary and Tazin Lake. Seven occurrences have been reported from claims held by Uranium Ridge Mines Limited near Cypress River and drilling is under way. Some of the occurrences contain visible pitchblende in fractures in quartzite and gneiss. Radioactivity has been noted along fractures on claims held by Great West Uranium Mines Limited at the north end of Harper Lake, but the mineral has not been identified as yet. Near Sheppard Lake a discovery was made as a result of a survey by a helicopter-borne scintillometer and was staked by G. T. Warren and associates. Radioactive occurrences are also reported from the vicinity of Thainka Lake. Late in the season much staking was done on islands in Tazin Lake, following pitchblende discoveries on Laird Island.

A few pitchblende and pegmatitic occurrences had been reported previously from the vicinities of Nevins Lake and Beaver River, about 25 miles east of Goldfields. Work was done on some of these during 1953 and additional discoveries were reported. Drilling was done on the Ram group of Homer Yellowknife and Nu Age Uranium Mines.

Stony Rapids-Porcupine River Region

Underground diamond drilling was done at the Nisto property, but this was reported not to have added appreciably to the amount of pitchblende-bearing material available, so work was suspended. Prospecting and limited amounts of exploration were done in other parts of the region, but no major exploration programs were reported.

There appears to have been little activity in the Charlebois Lake area.

Foster Lake Region

At the end of the 1952 season a prospector for Eldorado brought back small high-grade specimens from the Foster Lake region, 100 miles north of Lac La Ronge. The company decided to stake the ground and to investigate it after breakup. News of this staking caused much additional staking in the region during the winter of 1952-53. Eldorado explored its claims from May to July, during which it made an experimental radioactivity survey by helicopter and did considerable ground prospecting and stripping and trenching of showings. These proved to be of the general pegmatitic class although not typical pegmatites. The main showing is fairly small and the uranium content is very spotty. Accordingly the company ceased its exploration at the end of July.

Several other occurrences were found on ground held by other individuals and companies.

Lac La Ronge Region

Diamond drilling was done on the properties of Jahala Lake Uranium Mines Limited and Transland Uranium Mines Limited near Nunn Lake. The former company stated that a prospect shaft was sunk on its main zone.

Prospecting and surface work were done at other places in the region.

NORTHWEST TERRITORIES

Mining was continued at the normal rate at the Eldorado mine at Port Radium, Great Bear Lake. The new mill and plant for leaching tailings, completed in April, 1952, resulted in more efficient recovery. Production was mainly from No. 3 vein. Considerable lateral exploration was done, chiefly on the northeastward extensions of the No. 3, 5, and 7 veins. Sinking to the 1,675 level was completed to permit developing the downward extension of the No. 1 and 2 veins. Under an agreement, Eldorado is developing the continuation of No. 7 vein in adjoining ground owned by Ventures Limited and Dominion Explorers Limited and there was some production from development ore.

A few pitchblende discoveries were reported from the Hottah Lake area about 50 miles south of Great Bear Lake. Work was reported to have been done on some of the recent discoveries and on others as well.

In the Marian River region, about 100 miles northwest of Yellowknife, considerable staking followed a report of a discovery late in 1952. In 1953 diamond drilling was done on properties held by Altomac Uranium Mines Limited, Fleetwood Yellowknife Mines Limited, and Motsen Explorations Limited. Surface work was done on several other properties and additional pitchblende occurrences were reported. Pitchblende was also reported to have been found on two groups of claims staked near Ingray Lake, about 150 miles north of Yellowknife.

About 250 claims were staked near Trout Rock, 30 miles west of Yellowknife, following a discovery of small amounts of secondary uranium minerals staining large areas of granitic rocks.

In Stark Lake region, at the east arm of Great Slave Lake, limited amounts of surface work were reported to have been done on a few properties.

Late in the year a discovery was reported to have been made by prospectors for The Consolidated Mining and Smelting Company of Canada Limited near Tourangeau Lake, which is between the Nonacho region and Fort Smith.

ONTARIO

Lake Huron Region

Great activity took place in a large area north of Lake Huron after encouraging results were obtained at the former Breton property in Long township. A deposit there had been described in published reports. This property was acquired by Peach Uranium Syndicate to test by drilling a theory that the presence of pyrite might lead to natural leaching of uranium from surface exposures, although surface assays were low in uranium. Pronto Uranium Mines Limited was later organized to take over the property. Recently published accounts indicate that a conglomerate bed about 9 feet thick and dipping gently southward has been drilled for a strike length of about 4,000 feet, with holes 200 to 300 feet apart. Four rows of holes have been drilled, the fourth being about 1,000 feet horizontally from the strike of the surface showings. The first hole of a fifth row is reported to have intersected the conglomerate at a distance of about 1,500 feet horizontally. The intersections are reported to show a gross average of approximately 0.15 per cent U_3O_8. Preliminary treatment tests on core samples are reported to have shown encouraging results with acid leaching, and an adit has been driven to obtain a bulk sample for further tests.

Additional discoveries of radioactive conglomerate, as well as a few of other types, have been reported from such widely separated

places as Baldwin and Hyman townships, north of Espanola, and Parkin and Roberts townships, north of Sudbury. Prospecting and staking have spread to the Timagami region, about 150 miles northeast of the original find.

About ten discoveries in the Lake Huron region appear to have been diamond drilled and exploratory drilling based on geology rather than on surface showings appears to have been done at eight or ten additional properties.

Mention should be made of the work being done by Algoma Uranium Mines Limited, which reports that two drills are testing showings at Quirke Lake, two at Pecors Lake, and one at Elliot Lake. Recently published accounts state that the main Quirke Lake deposit has been drilled at 200-foot intervals for a length of 2,200 feet and that the 1,500-foot length for which assays are available has yielded cores averaging 0.112 per cent U_3O_8 for a width of 8 feet. A few high assays in gold are reported. The property is reported also to contain discoveries in conglomerate beds at higher horizons in the formation.

North Bay Region

Beaucage Mines Limited did much diamond drilling to explore niobium (columbium)-uranium discoveries on and near Manitou Islands in Lake Nipissing, with the object of outlining one or more bodies that could be mined for niobium and uranium and possibly also for apatite. Much of the drilling on the main zone is within 300 feet of lake level and reports issued by the company take cognizance of the fact that the part of the deposit above 300 feet would probably be inaccessible. However, a good deal of deeper drilling has been done and reports state there may be a large tonnage below 300 feet that may average about 0.8 per cent niobium oxide (Nb_2O_5) and 0.05 per cent U_3O_8. The company announced recently that tests on a bulk sample, made in the United States, encourage the hope that recovery of niobium, uranium, and apatite may be possible.

Reports of the discovery on Manitou Islands caused much staking in the winter of 1952-53, but few additional discoveries have been reported. The one that received most attention is on the property of Nipiron Mines Limited, surrounding another group of islands in Lake Nipissing. This property was being diamond drilled as an iron prospect. News of the Manitou discovery caused the company to look for the presence of niobium and uranium. In October it announced that three holes showed intersections containing these metals.

Haliburton-Bancroft Region

Revival of interest in the uranium possibilities of this region followed reports of encouraging results obtained at a property south of Wilberforce. This property and some adjoining claims were acquired by Centre Lake Uranium Mines Limited, which did extensive trenching and diamond drilling with sufficiently encouraging results to warrant the start of underground exploration from an adit. The work done so

far indicates that a large tonnage of material averaging 0.08 to 0.10 per cent U_3O_8 may be available. Prospecting and drilling on the adjoining property to the north, held by Croft Uranium Mines Limited, has shown an extension of the general zone.

Encouraging results are also reported from drilling on the Faraday property west of Bancroft. Newkirk Mining Corporation recently financed further drilling, which is reported to have outlined a body averaging 0.129 per cent U_3O_8 for a width of 28 feet and a length of 320 feet, and a lower-grade section averaging 80 feet in width for a length of 1,160 feet.

The results obtained at the Centre Lake and Faraday properties, coupled with reports that special prices might be paid for uranium from substantial low-grade operations, caused much optioning and staking early in 1954. Drilling was reported to have begun at several additional properties.

BRITISH COLUMBIA

The principal exploration for uranium in 1953 was at the Rexspar property, about 90 miles north of Kamloops. Continuation of drilling on the main zone was reported to have indicated 160,000 tons averaging 0.09 per cent U_3O_8. Later an adit was driven for 190 feet to explore the zone and to permit underground diamond drilling. A discovery of the same general character was reported on the adjoining property of Deer Horn Mines Limited and preliminary drilling was begun.

Diamond drilling was done on the Gem claims in Bridge River district under an option agreement that was afterwards terminated.

A discovery near Atlin in northwestern British Columbia caused considerable activity, and some trenching and drilling were done. About 350 claims were staked, but no additional discoveries were reported.

ALBERTA

Pitchblende was reported to have been found at two widely separated places within the Canadian Shield portion of the Province and at least 1,000 claims were recorded. A discovery near Fidler Point on Lake Athabasca, about 80 miles west of Beaverlodge, was optioned to Goldfields Uranium Mines Limited, which explored by diamond drilling a zone in which pitchblende is reported to have been found in fractures. Pitchblende was also reported to have been discovered on claims held by Dog River Mining Company at Leggo Lake, about 30 miles east of Fitzgerald. A discovery about 15 miles east of Fort Chipewyan was reported to have yielded uranium assays.

MANITOBA

The principal activity in 1953 was at the Dion Lake property in the Herb Lake region, where a pegmatitic occurrence optioned to Cyprus Exploration Corporation Limited was explored by drilling. The surface showing was reported to be of encouraging size and grade, but the drilling was stated to have shown that the deposit does not extend far below the surface. The interest taken in this property caused considerable staking and a few other pegmatitic discoveries were reported.

QUEBEC

Much prospecting and staking for uranium took place in 1953, and 45 additional radioactive properties were reported. These are almost entirely in the extension of the Grenville geological sub-province in Quebec, which has long been known to contain many occurrences of radioactive pegmatite. Reports of discoveries caused much excitement and staking in the Maniwaki region during the spring and summer of 1953, and in and near Grand Calumet Island and Huddersfield townships not far from Campbell's Bay during the winter of 1953-54. Prospecting and exploration were carried on in several other parts of the Grenville region, among them the vicinities of St. Simeon and Seven Islands. Diamond drilling was done on four properties, one held by Opawica Explorers Limited in the Maniwaki region, another by South State Uranium Mines Limited in Berthier county, the third by St. Simeon Uranium Corporation in Charlevoix county, and the fourth by Seven Islands Mining and Exploration Corporation Limited near Seven Islands.

Late in 1953 a discovery was reported to have been made in Beraud township about 20 miles south of Cadillac and the same distance north of the Grenville sub-province. The discovery is understood to be pegmatitic. A staking rush followed announcement of the find in January 1954.

Prospecting was also carried on in parts of the Abitibi and Ungava regions and in Gaspé and the Eastern Townships, but the only new discoveries reported were a few apparently pegmatitic finds in the Abitibi region.

NEW BRUNSWICK

A discovery of radioactive material resembling thucholite was reported from Hampton about 30 miles east of St. John.

ZINC

Canada's zinc production, which consists of refined zinc and the recoverable zinc content of zinc concentrates exported, was higher in 1953 than in any preceding year. Altogether 401, 762 tons of zinc valued at $96, 101, 386 was produced, compared with 371, 802 tons valued at $129, 833, 285 in 1952. More than half of the increase in production came from British Columbia where the output would have been substantially greater but for the closing of a number of zinc-lead mines at which operations proved unprofitable at prevailing metal prices.

The Consolidated Mining and Smelting Company of Canada Limited (Cominco), Trail, British Columbia, and Hudson Bay Mining and Smelting Company Limited, Flin Flon, Manitoba, which operate Canada's two zinc plants, produced 250, 961 tons of refined zinc, this being 28, 761 tons more than in 1952. A certain amount of zinc contained in imported ores treated at Trail is included in the refined zinc production.

All zinc concentrate produced in Eastern Canada was exported to United States or to Europe. Part of the zinc concentrate produced in British Columbia and Yukon was treated at the Trail plant, but a number of producers in British Columbia exported concentrates to the United States. The domestic consumption of zinc at 50, 718 tons, compares with 51, 581 tons in 1952.

The price of zinc, which declined from over 20 cents a pound to 13 cents a pound in 1952, continued downward in 1953 and dropped below 10 cents a pound early in 1954. The decline had an adverse effect on the development of new deposits.

GENERAL DEVELOPMENTS

British Columbia

The Sullivan zinc-lead-silver mine at Kimberley, owned by Cominco, is Canada's principal source of zinc. There were 2, 643, 251 tons of ore mined in 1953 compared with 2, 699, 533 tons in 1952. Thirty per cent of the ore was mined in open-pit operations. In the Sullivan concentrator 226, 772 tons of zinc concentrate and 144, 573 tons of lead concentrate were produced: these concentrates contained 114, 905 tons of zinc and 103, 893 tons of lead. About 4, 000 tons a day of coarse waste rock was removed from the mill feed in a sink-float plant and returned to the mine for use as backfill.

Production, Trade, and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production, all forms*				
British Columbia	191,150	45,723,183	174,288	60,861,359
Quebec	100,430	24,022,766	94,898	33,138,567
Saskatchewan and Manitoba	65,731	15,722,852	61,784	21,574,670
Newfoundland	28,002	6,698,029	30,517	10,656,475
Yukon	9,014	2,156,046	5,535	1,932,853
Nova Scotia	7,349	1,757,964	4,408	1,539,298
Ontario	86	20,546	372	130,063
Total	401,762	96,101,386	371,802	129,833,285
Production, slab zinc**	250,961		222,200	
Exports, refined metal				
To: United States	107,841	24,747,498	70,934	23,188,461
United Kingdom	48,894	9,213,908	87,167	33,455,858
Taiwan (Formosa)	1,000	197,165	-	-
Brazil	543	112,980	151	57,417
Other countries	110	21,333	8,612	4,608,237
Total	158,388	34,292,884	166,864	61,309,973
Exports, zinc contained in concentrates				
To: United States	168,856	20,334,969	149,223	28,231,783
Belgium	9,578	750,152	7,191	1,471,341
France	6,874	518,495	11,796	1,742,417
United Kingdom	4,178	1,138,686	13,544	3,046,185
Norway	3,170	180,930	-	-
Total	192,656	22,923,232	181,754	34,491,726
Exports, scrap dross and ashes (gross weight)				
To: United States	2,181	189,540	3,036	427,363
Belgium	1,374	68,179	444	37,607
West Germany	300	36,928	25	7,017
Other countries	328	60,830	122	9,765
Total	4,183	355,477	3,627	481,752
Exports, zinc manufactures				
To: Mexico		35,563		35,335
United States		34,824		204,650
Colombia		28,112		3,043
Other countries		28,504		176,968
Total		127,003		419,996

* Includes only zinc produced from Canadian ore and zinc estimated as recoverable from concentrates exported.

** Includes zinc recovered from imported ores and concentrates.

	1953	1952
	$	$
Imports, zinc and zinc products		
Blocks, pigs, bars, and plates	16,048	194,032
Strips, sheets	587,732	421,759
Dust	104,831	113,957
Zinc manufactures n.o.p.	2,368,677	1,777,968
Slugs or discs	388,991	332,612
Zinc chloride	29,457	22,171
Zinc sulphate	142,547	143,394
Zinc white	343,820	226,247
Lithopone	474,638	481,466
Total	4,456,741	3,713,606
Consumption of slab zinc	short tons	short tons
Electro-galvanizing	531	424
Hot-dip galvanizing	21,445	22,667
Zinc diecasting alloys	9,065	7,909
Brass and bronze	9,485	11,983
Other alloys	1,667	1,827
Rolled and ribbon zinc	1,205	1,257
Zinc oxide	7,013	5,189
Miscellaneous	307	325
Total	50,718	51,581

* Includes only zinc produced from Canadian ore and zinc estimated as recoverable from concentrates exported.
** Includes zinc recovered from imported ores and concentrates.

At Cominco's Bluebell mine on the east side of Kootenay Lake, production was increased from 500 tons per operating day to 750 tons. Shipments to Trail contained about 13,024 tons of zinc and 12,005 tons of lead.

At the H.B. zinc-lead mine near Salmo, also owned by Cominco, the construction of a 1,000-ton a day concentrator was completed and extensive underground development was carried out. It was decided, however, to postpone commencement of production at this property.

Canadian Exploration Limited, one of the larger zinc producers, completed a large-scale development program at its tungsten-

zinc-lead property near Salmo. Owing to declining metal prices the tonnage treated at the company's zinc-lead mill was reduced late in the year from about 1,800 tons a day to 1,200 tons.

Sil-Van Consolidated Mining and Milling Company Limited commenced the production of lead and zinc concentrates in June in a new 150-ton mill on its property near Smithers.

Other producers of zinc concentrates included: Tulsequah Mines Limited, a subsidiary of Cominco, in the Taku River area; Britannia Mining and Smelting Company Limited, Howe Sound; Sunshine Lardeau Mines Limited, near Camborne; Violamac Mines Limited and Carnegie Mines Limited, near Sandon; Yale Lead and Zinc Mines Limited, at Ainsworth; and Silver Standard Mines Limited, near Hazelton.

Reeves MacDonald Mines Limited near Salmo, one of the largest producers of zinc concentrates in recent years, suspended operations in April. Other zinc mines closed owing to declining prices included: the Zincton and Paradise mines of Sheep Creek Gold Mines Limited; the Monarch, Kicking Horse, and Cork Province mines of Base Metals Mining Corporation Limited; the Premier and Indian mines of Silbak Premier Mines Limited; Estella Mines Limited; and Mastodon Zinc Mines Limited.

Sheep Creek Gold Mines Limited constructed a 450-ton concentrator at its Mineral King zinc-lead-barite mine 26 miles west of Lake Windermere, which it expected to bring into production early in 1954.

At Cominco's zinc plant, an extension with a capacity of 66 tons per day was completed; this increased the plant's capacity to 520 tons of slab zinc per day.

Manitoba and Saskatchewan

Hudson Bay Mining and Smelting Company Limited mined 1,497,093 tons of copper-zinc ore from its Flin Flon orebody on the Manitoba-Saskatchewan boundary. It treated 122,527 tons of concentrates as well as 42,947 tons of zinc oxide fume for a record output of 65,731 tons of slab zinc and 47,967 tons of residue. Most of the residue was added to the copper smelter reverberatory furnace charge. The zinc fuming plant treated all available reverberatory slag and produced 42,947 tons of fume containing 71 per cent zinc.

At the company's Schist Lake copper-zinc mine, 3 1/2 miles south of Flin Flon, underground development was continued on six levels and 5,086 tons of ore from development headings was shipped to the Flin Flon concentrator.

Cuprus Mines Limited (a subsidiary of Hudson Bay Mining and Smelting Company), 7 1/2 miles southeast of Flin Flon, mined

86,549 tons of copper-zinc ore and produced 6,816 tons of zinc concentrate containing 44.1 per cent zinc, which was shipped to the Flin Flon zinc plant. Ore reserves at this mine are approaching exhaustion.

Ontario

The discovery of a large deposit of copper-zinc ore near Manitouwadge Lake, about 40 miles northeast of Heron Bay on Lake Superior, was reported in December. Geco Mines Limited was formed to carry out a diamond drilling and development program on the deposit.

Ontario Pyrites Company Limited continued the exploration of its extensive zinc-copper-lead properties 18 miles northwest of Sudbury. A test mill, in which it was planned to carry out ore-dressing investigations, was constructed on the company's Errington property.

Matarrow Lead Mines Limited in the Matachewan area discontinued production of lead and zinc concentrates in January, 1953.

Jardun Mines Limited prepared its property near Sault Ste. Marie for production of zinc and lead concentrates in 1954. A new 250-ft. shaft was sunk, and two levels were established.

Quebec

Zinc concentrates, in addition to concentrates of copper or lead, were produced by the following companies:

Company	Location of Mine	Type of ore
Anacon Lead Mines Ltd.	Portneuf county	zinc-lead
Ascot Metals Corp. Ltd.	Sherbrooke	zinc-lead-copper
Barvue Mines Ltd.	Abitibi county	zinc
Consolidated Candego Mines Ltd.	North Gaspé co.	lead-zinc
East Sullivan Mines, Ltd.	Abitibi county	copper-zinc
Golden Manitou Mines Ltd.	Abitibi county	zinc-lead
New Calumet Mines Ltd.	Pontiac county	zinc-lead
Normetal Mining Corp. Ltd.	Abitibi county	copper-zinc
Quemont Mining Corp. Ltd.	Abitibi county	copper-zinc
United Montauban Mines Ltd.	Portneuf county	zinc-lead
Waite Amulet Mines Ltd.	Abitibi county	copper-zinc
Weedon Pyrite and Copper Corporation Ltd.	Wolfe county	copper-zinc

Barvue Mines Limited, which commenced production in 1952, completed the stripping of clay overburden from its large zinc deposit in Barraute township; about 5,000 tons of ore had been mined daily by open-cut methods by mid-1953. Zinc concentrates produced in the 6,000-ton mill contained about 33,000 tons of zinc.

East Sullivan Mines Limited, near Val d'Or, mined those sections of its ore-bodies containing relatively high copper and low zinc values. It discontinued the production of zinc concentrate in April.

Operations at the Waite Amulet, Quemont, and Normetal mines were suspended in October owing to a strike that was still in progress as the year ended.

Ascot Metals closed its Moulton Hill mine in the Sherbrooke area in July. It continued to draw mill feed from its Suffield mine 9 miles south of Sherbrooke.

United Montauban Mines Limited (formerly United Lead and Zinc Mines Limited and Montauban Mines Limited), Portneuf county, commenced production of zinc and lead concentrates in August in a new 500-ton mill at its property at Montauban-les-Mines, adjoining the Anacon mine.

Federal Metals Corporation discontinued exploratory operations at its property in North Gaspé county.

New Brunswick

Brunswick Mining and Smelting Corporation continued exploration by diamond drilling on its extensive zinc-lead-pyrite deposit 17 miles southwest of Bathurst, which was discovered in 1952. Overburden was removed from a section across the ore zone to permit the mining of ore for metallurgical investigations. In September the company acquired the Anacon-Leadridge property, about 5 miles north of the Brunswick deposit, where a similar type of orebody has been outlined. The two deposits are estimated to contain about 46 million tons to a depth of 1,000 feet, averaging 5.25 per cent zinc, 1.84 per cent lead, appreciable amounts of silver, copper, and tin, and considerable pyrite.

Keymet Mines Limited began construction of a 200-ton mill at its property 15 miles north of Bathurst; production of zinc and lead concentrates was expected to commence early in 1954.

Nova Scotia

Mindamar Metals Corporation Limited deepened its shaft and opened up four new levels at its Stirling zinc-lead-copper mine on Cape Breton Island. About 500 tons of ore a day was milled and zinc concentrates containing about 9,000 tons of zinc were produced.

Newfoundland

Buchans Mining Company Limited in central Newfoundland operated its 1,350-ton mill at an average of 950 tons a day for the production of zinc, lead, and copper concentrates. The zinc concentrates contained about 36,914 tons of zinc.

Northwest Territories

Pine Point Mines Limited, a subsidiary of Cominco and Ventures Limited, discontinued in September an exploratory diamond-drilling program which it has been carrying out for several years on its zinc-lead deposit at Pine Point, Great Slave Lake. Several million tons of ore averaging 10 per cent combined metals have been blocked out on the Pine Point property, a large part of which can be mined by open-pit methods. Ore-dressing tests showed that high-grade concentrates can be produced from the ore.

Yukon

United Keno Hill Mines Limited increased production of lead and zinc concentrates from its property in the Mayo district. The ore was derived mainly from newly developed levels in the Hector mine. At the company's adjoining Calumet mine a winze was deepened to establish a new level. Concentrates containing about 9,500 tons of zinc were produced.

Production of lead and zinc concentrates was commenced in April by a 150-ton mill constructed jointly by Mackeno Mines Limited, Yukeno Mines Limited, and Bibis Yukon Mines Limited on land adjoining the United Keno Hill property.

USES

Zinc has a wide range of industrial uses, the more important being in galvanizing, die-casting, and the manufacture of brass products. Including scrap zinc, the United States consumed about 1,000,000 tons in 1953 and the United Kingdom used 310,000 tons.

Zinc is marketed in grades that vary according to the presence of impurities such as lead, iron, and cadmium. In North America, the principal grades produced are "Special High Grade", used chiefly for die-casting; "Regular High Grade", used for brass manufacture; and "Prime Western", used for galvanizing. In Canada zinc is refined by the electrolytic process only, by which most "Special" and "Regular High Grade" zinc is produced. To fill orders for "Prime Western", Canadian producers lower the higher grades by the addition of lead to meet consumer specifications.

In galvanizing, zinc is usually applied to the iron or steel by hot-dipping methods, but for certain purposes electro-plating is used.

Zinc-base alloys are used extensively for die-casting complex shapes, especially automobile parts. They are prepared from high-grade electrolytic zinc, to which is added 3 to 4 per cent aluminum, up to 3.5 per cent copper, and 0.02 to 0.1 per cent magnesium.

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 principally for making dry-cell battery cups, also for articles exposed to corrosion, such as weather-stripping, roofing downspouts, and gutters; it is also used for anti-corrosion plates for boilers and ships' hulls. Zinc dust is used to make zinc salts and compounds, in purifying fats, in manufacturing dyes, and to precipitate gold and silver from cyanide solutions. Zinc oxide is used in compounding rubber and in making paint, ceramic materials, ink, matches, and many other commodities. Among the more industrially important compounds of zinc are zinc chloride, zinc sulphate, and lithopone, a mixture of barium sulphate and zinc sulphide used for making paint (in recent years, lithopone has been largely replaced by titanium dioxide).

PRICES

The Canadian price of ordinary electrolytic (regular high-grade) zinc declined from 14.05 cents a pound in January, 1953, to 11 cents in September; it increased to 11.35 cents at the end of October, and remained unchanged to the end of the year. Prime Western zinc showed a corresponding decrease, and was selling for ten cents a pound at the year's end.

INDUSTRIAL MINERALS

NATURAL ABRASIVES

Save for a small output of grinding pebbles, and a dwindling production of grindstones, no natural abrasives are produced in Canada. Certain abrasives have been produced in past years and, as the notes below indicate, may be produced again if circumstances are favourable.

Brief reviews only are given below of corundum, emery, garnet, grindstones, oilstones and pulpstones, pumice and pumicite (volcanic dust), and grinding pebbles.

CORUNDUM

There has been no production of corundum (Al_2O_3) in Canada since completion of the treatment of the tailings at the disposal dump on the Craigmont property, Renfrew county, Ontario, in October, 1946. From this operation, approximately 2,600 tons of concentrate containing 1,726 tons of fine corundum were shipped to American Abrasive Company at Westfield, Massachusetts, the only dealer in corundum in North America.

Several deposits of corundum occur in the nepheline syenite belt, which is about 100 miles long and 6 miles wide and crosses Haliburton, Hastings, and Renfrew counties in eastern Ontario. However, these deposits are small and scattered, with a corundum content rarely reaching 5 per cent.

In 1951 Ortona Gold Mines Limited, Toronto, optioned the Monteagle property, on which is a large deposit of nepheline-feldspar mixture containing, according to engineer's reports, about 5 per cent fine-grained corundum and some fine muscovite mica. The deposit outcrops on the east bank of the York River in Monteagle township, about 9 miles northeast of Bancroft, eastern Ontario. Beneficiation test work on a large sample of the material to obtain marketable products (nepheline syenite, corundum, and white mica) was continued in the Mines Branch laboratories. No decision on the operation of the property had been reached by the end of the year.

Grain corundum is chiefly used in making grinding wheels, and very coarse grain is used in 'snagging' wheels. Both types of wheels are used in the metal trades, where the hardness of corundum, coupled with its characteristic of fracturing into sharp edges, makes it an ideal cutting tool. The finest corundum (flour grades) is used for fine-grinding lenses and other optical components.

In 1953, Canada imported 162 tons of corundum, valued at $43,450, ranging from fine to coarse grain, compared to 125 tons valued

at $31,066 in 1952. Imports enter Canada via United States from the Transvaal, Union of South Africa, the chief world producer for the past 30 years.

Quotations on crude corundum imported into United States varied from $90 to $110 per ton, according to grade. A minimum corundum content of 90 per cent is desired. Prices of prepared grain vary considerably according to mesh size, and during 1953 remained at 1952 levels, namely: for natural corundum, per pound, mesh size 8 to 60 inclusive, 8 1/2 cents; 70 to 275, 9 1/2 cents; 500, 28 cents; 850 to 1000, 45 cents; 1,200 to 1,600, 65 cents; and 2,600, 70 cents.

EMERY

True emery is an intimate mixture of corundum and magnetite, with or without hematite, and varies in hardness and toughness according to the amount of iron oxide present: it is massive, nearly opaque, and dark grey to blue-black with a reddish tint depending upon the amount of hematite present. The iron oxide is physically inseparable from the corundum, and while it detracts from the efficiency of emery as an abrasive, it improves its polishing action. The grain shape of emery is more or less round and for this reason its cutting action is slight: it is, in fact, more of a polishing agent than a cutter.

Commercial emery has not been found in Canada, although some deposits of corundum east of the Madawaska river in Ontario are so intimately mixed with magnetite that they are practically a coarsely crystalline emery. The three main producers are Greece, Turkey, and United States. Grecian (or Naxos) emery contains approximately 65 per cent corundum with about 25 per cent iron oxide, mostly magnetite. Turkish emery approaches that produced in Greece in corundum content and quality. American emery, most of which comes from the states of New York and Virginia, and which is the softest of the three, contains about 45 per cent iron oxide.

Total Canadian imports of emery in powder, grains, and grits from United States were valued at $95,110 in 1953 compared to $54,566 in 1952. A large part of the United States production of about 10,000 tons a year is consumed as the 'nonskid' agent in concrete and asphalt floors in industrial plants, owing to its marked resistance to wear and its non-skid nature. The balance of the output, together with imports from Greece and Turkey, is used in abrasive products such as grinding wheels, abrasive sticks, and coated papers.

In 1953, American first-grade emery ore f.o.b. New York was priced at $12 per ton, and grain emery f.o.b. Pennsylvania at 10 cents per pound for Turkish and Naxos grain, and 6 1/2 cents per pound for American grain. These prices were the same as in 1952.

GARNET

The United States produces the major portion of the world

supply of industrial garnet. Output in recent years has run between 10,000 and 14,000 tons annually. The deposits near North Creek, New York, operated by the Barton Mines Corporation, yield a grade of garnet that is regarded as the world standard for abrasive-coated papers; output in recent years has averaged 8,000 tons a year. Most garnet is used for this purpose, but its use in sandblasting is increasing. Flour grades (minus 350 mesh) are used for fine-grinding in optical work.

Canadian consumption of garnet grain, for making 'sandpapers' has risen to about 450 tons annually from the 350-400 tons consumed a few years ago. The Canadian manufacturers of garnet abrasive papers import graded grain from the United States. In 1953, the three companies that manufactured such papers were: Canada Sandpapers Limited, Preston, Ontario; Minnesota Mining and Manufacturing Company, Ltd., London, Ontario; and Behre-Manning Company, Limited, Brantford, Ontario. The last two companies continued garnet paper manufacture following the breakup in 1951 of Canadian Durex Abrasives Company, Ltd., which in former years manufactured garnet papers in the Brantford plant now operated by Behre-Manning.

The prices of various garnet products have remained fairly steady over the past several years. Ungraded garnet grain suitable for 'garnet abrasive paper' manufacture was quoted at about $95 per ton, f.o.b. New York, in 1953. Prices of graded garnet grain ranged from $110 to $160 a short ton, with the superfine powders in 5- to 10-micron size used for lens grinding selling for about $200 a ton.

GRINDSTONES, OILSTONES, PULPSTONES, ETC.

Materials suitable for these stones occur in certain sandstone beds in Nova Scotia, New Brunswick, and on the coast of British Columbia. Although many years ago the output was considerable, it is now small, owing mainly to competition from artificial abrasives.

