# THE INDUSTRIAL MINERALS OF NEWFOUNDLAND

by

G. F. Carr
Industrial Minerals Division

Mines Branch, No. 855

DEPARTMENT OF MINES AND TECHNICAL SURVEYS
OTTAWA

91230—1

# Table of Contents





91230—1½

## TABLES



## ILLUSTRATIONS

### *Figures*

## Plates

## Plates

# Chapter 1

## INTRODUCTION

THE province of Newfoundland comprises the island of Newfoundland and Labrador on the adjacent mainland. It covers an area of approximately 155,000 square miles, about 4 per cent of the area of Canada and "more than three times the combined area of the three maritime provinces of Nova Scotia, New Brunswick and Prince Edward Island" (8, p. 2). Its population totals 361,416, with more than 95 per cent on the island and the remainder in Labrador. Newfoundland is the nearest land in the Western Hemisphere to Europe and is nearer to Africa than any other part of North America. It is thus well situated for trans-ocean transport and the principal mineral markets of the world. Its deeply indented coastline and many excellent harbours provide safe anchorage in all types of weather.

The value of Newfoundland's industrial mineral production in 1956 reached an all-time high of $7,650,821*, a 14.7 per cent increase over that of the previous year and a 19.6 per cent increase over that of 1954. The increase was due primarily to outstanding volume gains made by fluorspar, production of which in 1956 amounted to 139,801 tons valued at $3,395,061 placing it tenth in value among Canadian non-metallic minerals. Minerals produced in 1956, in order of value, were:

* Dominion Bureau of Statistics.



91230—2

| | % |
|---|---|
| Fluorspar | 44.5 |
| Sand and gravel | 22.0 |
| Cement | 21.7 |
| Limestone | 7.5 |
| Gypsum | 2.4 |
| Sulphur (Pyrite) | 0.8 |
| Clay products | 0.6 |
| Granite | 0.3 |
| Pyrophyllite | 0.2 |
| | 100.0 |

The industry provides employment for more than 1,200 persons.

As shown in Table I, there has been a considerable increase in the production of industrial minerals in Newfoundland since 1950, and much headway has been made in other directions as well. Fluorspar production has been doubled; cement and gypsum industries have been established; sand and gravel production has increased 50 per cent; and there has been a marked improvement in the clay products industry as a result of one of the plants switching from clay to shale as a raw material. The cement and gypsum industries came into production in 1952, and including the wallboard plant operated by the latter industry, provide employment for more than 300 persons and have a combined output valued at over $3,000,000 annually. Production of limestone and granite has shown little change singe 1950, whereas the output of lime decreased steadily and ceased in 1953. Production of a pyrite concentrate at Buchans got under way early in 1955 and in June 1956 the pyrophyllite industry resumed operations on a full-time basis.

In the past there was also a small production of asbestos, barite, building stone (granite, marble and sandstone), chromite, grinding pebbles, mica and roofing slate.

A large proportion of the industrial mineral production of the island is shipped to the mainland. The fluorspar is shipped mainly to Quebec and the United States. About 75 per cent of the limestone is shipped to Sydney, N.S. and the remainder is used locally. About 40 per cent of the cement and most of the gypsum wallboard and lath are shipped to the neighbouring provinces, and 90 per cent or more of the pyrophyllite is exported to the United States. The clay products, lime and pyrite concentrates are consumed locally.

91230—2½

## Table I
## Production of Industrial Minerals in Newfoundland[1]
## 1950-1956

| | 1950 | | 1951 | | 1952 | | 1953 | | 1954 | | 1955 | | 1956 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Short Tons | Value $ | Short Tons | Value $ | Short Tons | Value $ | Short Tons | Value $ | Short Tons | Value $ | Short Tons | Value $ | Short Tons | Value $ |
| Cement | — | — | — | — | 126,100[2] | 529,750 | 395,834[2] | 1,345,073 | 403,515[2] | 1,330,018 | 468,600[2] | 1,499,800 | 83,902[3] | 1,660,300 |
| Clay products | — | 31,089 | — | 32,183 | — | 29,285 | — | 39,500 | — | 33,042 | — | 45,000 | | 47,145 |
| Fluorspar | 55,595 | 1,290,361 | 67,925 | 1,966,477 | 81,283 | 2,484,943 | 87,693 | 2,631,698 | 118,065 | 2,946,896 | 131,049 | 3,034,080 | 139,801 | 3,395,061 |
| Gypsum | — | — | — | — | 8,660 | 54,881 | 26,531 | 117,208 | 26,653 | 124,385 | 44,800 | 212,800 | 37,000 | 186,727 |
| Lime | 396 | 20,436 | 436 | 17,533 | 436 | 19,952 | 160 | 6,942 | — | — | — | — | — | — |
| Pyrophyllite | — | — | — | — | — | — | — | — | 9 | 230 | — | — | 1,379 | 12,077 |
| Sand and gravel | 1,619,389 | 780,315 | 1,483,951 | 648,346 | 1,654,471 | 936,013 | 1,908,187 | 1,023,622 | 2,105,522 | 1,096,883 | 3,142,226 | 1,660,984 | 2,490,580 | 1,686,320 |
| Stone: | | | | | | | | | | | | | | |
| Granite | — | — | 3,546 | 13,135 | 20,150 | 32,725 | — | — | 1,896 | 14,220 | 1,800 | 14,000 | 4,826 | 21,130 |
| Limestone | 443,336 | 734,599 | 462,894 | 779,184 | 455,554 | 735,601 | 391,617 | 647,349 | 357,454 | 605,254 | 333,354 | 590,945 | 319,261 | 573,304 |
| Sandstone | 26,315 | 52,629 | — | — | — | — | 16 | 120 | — | — | — | — | 3,856 | 9,660 |
| Sulphur (Pyrite) | — | — | — | — | — | — | — | — | — | — | — | 24,750 | — | 59,097 |
| Total | | 2,909,429 | | 3,456,858 | | 4,823,150 | | 5,811,512 | | 6,150,928 | | 7,082,359 | | 7,650,821 |

[1]Dominion Bureau of Statistics.
[2]Barrels of 350 pounds.
[3]Short ton is measurement unit for cement, effective 1956. This figure represents 479,400 bbl.

Table II gives the industrial mineral production as a percentage of the total mineral production for the years 1938 to 1956 inclusive. The percentages for 1953 to 1956 were affected by the large rise in output of iron ore at Wabana in 1953 and the coming into production in 1954 of the Labrador-New Quebec operations of the Iron Ore Company of Canada. The total mineral production of Newfoundland in 1956 was $203.25 per capita, as compared with the per capita figure of $18.44 for the industrial minerals. The corresponding figures for Canada as a whole were $128.58 and $26.02 respectively, on a preliminary basis.

TABLE II

INDUSTRIAL MINERAL PRODUCTION AS A PERCENTAGE OF TOTAL MINERAL PRODUCTION[1]

1938-1956

| Year | Total Mineral Production | Industrial Mineral Production | Industrial Mineral Per Cent of Total |
|---|---|---|---|
| | Value $ | Value $ | |
| 1938 | 8,570,612 | 365,265 | 4.3 |
| 1939 | 8,814,425 | 448,830 | 5.1 |
| 1940 | 7,228,571 | 573,510 | 7.9 |
| 1941 | 6,145,781 | 582,188 | 9.4 |
| 1942 | 7,226,355 | 851,709 | 11.8 |
| 1943 | 8,489,271 | 2,328,531 | 27.4 |
| 1944 | 6,843,259 | 1,620,070 | 23.7 |
| 1945 | 8,687,328 | 1,670,914 | 19.2 |
| 1946 | 11,748,123 | 547,944 | 4.7 |
| 1947 | 15,710,635 | 774,412 | 5.0 |
| 1948 | 21,273,938 | 1,765,657 | 8.3 |
| 1949 | 27,583,615 | 3,088,516 | 11.2 |
| 1950 | 25,824,047 | 2,909,429 | 11.3 |
| 1951 | 32,410,443 | 3,456,858 | 10.7 |
| 1952 | 32,512,313 | 4,823,150 | 14.8 |
| 1953 | 33,780,622 | 5,811,512 | 17.2 |
| 1954 | 42,898,033 | 6,150,928 | 14.3 |
| 1955 | 70,317,215 | 6,513,345 | 9.3 |
| 1956 | 84,349,006 | 7,650,821 | 9.1 |
| Total and average | 460,413,592 | 51,933,589 | 11.2 |

[1] Figures for 1938-48 as given by Geological Survey of Newfoundland (9); figures do not include production of clay products, lime, sand and gravel, or crushed stone for concrete aggregate and road metal. Figures for 1949-56 represent shipments; source, Dominion Bureau of Statistics.

Very little is known of the industrial mineral resources of Labrador. Their mention in the following pages is confined to brief references in the chapters on Abrasives, Asbestos, Fluorspar, Granite, Graphite, Mica, Talc and Soapstone, and Titanium Minerals. With the exception of the newly discovered deposits of titaniferous magnetite in the area south of Lake Melville, no deposits of commercial size and grade have as yet been disclosed. However, because of the close geological similarity between Labrador and northern Quebec, where commercial deposits of graphite, mica, magnesite, pyrite, and other minerals have been discovered, it is probably only a matter of time and more intensive exploration before important deposits of these minerals are found in Labrador.

No further attempt has been made to exploit the Rowsell Harbour pyrite deposit on which, in 1904, Dupont Powder Company of Wilmington, Del., sank several test pits and drove a number of drifts, besides shipping 20 to 30 tons of ore to the United States for test purposes (5, p. 543). The area is underlain by sedimentary rocks of Precambrian age which dip to the west at angles of 15 to 20 degrees. The deposit, a pyrite-rich band of argillite underlying a chert horizon, extends for a known length of 5,000 feet along the south side of the harbour. Channel sampling along the zone in 1946 gave sulphur values ranging from 33.58 to 44.80 per cent, with an average of 38.10; thicknesses ranged from 2 to 6½ feet and averaged 4½ feet. No copper, gold, or silver were present. Described as a large pyritic body of marginal grade, the deposit is estimated to contain 2,500 tons per foot down dip, assuming an average ore thickness of 6 feet (1, pp. 62-65).

## Topography and Geology

### • *NEWFOUNDLAND*

The island of Newfoundland lies across the Gulf of St. Lawrence, separated from the mainland by the Strait of Belle Isle on the north and by Cabot strait on the south. Roughly triangular in shape, it measures 317 miles north to south and 316 miles east to west, and has an area of approximately 42,700 square miles. It has a long stretch of coast, for the most part very irregular in outline and with many large inlets or bays. These (proceeding in a clockwise direction from St. John's) are: Trepassey bay, St. Marys bay, Placentia bay, Fortune bay and Hermitage bay on the south coast; St. Georges bay, Port au Port bay, and Bay of Islands on the west coast; Hare bay, White bay, Notre Dame bay, Hamilton sound, Bonavista bay, Trinity bay, and Conception bay on the east coast. These great bays in their reaches inland have formed several large peninsulas, two of which—the Northern and Avalon—form an appreciable portion of the island. Most of the island is a plateau of low, gently rolling relief, rising to a maximum elevation of more than 2,500 feet in the Long Range mountains on the west coast, and decreasing to about 700 feet in the Avalon peninsula on the east coast. Elsewhere are a number of separated ridges and isolated peaks. There are numerous rivers and brooks, lakes and ponds; and a large number of islands and island groups are met with almost everywhere along the coast. The principal rivers are the Humber and St. George, which flow toward the west, and the Gander, Exploits and Terra Nova, emptying into eastern bays. Grand lake, Red Indian lake and Gander lake are the largest lakes (2). A striking feature in the topography of the island is "the marked parallelism of the peninsulas, reëntrants, lakes, rivers, ridges, and outcrops, which in nearly every case approximate a direction about N.28°E." (6, p. 5).

Geologically, Newfoundland is essentially the northeast continuation of the Appalachian region which occupies the Maritime Provinces, Gaspé, and part of the Eastern Townships of Quebec. The rocks of Newfoundland range in age from early Precambrian to Pennsylvanian, or late Palaeozoic, with those of each period presenting a wide variety of types. The island, to quote MacClintock and Twenhofel (4, p. 1732), "is composed dominantly of metamorphic and plutonic igneous rocks into which have been folded or faulted areas of volcanics and of Paleozoic sediments in northeast-southwest lineaments. These latter have been introduced in places by considerable masses of basic and ultrabasic rocks." They continue:

"The whole area has been subsequently peneplained, rejuvenated, partially peneplained, rejuvenated again, partially peneplained again, and finally rejuvenated and slightly dissected to the topography as it was at the onset of glaciation. During the erosion which followed the initial rejuvenation the softer rocks were etched out to form the lowlands specified by Snelgrove (1939) as the West Coast Lowlands, Grand Lake-White Bay Basin, and Notre Dame Bay Basin. The resistant igneous and crystalline rocks stand as uplands such as the Long Range Plateau, the Indian Head Range, and the Bay of Islands "Serpentine" Range, as also do some of the resistant sedimentary rocks such as form the Anguille and the Table mountains at Port au Port."

From the presence of fresh erratic stones and ice-scoured topography, they conclude that the island was completely glaciated during the Wisconsin stage of the Pleistocene.

- ***LABRADOR***

Labrador comprises about 112,000 square miles, approximately three times the size of the island of Newfoundland. It has an over-all length (north-south) of about 700 miles and a maximum width of nearly 500 miles. It is bounded on the east by the Atlantic ocean, on the southeast by the Strait of Belle Isle, and on the south and west by the province of Quebec. Its boundary line with Quebec begins at the east side of Blanc Sablon harbour, and runs due north to the 52nd "degree of north latitude, and from thence westward along that parallel until it reaches the Romaine river, and then northward along the left or east bank of that river and its head waters to their source and from thence due north to the crest of the watershed or height of land there, and from thence westward and northward along the crest of the watershed of the rivers flowing into the Atlantic Ocean until it reaches Cape Chidley." (7, pp. 22-23).

The southeast coast presents an even, rocky shoreline, with few bays and inlets, whereas the Atlantic coast is rugged and rocky and broken by many large bays and fiords, and fringed by a multitude of small rocky islands. Hamilton inlet is the largest and longest of the inlets, extending inland over 150 miles from its mouth. Among others, Sandwich, Kaipokok and Saglek bays and Nachvak fiord are from 30 to 50 miles deep. From the Strait of Belle Isle to Nain the terrain rises abruptly inland almost everywhere, reaching altitudes of 1,000 to 1,500 feet. North of Nain the land is much higher, and in the Nachvak fiord-Eclipse harbour area, rises abruptly from the sea to heights varying from 2,500 to over 4,000 feet. Farther north, the land decreases in altitude. The highest part of the coast, between Saglek and Ryan bays, is known as the Torngat mountains (3, pp. 20-23).

Labrador is underlain entirely by rocks of Precambrian age, most being rocks of granitic composition, which nearly everywhere are more or less foliated. Some of these gneisses are highly metamorphosed materials of clastic origin; others are foliated rocks of igneous origin. Next in importance in space occupied are the basic and ultrabasic rocks, mainly anorthosite and gabbro. Nearly two dozen such bodies are known (10), the largest covering an area of nearly 5,000 square miles. Also present are several belts of folded Proterozoics, the largest of which is over 500 miles long, extending north-northwest from the Ashuanipi river area of Labrador, to the western side of Ungava bay, in northwestern Quebec. This belt is of particular interest as it contains the important Labrador-New Quebec iron ore deposits.

## References


(1) **Douglas, G. V.:** Notes on localities visited on the Labrador coast in 1946 and 1947; *Geol. Surv., Canada,* Paper 53-1, 1953.

(2) **James M. J.:** "The Geography of Newfoundland" in *The Book of Newfoundland,* (edited by J. R. Smallwood), Newfoundland Book Publishers, Ltd., St. John's, 1937, vol. 1, pp. 47-54.

(3) **Low, A. P.:** Report on explorations in the Labrador peninsula along the East Main, Koksoak, Hamilton, Manicuagan and portions of other rivers in 1892-93-94-95; *Geol. Surv., Canada,* Ann. Rept. (New Series), vol. 8, pt. L, 1896.

(4) **MacClintock, P., and Twenhofel, W. H.:** Wisconsin glaciation of Newfoundland; *Bull. Geol. Soc. Amer.,* vol. 51, 1940, pp. 1729-1756.

(5) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1881 to 1909; St. John's, Nfld., 1918.

(6) **Twenhofel, W. H.:** Physiography of Newfoundland; *Am. J. Sci.,* 4th ser., vol. 33, 1912, pp. 1-24.

(7) In the Matter of the Boundary between the Dominion of Canada and the Colony of Newfoundland in the Labrador Peninsula; *Report of the Lords of the Judicial Committee of the Privy Council,* delivered the 1st March, 1927, London, 1927.

(8) Industrial survey of the resources of the Province of Newfoundland; Donald, Ross & Co., Montreal, Que., rept. to Nfld. Ind. Development Bd., 1950.

(9) Production and value of Newfoundland minerals from 1934 to 1947 inclusive; table presented on request to Bureau of Mines, Ottawa, by *Geol. Surv., Newfoundland,* October 1948.

(10) Geological map of Canada; *Geol. Surv., Canada,* Map 1045A, 1955.

# Chapter 2

## ABRASIVES

### Garnet

**• *ISLAND OF NEWFOUNDLAND***

NO garnet occurrences of economic interest have been found nor is there any recorded production. Snelgrove (6, p. 103) noted that "Garnets occur profusely in the schists and gneisses of the older formations. They have been noted particularly in the schists of Burnt Island Bay on the south coast, 10 miles east of Port aux Basques, and also on the east side of White Bay, north coast."

Cooper (3, pp. 37-38) reports that garnet is present as an accessory mineral in the granite-pegmatite dykes of the La Poile-Cinq Cerf area:

"The granite-pegmatite dykes . . . contain feldspar, mica, beryl, and garnet. Unfortunately, the possibility of commercial deposits is remote. Beryl and garnet are scarce, but might conceivably be sought as gems. Although some of the garnet has an attractive red colour, all observed garnet was too flawed for this use."

**• *LABRADOR***

Large areas of Labrador are underlain by garnet-bearing gneisses of Archaean age, although no deposits of commercial grade have been found. Christie (2, pp. 5, 7) has noted the occurrence of garnets in many of the gneisses along the coast, including the granulites near the head of Nachvak and Hebron fiords and a border phase of the intermediate gneisses just north of Ryans bay. He refers to the latter as "a complex of banded, garnetiferous rocks", the garnet content being "considerably higher than in the more massive phase of the intermediate gneisses". The granulites are described as "highly garnetiferous, light-coloured, and strongly foliated rocks, commonly of even grain, although garnets or small lenses or rods of quartz may occur as porphyroblasts considerably larger than the other mineral grains."

According to Douglas (4, pp. 12-13), garnet occurs in mineralized lenses in gneiss on the northwest side of Mountaineer cove, Hawke bay. The lenses strike with the gneissic foliation, and the largest lens is described as having a width of about 100 feet and an unknown length.

Agar (1, p. 712) has recorded the occurrence of garnetiferous intrusions in the gneisses of the Saglek bay area. He wrote as follows:

"The rock forming the mountain at the head of the bay is a garnet gneiss with irregular intrusions of a quartz-feldspar-garnet rock. Small garnets are an integral part of the gneiss, but many large ones, up to six inches in cross section, accompany the later intrusion".

Kranck (5, p. 34) was of the opinion that a "closer examination of this and other garnetiferous deposits should be made to determine if a commercial source of abrasive exists".

## Grinding Pebbles

### • *ISLAND OF NEWFOUNDLAND*

**Conception Bay**

Production of grinding pebbles in Newfoundland has been confined to the southeast shore of Conception bay, southeast coast. With the exception of one shipment to the United States and several to Germany about 40 years ago, production may be said to have commenced in 1940 and to have ended in 1947. The pebbles were exported by Joseph Dawe, of Long Pond, on behalf of the Clinchfield Sand and Feldspar Corporation, of Baltimore, Md. Between 1940 and 1947, 2,641 long tons valued at $29,247 were exported and except for one order for 100 tons shipped to

*Plate I*

*Beach at Topsail where grinding pebbles were gathered during World War II.*

Canada, all went to the United States. During the war this material replaced supplies from Europe. The pebbles are mainly composed of fine-grained, hard and tough rhyolite, although other types composed of granite, slate or felsite, etc., are also present. The source beach extends from Topsail to Foxtrap head, a distance of approximately 5 miles. It is close to the railroad and Trans-Canada Highway.

The pebbles were shipped in six grades according to size, the sizes ranging from 1 inch to 6 inches in diameter, each size, from No. 1 to No. 6, being about one inch larger than the preceding one. The pebbles were packed in 150-pound bags and trucked 10 or 15 miles to St. John's for shipment. The following information on a 50-ton shipment of May 12, 1947, was supplied by Mr. Dawe who supervised the gathering, sorting, trucking and shipping. This shipment consisted of 5 tons of No. 1, 35 tons of No. 2, and 10 tons of No. 5 grade.

| | $ |
|---|---|
| Wages to pebble gatherers | 295.20 |
| Wages to sorters and truckers | 233.50 |
| Transportation to and from beach | 44.00 |
| Agent's commission | 100.00 |
| Wharfage | 28.18 |
| Labour charges to longshoremen | 12.70 |
| Miscellaneous | 10.90 |
| Total | 724.48 |

Thus the cost per long ton, f.o.b. St. John's, amounted to $14.49. In addition, a royalty of $0.25 per ton was paid the provincial Government.

Although the reserves of grinding pebbles in the Conception bay area are undoubtedly large, recovery is costly and as long as the imported varieties are available it is unlikely that operations will be resumed. However, the local grinding pebbles were found to be highly satisfactory and the area would be an excellent source of this essential material should supplies from Europe be again cut off. The imported varieties, including the Danish pebbles which are recognized as the standard because of their great hardness and toughness, have been available since 1945.

**Little Lawn Harbour**

About 12 years ago St. Lawrence Corporation of Newfoundland Limited obtained rhyolite beach pebbles from Little Lawn harbour, about

4 miles south of St. Lawrence and shipped several hundred pounds of 1-inch and 2-inch pebbles to the United States for tests. Results of the tests are not known, but the percentage of pebbles sufficiently rounded for grinding purposes is limited and the deposit is not considered to be of commercial value.

Table III gives the annual production and value of grinding pebbles for the period 1940-1947.

TABLE III

PRODUCTION OF GRINDING PEBBLES IN NEWFOUNDLAND[1]
1940-1947

| Year | Long Tons | Value $ |
|---|---|---|
| 1940 | 931 | 5,586.00 |
| 1941 | 655 | 7,171.07 |
| 1942 | 104 | 1,283.00 |
| 1943 | 165 | 2,310.00 |
| 1944 | 398 | 6,241.14 |
| 1945 | 105 | 1,541.12 |
| 1946 | 18 | 345.00 |
| 1947 | 265 | 4,770.00 |
| Total | 2,641 | 29,247.33 |

[1] Figures as supplied by Geological Survey of Newfoundland (7).

## References


(1) **Agar, W. M.:** The east coast of Labrador; *Can. Min. J.*, vol. 43, 1922, pp. 709-712.

(2) **Christie, A. M.:** Geology of the northern coast of Labrador, from Grenfell sound to Port Manvers, Newfoundland; *Geol. Surv., Canada,* Paper 52-22, 1952.

(3) **Cooper, J. R.:** La Poile-Cinq Cerf map-area, Newfoundland; *Geol. Surv., Canada,* Mem. 276, 1954.

(4) **Douglas, G. V.:** Notes on localities visited on the Labrador coast in 1946 and 1947; *Geol. Surv., Canada,* Paper 53-1, 1953.

(5) **Kranck, E. H.:** Bedrock geology of the seaboard region of Newfoundland Labrador; *Geol. Surv., Newfoundland,* Bull. No. 19, 1939.

(6) **Snelgrove, A. K.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4, 1938.

(7) Production and value of Newfoundland minerals from 1934 to 1947 inclusive; table presented on request to Bureau of Mines, Ottawa, by *Geol. Surv., Newfoundland,* October, 1948.

# Chapter 3

## ASBESTOS

AT least three different kinds of asbestos—chrysotile, tremolite and actinolite—occur in the province. Chrysotile, or fibrous serpentine, the asbestos of commerce, has been found at a number of localities, two of which may be of commercial importance. Tremolite is found in several localities in the White bay district on the northeast coast of the island, but nothing likely to be of economic importance has been reported. Actinolite, the high-iron variety of tremolite, has been reported only from the Hopedale region of Labrador.

The chrysotile is found in several belts of serpentine rocks which lie approximately north-northeast, parallel to the general structural trend of the island. These serpentinized basic and ultrabasic rocks represent the northeastward extension of the Appalachian serpentine belt in which the principal deposits of Quebec and those of northern Vermont are found. Snelgrove and Baird (11, p. 97) describe the serpentine belts and asbestos occurrences as follows:

"Several belts of serpentine rocks, of the type with which asbestos is sometimes found, occur in Newfoundland. One zone extends intermittently from Port au Port Bay to Bonne Bay on the west coast. Another area is found on the north side of Hare Bay on the north end of the Northern Peninsula. Numerous small masses are found in the Burlington Peninsula. Another zone is found in the central part of Newfoundland between Gander Lake and the region of Maelpaeg Lake. A series of small discontinuous bodies extends northeastward from Gander Lake toward Ragged Harbour on the northeast corner of Newfoundland.

"Small asbestos veins and irregular patches showing thin fibrous zones can be found in any of these masses and in recent times have led to considerable excitement without much foundation. In 1896 asbestos to the value of $2,000 was exported from workings presumed to be in the region of Bluff Head on the west coast. No other production is recorded."

The occurrence of chrysotile asbestos in the western belt, first mentioned by Murray (8, p. 341) in 1873, aroused some interest about 60 years ago, and from 1891 to 1896 several small bodies were found in the Bluff head, Lewis brook and Spruce brook localities. No further work was done in the area until Asbestos Corporation's investigation of 1946 and 1947. Although this failed to disclose any large deposits in the Bluff head-Lewis brook area, it located several small bodies of commercial grade. At present the deposits at Lewis brook are being explored and developed by Newfoundland Asbestos Limited, and a small mill is being erected to treat the ore.

Chrysotile asbestos of good quality was recently discovered near Baie Verte, northeast coast, but at the time of writing little information was available as to the nature and extent of the deposit*. As early as 1939, Watson (13, p. 37) noted that narrow, cross-fibre veinlets of chrysotile are abundant in the serpentinized ultramafic rocks of the Baie Verte-Mings bight area. However, it was not until the recent discovery that the mineral was found in sufficient quantity to be of possible economic importance. Watson had also noted the presence of tremolite asbestos in the same general area. He wrote (13, p. 37): "Tremolite asbestos was observed as slip-fibre and narrow cross-fibre veinlets in the metagabbro in a few places, particularly in the highly mafic portions. Although some of the fibre exceeds 6 inches in length, it is harsh . . . no commercial concentration was observed."

### • *BLUFF HEAD-LEWIS BROOK*

Bluff head, a bald, flat-topped headland nearly 2,000 feet high, is about 18 miles north of Port au Port, Port au Port bay, west coast. Lewis brook occupies a deep gulch or ravine which runs in a north-south direction about 2 miles east of the bay. The nearest settlement is Point-à-Mal, about 10 miles to the south.

---

*The occurence is on the Burlington peninsula near Baie Verte between Notre Dame bay and White bay. Extensive diamond drilling undertaken in 1956 outlined part of a deposit of good quality chrysotile fibre. Advocate Mines Limited has been incorporated to further develop this occurrence. *Ed. note.*

According to Cooper (1, p. 50) the deposits are in a small outlying part of the Lewis Hills mass which lies to the northeast. The asbestos "occurs in two belts of serpentinized ultramafic rocks, one extending from Bluff Head northward for about 1½ miles parallel to the shore, the other parallel to Lewis Brook several miles up the canyon." The possibility of a flat-lying band containing asbestos extending the full width of the property (i.e., from Bluff head to Lewis brook) has also been mentioned (6).

Newfoundland Asbestos Limited entered the field in 1951. From its preliminary survey it was estimated (9) that about 20,000 tons of asbestos ore—enough to warrant consideration of a mill—were indicated in the Lewis brook area. It was recommended that further drifting and raising be done in the "B" adit* in an attempt to block out and develop this indicated tonnage and to determine whether the rather incompetent ore could be mined safely and economically.

Late in July, 1951 the company obtained the financial help of the Newfoundland Government; this was to be followed by additional aid in erecting a mill at the property should the attempt to block out the ore prove successful.

Actual underground work was commenced on October 21, and completed on December 9 with, it was believed, sufficient of the objectives achieved. This work, which was confined to the "B" adit, consisted of 204 feet of drifting, 70 feet of cross-cutting and 95 feet of raising. As a result of this work, the reserves for the "B" orebody, including all classes of ore, were estimated at 112,500 tons. This included 25,000 tons of proven and semi-proven ore, and was considered sufficient to justify the erection of a mill to treat 100 tons a day. Development work also showed that: the ore occurs on the footwall of a troctolite** dyke which dips to the west at angles ranging from 60 degrees to vertical; men can work safely under timber in a retreating system of mining; means of egress and access can be protected and kept open; and the troctolite affords a "safety wall"(10).

When the writer visited the property in September 1952, work was confined to the mill building which was being erected on the west side of Lewis brook about 100 yards east of adit "B". The mill machinery and equipment had arrived but were stored at Fox Island river, about 5 miles to the south, awaiting transportation over the tractor trail to the campsite. The mine was inactive, although it was understood that some more development and exploration work had been done recently as a result of which

---

* One of two exploratory drifts completed by Asbestos Corporation Limited. These adits, "A" and "B", 186 and 429 feet long respectively, are 360 feet apart and driven in a westerly direction 20 feet above brook level.

** Gabbro composed essentially of feldspar and olivine.

the estimated ore reserves were considered to be somewhat higher than the above amount. Considerable difficulty was being experienced in getting supplies in over the trail, which is partly why the company suspended operations late in 1952 before completing the mill and bringing the mine into production.

Early in 1954 additional funds became available, and in July preparations were being made to resume the underground development work and complete the mill. The mill equipment had been moved in to the campsite and stored ready for erection. About 2 miles of the gravel road connecting the property with Point-à-Mal remained to be completed, but it was possible to travel the whole distance by truck.

Samples of the fibre examined by the Industrial Minerals Division, Ottawa, revealed it to be soft, silky, and lighter in colour than that usually found in the Thetford Mines area of Quebec. Its strength and the above qualities should make it an acceptable spinning grade providing sufficient long fibre exists.

• ***BOND PROSPECT***

This asbestos prospect is about 15 miles due east of the Lewis brook deposit and about 4 miles west of Spruce Brook railway station. It was investigated by Johns Asbestos Company of New York about 1891. This work was abandoned after several prospect pits and shafts were opened, owing to the then difficult and expensive means of transportation (11, p. 98).

The property was examined by Walthier (12, pp. 41, 44) in 1945 on behalf of the Geological Survey of Newfoundland. He reported finding serpentine containing a few small veinlets of asbestos, probably of the chrysotile variety. The following is from his description of the property.

"The three trenches and the two exploratory shafts are cut into massive light green to dark grayish-green serpentine. This serpentine is strongly fractured and most of the fractures are slickensided and a few show small amounts of slip-fibre asbestos. Some light green cross-fibres $\frac{1}{4}$-$\frac{1}{2}$ inch long can be found on the dumps. It is reported that fibrous masses of this mineral, 2 inches long, have been mined here but such masses cannot be found there now; in fact, almost no asbestos shows on the present faces nor is much present on the dumps."

He concluded that, "In spite of this absence of asbestos at the Bond Mine, the geological setting suggests that quantities of asbestos might exist nearby." Exposures are relatively scarce and "until the area is explored thoroughly by drilling or trenching, the possibility remains that such a deposit does exist."

### • GANDER RIVER

Chrysotile asbestos has been reported from four localities in the Gander river area, namely, "on the east side of Cole Hill, on the southeast side of Bursey Hill, at the north end of Weirs Pond, and near the crest of Chrome Hill" (7). These deposits occur in peridotite and from information available to date, do not appear to have any commercial value. Snelgrove and Baird (11, p. 99) mention two of the occurrences as follows:

"Bursey Hill prospect on the lower Gander River consists of a few veins of less than ¼ inch thick along the base of a sill-like body of peridotite, 16 feet thick; no commercial quantities of asbestos were encountered. At Cole Hill in the same district veins less than ⅛ inch thick occur in a similar sill of peridotite 15 feet thick."

### • HARE BAY

The presence of chrysotile asbestos in the peridotites of Hare bay on the north coast of the island has been reported by Cooper (2, pp. 25-26). The following information is taken from his report:

"Cross-fibre veins of serpentine asbestos (chrysotile) cut the peridotite at many places. They may have no regularity or may occur in closely spaced, parallel planes, giving typical ribbon structure. In the latter mode of occurrence, the asbestos makes up ten to twenty per cent of the rock in some places."

The asbestos appeared to be of good quality, but Cooper was unable to discover any place where rock approximating ore grade extended over more than a few feet in width. The veins seldom exceeded three-sixteenths of an inch in width, whereas in most places they were less than one-sixteenth. He was of the opinion that the most favourable field for prospecting in the Hare bay area was in the west margin of the White hills where the rocks have undergone fracturing and alteration.

### • HOPEDALE

Kranck (5, p. 36) reports the occurrence of actinolite asbestos in the Hopedale region of Labrador, and adds that "there may be some hope of finding more inland."

### • LARK HARBOUR

In 1952 an asbestos prospect near the south entrance to the Bay of Islands, west coast, was investigated by the Geological Survey of Newfoundland. The asbestos occurs in a belt of serpentine and peridotite that outcrops on the shore of Trumpet cove, half a mile south of South head. No deposit of commercial grade was located as a result of this preliminary survey, but the area is considered to be of interest in "that the asbestos is found in more than the usual amount in the serpentine."

The asbestos in the peridotite, according to Gillespie (3), occurs in very fine veinlets, generally under one-thirty-second of an inch wide, which form a network throughout the rock. In the serpentine, however, the asbestos veins are found paralleling a number of granitic dykes which intrude the serpentine at this point. These asbestos veins approach a quarter of an inch in width but "in all but one or two cases there are only three or four separate veins, forming a ribbon structure."

- ***SOPS ARM***

Heyl (4, pp. 25-26) reports a minor occurrence of tremolite asbestos in the Sops arm area. Snelgrove and Baird (11, p. 99) have recorded this occurrence as follows:

"In Giles Cove located at the west end of Sops Arm, White Bay, northeast coast, a pit has been dug on a minor occurrence of tremolite asbestos occurring in volcanic rocks of the Giles Cove formation of Ordovician age."

## References


(1) **Cooper, J. R.:** Geology of the southern half of the Bay of Islands igneous complex; *Geol. Surv., Newfoundland,* Bull. No. 4, 1936.

(2) ——————— Geology and mineral deposits of the Hare Bay area; *Geol. Surv., Newfoundland,* Bull. No. 9, 1937.

(3) **Gillespie, C. R.:** Preliminary report on the Lark Harbour asbestos prospect; *Geol. Surv., Newfoundland,* unpub. rept., July 22, 1952.

(4) **Heyl, G. R.:** The geology of the Sops Arm area, White bay, Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 8, 1937.

(5) **Kranck, E. H.:** Bedrock geology of the seaboard of Labrador between Domino run and Hopedale, Newfoundland; *Geol. Surv., Canada,* Bull. 26, 1953.

(6) **Jenkins, G. F., and Rainboth, E. L.:** Report on trip to Lewis Hills asbestos prospect, Newfoundland, Sept. 30th-Oct. 3rd, 1947; *Asbestos Corporation Limited,* private rept.

(7) **Jenness, S. E.:** Preliminary report on the geology of the Gander River ultrabasic belt; *Geol. Surv., Newfoundland,* unpub. rept., 1953.

(8) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1864 to 1880; London, 1881.

(9) **Rukeyser, W. A.:** Lewis Brook Gulch area, Newfoundland Asbestos Limited; *Newfoundland Asbestos Limited,* private rept., July 1950.

(10) ——————— Report on Lewis Brook Gulch area, Newfoundland Asbestos Limited, near Port au Port, Newfoundland, January 1952; *Newfoundland Asbestos Limited,* private rept.

(11) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(12) **Walthier, T. N.:** Geology and mineral deposits of the area between Corner Brook and Stephenville, western Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 35, pt. 1, 1949.

(13) **Watson, K. de P.:** Geology and mineral deposits of the Baie Verte-Mings Bight area; *Geol. Surv., Newfoundland,* Bull. No. 21, 1947.

# Chapter 4

## BARITE AND CELESTITE

### Barite

SEVERAL deposits of barite on the island were visited during the investigation, the most important of which were the Collier cove mine, in Trinity bay, southeast coast, and the Ronan and Gillams cove prospects, on the Port au Port peninsula, west coast. The Collier cove occurrence appears to have definite possibilities as a producer of high-grade white barite, but little if any attempt has been made to exploit the deposit since 1900 when it was worked by Collier Cove Barite Company for a short period. The Ronan and Gillams cove deposits have never been exploited, although they were investigated in 1942 and 1943 by the Geological Survey of Newfoundland and shown to have commercial possibilities as producers of barite (barium sulphate) and celestite (strontium sulphate). No attempt has been made to exploit them to date, however.

The Cross point and Curslett cove occurrences on the eastern side of Placentia bay, southeast coast, do not appear to have any commercial value, at least from a preliminary examination. However, they may indicate the presence of larger, more important deposits in that general area. The deposits examined at Ragged head and Middle Bight cove, on the west side of Placentia bay, are of no commercial value. The occurrences in the Baie d'Espoir area, south coast, and at Romaines brook, west coast, though not visited during the investigation, are also reported to be valueless.

Barite occurs at a number of other localities in Newfoundland. It has been reported from Topsail head, in Conception bay; from Rantem, in Trinity bay; from Oderin island and Little harbour, in Placentia bay; and from St. John island, on the west coast (7, p. 100). Small quantities are present in some of the fluorspar veins of the St. Lawrence district (8, p. 43). Barite occurs "in the LaManche lead vein, the Silver Cliff lead-zinc-silver veins, and in small veins of the Silver Cliff type near Placentia", but "in too small a quantity to be of commercial importance" (7, p. 100). In the copper-lead-zinc ore at Buchans, however, barite is present in the exceptionally large proportion of 30 per cent and can be recovered commercially if desired.

Snelgrove and Baird (7, p. 102), who obtain their information from an unpublished report (2) of the Geological Survey of Newfoundland, make the following statement regarding the origin of the barite veins of the Placentia bay area:

"The origin of the barite veins is not certainly known. However, the wide distribution of the barite, its occurrence in different kinds of rocks, and its presence in the sulphide veins suggest that the barite veins belong to the same mineralization episode as the sulphide veins and like them, are of hydrothermal origin."

Described below in alphabetical order are the barite occurrences at Baie d'Espoir, Collier cove, Cross point, Curslett cove, Middle Bight cove, Ragged head and Romaines brook. The Ronan and Gillams cove barite-celestite prospects, along with several other similar but smaller deposits, are dealt with in the concluding portion of this chapter.

### • *BAIE D'ESPOIR*

Jewell (3, p. 20) mentions several occurrences of barite in the Baie d'Espoir area, south coast, as follows:

"Barite occurs with lead-zinc veins at Roti Point and in an old project just north of Muddy Hole on the west side of Baie d'Espoir, and as narrow veins and stringers with quartz along the east side of the bay north of Crow Head and along the north side of Lampidoes Passage west of the mouth of Roti Bay. The veins are probably not workable because of their small width and the presence of other minerals such as pyrite, sphalerite, galena, and fragments of slate."

### • *COLLIER COVE MINE*

The Collier cove barite mine is at tidewater along the southeast shore of Collier bay, Trinity bay. It is most conveniently reached by boat from the fishing settlement of Thornlea, about 2 miles to the west on the Trans-Canada Highway. According to Snelgrove and Baird (7, p. 100), the mine was worked about 50 years ago by Collier Cove Barite Company and 5,075 tons of barite valued at $35,700 were shipped from the area between 1902 and 1904. There has been no production since.

The vein strikes approximately north and south, has a nearly vertical dip, and occurs in sedimentary rocks of Precambrian age which strike N70°E and dip at 25 degrees north. The land here rises vertically from sea-level to an elevation of 25 feet and then rises rapidly to the south along the strike. In the open pit, which has a length of about 200 feet, widths of 10 and 13 feet of barite were seen. The barite occurs in well-developed tabular crystals, about one-third being white and the remainder salmon-pink. According to Snelgrove and Baird (7, p. 100), the mine "was worked largely as an open cut, supplemented by one 40-foot shaft and 100-foot drift", and the vein "is said to have averaged 20 feet over a distance of 300 feet."

The following measurements, taken at the foot of the sea cliff during low tide, and reading from east to west, show the total width of the mineralized zone at this point to be 20 feet:

*Cross-Section of Vein at Sea Level*

| *Legend* | *Width (inches)* |
| --- | --- |
| Barite | 55.0 |
| Country rock | 3.0 |
| Barite | 0.5 |
| Country rock | 6.5 |
| Barite | 1.5 |
| Country rock | 7.0 |
| Barite | 0.5 |
| Country rock | 5.5 |
| Barite | 3.0 |
| Country rock | 8.0 |
| Barite | 1.0 |
| Country rock | 6.0 |
| Barite | 12.0 |
| Country rock | 10.0 |
| Barite | 0.5 |
| Country rock, with a few ½-inch veins | 120.0 |
| Total width of mineralized area | 240.0 |

The deposit was investigated by Toronto mining interests in January 1951, who concluded that the deposit was not large enough to produce pink or off-colour barite in sufficient quantity to compete in the drilling mud or similar markets. However, as a producer of pure white barite it had possibilities, providing the salmon-pink variety, which makes up two-thirds of the ore, could be bleached. Bleaching tests were reported successful and it was understood negotiations were under way with a view to optioning and diamond drilling the deposit. However, as of December 1955 no work had been done.

It is reported that the Collier cove vein is exposed in Long cove, one mile to the south, and also on the north shore of Collier bay, but this was not confirmed.

### • CROSS POINT

Cross point is on the eastern side of Placentia bay, about one mile north of the settlement at St. Brides. One of the two barite veins examined in this area occurs at Cross point and the other at Perch cove, half a mile to the north; both veins are exposed in the sea cliff which, in this area has an average height of 60 feet.

