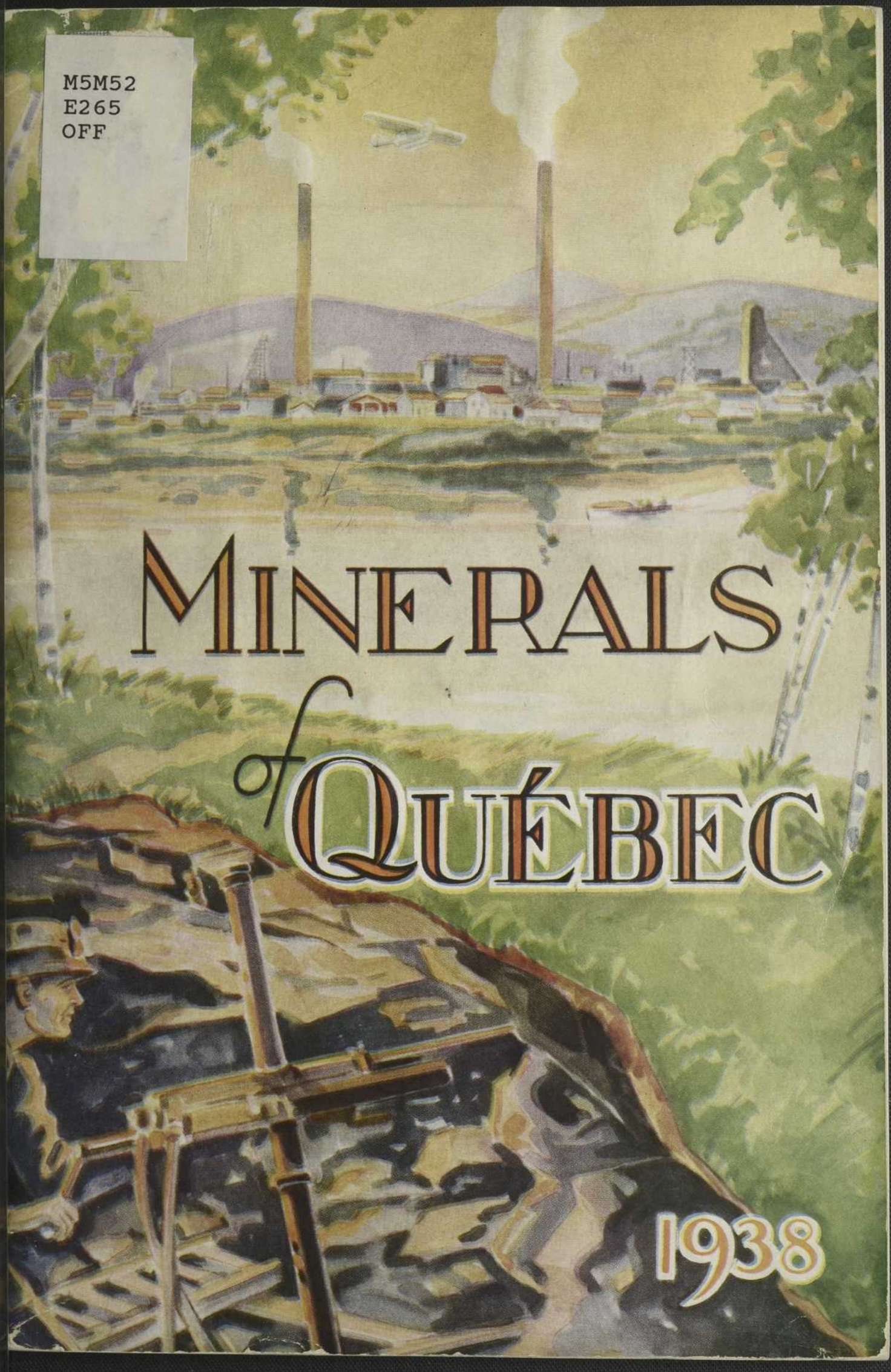
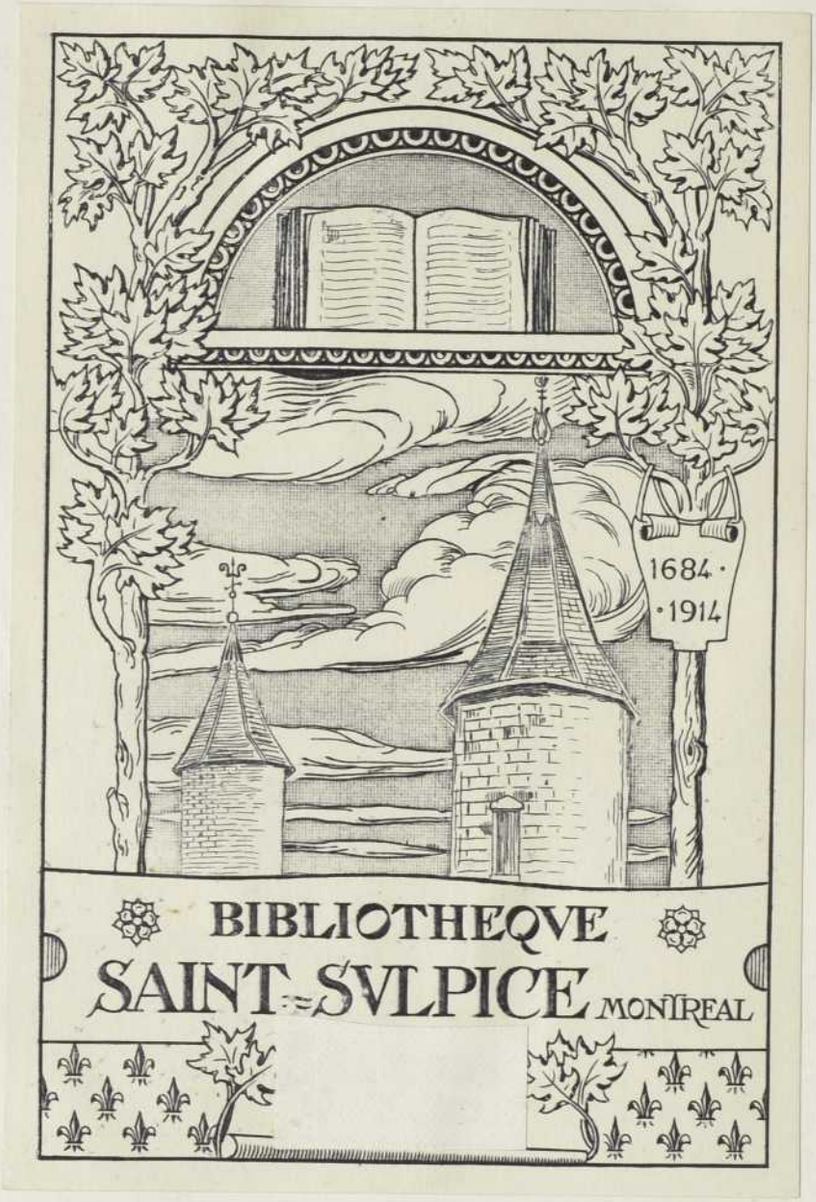


MINERALS of QUÉBEC

1938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THE ECONOMIC MINERALS OF THE PROVINCE OF QUÉBEC

Department of Mines and Fisheries
Québec
February 1938

Printed in Canada

Province of Québec

Department of Mines and Fisheries

Hon. Onésime Gagnon, Minister — L. A. Richard, Deputy Minister

Bureau of Mines

A. O. Dufresne, Director

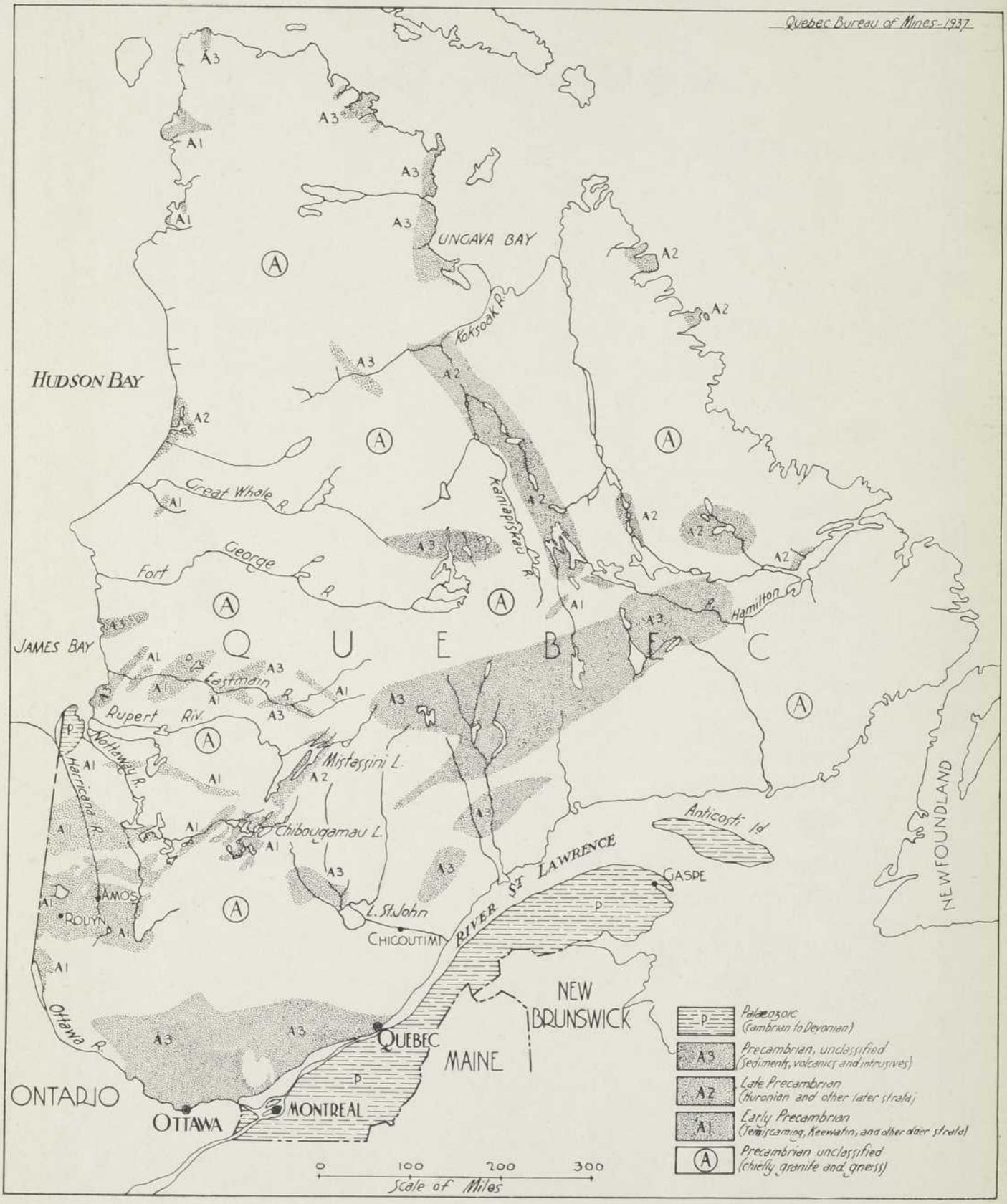
THE ECONOMIC MINERALS of the Province of QUÉBEC

Compiled by

The Technical Staff of the Bureau of Mines

CONTENTS

CONTENTS (continued)



Geological sketch-map of the Province of Québec.

PREFACE

This booklet is designed to offer, in a condensed form, some account of the known deposits of economic minerals in the Province, and of the mining and metallurgical industries based on them.

The tremendous expansion of our mining industry during the past fifteen years has drawn worldwide attention to the fact that we have, within the Province, vast potential mineral resources. The construction of new roads and railways in the recently developed mining areas, together with important improvements in our mines' legislation and in the Government's services to the industry, have greatly encouraged prospecting, exploration, and the development of new mines.

We hope that this booklet will serve its purpose of furnishing to those interested a broad view of the possibilities of our mineral industry. More detailed information respecting any mineral, or product, in which they may be particularly interested may be obtained by writing to the Director, Bureau of Mines, Québec. The information and statistics given here were compiled from official sources, federal and provincial. A large number of the illustrations have been furnished by mining and metallurgical companies, for all of which grateful acknowledgment is here made.

ONÉSIME GAGNON
Minister of Mines and Fisheries

Department of Mines and Fisheries,
Québec, Canada.
February 1, 1938.

ILLUSTRATIONS

ECONOMIC MINERALS
OF THE
PROVINCE OF QUEBEC

INTRODUCTION

The Province of Quebec is by far the largest of the provincial subdivisions of the Dominion of Canada. Its extreme measurements are 1,250 miles from north to south and 950 miles from east to west; its total area is only slightly less than 600,000 square miles. The Province is thus more than six times the size of Great Britain; but the population of England, Scotland, and Wales is almost sixteen times that of the Province of Quebec.

The history of mining in the Province of Quebec extends over a period of at least two hundred years. As early as the year 1733, a furnace for smelting the bog iron ores of the district was established at Saint-Maurice, near Trois-Rivières, and castings and wrought iron of excellent quality were produced from these ores until 1910. Even today there is each year an appreciable output of natural iron oxides from the same sources, for use in the manufacture of mineral pigments and for other purposes. As time went on, discoveries were made, at various points, of deposits of other minerals of economic value, but for the most part search for these was confined to the more thickly settled sections of the Province. As a consequence, until the year 1927 almost the entire mineral production was derived from deposits in the southern strip of the Province that forms the basins of the Saint-Lawrence and Ottawa rivers. Also, the great bulk of the production was of non-metallic minerals and building materials, the main items being asbestos, mica, feldspar, and magnesitic-dolomite, and limestone, marble, granite, sandstone, and clay products. In 1923 and following years, however, spectacular discoveries of gold and copper deposits were made in Western Quebec, in the territory served by the Transcontinental line of the Canadian National Railways. Prospectors in large numbers flocked to the district, mines were developed and brought to production, and in a very short time a metal mining industry was firmly established in that hitherto undeveloped country. As a result, the value of our production of metals — chiefly gold and copper — rose from $1,897,528

10 THEN

Means of communication and transportation in early days of mining industry in Western Quebec.

NOW *One of the new Provincial Highways in the mining district of Western Quebec* (1937).

TABLE I. — ANNUAL VALUE OF MINERAL PRODUCTION SINCE 1898

Year	Value	Year	Value
1898	$1,673,337	1918	$18,707,762
1899	2,083,272	1919	20,813,670
1900	2,546,076	1920	28,392,939
1901	2,987,731	1921	15,522,988
1902	2,985,463	1922	18,335,153
1903	2,772,762	1923	21,326,314
1904	3,023,568	1924	18,952,896
1905	3,750,300	1925	23,824,912
1906	5,019,932	1926	25,740,002
1907	5,391,368	1927	29,124,110
1908	5,458,598	1928	37,325,287
1909	5,552,062	1929	46,454,820
1910	7,323,281	1930	41,158,740
1911	8,679,786	1931	36,051,366
1912	11,187,110	1932	25,683,066
1913	13,119,811	1933	28,164,540
1914	11,732,738	1934	31,310,752
1915	11,765,873	1935	39,141,734
1916	13,287,024	1936	49,755,985
1917	16,189,179	1937	60,500,000(x)

(x) Estimated from partial returns.

in 1926 to a record figure of $30,643,787 in 1936. Complete statistics of metal production for 1937 are not yet available, but returns received to date from operators show that the year just closed has again set a new mark, with an output having a value tentatively estimated at $36,500,000.