Read Stone Company, Limited, of Sackville, New Brunswick, has marketed small amounts of stone from its quarries near Stonehaven in recent years. Bay of Chaleur Grindstone Company at Clifton, New Brunswick, last reported small shipments in 1950. This company obtained its material at low tide near Grand Anse on the Bay of Chaleur.

Natural pulpstones for the log grinders of pulp mills have been largely superseded by artificial segmental pulpstones built of bonded silicon carbide grit. Most of these are supplied by Norton Company of Canada Limited, Hamilton, Ontario. Pulpstones supplied by Canadian Carborundum Company, Limited, to Canadian firms are made in its United States plant and imported into Canada. Some segmental pulpstones of artificial abrasive material are exported.

Natural grindstones imported from the United States in 1953 were valued at $22,054, compared to $27,376 in 1952. Whetstones, sticks, files, and blocks of natural abrasives weighing 30 short tons

and valued at $31,459 were imported from the United States in 1953 compared to 26 short tons valued at $21,798 in 1952.

PUMICE AND PUMICITE (VOLCANIC DUST)

Volcanic dust, or pumicite, is a natural glass or silicate, pulverized by volcanic explosions and thrown into the air in great clouds that ultimately settle into beds varying from a few inches to many feet in thickness. The dust occurs as finely divided powder of a white to grey or yellowish colour and is composed of small, sharp, angular fragments of highly siliceous volcanic glass.

Pumice is a highly cellular material ejected in the course of volcanic eruptions, and occurring as porous masses of a white or light grey colour. It has the same composition as normal rhyolites, and when ground has the same appearance and character as pumicite.

Widespread deposits of volcanic dust occur in Saskatchewan, Alberta, and British Columbia, but owing either to thinness of beds or remoteness from markets there has been no production for many years.

Volcanic dust is used in Canada mainly for making scouring and cleansing aids. Lightweight building blocks composed of pumice aggregate and cement are made at several plants in British Columbia. The pumice aggregate is imported from Oregon and Washington at prices ranging from $6 to $9 a short ton, f.o.b. Vancouver plants.

In United States increasing amounts of pumicite and pumice are being used as concrete admixture and concrete aggregate. Pumicite is also used as a carrier or filler for insecticides, and as a cleaning and scouring agent in soaps and powders.

Imports are grouped with a number of similar products (pumice, pumicite, volcanic dust, lava, and calcareous tufa) and in 1953 were valued at $165,709 compared with $110,369 in 1952. Most of these imports came from United States.

From time to time quotations on pumice and pumicite are found in trade journals, but generally these quotations are wholly nominal and actual prices depend on quantity purchased, purity, and use. Pumice-stone, per pound, f.o.b. New York or Chicago, packed in barrels, was 6 to 8 cents per pound for lump and 3 to 5 cents per pound for powdered (pumicite or volcanic dust).

GRINDING PEBBLES

Extremely hard, tough, and rounded pebbles, usually of flint, are used in cylindrical or conical mills for the grinding of ores and minerals (mainly of a non-metallic nature) where iron contamination from the usual steel grinding balls would prove detrimental.

Grinding pebbles were produced in the past in several localities. Production in recent years, however, has been confined to Alberta where W. May produces pebbles from deposits at Elkwater and ships them to several Canadian mining and milling companies.

ASBESTOS

Canadian production of asbestos during 1953 declined slightly for the second consecutive year; 911,226 tons of all grades valued at $86,052,895 were shipped by producers, compared with 929,339 tons valued at $89,254,913 in 1952. The decline in production reflected a lower demand for several milled fibre grades, owing in part to a smaller demand for spinning fibre in the United States. Over 95 per cent of the asbestos output in Canada came from the Eastern Townships of Quebec; the remainder came from northern Ontario and British Columbia.

Canada maintained its position as the leading producer, its output in 1953 being about 62 per cent of the world total. Aided in some measure by increased markets in the sterling area, production in Commonwealth countries of Africa has grown notably since the war.

All of the Canadian production is of the chrysotile variety. In addition to the producing areas it occurs elsewhere in Quebec, Ontario, and British Columbia, and there are occurrences also in Newfoundland, Manitoba, and Saskatchewan. There are no commercial deposits of amosite or crocidolite, although an occurrence of the latter variety was reported at the iron ore property of Labrador Mining and Exploration Company Limited in Labrador. However, fibrous tremolite, actinolite, and anthophyllite do occur in several places; fibres of these varieties generally lack the strength so characteristic of chrysotile, and, although often long, are unsuitable for the textile industry. However, they offer higher resistance to acids and are used in filtration. During World War II there was a small production of tremolite fibre from eastern Ontario.

Quebec

Seven companies produce asbestos in the province at properties in the vicinities of Thetford Mines, Black Lake, East Broughton, and Danville, the main sources of the output being the extensive deposits of chrysotile in Richmond, Megantic, Arthabaska, Wolfe, and Beauce counties. At Thetford Mines, the main line of the Quebec Central Railway is being relocated to permit extension of the block-caving program by the mines there.

Although there has been continuous production of the mineral from the Eastern Townships since 1878, reserves are sufficient for many years of operation at present mining rates. The persistence of the mineral at depth without deterioration in quality has been established by deep drilling. There are other deposits of lower-grade material which, at present market prices and recovery costs, are not economic.

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Production (shipments)				
Crude	781	837, 623	741	726, 827
Milled fibres	326, 340	56, 226, 083	351, 644	58, 822, 472
Shorts and refuse	584, 105	28, 989, 189	576, 954	29, 705, 614
Total	911, 226	86, 052, 895	929, 339	89, 254, 913
Exports of crude				
To: United States	289	273, 814	371	334, 308
United Kingdom	206	321, 459	150	224, 250
Other countries	143	124, 310	171	146, 362
Total	638	719, 583	692	704, 920
Exports of milled fibres				
To: United States	168, 713	28, 062, 395	192, 440	30, 690, 024
United Kingdom	19, 403	4, 444, 483	36, 576	6, 878, 791
France	17, 130	3, 306, 855	18, 349	3, 145, 104
Australia	15, 629	2, 436, 030	10, 919	1, 763, 653
Belgium	15, 394	2, 751, 854	13, 263	2, 411, 315
Japan	11, 829	1, 856, 836	7, 065	1, 350, 954
West Germany	11, 775	2, 036, 530	9, 614	1, 504, 953
Other countries	56, 715	10, 287, 903	51, 592	8, 902, 136
Total	316, 588	55, 182, 886	339, 818	56, 646, 930
Exports of shorts				
To: United States	474, 808	22, 829, 483	465, 800	22, 551, 058
United Kingdom	32, 313	1, 322, 763	20, 614	878, 394
West Germany	11, 695	782, 213	14, 130	994, 951
Belgium	9, 201	634, 785	10, 900	820, 201
Japan	8, 153	723, 849	6, 743	649, 762
France	7, 864	533, 717	18, 961	1, 435, 206
Other countries	17, 270	1, 242, 884	24, 400	1, 828, 126
Total	561, 304	28, 069, 694	561, 548	29, 157, 698
Exports of manufactures*				
To: United States	-	286, 118	-	606, 618
Mexico	-	59, 737	-	87, 685
Ecuador	-	25, 642	-	23, 620
Indonesia	-	23, 959	-	31, 533
Colombia	-	19, 533	-	52, 009
Cuba	-	19, 101	-	75, 827
Other countries	-	151, 151	-	387, 843
Total	-	585, 241	-	1, 265, 135
Imports of manufactures**				
Asbestos packing	-	305, 455	-	222, 539
Brake linings (automobile)	-	297, 460	-	313, 765
Clutch facings "	-	270, 123	-	521, 443
Brake linings and clutch facings, other	-	89, 263	-	109, 078
Miscellaneous		2, 347, 874	-	2, 231, 536
Total	-	3, 310, 175	-	3, 398, 361

* See Uses for details

** 86% from U. S. A. in 1953

In general, the asbestos occurs in two forms, namely, "cross fibre" and "slip fibre". The former type is characterized by the arrangement of the individual fibres across the vein in a parallel form. The vein width is indicative of fibre length, and varies up to 1/2 inch with occasional veins reaching 5 inches. Most production is of fibre of this type. Slip fibre is associated with occurrences in fault planes; it is at present recovered in the East Broughton area.

The largest producer, Canadian Johns-Manville Company Limited, works the Jeffrey mine at Asbestos, near Danville, the world's largest asbestos mine. Currently, production is derived in the main by underground mining, using block caving methods. The company is expanding and modernizing its facilities and is rebuilding the present milling plant.

Asbestos Corporation Limited recovers the mineral by underground mining at its King property in Thetford Mines and by open-pit methods at its Beaver property near by, at its British Canadian mine at Black Lake, and at its Vimy mine in Coleraine township. The company is erecting a 5,000 ton-per-day mill on its Normandie property near Vimy, where it is developing a new orebody. Production from the property is expected to commence in 1954.

Johnson's Company Limited operates an underground mine at Thetford Mines, and an open-pit property at Black Lake. At the latter, the erection of its 4000-ton mill was nearing completion at the end of 1953.

Bell Asbestos Mines Limited works an underground mine by block caving at Thetford Mines.

Flintkote Mines Limited and Quebec Asbestos Corporation Limited mine deposits a few miles east of Thetford Mines and at East Broughton, respectively, and Nicolet Asbestos Mines Limited at St. Remi de Tingwick.

There was a small production in 1953 by Dominion Asbestos Mines Limited from its deposit near St. Adrien in Ham township, Wolfe county.

Lake Asbestos of Quebec Limited, a subsidiary of American Smelting and Refining Company, was formed during 1952 to test the Black Lake deposit of United Asbestos Corporation Limited and to prepare it for production. It continued exploration of the deposit in 1953, and permission to drain Black Lake was granted as the year ended.

Ontario

East of Matheson in Munro township, northern Ontario, Canadian Johns-Manville mines asbestos by the open-pit method. The

fibre is characterized by a harsher texture than that normally recovered in Quebec and when blended with other fibres is well suited for the manufacture of asbestos cement products. The company acquired a new property in Reeves township southwest of Timmins.

British Columbia

Cassiar Asbestos Corporation Limited made its first shipments of fibre from its McDame Mountain deposit in northern British Columbia early in 1953. The company carried out extensive development work in readiness for full-scale open-pit mining in 1954. Shipments are being made by road 86 miles to the Alaska Highway, a further 265 miles to the company's warehouse at Whitehorse, and from there by rail on the White Pass and Yukon Railway to Skagway and thence by boat to Vancouver. The company plans to expand the mill in 1954.

WORLD REVIEW

World production of all varieties of asbestos continues at a rate of approximately 1,500,000 short tons a year, though this total may be somewhat larger in view of reported recent increases in production from Russia. Russian fibre has been offered in Europe in increasing amounts. The Union of South Africa, Southern Rhodesia, and Swaziland are the other major producers of asbestos. The Union of South Africa is the sole source of amosite and principal source of crocidolite. Production in 1953 is estimated at 115,000 tons, a slight decline from 1952, approximately 20 per cent of the output being chrysotile. Southern Rhodesia produced 87,739 tons of chrysotile fibre in 1953. Much of its output is a low-iron fibre suitable for a number of electrical uses.

USES AND PRICES

Asbestos has a variety of industrial uses. The longer-fibred spinning material is formed into textiles, packing, and certain insulating and heat-resisting friction materials. Other fibres are used in the asbestos-cement industry for the production of pipe, shingle, tile, millboard, siding, roofing, etc., and for the production of asbestos paper. The short-fibred material is used in protective coatings, plastics, in the manufacture of lubricating greases, and in a number of specialized applications where it has characteristics desired as an industrial fibrous filler.

During 1953 the prices of Canadian fibre remained unchanged. According to the Engineering and Mining Journal Metal and Mineral markets Bulletin of December 31, 1953, the following United States prices per short ton are quoted:-

Crude No. 1	$960 to $1,500
Crude No. 2	$595 to $900
Spinning fibres	3F - $514
	3K - $436
	3R - $371
	3T - $348
	3Z - $321
Shingle stock	$150 to $200
Paper stock	$109 to $137
Waste	$77
Shorts	$35 to $70

Per short ton, f. o. b. Vancouver, B. C., United States funds:

Spinning fibre (3K)	$460
Shingle fibre (4K)	$185

BARITE

Production of barite in Canada in 1953, as represented by mine shipments, reached an all-time high of 247,227 tons valued at $2,220,292 an increase of 82 per cent over 1952 in tonnage. Most of this production came from Walton, Nova Scotia, where one of the world's largest deposits is located. Barite is also produced at Parson and Brisco in the Columbia Valley, British Columbia.

Almost the entire production was exported, about 80 per cent as crude and 20 per cent as ground barite. The principal export markets are the United States, West Indies, and Venezuela.

PRODUCTION AND DEVELOPMENT

Nova Scotia

The deposit at Walton, Hants county, on the Bay of Fundy, is owned and operated by Canadian Industrial Minerals Limited. Mining of the massive, high-grade barite is by open-pit methods. Milling involves only crushing, screening, washing, and fine grinding for preparation of shipping-grade products. The mill is at the wharf, where the products are loaded directly on ocean-going ships for export to foreign markets. All production is shipped either as crude lump for further processing or as finely ground barite ready for direct use in well-drilling muds. The company reports estimated reserves of ore to be close to three million tons.

British Columbia

Mountain Minerals Limited mines barite at Parson and Brisco, British Columbia. Part of the production is shipped to its

Production, Trade and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production (mine shipments)				
Crude	196,199	1,487,557	85,742	711,292
Ground	51,028	732,735	50,260	809,870
Total	247,227	2,220,292	136,002	1,521,162
Imports (ground)				
From: United States	830	30,432	1,014	34,571
West Germany	341	8,106	379	8,353
Italy	33	867	-	-
United Kingdom	3	738	52	1,564
Total	1,207	40,143	1,445	44,488
Exports				
Crude	194,509		85,041	
Ground	48,021		49,085	
Total	242,530		134,126	

	1952	1951*
	Short Tons	Short Tons
Consumption (1953 figures not available)		
Paints	1,051	1,219
Rubber goods	513	375
Glass	209	212
Drilling Mud	2,000**	1,976
Miscellaneous	254	866
Total	4,027	4,648

* Revised
** Estimated

Lethbridge, Alberta, plant for further processing, and the remainder to Eastern Canada, where it is utilized in the paint trade.

Other Occurrences

A new deposit of witherite (barium carbonate) was found during the year at Liard River Crossing in the northernmost portion of British Columbia. The witherite is associated with fluorite, barite, and quartz, and the occurrence is reported to be extensive in size.

Exploratory investigations are under way. Because it is readily soluble in the common acids, witherite is a favoured material for the preparation of barium salts for chemical use.

Numerous other occurrences of barite are widely distributed throughout Canada, mainly in Nova Scotia, Quebec, Ontario, Manitoba, and British Columbia.

Statistics pertinent to the trade and consumption of barium compounds in Canada are shown in the following table:

	1953		1952	
	Short Tons	$	Short Tons	$
Imports of barium compounds				
Lithopone (70% $BaSO_4$)				
From: United States	2,158	324,740	2,678	410,596
United Kingdom	1,076	137,465	384	58,026
Other countries	114	12,433	93	12,844
Total	3,348	474,638	3,155	481,466
Blanc fixe (precipitated $BaSO_4$)				
From: West Germany	184	11,475	123	7,231
Belgium	35	2,628	17	1,080
United States	33	3,758	65	10,436
Other countries	10	1,101	7	534
Total	262	18,962	212	19,281

	1952	1951
	Pounds	Pounds
Consumption of main barium compounds*		
Barium chloride	348,401	305,244
Barium nitrate	111,065	175,744
Barytes (barite)	2,436,167	2,721,999
Blanc fixe	462,726	488,109
Lithopone	6,441,377	13,175,750

* 1953 figures not available

WORLD SOURCES

Total world production of barite in 1953 has been estimated to be about 2,100,000 tons. The United States, by far the largest producer, accounted for about 50 per cent of this production. Other major producers in addition to Canada are West Germany, United Kingdom, Italy, France, and Greece.

USES AND SPECIFICATIONS

The principal use of barite is in oil-well drilling muds along with bentonite and other minor conditioning agents. In the United States, which consumes over half the world's production, 65 per cent is used in drilling muds. It is used also as a pigment and filler in paints, rubber, linoleum, and papers; in the manufacture of barium chemicals; as an additive to glass batches; as an aggregate in concrete where additional weight is required such as in coatings for underwater pipes, or where shielding is required against radiation such as in X-ray rooms or atomic energy plants. A use recently reported is as an additive with latex to asphaltic road surfaces.

The manufacture of lithopone, a white pigment, formerly consumed appreciable quantities of barite, but the present use of titanium dioxide white in paints and enamels has greatly reduced the use of lithopone for this purpose. As a result of this development, DuPont discontinued the manufacture of lithopone in the eastern United States during the past year.

Specifications for barite vary widely, depending on use, and on agreement between producer and consumer. In drilling muds, which are used to combat high pressures of gas and water in wells and to float drill cuttings, the specific gravity and grain size of the barite are important factors. The usual specifications require a minimum specific gravity of 4.2, and a grind of 98 per cent minus 325 mesh. A minimum of 90 per cent $BaSO_4$ is also usually demanded. Soluble salts are objectionable because of their flocculating tendencies. The chemical trade demands a minumum of 95.0 per cent $BaSO_4$, with the Fe_2O_3 content not in excess of 1.75 per cent. The material is required in lump form, and colour is not important.

As a filler for paints, rubber, paper, etc., an almost pure white colour is essential, and usually a grind of 200 mesh or finer is required. A minimum of 95 per cent $BaSO_4$ is specified. For the glass trade, barite serves as a fluxing agent, deoxidizer, and decolourizer. For this purpose a minimum of 98 per cent $BaSO_4$ may be specified, and a very low iron content, about 0.20 per cent or less. Grain sizes up to 20 mesh are required with a minimum of minus 200 mesh.

Barium compounds are used widely 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; in the purification of salt brine and in 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

No published quotations on barite, crude or ground, are available in Canada.

Quotations in United States trade journals at the end of the year were as follows:

Georgia - f.o.b. mines

Crude, jig, and lumps - $14.00 per net ton.
Beneficiated - $17.00 to $19.00 per net ton in bulk;
$19.00 to $20.00 in bags.

Missouri

Water-ground, floated, and bleached - $41.35 per ton car lots, f.o.b. works.
Crude ore - minimum 94% $BaSO_4$, less than 1% iron, $13.25 per ton.

Tariffs

Canada

British preferential	-	free
Most favoured nation	-	25% ad valorem
General	-	25% ad valorem

United States

Crude	-	$3.00 per long ton
Ground or manufactured	-	$6.50 per long ton

BENTONITE

All Canadian production of bentonite in 1953 continued to come from Manitoba and Alberta. The output was valued at $418,633 in 1953 compared to $388,542 in 1952.

In Manitoba, Pembina Mountain Clays Limited, 945 Logan Avenue, Winnipeg, mines a non-swelling bentonite from a deposit near Morden, about 40 miles south and west of Winnipeg. The company ships the dried, ground clay to its Winnipeg plant for activation (treatment with sulphuric acid). It markets the activated material to oil refineries for bleaching and clarifying mineral oils. Some activated bentonite is also sold for the clarification of animal and vegetable oils. Dried, ground, natural bentonite is also marketed by the company for oil clarification.

In Alberta, Mr. G. L. Kidd of Drumheller again shipped lump bentonite from the area to Alberta Mud Company Ltd. at Calgary. This company dried, ground, bagged, and shipped the swelling bentonite to consumers in Western Canada. Most of the output is used as a carrier in the manufacture of dusting agents for weed killing. The remainder is used as an aid to core drilling in the mining industry, as a foundry sand bond, and in the sealing of irrigation ditches.

Imports of activated bentonite, all from the United States, declined in value from $460, 743 in 1952 to $443, 510 in 1953. Considerable amounts (tonnage and value not available in trade returns)a of natural ground bentonite are imported from the United States, mainly for use in oil-well drilling, and as a bonding agent in foundry sand moulds.

OCCURRENCES AND PRODUCTION

In Manitoba, the bentonite mined near Morden by Pembina Mountain Clays possesses good bleaching properties even in the natural state: when activated, it compares favourably with that imported from the United States. It occurs near the base of the Pembina member of the Vermilion River formation, which is of Upper Cretaceous age. This horizon is quite pronounced from the United States border northwestward to Miami, a distance of about 35 miles.

In Saskatchewan, there are a number of occurrences of bentonite in the southern portion of the province. However, there has been no production other than that used in trial shipments and for testing by the Resources Utilization Branch of the Saskatchewan Department of Natural Resources.

In Alberta, swelling bentonite has been mined at several points in the Drumheller area, Red Deer Valley, north of Calgary, In 1953, Gordon L. Kidd shipped material from a bed about 4 feet thick just north of Drumheller to the Alberta Mud Company Limited. Aetna Coal Company at Drumheller has also made shipments of a good-quality swelling bentonite in recent years but no production was reported in 1953. Barymin Company Limited early in 1954 reported the discovery of a 10-foot thickness of "expandable" bentonite northwest of Edmonton but details of extent and quality are lacking. Deposits of bentonite in Alberta are of the swelling variety and are often found in thin beds associated with coal seams.

Production, Trade, and Consumption

	1953	1952
	$	$
Production, processed and crude bentonite*	418,633	388,542
Imports, activated bentonite		
From: United States	443,510	460,743
	1952	1951
	Short Tons	Short Tons
Consumption		
Foundries	4,959	4,349
Miscellaneous non-metallic mineral products	885	840
Soaps and cleaning preparations	759	666
Pulp and paper	256	204
Petroleum refining	6,658	8,185
Vegetable oil mills	329	424
Oil well drilling	16,000	16,002
Total	29,846	30,670

* Includes ground and activated bentonite.

In British Columbia, bentonite beds of the non-swelling variety up to 15 feet thick occur in gently dipping Tertiary sediments. The larger occurrences are located at Quilchena Creek, about two miles south of the Quilchena post office, at the outskirts of Princeton on Copper Mountain Railway, and about five miles south of Princeton on the same railway. There has been no significant production from any of these deposits.

UNITED STATES PRODUCTION AND CONSUMPTION

The Bureau of Mines, United States Department of the Interior, reported that the 1952 United States bentonite production of 1,421,902 short tons valued at $15,431,214 had topped the previous peak production of 1,218,868 short tons valued at $13,006,645 in 1951. End-use consumption of bentonite, in short tons, for 1951 and 1952 is reported as follows:

End Use	1952	1951
Rotary drilling mud	705,280	460,261
Filtering and decolourizing oils	307,685	397,940
Foundry-sand bond	322,746	282,753
Miscellaneous	86,191	77,914
Total	1,421,902	1,218,868

USES

Bentonite is used chiefly to control the viscosity of oil-well drilling muds; for the bleaching, or decolourizing and filtering, of mineral, animal, and vegetable oils; and as the bonding agent in foundry sand moulds.

The colloidal, or swelling-type, of bentonite has a wide range of minor uses including the bonding and plasticizing of ceramic and refractory bodies; 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; 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 water seepage around foundations of buildings. Considerable quantities of swelling bentonite may, in future years, be used in the pelletizing of the magnetic, filtered concentrates derived from the treatment of taconites (low-grade magnetic iron ores). Bentonite has proven successful on a pilot-plant scale as a binder for producing pellets suitable for blast-furnace feed. Treated bentonite is used as a desiccant to prevent atmospheric moisture from entering packaged goods, and for coating small seeds to increase their bulk and to facilitate sowing.

PRICES AND TARIFFS

The price of bentonite varies within wide limits according to the grade of the material and the amount of processing it has received. Activated bentonite, for bleaching of mineral and vegetable oils, costs from $60 to $80 per short ton in bulk carload lots, delivered to points in Ontario and Quebec. The selling price of ground Alberta bentonite remained unchanged at $40 per ton f. o. b. Calgary plant. The price of processed bentonite in 1953, f. o. b. Montreal or Toronto, ground to 200 mesh, in bags, was $42 per short ton, according to trade journals.

Wyoming and South Dakota standard 200-mesh bentonite sold for $12.50 per ton, bagged, in carload lots, f. o. b. plant. Oil-well grade bentonite sold for $14.00 per ton, bagged in carload lots, f. o. b. plant. Special grades in dust form were quoted as high as $90.00 per ton. Powdered Mississippi bentonite sold for $14.00 per ton, bagged, in carload lots, f. o. b. plant.

Tariffs on bentonite entering Canada and United States in 1953 were as follows:

Canada

Not further processed than ground - free	
Activated, when imported for use in refining of oils	
British preferential	- 10% ad valorem
Most favoured nation	- 10% ad valorem
General	- 25% ad valorem

United States

Unwrought and unmanufactured	- 37 1/2 cents per long ton
Wrought or manufactured	- 81 1/4 cents per long ton
Artificially activated	- 1/8 cent per lb. and 15% ad valorem

CEMENT

The cement industry in Canada in 1953 continued the rapid growth that has characterized it since World War II. During this period Canadian production increased 162 per cent, from 8,471,000 barrels in 1945 to 22,238,000 barrels in 1953, compared with a 153 per cent increase in production in the United States and a 177 per cent increase in the United Kingdom during the same period.

The increase in productive capacity was inevitable in view of the curtailing of all construction not directly related to war work during the period 1939-45. The backlog of construction thus caused, plus the demand by an increased population for residential and industrial buildings and adequate hydro-electric power plants, combined to create a market which at times was without sufficient supplies of cement. Heavy demands for cement for defence construction further emphasized the need for increased productive capacity.

The record output in 1953 was valued at $58,842,000, an increase of 20 per cent in volume and 22 per cent in value over 1952. Towards the end of 1953 there were indications of a slackening in demand, mainly because of the completion of most of the concrete work in defence and hydro construction projects.

Imports, which came mainly from the United States and United Kingdom, with lesser amounts from West Germany and Belgium, declined from 2,914,000 barrels valued at $9,068,000 in 1952 to 2,483,000 barrels valued at $7,403,000 in 1953.

St. Lawrence Cement Company began construction in 1953 of a new plant at Villeneuve near Quebec City which is to be completed in 1955; it will bring to 12 the number of producing plants in Canada. Additions under way to existing plants will raise Canada's total rated annual capacity to 25,400,000 barrels.

The raw materials for making cement occur throughout Canada, and plants are operated in British Columbia, Alberta, Manitoba, Ontario, Quebec, New Brunswick, and Newfoundland. Five companies with a total of 26 kilns make portland cement, while a sixth imports and grinds clinker for making white cement.

Canada Cement Company, Limited, by far the largest producer in Canada, operates plants at Exshaw, Alberta; Fort Whyte, Manitoba; Port Colborne and Belleville, Ontario; Hull and Montreal, Quebec; and Havelock, New Brunswick. During 1953, two new kilns installed in 1952, one at Belleville and the other at Exshaw, were in full production. Further expansion plans at the Fort Whyte plant call for an additional kiln which will almost double the present capacity of 1,600,000 barrels annually.

British Columbia Cement Company Limited completed installation of its fourth and largest kiln and of a new material preparation and finishing section at its plant on Saanich Inlet, Vancouver Island, thus increasing plant capacity by over 1,000,000 barrels annually.

St. Mary's Cement Company Limited, St. Mary's, Ontario, increased plant capacity in 1953 by 700,000 barrels annually by the addition of a new kiln during the year.

Le Ciment Québec, Inc., at St. Basile, Portneuf county, Quebec, produced approximately 100,000 barrels of cement during 1953. All production is used locally. St. Lawrence Cement Company's new plant at Villeneuve near Quebec City will have an annual capacity of 1,500,000 barrels.

North Star Cement Limited, Corner Brook, Newfoundland, burns clinker throughout the year but does not grind it during the winter months, when demand is low. The plant has a rated annual capacity of 600,000 barrels.

USES

The major use for cement is in concrete construction. However, demand is increasing for plant-manufactured concrete products, made on a mass-produced basis, which are delivered ready for use on the job. In 1952 the selling value of these products at works amounted to $43,896,027 compared with $34,884,967 in 1951.

In 1952 the concrete products industry used 4,824,430 barrels of cement at a cost at works of $16,616,706. Products included

ready-mix concrete worth $23,415,036, concrete pipe of all kinds valued at $10,036,049, gravel blocks at $15,063,315, cinder blocks at $3,241,478, other lightweight aggregate blocks at $1,309,414, artificial stone at $2,084,935, concrete bricks at $2,556,862, and other items such as laundry tubs, burial vaults, chimney blocks, etc., at $9,787,821. Altogether, 451 plants were in operation during 1952, Ontario having 195, Quebec 141, British Columbia 36, Alberta 29, Saskatchewan 18, Manitoba, New Brunswick, Nova Scotia each having 8, Newfoundland 7, and Prince Edward Island 1. Ontario plants produced 51 per cent of the total, those in Quebec 27, Alberta and British Columbia plants 11 and 6 per cent, respectively, while the remaining 5 per cent came from the other producing provinces.

Production, Trade, and Consumption

	1953		1952	
	Barrels of 350 lbs.	$	Barrels of 350 lbs.	$
Production	22,238,335	58,842,022	18,520,538	48,059,470
Exports				
To: United States	13,613	73,070	3,200	16,062
Other countries	1,115	4,489	1,106	4,624
Total	14,728	77,559	4,306	20,686
Imports				
From: United States	1,237,474	4,252,759	1,459,743	5,057,973
United Kingdom	714,529	1,856,641	696,700	1,888,222
W. Germany	270,958	654,632	207,230	626,687
Belgium	247,966	580,479	506,888	1,370,796
Other countries	11,856	58,647	43,420	124,503
Total	2,482,783	7,403,158	2,913,981	9,068,181
Imports (clinker)				
From: United States	65,837	211,513	48,132	153,383
Apparent consumption (exclusive of clinker)	24,706,390	-	21,430,213	-

CLAYS AND CLAY PRODUCTS

The production of structural clay products manufactured in Canada from both domestic and imported clays increased from $40,629,124 in 1952 to $44,649,679 during 1953 owing to expanded house building programs and to increased government and industrial construction. Most of this increase occurred in the value of structural clay products made from domestic common clays. Imports of clay in 1953, largely china clay, were valued at $3,083,380, compared to $2,770,318 in 1952.

The production capacity for brick and structural tile was expanded, and considerable attention was given to finding new sources of raw material suitable for making building products in areas where they have not as yet been manufactured.

The export of high-tension porcelain electrical insulators decreased markedly, mainly because of trade difficulties in sterling areas. This is also thought to account largely for the reduction of almost 5 per cent in the value of products made from imported clays in 1953 below that of 1952. There are indications that the demand for refractories has levelled off, but this is believed to be temporary only.

Various kinds of clay are required by the clay products industry, principally (1) common clay for structural items, (2) stoneware clay for sewer pipe, flue linings, stoneware, artware, kitchen bowls, crocks, etc., (3) fireclay for refractories and (4) china clay and ball clay for porcelains (mainly electrical), sanitary ware, tableware, floor and wall tile, etc. Large quantities of china clay are also used in the paper and rubber industry, and substantial amounts of bleaching clays are used in oil refineries.

Common Clays

Clays or shales suitable for the production of good quality brick and tile are not too plentiful in Canada, although good brick clays occur in all provinces at points not too distant from the more thickly populated areas. Sources of new and better raw material are therefore being sought constantly to meet the greatly increased demand for structural clay products. Surveys sponsored in recent years by both government and commercial agencies have located many new deposits, and new plants have already been established at some of these. Other new deposits have permitted the manufacture of improved products in existing plants. The Mines Branch of this Department carries out evaluation tests on samples submitted from all parts of Canada, and conducts field tests in connection with the development of new deposits.