The Cross point vein is steeply dipping, strikes approximately N70°E, and occurs in flat-lying pebble conglomerates believed to be of Precambrian age. Seven and a half feet wide at the base of the sea cliff, the vein gives way to two much smaller veins separated by a nearly barren zone as the top of the cliff is approached. "The barite occurs in thin, white to salmon pink, semi-radiating aggregates in which the pink colouration appears to be due to an iron oxide that is probably much less abundant in the fresh, unweathered barite below the outcrop" (7, p. 101). This is apparently the same vein mentioned by Milne (5, p. 729) in 1874 and by Howley (6, p. 445) in 1900.

The other vein is on the south side of Perch cove; it is exposed for a length of about 40 feet, near the top of the sea cliff. It strikes approximately N25°E and dips towards the west at 75 degrees. Its width varies from 1 inch to 10 inches. Several trenches put down along the strike of the vein have long since fallen in and show no signs of mineralization.

### • CURSLETT COVE

Curslett cove is on the eastern side of Placentia bay about 2 miles north of Cross point and 3 miles north of St. Brides. The barite vein is exposed in a 60-foot sea cliff about half a mile north of the cove.

This vein, known as the Otterrub vein, strikes approximately N80°E, is nearly vertical, and occurs in red conglomerate which dips to the south at 15 degrees. The "vein" consists of several stringers of barite which widen out about 30 feet above sea-level, at an undercut portion of the sea cliff, to give 3 feet of solid barite. The barite here, as at Cross point, is white to salmon-pink. Several trenches noted east of the sea cliff, along the strike of the vein, have fallen in and show no trace of barite.

### • *MIDDLE BIGHT COVE*

Middle Bight cove is a mile east of Little St. Lawrence harbour, on the western side of Placentia bay. The barite occurs in veinlets in a schisted zone about 5 feet thick, the veinlets "ranging in thickness from a fraction of an inch to 1 foot" (8, p. 43). The country rock is of Ordovician (?) age.

### • *RAGGED HEAD*

This deposit occurs near Ragged head, half a mile west of Lawn harbour on the western side of Placentia bay. The barite occurs in small lenses or pockets "along a fault in silicified Cambrian limestone" (8, p. 42). "The mineral is coarsely crystalline and is not contaminated by gangue, but only a few pockets have been found" (7, p. 100).

### • *ROMAINES BROOK*

Walthier (9, p. 80) mentions the occurrence of barite in the Romaines (Kippens) brook area, near Port au Port, west coast, as follows:

"Two miles up Kippens Brook several vuggy veins cutting quartzite carry crystals of barite and quartz. The barite is colourless and transparent; several well-formed crystals an inch in diameter were found. Nothing of commercial quantity is indicated."

## Celestite

Celestite, occurring in close association with barite, is found in four or more localities in the East bay area of Port au Port bay, west coast. The principal occurrence is "approximately 3,000 feet southwest of the church at Boswarlos; a second is at Gillams Cove, about $\frac{3}{4}$ mile west of Aguathuna; a much smaller lens is exposed in a gully a few hundred yards west of Gillams Cove; and a slightly mineralized zone occurs in the sea cliff about 200 feet beyond the last mentioned. In addition to these occurrences, indications of strontium mineralization may be seen in three gullies in the limestone quarry at Aguathuna" (4, p. 1).

Johnson (4, p. 10) describes the deposit as: "Irregular tabular to wedge-shaped masses of ore containing celestite, barite, aragonite, and calcite, with minor amounts of sulphides of lead and iron". The strontium and barium minerals occur as replacements of calcareous and arenaceous beds of the Codroy group of Upper Mississippian age. These beds occupy depressions in the Table Head (Ordovician) limestones which are thought to represent Karst or solution valleys in the pre-Carboniferous land surface.

### • GILLAMS COVE

"Gillams Cove lies about ½ mile west of Aguathuna, in the northern end of a small brook valley. On the east wall of this valley a bench of horizontal Codroy strata is bounded on the west by the brook and on the east by a wall of Table Head limestone. The bench is approximately 40 feet high, 150 feet wide, and extends southward from the cove for a distance that may be as much as 2,000 feet."

The mineralized zone, as exposed at the base of the sea cliff and for a short distance along the side of the valley, is 10 feet thick. It is "a mixture of crushed and shattered sandy limestone in irregular bouldery masses together with crystalline aggregates of celestite that enclose smaller amounts of barite, calcite, and aragonite. It is estimated that 35 to 40 per cent (by volume) of the ore zone is a mixture of these minerals and that 60 to 65 per cent of the mixture is celestite. If the mineralized area continues beneath the overburden to the limit of the pre-Carboniferous valley, the minimum size of the orebody is estimated to be 150 by 250 by 5 feet; in that case is would contain at least 17,400 tons of mixed strontium and barium ore" (4, pp. 10-11).

### • RONAN *(Boswarlos)*

This deposit is situated on the east side of Hoopers brook about half a mile southwest of the brook mouth and 300 yards south of the motor road.

"The orebody, as proved by drilling, appears to be wedge-shaped; it is parallel with the bedding of the Codroy strata and is confined to a pre-Carboniferous depression that" slopes northward at approximately the same angle (16 to 18 degrees) as the underlying Table Head strata (4, p. 13). It "varies in thickness from less than 1 foot in the trench at the southern boundary to more than 40 feet at the northern limit of drilling" (4, p. 15).

Although insufficient work was done to block out the mineralized zone completely, trenching and drilling indicated the deposit to have a length (north-south) of at least 350 feet, a width of 250 feet, and an average thickness of not less than 15 feet. According to Johnson (4, p. 15), reserves are estimated at over 150,000 tons of mixed sulphate ores. No grade is given, but from an examination of the core and sludge analyses for 1942, as tabulated by Johnson, the writer would estimate the ore to average around 30 to 40 per cent barite and 15 to 20 per cent celestite. As encountered in the first ten holes, overburden varied from 0 to over 20 feet with an average of 8 feet (1).

Johnson (4, p. 19) concludes his report with the following remarks:

"Selective marketing of the Boswarlos ore may be possible if great care is exercised in hand separation of the celestite and barite. As much of the ore is an intimate mixture of these two minerals, mechanical concentration and separation would yield a much higher percentage of marketable celestite, and barite could possibly be recovered as a by-product."

## References


(1) **Campbell, C. O.:** Appendum to "Preliminary report on celestite property", Boswarlos, Newfoundland; *Geol. Surv., Newfoundland,* unpub. rept., Sept. 29, 1942.

(2) **Chute, N. E.:** Mineral deposits of Placentia bay; *Geol. Surv., Newfoundland,* unpub. rept., 1937.

(3) **Jewell, W. B.:** Geology and mineral deposits of the Baie d'Espoir area; *Geol. Surv., Newfoundland,* Bull. No. 17, 1939.

(4) **Johnson, H.:** The strontium deposits of Port au Port peninsula; *Geol. Surv., Canada,* Bull. 27 (Contributions to the economic geology of western Newfoundland), 1954, pp. 1-19.

(5) **Milne, T.:** Notes on the physical features and mineralogy of Newfoundland; Quart. J., *Geol. Soc. London,* vol. 30, 1874, pp. 722-745.

(6) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1881 to 1909; St. John's, Nfld., 1918.

(7) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(8) **Van Alstine, R. E.:** Geology and mineral deposits of the St. Lawrence area, Burin peninsula, Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 23, 1948.

(9) **Walthier, T. N.:** Geology and mineral deposits of the area between Lewis hills and Bay St. George, western Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 35, pt. 2, 1949.

# Chapter 5

## CEMENT

LIMESTONES and argillaceous materials suitable for the manufacture of Portland cement are found at a number of localities in Newfoundland. The question of their utilization depends almost entirely on the availability of markets and the cost of fuel and transportation.

The province's only Portland cement plant is at Humbermouth, Bay of Islands, west coast, within 1,000 feet of the Trans-Canada Highway and about 3,500 feet south of the shipping wharf and Humbermouth railway station. It is operated by North Star Cement Limited and the cement is sold under the trade name "North Star". The plant is capable of producing 600,000 barrels of cement and 35,000 tons of agricultural limestone annually, and employs on a permanent basis approximately 150 men. It is a wet process plant, and was officially opened on November 19, 1951. Production of cement in 1956 amounted to 83,902 short tons compared with 468,600 barrels (82,000 short tons) in 1955[1]. The plant is described below.

[1] Dominion Bureau of Statistics.

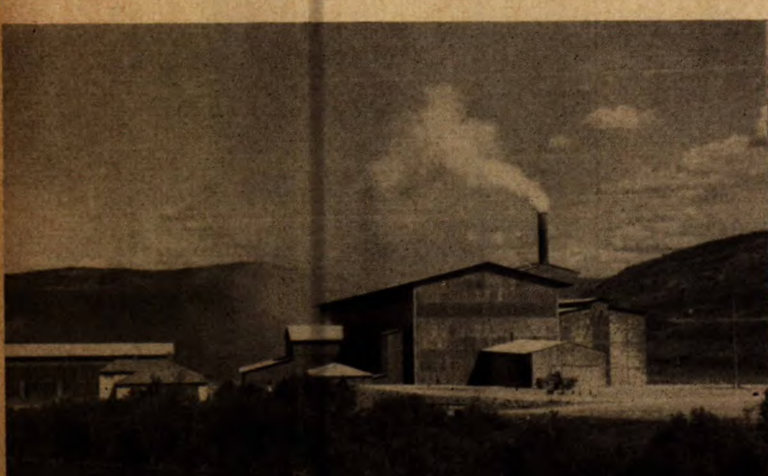


*Plate II*

*Cement plant, North Star Cement, Limited, at Humbermouth, west coast. Machine shop on left, crushing section at near end of main building. Note road to quarry at extreme upper right.*

The possibility of the argillaceous limestone of Cambrian age in Trinity bay, east coast, being suitable for the manufacture of cement has been frequently mentioned. Some investigating has been done along this line by the provincial government, but the results of the investigation have never been published. According to Snelgrove and Baird (5, p. 121), who obtained their information from an unpublished report of Bogert (1), the best exposures of limestone are on the east side of Trinity bay between Heart's Desire and Heart's Delight, and at points southeast of Islington and south of Cavendish. They write:

"The exposures between Heart's Desire and Heart's Delight constitute the largest available supply of limestone that could be quarried. The beds are here about 45 feet in thickness. They strike north 20° east and dip 45° northwest. The crest of the hill is approximately 250 feet above tidewater. The length which could be quarried appears to be in excess of 2,000 feet. The combined quantity which might be quarried at the Islington and Cavendish localities equals that in Heart's Desire and Heart's Delight area."

According to Hutchinson (2, p. 35), Bogert concluded "that the composition of the rock was suitable for the manufacture of Portland cement, but that the available material would support a production of only about 300 barrels of cement a day, and that this rate of production was insufficient to warrant investment in a modern cement plant."

## Humbermouth Cement Plant

The erection of a Portland cement plant at Humbermouth was the second of a series of projects undertaken by the provincial government in its endeavour to bring more primary industries to Newfoundland.

- ***RAW MATERIALS***

Raw materials used are limestone and shale obtainable from local quarries operated by the company, and gypsum, purchased locally from Atlantic Gypsum Limited. Limestone comprises about 80 per cent by weight of the raw mix to the slurry mill, and shale about 20 per cent. The amount of gypsum added to the cement or finishing mill depends upon the rate of setting required, but normally it comprises about 3½ per cent. The limestone and shale are delivered to the plant in 11.4-cu.yd. side-dump Athey wagons, drawn by DW10 Caterpillar tractors, with the average load running around 12 tons; the gypsum is delivered in trucks. Operations at both quarries are confined to the day shift.



91230—3½

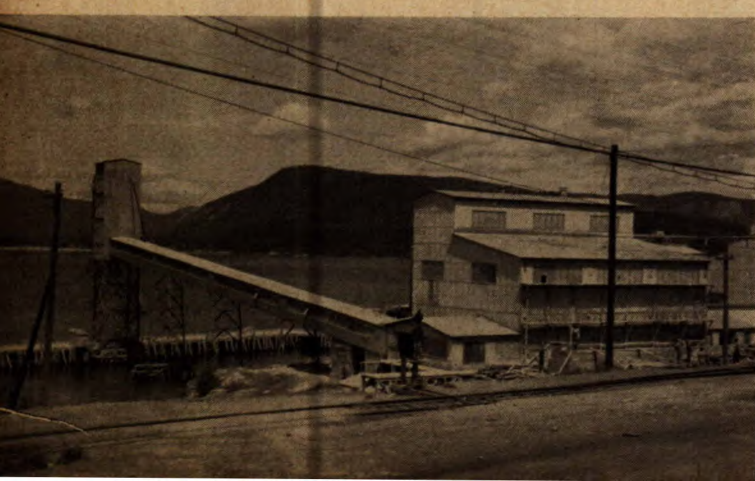
## Plate III

*North Star Cement, Limited. Limestone quarry that feeds the cement plant.*

The limestone quarry is about 4,000 feet east of the plant, on the north end of a north-south trending limestone escarpment about 450 feet above sea-level. It is about 400 feet long, 150 feet wide, and has an overall height of 195 feet. Workings are on three levels, the faces in each being 65 feet high. The stone is quarried by benching, using a wagon drill and jackhammers for drilling and two diesel shovels (0.6- and 1½-cu. yd. capacity) for loading. Compressed air is furnished by two portable diesel compressors, each supplying 210 cubic feet of air per minute. Tungsten carbide-tipped bits and 1¼-inch steel are employed in drilling.

The stone is a marble, or crystallized limestone, belonging to the Table Head formation of Ordovician age, similar to that quarried at the Dormston quarry, a mile to the south. The beds strike approximately N20°E and are steeply dipping. Before quarrying got under way, the area had been diamond drilled and sampled by the provincial Mines Branch working in conjunction with the Newfoundland Department of Economic Development. Over 40 diamond-drill holes, averaging over 200 feet, were put down in the area. As a result it was estimated that approximately 15,000,000 tons of limestone, suitable for the manufacture of cement, are available in the area. The stone averages 95 per cent calcium carbonate and 4 per cent magnesium carbonate. Quarrying however, is complicated by the presence of beds containing up to 10 per cent or more of magnesium carbonate.

The shale quarry is about 1,500 feet north-northeast of the cement plant, at a slightly lower elevation. It has a length of 250 feet, a width of 250 feet, and a face averaging 15 feet in height. Quarrying equipment here



## Plate IV

*Storage and packing plant, wharf and loading tower at Humbermouth, North Star Cement, Limited.*

includes a ¾-cu.yd. diesel shovel and a portable diesel compressor having a rated capacity of 85 cubic feet of air per minute. The shale beds are steeply dipping and strike approximately due north. Overburden ranges up to 6 feet. Outcrops of shale are scarce in the area due to overburden, but the formation has a width (east-west) of at least 1,000 feet, and as far as the cement plant is concerned the supplies of shale are more than adequate. The shale is exposed along the waterfront in the vicinity of the gypsum plant and may also be noted in a roadcut west of the Humbermouth railway station.

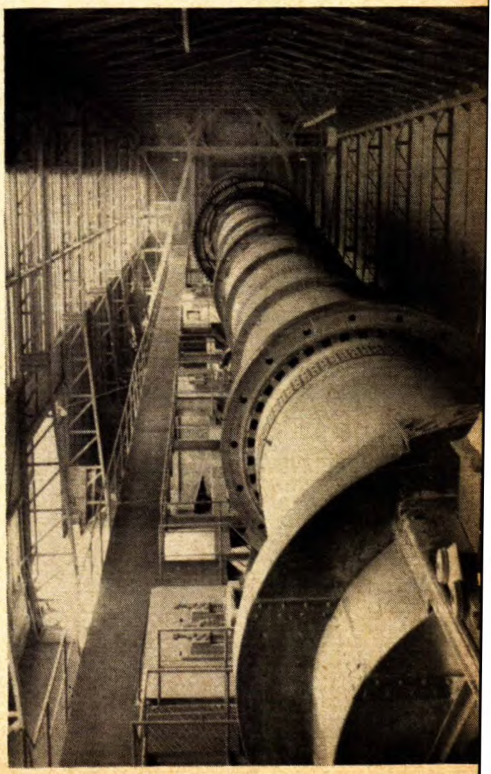
The following analyses, supplied by the company, were considered representative of the limestone and shale being quarried in September, 1952 at the time of the writer's previous visit to the property.

| | *Limestone* | | *Shale* |
|---|---|---|---|
| | % | % | % |
| $SiO_2$ | 4.36 | 4.09 | 57.45 |
| $R_2O_3$ | 0.30 | 1.85 | 19.75 |
| CaO | 52.63 | 52.09 | 5.00 |
| MgO | 1.41 | 2.14 | 4.57 |
| Loss on ignition | 42.00 | 41.28 | 8.13 |
| | 100.70 | 101.45 | 94.90 |

The gypsum quarry at Flat bay, 63 miles by rail south of Humbermouth, is described in the chapter on gypsum.

**Plate V**

***North Star Cement, Limited. View in kiln section of cement plant, looking towards feed end of the 10- by 213-foot kiln.***



## • DESCRIPTION OF PLANT

The cement plant is divided into two units: the storage and packing departments at tidewater near the shipping wharf; and the manufacturing departments, or cement plant proper, 3,000 feet south at an elevation of about 320 feet above sea-level. The units are connected by pipelines for finished cement and agricultural limestone. A brief description of the plant follows. (For a detailed account see a recent article by Leja (3).)

The cement plant proper comprises the following sections: the primary crushing section, where the limestone and shale are reduced to minus ⅝-inch size; the storage section, where covered storage for 5,000 tons of limestone and shale and 32,000 tons of clinker and gypsum are provided; the grinding section, containing a 7¼- by 39-foot slurry mill and an 8- by 46-foot finishing mill; the slurry storage section, containing slurry blending tanks and kiln feed tanks; the kiln section, containing a 13- by 9-foot calcinator, 10- by 213-foot oil-fired kiln, clinker cooling and crushing equipment; and the agstone section, further reference to which is made below.

From the finishing mill, the finished cement is air-conveyed through a 6½-inch by 3,000-foot pipeline to the storage silos and packing plant at Humbermouth. From these storage silos, each of which has a storage capacity of 10,000 barrels, the cement may be shipped in bags or in bulk, by truck, railroad, or ship. The loading capacity of the equipment for bagged or bulk cement is 100 tons per hour. For loading ships with bagged cement, two 26-inch by 265-foot belt conveyors are used. These feed to two 26-inch conveyors carried in a 40-foot steel frame, arranged for lifting or lowering, located in a 95-foot steel tower at the wharf. The 40-foot conveyors terminate in two swinging telescope-type spiral chutes which convey the bagged cement into the ships' hatches.

## • AGSTONE PRODUCTION

Raw material for this purpose is obtained from a section of the limestone quarry where the beds, because of their high magnesia content, are unsuitable for the production of cement.

As before, the limestone is hauled to the primary crushing plant where it is reduced to minus ⅝-inch size, then conveyed to the raw material storage section. Secondary crushing is handled by two 24- by 31-inch impact mills, the grinding capacity of each being 5 tons per hour. Following screening, the fines (100 per cent minus 10-mesh and 70 per cent minus 100-mesh) are air-conveyed through a 6-inch by 3,000 foot pipeline to the 550-ton agstone storage silo at Humbermouth. As with cement, the finished material may be shipped in bags or in bulk, by truck, railroad, or ship (4).

## References


(1) **Bogert, J. C.:** Natural cement deposits in Trinity bay; *Geol. Surv., Newfoundland,* unpub. rept., 1938.

(2) **Hutchinson, R. D.:** Geology of Harbour Grace map-area, Newfoundland; *Geol. Surv., Canada,* Mem. 275, 1953.

(3) **Leja, E. A.:** Newfoundland's new cement plant; *Pit and Quarry,* vol. 46, No. 9, March 1954, pp. 91-96.

(4) ——— Agstone for Newfoundland farming supplied by North Star Cement, Ltd.; *Pit and Quarry,* vol. 47, No. 2, August 1954, pp. 109 and 112.

(5) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

# Chapter 6

## CHROMITE

There are a number of small chromite occurrences in Newfoundland, mainly along one of two serpentine belts which traverse the island in a north-northwesterly direction. In past years some 5,614 tons of ore were produced and exported, practically all of which came from the Bluff Head mine, west coast, about 60 years ago. There has been no production since 1919. Estimates of reserves "are of doubtful value with the data available. The discoveries to date are chiefly concentrating ores; the composition of some of the chromites is such that a high-grade concentrate is possible. In the American market, these would have to compete with direct-smelting ores from the eastern hemisphere. The present availability of Newfoundland chromites is, therefore, conditioned by ability to balance favourably concentration costs against the longer transportation of foreign ores" (7, p. 26).

TABLE IV
PRODUCTION (EXPORTS) OF NEWFOUNDLAND CHROMITE[1]
1895-1919

| Year | Metric Tons | Value $ |
|---|---|---|
| 1895 | 44 | |
| 1896 | 1,031 | |
| 1897 | 3,084 | 87,350 (1895–1899) |
| 1898[2] | 657 | |
| 1899 | 717 | |
| 1919 | 81 | 2,900 |
| Total | 5,614 | 90,250[3] |

[1] As given by Snelgrove (7, p. 2).
[2] Averaged 55 per cent $Cr_2O_3$.
[3] Given elsewhere by Snelgrove (8, p. 7) as $106,610.

According to Snelgrove (7, p. 2), the chromite "is associated with serpentinized ultrabasic intrusives, particularly the type of peridotite known as dunite." These serpentines "are the northeastward extension of the Appalachian Serpentine Belt which, on the mainland, extends intermittently from Georgia to Gaspé." He recognized two main belts—the Eastern and Western belts,—both of which "lie parallel to the general structural trend of the island, viz., north twenty-seven degrees east (true)" (7, p. 4).

The eastern serpentine belt extends for about 120 miles in a southwesterly direction from the northeast coast near Carmanville to the headwaters of the Gander river. These chromite prospects are located along this belt: "Shoal Pond, at the northern extremity; Burnt Hill, near the headwaters of the Gander river; and Mount Cormack, in the centre of the island" (7, p. 5). Smaller concentrations are found near First and Second ponds, on the lower Gander river.

The western belt, with a width up to 10 miles, is exposed at intervals for nearly 65 miles parallel and adjacent to the west coast, between Port au Port bay and Bonne bay. Four chromite prospects are located along this belt: Stowbridge, on the north side of Bay of Islands; Blow-me-down and Chrome Point, south of Bay of Islands; and Bluff Head, on the east side of Port au Port bay. Small concentrations of chromite are found elsewhere along the belt (2, p. 49).

Extensive exposures of serpentine are found at other localities in Newfoundland, including the Hare bay area, north coast, and the Burlington peninsula, between White bay and Notre Dame bay, northeast coast. In the Hare bay area the chromite occurs as an accessory mineral of the dunite and as thin stringers in dunite bands. On the Burlington peninsula the chromite occurs as an accessory mineral of the serpentines (1, p. 38).

### • *BLUFF HEAD*

The Bluff Head mine workings are on the north side of Bluff Head brook "halfway up the headwall of a hanging cirque", one mile east of Port au Port bay, west coast. Bluff head, "a bald, flat-topped promontory" from which the mine takes its name, is one mile south. The nearest settlement is Point-à-Mal, about 10 miles south.

The Bluff Head deposit was identified as chromite on June 27, 1894 by J. Obalski, a Quebec Government mining engineer who had visited the area to examine an asbestos property (4, p. 283). As mentioned above, the property was worked between 1895 and 1899, during which time over 5,000 tons of ore were shipped. Howley, who visited the area in 1896, found ten rudely parallel bands, one of which "showed eight feet of solid



91230—4

ore at the outcrop, while the whole averaged about two feet in thickness each. Like all chromite deposits, the veins are pockety and very irregular in thickness; nevertheless, the amount of ore exposed on the surface was very considerable, and it was traced for over half a mile eastward by the loose fragments of ore scattered along the surface" (6, p. 336). An attempt to reopen the mine in 1919 resulted in only a small production.

In 1942 the area was investigated by the Geological Survey of Newfoundland. Seven tunnels and winzes of the old workings were located and examined, and the whole area bounded by Bluff head on the south, Lewis brook on the north, and for a distance of about 2 miles inland, was carefully searched for new occurrences, but no deposits of economic importance were located (10).

On a visit to the property in September, 1950, the writer obtained two grab samples of the ore,—one of massive chromite, the other of disseminated ore. The massive chromite analysed 46.68 per cent $Cr_2O_3$, 14.31 per cent FeO, 6.76 per cent $Al_2O_3$, 19.06 per cent MgO, and 9.40 per cent $SiO_2$, with a Cr: Fe ratio of 2.87:1. The disseminated variety analysed 40.77 per cent $Cr_2O_3$, 13.51 per cent FeO, 5.70 per cent $Al_2O_3$, 21.43 per cent MgO, and 12.40 per cent $SiO_2$, with a Cr: Fe ratio of 2.66:1.

### • BLOW-ME-DOWN

This deposit is approximately 4 miles south of the mouth of Blow-me-down brook, on the south shore of Bay of Islands, west coast. The deposit outcrops on the flat summit of Blow-me-down mountain range, approximately 1,700 feet above sea-level. The nearest settlement is Frenchman Cove, 6 miles to the east.

The deposit was discovered and investigated near the end of World War I. Development work consisted of one pit which was sunk on solid chromite to a depth of 20 feet, and one trench, 1,000 feet southwest of the pit, where disseminated chromite was encountered. According to Snelgrove (7, p. 13), 100 tons are said to have been mined from a lens of nearly solid chromite which was 8 feet wide and 21 feet long at the surface. A small remnant of this lens may be seen in the pit; a sample obtained by the writer in 1950, ran as under:

| | % |
|---|---|
| $Cr_2O_3$ | 31.52 |
| FeO | 15.10 |
| $Al_2O_3$ | 32.15 |
| MgO | 17.97 |
| $SiO_2$ | 2.06 |

A sample of disseminated ore from the trench, obtained at the same time, assayed:

| | % |
|---|---|
| $Cr_2O_3$ | 19.17 |
| FeO | 14.58 |
| $Al_2O_3$ | 18.30 |
| MgO | 25.67 |
| $SiO_2$ | 14.85 |

### • BURNT HILL

This prospect is about 5 miles northeast of Burnt hill, near the headwaters of the Northwest Gander river, in south-central Newfoundland. It is approximately 24 miles from tidewater at Baie d'Espoir on the south coast.

Discovered early in the present century, the deposit was explored in 1931 and 1932 by 22 trenches and some stripping, with the discovery of additional mineralization. No work has been done since. Two distinct types of chromite are found in the area: lenses of disseminated chromite in serpentine, as found on the west side of the river; and pods of massive chromite in serpentine, as exposed on the east bank of the river. The largest lens of the disseminated type is 16 feet long by 4 feet wide and contains about 35 per cent chromite. The maximum dimensions of solid pods are 3 feet by 3 feet 9 inches; four smaller lenses, varying in length from a few inches to 10 feet and in width up to 3 inches, are exposed nearby (7, p. 9).

A sample of massive chromite analysed (7, pp. 18-19) as under:

| | % |
|---|---|
| $Cr_2O_3$ | 49.98 |
| FeO | 15.80 |
| $Al_2O_3$ | 5.40 |
| MgO | 17.10 |
| CaO | 0.75 |
| $SiO_2$ | 6.76 |

A sample of mechanically concentrated chromite from this area ran (7, pp. 18-19):

| | % |
|---|---|
| $Cr_2O_3$ | 55.76 |
| FeO | 25.30 |
| $Al_2O_3$ | 6.80 |
| MgO | 10.14 |
| CaO | 0.7 |
| $SiO_2$ | 1.24 |

• *CHROME POINT*

This prospect lies on the eastern edge of the Lewis hills about 13 miles above the mouth of Fox Island river and 10 miles east of Bluff head, Port au Port bay. The deposit outcrops on Chrome point, a flat conical peak half a mile east of the river. The nearest settlement is Point-à-Mal, 4 miles south of the river mouth.

The deposit was discovered in 1899. C. A. Meissner (5) in 1901, found float chromite scattered over an area 2,000 feet in length by 900 feet in width. Sixteen pockets of ore are reported to have been found, ranging in thickness from 3 inches up to 14 feet. The seven trenches which were dug at that time are, to quote Snelgove (7, p. 17), "now practically obliterated by talus creep."

In 1933, Snelgrove located about 40 masses of chromite in the area. These varied from half an inch up to 3 feet in width, from a few inches up to 18 feet in length, and from 10 to 75 per cent in tenor of chromite. The largest single mass was from 4 inches to 2 feet in width and 18 feet in length. In shape, the masses were "lenticular, wedge-like, bulbous, or irregular" (7, p. 16).

The area was investigated by Toronto mining interests in 1940-41, and a deposit about a mile north of Chrome point was diamond drilled. According to Snelgrove and Baird (9, p. 36) "a small tonnage of low-grade ore was found and further drilling suggested." Tests conducted at the Bureau of Mines, Ottawa, in 1940 on ore from this locality, indicate that fairly good recoveries may be obtained by jigging and tabling or by tabling alone (11, p. 9). In one of the runs, in which the ore was ground to minus 35-mesh and passed over a Denver mineral jig followed by tabling, a combined concentrate assaying 52.97 per cent $Cr_2O_3$ was obtained; recovery was 79.26 per cent and the chronium to iron ratio, 2.75: 1. The ore used in the investigation ran 41.01 per cent $Cr_2O_3$ and 13.82 per cent FeO, with a Cr:Fe ratio of 2.61:1.

• *FIRST POND AND SECOND POND*

"The chromite just east of First Pond occurs as layers and lenses in a reddish quartz-carbonate schist over an area of about 12 feet by 30 feet. The layers measure less than ½ inch wide, although they are several feet long. The lenses measure 2 to 4 inches in width and up to 8 inches in length. Some of the lenses show a lineation parallel to the schistosity (N60E). The concentration within the entire exposure area would probably average less than 30 per cent by volume of the quartz-carbonate schist.

"The chromite south of Second Pond occurs as a small lens in reddish talc-carbonate schist, measuring about 3 feet by 8 inches on the surface" (9, pp. 32-33).

• *HARE BAY*

According to Cooper (3, p. 25), chromite (picotite variety) is an accessory mineral in the peridotite and dunite of the Hare bay area, north coast. "Thin stringers of it occur in dunite bands at many places, but larger concentrations are scarce. Schlieren-like lenses about an inch wide and a foot or two long were seen at half a dozen places. The lenses occur singly and without apparent system. Loose fragments on the surface indicate somewhat larger concentrations. A rectangular piece of nearly solid chromite weighing about fifteen pounds was found 1½ miles northeast of Three Brooks Pond. It is a glacial erratic but unquestionably of local derivation. Numerous small pieces of solid chromite are mixed with the gravel of a raised beach east of Howe Harbour. . . . They are scattered rather abundantly over an area 15 feet by 50 feet and are evidently a residual accumulation from a chromite lens in bedrock."

He reports that some ore fragments from the locality east of Howe Harbour ran 54.05 per cent $Cr_2O_3$.

• *MOUNT CORMACK*

The Mount Cormack deposits, found in 1899, are on a plateau 1,000 feet above sea-level, in the south-central part of the island, 35 miles southwest of Grand Falls on the railway. They are about 14 miles northwest of the Burnt Hill prospect and 32 miles from tidewater at Baie d'Espoir on the south coast. Like the Burnt Hill prospect, this area is difficult of access.

The prospect was examined in 1901 by C. E. Willis, who found a number of lenses of chromite over a distance of 400 yards. Snelgrove (7, p. 10), who obtained his information from a report of Willis, describes the chromite concentrations as follows:

"The chromite is reported to occur in lenticular masses or pockets and stringers in serpentine, the majority of them running at an acute angle to the general strike of the rocks.

"On Middle ridge, 3½ miles south of Mount Cormack, Willis found nine or ten outcrops of chromite of fair size, in a distance of 1,163 feet; one of these had a width of over five feet. He believed that many hundreds of pockets of ore ranging in size from a few inches to five and ten feet exist along this ridge. Willis also reported numerous chromite boulders and sands strewn over the surrounding barren and glaciated terrain."

There has been no development to date. A sample of chromite, representing "small veins at north end, Sit Down ridge", assayed (7, pp. 18-19):

| | % |
|---|---|
| $Cr_2O_3$ | 50.24 |
| FeO | 14.47 |
| $Al_2O_3$ | 12.50 |
| MgO | 10.22 |
| $SiO_2$ | 6.76 |

• ***SHOAL POND***

This prospect is about 2 miles south of Southwest arm, Rocky bay, Sir Charles Hamilton sound, northeast coast. The chromite concentrations are found on Chrome hill, a monadnock of serpentine which rises 150 feet above Shoal pond. The nearest town is Carmanville, in the northwest arm of Rocky bay 5 miles west of Southwest arm.

Development consists of six pits, four trenches, and some surface stripping. This work was done either in 1898 when the deposit was discovered or in 1931 when additional finds were made. No ore appears to have been shipped.

Three types of chromite concentrations were recognized by Snelgrove (7, p. 8): "(*A*) Disseminations of chromite averaging less than 10 per cent of the serpentinized rock in which they occur. This type composes most of Chrome hill and the serpentine band in general. The chromite content is only slightly more than that of a normal dunite rock type. (*B*) Lenses of disseminated chromite in which the mineral chromite forms as much as 40 per cent, and serpentine the remainder, of the rock. The largest example of this type is exposed on the southwest side of Chrome hill, 150 feet south of the Reid Lot boundary, where a body 7 feet in thickness and some 40 feet in length, dipping 40 degrees northwest, averages between 10 and 20 per cent chromite. (*C*) Lenses of nearly solid chromite in serpentinized dunite. The maximum dimensions observed in these lenses do not exceed ten inches in thickness and a few feet in length. Nearly four dozen of such lenses outcrop on Chrome hill. They dip northward from 25° to 85° and for the most part approximate roughly the strike of the serpentinized dunite band."

A sample of the massive chromite analysed, (7, pp. 18-19):

| | % |
|---|---|
| $Cr_2O_3$ | 47.77 |
| FeO | 18.67 |
| $Al_2O_3$ | 4.18 |
| MgO | 19.69 |
| CaO | 1.46 |
| $SiO_2$ | 4.10 |

The disseminated chromite ran:

| | % |
|---|---|
| $Cr_2O_3$ | 14.34 |
| FeO | 8.82 |
| $Al_2O_3$ | 1.00 |
| MgO | 33.60 |
| CaO | 0.25 |
| $SiO_2$ | 31.92 |

• ***STOWBRIDGE***

This deposit is in a gentle talus-strewn slope 1,600 feet above sea-level and 1½ miles northeast of Stowbridge (or Stone) brook, on the north arm of Bay of Islands, west coast. Curling, on the railway, 21 miles southeast, is the nearest large settlement.

Originally noted late in the 19th century, the deposit was rediscovered and extensively sampled during World War I. H. B. Hatch of Reid Newfoundland Company Limited who sampled the 11 chromite-bearing outcrops, found the largest averaged about 9 per cent $Cr_2O_3$ over 90 feet length and 17 feet width. Another outcrop averaged 11.3 per cent $Cr_2O_3$ over a length of 10 feet and width of 6 feet. According to Snelgrove, the greatest width of solid chromite exposed in the largest outcrop (130 by 70 feet) is 8 inches; wider lenses vary in tenor from 20 to 50 per cent chromite (7, pp. 10, 12).

This deposit, "one of the most extensive deposits of known chromite in the island", is considered to hold possibilities for mechanical concentration (9, p. 34). A magnetically separated concentrate from the largest outcrop, analysed 40.26 per cent $Cr_2O_3$, 24.77 per cent FeO, 19.34 per cent $Al_2O_3$, 13.90 per cent MgO and 1.92 per cent $SiO_2$. One high-grade sample, representing a 4-inch lens, contained 50.5 per cent $Cr_2O_3$ (7, pp. 18-19).

## References


(1) **Baird, D. M.:** The geology of Burlington peninsula, Newfoundland (report and map); *Geol. Surv., Canada,* Paper 51-21, 1951.

(2) **Cooper, J. R.:** Geology of the southern half of the Bay of Islands igneous complex; *Geol. Surv., Newfoundland,* Bull. No. 4, 1936.

(3) ——— Geology and mineral deposits of the Hare Bay area; *Geol. Surv., Newfoundland,* Bull. No. 9, 1937.

(4) **Maynard, G. W.:** The chromite deposits on Port au Port bay, Newfoundland; *Trans. Am. Inst. Mining Engrs.,* vol. 27, 1897, pp. 283-288.

(5) **Meissner, C. A.:** Private rept., 1901.

(6) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1881 to 1909; St. John's, Nfld., 1918.

(7) **Snelgrove, A. K.:** Chromite deposits of Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 1, 1934.

(8) ——— Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4, 1938.

(9) **Snelgrove, A. K., and Baird, D. M.** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(10) **Wiseman, R.:** Bluff Head chromite deposit; *Geol. Surv., Newfoundland,* unpub. rept., 1942.

(11) Concentration of chromite ore from the Port au Port Bay district, Newfoundland; *Bur. Mines, Canada;* Ore Dress. & Met. Lab. Investig. No. 940, Dec. 31, 1940, 9 pp.

# Chapter 7

## CLAY AND SHALE

"IN the valleys of the major rivers and along the coast of the island are large deposits of clay, most of which was transported into its present position by glacio-fluvial action. For agricultural reasons, the distribution of these deposits has exerted a marked influence on the location of settlements. In a few instances, a ceramic industry restricted to common bricks has been based on such clay deposits.

"In the sixties a first attempt was made by Mr. Cameron, a St. John's builder, to manufacture brick at Brick Yard", near the settlement of Harcourt, Smith sound, Trinity bay. "This enterprise was later acquired by Messrs. Pitman, who carried out the business on a small scale for many years, depending on local markets for the disposal of their product. In the nineties the output averaged about 60,000 bricks per annum" (6, p. 120). The plant has not operated since 1920.

About 1886, a plant was opened at Elliotts cove on Random island, from which the annual output for some years averaged about 750,000 bricks (6, p. 120). This operation ceased in 1904. The site is now overgrown and strewn with pebbles which apparently had been removed from the clay in processing. The clay appears to be similar to that encountered in the Aaron Smith and Sons pit, 3 miles to the northwest.

At Georges Brook, Smith sound, Messrs. Pelly began making brick in 1886, and in 1900 Aaron Smith and Sons started a brick plant near Snooks Harbour, on the north shore of Random island. Both plants operated during 1949, 1950 and 1951, but since then operations (and the manufacture of structural clay products in Newfoundland) have been confined to the C. and M. Pelly plant (Pelly's Brickyard) at Georges Brook. The following table gives the production for the period 1949-1956; production figures prior to 1949 are not available:

TABLE V

PRODUCTION OF CLAY AND CLAY PRODUCTS IN NEWFOUNDLAND[1]

1949-1956

| | *Building Brick* | | *Drain Tile* | *Total* |
|---|---|---|---|---|
| | *Quantity* | *Value* | *Value* | *Value* |
| *Year* | M[2] | $ | $ | $ |
| 1949 ........... | 700 | 25,450 | —— | 25,450 |
| 1950 ........... | 805 | 30,419 | 670 | 31,089 |
| 1951 ........... | 818 | 31,216 | 967 | 32,183 |
| 1952 ........... | 692 | 29,285 | —— | 29,285 |
| 1953 ........... | 792 | 39,500 | —— | 39,500 |
| 1954 ........... | 865 | 33,042 | —— | 33,042 |
| 1955 ........... | —— | 45,000 | —— | 45,000 |
| 1956 ........... | 940 | 47,145 | —— | 47,145 |

[1] Dominion Bureau of Statistics.
[2] Thousand.

In 1950 a number of clay and shale deposits in Newfoundland were investigated and sampled by the Industrial Minerals Division, Mines Branch, Ottawa. Subsequent tests obtained promising results on a sample collected from a shale deposit at Riders brook on the north shore of Smith sound, only a few miles from Pelly's Brickyard. Repeated tests on the shale indicated desirable properties for production of structual clay products. Early in 1954 the soft mud process was discontinued and the plant was changed over to make dry press brick from shale. The shale belongs to the Clarenville formation of Lower Ordovician age (1, map) which extends across the northern tip of Random island and it is from the latter source that Pelly's new raw material is derived.

Both brick plants were visited in 1950 by S. Matthews of the Industrial Minerals Division during his investigation of the clay and clay products industry of the province. The following description of the C. and M. Pelly operation is taken largely from his field report (2) and his more recent notes.

## C. and M. Pelly Brick Plant

**• *PLANT LOCATION***

The plant is near Georges Brook, Trinity bay, about 6 miles north of Clarenville on the Canadian National branch line to Bonavista.

## Plate VI

*Shale pit, C. & M. Pelly, on Random Island, Trinity Bay, east coast.*

### • PRODUCTS

Previous to 1954 the product consisted of common brick made by the soft mud process. In 1954, the plant was changed over to make dry press brick from shale.

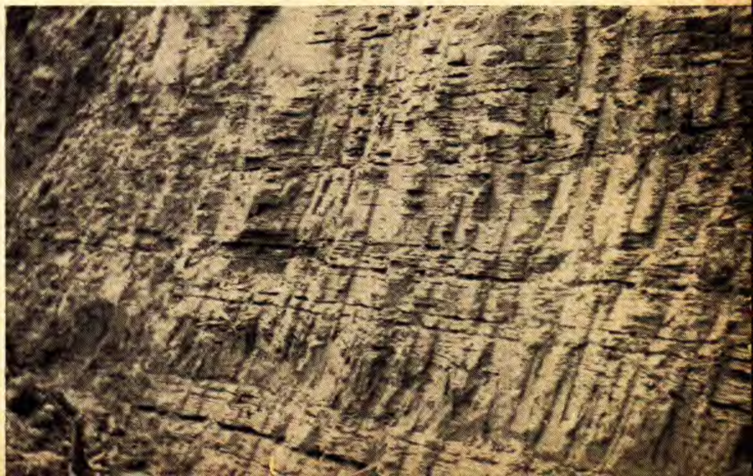
### • RAW MATERIALS

The shale is obtained from a pit on the northern tip of Random island about 2 miles from the plant by way of a new causeway connecting the island with the mainland. At the time of the writer's visit in June 1954 the quarry was being worked on a 10-foot face using a traxcavator for excavating and loading the shale; no blasting was required. Trucks delivered the shale to a small hopper at the mill head.

