

# NEWFOUNDLAND



DEPARTMENT OF NATURAL RESOURCES

SIR JOHN HOPE SIMPSON, C.I.E., Commissioner

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GEOLOGICAL SECTION

A. K. SNELGROVE, Ph.D., Government Geologist

BULLETIN No. 2

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GEOLOGY OF GOLD DEPOSITS  
OF NEWFOUNDLAND

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A. K. SNELGROVE

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## Chapter I

### Introduction

This report is based on field work done in the summer of 1934 by the Geological Section. It forms the second of a series of bulletins on the mineral deposits of Newfoundland, the chief purpose of which is to supply precise information of a geological nature on the possibilities which the island offers for mining development.

As in the case of the chromite deposits of Newfoundland, which are described in Bulletin No. 1, so also this report deals with a mineral resource which has been of minor importance as regards production. At the present time, however, due to the enhanced price of gold, new interest is being manifested in investigating known gold prospects and in search for others.

The purposes of the present investigation by the Geological Section, consequently, are threefold: (1) To make a preliminary appraisal of gold mining possibilities in view of current prices of gold, which in many instances may make ore of what was hitherto rock; (2) To act in some measure as a guide to intelligent development of known deposits which may be economically available; and (3) To develop criteria of service to the prospector in and beyond the known regions of gold mineralization.

The first purpose has been served partially by the publication of an Information Circular on "Results of Sampling Newfoundland Gold Deposits."<sup>1</sup> The present bulletin supplements Information Circular No. 1, and is a geological contribution to the purposes mentioned.

The scope of this work is restricted to those deposits, occurring in the island of Newfoundland, whose sole or chief potential value is gold. (Fig. 1) No reference is made to Newfoundland Labrador,

the mineral deposits of which are still largely an unknown quantity and await systematic investigation.

The field observations were confined almost entirely to the surface of the areas examined. In those prospects which have been somewhat developed, underground workings were inaccessible for the most part at the time of examination. For this reason, and the reconnaissance character of much of the work, the prospecting criteria as described herein are to be regarded merely as tentative guides to ore until better ones present themselves.

This report presupposes the reader's familiarity with ordinary geological terms. No attempt has been made to describe the origin and mode of occurrence of gold ores in general.<sup>2</sup>

### History

The first reference to Newfoundland gold deposits in the literature is that by Murray in 1867.<sup>3</sup> The area referred to is Mings Bight, on the northeast coast, which was worked nearly forty years later.

In the last decade of the nineteenth century, auriferous antimony and arsenic ores were worked on a small scale at Mortons Harbour, northeast coast.

Gold mining, per se, began in 1903, when the Sops Arm mine, White Bay, began a short period of production, to be followed in the two succeeding years by the Goldenville mine at Mings Bight.

However, most of the gold production credited to Newfoundland was derived as a by-product from copper ores. The local copper mining industry, chiefly in Notre Dame Bay, northeast coast, flourished between 1870 and 1918.

Since 1932 several auriferous deposits have been discovered in Newfoundland, notably at Simms Ridge in Sops Arm,

1. Information Circular No. 1, Geological Section, Dept. of Natural Resources, 1934.

2. For information of these subjects, the reader is referred to "Gold Occurrences of Canada" (Price 20 cents), and "Prospecting in Canada" (Price 50 cents), both published by the Geological Survey of Canada, Ottawa.

3. "Mineral Resources of Newfoundland", Geol. Surv. of Nfld., Reports, p. 106 (1881); reprinted from Journal of the Society of Arts, October 11, 1867.

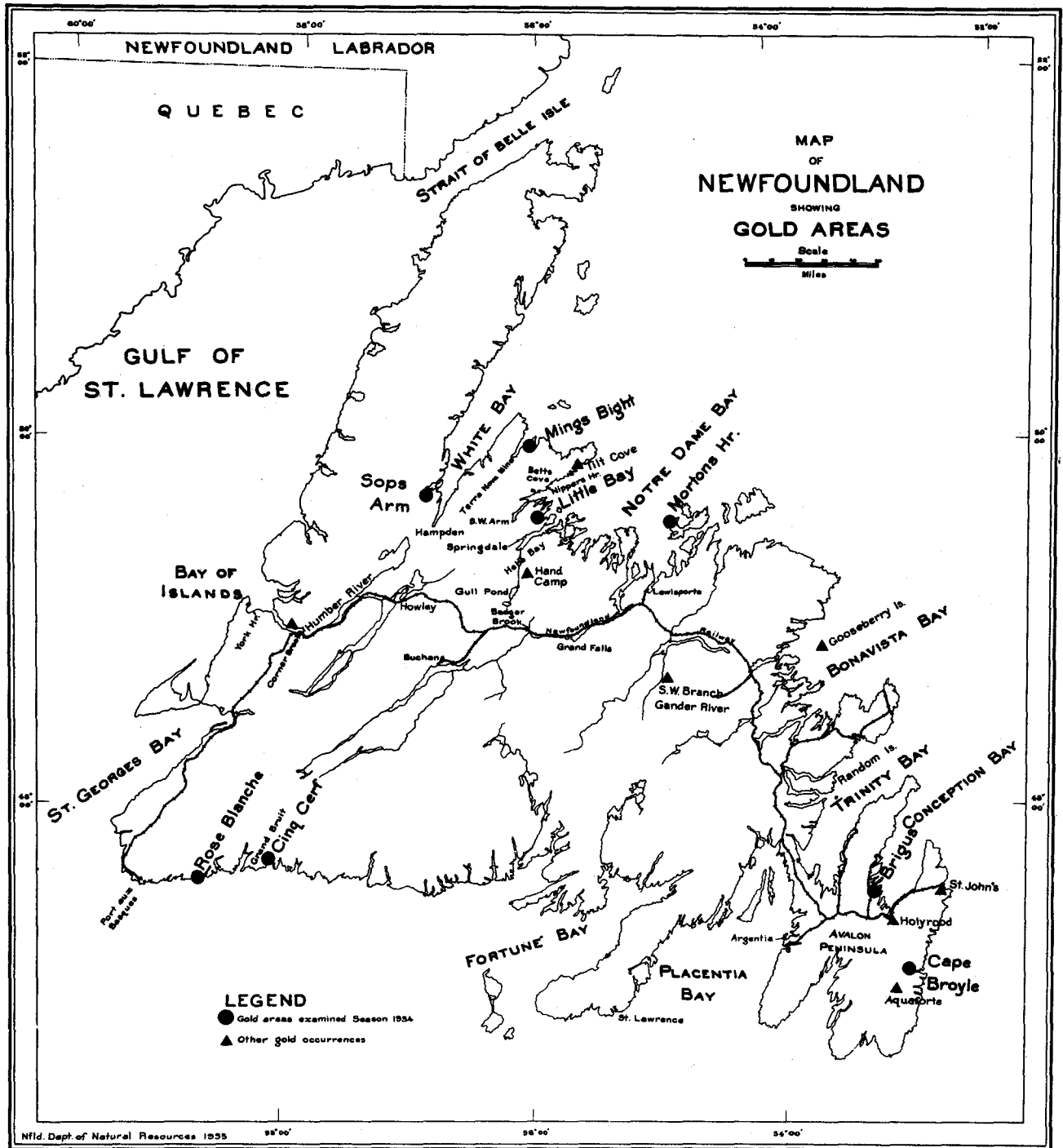


Fig. 1. Map of Newfoundland showing location of gold deposits

White Bay, and at Little Bay, Green Bay.

#### Production

Owing to inadequate and conflicting records, the total gold production of Newfoundland can be estimated only roughly.

The figures quoted in Table 1 are compiled from two main sources: (1) Reports of the Geological Survey of Newfoundland, 1864-1909, in which mineral statistics are based largely on Customs' returns, and (2) "The Mineral Industry", New York, yearly 1893 to date.

The gold content of copper produced at the Tilt Cove mine, Notre Dame Bay, averaged 2 ounces per ton of copper metal.<sup>1</sup> The copper of Terra Nova and York Harbour mines contained a like proportion of gold. It is improbable, however, that the gold content of these copper ores was detected or recovered previous to 1890.<sup>2</sup> On the assumption that all of the copper produced in Newfoundland averaged 2 ounces of gold per ton of copper metal, it may be computed that the total quantity of gold mined with the copper ores between 1861 and 1917 (but not necessarily recovered) approximated 163,647 ounces, valued at \$3,382.583. (with gold at \$20.67 per ounce).<sup>3</sup>

Mr. Henry Edwards, late of the Cape Copper Co., Ltd., estimates that during

the period his company operated Tilt Cove mine, Notre Dame Bay, over 50,000 ounces of gold were produced.<sup>4</sup>

#### Acknowledgments

The field work upon which this report is based was facilitated in many ways by the co-operation of claim holders and local residents of the areas investigated. Particular acknowledgment is made of courtesies received from Morton's Harbour Antimony Mining Co.; Mr. Thomas Hearn, Little Bay; Mr. Fred W. Chalmers, at Mings Bight; Mr. W. F. Hutchings, Manager, Professor G. V. Douglas, Consulting Geologist, and Mr. E. P. Sheppard, Field Engineer, of Sops Arm Mining Co. Ltd.; and Burgeo Mines, Ltd.