Production and Trade

	1953	1952
	$	$
Production from domestic clays		
Clays, including bentonite . .	517, 382	532, 754
Clay products		
From: Common clays . . .	24, 224, 704	19, 997, 038
Stoneware clays . .	4, 212, 982	3, 615, 951
Fireclays	660, 101	675, 163
Other products	162, 562	140, 622
Total	29, 777, 731	24, 961, 528
Production from imported clays		
From: Stoneware clays . .	886, 370	889, 265
Fireclay	2, 113, 310	2, 153, 421
China clay	11, 872, 268	12, 624, 910
Total	14, 871, 948	15, 667, 596
Grand total	44, 649, 679	40, 629, 124
Imports of clay		
Fireclay	460, 296	406, 169
China clay	1, 647, 140	1, 455, 792
All other, including activated, filtering, and bleaching clays	975, 944	908, 357
Total	3, 083, 380	2, 770, 318
Imports of clay products		
From: United States . . .	21, 981, 595	20, 126, 684
United Kingdom . .	13, 539, 058	12, 969, 697
Other countries . .	1, 802, 077	1, 488, 536
Total	37, 322, 730	34, 584, 917
Exports of clay		
To: United States . . .	23, 069	36, 728
Other countries . .	2, 025	2, 316
Total	25, 094	39, 044
Exports of clay products		
To: United States . . .	1, 099, 244	1, 084, 260
Finland	149, 833	38, 486
Sweden	131, 304	121, 718
Belgium	117, 048	150, 251
Brazil	107, 066	262, 441
Union of S. Africa	70, 489	122, 309
Other countries . . .	246, 378	664, 275
Total	1, 921, 362	2, 443, 740

An investigation into the possibilities of making lightweight aggregate from Canadian clays and shales has been under way for several years in the Mines Branch. The object is to find clays or shales suitable for use as lightweight aggregate when bloated by heat treatment.

Owing to a diminishing supply of suitable cinders, and to the trend toward lightweight concrete construction, new sources of clay or shale suitable for the production of lightweight aggregate are needed in various parts of Canada, so that production of such aggregate may be carried out reasonably close to consuming centers.

Two new units producing lightweight aggregate, one in Ontario and the other in Alberta, have been constructed.

Stoneware Clays

The largest Canadian production of stoneware clays is in southern Saskatchewan, particularly in the vicinity of Eastend. The clay is selectively mined and is shipped to Medicine Hat, Alberta, where a wide variety of stoneware articles, sewer pipe, pottery, etc. is made, the kilns being fired by natural gas from local wells. Tableware, including vitreous hotel ware, is also made in this area, with imported china clay as part of the body composition.

The stoneware clays or semi-fireclays that occur associated with the fireclays in the Sumas Mountain area, south of Vancouver in British Columbia, are utilized on a large scale for making sewer pipe, flue liners, and other stoneware products. These clays also occur in the province near Williams Lake and Chimney Creek Bridge, and in Manitoba, near Swan River and Pine River, but they are difficult of access and have not been exploited extensively. Ontario and Quebec import their requirements of stoneware clays.

The stoneware clays and moderately refractory fireclays that occur near Shubenacadie and Musquodoboit, Nova Scotia, used for the production of pottery, certain stoneware products, and low-grade refractories, have not been developed extensively for ceramic use.

Fireclays

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 area. Smaller enterprises have also been established in this area in recent years for the manufacture of refractories or like products from material obtained from these 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, and some of the Musquodoboit clay has been used for the production of stove linings, and for foundry purposes.

Other production of fireclay refractories such as firebrick, high-temperature cements, plastic refractories, etc., particularly in Eastern Canada, is from imported clays.

The rather extensive deposits of plastic fireclays that occur on the Mattagami, Missinaibi, and Abitibi Rivers in northern Ontario have not been developed commercially owing to their remoteness and to certain difficulties in extracting uniform high-quality material from them.

A considerable amount of investigational work was carried out in the Mines Branch during the year with a view to finding an economic method of recovering kyanite from the newly discovered kyanite-bearing occurrences in the Mattawa and Sudbury areas of northern Ontario. Kyanite constitutes an important ingredient in certain kinds of high-grade refractories, and Canadian requirements are imported.

Fireclays imported from the United States enter Canada duty free if not processed further than by grinding.

China and Ball Clay

Imports of china clay used to make electrical and other porcelains, sanitary ware, tableware, ceramic floor and wall tile, etc., were valued at $1,647,140 in 1953, of which $1,065,600 worth came from the United States, and $581,540 worth from the United Kingdom.

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 some 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.

There are several other smaller deposits of kaolin in Quebec. One of these is near Point Comfort, Thirty-one Mile Lake, Gatineau county; others are near Brebeuf, Lake Labelle, and Chateau Richer. None of these occurrences, however, has proved of sufficient size and uniformity for commercial use.

The clay deposits in northern Ontario (see "Fireclays") contain material that may be classified as crude china clay, but the

distance from industrial centres has prevented development.

Extensive deposits of clay of varying quality occur at Giscombe Rapids on the Fraser River, about 25 miles above Prince George, British Columbia. A road has been built into this district, making the occurrences more accessible for exploitation.

The Saskatchewan Government is continuing to carry out an extensive program of exploration of its ball clay and other clay resources, particularly in the southern part of the province, largely with the hope that markets for western ball clays may be expanded in Eastern Canada and United States.

PRICES

Average prices for the various kinds of clay are difficult to obtain, because of the variability in quality. An approximate indication of the 1952 prices per ton, f. o. b. shipping point, for three kinds of imported clay is as follows:

Fireclay	-	$4.50 to $ 6.00
China clay	-	$9.00 to $30.00
Ball clay	-	$6.00 to $20.00

DIATOMITE

Canadian production of diatomite has always been both irregular in character and small in quantity. In 1953, the total domestic production (sales) amounted to 103 tons only, of which 100 tons was bog diatomite produced in the Muskoka district of Ontario and marketed as a livestock feed additive. The remaining 3 tons was regular diatomite shipped from stock, and originating in Nova Scotia.

Practically all Canada's requirements are imported from the United States. Imports in 1953 totalled 19, 350 short tons valued at $670, 610, as against 15, 888 tons valued at $563, 950 for 1952. The increase may be largely attributed to the use of diatomite as a coating in the manufacture of nitraprill fertilizers, while its use in filtration also showed an increase.

OCCURRENCES IN CANADA

Deposits of Recent, fresh-water diatomite are quite common in Canada, but the processed material has not been found suitable for the major uses. The largest such deposit, in Nova Scotia, has been operated intermittently over a number of years.

Production, Trade, and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production (sales)	103	12,150	36	1,800
Imports				
From: United States	19,308	669,273	15,799	557,086
Other countries	42	1,337	89	6,864
Total	19,350	670,610	15,888	563,950
Consumption*				
Fertilizer coatings	8,989		5,699	
Filtration	8,634		6,091	
Fillers	1,274		1,017	
Insulation	137		165	
Miscellaneous			107	
Total	19,034		13,079	

* Based on information supplied to the Mines Branch by distributors and consumers.

The Tertiary fresh-water deposits along the Fraser River, near Quesnel, British Columbia, are by far the largest known in Canada. The material has been found satisfactory for all uses except filtration. The deposits have been worked intermittently in recent years.

WORLD PRODUCTION

The United States is the world's largest producer and consumer of diatomite. During the period 1948-1952, inclusive, its average annual production was 232,800 tons. Reserves of high-quality material are considered adequate for many years.

Other countries producing diatomite are Denmark, Germany, and France (continental and Algeria).

USES

For many years, the chief use of diatomite was as a filtering agent, in which capacity it was used by the chemical, food-processing, liquor, sugar-refining, dry-cleaning, gold-mining, and water-purification industries to the extent of about 45 per cent. In Canada, these uses have now been overtaken by a recent development -- the use of diatomite as an anti-stick coating on nitraprills (ammonium nitrate fertilizers). These are made in Canada by The Consolidated Mining and Smelting Company of Canada Limited, and by North American

Cyanamid, and production is increasing. This use accounted for about 47 per cent of the total Canadian consumption in 1953.

Diatomite is also used in large quantities as a filler and absorber in making such things as paints, paper, rubber, soaps, textiles, cosmetics, polishes, and many other items. In the building industry, it is used as a concrete admixture, in mortars and plasters, and as a preferred source of silica in the manufacture of lime-silica insulating and structural materials. It is widely used in the form of blocks, bricks, slabs, aggregates, and powders for industrial thermal insulation.

There are many properties of diatomite that must be considered in order to determine the use to which a given deposit might be put. These properties include freedom from impurities (sand, volcanic ash, lime, clay, etc.), microscopic structure (types of diatoms and their condition), presence or absence of extremely fine particles, apparent or bulk density, colour, and others. Acceptance by consumers depends upon these properties.

PRICES

Diatomite varies widely in price, depending upon the type of diatomite and the quantities purchased. Prices of the various grades have not changed materially over the past several years. United States trade journal quotations ranged from $42 to $100 per ton, depending upon quality, quantity, and point of sale.

Filtration grades, f.o.b. Toronto or Montreal, vary from $100 to $160 per ton in ton lots, with filler grades somewhat lower at $75 to $110 per ton. Diatomite for nitraprill coating, insulation, concrete admixture, and other purposes varies from $30 to $60 per short ton f.o.b. producer. Diatomite insulation bricks range from $50 to $200 per thousand depending on grade, source, and insulating properties.

FELDSPAR

Production of feldspar in Canada in 1953 amounted to 21,246 short tons, a five per cent increase over 1952. Almost 88 per cent of the output came from Quebec and the remainder from Ontario. Exports, mainly to the United States, rose eight per cent to 6,848 tons.

Quebec

Canadian Flint and Spar Company Limited, Ottawa, operating in Derry township, Papineau county, and E. Wallingford Limited,

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Production				
Quebec	18,591	319,146	16,645	293,007
Ontario	2,655	28,018	3,622	37,628
Total	21,246	347,164	20,267	330,635
Imports				
From: United States	335	7,085	155	3,769
Exports				
To: United States	6,845	63,982	6,330	52,499
Other countries	3	252	30	2,400
Total	6,848	64,234	6,360	54,899

Consumption

	1952	1951
	Short Tons	Short Tons
Glass	4,042	3,484
Cleansers	1,807	1,701
Abrasives	61	32
Clay products	4,936	5,828
Enamelling	798	1,105
Heating and cooking apparatus	208	137
Iron castings	90	75
Electrical apparatus	680	958
Total	12,622	13,320

Perkins, in the Gatineau area, were the principal producers.

The grinding plant of Canadian Flint and Spar Company Limited continued to produce ground spar for the domestic trade. Bon Ami Company, Limited, Montreal, continued to grind feldspar for its own use.

Ontario

Canadian Flint and Spar Company Limited commenced production from a new deposit near Plevna, Miller township, Frontenac county, during the latter part of the year. Wallace Cameron, operating in Murchison township, Renfrew county, and Bathurst Feldspar

Mines Limited, operating in Bathurst township, Frontenac county, contributed to the output.

USES AND SPECIFICATIONS

Feldspar is the principal source of alumina and the alkalis in the manufacture of pottery, glass, enamels and other ceramic goods. To qualify as No. 1 ceramic spar, it should contain a maximum of 0.06 per cent iron and other colouring oxides. Normally the quartz content should not exceed about 5 per cent, but this may vary according to customer's requirements. Both potash and soda spar, regardless of colour, are acceptable.

For use as a cleanser, feldspar, either potash or soda, should be of good white colour and free from grit.

Dental spar is high-quality potash spar selected by the trade according to its firing characteristics. Iron oxide content should not exceed 0.10 per cent in any case, and a lower content is preferred. The spar must be free from tourmaline, biotite, and other minerals that may leave specks in the finished product.

MARKETS, PRICES, AND TARIFFS

Canadian Flint and Spar Company Limited is the principal purchaser of crude feldspar of all grades in Canada. Bon Ami Company, Limited, purchases white spar for cleanser use. Ceramic grade spar is bought in United States by Shenango Pottery Company, New Castle, Pennsylvania. Buyers of dental grade include Myerson Tooth Corporation, Cambridge, Massachusetts; Dentists' Supply Company, 220 W. 42nd St., New York City; and Universal Dental Company, Brown at 48th St., Philadelphia, Pennsylvania.

Prices for No. 1 ceramic grade spar in 1953 remained unchanged at about $10.00 per short ton f. o. b. rail. The declared unit value of crude shipped to United States was $9.38 per short ton compared to $8.63 in 1952. Final 1953 quotations were, for ground pottery grade per short ton, f. o. b. Toronto or Montreal, bagged, carload lots - $24.20; less than carload lot - $26.40.

The duty on crude feldspar entering United States is 12 1/2 cents per long ton and on ground feldspar 7 1/2 per cent ad valorem.

The Canadian tariff is as follows:

Crude - Free
Ground -

British preferential	-	Free
Most favoured nation	-	15% ad valorem
General	-	30% ad valorem

FLUORSPAR

Production of fluorspar in Canada in 1953 reached a new high of 88,569 tons valued at $2,670,585, compared with the previous record of 82,187 tons valued at $2,523,408 in 1952. By far the greater part of the output came from Newfoundland, the remainder being from Ontario. Exports, all to the United States, amounted to 22,079 tons, an increase of 18 per cent over the previous year. Imports totalled 20,161 tons, a decrease of 11 per cent from 1952.

Production, Trade, and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production (shipments)				
Newfoundland	87,693	2,631,698	81,283	2,484,943
Ontario	876	38,887	904	38,465
Total	88,569	2,670,585	82,187	2,523,408
Imports				
From: Mexico	8,696	214,965	11,790	298,199
United States	4,987	166,355	5,229	185,997
Spain	4,810	113,453	1,761	77,285
United Kingdom	1,435	45,046	628	11,127
Other countries	233	7,096	3,306	112,360
Total	20,161	546,915	22,714	684,968
Exports*				
To: United States	22,079		18,675	
	1952		1951	
Consumption (reported: 1953 figures not available)				
Heavy chemicals and non-ferrous smelters	45,399		33,266	
Steel furnaces	22,576		23,374	
Glass	642		586	
Enamelling and glazing	6,535		300	
Total	75,152		57,526	

* From United States Imports of Merchandise for Consumption.

PRODUCTION

The newly opened Kilpatrick mine of Huntingdon Fluorspar Mines Limited, about one mile southwest of Madoc, was the only Ontario producer during 1953. Reliance Fluorspar Mining Syndicate Limited made several shipments from material stockpiled from the previous year.

In Newfoundland, two companies were producing, namely, St. Lawrence Corporation of Newfoundland Limited and Newfoundland Fluorspar Limited. St. Lawrence operated five properties, with the Iron Springs mine supplying about 60 per cent of the total output. All material was treated in the company's mill about one mile west of St. Lawrence. A heavy-media separation unit was installed in 1953 and came into operation in October. The output for 1953 totalled 32, 362 short tons, made up of 6, 471 tons of heavy-media concentrates, 4, 806 tons of metallurgical grade, and 21, 085 tons acid grade.

Newfoundland Fluorspar, a subsidiary of Aluminum Company of Canada Limited, operates the Director mine, one and one-half miles west of St. Lawrence. This is the most important deposit discovered to date, the vein varying from one to 70 feet in width, and having a calcium fluoride content of from 60 to 80 per cent. The material was treated in the recently installed heavy-media separation plant at the mine. The output totalled 63, 933 tons, of which 45, 997 tons were heavy-media separation sink, and 17, 936 fines. The entire output was shipped to the Arvida smelter.

While no accurate estimate of Newfoundland's reserves of fluorspar has been made, they are known to be very large, and may be classed as among the most important in the world. Fluorite mineralization in the St. Lawrence area is known to extend for as much as three miles longitudinally, and at depths of 600 feet and more no significant changes in grade or width are noted. The higher-grade veins average four to five feet in width and have a fluorite content of 95 per cent or more, with a silica content of one to four per cent, while the lower-grade veins run from 15 to 20 feet in width, and have a fluorite content of about 75 per cent, with silica ranging from 10 to 15 per cent.

Other Occurrences

Deposits of fluorspar occur in Ross township, Renfrew county, Ontario; Huddersfield township, Pontiac county, Quebec; in the Lake Ainslie district, Cape Breton Island, Nova Scotia; and near Grand Forks, British Columbia.

An occurrence of fluorite in association with witherite, barite, and quartz was located in 1953 at Little River Crossing in northern British Columbia. The occurrence is reported to be extensive, and is now being explored.

USES

Fluorspar in Canada is consumed chiefly in the manufacture of aluminum fluoride, which is added directly to the pots as a make-up to the electrolyte in producing aluminum. Other uses, in order of importance, are: as a powerful fluxing agent in the steel industry, where about 6 pounds of spar are required per ton of steel made in the open hearth, and 20 pounds per ton for that made in the electric furnace; in the manufacture of heavy chemicals; and in the ceramic industry as a fluxing and opacifying ingredient in glass and enamels. Fluorspar is used in small amounts in numerous other metallurgical industries, including foundries and various metal-refining plants.

In United States, the largest consumer is the steel industry, which also consumes substantial quantities of hydrofluoric acid and sodium fluoride. The next largest use is in the manufacture of hydrofluoric acid.

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 maximum of 5 per cent silica and 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 maxima of 2 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 97 per cent CaF_2 and not over one per cent silica. Like the ceramic grade, it is used mainly in powder form.

PRICES

Canadian prices of ceramic grade fluorspar, as quoted by Aluminum Company of Canada f.o.b. Arvida, Quebec, and published in the December 17, 1953, issue of The Northern Miner, were as follows:

Ceramic coarse grade: (a) In 100-lb. bags: Carload, $61.50; L.C.L. to one ton, $70.70; less than one ton, $76.85. (b) In bulk, any quantity, $57.75. Ceramic fine grade: (a) In 100-lb. bags: Carload, $63.50; L.C.L. to one ton, $73.00; less than one ton, $79.35. (b) In bulk, any quantity, $59.75. Specifications: 96 per cent CaF_2 minimum with maximum 2 per cent $CaCO_3$, 3 per cent SiO_2 and 0.2 per cent Fe_2O_3.

TARIFFS

The duty on fluorspar entering United States is $1.875 per short ton if it contains more than 97 per cent CaF_2, and $7.50 per short ton if it contains 97 per cent or less. Fluorspar enters Canada duty free.

GRANITE

Production of granite in 1953 amounted to 1,350,917 tons valued at $5,554,530 as compared with the all-time high of 2,490,086 tons valued at $7,327,022 for the previous year. Rubble and riprap, concrete aggregate, road metal, etc., account for over 96 per cent of the tonnage but little more than 50 per cent of the value. The remaining tonnage is used for building and monumental purposes.

Production of Canadian granites for building purposes is fairly well established, and the many splendid granite buildings already erected across Canada bear witness to the excellent class of material available. The granites quarried in many parts of Canada compare favourably with those produced elsewhere, and no difficulty should be encountered by an architect or contractor in obtaining suitable material of almost any colour desired. Canada also produces a wide variety of monumental stone equal to many of the imported stones, and this branch of the industry is expanding steadily in spite of competition from the better-known, lower-priced imports.

Quebec has long been the leading Canadian producer of granite. In the stone industry the term 'granite' covers all compact igneous rocks, as well as metamorphic rocks of igneous origin, adaptable to commercial use; thus, syenites, diorites, andesites, gneisses, and other related rocks are known to the trade under the general name 'granite'. 'Black granite' is merely a trade name employed to distinguish the darker-coloured commercial stones of igneous origin. These are rarely true granites in the mineralogical sense, and are not necessarily black, but may be of varying shades of dark grey or dark green.

Newfoundland

Granite deposits suitable for dimension stone are widespread in Newfoundland, but they have been utilized on a small scale only for local buildings, bridge abutments, and paving. Quarrying has been confined mainly to the Petites (Rose Blanche) area of the southwest coast, the south side of Conception Bay, and to several points along the railroad. There has been little, if any, production in recent years and at present the industry is at a standstill.

Nova Scotia

Although granite quarrying has been carried on in Nova Scotia for many years, no extensive development has yet taken place, probably because of limited local markets and lack of variety and quality of the granite types. These are mainly grey in colour and

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Production				
Monumental and building granite				
Rough	22,087	566,683	18,282	356,122
Dressed	23,057	2,198,789	24,403	2,180,484
Total	45,144	2,765,472	42,685	2,536,606
Rubble and riprap, roofing granules, concrete aggregate, road metal, etc.	1,305,773	2,789,058	2,447,401	4,790,416
Total	1,350,917	5,554,530	2,490,086	7,327,022
Exports, granite and marble (unwrought)				
To: United States	3,441	65,528	1,839	40,411
Imports, granite				
Rough				
From: United States		90,033		65,109
Sweden		69,336		44,244
Finland		26,644		19,604
Other countries		-		1,237
Total		186,013		130,194
Sawn				
From: United States		51,265		32,212
Finland		17,551		8,410
Sweden		17,367		15,532
Other countries		6,305		1,770
Total		92,488		57,924
Manufactures				
From: W. Germany		84,779		46,765
Sweden		80,870		40,146
Finland		61,395		35,683
United States		58,722		25,845
Other countries		15,038		33,719
Total		300,804		182,158

medium to coarse in texture, while the diorites, where present, are usually on the dark side. Grey granite is produced in the Nictaux and Shelburne areas, and black from the Shelburne area.

New Brunswick

Extensive masses of granite, the greater part suitable for at least some forms of construction, and in a number of places of monumental grade, occur in several areas of New Brunswick. These granites are greatly diversified, not only in texture, which varies from the finest grain to extremely coarse, but in colour, which ranges from dark red to the lightest pink, and various shades of grey, green, and black. Each type of stone has its special characteristics, and there is scarcely a use for granite that cannot be satisfactorily supplied from one or other of the granite districts of this province. The industry has been quiet and comparatively small for many years. At present operations are confined to the Hampstead (Spoon Island) district, where a pinkish-tinted grey granite is being quarried on a small scale, mainly for monumental use; to the Bathurst district, where a reddish-grey granite is quarried intermittently for the local building trade; and to the Antinouri Lake district, where a pink granite is being quarried for building purposes.

Quebec

For many years Quebec has been the leading producer of granite in Canada. Most of the production comes from the Eastern Townships south of the St. Lawrence River where a highly developed industry is based on the production of a well-known granite. North of the river, the resources of granite are more varied, but the industry is less developed. At present there are at least ten important granite-producing areas in the province.

The Precambrian Shield occupies most of the province of Quebec north of the St. Lawrence. In the deposits already opened, these Precambrian rocks provide a wide variety of colour, composition, and texture, and it is believed that many new types remain to be found. Thus, there are the blacks, pinks, browns, and reds of the Lake St. John region; the reds, greens, and greys of the Rivière-à-Pierre district; the pinks of Guenette; the banded gneisses of St. Raymond; the blacks and pinks of Rouyn; and the reds and greens of the Grenville area.

South of the St. Lawrence the granites are considerably more recent in age than those of the Precambrian Shield and they occur as a large number of comparatively small isolated deposits. Although the stones from the various areas may vary considerably in composition and texture, there is very little variety in colour and all may be considered as grey granites. These are produced in the Stanstead, Stanhope, Scotstown, St. Gerard, St. Samuel, and St. Sebastien areas. At Mount Johnson, a dark, mottled, grey 'granite', of medium texture is being produced.

Ontario

Although Ontario contains large areas and numerous outcrops of granitic rocks, they have been exploited to a limited extent only. The industry is rather quiet at present, production being confined to the River Valley area, where a medium-grained black granite is produced, and to the Lyndhurst area, where a coarse-grained red granite is quarried. The red granite quarry at Vermilion Bay did not operate during 1953.

Manitoba and Saskatchewan

Granites, granite-gneisses and allied rocks of Precambrian age occupy a large part of eastern and northern Manitoba, northern Saskatchewan, and the extreme northeastern corner of Alberta. Very little of the region, however, is served by rail and road communication, and the only activity of consequence in recent years has been in the West Hawk Lake area, 100 miles east of Winnipeg, where small amounts of grey and black granite are quarried intermittently.

British Columbia

British Columbia has large areas of igneous rocks, many of which are close to the principal roads and railroads, or along the Pacific Coast and thus close to water transportation. The predominating type being quarried consists of grey granites of varying shades, but in a few localities stone of other colour has been or is being produced, and at Haddington Island another highly desirable building stone, an andesite, is quarried. Granite quarrying in the interior of British Columbia is small and intermittent and confined to areas near Nelson and Sirdar.

USES

Granite is quarried chiefly for the building and monumental trades. Most other uses are secondary, as they utilize the waste material left after extraction of building and monumental stone. Such uses include concrete aggregate, road metal, breakwaters, poultry grit, stucco dash, and rubble retaining walls. In some cases granite quarries are opened for the sole purpose of supplying concrete aggregate or road metal.

For building purposes the stone must have an even texture, be of uniform composition, and have a pleasing and lasting colour. For use in polished form in base courses and trim, a stone of the same quality as for monumental work is desired, but when other finishes are employed the specifications need not be quite so rigid. Iron is at all times an objectionable constituent, as it will sooner or later cause disfiguring stains. For massive structures, a coarse-textured stone may be used with pleasing effect, although fine-textured stones are also in demand.

The specifications for monumental granite are more rigid and exacting, and only stone of the highest quality is used for this purpose. The stone must be free from flaws such as cracks, knots, hair lines, iron spots and any other imperfections that would mar its beauty. The texture and composition must be uniform, and the colour must be pleasing. The stone must be capable of taking and retaining a high polish, and there must be a good contrast between the different finishes such as polished and hammered surfaces. It is probably true to say that a good monumental stone will always make a good building stone whereas good building stones will not necessarily make good monumental stones.

A special use for granite is in the manufacture of press rolls for pulp and paper machines. Granite for this purpose should be fine-grained, hard, of uniform close texture, of high tensile strength, and free from soft spots and sulphides that might be acted upon by any residual chemicals remaining in the paper stock. Mica is undesirable as, besides being soft, it seems to have an affinity for the paper. Colour is unimportant, but the stone should be capable of taking a high polish.

GRAPHITE

Production (shipments) of natural graphite in Canada in 1953, all of which came from the Black Donald Mine near Calabogie, Ontario, increased 70 per cent in volume and 43 per cent in value over 1952. The mine, which is operated by a division of Frobisher Limited, has been in operation since 1906. Most of the year's output was derived from the westerly extension of the ore zone, which was made available for mining by an earthwork dam completed in 1952. Of the total shipments, 85 per cent consisted of amorphous foundry grades, 7 per cent of dust grades, and 8 per cent of high-grade lubricating and pencil flake.

The 1953 production has been exceeded only three times in the record of Canada's graphite production; in 1916 it was 3,955 tons, in 1917, 3,714 tons, and in 1950, 3,586 tons. Only in 1917 was the value of output greater than the total for 1953.

Total unmanufactured imports, which rose 29 per cent in value over 1952, came chiefly from Mexico (73 per cent), United States (23 per cent), and Norway (4 per cent). Imports of ground and manufactured graphite increased 11 per cent in value over 1952, while crucible imports were virtually unchanged.

Up to the present, Canada's graphite production has consisted mostly of small flake and amorphous grades derived from widely

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Shipments by types				
Amorphous foundry grades	2,950	254,569	1,765	180,322
Dust grades	235	41,222	81	14,812
High-grade lubricating and pencil grades	281	70,737	194	60,598
Total	3,466	366,528	2,040	255,732
	Per Cent		Per Cent	
Shipments by destination				
United States and other countries	94		83	
Domestic market	6		17	
	Short Tons		Short Tons	
Exports, crude and refined				
To: United States	3,251	320,227	1,685	191,344
Australia	2	461	1	219
Total	3,253	320,688	1,686	191,563
Imports, unmanufactured				
From: Mexico		91,850		59,123
United States		28,601		32,213
Norway		5,020		6,117
United Kingdom		269		-
Other countries		-		205
Total		125,740		97,658
Imports, ground and manufactured				
From: United States		467,078		410,107
United Kingdom		10,161		15,650
Other countries		4,743		8,893
Total		481,982		434,650
Imports, crucibles				
From: United Kingdom		131,179		120,028
United States		85,127		93,401
W. Germany		760		-
Total		217,066		213,429

separated deposits in the area of the Gatineau and Lièvre Rivers north of Ottawa, and in adjacent portions of Ontario. Graphitic shales and schists are common in the Maritime Provinces and in British Columbia. Artificial graphite is produced by Electro Metallurgical Company of Canada Limited, Welland, Ontario.

Principal world sources are Mexico (amorphous), Ceylon, (plumbago), and Madagascar (large flake).

USES AND SPECIFICATIONS

Natural graphite is used mainly as a refractory in the form of crucibles, foundry facings, and similar components in the iron and steel industry, the largest user, and in the paint industry as a pigment and anti-corrosive element in protective coatings. Graphite is used widely as a lubricant, particularly under high-temperature and corrosive conditions, as a conductive filler for dry batteries, in lead pencils, in corrosion-resistant pipes and fittings for the chemical industry, for impregnating wood and metal surfaces in oil-less bearings, in the manufacture of stove and other polishes, and as a polishing agent for lead shot, explosives, and fertilizers. Considerable quantities of graphite have been used as a moderator in atomic piles.

Artificial graphite, which is made from petroleum coke or anthracite by electric furnace treatment, is used in the manufacture of electrodes, brushes, and other special shapes. In powdered form it competes with natural amorphous graphite in paints, polishes, foundry facings, boiler compounds, etc., and particularly where high purity is desirable, as in dry batteries.

Carbon content, mesh size, and type (flake, crystalline, or amorphous) are the principal factors that govern the selection of graphite for its various uses. The different types of graphite are interchangable to some extent and are frequently blended according to formulas developed and protected by the manufacturers.

No universal code of specifications is recognized, but those for No. 1 crucible flake usually require 85 or 90 per cent carbon, through 20-mesh on 60- or 90-mesh. For lubricants, the requirement is usually a minimum of 95 per cent carbon. In general the demand is for material containing at least 70 per cent carbon, although lower-grade material is potentially salable.

MARKETS

Buyers of crude and finished graphite in the United States include Joseph Dixon Crucible Company, Jersey City, New Jersey; Charles Pettinos, 1 East 42nd St., New York, N. Y.; and George F. Pettinos Inc., 1206 Locust St., Philadelphia 7, Pa.

Consumption

Industry	1952 Short Tons	1951[a] Short Tons
Polishes and dressings	23	24
Miscellaneous non-metallic mineral products	56	288
Paints	69	72
Brass and copper products	38	42
Electrical apparatus	350	406
Heavy chemicals	309	332
Boilers, tanks, and plate work	6	8
Steel ingots and castings	1,024	736
Farm implements	4	5
Railway rolling stock	83	72
Machinery	72	71
Iron castings	305	290
Cooking and heating	17	14
Miscellaneous iron and steel products	72	70
Ferro-alloys	179	291
Explosives	1	-
Asbestos products	237	19
Total	2,845	2,740

a. Revised

PRICES

Closing prices for 1953 as published in trade journals were as follows:

Canada - f. o. b. shipping point, per pound:
Crucible flake - 10 to 12 cents
Lubricating and pencil grades - 12 to 15 cents
Fines for foundry facings - 4 to 7 cents

United States - f. o. b. shipping point, per pound:
Crystalline flake - 13 to 26 1/2 cents
Amorphous, up to 85% C - 9 cents

Madagascar c. i. f. New York:
Standard grades 85 to 87% C - $235 per ton
Special mesh - $260 per ton

Amorphous, Mexican, f. o. b. point of shipment (Mexico) per metric ton -$9 to $16 depending on grade.

TARIFFS

	British Preferential	Most Favoured Nation	General
Canada			
Graphite, not ground or otherwise manufactured	free	5%	10%
Graphite flakes	5%	5%	25%
Graphite, ground and manufactured	15%	20%	25%
Graphite foundry facings	15%	22 1/2%	25%
Graphite crucibles	free	15%	15%
Graphite bearings for use in automobiles and motor vehicles, etc.:			
of a class not made in Canada	free	free	30%
of a class made in Canada	free	17 1/2%	30%

United States

Amorphous - 5% ad val.
Crystalline chip, dust, or lump - 7 1/2% ad val.
Crystalline flake
valued per lb.:
under 2 3/4 cents - 0.4125 cents per lb.
2 3/4 cents or more but not over 5 1/2 cents - 15% ad val.
over 5 1/2 cents per lb. - 0.825 cents per lb.