The raw material formerly used was derived from an alluvial deposit composed of interlayered sand and clay. The layers were about one inch thick, corresponding to the type of structure sometimes referred to as "varved clay". Workings at the pit face were estimated to be from 50 to 75 feet in vertical depth, overlain by some 12 feet of stony overburden which had to be stripped. Water seepage between the clay seams rendered the material too wet to be used directly from the pit. On account of this, it was customary to dig, by hand, a quantity of clay each spring and stockpile it at the base of the pit where it dried out sufficiently to be used.

## Plate VII

*The C. & M. Pelly inactive clay pit, beside plant at Georges Brook. Closeup of face, showing varved nature of deposit.*



• ***PROCESSING***

Changing over to make brick from shale by the dry press process involved several major alterations to the plant, including installation of new grinding, screening and forming equipment. By means of a rim-discharge grinder, bucket elevator and vibrating screen, the shale is ground and screened to minus 8-mesh. On being tempered with water to the proper consistency, the ground material is in condition for pressing. The ware is formed on a two-mould press having a capacity of 10 to 12 thousand bricks per day. The bricks, as they come from the press, are set directly in the kilns without drying.

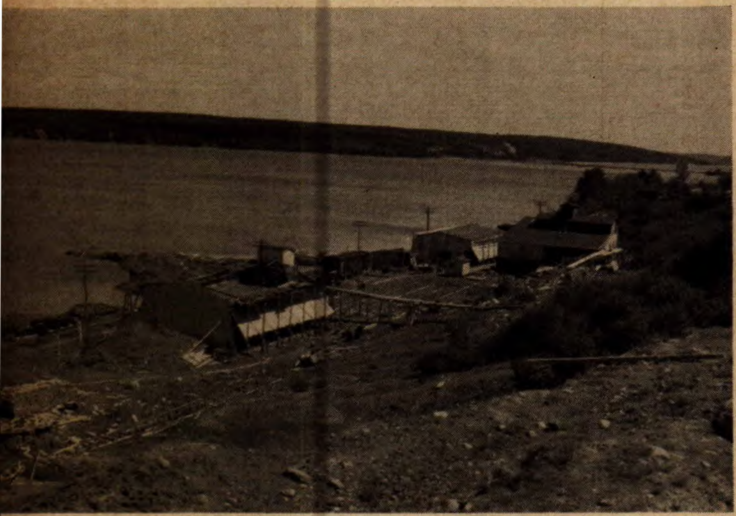


*Plate VIII*

*View of C. & M. Pelly brick plant looking east towards Random Island, showing two scove kilns and brick plant. Note causeway to Random Island at upper right.*

• ***FIRING***

The bricks are set 40 high in scove kilns and fired with oil. Burning units consist of two kilns having capacities of 230 M and 190 M respectively. Oil firing was introduced in 1951 and all bricks are now fired by this method.

Bricks produced by this company are attractive reddish-bown. Examples of their use may be seen in the Glyn Mill inn at Corner Brook, where they are used as a veneer, and in two large buildings of the Dominion Steel and Coal Corporation Limited, at Wabana.

## Investigations by Mines Branch, Ottawa

About two dozen clay and shale samples were collected in Newfoundland in 1950 and subsequently tested at the Industrial Minerals Division ceramics laboratory in Ottawa. The respective locations from which the samples were obtained and the corresponding report numbers are listed below:

| Nature of Material | Where Sample Obtained | Report No. |
|---|---|---|
| Clay | O'Rourkes brook, Curling, Bay of Islands | 3279 |
| " | Petries brook, " " | 3280 |
| " | Near Petries brook, Curling, Bay of Islands | 3281 |
| Slate | Old slate quarry, " " | 3534A |
| " | " " " " " | 3534B |
| Shale | Near railway crossing, Humbermouth, Bay of Islands | 3535A |
| " | " " " " " | 3535B |
| " | " " " " " | 3540A |
| " | " " " " " | 3540B |
| Clay | Muddy brook, Port Blandford, Bonavista bay | 3277 |
| " | First point, Fortune, Fortune bay | 3160 |
| " | " " " " | 3161 |
| " | Come by Chance pond, Come by Chance, Placentia bay | 3174 |
| " | Near Hoopers brook, Aguathuna, Port au Port bay | 3282 |
| " | C. and M. Pelly clay pit, Georges Brook, Trinity bay | 3234 |
| " | " " " " " | 3235 |
| " | " " " " " | 3236 |
| " | " " " " " | 3237 |
| " | " " " " " | 3244 |
| " | " " " " " | 3238 |
| " | 4 miles east of Georges Brook, Trinity Bay | 3239 |
| " | " " " " | 3240 |
| " | Old Pitman clay pit, Harcourt, Trinity bay | 3171 |
| Shale | Near old Pitman clay pit, Harcourt, Trinity bay | 3170 |
| " | Riders brook, 2 miles east of Georges Brook, Trinity bay | 3167A |
| " | " " " " " " | 3167B |
| Clay | Along shore, Shoal Harbour, Trinity bay | 3172 |
| " | Aaron Smith and Sons clay pit, Snooks Harbour, Trinity bay | 3168 |
| Shale | Near Aaron Smith and Sons clay pit, Snooks Harbour, Trinity bay | 3169A |
| " | Near Aaron Smith and Sons clay pit, Snooks Harbour, Trinity bay | 3169B |
| Clay | North shore of Deer lake, west central Nfld | 3278 |

A number of the clays covered in these reports contain pebbles, a very undesirable condition and unless removed or finely ground, they constitute a potential source of trouble in the manufacture of clay products. Pebbles found in these clays were very hard and difficult to grind so that rolls used for this purpose would soon wear and become only partly effective (3) (4).

Desirable properties are exhibited by samples of shales from Random island and the north shore of Smith sound, Trinity bay, as dealt with under reports 3167A, 3167B, 3169A, 3169B and 3170, above. The results of these preliminary tests are very favourable and indicate these shales to be excellent materials generally used in Canada for the production of structural clay. The results obtained showed sufficient promise to warrant further investigation (3) (4). Further work on the Riders brook shale (3167A and 3167B), undertaken at the request of Mr. Pelly, showed the quality of this material to be outstanding and by comparison, to rank "well above the average in materials generally used in Canada for the production of structural clay products" (5).

Promising results indicated for a sample of light grey clay from the district east of Georges Brook (Report No. 3240), also warrant further investigation (4).

## References


(1) **Christie, A. M.:** Geology of Bonavista map-area, Newfoundland; *Geol. Surv., Canada,* Paper 50-7, 1950.

(2) **Matthews, S.:** Report on field work in Newfoundland and Nova Scotia, July 30 to August 21, 1950; *Mines Br., Canada,* Ind. Minerals Div., unpub. rept.

(3) ——— Report of the Ceramic Section, Industrial Minerals Division, on clays and shales from Newfoundland: preliminary test data; *Mines Br., Canada,* Ind. Minerals Div., unpub. rept., Dec. 15, 1950.

(4) ——— Report of the Ceramic Section, Industrial Minerals Division: preliminary test data on clays and shales from Pelly's Brickyard and vicinity, Newfoundland; *Mines Br., Canada,* Ind. Minerals Div. unpub. rept., Jan. 30, 1951.

(5) **Matthews, S., and Shonk, R. A.:** Report of the Ceramic Section, on a new shale for structural clay products in Newfoundland; *Mines Br., Canada,* Ind. Minerals Div., Ceram. Sec. Investig. No. 36440, unpub. rept., May 15, 1952.

(6) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

# Chapter 8

## DIATOMITE

DIATOMITE, or diatomaceous earth, is reported to occur in many of the lakes and ponds of the Avalon peninsula, southeast coast. However, as Snelgrove and Baird (2, p. 102) remarked, the "deposits have not yet been investigated carefully and very little information is available on their extent and purity".

Eardley-Wilmot (1, pp. 93, 97) gives the following analyses of samples obtained from Oxen, Parkert, Long, and McIsaac ponds, in the vicinity of St. John's.

ANALYSES OF NEWFOUNDLAND DIATOMITES

| Name of Deposit | $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | CaO | MgO | $H_2O$ at 105°C | $CO_2$+ Organic | Total |
|---|---|---|---|---|---|---|---|---|
| Oxen Pond.......... | 83.13 | 4.27 | 1.72 | 0.44 | 0.56 | 7.81 | 1.67 | 99.60 |
| Parkert Pond........ | 71.50 | 10.01 | 1.89 | 0.34 | 0.40 | 8.92 | 4.48 | 97.54 |
| Long Pond.......... | 63.64 | 17.67 | 2.63 | 0.57 | 0.66 | 9.60 | 1.36 | 96.13 |
| McIsaac Pond....... | 68.60 | 10.60 | 2.26 | 2.26 | 2.34 | 9.40 | 4.46 | 99.92 |

The diatomite is white to grey and occurs in beds of from one to three feet in thickness. The Oxen pond sample was white and appeared to be the best grade. The samples were submitted by A. English, of St. John's, Newfoundland, and analysed in the Mines Branch, Ottawa.

### References

(1) **Eardley-Wilmot, V. L.:** Diatomite: its occurrence, preparation, and uses; *Mines Br., Canada,* Rept. 691, 1928.

(2) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

# Chapter 9

## FELDSPAR

PEGMATITE dykes, the main source of commercial feldspar, are of common occurrence in the Patridge point and Hardy harbour areas, between White bay and Notre Dame bay, northeast coast. They are also reported to occur in the Trinity bay area, east coast, and near the southwest end of Grand lake where they are said to attain 12 feet in thickness (6, p. 102). There has been no production to date nor is any expected in the near future, although some of the deposits may be of mineable width and grade. High transportation costs would make it difficult to compete with more favourably situated producers of Ontario and Quebec.

The Partridge point and Hardy harbour occurrences are described below. References to a number of occurrences in Labrador appear in the chapter on mica.

Anorthosite, a rock composed almost entirely of soda-lime feldspar, occurs in large quantity at Indian head and east of St. Georges, St. Georges bay, west coast. In Labrador nearly two dozen such occurrences are known, the largest of which covers an area of close to 5,000 square miles (7). The occurrences at Indian head and east of St. Georges receive brief mention below, while an occurrence of anorthosite in the Paul island-Nain region of Labrador is referred to in the chapter on granite. Preliminary investigations by the Mines Branch, Ottawa, several years ago, showed that anorthosite "has a possible use as a ceramic flux, providing the fired colour is not of too great importance, and for some purposes may have advantages" (5, p. 38).

## Pegmatite Dykes

• ***HARDY HARBOUR***

"Numerous pegmatite dykes and sills occur in a zone 1½ miles wide that extends northwest from Pacquet to Cape Hat" (1, p. 54). The dykes, about 50 of which were mapped by Baird, range up to 20 feet in width and 3,000 feet in length but are generally much smaller. According to him the dykes are composed largely of feldspar and quartz, with minor muscovite and biotite, and accessory garnet, smoky quartz, and tourmaline. They vary considerably in composition, "and gradations exist from those of nearly pure feldspar to those that could be termed quartz veins. The feldspar is orthoclase, microcline, albite, and perthite, and graphic intergrowths of quartz and orthoclase were observed in some of the smallest dykes of this region." The pegmatite dykes are probably off-shoots from the Dunamagon granite, a Devonian granite which outcrops immediately south of the area.

Baird (1, p. 54) mentioned the occurrence of: a pegmatite dyke, from 8 to 15 feet wide, on the southeast side of Hardy harbour; a mass of pegmatite of irregular outline, from 10 to 40 feet wide and containing feldspar crystals as much as 2 feet in length, on the north side of the harbour; and an irregular mass of pegmatite about a quarter of a mile south of Teakettle cove. The latter deposit "is about 1,800 feet long and varies in width from 2 feet at the inland end to about 100 feet near the shore." According to Baird, this body has been mentioned as a possible source of feldspar, and is of further interest inasmuch as a pocket of tourmaline crystals was observed in it near its seaward extremity.

• ***PARTRIDGE POINT***

Pegmatite dykes are of common occurrence in the Partridge point area, about 15 miles northwest of Hardy harbour and 3 miles north of Fleur-de-Lys. According to Fuller (3, p. 16), they are most numerous immediately adjacent to the Partridge granite, a dyke-like body of Devonian granite which outcrops along the coast for slightly more than a mile. Three types of pegmatite dykes were observed by Fuller; a mixture of quartz and feldspar, pure feldspar, and quartz and calcite.

## Anorthosites

• ***INDIAN HEAD***

At Indian head and to the northeast is a stock-like body of anorthosite measuring approximately 10,000 feet in length (northeast-southwest) and 6,000 feet in width. This rock forms cliffs at the tip of Indian head and at one point along the shore, has, according to Heyl and Ronan (4, p. 61), been quarried by the United States Government as a source of coarse rock fill, some dimension stone, and railroad ballast. The anorthosite is white to light grey in colour, coarse grained, and in composition "is almost wholly labradorite with minor amounts of hypersthene, hornblende, and magnetite" (4, p. 45). It is classed as pre-Carboniferous in age.

• ***ST. GEORGES***

East of St. Georges is a rectangular-shaped body of anorthosite estimated by Baird (2, p. 25) to cover an area of approximately 175 square miles. It has an overall length of approximately 20 miles and reaches a maximum width of 12 miles in the neighbourhood of Flat Bay brook. This anorthosite has attracted some attention on account of the pods and lenses of titaniferous magnetite of various sizes and shapes which occur widely scattered throughout it, further reference to which will be found in the chapter on titanium minerals. Baird recognized four distinct types of anorthosite in the area, together with many gradational varieties. One of these types, the Cairn Mountain type, is described as "typically light to dark grey, coarse grained, and composed of at least 90 per cent feldspar. The feldspar is usually basic andesine although some is labradorite."

## References

(1) **Baird, D. M.:** The geology of Burlington peninsula, Newfoundland (report and map); *Geol. Surv., Canada,* Paper 51-21, 1951.

(2) ——— The magnetite and gypsum deposits of the Sheep Brook-Lookout Brook area; *Geol. Surv., Canada,* Bull. 27 (Contributions to the economic geology of western Newfoundland), 1954, pp. 20-41.

(3) **Fuller, J. O.:** Geology and mineral deposits of the Fleur-de-Lys area; *Geol. Surv., Newfoundland,* Bull. No. 15, 1941.

(4) **Heyl, A. V., and Ronan, J. J.:** The iron deposits of Indian Head area; *Geol. Surv., Canada,* Bull. 27 (Contributions to the economic geology of western Newfoundland), 1954, pp. 42-62.

(5) **Shonk, R. A.:** Canadian anorthosite as a ceramic flux; *J. Can. Ceram. Soc.,* vol. 21, 1952, pp. 32-38.

(6) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(7) Geological map of Canada; *Geol. Surv., Canada,* Map 1045A, 1955.

# Chapter 10

## FLUORSPAR

THE fluorspar deposits of Newfoundland are quite extensive, and represent one of Canada's great mineral assets and one of the most important reserves of fluorspar in North America.

Fluorite is found at several localities in the island, but all the commercial deposits discovered to date are in the vicinity of St. Lawrence, an incorporated town on the south coast, where the mineral occurs in the form of veins filling fault fissures, mainly in granite. Most of the veins are within 6 miles of St. Lawrence harbour and between sea-level and an altitude of 400 feet. Four of the veins are being mined. Mining is carried on underground, by shrinkage stoping mainly, and operations have so far attained a maximum depth of 900 feet. St. Lawrence Corporation of Newfoundland Limited and Newfoundland Fluorspar Limited, a subsidiary of Aluminum Company of Canada Limited, are the two producers.

The presence of fluorspar in the St. Lawrence district has been known ever since Jukes (4, p. 154) noted its occurrence in 1839. However, aside from "the early prospecting of some of the fluorite veins for their lead content" (13, p. 113), the area remained dormant until March, 1933, when the St. Lawrence Corporation of Newfoundland Limited began surface mining for shipment to Dominion Steel and Coal Corporation, Limited, at Sydney, N.S.

Newfoundland Fluorspar Limited entered the field in 1940, and began to make shipments in the spring of 1942. The district now ranks as the most important fluorspar-producing centre in the British Empire and second or third largest in the world. In addition, one of the mines, the Director, is the world's largest single producer of fluorspar.

Table VI gives the fluorspar production of the St. Lawrence area for the period 1933-1956.

TABLE VI

PRODUCTION OF FLUORSPAR IN NEWFOUNDLAND 1933-1956[1]

| Year | Short Tons | Value $ |
|---|---|---|
| 1933 | 2,128 | 27,664 |
| 1934 | 2,352 | 30,576 |
| 1935 | 4,480 | 58,240 |
| 1936 | 11,675 | 151,775 |
| 1937 | 12,575 | 178,596 |
| 1938 | 13,163 | 176,295 |
| 1939 | 14,576 | 195,210 |
| 1940 | 14,000 | 187,500 |
| 1941 | 12,702 | 170,115 |
| 1942 | 38,853 | 484,876 |
| 1943 | 111,005 | 1,855,779 |
| 1944 | 53,537 | 1,089,771 |
| 1945 | 50,671 | 1,134,215 |
| 1946 | 22,705 | 202,720 |
| 1947 | 28,832 | 297,134 |
| 1948 | 89,183 | 1,103,905 |
| 1949 | 58,077 | 1,405,033 |
| 1950 | 55,595 | 1,290,361 |
| 1951 | 67,925 | 1,966,477 |
| 1952 | 81,283 | 2,484,943 |
| 1953 | 87,693 | 2,631,698 |
| 1954 | 118,065 | 2,946,896 |
| 1955 | 131,049 | 3,034,080 |
| 1956 | 139,801 | 3,395,061 |
| Total | 1,221,925 | 26,498,920[2] |

[1] Figures for 1933-36 as given by Snelgrove (11, p. 31) and converted to short tons. Figures for 1937-48 as given by Newfoundland Geological Survey (16) and converted to short tons. Figures for 1949-56 represent shipments; source, Dominion Bureau of Statistics.

[2] Estimating value of 1933-36 production at $13.00 per ton.

From the standpoint of value of production and number of people directly employed, fluorspar is Newfoundland's most important industrial mineral. The fluorspar industry accounts for approximately 50 per cent of the province's industrial mineral production, and employs between four and five hundred men the year round. In 1956, as in 1955, Newfoundland supplied over 99 per cent of the Canadian output.

With the entry of Newfoundland into Confederation, Canada became one of the world's leading sources of fluorspar, ranking fifth among the producing countries in 1953 with its production of nearly 7 per cent of the total reported production (17, p. 118). In the past, Canada depended

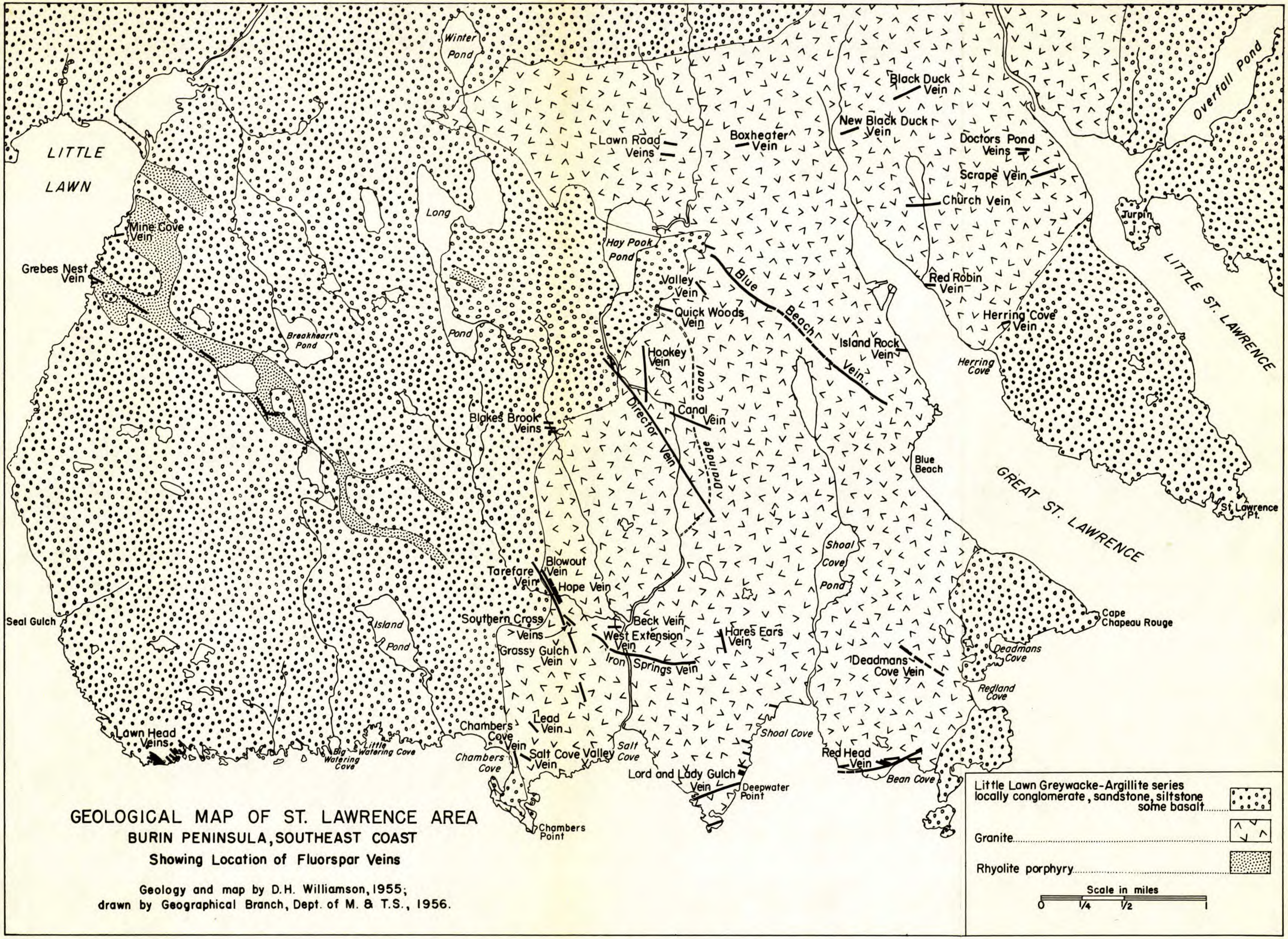



**Figure 3.** Geological map of St. Lawrence area, Burin Peninsula, southeast coast, showing location of fluorspar veins.

chiefly upon imports to meet its requirements, as is shown by the fact that 82 per cent of the average consumption of 21,800 tons during the 30-year period ended 1948 was imported.

Fluorspar is found at several other localities in Newfoundland. Fluorite veinlets a few inches thick are found in the Shearstick brook alaskite granite about 12 miles northeast of St. Lawrence; and in the Grand Beach area, about 15 miles to the northwest, fluorite occurs with calcite in rhyolite porphyry as small irregular masses up to 4 inches in diameter (14, p. 28). Fluorite, in variable amounts, is an almost constant associate of molybdenite in granite in the Rencontre East area of Fortune bay (15, p. 988); and in the Long Harbour area, about 10 miles southeast, fluorite, either as joint fillings or as part of the matrix of breccia zones, is of widespread occurrence in the felsite country rock, although no deposits approaching commercial grade have been located (10, p. 15). In 1952 a 6-inch fluorite vein was discovered on Harbour island, Placentia bay, about 10 miles north of Argentia, but it has little commercial value (6). Fluorite is also a minor constituent in the Chetwynd gold-copper deposit at Cinq Cerf, about 50 miles east of Port aux Basques (12, p. 66), and in the old La Manche lead mine, at La Manche, Placentia bay (7, p. 233).

The high percentage of fluorine present in the 'Strawberry granite' of the Makkovik-Aillik region of Labrador, has been suggested by Kranck (5, p. 34) as a possible indication of mineralization in the surrounding rocks.

## St. Lawrence Area

In 1956 the St. Lawrence area commenced its twenty-fourth consecutive year as a producer of fluorspar. Production has increased more or less steadily during this period, as shown in Table VI, and is now at an all-time high. Further increases may be expected in view of the great projected increase in production of aluminum in Canada and in view of a recent agreement made by one of the companies with the United States Government for large tonnages of fluorspar (1, p. 55).

Production of the St. Lawrence Corporation of Newfoundland Limited was derived from several mines in 1955, while that of Newfoundland Fluorspar Limited was supplied by a single mine. Both companies operate mills at St. Lawrence, the St. Lawrence Corporation producing an acid grade concentrate by flotation, and both producing metallurgical grades by heavy-media separation. The St. Lawrence Corporation ships its metallurgical grades to steel plants in Canada and the United States (none since 1953), and to Wilmington, Del., where it receives further treatment in a newly erected flotation mill operated by an affiliated company, St. Lawrence

Fluorspar, Incorporated. The acid grade concentrate is also shipped to Wilmington where it is dried and warehoused, and eventually shipped to consumers in the chemical and ceramic industries. Newfoundland Fluorspar Limited ships its sub-metallurgical grade to Arvida, Que., and until 1952 shipped its metallurgical grade to the steel and chemical industries of Canada. At Arvida the ore is improved by flotation and, with the exception of a few shipments to other consumers, is used in the manufacture of aluminum.

"Both companies maintain their own shipping facilities with storage areas located at the point of shipment. Concentrates are moved from mill bins, approximately one and one half miles, to these storage areas by diesel and gasoline trucks. Ship loading is accomplished by the use of conveyor belts and gantries in one case and portable cranes in the other. The port of St. Lawrence is ice-free the year round, but due to winter conditions both here and at the customers' plants, the bulk of the shipping is done during the summer months" (8).

## • GEOLOGY

Nearly all the commercial fluorspar veins occur as fissure fillings in a granite intrusive believed to be of Devonian age. Apparently these fissures are tension cracks in the granite due to regional movement and contraction on cooling. The granite, which is regarded by van Alstine (14, p. 18) as a "batholithic mass only slightly exhumed by erosion", is composed essentially of quartz and pink feldspars and is classed by him as an alaskite granite. The following information on the fluorite veins is taken largely from his report.

The fluorite veins are typically epithermal, commonly consisting of finely banded fluorite along the walls and coarsely crystalline fluorite in the open centers of the veins and in vugs, all more or less brecciated and containing a varying amount of granite breccia. The banded fluorite suggests rhythmic deposition. Vugs and openings in the veins are commonly lined with fluorite crystals, the crystals ranging from a fraction of an inch to 18 inches on an edge. The fluorite may be colourless, white, yellow, red, pink, blue, or purple; a wide variety of colours is found in practically all veins.

The gangue in the different veins varies as to composition and amount, but consists principally of brecciated granite, fine-grained quartz, and calcite. An important occurrence of quartz in some veins is in the material known locally as "blastonite", which consists of a brecciated fluorite in a mixture of microcrystalline quartz. This mixture may contain up to 80 per cent of either fluorite or quartz, but at the Director mine the hand-picked blastonite averages 50 per cent $CaF_2$, 40 per cent $SiO_2$, and less than

10 per cent $CaCO_3$. Associated minerals, which usually make up less than one per cent of the veins, are galena, pyrite, sphalerite, chalcopyrite, chalcocite, azurite, chrysocolla, hematite, opaline and crystalline silica, barite, limonite, pyrolusite, bitumen and clay.

The fluorite veins are steeply dipping, ranging, with a few minor exceptions, from vertical to 65 degrees, and they vary in width from a few inches to more than 70 feet but even some of the latter are not of economic value. The 'higher grade' veins, averaging between 4 and 5 feet in width, have a $CaF_2$ content of at least 95 per cent, and a silica content of 1 to 4 per cent, while the 'lower grade' veins averaging 15 to 20 feet in width, have a $CaF_2$ content of about 75 per cent, and silica 10 to 15 per cent.

No close estimate of Newfoundland's ore reserves can be made, but they are very large and are among the most important in the world. In recent articles by an officer of the Newfoundland Geological Survey, they have been referred to as being "considerably in excess of 20,000,000 tons" (2, p. 75), or in "tens of millions of tons" (3, p. 301). Van Alstine (14, p. 40), who examined the area in 1939-41, at which time less than 100,000 tons had been shipped, predicted that the area would produce several million tons of ore and become a principal world source of fluorspar. Over 1,200,000 tons valued in excess of $26,000,000 have so far been shipped from the area, by far the greater part of which has come from the Director and Iron Springs mines, which together supplied 70 per cent of the 235,785 tons hoisted during 1955.

About 40 veins* have been located to date many of which have been untouched, and none completely traced longitudinally or vertically. However, fluorite mineralization extends for as much as 3 miles longitudinally, and at depths up to 890 feet no significant changes are noted in grade and width. According to van Alstine (14, p. 40), a conservative estimate of the depth of a vein is one-half of the length. If this is the case at St. Lawrence, the Iron Springs vein should persist to a depth of at least 1,600 feet and the Director vein to over 3,000 feet. After noting that no marked changes in the mineralogy or grade of the fluorspar veins had been observed with increased depth of mining to a level of 350 feet, he states that "Vertical zoning may never be detected at St. Lawrence, where most veins occupy fissures in a granite whose physical and chemical character is not expected to change within the depth of mining. It is possible however, that the sulphide content of the veins may increase in depth, and less vugs and breccia may be encountered in the fluorspar".

---

* Personal communication from Dr. D. H. Williamson, Dept. of Geology, Mount Allison University, Sackville, N.B.

• ***POWER***

Hydro-electric power is obtained from the three plants of United Towns Electric Company Limited, one at Lawn and two at Little St. Lawrence, which have a combined rated output of 2,000 h.p. Owing to insufficient water storage facilities, however, the actual output rarely approaches this figure and is sometimes barely sufficient to supply the various communities of the district. Consequently, "both companies generate the greater part of their needs with their own diesel plants" (8). At present they "have a diesel generating capacity that exceeds 2,000 k.w. and through a network of connecting lines, can help each other or supply the municipality" (8).

## St. Lawrence Corporation of Newfoundland Limited

Production at St. Lawrence Corporation in 1955 totalled 62,684 tons of heavy-media concentrates (sub-metallurgical grade), 58,443 tons of which was shipped to Wilmington, Del.; no other shipments were made. Production came from four mines, with the Iron Springs mine supplying 39.6 per cent of the 112,730 tons hoisted. The others, in order of importance, were Number 2 (25.5 per cent), Number 3 (22.7 per cent), and Lord and Lady Gulch (12.2 per cent). The Iron Springs and Lord and Lady Gulch mines are opened on veins of the 'higher grade' type, while Number 2 and Number 3 mines are opened on the Blue Beach vein, one of the 'lower grade' veins encountered in the area. As underground conditions and mining procedures are somewhat similar at all four mines, a description is given of the Iron Springs operation, and a brief reference is made to the Blue Beach vein. This is followed by a description of the milling practice.

• ***IRON SPRINGS MINE***

The Iron Springs mine is 2½ miles southwest of St. Lawrence and half a mile north of Salt cove. It is serviced by a 3-compartment, inclined (70-degree) shaft which extends to a depth of 901.6 feet. This shaft is located in the footwall of the vein, with the collar having an elevation of about 40 feet above sea-level. Levels are established at 50, 100, 180, 240, 340, 450, 560, 670, 780, and 890 feet (slope distances) below the surface. The overall length of the underground workings is approximately 3,200 feet.

The Iron Springs vein strikes approximately N60°W and ranges in dip from 65 degrees to vertical. It pinches and swells markedly, both horizontally and longitudinally, from a few inches in the pinches to 6 feet and over in the swells; the pinches occur at approximately 150-foot intervals. The overall average width of the vein is 2½ feet. Due to dilution the average $CaF_2$ content of the ore hoisted is 65 to 70 per cent, whereas in

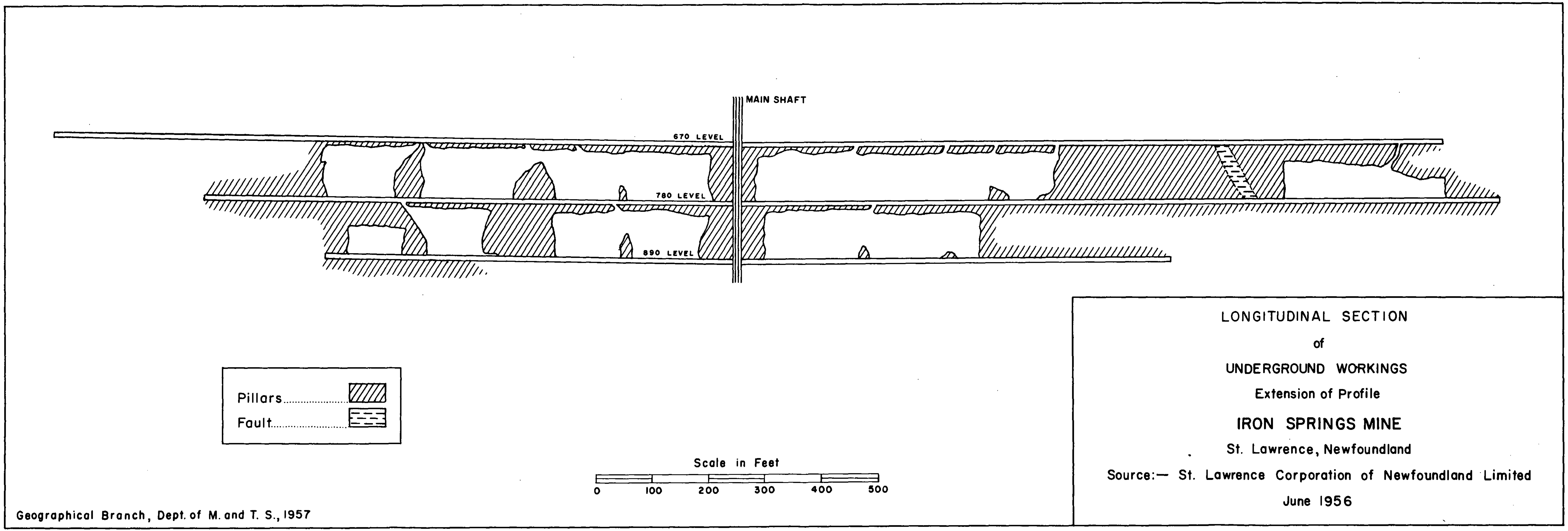



*Figure 4 (b).* Plan and longitudinal section of underground workings, Iron Springs mine, St. Lawrence Corporation of Newfoundland Limited, St. Lawrence, Newfoundland.

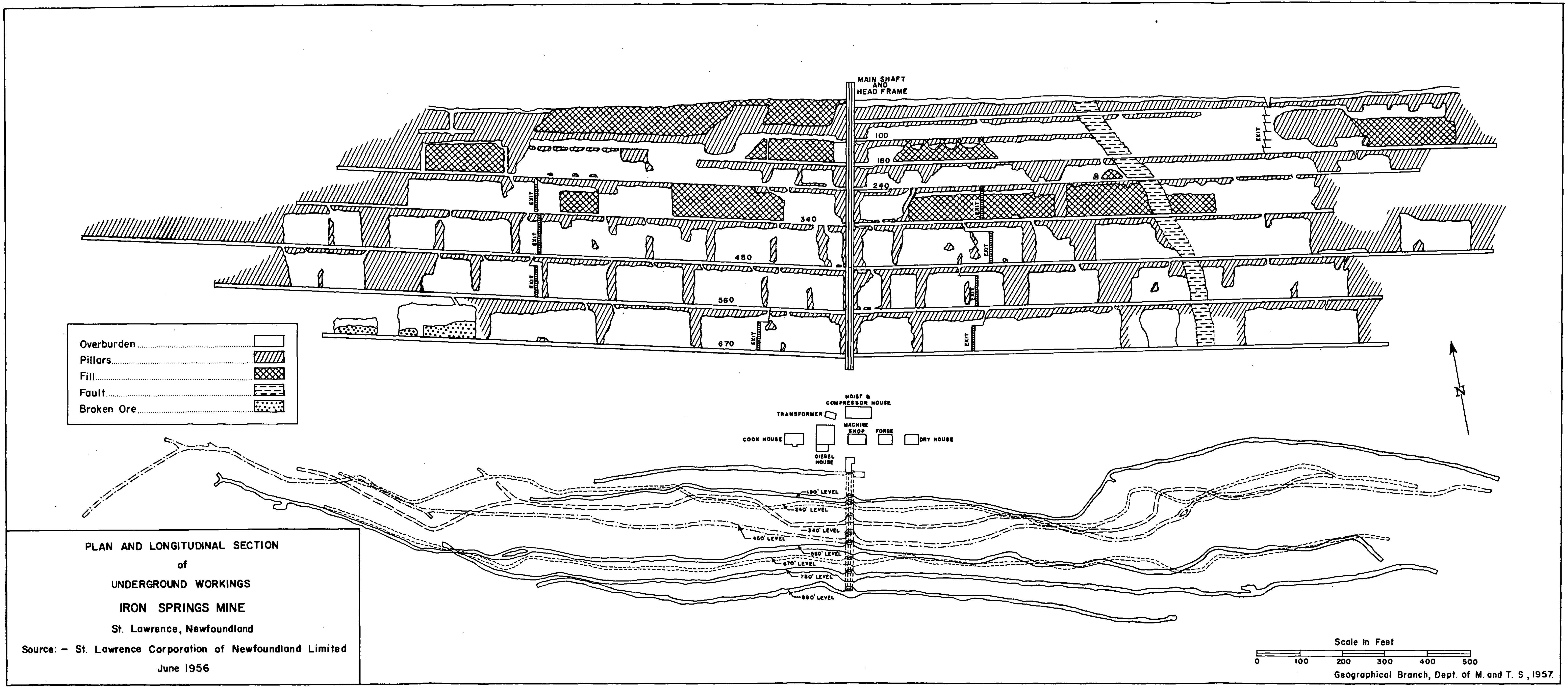



*Figure 4 (a).* Plan and longitudinal section of underground workings, Iron Springs mine, St. Lawrence Corporation of Newfoundland Limited, St. Lawrence, Newfoundland.

**Plate IX**

*Headframe and mine plant, Iron Springs mine, St. Lawrence Corporation of Newfoundland Limited.*

the vein proper it is over 95 per cent. No noticeable change in mineral composition nor in the average width of the vein with depth has been observed to date, and for this reason and from a consideration of the known length of the vein, it is assumed that little change will be noted to a depth of, say, 1,500 feet. Contrary to geological expectations, the sulphides have diminished with depth.

Drifting is done on the vein. The drifts are cut 8 feet high by 6 feet wide, or the full width of the vein if it is over 6 feet. Due to the large volume of water encountered in the mine, drifts are advanced on a 2 per cent grade.

Shrinkage stoping over stulls is the standard method of mining although, in the past, cut-and-fill was used in certain sections. The shrinkage stopes average about 150 feet long, 3 feet wide, and contain two cribbed manways, usually about 70 feet apart. The stopes are laid out to utilize the lenticular structure of the vein, with the narrow uneconomical areas between the lenses being left as pillars. In preparing a stope for production, the usual practice is to take down the 'backs' for a length of 75 to 100 feet in two 6-foot lifts, and then timber, installing the chutes on 12-foot centres. When the stope back has advanced 45 to 60 feet above the drift, a raise is driven through to the level above. It is general practice to leave 12-foot sill and vertical pillars.

The ore is hauled to the shaft in 20-cu. ft. side-dump cars drawn by storage battery locomotives or air trammers. At the shaft the ore is dumped over grizzlies, with bars spaced about 8 inches apart, into storage bins or pockets beneath the shaft station, from which it is drawn off into

**Plate X**

*Lord and Lady Gulch mine, St. Lawrence Corporation of Newfoundland, Limited.*

a 24-cu. ft. skip and hoisted to the surface. From the 200-ton surface ore-bin, which is incorporated in the 50-foot wooden headframe, the ore is trucked to the mill, 1½ miles to the east.

For many years conventional forged steel was used for both stoping and development, but during the past two years the Corporation switched, with excellent results, to a light-weight drill using a Swedish tungsten-carbide-tipped chisel bit. Similar results were obtained at the Director mine, where formerly all drilling was done with drill steel and detachable steel bits. As a result, integral tungsten-carbide chisel bit steel is used almost exclusively by both companies at present, accounting for 95 per cent of all drilling (8).

At the Iron Springs mine, from 1,025 to 1,450 gallons of water per minute are pumped to the surface, by single and two-stage centrifugal pumps, from sumps on each level; the actual amount varies with the season, and averaged 1,100 gallons per minute at the time of the writer's visit in June, 1954; 17 pumps, ranging from 5 to 60 h.p. and totalling 355 h.p., were required for this operation. Small centrifugal pumps are used "because of power limitations and portability in case of flooding" (8).

### • BLUE BEACH VEIN

The Blue Beach vein, with a length of 7,700 feet and a width ranging from 3 inches to 55 feet (14, p. 26), is located about half a mile west of St. Lawrence harbour. It has a strike of N46°W and ranges in dip from vertical to 70 degrees southwesterly. During 1955 this vein supplied approximately 48.2 per cent of the ore hoisted by the Corporation. The ore is mined by shrinkage methods, from stopes averaging 200 feet in length and 10 to 15 feet in width. Seibert (9) has described the ore as follows:

"The ore . . . is banded with granite, calcite, dolomite, at least three definite zones of fluorite, and numerous combinations of replacement between fluorite, carbonates, and chert. The fluorite is translucent to opaque. The granite walls are not sharply defined and do not break cleanly. This, coupled with the fact that the ground is not nearly as solid as at Iron Springs, causes additional dilution. There is quite a bit of high carbonate pug and manganiferous slime. The run-of-mine analyses 40-60 per cent $CaF_2$, 5-30 per cent $CaCO_3$, and 30-40 per cent $SiO_2$."

Three shafts, No. 2, No. 3, and the Haypook, all three-compartment shafts averaging 5 by 6 feet per compartment have been sunk on this vein at elevations of 175, 225, and 300 feet respectively, above sea-level.

No. 3 was an exploratory shaft, now used for handling materials, and follows the dip of the vein; the other two are vertical. No. 2 is 1,585 feet southeast of No. 3 shaft and Haypook about 800 feet northwest of No. 3. Levels have been opened 55 feet and 165 feet below the collar of No. 2 shaft, and connect through to the corresponding levels of the other two.