The writer was ably assisted in the field by Mr. C. K. Howse, Assistant Government Geologist. Mr. R. H. Pumpelly, Princeton '35, aided in the field and laboratory study of Rose Blanche and Cinq Cerf areas.

The Department of Geology of Princeton University generously placed at the writer's disposal its laboratory facilities, and also field data collected by numerous Princeton Geological Expeditions to Newfoundland, for purposes of comparison. Professors A. F. Buddington and E. Sampson kindly read and criticized the manuscript, and Dr. H. H. Hess contributed some of the optical data.

1. Geol. Surv. of Nfld., Reports, p. 407 (1918).

2. Op. cit., p. 226.

3. Based on copper statistics in "Summarized Data of Copper Production", Economic Paper 1, U. S. Bureau of Mines, Washington, D. C., 1928.

4. Private communication.



TABLE 1

GOLD PRODUCTION OF NEWFOUNDLAND  
(Chiefly as by-product of copper ores)

YEAR	Compiled from Geol. Surv. of Nfld. Reports		Compiled from "The Mineral Industry" N.Y.		REMARKS
	Ounces	Value	Ounces	Value	
1890					Gold content of \$1,200 worth antimony ore not reported. (Mortons Hr.)
1891		\$ 48,666.			Gold content of \$1,000 worth antimony ore not reported. (Mortons Hr.)
1896	3,000	62,010.	3,000	\$ 62,010.	
1897	3,000	62,010.	3,000	62,010.	Gold content of 125 tons arsenic ore not reported. (Mortons Hr.)
1898	2,783	57,525.	3,000#	62,010.	
1899	2,075#	42,890.	2,600	53,742.	
1900	2,400	49,608.	2,400	49,608.	
1901	2,180.5	43,609.	2,110	43,613.	
1902	4,000#	82,680.	4,000	82,680.	
1903	6,844#	141,471.	6,844	141,477.	Approximately 149 oz. from Sops Arm Gold Mine.
1904	6,242	124,623.	11	209.	11 oz. from Goldenville Gold Mine, Mings Bight.
1905			4,550	94,049.	
1906	147	2,800.	4,475	92,500.	147 oz. from Goldenville Gold Mine, Mings Bight. Gold content of 100 tons antimony ore not reported. (Mortons Hr.)
1907			4,315	89,191.	
1908			4,300#	88,881.	
1909			2,438#	50,330.	
1929	6,994#				From Buchans Zinc-Lead-Copper Ore.
1930	7,444#				Do.
1931	10,978#				Do.
1932	17,829#				Do.
1933	15,846#				Do.
1934	15,394#				Do.
TOTAL	107,156.5#		47,043#	\$972,310.	

#Estimated.

Production 1929-1933 compiled from "Milling Practice at Buchans Mine, Buchans, Newfoundland", Hellstrand, G. A., and George, P. W., A. I. M. E., Tech. Pub. No. 573, p. 15 (1934).

Production in 1934 based on 1934 annual returns and 1933 assay values.

## Chapter II

## GEOLOGICAL RELATIONS

Though the gold deposits of Newfoundland offer particular problems from the geological point of view, they will be shown in this chapter to constitute part of a larger Appalachian metallogenetic province which borders the eastern edge of the North American continent. The gold deposits of this mountain system have certain community of characters.

## THE APPALACHIAN GOLD BELT

Extending interruptedly from Nova Scotia to Alabama and genetically related to intrusive rocks of early Paleozoic age is a series of gold-quartz deposits to which the name "Appalachian Gold Belt" has been given. The auriferous deposits of Newfoundland may properly be considered as the most northeasterly extension of this belt. In order to compare the Newfoundland deposits with those of the mainland, the salient features of the Appalachian Gold Belt will be reviewed briefly.

United States<sup>1</sup>

Previous to 1850 the greater part of United States gold production was derived from placers and veins in the states of Virginia, Alabama, Georgia, and the Carolinas. Since their discovery, about 1800, the placer deposits have yielded gold estimated at \$30,000,000. Although the veins from which the placers were derived proved less productive, they have been worked profitably in places. Parsons estimates the aggregate gold production from these states between 1830 to 1934 at 2,541,000 oz.<sup>2</sup> Production from the south-

ern Appalachian states reached a minimum of \$7,000 in 1919.

The quartz occurs as lenticular fissure veins which lie parallel to the foliation of schistose crystalline rocks, granites, or quartz monzonites, intrusive into mica schists, clay slates, altered volcanic tuffs and amphibolites. Sharply defined veins cutting across the schistosity also occur. The quartz is massive, without banded or drusy structure. In addition, replacement deposits are found as irregular bodies of silicified and pyritic schist.

The principal gangue mineral is quartz, often glassy and semi-transparent, which may be accompanied by calcite, dolomite, apatite, chlorite, ilmenite, magnetite, tourmaline, albite, and sometimes zinc spinel and garnet. The ore minerals are free gold, pyrite, arsenopyrite, pyrrhotite, molybdenite, more rarely galena, sphalerite, chalcopyrite, and cassiterite. Enargite, and several tellurides are recorded, but are rare. The pyrite is always the oldest sulphide, and the gold fills minute fractures in it, or in the quartz.

Lindgren classifies most of the deposits as of the deep-seated type, but states that some were formed at intermediate temperature and pressure, and others seem to be related to pegmatite dikes.

The alteration of the wall rocks of the deposits shows considerable variations. The most intense action is shown by some quartz-tourmaline veins; the adjoining amphibolite is altered to garnet, tourmaline, and magnetite. In some of the veins the included amphibolite, as well as the adjacent wall rock, is altered to well-developed crystals of pale red garnet and

1. Mineral Deposits; Lindgren, W., 4th edition, pp. 660-662 (largely quoted).  
Gold fields on the southern Appalachians; Becker, G. F., 16th Ann. Rept., U. S. Geol. Surv., pt. 3, 1895.  
The Gold Resources of the World; International Geol. Cong., p. 398, 1929.  
Ore Deposits of the United States and Canada; Kemp, J. F., New York, 1906.
2. Parsons, A. B., Gold in the Land of Cotton, Mining and Metallurgy, Vol. 16, No. 342, p. 251, (1935).

a dark green mica. The garnets contain visible gold. In other veins a chestnut-brown biotite is the only mineral resulting from metasomatic alteration; in places both muscovite, in comparatively large foils, and biotite are present, sometimes with calcite or dolomite, besides more or less pyrite or pyrrhotite. Amphibolite is the most easily attacked of the various kinds of country rock. The alteration of granite is usually slight.

The replacement bodies are generally in the acidic schist derived from volcanic fragmental rocks; these are extensively silicified and contain also both sericite and biotite as products of alteration.

Nitze and Wilkens have described pyrophyllite which occurs in association with gold mineralization at the Brewer Mine, Chesterfield County, South Carolina.<sup>1</sup>

In the Southern Appalachian gold area the rocks have been deeply weathered. The name "sapolite" has been given to the clayey material composing the topmost oxidized zone which may extend 50 to 100 feet below the surface. According to Pardee, "The sapolite adjoining the gold-bearing lodes retains much of the gold that was released from the rock by weathering, and in addition it has generally been enriched by gold descending from higher layers that, in course of time, have been worn away."<sup>2</sup>

### Eastern Canada<sup>3</sup>

In southeastern Quebec, south of the St. Lawrence River, is the Canadian extension of the folded Appalachian Mountain System, but here no primary gold mineralization of importance has been discovered. In the Chaudière River area placer gold was mined in the latter half of last century, especially between 1875 and 1885. Approximately 13,500 ozs. were produced between 1877 and 1900.<sup>4</sup> The placers appear to have been derived from quartz veins in

the vicinity. Apparently some or many of the veins contain free gold, in some cases fairly coarse, but no vein large enough or rich enough to mine has so far been discovered.