GYPSUM AND ANHYDRITE

The production of crude gypsum, or hydrous calcium sulphate, in 1953 was 3,841,457 tons, an increase of about 7 per cent over the 3,590,783 tons produced in 1952. A total of 2,770,077 tons, 72 per cent of the total Canadian production, was exported in 1953. The remainder of the output was used in the manufacture of plasters and plaster products, and in the cement industry.

Nova Scotia was the chief producer of gypsum in 1953 and accounted for nearly 80 per cent of the total production. Ontario was second, followed by Manitoba, British Columbia, New Brunswick, and Newfoundland. Gypsum is found in every province except Prince Edward Island and Saskatchewan.

Anhydrite, or anhydrous calcium sulphate, is of little commercial importance in Canada. Most of the anhydrite produced comes

Production and Trade

	1953		1952	
	Short Tons	Dollar Value	Short Tons	Dollar Value
Production, crude gypsum				
Nova Scotia	3,050,832	5,200,420	2,969,312	4,373,842
Ontario	334,495	899,630	278,992	1,060,429
Manitoba	163,313	414,401	130,934	473,841
British Columbia	145,470	387,655	92,702	241,443
New Brunswick	120,816	380,570	110,183	333,638
Newfoundland	26,531	117,208	8,660	54,881
Total	3,841,457	7,399,884	3,590,783	6,538,074
Exports, crude and ground gypsum, plaster of paris, and wall plaster				
United States	2,770,067	3,796,936	2,763,611	2,851,703
New Zealand	10	197	200	3,630
Other countries	-	-	18	177
Total	2,770,077	3,797,133	2,763,829	2,855,510
Imports, gypsum, wall plaster, plaster of paris				
United States	22,394	477,380	13,150	281,245
United Kingdom	184	6,292	166	7,347
Total	22,578	483,672	13,316	288,592

from Nova Scotia, where its removal is frequently necessary in mining gypsum. It finds limited use as a soil conditioner, and is a potential source of sulphur, being processed for this purpose at several European plants.

GYPSUM

Canadian Producers

Nova Scotia

The largest producer of crude gypsum in Nova Scotia is Canadian Gypsum Company, Limited. This company operates quarries at Wentworth, near Windsor, for export purposes. Gypsum from Wentworth is shipped by rail to Hantsport, from where it is taken by boat to plants of United States Gypsum Company located on the eastern coast of the United States.

National Gypsum (Canada) Limited quarries gypsum at Walton in Hants county and at Dingwall in Victoria county. Gypsum from these quarries is shipped by water to company-owned plants in the United States. A small percentage of the production from Dingwall is shipped to gypsum plants in Quebec and to cement plants in Eastern Canada. This company is developing a large gypsum deposit near Milford Station, which is about 30 miles northwest of Halifax, Nova Scotia. It is expected that production from this deposit will commence in 1955. Most of the gypsum rock will be exported to the United States by water from Dartmouth; however, a small percentage will be shipped to gypsum plants in Quebec for processing.

Windsor Plaster Company, Limited, operates a small quarry near Brooklyn to supply its plaster mill in Windsor. Victoria Gypsum Company, Limited, quarries gypsum at Little Narrows for export to the United States and the West Indies.

Ontario

Gypsum, Lime and Alabastine, Canada, Limited, at Caledonia, and Canadian Gypsum Company Limited, at Hagersville, manufacture gypsum plasters and wallboards from gypsum rock obtained by the underground mining of beds underlying their plants.

Manitoba

Gypsum, Lime and Alabastine, Canada, Limited, produces gypsum plasters and wallboards at Winnipeg, using gypsum rock obtained from its quarry at Gypsumville. Western Gypsum Products, Limited also have a plant at Winnipeg for the production of gypsum plasters and wallboard. Gypsum rock for this plant is obtained from a mine at Amaranth, Manitoba.

British Columbia

Gypsum, Lime and Alabastine, Canada, Limited, manufactures gypsum board, insulation, and plaster products at its Port Mann plant, using gypsum rock obtained from the company's quarry at Falkland. Rock from the same quarry is shipped to Calgary, Alberta, for processing.

Gypsum rock from the deposits at Windermere, owned by Columbia Gypsum Products, Incorporated, is shipped to cement plants at Exshaw, Alberta, and Bamberton, British Columbia. Part of the production is shipped to the stucco plant of Columbia Gypsum Products, Incorporated, near Spokane, Washington.

The gypsum quarry at Mayook is owned by the Canada Cement Company, Limited. Gypsum rock from this quarry is shipped to the company's cement plant at Exshaw, Alberta.

New Brunswick

Canadian Gypsum Company, Limited produces plaster and wallboard at its plant in Hillsborough. Gypsum rock for this plant is obtained from nearby quarries.

Newfoundland

Atlantic Gypsum Limited, a Crown corporation, continued the development of gypsum deposits in the Bay St. George area. Gypsum rock from this deposit is used to manufacture wallboard and plaster at Humbermouth.

Other Gypsum Processing Plants

Quebec

Gypsum Lime and Alabastine, Canada, Limited, operates a plant in Montreal East for the production of plasters and wallboard. Gypsum rock for this plant is obtained from Dingwall, Nova Scotia.

The construction of a new gypsum plant at Montreal was undertaken by Canadian Gypsum Company, Limited, during the latter part of the year. Crude gypsum from Nova Scotia will be processed in this plant to produce plaster, wallboard, and lath.

Alberta

Gypsum, Lime and Alabastine, Canada, Limited produces gypsum plasters at its plant in Calgary from raw gypsum obtained from the company's quarry at Falkland, British Columbia.

Western Gypsum Products, Limited manufactures plaster and wallboard at a plant in Calgary. Raw gypsum is obtained from the company's mine at Amaranth, Manitoba.

USES

Calcined gypsum, commonly known as plaster of paris, is the principal component of plasters and wallboards. It is also used to a limited extent in moulding and ceramic work and in the manufacture of special products such as acoustic board, partition tile, fire-resisting walls, insulating tile, etc.

Gypsum is added in small quantities to portland cement, where it acts as a retarder in setting time, and has a limited use in ground form as a fertilizer for black alkali soils.

PRICES

The nominal price of crude gypsum in 1953 was $4 to $5 per ton f. o. b. quarry or mine. However, large contracts with seaboard quarries were at prices much below these figures.

IRON OXIDES (OCHRES)

The production of natural iron oxides, crude and calcined, in Canada amounted to 10,308 tons valued at $195,801 in 1953, compared to 11,487 tons valued at $194,922 in 1952. Output of natural iron oxides in recent years has been confined to the province of Quebec, where total production to the end of 1953 amounted to 433,617 tons valued at $5,353,782.

OCCURRENCES

Quebec

In Quebec, there are extensive deposits of iron oxide in St. Maurice and Champlain counties adjacent to the north shore of the St. Lawrence River, northward from Lake St. Pierre and the city of Trois-Rivières. It is from these deposits that the whole of the present production is obtained. The ochres in them consist of high-grade iron oxide, and the calcined product contains about 90 per cent Fe_2O_3.

Many other occurrences of a quality equal to those now being exploited are known, but are less favourably situated for development.

Western Provinces

Large deposits of iron oxide occurring near Grand Rapids and Cedar Lake in Manitoba remain undeveloped owing to lack of markets. The principal deposit of possible economic interest in Saskatchewan is located at Loon Lake, 32 miles from St. Walburg on the Canadian National Railways.

The Alta Lake deposit in British Columbia, formerly operated for the B.C. Electric Company, was considered mined out in 1949 and has been idle since then. The Lomong (International Lead and Iron) deposit near the Pend d'Oreille River in south central British Columbia has not shipped ochre in recent years. Bog iron ore suitable for the manufactured-gas industry occurs in the Peace River district but has not been mined.

PRODUCING COMPANIES

Sherwin Williams Company of Canada Limited, the sole producer of calcined iron oxides in Canada, operates two 'mines' and a calcining plant in Champlain county. The 'ore' is calcined at high temperatures and then finely ground in ball mills. The product is used as pigment in the paint and other industries, and as a polishing material, especially for plate glass, optical work, and the highest grade of metal polishing.

Production, Trade, and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production (sales)				
Natural (crude and calcined)	10,308	195,801	11,487	194,922
Imports, ochres, siennas, umbers				
From: United States	1,017	62,864	909	51,435
United Kingdom	127	7,336	89	5,305
Other countries	27	1,364	-	-
Total	1,171	71,564	998	56,740
Exports, natural and synthetic iron oxides				
To: United States	2,795	319,814	2,761	298,146
France	124	19,999	53	10,177
Mexico	62	9,696	123	20,418
Other countries	67	10,377	123	21,873
Total	3,048	359,886	3,060	350,614
	1952		1951	
Consumption in specified industries				
Coke and gas industry	8,302	81,822	10,310	105,709
Paint industry				
Calcined and synthetic iron oxide	2,441	406,781	2,946	467,059
Ochres, siennas, and umbers	227	49,738	249	50,851

Crude, air-dried iron oxide produced by other operators in the area is used as a purifying agent in the manufactured-gas industry. Exploitation of bog iron deposits is governed by the low market value of the product and the transportation costs to the market area. About 75 per cent of the 8,000 to 11,000 tons of iron oxide produced in Canada annually is used as the cleaning agent in the manufacture of illuminating gas.

Northern Pigment Company Limited, New Toronto, manufactures synthetic iron oxides from scrap iron by the ferrite process for domestic consumption and export. The product from the chemical reaction, a yellow iron oxide ($Fe_2O_3H_2O$), is washed, dried, and ground for marketing as such, or calcined to produce red iron oxides.

MINERAL-EARTH PIGMENTS IN THE UNITED STATES

The United States Bureau of Mines reported that total sales of mineral-earth pigments by domestic producers in 1951 amounted to 126,432 short tons valued at $14,987,075. Sales of natural mineral-earth pigments accounted for 64.6 per cent of the total tonnage and sales of synthetic pigments accounted for the remainder, or 44,769 short tons.

The following table indicates the natural mineral pigments and manufactured iron-oxide pigments, by kind, sold by processers in the United States in 1951, the latest year for which figures are available:-

Pigment	Short tons	$ per ton
Mineral blacks	17,247	20
Precipitated magnetic blacks	2,010	239
Natural brown oxides (metallic brown)	7,710	64
Vandyke brown (finished pigment)	150	194
Pure browns (96% or better iron oxides)	1,072	255
Natural red oxides	23,497	50
Pure red oxides (98% or better Fe_2O_3)	21,560	243
Venetian reds	4,910	100
Pyrite cinder	1,419	80
Other red iron oxides	17,096	130
Natural yellow oxides (high Fe_2O_3)	6,178	23
Pure yellows (85% or better Fe_2O_3)	13,798	199
Ochres (low Fe_2O_3)	2,188	48
Siennas		
Burnt	1,108	177
Not burnt	1,458	161
Umbers		
Burnt	3,473	122
Not burnt	817	106
Other	741	241
Total	126,432	
Total dollar value	$14,987,075	

USES

In Canada, from a tonnage point of view, the manufactured-gas industry uses about 75 per cent of the annual consumption of iron oxide. The value of this material, however, is under $100,000 a year, averaging slightly more than $10 a short ton. It is used in the removal of hydrogen sulphide from the manufactured gas.

The mineral pigments' share of the iron oxide market is smaller in tonnage but considerably higher in value than that of the

gas industry. Iron-oxide pigments are used as colouring agents in paints, linoleum, floor tile, oilcloth, wood stains and wood fillers, cement, stucco, mortar, and brick. They are used as colouring agents and fillers in imitation leather, shade cloth, shingle stain, paper, and cardboard. Finely ground, grit-free iron oxides are used in the manufacture of jewellers' rouge for polishing plate glass, optical glass, and metal. Siennas and umbers are used primarily in wood stains and wood fillers.

PIGMENT MATERIALS

Pigment materials provide colour, opacity, or body (or all three) to paint, plaster, linoleum, cement, rubber, and similar materials. They must be finely divided, practically insoluble, and inert. They may, in general, be divided into three main sub-groups, as follows:-

1. Natural mineral pigments such as ochres, umbers, and siennas that are dug from the earth.
2. Pigments that are made directly from ores and ore residues, such as zinc oxide, lead pigments, and titanium white.
3. Chemically manufactured pigments such as chrome yellow, Prussian blue, ultramarine, and the like.

The groups listed above overlap to some extent and the listing must be rather broadly interpreted.

Natural mineral pigments commonly used are some form of iron oxide and are classed as ochres, siennas, or umbers. The natural iron-oxide ores most extensively used for pigment purposes are hematite, limonite, or goethite. These always contain varying percentages of other oxides, chiefly of silica and alumina.

Ochre is a pulverulent iron oxide, usually containing varying amounts of clay, sand, and organic matter. Brown and yellow ochres consist of limonite or goethite, and red ochres of hematite. Sienna is a yellow-brown to brown clay coloured by iron and manganese oxides. Umber is a chestnut-brown to liver-brown hydrated ferric oxide containing manganese oxide and clay. As it occurs naturally, it is called raw umber, and when heated to produce a reddish-brown colour, burnt umber. Yellow ochres and siennas vary in iron-oxide content from 20 to 50 per cent; red and brown burnt siennas and umbers vary from 50 per cent iron-oxide content to as high as 85 per cent in the case of Spanish red.

The value of mineral pigments depends upon a number of factors which include uniformity of colour, tinting strength, uniform particle size and freedom from grit, oil absorption properties, opacity and hiding power, chemical composition, and the use to which the pigment is to be put. A number of standard A. S. T. M. tests have been devised for testing mineral pigments but most paint manufacturers

have their own standards, tests, and specifications, and in the end the pigment must meet these tests and specifications or be rejected. The final test rests with the customer and the appraisal of the material usually ends on a personal, visual basis rather than on any standard testing procedures that have been devised.

PRICES

There were no price quotations on iron-oxide pigments in 'Canadian Chemical Processing' in 1953. The March, 1952, issue of that journal quoted the following Canadian prices at that time:

Synthetic iron oxide, domestic, per lb.:-

Red	-	10 1/2 cents
Yellow	-	8 3/4 cents
Brown	-	6 1/4 cents

Synthetic iron oxide, imported, per lb.:-

Black	-	9 to 11 1/4 cents

There were no market quotations during 1953 for crude or calcined iron oxide, but crude air-dried iron oxide sells from $4 to $5 a ton, f. o. b. mine, and calcined iron oxide from $80 to $100 a ton, depending upon grade.

TARIFFS

At the end of 1953, tariffs were as follows:-

Canada

	British Preferential	Most favoured Nation	General
Ochres, ochrey earths, siennas, and umbers	5%	12 1/2%	15%
Oxides, fireproofs, rough stuff, fillers, and colours, dry . .	12 1/2%	17 1/2%	22 1/2%
Colours and pigments for the colouring of roofing granules	free	free	22 1/2%

United States

Iron oxide and iron hydroxide pigments	
Natural	20%
Synthetic	10%
Ochres and siennas	
Not ground	
Ochres, crude	1/8 cent lb.
Siennas, crude	1/16 cent lb.

Washed or ground	
Ochres	1/8 cent lb.
Siennas	1/4 cent lb.
Umbers	
Crude, not ground . . .	1/16 cent lb.
Washed or ground . . .	3/16 cent lb.

LIME

Production of lime in Canada in 1953 was 1,228,760 tons valued at $14,484,013 compared with 1,175,786 tons valued at $13,613,221 in 1952.

Lime is manufactured in all provinces except Prince Edward Island, Nova Scotia, and Saskatchewan; the two last, however, have suitable deposits. Across Canada the limestones vary in type and quality from deposit to deposit. Although occurrences from which lime may be made are plentiful, there is little stone available for producing a chemical lime that is high in calcium, white, and relatively free of impurities.

In British Columbia, Alberta, Quebec, and Newfoundland, production is of the high-calcium type. In Ontario, Manitoba, and New Brunswick both dolomitic and calcium limestones are burned.

There are 42 plants making lime in approximately 150 kilns, which range in sizes from the small pot type to large continuous rotary units. Several plants manufacture lime solely for their own use as a raw material in certain industrial processes, among these being the cyanamide and carbide industries and several sugar refineries.

Because of the widespread geographical occurrences of limestone and the relatively low price, lime is not traded internationally except on a small scale where local economic conditions dictate. In Canada, there is a small export trade on the west coast, while on the east coast lime is imported from the United States.

PRODUCTION

Newfoundland

Production in Newfoundland is small and is used solely for building purposes. Newfoundland Lime Manufacturing Company Limited burns lime at St. John's from stone quarried at Notre Dame Bay on the northeast coast.

Production, Trade, and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production by types				
Quicklime	923,133	11,300,914	912,143	10,677,367
Hydrated lime	305,627	3,183,099	263,643	2,935,854
Total	1,228,760	14,484,013	1,175,786	13,613,221
Production by provinces				
Newfoundland	160	6,942	436	19,952
New Brunswick	21,184	430,226	19,837	366,457
Quebec	424,305	4,236,639	408,522	4,056,100
Ontario	659,062	7,714,252	622,279	6,921,062
Manitoba	50,981	787,032	46,973	750,009
Alberta	29,263	430,924	30,006	415,348
British Columbia	43,805	877,998	47,733	1,084,293
Total	1,228,760	14,484,013	1,175,786	13,613,221
Imports, quicklime				
From: United States	21,415	230,636	16,609	167,709
United Kingdom	84	2,097	83	2,488
Total	21,499	232,733	16,692	170,197
Exports				
To: United States	33,290	543,132	23,145	372,676
Other countries	4	131	34	828
Total	33,294	543,263	23,179	373,504
Consumption by industries				
Finishing lime	77,651	1,422,813	72,630	1,402,506
Masons' lime	97,932	1,531,670	86,767	1,398,325
Non-ferrous smelters	178,844	1,100,170	156,713	1,013,099
Iron and steel plants	57,917	680,011	42,446	515,564
Cyanide and flotation mills	24,499	345,318	24,963	356,653
Pulp and paper mills	211,120	2,651,304	203,861	2,664,446
Glass making	11,861	108,857	10,091	111,142
Sugar refineries	24,956	319,620	31,763	389,173
Tanning	7,301	88,089	5,166	72,757
Sand-lime brick	14,181	167,806	11,985	142,932
Insecticides and fungicides	1,898	22,648	1,032	18,464
Other industrial uses	465,936	5,478,839	473,132	4,956,772
Agriculture	12,310	172,434	13,587	195,176
Other uses	42,354	394,434	41,650	376,212
Total	1,228,760	14,484,013	1,175,786	13,613,221

New Brunswick

There are two plants manufacturing lime, namely, Snowflake Lime Limited at Saint John, and Bathurst Power and Paper Ltd., at Bathurst; the latter makes lime solely for its own use.

Quebec

Shawinigan Chemicals Limited burns lime at Shawinigan Falls from a high-calcium stone quarried at Bedford, Missisquoi county. The lime is used mainly in making calcium carbide.

Standard Lime Company Limited burns lime at Joliette and at St. Marc des Carrières, Portneuf county. In both cases a high-calcium limestone is quarried locally.

Dominion Lime Limited also produces high-calcium quicklime and hydrated lime from stone quarried at Lime Ridge, Wolfe county.

At Wakefield, about 25 miles north of Ottawa, Aluminum Company of Canada Limited produces quicklime and hydrated lime in the recovery of magnesia from brucitic limestone.

There are seven other smaller producers in the province.

Ontario

Gypsum, Lime and Alabastine, Canada, Limited, produces quicklime and hydrated lime, both dolomitic and high-calcium. The company has kilns and quarries in operation at Beachville, and near Hespeler and Milton.

North American Cyanamid Limited burns lime at Niagara Falls for use in the production of cyanamide. The stone is quarried at Beachville.

Brunner Mond Canada Limited burns a high-calcium stone at Amherstberg for use in making sodium carbonate.

Canadian Gypsum Company Limited produces a dolomitic lime near Guelph.

At Beachville, Chemical Lime Limited produces a high-calcium lump lime for the iron and steel industry.

Six other smaller plants manufacture lime.

Manitoba

Building Products and Coal Company Limited burns a dolomitic limestone at Inwood.

Winnipeg Supply and Fuel Company Limited operates kilns at Moosehorn and Stonewall, producing both high-calcium and dolomitic lime.

Alberta

Lime is manufactured by Loder's Lime Company Limited at Kananaskis and by Summit Lime Works Limited near Crowsnest on the British Columbia border from high-calcium limestone.

Three refineries of Canadian Sugar Factories Limited burn lime for their own use.

British Columbia

Pacific Lime Company Limited burns a high-calcium limestone at Blubber Bay, Texada Island. The company is building a second plant at Vancouver.

Pacific Mills Limited at Ocean Falls burns lime for use in making paper.

USES AND MARKETING

Lime is the cheapest and most plentiful alkali chemical and as such is used widely for control of acidity and as a causticizing agent. It is essential in the production of calcium carbide, calcium cyanamide, soda-ash, and other chemicals. Large quantities are used by the pulp and paper industry and in metallurgical operations. It is a constituent in the manufacture of glass and is used in the refining of sugar.

In the building trades lime is used in the preparation of mortar and in plastering. It is also a component of sand-lime bricks.

In agriculture, lime is used to control soil acidity and correct calcium deficiency of soils, as well as in spray mixtures and dusting compounds.

Lime is marketed as the oxide or quicklime and in the slaked (hydrated) form. The former accounts for about three-quarters of the Canadian output and is shipped in bulk as lump or as pebble either in bulk or containers. Part of the output is pulverized, in which case it is bagged. The hydrate, which is a dry, slaked form with a fineness of 95 per cent or more passing a 325-mesh sieve, is sold in containers, usually multi-wall bags.

PRICES

Market prices for 1953 in the Montreal area for hydrated lime, bagged, in carload lots, were $16.00 to $17.00 per ton, and for lump quicklime, from $10.00 to $11.00 per ton.

LIMESTONE (GENERAL)

Canadian production of limestone in 1953 was greater than in any previous year. Output for all uses other than the manufacture of cement and lime was 17,461,720 tons valued at $23,783,230 compared with 15,957,799 tons valued at $22,319,143 in 1952.

With the exception of some 80,000 tons of dimensional stone used in construction during 1953, almost all quarry production was marketed in crushed from for a variety of uses. The availability of deposits and the ease with which they can be quarried have resulted in a wider use for Canadian limestone than for any other native rock -- as an aggregate in concrete, crushed stone for road construction, and ballast for railway lines. It is also a raw material in several manufacturing processes. Although there are quarries operating in all provinces except Prince Edward Island and Saskatchewan, almost 90 per cent of the production comes from Ontario and Quebec.

Canadian limestone deposits are of varied composition, ranging from high-calcium to dolomite, and include both argillaceous and siliceous types as well as brucitic limestone and magnesitic dolomite. However, high-calcium stone sufficiently pure to meet the needs of modern chemical and metallurgical processes is available in a few areas only.

In 1953 a subsidiary of Republic Steel Corporation discovered a deposit of high-calcium limestone in Oxford county, Ontario, near Embro. The stone, of excellent quality and suitable for metallurgical use, occurs in the valley of the Thames River (Middle Branch) four miles northwest of Beachville.

Since limestone is plentiful and is a relatively low-cost commodity, international trade is virtually non-existent. There are, however, localities where geographic and economic factors favour export of minor amounts of stone to the United States for the manufacture of pulp and paper, sugar refining, and as a metallurgical flux. In other localities similarly small amounts are imported.

USES

Approximately 82 per cent of the limestone quarried in Canada is used as concrete aggregate, road material, and rail ballast.

In metallurgical operations, especially in making iron and steel, the stone is important as a flux. It is also used in the preparation of calcium bisulphite liquor in manufacturing pulp and paper. It is one of the raw materials required in the manufacture of glass, and

Production and Consumption, 1952 and 53

	1953	1952
	Short Tons	Short Tons
Production by provinces		
Newfoundland	391,617	455,554
Nova Scotia	79,524	117,895
New Brunswick	129,503	113,580
Quebec	7,232,775	6,459,829
Ontario	8,390,852	7,818,958
Manitoba	374,869	239,615
Alberta	18,833	22,773
British Columbia	843,747	729,595
Total tonnage	17,461,720	15,957,799
Total value	$23,783,230	$22,319,143
Consumption (shipments)		
Structural[a]	80,299	64,805
Metallurgical	1,441,577	1,312,508
Glass making	32,789	30,191
Sugar refining	11,137	8,934
Pulp and paper	398,541	440,780
Other chemical uses	37,702	23,726
Pulverized, agricultural and fertilizer	510,547	461,930
Pulverized, other	104,258	87,045
Rubble and riprap	423,639	1,222,961
Concrete aggregate	6,747,666	4,873,693
Road metal	6,755,240	6,342,270
Rail ballast	888,258	1,063,596
Other uses	30,067	25,360
Total tonnage	17,461,720	15,957,799
Total value	$23,783,230	$22,319,143
Manufacture of cement	5,330,778	4,513,625
Manufacture of lime	2,163,427	2,131,563

(a) Includes building, monumental, and ornamental stone, flagstone, and curbstone.

in sugar refining. Chemical and metallurgical industries together used 1,921,746 tons in 1953. Limestone is also marketed in a ground form as a filler for use in various industrial processes and as agricultural limestone. In the latter case it is applied directly to the soil to correct acidity and overcome calcium and magnesium deficiencies. Canadian sales of agricultural limestone in 1953 amounted to $1,242,665.

High-purity dolomite quarried near Haley, Ontario, is used in the thermal ferrosilicon process as a source of magnesium metal.

The latter is also made from magnesia obtained from brucitic limestone quarried near Wakefield, Quebec. Dolomite is quarried and dead-burned at Dundas, Ontario, by Steetly of Canada Limited for use as a refractory material in basic open-hearth steel furnaces. The company is building a modern, rotary-kiln, dead-burning plant to replace the existing shaft kiln. Production from the new plant is expected in 1954. Magnesitic dolomite is mined at Kilmar, Quebec, and used in the manufacture of basic refractories. The latter are also made from magnesia recovered from brucitic limestone near Wakefield, Quebec.

Limestone is the raw material used in the production of lime and is an important raw material in the manufacture of portland cement.

Geographical location, quality, and use all affect the price of limestone. As a commercial stone used as concrete aggregate, the price at the quarry may be as low as $1.50 per ton.

LIMESTONE (STRUCTURAL)

The output of structural limestone quarried in Canada in 1953 was about 23 per cent greater than in 1952, although the value of the production was less. In 1953, 78,090 tons valued at $2,341,009 were produced compared with 63,473 tons valued at $2,465,198 in 1952. The increase in output was principally due to greater production from Ontario. The stone is quarried in Quebec, Ontario, and Manitoba, and to a smaller extent in Newfoundland and New Brunswick.

In contemporary construction the principal use for structural limestone is in the larger types of buildings. Here the stone is used as an exterior facing, and for doorways, window sills, lintels, etc. Much of the stone so used is in slabs 4 feet long by 2 feet or more high and from 4 inches to 8 inches thick. Stone for this use must therefore be heavily bedded, free from cracks and flaws, and easily worked. The colour and texture must be pleasing, and the stone must be durable enough to resist the severe Canadian climatic conditions. Production from the quarries is in large rough blocks or sawn slabs. These are shipped to dressing plants where the stone is cut to exact dimensions. Occurrences of suitable limestone are not common in Canada, and a considerable quantity is imported, principally from the United States. Some hand-trimmed stone in the form of sills, lintels, and small facing blocks for use in residential and small building construction is also quarried in Canada.

Structural limestone is quarried at St. Marc des Carrières, Portneuf County, and in the vicinity of Montreal, Quebec. In both instances the stone is of a grey colour. At St. Marc, three quarrying

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Production of limestone for building purposes*				
Newfoundland	491	1,687	-	-
New Brunswick	150	300	200	500
Quebec	27,582	1,447,513	30,057	1,672,943
Ontario	45,427	564,998	27,917	371,742
Manitoba	4,440	326,511	5,299	420,013
Total	78,090	2,341,009	63,473	2,465,198
Imports of building stone**				
From: United States	30,371	580,603	24,594	391,563
United Kingdom	615	13,789	218	2,958
Italy	14	742	2	284
Total	31,000	595,134	24,814	394,805
Exports of building stone unwrought**				
All to United States	105	2,217	235	5,553

* Value of production refers 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.

** Except marble and granite.

firms have dressing plants for the production of finished stone. In the Montreal area several quarries produce hand-trimmed stone used as facing in residential construction.

Near Queenston, in the Niagara district of Ontario, a heavily bedded deposit of the Lockport formation is quarried for the production of mill blocks. The stone is in silver grey and variegated buff and grey colours and enjoys wide use in Eastern Canada in the construction of large public buildings.

In Manitoba, at Tyndall, 30 miles northeast of Winnipeg, a unique limestone with mottling in buff and grey is quarried by two firms. It is used both as an exterior facing and in interior work. When the stone is polished it takes on a pleasing finish.

PRICES

The price of quarry blocks for structural limestone depends on quarry location, size and grade of stone, and ease of quarrying. A typical price is of the order of $2.50 per cubic foot at the quarry.

MAGNESITE AND BRUCITE

The value of calcined brucite granules and magnesitic dolomite amounted to $3,056,392, compared with $2,715,266 in 1952. The figures include the value of magnesium metal produced in Quebec, and the increase in 1953 was largely due to increased output of metal.

The deposits of magnesia-bearing minerals being worked are in the province of Quebec north of the Ottawa River. Canadian Refractories Limited at Kilmar, Argenteuil county, mines magnesitic dolomite. The mine output is crushed and in the subsequent processing impurities are controlled in a heavy-media separation plant to give a uniform kiln feed. This is calcined in a rotary kiln to a dead-burned clinker from which a number of basic refractory products are processed for use in metallurgical works. The products include basic bricks of various sizes and shapes, high-temperature cement, ramming mixtures, and other specialized refractory products. In 1953 the company placed in operation a new plant for the production of basic brick at Marelon, ten miles south of the Kilmar plant, near the Ottawa River.

Near Wakefield, Quebec, 22 miles north of Ottawa, Aluminum Company of Canada Ltd. quarries a deposit of brucitic limestone for the production of magnesia and lime. The mineral brucite, a hydroxide of magnesium, occurs as granules in the matrix of limestone. The rock is crushed, calcined, and separated into marketable forms of magnesia, quicklime, and hydrated lime. The magnesia is used for the production of magnesium metal and high-magnesia basic refractories, as a soil additive in the citrus-growing areas of the United States, and for other purposes. The lime is marketed for building and industrial applications.

There are other deposits of brucitic limestone near Wakefield and Bryson, Quebec, and Rutherglen in Ontario, and on West Redonda Island in British Columbia.

Although magnesite and hydromagnesite occur at several locations in Western Canada, mostly in British Columbia and the Yukon, they are generally either not extensive or are remote from transportation and, consequently, are not worked. The more important of these occurrences are at Marysville, near Cranbrook, British Columbia, and are owned by The Consolidated Mining and Smelting Company of Canada, Limited.

Hydromagnesite occurrences near Atlin and Clinton, British Columbia, have been worked intermittently.