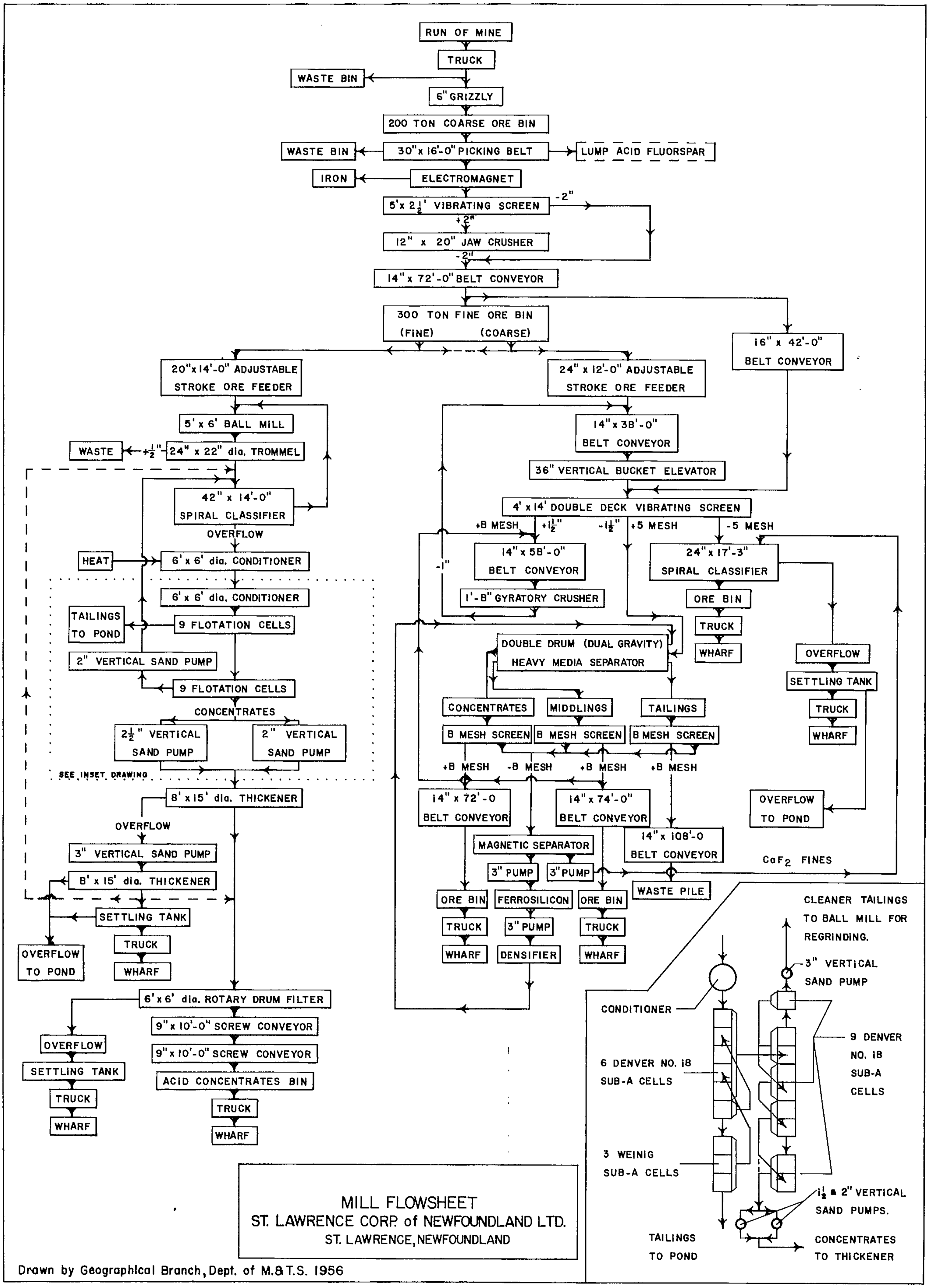



*Figure 5.* *Mill flowsheet, St. Lawrence Corporation of Newfoundland Limited, St. Lawrence, Newfoundland.*

*Plate XI* ***Fluorspar mill, St. Lawrence Corporation of Newfoundland Limited, St. Lawrence, southeast coast. Note truck ramp and bins at left, at entrance to primary crushing plant; flotation plant on right, behind which is the heavy media plant.***

Total underground workings along the strike of the vein have an overall length of 2,900 feet. Surface trenching indicates another 2,000 feet of vein, as yet not worked from underground.

All the pumping for the vein is done at No. 2 shaft (the lowest collar elevation) and maximum flow is 750 g.p.m. Single-stage, centrifugal pumps are used, with multiples of standard size, usually 40 h.p.

Ore loading pockets below the bottom level at No. 2 shaft could not be maintained because of the heavy flow of water and loose, open structure. Accordingly, the ore cars are hoisted as the ore is trammed from the drift, and dumped from a trestle. The ore is then mechanically loaded into diesel trucks and transported to the mill.

The Haypook shaft on the northwest end of the vein also services the Haypook vein, and is equipped with a 30 cu. ft. self-dumping aluminum skip and a cage. As the water flow is confined to No. 2 shaft, Haypook ore is hoisted from level pockets into a 400-ton ore bin at the surface, from which trucks load for haulage to the mill.*

## • *MILLING PRACTICE*

Prior to 1938 the only treatment was that of washing, hand-picking, and crushing the ore, but since then jigs and tables, flotation, and heavy-media separation have been introduced. The mill now contains three complete units: a primary crushing plant; a flotation plant, with a capacity of 125 tons per day, which supplies a high-grade acid concentrate to the chemical and ceramic industries of the United States; and a 400-ton heavy-media plant, which supplies a preconcentrate to the Wilmington flotation mill and a metallurgical grade to the steel industry. The crushing and flotation plants have operated since 1943 and the heavy-media plant since October, 1953.

The ore is first dumped onto a steel apron for sorting-out of the coarse granitic waste, then shovelled over a 6-inch grizzly into the 200-ton coarse-ore bin. This bin feeds to a picking belt where a small quantity of clean waste, utilized as concrete aggregate and road material, is removed; sometimes high-grade lump fluorspar is also removed at the picking belt and trucked direct to the wharf for shipment. From the picking belt the

* Personal communication from D. A. Poynter, Vice-President, St. Lawrence Corporation of Newfoundland Limited, October 23, 1957.

ore passes through a jaw crusher where it is reduced to minus 2-inch, and thence by belt conveyor (and gravity split, if both flotation and heavy-media units are operating) to one of two compartments in the 300-ton fine-ore bin.

From the fine-ore bin, the 'fine' ore moves to the flotation plant where, after fine-grinding and conditioning, it is concentrated by flotation, using 15 Denver Sub-A and 3 Weining Sub-A flotation cells. The classifier overflow averages around 50 per cent minus 200-mesh and 100 per cent minus 60-mesh. The flotation reagents used are: soda ash, which is added to the ball mill, and sodium metasilicate, quebracho, and oleic acid (and sometimes B-25 frother), which are added to the conditioner and to the cells. The concentrates are cleaned and re-cleaned three times. After thickening and filtering, a filter cake containing approximately 8 per cent moisture is conveyed to the storage bins and thence trucked to covered storage on the wharf, a mile to the east.

From the fine-ore bin, the 'coarse' ore (resulting from the gravity split) moves to the heavy-media separation plant. The ore is fed by belt conveyors and bucket elevator to a double deck vibrating screen containing 1½-inch and 5-mesh screens. The minus 5-mesh material flows to a dewatering spiral, which discharges the sand directly into an ore bin; the plus 1½-inch material is reduced to minus 1-inch in a gyratory crusher, which operates in closed circuit with the vibrating screen; and the plus 5-mesh minus 1½-inch material flows to the 6- by 10-foot double drum (dual gravity) separator of the heavy-media unit. This unit has a rated capacity of 40 tons per hour, and employs a mixture of ferro-silicon and water as media. The two drums are connected internally in series, and employ separate gravities, "thereby yielding a middlings product which, depending on markets, is either shipped direct or recrushed for further beneficiation" (8). The concentrates (sink), middlings (sink), and tailings (float) discharge to a triple section vibrating drain and wash screen. From this point the concentrates and middlings are conveyed to storage bins, the tailings to waste disposal outside the mill.

When visited in June, 1956 the heavy-media plant was treating about 400 tons of ore a day and producing a concentrate averaging about 75 per cent $CaF_2$. The flotation unit was not operating.

## Newfoundland Fluorspar Limited

Production at Newfoundland Fluorspar Limited in 1955 amounted to 78,091 tons of heavy-media concentrates (sub-metallurgical grade). Shipments, all to Arvida, Que., totalled 71,049 tons. Production is from the Director mine, 1½ miles west of St. Lawrence. The vein, discovered


**Figure 6.** Plan and longitudinal section of underground workings, Director mine, Newfoundland Fluorspar Limited, St. Lawrence, Newfoundland.

in 1937, varies from one foot to 70 feet in width, has a calcium fluoride content of 60 to 80 per cent and is the most important deposit located to date in the St. Lawrence area. Ore hoisted in 1955 amounted to 123,055 tons. Other important deposits located on the company's property are the Tarefare, Grebes Nest, and Big Meadows veins.

### • DIRECTOR MINE

This vein is over 6,000 feet long; strikes N40°W and ranges in dip from 75 degrees to vertical. The vein pinches and swells longitudinally and probably vertically forming distinct lenses. Three such lenses are known on the surface, and have been opened up underground by the 250- and 400-foot levels. The vein almost dies out at the pinches, with a possible width of 70 feet in the thickest part of the lens. The average calcium fluoride content is approximately 70 per cent.

Three shafts have been sunk along the vein, and levels have been opened at 150, 250, and 400 feet below the surface. The Main shaft (Number 2) through which the entire production is hoisted to the surface, is collared about 2 miles north of Salt cove at an elevation of about 130 feet above sea-level; it is a 3-compartment, 420-foot vertical shaft sunk in the granite hangingwall. Number 3 shaft, a 2-compartment vertical shaft of about the same depth, is sunk on the vein about 2,600 feet southeast of the Main shaft; it is connected with the Main shaft along the 250- and 400-foot levels. Number 1 shaft, an inclined, single-compartment shaft about 280 feet deep, is sunk on the vein about 270 feet southeast of the Main shaft. The overall length of the underground workings is approximately 6,200 feet.

Drifts are usually driven on the footwall although they are sometimes taken the full width of the vein. Standard drift grade is set at half of one per cent, but actual grades average slightly over one per cent. Cross-cuts are driven at 100-foot intervals into both walls as long as there are signs of mineralization. Raises are driven from level to level as the drifts advance and as they are required for stope preparation or ventilation; they are either inclined or vertical, depending on their use. Mucking is done by mechanical loaders and tramming by storage battery locomotives. At the Main shaft, the ore is delivered to the station in 20-cu. ft. cars which are hoisted to surface bins.

The ore is mined by flatback shrinkage, horizontal breasting being the method employed. Vertical blasthole diamond drilling has been tried, but was soon abandoned due to the heavy diamond losses experienced when drilling the 'blastonite' seam which occurs throughout the whole known length of the Director vein. The stopes have an average length of 200 feet, are separated by 15- to 25-foot vertical pillars, and by the end of 1952 averaged

*Plate XII*

*Director mine, Newfoundland Fluorspar Limited. View shows the main shaft headframe (No. 2 shaft), the mill, and other buildings at the mine.*

24 feet in width. Formerly, when the drift backs were solid, a sill 8 to 12 feet thick was left above the drift, and boxholes were driven and chutes installed at 18- to 25-foot centres. Now, however, all backs—except in drawpoint stoping—are taken down and replaced with timber decks.

Pumping at the Director mine, as at the Iron Springs mine, is one of the heaviest items of expense. In May 1956, for example, an average of 2,774 gallons of water per minute were being pumped to the surface; the weekly high was 2,831 gallons. Single- and two-stage centrifugal pumps are used, in sizes ranging from 40 to 100 h.p.

**• *TAREFARE MINE***

The mine is about half a mile northwest of the Iron Springs mine and a mile southwest of the Director. Three high-grade veins, having an average strike at N36°W, occur at this mine. A vertical 3-compartment shaft has been sunk midway between the two principal veins, the Tarefare and the Blowout, which are 115 feet apart, and a level established 85 feet below the surface. The main vein, the Tarefare, is west of the shaft, has a width of 7 feet, and dips at 85 degrees to the west. Its northwest drift has a length of 1,200 feet, and the southeast drift, 1,000 feet.

**• *GREBES NEST VEIN***

This vein is west of the Director mine. It begins under the sea and has been traced for about 3 miles inland, its width varying from 6 inches to 20 feet. It strikes N54°W and dips from 70 degrees south to 50 degrees north. A 50-foot prospect shaft has been sunk on the vein and a 35-foot cross-cut driven, which was mineralized over its entire length.

**• *BIG MEADOWS VEIN***

About 4 miles north of Lawn and 12 miles northwest of St. Lawrence the Big Meadows vein strikes S75°E and has been traced on the surface for 1,620 feet. The average width is 6½ feet. A prospect shaft 40 feet deep has been sunk on the vein 300 feet from the present east end. A channel sample of the vein at the shaft analysed 58 per cent fluorite, 20 per cent

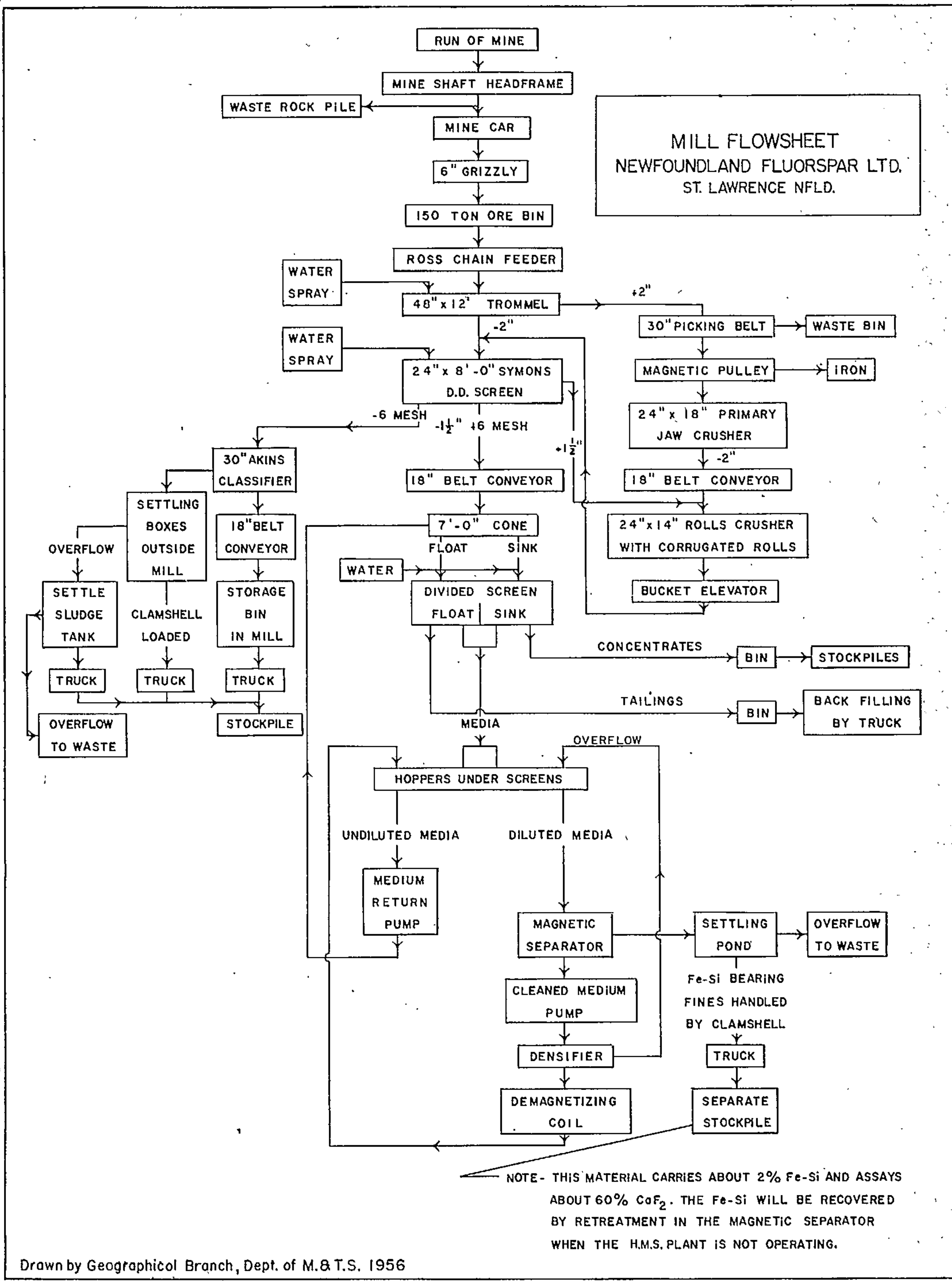



*Figure 7. Mill flowsheet, Newfoundland Fluorspar Limited, St. Lawrence, Newfoundland.*

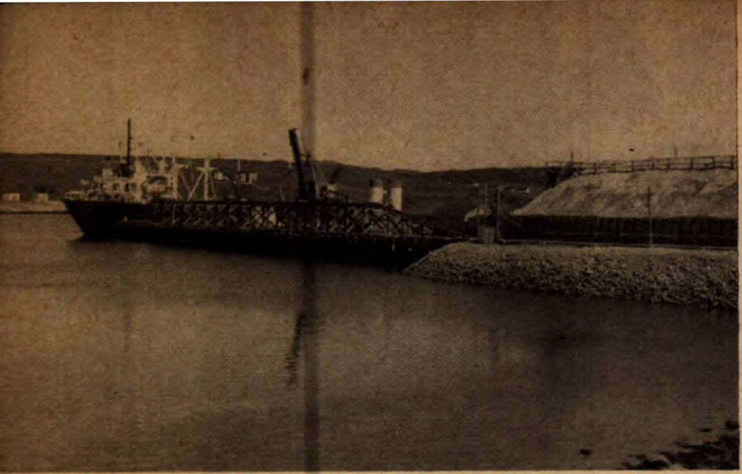


*Plate XIII*

*Loading dock (shipping wharf) of Newfoundland Fluorspar Limited, at St. Lawrence. Fluorspar stock-pile is shown at right, and belt conveyor and travelling gantry to the left.*

barite, and 2 per cent galena. The lead content here, however, is high compared with that encountered elsewhere on the vein.

• ***MILLING PRACTICE***

Formerly the ore was treated only by washing, screening, hand-sorting, and crushing. Mill feed ran between 65 and 70 per cent $CaF_2$, and the output, which contained 70 to 80 per cent $CaF_2$, was shipped to Arvida, Que., where it was concentrated by flotation.

Late in 1950, a heavy-media separation plant, having a rated capacity of 30 tons per hour, was installed at the Director mine near the Main shaft. The plant contains a 7-foot cone and employs a mixture of ferro-silicon and water as media, with a little magnetite added to decrease the gravity differential between top and bottom. Feed to the cone is minus 1½-inch plus 6-mesh material. This plant has been operating since January, 1951, and the product, averaging 75 to 80 per cent $CaF_2$, is shipped to Arvida for further treatment. If desired, this beneficiation could be carried to 85 to 90 per cent for sale to the steel trade as metallurgical grade. The mill is currently handling 450 tons per day.

At Arvida the heavy-media product is improved by flotation, and is then converted into aluminum fluoride for use in the aluminum plant, or else bagged and sold to other consumers.

## References


(1) **Carr, G. F.:** Newfoundland fluorspar; *Trans. Can. Inst. Mining Met.*, vol. 57, 1954, pp. 55-59.

(2) **Howse, C. K.:** The mining industry of Newfoundland; *Proceedings of the sixth annual conference* of the Provincial Ministers of Mines of Canada, Fredericton, N.B., Sept. 7-10, 1949, pp. 73-76.

(3) ——— Geology of the St. Lawrence fluorspar deposits, Newfoundland; *Trans. Can. Inst. Mining Met.*, vol. 54, 1951, pp. 295-301.

(4) **Jukes, J. B.:** General report of the *Geological Survey of Newfoundland* during the years 1839 and 1840, London, 1843.

(5) **Kranck, E. H.:** Bedrock geology of the seaboard region of Newfoundland Labrador; *Geol. Surv., Newfoundland*, Bull. No. 19, 1939.

(6) **McCartney, W. D.:** Argentia, Newfoundland (Preliminary map with marginal notes); *Geol. Surv., Canada,* Paper 55-11, 1956.

(7) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1881 to 1909; St. John's, Nfld., 1918.

(8) **Poynter, D. A.:** Fluorspar operations at St. Lawrence, Newfoundland; paper presented at the first official meeting of the *Newfoundland Branch, Can. Inst. Mining Met.*, by C. Warren, St. John's, Nfld., Feb. 13, 1954.

(9) **Seibert, W. E., Jr.:** New fluorspar milling at St. Lawrence, Newfoundland, and Wilmington, Delaware; paper submitted for the 1954 annual meeting, *Am. Inst. Mining Met. Engrs.,* New York N.Y., Feb. 15-18, 1954.

(10) **Smith, B. L.:** Fluorite deposits of Long Harbour, Fortune bay; *Geol. Surv., Newfoundland,* Rept. No. 2, 1953.

(11) **Snelgrove, A. K.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4, 1938.

(12) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4, (revised edition), 1953.

(13) **Van Alstine, R. E.:** The fluorspar deposits of St. Lawrence, Newfoundland; *Econ. Geol.,* vol. 39, 1944, pp. 109-132.

(14) ———— Geology and mineral deposits of the St. Lawrence area, Burin peninsula, Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 23, 1948.

(15) **White, D. E.:** The molybdenite deposits of the Rencontre East area, Newfoundland; *Econ. Geol.,* vol. 35, 1940, pp. 967-995.

(16) Production and value of Newfoundland minerals from 1934 to 1947 inclusive; table presented on request to Bureau of Mines, Ottawa, by *Geol. Surv., Newfoundland,* October, 1948.

(17) Statistical summary of the mineral industry: production, exports and imports, 1948-1953; *Colonial Geol. Surv.,* Mineral Res. Div., London, 1955.

# Chapter 11

## GRANITE

ALTHOUGH granites suitable for dimension stone are of widespread occurrence in Newfoundland, they have, as Snelgrove and Baird (9, p. 122) state, "been utilized on only a small scale for local buildings, bridge abutments, and paving". Quarrying has been mainly confined to the Petites-Rose Blanche area of the southwest coast and to the south side of Conception bay, although several quarries along the railroad right-of-way were opened during construction in the 1890's to supply stone for bridge pier and abutment work. For this purpose quarries were opened at Shoal Harbour, Trinity bay; near Benton, about 10 miles south of Gander; and near Quarry, 15 miles west of Millertown Junction. There has been very little production in recent years and at present the industry is confined to the production of crushed stone. These quarries, situated at various points along the highway, are operated by the provincial Department of Highways for the production of road metal. Production in 1956 amounted to 4,826 tons valued at $21,130, as compared with 1,800 tons valued at $14,000 in 1955.[1]

The bedrocks of Newfoundland range in age from early Precambrian to Pennsylvanian, or late Palaeozoic. The Precambrian rocks are the most extensively developed, occupying from one-quarter to one-half of the total area of the province. They constitute the Long Range mountains of the west coast, parts of the interior of the island, and most of the east coast, including the Avalon peninsula. A wide variety of intrusive rocks are to be found in the Precambrian. In the west they are represented by wide

[1] Dominion Bureau of Statistics.

belts of granites and gneisses, and by large masses of anorthosites and related rocks, while in the east they are represented by rock types ranging from aplites to gabbros, with the more acidic types predominating.

Intrusives of Palaeozoic age are also well represented. They are widely distributed and consist mainly of granites and related rocks which reach their maximum development in the west-central part of the island where one such body is known to have a length of 100 miles and to cover an area of approximately 1,000 square miles. In comparison, the occurrences of basic and ultrabasic rocks of Palaeozoic age are fewer and smaller in extent and are confined mainly to the western and northern portions of the island.

A wide variety of intrusive rocks are within easy reach of existing lines of communication, and many would undoubtedly afford excellent quarrying sites for the prospective granite quarrying operator. Newfoundland has already produced several varieties of highly suitable building stone and there is every reason to believe that other equally good, or possibly better, sites may be disclosed from which granite suitable for both building and monumental purposes may be produced.

Granite quarrying operations in Newfoundland are limited by lack of local markets. The population of the island is small, and apart from small scattered communities along the coast there are only 3 towns or cities with populations over 5,000 (11, p. 140).

Visits were made to several of the once active quarrying areas, and to several other localities that have been described in various reports of the Newfoundland Geological Survey as suitable for the production of dimension stone. These areas are described below.

There are other deposits of granite suitable for the production of building stone but owing to their location no attempt has been made to exploit them. Such deposits occur at Pomley cove and North and East bays, Baie d'Espoir (7, p. 19); in the La Poile-Cinq Cerf area (3, p. 38); on Fogo island (1, p. 55); and on the eastern shore of Baie Verte between Devils cove and Pointe Rousse (10, p. 37).

Good building stones are of widespread occurrence in Labrador but, as Kranck (8, p. 34) remarked, "the remoteness of the region from large cities robs them of value". Labrador has long been known as a source of the plagioclase feldspar called labradorite. According to Coleman (2, p. 50), labradorite is the essential mineral of the anorthosite which covers many square miles in the Paul Island-Nain region. In referring to the gem variety that occurs in a few places, he wrote:

"The gem variety of labradorite was first obtained from Paul Island, but according to Daly[1] the best specimens have come from a quarry opened by R. G. Taber on Napotulagatsuk island between Paul Island and the mainland."

**• BENTON AREA**

The Benton quarries are at Mile 199 of the railway, 14 miles south of Gander. Benton, the nearest settlement, is about 5 miles to the north.

Granite from this area was employed in the construction of railway bridges in the 1890's by Reid Newfoundland Company Limited and there has been no production since then. The workings consisted of small excavations along both sides of the railway, several of which were seen a short distance to the west of the railway line. Although the excavations were flooded, some quarried blocks were seen near them and some near the railway.

The Benton granite, a light pink, coarse-grained stone, consists mainly of feldspar, smaller amounts of quartz, and only minor amounts of biotite. In some cases the feldspar crystals exceed one inch in length. The granite has an attractive appearance and is suitable for building purposes, but due to its light colour and coarse grain, is unsuitable for monuments.

**• INDIAN HEAD AREA**

"At Indian Head, on the north shore of Bay St. George, southwest coast, anorthosite (labradorite rock) is found in large quantities and presents excellent quarry sites. The stone is well jointed and takes a good polish. No quarrying has been done at this locality which appears to be equally as good as Labrador as a source of labradorite for dimension stone" (9, p. 122).

Several samples of anorthosite were obtained in the area by the writer. This stone is white to light grey, coarse grained and in composition "is almost wholly labradorite with minor amounts of hypersthene, hornblende, and magnetite" (6, p. 45). It has a pleasing appearance when polished, with a colour ranging from light grey to light green or bluish grey, depending upon the amount of hypersthene and hornblende present. One sample which contained more than the usual amount of hypersthene and hornblende presented a very attractive dark green appearance on polishing, although all polished surfaces were badly marred by fractures.

Outcrops are numerous in this area but all appeared to be too badly cut up by joints and fractures to permit quarrying of dimension stone. The logical place at which to attempt quarrying operations would be along the shore at the foot of the sea cliff where, as Snelgrove and Baird have stated,

---

[1] *Bull. Mus. Comp. Zool.*, Harvard, vol. 38, Geol. Ser., vol. 5, pp. 216-17.

the stone is well jointed and takes a good polish. Transportation in this case would have to be by water.

The rocks of this area have been classed as pre-Carboniferous in age (6, p. 43).

### • LONG ISLAND-LOON PENINSULA AREA

Long island is in the Bay of Exploits area, about 14 miles north of Lewisporte, the Notre Dame bay terminus of the railway. The island is about 3 miles long and a mile wide. Loon peninsula, on the mainland, is about 8 miles southeast of Long island and 12 miles northeast of Lewisporte.

Both Long island and Loon peninsula have been mentioned as a possible source of building stone by Heyl (5, p. 56):

"The granodiorite of the Long Island and the Loon Bay batholiths is a stone suitable for building purposes; commercially this rock would be classified as a granite. There are both moderately coarse and medium-grained types, and these vary from pink to very light gray in colour. The constituent minerals are quartz, feldspar, and either mica or hornblende, or both. The rock is unaltered and has the strength and hardness suitable for structural work. Commonly, the jointing in the granodiorite is evenly spaced at fairly wide intervals, intersecting approximately at right angles. . . . This is particularly true on much of Long Island, on the eastern shore of Southern Head, and on parts of the Loon Peninsula. At all of these places quarrying could be carried on at tidewater."

Samples of fine-grained and medium-grained granite were obtained from the northwest and southwest corners of Long island and from the east side of Loon peninsula about a mile north of Gull island. Owing to their colours, which range from light pink to an offshade of grey, and to their location, it is very improbable that any granite quarries will be opened in the area.

### • PETITES-ROSE BLANCHE AREA

Petites is on the southwest coast, 4 miles east of Rose Blanche and 25 miles east of Port aux Basques.

The stone at Petites is a light-pink porphyritic syenite with a coarse-grained texture. It is composed mainly of feldspar, a small amount of quartz, and smaller amounts of biotite, the feldspar ranging from white to pink. A brief examination of the quarries and outcrops in the area did not disclose any marked variation in colour, composition or texture of the syenite, nor were any blemishes or impurities noted in the stone. It appears highly suitable for use as a building stone and the court house at St. John's, which is faced in part with stone from this area, has a very attractive appearance. An examination of the rough syenite blocks in the various quarries, last worked about 40 years ago, failed to disclose any trace of iron stains or weathering.

*Plate XIV*

*One of the abandoned granite quarries in the Petites area, southwest coast. Note plug-and-feather holes and quarried blocks from former operations.*

Five small quarries were viewed at Petites, four on the mainland and one on Billards island at the entrance to the harbour. The latter was not visited because of heavy seas, but was seen in the distance. All of these quarries are of the 'side-hill' type, having been opened on the hillsides bordering the ocean at elevations ranging up to 50 feet above sea-level. Of the four quarries examined, one was at the southeast entrance to Petites harbour on the property of Mr. Newman, a local merchant, and the other three on the northwest side of the harbour not far from the entrance. All five quarries contained a fair amount of rough quarried stone left over from former quarrying operations.

The quarry at the southeast entrance to the harbour covers an area of about 1,500 square feet. It is within 50 feet of the shoreline, with the sill about 5 feet above sea-level. Two main sets of joints occur at this quarry, both quite prominent: one set strikes east-west and dips uniformly at 65 degrees to the north, with the joints ranging from 6 inches to 4 feet apart; in the other set the joints are spaced 5 to 15 feet apart, are nearly vertical, and have strikes ranging from due north to N20°E. A few vertical joints occur cutting the two main sets at an angle of about 45 degrees. An examination of the quarry face, which ranges up to 15 feet in height, and of the outcrops in the immediate vicinity, failed to disclose any horizontal jointing or sheeting planes.

The quarry on the northwest side of the harbour is about 15 feet above sea-level, and the face, which is an exposed joint plane, has a maximum height of 15 feet. Here again there are two main sets of joints, one set striking east-west and dipping at 80 degrees to the north, and the other having a north-south strike and vertical dip; the east-west joints are spaced farther apart than the corresponding joints at the first quarry described.

At the quarry several hundred yards to the northwest, only one well-defined set of joints was observed, namely, the east-west, vertical joints; the quarry face is an exposed joint plane belonging to this set. In addition, a minor set of vertical joints was seen cutting the major set at about 45 degrees.

At the quarry several hundred yards still farther to the northwest, two sets of joints were observed, one striking north-south and dipping at 85 degrees to the east, the other striking approximately east-west and dipping at 75 degrees to the north. The joints are spaced farther apart at this quarry, the north-south joints ranging from 6 to 10 feet apart and the east-west joints spaced even farther apart; no horizontal joints were observed.

• ***QUARRY AREA***

Quarry is about 15 miles west of Millertown Junction and about 30 miles east of the Trans-Canada Highway at Badger.

Reid Newfoundland Company Limited quarried granite in this area in the 1890's for railway construction. The railway station at St. John's was faced with granite quarried at this locality, and Davies (4, p. 30) reported that the stone was also used to pave Water Street. An examination of the railway station showed that, with the exception of an occasional black knot an inch in diameter, the granite is free from impurities and uniform as to colour, texture and mixture. The stone is a coarse-grained, light grey hornblende granite of Devonian (?) age and is massive but well jointed.

At Quarry the land is flat, overburden is absent, and quarrying appears to have been confined to opening small pits where well-defined vertical joints are present; most of these pits are now flooded. Occasional plug holes show that in some cases only a few blocks or possibly one block may have been quarried at these places, and that most blocks were quarried from pits up to 20 feet in diameter.

## References


(1) **Baird, D. M.:** Fogo Island map-area, Newfoundland (report and map); *Geol. Surv., Canada,* Paper 50-22, 1950.

(2) **Coleman, A. P.:** Northeastern part of Labrador, and New Quebec; *Geol. Surv., Canada,* Mem. 124, 1921.

(3) **Cooper, J. R.:** La Poile-Cinq Cerf map-area, Newfoundland; *Geol. Surv., Canada,* Mem. 276, 1954.

(4) **Davies, D. J.:** *A Pamphlet on the Mineral Deposits of Newfoundland;* St. John's, Nfld., 1927.

(5) **Heyl, G. R.:** Geology and mineral deposits of the Bay of Exploits area; *Geol. Surv., Newfoundland,* Bull. No. 3, 1936.

(6) **Heyl, A. V., and Ronan, J. J.:** The iron deposits of Indian Head area; *Geol. Surv., Canada,* Bull. 27 (Contributions to the economic geology of western Newfoundland), 1954, pp. 42-62.

(7) **Jewell, W. B.:** Geology and mineral deposits of the Baie d'Espoir area; *Geol. Surv., Newfoundland,* Bull. No. 17, 1939.

(8) **Kranck, E. H.:** Bedrock geology of the seaboard region of Newfoundland Labrador; *Geol. Surv., Newfoundland,* Bull. No. 19, 1939.

(9) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(10) **Watson, K. deP.:** Geology and mineral deposits of the Baie Verte-Mings Bight area; *Geol. Surv., Newfoundland,* Bull. No. 21, 1947.

(11) The Canada year book, 1955.

# Chapter 12

## GRAPHITE

### • *ISLAND OF NEWFOUNDLAND*

GRAPHITE has been reported from a number of localities in Newfoundland, including the Long Range mountains of the west coast (5, p. 111), the Baie d'Espoir area of the south coast (2, p. 19), the Bonavista bay area of the east coast (5, p. 112)(4), and the Baie Verte area of the northeast coast (6, p. 37). None of these occurrences are considered to have any commercial value, and there has been no recorded production of graphite on the island.

### • *LABRADOR*

Graphite also occurs in Labrador, more particularly in the Nachvak fiord and Saglek bay areas of the northern part of the coast. Coleman (1, p. 51) writes of the occurrences in the Nachvak fiord area:

"Among non-metallic minerals graphite is mentioned by Daly as occurring abundantly in gneiss and schist at the west end of Nachvak and he states 'that a rounded piece of pure graphite measuring 4 by 5 inches has been found at the foot of the talus near the great alluvial fan.'[1]. The writer's work has shown that graphitic gneiss or schist is widely distributed in that region and for 14 or 15 miles to the west. Most of it is in the form of disseminated scales, but pieces of amorphous-looking graphite were found in a zone of crushing near a creek coming in on the north side of the fiord 6 miles east of the end where Daly reports the mineral. Whether graphitic rock of a workable kind occurs has not been determined."

[1] *Bull. Mus. Comp. Zool.*, Harvard, vol. 38, Geol. Ser., vol. 5, No. 5, p. 234.

Graphite occurs in and about the Saglek bay area, one deposit having been examined by the writer in September 1942 on behalf of W. E. Seibert, of New York. It is at an elevation of about 2,000 feet, on the eastern slope of a northeastward trending ridge about 3 miles north of the entry of Ugjuktok river into the bay. Due to the rugged nature of the terrain, a landing had to be made at the mouth of the Noch-tish-swock river about 10 miles to the east. The route to the deposit follows the river valley for 4 miles, and then turns westerly for 6 miles to the base of the hill on which the deposit is situated. From the base of the hill it is approximately 200 feet up a very steep grade to the deposit itself; this hillside is boulder-strewn and is given to rock slides when disturbed.

The graphite occurs as a lens in a garnet-biotite gneiss of Archaean (early Precambrian) age. This lens lies parallel with the gneissic foliation and with the slope of the hill, its distance below the surface ranging from one to 3 feet. Due to erosion, the lens is exposed on all four sides—up and down the dip, and north and south along the strike. It varies in thickness from a few inches to over 3 feet, reaching its maximum thickness in the middle of the south face, and thinning out up and down the dip and north along the strike. It was estimated to contain at least 20 tons of massive amorphous graphite; in addition, about 10 tons of graphite float, ranging from a few pounds to half a ton, were exposed at the foot of the hill directly below the deposit. Impurities in the graphite consisted of small amounts of garnet, feldspar and quartz. As MacLean (3, p. 50) observed, only "a very minor part of this graphite has the coarsely crystalline texture necessary to merit the trade name of 'flake' graphite."

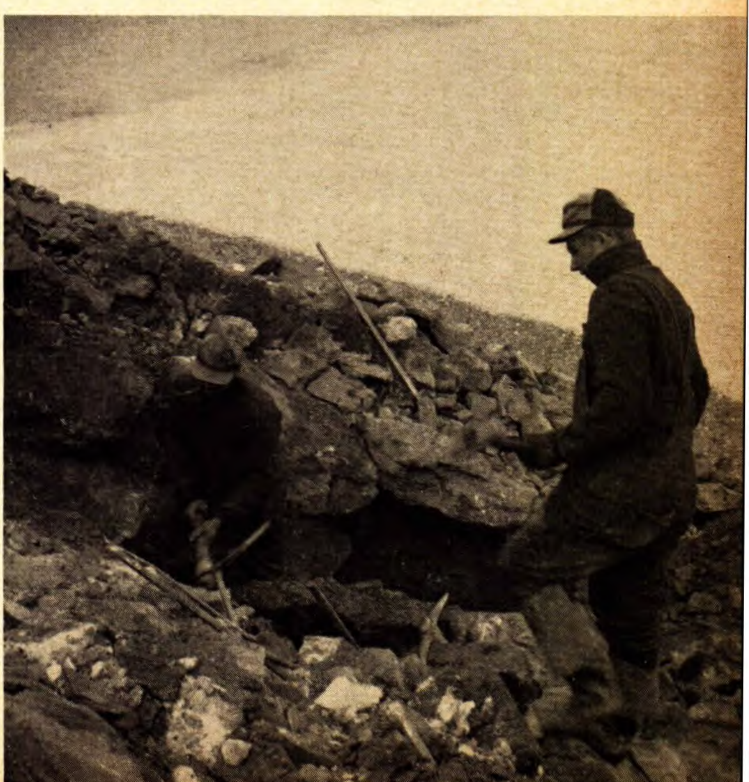


*Plate XV*

*Working on graphite deposit at Saglek Bay, Labrador, in 1942.*

To recover the graphite from this lens would require the removal of several tons of solid rock and one ton of loose boulders per ton of graphite removed. Very little blasting would be required, but rock slides would have to be constantly guarded against. For transporting the ore to the mouth of the Noch-tish-swock river D-6 Caterpillar tractors and Athey Trac-tractor trailers, or similar equipment, would have to be employed.

Several smaller stringers or lenses of graphite were also seen in the vicinity. These lenses ranged up to 2 inches in width, were of undetermined length, and all were parallel to the foliation in the gneiss. Disseminated flakes of graphite were also seen in the country rock in the area. Other occurrences of graphite, similar to the above described deposit, are known to occur in the Saglek bay area but time did not permit of their examination. The chances of finding larger, more important deposits in this area would appear good.

## References


(1) **Coleman, A. P.:** Northeastern part of Labrador, and New Quebec; *Geol. Surv., Canada,* Mem. 124, 1921.

(2) **Jewell, W. B.:** Geology and mineral deposits of the Baie d'Espoir area; *Geol. Surv., Newfoundland,* Bull. No. 17, 1939.

(3) **MacLean, H. J.:** Saglek bay; *Geol. Surv., Canada,* Paper 53-1 (Notes on localities visited on the Labrador coast in 1946 and 1947, by G. V. Douglas), 1953, pp. 48-50.

(4) **McKillop, J. H.:** Fair and False Bay graphite prospect; *Geol. Surv., Newfoundland,* unpub. rept., 1952.

(5) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(6) **Watson, K. de P.:** Geology and mineral deposits of the Baie Verte-Mings Bight area; *Geol. Surv., Newfoundland,* Bull. No. 21, 1947.

# Chapter 13

## GYPSUM

ALTHOUGH the existence of gypsum in commercial quantities in Newfoundland has been known for many years, it was not until 1950 that any serious attempt was made to establish a gypsum industry in the province. In that year the Newfoundland government, upon the advice of its Department of Economic Development, entered into an agreement with a German construction syndicate for the erection of a "gypsum and gypsum wallboard factory" at Humbermouth, Bay of Islands, west coast. Operating since May, 1952 this mill is capable of producing 250,000 square feet of wallboard and lath and 100 tons of gypsum plaster per 24 hours. The mill is operated by Atlantic Gypsum Limited, a subsidiary of Bellrock Gypsum Industries Limited, of London, England, and, working at capacity, provides employment for upwards of 250 men.

Gypsum outcrops at many places and underlies large areas of the lowland that lies along the southwest coast of Newfoundland west of the Long Range mountains. From 5 to 15 miles wide, and 65 miles long, this lowland presents an eroded surface of complexly folded and faulted strata of Mississippian and Pennsylvanian age. The gypsum forms part of the Codroy series of Mississippian age and is equivalent geologically to the gypsum deposits of Nova Scotia and New Brunswick. The reserves of gypsum and gypsum-anhydrite in this region are very large and, to quote Baird (1, p. 94), "The problem of location of any particular operation resolves itself into finding those areas that are best suited for ease of access and purity of gypsum". Baird (1, p. 88) described the gypsum as follows:

"The gypsum of the Codroy beds is of all colours—white, grey, black, red, and yellow. The white and grey varieties are much the most common. The gypsum varies in coarseness of grain from fine alabaster-like types to sugary gypsum, which is the most common. In some localities, masses of coarsely crystalline selenite, from which cleavage plates as much as a foot in diameter are recoverable, occur as veins and as thin tabular masses cutting the finer-grained, sugary gypsum. The selenite zones are evidently related to faults and slips.