The veins are of two general types: one, barren quartz veins, extremely numerous; the second type consists of quartz accompanied by some or all of the sulphides pyrite, marcasite, arsenopyrite, chalcopyrite, galena, and sphalerite. The second type of veins generally shows at least traces of gold.<sup>5</sup>

Nova Scotia lies to the east of the true Appalachian Mountain Province and geologically is related more closely to eastern Newfoundland than to any other part of the Atlantic border. Western Newfoundland, on the other hand, has many geological affinities with southeastern Quebec.

Gold was first discovered in Nova Scotia about seventy years ago. Between 1862 and 1933 the province produced 974,439 oz. of gold.<sup>6</sup> The total recorded production is less than half that of Ontario in 1931, alone.

In November 1934, six gold districts were producing, 14 were being developed and 16 were being prospected in Nova Scotia.<sup>7</sup>

The ores occur in quartz veins in the so-called "Gold-bearing series" of Nova Scotia, a monotonous succession of quartzites and slates, folded into long east-west anticlines and synclines. This series is of either Pre-Cambrian or Cambrian age; it is invaded by numerous large and small masses of granite of Devonian age.

The following description of the regional setting and the character of the Nova Scotia deposits is taken from Cooke and Johnston.<sup>8</sup>

"The Gold-bearing series is more than 30,000 feet thick, occupies that half of the province lying along the Atlantic coast, and extends the full length of Nova Scotia peninsula. The beds commonly dip

1. North Carolina Geol. Surv., Bull. 10, pp. 144-145, 1897.

Cf. also Shepard, C. U., On Lazulite, Pyrophyllite and Tetradymite in Georgia; Amer. Jour. Sci. and Arts., 2nd series, vol. 27, pp. 36-40, 1859.

2. Quoted by Parsons, *op. cit.*

3. Gold occurrences of Canada, Summary Account; Cooke, H. C., and Johnston, W. A.; Canada, Geol. Survey, Economic Geology Series No. 10, 1932.

Gold in Canada, Robinson, A. H. A., Canada, Dept. of Mines, Mines Branch, Publication No. 730, 1932. Gold Fields of Nova Scotia, Malcolm, W.; Geol. Surv. of Canada, Memoir 156, 1929.

4. Robinson, *op. cit.*, Table 38, p. 83.

5. Cooke and Johnston, *op. cit.*, p. 31.

6. Nova Scotia, Dept. Public Works and Mines, Ann. Rept. on Mines, 1933, p. 180.

7. Nova Scotia, Dept. of Public Works and Mines. Circular No. 10, 1934.

8. Cooke and Johnston, *op. cit.*, pp. 31-33.

at high angles, and the anticlines are more or less regularly spaced about 3 miles apart. Many of them are of great length; some have been traced for 100 miles. The anticlines plunge east and west at low angles, so as to form a series of domes, the crests of which may be 10 to 25 miles apart on any one anticline. Towards the west end of the province the folds become broader and less tightly compressed than in the eastern part, a change that has seriously affected gold deposition.

"Fairly important amounts of gold have been produced from more than a score of fields, and of these all but four or five occur in the eastern part of the province, east of the great granite mass which comes down to the Atlantic coast at Halifax. The others are fairly closely grouped, in the northeastern part of Queens and the adjoining part of Lunenburg counties. No deposits of importance have been found in the western fifth of the province.

"The gold occurs in quartz veins, most of which lie in thin slate beds between bands of quartzite. The veins are found near the crests of plunging anticlines, and in many instances pass completely across a crest from one limb to the other. Because of their habit of thus straddling the anticlines, they are termed saddle veins. In some anticlines a whole series of parallel saddles is developed, many of which, mining operation have shown, do not come to the surface. Many veins appear to have been formed before the folding processes were completed, because the vein matter is wrinkled and thickened at the noses of the anticlines, as if dragged between the quartzite walls. The corrugations in many cases are quite large and are then known as barrels.

"As a general rule the veins are limited to those parts of an anticline or dome in which the strata have a pronounced curvature. Thus little or no vein material is found on the flanks, where the beds maintain a uniform dip in depth, or at the summits of anticlines that have broad, flat tops. This is the reason that veins are few and poor in the western part of the province, where folds are broad and open. The best veins are found at the crests of fairly sharp folds, in which the two limbs enclose an angle of 45 degrees or less. In

such anticlines the veins form saddles, curving around the crests and extending down the limbs until the strata cease to bend. In short domes, veins may run completely round the dome. In broad anticlines, there may be no quartz at the crest, but some may be developed at a distance from the axis, where the beds bend from their nearly horizontal position on the axis to the normal steep dip of the limbs. In some districts vein formation is closely connected with subordinate flexures on the limbs of a fold. In others the anticlinal axis itself is curved or bent, and where this occurs veins are more numerous on the convex side.

"All these facts indicate an intimate connection between folding and vein formation. The accepted theory is that the slipping of one bed over another during folding produced opening along the bedding planes, which were widest where curvature was sharpest. As the slipping was concentrated in the beds of easily deformed slate, the openings were formed in the slate. Into these openings the vein matter was introduced by solutions.

"The principal gangue mineral is quartz, but calcite and sulphides occur locally, usually in subordinate amount. Pyrite and arsenopyrite are the principal sulphides, but galena, sphalerite, pyrrhotite, and chalcopyrite are also found. Auriferous stibnite is mined at West Gore, chiefly for the antimony. In some instances the sulphides are distributed more or less evenly throughout the quartz, but more generally they are concentrated along the walls and in the wall-rock for a few inches from the vein. Films and fragments of the slate walls form a minor part of the vein matter. The chief constituent of economic value is native gold, much of which is very coarse; but some gold is intimately combined with the sulphides, from which it cannot be separated by amalgamation.

"For the most part the veins rarely exceed 2 feet in width, and many that have been worked are less than 1 foot. In places, however, especially where a vein has been thickened by corrugation near the apex of a fold, the width greatly exceeds this figure. The quartz in many of the narrow veins was very rich, carrying \$50 to \$60 in gold a ton. The common method

of mining has been to stope just the width of the vein as far as economically possible, then to blow down the wall to a working width, leaving the waste in the stope.

"Some of the wider beds of slate carry several quartz veins, which may be so small that they cannot profitably be separated from the slate. Such belts', as they are locally termed, attain widths of 10 to 20 feet. Some of them are sufficiently rich to be worked as a whole and furnish large bodies of low-grade ore."

Malcolm<sup>1</sup> notes that the "Gold is very commonly associated with arsenopyrite, and almost invariably with galena."

#### Newfoundland

The gold quartz deposits of Newfoundland occur in a variety of geological associations, and are genetically related to intrusives ranging in composition from diorite to granite. The age of the intrusions is in most cases not definitely known; the presumption is strong, however, that they are of either Caledonian (at the end of the Silurian period) or Acadian age (at the end of the Devonian period). The gold deposits of the Avalon peninsula, southeastern Newfoundland, are more probably of Pre-Cambrian age.

The country rocks of the auriferous quartz veins are commonly lavas or pyroclastics of andesitic composition, but the veins also occur in slates and quartzites, quartz porphyry and granite porphyry, rhyolite and diabase, chert and pyrophyllite schist. The auriferous veins and replacements possess the characteristics of deposits formed at high to intermediate temperatures.

In Table 2 are summarized the types of wall-rock alteration, hydrothermal mineral sequences, and supergene mineralization encountered in the Newfoundland deposits.

While most of the auriferous deposits of the Appalachian Gold Belt are roughly contemporaneous geologically, and were formed in the same general temperature ranges, the relations as described above permit noteworthy distinctions to be made.

The Canadian and Newfoundland deposits have suffered continental glaciation; secondary enrichment is consequently of negligible importance as a rule, in contrast with those of the Southern Appalachians. The type of structural control of ore deposition, exemplified by the Nova Scotian deposits, is of little importance elsewhere in the whole belt. Mineralogically, many of the Newfoundland deposits are akin to those of Nova Scotia, insofar as the commonly associated sulphides are concerned, but coarse native gold is extremely rare in the Newfoundland veins. The auriferous antimony deposit of West Gore, Nova Scotia, is partly analogous to the Little Harbor vein at Mortons Harbor, Newfoundland.

A further noteworthy resemblance is found in the seldom-recorded type of pyrophyllite alteration as at Cinq Cerf and Sops Arm, Newfoundland, and that described by Nitze and Wilken<sup>2</sup> at the Brewer Mine, Chesterfield Co., South Carolina. It is of interest also that copper sulpharsenides occur in this association at both the Brewer Mine and Cinq Cerf.