The accompanying Table I, giving the value of the mineral production of the Province for each year since 1898, illustrates in a striking manner the remarkable expansion of our mining industry during the past forty years, from a value, in round figures, of $1,700,000 in 1898 to $60,500,000 in 1937. Except for minor set-backs due to conditions outside the control of the industry, progress has been steady and continuous. Such exceptional years were during, and a few years following the close of, the World War, and the period of world-wide economic depression which commenced late in 1929. Fortunately, however, our newly discovered gold and copper mines in Western Quebec were already coming into production before the business crisis set in, and our rapidly growing output of copper and gold, together with the rise in price of the latter metal which came a year or two later, largely compensated the inevitable decrease in production of non-metallic minerals and building materials, for which there was little demand. During these years, also, many new mines were developed as a result of successful prospecting. In 1933, the total value of our mineral production again began to climb, and in 1936 it was more than 7 per cent above the record established in 1929.

Installing telephone and telegraph facilities along the new Provincial Government winter road to Chibougamau.

New Provincial Government winter road to Chibougamau mining district (1937).

TABLE II. — SUBDIVISION OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC FOR THE YEARS 1926 – 1937

Year	Metallics	%	Non-Metallics	%	Building Materials	%	Total
1926	$ 1,897,528	8	$10,837,545	42	$13,004,929	50	$25,740,002
1927	2,412,268	8	11,328,885	39	15,382,957	53	29,124,110
1928	8,127,152	22	12,058,974	32	17,139,161	46	37,325,287
1929	13,671,009	29	14,249,646	31	18,534,165	40	46,454,820
1930	13,926,682	35	9,322,151	22	17,909,907	43	41,158,740
1931	12,367,932	34	5,516,899	15	18,166,535	51	36,051,366
1932	13,914,089	54	3,671,634	14	8,097,343	32	25,683,066
1933	16,360,011	58	6,043,308	22	5,761,221	20	28,164,540
1934	19,258,094	61	6,579,453	21	5,473,205	18	31,310,752
1935	23,804,792	61	8,824,178	22	6,512,764	17	39,141,734
1936	30,643,787	62	12,388,178	25	6,724,020	13	49,755,985
1937	36,500,000	61	16,000,000	26	8,000,000	13	60,500,000(x)

(x) Estimated from partial returns.

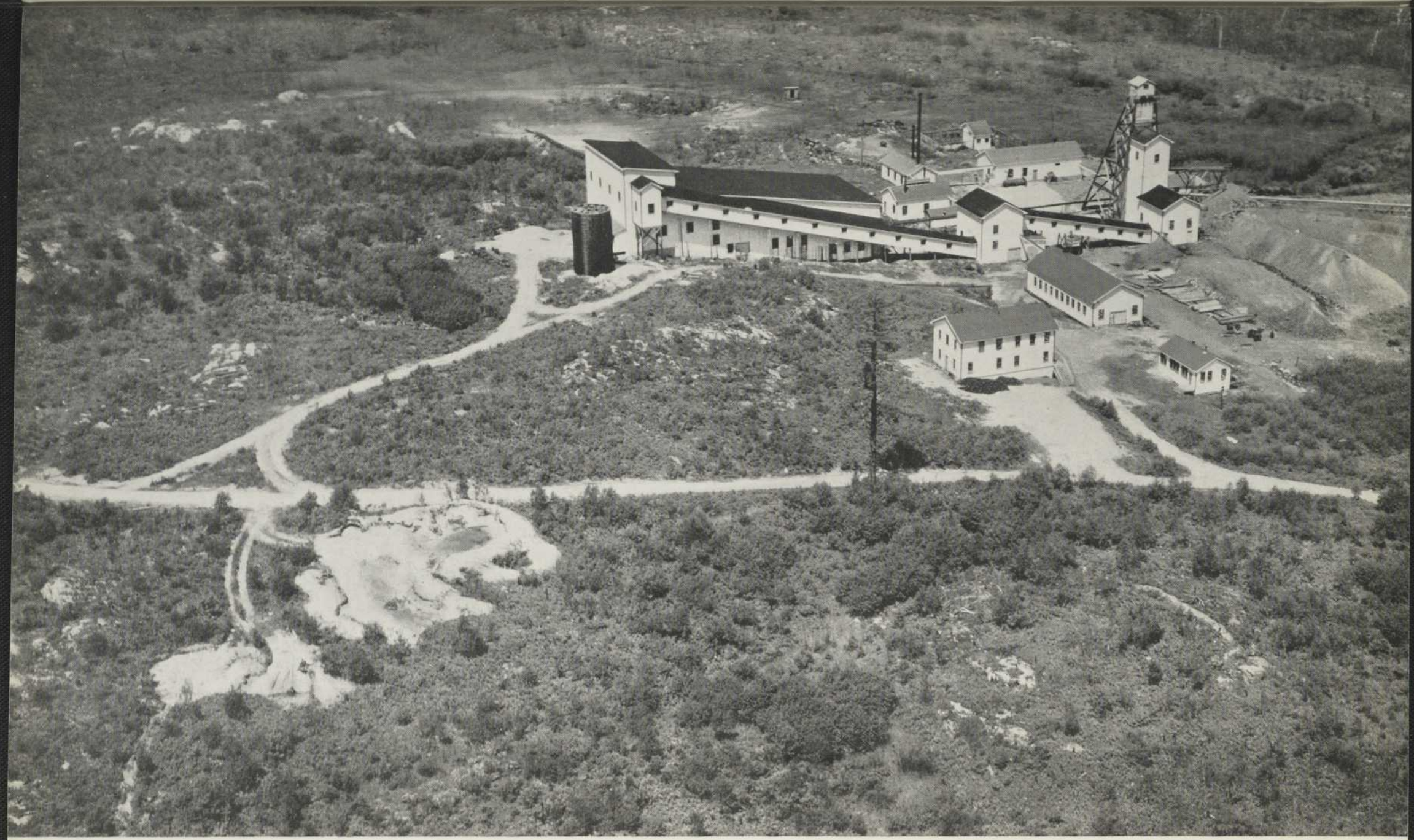
Table II shows how completely the trend of our mining industry has been changed by the new developments in Western Quebec. "Metallics", which contributed only 8 per cent to the total value of our production in 1926 and 1927, accounted, in 1936, for 62 per cent of the total.

The accompanying geological sketch-map shows in a general way the nature and distribution of the rocks underlying the Province of Quebec. It will be noted that Palaeozoic rocks occupy only a small portion of the total area, forming a strip less than 75 miles wide by 500 miles long, lying almost entirely to the south of the Saint-Lawrence and Ottawa rivers. North of this strip to Hudson strait, and from the western to the eastern limits of the Province, the rocks are exclusively of Precambrian age. These ancient rocks, forming a part of the Canadian Shield — the nucleus of the continent of North America — underlie some 500,000 square miles in the Province of Quebec, or more than 90 per cent of the total area. They include highly metamorphosed volcanic and sedimentary rocks as well as intrusive rocks of various ages.

It is within these Precambrian rocks of the Canadian Shield that some of the greatest and most valuable known mineral deposits of Canada occur, as, for example, the gold and silver deposits of northern Ontario, the immense nickel-copper ore-bodies of the Sudbury district, also in Ontario, and the gold - copper - zinc deposits of Manitoba and Saskatchewan. There is ample evidence to indicate that the portion of the Shield within the Province of Quebec is equally rich in valuable minerals, and that the gold-copper and gold-quartz mines of the Rouyn-Bell River district of western Quebec, developed during the past decade, are but the first-fruits of what may reasonably be expected from more intensive and more widespread prospecting of our vast Precambrian area.

18 THEN *Aldermac Mines, Limited (Beauchastel township, Témiscamingue county). Erecting the first camps and machine shop in 1928.*

18 THEN Aldermac Mines, Limited (Beauchastel township, Témiscamingue county). Erecting the first camps and machine shop in 1928.



(Courtesy Airmaps, Limited)

19 NOW *Aldermac Copper Corporation, Limited (formerly Aldermac Mines, Limited), Beauchastel township, Témiscamingue county.*
An up-to-date milling plant.

Prospecting activity in Western Quebec first began to assume importance in 1922, when some 2,000 miners' certificates were issued by the Bureau of Mines and more than 1,000 claims were recorded, both figures being four-fold increases over the previous year. Every year since then, new discoveries have been made, particularly of gold-quartz deposits, and new mines have been developed. As a consequence, more and more prospectors have been attracted to the district, and their field of activity has continually widened. By the fiscal year 1927-28, the number of certificates issued had risen to 4,090 and claims recorded totalled 13,707. Then, following some minor fluctuations in the totals from year to year, a steady increase again set in, commencing with 1934-35, and for the fiscal year 1936-37 the figures far surpassed any previous record, with 7,099 certificates issued and 23,823 claims recorded.

Comparison of Tables II and III brings out the interesting fact that there has been a close correspondence between prospecting activity and metal production, the tendency being for years in which there was a decrease in number of certificates issued and claims recorded to be followed by years of decreased metal production, and *vice versa*.

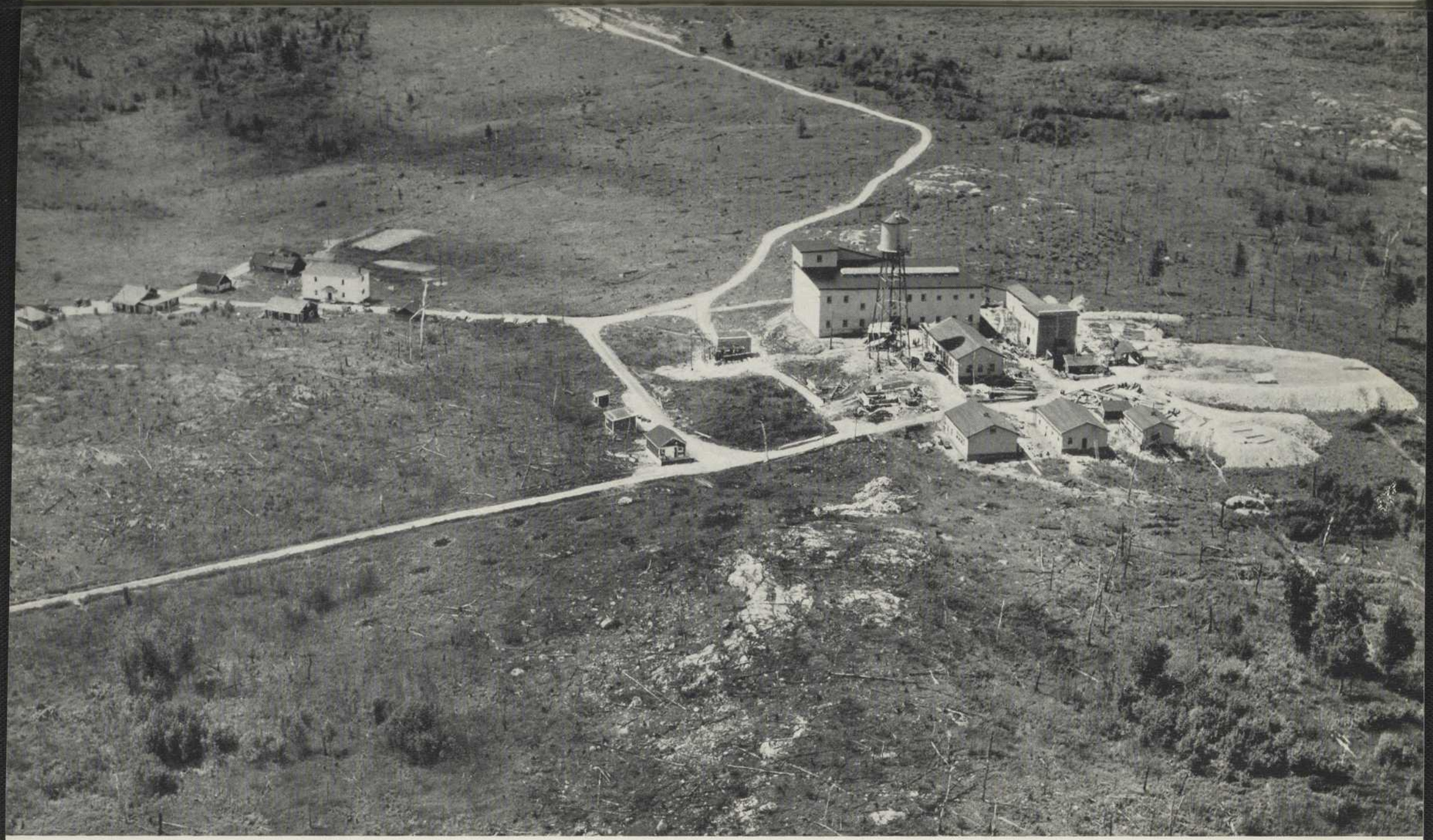
Table IV gives details, both as regards quantity and value, of the mineral production of the Province during the calendar year 1936, together with the comparative value figures for 1935.

TABLE III. — MINERS' CERTIFICATES ISSUED AND CLAIMS RECORDED IN FISCAL YEARS 1920 – 21 TO 1936 - 37

Fiscal Year	Miners' Certif. Issued	Claims Recorded	Fiscal Year	Miners' Certif. Issued	Claims Recorded	Fiscal Year	Miners' Certif. Issued	Claims Recorded
1920–21	493	335	1926–27	3,799	12,686	1932–33	3,178	11,211
1921–22	509	321	1927–28	4,090	13,707	1933–34	3,022	10,915
1922–23	1,973	1,183	1928–29	3,086	9,544	1934–35	3,395	11,397
1923–24	1,928	1,750	1929–30	2,500	8,245	1935–36	4,043	12,770
1924–25	2,339	5,143	1930–31	1,981	6,034	1936–37	7,099	23,823
1925–26	3,315	9,407	1931–32	2,324	8,108			

THEN

Arntfield Gold Mines, Limited (Beauchastel township, Témiscamingue county). Sinking the first shaft (1933).