"Folding, faulting, and plastic movement within the gypsum masses obscure relations of the gypsum to the immediately adjacent beds. Fault contacts are very common and inclusions of dark limestone, which are commonly finely comminuted and dispersed through the gypseous paste, show the extent of the distortion of the originally flat-bedded gypsum. There can be little doubt, however, that the gypsum is approximately in its correct stratigraphic position."

## Humbermouth Gypsum Plant

The plant is at tidewater near the Humbermouth railway station. It is served by a siding from the railway and has its own shipping wharf.

• ***RAW MATERIALS***

The gypsum is obtained from a deposit at Flat Bay, St. Georges bay, southwest coast, 63 miles by rail south of Humbermouth. There, cliffs of high-grade gypsum, rising over 50 feet above general ground level, are exposed several thousand feet from the railway line. According to officials of the Department of Economic Development the deposit is about 6,000 feet in length, 1,000 feet in width, and has an average depth (above ground water level) of 40 feet. They estimate the deposit to contain approximately 18,000,000 tons, about 80 per cent of which is on Crown land, the remainder on Reid lot 17. The overburden, mainly sand, is estimated to range from 2 to 20 feet in depth.

*Plate XVI*

***Electric auger drills at Flat Bay gypsum quarry, Bellrock Gypsum Industries Limited.***

The quarry is on the Reid property about 1¼ miles southeast of the Flat Bay railway station and is connected with the railway by a road about 1½ miles in length. The quarry is about 700 feet long (northwest-southeast), 150 feet wide, and has a face ranging up to 80 feet in height. The top 30 feet of the face are uneven, with some potholes; the bottom 50 feet are solid gypsum. Electric drills are used with tungsten carbide-tipped auger bits ranging up to 10 feet in length, powered by a portable diesel generating set. A 1½-cu.yd. diesel shovel and two traxcavators are used for loading. The gypsum is transported to the railway loading-ramp in two 13-cu.yd., side-dump Athey wagons drawn by DW10 Caterpillar tractors. On the loading-ramp the wagons discharge their loads directly into 25-ton railway cars spotted on the siding below. Operations are confined to the day shift. Production in 1956 amounted to 37,000 tons of crude gypsum, as compared with 44,800 tons in 1955[1].

For the week ending May 19, 1956, at a time when the quarry was being enlarged and much of the mill feed was coming from the top 30 feet, company analyses of the material used in the mill showed a gypsum content ranging from 86.40 to 90.70 per cent. The moisture content ranged from 3.1 to 4.8 per cent, and the insoluble residue from 3.36 to 4.47 per cent. This compares with a gypsum content ranging from 90.90 to 94.30 per cent, a moisture content from 1.6 to 2.6 per cent, and an insoluble residue content from 1.09 to 3.54 per cent for the week ending June 17, 1954, at the time of the writer's previous visit to the property.

The high percentage of impurities and moisture in the rock were largely due to the overburden adding to it from the potholes in the top 30 feet.

### • *DESCRIPTION OF PLANT*

Railway cars discharge the gypsum into one of two concrete receiving pits, from which it is fed by traxcavator and apron feeder to the hammer-mill, or primary crusher, where it is reduced to minus 1-inch. The crushed gypsum is then delivered to a 55-cu.yd. feeding bin situated over the feed end of a 6½- by 33-foot rotary calciner, or to a 1,400-ton raw-material storage-hall.

The calcined gypsum is delivered by screw conveyor and bucket elevator to one of two 360-ton recalcining silos. From these silos the material, after screening and passing under an electro-magnet to remove any tramp iron, is fed to one of three Wemag disc pulverizers for fine grinding. Following air classification, the fines (minus 90-mesh) are delivered by screw conveyors and bucket elevator to: the 220-ton ground gypsum plaster silo; the 110-ton plaster bin situated in the adjoining wallboard plant; or to the automatic bagging machine.

[1] Dominion Bureau of Statistics.

The plaster bin feeds by drag-chain discharger and belt conveyor to a double-screw mixing conveyor where glue and an accelerator are mixed with the plaster. This dry mix then enters the continuous mixer where water, foam and pulp are added. The continuous mixer delivers the resulting thoroughly-mixed slurry to the forming table where the wallboard and lath are prepared.

The forming table feeds to a 300-foot belt table (a 55-inch rubber belt) which is followed by an open roller conveyor table 147 feet in length. The board is carried along the tables in a continuous strip, and travels at such a rate that by the time it reaches the cutting knife the slurry has set sufficiently hard to allow handling if necessary. After being cut into the desired lengths, the boards are automatically transferred to a Schilde dryer where they are completely dried by steam. They are then inspected, packaged, and conveyed to the wallboard storage hall where storage space for 3,500,000 sq. ft. of wallboard and 500 tons of wallboard paper is provided.

## Other Deposits

As already mentioned, gypsum outcrops at many places and underlies large areas of southwestern Newfoundland. Baird (1), who has investigated this Carboniferous region in some detail, lists about 35 different localities where gypsum outcrops are known to occur. A description of each of the main occurrences may be found in his paper. This publication records only the principal deposits and describes briefly those most favourably situated for development.

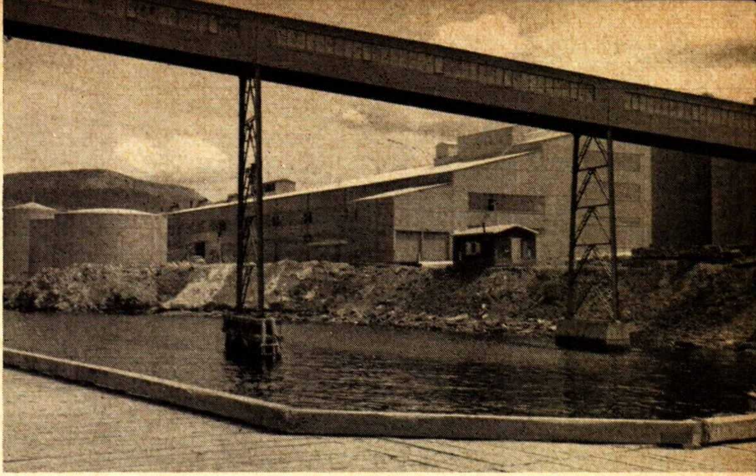
According to Baird (1, p. 94), the most favourable localities are at Flat Bay (already described), Heatherton, Highland river and Fishels river, each of which "offers reserves of gypsum measuring several tens of millions of tons." He adds that, "Other localities with some difficulty of access but large reserves of potential high-grade gypsum are Ryans brook, Codroy, Ship cove, Coal brook and northeast, Sheep brook and Romaines brook." Brief descriptions of the Heatherton, Highland river, Fishels river and Romaines brook occurrences are given below, followed by a brief reference to the Boswarlos-Piccadilly deposit on the Port au Port peninsula.

### • *HEATHERTON-PLASTER POND*

"A zone of gypsum outcrops and sinks two miles long lies about a mile and a half southeast of the railway at Heatherton. The bed here is about 500 feet thick and dips to the northwest at about 30°. Drilling for salt in this area in 1947 shows that the gypsum goes to a vertical depth of several hundred feet and there is no reason to think that it does not continue down the dip of the regional structure" (1, p. 94).

**Plate XVII**

*Bellrock Gypsum Industries Limited. View of gypsum plant from cement plant wharf, Humbermouth.*



## • HIGHLAND RIVER

This deposit lies along the east side of the railway immediately south of the crossing over Highland river. The gypsum occurs as a zone of closely spaced sinks, which extends for some distance to the northeast and the southwest. The gypsum is approximately 400 feet thick and dips to the southeast at about 50 degrees. Outcrops are few but show white and grey gypsum of good quality (1, p. 94).

## • FISHELS RIVER (Lower)

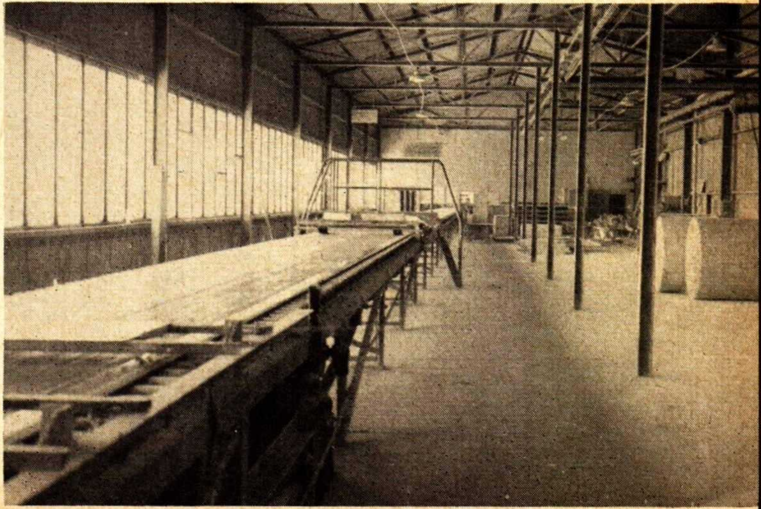
Gypsum "occurs at and above the railway. On the right bank of the river it can be traced for a few hundred feet to the northwest where it disappears under outwash deposits. The outcrops in the right bank show considerable faulting within the mass.

"The gypsum of the left bank is a massive bed whose exact thickness is not easily estimated but which must exceed 400 feet. The basal portion of the outcrop in the river exposure is a pale blue anhydrite. This grades upward into pure gypsum at the top of the river cliffs, indicating that surface hydration is important. . . .

"The gypsum . . . can be traced southwestward for several thousand feet but becomes lost in the boggy and heavily wooded country. It is

**Plate XVIII**

*Bellrock Gypsum Industries Limited plant at Humbermouth. View in wallboard plant, looking along the belt table towards the cutting knife and feed end of dryer.*



evidently continuous with the Plaster Pond outcrops with which it lies in direct line and with which it can be stratigraphically correlated" (3, p. 126).

**• *ROMAINES BROOK***

At the mouth of Romaines brook, on the north shore of St. Georges bay, a cliff of gypsum rises 40 to 95 feet above the river level and extends several hundred feet along the stream. "The bed dips 15° east, and sink-holes indicate its eastward continuation. The gypsum weathers white and appears to be of good quality" (2, p. 4).

*Plate XIX*

***Gypsum outcrop at Romaines Brook, west coast, as seen from highway bridge.***

Hayes and Johnson (2, p. 5) report that two adits were driven into the outcrop in 1926 by Reid Newfoundland Company Limited. From one of these adits, 257 feet in length, "the Company records show an average analysis of 43.5% sulphur trioxide ($SO_3$) for thirty-five samples." Seventeen test pits put down by the company "indicate that the gypsum is probably 280 feet in thickness and that the overburden of gravel and sand approximates twenty feet in thickness. A gross tonnage of over 13,000,000 short tons of gypsum to a depth of 50 feet below sea level" was indicated.

**• *BOSWARLOS-PICCADILLY***

The Boswarlos-Piccadilly area, Port au Port peninsula, is a future possible source of high-grade gypsum. Although not as close to the railway as some of the other deposits, gypsum occurs within easy reach of tidewater at both Piccadilly and Boswarlos. One such occurrence is near Spruce point, West bay, about 2 miles east of Piccadilly. Here a quarry could be opened less than half a mile inland, and faces 50 to 75 feet high advanced south, and east and west along the strike. About 200 yards west of Spruce point is a suitable location for a shipping wharf. Here the bay is not as shallow as to the east and west, and 24 feet of water occur within a short distance of the shoreline, and the area is sheltered.

### *Analyses*

About a dozen of the gypsum occurrences described by Baird (1) and Baird and Snelgrove (3) were examined and sampled by the writer in 1950 and 1951. Altogether about two dozen samples of gypsum and half a dozen samples of anhydrite were obtained. Ten of these have been analysed for sulphur trioxide and for water at 420°F., and their hypothetical compositions are given below. These samples do not represent the compositions of the various deposits in question, as they give no indication of the amount of relatively pure anhydrite occurring in each deposit; such information must be obtained by sampling the deposit by diamond drilling or some other method.

ANALYSES OF SOME NEWFOUNDLAND GYPSUMS

| Sample No. | Gypsum ($CaSO_4 \cdot 2H_2O$) | Anhydrite ($CaSO_4$) | Impurities |
|---|---|---|---|
| 1 | 90.30 | 2.01 | 7.69 |
| 2 | 91.68 | 1.29 | 7.03 |
| 3 | 0.34 | 97.85 | 1.81 |
| 4 | 90.58 | 5.13 | 4.29 |
| 5 | 94.94 | 1.26 | 3.80 |
| 6 | 90.26 | 6.24 | 3.50 |
| 7 | 95.61 | 2.01 | 2.38 |
| 8 | 79.74 | 3.16 | 17.10 |
| 9 | 96.47 | 1.58 | 1.95 |
| 10 | 96.36 | 1.92 | 1.72 |

| | |
|---|---|
| 1. Fishels river | Channel sample of gypsum from outcrop on north side of river, several hundred feet east of the railway bridge. |
| 2. Fishels river | Channel sample of gypsum from outcrop on south side of river near the railway bridge. |
| 3. Fishels river | Grab sample of anhydrite from outcrop on south side of river near the railway bridge. |
| 4. Flat Bay | Channel sample of gypsum from north face of a large U-shaped outcrop. |
| 5. Flat Bay | Channel sample of gypsum from south face of the U-shaped outcrop. |
| 6. Coal brook | Grab sample of gypsum collected from various sink holes in the area. |
| 7. Boswarlos | Grab sample of gypsum from outcrop several hundred feet from the highway between Boswarlos and Piccadilly. |

| | |
|---|---|
| 8. Romaines brook | Grab sample of grey gypsum. |
| 9. Romaines brook | Grab sample of pink gypsum. |
| 10. Romaines brook | Grab sample of white gypsum. |

## References


(1) **Baird, D. M.:** Gypsum deposits of southwestern Newfoundland; *Trans. Can. Inst. Mining Met.,* vol. 54, 1951, pp. 85-94.

(2) **Hayes, A. O., and Johnson, H.:** Preliminary report on gypsum deposits of Bay St. George, southwestern Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 3, 1937.

(3) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

# Chapter 14

## INDUSTRIAL WATERS

**A** survey of the chemical character of the major water supplies available for industrial and domestic use in Newfoundland is being undertaken by the Industrial Minerals Division, Mines Branch, Ottawa. About eight of the larger rivers are being sampled monthly and bi-monthly to determine their seasonal variation and to assess their suitability for such use. Information on all organized waterworks systems is also being obtained under the headings: *population, ownership, source, treatment, storage capacity, water consumption,* and *industrial use,* and samples of all such waters, treated and untreated, will be analysed. The survey was completed in 1956, and a report will be published as soon as possible.

Preliminary analytical results indicate the waters are highly coloured and have little dissolved mineral matter; they generally vary in hardness from 5 to 20 parts per million as $CaCO_3$.[1]

[1] *See,* Industrial Water Resources of Canada (Water Survey Report No. 1): Scope, Procedure, and Interpretation of Survey Studies, by J. F. J. Thomas; *Mines Br., Canada,* Rept. 833, 1953.

# Chapter 15

## LIMESTONE

NEWFOUNDLAND is well supplied with limestones. They range in type from the high-calcium variety to dolomite, and in purity from those containing less than 1 per cent total impurities to those containing 50 per cent of siliceous and argillaceous impurities. Limestones of geological ages ranging from Precambrian to Carboniferous are represented, but only those of Ordovician age are being worked at present. Limestone has long constituted an important item in the mineral production of the province, and at present the industry provides seasonal employment for approximately 200 individuals. As shown in Table VII, production in 1956 amounted to 319,261 tons valued at $573,304, as compared with 333,354 tons valued at $590,945 in 1955. These figures do not include limestone utilized in the production of cement.

The principal products of the quarries in order of tonnage are: flux for smelting operations; stone for making Portland cement; stone for use in the making of sulphite pulp; crushed stone for concrete aggregate and road metal; agricultural limestone, monumental and ornamental stone (rough). Limestone for use as a flux in smelting operations constitutes the main product both in value as well as tonnage. Stone for this purpose is produced at Aguathuna, Port au Port bay, west coast, by Dominion Limestone Limited, a subsidiary of Dominion Steel and Coal Corporation Limited. The stone is shipped to the steel plant at Sydney, N.S.

Limestone for making Portland cement and for agricultural purposes is produced at Humbermouth, Bay of Islands, west coast, by North Star Cement Limited. Limestone for use in making sulphite is produced at Cobbs Arm, New World island, Notre Dame bay, northeast coast, by the Newfoundland Lime Manufacturing Company Limited; and at Corner Brook, 2 miles west of Humbermouth, by Bowaters Newfoundland Pulp and Paper Mills Limited. Concrete aggregate and road metal and a small amount of rough building stone are also produced at the Corner Brook quarry.

TABLE VII

PRODUCTION OF LIMESTONE IN NEWFOUNDLAND[1]
1936-1956

| Year | Short Tons | Value $ |
|---|---|---|
| 1936 | 202,907 | 171,960 |
| 1937 | 408,800 | 365,000 |
| 1938 | 209,978 | 187,480 |
| 1939 | 282,081 | 253,620 |
| 1940 | 418,733 | 378,744 |
| 1941 | 436,182 | 399,902 |
| 1942 | 350,000 | 350,000 |
| 1943 | 333,343 | 446,442 |
| 1944 | 380,037 | 521,859 |
| 1945 | 392,156 | 530,258 |
| 1946 | 323,073 | 338,379 |
| 1947 | 349,614 | 466,424 |
| 1948 | 434,021 | 661,752 |
| 1949 | 372,223 | 595,895 |
| 1950 | 443,336 | 734,599 |
| 1951 | 462,894 | 779,184 |
| 1952 | 455,554 | 736,101 |
| 1953 | 391,617 | 647,349 |
| 1954 | 357,454 | 605,254 |
| 1955 | 333,354 | 590,945 |
| 1956 | 319,261 | 573,304 |

[1] Figures for 1936-48 as given by Geological Survey of Newfoundland (9) and converted to short tons; production for 1942 is estimated. Figures for 1949-56, Dominion Bureau of Statistics.

TABLE VIII

PRODUCTION OF LIMESTONE IN NEWFOUNDLAND, BY KINDS[1]
1954-1956

| For use as: | 1954 | | 1955 | | 1956 | |
|---|---|---|---|---|---|---|
| | Short Tons | Value $ | Short Tons | Value $ | Short Tons | Value $ |
| Monumental and ornamental stone, rough... | 470 | 1,848 | 63 | 272 | 114 | 513 |
| Flux in iron and steel furnaces............. | 312,856 | 469,284 | 300,043 | 450,064 | 279,979 | 419,968 |
| Pulp and paper mills.... | 30,873 | 103,800 | 28,189 | 113,088 | 35,859 | 118,126 |
| Agricultural purposes... | — | — | 4,055 | 24,288 | 2,970 | 33,381 |
| Crushed stone: | | | | | | |
| Concrete aggregate.... | 10,413 | 21,663 | — | — | — | — |
| Road metal.......... | 2,842 | 8,659 | 1,004 | 3,233 | 339 | 1,316 |
| Total.......... | 357,454 | 605,254 | 333,354 | 590,945 | 319,261 | 573,304 |

[1] Dominion Bureau of Statistics.

The Department of Highways operates granite, limestone and sandstone quarries at various points along the highways.

A description of the various operations is given below, with the exception of the previously mentioned North Star Cement Limited quarry, and quarries operated by the Department of Highways.

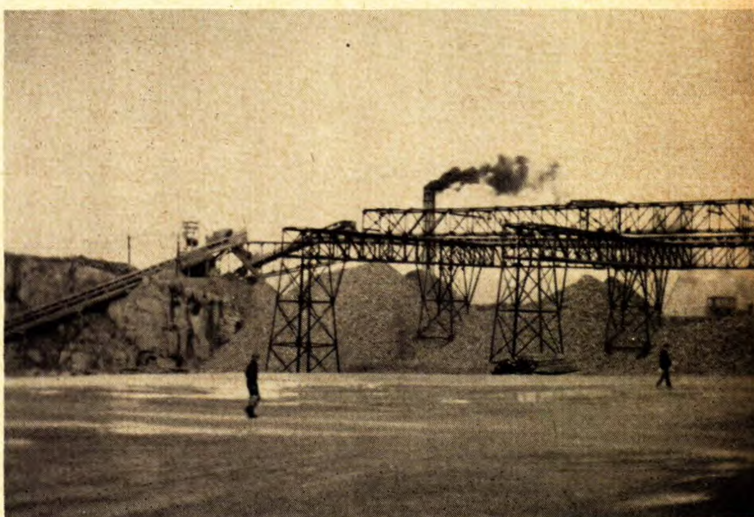
## Aguathuna Quarry

The Aguathuna quarry is on the south side of Port au Port bay, west coast, 18 miles west of Stephenville Crossing. The total annual output, averaging somewhat more than 300,000 tons of high-calcium limestone is shipped to Sydney, Nova Scotia, for use as a flux in the steel industry. The quarry was opened in 1913, and with the exception of the years 1915, 1925, 1932 and 1933, production has been continuous. The quarry operates on a seasonal basis, the normal season for drilling being 8 months and for actual quarrying, 4 or 5 months. During the quarrying period production averages around 3,500 tons a day and between 130 and 140 men are employed by the company.

The Aguathuna limestone is a massively-bedded, medium to coarse-grained, grey limestone. Gillis (5, p. 369) describes the stone as hard and crystalline and having "a conchoidal fracture, as a result of which it breaks into thin, brittle slivers when crushed, and also yields a large percentage of fines on handling into stock piles and in loading steamers." The limestone belongs to the Table Head series (Middle Ordovician) which at Aguathuna is represented by a total thickness of 200 feet. The beds dip northward toward the shore at about 20 degrees. Bedding planes are well defined and are usually spaced about 15 feet apart.

**Plate XX**

*Storage yard for crushed limestone at Aguathuna, Port au Port Bay, west coast. Dominion Limestone Limited.*



The Aguathuna quarry has an over-all length (east-west) of slightly more than one mile. The main face roughly parallels the shoreline and strike of the limestone formation, its distance from the shoreline ranging from 100 to 300 yards, and its sill elevation from 10 to 30 feet above sea-level. For convenience in description it may be divided into two quarries, the East quarry, with an over-all length of 4,000 feet and a face from 40 to 120 feet high, and the West quarry, with a face 1,000 feet long and from 15 to 100 feet high. It is only within the last few years that the West quarry came into production, as a result of the East quarry having been worked to the southern and eastern boundaries of the property. As recently as 1949 the entire production was derived from the East quarry, where the east face and 1,000 feet of the main face were being advanced.

The main face of the East quarry is broken by north-south trending valleys which cut across the measures at intervals from the shoreline to the rear of the property. At one time these valleys were thought to represent grabens formed from faulting and down-dropping of limestone blocks, but recent quarrying has not supported this theory.

*Plate XXI*

*Quarrying operations at Aguathuna quarry of Dominion Limestone Limited.*

• ***DRILLING AND BLASTING***

Where the faces exceed 60 feet in height, the primary drilling is carried out with deep-well drills using 6-inch chisel bits. These are of the non-traction gasoline-operated type or self-propelled diesel-powered type. The holes are spaced 12 feet apart and 20 to 25 feet back from the face, and are drilled from 4 to 6 feet below the quarry floor. When the faces do not exceed 60 feet in height, three derrick drills and one wagon drill are used. The derrick drills can drill up to 40-foot holes, use 1¼-inch forged steel for drilling, and bottom to take 2-inch powder. These holes are spaced 6 feet apart and 8 feet back from the face. Snake holes, which are drilled to assist taking bottom, are put in by hand-fed drifters. The wagon drill uses 1¼-inch forged steel and is used only for drilling the shorter bench holes. Compressed air for drilling is supplied by three portable diesel-powered units delivering 500 c.f.m. each.

Deep-well drill holes are loaded with 5- by 16-inch "Dynamex" to 10- to 15-foot collars; 70 per cent dynamite is used in the lower part of the hole and 50 per cent dynamite in the upper part of the hole. No chambering is employed. Single row blasting is the general practice and from 80 to 100 holes are fired in a single blast. Derrick drill holes are loaded with 2- by 8-inch, 50 per cent "Dynamex".

*Plate XXII*

*Aguathuna quarry, showing derrick drills in operation in the west quarry.*

To break the oversize and at the same time get a minimum amount of fines, a 2,600-pound steel ball operated from a Lorain travelling crane is used instead of secondary blasting with dynamite.

## • LOADING, HAULING AND CRUSHING

All stone is loaded by two 2½-cu.yd. diesel shovels, and for haulage purposes nine diesel trucks are used—two 11-ton units, two 15-ton units, and five 17-ton units. The maximum length of haul to the crushing plant is 2,800 feet. The stone is delivered to a large hopper from which it is fed by apron feeder to a 56- by 72-inch jaw crusher, where it is reduced to minus 8-inch size. The stone then moves over a belt conveyor and 4-inch grizzly to a gyratory crusher where it is reduced to minus 4-inch size.

*Plate XXIII*

**Quarrying operations, east quarry, Aguathuna, showing Lorrain rock breaker.**

## • STOCKPILING AND SHIPPING

The crushed stone, together with the grizzly undersize, is "delivered onto a belt conveyor that elevates it to the stocking conveyor, carried on a bridge 70 feet above yard grade. The stocking conveyor is equipped with a tripper to permit stocking at any point on the bridge. The storage yard will carry about 24,000 tons of free-running stone. Recovery is through hoppers which feed directly onto a 40-inch conveyor-belt carried in a concrete tunnel beneath the stock pile. This recovery belt, in turn, delivers to the loading belts, also 40 inches wide, running to the pier-head, where the product passes over a loading chute directly into the steamers" (5, pp. 371-372).

A bar screen or grizzly about 8 feet long is installed on the loading belt system to remove all fines under ¾-inch. These fines are delivered to the waste stockpile by a 7-ton side-dump skip car operated by a head-and-tail rope drive. Gillis (5, p. 372) states that the screen removes about 10 per cent of the flow to the steamer or about 100 tons per hour.

## • POWER

Power is supplied from St. Georges by the West Coast Light and Power Company Limited, a subsidiary of the United Towns Electric Company Limited. It enters the plant at 33,000 volts, is stepped down and converted from a.c. to d.c. in a 750 h.p. motor-generator set.

## • ANALYSES

The following analyses of Aguathuna limestone were furnished by the company. Each sample represents a shipment of approximately 10,000 tons of limestone made during the 1950 season. An everage of the nine shipments gives 91.91 per cent $CaCO_3$, 4.54 per cent $MgCO_3$, 2.03 per cent $SiO_2$ and 1.23 per cent $Al_2O_3 + Fe_2O_3$.

| Sample No. | Loss on Ignition | CaO | MgO | $SiO_2$ | $Fe_2O_3 + Al_2O_3$ | Total | Insol.* |
|---|---|---|---|---|---|---|---|
| 1 | 42.80 | 51.50 | 2.30 | 2.00 | 1.40 | 100.00 | 5.70 |
| 2 | 43.00 | 51.65 | 2.16 | 2.00 | 1.00 | 99.81 | 5.16 |
| 3 | 43.22 | 52.14 | 1.89 | 1.80 | 0.90 | 99.95 | 5.61 |
| 4 | 43.10 | 51.81 | 1.93 | 1.96 | 1.00 | 99.80 | 4.89 |
| 5 | 42.96 | 51.24 | 2.29 | 2.32 | 1.08 | 99.89 | 5.69 |
| 6 | 42.92 | 50.52 | 2.44 | 2.26 | 1.72 | 99.86 | 6.42 |
| 7 | 42.80 | 51.67 | 2.16 | 1.68 | 1.44 | 99.75 | 5.28 |
| 8 | 42.80 | 51.55 | 2.16 | 1.92 | 1.40 | 99.83 | 5.48 |
| 9 | 42.60 | 51.40 | 2.20 | 2.30 | 1.20 | 99.70 | 5.70 |
| Average | 42.91 | 51.50 | 2.17 | 2.03 | 1.23 | 99.84 | 5.55 |

*$MgO + SiO_2 + (Al_2O_3 + Fe_2O_3)$.

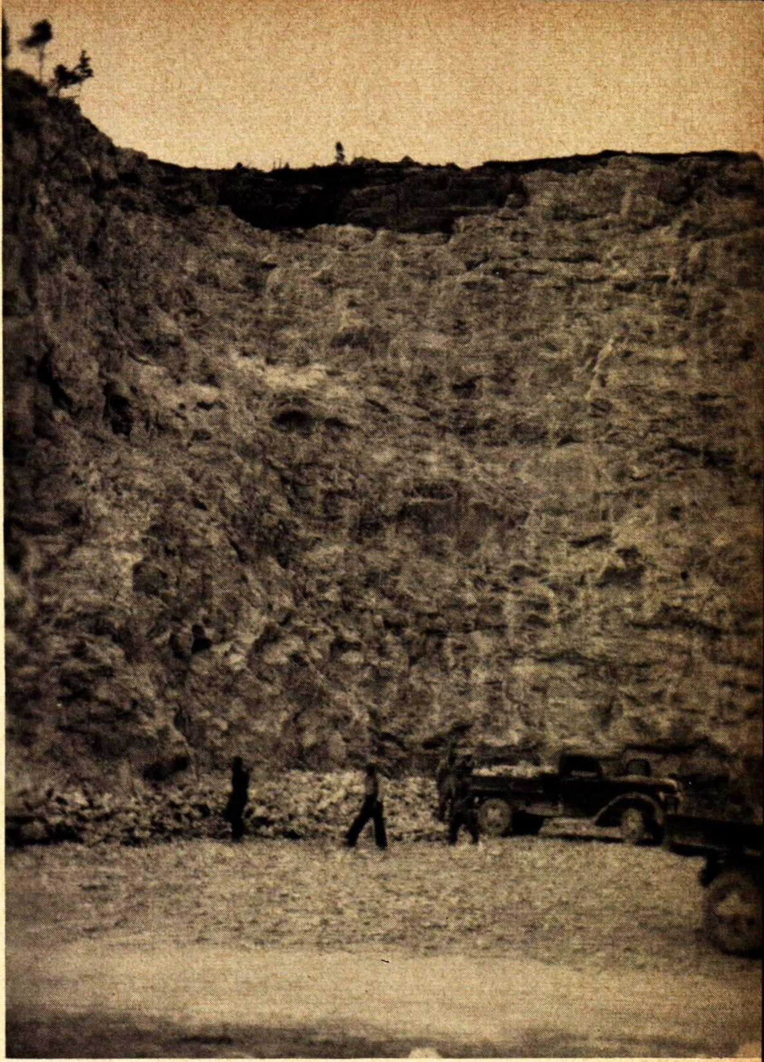


*Plate XXIV*

**Section of face at Cobbs Arm quarry, Newfoundland Lime Manufacturing Company Limited, New World Island, northeast coast.**

## Other Quarries and Deposits

• ***COBBS ARM QUARRY***

Cobbs Arm, on the eastern side of New World island, Notre Dame bay, northeast coast, has been a source of high-calcium limestone for over 70 years. The stone is produced by Newfoundland Lime Manufacturing Company Limited, of St. John's, who have operated in the area since 1912. Shipments in 1956 amounted to approximately 12,000 tons, all of which went to Botwood, 50 miles to the southwest, for use in Anglo-Newfoundland Development Company's pulp and paper mill at Grand Falls. Previous to 1954 the stone was also used in the production of lime and for agricultural purposes. The lime plant was dismantled early in 1956, and North Star



91230—7½

Cement Limited now meets the local demand for agricultural limestone, production of which in 1956 amounted to approximately 3,000 tons. The quarry normally operates 4 or 5 months of the year.

The stone is a dark, medium-grained, high-calcium crystalline limestone containing calcite stringers. Analyses of the stone, which is considered to be of Ordovician age, yield as much as 99 per cent calcium carbonate. According to Baird (1, p. 8) the limestone bed in which the present quarry is opened is "of irregular thickness, but not exceeding one hundred feet", and is exposed along the shore for more than half a mile.

The quarry is near the head of Cobbs arm about 100 yards south of the shoreline and half a mile west of the local wharf. It has a length (east-west) of about 500 feet and a face ranging in height from 90 feet near the centre to 15 feet at the sides. As exposed in the quarry, the beds are approximately horizontal and appear to dip to the southeast at 5 degrees. With the exception of a narrow lens of low grade black limestone ranging from 6 inches to 3 feet wide near the sill, the stone appears to be of uniform composition. The face is cut by a number of steeply dipping joints and faults, with some of the latter showing a maximum movement of 3 feet.

The limestone is quarried by benching methods in which benches 8 to 10 feet wide and 6 to 8 feet deep are taken the full width of the face. They are drilled with jack-hammers using detachable steel bits, and are blasted electrically, 20 holes at a time. The large blocks are further reduced by secondary blasting or sledge hammers to the 8-inch, 40-pound size required by the pulp and paper industry. Compressed air is supplied by one portable diesel-powered compressor.

### • DEER LAKE QUARRY

The Deer Lake quarry is situated along the Trans-Canada Highway about 6 miles north of the town of Deer Lake, in west central Newfoundland. It was opened in 1947 by the Agricultural Division, Department of Natural Resources, to supply agricultural limestone to the new farming community of Cormack about 6 miles to the northeast. Production averaged around 1,000 tons a year, but there has been no production since 1950 or 1951.

The quarry is about 200 feet northwest of the highway at an elevation of about 20 feet. It has a length of 50 feet and a face 10 feet high. The stone here is a pure, fine-grained, buff-coloured dolomite, considered to be of Carboniferous age. The beds strike approximately northeast-southwest and have a vertical dip. Overburden averages 2 to 3 feet.

Agricultural limestone was produced by passing the stone through a Jeffrey lime pulverizer, power for this unit being provided by a D4 Caterpillar tractor.

## • DORMSTON QUARRY

The Dormston quarry is at the base of an erosional escarpment 2 miles southeast of Corner Brook. It is operated by Bowaters Newfoundland Pulp and Paper Mills Limited in connection with its sulphite plant which requires 15,000 to 20,000 tons of limestone annually. The quarry undersize (minus 8-inch, 40-pound size), which usually amounts to another 15,000 to 20,000 tons, is crushed and sorted at the quarry and sold locally as concrete aggregate, road metal and railroad ballast. Several hundred tons of the larger sized blocks (shown in Table VIII as monumental and ornamental stone, rough) are used annually by the local building trade for rough stone work. The quarry normally operates from May to December.

The quarry is approximately 500 feet long (north-south), has a face slightly more than 300 feet high, and is about 650 feet above sea-level. It is opened in fine- to coarse-grained black marble belonging to the Table Head series of Ordovician age. The beds strike approximately due north and dip to the west at 60 degrees; they range up to 3 feet in thickness and are cut by several sets of joints, some of which are filled with calcite.

The stone is quarried by benching, with the benches more or less following the steeply-dipping bedding planes. The benches are taken the full length of the face and average about 3 feet in width and 10 feet in height. Holes are drilled with jack-hammers using 1-inch steel and detachable steel bits; dry drilling is practised. Compressed air is supplied by two 75 h.p. electric compressors.

The broken stone for the sulphite plant (40-pound, 8-inch size) is collected in five 3-ton "pans". A "load-lugger"—a truck equipped with a hydraulic lifting device in place of a dump-box—picks up the loaded pans, carries them to a nearby ramp, and transfers their load to trucks which haul the limestone to the mill stockpile at Corner Brook.

## • JUNCTION QUARRY

The Junction quarry lies along the south side of the Trans-Canada Highway about 4 miles east of Humbermouth, at the foot of a cliff some 300 feet high. It has not operated for 10 years. It was abandoned by Bowaters Pulp and Paper Mills Limited in favour of the Dormston quarry, due to the difficulty of mining such a high and badly-fractured face and to its close proximity to the railroad. The stone here is a marble belonging to the St. George series of Lower Ordovician age.

## • MOSQUITO COVE DEPOSIT

Mosquito cove, about half a mile south of Ship cove, Burin, Placentia bay, southeast coast, has been mentioned as a possible source of agricultural limestone by Van Alstine (8, p. 43). He describes two beds of high quality magnesian limestone which outcrop on the south side of the cove, one of which is 40 feet thick and the other, 5 feet. The limestone belongs to the Burin series of Ordovician (?) age. The 40-foot bed, which has been traced southward for more than 3,000 feet to Whale cove, would undoubtedly afford several excellent quarrying sites; the amount of overburden is negligible, and a shipping wharf could easily be constructed in the area.

Snelgrove and Baird (7, p. 131) report that in the past a small amount of lime was burnt from a quarry at Ship cove.

### • *O'REGANS QUARRY*

O'Regans quarry is in the Codroy lowland area of southwestern Newfoundland about 9 miles east of Codroy and 5 miles west of Doyles. It was opened about 15 years ago by the Agricultural Division, Department of Natural Resources, in order to supply agricultural limestone to the many small farms in the area. The demand was small, however, and production was usually less than 1,000 tons a year. There has been no production since 1951.

The quarry is on the north side of the Grand Codroy river about 200 feet north of the highway and 300 feet east of Ryans brook. The stone is a siliceous, dense-textured, greyish-brown limestone having a slaty structure; it forms part of the Codroy series of Mississippian age. The beds strike approximately northeast-southwest paralleling the highway and dip to the southeast at 40 degrees. The quarry face, an exposed bedding plane, has a slope height of about 20 feet and a length of over 50 feet.

Agricultural limestone was produced by passing the stone through a Jeffrey pulverizer, power for this unit being provided by a D2 Caterpillar tractor.

### • *MISCELLANEOUS*

According to Cooper (4, p. 32), there is much limestone in the Hare bay area, north coast, "for use as building stone, crushed stone, and agricultural or chemical lime." He mentions that the Hare Island limestone has been used as road metal at St. Anthony and that analyses indicate this stone to contain well over 90 per cent calcium carbonate. He thought that suitable building stone could be obtained at a number of places within the Southern Arm limestone.

Betz (2, p. 43) mentions that limestones are abundant in the Canada bay area, north coast, some of which could be used for local building purposes, road metal, and in the production of lime. He gives nine analyses of representative samples from various formations and localities in the area. Analysed were : four dolomites, one magnesian limestone, and four calcium limestones, three of the latter being of the 'high-calcium' variety, containing over 98 per cent calcium carbonate.

The possibility of quarrying limestone at Big Coney arm, White bay, northeast coast, for the production of lime, was seriously considered in 1938, but so far no work has been done. Betz (3, p. 19) thought this limestone belonged to the Doucers formation, which contains marble beds in the Sops arm area, further referred to in the chapter on marble.

Heyl (6, p. 56) mentions that a large lens of light blue limestone which outcrops along the southern shore of Cottel bay, Bay of Exploits area, northeast coast, has been quarried in the past and would be suitable for road metal.

ANALYSES OF NEWFOUNDLAND LIMESTONES

| Sample | $SiO_2$ | $Fe_2O_3$ | $Al_2O_3$ | $Ca_3(PO_4)_2$ | $CaCO_3$ | $MgCO_3$ | Total | S | CaO | MgO | Ratio of CaO to MgO |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.20 | 0.57 | 0.50 | 0.02 | 89.77 | 4.98 | 99.04 | 0.06 | 50.30 | 2.38 | 21.1:1 |
| 2 | 5.30 | 0.50 | 0.44 | 0.02 | 87.93 | 4.12 | 98.31 | 0.06 | 49.27 | 1.97 | 25.0:1 |
| 3 | 4.59 | 0.61 | 1.01 | 0.04 | 88.69 | 1.25 | 96.19 | 0.10 | 49.70 | 0.60 | 82.8:1 |
| 4 | 0.86 | 0.34 | N.D. | 0.04 | 97.21 | 0.21 | 98.66 | 0.06 | 54.47 | 0.10 | 545:1 |
| 5 | 0.40 | 0.36 | 0.02 | 0.20 | 98.37 | 0.04 | 99.39 | 0.09 | 55.12 | 0.02 | 2756:1 |
| 6 | 5.24 | 1.53 | 2.35 | 0.31 | 87.89 | 1.84 | 99.16 | 0.77 | 49.25 | 0.88 | 56.0:1 |
| 7 | 1.51 | 0.55 | 0.60 | 0.37 | 96.17 | 0.13 | 99.33 | 0.06 | 53.89 | 0.06 | 898:1 |
| 8 | 3.19 | 0.46 | 0.43 | 0.02 | 52.41 | 44.13 | 100.64 | 0.03 | 29.37 | 31.10 | 1.30:1 |
| 9 | 5.95 | 0.68 | 0.92 | 0.02 | 50.97 | 41.93 | 100.29 | 0.09 | 28.46 | 20.05 | 1.41:1 |
| 10 | 4.74 | 0.75 | 0.74 | 0.04 | 85.77 | 8.20 | 100.24 | 0.14 | 48.06 | 3.92 | 12.3:1 |
| 11 | 3.38 | 0.52 | 0.96 | 0.04 | 86.98 | 5.81 | 97.95 | 0.08 | 48.74 | 2.78 | 17.5:1 |
| 12 | 9.88 | 0.50 | 0.35 | 0.03 | 54.82 | 34.19 | 99.77 | 0.03 | 30.72 | 16.35 | 1.88:1 |
| 13 | 13.12 | 1.57 | 3.03 | 0.09 | 77.36 | 3.41 | 98.58 | 0.23 | 43.35 | 1.63 | 26.6:1 |
| 14 | 13.02 | 1.28 | 2.52 | 0.09 | 78.88 | 1.59 | 97.38 | 0.20 | 44.20 | 0.76 | 58.2:1 |

1. Grab sample of Table Head limestone from Aguathuna East quarry.
2. Grab sample of Table Head limestone from Aguathuna East quarry.
3. Grab sample of Table Head limestone from Aguathuna fines stockpile.
4. Grab sample of Table Head limestone from Aguathuna West quarry.
5. Grab sample of limestone from Cobbs Arm quarry.
6. Grab sample of limestone from low grade lens at Cobbs Arm quarry.
7. Pulverized limestone from stockpile at Cobbs Arm quarry.
8. Grab sample of dolomite from Deer Lake quarry.
9. Pulverized dolomite from storage bin at Deer Lake quarry.
10. Grab sample of limestone from Dormston quarry.
11. Grab sample of limestone from Dormston quarry.
12. Grab sample of limestone from outcrop at Mosquito cove.
13. Grab sample of limestone from O'Regans quarry.
14. Pulverized limestone from storage bin at O'Regans quarry.