1. Cooke and Johnston, op. cit., p. 44.

2. Op. cit.





## Chapter III

All gold occurrences in the island of Newfoundland which are known to the Geological Section are described in the following pages. The areas in which field work has been done in connection with the present investigation are listed alphabetically and described in some detail; under "Miscellaneous Occurrences" will be found a brief account of other areas in which gold has been reported, but of which less is known.

## DESCRIPTION OF GOLD AREAS

## (1) BRIGUS

Location

Brigus is situated in Conception Bay, Avalon Peninsula, southeastern Newfoundland.

In 1880, native gold was discovered in this vicinity. It is the subject of a special report by Murray.<sup>1</sup> No production of gold resulted from these discoveries.

Geology

The Pre-Cambrian slates of Brigus, in which auriferous quartz veins were found, are referred by Murray to division "C" of his "Intermediate system", supposed to be the equivalent of the Huronian of Canada. A detailed plan of the area is included as a frontispiece in the collected reports of the Geological Survey of Newfoundland, published in 1918.

Murray noted the similarity of the slates of his division "C" to the gold-bearing series of Nova Scotia and showed that the local auriferous series was overlain unconformably by the "Primordial group" (Cambrian).

No intrusive rocks have been recorded in the Brigus area.

Character of Deposits

As described by Murray "A rough and hummocky belt of country from three-quarters to one mile wide, which forms the nucleus of the peninsula between Bay de Grave and Brigus Harbour, is thickly intersected by reticulating quartz veins, varying in thickness from less than an inch to upwards of a foot, which often appear to ramify from a central boss or great mass of quartz, often extending over many square yards, and usually forming low, isolated hummocks or hills. The general run of the belt is as nearly as possible northeast and southwest from the true meridian, having been traced in a southwest direction from Brigus Lookout as far as Fox Hill, and as I am informed, can be traced for several miles more in the same direction. Thus, although many of the veins, both small and large, may be seen for considerable distances to run exactly parallel with the bedding, the network of the whole mass runs obliquely to the strike of the beds, which are also minutely intersected by the smaller veins crossing and reticulating in all directions.

"Chlorite is profusely disseminated through the quartz veins, filling up cracks and drusy cavities; and it was observed that the visible gold was always in or near a patch of chlorite." Murray also noted, in some specimens, the presence of small cubes of galena and minute cubes of pyrite.

Howley, who visited the area in 1881, failed to discover any visible gold, but observed pinkish barite and also chalcopyrite in some of the quartz veins.<sup>2</sup> The veins rarely carry small amounts of carbonate.

\* \* \* \* \*

1. Geol. Survey of Nfld., Reports, pp. 532-536 (1881).

2. Op. cit., pp. 18-19 (1918).

Assays

Six samples were taken during the present cursory examination of this area, within a radius of one and a half miles from Brigus Harbour, at places referred to by Murray as auriferous. All yielded negative results on assay.<sup>1</sup>

## (2) CAPE BROYLE

Location

Cape Broyle Harbour is situated on the Avalon Peninsula, southeastern Newfoundland, and is 30 miles south of St. John's.

At Red Ridge, four and a third miles northwest (magnetic) from Cape Broyle Harbour, a prospect pit was sunk by Messrs. Oxley and McColloch about the beginning of the present century on a quartz vein in which gold values were reported. The pit is said to have been 19 feet deep but is now partly filled with debris. No further work was done on this prospect. The area was examined cursorily in connection with the present investigation.

Geology

This prospect lies in the Pre-Cambrian terrain of southeastern Newfoundland. The country rocks in the vicinity of the prospect consist of pyroclastics and amygdaloidal flows, which strike approximately north-south (true) and dip steeply west. Less than half a mile west of the prospect this volcanic series is intruded by granite porphyry.

The area is heavily covered with glacial drift.

Character of Deposit

The deposit is a vein of milky and partly drusy quartz which fills an arcuate fissure in lava and terminates abruptly at the contact of the lava with overlying tuff. It is exposed over a distance of one hundred feet and shows a variation of 40 degrees in strike, the dip ranging from 40 to 60 degrees westward.

The vein is rather evenly mineralized with finely disseminated chalcopyrite and galena; pyrite is comparatively rare.

Assays

Assay results on four samples from the vein and dump are given in Information Circular No. 1 of this Department (December, 1934). A 1-foot channel sample taken in the shaft yielded a minute trace of gold and 3 ozs., 5 dwts., 8 grains of silver per long ton.

Prospecting Criteria

Although the Avalon Peninsula is the most populous region in Newfoundland, the interior has been only slightly prospected for minerals. Bedrock is obscured in many places by glacial drift. The country rocks bordering the granite intrusions of the peninsula appear to warrant close search for auriferous quartz veins.

## (3) CINQ CERF

Location

The mineral deposits of the Cinq Cerf area lie east and west of the lower stretches of Cinq Cerf River (latitude 47° 42' N, longitude 58° 8' W). Cinq Cerf is uninhabited; the nearest settlement and port of call for the coastal steamship service from Port aux Basques (western terminus of the Newfoundland Railway, 45 miles to the west) is Grand Bruit, located 4 miles west of the mouth of Cinq Cerf River.

The Chetwynd fee simple claim, the approximate location of which is shown in Fig. 2, contains the principal deposit of the area. Other prospects, chief among which are Woodmans Droke and Hope Brook, lie west and east of the Chetwynd claim.

History<sup>2</sup>

The mineralization on what is now known as the Chetwynd claim was discovered about 1902 by John and Samuel Billiard of Grand Bruit. Samples were taken to John P. Chetwynd, who was then in business at Grand Bruit, and Mr. Chetwynd took out a mining claim. The three shafts on the claim were sunk between 1903 and 1905 by Messrs. Kenyon, Devereux, Brown, and Furlong, who represented New York interests. About the same time a Newfoundland

1. Except where otherwise mentioned, all assays in this report were made by J. F. Newman, F. C. S., Assistant Government Analyst.
2. Many details of the local history were kindly supplied by Messrs. Gordon and James Miles of Grand Bruit. The only published references on the mining history of this area are in Geol. Surv. of Nfld., Reports, pp. 521, 559, 565 (1918).



prospector, named Barnes, dug three pits on the Woodmans Droke prospect at the northwest corner of the map area (Fig. 2).

Work in the area was suspended shortly after 1905. Several attempts have since been made to re-open the Chetwynd property, the latest dating from 1930 when A. L. Reading of Toronto, representing Canadian interests, made an open cut across the main mineralized zone, immediately east of the main shaft. In 1933, Mr. Reading's associates formed the Burgeo Mines, Limited: this company received a concession from the Newfoundland Government, granting exclusive right to prospect and stake claims in a large surrounding area, on condition that certain sums of money were to be spent on prospecting or mining. Burgeo Mines, Ltd. brought in machinery, pumped out and examined the main shaft, trenched near-by outcrops and erected a cabin, but their concession was revoked because of non-performance of conditions. The property was idle at the time of this examination (September, 1934).

#### Geology

That part of Cinq Cerf River and estuary included in Fig. 2 flows in a gentle valley with a gradient of 17 feet per mile. The river banks are fringed with a small growth of spruce; the valley floor is marsh covered. To the north of the river are parallel foothills of conglomerate and granite, capped by a barren range of quartz porphyry which rises more than 700 feet above sea level. The south slopes of the valley rise more gradually to the low coastal hills of granite.

The occurrence of well-preserved glacial striae in the river bed and on the foothills, varying only slightly from a magnetic west direction, indicates that Cinq Cerf River valley owes its origin partly to glacial erosion. The drainage is well adjusted to belts of less resistant rocks; where Cinq Cerf River traverses the hard conglomerate and quartz porphyry, waterfalls up to 30 feet high are found with excellent examples of pot holes.

On the Chetwynd claim near the main shaft and also near the mouth of Hope Brook are exposures up to 20 feet above summer river level, of water worn cobbles cemented by limonite; these are evidently remnants of a river terrace.

Below the Chetwynd claim, Cinq

Cerf River contains many islands and bars of sand.

The bedrock geology, as shown in plan and section in Fig. 2, reveals the close relation of the physical features of the area to the distribution and structure of the underlying rocks. The Cinq Cerf district flanks a large granite mass which lies along the sea coast; this granite, together with large sills of granite porphyry and quartz porphyry, appears to be intrusive into a series of dominantly sedimentary, but partly volcanic, rocks which now dip 60 degrees south and strike approximately east-west (true), and are all more or less schistose.