(Courtesy Airmaps, Limited)

23 NOW *Arntfield Gold Mines, Limited (Beauchastel township, Témiscamingue county). Aerial view of the mill now in operation.*

TABLE IV. — MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC DURING 1936

Substance	Quantity	Value in 1936	Value in 1935
METALLICS		$	$
Chrome, tons	545	8,508	5,371
Copper, lb	66,340,175	6,287,058	6,162,350
Gold, oz	666,905	23,361,682 (1)	16,558,478 (1)
Lead, lb	2,047,689	80,126	64,156
Selenium, lb	168,417	298,098	396,328
Silver, oz	724,339	326,872	433,338
Tellurium, lb	19,502	34,519	3,416
Titaniferous iron ore, tons	2,566	18,318	16,400
Zinc, lb	6,896,123	228,606	164,955
Sub-totals	.....	$30,643,787	$23,804,792
NON-METALLICS			
Asbestos, tons	301,287	9,958,183	7,054,614
Feldspar, tons	8,115	75,703	63,075
Graphite	.....	.....	1,281
Industrial lime, tons	121,654	630,436	587,680
Industrial limestone, tons	135,554	149,909	144,236
Kaolin	.....	.....	1,520
Magnesitic dolomite	.....	768,742	486,084
Marl, tons	27,186	10,874	12,325
Mica, lb	544,214	63,123	74,894
Mineral water, gals	131,186	17,399	15,113
Ochre and iron oxide, tons	5,458	65,630	75,388
Peat, tons	295	7,106	2,958
Phosphate, tons	525	4,927	1,043
Pyrite, tons	86,919	282,743	47,779
Quartz and industrial sand, tons	78,975	320,634	224,135
Talc and soapstone	.....	32,769	32,053
Sub-totals	.....	$12,388,178	$ 8,824,178
BUILDING MATERIALS			
Building lime, tons	11,404	87,341	88,981
Building limestone, tons	1,114,275	915,475	943,145
Cement, barrels	2,093,130	2,945,074	2,472,008
Clay products :			
Brick, M	33,582	516,248	439,143
Other products	.....	175,517	152,499
Granite, tons	137,910	429,281	800,685
Marble, tons	6,091	120,582	31,071
Sand and gravel, tons	5,490,280	1,418,231	1,442,468
Sand-lime brick, M	1,267	13,029	19,226
Sandstone, tons	92,094	102,056	121,864
Slate and shale, tons	937	1,186	1,674
Sub-totals	.....	$ 6,724,020	$ 6,512,764
TOTALS	.....	$49,755,985	$39,141,734

(1) Value in Canadian funds.

In brief, the present situation of the mining industry in the Province of Quebec is as follows :

(1) The value of the total production is about $60,000,000 yearly.

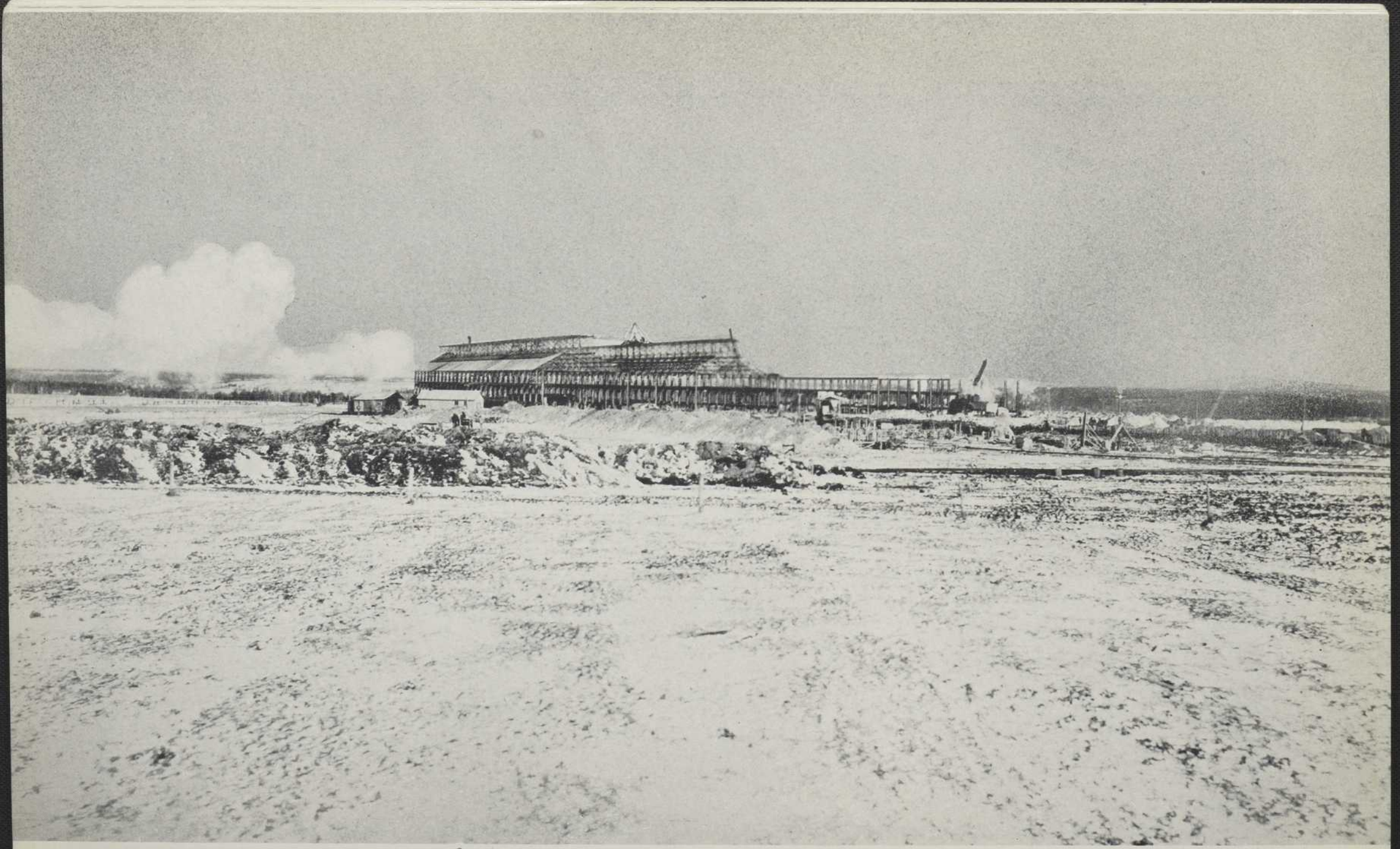
(2) Approximately two-thirds of the production (in value) is represented by metallics, of which gold and copper are the most important.

(3) Asbestos is our most important non-metallic product, with a value in 1937 of about $12,000,000 and a record value of $14,750,000 in 1920. Non-metallics as a group account for 25 per cent of the value of the total production.

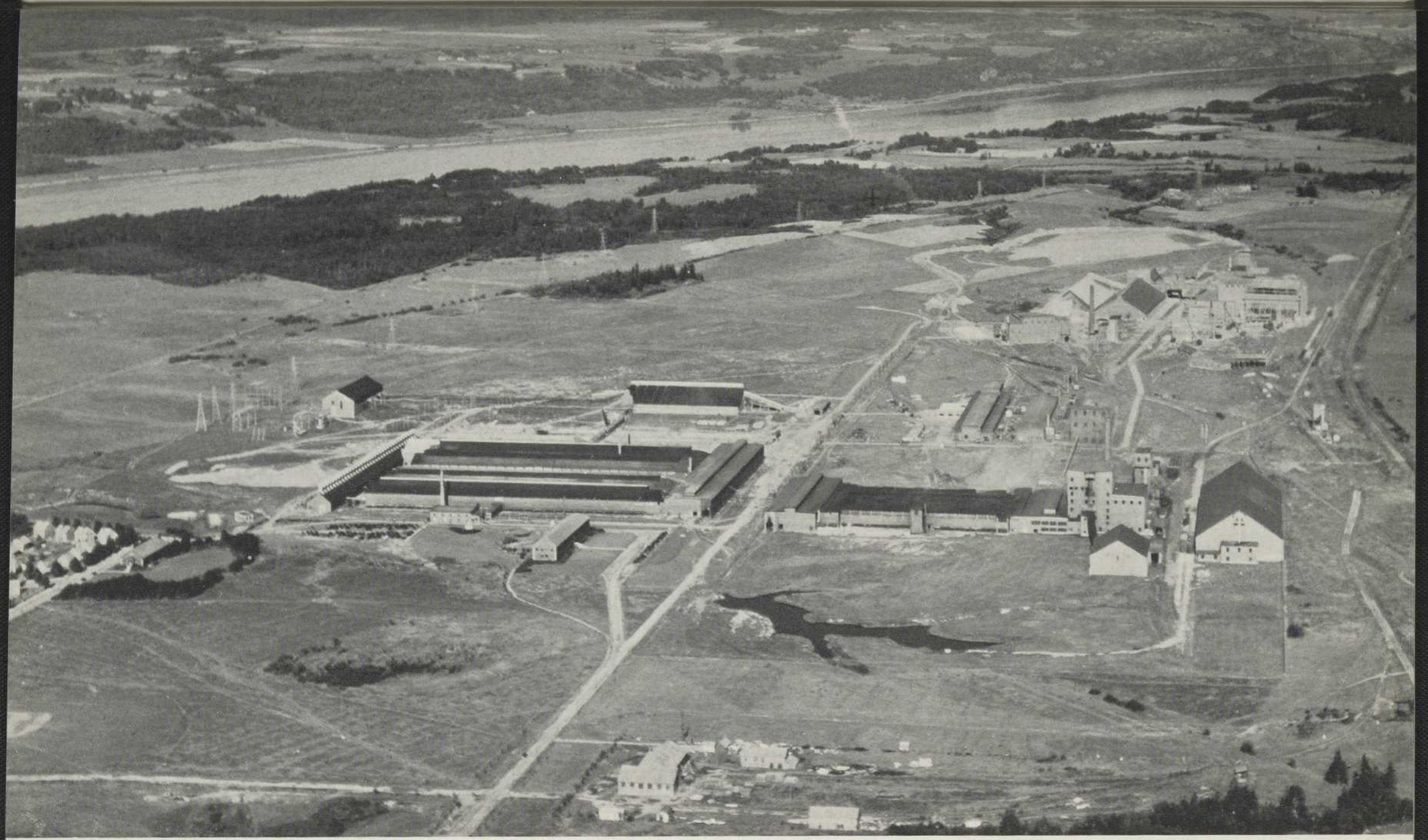
(4) Building materials contributed $8,000,000, or 13 per cent, to the 1937 total, as compared with an average of $17,500,000 for the years 1927 to 1931. Cement is the most important item, the 1936 output having a value of about $3,000,000.

(5) A considerable part of our mineral production each year comes from new metal mines, chiefly gold, that have been brought to production during the year. On the other hand, there are mines, some of them once active producers, containing deposits of copper, lead, or zinc ores, which are at present not worked because of the relatively low market prices of the metals. These mines are in a position to resume or commence production at any time that higher metal prices permit of profitable operation.

In the following pages, brief reviews are given relating to the various products of our mines. These are arranged, first, under the three principal sub-divisions of metallics, non-metallics, and building materials, and second, alphabetically under each subdivision. Preceding these reviews is a brief chronological sketch, showing successive stages in the progress of the industry.



26 THEN *The Aluminum Company of Canada, Limited (Arvida). Erecting steel for the first pot-rooms during the winter of 1925-26.*



NOW *The Aluminum Company of Canada, Limited (Arvida). The plant in 1936. Part of Arvida townsite is shown on the left.*

Means of transportation to Chibougamau mining district (1928).

BRIEF CHRONOLOGICAL SKETCH

The first steps toward the utilization of the mineral resources of the Province of Quebec date back to the beginning of settlement, under the French régime, when stone-quarries, especially limestone, were opened in the immediate vicinity of the site of the city of Quebec. The first lime-kiln was built about 1620. A little later, the intendant Talon turned his attention to the metallic resources of the Province and fostered the search for *iron ore* deposits. He sent for the Sieur de la Potardière, a French ironmaster, to open up the iron deposits of Baie-Saint-Paul, and of the Saint-Maurice district. These first attempts were unsuccessful, and it was not until 1733 that the first iron-furnaces, under the name of Les Forges de Saint-Maurice, were erected north of Trois-Rivières, by *Francheville et Compagnie*, using the bog-iron ores of the region and wood-charcoal. This industry was carried on, almost without interruption, until 1910.

The first discovery of *placer gold*, or of gold occurring in deposits of sands and gravels derived from the disintegration of gold-bearing rocks, was made in the basin of the Chaudière river, in Beauce county, in 1823, but it was only in 1835 that the working of these auriferous sands was begun. The most active period of this industry was between 1875 and 1885, during which, it is reported, gold to the value of some $2,000,000 was produced from Quebec placer deposits.

Before the middle of the 19th century, occurrences of *copper* ores had been reported at a number of localities in the section of the Province to the south of the Saint-Lawrence river which is known as the Eastern Townships, and in 1848 the Megantic Mining Company was organized to develop and mine a deposit in the township of Inverness. In rapid succession, other copper mines were opened in the district, and especially during the period of the Civil War in the United States (War of Secession, 1861 to 1865) when, as a consequence of the extraordinary demand for copper, the price of the metal soared as high as 55 cents per pound. The Eustis mine, near Sherbrooke, was opened in 1865 during this period of intense demand, and it is the only one of these copper ventures which has survived to the present day. It has been in operation almost continuously and still produces each year a very appreciable tonnage of copper ore and of iron pyrite (sulphur ore). It is not only the oldest, but also the deepest, of our operating metal mines. The hoisting shaft, inclined at about 40 degrees, has a length of 7,090 feet, and ore is now being mined on the 7,000-ft. level.

As early as 1829, deposits containing *apatite*, the crystalline phosphate of lime, were discovered in the adjacent valleys of the Gatineau and Lièvre rivers. These deposits were first exploited in 1875, following which, for a period of twenty years, apatite mining in the Province was very active, the material being used in the manufacture of fertilizers. Then, with the discovery and development of the large and much more cheaply mined rock-phosphate deposits of Florida and Tennessee, the Quebec industry rapidly declined. In recent years, production of apatite has been negligible.

Asbestos, one of the most arresting of minerals by reason of its occurrence in silk-like fibres, was observed as early as 1847 forming veins in the serpentine rocks of the Eastern Townships. These occurrences, however, appeared of mineralogical interest only, as at that time the industrial uses of asbestos were very limited. Then, in 1877, extensive deposits of the mineral were found in Thetford and Coleraine townships, Megantic county, and the economic possibilities of the discoveries became apparent. Development of the deposits was greatly facilitated by the building at that time of the Quebec Central railway, and the first shipments of fibre were made in 1879. From modest beginnings, an industry sprang up which soon assumed world-wide importance, and it may be said that the modern demand for asbestos products has been entirely created by the output from our mines, which still supply the bulk of the world's asbestos requirements.

Mica mining has been carried on in the Province for upwards of fifty years. Production has consisted almost entirely of phlogopite, known to the trade as "amber mica", from deposits within an area about twenty miles square immediately north of Ottawa. For many years, the value of the output was of the order of $300,000, but latterly production has been on a smaller scale as the Quebec mica has met increasingly keen competition in the world markets from Indian and Madagascar mica. Commercial deposits of muscovite, or "white mica", are known in various parts of the Province and from time to time there has been a small production from some of these.