USES

The principal uses for magnesia in Canada are in the manufacture of basic refractories and in the production of magnesium metal,

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Production*				
Magnesitic dolomite and brucite		3,056,392		2,715,266
Imports				
Dead-burned and caustic calcined magnesite				
From: United States	6,711	389,893	8,824	444,958
United Kingdom	90	8,426	191	16,732
Other countries	-	-	1,263	56,469
Total	6,801	398,319	10,278	518,159
Magnesite fire-brick				
From: United States		954,861		652,090
United Kingdom		-		4,950
Total		954,861		657,040
Magnesia alba and levis				
From: United States	3,220	225,055	1,231	216,204
United Kingdom	116	47,512	113	45,155
Other countries**	18	1,020		
Total	3,354	273,587	1,344	261,598
Magnesia pipe covering				
From: United States		160,729		181,167
United Kingdom		26,324		49,927
Total		187,053		231,094
Magnesium sulphate				
From: West Germany	1,660	33,378	1,020	23,365
United States	998	42,159	988	44,537
United Kingdom	70	4,425	111	6,485
Netherlands	33	923	66	2,032
Total	2,761	80,885	2,185	76,419
Magnesium carbonate and magnesium oxide				
From: United States	5,999	551,198	3,479	272,891
United Kingdom	306	45,352	336	44,168
Total	6,305	596,550	3,815	317,059
Exports				
Basic refractory materials, dead-burned				
To: United States	4,015	277,931	2,887	163,967
Other countries	586	27,764	73	3,750
Total	4,601	305,695	2,960	167,717

* Does not include value of secondary products such as refractories but does include value of magnesium metal produced in the province of Quebec

** In 1952, 100 pounds valued at $239 were imported from France.

where the magnesia is the chief raw material.

In industry, it is used to control acidity; for example, it is used in neutralizing sulphuric acid solutions, where it forms a compound more soluble than is obtained from lime. In agriculture it is used to ameliorate magnesium deficiency of soils. Solutions of magnesium chloride, when combined with magnesia of the required characteristics, form a strong cement used principally as a flooring material. Magnesia likewise combines with magnesium sulphate solutions. The cements thus produced are magnesium oxychloride and oxysulphate respectively. Magnesia is also used in the production of a magnesium bisulphite liquor for the treatment of wood pulp. By this process it is possible to recover a part of the magnesia and the sulphur for re-use.

MARBLE

There was an increase in Canadian marble production in 1953; 59,655 tons valued at $546,991 were produced compared with 57,637 tons valued at $524,873 in 1952. Currently producing quarries are located in Quebec and Ontario, with production almost equally divided between the two provinces.

Canadian marble, apart from a small production of mill blocks, is quarried principally for marketing in crushed or ground form. It is sold as chips for terrazzo flooring, for use in stucco dash and artificial stone, as poultry grit, and in the manufacture of whiting substitute. Some white marble is used by the pulp and paper industry. Marble quarried as mill blocks is later sawn, shaped, and polished for use as an ornamental stone in building construction. Canadian production of marble in this form is relatively small, and the market is mostly supplied by imports from United States, Italy, and other countries. The imports are in the form of mill blocks or slabs which are finished in Canadian marble dressing plants.

CANADIAN MARBLE QUARRIES

Quebec

Missisquoi Stone and Marble Company Limited quarries a clouded grey marble at Phillipsburg near Lake Champlain. This is the largest marble quarry in Canada and its products include mill blocks, sawn slabs, and finished marble. In addition, quarry and mill waste are crushed and sized for use as terrazzo chips and poultry grit.

Near North Stukely, in Shefford County, the Orford Marble Company Limited is working an occurrence of serpentine marble in red, green, and grey. Both mill blocks and terrazzo chips are produced.

Production, 1952 and 1953

	1953		1952	
	Short Tons	$	Short Tons	$
Quebec	28,319	284,846	26,999	313,678
Ontario	31,336	262,145	30,638	211,105
Total	59,655	546,991	57,637	524,783

Dollar Value of Imports, 1953*

	United States	Italy	Belgium	France	Other countries	Total 1953	Total 1952
Rough marble	33,336	87,162	1,631	7,635	1,311	131,075	88,675
Sawn marble	98,215	101,865	4,586	-	2,040	206,706	122,061
Marble for tombstones	50,117	4,155	-	2,491	-	56,763	57,750
Marble manufactures	15,585	13,733	1,247	241	1,439	32,245	19,789
Ornamental marble for churches	-	123,507	-	-	8,700	132,207	49,283
Total	197,253	330,422	7,464	10,367	13,490	558,996	337,558

* Imports of mosaic flooring material, part of which is marble, were valued at $243,286 in 1953 compared to $341,190 in 1952.

This marble has been used recently as an interior decorative stone in the construction of several public buildings.

At Portage du Fort, Pontiac County, Canadian Dolomite Company Limited quarries a white crystalline variety of dolomite that is crushed and sized for the production of terrazzo chips, stucco dash, artificial stone aggregates, and similar products. South Stukely Marble and Terrazzo Company and Delbo Incorporated, North Stukely, both in Shefford County, produce white marble for similar purposes.

Ontario

Mill blocks and terrazzo chips are produced from a black marble by Silvertone Black Marble Quarries Limited, St. Albert Station, thirty miles southeast of Ottawa.

Terrazzo chips in red, pink, buff, green, black, and white are produced by Stocklosar Marble Quarries from deposits in the vicinity of Madoc, Hastings County, and by Pulverized Marble Products Limited, whose plant is located at Kaladar in Lennox and Addington county. The latter company also quarries a crystalline dolomite at Kaladar for the production of plaster aggregate and other uses.

Bolenders Limited, north of Haliburton at Eagle Lake, produces poultry grit and stucco dash from a crystalline limestone.

OTHER OCCURRENCES IN CANADA

There are a number of undeveloped occurrences of highly coloured marbles in Manitoba along the Hudson Bay and the Flin Flon branches of the Canadian National Railways and at Fisher Branch, 100 miles north of Winnipeg. Other deposits exist in British Columbia.

PRICES

The price of marble varies widely and is affected by use, quality, colour, and figure.

MICA

Primary production (sales) of mica of all classes in Canada in 1953 increased 12 per cent in volume and decreased 17 per cent in value below 1952. Imports dropped slightly while exports of unmanufactured mica rose 28 per cent in volume and 12 per cent in value, the largest percentage increase being recorded in exports of trimmed phlogopite sheet to Japan which, in volume, were double those of the previous year and more than double in value. Exports of scrap, all to the United States, increased 52 per cent in volume and were more than double in value.

PRODUCTION

All the Canadian phlogopite production comes from Quebec and Ontario; the greater part being produced in Quebec. Muscovite production was confined to Ontario. In British Columbia, mica production is limited to a small output of schist rock for roofing purposes.

Quebec

The year's output, which consisted entirely of phlogopite, came from numerous scattered deposits in the area of the Gatineau and Lièvre Rivers, operations being conducted mainly in Buckingham, Templeton, Portland, and Blake Townships. Substantial deliveries were made also from Wentworth Township, Argenteuil County.

Ontario

North Bay Mica Company Limited, operating the Purdy Mine near Eau Claire, and Croft Mining Company, operating in Croft and Chapman Townships, were the only recorded producers of muscovite. Operations at the Purdy Mine ceased late in September. Phlogopite production came mainly from the Stanleyville area, North Burgess Township.

Production, Trade, and Consumption

	1953		1952	
	Pounds	$	Pounds	$
Production (primary sales)				
Trimmed	50,933	65,949	61,625	111,830
Splittings	8,289	16,568	6,900	10,849
Sold for mechanical splittings	168,537	30,521	105,795	19,756
Rough, mine-run or rifted	62,744	5,310	14,350	850
Ground or powdered	664,741	25,236	988,051	41,545
Scrap	1,309,884	17,544	838,220	9,276
Total	2,265,128	161,128	2,014,941	194,106
Imports (including manufactures)				
From: United States		472,004		438,697
India		231,519		265,244
United Kingdom		16,021		20,342
Other countries		-		4,606
Total		719,544		728,889
Exports, unmanufactured				
Rough				
To: United States	240,500	43,704	178,700	31,291
Japan	-	-	100	28
Total	240,500	43,704	178,800	31,319
Trimmed				
To: Japan	57,800	55,775	28,900	23,905
United States	21,600	37,785	21,700	61,729
Total	79,400	93,560	50,600	85,634
Scrap				
To: United States	1,354,700	19,583	889,000	8,434
Ground				
To: United States	320,000	19,158	440,400	26,020
Splittings				
To: Japan	-	-	3,100	4,689
United States	-	-	400	400
Total	-	-	3,500	5,089

	1953		1952	
	Pounds	$	Pounds	$
Total Exports of Unmanufactured Mica	1,994,600	176,005	1,562,300	156,496
Exports, mica manufactures				
To: United States		123		277
Brazil				86
Total		123		363

	1952	1951
	Pounds	Pounds
Consumption		
Roofing	782,000	994,000
Wallpaper	98,000	150,000
Electrical apparatus	520,957	737,030
Rubber goods	308,795	313,147
Paints	1,503,321	1,594,733
Mica products	62,203	119,719
Asbestos products	40,155	28,247
Coal-tar distillation	108,000	188,000
Miscellaneous	640	-
Total	3,424,071	4,124,876

British Columbia

Geo. W. Richmond Company Limited and Fairey and Company, Limited, both of Vancouver, continued to grind mica schist mined near Albreda for the local roofing trade.

USES

Mica is used in three principal forms, namely, natural sheet, splittings, and ground mica.

Natural Sheet

Sheet mica is used principally for electrical insulation in a wide variety of electrical machines, instruments, lighting and power fixtures, and industrial and household appliances; in electronic equipment such as radios, television, and sound-recording devices; as the dielectric in capacitors; and as a glazing material for compass dials, boiler gauges, furnace observation holes, and lamps. Sheet mica is sold commercially according to variety, size, and quality.

Muscovite (potassium mica) of superior quality possesses the best dielectric properties of all the micas and is used extensively for insulation at high frequencies and high voltages and for capacitors. Because of its high mechanical strength and transparency it is preferred for glazing.

Phlogopite (magnesium or amber mica) varies considerably as regards dielectric strength, hardness, structural strength, and other properties, but its electrical properties are such that it finds wide acceptance as an insulator in a variety of electrical installations at normal industrial and domestic frequencies and voltages. Its high thermal resistance makes it suitable for use under high-temperature conditions, as in heaters, toasters, flat-irons, etc. and its softness, as compared to muscovite, makes it particularly suitable for flush commutators, in which the copper and mica segments are required to wear at the same rate.

Biotite (iron or black mica) has comparatively low dielectric strength and is somewhat brittle. However, it finds limited application as insulation in low-powered fixtures and appliances.

Splittings

Mica splittings are used in the manufacture of built-up sheet, in which the mica is bonded with natural or synthetic resins of suitable dielectric properties, baked, and pressed into sheets of any required size; either muscovite or phlogopite may be used. Splittings are also used in the manufacture of mica tape, cloth, and paper, and are cut or moulded into washers, tubes, and many other forms.

Built-up mica sheet is used, within the limits of its dielectric characteristics, in place of natural sheet -- particularly in cases where large size would make the use of natural sheet uneconomical.

Ground Mica

Mica may be ground wet or dry according to use. Dry-ground mica is usually lower-grade, off-colour material, mainly muscovite and phlogopite but to some extent biotite, and is used principally in the roofing trade as a backing for asphalt tile and tar paper. It is also used for moulded high-frequency insulation, in which the mica is bonded with ceramic or plastic binders to form a compound which may be pressed into any desired shape. Other uses are in protective coatings and to a limited extent in grease lubricants.

Wet-ground mica is prepared mainly from good quality muscovite scrap, chiefly for the paint, rubber, and wallpaper trades. White products are preferred. In paint, wet-ground mica serves as a pigment and extender; in rubber, as a dusting agent and lubricant on tire walls, and as a filler in hard rubber. In wallpaper it is used to produce decorative effects. Wet-ground biotite also is used as a lubricant in rubber tire manufacture.

A new form of mica insulation is now being prepared in United States from muscovite scrap treated by a chemical process. The resulting pulp is formed into a continuous sheet by methods similar to those used in the manufacture of paper.

PRICES

Approximate prices offered for trimmed sheet phlogopite by Ottawa region dealers at the close of 1953 ranged from .45¢ a pound for sheets not over 1 x 2 inches up to $3 a pound for sheets 5 x 8 inches.

Clean scrap phlogopite sold up to about $25 per ton delivered at plant and scrap muscovite about $25 to $30 per ton f.o.b. shipping point.

E. and M. J. Metal and Mineral Markets of December 24, 1953 quoted the following price ranges for North Carolina clear sheet:- 1 1/2 x 2 inches, from $0.70 to $1.60 a pound, rising to $4 to $8 for 6 x 8 inches.

NEPHELINE SYENITE

Shipments of nepheline syenite in Canada in 1953 rose to an all-time high of 113,345 short tons, an increase of 37 per cent over 1952, the previous record year. Glass-grade shipments comprised 71 per cent of the total and pottery-grade 20 per cent. Exports rose 36 per cent over 1952 to 76,375 tons and accounted for 67 per cent of total shipments.

Production was confined to American Nepheline Limited, Lakefield, Ontario, sole producer of ceramic-grade nepheline syenite in the western hemisphere, operating extensive deposits on Blue Mountain, Peterborough county, Ontario.

During the year Canadian Flint and Spar Company, Limited, Ottawa, carried out active development work on the northeasterly extension of the Blue Mountain deposits and outlined a large tonnage of commercial-grade ore by diamond drilling.

OTHER OCCURRENCES

Deposits of nepheline syenite occur elsewhere in Ontario near Bancroft, Hastings county; Gooderham, Haliburton county; in the French River area, Georgian Bay district; and at Fort Caldwell, Thunder Bay district. In Quebec, nepheline syenite occurs in the Labelle-Annonciation and other areas, and in British Columbia in the Ice River district near Field.

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Production, crude (ore transported to storage)	160,918		79,968	
Shipments				
Ground				
Glass grade	80,677		57,479	
Pottery grade	22,577		19,507	
Miscellaneous	8,918		4,256	
Total	112,172		81,242	
Crude	1,173		1,439	
Total	113,345	1,576,271	82,681	1,111,950
Exports, crude and processed materials				
To: United States	72,031	1,044,978	54,120	763,882
Puerto Rico	2,700	45,900	850	14,450
United Kingdom	585	10,483	338	6,047
Netherlands	551	9,922	550	9,906
Other countries	508	9,498	465	8,091
Total	76,375	1,120,781	56,323	802,376

Canada and Russia are the only important producers of nepheline syenite. Canada is the sole source of high-grade ceramic material.

USES

Nepheline syenite is used widely in the ceramic industry, replacing feldspar as a source of alumina and the alkalis in the manufacture of glass, pottery, enamels, floor and wall tile, refractory cements, porcelain balls and liners, and other ceramic products. About two-thirds of the annual Canadian output is consumed by the glass industry. Low-grade by-products find a limited market for use in cleansers and certain clay products.

To be of commercial interest nepheline syenite must be amenable to treatment for the removal of iron-bearing impurities such as tourmaline, hornblende, magnetite, and biotite, so that the iron oxide content can be reduced to a maximum of about 0.08 per cent. Finely

divided iron impurities often cannot be removed by ordinary dry methods and are frequently the cause of rendering otherwise promising deposits useless for commercial purposes.

Mesh sizes of nepheline syenite products sold in Canada are: glass grade, minus 28-mesh; pottery grade, minus 200-mesh and finer.

PRICES AND TARIFFS

Prices of processed nepheline syenite in Canada during the latter half of 1953 were as follows:

Bulk, carload lots, per ton, f.o.b. Lakefield, Ontario

Glass grade, 28-mesh - $14.50
Pottery grade, 270-mesh - $19.00
" " , 200-mesh - $18.50
Lower grades - $8.00 to $10.00 per ton depending upon quality.

Nepheline syenite, all classes, entered United States free of duty.

PHOSPHATE

Phosphate mining in Canada reached its peak about 60 years ago, prior to the development of large sedimentary deposits in the United States. Since then Canadian output of phosphate rock has been insignificant. There was no production in 1953.

During the year, Multi-Minerals Limited, Toronto, was incorporated for the purpose of acquiring a large magnetite-apatite property near Nemegos, near Chapleau, Ontario, formerly owned by Nemegos Uranium Corporation, and to continue the development of the property.

Canadian requirements of phosphate rock are obtained mainly from the United States, Eastern Canada being supplied from Florida and the West mainly from Montana.

USES

Most of the phosphate rock imported into Canada is used for the manufacture of commercial fertilizers, chiefly superphosphate, made by treating the raw material with sulphuric acid. In the United States, phosphate rock is used in making fertilizers of the slag or calcined type also. Finely ground phosphate rock is used to some extent for direct application to the soil. Phosphate rock is also the source of elemental phosphorus, whose compounds find wide application in the

Production, Trade, and Consumption

	1953		1952	
Production	Short Tons -	$ -	Short Tons -	$ -
Imports				
Phosphate rock				
From: United States . .	565,300	3,659,858	457,518	2,891,087
Netherlands . . .				
Antilles	11,200	291,460	8,960	210,600
Other countries	-	-	4,435	28,619
Total	576,500	3,951,318	470,913	3,130,306
Superphosphate				
From: United States . .	200,311	3,986,386	206,390	3,868,987
Netherlands . . .	4,252	199,103	6,600	228,990
United Kingdom	25	795	-	-
Other countries	-	-	2,295	141,622
Total	204,588	4,186,284	215,285	4,239,599
Phosphoric acid				
From: United States . .	422	57,767	346	41,650

	1952	1951
	Short Tons	Short Tons
Consumption		
Fertilizers	418,495	425,107
Heavy chemicals	65,394	67,509
Stock and poultry	17,615	16,516
Pig-iron	671	236
Refractories	582	286
Misc. non-metallic . . .		
mineral products	9,000	9,500
Total	511,757	519,154

manufacture of detergents, flame retardants, water softeners, pigments, opacifiers, food preservatives, pharmaceutical preparations, livestock feed supplements, leavening agents, flotation reagents, rodent poisons, fireworks, and many other products. Ferro-phosphorus is added to iron and steel castings to increase fluidity and to rolled sheet to prevent sticking. Phosphorus is used as a hardening agent in non-ferrous alloys.

SPECIFICATIONS

Because of its open texture, sedimentary phosphate rock is preferred for acid treatment to the compact, crystalline apatite. The tri-calcium phosphate (B.P.L.) content should approach 80 per cent.

For furnace treatment, apatite should contain a minimum of 70 per cent tri-calcium phosphate. Size specifications call for a minimum of 80 per cent on 10-mesh. Such material is purchased by Electric Reduction Company, Limited, Buckingham, Que.

PRICES AND TARIFFS

Prices quoted by United States journals at the close of 1953 were unchanged from the previous year; Florida pebble phosphate, f.o.b. mine ranged from $3.95 to $7.00 per long ton for material grading from 66 to 77 per cent. B.P.L.

Domestic apatite lump from the Ottawa region, when available, sells for about $16.00 per short ton delivered at plant.

Phosphate rock is not dutiable under the Canadian tariff.

ROOFING GRANULES

Canadian consumption of roofing granules, as reported to the Mines Branch by manufacturers of roofing and siding, reached an all-time high of 127,011 tons, valued at $3,414,318 (f.o.b. consuming plant) in 1953. Comparative figures for 1952 were 108,815 tons valued at $2,781,192 and for the previous peak consumption year, 1951, 124,640 tons valued at $3,085,521.

Total imports of roofing granules amounted to 88,924 tons valued at $2,521,578 in 1953 compared to 76,755 tons valued at $2,041,547 in 1952. Of the total imports, 76,681 tons were artificially coloured and 12,243 tons were natural. Approximately 80 per cent of the granules imported were made from igneous rocks and the remainder consisted of slate, either natural or artificially coloured. All imports come from the United States.

ROOFING GRANULE PLANTS IN CANADA

Quebec

Operations at the quarry and colouring plant of Wendell Mineral Products at Landrienne, Quebec, were suspended late in 1953. The company, with head office in Montreal, owns a large deposit of grey rhyolite rock about one mile north of Landrienne station in western Quebec, a few miles east of Amos. Natural grey granules and artificially coloured granules were sold to consumers in Ontario and Quebec during 1953. Resumption of operations is planned in 1954.

Ontario

Building Products Limited, by far the largest producer of roofing granules in Canada, artificially colours granules in a plant a short distance east of Havelock. The company operates a black amphibole ryholite quarry and a pink syenite quarry which are a few miles west and northwest of Madoc, and a grey basalt quarry near Havelock. Material from the first two quarries is trucked to the company's granule plant for crushing and sizing. Road metal is produced from the basalt quarry and roofing granules are made from the road metal undersize. The sodium silicate colouring process is used to produce a complete line of roofing granules in the plant that adjoins the crushing and screening operation.

British Columbia

Geo. W. Richmond continued to supply natural granules from his crushing and screening plant in Vancouver to west coast roofing manufacturers. Sources of material are dark grey slate at McNab Creek, Howe Sound, and a green siliceous rock at Bridal Falls near Chilliwack.

ROOFING AND SIDING PLANTS IN CANADA

Granule-coated roofings and sidings are manufactured by 9 companies at 15 plants across Canada, as follows:

Quebec

Bishop Asphalt Papers Limited, Portneuf Station; The Philip Carey Company, Limited, Lennoxville; Building Products Limited and The Barrett Company, Limited, Montreal; Canadian Johns-Manville Company, Limited, Asbestos.

Ontario

Bishop Asphalt Papers Limited, London; The Brantford Roofing Company, Limited, Brantford; Canadian Gypsum Company, Limited, Mount Dennis; Building Products Limited, Hamilton.

Manitoba

Building Products Limited, Winnipeg.

Alberta

Building Products Limited, Edmonton; Sidney Roofing & Paper Company, Limited, Lloydminster.

British Columbia

Sidney Roofing & Paper Company, Limited, Victoria; Canada

Consumption and Trade*

	1953		1952	
Consumption	Short Tons	$	Short Tons	$
Natural	26,018	463,837	22,596	429,135
Artificially coloured	100,993	2,950,481	86,219	2,352,057
Total	127,011	3,414,318	108,815	2,781,192
Consumption by colour				
Black & grey-black**	36,443	762,782	33,408	675,240
Green	43,075	1,148,688	33,909	894,002
Red	20,475	498,294	18,625	439,931
Blue	13,352	457,946	10,087	361,829
White & grey-white	10,332	446,113	9,671	321,223
Buff & brown	3,334	100,495	3,115	88,967
Total	127,011	3,414,318	108,815	2,781,192
Imports				
From: United States	88,924	2,521,578	76,755	2,041,547

* Compiled from figures supplied to the Mines Branch by consumers.
** Includes natural granules used by some manufacturers as undercoat granules.

Roof Products Limited and The Barrett Company Limited, Vancouver.

SPECIFICATIONS AND COLOURING

Specifications for rock types suitable for making roofing granules are very rigid and few rocks possess all the qualities required. The rock should break well with a not too sharp fracture and yield, on crushing, a high percentage in the required size range (-10 + 35 mesh for coarse, and minor amounts of -28 + 48 mesh for fines). No source should be considered unless it contains many years' supply of rock having uniform characteristics chemically, physically, and mineralogically and unless it lies within economical hauling distance of the plant.

The stone should contain a minimum of acid-reactive materials such as carbonates, sulphides, sulphates, or high-alkali materials. Pyrites alone in small quantities do no harm, but pyrites in conjunction with carbonates inevitably lead to poor weathering. It should be hard and tough enough to withstand breakage and dusting through handling with mechanical equipment. The stone should be fine-grained with low porosity so that it withstands weathering effects from freezing and thawing

and so that a minimum of pigment is required to cover the granules.

A granule should have 'tooth', or adhesive properties in relation to asphalt and the ability to 'wet' well with that material. For instance, granules made from quartz, feldspar, and some rhyolites do not have this latter property because, on crushing, they fracture with a glassy smooth surface. There is no rule by which to determine the ability of a granule to take colour but, in general, for a full range of colours a light-shade base granule is preferred to a dark-shade one because less pigment is required to hide the colour of the base.

Opacity appears to be a very important property by which to determine the acceptability of a base-rock material. If the ultra-violet light of the sun's rays passes through the granules, the resultant deterioration of the asphalt underneath causes a loss of adhesion. Some manufacturers and consumers of granules claim that the infra-red (heat) rays of the sun have a more direct influence on the durability of roofings than the ultra-violet. Major producers of roofing granules maintain test stations in warm, humid climates where panels of roofing and siding can be exposed to accelerated weathering over a period of years. The results of such tests are taken as the final criterion of the durability of the roofing and the quality of the granule. Quick laboratory tests of the quality of a granule and the stability of the colour coat that check with actual weathering conditions have been devised.

Processes for colouring granules are covered by many patents. The two most widely used processes are the sodium silicate process, in which the granules are thoroughly coated with sodium silicate, clay, the required pigment, and a little titanium dioxide, and heated to the required temperature in a rotary kiln, and the phosphoric acid process, in which the granules are mixed thoroughly with zinc oxide, clay, liquid phosphoric acid, and the required pigment, and then heated.

The colour of granules is usually heightened by oiling with a paraffin-base oil after colouring, but this effect tends to wear off in use. Oiling also improves the adhesiveness of the granules. A good granule shingle has a life expectancy of twenty years or more.

PRICES

Prices paid for roofing granules, f.o.b. consumers' plant, depend upon the type of granule, distance from producing plant, and whether the colour is natural or artificial. Imported natural granules in 1953 averaged $17.83 per short ton compared with $18.64 per short ton in 1952, f.o.b. Canadian roofing manufacturing plants. The average prices of artificially coloured granules per short ton in 1953, with 1952 figures in brackets were: reds $24.34 ($23.62); greens $26.66 ($26.36); blues $34.37 ($35.87); buff and brown $30.14 ($28.56); white and grey-white $43.18 ($33.21). The average value of all types of granules per short ton f.o.b. consumers' plants was $26.88 in 1953 compared with $25.55 in 1952.

SALT

Salt production in 1953 was 954,928 short tons, 1.7 per cent less than the 971,903 tons produced in 1952. Imports amounted to 307,332 short tons, 6.7 per cent more than in 1952.

All of Canada's salt output comes from underground salt beds, practically 90 per cent being produced by the evaporation of brine. The only rock-salt mine operated in Canada at present is at Malagash, Nova Scotia. However, Canadian Rock Salt Company Limited is preparing to mine salt from a bed 1,100 feet below the surface at Ojibway, near Windsor, Ontario. Ontario is the chief producer of salt in Canada, followed by Nova Scotia, Saskatchewan, Alberta, and Manitoba.

Western Chemicals Ltd. of Calgary, Alberta, completed, towards the end of 1953, a new chemical plant at Duvernay, Alberta. This plant will produce caustic soda and chlorine from salt brine obtained from beds 3,500 feet below the plant, using natural gas as a source of power. It is expected that the plant will reach full production early in 1954.

PRODUCERS

Ontario

Ontario accounted for 78 per cent of the total production in 1953. The salt is obtained from wells drilled into beds that lie from 800 to 1,500 feet below the surface in southwestern Ontario.

Fine salt, obtained by vacuum-pan evaporation of brine from local wells, is produced by Purity Flour Mills, Limited at Goderich, by Canadian Salt Company Limited at Sandwich, and by Dominion Salt Company, Limited with plants at Goderich and Sarnia.

Coarse salt, obtained by the open-pan evaporation of brine, is produced near Warwick by Warwick Pure Salt Company, Limited and by Canadian Salt Company Limited at Sandwich.

Dow Chemical of Canada Limited produces caustic soda and chlorine at its plant in Sarnia from brine obtained from nearby wells.

Brunner-Mond Canada Limited operates a large soda-ash plant at Amherstburg. Brine for this plant is obtained from wells a few miles to the north.

Nova Scotia

Canadian Salt Company Limited operates a salt mine at

Malagash. The rock salt, after crushing and screening, is used for ice removal on highways and railways, and for dust control.

Dominion Salt Company, Limited produces fine salt at a plant near Amherst. The brine used is obtained from salt beds 860 feet below the surface.

Prairie Provinces

Fine salt is produced by Canadian Salt Company Limited at Neepawa, Manitoba, by vacuum-pan evaporation of brine from wells over 1,000 feet deep.

Prairie Salt Company, Limited, a subsidiary of Dominion Tar and Chemical Company Limited, obtains brines from beds of salt over 3,500 feet below the surface at Unity, Saskatchewan. This brine is evaporated in vacuum-pan evaporators to give a fine, pure salt.

Canadian Salt Company Limited produces fine salt at Lindbergh, Alberta, by the vacuum-pan process from brines obtained from salt beds 2,800 feet below the surface. Part of the output is fused, crushed, and screened to give a coarse salt that is used for icing refrigerator cars, tanning hides, etc.

UNDEVELOPED DEPOSITS

Salt beds have been found at depth on the west coast of Cape Breton Island; under Hillsborough Bay, Prince Edward Island; and at Weldon and Dorchester in New Brunswick.

In the Prairie Provinces, underground salt beds varying in thickness from a few feet to many hundreds stretch in a great crescent from the extreme north of Alberta through central Saskatchewan into the southern part of Manitoba.

Brine springs occur in Antigonish, Pictou, and Cumberland counties in Nova Scotia, in western Newfoundland, and in various parts of British Columbia.

USES

The finer grades of salt, produced by the vacuum-pan evaporation of brine, are used in the chemical industries and for household and food purposes. The coarser grades are used in the curing of fish, for ice and dust control on highways, for dairy uses, and in refrigeration. Coarse salt is obtained by the use of open-pan evaporators, and by the mining, crushing, and screening of rock salt. Coarse salt produced by evaporation is very pure, but expensive, and hence is used only where purity is essential. The mined salt is impure and is used for such purposes as de-icing and dust control on highways. The rock salt mined at Malagash, Nova Scotia, is too impure for use in the fishing industry,

Production, Imports, and Exports of Salt, 1952-53

	1953		1952	
	Short Tons	Dollar Value	Short Tons	Dollar Value
Production by types				
Fine vacuum salt	375,928	5,605,107	377,349	6,317,694
Coarse grainer salt	4,934	100,042	6,995	190,539
Mined rock salt	70,510	536,190	82,881	583,172
Salt, chemical*	503,556	733,162	504,678	683,410
Total	954,928	6,974,501	971,903	7,774,815
Production by provinces				
Ontario	749,046	3,919,810	757,025	4,401,780
Nova Scotia	127,819	1,272,463	138,845	1,565,814
Saskatchewan	35,100	760,082	33,540	789,000
Alberta	24,885	601,515	24,380	614,522
Manitoba	18,078	420,631	18,113	403,699
Total	954,928	6,974,501	971,903	7,774,815
Imports				
From: United States	235,622	1,461,727	211,287	1,498,126
Bahamas	35,806	165,260	27,989	143,417
Spain	20,619	154,787	29,734	172,681
United Kingdom	7,505	157,535	6,867	157,049
Other countries	7,780	78,065	12,248	88,382
Total	307,332	2,017,374	288,125	2,059,655
Exports				
To: United States	2,218	26,323	2,680	37,142
Bermuda	122	5,212	136	6,386
Other countries	14	964	28	1,103
Total	2,354	32,499	2,844	44,631
Apparent Consumption	1,259,906	8,959,376	1,257,184	9,789,839

* Mainly in brine and used by the producers in the manufacture of chemicals.

and therefore large quantities of coarse salt are imported for this purpose. These imports are obtained from the West Indies and California, where salt is produced by the solar evaporation of brine.

SAND AND GRAVEL

Production of sand and gravel in 1953 totalled 101,033,949 tons valued at $53,485,401; this is somewhat below the 1952 record of 102,895,545 tons valued at $51,339,043. Apparent domestic consumption amounted to 100,853,268 tons, and net export to 180,681 tons only. The large home consumption resulted from the extensive post-war construction in practically all fields of the Canadian economy. Road construction and maintenance, concrete construction, and rail ballast normally account for by far the largest proportion of sand and gravel consumed; in 1953 this proportion amounted to 85 per cent of total production.

On account of the widespread occurrence of gravels and sands and their bulk in relation to value, local needs for these materials are usually supplied from the nearest deposit, as the cost to the consumer is governed largely by the length of haul; hence the large number of small plants and the comparative rarity of large ones.