The sedimentary series has not yet been studied in detail. The most common member is a schistose grit or sandy tuff consisting of angular quartz and feldspar clasts in a matrix which is altered to sericite and chlorite but appears to be at least partly of volcanic origin. This clastic rock is in many places poorly bedded, and where highly schistose resembles closely the sheared quartz porphyry and granite porphyry of this area; in thin section, absence of embayment of quartz by the ground mass was used as a criterion in distinguishing schistose grit from the altered intrusive rocks, although this was not always practicable. Typically light weathering, the grit is locally green and more pronouncedly volcanic.

This grit grades into a quartz conglomerate with rounded white quartz clasts several inches in diameter. A further increase in coarseness gives rise to an unusual conglomerate, with rounded and squeezed lenticular cobbles of granite and related acidic porphyries up to 30 inches across and averaging half that size; one thick and persistent bed of this coarse conglomerate is represented on the accompanying map.

Finer-grained members of the clastic series comprise finely bedded grey-wacke and slate which are of limited distribution. Also included is chlorite schist which is more common south of Cinq Cerf River and south of Woodmans Droke; this rock appears to be an altered basic tuff but may have been derived, in part, from lava.

The clastic series as a whole shows evidence of dynamic metamorphism in the squeezed clasts and the development of

foliation. In thin section, the quartz clasts typically exhibit undulatory extinction. In the vicinity of the granite of the coastal hills, the grits are quartzitic.

The intrusive rocks of the area are acidic in composition. The granite of the coastal hills is holocrystalline and, where examined, is chloritized and epidotized. Quartz porphyry, which occurs as large and small sills, is usually flinty in appearance and contains relatively few phenocrysts of quartz and orthoclase in a siliceous matrix. Where the large sill composing the high hill at the north of the map area descends gradually to the level of Cinq Cerf Brook, the quartz porphyry is gritty in appearance, probably due to partial assimilation of the country rock. The small sills at the southwest of the map area are more chloritized. In thin section, the quartz porphyry is seen to contain quartz and orthoclase phenocrysts in about equal quantity. Some microcline and albite are also present. Both feldspars and ground mass are partly sericitized; some of the quartz phenocrysts are granulated.

The fresh granite porphyry is brick red in color, but on sericitization and silicification, especially near sulphide mineralization, assumes a waxy appearance, resembling the quartz porphyry. As a rule, however, the granite porphyry is readily identified by its relatively abundant phenocrysts of orthoclase and quartz. Rarely the phenocrysts attain a length of one inch. Orthoclase is the predominating feldspar; a little albite is present. The quartz phenocrysts usually show undulatory extinction and are embayed by the fine-grained matrix. Accessory minerals include, biotite, muscovite, titanite, and magnetite. Chlorite, zoisite, and carbonate are secondary products. In the groundmass are spherulitic structures and graphic intergrowths of quartz and feldspar. This rock locally contains chloritized inclusions of the clastic series.

On the accompanying map the zone along Cinq Cerf River in which ore occurs is denoted as sericite and pyrophyllite schist. Because of the highly altered character of this schist, the determination of its origin is problematical; the presumption is strong, however, that it is an alteration product of one of the acidic

porphyries rather than a replacement of a sericitic member of the clastic series. In sheared areas within the southernmost granite porphyry sill, a similar sericite schist is found and veinlets of radial pyrophyllite also occur.

An analysis of relatively pure pyrophyllite schist from Cinq Cerf River near the Chetwynd main shaft follows:

Pyrophyllite Schist\* (290-132)

SiO <sub>2</sub> .....	57.30%
Al <sub>2</sub> O <sub>3</sub> .....	33.33%
Fe <sub>2</sub> O <sub>3</sub> .....	0.17%
MgO .....	0.26%
CaO .....	2.00%
H <sub>2</sub> O <sup>+</sup> .....	5.32%
H <sub>2</sub> O <sup>-</sup> .....	0.30%

\*J. F. Newman, Analyst

The geological age of the rocks of the Cinq Cerf area is unknown.

CHETWYND CLAIM

Character of Deposits

The main mineralized zone in this claim is exposed along the south bank of Cinq Cerf Brook (Fig. 2) about two and one-half miles above its mouth. An open cut east of the main shaft affords a good cross section. The width of the zone is here nearly forty feet, and dips steeply southward. The zone consists chiefly of soft, waxy, light gray pyrophyllite schist interspersed with a dense siliceous rock both of which contain disseminations and veinlets of pyrite and bornite, etc. Immediately west of the main shaft, the hanging wall of chlorite schist is exposed. This main mineralized zone is exposed for a length of over 500 feet east of the open cut, and also extends for a greater distance west along the bank of the river.

In the middle of Cinq Cerf River several hundred feet east of the main shaft is a small island which is composed of quartz mineralized with pyrite and some native gold. The width of this quartz has not been determined; it appears to parallel the mineralized zone on the south bank.

Four hundred feet southeast of the main shaft is a mineralized area known as the "Iron Hat", also approximately parallel

to the main zone. On the east end of this outcrop a coarse quartz vein is mineralized with specularite, chlorite, and a little tourmaline. On the west end of the outcrop the granite porphyry country rock is schistose and impregnated with pyrite.

#### Mineralogy

This area has proven to be of extraordinary mineralogical interest. The original country rock of the main ore zone is assumed to have been an acidic intrusive, probably granite porphyry or quartz porphyry, but pyrophyllitization and silicification have completely obscured the original textures. The pyrophyllite schist contains some sericite and also small grains of a mineral tentatively determined as either topaz or andalusite. The "Iron Hat" outcrop represents the highest temperature (perhaps pneumatolytic) phase of the ore mineral sequence. The quartz is coarsely crystalline, milky-white to glassy and drusy. It contains aggregates of flaky specularite, which is associated with chlorite and some tourmaline. Pyrite of the hydrothermal stage is often found surrounding small grains of a hard mineral which in part exhibits skeletal habit, is gray in color, anisotropic, negative to the usual etch reagents and gives yellow to dark brown internal reflections. It was suspected that this mineral might be cassiterite but spectroscopic and chemical analyses fail to show the presence of tin; it now appears to be a titanium mineral. Following pyrite, and stated in their order of deposition, are chalcopyrite (very little), tetrahedrite, bornite, luzonite ( $3\text{Cu}_2\text{S}\cdot\text{As}_2\text{S}_5$ ), native gold (observed only in polished sections from the island in Cinq Cerf River), fluorite, barite, and byrophyllite. A second generation of pyrite, tetrahedrite, and bornite occurs in druses and fissures along with the light green radial pyrophyllite, purple fluorite of cubic habit, and fine tabular barite which are found only in cavities. Supergene minerals comprise chalcocite, covellite, malachite, and limonite.

Native gold was observed only in specimens from the island in Cinq Cerf River, where the sulpho-compounds are absent. Its position in the sequence, therefore, is not definitely established. It occurs as fine grains in fractured quartz. The rare mineral luzonite, a pink variety of enargite,

is seen only under the microscope as fairly large grains in bornite.

#### Development

The underground workings were not entered during this examination.

The main shaft (Fig. 3) is understood to attain a depth of between 90 and 100 feet. At a depth of between 33 and 50 feet a cross-cut has been driven south for 45 feet.

Below the entrance of this cross-cut, the shaft is no longer vertical but is inclined southward. Near the bottom of the shaft is a second cross-cut driven north for about 40 feet. It is improbable that the north cross-cut is sufficiently long to intersect the quartz zone which outcrops in Cinq Cerf River.

Two shallow shafts have been sunk on the main mineralized zone 500 feet east of the main shaft; their depth is said to be between 25 and 35 feet.

Trenching has been done on the west end of the "Iron Hat" outcrop, 400 feet southeast of the main shaft.

There is no recorded production from the Chetwynd claim, and it is understood that samples only have been shipped.