## References

(1) **Baird, D. M.:** Reconnaissance geology of part of the New World Island-Twillingate area; *Geol. Surv., Newfoundland,* Rept. No. 1, 1953.

(2) **Betz, F.:** Geology and mineral deposits of the Canada Bay area, northern Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 16, 1939.

(3) ———— Geology and mineral deposits of southern White bay; *Geol. Surv., Newfoundland,* Bull. No. 24, 1948.

(4) **Cooper, J. R.:** Geology and mineral deposits of the Hare Bay area; *Geol. Surv., Newfoundland,* Bull. No. 9, 1937.

(5) **Gillis, H. B.:** The limestone quarry of the Dominion Iron and Steel Company at Port au Port, Newfoundland; *Bull. Can. Inst. Mining Met.,* No. 294, October 1936, pp. 369-372.

(6) **Heyl, G. R.:** Geology and mineral deposits of the Bay of Exploits area; *Geol. Surv., Newfoundland,* Bull. No. 3, 1936.

(7) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(8) **Van Alstine, R. E.:** Geology and mineral deposits of the St. Lawrence area, Burin peninsula, Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 23, 1948.

(9) Production and value of Newfoundland minerals from 1934 to 1947 inclusive; table presented on request to Bureau of Mines, Ottawa, by *Geol. Surv., Newfoundland,* October 1948.

# Chapter 16

## MAGNESITE

EXTENSIVE deposits of siliceous magnesite have been discovered at two localities in central Newfoundland. These deposits are known as the 'Great Bend' and 'Lower Gander River' occurrences, and are situated in the concession area held by the Newfoundland and Labrador Corporation Limited. The magnesite is associated with ultrabasic intrusions and is believed to have been formed by the alteration of serpentinized peridotite in zones of shearing and brecciation. The silica is so intimately associated with the magnesite that the magnesite will not meet present market specifications without beneficiation. To date, no successful means of beneficiation has been found.

"Previous to this discovery, J. R. Cooper[1] (1937) reported veins of magnesium carbonate in serpentine north of Hare bay, but later found that most were calcite containing small proportions of Mg and Fe. Baird[2] (1947) describes several areas of a carbonate rich alteration facies in ultrabasic rocks on the Burlington peninsula. The carbonate in this area is ferro-dolomite with only local patches of magnesite present. Although this discovery is of academic interest, the magnesite is not considered to be of commercial importance" (1).

The magnesite occurrences of central Newfoundland were not visited by the writer, and the information which follows is a synopsis of a recent report (1) of G. E. Cooper, Chief Geologist, Newfoundland and Labrador Corporation Limited.

[1] *Geol. Surv., Newfoundland,* Bull. No. 9, 1937, p. 21.
[2] McGill University, Montreal, unpublished thesis, 1947.

## Central Newfoundland

The initial discovery was made in the Great Bend area, by geologists of the provincial Department of Mines and Resources during their examination (2) of the ultrabasics of the Upper Gander river area in 1952. These deposits were mapped and sampled by geologists of the Newfoundland and Labrador Corporation in 1953 and 1954. Other ultrabasic zones were subsequently examined and a second series of low grade magnesite deposits were discovered in the Lower Gander river area.

### • GREAT BEND

These deposits are located near the 'Great Bend' on the Northwest Gander river about 30 miles south-southeast of Grand Falls and 30 miles southwest of Gander lake. They are accessible only by float-equipped aircraft and distant from existing roads. The ultrabasic plug in which the magnesite occurs covers a known area of about 25 square miles. Magnesite is found throughout the area, but with the possible exception of two localities—in the southwest corner of the area and northwest of Lizard pond —the deposits are too low in grade to have any commercial value.

"The magnesite is easily recognized by its purplish to reddish brown colour on weathered surfaces and the intricate network of quartz stringers that it usually contains. These quartz stringers produce an extremely rough weathered surface, through their much greater resistance to erosion than the surrounding carbonate. The fresh surface is usually buff coloured or white" (1).

"The shear zones are usually small, up to 25-30 feet wide and 100-200 feet long. The change from serpentine to magnesite in these zones is gradual, and an intermediate rock, talc carbonate schist, is commonly present. Usually large fragments of highly schistose serpentinized peridotite are present near the boundaries of the magnesite bodies . . .

"Breccia zones account for a greater amount of magnesite than the schistose zones. They are considerably larger in size, the largest being several hundred feet wide and up to a thousand feet long. Around the outside borders of these deposits the characteristics of a breccia are readily distinguished. Numerous small fragments, which increase in abundance toward the outer rim of the deposit, are set in a magnesite matrix. The fragments are composed almost entirely of serpentine, although a few small fragments of talc and unaltered peridotite are present. Many fragments show incomplete conversion from serpentine to magnesite, being composed of magnesite on the outer layers grading into serpentine at the core. The outline of these fragments is visible only because of a slight difference in colour between the magnesite of the matrix and that of the fragments.

"The magnesite within the breccia zones is usually free of large inclusions of unconverted serpentine whereas in the shear zones, lenses of unaltered serpentine are common" (1).

A large bulk sample of material from this area, received at the Mines Branch, Ottawa, in December 1953 for test purposes, was analysed with the following result:

| | % |
|---|---|
| Insoluble | 29.28 |
| Alumina | 0.41 |
| Ferric oxide | 5.23 |
| Calcium oxide | Trace |
| Magnesium oxide | 29.87 |
| Loss on ignition | 34.51 |
| | 99.30 |

As a large part of the silica in the sample was extremely fine grained and intimately associated with the magnesite, preliminary flotation results were not encouraging. By regrinding the rough concentrate (minus 65-mesh) to 95 per cent minus 200-mesh prior to cleaning, the insoluble in the final concentrate was reduced to 8.56 per cent, but the recovery was very low.

"Further investigations are planned to determine which magnesite bodies,

(1) have a lower visual silica content, and
(2) are more coarsely crystalline, which will enable a higher degree of liberation between the magnesite and silica through grinding" (1).

### • LOWER GANDER RIVER

These deposits are situated on the east side of Gander river about 20 miles north of Gander lake and 10 miles south of Gander bay and tidewater. Roads are absent, but the area is readily accessible by boat along the Gander river or by float-equipped aircraft from Gander lake. The magnesite is associated with an ultrabasic belt which has been traced in a southwesterly direction from Ragged harbour, on the north coast, to a point approximately 20 miles south of Gander lake. The magnesite is apparently confined to a zone roughly 7 miles long, approximately midway between Gander lake and Ragged harbour.

Over a dozen deposits have been located to date. They are lens-shaped and vary considerably in size, ranging from a few hundred feet long and up to 60 feet wide, to discontinuous lenses up to 200 feet wide and over 1,000 feet long. In contrast to the Great Bend deposits, "the conversion of serpentine to magnesite has, in at least three of the deposits, progressed to completion, with the result that these deposits although relatively impure due to a high silica content, are free of serpentine inclusions. As in the Great Bend deposits, breccia zones account for the largest and fragmental free magnesite. Shear zones have resulted in the formation of talc carbonate schists with only small narrow zones of magnesite" (1).

"The magnesite is characterized by a purplish to reddish weathered surface which is frequently pitted. The fresh surface is buff or nearly white in colour. At a few localities the magnesite is cut by numerous narrow quartz veinlets which fill tension fractures. The magnesite is crystalline and usually massive and fine grained" (1).

Chemical analyses indicate the material to grade approximately as follows:

| | *High* % | *Low* % | *Average* % |
|---|---|---|---|
| Silica | 46.96 | 21.40 | 32.00 |
| Alumina | 1.55 | 0.52 | 0.6 |
| Ferric oxide | 8.00 | 7.10 | 7.5 |
| Calcium oxide | 0.06 | 0.05 | 0.055 |
| Magnesium oxide | 41.20 | 26.60 | 30.00 |
| Loss on ignition | ........ | ........ | 33.00 |

Examination of two thin sections showed that approximately 20 per cent "of the silica present is in the form of free quartz grains, the remainder being in the form of hydrous silicates. Practically all the quartz (estimated at plus 95%) occurs as grains larger than 0.05 mm. in diameter. Much of the quartz was present in grains considerably larger than this figure. This is considerably more coarse-grained than the Great Bend magnesite" (1).

## References


(1) **Cooper, G. E.:** Magnesite occurrences in central Newfoundland; *Newfoundland and Labrador Corporation Limited,* unpub. rept., 1955.

(2) **Grady, J. C.:** Preliminary report on the ultrabasic rocks of the Upper Gander river, Newfoundland; *Geol. Surv., Newfoundland,* unpub. rept., 1952.

# Chapter 17

## MARBLE

IN its broadest commercial sense the term "marble" is meant to include all calcareous and serpentine rocks capable of taking a good polish. Three general classes are considered important in the marble industry, namely, the simple sedimentary limestone type, the crystalline limestone variety, and the silicate or serpentine marbles. All three types are represented in Newfoundland. The limestone type of marble has been reported in the St. Georges bay area, southwest coast; in the Corner Brook-Humbermouth area, west coast; along the south side of Conception bay, east coast; near the portage from Sandy lake to Hampden, White bay, northeast coast; along the west end of Sops arm, White bay; and at Chimney arm, Canada bay, north coast. Crystalline limestone types of marble are found along the east side of White bay and along the extreme eastern part of Canada bay. Serpentine marbles occur locally in the serpentine belts of the island and are also reported in the Long Range mountains east of St. Georges bay (6, p. 131).

Production of marble in Newfoundland is confined to the Corner Brook-Humbermouth area where two quarries have been opened in a crystallized nodular limestone of the Table Head series. The output is used by the chemical and metallurgical industries and as crushed stone. One of these quarries, the Dormston quarry, has been mentioned (7, p. 44) as a possible source of building and ornamental stone but so far none has been sold for this purpose, although a small amount has been used locally for rough stone work. The new hospital at Corner Brook was constructed in part with stone from this locality.

Quarrying for dimension stone was attempted at Canada harbour, Canada bay, and Purbeck cove, White bay about 40 years ago but neither quarry reached the state of active operation. The quarries were opened in white marble. At Canada harbour, where the most serious attempt was made, two quarries were opened and a number of large blocks removed and a mill erected, but no commercial shipments were made. The marble deposits of the Canada bay area were investigated by Canada Bay Marble

***Plate XXV***

***Memorial hospital at Corner Brook, showing use of Dormston black marble as dimension stone for building purposes (rock-face ashlar).***

and Mines Limited in 1936 and several of the most promising occurrences were diamond drilled (2, pp. 35-36). Little, if any, production resulted from this investigation and no further attempt was made to establish a marble industry in the island.

The marble possiblities of northern Newfoundland were investigated by Bain in 1936. He concluded (1, p. 10) that: "Marble possibilities for all three types of stone exist in the northern part of Newfoundland. However, excessive optimism should be discouraged because of the great amount of faulting which has broken and jointed the beds and because much folding subsequent to the initial recrystallization produced granulated and glide structure in the stone. These open up under fabrication and attack of weather. Localites with suitable material to make commercial marble must be considered extremely limited." For detailed descriptions of the main occurrences, together with results of the sawing, polishing, absorption and coherence tests conducted on the stone from the more important localities, the reader is referred to Bain's report. In the present report the principal occurrences of marble in the Canada bay and White bay areas are simply listed, with Bain's summary and conclusions regarding each.

The Cambrian limestones on the south side of Conception bay have been mentioned by Rose (5, p. 44) as a possible source of marble. He wrote:

"Nodular, crystalline limestone beds up to 3 feet in thickness occur in the Lower and Middle Cambrian formations. Specimens of reddish marble taken from one of the beds analysed 78.52 per cent calcium carbonate, and had a pleasing appearance when polished. The beds are a possible source of lime in limited amounts, as well as of ornamental stone."

## Canada Bay

The marble deposits of Canada bay are of the crystalline limestone type. They are found in the Bide Arm formation of Middle Ordovician age. Two varieties are present, dark blue-grey, and white. They are part of the same limestone series and appear to grade into one another through an intermediate zone with much interbedded dolomite; the dark blue-grey forms the upper part of the series.

### • *WHITE MARBLE*

The principal occurrences of white marble are limited to a zone beginning about 1½ miles south of Canada harbour and extending to Canada White point; it reappears at Englee White point and continues for about a quarter of a mile along the east side Englee island. Other zones occur a mile west of Canada harbour; along the western shore of Bide arm, especially between Bide head and Seal cove and in the vicinity of Locklings cove; in the interior of Bide neck, west of Inner Seal Cove pond; and in the bed of Marble brook about 2 miles north of the bottom of Bide arm. The marble is generally white in colour and very fine-grained.

"The white marble at Canada Harbour and on Englee Island, Canada Bay, is very attractive especially in its central and lower or western part. It is badly jointed on all exposures at both localities. However, one series of exposures of blue marble at between ½ and 1 mile south of Canada Harbour is free from jointing and the white marble west of it may be equally sound. This is the half-mile stretch from the present prospect southward along Marble Ridge" (1, p. 10).

### • *DARK BLUE-GREY MARBLE*

Dark blue-grey marble occurs in the Canada harbour-Englee zone; at Burnt point, about a mile west of Canada harbour; in the large cove east of Wild cove; and on the western shore of Bide arm. The marbles range in colour from grey and blue to blue-black. As a rule the texture is finely crystalline.

"The most promising blue marble is on Burnt Point, Canada Bay. A 100-foot stretch is free from joints and is dominantly a darker blue marble than Blue Belge and takes just as high polish as that well-known variety. It is very fine textured and has a velvet-like appearance on highly polished surfaces. Beds of absolutely uniform colour are not over 18 inches thick so that large cubic pieces of great uniformity would be difficult to obtain. However, the stone does not part along the colour banding and it could be quarried in large blocks.

"A medium dark-grey marble outcrops on the northern limit of Englee, Canada Bay. A small stretch of 100 to 150 feet over a width of 70 feet appears to be free from joints and others of slightly less promise appear nearby.

"Blue marble appears west of Bide Arm, Canada Bay. The eastern part of the occurrences seem to be more coherent than the western portion. The ledge is very sound and has a uniform eastward dip of about 28°. The stone is a little lighter coloured than that from Burnt Point yet is darker than many blue and grey marbles for which there is current demand" (1, p. 10).

#### • BLACK LIMESTONE

Ordinary limestones are abundant in the area but none of marble quality has yet been discovered. However, a black limestone outcropping on the east shore of Chimney arm has an attractive colour and may be worthy of investigation. Outcrops of this limestone are abundant and may be seen at such points as Black point, Crow cliff, Drunkards head, Narrows point, and Berry head (2, p. 37).

## White Bay

Marble deposits are present in several areas of the White bay region: they occur in the Sops arm area on the west side of the bay; in the Purbeck cove, Western arm, and Hampden areas on the east side of the bay; and at several points south of the bay, along the road leading south from Hampden.

#### • SOPS ARM

The Doucers marble and limestone formation of Cambrian age forms a narrow discontinuous belt along the foot of the Long Range mountains in the Sops arm area. The formation consists mainly of blue-grey and white marble. Intense fracturing is a conspicuous feature. The principal exposures are southwestward along Doucers brook, notably due west from Giles cove. Bain (1, p. 10) refers to the latter occurrence as follows:

"Massive, light-coloured marble outcropping as a cliff at about one mile up Doucers Brook, Sops Arm, is the only encouraging occurrence of breccia-limestone marble. The stone is light coloured and has a very warm tone due to numerous red and orange veinlets running irregularly through it; it is hard and takes an excellent polish. The stone resembles some of the Sienna marbles from Italy. Most other exposures of this formation are too dark coloured to be encouraging or are too unsound to yield commercial blocks."

### • *PURBECK COVE*

At Purbeck cove, due east across White bay from Sops arm, a fine- to coarse-textured marble of white to water-white colour appears. Finished specimens of the fine-textured stone have a dull cream colour. According to Bain (1, p. 10) the marble is "lusterless and unattractive." He adds elsewhere (1, p. 24) that "the marble is badly broken by cross-cutting joints which are of a type that cannot be expected to close up after the surface layer of rock is removed." The stone, along with that at Western arm and east of Hampden, appears to belong to the White Bay group of Precambrian age.

### • *WESTERN ARM*

Occurrences in the Western arm area, about 8 miles north of Purbeck cove, are a coarse-grained white marble at White point and a variegated pink, white, and grey marble at Bear cove. It is not known whether the marble has been examined for its commercial possibilities (3, pp. 19-20).

### • *HAMPDEN AREA*

In the area east of Hampden, coarse-textured white to pink marble is exposed at Big Chouse brook, and fine-grained blue-white mottled marble is found near the mouth of Georges Cove brook and on the shore at The Beaches (3, p. 20).

### • *SOUTH OF WHITE BAY*

A few limestone outcrops have been found along the road connecting Hampden and Sandy lake. The largest exposure is on the eastern side of Rushy brook near Mile 7 of the road. Other exposures occur farther to the south. The stone is a fine-grained blue to white dolomitic limestone. Betz (3, p. 21) considers it to belong to the Spear Point formation of Mississippian age.

## Serpentine Marbles

In view of the widespread distribution of serpentinized ultrabasic rocks in Newfoundland, it appears safe to assume that serpentine marbles of commercial importance are of fairly common occurrence in the island. Fuller (4, p. 29) has described several such occurrences near the town of Fleur-de-Lys, northeast coast, as follows:

"The serpentine mass east of the molybdenite shaft is about 1,000 feet wide and 2,000 feet long. From the offset along Fleur-de-Lys river the band narrows to 500 feet in width and can be traced inland for about 7,000 feet. In a roughly parallel band 1,500 feet to the west, serpentine occurs in three small hills. As a rule, the serpentine is tough and weathers to smooth rounded hills or ridges. It is of the antigorite variety which weathers whitish-green rather than red. According to Bain (1, p. 4) this type of serpentine is considered to be a source of premium building stone if it occurs in masses approximately 500 feet wide and 2,000 feet long. . . . The bodies at Fleur-de-Lys are about the requisite size. Thin sections show intimately interlocking antigorite crystals and no talc except along the lower border of the mass. Specimens which were polished by the writer show a matted, dark green serpentine. In some cases this surface is specked with light green material which gives the stone a very attractive appearance. Faults and joints are present, but it is believed that much of the broken rock lying on the surface was affected by weathering. Further examination of the frequency of faults and joints and of the character of the stone at depth is necessary; the serpentine appears to have commercial possibilities as a building stone."

## References


(1) **Bain, G. W.:** Marble deposits of northern Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 11, 1937.

(2) **Betz, F., Jr.:** Geology and mineral deposits of the Canada Bay area, northern Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 16, 1939.

(3) ———: Geology and mineral deposits of southern White bay; *Geol. Surv., Newfoundland,* Bull. No. 24, 1948.

(4) **Fuller, J. O.:** Geology and mineral deposits of the Fleur-de-Lys area; *Geol. Surv., Newfoundland,* Bull. No. 15, 1941.

(5) **Rose, E. R.:** Torbay map-area, Newfoundland; *Geol. Surv., Canada,* Mem. 265, 1952.

(6) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(7) **Walthier, T. N.:** Geology and mineral deposits of the area between Corner Brook and Stephenville, western Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 35, pt. 1, 1949.

# Chapter 18

## MARL

MARL is known to occur at several localities in western Newfoundland: it is found in an area between Corner Brook, Pinchgut lake, and Corner Brook lake; and near Codroy, Highlands, and Romaines brook in the St. Georges bay Carboniferous area. These deposits are all small in extent and with the exception of that near Romaines brook, and possibly one or two in the Corner Brook area, appear to have very little commercial value. There has been no recorded production. A brief description of each deposit follows.

### • *CODROY*

This deposit is situated in a cove between Stormy point and Woody point, near the mouth of the Grand Codroy river and about 3 miles east of Codroy. As exposed in the sea-cliff the deposit has a width of about 100 feet, a maximum thickness of 1½ feet, and is covered by 6 feet of overburden consisting mainly of peat and tree stumps. Hayes and Johnson (1, p. 30) described the marl as being similar to that at Highlands (*see* below) and estimated the deposit to cover an area of about 400 square yards.

### • *CORNER BROOK-PINCHGUT LAKE*

According to Walthier (3, p. 47), several of the smaller ponds and lakes in the area between Corner Brook, Pinchgut lake, and Corner Brook lake have bordering deposits of pure white marl. The thickness of the marl varies, "being at least 4 to 6 feet in places and thinning to only a few inches near the mouths of brooks draining into these ponds and lakes." He described the marl as an easily accessible source of agricultural lime, and thought that small scale operations would probably be feasible. He mentioned that test piles of the marl bordering one of the lakes dried satisfactorily in a week or so of dry weather.

### • *HIGHLANDS*

Hayes and Johnson (1, p. 30) describe two deposits in the Highlands area as follows:

"Marl occurs in two places southeast of Highlands, one between Butter Brook and French Brook; the other is crossed by French Brook. The latter underlies a swamp. The thickness is not over 2 feet and it may cover a total of two or three square miles. It is nearly pure calcium carbonate with a few grains of quartz. It contains minute gastropod and pelecypod shells."

### • *ROMAINES BROOK*

This deposit is half a mile west of Romaines brook, on the north shore of St. Georges bay. It was first reported in 1866 by Murray (2, p. 100) who described the deposit as "not very extensive, but of considerable thickness; it is white and contains Planorbis and other fresh-water shells." As exposed in the sea-cliff the deposit has an approximate length (east-west) of 300 feet, and ranges in thickness from a few inches to 9 feet 8 inches, with an average of 6 feet, giving the exposed section an area of about 1,800 square feet. Assuming the deposit to taper out 150 feet to the north, a total of 135,000 cubic feet or nearly 10,000 tons of marl assaying over 90 per cent calcium carbonate are indicated. Overburden is negligible and the deposit is within easy reach of the Aguathuna-Stephenville Crossing motor road. The analyses of three samples of marl from this deposit are given below.

| Sample No. | L.O.I. | CaO | Total | CaCO3 |
|---|---|---|---|---|
| 1 | 44.18 | 50.70 | 94.88 | 90.48 |
| 2 | 44.93 | 50.93 | 95.86 | 90.89 |
| 3 | 44.68 | 51.29 | 95.97 | 91.53 |

1. 4 ft. 7 in. channel sample obtained 40 feet from west end of deposit.
2. 9 ft. 2 in. channel sample obtained 70 feet east of Sample No. 1.
3. 4 ft. 10 in. channel sample obtained 150 feet east of Sample No. 2.

## References


(1) **Hayes, A. O., and Johnson, H.:** Geology of the Bay St. George Carboniferous area; *Geol. Surv., Newfoundland,* Bull. No. 12, 1938.

(2) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1864 to 1880, London, 1881.

(3) **Walthier, T. N.:** Geology and mineral deposits of the area between Corner Brook and Stephenville, western Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 35, pt. 1, 1949.

# Chapter 19

## MICA

MICA is reported to occur in the Long Range mountains of the southwest coast, in the Hardy harbour area of the northeast coast, and at a number of localities in Labrador. However, little or no mining has been attempted on these deposits and definite information as to their economic value is, for the most part, lacking. Production has been insignificant, amounting to 12 pounds of mica valued at $240 in 1887 (5, p. 250) and 23 tons of mica valued at $660 in 1899 (5, p. 420).

### • *ISLAND OF NEWFOUNDLAND*

In the Long Range mountains, on the eastern half of Reid lot 7, near South Branch, mica is reported (2, p. 30) to occur in sheets up to 40 inches square. Apparently the mica occurs in a pegmatite dyke 3 feet in width.

The occurrence of mica in the pegmatite dykes of the Hardy harbour area has already been noted in the chapter on feldspar. Baird (1, p. 54) refers to the mica as follows:

"Although commonly distributed uniformly, biotite has been noted in crystals up to 6 inches across and may form as much as 30 per cent of the rock. Greenish muscovite occurs in some dykes as crystals from 1 inch to 3 inches across."

### • *LABRADOR*

On the north bank of the Paradise river, 37 miles from Cartwright, is a group of pegmatite dykes cutting gneisses of metasedimentary origin.

One of the dykes contains a quarry which, according to Douglas and Goodman (3, p. 16), was opened about 1910 for the production of mica. The information which follows is from their description of the prospect:

"The deposit is reached by crossing the long portage from the head of Hinchinbrook Bay. This portage leads to a chain of lakes that connect with the main river above the rapids. The overall distance from Cartwright is 37 miles. The prospect is at 53° 17′ N. lat. and 57° 34′ W. long., on the right or southeast bank of the river and back about 1,000 feet, opposite a long, low, wooded island in the river. It might be difficult to find without a guide.

"The quarry is on the northern side of a low, scrub-covered ridge, and stands approximately 50 feet above the level of the river. It measures about 60 feet by 30 feet, and is less than 12 feet deep, but this last dimension may be low as some of the dumps have slumped back onto the floor of the quarry.

"The area in the vicinity of the quarry is underlain by granitized sedimentary gneiss, the foliation of which strikes north and dips vertically. The gneiss is cut by several bodies of biotite-muscovite pegmatite, one of which, possibly the largest, has been quarried. This pegmatite is of granitic composition, and there is no preferred position in it for the feldspars, the micas, or the quartz. The dyke appears to have crystallized from a magma in which 'turbulent flow' prevailed, and the contrast between the texture of this deposit and the pegmatites in India, where deposition from streamline flow took place, is very striking. . . . The largest plates of biotite seen were 5 inches across, and of muscovite 3½ inches. Biotite seems to be the more abundant.

"From a mining point of view this irregular (turbulent) texture would make it extremely difficult to obtain plates of mica in good condition. No other economic mineral, except feldspar, was seen in the pegmatite, which has no commercial value."

A number of other, minor occurrences of mica have been recorded in Labrador. These include: muscovite, biotite and phlogopite in pegmatite dykes on the main island of the Seal Islands group, situated to the east of Henley harbour on the Strait of Belle Isle (3, pp. 8-10); muscovite in pegmatite dykes cutting gneiss at White Mica cove, 10 miles north of Henley harbour (3, p. 10); mica plates in pegmatites cutting gneisses at Hoop-pole cove and a bay about 3 miles northwest of Fox harbour (3, p. 12); an occurrence at St. Michaels bay, where the mica is said to occur in sheets ranging from 6 to 15 inches square (6, p. 141); biotite in mineralized lenses in gneiss on the northwest side of Mountaineer cove, Hawke bay

(3, p. 13); books of muscovite up to 2 inches in diameter in pegmatites in the Paradise river area (3, p. 15); and mica occurrences on Dog island, and the Black islands near Tuchialic bay (4, p. 38).

At the Seal islands occurrence, writes Douglas (3, p. 10), the "mica plates average 1 inch by 1½ inches in size, and the largest plate of phlogopite seen was 2 inches by 3 inches. The books of mica are very closely intergrown with the feldspar and quartz. It is doubtful if the deposit is commercial."

Snelgrove and Baird (6, p. 141) report that in 1952 "several claims were staked for mica in pegmatites of the lower Hawks River."

## References


(1) **Baird, D. M.:** The geology of Burlington peninsula, Newfoundland (report and map); *Geol. Surv., Canada,* Paper 51-21, 1951.

(2) **Davies, D. J.:** *"A Pamphlet on the Mineral Deposits of Newfoundland";* St. John's, Nfld., 1927.

(3) **Douglas, G. V.:** Notes on localities visited on the Labrador coast in 1946 and 1947; *Geol. Surv., Canada,* paper 53-1, 1953.

(4) **Kranck, E. H.:** Bedrock geology of the seaboard of Labrador between Domino run and Hopedale, Newfoundland; *Geol. Surv., Canada,* Bull. 26 1953.

(5) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1881 to 1909; St. John's, Nfld., 1918.

(6) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

# Chapter 20

## PYROPHYLLITE

PYROPHYLLITE is a soft, white or light-coloured mineral closely resembling talc in appearance and general characteristics, but containing alumina in place of magnesia; theoretically it contains 66.7 per cent silica, 28.3 per cent alumina, and 5.0 per cent water. It can be substituted for talc for many trade uses, and for this reason it is often recorded with talc in production statistics.

Pyrophyllite is found as a gangue mineral in auriferous sulphite deposits at Cinq Cerf (4, p. 13), at certain localities in Sops arm of White bay (2, p. 27), and in the St. Lawrence area of Placentia bay (5, p. 43). However, the only known deposits of commercial grade are those which occur near Manuels, Conception bay, southeast coast. These are being worked by Newfoundland Minerals Limited, a subsidiary of American Encaustic Tiling Company Inc., of Lansdale, Penn. Most of the output is shipped to Lansdale; small amounts are used locally.

### Manuels Deposits

The deposits lie in a narrow belt extending about 6 miles south from Manuels. They are formed by hydrothermal alteration of sheared rhyolite lavas and conglomerates of Precambrian age near a granite contact. Large areas of quartz-pyrophyllite schist are to be found along this belt, a number of which contain a high percentage of pyrophyllite in addition to scattered lenses of nearly pure pyrophyllite. The formation of the pyrophyllite seems to have been influenced and localized by proximity to fissures near the granite boundary, and to the acidic composition and sheared condition of the country rock (6, pp. 1, 13).

The deposits are first mentioned in the Newfoundland Geological Survey report of 1900, and during the period 1904 to 1905 7,562 tons of pyrophyllite valued at $31,000 were shipped to the United States (3, pp. 443, 533, 561). Nothing further was done until the provincial government investigation of 1936. This examination indicated that a large tonnage of high-grade and medium-grade quartz-pyrophyllite schist was available. It was estimated that in one of the deposits—the Mine Hill deposit—over 50,000 tons averaging 75 per cent, 140,000 tons averaging 55 per cent, 200,000 tons averaging 45 per cent, and 200,000 tons averaging 30 per cent pyrophyllite were present, using a conservative depth figure of less than 100 feet. An adjacent pyrophyllitized area was estimated to contain as much, if not more, medium- to high-grade material (6, pp. 28-29).

The Industrial Minerals Company of Newfoundland began producing in 1938, and in 1939 erected a mill near Manuels to treat the ore. Mill feed consisted of the pure massive pyrophyllite which was sorted out by hand from the quartz-pyrophyllite schist. Regular shipments were made to the United Kingdom, and smaller shipments to the United States, Canada, and elsewhere. There was also a small local market. As shown in Table IX, production in 1947, the last year of operation by this Company, amounted to 271 tons valued at $6,084.

TABLE IX

PRODUCTION OF PYROPHYLLITE IN NEWFOUNDLAND[1]
1938-1956

| Year | Short Tons | Value $ |
|---|---|---|
| 1938 | 1,120 | 1,490 |
| 1939 | — | — |
| 1940 | 314 | 1,680 |
| 1941 | 560 | 5,000 |
| 1942 | 1,742 | 15,550 |
| 1943 | 2,688 | 24,000 |
| 1944 | 246 | 2,200 |
| 1945 | 784 | 4,900 |
| 1946 | 728 | 6,500 |
| 1947 | 271 | 6,084 |
| 1948-53 | — | — |
| 1954 | 9 | 230 |
| 1955 | — | — |
| 1956 | 1,379 | 12,077 |
| Total | 9,841 | 79,711 |

[1] Figures for 1938-48 as given by Newfoundland Geological Survey (8) and converted to short tons. Figures for 1949-56, represent shipments; source, Dominion Bureau of Statistics.

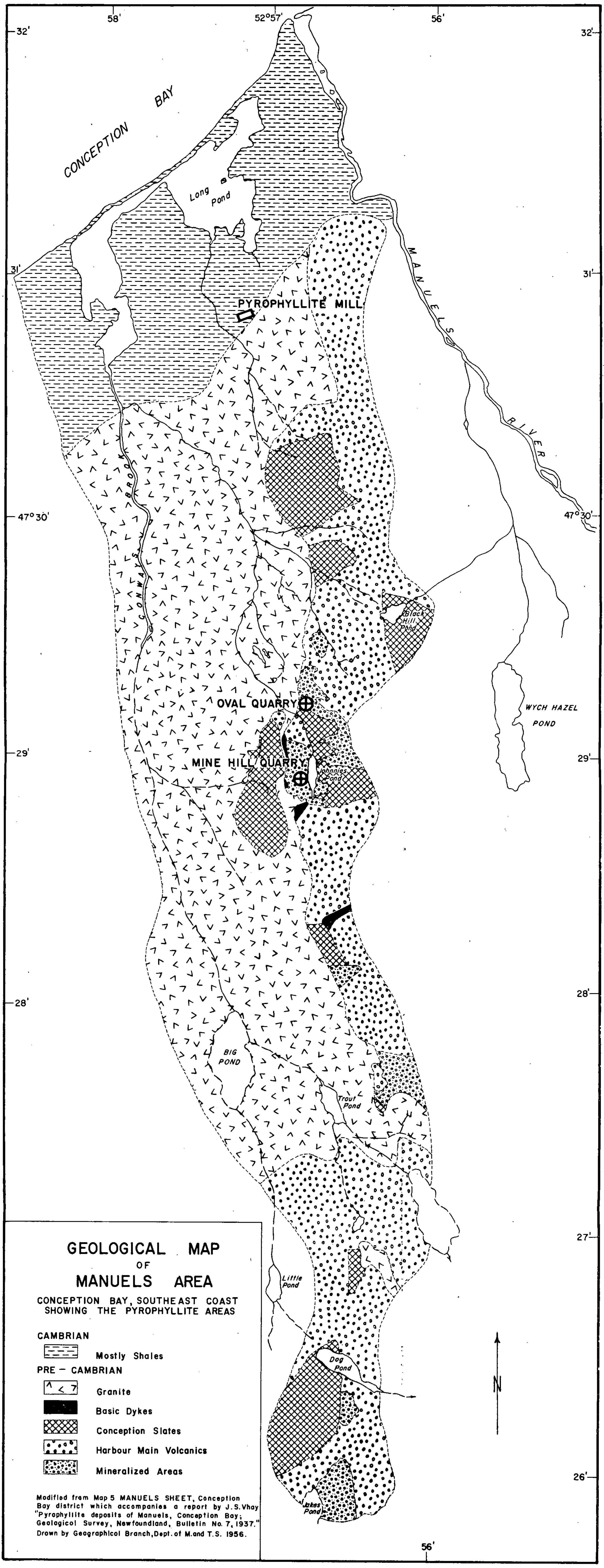



*Figure 8.* Geological map of Manuels area, Conception Bay, southeast coast, showing pyrophyllite areas.

Plate XXVI

*Pyrophyllite mill, (American Encaustic Tiling Co. Inc.) at Long Pond, Conception Bay, east coast, in June 1956.*

American Encaustic Tiling Company Inc. entered the field early in 1956. Milling operations were resumed early in June, and at the time of the writer's visit to the property a week later, production averaged around 10 tons per day. Plans called for a production of 2,000 tons in 1956 and for the erection of a shipping wharf and new mill at Long Pond in 1957, the latter to have a capacity of 72 tons per 24 hours. The deposits are currently being investigated by two diamond drills of the Mines Branch, Newfoundland Department of Mines and Resources.

• ***QUARRYING***

There are two principal quarries, the Mine Hill quarry about 100 yards west of Johnnys pond, and the Oval quarry, a quarter of a mile to the northeast. They are situated about 2½ miles south of the mill and tidewater, about 600 feet above sea-level.

The Mine Hill quarry was originally opened in 1903, and was operated by The Industrial Minerals Company of Newfoundland during the period 1938 to 1942, at which time it was abandoned in favour of the Oval quarry

Plate XXVII

*Mines Branch of Newfoundland drill set up in Oval quarry in June 1956. Note mine cars containing pyrophyllite.*

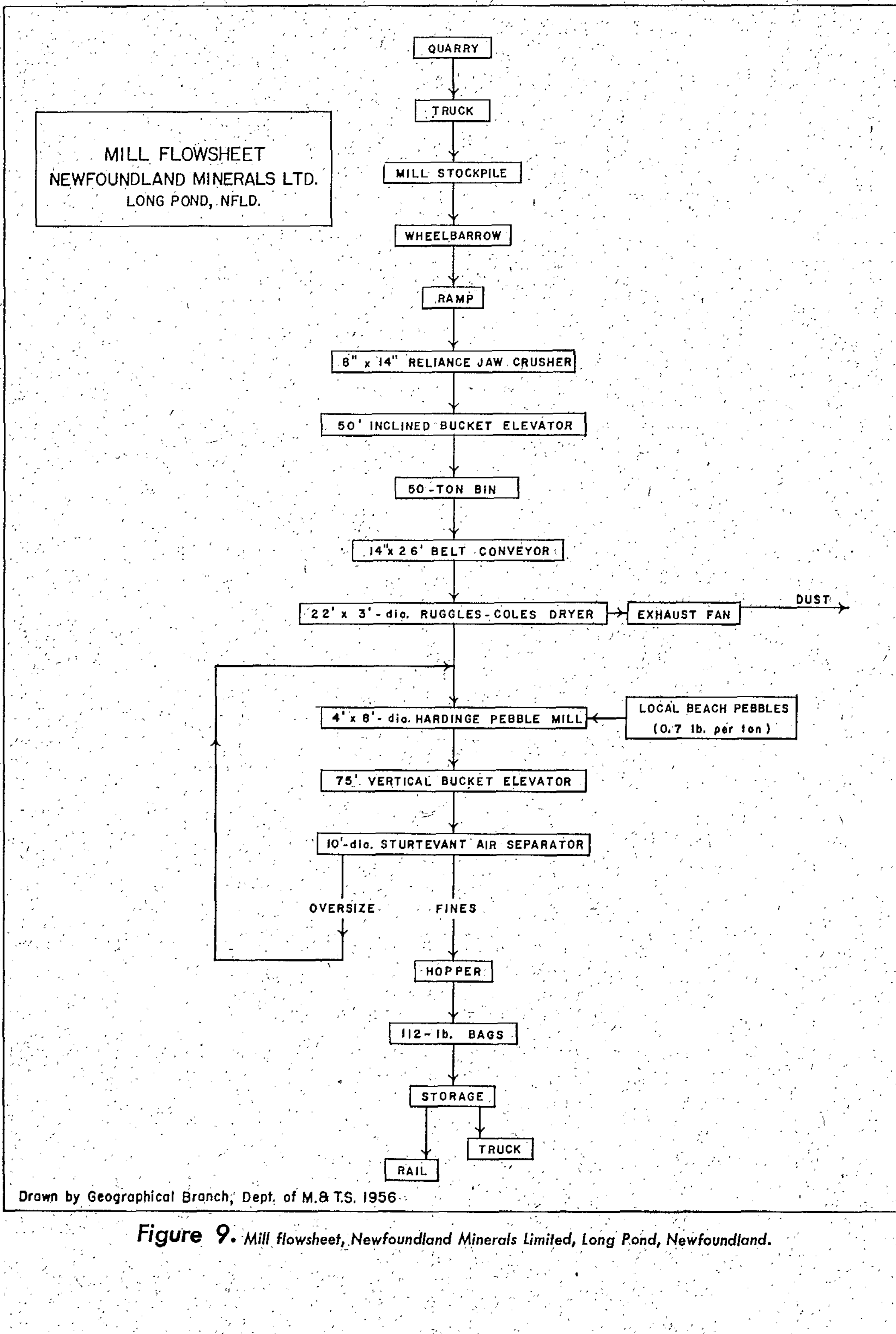



**Figure 9.** *Mill flowsheet, Newfoundland Minerals Limited, Long Pond, Newfoundland.*

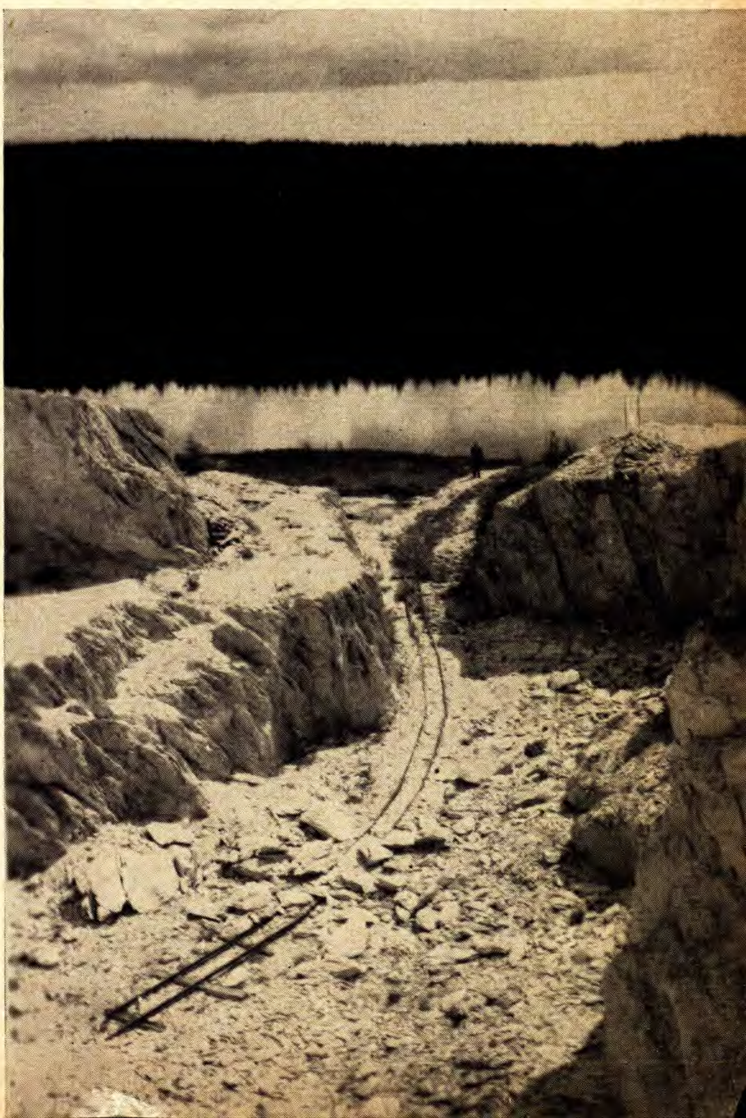
location where the ore appeared to be of higher grade. The Mine Hill quarry has an overall length (east-west) of about 150 feet, a maximum width of 70 feet, and a face ranging up to 35 feet high. The entrance is quite narrow —no more than 12 feet—and the sill stands about 10 feet above road level.