In 1906, two prospectors, Olier and Renault, of Ville-Marie, made the first discovery of *lode gold* in Western Quebec, on the shore of lake Fortune, situated in what is now Beauchastel township, in Témiscamingue county. An attempt to develop the deposit was unsuccessful. The region, destined to become a very important gold mining centre, was very difficult of access at the time.

In 1910, deposits of *zinc* and *lead* ore were discovered in Montauban township, Portneuf county, within fifty miles of the city of Quebec. They were successfully developed and the Tétreault mine began shipping ore in 1913. Since then it has produced a considerable tonnage of a complex ore containing zinc, lead, gold, and silver.

In 1910, Western Quebec once more attracted the attention of prospectors, and there was quite a 'rush' of claim staking in the proposed townships of Bousquet, Joannès, and Cadillac, to the east of the original gold discovery of Olier and Renault. This interest was kept up for about two years. In 1911, the Transcontinental (now the Canadian National) railway was opened, giving easy access to the Harricana River basin, and in that year J. J. Sullivan discovered, on the east shore of Montigny lake, the gold deposit which is now successfully mined by Sullivan Consolidated Mines, Limited.

During the years 1914 to 1919, when "war metals" were in great demand and commanded very high prices, the gold deposits of Western Quebec were almost wholly neglected, in spite of the promising appearance of many of the discoveries and their favourable geological setting. At that time, however, and until about five years later, no very large base-metal mines had been developed in the Province, so that our mining industry was unable to benefit by the high metal prices prevailing. Our production consisted predominantly of non-metallic minerals and building materials. Thus, the average annual value of our production of *metals* between 1916 and 1926 was of the order of only $1,000,000, whereas that of our *non-metallics*, including building materials, was $20,000,000. It had taken nearly two centuries to reach these figures. Within the next few years, the whole aspect of the industry was changed.

In 1920, Edmund Horne, a prospector, staked several claims in Rouyn township, which adjoins, to the east, Beauchastel township, where, as already noted, gold had been discovered by Olier and Renault in 1906. Noranda Mines, Limited, acquired the Horne group of claims and actively developed them. In six years, Horne's discovery was transformed into one of Canada's leading mines. This success raised great interest in the region, and Quebec's metal-mining industry entered a new era of development and expansion.

Ten years after the development of the Horne mine, the Rouyn-Harricana district had twenty-one mines in production, yielding copper,

gold, silver, zinc, iron pyrite, selenium, and tellurium. Their output for 1936 had a value in excess of $30,000,000 and incomplete returns indicate a value of more than $36,000,000 for 1937.

The total value of the products of our mines and quarries in 1937 was of the order of $60,000,000. This is the highest value ever recorded; but the great wave of prospecting activity which is sweeping the Province, and the numerous discoveries of promise that continue to be made, warrant the expectation that the industry will continue to expand for many years to come.

METALS

Aluminium

Canada is one of the world's large producers of aluminium and her entire output comes from two plants in the Province of Quebec operated by the Aluminum Company of Canada, Limited — one at Arvida, on the Saguenay river about thirty-five miles east of lake Saint-Jean, and the other at Shawinigan Falls, on the Saint-Maurice river some twenty miles north of Trois-Rivières.

Aluminium is made by an electro-metallurgical process, the chief raw materials required being bauxite, the ore; cryolite, the flux; and petroleum-coke, used in making the electrodes. Neither bauxite nor cryolite occur in Canada, and sufficient supplies of petroleum-coke of the required characteristics are not obtainable in the Dominion. These materials, therefore, all have to be imported: bauxite from British Guiana, cryolite from Greenland, and petroleum-coke from Gulf of Mexico ports.

The main reason for the establishment of this important and successful metallurgical industry in the Province of Quebec is the abundant and cheap power available in the Saguenay and Saint-Maurice districts as the result of comparatively recent developments of large water powers. Cheap power is absolutely essential for the production of aluminium, since it requires electrical energy equivalent to that obtainable from sixteen tons of coal to make one ton of aluminium.

The Aluminum Company's smelter at Shawinigan Falls was placed in operation in 1901. Adjacent to the smelter is a plant for the production of aluminium rods, bars, wires, cables, and structural shapes.

The Arvida plant, one of the largest aluminium plants in the world, was erected in 1926, in the midst of what, at that time, was virgin forest. It includes smelter, ore-concentrating, carbon, and cryolite-refining plants; and, to take care of employees and their families, the model city of Arvida, comprising some ten square miles, has been laid out nearby. Ocean shipping facilities have been developed at Port Alfred on Ha! Ha! bay, twenty miles distant, where vessels of any draught can dock at any tide.

Less than two per cent of the production capacity of these plants is used in the Province of Quebec.

Antimony

Antimony minerals have been observed at several localities in the Province of Quebec, but, with one possible exception, the occurrences noted are too small to offer more than a mineralogical interest. The deposit referred to is in the township of Ham South. It was worked in a small way from time to time between 1863 and 1886, and altogether about 180 tons of antimony ore was produced.

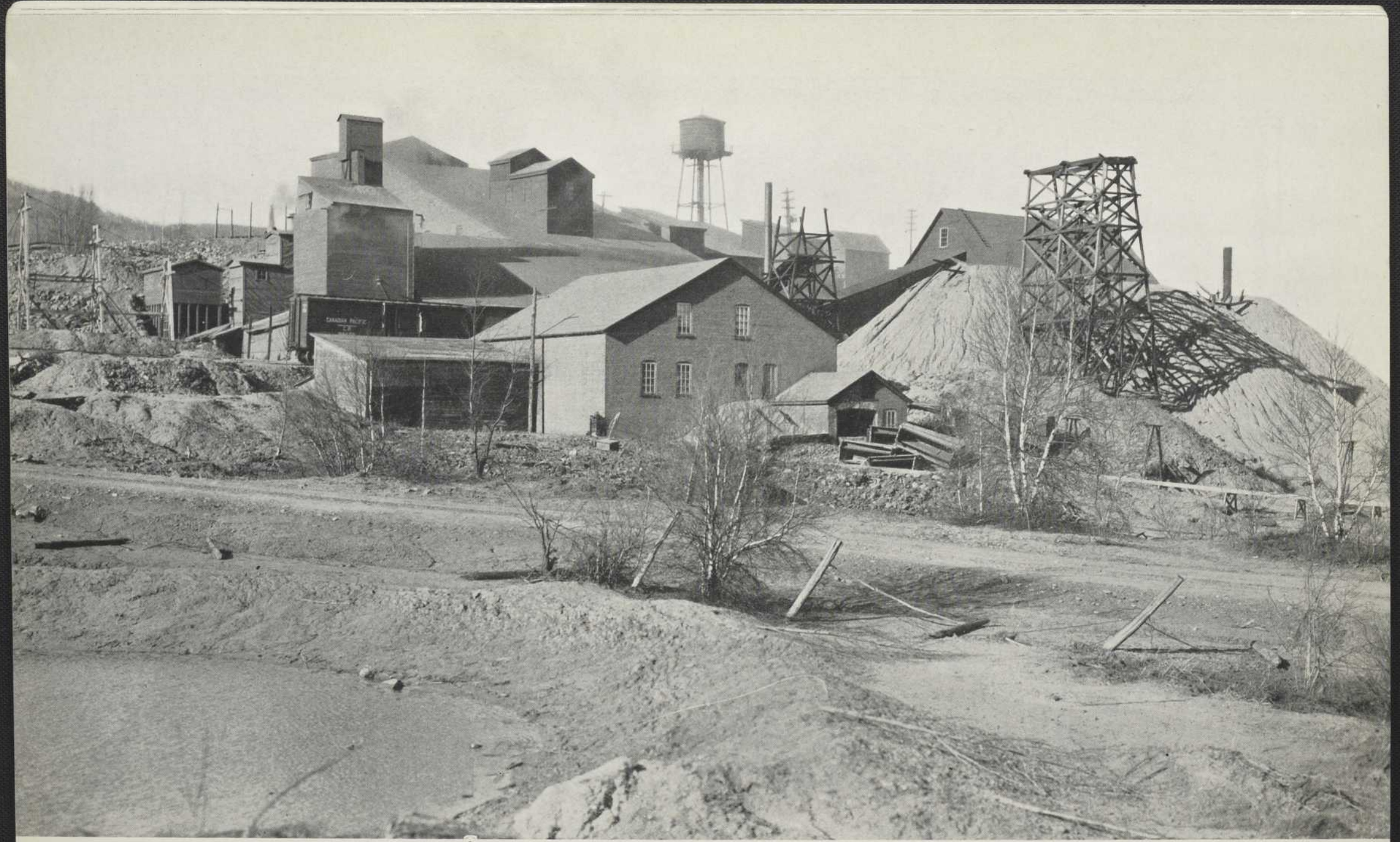
Occurrences of stibnite in quartz veins have been noted in the townships of New Richmond and Carleton, in Gaspé peninsula. They appear to be unimportant.

Arsenic

White arsenic (arsenious oxide) is being produced in Western Quebec as a by-product at the roasting plants of O'Brien Gold Mines, Limited, and of Beattie Gold Mines, Limited, from the treatment of gold ores carrying arsenopyrite. These roasters were only recently erected, and so far the arsenic is being stocked at the plants awaiting an outlet. Consequently, white arsenic has not yet appeared in our tables of mineral production, as none has been marketed.

Bismuth

Native bismuth and bismuthinite have been found associated with molybdenite in deposits of the latter mineral in Preissac township, Abitibi county. Bismuthinite has also been noted near Jonquières, in the Lake Saint-Jean region, but the occurrence is not of commercial interest.



The Eustis mine of the Consolidated Copper & Sulphur Company, Limited (Ascot township, Sherbrooke county). This mine has been in operation since 1865 and is the oldest Canadian copper mine.

(Courtesy Associated Screen News, Limited)

Chromite or Chrome Iron Ore

There are workable deposits of chromite in Coleraine township, about 75 miles north of the city of Sherbrooke. These deposits occur in the rocks of the "serpentine belt" of southeastern Quebec.

During the period 1894 to 1908, the mining of chromite was very active in Coleraine. Following the discovery and development of very extensive deposits of the mineral in other countries, however, particularly in Southern Rhodesia, the Quebec industry declined rapidly and in 1912 and 1913 all the mines were closed down. The need for "war minerals" in the following years brought new life to the industry, and the production in 1918 amounted to 36,181 tons; but the armistice ushered in another gradual decrease in production and by 1925 all the chrome mines of the Province were again idle. However, in the course of the past few years, an increasing demand for chromite has re-awakened interest in these deposits and for each of the years 1934 to 1936 a small production was reported. That for 1936 was 545 tons, valued at $8,508.

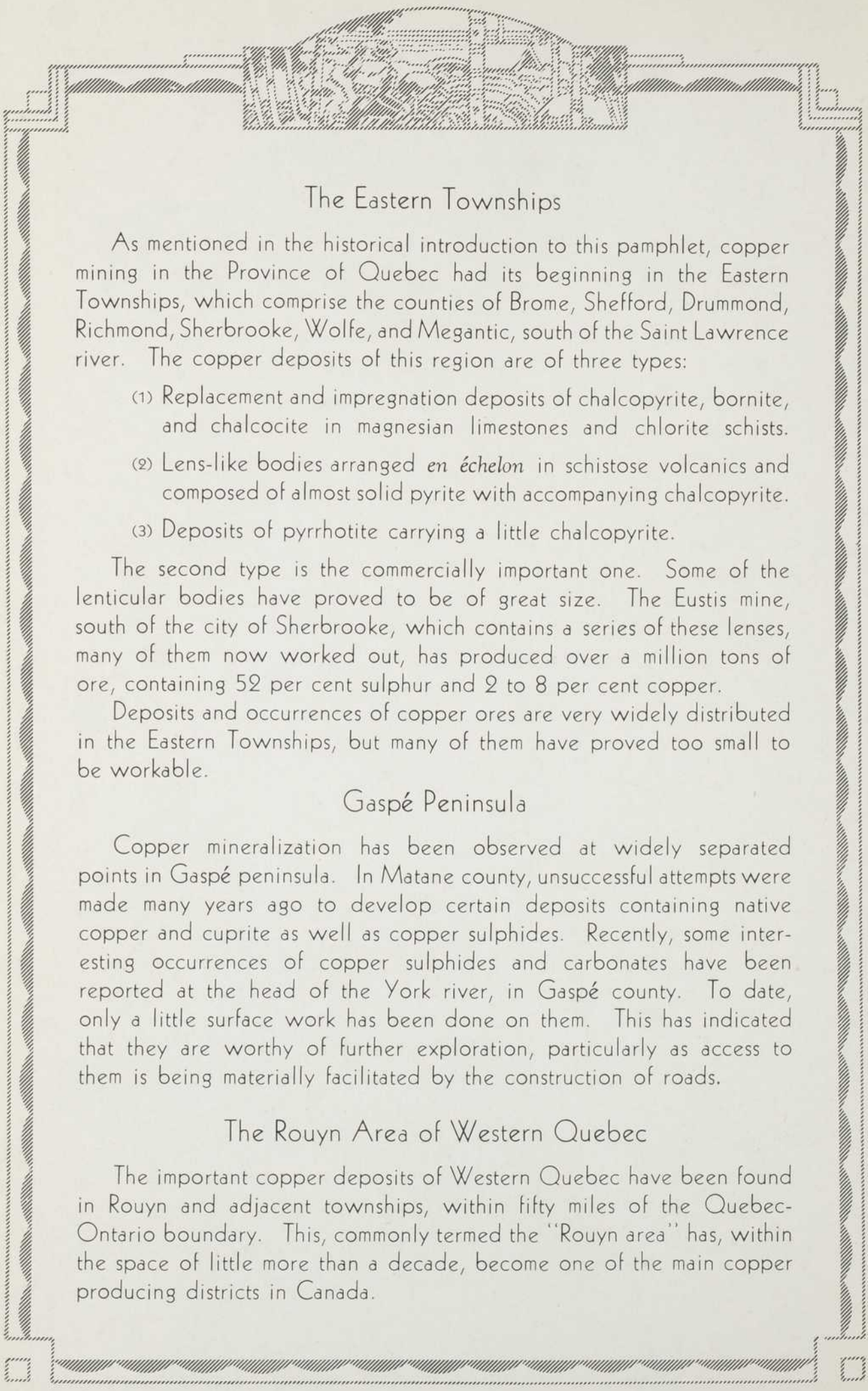
The most extensive use of chromite is in the manufacture of various chrome-iron alloys, or steels, which have great hardness and toughness and are non-rusting or "stainless". Salts of chromium are used as pigments, as mordants for fixing dyes, in leather tanning, and in chromium plating, a use that is increasing rapidly.

Large quantities of chromite are used as refractory material for lining metallurgical furnaces, and it is to this use that our Quebec chromite is put.

Copper

The copper industry of Quebec has assumed great importance in recent years, both from the mining and the metallurgical standpoint, as a result of the development of deposits in the western section of the Province. But it is of interest to note that a part of our production is still derived from the Eastern Townships, where copper ores have been mined since the middle of the last century.

In addition to the deposits in these two producing areas, there are a number of occurrences of copper ores in Gaspé peninsula which appear to warrant more intensive prospecting.