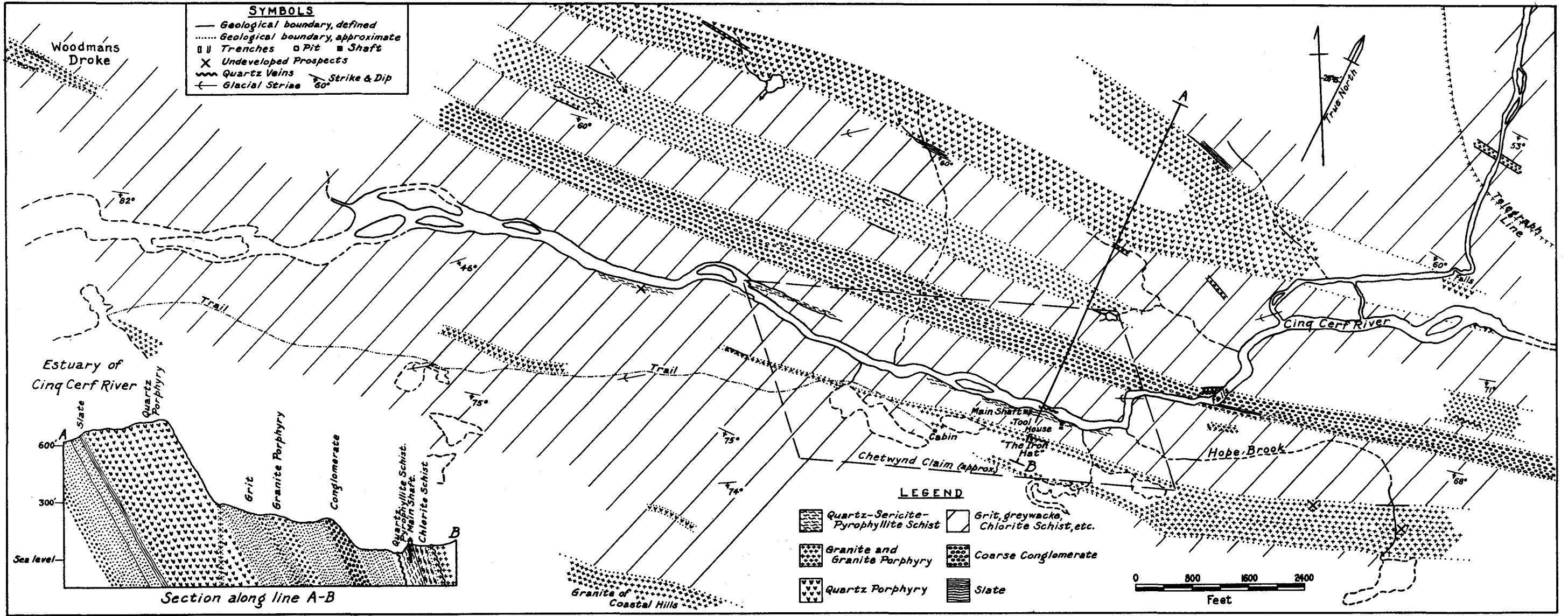
#### Assays

Assay results on a series of eight channel samples taken from the open cut immediately east of the main shaft are given in Information Circular No. 1 of this department. The greatest values over a 5-foot section were 2 dwts. 14.72 grs. of gold per long ton, and the highest copper content in a 5-foot section 1.09%. It should be pointed out, however, that this outcrop is weathered and that at least copper has been leached out. Local miners who worked in the main shaft state that lenses of bornite and other sulphides, several feet in thickness, were encountered near the bottom of the workings.

A grab sample of pyritized porphyry from a trench west of the "Iron Hat" revealed no gold on assay. A selected sample from the dump of the more northerly of the shallow shafts contained half a pennyweight of gold per long ton.

A grab sample of quartz containing pyrite from the island in Cinq Cerf Brook contained 16.128 grains of gold per long ton (Ledoux and Co., Inc., New York, analysts).





Nfld. Dept. of Natural Resources, 1935

RECONNAISSANCE GEOLOGICAL PLAN AND SECTION  
CINQ CERF AREA

FIG. 2



Fig. 3. Main Shaft, Chetwynd Claim, Cinq Cerf River, looking east

A panned concentrate of sulphides from the open cut east of the main shaft after drying, yielded arsenic 0.36%, and silver 6.384 oz. per long ton (Ledoux and Co., Inc., analysts).

A sample from the Hope Brook prospect was analyzed for tin with negative results (Ledoux and Co., Inc., analysts); also one from the open cut east of the main shaft contained no tin but yielded 0.46% titanium dioxide (A. Willman, analyst; University of Minnesota Laboratory for Rock Analysis).

#### HOPE BROOK PROSPECT

##### Character of Deposit

Near the southeast corner of the map area (Fig. 2) Hope Brook flows at right angles across a sill of granite porphyry, in which it forms a shallow but steep canyon. North and south of this sill are conformable, chloritic grits. The porphyry is fractured and silicified, and contains disseminations and veinlets of pyrite over the greater part of its width. The pyrite is finely crystalline; its deposition has been controlled by fractures in the porphyry. In part, the pyrite occurs in quartz veinlets.

In this area, the unidentified titanium mineral noted in the main miner-

alized zone of the Chetwynd claim is also uniformly disseminated. Accessory minerals at Hope Brook are rare; they include specularite and magnetite. Barren quartz veinlets transect the earlier hydrothermal mineralization.

##### Assays

Three grab samples, taken along the Hope Brook Canyon, yielded, on assay, no more than a minute trace of gold.

#### WOODMANS DROKE PROSPECT

##### Character of Deposit

Woodmans Droke is at the northwest corner of the map area. Three shallow prospect pits were sunk about thirty years ago, each on flat-lying quartz veins which occur in a small intrusion of granite porphyry into conglomerate. The veins are localized along joint planes in the porphyry. The most southerly of the quartz veins is the largest, being about five feet thick, and contains shoots of sulphide mineralization up to several feet square on the surface, and probably half a foot in thickness. The area is now partly overgrown with brush. It appears that all three veins are discontinuous since they are flat-lying and occur at different elevations. The mineralization of the veins is essentially similar.



Mineralogy

The quartz is coarsely crystalline, milky white and fractured. Well developed druses contain euhedral quartz crystals.

Sulphides are found as massive bunches and veinlets in the fractured quartz. The ore minerals consist of pyrite, sphalerite, chalcopyrite, galena (containing small oval-shaped bodies of dyscrasite-- $\text{Ag}_3\text{Sb}$ ), cuprite, anglesite, and limonite. The last three named are of supergene origin. Inclusions of granite porphyry wall rock in the veins are silicified and sericitized.

Assays

Selected samples of sulphide-bearing quartz were assayed, the best results being 1 dwt., 7.36 grs. of gold and 1 oz., 1 dwt., 1.76 grs. of silver, each per long ton.

## OTHER PROSPECTS

Twelve hundred feet west of the Hope Brook prospect is a mineralized zone consisting of disseminated pyrite over a width of nearly twelve feet in granite porphyry. A grab sample from this deposit gave no gold on assay.

On the south bank of Cinq Cerf River, at a point about one mile west of the Chetwynd main shaft, sericite and chlorite schists, striking parallel to the river and dipping 70 degrees south, are pyritized over thicknesses up to 20 feet. A grab sample of this mineralization, on assay, showed a minute trace of gold and no silver.

Above the falls where Cinq Cerf River crosses a wide band of conglomerate, as shown on the accompanying map, is a slightly rusty quartz vein three to five feet in thickness. Nearly three-quarters of a mile to the east of the falls, granite porphyry is replaced over an outcrop width of about sixty feet by milky quartz. Neither of these veins is known to contain any mineralization.

Prospecting Criteria

The mineral deposits of the Cinq Cerf area are notably aligned along a direction varying only slightly from east-west (true bearing). This peculiarity of distribution is due to fracturing which

has occurred along this direction, and has caused a permeable zone in which hydrothermal solutions arising from an acidic magma have deposited the ore minerals. For the greater part of its length in the map area, this fracture zone dips steeply southward; at Woodmans Droke nearly horizontal fractures, filled by quartz, may have had their origin in the same stresses.

(Intense hydrothermal alteration of the fracture zone to pyrophyllite and sericite schist, together with silicification, provides a broad guide to the prospector in searching for ore. The relations of gold to other ore minerals within such zones of alteration is not yet clear; most of the simple pyrite-quartz mineralization, however, is not auriferous.

Although the sands occurring in the lower stretches of Cinq Cerf River were not panned in connection with this examination, the fact that the course of the river is immediately parallel to the main zone of mineralization in the Chetwynd claim, and traverses the auriferous quartz of the island near Chetwynd main shaft, warrants an investigation of the sands for possible placer deposits.

## (4) LITTLE BAY AND VICINITY

Location

The town of Little Bay is located at the head of Indian Bight, in Green Bay, on the west side of Notre Dame Bay, northeast coast of Newfoundland (latitude  $49^{\circ} 36' \text{ N}$ , longitude  $55^{\circ} 57' \text{ W}$ ).

At the south side of Indian Bight is the idle Little Bay Copper Mine. The Hearn gold prospect lies immediately north of the town (Fig. 4).

Little Bay is a port of call for the coastal steamship service from Lewisporte railway terminus. The town may also be reached from Badger Brook Station on the Newfoundland Railway by way of Badger motor road to South Brook, Halls Bay, ferryboat to Springdale, and motor road from Springdale to Little Bay, a total distance of approximately 50 miles from Badger Brook.