The Oval quarry was operated by The Industrial Minerals Company of Newfoundland during the period 1942 to 1947, and was reopened in June, 1956 by Newfoundland Minerals Limited. It has an overall length (northeast-southwest) of 180 feet, a maximum width of 50 feet, and a face ranging up to 30 feet high. It is located on the side of a steep hill 125 feet above road level, and the pyrophyllite is transferred from quarry to truck by means of a chute constructed on the hillside.

The pyrophyllite at the Oval quarry is ivory-coloured, whereas at the Mine Hill quarry it is white to cream-coloured. From a brief examination

*Plate XXVIII*

*Mine Hill quarry, looking towards Johnnys Pond.*



of both quarries it was seen that the ore designated as high-grade on the detailed geological map of the area, contains sizeable amounts of quartz distributed throughout it. As a result, a considerable amount of the pyrophyllite ore—possible 40 per cent—is discarded as being too low in grade for milling. No trouble is experienced in obtaining a high-grade product, however.

## • MILLING

The mill is at Long Pond, a mile west of Manuels and 15 miles west of St. John's, along the railway 1,000 feet south of the highway.

On arrival at the mill, the ore is delivered to a small ramp from which—after any remaining low-grade material is removed—it is fed by hand to an 8- by 14-inch jaw crusher and reduced to minus ½-inch size. The crushed product is then conveyed by inclined bucket elevator to a 50-ton storage bin. From the storage bin the ore moves by belt conveyor to a 22- by 3-foot oil-fired rotary dryer, and then to an 8- by 4-foot pebble mill for fine grinding. This pebble mill is equipped with granite liners—obtained locally—and 3½-inch beach pebbles—also obtained locally—are used as the grinding media. From the pebble mill the pyrophyllite is conveyed by vertical bucket elevator to an air separator. The fines from this operation (minus 325-mesh) are bagged manually and wheeled to the 200-ton storage room to await shipment; the oversize material returns to the pebble mill for further grinding. The capacity of the mill is one ton an hour.

## • PHYSICAL AND CHEMICAL PROPERTIES

One large paint manufacturer, from tests conducted over a 3-year period, described the pyrophyllite as: excellent in colour and brightness; satisfactory in the way in which it incorporates in oil, in the consistency which it gives, and the fineness and smoothness obtained; and satisfactory as to weathering ability. Another paint company, after testing, stated that the absence of carbonate, especially magnesium, should make the product very attractive for paint use. One local paint company found the pyrophyllite highly satisfactory and preferred it to the imported variety.

One English consumer reported that the pyrophyllite was chemically as good, if not better, than any of the other 15 imported varieties they had examined. In the following laboratory report of January 28, 1947 this consumer compares the 200-mesh Newfoundland product (2584) with its standard:

| | 2584 % | Standard % |
|---|---|---|
| Ignited insol. in HCl | 94.3 | 94.8 |
| Iron oxides | 0.6 | 0.27 |
| Loss at red heat | 5.3 | 4.80 |
| Copper | 0.0015 | nil |
| Manganese | trace | 0.003 |
| Residue on 200-mesh | 0.64 | 0.002 |
| Nature of residue | oversize | — |

Colour: Slightly darker than standard.
Slip test: Equal to standard.
Dusting properties: Equal to standard.

Tests carried out by one United States company in 1948 indicate the pyrophyllite to be entirely suitable for the production of insecticides and to compare favourably with the best United States talcs used for this purpose.

### • *INVESTIGATIONS BY MINES BRANCH, OTTAWA*

Investigations were conducted by the Ceramics Section and the Mineral Dressing and Process Metallurgy Division on samples of the high-grade, low-grade, run-of-mine, and milled (minus 325-mesh) pyrophyllite. The last-mentioned sample was representative of the high-grade product manufactured in 1947. Partial analyses of these four samples appear at the end of the chapter.

For the purpose of determining the possible use of the pyrophyllite in ceramics, the following body formulae were used:

| Formula No. 1 *Walltile body* | % | Formula No. 2 *Walltile body* | % | Formula No. 3 *Artware body* | % |
|---|---|---|---|---|---|
| Ball clay | 21.0 | Flint | 10 | Flint | 10 |
| China clay | 14.3 | Ball clay | 18 | Feldspar | 9 |
| Talc | 38.1 | China clay | 18 | Ball clay | 29 |
| Nepheline syenite | 4.7 | Talc | 12 | China clay | 18 |
| | | Whiting | 2 | Talc | 7 |
| Pyrophyllite | 21.9 | Pyrophyllite | 40 | Pyrophyllite | 27 |

Five batches of each body were made up, the pyrophyllite used in each case being North Carolina milled product, Nfld. highgrade, Nfld. low-grade, Nfld. run-of-mine and Nfld. milled product. Trial pieces from each batch were made up and fired to five different temperatures, and shrinkage and absorption were measured on each piece.

Substitution of any of the four Newfoundland pyrophyllite samples for North Carolina pyrophyllite in either of the three formulae showed no appreciable change in shrinkage, absorption or colour. It would therefore seem reasonable to expect satisfactory results if pyrophyllite from this deposit were used for ceramic purposes with no further beneficiation than fine grinding (7).

The high-grade material is essentially all pyrophyllite, although a few grains of zoisite and opaque minerals (probably iron oxides) are present. Texturally the material forms a mat of very fine-grained, foliated and slightly fibrous flakes of pyrophyllite. In the low-grade material there is 80 per cent or more pyrophyllite present which exhibits the same textural features as the high-grade ore. The balance is made up of opaque minerals together with zoisite and clinozoisite, the opaque minerals being present in excess of the latter two (1, pp. 2, 3).

Flotation tests show that in the run-of-mine and low-grade pyrophyllite, a recovery of 65 to 84 per cent of the rock should be obtained in a product assaying about 0.02 per cent acid soluble iron with no lime, when grinding to 92 per cent minus 325-mesh. This product also appeared to be satisfactory as regards colour, texture and slip. A simple flowsheet consisting of pebble mill, classifier and a bank of flotation cells, should therefore give satisfactory results (1, p. 6).

One hundred and twenty-six pounds of the high-grade pyrophyllite was crushed to minus 14-mesh and ground in a Raymond mill to a fineness of 94 per cent minus 325-mesh. The material appeared to be of good grade as regards colour, texture and slip (1, p. 6). Samples of this material along with samples of the flotation concentrate were sent to several Canadian manufacturing companies in order to determine their suitability in the manufacture of various products. Replies received were very encouraging and show the pyrophyllite to be suitable for use in the paint, rubber, ceramic, insecticide and other industries, all of which are importing talc or pyrophyllite at present to meet their requirements.

ANALYSES

| Sample | L.O.I. | $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | CaO | MgO | Total Alkali | $MnO_2$ | Cu | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1........... | 4.60 | 68.22 | 26.16 | 0.50 | 0.14 | 0.30 | 0.65 | Trace | N.D. | 100.57 |
| 2........... | 5.20 | 63.78 | 29.24 | 0.36 | 0.34 | 0.10 | 1.22 | " | " | 100.24 |
| 3........... | 3.83 | 71.78 | 23.06 | 0.50 | 0.14 | 0.18 | 0.96 | " | " | 100.45 |
| 4........... | 5.07 | 63.36 | 30.12 | 0.64 | 0.00 | Trace | | | | 99.19 |
| 5........... | 4.25 | 70.92 | 23.17 | 2.07 | Trace | 0.29 | | | | 100.70 |
| 6........... | 3.81 | 74.02 | 21.33 | 0.43 | 0.30 | 0.20 | | | | 100.09 |
| 7........... | 4.78 | 66.96 | 26.84 | 0.36 | Trace | 0.09 | | | | 99.03 |

1. Grab sample of low-grade pyrophyllite from Oval and Mine Hill quarries.
2. Grab sample of high-grade pyrophyllite from Oval quarry.
3. Grab sample of high-grade pyrophyllite from Mine Hill quarry.
4. 485-lb. bulk sample of high-grade pyrophyllite from Oval quarry.
5. 484-lb. bulk sample of low-grade pyrophyllite from Oval quarry waste dump.
6. 982-lb. bulk sample of regular run-of-mine pyrophyllite from Oval quarry.
7. 112-lb. bag of milled (minus 325-mesh) high-grade pyrophyllite from Oval quarry.

## References


(1) **Beer, H. L.:** Flotation tests on shipments of pyrophyllite from the Newfoundland Minerals Limited, Conception bay, Newfoundland; *Mines Br., Canada,* Mineral Dress. & Process Met. Div. Investig. No. MD2750, Apr. 2, 1951.

(2) **Heyl, G. R.:** The geology of the Sops Arm area, White bay, Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 8, 1937.

(3) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1881 to 1909; St. John's, Nfld., 1918.

(4) **Snelgrove, A. K.:** Geology of gold deposits of Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 2, 1935.

(5) **Van Alstine, R. E.:** Geology and mineral deposits of the St. Lawrence area, Burin peninsula, Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 23, 1948.

(6) **Vhay, J. S.:** Pyrophyllite deposits of Manuels, Conception bay; *Geol. Surv., Newfoundland,* Bull. No. 7, 1937.

(7) **Wright, I. F.:** Ceramic tests on pyrophyllite from Manuels, Conception bay, Newfoundland; *Mines Br., Canada,* Ceram. Sec. memo., May 9, 1951.

(8) Production and value of Newfoundland minerals from 1934 to 1947 inclusive; table presented on request to Bureau of Mines, Ottawa, by *Geol. Surv., Newfoundland,* October, 1948.

# Chapter 21

## QUARTZ CRYSTALS

As far as is known, Clifford Baggs of Adams Cove, Conception bay, east coast, is the only person to report the occurrence of quartz crystals in Newfoundland. In 1946 he obtained a miner's licence and staked a quarter-mile (40-acre) claim to cover an occurrence of crystal-bearing glacial drift. The occurrence is about 7 miles northwest of Adams Cove in the district of Carbonear-Bay de Verde, and is not considered to have any commercial value.

It lies on a low ridge not far from Forked pond, and has been investigated by means of six or more trenches and pits ranging in depth from 2 to 6 feet. As exposed in these excavations, the glacial drift is seen to consist mainly of milky quartz fragments ranging in size from extremely small particles to pieces measuring over 2 inches in diameter. The quartz crystals are very sparsely distributed throughout the drift and are usually quite small, averaging about ½ inch x ½ inch x 1 inch in size. The crystal faces are very smooth and remarkably well-developed, and show no signs of abrasion such as being rounded or frosted. It was also noted that the fragments of milky quartz in which the crystals occur, without exception, have very sharp edges indicating that the material in its present state has not been transported any great distance through stream action.

At the time of the writer's visit to the property in 1950, approximately 50 pounds of crystals had been recovered. The average size was ½ x ½ x 1 inch; the largest, 3½ x 2½ x 7 inches; and the smallest, ½ x ½ x ¾ inch.

Twenty-three pounds of these crystals were shipped to Ottawa for examination. Only five of the crystals came up to the minimum weight requirement of 100 grams, but these were much too highly fractured to be of any commercial use; the smaller crystals were fractured to the same extent. Another later shipment contained half a dozen crystals which weighed approximately 100 grams each. A small portion of the prism ends or terminations of these crystals was free of fractures and could possibly be used. In actual practice, however, these crystals would be discarded as it would not be economical to make use of such a small portion of any crystal.

There did not seem to be any point in performing additional assessment work on the deposit. However, it was recommended that, before being dropped, the claim should be carefully prospected on the chance that some glacial gravel does occur containing quartz crystals of the required grade and in sufficient quantity to make their recovery profitable. The whole area within a radius of several miles was recommended for prospecting, as crystals are known to occur more than a mile from the original discovery.

# Chapter 22

## SALT

BEDS of rock salt have not as yet been discovered in Newfoundland, although their possible occurrence in the St. Georges bay Carboniferous region is indicated by the presence of brine springs and of gypsum-bearing strata corresponding to the gypsum and salt-bearing Windsor series of Nova Scotia. The salt possibilities of the region were investigated in some detail several years ago by Baird (1) for the provincial government. For a description of each of the localities where brine springs and gypsum beds are known to occur, together with recommendations regarding drilling for salt at these localities, the reader is referred to his report. The report opens with a detailed discussion of the physiography, glaciation, stratigraphy and structural geology of the area, to serve as a background for the evaluation of the individual deposits. The following are Baird's conclusions regarding the possible occurrence of commercial salt deposits in southwestern Newfoundland:

"1. Salt may occur in southwestern Newfoundland. Paleophysiographic conditions during Codroy times were favourable.

2. Adequate exploration must include deep drilling.

3. Such deep drilling will be speculative by the very nature of the problem.

4. There are many localities which are of reasonable speculative possibility. The best are the nose of the Fishells-Barachois anticline . . ., the Highland River locality . . . and the Ryans Brook area. . . ."

In the above-mentiond report it is pointed out that gypsum beds are commonly persistent over wide areas in the St. Georges bay Carboniferous region, and that if salt beds do occur in the region, they should also be persistent. The gypsum, "which occurs at the surface in many places . . . shows abundant evidence of having flowed out of its original position as flat lying beds and to have clumped together in bulbous masses in some portions and have squeezed almost to zero thickness in other places. Contacts with the surrounding beds are almost invariably at fault or plastic flow surfaces. Salt in the area can be expected to show the same characteristics perhaps on a slightly more extreme scale" (1). Consequently, "Salt exploration by random drilling in such an area will be at best speculative and will have a large element of chance under the best of circumstances."

Several of the most promising sites have already been diamond drilled by the provincial government. This investigation, commenced in 1947 and not yet completed, is referred to briefly by Snelgrove and Baird. (2, p. 116).

The brine of salt springs of the region are also mentioned in their report (2, pp. 115-116):

"Salt springs have been noted at East Bay of Port au Port Bay about a mile west of Lead Cove; at Salt Mine Pool on Fishells River about 2½ miles above the railway bridge; on Robinsons River near an exposure of gypsum; on the left bank of Middle Barachois River; on Crabbs River about 4 miles below the gorge where it leaves the Long Range Mountains; and close to the railway about 5 miles southeast of St. Fintans. None of these springs exceeds the salinity of ordinary sea water. It seems likely that most of them derive their salinity from scattered and disseminated grains of halite in shales and siltstones they encounter underground."

## References


(1) **Baird, D. M.:** Salt possibilities of southwestern Newfoundland; *Geol. Surv., Newfoundland,* unpub. rept., Mar. 12, 1949.

(2) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

# Chapter 23

## SAND AND GRAVEL

### General

SAND and gravel have been produced in Newfoundland for many years, but it is only since 1948 that any attempt has been made to record and publish their annual production and value. Production in 1956 amounted to 2,490,580 tons valued at $1,686,320 as compared with the all-time high of 3,142,226 tons valued at $1,660,984 in 1955. Approximately 5 per cent of the output in 1956 was washed and screened; the remainder was marketed as bank or pit-run grade for use primarily in concrete work, road construction, and as railway ballast. Probably about 80 per cent of the gravel used goes into road building. Many stretches of road are built entirely of gravel from the bottom of the fill to the top of the wearing course.

Table X gives the sand and gravel production of Newfoundland for the period 1949-1956, while Table XI shows the sand and gravel production, by kinds, for the period 1954-1956.

The two principal sand and gravel producers in Newfoundland in 1956 were Concrete Products (Nfld.) Limited and the provincial Department of Highways. The latter operates sand and gravel pits at various points along the highway, including one in stratified gravelly sand at Shoal Harbour, Trinity bay, for the production of aggregate used in making concrete pipes and culverts for roads. Concrete Products (Nfld.) Limited operates a

## TABLE X

### PRODUCTION OF SAND AND GRAVEL IN NEWFOUNDLAND*
### 1949-1956

| Year | Short Tons | Value $ |
|---|---|---|
| 1949 | 1,416,202 | 999,598 |
| 1950 | 1,619,389 | 780,315 |
| 1951 | 1,483,951 | 648,346 |
| 1952 | 1,654,471 | 936,013 |
| 1953 | 1,908,187 | 1,023,622 |
| 1954 | 2,105,522 | 1,096,883 |
| 1955 | 3,142,226 | 1,660,984 |
| 1956 | 2,490,580 | 1,686,320 |
| Total | 15,820,528 | 8,832,081 |

*Dominion Bureau of Statistics.

## TABLE XI

### PRODUCTION OF SAND AND GRAVEL IN NEWFOUNDLAND, BY KINDS*
### 1954-1956

| For use as: | 1954 | | 1955 | | 1956 | |
|---|---|---|---|---|---|---|
| | Short Tons | Value $ | Short Tons | Value $ | Short Tons | Value $ |
| Sand: | | | | | | |
| Building sand and sand for concrete, road-work, etc. | 1,148 | 1,022 | — | — | 26,416 | 10,698 |
| Other sand | 522 | 176 | 23,724 | 5,571 | 50,965 | 12,741 |
| Sand and gravel: | | | | | | |
| Sand and gravel for railway ballast | 296,830 | 93,546 | 66,332 | 17,374 | 261,016 | 79,676 |
| Sand and gravel for concrete, road building, etc. | 1,807,022 | 1,002,139 | 3,052,170 | 1,638,039 | 1,981,764 | 1,411,993 |
| Crushed gravel | — | — | — | — | 170,419 | 171,212 |
| Total | 2,105,522 | 1,096,883 | 3,142,226 | 1,660,984 | 2,490,580 | 1,686,320 |

*Dominion Bureau of Statistics.

concrete products plant at Mount Pearl, 5 miles southwest of St. John's, and a large gravel pit at Seal cove, Conception bay, 18 miles farther west; both are situated along the railway and within easy reach of the Trans-Canada Highway. At Mount Pearl are produced concrete building blocks, weeping tiles, culvert tiles and ready-mixed cement. The Seal cove pit is opened in unsorted glacial drift which is crushed, screened and washed and sold as concrete aggregate, road material and railway ballast, besides supplying concrete aggregate to the Mount Pearl plant.

In addition to Concrete Products (Nfld.) Limited, there were six other producers of concrete products in Newfoundland in 1956.† Two of the larger plants, that of C. G. Jennings at Humbermouth and that of Dawe's Dunbrik Products at Makinson, were visited during the 1950 field work investigation and are mentioned below.

Dawe's Dunbrik Products plant is situated at Makinson, Conception bay, along the Trans-Canada Highway and Brigus Junction-Carbonear branch of the railway. Operated since 1943, this company produces concrete bricks, building blocks, weeping tiles and flue linings. The greater part of the output is shipped to St. John's, with the remainder going to the larger towns such as Corner Brook, Bay Roberts, Harbour Grace and Carbonear. Sand for this operation is obtained from a pit situated about half a mile from the plant. The sand, a dark green in colour, is washed and screened at the pit to remove the clay and plus ½-inch material present. The amount of clay present is negligible but the oversize (plus ½-inch) makes up approximately 15 per cent of the deposit.

The C. G. Jennings operation is about a mile east of Humbermouth along the road to Deer Lake. Here are manufactured concrete bricks, building blocks and culvert tile. Sand used in brick and block manufacture is obtained from Bowaters Newfoundland Pulp and Paper Mills Limited who dredge it from the Humber river, while that used in making culvert tile is obtained from a large pit opened in stratified, sandy gravel about half a mile to the west. This is the "largest gravel deposit and by far the most important source of gravel along the Deer Lake-Humbermouth highway both because of the quality and the amount of material available" (1). In former years the sand was obtained from the shore of Deer lake at Pasadena, 16 miles east of Humbermouth.

## Road Materials Surveys

During 1950, 1951 and 1953 extensive investigations (1) (2) (3) were carried out by the Mines Branch, Ottawa, of road materials occurring along or close to the route of the Trans-Canada Highway in Newfoundland.

†Dominion Bureau of Statistics.

The investigations disclosed that the two most common types of materials suitable for road improvement were glacial drift (unsorted or unstratified gravel) and rock. They are found almost everywhere along the road, and the amount of each occurring along many stretches appears to be almost unlimited. Other types of gravel are found along the highway and in some instances have been used for road surfacing, but they are relatively scarce and local in distribution.

## References


(1) **Picher, R.H.:** Road materials survey in Newfoundland in 1950; *Mines Br., Canada,* Ind. Minerals Div. rept., January 1951.

(2) ——— Road materials survey in the Province of Newfoundland in 1951; *Mines Br., Canada,* Ind. Minerals Div. rept., March 1952.

(3) ——— Road materials survey in Newfoundland in 1953; *Mines Br., Canada,* Ind. Minerals Div. rept., April 1954.

# Chapter 24

## SANDSTONE

### Building Stone

SANDSTONES suitable for building purposes are well represented in Newfoundland, although there has been no production for many years. Production in the past appears to have been largely, if not wholly, confined to the Avalon peninsula, more particularly to Kellys island and Little Bell island in Conception bay, and to the general vicinity of St. John's. Quarrying in the St. John's area appears to have been fairly extensive at one time, as a large number of the prominent buildings in the city are constructed in whole or in part of the local sandstone. These buildings, several of which are listed below, are witness to the high quality and excellent durability of this stone which may be obtained in various shades of grey, green and red.

Sandstones suitable for building purposes are of common occurrence in the Lower Carboniferous rocks of the Codroy and St. Georges bay districts, southwest coast. These sandstones, to quote Howley (2, p. 140), "present a variety of colour and consistency, from dark brick red, through various shades, till it merges into yellowish, greyish, greenish and white, and from coarse grit to very fine-grained freestone." Worthy of note are the occurrences "on Codroy Island, in the section between the great and little rivers Codroy, and on the Great Codroy River", further reference to which may be found in Murray's report (1, p. 98) for 1866.

Sandstones of this quality are also reported to occur in the Rocky river area of St. Marys bay, southeast coast (1, p. 296); the Clode sound area of Bonavista bay, east coast (2, p. 312); the Gander river area, northeast coast (1, p. 367); the eastern side of Change islands, Notre Dame bay, northeast coast, where a grey micaceous sandstone is represented (1, p. 277); and the Notre Dame bay area between Peters Arm and Wigwam point, where a yellowish-grey sandstone is exposed (1, p. 277).

### • CONCEPTION BAY AREA

According to Murray (1, p. 97), a "good material for building may be procured in ample abundance from the sandstones of Kelly's Island, in Conception Bay. The stone is usually of a greenish tinge, sometimes weathering yellowish; some beds are very hard and difficult to dress with

*Plate XXIX*

*View along Little Bell Island, Conception Bay, showing sandstone formation that has been worked intermittently for the production of dimension stone. The stone is fairly massive here.*

the hammer; others are freer in the grain, and dress with facility." The Roman Catholic cathedral and court house at St. John's are constructed chiefly of sandstone from this locality.

Both Kellys island and Little Bell island, 1½ miles to the northeast, are made up of shales and sandstones belonging to the Bell Island group of Lower Ordovician age (3, p. 33). The strata dip to the north at a low angle and commonly consist of alternating beds of shale and sandstone, with the individual beds varying from a few inches to several feet in thickness. This is very well illustrated in Plate XXIX taken along the shore of Little Bell island.

Attempts by the writer to locate any large quarries were unsuccessful, but several points were noted along the shores of both islands where sandstone appears to have been quarried in the past. At one of these points, on



91230—10½

the northeast corner of Kellys island, the sandstone beds are cut by two well-developed sets of joints, both vertical, which strike N36°W and N40°E, respectively. At another locality, on the eastern end of Little Bell island, the main joints are vertical and strike N35°W and N50°E, respectively; the sea-cliff is about 30 feet high and is composed principally of beds of sandstone, with only minor amounts of shale. The sandstone beds range from 6 inches to 3 feet thick at both localities.

It was concluded that both islands offer a number of localities where dimension stone sufficiently large for most building purposes might be obtained at reasonable cost. Quarrying operations would be facilitated by the fact that the sandstone beds are frequently separated by thin beds of shale. The stone, a fine-grained light-green sandstone, appears to weather exceptionally well.

### • *ST. JOHN'S AREA*

In his report for 1892, Howley (2, pp. 244-245) mentions that a "hard grey and reddish whinrock . . . known locally as the Signal-hill sandstone, is much used in St. John's for building purposes. The Episcopal cathedral of St. John the Baptist and St. Patrick's church, afford good examples of it. But the principal use it is put to is for the foundation of houses, bridge abutments, retaining walls, etc. The rock is not easily cut, but can be readily dressed into blocks of any size or shape by the hammer, while the numerous cleavage planes afford, frequently, two or more sides perfectly shaped, as though from the chisel. . . .

"The Government House at St. John's, a handsome building, is chiefly constructed of the red sandstone, or whinrock, from Signal hill, as are also many of the old fortifications near the entrance to the harbour of St. John's, all derived from the neighbouring hills. The rock generally, but especially the greenish grey variety, is of so intractable a nature that the action of the weather seems to have no appreciable effect whatever upon it. . . ."

These sandstones belong to the Cabot group (St. John's, Signal Hill, and Blackhead formations) of Proterozoic age. (3, map).

## References

(1) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1864 to 1880; London, 1881.

(2) ———— Reports of *Geological Survey of Newfoundland* from 1881 to 1909; St. John's, Nfld., 1918.

(3) **Rose, E. R.:** Torbay map-area, Newfoundland; *Geol. Surv., Canada,* Mem. 265, 1952.

# Chapter 25

## SLATE

ALTHOUGH Newfoundland possesses large deposits of slate of high quality, production has been intermittent and on a small scale and confined to the 45-year period beginning with 1865 and ending with 1909. During this period, according to Howley (3, p. 642), 153,702 squares of roofing slate were produced from quarries in the Random island area of Trinity bay, east coast. The greater part of the output was exported to English markets, with only a small amount being used locally. Elsewhere (5, p. 585) it is stated that the slate was manufactured in two sizes, 10- x 20-inch and 12- x 24-inch, with the former being exported to Newcastle, and the latter to London. No attempt was being made to utilize the material for purposes other than roofing slate, although it was considered to be equally suited "for any other purpose to which slate is applied" (3, p. 642). Production consisted mainly of the dark purple slate, with smaller amounts of the reddish and pea-green varieties.

The following table on slate production was compiled from information contained in various reports (3) of the Geological Survey of Newfoundland. As shown in the table, production for the period 1894 to 1906 amounted to 60,460 squares (20,153 tons) valued at $255,268. Production figures for the period 1907 to 1909 are not available, while those for the period 1865 to 1893 are not complete and there is some doubt as to the correct unit of measurement to be applied to those which have been given.

The chief deposits of commercial slate in Newfoundland occur in two belts. The Eastern belt extends intermittently from Keels, Bonavista bay, on the north, to Placentia bay on the south. The slates are of Cambrian age and dark purple to light green in colour. The Western slate belt extends from Bonne bay to Humber arm, Bay of Islands. The slates are of Ordovician age and practically identical in colour to those of the Eastern belt (4).

TABLE XII

PRODUCTION OF SLATE IN NEWFOUNDLAND
1865-1909

| Year | Quantity Squares (100 square feet) | Value $ |
|---|---|---|
| 1865 | 31,000[1] | 1,240 |
| 1866 | — | — |
| 1867 | 50[2] | 600 |
| 1868 | 101,000[1] | 2,020 |
| 1869-73 | — | — |
| 1874 | 6,000[1] | 120 |
| 1875 | 6,000[1] | 120 |
| 1876-93 | — | — |
| 1894 | 300 | 1,350 |
| 1895 | 300 | 1,350 |
| 1896 | 300 | 1,350 |
| 1897 | 300 | 1,350 |
| 1898 | 300 | 1,350 |
| 1899 | — | — |
| 1900 | 1,800 | 10,800 |
| 1901 | 6,000 | 22,500 |
| 1902 | 11,000 | 44,000 |
| 1903 | 12,600 | 63,000 |
| 1904 | 8,100 | 37,800 |
| 1905 | 11,852 | 45,000 |
| 1906 | 7,608 | 25,418 |
| 1907[3] | — | — |
| 1908[3] | — | — |
| 1909[3] | — | — |
| Total 1894-1906 | 60,460 | 255,268 |

[1] Tons, but assumed to mean squares (3 squares=1 ton) or, more probably, individual slates.
[2] Tons.
[3] Not available.

## Eastern Slate Belt

As Christie (1, p. 36) has observed, the Eastern belt can be subdivided into two smaller belts, a western belt in which the cleavage is not well developed, and an eastern belt in which the cleavage is strongly developed. It is the eastern belt in which the various quarries have been opened. The most notable are the Smith sound quarry, on the mainland 3 miles east of Burgoynes cove; the Winter and Alison quarries, on Random island near Hickmans Harbour; and Grieves quarry on the mainland opposite Hickmans Harbour.

From his survey of the Random island area in 1899, Walcott of the United States Geological Survey concluded that the area contained one of the great roofing slate deposits of the world. The revival of the slate industry in 1900 was due chiefly to Walcott influencing American manufacturers to take over the quarries, which up until that time had been operated by local residents (3, p. 461).

Walcott's opinion was fully shared by Giller (2), a man with long experience in the Welsh slate districts, who visited Newfoundland in 1947 to "report on the possibilities of entering into production of roofing slate, mainly for export to Scotland and the North of England." From this survey, which lasted approximately one month, it was concluded that, "The Newfoundland slate deposits of the Random area can be listed as one of the finest slate deposits of the world, as yet untouched. In these can be found all the best features which enable such deposits to be exploited on a large scale and at low cost, with very few physical or structural conditions that add to the cost of quarrying and processing operations."

The slate of this belt "has the same physical characteristics as the Cambrian slate formation of Caernarvonshire, North Wales, and is practically identical in texture and colour, ranging from dark purple to light green, but whilst the Random deposit contains a few stripes similar to its Welsh counterpart, it is, however, completely free from the interlaying grits found in the Welsh deposit" (2).

Tests carried out at the Smith sound quarry showed that the slate can be cleaved or split into thin sheets with ease. In no single instance was any tendency to curved or irregular cleavage encountered, and the deposit is perfectly free from slips or false cleavage. The slate is free of all impurities which affect the insulating properties of slate so that it would be ideally suited for electrical purposes (2).

• ***SMITH SOUND QUARRY***

This quarry is on the north side of Smith sound near Burn point. Situated at tidewater, it has an overall length (east-west) of approximately 600 feet, a width of 300 feet, and a face 150 feet high. It was apparently worked from three levels, the lowest of which is situated approximately 6 feet above sea-level. The slate cleavage has a uniform strike of N50°E, but ranges in dip from 76 degrees east in the western part of the quarry to 67 degrees east in the eastern portion. The principal joints strike N20°E and are vertical and widely spaced. The slate is predominantly purple although large amounts of green slate are also present. Ribbons dipping at 15 degrees to the southwest may be seen at one or two points on the quarry face.

"This is the only quarry where any attempt was made to extend development beyond the trial stage. There still remain traces of a plan

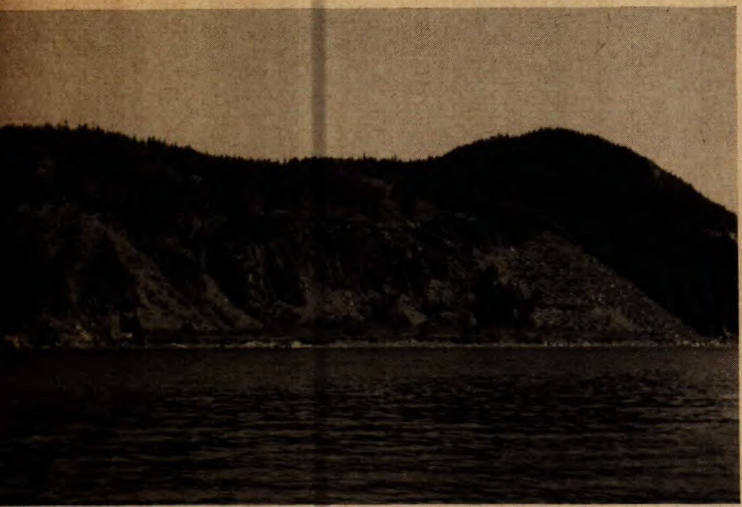


*Plate XXX*

***Smith Sound slate quarry on north side of Smith Sound, Trinity Bay, east coast.***

for operating the quarry on the gallery system to which the formation of the slate bed and the contour of the land would naturally lend itself.

"For some reason or other, perhaps lack of capital played some part, the top gallery of weathered and unprofitable rock was not cleared in step with the two lower galleries, until finally the original plan was abandoned altogether and the lower galleries of profitable rock pushed forward until the working face attained a height of 150 ft. or more" (2).

"The appearance of this quarry today proves that brute force was the order of the day. Numerous groups of drill holes, 4″ starting diameters, 15 ft. to 18 ft. long, were driven into the rock, often obliquely across the pillaring line, then forced by battery, which could only result in shattered rock, which increased the proportion of waste to finished slate, increased cost of production, and lead directly to ruin and liquidation" (2).

- ***WINTER AND ALISON QUARRIES***

"Numerous trials can be observed east of Hickmans Harbour, but not one has been developed beyond the trial stage. All of them would seem very promising prospects, indeed the whole formation on this side of the Sound seems to be one solid mass of pure slate" (2).

The two principal quarries in the area are about 1,500 feet apart. The eastern quarry is near the slate's eastern contact, with the sill having an elevation of approximately 200 feet above sea-level. As exposed in the quarry, which has a length (east-west) of 150 feet and height of 100 feet, the slate cleavage strikes N50°E and dips towards the east at 68 degrees. Green slate was common at this quarry. The western quarry, about 600 feet east of the slate formation's western contact, has a length of about 100 feet and a face 60 feet in height. The quarry face is actually an exposed joint plane striking S45°E and dipping at 68 degrees to the northeast. The slate cleavage strikes N43°E and dips at 84 degrees to the east. Most of the slate here is of the purple variety.

- ***GRIEVES QUARRY***

Grieves quarry lies in Dartmouth cove on the south side of Northwest arm opposite Hickmans Harbour. Work did not progress beyond the trial stage and the quarry was abandoned before reaching any signs of stability and solid rock. Practically all of the slate here is of the purple variety, with only a little green occurring. It appears as if the slate was quarried from two main levels, the first of which is about 100 feet above sea-level and the other, 160 feet above sea-level. On the lower level a U-shaped cut 20 feet in width was taken into the hillside. The walls at the back of the cut range up to 100 feet in height.

## Western Slate Belt

Several small quarries have been opened in the Western slate belt. These are located at Curling, on the south side of Humber arm, Bay of Islands; and at Summerside, on the north side of the arm opposite Curling. There has been no recorded production. Although their colours are practically identical, the slate beds of this area cannot be placed in the same class as those of the Random island area. They could only be developed on a small scale for local use (assuming there was a demand) and would not warrant large scale expenditure of capital (2).



91230—11

"The trials opened at Summerside and the outcrops along the beach show clearly the extreme folding of the formation in this district. The original bedding planes are tilted at varying angles and there has been some tendency to sliding causing fracture along these planes, thus forming a series of joints at extreme angles to the cleavage and the usual fracture joints. This special feature of the slate bed in this area would tend to increase the proportion of waste to finished product and the angle of dip at the limit of the fold would create conditions eventually where mining as distinct from open quarrying would have to be undertaken" (2).

## References


(1) **Christie, A. M.:** Geology of Bonavista map-area, Newfoundland; *Geol. Surv., Canada,* Paper 50-7, 1950.

(2) **Giller, O.:** Newfoundland slate quarries and deposits; *Nfld. Ind. Development Bd.,* unpub. rept., 1947.

(3) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1881 to 1909; St. John's, Nfld., 1918.

(4) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(5) Slate; *The Mineral Industry,* vol. 10, 1901, pp. 583-585, 1902.

# Chapter 26

## SULPHUR AND PYRITES

NEWFOUNDLAND has no known deposits of elemental sulphur, but pyrites—the all-inclusive name for metallic sulphides and at present the second most important world source of sulphur—has been found in many localities, most of which occur in the Notre Dame bay area. Mining of pyrites in Newfoundland actively commenced with the opening of the Tilt Cove mine in 1864. In the following years many other discoveries were made, and for the decade 1871 to 1880, to quote Snelgrove and Baird (15, p. 4), "Newfoundland attained fourteenth place among the copper producing countries of the world."

Practically all of these deposits were of the pyritic copper replacement type, and their pyritic content was in several instances a valuable asset. In the case of the almost massive bodies of pyrite at Pilleys Island, however, "pyrite was the main ore and copper merely an adjunct" (15, p. 116). Altogether, over 600,000 tons of pyrite ore valued at $3,918,622 (14, p. 7) have been exported from Newfoundland, approximately 80 per cent of which was shipped during the period 1883 to 1906 (7, p. 128) (11).

Recovery of pyrite from current mill tailings at Buchans commenced early in 1955, this being the first production of pyrite concentrates since the World War I period. However, the island has been a regular exporter of copper, lead, and zinc sulphides, in the form of concentrates, ever since the Buchans mine came into production in 1928; these concentrates are transported by rail to Botwood, Notre Dame bay, from which port they are shipped for overseas refining.



91230—11½

About half of the sulphur consumed in Canada at present is derived from pyrite by roasting; the pyrite is obtained as a by-product from the treatment of base metal ores (8, p. 5).

The extensive gypsum and anhydrite deposits of southwestern Newfoundland are a large potential source of sulphur and its compounds. Although they do not constitute an economic source of supply at present, it should be noted that plants for the recovery of sulphur as sulphuric acid and production of portland cement from anhydrite are in operation in England, on the European continent, and in India.

Described below are the Buchans operation and four of the major sulphide occurrences on which work has been done in the past, namely, the Gull pond, Little Bay, Pilleys island and Tilt Cove mines. These, along with 10 other major occurrences—Betts cove, Chapel island, Gregory river, Lockport, Mud pond, Rendell-Jackman, Sunday cove, Terra Nova, Wild cove and York harbour—several of which are being actively explored and developed by Canadian mining interests at present, have been described in a recent report of the Mines Branch, Ottawa (8, pp. 13-21). For a complete list and more detailed descriptions the reader is referred to *Copper Deposits of Newfoundland*, published by the Geological Survey of Newfoundland in 1940 (1).

## Buchans Mining Company Limited

The Buchans mine is about 3 miles north of Red Indian lake, in central Newfoundland, at an elevation of about 900 feet above sea-level. It is managed by the American Smelting and Refining Company on a percentage of net profits basis with Anglo-Newfoundland Development Company Limited which owns the property. Buchans is reached by a 36-mile private railway from Millertown Junction on the Canadian National railway, and by road from Badger on the Trans-Canada Highway.

Ore was first discovered in the Buchans area in 1905. Development work soon indicated an orebody containing 100,000 tons of extremely fine-grained copper-lead-zinc ore, but owing to the metallurgical difficulties presented by the ore, operations were suspended in 1911. The American Smelting and Refining Company solved the milling problem by selective flotation in 1925, and in the following year an intensive prospecting program was initiated. Geophysical work, followed by diamond drilling, revealed the presence of two additional groups of orebodies of characteristics similar to those of the 'Buchans River' deposits. 'Lucky Strike', the largest group of orebodies, was encountered some 4,000 feet west of the original discovery, and the other group, the 'Oriental', some 2,000 feet to the east. These new deposits represented about 6,600,000 tons of ore averaging 1.4 per cent copper, 8.5 per cent lead, 17.4 per cent zinc, 0.05 oz. gold, 3.1 oz. silver,

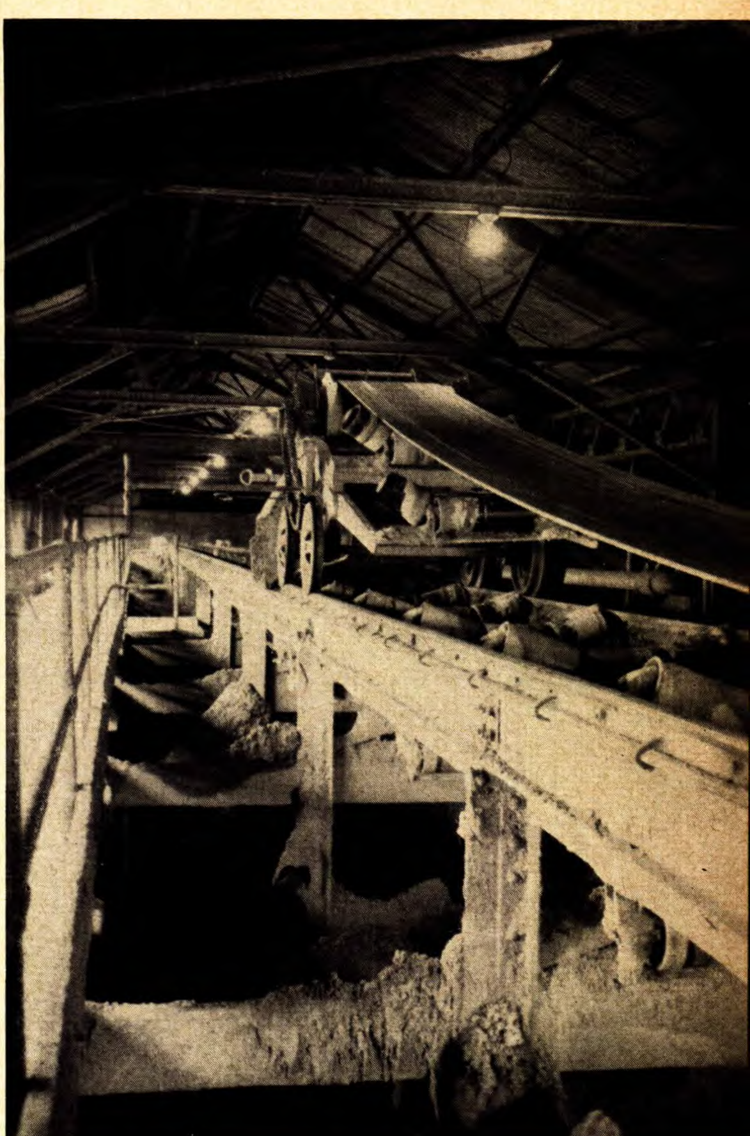


*Plate XXXI*

*Conveyor belt delivering ore from the crushing plant to the fine ore bins at Buchans Mining Company mill, Buchans.*

7.6 per cent iron, and 30.0 per cent barite (4, p. 489). Milling commenced in 1928, and operations have been continuous since that date. The mill is currently handling 1,250 tons per day.

The ore is a massive, intimate mixture of fine-grained sphalerite, galena, pyrite, chalcopyrite, and very little tetrahedrite, with the gangue minerals barite, quartz, and calcite. The deposits are of the mesothermal type and occur principally in tuff beds belonging to the Buchans series of Ordovician (?) age. This series has been intruded by granite, diabase and quartz porphyry. Mineralization followed the quartz porphyry intrusion. The Lucky Strike orebodies lie on the axis of a westward-plunging anticline, while the Buchans River and Oriental orebodies are on the north limb of the same anticline (4) (12).