The Eastern Townships

As mentioned in the historical introduction to this pamphlet, copper mining in the Province of Quebec had its beginning in the Eastern Townships, which comprise the counties of Brome, Shefford, Drummond, Richmond, Sherbrooke, Wolfe, and Megantic, south of the Saint Lawrence river. The copper deposits of this region are of three types:

(1) Replacement and impregnation deposits of chalcopyrite, bornite, and chalcocite in magnesian limestones and chlorite schists.

(2) Lens-like bodies arranged *en échelon* in schistose volcanics and composed of almost solid pyrite with accompanying chalcopyrite.

(3) Deposits of pyrrhotite carrying a little chalcopyrite.

The second type is the commercially important one. Some of the lenticular bodies have proved to be of great size. The Eustis mine, south of the city of Sherbrooke, which contains a series of these lenses, many of them now worked out, has produced over a million tons of ore, containing 52 per cent sulphur and 2 to 8 per cent copper.

Deposits and occurrences of copper ores are very widely distributed in the Eastern Townships, but many of them have proved too small to be workable.

Gaspé Peninsula

Copper mineralization has been observed at widely separated points in Gaspé peninsula. In Matane county, unsuccessful attempts were made many years ago to develop certain deposits containing native copper and cuprite as well as copper sulphides. Recently, some interesting occurrences of copper sulphides and carbonates have been reported at the head of the York river, in Gaspé county. To date, only a little surface work has been done on them. This has indicated that they are worthy of further exploration, particularly as access to them is being materially facilitated by the construction of roads.

The Rouyn Area of Western Quebec

The important copper deposits of Western Quebec have been found in Rouyn and adjacent townships, within fifty miles of the Quebec-Ontario boundary. This, commonly termed the "Rouyn area" has, within the space of little more than a decade, become one of the main copper producing districts in Canada.

Westward from Rouyn, in Ontario, lies the Kirkland Lake district, and, still farther west, the Porcupine district, both famous gold mining camps. The reports of geologists, both of the Federal Department of Mines and the Quebec Bureau of Mines, pointed out that it was highly probable that the Porcupine-Kirkland Lake mineralized belt continued eastward into Quebec, and this opinion received its first important verification in 1920, when Edmund Horne staked the deposits which have since been developed in the Horne mine of Noranda Mines, Limited. This Company is now hoisting and treating ore at the rate of 6,000 tons per day, and produces some 40,000 tons of copper metal per year, as well as a large quantity of gold and silver and important amounts of selenium and tellurium.

The Rouyn copper-gold deposits (some contain also zinc and lead) are for the most part replacements in Keewatin volcanics. They are consequently irregular in shape though usually rudely lenticular, or potato-shaped, and several may be closely grouped, particularly one below another. Some consist of practically solid sulphides; in others, the sulphides are sprinkled through the silicified or chloritized country rock. Solid sulphide bodies several hundred feet in length are known in some of the mines. They consist usually of pyrite and pyrrhotite, with chalcopyrite; rarely, sphalerite is present in important amount or may even form the bulk of the ore-body.

The copper and gold content of the ore varies considerably from lens to lens and also with the type of ore, whether solid sulphide or disseminated. In the case of the Horne mine, ore delivered to the smelter during 1935 included 430,000 tons carrying 3.08 per cent copper and 0.25 ounces gold per ton, and 1,000,000 tons containing 2.52 per cent copper and 0.133 ounces gold per ton, with, in each case, about one-third of an ounce of silver per ton. The lower grade ore is concentrated before smelting.

Other base-metal mines in the Rouyn area which either are producing or have produced in the past are the Amulet (zinc – lead – gold), the Waite (copper – zinc – gold), the Aldermac (copper and pyrite or sulphur ore), and the Normetal (copper – zinc – gold – silver).

The copper ores of the area are all sent to the Noranda smelter for treatment. At this plant, the copper is not finally refined, but, still containing all the gold, silver, selenium, and tellurium that were present in the ore treated, it is cast into copper anodes which are

shipped to the electrolytic refinery of Canada Copper Refiners, Limited, at Montreal East, where the several metals are separated and refined.

Copper and copper-gold deposits of similar nature to those of the Rouyn area have been discovered far to the northeast, in the region of Chibougamau and Opemisca lakes, but none of these have yet been developed to the producing stage.

Gold

Alluvial gold deposits were exploited very actively some sixty years ago in the county of Beauce, in the basin of the Chaudière river, fifty miles south of the city of Quebec. Between the years 1870 and 1890, gold to the value of some two and a half million dollars was extracted from these sands and gravels. Production continued intermittently and on a small scale until 1912. The enhanced price of gold has led to a revival of interest in the district in recent years and a considerable amount of new exploration work has been carried out.

A certain amount of gold is recovered each year as a by-product in the treatment of the copper ores of the Eastern Townships. The great bulk of our output of gold, however, is derived from gold-quartz and copper-gold-zinc mines in Western Quebec.

Rouyn-Bell River Deposits

The mineralized belt of the Rouyn area, already referred to under the heading of "copper", extends eastward in Quebec for more than 100 miles, to and beyond the Bell river. Eastward from Rouyn, the deposits found to date within this belt are mainly gold-quartz deposits containing little or no sulphide mineralization. Some of the deposits in the western section of the belt are of this type also. In 1936, seventeen of these "straight" gold mines were in production, and they contributed about one-half of our total output of 666,905 ounces of gold, valued at $23,361,682.

The gold deposits may be grouped under three general types:

(1) Replacement and impregnation deposits. The ore-bodies of the Beattie mine are of this type — large mineralized masses of low-grade ore, from which gold alone is extracted. The complex massive sulphide deposits of the Horne, Aldermac, and Amulet mines, mentioned under the heading of "copper", are also of this type.

(2) Deposits in shear-zones — in which the ore occurs partly as impregnations and partly as lenticular irregular veins, worked for gold alone, as at the McWatters and Arntfield mines.

(3) Veins of gold-quartz filling fissures, frequently forming complex systems, or networks, of veins and veinlets in fractured zones which grade into shear-zones. Such deposits may occur indiscriminately in Keewatin volcanics, Temiscamian sediments, or masses of igneous rock (granodiorite). The Stadacona mine deposits in Keewatin rocks, the O'Brien in sedimentary metamorphic rocks, and the Siscoe in granodiorite, are examples of such deposits.

As mentioned under the heading of "copper", there are copper-gold deposits of promise in the region of Chibougamau and Opemisca lakes. Straight gold deposits are under development in the Madeleine Lake district, 125 miles northeast of Rouyn, and in Guillet township, Témiscamingue county, 60 miles south of Rouyn. In their nature and geological setting, these outlying deposits are similar to those of the Rouyn-Bell River belt.

Iron

There are numerous occurrences of iron ore in the Province of Quebec but, unfortunately, most of those in settled or easily accessible areas are titaniferous and, therefore, refractory to smelting. Deposits of such ores are known on the Gatineau river; in the Saguenay district; and on the north shore of the Saint Lawrence river.

Besides the deposits of titaniferous magnetite mentioned, hematite has been reported by explorers and geologists as occurring in extensive deposits in the interior of the Province, in the region of the headwaters of the Manicouagan river and on the Koksoak river. These deposits are hundreds of miles from rail transportation, and are not likely to be exploited for many years to come. Nevertheless, they constitute important reserves which may eventually furnish ore for the establishment in the Province of an iron and steel industry.

Siderite (carbonate of iron) has been observed on the Madeleine river, in Gaspé peninsula. The geological formations in this part of the peninsula are equivalent in age to the beds which contain the large iron-ore deposits of Wabana, Newfoundland.

Beattie Gold Mines, Limited (Duparquet township, Abitibi county). The beginning of operations, in 1932.

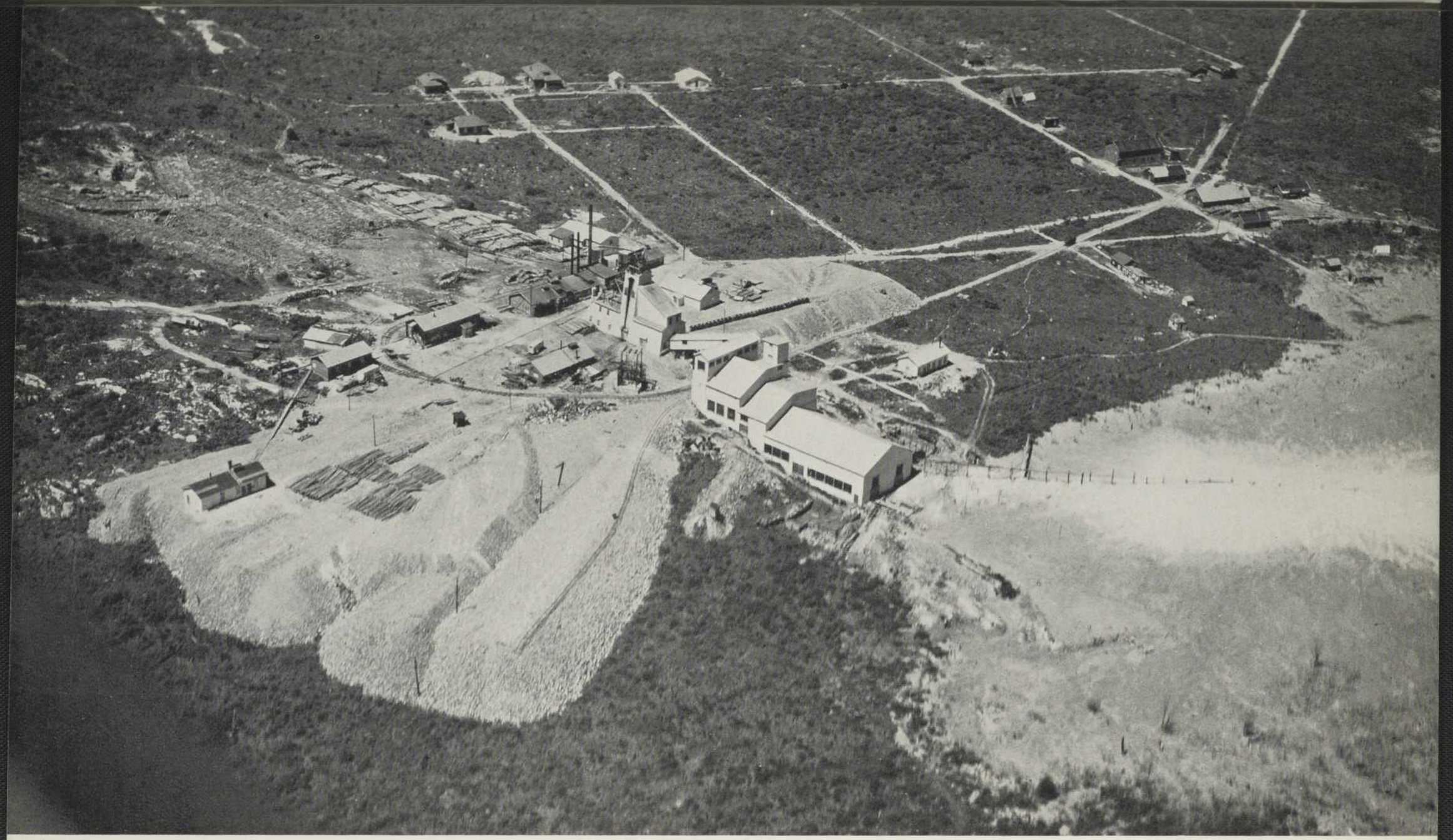
Beattie Gold Mines, Limited (Duparquet township, Abitibi county). The beginning of operations, in 1932.

NOW

Beattie Gold Mines, Limited (Duparquet township, Abitibi county). The plant in 1937.

42 THEN *Boussières Mining Company, Limited (Louvicourt township, Abitibi county). Starting mining operations, in 1931.*

Boussières Mining Company, Limited (Louvicourt township, Abitibi county). Starting mining operations, in 1931.



(*Courtesy Airmaps, Limited*)

Cournor Gold Mines, Limited (formerly Boussières Mining Company, Limited), Louvicourt township, Abitibi county.
The mine as it appears today.

44 THEN *Canadian Malartic Gold Mines, Limited (Fournière township, Abitibi county). First mining equipment, in 1928.*

NOW *Canadian Malartic Gold Mines, Limited (Fournière township, Abitibi county). The plant and part of the townsite in 1937.*

Lamaque Gold Mines, Limited (Bourlamaque township, Abitibi county) in 1928.

Lamaque Gold Mines, Limited (Bourlamaque township, Abitibi county) in 1928.

Lamaque Gold Mines, Limited (Bourlamaque township, Abitibi county) in 1937, milling one thousand tons per day.

48 THEN

The nucleus of the town of Noranda (Rouyn township, Témiscamingue county) in 1924.

The nucleus of the town of Noranda (Rouyn township, Témiscamingue county) in 1924.

(Courtesy Airmaps, Limited)

The modern and progressive mining town of Noranda (Rouyn township, Témiscamingue county). In background, the smelter of Noranda Mines, Limited.

THEN

One of the first hotels in the town of Rouyn (Rouyn township, Témiscamingue county), in 1924.

One of the first hotels in the town of Rouyn (Rouyn township, Témiscamingue county), in 1924.

The town of Rouyn as it appears today.

THEN

O'Brien Gold Mines, Limited (Cadillac township, Abitibi county). The first mining operations, in 1927.