History

Little Bay was uninhabited until 1877, when the copper deposit on the south side of Indian Bight was discovered. The copper mine closed down in 1891. Since that time several attempts were made to





Fig. 4. Sketch Plan showing location of Hearn Gold Prospect, Little Bay, Green Bay

reopen the property and a programme of diamond drilling was carried out in 1922.

In 1932, Thomas Armstrong, a little Bay prospector, in following up copper carbonate float noted by Thomas Hearn, discovered the gold-bearing mineralization on the north side of Indian Bight which is now covered by the Hearn mining claims. This discovery led to the present exploration.

#### Geology

The Little Bay area is underlain by lavas of andesitic and basaltic composition which in general are more or less chloritized. Along numerous and extensive zones striking east-west (magnetic) and dipping at high angles the lavas have been metamorphosed to chlorite schist. This rock is locally known by the Cornish term "killas." In the less altered phases, pillow, variolitic and amygdaloidal structures are common. Epidotization, locally pronounced, is less widespread. Although their exact stratigraphic horizon is as yet unknown, these lavas are probably of Ordovician age, in common with those of other parts of Notre Dame Bay.

Intrusive into the lavas are dikes of diorite and basalt, generally less than

50 feet in thickness and striking east-west (magnetic).

The copper deposits of the old Little Bay mine are of the pyritic copper replacement type in chlorite schist, in part associated with quartz veins and lenses, containing chalcopyrite and pyrite. These ores are thought to be related genetically to diorite intrusives. On the shores of South West Arm of Green Bay, seven miles northwest of Little Bay, is exposed a granite batholith of which the Burtons Pond granite porphyry and quartz porphyry (of Middle to late Devonian ? age) of the Betts Cove-Tilt Cove mines region is a part.<sup>1</sup>

Little Bay lies in a low, flat valley surrounded by east-west trending ridges rising to 660 feet but averaging less than half that height. Most of the ridges are covered by a thick growth of scrub spruce but large areas are bare. The south slope of the ridge which borders the north shore of Indian Bight is talusstrewn and barren of vegetation. (Fig. 5.)

The town of Little Bay is built on three well-defined post-glacial terraces, 1) Nearest Indian Bight between 6 and 11 feet above tidewater, 2) Rising abruptly to 37 feet and attaining 63 feet further inland, and 3) Half a mile from seashore, at a height of 72 feet.

#### HEARN GOLD PROSPECT

##### Character of Deposit

The main mineralized zone in the Hearn claims lies parallel to the north shore of Indian Bight approximately east-west (magnetic) and from 100 to 136 feet above tidewater. It consists of steeply dipping, sheared andesite (chlorite schist) which over widths up to six and one-half feet has been impregnated by sulphides and also contains numerous, small, parallel veins and lenses of sulphide-bearing quartz.

The characteristic alteration is chloritization, but silica and carbonate have also been introduced by the hydrothermal solutions from which the vein minerals were deposited. The general country rock is more or less massive andesitic lava. The records of Princeton University

1. Geology and Ore Deposits of Betts Cove-Tilt Cove Area, Notre Dame Bay, Newfoundland; Snelgrove, A. K., Can. Inst. of Min. and Met. Bull. 228, April, 1931, pp. 500-502.





Fig. 5. View of Trenches, Hearn Gold Prospect, Little Bay, looking northwest from lowermost post-glacial terrace. Note second terrace at lower left.

Geological Expeditions to Newfoundland<sup>1</sup> show that diorite outcrops at a waterfall a short distance north of the post office.

The best mineralization exposed at the time of examination occurs in pits 2, 4, and 5, (Fig. 6) representing a distance of 250 feet along the strike.

In pit 2 gossan extends to three feet below the surface; below this chloritic and partly carbonatized and silicified schist over a thickness of four and a half feet is impregnated with pyrite and contains several massive pyrite veins up to four and a half inches wide. This schist also contains quartz veinlets banded with pyrite, sphalerite, galena, and chalcopyrite. The schistosity forms two conjugate systems, the general dip of which is northwards at high angles.

Pit 4 contains similar schist with parallel quartz veins up to 6 inches in width. The quartz is mineralized with pyrite, sphalerite, a little chalcopyrite, and some marcasite.

Pit 5 reveals over 6 feet of pyritic chlorite schist, somewhat carbonatized, and several veinlets of quartz containing pyrite, galena, and minor amounts of sphalerite with ex-solution chalcopyrite.

East and west of the above-described pits, the lava as exposed in the other pits and trenches along this zone is less sheared and less mineralized. The sulphides consist chiefly of pyrite and chalcopyrite. Pit 12 appears to be on an independent shear zone, one and a half feet in width, mineralized with pyrite, and a little chalcopyrite, with very little quartz. Pit 13 reveals a shear zone 1 foot wide containing quartz, calcite, pyrite, chalcopyrite, sphalerite, covellite, and earthy hematite. Pit 3 is sunk on an independent shear zone paralleling the main zone, and contains a quartz vein several inches in width, mineralized with pyrite and chalcopyrite.

#### Mineralogy

The veins and replacements of carbonate, quartz, and associated sulphides are of the intermediate temperature type. Pyrite is the principal sulphide; chalcopyrite is next in abundance. Only locally are sphalerite and galena found, the former usually containing a little chalcopyrite formed by ex-solution.

Minerals of supergene origin, stated in the order of abundance, are limonite, hematite, marcasite, malachite, and

1. Field Notes, Princeton Expedition, 1919.







covellite. No visible gold has been discovered.

#### Development

This prospect has been explored by numerous shallow trenches (see Fig. 6) and over a dozen test pits.

#### Assays

Assay results on a dozen samples collected from the Hearn prospect are given in Information Circular No. 1 of this department (page 6, 1934). The best assays were obtained from samples collected in pits 4 and 5. A channel sample four and a half feet in width, from the bottom of pit 5, at a depth of nine feet below surface, yielded 9 dwts., 7.52 grs. of gold per long ton. This was the least weathered mineralization exposed at the time of examination.

The Little Bay Copper Mine which produced in 1878, 10,000 tons of ore; 1880-85, 61,796 tons; 1885-1891, over 40,000 tons of regulus and ingots of copper; and 1898, 220 tons of ore and 30 tons of 24% regulus, is said to have yielded between 1 and 2 pennyweights of gold per ton of ore.

#### Other Prospects, Little Bay

On the north shore of Indian Bight, two miles east (magnetic) from Little Bay, a vein of quartz, up to 2 feet in width, but averaging less than one foot, is exposed over a short distance. This vein occurs in massive andesitic lava. It strikes north 20 degrees west (magnetic) and dips 75 degrees west. The quartz contains disseminated pyrite and chalcopyrite. A grab sample from this vein, collected by a local prospector, is reported to have yielded over 7 dwts. of gold per long ton, on assay.

On the south side of Line Road, approximately one and a half miles west of Little Bay, a lens of quartz 5 feet in width, containing a little pyrite and chalcopyrite, occurs in andesitic lavas. A selected sample of this mineralization yielded a trace of gold on assay.

\* \* \* \* \*

#### NIPPERS HARBOUR PROSPECT

Nippers Harbour is located thirteen miles slightly east of north (true) from Little Bay. The region is composed of andesitic lavas probably equivalent to those of the Snooks Arm Series of Ordovician age in the Betts Cove-Tilt Cove area immediately northeast.<sup>1</sup>

Intrusive into these lavas is the Burtons Pond granite porphyry batholith immediately northwest of Nippers Harbour, and several dikes of the same rock near the entrance of the harbor.

At the north of the harbour are several small quartz veins in andesite. The veins and adjacent country rock contain disseminated pyrite, and a little chalcopyrite, and sphalerite. The greatest width of mineralized rock exposed is less than three and a half feet, and the largest vein ten inches wide.

Information Circular No. 1 of this department gives assay results on six samples collected from these veins; channel samples yielded only traces of gold and selected samples up to 3 dwts., 6.4 grs. of gold per long ton.

Other quartz veins in Nippers Harbour, carrying only chalcopyrite, proved to be non-auriferous.

#### ✓ HAND CAMP PROSPECT

Hand Camp is located several miles east of the Badger Road (Badger Brook Station to Halls Bay) at a point about ten miles south of Halls Bay. This area of andesitic pyroclastics and lavas, intruded by granites, was prospected in 1929 by Newfoundland Exploration Company, Ltd., who are reported to have discovered gold values in sulphides. The mineralization consists of pyrite, chalcopyrite, sphalerite, and galena, in quartz. No work is being done in this area at the present time.