It is virtually impossible to determine the exact number of producers of sand and gravel in Canada, since pits are being opened and closed continually and production in some cases is so small as to be negligible. However, principal producers are listed by Dominion Bureau of Statistics and their distribution is as follows:

Province	No. of Principal Producers, 1952*
Newfoundland	2
Nova Scotia	4
New Brunswick	3
Quebec	51
Ontario	199
Manitoba	16
Saskatchewan	33
Alberta	9
British Columbia	39

* Does not include production by railway companies for ballast or production by counties and townships in Ontario for road use.

Practically all large sand and gravel plants are equipped to wash and screen gravel. The product can successfully compete with most types of crushed stone, especially since both coarse and fine aggregate can be obtained from the same pit, whereas when crushed stone is used the fine aggregate has to be obtained from a separate source.

Production, Trade, and Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production by provinces				
Newfoundland	1,908,187	1,023,622	1,654,471	936,013
Nova Scotia	1,523,083	1,459,770	1,574,539	1,269,540
New Brunswick	2,648,235	1,282,421	3,670,289	1,815,576
Quebec	26,694,125	11,630,482	32,060,910	12,744,630
Ontario	43,658,099	24,359,496	43,423,737	23,240,203
Manitoba	4,686,323	1,524,629	3,763,418	1,253,642
Saskatchewan	4,770,368	2,216,894	3,544,602	1,657,919
Alberta	7,651,261	5,097,720	5,066,403	3,590,687
British Columbia	7,494,268	4,890,367	8,137,176	4,830,833
Total	101,033,949	53,485,401	102,895,545	51,339,043
Production by type				
Sand				
Moulding sand	20,675	61,222	23,434	65,625
Building sand	8,619,698	6,683,894	8,069,333	5,743,760
Core sand	1,134	2,248	941	1,943
Other sand etc.	505,631	246,374	711,283	387,663
Total	9,147,138	6,993,738	8,804,991	6,198,991
Sand and Gravel				
Railway ballast	8,436,245	3,032,939	7,122,550	2,403,865
Concrete, road building, etc.	66,125,694	32,228,212	68,157,943	31,125,978
Mine filling	3,007,909	1,074,757	3,898,609	1,159,186
Crushed gravel	14,316,963	10,155,755	14,911,452	10,451,023
Total gravel & sand	91,886,811	46,491,663	94,090,554	45,140,052
Total production	101,033,949	53,485,401	102,895,545	51,339,043
Exports of sand & gravel				
To: United States	367,962	348,119	350,443	329,631
Sweden	26	214	-	-
Total	367,988	348,333	350,443	329,631
Imports of sand & gravel				
From: United States	184,777	186,923	181,729	169,644
United Kingdom	2,530	3,190	1,650	5,001
Total	187,307	190,113	183,379	174,645
Apparent Consumption	100,853,268		102,728,471	

Gravels

Gravels vary in composition and in size of component particles, and these factors determine suitability for various uses. In some cases large stones and boulders are crushed to reduce them to a suitable size. About 14 per cent of all gravel is washed or screened to remove excess fines or undesirable constituents.

Most of the gravel used for road work comes from pits worked for that purpose. Usually a movable plant is used to extract enough gravel to supply the immediate need and then a sufficient reserve is built up in the form of stock piles for future requirements. The amount of gravel produced from year to year thus fluctuates, depending on the program of road construction and improvements.

Railway pits also operate intermittently and in recent years, on main lines, there has been a tendency to replace gravel with crushed stone as ballast. However, there has been an 80 per cent increase in the amount of gravel used as ballast from 1946 to 1953.

Sand

The amount of sand consumed follows the trend of building activity, as most of it is used in the building industry for concrete work, cement and lime mortar, or wall plaster. The sand must be clean, that is, free from dust, loam, organic matter, or clay, and must contain but little silt.

Other important uses of sand are in glass-making and for moulds in foundries, and since sands used for these purposes must conform to more rigid specifications than building sands, and must possess additional properties, they sell at a higher price.

SILICA MINERALS

Production of silica minerals in Canada in 1953 increased slightly to 1,785,574 tons, as compared with 1,783,081 tons in 1952. The value was down 8.1 per cent -- $1,799,463 as against $2,070,617 in 1952, owing to the combined effect of an increase in the production of low-priced lump silica and a decrease in that of higher-priced silica sand.

The requirements of the glass and chemical industries for silica sand are met by imports, chiefly from the United States. The Canadian output of quartz, quartzite, and silica sand is used as a fluxing material in the metallurgical industry, in the manufacture of silicon and ferrosilicon alloys, and in the manufacture of abrasives. Silica for the

manufacture of silica brick and moulding sands is also produced in Canada.

The Canadian Rock Salt Company Limited is sinking a shaft to salt beds 1,100 feet below the surface near Windsor, Ontario. This shaft will yield more detailed information on the nature of two beds of high-quality sandstone that were encountered at a depth of about 500 feet in the course of drilling to explore salt beds in the area. The lower bed of sandstone, which is the purer of the two, is about 10 feet thick. It is separated from the upper bed, which averages 75 to 100 feet in thickness, by 30 feet of limestone.

There is a possibility that a plant for the production of high-quality silica sand from local sandstone may soon be established near Gananoque, Ontario.

Peace River Glass Company Ltd. of Edmonton, Alberta, has announced plans for the construction of a plant at Edmonton to manufacture various types of glass products, using silica from a deposit north of the town of Peace River.

DOMESTIC PRODUCERS

Nova Scotia

Dominion Steel and Coal Corporation, Limited operates a quarry at Chegoggin Point, Yarmouth county. Quartzite is shipped to Sydney, where it is used in the manufacture of silica brick.

Investigations in this province have shown that there are a number of deposits of beach sands, sandstones, and quartzites that are potential sources of high-grade silica.

Quebec

Canadian Carborundum Company, Limited quarries silica sand from a sandstone deposit at St. Canut in Two Mountains county. The sand is used in the production of silicon carbide at Shawinigan Falls.

St. Lawrence Alloys and Metals Limited produces ferrosilicon at Beauharnois, using a Nepean sandstone quarried at nearby Melocheville.

The ferrosilicon plant of Electro-Reagents (Quebec) Limited, a subsidiary of Dominion Magnesium Limited, was completed at Beauharnois. Production was commenced in the latter part of April. The quartzite used in this operation is obtained from two firms, one of which operates a deposit in the Lac St. Jean area of Quebec and the other a deposit of quartzite on Manitoulin Island.

Dominion Silica Corporation Limited produced during part of the year several grades of silica in its new mill at Lachine, Quebec. Raw

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Production of quartz and silica sand	1,785,574	2,070,617	1,783,081	2,253,500
	Thousands of brick		Thousands of brick	
Production of silica brick	3,720	712,371	3,544	606,394
	Short Tons		Short Tons	
Imports of silica sand				
From: United States	681,238	1,900,358	642,841	1,771,667
Belgium	21,314	26,657	-	-
United Kingdom	669	1,423	39	510
Total	703,221	1,928,438	642,880	1,772,177
Exports of quartzite				
To: United States	200,169	674,777	191,152	635,346
United Kingdom	-	-	2,803	7,005
Total	200,169	674,777	193,955	642,351

material for this operation was obtained from company quarries at Lac Bouchette in the Lac St. Jean area and at Labelle, near Ste. Agathe, Quebec.

Ontario

Lorrain quartzite is quarried by the Electro Metallurgical Company of Canada, Limited at Killarney, Georgian Bay, and by Canadian Silica Corporation Limited at Sheguindah, Manitoulin Island. This quartzite is used in the manufacture of silicon and ferrosilicon. A large part of the production is exported to the United States. A small percentage of the quartzite quarried at Sheguindah is shipped to the grinding plant of Canadian Silica Corporation Limited at Whitby, Ontario where it is used to produce silica flour.

Algoma Steel Corporation Limited quarries quartzite at Bellevue, north of Sault Ste. Marie, for the manufacture of silica brick for its own use.

Other Areas

Very little silica is produced in the Prairie Provinces or in

British Columbia, although deposits which are potential sources of silica exist.

Silica for metallurgical flux is quarried near Noranda, Quebec; Sudbury, Ontario; Flin Flon, Manitoba; and Trail, British Columbia.

USES

Quartz and quartzite are used principally to supply siliceous metallurgical flux and for the production of silicon and ferrosilicon. If the quartz is of sufficiently high quality, it may be ground to a fine powder and marketed as silica flour for various uses, mainly in the ceramic industry. Crushed quartzite is used in making silica brick, for sand-blasting sand, and occasionally as a silica sand for glass manufacture, etc.

Sandstone is broken down and cleaned to produce silica sand for use in glass making, as steel foundry sand, in making sodium silicate, and in the manufacture of artificial abrasives. Coarser grades are used in sand-blasting, and the fines as fillers for asbestos-cement products, paints, and soaps. In value of products this is the most important silica raw material.

Quartz crystals. Clear crystals of quartz without flaws, and possessing the necessary piezo-electric properties, are valuable in radio-frequency control apparatus. Very few suitable deposits have been found in Canada. Brazil continued to supply most Canadian requirements, although there was a small production from an occurrence near Lyndhurst, Ontario.

SPECIFICATIONS

Typical specifications for the most important uses of silica are given below:-

I. Silica Sands

For Glass-making. This is one of the largest uses of silica sand. Chemical composition and grain size must be closely controlled in supplying sand to this industry. The iron content for most types of glass should be less than 0.04 per cent. Other impurities such as alumina, lime, magnesia, and alkalis should be closely controlled. Grain size is very important; grains should be between 28 and 150 mesh, with a minimum of coarse or fines.

For Foundry Use. Silica sands for foundry use may contain a greater percentage of impurities than do glass sands. They vary greatly in screen size and chemical composition, depending upon the type of casting and foundry practice of the firm. These sands usually contain no material coarser than 20 mesh or finer than 200 mesh, but percentage of fine to coarse must be varied greatly to produce all the types of foundry sand required by Canadian manufacturers. A rounded

grain is preferred for foundry sands.

For Artificial Abrasives. Silica sand for use in the artificial abrasive industry should have a silica content of 98.5 per cent. The chief impurity to be eliminated is alumina which should be less than 0.15 per cent. The sand used is slightly coarser than that required by the glass industry. Specifications vary considerably from company to company.

For Making Sodium Silicate. This industry requires a very pure silica sand. The silica content should be 99 per cent, the iron content less than 0.1 per cent. The grain size is generally slightly coarser than that of glass sand and more closely sized.

For Sand-blasting. Sand-blast sand is usually quite coarse. The grain size varies from 8 mesh to 48 mesh in closely sized ranges. The physical properties of these sands, such as shape of grains, friability, and hardness, are of great importance.

II. Lump Silica

For making Ferrosilicon. Quartz or quartzite of high purity and in sizes varying from 6" down to 1" is used in the manufacture of ferrosilicon. The silica content should be 98 per cent and the alumina content less than 1.0 per cent.

As a Flux. Silica is used in metallurgical operation as a flux to produce a siliceous slag. The composition of the silica used is dependent upon the type of ore being fluxed.

For Making Silica Brick. Quartzite of high purity and crushed to 8 mesh is used in the manufacture of silica brick. The silica content should be above 97 per cent, the alumina less than 1 per cent, and the iron and alkali content low.

III. Silica Flour

For Ceramics. Silica content should be 98 per cent. The iron oxide and alumina content should each be under 0.10 per cent. Size is generally all minus 325 mesh.

As a Filler. A white color is usually very important. The size of material is generally all minus 150 mesh and finer. The silica content should be quite high, but varies with the industry.

PRICE

The price of silica varies greatly according to the location of deposits, the purity of the product, and the purpose for which it is required.

SODIUM SULPHATE (NATURAL)

Production of natural sodium sulphate in Canada in 1953 showed a decrease of about 6 per cent from that of the previous year. As before, the entire output came from Saskatchewan. Imports, primarily to coastal regions, were about 68 per cent higher, while exports were about 26 per cent lower than in 1952.

Large reserves of sodium sulphate occur in beds and in the form of highly concentrated brines in many lakes in Saskatchewan, Alberta, and British Columbia.

Production, Imports, and Exports

	1953		1952	
	Short Tons	$	Short Tons	$
Production (shipments) . .	115,565	1,681,258	122,590	1,708,807
Imports				
From: United States . .	21,476	331,886	19,576	313,739
United Kingdom	11,326	184,977	-	-
Total	32,802	516,863	19,576	313,739
Exports*				
To: United States . .	20,132	298,374	27,144	382,274

* From United States import statistics.

DOMESTIC PRODUCERS

There were four producers of natural sodium sulphate in 1953, compared with five for the previous year:- Ormiston Mining and Smelting Company Limited at Ormiston; Midwest Chemicals Limited at Palo; Sybouts Sodium Sulphate Company Limited at Gladmar; and Saskatchewan Minerals, Sodium Sulphate Division, at Chaplin. A fifth company, Natural Sodium Products, Limited, with plant at Bishopric, ceased operations in 1952.

While production methods vary considerably, the general trend is towards the production of a higher-grade product by means of the crystallizing pond. 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 late summer months the brine in all lakes is usually almost saturated and is pumped from the lake into an enclosed pond. After being subjected to more evaporation

and the effects of 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. It is then fed to a dehydrating plant to remove the water of crystallization, which amounts to over 50 per cent of the weight. A dehydrating plant usually consists 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 their other salts and silt.

USES AND PRICES

The largest single use of sodium sulphate is in the sulphate process for making kraft pulp. Kraft pulp is used chiefly in the manufacture of brown wrapping paper and corrugated board boxes in which a high degree of strength is required.

Sodium sulphate is used in some of the synthetic detergent powders as a diluent and to improve the detergent action. It is also used in the manufacture of heavy chemicals, among which are sodium carbonate, sodium silicate, sodium sulphide, and sodium hydroxide.

Other minor uses of sodium sulphate are in the glass, dye, and textile industries. Small amounts are used for medicinal purposes, and for tanning.

The price of sodium sulphate varies considerably, depending upon the duration and size of contract and the purity of the salt cake supplied.

SULPHUR AND PYRITES

Total production of sulphur in all forms in Canada decreased from a record high of 428,013 short tons in 1952 to 374,922 short tons in 1953. This was due mainly to a decrease in the amount of by-product pyrites shipped by the major producers of western Quebec, caused by prolonged strikes during 1953.

The sulphur content of sulphuric acid derived from smelter gases increased from 160,547 tons in 1952 to 172,200 tons in 1953, and shipments of elemental sulphur recovered from natural gas increased from 4,225 tons to 16,072 tons.

The continued expansion in the world production of sulphur in various forms, both directly from surface and underground deposits, and indirectly from natural gas, smelter gases, pyrites, and anhydrite has gradually improved the supply. During 1953, consumers generally

Production, Trade, and Consumption

	1953	1952
	Short Tons	Short Tons
Production (sulphur content)		
By-product pyrites shipped	186,650	263,241
Recovered from smelter gases	172,200	160,547
Total	358,850	423,788
Production elemental sulphur from natural gas (shipments)	16,072	4,225
Total, all sulphur	374,922	428,013
Imports		
From: United States	359,105	415,185
Exports		
Sulphur content of by-product pyrites		
To: United States	101,927	154,698
United Kingdom	13,989	4,954
West Germany	10,434	112
Other countries	3,258	38,133
Total	129,608	197,897
	1952	1951
Consumption		
Pulp and paper	290,607	308,666
Heavy chemicals[a]	248,879	253,599
Miscellaneous chemicals	3,198	3,928
Explosives	2,271	2,084
Rubber	2,269	2,558
Starch	328	292
Petroleum refining	258	158
Sugar refining	171	377
Iron and steel	95	75
Adhesives	72	76
Asbestos	16	24
Total	548,164	571,837

a. Includes sulphur derived from smelter gases for manufacture of sulphuric acid.

who had been on allocation, were able to secure their full requirements.

SULPHURIC ACID

The production of sulphuric acid in Canada amounted to 826,901 tons of 100% acid in 1953 compared to 816,270 tons in 1952. Exports in these respective years amounted to 47,889 tons and 33,135 tons, and the apparent consumption was 779,082 and 783,220 tons.

Sulphuric acid derived from smelter stack gases is produced in Canada by The Consolidated Mining and Smelting Company of Canada Limited at Trail, British Columbia, and by Canadian Industries Limited at Copper Cliff, Ontario. The latter company also operates a plant, adjoining the Copper Cliff smelter of the International Nickel Company, for processing the gases resulting from International Nickel's new oxygen-flash process for smelting copper and nickel flotation concentrates to produce liquid sulphur dioxide. The plant has a rated annual capacity of 90,000 short tons of liquid SO_2, making it the largest producer in the free world. The product is shipped to pulp mills in Ontario and Quebec, where it replaces some of the elemental sulphur formerly imported.

Consolidated Mining and Smelting began operations in a newly constructed phosphatic fertilizer plant at Kimberley, British Columbia, in the last quarter of 1953. The sulphuric acid plant, which adjoins the concentrator, provides the acid required in the manufacture of phosphatic fertilizers from pyrrhotite recovered in milling.

Aluminum Company of Canada Limited makes sulphuric acid at its Arvida, Quebec, works from sulphur dioxide gas derived from the roasting of zinc concentrates from the operation of Barvue Mines Limited in Barraute township in western Quebec. The concentrates are flash-roasted at Arvida and the calcine is exported to the United States for recovery of the contained zinc. The 35,000 tons of sulphuric acid expected annually from this operation will be used in the company's works to manufacture aluminum sulphate that will find markets in the pulp and paper industry and in municipal waterworks treatment plants.

Nichols Chemical Company Limited manufactures acid at three plants in Canada from domestic by-product pyrite. These plants are at Barnet in British Columbia, Sulphide in Ontario, and Valleyfield in Quebec. Columbia Cellulose Company Limited makes sulphuric acid for its operations at Prince Rupert, British Columbia, from by-product pyrite supplied by Britannia Mining and Smelting Company Limited.

North American Cyanamid Limited, Welland, Ontario, and Canadian Industries Limited, Hamilton, Ontario, manufacture acid from imported sulphur for use in their fertilizer plants. Dominion Steel and Coal Corporation Limited imports sulphur for acid manufacture at Sydney, Nova Scotia, for use in its own works.

Production and Trade, Sulphuric Acid, 1949-1953
(short tons of 100% acid)

Year	Production	Imports	Exports	Apparent Consumption
1949	707,717	24*	17,336	690,405
1950	756,110	332	44,417	712,025
1951	820,867*	1,162	57,000	765,029*
1952	816,270	85	33,135	783,220
1953	826,901	70	47,889	779,082

* Revised

Consumption of Sulphuric Acid, 1951-52
(short tons of 100% acid)

	1952	1951
Fertilizers	510,600	510,090
Heavy chemicals	103,300	84,278
Coke and gas	33,700	32,008
Explosives	31,300	31,917
Iron and steel	29,400	30,814
Textiles	28,000	23,926
Non-ferrous metals, smelting and refining	12,900*	12,900*
Petroleum refining	9,500	12,684
Soaps	8,700	7,657
Plastics	8,000	8,881
Electrical apparatus	5,700	5,286
Pulp and paper	4,000	3,133
Miscellaneous chemicals	2,100	2,286
Leather tanning	1,900	1,747
Adhesives	500	718
Sugar refining	400	207
Vegetable oils	100	122
Total	790,100	768,654

* Estimated

PYRITES

Canada's output of pyrite in recent years has been obtained as a by-product from the treatment of base metal ores and has been considered as a small-profit operation bringing from $3.00 to $4.00 per long ton f.o.b. the mine. Production in 1953 came from Noranda, Waite Amulet, Quemont, East Sullivan, and Weedon mines in Quebec, and from the Britannia mine in British Columbia. Pyrite output of the major producers is generally sold by negotiation between producer and consumer for future delivery over a period of time.

Noranda Mines Limited is building a plant at Port Robinson (near Welland), Ontario, at an estimated cost of $4,700,000 for the recovery of elemental sulphur, sulphur dioxide, and iron sinter from pyrite. Construction began in 1953 and the plant is expected to be in operation in September 1954. Initial plans call for the roasting annually of about 100,000 tons of pyrite, which is to be obtained as a by-product of Noranda's operations at its Horne mine at Noranda, Quebec. The process, developed by Noranda, is essentially a method whereby most of the loosely held atom of sulphur is volatilized by roasting, and the residue from the roasting will be sintered. Elemental sulphur is recovered in the first step and the sulphur dioxide gas driven off in the second step will be used in the adjoining North American Cyanamid plant in making fertilizer. The residue will be processed into a high-grade iron

oxide sinter. It is expected that about 18,000 tons of elemental sulphur, 36,000 tons of sulphur as sulphur dioxide, and about 72,000 tons of iron sinter will result annually from the treatment of about 300 tons of pyrite concentrate daily.

Feed for the new Port Robinson plant will, it is expected, eventually come from the zinc-pyrite body of the former Macdonald Mines Limited, now owned by West Macdonald Mines Limited. The property, which is near the Horne mine, has large proven reserves of material containing about 80 per cent pyrite and low zinc values. Noranda is to build a 1500-ton mill at Noranda, Quebec, to treat the West Macdonald ore. This mill will subsequently treat pyritic ore from the Horne mine. Funds for the project, estimated at $5,000,000, are being provided by Noranda Mines Limited. A plant is being built at Noranda to convert pyrite concentrate into pellets, in which form it is more easily handled and processed. Over and above the by-product recovery from the mining of copper ore, Noranda Mines Limited has pyrite reserves estimated at 100 million tons, containing about 50 per cent pyrite and low copper values, in No. 5 orebody of the Horne mine. The company has blocked out very large reserves of copper ore carrying pyrite at the property of Gaspé Copper Mines Limited, 62 miles west of the town of Gaspé. Sufficient ore reserves, grading better than 1 per cent copper, have been developed to ensure continuous operation of the mine for about 35 years at a rate of 6,500 tons of ore per day.

Normetal Mining Corporation Limited, with mine in Desmeloizes township, western Quebec, recovered by-product pyrite by flotation during 1952. Since November of that year the pyrite recovery operation has been idle for lack of markets. The company can recover about 200 long tons of pyrite daily from the milling of about 1,000 tons of copper-zinc-pyrite ore.

Barvue Mines Limited has a potential recovery of about 200 tons of pyrite from its 4,000-ton-per-day zinc mining operation.

St. Lawrence Paper Mills Company Limited at Three Rivers, Quebec, and Columbia Cellulose Company, Prince Rupert, British Columbia, are the only pulp and paper companies burning pyrite as a regular source of sulphur in their plants. Other pulp and paper companies have tested or are testing the burning of pyrite in Dorr Fluo-Solids roasters as the source of sulphur for their operations. However, it appears that as long as elemental sulphur is readily available the pyrite burners will generally be used only as an alternative source of sulphur.

Deposits of pyrite occur in several localities in Canada, some of these being in Newfoundland, the Eastern Townships of Quebec, Ontario, and British Columbia. In the last-named province large tonnages of pyrite associated with copper and zinc sulphides have been indicated by diamond drilling in deposits on the Ecstall river near its junction with the Skeena about 35 miles above Port Essington. Very large reserves of pyrite are associated with the lead-zinc ores of the Bathurst area of New Brunswick.

However, as the output of sulphur obtained from the Gulf Coast of United States, together with that from other sulphur recovery operations, appears adequate for many years, it is unlikely that any pyrite deposit will be developed and operated solely for the sulphur content in the foreseeable future, as it would not pay to mine and concentrate pyrite for the prices currently paid for sulphur.

ELEMENTAL SULPHUR

Canada has no known deposits of elemental sulphur. Recovery of sulphur from the hydrogen sulphide in 'sour' natural gas is a development of recent years, and is being carried out in Alberta by Shell Oil Company of Canada and Royalite Oil Company, which treat gas from the Jumping Pound and Turner Valley fields respectively. Annual recovery, which was scheduled for 9-10,000 short tons from each plant, has not quite reached this figure since the start of operations in 1952. The amount of H_2S in natural gas varies, but large volumes of proven reserves have been established in the Pincher Creek, Jumping Pound, Turner Valley, and other fields of Alberta, the hydrogen sulphide content of the above-mentioned fields being estimated at 8, 4, and 2 per cent respectively. One million cubic feet of H_2S gas contains about 44.6 tons of elemental sulphur, of which 80 to 90 per cent is recoverable. With the completion of the proposed natural gas lines to British Columbia, the Pacific Northwest States, and Eastern Canada, increased production of elemental sulphur can be expected.

ANHYDRITE AND GYPSUM

The extensive deposits of anhydrite and gypsum in Canada, particularly in New Brunswick and Nova Scotia, are a large potential source of sulphur and its compounds. Although they do not at present constitute an economic source of supply, it is noted that plants for the recovery of sulphur as sulphuric acid and production of portland cement from anydrite are in operation in England, on the European Continent, and in India.

WORLD SUPPLY SITUATION

The critical world shortage of sulphur from 1950 to 1952 has now been alleviated. Increased recovery of sulphur from the salt dome deposits of the United States Gulf Coast and from other deposits of native sulphur, as well as from pyrites, natural gas, oil refinery gases, smelter gases, and anhydrite, have all contributed to a supply situation that is now adequate for all purposes.

Further improvement is expected in 1954 as a result of the bringing into production late in 1953 of two new salt-dome mines -- Garden Island Bay in Louisiana and Damon in Texas. Twelve mines in Texas and Louisiana now produce sulphur by the Frasch process -- the largest number in the industry's history -- and two additional ones are being prepared for production, the Nash mine in Texas in 1954 and the Chacahoula mine in Louisiana in 1955.

Salt-dome sulphur accounts for about 80 per cent of the total United States sulphur production of about 6,200,000 long tons. Free world annual production of sulphur from all sources has been estimated at 12,000,000 long tons annually for the past several years.

USES

Sulphur in elemental form is used in making many commodities, notably rubber and insecticides, and large tonnages are used in the manufacture of paper. In Canada the pulp and paper industry is by far the largest consumer, using about 75 per cent of the imports. Most sulphur, however, is converted into sulphuric acid, which is used chiefly in the manufacture of fertilizer, steel, and explosives, and in the petroleum refining, textile, chemical, and metallurgical industries.

PRICES

The price of sulphur, per long ton, f.o.b. Texas and Louisiana mines, remained at the 1952 price of $22 until mid-1953, when it was increased, ranging from $25.50 to $27.50. Including transportation charges, prices at Canadian consuming plants range from $35 to $45 per long ton, according to location.

E. and M.J. Metal and Mineral Markets Bulletin quoted pyrite nominal at $9 to $11 per long ton, f.o.b. point of shipment. The price paid for Canadian by-product pyrite is subject to negotiation between buyer and seller and consequently information on prices paid is not readily available. However, pyrite at the producer's plant is a relatively low-priced commodity and usually commands from $3.50 to $4.00 per long ton. Small shipments are sometimes made at prices ranging up to $7.00 per long ton. Contracts usually call for 48 per cent minimum sulphur content and low moisture and metallic impurities content.

TALC AND SOAPSTONE

Production (sales) of talc and soapstone in Canada in 1953 increased 9 per cent over 1952 to 27,408 tons, of which 11 per cent was exported. Production continued to be confined to the Eastern Townships of Quebec and the Madoc area, Ontario.

Exports, mostly to United States, declined 15 per cent in volume, while imports, consisting mainly of special grades for the ceramic, paint, and cosmetic trades, increased 36 per cent compared to 1952.

Production, Trade, and Consumption*

	1953		1952	
	Short Tons	$	Short Tons	$
Production (Sales)				
Ground	27,258	266,504	24,902	263,780
Sawn soapstone blocks and talc crayons	150	19,251	130	16,832
Total	27,408	285,755	25,032	280,612
Imports				
From: United States	10,700	319,487	7,891	238,790
Italy	1,129	51,784	838	36,742
France	32	1,113	20	964
India	6	244	-	-
Total	11,867	372,628	8,749	276,496
Exports				
To: United States	2,778	35,802	3,331	42,200
Ecuador	117	1,274	15	202
Panama	25	855	40	681
Other countries	17	262	49	1,842
Total	2,937	38,193	3,435	44,925

	1952	1951
	Short Tons	Short Tons
Consumption		
Paints	7,264	6,921
Roofing paper	8,255	8,861
Pulp and paper	2,568	1,974
Rubber goods	1,617	1,684
Toilet & medicinal prep.	807	778
Electrical apparatus	427	641
Clay products	1,164	894
Soaps and cleaning prep.	206	192
Linoleum and Textiles	533	520
Tanneries	20	8
Miscellaneous chemicals	7,638	6,419
Polishes and dressings	16	12
Coal tar distillation	133	305
Asbestos products	1	
Miscellaneous non-metallic mineral products	3,157	97
Total	33,806	29,306

* Consumption figures for 1953 not available at publication.

PRODUCTION

Quebec

Broughton Soapstone and Quarry Company Limited, Broughton Station, continued production of ground talc, sawn soapstone blocks, bricks, and crayons.

Baker Talc Limited, 301,215 St. James St. W., Montreal, with mine and mill near Highwater, continued production of ground talc.

Ontario

Canada Talc Industries Limited, Madoc, continued production of prime white talc for the ceramic, cosmetic, construction materials, rubber, paint, and other industries; mostly from the Conley mine.

Rehabilitation of the Henderson mine, which adjoins the Conley, was actively pursued during the year by underground development and diamond drilling.

British Columbia

Ground talc is produced from imported materials by Geo. W. Richmond and Company, Vancouver, for the local roofing trade.

USES AND SPECIFICATIONS

The roofing, insecticide, rubber, and paint industries account for the bulk of Canadian consumption. Lower-grade talc is used as a surfacing material and dusting agent for asphalt paper roofing, as a filler and dusting agent in rubber products, and as a polishing agent for wire nails, rice, peanuts, and other commodities. For paint use, colour, particle shape, packing index, and oil absorption are the principal factors. The ceramic trade demands prime white colour and the paper industry talc of high brightness, high retention in the pulp, low abrasiveness, and freedom from chemically active substances. For lubricants, talc must be soft, free from grit, and have high slip. Talc of high purity is demanded for the cosmetic and pharmaceutical trades. For preparations subject to heat treatment, such as asphaltic compounds, low ignition loss is of first importance.

It is also used in the manufacture of cleansers, plaster, polishes, plastics, foundry facings, linoleum and oilcloth, oil-absorbent preparations, textiles, pipeline enamel, and other products. Steatite, the massive, compact form of talc is used in making ceramic insulators.

Particle size generally specified for roofing purposes is through 48 to 80 on 200 mesh. For most other purposes the greater part is required to pass a 325-mesh screen.

MARKETS

Purchasers of crude talc for grinding purposes include Industrial Fillers Limited, Montreal, Que., and Geo. W. Richmond and Company, Vancouver, British Columbia.

PRICES

Prices quoted by United States journals at the close of 1953 were as follows:

Per short ton f.o.b. works	
200-mesh	$10.00 to $15.00
325-mesh	$12.00 to $20.00

Canadian prices ranged from $10.00 to $15.00 per short ton for roofing and filler grades and from $17.50 to $50.00 for ceramic and cosmetic grades, car lots, bagged, f.o.b. Madoc, Ontario.

PYROPHYLLITE

Pyrophyllite, a mineral similar to talc, but with alumina in place of magnesia, is adaptable generally to the same uses as talc. Pyrophyllite has been produced intermittently in Newfoundland from a large deposit near Manuels, Conception Bay, but there has been no production in recent years.

VERMICULITE

Vermiculite has not been produced commercially in Canada up to the present. All domestic requirements are met by imports from the United States (90 per cent of the total) and South Africa (10 per cent). The value of imports from the United States in 1953 increased 7 per cent over 1952, while South African imports dropped 25 per cent.

Consumption of raw vermiculite in 1952 (1953 figures not available) increased 25 per cent in volume and 8 per cent in value over 1951, while the total value of finished products increased 20 per cent in the same period.