52 THEN *O'Brien Gold Mines, Limited (Cadillac township, Abitibi county). The first mining operations, in 1937.*

53 NOW *O'Brien Gold Mines, Limited (Cadillac township, Abitibi county). The plant in 1937.*

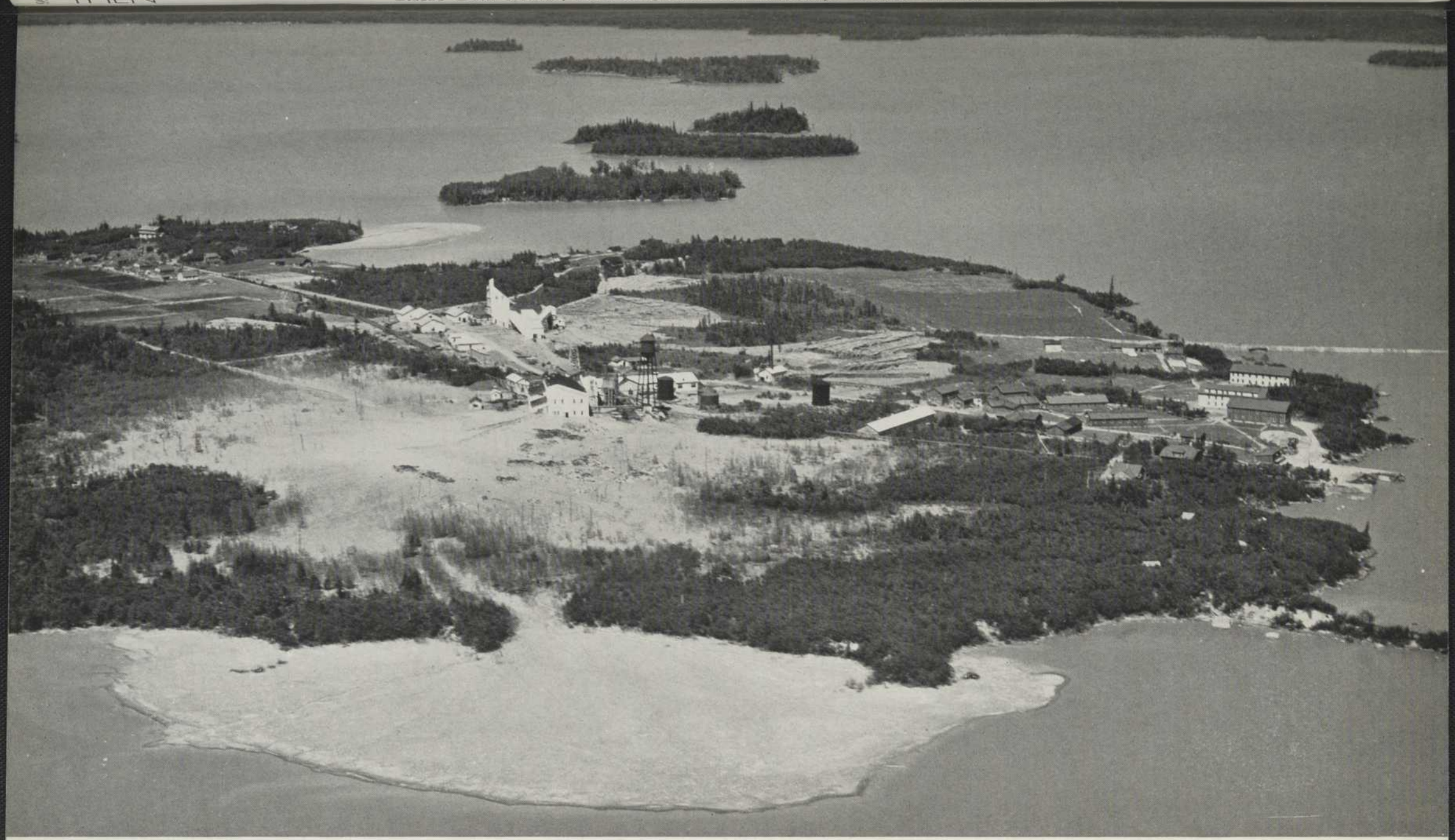
Sigma Mines, Limited (Bourlamaque township, Abitibi county), in 1935.

Sigma Mines, Limited (Bourlamaque township, Abitibi county), in 1935.

Sigma Mines, Limited (Bourlamaque township, Abitibi county), in 1938. Milling 500 tons per day.

Siscoe Gold Mines, Limited (Dubuisson township, Abitibi county), in 1919.

Siscoe Gold Mines, Limited (Dubuisson township, Abitibi county), in 1919.



Siscoe Gold Mines, Limited (Dubuisson township, Abitibi county) as it appears today.

(Courtesy Airmaps, Limited)

58 THEN *Sullivan Consolidated Mines, Limited (Dubuisson township, Abitibi county) in 1912, the year following discovery.*
(Left) J. J. Sullivan, discoverer of the deposit; (right) Dr. J. A. Bancroft, at that time engaged in field work for the Quebec Bureau of Mines.

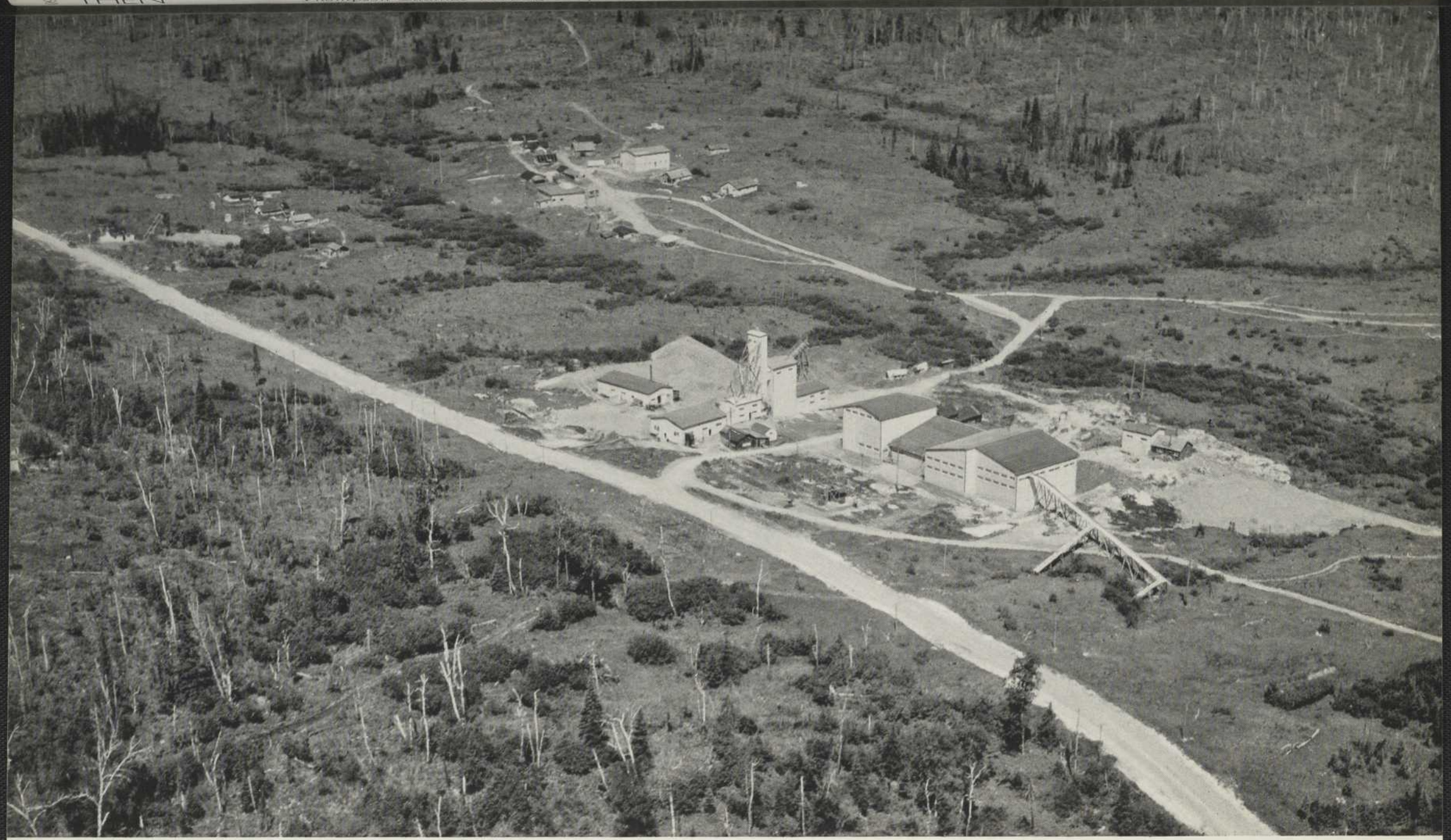
Sullivan Consolidated Mines, Limited (Dubuisson township, Abitibi county) in 1912, the year following discovery.

Sullivan Consolidated Mines, Limited (Dubuisson township, Abitibi county) in 1935.

(Courtesy Airmaps, Limited)

60 THEN

Thompson-Cadillac Mining Corporation (Cadillac township, Abitibi county). The camps in 1925.



NOW *Thompson-Cadillac Mining Corporation (Cadillac township, Abitibi county). Aerial view of the milling plant.*

(Courtesy Airmaps, Limited)

Lead

Anse-à-la-Mine

On an ancient map of Canada, dated 1741, a small bay on the east shore of the northern part of lake Témiscamingue is designated "Anse-à-la-Mine" (Mine Cove). Here, a galena deposit outcrops on the very edge of the lake. There are no records of early work on this deposit, but it was very actively exploited between the years 1877 and 1903, substantial shipments of lead concentrate having been made during that period.

Portneuf County

In 1910, deposits of lead and zinc ores were discovered in the township of Montauban. These were developed in the Tétreault mine which, since 1913, has produced some 38,000,000 pounds of lead. The mine was still in operation in 1936 (see also under zinc).

Calumet Island

Small shipments of lead and zinc ore have been made from a deposit in the south part of Calumet island — an island in the Ottawa river, 60 miles northwest of the city of Ottawa — which was worked spasmodically between the years 1892 and 1913.

Gaspé Peninsula

Deposits of lead and zinc ores have been discovered in several areas in Gaspé peninsula. Of special interest are those in Lemieux township, which is in the basin of the Cascapédia river; in the township of Christie, on the Marsoui river; and in Mann township, Bonaventure county.

On some of these deposits, particularly in Lemieux township, considerable development and exploration work has been done, but no regular shipments of ore have yet been made.

Besides the above, occurrences of lead, and also of zinc, minerals have been observed in numerous places bordering on Gaspé bay.

Molybdenum

Molybdenum is a metal which, added to steel in small quantities in the form of ferro-molybdenum, imparts to it special qualities of toughness and hardness. During the war, molybdenum was in great demand, and Quebec mines supplied very substantial quantities of molybdenite ore to meet the shortage.

One of our mines situated near the Ottawa river, thirty miles above the city of Hull, produced, in the year 1918, approximately 350,000 pounds of molybdenite. This was the Moss mine, at Quyon, which for two or three years held the world's record for the largest molybdenite production from an individual mine.

There are numerous deposits of molybdenite in the ancient rocks of the Canadian shield. In Quebec, the more important known deposits are in the townships of Huddersfield, Egan, Masham, Onslow, Preissac, Villemontel, La Corne, and Varsan.

There has been no production of molybdenite in the Province since 1929, but early resumption of operations is indicated by the erection recently of a small test-mill in Masham township, to treat the nearby ores.

Platinum

As far back as 1851, Dr. Sterry Hunt, at that time chemist to the Geological Survey of Canada, observed grains and scales of native platinum and iridosmine in the gold obtained from placer deposits on Rivière-du-Loup and Rivière des Plantes, in Beauce county. No mention of similar discoveries seems to have been made in any subsequent report relating to these or other placer deposits.

Radioactive Minerals and Rare Earths

No commercial radium deposits have yet been found in the Province of Quebec. However, numerous occurrences of radioactive minerals, as uraninite, pitchblende, cleveite, gummite, and samarskite have been reported in pegmatite dykes in various parts of the Province.

A comparatively important deposit of allanite (a complex silicate containing cerium and other rare-earth metals) has been observed on the east shore of Lac-à-Baude, in Normand township, north of the Seigniory of Cap-de-la-Madeleine.

Selenium

The selenium produced in the Province of Quebec is recovered in the course of refining the copper anodes of the Noranda smelter, which are shipped from Noranda to the plant of Canada Copper Refiners, Limited, at Montreal East.

The first output of selenium metal in Quebec was recorded in 1934. The total production in the three-year period 1934-1936 was, in round figures, 425,000 pounds, valued at $760,000.

The principal use of selenium is in the glass industry, for producing colours ranging from yellow to ruby-red. Another important industrial use is in the manufacture of red pigments. Better known popularly, perhaps, is its use in television, and in the so-called "electric-eye". In the electrical industry, selenium is used in making "rectifiers" for converting alternating into direct current. Various other uses are: in the manufacture of special alloys; as a catalyst for certain reactions; and in medicine.

Silver

There are no silver mines in the Province of Quebec. There is, however, a steady production of the metal, recovered in the treatment of gold ores, since the "native" gold always contains an appreciable percentage of silver; and also of copper, lead, zinc, and other sulphide ores. The silver output in any year therefore depends on the activity in the mining of these other ores. The production for 1936 was 724,339 ounces, valued at $326,872.

Tellurium

Tellurium is associated with selenium in the complex copper-gold ores of Western Quebec, and both metals are recovered in the course of refining the copper by the electrolytic process. This refining is carried out at the plant of Canada Copper Refiners, Limited, at Montreal East.

The Province of Quebec produced tellurium metal for the first time in 1935, when 1,708 pounds valued at $3,416 were recovered. The figures for 1936 were 19,502 pounds, valued at $34,519.

Two recent applications of tellurium are in rubber fabrication and as an alloy with lead. To rubber, it gives greater resistance to stretching and abrasion; a small amount added to lead increases the resistance of that metal to corrosion and to strains produced by frost.

Tin

No deposits of tin minerals have been found in the Province of Quebec, but microscopic grains and crystals of cassiterite have been observed in micaceous gneisses in Buckingham township, Ottawa county.

Titanium

Ilmenite deposits, carrying from 18 to 25 per cent of titanium, occur in the vicinity of Saint-Urbain, in Charlevoix county, and at Ivry, in Terrebonne county. In both areas, the deposits are favourably located with regard to exploitation and transportation.

The Saint-Urbain deposits carry about 40 per cent titanium dioxide and include in places bodies of rutile-bearing ore of commercial importance. From 2,000 to 2,500 tons of ilmenite are shipped annually from this area to the United States, where the material is used, mainly, in the manufacture of ferro-titanium.

The Ivry deposits were operated during the Great War, when approximately 16,000 tons of ore were mined, all of which was used in the production of ferro-titanium.

Titaniferous-magnetite deposits occur in many places in Quebec, particularly in the Saguenay district; but, so far, this ore has not been used as a source of titanium.

Tungsten

A quartz vein containing scheelite (tungstate of lime) was discovered in Marlow township in 1891. The scheelite content is less than one per cent, however, which is much too low for a commercial ore.

Zinc

The main production of zinc in the Province of Quebec has come from the Tétreault mine, in Montauban township, Portneuf county. Since production commenced, in 1913, ore containing 115,521,953 pounds of zinc and 38,000,000 pounds of lead has been shipped from this mine.

The only other production of zinc in recent years has come from the Rouyn area, Western Quebec. During 1937, several thousand tons of zinc concentrate was produced from the treatment of a complex

Mining asbestos in yesteryears in the Eastern Townships.

67 NOW *The up-to-date open-pit workings of the Canadian Johns-Manville Company, Limited, at Asbestos, Megantic county.*

copper-zinc-gold ore. This was the first shipment of zinc ore from Western Quebec mines since 1930.

Under the heading of "lead", reference is made to the former production of lead and zinc from deposits on Calumet island; and also to the development of lead-zinc deposits in Gaspé peninsula.

NON - METALLICS

Asbestos

Occurrence

The asbestos deposits of Quebec occur at certain points within a more or less continuous band of basic intrusive rocks, which is usually referred to as "The Serpentine Belt". This belt starts in the United States and, leaving the State of Vermont, enters Canada just west of lake Memphremagog. From the International boundary to within a short distance of the Chaudière river, a tributary of the Saint-Lawrence river, the rocks of the belt are exposed almost continuously, presenting a narrow zone over one hundred miles long. Thence, following the same northeasterly trend, the belt can be traced by disconnected outcrops for a further distance of seventy miles, as far as l'Islet county. Then occurs a gap of 130 miles, beyond which the rocks of the serpentine belt are again encountered in Gaspé peninsula, some occurrences being found in the Shickshock mountains, at Mount Albert; on the Dartmouth river; and in the township of Weir.