Beginning with 1947, a number of new orebodies were discovered at deeper horizons about half a mile northwest of the Lucky Strike. The ore was found to be of the same type and grade as that of the original discoveries. Ore reserves as of December 31, 1955 were estimated at approximately 6,000,000 tons of assured and probable ore, an increase of 306,000 tons during the year.

Recovery of pyrite from current mill tailings began early in 1955. The pyrite concentrate is shipped to the newly erected fluosolids reactor plant of Anglo-Newfoundland Development Company Limited, at Grand Falls, where it is burnt to produce sulphur dioxide gas. The gas is used to produce cooking acid, used in the production of sulphite pulp.

For a more complete description of the operations at Buchans, the reader is referred to two recent papers (6) (16) prepared by officials of the company.

## Other Mines

### • GULL POND MINE

This prospect is in the north-central part of the island, 40 miles northeast of Buchans. It is 4 miles by road from the Trans-Canada Highway and 17 miles by road from tidewater at Halls bay, Notre Dame bay. The main showings are at Mineral point, on the northwest shore of Gull pond; a smaller deposit of similar characteristics, and known as the Southwest Shaft orebody, occurs 1½ miles to the southwest.

The occurrence was discovered in 1905 and during the next 25 years was explored at various times by trenching, shallow shafts, diamond drilling and geophysical methods. As a result of this work, which terminated in 1929, an orebody containing 2,160,000 tons averaging 2.62 per cent copper, was indicated at Mineral point (15, pp. 46-47).

Nothing further was done until Falconbridge Nickel Mines Limited carried out geophysical work and drilled approximately 60 holes during the period 1950 to 1953. This work indicated 4,350,000 tons of ore averaging 1.24 per cent copper to a depth of 450 feet. Included in this tonnage was a higher grade central core calculated at 1,958,771 tons averaging 1.93 per cent copper. The zone was open for extension, along strike and to depth. Drilling outlined two main lenses plus several smaller ones along a strike length of 1,500 feet. On its surface extension the south body was about 300 feet long and 75 feet wide while the north body was 700 feet long and 40 to 50 feet wide. Ore widths bulged out to a maximum of 200 feet or more (21).

Maritimes Mining Corporation Limited, through its subsidiary Gullbridge Mines Limited, is currently investigating the property. Immediate plans call for the sinking of a 750-foot, 4-compartment shaft from which the orebodies outlined by Falconbridge will be developed and further explored by underground diamond drilling. Production is scheduled to commence during the latter part of 1958 at an initial daily rate of 1,000 tons. At last report (September 20, 1956), the shaft had been collared, the headframe completed, the service building (including hoist and compressor room, warehouse, and dry) was nearing completion, and all necessary mining plant and equipment delivered to the property (22).

The deposits, "pyrite-pyrrhotite-chalcopyrite replacement lenses" (9), lie within a northeast-southwest trending belt of andesitic lavas, cherts and siliceous tuffs of Ordovician age. This belt is invaded by Devonian rocks of granitic and dioritic composition and by numerous acidic and basic dykes of still later age. The principal ore minerals are chalcopyrite, pyrite and pyrrhotite, while cordierite, fibrous amphibole, biotite and quartz are the characteristic gangue minerals (1, p. 39).

## • LITTLE BAY MINE

The Little Bay mine workings are in a northeast-southwest trending valley about half a mile southeast of the town of Little Bay. Little Bay is on the west side of Notre Dame bay, northeast coast, 14 miles by road north of the Trans-Canada Highway.

The mine was discovered in the spring of 1878 and operated continuously from then until 1893 during which time an estimated 200,000 tons of 2½ to 10 per cent copper ore are reported to have been mined from the main ore body over a length of 600 feet and a depth of 1,400 feet. The average width of the ore body is reported to have been 25 feet. The eastern section of the mine is said to have collapsed, due to pillar robbing, down to the 1,000-foot level. Part of the ore was smelted on the mine property; the remainder was exported. Operations were resumed for a short time in 1898, when 663 tons of ore and 50 tons of matte assaying 24 per cent copper was shipped, and Snelgrove (14, p. 61) reports that a small shipment was also made in 1901. Attempts to revive the industry in 1905 and 1906 were without success. Diamond drilling to the east of the old workings in 1921-22 by the Little Bay Drilling Syndicate Limited is reported to have cut 24 feet of 2.35 per cent copper ore. The mine dumps were thoroughly sampled in 1926 and are estimated to contain 216,000 tons of material averaging 1.48 per cent copper (13).

At present the property is being explored on a 50-50 basis by New Highridge Mining Company Limited and O'Brien Gold Mines Limited, with the work being done under the direction of the latter company. Several holes drilled to late 1955 by New Highridge confirmed existence of further ore in the vicinity of the old mine workings, and at latest report (September 27, 1956) approximately 1,300,000 tons of copper-gold ore averaging 2.5 to 3.0 per cent copper had been outlined by drilling. One of the deepest holes so far put down cut 35 feet of ore at a depth of 1,000 feet that averaged 4.17 per cent copper. The drilling program is being continued. It is expected that a shaft sinking program leading to production will be announced before the year end (23).

The Little Bay deposits occur mainly as lenticular bodies in one of several *en echelon* chlorite schist zones which lie about 3,000 feet south of a major through-going fault. This particular schist zone has a known mineralized length of about 900 feet, strikes about N50°E, and dips to the south at 80 degrees. The deposits are considered to have been formed by hydrothermal solutions of intermediate temperature, although the ultimate source of the solutions is unknown. Highly-altered and steeply-dipping pillow lavas of Lower Ordovician (?) age constitute the country rock (1, p. 55) (10, p. 24). "In general", writes Williams (1, p. 52), "the ore consists of stringers and disseminations of chalcopyrite and pyrite in chlorite schist, the copper sulphide frequently occurring in veinlets and threads of quartz injected along planes of schistosity."

### • *PILLEYS ISLAND MINE*

Pilleys island, with an approximate length (north-south) of 5 miles and a width of 4 miles, is in the west-central part of Notre Dame bay, north-east coast, half a mile from the Newfoundland mainland. The mine lies at tidewater in a land-locked harbour along the south side of the island.

The occurrence of pyrite at Pilleys island was known as early as 1875, but mining was not started until 1889. Pyrites Company Limited operated the mine from 1891 to 1899 and shipped over 300,000 tons of ore during that period. Pilleys Island Pyrite Company acquired the property in 1901 and produced over 225,000 tons of ore up to 1908. At that time it was discovered that the orebody was cut off by faulting (15, p. 117). The property was subsequently acquired by Blast Furnace Products Corporation

*Plate XXXII*

*Diamond drilling at Pilleys Island, Notre Dame Bay, during the recent Halcrow-Swayze investigation.*

of New York and in 1919 and 1920, diamond drilling, under the direction of N. O. Lawton, disclosed the faulted portion of the orebody with an estimated 560,901 tons of ore indicated. Lawton estimated 211,061 tons of this to be cupriferous pyrite with 3 to 3.5 per cent copper and 44 to 48 per cent sulphur, and the remaining 349,840 tons as non-cupriferous pyrite with 46 to 50 per cent sulphur content. Old mine pillars and workings were estimated to contain 43,000 tons of ore, consisting of 15,000 tons cupriferous pyrite and 28,000 tons non-cupriferous pyrite (1, p. 80). No production resulted from this work, however.

Three kinds of ore were shipped in former operations: *Brown lump*—a massive nearly pure iron pyrites, non-cupriferous, assaying 45 to 51 per cent sulphur, 42 to 48 per cent iron and 0.07 per cent copper; *Hard* *copper lump*—a cupriferous pyrite assaying 44 to 48 per cent sulphur, 36 to 44 per cent iron, and 2 to 3 per cent copper; and *Fines*—screenings from the brown ore and crushed white (pure pyrite) ore assaying 42 to 46 per cent sulphur with no copper (1, p. 74).

Extensive diamond drilling was carried out on the property in 1951 and 1952 by Pilleys Island Copper-Pyrite Limited, under the joint sponsorship of Frobisher Limited and Halcrow Swayze Mining Company Limited. This work indicated an ore reserve of 622,000 tons, consisting of 412,000 tons of cupriferous pyrite ore averaging 1.7 per cent copper and 31 per cent sulphur, and 210,000 tons of pyrite ore running 43 to 45 per cent sulphur with no copper (17). Chances for further ore discoveries are regarded as excellent and plans for additional drilling have recently been completed. The present investigation is under the management of Matachewan Consolidated Mines Limited (19).

The Pilleys island orebody occurs as a replacement deposit in rhyolite flows of Ordovician age. It has a pod-like form, in places measuring up to 500 feet wide along the strike and 40 feet thick. It was mined for about 700 feet down the dip to the above-mentioned fault which displaced it (2, p. 36). The underground workings are shallow, with the bottom (7th) level at a vertical depth of only 291 feet from the shaft collar (1, p. 75).

### • *TILT COVE MINE*

Tilt Cove is on the west side of Notre Dame bay, northeast coast, about 52 miles northeast of the Gull pond mine. Snelgrove and Baird (15, p. 51) describe it as follows:

"The cove is a small indentation, less than 1,000 feet in length, in the abrupt cliffs which bound an undulating plateau lying nearly 500 feet above sea level. It is not a naturally good harbour, yet ships can be loaded in all but strong south winds. The depth of water at the pier is 20 to 35 feet. Inside the cove is a valley heading in an amphitheatre one quarter of a mile in diameter, in which lies Winser Lake with a surface elevation of only 11 feet above the sea. Between the lake and cove and surrounding Winser Lake the old town of Tilt Cove was built."

The Tilt Cove mine, Newfoundland's oldest and largest copper mine, was discovered in 1857 and operated more or less continuously from 1864 until 1918. During part of this period this operation was the biggest in Newfoundland and an important source of copper and sulphur. Two separate mines were operated: the West mine, situated on the hill slope immediately west of the cove; and the East mine, centred about two large open pits in the plateau half a mile east of the cove. Total shipments are given by Snelgrove and Baird (15, p. 65) as 1,491,136 tons of ore, 78,015

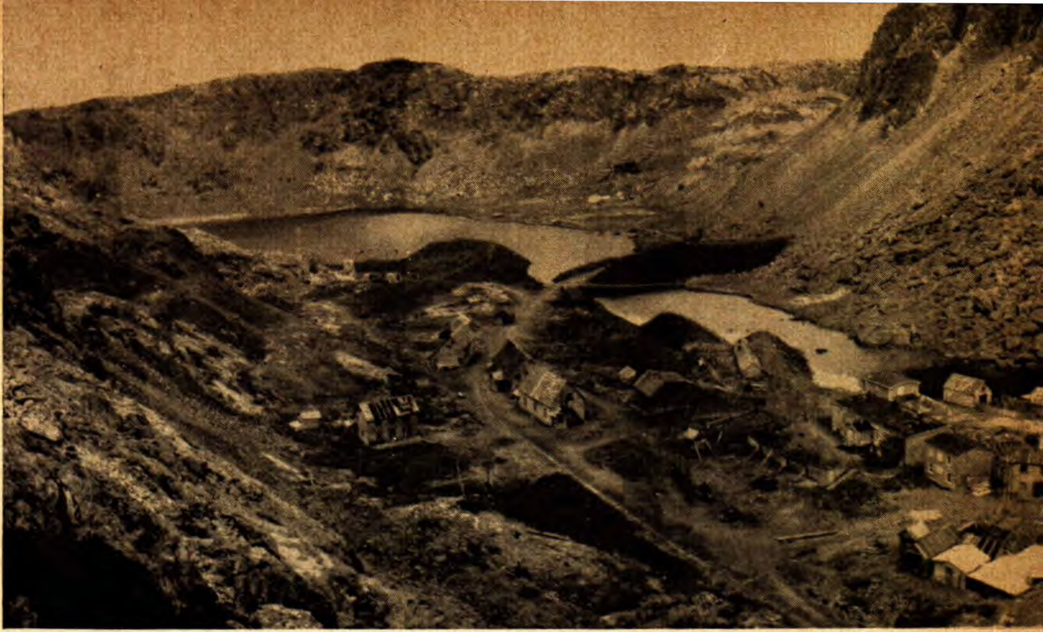


*Plate XXXIII* *Panorama of Tilt Cove, taken during an investigation of the property in the summer of 1950. The west mine workings are shown, the remains of the old mill, and waste dumps, as well as Winser Lake, the east mine and the settlement of Tilt Cove.*

tons of regulus (matte), and 5,416 tons of copper ingots. Reports vary as to the quantity of nickel ore shipped between 1869 and 1876 from a small deposit encountered in the West mine; some state 319 tons valued at $29,604 and others 411 tons valued at $32,740. A total of over $5,000,000 are "said to have been distributed in dividends to stockholders between the years 1888 and 1912; records of earnings in the earlier years are not available" (14, p. 2).

The Tilt Cove deposits occur in rocks of Ordovician age (15, p. 52), with the ore occurring "mainly as a partial or complete replacement of basic, andesitic lavas which have been invaded by quartz diorite porphyry and pyroxenite" (1, p. 116). The West mine ore consists largely of veinlets and impregnations of chalcopyrite and pyrite in a chloritized volcanic base, whereas the East mine ore was almost wholly composed of massive, slightly cupriferous pyrite (1, p. 116).

According to Rove (1, p. 120), the West mine during its period of operations, 1864 to 1912, shipped an estimated 84,448 tons of hand-picked ore averaging 9.1 per cent copper. Of this amount, 65,461 tons averaging 12 per cent copper were shipped before the East mine came into production, with most of the output coming from stopes on the main level 40 to 100 feet above sea-level. During this period (1864 to 1886) the orebody was opened up for a vertical range of 400 feet up the hill from the cove and to a vertical depth of 240 feet below sea-level. The mine was deepened an additional 240 feet between 1894 and 1902, and in 1907 the upper workings were partly converted into an open-cut. Rove (1, p. 121) estimated the average grade of ore mined from the West mine during its entire period of operation to be about 5 per cent copper.

The East mine main orebody was discovered in 1886 and came into production shortly thereafter, whereas the North and South lodes, situated one to two hundred feet away and discovered later on, did not start producing until 1901 to 1902 (15, p. 52). With the discovery of the East mine, Tilt Cove entered upon a period of "extraordinary prosperity", partly due to the high sulphur content of the ore and partly due to the fact that the large massive orebodies could be cheaply worked by quarrying and later by gloryholing. No record of production is available, but output during the 1890's reached a peak of 60,000 to 70,000 tons of cupriferous pyrite a year. Foote (3, p. 58) estimates that from 1888 to 1910 over 1,000,000 tons of ore averaging 4 per cent copper and 35 to 40 per cent sulphur were shipped.

In 1946 the property was optioned by The Consolidated Mining and Smelting Company of Canada Limited which completed 12,000 feet of diamond drilling. In 1951 the property was again optioned, this time to Falconbridge Nickel Mines Limited, which undertook a thorough geological and geophysical program followed by 16,000 feet of diamond drilling. In June, 1954 the Falconbridge option was acquired jointly by Bathurst Mining Corporation Limited and Maritimes Mining Corporation Limited. A small mining plant was moved in during the fall, and dewatering of the West mine started in December. By March 31, 1955 examination of old workings and diamond drilling had disclosed an estimated 2,200,000 tons grading approximately 2.2 per cent copper (5, p. 39) (18, p. 4).

At last report (September 20, 1956), ore reserves were calculated to be in excess of 9,000,000 tons grading 1.8 to 2.0 per cent copper, 40 per cent pyrite, 18 per cent magnetite, plus recoverable values in zinc, gold and silver. West mine ore reserves were estimated at: 810,878 tons averaging 1.35 per cent copper, above sea-level; 1,019,442 tons grading 1.32 per cent copper, below sea-level; 350,000 tons of 1.75 per cent grade, partially outlined by level sampling and drilling; and two more orebodies on which no estimate is made due to insufficient data. East mine ore reserves are estimated at 1,721,497 tons of 2.67 per cent copper, 1.45 per cent zinc, 33.2 per cent sulphur, 0.053 oz. gold and 0.194 oz. silver above sea-level; 389,900 tons of practically the same grade, below sea-level; and 4,800,000 tons of 1.35 per cent copper ore, 80 per cent above sea-level, partially outlined by level sampling and drilling (20, p. 4) (22, p. 25).

Output at a rate of 2,000 tons daily is planned to commence in April or May of 1957; this will be increased to 3,000 tons by the end of the year. At last report (September 20, 1956), the headframe had been completed; the service building, nearly completed; the 4-compartment, 750-foot shaft had reached a depth of 320 feet; and construction of a dock, designed to berth 10,000-ton vessels and capable of handling 1,000 tons of ore concentrates per hour, was well under way (22, p. 26).

## References


(1) **Douglas, G. V., Williams, D., Rove, O. N., and others:** Copper deposits of Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 20, 1940.

(2) **Espenshade, G. H.:** Geology and mineral deposits of the Pilleys Island area; *Geol. Surv., Newfoundland,* Bull. No. 6, 1937.

(3) **Foote, F. W.:** Geology and mining laws of Newfoundland; *Eng. and Mining J.,* vol. 131, 1931, pp. 56-58.

(4) **George, P. W.:** Geology of lead-zinc-copper deposits at Buchans, Newfoundland; *Trans. Am. Inst. Mining Met. Engrs.* vol. 126 (Metal Mining and Mining Geol.), 1937, pp. 488-511.

(5) **Grant, G. M.:** Major copper ore strike sparks Nfld. mine hopes; *Financial Post,* Apr. 9, 1955, pp. 1, 3, 39 (map).

(6) **Hodgson, V.:** Filling stopes with glacial drift at Buchans, Newfoundland; *Trans. Inst. Mining Met.,* (London), vol. 60, 1950-51, pp. 173-182.

(7) **Howley, J. P.:** Mining in Newfoundland; *Can. Mining Rev.,* vol. 17, 1898, pp. 127-129.

(8) **Janes, T. H.:** Sulphur and pyrites in Canada; *Mines Br., Canada,* Memo. Ser. No. 118, April 1952.

(9) **Kalliokoski, J.:** Gull pond, Newfoundland (second preliminary map); *Geol. Surv., Canada,* Paper 54-4, 1955.

(10) **MacLean, H. J.:** Geology and mineral deposits of the Little Bay area; *Geol. Surv., Newfoundland,* Bull. No. 22, 1947.

(11) **Murray A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1881 to 1909; St. John's, Nfld., 1918.

(12) **Newhouse, W. H.:** The geology and ore deposits of Buchans, Newfoundland; *Econ. Geol.,* vol. 26, 1931, pp. 399-414.

(13) **Poillon and Poirier:** Private report, *Reid Newfoundland Company Limited,* 1926.

(14) **Snelgrove, A. K.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4, 1938.

(15) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(16) **The Staff, Buchans Mining Company Limited:** Buchans operation, Newfoundland; *Bull. Can. Inst. Mining Met.,* No. 518, June 1955, pp. 349-353.

(17) Pilley's Island work halted; *Northern Miner,* Apr. 3, 1952, p. 11.

(18) Bathurst and Maritimes M.C. plan production from two big Newfoundland copper deposits; *Northern Miner*, Apr. 7, 1955, pp. 1-2, 4.

(19) Drilling under way at Pilley's Island; *Northern Miner*, Mar. 15, 1956, p. 20.

(20) Maritimes M.C. proves stature with major copper ore deposit; *Northern Miner*, Apr. 12, 1956, pp. 1, 4.

(21) Maritimes M.C. has second operation; *Northern Miner*, July 12, 1956, p. 9.

(22) Maritimes Mining expects fine profit from two mines; *Northern Miner*, Sept. 20, 1956, pp. 25-26.

(23) Copper orebody for New Highridge in Newfoundland; *Northern Miner*, Sept. 27, 1956, p. 3.

# Chapter 27

## TALC AND SOAPSTONE

TALC in the pure form and in soapstone is known to occur at a number of localities in Newfoundland. The deposits have not been investigated in detail, but with one possible exception they appear to have very little commercial value. The most promising deposits are those in the Fleur-de-Lys area, on the Burlington peninsula, where the talc is found—mainly as narrow bands—along the margins of serpentine bodies; here, in Fuller's (2, p. 29) opinion, the "talc appears to be of good grade and may have commercial possibilities." The chances of finding other similar but more extensive deposits of talc in Newfoundland appear good, in view of the widespread distribution of serpentinized and steatitized ultrabasic rocks in the island. For a description of the talc-carbonate rocks of the Burlington peninsula, on the north coast between White bay and Notre Dame bay, the reader is referred to a recent report by Baird (1, pp. 40-41). Reference has already been made, in the chapter on magnesite, to the occurrence of talc-carbonate rocks in the ultrabasic rocks of the Gander river area.

Kranck (3, p. 34) describes soapstone as occurring at a number of places in the coastal section between Forteau bay and Hebron, in Labrador, but was doubtful if the mineral could be worked profitably.

Brief descriptions of the Fleur-de-Lys and Mings Bight occurrences, and of two minor occurrences in the St. Lawrence area, southeast coast follow:

### • *FLEUR-DE-LYS*

Talc rock, occurring as long narrow bands and small isolated bodies along serpentine contacts, have been reported from several localities in the Fleur-de-Lys area. One such band, varying from 2 to 40 feet in width and measuring 750 feet in length, may be seen at the Parrell molybdenite prospect, located in the settlement of Fleur-de-Lys. According to Fuller

(2, p. 29), "The talc rock is composed of a mat of medium-size talc crystals cut by veins of tan-coloured, iron-bearing magnesite." The rock has a greyish-white cast with a slight greenish tint.

### • *MINGS BIGHT*

According to Watson (5, p. 12), talc-carbonate rock, resulting from the hydrothermal alteration of serpentinized ultrabasic rocks, is of common occurrence in the Mings bight area, about 10 miles southeast of Fleur-de-Lys. Rock of this type occupies "most of the Kidney Pond-Trimms Brook valley and the lower course of Mings South Brook. It also constitutes a considerable portion of the discontinuous belt of altered ultramafic rock extending from Deer Cove to Red Point." The average talc-carbonate rock contains the two minerals, talc and buff-coloured carbonate, in approximately equal amounts, but "Locally, talc occurs as fairly pure nodules up to 4 inches in length and constitutes about 75% of the assemblage." The talc prospect on the west side of Trimms brook, about a mile southwest of the bottom of Mings bight, is situated on a small zone of this type.

### • *ST. LAWRENCE*

Van Alstine (4, p. 43) refers to two minor occurrences of talc in the St. Lawrence area, Burin peninsula, southeast coast, as follows:

"West of Lawn Harbour, and south of Webbers Cove, an altered zone occurs near the fault contact of Ordovician (?) basalts and Cambrian calcareous beds. This schistose and altered zone is about 200 feet wide and is composed of hematite-stained talc and carbonate rock. Most of the carbonate is calcite and dolomite, but some is mesitite, $(Mg,Fe)CO_3$. The zone is more talcose for a thickness of about 25 feet.

"On the east side of Burin Bay Arm, talc and sericite are found at several places in schistose zones at the contact of metagabbro and basalt flows. The thickest talc zone measures 20 feet and is located on a small island south of Sugar Loaf Island."

## References

(1) **Baird, D. M.:** The geology of Burlington peninsula, Newfoundland (report and map); *Geol. Surv., Canada,* Paper 51-21, 1951.

(2) **Fuller, J. O.:** Geology and mineral deposits of the Fleur-de-Lys area; *Geol. Surv., Newfoundland,* Bull. No. 15, 1941.

(3) **Kranck, E. H.:** Bedrock geology of the seaboard region of Newfoundland Labrador; *Geol. Surv., Newfoundland,* Bull. No. 19, 1939.

(4) **Van Alstine, R. E.:** Geology and mineral deposits of the St. Lawrence area, Burin peninsula, Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 23, 1948.

(5) **Watson, K. de P.:** Geology and mineral deposits of the Baie Verte-Mings Bight area; *Geol. Surv., Newfoundland,* Bull. No. 21, 1947.

# Chapter 28

## TITANIUM MINERALS

### • *ISLAND OF NEWFOUNDLAND*

TITANIUM-BEARING minerals are found at a number of localities in the island, including the Sheep brook-Lookout brook area, St. Georges bay, west coast, where several hundred thousand tons of titaniferous magnetite averaging 5 to 6 per cent titanium are indicated; the Indian head area, 10 miles to the northwest, where smaller tonnages of titaniferous magnetite carrying up to 4 per cent titanium occur; the Grand Lake brook area, 14 miles south of Corner Brook, where rutile is found associated with sulphides in quartz and calcite veins; and the White bay area, north coast, where ilmenite and rutile are found associated with pegmatite dykes.

The titaniferous magnetites have little or no commercial value at present: they are too low in titanium to compete with the richer ilmenites, and (excluding some of the Indian head occurrences) too high in titanium to be considered as good iron ores. Consequently, no attempt has been made to exploit these deposits for their titanium content, although some of the Indian head occurrences were worked from 1941 to 1943 as a source of high-grade iron ore. The iron ore possibilities of both areas were investigated by the Geological Survey of Newfoundland in 1942, and those desiring detailed accounts of the various known prospects and occurrences are referred to recent reports of Baird (1) and Heyl and Ronan (7).

The Grand Lake brook occurrences, in which rutile is found associated with sulphides in quartz and calcite veins, are of relatively minor importance. Walthier (11, pp. 47-48) records them as follows:

"The lower, schistose part of the Cambrian, exposed along Grand Lake Brook, contains many veins of white quartz and calcite from several inches to a foot thick. Those striking N70°W and dipping 42°SW contain traces of sulphides, commonly pyrrhotite. Masses of sulphides a foot or two in diameter occur in a few of these veins. . . . The sulphides recognized, in order of abundance, are: pyrrhotite in masses; rutile in small crystals throughout the vein; galena and pyrite in very small grains in the pyrrhotite; chalcopyrite; sphalerite; and a mineral resembling chalcocite in very minor amounts. . . .

"No rutile was seen in the polished surface. In the hand specimens, it is closely associated with the gangue and suggests the two were deposited at about the same time. The sphalerite, gangue, rutile and chalcocite (?) form veins in the pyrrhotite."

The existence of rutile concentrations in the White bay area has been known for over 60 years (9, p. 229). Snelgrove and Baird (10, p. 95), who obtain their information from unpublished field notes, mention that the concentrations are "associated with pegmatite dykes which penetrate garnetiferous mica schists, possibly of lower Paleozoic age, on the east side of" the bay. Several small deposits have been found; they "consist of ilmenite, rutile, and hematite and occur in quartz veins and in schists as well as in granitic pegmatites. The chief localities are near Pigeon Island and Partridge Point. No deposits of economic importance have yet been discovered." According to Betz (2, p. 19) the occurrences on Pigeon island, 3 miles north of Western arm, were prospected about 50 years ago.

**• *LABRADOR***

Large areas of Labrador are underlain by anorthosite and related basic rocks. On the recently published geological map of Canada (13), nearly two dozen such bodies are shown, the largest of which (the Harp Lake mass, centred about 80 miles southwest of Hopedale) covers an area of close to 5,000 square miles. Very little is known about these large masses of anorthosite, and it is quite possible that future exploration will reveal important deposits of ilmenite or titaniferous magnetite similar to those associated with the same rock in Quebec. Recent work in the Mealy Mountains anorthosite, south of Lake Melville, has already disclosed the presence of seven small titaniferous magnetite bodies having an approximate average grade of 12 per cent titanium oxide. Insufficient work has been done on these deposits to form any estimate of possible ore reserves (3, p. 5). The investigation is being conducted by Newfoundland and Labrador Corporation Limited.

The presence of ilmenite or titaniferous magnetite in the anorthosites of the Labrador peninsula has been known for many years. Among the first to record its occurrence was Low in 1895, who wrote (8, p. 287) as follows:

"Throughout the great anorthosite areas of the peninsula, ilmenite or titanic iron ore is always found in more or less abundance, varying from small grains to masses several tons in weight. The banks of the rivers passing through these areas usually have thick beds of black iron-sands scattered at intervals along them, these iron-sands being derived from the disintegration of the anorthosite rocks."

Ilmenite and magnetite have been reported from a number of localities along the Labrador coast. One of the most northerly occurrences is on the south side of Nachvak fiord where, to quote Christie (4, p. 15), "the garnetiferous gneisses are replaced by magnetite in an irregular zone about 1 foot wide." He mentions that a chemical analysis of the material by the Mines Branch, Ottawa, gave 30.66 per cent iron, 0.30 per cent titanium, 0.04 per cent manganese and 52.33 per cent insoluble.

About 200 miles farther south, in the Nain bay area, Douglas (6, p. 37) has noted the occurrence of "small patches of pyrite, pyrrhotite, ilmenite, and magnetite in the anorthosites" on the southern side of Hillsbury (Bennet) island, facing Strathcona run; and "a few lenses of ilmenite, with lesser amounts of magnetite and a few cubes of pyrites" in anorthosite on the shore of Nain bay southwest from Iceberg islet. "The largest lens measures 20 by 3 feet, and appears to be very shallow, possibly only 6 inches." In the Tessisoak lake area, west of Nain bay, ilmenite occurs "(a) as segregations in the massive anorthosite, and (b) as epigenetic veins in sheared zones in the anorthosite associated with pegmatites" (6, p. 38). Wheeler (12, p. 629), in an earlier report on the region, had mentioned the occurrence of an "exceptional" ultrabasic rock "composed of olivine with a large amount of ilmenite and a little apatite." He describes the rock, an ilmenite dunite, as forming "thin bands parallel to the general banding at Port Manvers", about 30 miles north of Nain (12, p. 637). The occurrence of "iron ore" in this area (the Port Manvers-Mount Thoresby area) had been mentioned, according to Coleman (5, p. 51), in the *Newfoundland and Labrador Pilot, 1907*.

Farther south are a number of other occurrences. These include: patches of sedimentary rocks, in granite, "cut by short gash veins of quartz and ilmenite up to 3 inches wide and 2 to 3 feet in length", on the north side of October harbour, in the Tuchialic-Kaipokok area (6, p. 29); disseminated magnetite and ilmenite in gneiss just below the falls on Eagle river, in the Sandwich bay area (6, p. 17); occasional grains of hematite, ilmenite and magnetite in the pegmatites which cut the schists and aplite sills of the main island of the Seal islands group, which lie to the east of Henley harbour (6, p. 10); and minor concentrations of magnetite and ilmenite associated with aplite and pegmatite dykes that cut the gneiss country rock in Carrol cove, which lies to the west of Red bay on the north side of the Strait of Belle Isle (6, p. 8).

## References


(1) **Baird, D. M.:** The magnetite and gypsum deposits of the Sheep Brook-Lookout Brook area; *Geol. Surv., Canada,* Bull. 27. (Contributions to the economic geology of western Newfoundland), 1954, pp. 20-41.

(2) **Betz, F., Jr.:** Geology and mineral deposits of southern White bay; *Geol. Surv., Newfoundland,* Bull. No. 24, 1948.

(3) **Buck, W. K.:** A survey of developments in the titanium industry during 1954; *Mines Br., Canada,* Minerals Res. Div., Mineral Res. Inform. Circ. M.R. 14, April 1955.

(4) **Christie, A. M.:** Geology of the northern coast of Labrador, from Grenfell sound to Port Manvers, Newfoundland (report and map); *Geol. Surv., Canada,* Paper 52-22, 1952.

(5) **Coleman, A. P.:** Northeastern part of Labrador, and New Quebec; *Geol. Surv., Canada,* Mem. 124, 1921.

(6) **Douglas, G. V.:** Notes on localities visited on the Labrador coast in 1946 and 1947; *Geol. Surv., Canada,* Paper 53-1, 1953.

(7) **Heyl, A. V., and Ronan, J. J.:** The iron deposits of Indian Head area; *Geol. Surv., Canada,* Bull. 27 (Contributions to the economic geology of western Newfoundland), 1954, pp. 42-62.

(8) **Low, A. P.:** Report on explorations in the Labrador peninsula along the East Main, Koksoak, Hamilton, Manicuagan and portions of other rivers in 1892-93-94-95; *Geol. Surv., Canada,* Ann. Rept. (New Series), vol. 8, pt. L, 1896.

(9) **Murray, A., and Howley, J. P.:** Reports of *Geological Survey of Newfoundland* from 1881 to 1909; St. John's, Nfld., 1918.

(10) **Snelgrove, A. K., and Baird, D. M.:** Mines and mineral resources of Newfoundland; *Geol. Surv., Newfoundland,* Inform. Circ. No. 4 (revised edition), 1953.

(11) **Walthier, T. N.:** Geology and mineral deposits of the area between Corner Brook and Stephenville, western Newfoundland; *Geol. Surv., Newfoundland,* Bull. No. 35, pt. 1, 1949.

(12) **Wheeler, E. P., 2nd.:** Anorthosite and associated rocks about Nain, Labrador; *J. Geol.,* vol. 50, 1942, pp. 611-642.

(13) Geological map of Canada; *Geol. Surv., Canada,* Map 1045A, 1955.

# INDEX

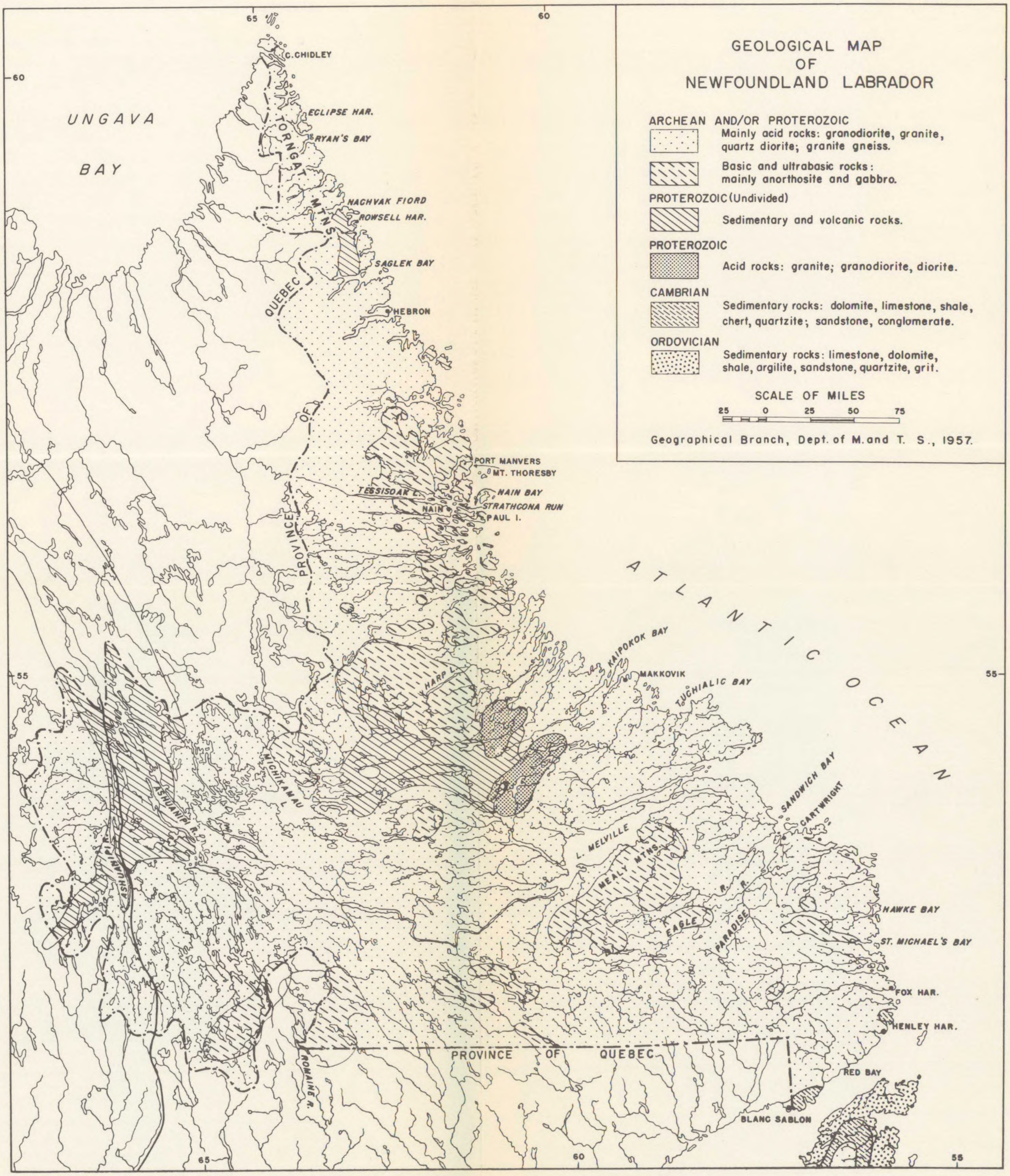
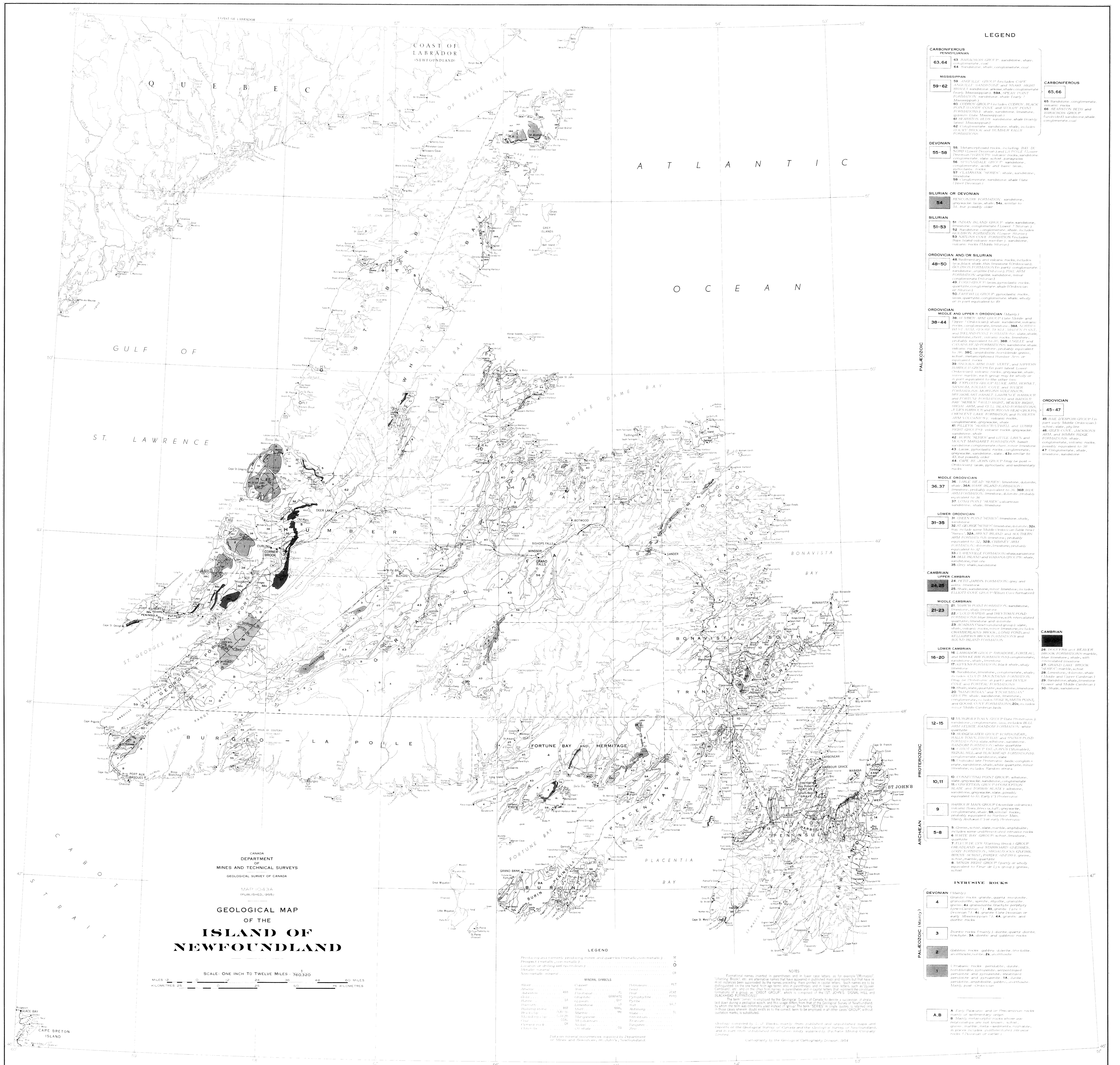



*Figure 2.* Geological map of Labrador.



COAST OF LABRADOR (NEWFOUNDLAND)
QUEBEC
STRAIT OF BELLE ISLE
ATLANTIC OCEAN
GULF OF ST. LAWRENCE
WHITE BAY
NOTRE DAME BAY
HUMBER
DEER LAKE
CORNER BROOK
GRAND FALLS
BISHOPS FALLS
WINDSOR
BOTWOOD
GANDER
BONAVISTA BAY
BONAVISTA
BONAVISTA SOUTH
TRINITY
ST GEORGES BAY
BURGEO - LA POILE
FORTUNE BAY AND HERMITAGE
FORTUNE BAY
PLACENTIA BAY
BURIN
GRAND BANK
ST JOHN'S
CABOT STRAIT
CAPE BRETON ISLAND
LEGEND
CARBONIFEROUS
DEVONIAN
SILURIAN OR DEVONIAN
SILURIAN
ORDOVICIAN AND/OR SILURIAN
ORDOVICIAN
MIDDLE ORDOVICIAN
LOWER ORDOVICIAN
CAMBRIAN
UPPER CAMBRIAN
MIDDLE CAMBRIAN
LOWER CAMBRIAN
PALAEOZOIC
PROTEROZOIC
ARCHEAN
INTRUSIVE ROCKS
NOTES
CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS
GEOLOGICAL SURVEY OF CANADA
MAP 1043A
(PUBLISHED, 1955)
GEOLOGICAL MAP
OF THE
ISLAND OF
NEWFOUNDLAND
SCALE: ONE INCH TO TWELVE MILES = 1/760,320
MILES 12 0 12 24 36 48 60 MILES
KILOMETRES 25 0 25 50 75 KILOMETRES

622(21(06) 855,c.1 C212

Canada, mines branch reports.

855, industrial minerals of Newfoundland, 1958, c. 1.

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1958