DESCRIPTION AND USES

Vermiculite is a hydrated magnesium-aluminum silicate that resembles mica, from which it is often derived by alteration. It is distinguishable from mica as a rule by its dull appearance and lack of elasticity. Colours range from black through brown and olive green to light buff. The only reliable method of identification for practical pur-

Trade and Consumption

	1953	1952
	$	$
Imports, crude		
United States	294,680	274,638
Union of South Africa . . .	34,337	45,700
Total	329,017	320,338

	1952		1951	
Consumption	Short Tons	$	Short Tons	$
Ore used in miscellaneous non-metallic mineral industry	20,975	466,964	16,720	430,526
Products (particulars not available)		1,169,696		975,661

poses is by heating, which causes minerals of the vermiculite group to expand to many times their original volume. Vermiculite is generally associated with basic ferro-magnesian rocks, crystalline limestones, and dolomites, particularly when the host rocks have been intruded by feldspathic dykes.

Vermiculite is used mainly as loose insulation in buildings, as lightweight aggregate in plaster, concrete, and asphaltic compounds, and as a rooting medium and soil conditioner. It is used also as a diluent in dry chemicals, as a pigment and extender in paint, and as a decorative filler in wallpaper. Its sound-proofing and fire-resistant properties, chemical inertness, low thermal conductivity, high heat resistance, and low bulk density make vermiculite useful in fire-resistant wall board, acoustic tile, sound-proof partitions, and in many other applications.

MARKETS AND SPECIFICATIONS

Purchasers of raw vermiculite include F. Hyde and Company Limited, 2315 Côte de Liesse Road, Montreal 9, Que; Insulation Industries (Man.) Ltd., 760 Wall St., Winnipeg, Man; Vermiculite Insulating Limited, 2337 Manufacturer St., Montreal, Que; and Siscoe Vermiculite Mines Limited, Cornwall, Ont.

Raw vermiculite is generally sold as a sized concentrate ready for heat treatment. Foreign impurities should not exceed 5 per cent and total unexpandable material 10 per cent.

Size classifications according to use are approximately as follows:

Acoustic tile: minus 1/2" plus 3-mesh
Loose insulation: minus 3-mesh plus 14-mesh
Plaster or concrete aggregate and
agricultural uses: minus 6- or 8-mesh plus 65-mesh

Bulk densities of finished vermiculite products range from about 5 pounds per cubic foot for loose insulation to 8 pounds or more for finer grades.

PRICES AND TARIFFS

Closing prices for 1953, published in E. and M.J. Metal and Mineral Markets, were as follows:

Vermiculite, per short ton, f.o.b. mines,
Montana - $12.00 - $14.00
South African crude, per ton c.i.f. Atlantic ports
$30.00 - $32.00

Crude vermiculite enters both Canada and the United States free of duty.

WHITING AND WHITING SUBSTITUTE

Canadian production of whiting substitute in 1953 was 16,913 tons valued at $181,112, compared with 17,527 tons valued at $188,044 in 1952. Production includes a quantity of finely ground, off-colour limestone used as an industrial filler. There were no new developments during 1953.

In Canada, whiting substitute is referred to generally as domestic whiting or marble flour. It is prepared by fine-grinding of white limestone, calcite, or marble from material low in magnesium carbonate. Quebec, Ontario, and British Columbia are the only producing provinces. Although marl can be used as a raw material, there has been no production from this source for several years.

In Quebec, Industrial Fillers Limited, Montreal, produces whiting substitute from a white marble quarried near St. Armand. Beale Quarries Limited, Vananda, Texada Island, British Columbia, prepares whiting substitute from a white marble quarried nearby. In Ontario, an off-colour limestone is ground, air-classified, and marketed as a filler for use where a white product is not necessary.

Production, Trade, Consumption

	1953		1952	
	Short Tons	$	Short Tons	$
Production				
Stone processed for whiting substitute				
Marble	11,767	141,204	12,481	149,772
Limestone[a]	5,146	39,908	5,046	38,272
Total	16,913	181,112	17,527	188,044
Imports				
Whiting, gilder's whiting, and Paris white				
From: United States	6,605	217,986	6,234	211,317
United Kingdom	4,292	54,930	4,134	60,371
Other countries	1,350	11,313	1,618	19,195
Total	12,247	284,229	11,986	290,883
Chalk, prepared				
From: United States		1,662		2,443
Miscellaneous -- chalk, china, Cornwall or Cliff stone (ground or unground), and mica schist				
From: W. Germany		3,070		-
United States		1,827		3,637
United Kingdom		1,353		106
Total		6,250		3,743
	1952		1951	
Consumption				
Ground chalk, whiting, and whiting substitute				
Explosives	331		301	
Medical and pharmaceuticals	28		124	
Paints	10,599		10,007	
Soaps	59		54	
Toilet preparations	3		4	
Miscellaneous chemicals	871		789	
Electrical apparatus	297		666	
Enamelling	116		100	
Linoleum and oilcloth	6,592		6,308	
Rubber goods	5,840		6,575	
Tanneries	216		155	
Non-ferrous smelters[b]	50		50	
Gypsum products	140		173	
Polishes and dressings	2		15	
Adhesives	32		18	
Asbestos products	365		527	
Clay products	1		-	
Cement products	12		-	
Total	25,554		25,866	

a. Includes production of off-colour ground limestone.
b. Estimated

In some countries, precipitated calcium carbonate, obtained as a by-product in the manufacture of caustic soda from soda ash and lime, is marketed as a whiting substitute. It is not produced in Canada.

True whiting is prepared by fine-grinding and sizing chalk, a soft, fine-grained, light-coloured stone composed of the calcareous shells of microscopic marine organisms. Canadian requirements for chalk whiting are met entirely by imports from Europe and the United States. These imports comprise finished whiting and also lump stone to be ground domestically.

USES

Whiting and whiting substitute are used in many industries in making such diversified materials as paint, putty, rubber products, linoleum and oilcloth, moulding plastics, polishes, cleaning compounds, and paper.

Among the characteristics desirable in whiting are proper particle size and shape, white colour, and absence of grit. Other physical characteristics, such as oil absorption, are important for certain uses.

If of sufficient purity and whiteness, and with satisfactory oil absorption and particle shape, whiting substitute may be used as an extender pigment in paint and in preparation of putty. The rubber industry requires a product that has bonding power, satisfactory particle size, adequate workability, and compatibility with the rubber batch. For both uses a very finely ground product is required.

True whiting is essential for certain uses, particularly in the pharmaceutical and ceramic industries. In the latter case it is used for glazing and in the manufacture of whiteware.

PRICES

In 1953, the price of whiting substitute per ton, bagged, ranged between $15.00 and $20.00 per ton f.o.b. plants.

COAL

The Canadian coal industry continued to show the effect of increasing competition from other fuels. Production at 15,900,673 tons was 9.5 per cent below that of 1952, and 16.9 per cent below the record 19,139,112 tons in 1950. All producing provinces showed some reduction, by far the greatest being in Alberta, where the output was about 18 per cent lower than in 1952. That province contributed about 37 per cent of the total, Nova Scotia 36, Saskatchewan 13, British Columbia and Yukon 9, and New Brunswick 5.

About 39 per cent of the output in 1953 was produced by strip mining, which is practised in all provinces except Nova Scotia. In Saskatchewan, practically all the output is strip mined, in Alberta 57 per cent, in New Brunswick about 73 per cent, and in British Columbia about 19 per cent.

Although the output per man-day in strip mining varies from about 5 to 24 short tons, depending upon thickness and type of cover and thickness of coal seam, it is in all cases greater than for underground mining. Considering the average for all provinces, the output was about 14.5 tons per day for strip mining as against 2.4 for underground.

Apparent consumption decreased from 41,353,105 tons in 1952 to 38,140,497 tons in 1953, the decrease being split fairly evenly between Canadian production and imported coal. Imports made up 60 per cent of coal consumed - about the same as in 1952. The decrease in consumption was again due mainly to the increased use of oil and natural gas in domestic and building heating, railway use, and power production.

Production of Coal by Provinces[a]
(Short Tons)

		Bituminous	Sub-bituminous	Lignitic	Total
Nova Scotia	1953	5,787,026	-	-	5,787,026
	1952	5,905,265	-	-	5,905,265
New Brunswick	1953	721,252	-	-	721,252
	1952	742,823	-	-	742,823
Saskatchewan	1953	-	-	2,021,304	2,021,304
	1952	-	-	2,083,465	2,083,465

FUELS

		Bituminous	Sub-bituminous	Lignitic	Total
Alberta	1953	3,517,500[b]	2,399,974	-	5,917,474
	1952	4,378,622[b]	2,816,135	-	7,194,757
British Columbia	1953	1,443,006	-	-	1,443,006
	1952	1,644,250	-	-	1,644,250
Yukon	1953	10,611	-	-	10,611
	1952	8,442	-	-	8,442
Total	1953	11,479,395	2,399,974	2,021,304	15,900,673
	1952	12,679,402	2,816,135	2,083,465	17,579,002
Dollar Value	1953	87,799,281	11,088,139	3,834,455	102,721,875
	1952	92,805,928	14,215,913	4,004,308	111,026,149

a. Coals classed according to A. S. T. M. Classification of Coal by Rank -- A.S.T.M. Designation D388-38.
b. Includes a small quantity of semi-anthracite from the Cascade area.

Consumption of Coal[a] in Canada for Fiscal Years Ending March 31, 1953 and March 31, 1954
(thousands of short tons)

Use	Bituminous[b]	Anthracite	Briquettes	Total
		1952-53		
Domestic	7,144	3,028	273	10,445
Industrial	13,681[c]	273[d]	-	13,954
Railroads	9,520	-	545	10,065
Coke & Gas	5,623	-	-	5,623
Water Transp.	460	-	-	460
Total	36,428	3,301	818	40,547
		1953-54		
Domestic	6,810	2,574	248	9,632
Industrial	14,350[c]	265[d]	-	14,615
Railroads	8,002	-	623	8,625
Coke & Gas	5,670	-	-	5,670
Water Transp.	486	-	-	486
Total	35,318	2,839	871	39,028

a. Domestic & imported: compiled by Dominion Coal Board
b. Includes lignite.
c. Includes coal used by mines.
d. Includes some uses other than industrial.

Imports of Coal for Consumption[a]
(Short tons)

Country of Origin	1953			1952		
	Anthracite	Bituminous	Total	Anthracite	Bituminous	Total
U. S.	2,650,193	20,027,273[b]	22,677,466	3,550,120	20,854,281[c]	24,404,401
U. K.	338,861	13,522	352,383	344,743	11,289	356,032
Total	2,989,054	20,040,795	23,029,849	3,894,863	20,865,570	24,760,433
Value $	40,088,265	96,296,421	136,384,686	49,433,409	101,472,799	150,906,208

a. From Trade of Canada: includes briquettes but does not include coal imported and subsequently sold for use on board ship.
b. Includes 3,062 tons of lignite and 128,673 tons of briquettes.
c. Includes 7,487 tons of lignite and 155,597 tons of briquettes.

Exports of Coal
(Short tons)

Destination	1953	1952
United States	244,321	276,225
Japan	-	56,126
Brazil	-	44,738
St. Pierre & Miquelon	10,928	11,850
Alaska	25	21
Total	255,274	388,960
Value $	1,999,908	3,203,522

CONSUMPTION OF BRIQUETTES

Apparent consumption of briquettes decreased from 865,289 tons in 1952 to 835,838 tons in 1953. Of the total amount marketed in Canada, about 81 per cent was used by the railways, mainly as locomotive fuel. Saskatchewan output is made from carbonized lignite, and Alberta output from low-volatile bituminous and semi-anthracite coals of the Nordegg and Cascade areas and from medium-volatile bituminous coals of the Crowsnest and Mountain Park areas. Imports of briquettes from the United States in 1953 amounted to 128,673 tons made from low-volatile bituminous coals and anthracite, alone and mixed.

PRODUCING AREAS

Nova Scotia and New Brunswick

Nova Scotia produces high- and medium-volatile bituminous coking coals in the Sydney, Cumberland, and Pictou areas and some non-

coking bituminous from the Inverness area. Production in 1953 amounted to 5,787,026 tons. New Brunswick's output of 721,252 tons of high-volatile bituminous coal in 1953 came from the Minto area.

Most of the production from the two provinces is used locally for industrial and domestic purposes and the remainder is shipped to central Canada, the latter amounting to 1,861,834 tons compared with 1,689,880 tons in 1952.

Saskatchewan

Only lignite is produced, chiefly from Bienfait, Estevan, and Roche Percee fields in the Souris area. Approximately 53 per cent of the 2,021,304 tons produced in 1953 was shipped to Manitoba for domestic and industrial use.

Alberta

Alberta produces almost all types 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 areas. These are mainly railway and industrial steam coals, but commercial and domestic markets are also supplied. In the Lethbridge, Coalspur, Saunders, and several other areas of the foothills lower-rank bituminous non-coking coals are produced. These are mainly domestic and commercial coals but the industrial and railway market for certain types of these coals is substantial. The coal in the Drumheller, Edmonton, Brooks, Camrose, Castor, and Carbon areas is classed as sub-bituminous and that in the Tofield, Redcliff and several other areas is on the border of sub-bituminous and lignite. These are all mainly domestic and commercial coals, a small proportion being used industrially.

The Cascade area was the only field that produced semi-anthracite in 1953. About 59 per cent of Alberta's coal output in 1953 was bituminous and 41 per cent sub-bituminous and lignite, mainly the former. With the closing of another large bituminous coal mine in the Mountain Park area, this coalfield has only one mine and its life, as well as that of the one operating mine in the Nordegg area, are almost entirely dependent upon the continued use of coal by the railway.

British Columbia

Bituminous coking coal, ranging from high to low volatile, is mined on Vancouver Island and in the East Kootenay, Telkwa, and Nicola areas. Small quantities of sub-bituminous coal have been produced, mainly in the Princeton field. In the Kootenay (Crowsnest) area, the largest producing field, medium-temperature oven (by-product) coke is manufactured, chiefly for industrial consumption, and in 1953 a plant was being constructed for the manufacture of railway briquettes.

BENEFICIATION

Although the industry has suffered from competition of other fuels, it has continued to increase its efforts to improve the quality of its products by the use of modern methods of beneficiation such as cleaning, drying, and the briquetting of fines.

A major problem continues to be the beneficiation of fines, both from the viewpoint of preparing a reasonably low-ash product and the production of a lump fuel that will find greater acceptance in the domestic and industrial markets.

The Mines Branch, Ottawa, and other research organizations, as well as the industry, have been conducting plant, pilot-plant, and laboratory investigations dealing with wet and pneumatic methods of coal cleaning and with processes for drying, dust-proofing, and freeze-proofing coal.

The activity in briquetting was increased in 1953, especially in Western Canada, in connection with the preparation from fines of briquettes suitable for use as locomotive fuel. The output of such fuel was increased in the Mountain Park, Cascade, and Crowsnest areas of Alberta and a new plant was placed in operation in the East Kootenay area of British Columbia. Even though dieselization and conversion of steam locomotives from coal to oil continues, the preparation of briquettes from coal fines has helped to improve the competitive position of the coal industry. Increased interest is being shown in the possible production of briquettes for use in both domestic and industrial stokers, and during 1953 the Mines Branch initiated a practical investigation which will include a study of the briquetting characteristics of both Western and Eastern coals.

COMPETITION

A preliminary survey for 1953 indicates no relative change from 1952 in consumption of coal and oil by railway locomotives. However, it should be noted that there was a decrease in consumption of both fuels owing to decreased traffic - one major railway reporting a 13 per cent drop - and to the unusually mild weather, especially in Western Canada.

The conversion of steam locomotives from coal to oil continues. During 1953, the Canadian National Railways, as part of its five-year conversion plan to be completed in 1956, converted 99 coal-burning steam locomotives to oil, mainly in Western Canada. On the basis of an average consumption per locomotive of 3,000 tons per year this would account for a market loss of 297,000 tons. By the end of 1953 there were 969 diesel units in Canada in comparison with 763 in 1952 and it is estimated that close to 1100 units will be in use by the end of 1954. Speaking generally, conversion of steam locomotives from coal to oil has displaced more coal than has the adoption of diesel units.

The use of oil for domestic and building heating and cooking, and of natural and manufactured gas for domestic, commercial, and industrial purposes continued to increase. Whereas the use of fuel oil

has increased since 1945 by over 737 per cent in comparison to the 1941 - 1945 average annual consumption, coal consumption has decreased by about 35 per cent compared to the average in the same period. During the 1941 -45 period the oil consumed, estimated as the heat equivalent in terms of coal, amounted to 5.9 per cent of the total fuel used; in 1953 it amounted to 44.8 per cent. If the natural gas used in 1953 were entirely replaced by coal, almost 2 3/4 million tons of 13,000 B.t.u./lb coal would be required. Gas and oil are strong competitors of coal in the production of power at central electric stations, also.

The data below indicate the extent to which oil and natural gas are replacing coal.

Fuel Consumed by Railway Locomotives[a] 1942-53

Year	Coal	Fuel and Diesel Oil	Estimated Heat Equivalent of Oil in terms of Coal[b]	Estimated Heat Equivalent of Oil as a Percentage of Total Coal+Oil
	Thousands of Tons	Millions of Imp. Gals.[c]	Thousands of Tons	%
1942	10,614	72.0	490.9	4.4
1943	11,987	79.0	538.6	4.3
1944	11,993	80.9	551.6	4.4
1945	12,084	78.3	553.8	4.2
1946	11,632	82.2	560.4	4.6
1947	12,331	86.7	591.1	4.6
1948	12,422	96.3	656.6	5.0
1949	11,444	139.3	949.7	7.7
1950	10,452	217.9	1485.6	12.4
1951	10,505	260.4	1775.4	14.5
1952	9,798	291.9	1990.2	16.9
1953[d]	8,884	Not available	-	

a. Steam Railways, D.B.S.
b. Estimated in terms of coal at 13,000 B.t.u./lb., taking oil at 9.33 lb./gal. with a calorific value of 19,000 B.t.u./lb.
c. Revised
d. Preliminary

COKE

Production of coke from bituminous coal in 1953 was 4,252,833 tons compared with 4,056,655 tons in 1952. Coal processed for the manufacture of coke amounted to 5,732,302 tons, of which 1,079,067 tons were of Canadian origin and 4,653,235 tons were imported from the United States. Petroleum coke produced at the refineries amounted to 238,663 tons compared with 203,388 tons in 1952.

Imports of coke totalled 656,259 tons, a decrease of 169,000 tons from 1952, while exports decreased from 359,456 tons in 1952 to 200,017 tons in 1953.

Most of the coke produced for the Canadian market is obtained from standard by-product coke ovens that process coal in large tonnages for use in producing steel and non-ferrous metals or as domestic fuel. The retort coke, a by-product of the gas industry, forms only a small part of the total coke production and is used largely to make carburetted water-gas for city use.

Several types of plant produce coke in Canada. They comprise seven by-product coke oven plants, one Curran-Knowles installation, three continuous vertical retort plants, and a coking stoker type of plant designed and operated by Shawinigan Chemicals Company, Shawinigan Falls, P.Q. Many of the smaller gas retort plants that were in operation in the earlier part of the century have been replaced by carburetted water-gas plants or propane units.

About 80 per cent of the coal used in the production of coke in Canada is processed at six plants in Eastern Canada, namely: Dominion Steel and Coal Corporation at Sydney, Nova Scotia, with rated annual capacity of 1,001,900 tons of coal; Montreal Coke and Manufacturing Company at Ville La Salle in Quebec, with rated annual capacity of 656,000 tons of coal (the company 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 a rated annual capacity of 1,761,000 tons of coal; Hamilton By-Product Coke Ovens Limited at Hamilton, Ontario, with a rated annual capacity of 415,000 tons of coal; Dominion Steel Foundries Limited, with an annual capacity of 300,000 tons; and Steel Company of Canada Limited at Hamilton, with a rated capacity of 1,470,000 tons of coal a year.

Production and Trade

	1953		1952	
	Short Tons	$	Short Tons	$
Production from bituminous coal				
Ontario	2,932,928	42,954,291	2,686,544[a]	36,935,991
Nova Scotia, New Brunswick, Quebec and Newfoundland	1,032,762	17,675,957	1,073,806	18,109,639
Manitoba, Saskatchewan, Alberta and British Columbia	287,143	3,541,501	296,305	3,655,480
Total	4,252,833	64,171,749	4,056,655[a]	58,701,110
Production of pitch coke	8,214	186,689	14,180	315,421
Production of petroleum coke	238,663	1,935,086	203,388	2,157,262
Total production	4,499,710	66,293,524	4,274,223[a]	61,173,793
Bituminous coal used to make coke				
Imported	4,653,235	48,657,658	4,288,413	44,545,466
Canadian	1,079,067	9,585,573	1,167,632	10,201,916
Total	5,732,302	58,243,231	5,456,045	54,747,382
Imports, all types				
From: United States	656,073	11,560,791	825,235	13,464,345
United Kingdom	186	4,979	24	588
Total	656,259	11,565,770	825,259	13,464,933
Exports, all types				
To: United States	179,013	2,321,852	339,023	5,117,173
Other countries	21,004	887,394	20,433	820,176
Total	200,017	3,209,246	359,456	5,937,349

a. Revised

NATURAL GAS

Estimated gross production of natural gas, less field waste, was 100,985,923 M cu. ft. in 1953, nearly 14 per cent higher than 1952. Alberta supplied 89 per cent of the 1953 production, the remainder coming from Ontario, Saskatchewan, New Brunswick, and Northwest Territories. Although large reserves have been developed in northeastern British Columbia, market outlets are not yet available.

The most important developments in the natural gas industry in Canada during 1953 related to the proposed export of Alberta natural gas to central Canada.

DEVELOPMENT AND PRODUCTION BY PROVINCES

British Columbia

There has been no production in British Columbia as yet. Reserves of natural gas are, however, being built up in anticipation of a market outlet to the Pacific coast. The main centre of exploration is the Peace River district, where exploratory projects were designed primarily to expand and evaluate the large Fort St. John gas field and surrounding areas. At the end of the year 31,426,332 acres were held under permit, license, and lease. Eighteen wells were completed as potential gas wells; 18 wells were abandoned; total footage drilled was 196,227 feet; and at the height of drilling activity, in June and July, 15 rigs were operating. Eight of these were in use at the end of the year.

Reserves of natural gas, in situ, in the Peace River district of British Columbia are in excess of 2,000,000,000 M cu. ft. with a further 1,500,000,000 M cu. ft. in the Alberta part of the Peace River region. Most of the British Columbia reserves are in the Fort St. John field which is approximately 25 miles by five miles in size with field limits not yet defined. Gas has been found in eight separate pay zones in formations of Lower Cretaceous, Triassic, and Permo-Pennsylvanian ages.

Alberta

Natural gas has been discovered in almost every area in which drilling for oil has been carried out, the present large reserves being mainly the result of the extensive search for oil. At the end of 1953, there were 404 gas wells capable of being operated and of these 272 were in production. These totals exclude wells classified as crude oil wells, from which almost two-thirds of current production is coming. Fifty-three wells were classified as new gas producers during 1953, and 142 other wells were suspended and classed as potential gas producers awaiting market outlets.

Natural Gas Production[a]

	1953		1952	
	M cu. ft.	$	M cu. ft.	$
Alberta[b]				
Turner Valley	27,103,751		28,498,793	
Viking-Kinsella-Wainwright	17,861,187		17,398,977	
Leduc-Woodbend	10,473,926		7,522,015	
Jumping Pound	10,425,400		7,384,848	
Pakowki Lake	9,697,353		8,308,127	
Medicine Hat-Redcliff	5,788,418		5,097,249	
Other fields & areas	8,301,570		4,939,886	
Total	89,651,605	6,723,870	79,149,895	5,936,242
Ontario[c]				
Moore (Kimball-Payne) Dawn & Becher	4,351,132		2,696,883	
Haldimand	1,313,761		1,594,783	
Kingsville-Tilbury	1,745,755		1,640,464	
Welland	596,771		686,528	
Other fields	1,701,550		1,683,532	
Total	9,708,969	3,883,588	8,302,190	3,320,876
Saskatchewan				
Unity	611,322			
Lloydminster	332,786			
Brock	271,731			
Other fields & areas	206,289			
Total	1,422,128	127,992	1,007,491	100,749
New Brunswick				
Stoney Creek	177,112	131,368	202,042	150,073
Northwest Territories				
Norman Wells	26,109	10,199	24,847	9,698
Canada total	100,985,923	10,877,017	88,686,465	9,517,638

a. Price per M cu. ft. is the average well-head price in Alberta and Saskatchewan. In Ontario, New Brunswick, and the Northwest Territories it is the average wholesale price paid at collecting points.

b. Average price of 7.5 cents per M cu. ft. applied to well-head production less field waste. Field waste correction is made to Alberta total production because of the considerable flaring wastage. For other provinces, total production figures are used.

c. Wholesale value of 40 cents per M cu. ft. of natural gas production.

In central Alberta, the Homeglen-Rimbey area was opened by Devonian (Leduc) reef discoveries which assured the area a rating as a major "wet gas" reserve with a considerable crude oil reserve as well. This Devonian (Leduc) reef zone is south of the line of major Devonian oil fields — Leduc-Woodbend, Wizard Lake, Bonnie Glen, and Westerose, all of which lie southwest of Edmonton. One well has indicated that the reef has a gas cap 396 feet thick. Four gas wells were completed in the Fort Saskatchewan field, where reserves amount to approximately 100,000,000 M cu. ft. Drilling extended the field two and one-half miles and brought the total number of wells to 13. A two-mile extension was made to the Medicine Hat gas field and also to the Etzikom gas field, 40 miles to the southwest. A well completed in the Pincher Creek field has a calculated absolute open-flow potential of 168,000 M cu. ft. a day, the highest potential in this field; the well also has the thickest producing section found in the field to date. Tests also showed 33.4 barrels of condensate and oil per million cu. ft. of high pressure separator gas. The field has a disposable reserve of 2,000,000,000 M cu. ft. A two-mile extension to the Pouce Coupe field was indicated by two wells which flowed 27,000 M cu. ft. and 35,000 M cu. ft. daily during drillstem tests. A successful gas well completed in Lower Cretaceous sands at the Drumheller field established an initial potential comparable to flow rates of Viking-Kinsella gas field wells.

The 53 natural gas wells and 142 potential gas wells drilled during 1953 have a wide geographic distribution, from the Pouce Coupe area 300 miles northwest of Edmonton to the southwest corner of the province. The gas-bearing formations of many of these wells are of Cretaceous age. In addition to the natural gas wells, a large percentage of the year's 884 oil wells completed in formations ranging from Devonian to Cretaceous in age are also sources of natural gas.

A reserve study made during the year by the Petroleum and Natural Gas Conservation Board of Alberta showed that marketable reserves of Alberta natural gas as of June 30, 1953 were 11,500,000,000 M cu. ft. As a result of this finding, 4,800,000,000 M cu. ft. was declared surplus to 1953-82 requirements of the Province. The Board anticipates an increase in reserves of 1,250,000,000 M to 1,500,000,000 M cu. ft., which would also be available for export, each year during the next 10 years.

The average 1953 price at the well-head was 7.5 cents per M cu. ft.

Saskatchewan

Production continued to rise steadily, the major gains being in the Brock and Unity fields; the Lloydminster field showed a decrease. Output in 1953 came mainly from 12 wells in the Lloydminster field, one in the Lone Rock field, three in the Unity field, one in the Coleville field, nine in the Brock field, and one in the McLaren Sparky Pool. At the end of 1953 there were 20 areas classified as gas fields. These

fields, with date of completion of the discovery well, are as follows: Battle Creek (July 1953), Brock-Newburg (August 1951), Coleville-Driver-Eureka-Dewar-Smiley-Buffalo Coulee (September 1951), D'Arcy (June 1952), Dodsland (December 1951), Elrose (February 1952), Gull Lake (December 1952), Lloydminster (July 1935), Lone Rock (November 1946), Midway (August 1952), Odenbach (October 1953), St. Florence (June 1952), Success (January 1953), Unity (July 1944), Vera (July 1946). The natural gas reserves are, therefore, all in or near the oil fields of southwestern Saskatchewan. Slightly more than 80 per cent of the proven reserves of 181,000,000 M cu. ft. of recoverable gas developed to date is in the Viking (Cretaceous) sand of the Coleville-Driver and Brock-Newburg fields at average depth of 2,300 feet. No gas discoveries have been made in southeastern Saskatchewan, the other oil area of the province.

In 1953 a total of 19 wildcat and development wells was completed, including the three wells which resulted in the discovery of the Battle Creek, Odenbach, and Success fields.

The average well-head price was 10.5 cents per M cu. ft. compared with 10 cents in 1952.

Manitoba

Although oil has been found in southwestern Manitoba at Virden, Tilston, Waskada, Whitewater, and Lulu Lake, wells in Manitoba, as in southeastern Saskatchewan, do not yield gas in commercial quantities.

Ontario

The natural gas and oil fields are in the southwestern portion of the province. In all, 150 successful gas wells were completed, of which 146 resulted from development drilling and four from exploratory tests. Of the 150 gas-well completions, 138 had an average open-flow measurement of 75 M cu. ft. a day, and the remaining ten an average of 12,600 M cu. ft. a day. Two wells in Lambton county classified as oil wells had the highest gas production rates of the 1953 completions, open-flow measurements being 20,000 M cu. ft. a day. The average depth of all gas wells drilled during the year was 918 feet.

In addition to the 150 gas wells, there were 82 oil well completions and 163 dry holes, bringing the total number of gas wells in the province to 3,534 and oil wells to 2,095.

The price per M cu. ft. received by producers in both years was 40 cents.

New Brunswick

Production, which comes from the Stony Creek field in Alberta and Westmorland counties about nine miles south of Moncton, has

gradually diminished from more than 600,000 M cu. ft. a year to 177,000 M cu. ft. in 1953. Unit value to producers in the past two years was 75 cents per M cu. ft.

No new oil or gas wells were drilled in New Brunswick in 1953. Work was confined to deepening existing gas wells in the Stony Creek field, which now has about 40 natural gas wells.

Northwest Territories

The small natural gas production comes from the Norman Wells field and is used to meet local needs. The well-head value was 40 cents per M cu. ft.

Ten exploratory wells were drilled during 1953 south of Norman Wells in a large area currently under exploration south and west of Great Slave Lake.

TRANSPORTATION

Of great importance to the natural gas industry are the transportation plans made during 1953 for making the large reserves of Alberta natural gas available to the central Canada market by construction of a pipe-line system from Alberta to Ontario and western Quebec. Several pipe line projects were proposed, the chief being those of Trans-Canada Pipe Lines Limited and Western Pipelines Limited. The former wished to build a pipe line over an all-Canadian route to Toronto and Montreal; the latter based its plan on a route to Winnipeg and south to Minneapolis, to be followed in a second phase of construction by a route to the central Canada area. Early in 1953, the Federal Government announced that permission to export gas from Canada could only be given after present and future economic demand had been provided for within Canada. During 1953, the Government of Alberta declared a surplus of 4,800,000,000 M cu. ft. All of this except 217,000,000 M cu. ft. in the Peace River area and 800,000,000 M cu. ft. in scattered areas in northern Alberta is available for eastern export. Early in 1954 the two principal contenders combined into one company, Trans-Canada Pipe Lines Limited, at a meeting with the Minister of Trade and Commerce in Ottawa, for the purpose of constructing a pipe line from Alberta to central Canada.

Trans-Canada Pipe Line

A trans-Canada pipe line would be almost 2,300 miles long and would serve an area with a population of more than 4.5 millions in about 200 communities between Alberta and Montreal. Natural gas services in 1953 were available to only about 15 per cent of this population. Two pipe-line sizes are under consideration: a 30-inch diameter line that would have an initial capacity of about 96,000,000 M cu. ft. in the first year and a capacity of 155,000,000 M cu. ft. by the fifth year, and an ultimate capacity of 500,000 M cu. ft. a day; and a 36-inch

diameter line with an initial capacity of 500,000 M cu. ft. a day, increasing to 650,000 M cu. ft. a day and eventually increasing the amount carried to Winnipeg to as much as 800,000 M cu. ft. à day, depending on the export market.