In certain sections along the belt, the basic igneous rock of which it is composed is completely altered to serpentine, and it is in such places, and where other conditions have been favourable, that the commercial deposits of asbestos (chrysotile) occur. The deposits are of two types : (a) cross-fibre veins, which have well defined walls along which the asbestos will break easily and cleanly from the massive serpentine wall-rock; and (b) disseminated fibre, which is distributed through the rock with no definite orientation.

Producing Areas

Asbestos deposits have been found in five separate fields or districts within the serpentine belt. These may be designated as follows:

(1) Gaspé Peninsula occurrences. Not worked.

(2) Broughton Township area. Worked; yield is mainly short fibre.

(3) Thetford-Black Lake field. Most important asbestos producing district in the world.

(4) Danville district. Produces crude, long and short fibre.

(5) Bolton area, west of lake Memphremagog. Has never passed beyond the prospecting stage.

Mining of Asbestos Rock

For many years, until about 1914, all the asbestos deposits were worked by open-cast quarrying methods, and the rock, or ore, was hoisted from the pit bottom by cable-derricks. At present, mining is carried on by one or other of the following methods : (1)Breaking down a series of faces of asbestos rock, by large blasts, along wide benches, on which run trains of ore-cars hauled by locomotives. (2)Open-cast quarries, from the floor of which the asbestos rock is taken to the surface in strings of mine-cars hauled up an inclined tunnel. (3)Underground mining by block-caving. This is the latest method introduced in asbestos mining and it has been so successful that many mines are adopting it. It is an adaptation of the mining method developed in the large porphyry copper mines of the Western United States.

The long fibre asbestos, termed "crude asbestos", is separated from short-fibre rock before the latter leaves the floor of the pit. This "crude" includes all fibre half an inch and more in length. It commands a high price but constitutes only a small part — from one to five per cent — of the output of our Quebec mines.

Market Prices and Production Figures

The market price of asbestos is governed by the length of the fibre. A common range would be from $11.00 a ton for the very short qualities to $600.00 a ton for the long fibre quality designated as "Crude No. 1". The latter is used exclusively for weaving incombustible cloth, such as that from which fireproof theatre curtains are made.

In 1936, a total of 4,700,000 tons of asbestos-bearing rock was hoisted from the Quebec mines. Recovery of marketable fibre amounted to 6.63 per cent of the rock mined, or 311,205 tons, the market value of which was $10,001,706. This tonnage of asbestos fibre represented more than 50 per cent of the world's consumption of this substance during 1936.

Canadian Kaolin Silica Products, Limited, St-Rémi-d'Amherst (Papineau county).

Uses of Asbestos

Asbestos is highly flexible, "weavable", incombustible, and a good insulator of both heat and electricity. These qualities are not found combined in any other substance. It can withstand high temperatures of 800° to 1,000°F., and suffer no ill effects. The applications of asbestos, therefore, are very wide, and it will be sufficient to enumerate only a few of them, as new uses are being introduced almost daily. Some of these uses appeal to the popular imagination as, for example, where the asbestos is woven into cloth for making incombustible theatre curtains; protective gloves, leggings, and aprons for workers in metallurgical plants; and firemen's garments. But it is in less spectacular services that the great bulk of the asbestos produced by our mines is consumed. Some of the major industrial applications are as follows: steam packing; packing sheets; gaskets and washers; ropes and yarns; heat-insulating coverings and jackets for steam boilers and steam pipes; fire-proof felts and papers; fire-proof building materials, as asbestos shingles, boards and lumber; lagging for railway locomotive boilers and marine engines; insulating coverings for electric wires; and brake-band lining for automobiles.

Feldspar

Almost the whole of the area of the Province of Quebec lying to the north of the Ottawa and Saint-Lawrence rivers is underlain by Precambrian rocks, which are in large part of a granitic nature. In many places these rocks outcrop as dykes of pegmatite carrying coarsely crystalline feldspar of excellent quality.

The valley of the Lièvre river, tributary of the Ottawa, is the main feldspar producing district of the Province, and the town of Buckingham is the principal shipping centre. The feldspar of this district is generally high in potash, carload lots running as high as 13½ per cent potash, with only 1 to 1½ per cent soda, and 4 to 5 per cent free silica.

Large deposits of feldspar, of good grade, occur in various places on the north shore of the gulf of the Saint-Lawrence. One such deposit has been worked at Quatachou-Manicouagan bay, some 500 miles below the city of Quebec.

Feldspar is used mainly in the ceramic and scouring-soap industries. Artificial teeth are manufactured from very pure orthoclase (potash) feldspar, known as "dental spar".

Production in 1936 was 8,115 tons, valued at $75,703. The output is limited only by the demand.

Garnet

Occurrences of garnet, or highly garnetiferous rocks, are numerous in the Province of Quebec, and some of them may be found to be of workable size and grade. Two deposits which appear to offer economic possibilities are situated respectively two miles southwest of the town of Labelle, in Labelle county, and near Langlade, in Abitibi county.

Graphite

Graphite mining began in the Province of Quebec as early as the year 1847, when several tons of the mineral were extracted from a vein in crystalline limestone near Grenville, on the north shore of the Ottawa river.

Deposits of graphite are numerous in the Province, especially in the basin of the Lièvre river. Mining on a considerable scale has been carried on at various times in the townships of Grenville, Buckingham, Lochaber, Amherst, and Campbell. In all the deposits worked, the graphite flakes are disseminated in crystalline limestone and sillimanite gneiss of the Grenville series.

There was no production of graphite in 1936.

Infusorial Earth

Deposits of infusorial earth, or diatomite, are known at several localities in the Province of Quebec. Three occurrences which appear to be of particular economic interest are as follows:

Montmorency County. — Laval Settlement, range II, lot 10. This deposit is on the right bank of the Brais river, at its junction with the Montmorency river. The bed is reported to be 15 feet thick, at a height of 40 feet above the water, and is covered by 50 feet of overburden.

Portneuf County. — Colbert township, range IV, lot 41B. The diatomite here is in a flocculent state. The deposit extends over some two acres with an average thickness of about four feet.

Montcalm County. — Chertsey township, range V, lot 16. The deposit extends over four acres with a depth of 12 to 18 inches. The diatoms are rather badly broken and sponge spicules are present.

None of these deposits have been worked.

Kaolin (China-Clay)

A few deposits of quartz-kaolin, of large extent, occur in Amherst township, Labelle county. In one of these, the "ore" carries about 35 per cent china-clay. Two mines are in operation. At one, the deposit is mined primarily for the production of silica-sand, and the kaolin is recovered as a by-product. The other mine, which has only recently been opened, produces kaolin as its main product. The mills of the two operating companies have a combined capacity for treating about 400 tons a day of the quartz-china-clay material.

Lithium

An occurrence of lepidolite, a lithium-bearing mica, has been recorded in Wakefield township, Hull district. The lepidolite is in large flakes and sheets distributed irregularly through a pegmatite dyke. Sufficient development work has not yet been carried out to ascertain the commercial possibilities of the deposit.

Magnesite

The only magnesitic-dolomite deposits of workable size known in the eastern part of North America are in the Province of Quebec, in Grenville and Harrington townships. In both districts there are large operating mines.

This mineral is sold in the crude, calcined, and dead-burned state. It is further produced as cements, refractory bricks, and for other finished and semi-finished products both refractory and neutral. Mixed with chromite it finds a large market in the form of chrome-magnesite bricks and special products.

Magnesite, or magnesitic-dolomite, has a wide variety of uses, due especially to its excellent refractory properties. The ore is shipped in the crude state, as mined, or it may be first calcined, or dead-burned. However, the operating companies themselves use a considerable portion of their output for the manufacture of cements, refractory bricks, and other finished and semi-finished products. Of particular interest are the chrome-magnesite brick now being made, in which the magnesitic-dolomite is mixed with chromite obtained from deposits in the Eastern Townships of Quebec. These refractory materials are used mainly for lining furnaces in metallurgical works. They have also been used

successfully in lining cement kilns. Caustic calcined products, such as magnesian flooring cements and stuccos, are marketed to the building trade.

Crude, calcined, and dead-burned magnesitic-dolomite produced from Quebec mines in 1936 was valued at $768,742.

Manganese

Occurrences of pyrolusite have been observed in the Magdalen islands, and of bog manganese at various places in the Eastern Townships and on the south shore of the lower Saint-Lawrence river, but nowhere have deposits of commercial size been found.

Marl

There are numerous deposits of marl in Gaspé peninsula. Many of these are worked on a small scale. Marl is used as a soil amendment, to counteract acidity.

Mica

The mica produced in the Province of Quebec is almost all phlogopite, or "amber mica", and it is obtained mainly from deposits, of which there are literally hundreds, in the basins of the parallel-flowing Lièvre and Gatineau rivers, to the north of the city of Ottawa.

However, deposits of phlogopite, and of the white mica, muscovite, are known in other parts of the Province, and there has been some production of both varieties of mica from mines outside the main producing belt, as in Wentworth and Joliette townships, at Petit-Pré in Montmorency county, and in Lacoste township, Charlevoix county.

The principal use of mica is in the manufacture of electrical machinery and supplies. For such uses, the Quebec amber mica is second to none. It has high dielectric strength (insulating qualities), great flexibility and toughness, and perfect cleavability, into leaves one-thousandth of an inch in thickness. Moreover, its "edge hardness" is the same as that of copper, so that it meets the wearing-down requirements of commutator insulation better than the harder muscovite.

Ground, or pulverized, mica enters into the manufacture of roofing papers.

During 1936, Quebec mines produced 544,214 pounds of mica, valued at $63,123.

Mineral Pigments

Natural Iron Oxides and Ochres

The Province of Quebec possesses numerous deposits of natural iron oxides and ochres, the majority of which contain material of very high grade, assaying, after drying and calcination, 90 per cent or better iron oxide. Several of the deposits have been worked for many years.

Most of these deposits are found in the low plain fronting the southern escarpment of the Laurentian plateau, which is parallel to, and some miles to the north of, the Saint-Lawrence river, from Montreal to the strait of Bellisle.

Deposits in the vicinity of the city of Trois-Rivières, and in Marchand township, Labelle county, are worked on a comparatively large scale. Some of them attain a thickness of 20 feet and over.

The raw oxides, marketed without any preparation, are used by manufacturers of coal gas, as a purifying agent to absorb hydrogen sulphide from the gas. The calcined oxides are used mainly for the manufacture of paints.

The Quebec production of ochres, partly raw oxides and partly calcined, for 1936, was of 5,458 tons, valued at $65,630.

Barytes

Barium sulphate, or heavy spar, is the main constituent of the white pigment "lithopone", which is composed of 50 per cent barium sulphate, 25 per cent zinc sulphide, and the balance, zinc oxide.

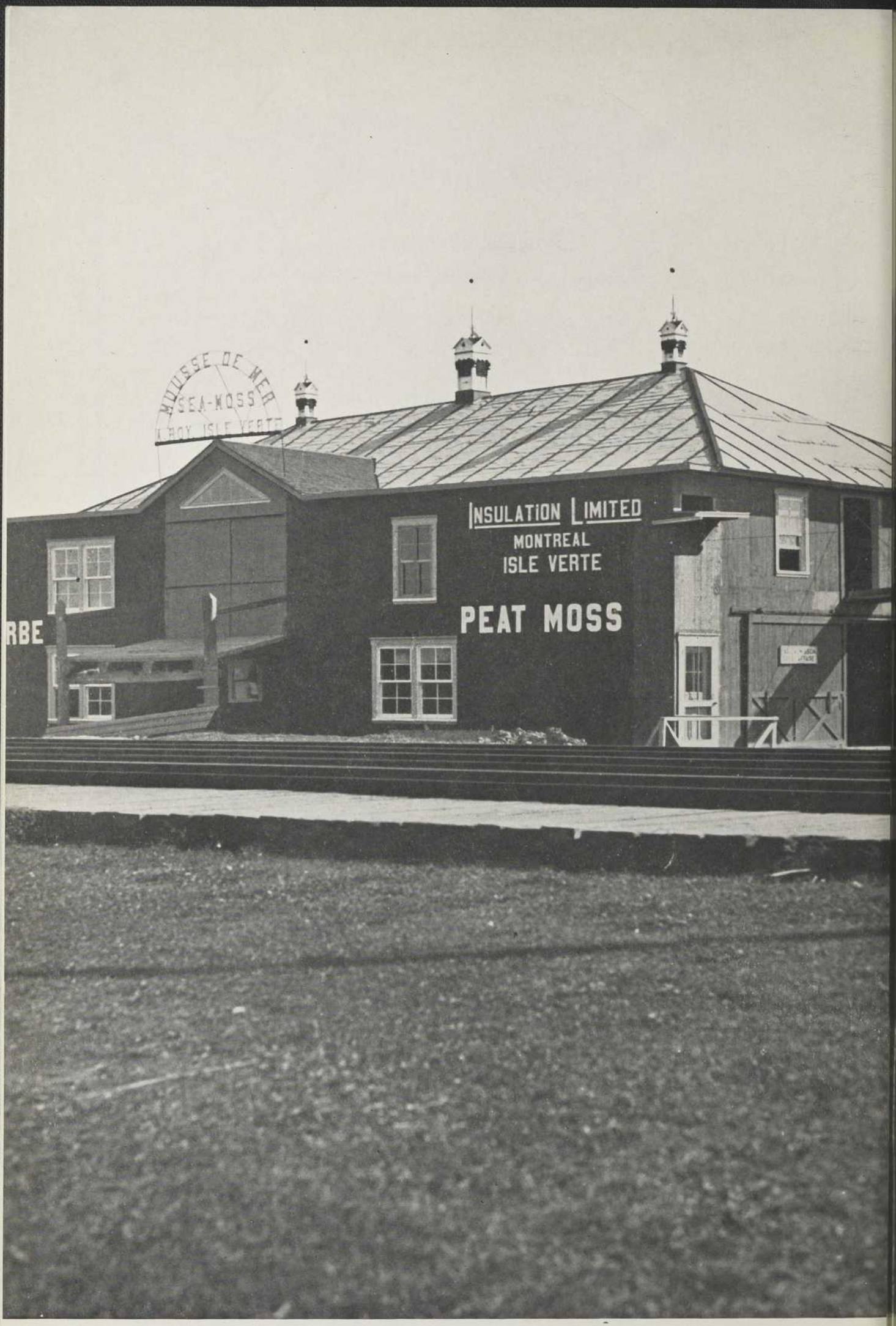
Several occurrences of barytes are known in the Province. One deposit, in the township of Hull, was formerly worked.

Titanium White

Ilmenite deposits carrying more than 40 per cent titanium dioxide occur at Saint-Urbain, in Charlevoix county. These may eventually be used as a source of raw material for the production of titanium white.

Natural Gas

It has been known since the middle of the nineteenth century that natural gas occurs in the Palaeozoic rocks bordering the Saint-Lawrence river between Montreal and Quebec. At one time, gas was produced



A section of the warehouse of Insulation, Limited, established at Isle Verte, in the Seigniory of Isle Verte, Rivière du Loup county, for the preparation of peat moss.

A one-piece strip of peat moss at St-Philippe-de-Néri in the Seigniory of Rivière Ouelle, Kamouraska county. On left, part of drying installation.

78 *No. 20 well, Gaspé oil-field; showing oil to the top of the casing.*

from wells in the Louiseville district and supplied the towns of Yamachiche, Louiseville, and Trois-Rivières. After a very short period, however, the supply failed. Drilling operations have been carried on at numerous points, both north and south of the Saint-Lawrence, in attempts to find gas in commercial quantities, but, though some gas has been encountered in nearly all the wells drilled, in none has the volume been sufficient for practical utilization.

Peat

It is conservatively estimated that in the settled part of the Province of Quebec, areas totalling some 500 square miles are occupied by peat bogs of sufficient thickness to offer economic interest. Several plants have been erected in the past, on various bogs, for the production of peat-fuel, but without achieving commercial success.

However, there is, in Quebec, a small but expanding industry based on the utilization of peat as a soil amendment, of peat-moss for stable litter, and of partly humified peat for insulating and filler material. In 1936, some 300 tons of such products were marketed, valued at $7,000.

Petroleum

The occurrence of oil-bearing springs in the eastern part of Gaspé peninsula, in the lower part of the basins of the York and Dartmouth rivers, was known as early as 1845. A well was drilled in this region in 1860 and several others were put down in the course of the next thirty years, but without success. Then, from 1890 to 1902, drilling was very active, more than fifty wells being sunk during that period, some of which reached a depth of nearly 3,700 feet. In none was oil found in commercial quantity. It is noteworthy, however, that of 56 wells drilled to a depth of 600 to 3,640 feet, 39 gave some petroleum, a few of them as much as several gallons per day, and that, of these 39 wells, there is still oil in 17. It appears from recent investigations that most of the wells were not favourably located with respect to geological structures.

The region undoubtedly warrants further investigation and possibly drilling in localities other than those tested during previous operations.

Phosphate of Lime or Apatite

Phosphate of lime, in the form of crystalline apatite, occurs in veins and pockets in granitic gneisses, pyroxenites, and crystalline limestones in the basin of the Lièvre river, north of the Ottawa river, some twenty-five miles below the city of Ottawa. Although irregular in form and distribution, these apatite deposits are nevertheless large and numerous, and between 1880 and 1892 a flourishing industry was based on their exploitation. However, the discovery and development about that time of the extensive bedded deposits of rock-phosphate in Florida and Tennessee, where the production costs are but a fraction of those for the Lièvre apatite, very soon caused the Quebec mines to close down. The apatite deposits remain, however, a reserve that will doubtless again assume importance in years to come.

At present, the Quebec production of apatite is small, and consists mainly of material obtained as a by-product in the mining of mica. In 1936, it totalled 525 tons, valued at $4,927. This apatite is used for the manufacture of phosphorus and phosphorus salts.

Pyrite

Although iron pyrites is a metallic substance, it is included here with the non-metallics because, commercially, it is an ore, not of iron, but of sulphur and sulphur products.

Mention has already been made, under "copper", of the Eustis mine, where large quantities of pyrite have been mined for many years. The pyrite concentrate shipped from this mine contains 40 to 45 per cent sulphur. Besides the Eustis, there are other large deposits of pyrite known in the Eastern Townships. In the northwestern part of the Province, also, the massive sulphide ore-bodies referred to under the heading of "copper" consist, in the main, of pyrite and pyrrhotite.

The sulphur dioxide obtained from the roasting of pyrite is used in the manufacture of sulphuric acid and in the paper-making industry. Processes have recently been perfected for the commercial production of elemental sulphur from pyrite.

Quartz and Industrial Sand

The Province of Quebec has numerous deposits of quartz and industrial sand. Production at present is mainly from deposits at Saint-Canut, Melocheville, East Templeton, Saint-Rémi-d'Amherst, Guigues, and Lac Bouchette.

On account of its purity, the output from some of these deposits is used in the glass industry. In other deposits, characteristics of uniformity, grain-form, etc., render the material excellent for moulding-sand and abrasives.

The production of quartz and industrial sand in the Province during 1936 was 78,975 tons, valued at $320,634.

Talc and Soapstone

Deposits of the massive variety of talc, known as soapstone or steatite, are found in several localities in Quebec, particularly associated with rocks of the "serpentine belt" in the counties of Brome, Richmond, Mégantic, and Beauce. Active quarrying operations are being conducted on two deposits in Broughton township, and on a third at Robertsonville in Thetford township.

A large part of our output of soapstone is used in the paper industry, as furnace-lining in sulphate pulp mills. Some is used as tops for tables, for fireplaces, stove-linings, and for ornaments and other artistic objects. In powdered form, talc is used as a paper filler, in the paint industry, in the manufacture of rubber goods, in textiles, and in the manufacture of cosmetics.

Production in 1936 had a value of $32,769.

BUILDING MATERIALS

About one-seventh of the total value of the mineral production of the Province of Quebec represents mineral products that are used as building materials. For the year 1936, their value was $6,724,020. The list includes: limestone, granite, sandstone, marble, slate, clay-brick, shale-brick, cement, lime, and sand.

Quarrying soapstone near Leeds, Leeds county.

Limestone

From the economic standpoint, the limestones of the Province may be divided into three groups:

(1) Bedded limestones, of Ordovician age, of the Saint-Lawrence valley. These constitute the most important group. They are quarried for the production of lime for the manufacture of cement; for crushed stone; and for building stone.

(2) Metamorphic limestones, of Cambrian, Ordovician, and Silurian ages, of the Appalachian region. Some of these are high-calcium limestone, others are magnesian (dolomite). They are used for the manufacture of calcium carbide and are also burned for lime.

(3) Crystalline limestones of Grenville (Precambrian) age. These are used in the manufacture of terrazzo floors, in the making of artificial building stone, and for a variety of other industrial purposes.

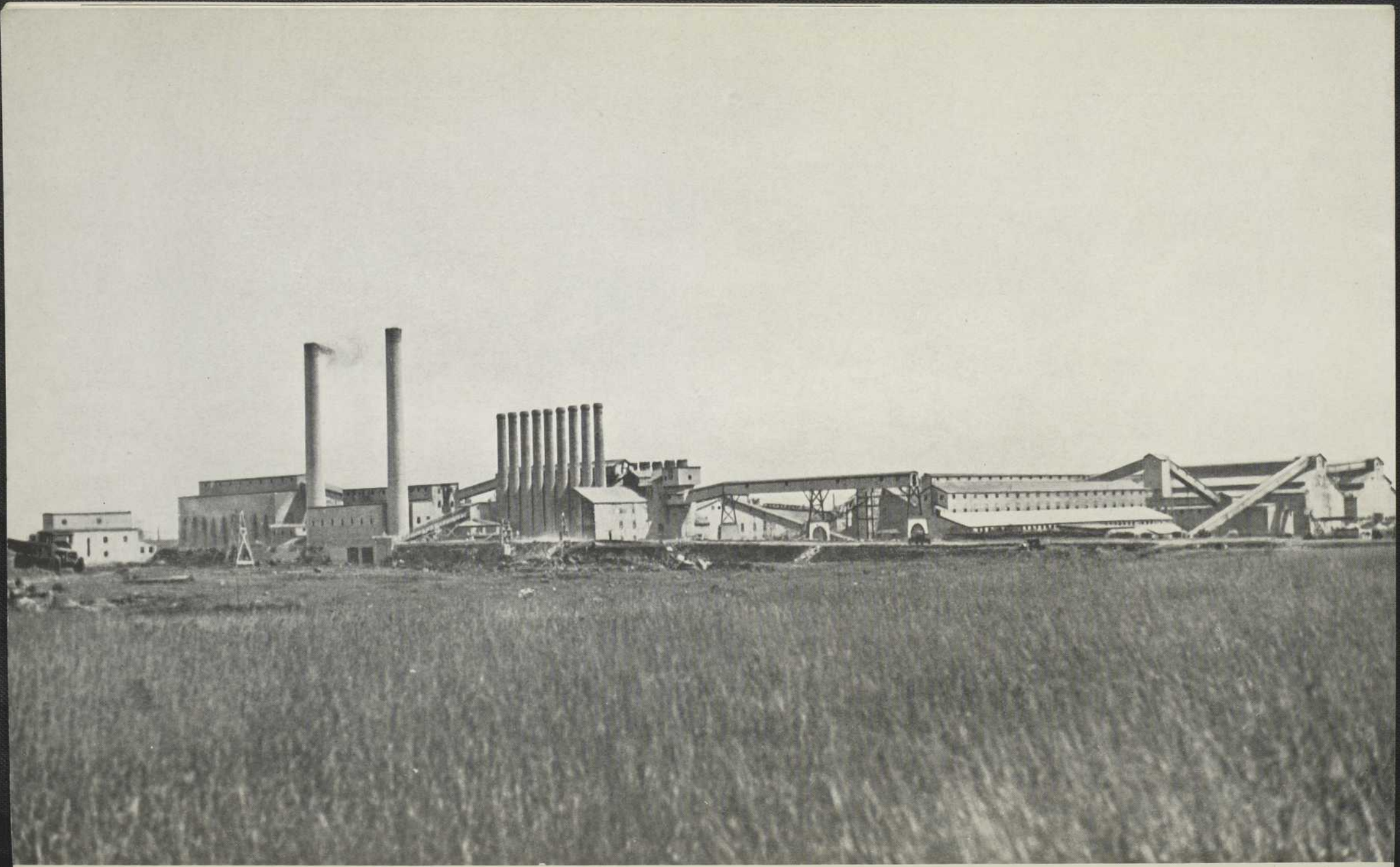
Limestone deposits are widespread in the Province. Production is governed entirely by demand and can be increased without effort to meet any need. For the past decade it has varied between 1,500,000 tons and 4,500,000 tons per year.

Granite

Building and ornamental granites of excellent quality, and obtainable in large blocks, are quarried in several districts in Quebec. The grey granites of the Appalachian hills, the pink and variously coloured granites of the Laurentian plateau, and the black granite of Mount Johnson and of the Lake Saint-Jean area, are examples.

The grey and pink granites of Quebec have been used throughout Canada in the construction of a great number of public buildings. These granites are also used extensively as monument stone, curbstone, and paving blocks.

Used in buildings in conjunction with stone of a lighter shade, the black granite of Mount Johnson and of the Lake Saint-Jean area presents a sharp and pleasing contrast. For this reason, the black granite enjoys great popularity in modern architecture.



The plant of the Canada Cement Company, Limited, at Montreal East. Capacity, 10,000 barrels per day. This is one of the largest, if not the largest, cement plant in the world operating by the wet process.

Marble

Only one quarry in the Province of Quebec is at present producing marble for use as decorative stone. It is situated at Philipsburg, Missisquoi county. The stone is of pleasing shades of grey, cream, green, and pink, veined and banded. The cutting and polishing plant at Philipsburg is modern, well equipped, and has a large output capacity.

Sand and Gravel

Sand and gravel deposits are very widespread in the Province. Numerous pits are producing building sand, filter sand, and gravel for road surfacing and railway ballast.

Sandstone

There are large areas in the Province underlain by sandstone formations, particularly to the west and southwest of Montreal, in the Quebec City district, and in Gaspé peninsula.

Our output of sandstone is used mainly for rubble work and, in the form of crushed stone, as road material and concrete aggregate.

Shale and Clay Products

Marine clays, of Champlain age, as also Utica and Lorraine shales, are excellent raw materials for the manufacture of building brick, structural tile, drain tile, and sewer pipe.

There are several plants in the Province for manufacturing these products.

Slate

In past years, there have been slate quarries operating in the Province for the production of roofing slate, and of slate granules for roofing papers. No production has been recorded for some years and all the slate quarries are at present inactive.

A deposit of slaty shale has been quarried for a number of years at Sainte-Hénédine-de-Dorchester. The material is pulverized and used as a filler in various industries.

The plant of the Canadian Carborundum Company at St-Canut, Argenteuil county.

ACQUISITION OF MINING LANDS IN THE PROVINCE OF QUEBEC

The mining laws in force in the Province of Quebec are very liberal and offer every encouragement to the prospector. The provisions of the law give security of title and they are not onerous as regards requirements, either in cash payments or in assessment work. Moreover, it may be mentioned that, in the Province of Quebec, mineral lands on which the mining rights belong to the Crown — which means in the vicinity of 90 per cent of the total area of the Province — may be taken up, held, or acquired by British subjects or by aliens alike on the same terms, without distinction of any sort between them.

The procedure to acquire mining lands is as follows:

The intending prospector gets from the Department of Mines and Fisheries a "Miner's Certificate", cost $10, which expires on December 31st following.

This certificate entitles the holder to stake out, anywhere in the Province, on lands on which the minerals belong to the Crown, mining claims to a maximum area of 200 acres, in parcels of 40 acres each in unsurveyed lands and of "half-lots" in sub-divided townships. The surveyed lots are, as a rule, 100 acres each.

After the staking, that is, driving a stake at each corner of the ground and inscribing it with his name, date of pegging, and number of his certificate, the prospector must register his claim without delay. This registration is done at the nearest mining recorder's office, of which there is one in Témiscamingue county, another in Abitibi, and the central office in Quebec City. There is no fee for registration.

In the course of the following twelve months, the claim-holder must do twenty-five days' work on each claim of 40 acres.

At the end of the twelve months, he may apply for the concession; that is, he may apply to buy the land outright in fee simple. Or, if not yet sufficiently assured of the value of his claim to invest the price of the concession, he may apply for a working license (development license), good for one year from the date of expiration of the claim.

If he applies for the concession in fee simple, he must have his claim surveyed by a Provincial Land Surveyor, and pay the purchase price — $5.00 per acre for "superior" minerals (metallic and non-metallic, as enumerated in Article 3 of the Mining Law), or $3.00 per acre for

"inferior" minerals. Then, before the expiration of two years following the application, he must spend $1,000, for each 100 acres held, in bona fide, actual mining work. He is then entitled to his patent. If these conditions are not fulfilled within the specified time, the Minister has discretionary power to cancel the sale or concession.

All mining lands thus conceded are subject to an acreage tax of 10 cents per acre yearly, and to a duty on annual profits.

If the holder of the claim chooses to apply for a working license, good for one year, he pays 50 cents an acre per year, and a registration fee of $10.00, and he must do 25 days' work on each claim of 40 acres during the year in force. At any time, the holder of a working license (called development license in the Quebec law) may apply for the concession on the terms enumerated above.

The Quebec Bureau of Mines will gladly furnish to interested parties all information available and at their disposal relating to the mines, mineral resources, and mining regulations of the Province on request addressed to : The Director, Bureau of Mines, Quebec, Que., Canada.