In December, the House of Commons gave approval to a Government bill granting the Board of Transport Commissioners complete jurisdiction over location, construction, and operation of interprovincial and international oil and gas pipe lines in Canada.

Westcoast Transmission Company Limited

Although Westcoast Transmission Company Limited received Canadian approval in 1952 to construct a pipe line for delivery of Peace River area natural gas to Vancouver and into the Pacific northwest area of the United States, approval for entry into the United States has still to be obtained from the Federal Power Commission in Washington. The American outlet is essential to the project, as the British Columbia market is not large enough to support the $113,000,000 expenditure required to construct the line. In addition to the proving up of more natural gas reserves in the Peace River area of British Columbia and Alberta in 1953, decisions made by the Board of Transport Commissioners in Ottawa during the year gave further impetus to the pipe-line project. The Board granted Westcoast Transmission Company Limited a 22-year permit to export natural gas to the United States from the Peace River district of Alberta and British Columbia, authorized construction of a branch pipe line from Sumas, British Columbia, to the United States border to tap the main line from Peace River to Vancouver, and also approved construction of a branch line from Brookmere to carry gas to Trail and eastern Washington, crossing the International Boundary at Osoyoos.

Canadian-Montana Pipe Line Company

During 1953 a reserve of 334,000,000 M cu. ft. of natural gas was made available to Canadian-Montana Pipe Line Company for export to the Anaconda Company smelter at Butte, Montana. Natural gas exports to Butte commenced in April 1951 and have been at the annual rate of 10,000,000 M cu. ft.

Other 1953 Pipe Line Developments

In Alberta, Grande Prairie Transmission Company commenced delivery of natural gas through a 45-mile pipe line to the Peace River district town of Grande Prairie and intermediate points from the Rycroft field. A 10-mile, 8-inch gas line with working capacity of 55,000 M cu. ft. a day was laid by Mid-Western Industrial Gas Limited between the Fort Saskatchewan gas field and the Sherritt Gordon Mines Limited nickel refinery, at a cost of $300,000. A short line to carry gas from two wells in the Cold Lake area of northeastern Alberta to a defense project at Cold Lake was completed. The most important

gas pipe line system installation in Canada during 1953 took place in Saskatchewan, when the 101-mile, 10-inch line of the Saskatchewan Power Corporation was built between Brock gas field and Saskatoon at a cost of $7,000,000. Initial capacity of the line is 30,000 M cu. ft. a day and by the end of 1953 service lines to 6,000 residential and commercial customers were being installed.

NATURAL GAS PROCESSING PLANTS

During 1953, there were five "wet gas" processing plants in operation, all in Alberta, with a total capacity of 280,000 M cu. ft. a day. Three of these plants are in Turner Valley, one in the Leduc field, and the fifth in the Jumping Pound field. All of the plants produce natural gasoline, two produce propane, and one produces butane. The plant at Jumping Pound and one of the Turner Valley plants have sulphur recovery units of 30 long tons daily capacity. The sulphur is being sold to pulp and paper mills on the British Columbia coast. Sulphur sales in 1953 by these two plants totalled 16,072 short tons. At the end of 1953, four other natural gas processing plants were either in the planning or early construction stages.

MARKETS FOR NATURAL GAS IN 1953

The following table shows the sales of natural gas in Canada by distributing companies to customers; amounts used by producers are not included.

Sales of Natural Gas, 1953 (Preliminary)

Customers	M cu. ft.	$
Eastern Canada		
Domestic	8,882,268	10,723,336
Industrial	2,204,309	2,402,260
Commercial	1,445,414	1,611,581
Miscellaneous	-	57,934
Total	12,531,991	14,795,111
Western Canada		
Domestic	21,500,578	7,944,092
Industrial	22,079,524	3,727,311
Commercial	14,562,394	3,679,904
Miscellaneous	-	20,828
Total	58,142,496	15,372,135

Western Canada

In 1953, three major industrial enterprises employing 1,200 people were on the threshold of production. The Canadian Industries Limited $13,000,000 polyethylene plant at Edmonton has an annual capacity of 6,000 tons of polyethylene ("Polythene"). The manufacturing process is based primarily on ethane. Leduc field natural gas, which has one of the highest percentages of ethane of any gas in the continent, is delivered to the plant at a daily rate of 10,000 M cu. ft. The polyethylene flake produced at Edmonton is shipped to Shawinigan Falls for processing into moulding compounds and sale to the electrical, pharmaceutical, packaging, tableware and other industries. The new $55,000,000 Edmonton plant of Canadian Chemical Company can produce 25,000,000 pounds of cellulose acetate flake annually and a number of chemicals such as formaldehyde, acetic acid, and acetone. This plant requires 75,000 gallons daily of liquefied propanes and butanes, which are recovered in Alberta gas conservation plants, and also uses 25,000 M cu. ft. of dry natural gas as fuel. The third major industrial outlet is the Sherritt Gordon Mines Limited nickel refinery at Fort Saskatchewan, 15 miles northeast of Edmonton. This $24,004,000 plant is expected to consume about 3,000,000 M cu. ft. of natural gas in its first year of operation.

A large market for Saskatchewan natural gas was also opened up by the completion of the 101-mile natural gas pipe line from Brock gas field to Saskatoon in July.

Eastern Canada

Southwestern Ontario's 1953 production was supplemented by summer and fall imports from the United States amounting to 6,095,344 M cu. ft. The gas is brought into Canada by pipe line via Detroit and most of it is stored in Dawn township underground reservoirs until required for winter use. Plans are being made to expand the present Ontario gas distribution system in preparation for greatly increased supplies of natural gas to be made available on completion of the Trans-Canada pipe line. The present market demand far exceeds supply from local fields and United States sources.

Average unit prices charged by distributing companies were $1.26 per M cu. ft. for manufactured gas and $1.20 for natural gas; natural gas has about twice the b.t.u. value of manufactured gas.

Exports and Imports

Canadian natural gas exports during 1953 amounted to 9,629,354 M cu. ft. The principal exporter was Canadian-Montana Pipe Line Company, which delivered gas to Montana Power Company for use at the Anaconda Copper Mining Company smelter at Butte, Montana. Natural gas production in southwestern Ontario was supplemented by imports from the United States of 6,095,344 M cu. ft. valued at $1,990,785. The Canadian import duty on gas used for heating and cooking is three cents per M cu. ft.

PEAT MOSS

Peat moss is widely distributed in Canada, but commercial production is confined to British Columbia, Manitoba, Ontario, Quebec, New Brunswick, and Nova Scotia. 85.5 per cent of the 81,654 tons produced in 1953 came from the Rivière-du-Loup area of Quebec and the delta of the Fraser River in British Columbia. Nearly 90 per cent of the Canadian output is exported to the United States, where it has to compete with German peat moss, which enjoys certain preferential freight rates. United States imports of German moss totalled 90,000 tons, valued at nearly $3,000,000, in 1952. To meet this situation, British Columbia producers have formed a co-operative organization which it is hoped will reduce marketing costs.

PRODUCTION AND TRADE

	1953			1952		
	Producers	Short Tons	$	Producers	Short Tons	$
Production						
British Columbia	13	47,756	1,657,726	13	46,939	1,685,406
Quebec	13	22,021	587,671	14	19,609	405,852
New Brunswick . .	2	8,323	246,946	2	2,400	96,000
Ontario	2	1,319	52,535	3	1,939	69,013
Manitoba and Nova Scotia	2	2,235	98,139	2	4,012	187,494
Total	32	81,654	2,643,017	34	74,899	2,443,765
Exports						
To: United States		73,489	3,288,744		68,265	3,127,017
Other countries		20	1,011		10	576
Total		73,509	3,289,755		68,275	3,127,593

Peat moss is the dead, slightly humified, fibrous moss found in peat bogs. When dried and shredded it has a high absorptive capacity, for which reason it finds wide use in the horticultural business both as a packing material and as a means of introducing humus into the soil, and in stables and poultry runs as litter.

In British Columbia, the harvesting of peat moss is largely mechanized, although considerable manual labour is required also. One operation is almost completely mechanized; the peat is excavated by hydraulic jets and pumped to the plant, where it is dried by steam heat in a modified paper-making machine. In Eastern Canada generally there is little mechanization, except for the use of tractors for haulage purposes.

Dried peat has long been used as a fuel, but the amount used in Canada for this purpose in recent years has been less than a hundred tons a year. The type of peat required for use as fuel is a well-humified grass or sedge peat rather than the unhumified sphagnum variety required for the preparation of peat moss. Some fuel peat has been produced in recent years at a small bog at Gads Hill Station, near Stratford, Ontario, but there was no production from this source in 1953. On the Burin peninsula in Newfoundland peat fuel has been dug for local use. In Quebec, drainage work was completed in 1953 on a large bog near Shawinigan Falls in preparation for the possible production of peat fuel.

PRODUCERS

British Columbia

The peat operations in the Fraser River delta near New Westminster are the largest in Canada. Four bogs are being worked, Pitt Meadows, Byrne Road, Lulu Island, and Delta (or Burns), and from this small area 13 companies in 1953 produced 47,756 tons, nearly two-thirds of the Canadian production. The largest producers are Industrial Peat Limited, Atkins and Durbrow Limited, and Lulu Island Peat Company Limited.

Manitoba

Western Peat Company Limited, the only producer, operates the Julius (or Shelley) bog about 50 miles east of Winnipeg.

Ontario

Only two companies are operating now, as Arctic Peat Moss Co., Limited of Fort Frances ceased operating in April, 1953. Most of the output in 1953 was produced by Atkins and Durbrow (Erie) Limited at its plant near Port Colborne. The other producer, Humar Corporation Ltd., processes and sells humus from a bog near Dundas.

Quebec

The peat moss deposits being worked are mainly in the lower St. Lawrence region. Thirteen companies contributed to the output in 1953, but most of the production came from three, namely: Premier Peat Moss Corporation with operations at Rivière-du-Loup, Isle Verte, and Cacouna; Tourbières Rivière-Ouelle in the Rivière-du Loup area; and Quebec Peat Moss Company, St. Guillaume.

New Brunswick

The most important peat moss deposits are in Northumberland and Gloucester counties on both shores of Miramichi Bay, and on Miscou and Shippigan Islands. Two companies produced peat moss in 1953, namely; Fafard Peat Moss Company at Pokemouche; and Atlantic Peat Moss Company, Limited on Shippigan Island. Production in northern New Brunswick is handicapped by poor drying weather along the coast.

Nova Scotia

Annapolis Peat Moss Company, Limited, the only producer of peat moss, had a small output from the Caribou bog near Berwick in 1953. Experiments in the rapid digging and drying of peat moss, involving the use of a mechanical excavator, have been made on this bog.

Newfoundland

Peat moss is not produced in Newfoundland. Although deposits are available, they are close to the coast and their development would probably be handicapped by the same poor drying weather that is experienced in northern New Brunswick.

PRICE

The price of peat moss in 1953 varied from $24.00 to $35.00 a ton according to location.

PETROLEUM

Canadian crude oil production in 1953 totalled 80,898,897 barrels, valued at $200,582,276, an increase of 19,661,575 barrels over 1952. Average daily output was 221,640 barrels, compared with 167,315 barrels in 1952, and potential output was estimated at 345,000 barrels a day, an increase of about 63,000 barrels a day over 1952. Alberta accounted for 95 per cent of the production, and Saskatchewan, which doubled its 1952 output, 3.5 per cent. The remainder came from Manitoba, the Northwest Territories, Ontario, and New Brunswick. In

value of production, crude petroleum became Canada's leading mineral, replacing gold, which had held this position for over 20 years.

During 1953 the 718-mile Trans Mountain pipe line from Edmonton to Vancouver was completed and the Interprovincial pipe line from Edmonton to Superior, Wisconsin, was extended 643 miles to Sarnia, Ontario, making it the world's longest - 1, 765 miles.

Canadian refinery capacity was increased by 65, 250 barrels to 523, 650 barrels a day, double that of 1947.

At present transportation costs, Canadian crude petroleum would not be competitive with imported oil in the large Montreal refinery centre, but it is anticipated that export markets will be developed in the Puget Sound area of Washington and along the general route of the Interprovincial pipe line system, particularly in Minnesota. Access of Canadian crude oil to these markets would tend to offset imports into the Montreal area and the Maritimes, and thereby enable Canada eventually to become self-sufficient on trade balance in crude petroleum.

Imports into Canada in 1953 consisted of 81, 627, 471 barrels of crude petroleum valued at $213, 093, 794 and 33, 866, 020 barrels of refined petroleum products valued at $147, 247, 889.

Exports of crude petroleum, all of which went to refineries near Superior, Wisconsin, amounted to 2, 507, 314 barrels valued at $6, 227, 828. Refined petroleum products exported totalled 352, 413 barrels valued at $1, 613, 581.

DEVELOPMENTS AND PRODUCTION

Although most of Western Canada's drilling continued to be carried out in Alberta, there were marked increases in exploratory and development activity in Saskatchewan and Manitoba. In all, 2, 220 wells were drilled in Western Canada in 1953, resulting in 1, 300 oil wells, 90 gas wells, and 830 dry holes. There were 1, 416 completions in Alberta, 669 in Saskatchewan, 89 in Manitoba, 36 in British Columbia, and 10 in the Northwest Territories, compared with 1, 629 completions in Alberta in 1952, 496 in Saskatchewan, 70 in Manitoba, 14 in British Columbia, and 10 in the Northwest Territories. The number of active drilling rigs in Western Canada reached a high of 194 compared with a peak of 253 in 1952. Total drilling in Western Canada amounted to 9, 277, 229 feet, of which 3, 756, 463 feet was classified as exploratory drilling.

The Canadian Petroleum Association estimated proven reserves of crude oil in Canada at the end of 1953 to be 1, 845, 422, 000 barrels, an increase of 165, 913, 000 barrels over 1952. Of these, 1, 624, 496, 000 barrels were in Alberta and 182, 159, 000 in Saskatchewan.

Production of Crude Petroleum, 1952 and 1953
(In barrels of 35 Imperial gallons)

	1953		1952	
	Barrels	$	Barrels	$
Alberta				
Redwater	23,281,597		23,975,842	
Leduc-Woodbend	21,360,474		17,845,212	
Bonnie Glen	5,550,715		743,490	
Armena-Camrose	3,257,720		1,307,526	
Wizard Lake	3,095,287		1,696,077	
Acheson	2,497,850		2,016,855	
Turner Valley	2,404,967		2,655,007	
Golden Spike	2,167,636		1,279,103	
Fenn	1,412,996		343,766	
Joseph Lake	1,286,736		998,268	
Excelsior	1,060,555		933,644	
Lloydminster	1,059,552		1,057,354	
North Big Valley	980,561		74,446	
Westerose	930,073		98,115	
Big Valley	810,190		657,875	
Malmo	671,785		270,474	
West Drumheller	539,586		11,856	
Duhamel	535,986		347,140	
Stettler	438,041		607,078	
Glen Park	414,978		282,719	
New Norway	325,142		287,988	
Drumheller	278,862		175,688	
Clive	148,919		33,452	
Conrad	126,170		135,037	
Bon Accord	124,022		83,526	
Jumping Pound	96,033		67,257	
Other Fields and areas	1,959,950		930,928	
Total	76,816,383	193,761,644	58,915,723	139,512,432
Saskatchewan				
Lloydminster	845,390		698,513	
Coleville	767,045		279,943	
Lone Rock	548,221		547,073	
Success	124,001			
Wapella	96,614		4,804	
Fosterton	67,532		19,258	
Other fields and areas	349,085		146,914	
Total	2,797,888	3,833,107	1,696,505	2,256,352
Manitoba	653,514	1,714,806	104,826	229,299
Northwest Territories	316,689	257,251	314,217	379,160
Ontario	299,685	994,835	191,814	641,037
New Brunswick	14,738	20,633	14,237	19,932
Canada Total	80,898,897	200,582,276	61,237,322	143,038,212

Alberta

An estimated $280,000,000 was spent in 1953 on exploration and development as compared with $250,000,000 in 1952 and $200,000,000 in 1951. Drilling activity resulted in 884 new oil wells, 53 new gas wells, and 479 suspensions and abandonments. At the end of the year there were 118 drilling rigs in use. By December 1953, Alberta had 4,506 crude oil wells capable of being operated, 4,000 of which were in production.

Two new major oil fields, Sturgeon Lake and Pembina, were being developed. The Sturgeon Lake Devonian (Leduc) reef field, 175 miles northwest of Edmonton, was being opened up over a length of 20 miles. In the Pembina field, about 70 miles southwest of Edmonton, the discovery well (completed in June) is Canada's first commercial oil well to find production in the Cardium (Upper Cretaceous) sand, which was topped at 5,310 ft. By the end of 1953 a field at least eight miles long and four miles wide was indicated. The crude oil from both of these new fields has an A.P.I. gravity of 36° to 38°.

The Homeglen-Rimbey area, 65 miles south-southwest of Edmonton, in which large reserves of gas were discovered in 1953, was also indicated as a source of high gravity oil. This area is a 25-mile southward extension of the Leduc-Wizard Lake-Bonnie Glen-Westerose Devonian coral reef trend. Forty-one successful oil wells were completed in the 3-zone Drumheller field during the year. A number of other discoveries in formations of Devonian and Cretaceous ages were made throughout Alberta and development drilling was under way to establish field status.

At the end of 1953 there were 60 areas in Alberta officially defined as fields, an increase of 14 during the year. Redwater and Leduc-Woodbend fields continued as the main sources of oil production, the former accounting for 30 per cent of the total for the province and the latter 27 per cent, compared with 41 per cent and 30 per cent, respectively, in 1952.

Saskatchewan

Estimated expenditures on exploration, drilling, and pipe lines in the province in 1953 reached a record $51,337,000, an increase of $20,337,000 over the amount expended in the search for oil and gas in 1952. Exploration and development during the past two years, and particularly in 1953, have resulted in the discovery and development of 12 of the 19 important oil fields in the province and 20 of the 24 minor fields, and have opened up considerable reserves of medium and light crude oil.

The most important discovery in 1953 was made in the Smiley area, 18 miles northwest of Kindersley. The producing formation is the Viking (Cretaceous) sand which underlies much of Saskatchewan and holds large reserves of natural gas in the Brock and Coleville fields.

Areas Defined as Oil Fields in Alberta During 1953

Field	Geological Age of Producing Formation	Depth to Top of Producing Zone in Discovery Well	No. of Wells End of 1953(1)	1953 Production (bbls.)	A. P. I. Gravity
Battle	Cretaceous (Viking)	3231'	8 (8)	53,856	36°
Cessford	Upper Cretaceous (Basal Colorado)	2920'	20 (26)	85,903	25°
Chamberlain	Lower Cretaceous	3687'	3 (5)	29,323	26°
Chauvin	Lower Cretaceous (Colony)	1986'	26 (27)	90,747	21°
Erskine	Devonian (Leduc)	5327'	18 (19)	48,897	28°
Fairydell	Devonian (Nisku) Devonian (Leduc)	3765' 4006'	7 (7)	80,842	27°
Joffre	Cretaceous (Viking)	4880'	11 (11)	28,814	38°
Legal	Cretaceous (Viking)	2803'	7 (7)	68,687	30°
Morinville	Devonian (Wabamun)	3802'	1 (1)	5,028	34°
Oberlin	Lower Cretaceous (Basal Quartz)	4328'	1 (3)	237	68°
Peavey	Cretaceous (Viking)	2757'	6 (11)	46,795	30°
Samson	Lower Cretaceous (Basal Quartz) Devonian (Leduc)	4763' 5330'	3 (4)	14,914	28°
West Drumheller	Devonian (Nisku) Devonian ("Green Shale") Devonian (Leduc)	5510' 5585' 5645'	42 (44)	539,586	41°
Westerose	Devonian (Leduc)	6851'	14 (14)	930,073	41°

(1) Number of wells operating, followed by number of wells capable of production.

The discovery well entered the Viking sand at 2,309 ft. and revealed a 20-foot oil zone. The oil is 36° A.P I. gravity.

Oil well completions in 1953 numbered 669, a 40 per cent increase over 1952. Approximately one-half of the new oil wells tested as medium gravity producers, 40 per cent as heavy gravity, and 10 per cent as light gravity. At the end of the year, 32 drilling rigs and 20 geophysical crews were active and the number of wells capable of production had reached 792, although only 447 were producing. Saskatchewan's producing fields extended over an area in the southwestern part of the province outlined by the provincial boundaries and a line through the Lloydminster, North Battleford, and Swift Current areas. In addition there are the Wapella, Forget, and Midale producing fields in the southeast corner of the province.

The tabulation of the important oil fields of Saskatchewan summarizes development of the crude oil industry in this province to date. It does not include 24 minor fields from which production has been very small owing to lack of field development, recent date of discovery, or economic factors.

Manitoba

The oil-producing area centres about the town of Virden, 200 miles west of Winnipeg. Of the 89 completions during the year, 68 were classified as oil wells and 21 were abandoned, compared with 37 wells successfully completed and 32 abandoned in 1952.

Highlight of drilling activity in 1953 was the discovery and subsequent development of the Roselea field, one mile west of the town of Virden. The discovery well found oil of 35° A.P.I. gravity in a formation of Mississippian age at a depth of 2,082 feet. Wells in this field are being completed with high-flowing capacities, in contrast to the low-potential pumping wells previously found in the province.

The new wells in the Roselea field accounted for 56,483 barrels of the province's 1953 output of 648,930 barrels, the remainder coming largely from the Daly field, 10 miles west of Virden. The Daly field had 78 oil wells capable of production at the end of 1953, the Roselea eight, and three wildcat wells were on production.

British Columbia

There has been no commercial production of crude oil in the province to date. Chief attention is being given to the development of natural gas reserves in the Fort St. John group of fields in the Peace River area, where gas has been found in eight separate pay zones in formations of Lower Cretaceous, Triassic, and Permo-Pennsylvanian ages. Four of these zones have significant oil showings.

Altogether, 31,426,332 acres were held under oil and gas permit, licence, or lease in northeastern British Columbia at the end

of 1953 and eight drilling rigs were in operation.

Northwest Territories

Ten wells were drilled in the Northwest Territories compared with 16 wells and test holes in 1952. Drilling during the past three years has been done in the Great Slave Lake region in or near the area bounded by the Mackenzie, Liard, and Hay Rivers and the Alberta border.

The crude oil production comes from the Norman Wells field. A refinery at Norman Wells makes petroleum products for Yellowknife, Port Radium, and the settlements along the Mackenzie River and Arctic Coast.

Ontario

All productive oil and gas fields are in southwestern Ontario. In all, 399 wells were drilled, of which 328 were development wells and 71 were exploratory tests. Development drilling resulted in 146 gas wells, 80 oil wells, and 102 dry holes, and exploratory tests in four gas wells, one oil well, and 66 dry holes. Three wells drilled to a depth of about 1,500 feet in Warwick township, Lambton county, gave the highest oil yield of all new wells in Ontario in 1953, namely 200 barrels a day, and two of them measured the highest gas volumes, 20,000 M cu. ft. a day on open flow. The Warwick township drilling resulted in the only new oil pool discovery in 1953. Sixty-nine of the 81 oil wells completed are in Aldboro township of Elgin county.

Southwestern Ontario had 2,095 oil wells and 3,534 gas wells at the end of 1953.

Quebec

Drilling was carried out at six well sites in Galt, Douglas, and Holland townships on the Gaspé peninsula in 1953.

Maritime Provinces and Newfoundland

Although certain areas were held under exploration permit in New Brunswick, Nova Scotia, and Newfoundland, no drilling was carried out in 1953.

PIPE LINE TRANSPORTATION

At the end of 1953, a total of 3,794 miles of crude oil trunk lines, gathering lines, and oil products lines, were in use in Canada This does not include the 960-mile section of the Interprovincial system in the United States, which carries Canadian crude oil only.

Trans Mountain Oil Pipe Line Company. Construction of the 718-mile, 24-inch Trans Mountain pipe line from Edmonton to Vancouver, which

Important Oil Fields In Saskatchewan

Field or Pool	Date of Discovery Well	Geological Age of Producing Formation	Average Depth	No. of Wells[1]	Gravity A. P. I.
Buffalo Coulee	Aug. 1952	Mississippian	2700	2 (27)	13
Cantuar	July, 1952	Lower Cretaceous Jurassic	3100) 3300)	0 (6)	12 23
Coleville	Sept., 1951	Mississippian	2700	87 (107)	14
Dollard	Sept., 1953	Jurassic	4600	6 (6)	23
Eastend	Sept., 1952	Jurassic	4700	0 (6)	21
Fosterton	Jan., 1952	Lower Cretaceous-Jurassic	3100	8 (12)	24
Gull Lake	Dec., 1952	Jurassic Lower Cretaceous	4000) 3575)	15 (20)	22. 7 23. 4
Gull Lake	June, 1953	Jurassic	3875)		22. 6
Lloydminster	Nov., 1944	Lower Cretaceous	1900	153 (190)	8-16
Lone Rock	Nov., 1946	Lower Cretaceous	1875	113 (131)	5-8
Maidstone-Sparky Pool	Mar., 1949	Lower Cretaceous	1550	3 (6)	12-13
Marsden	Oct., 1948	Lower Cretaceous	1800	9 (13)	8-15
Midale	May, 1953	Mississippian	4600	3 (7)	27
McLaren-Sparky Pool	June, 1948	Lower Cretaceous	1660	4 (25)	8-15
North Premier	Jan., 1953	Lower Cretaceous Jurassic	3300 3500	0 (7)	24 23
Rapdan	Feb., 1953	Jurassic	4600	0 (3)	23
Smiley	Sept., 1953	Cretaceous (Viking)	2300	17 (38)	36
Success	Aug., 1952	Lower Cretaceous-Jurassic	3200	16 (25)	22. 6
Wapella	Oct., 1952	Lower Cretaceous	2300)	16 (18)	26
Wapella	Dec., 1952	Jurassic	2400)		26-27
Waseca-Sparky Pool	Aug., 1949	Lower Cretaceous	1670	1 (8)	8-15

(1) Number of wells operating, followed by number of wells capable of production at the end of 1953.

was started in February, 1952, was completed in October, 1953, at a cost of $93,000,000. The laying of this pipe line across the mountainous Cordillera Region is considered to be one of the greatest achievements in pipe line construction.

The line has an initial capacity of 120,000 barrels a day although only 35,000 barrels a day was being moved at the end of 1953. The Edmonton terminal has a storage capacity of about 1,500,000 barrels and receives oil via five pipe lines from most of the principal oil fields of Alberta. The Burnaby storage facilities near Vancouver have a capacity of 1,200,000 barrels. The cost of transporting oil from Edmonton to Vancouver is 45 cents a barrel.

Interprovincial Pipe Line Company. Completion of the 643-mile, 30-inch extension from Superior, Wisconsin, to Sarnia, Ontario, which was built at a cost of $72,000,000, now permits year-round movement of crude oil to Sarnia refineries. The pipe line has a capacity of 200,000 barrels a day out of Edmonton. The cost of transporting oil from Edmonton to Sarnia is 64 cents a barrel.

Oil Products Pipe Lines

Canada's oil products pipe line system was also expanded during 1953. Construction of the 210-mile, 8-inch line of Sun-Canadian Pipe Line Company Limited between Sarnia and Toronto was carried out and the line was in operation at an initial capacity of 17,500 barrels daily at the end of 1953. The ultimate capacity will be 35,000 barrels daily. Trans Northern Pipe Line Company's 397-mile, 10-inch line from Montreal to Toronto, with a 42-mile, 8-inch lateral from Farrows Point to Ottawa, was increased in capacity by 14,000 barrels daily to 54,000 barrels daily by installation of a booster station.

PETROLEUM PROCESSING

There were 41 refineries in Canada at the end of 1953. Three new refineries were completed in 1953, and one plant neared completion. At Sarnia, Ontario, Sun Oil Company Limited commenced petroleum refining operations in its new plant of 15,000 barrels throughput capacity. In Saskatchewan, Royalite Products Limited with a refinery capacity of 5,000 barrels a day commenced production of most of the petroleum products at its new refinery at Coleville, and Petroleum Fuels Limited started manufacture of naphtha specialties and heavy fuel oils at its new 1,000 barrels a day plant at Moose Jaw. British Columbia was second only to Ontario in refinery expansion in 1953. Enlargement of Vancouver refineries and completion early in 1954 of the new Royalite Products Limited plant at Kamloops, with a capacity of 5,000 barrels a day, raised the province's crude oil throughput capacity from 28,350 barrels to 50,850 barrels a day. One small refinery at Calgary, Alberta, and a dehydration plant at Borradaile, Alberta, were shut down in 1953.

The use of petroleum and natural gas as raw materials for chemical synthesis is increasing rapidly in Canada and during 1953 several new petrochemical plants were put into operation. In Ontario and Quebec the petrochemical industry is closely related to the petroleum refining industry and in 1953 important additions to Canada's petrochemical industry were made with the opening of the plants of B. A. - Shawinigan Limited and Shell Oil Company of Canada Limited at Montreal, Quebec, and the plant of Cabot Carbon of Canada Limited at Sarnia, Ontario.

MARKETS FOR CRUDE OIL AND PETROLEUM PRODUCTS

In 1953, domestic production of crude oil was almost 44 per cent of the total domestic demand for all oils.

The following table shows the supply and demand for crude oil and all petroleum products in 1953, with comparative figures for 1952:

Supply and Estimated Demand of all Oils
(in Barrels of 35 Imperial Gallons)

	1953	1952
New Supply		
Domestic production		
Crude petroleum	80,898,897	61,237,322
Daily average	221,640	167,315
Natural gasoline	593,119	579,873
Total production	81,492,016	61,817,195
Imports		
Crude petroleum	79,477,823	81,199,635
Petroleum tops	2,149,648	1,551,526
Natural gasoline	788,862	676,571
Refined petroleum products	33,866,020	32,667,166
Total imports	116,282,353	116,094,898
Total new supply, all oils	197,774,369	177,912,093
Daily average	541,848	486,099
Change in stocks, all oils	+9,487,246	+7,199,565
Demand		
Total demand	188,287,123	170,712,528
Daily average	515,855	466,428
Exports		
Crude petroleum	2,507,314	1,424,456
Refined products	352,413	1,213,344
Domestic demand for all refined petroleum products	185,427,396	168,074,728
Stocks (end of year)		
Crude petroleum	21,526,218	16,200,110
Natural gasoline	5,702	6,391
Refined petroleum products(1)	35,495,543	31,592,468
Unfinished products	4,135,751	3,876,999
Total	61,163,214	51,675,968

(1) Includes (a) refinery inventories of all petroleum products,
(b) marketing inventories of liquid petroleum fuels.

The following table shows the regional nature of the refinery market for domestic crude oil in 1953 as compared with several previous years.

Percentages of Domestic Crude Oil Received by Refineries

	1953	1952	1951	1950	1947
Maritimes and Quebec	0	0	0	0	0
Ontario	68	59.5	46.5	1	0.5
Manitoba	100	99.5	98	90	55
Saskatchewan	100	100	100	99.5	9.5
Alberta	100	100	100	100	80.5
British Columbia	31	6.5	0	0	0
Northwest Territories	100	100	100	100	100
Canada	47	41.5	36	24.5	8.5

PRICES AND TARIFFS

Light gravity crude oil prices were raised 26 cents a barrel in July and Alberta field prices moved into the range of $2.37 to $3.73, with Leduc and Redwater prices being $2.745 and $2.645 a barrel, respectively. Lloydminster field type of "heavy" crude oils are in the general price range of $1.40 a barrel for oils testing 10° A.P.I. gravity or under to $1.52 for those testing 19.9° or higher. In Manitoba, crude oil of comparable gravity to Redwater crude is priced at $2.70 a barrel.

There is no Canadian tariff on crude oil imports. The United States tariff on Canadian crude oil exports is 5 1/4 cents a barrel on oil testing under 25° A.P.I. gravity and 10 1/2 cents a barrel on oil testing at or above that gravity.