#### Prospecting Criteria

All of the above-described prospects in Little Bay and vicinity occur in fracture or shear zones, usually with quartz veins, in lavas or pyroclastics of

1. Snelgrove, A. K.; op. cit.



intermediate composition; the mineralization is related genetically to either diorite or granite. Most of the mineral deposits of this part of Newfoundland are of the pyritic copper replacement type, such as are found in the inactive Little Bay, Betts Cove, Tilt Cove and Gull Pond copper mines; these pyritic copper deposits as a rule contain only a few pennyweights of gold per ton. A chemical assay is the surest way to distinguish higher-grade auriferous mineralization. A mineralogical guide to gold ore in this region is provided, however, by the presence of galena and sphalerite as fine disseminations in most of the higher-grade samples assayed. It is possible that the gold is also associated with chalcopyrite.

#### (5) MINGS BIGHT AREA

##### Location

Mings Bight, the site of a small fishing settlement, is located on the peninsula separating White Bay from Notre Dame Bay, on the northwest coast of Newfoundland (latitude 50° N., longitude 56° W.).

The large, deep, and protected harbour of Mings Bight is served occasionally by the coastal steamship service from the St. John's terminus. Coachman's Cove, five miles northwest of Mings Bight, is the nearest regular port of call and also the nearest post and telegraph office.

Inland from the west side of Mings Bight are the Goldenville, and the Barry and Cunningham mining claims, both of which have been worked in the past. (Fig. 7.) There are no roads in the area but both properties may be reached from the shore by trails.

##### History.

Auriferous quartz is said to have been discovered at Mings Bight previous to 1867.<sup>1</sup> Some time before 1892, "The proprietors of the Betts Cove Copper Mine (Notre Dame Bay) had commenced mining here on a copper deposit, and when about thirty or forty feet down, came across some thin

veins of quartz and bitter spar (dolomite) penetrating the chlorite rock of the lode, which were found to be well charged with gold."<sup>2</sup> No returns are available of gold or copper production resulting from this development. "Work was suspended in a short time, owing, it is said to some litigation and the interference of the French ships of war--the mine being situated on what has been called the French Shore of Newfoundland, or that portion over which the French nation exercises certain treaty rights."<sup>3</sup> The exploratory work was evidently done on what is now known as the Barry and Cunningham claim, the approximate position of which is indicated in Fig. 7.

In 1902, prospectors looking for iron ore discovered gold-bearing gravel and surface deposits on what is now known as the Goldenville claim. These were treated by washing. Shortly after, the Goldenville lode deposit was found. Mining operations were carried on intermittently until 1906. In 1906, the Goldenville Mining Company, Ltd. installed a 10-stamp mill and a Wilfley concentrator. These were run for four months with disappointing results, probably due to lack of facilities for cyanidation.<sup>4</sup> This plant has since been demolished.

In 1935, the Goldenville property was optioned to The N. A. Timmins, Corporation, of Canada.

##### Geology

The geology of the region is imperfectly known. In 1864, after a hasty reconnaissance, Murray assigned the rocks of Mings Bight area to the middle division of the "Quebec group"; he noted the presence of serpentine in both Mings Bight and Baie Verte (five miles to the west), discovered that the peninsula separating these two bays was underlain by granitic rock, and suggested that each bay corresponded to a syncline of middle Quebec group rocks resting on the Laurentian series.<sup>5</sup>

A reconnaissance of the shore lines and trails of this area, made in connection

1. Geol. Surv. of Nfld., Reports p. 106 (1881).

2. Geol. Surv. of Nfld., Report for 1892, pp. 225-226 (1918).

3. Ibid. These rights were abrogated by the Anglo-French Convention of 1904.

4. Geol. Surv. of Nfld., Reports pp. 521, 531-532, 538-539, 564, 582-584, 633-634. (1918).

5. Geol. Surv. of Nfld., Report for 1864, pp. 31-32 (1881); also Murray, A.; Mineral Resources of Newfoundland, Jour. Soc. of Arts. vol. XV, No. 777, map p. 710, (1867).



with the present investigation, (Fig. 7), indicates that the gold and copper mineralization lies in a series of "greenstones" which are intruded by gabbro and also by ultramafic rocks. The ultramafic rocks comprise peridotite and pyroxenite which are now largely metamorphosed to talc-carbonate and serpentine alteration products.

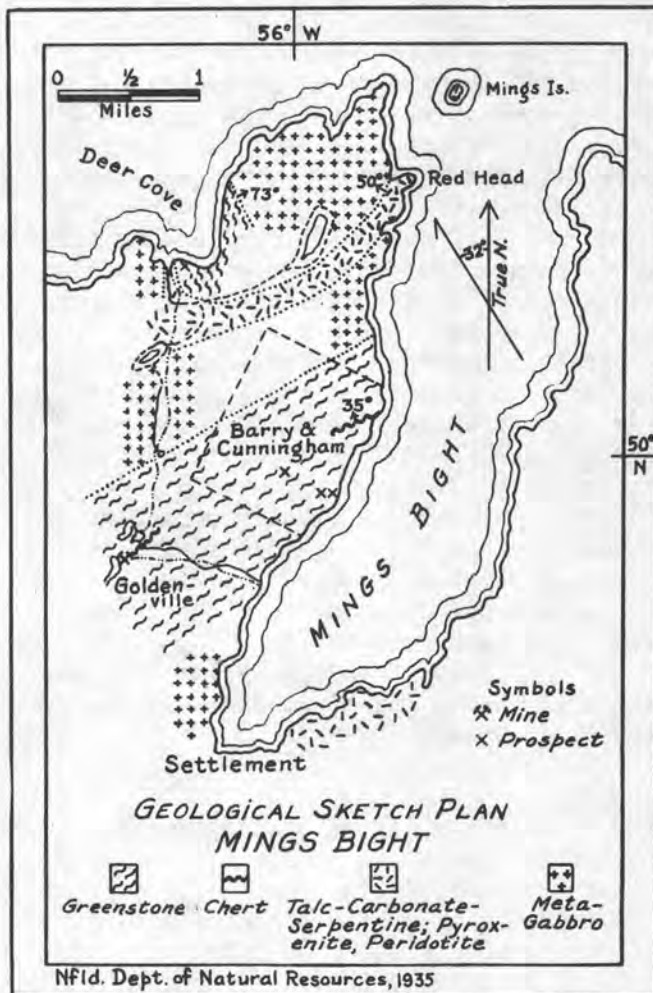


Fig. 7. Geological Sketch Plan, Mings Bight

The term "greenstone" is here applied provisionally to a variety of rock types, all of which appear to be of volcanic origin, although some may represent intrusives. The dominant type is chloritic, more or less wavy, schist of andesitic composition. In many places, especially on the western shore of Mings Bight, extensive areas of this rock are rusty and carbonatized. Interbedded with the "greenstones"

are small quantities of pyroclastics of the same general composition, commonly fine-grained tuffs such as occur in the Goldenville ore zone but occasionally with larger clasts exceeding a foot in diameter, as exposed on the shores of Mings Bight in the Barry and Cunningham claim. Both the andesitic lava and pyroclastic members of the "greenstone" series contain beds and lenses, up to three feet in thickness, of red, ferruginous chert, associated with some of which are iron oxides; the latter are discussed under the section on Character of Deposits.

The dip of the "greenstone" series on the west side of Mings Bight, as determined from chert and pyroclastic beds, varies between  $35^{\circ}$  and  $70^{\circ}$  northwest (true bearing).

The intrusive rocks are for the most part so highly altered that it is difficult to determine their original composition. The commonest type is meta-gabbro containing much actinolite and zoisite. South of Red Head, this rock contains zones of sheared tremolite. Only on the trail between Goldenville and Deer Cove were relatively fresh pyroxenite and peridotite observed. Alteration products of these ultramafic rocks are, however, well developed; the commonest is a rusty-weathering mixture of talc and brown carbonate, containing small plates of specular hematite and more rarely a green chromiferous actinolite. Serpentine is of less common occurrence.

The geological age of the rocks of Mings Bight area is unknown. The strong similarity of the "greenstones" and intercalated pyroclastics and ferruginous chert to those of the Snooks Arm Series (Ordovician) of the Betts Cove-Tilt Cove area in Notre Dame Bay,<sup>1</sup> twenty miles to the east, suggests that these volcanics may be of similar age. It is noteworthy also that rocks of both these areas were assigned to the "Quebec group" by earlier workers and that both are intruded by ultramafic rocks and gabbros.

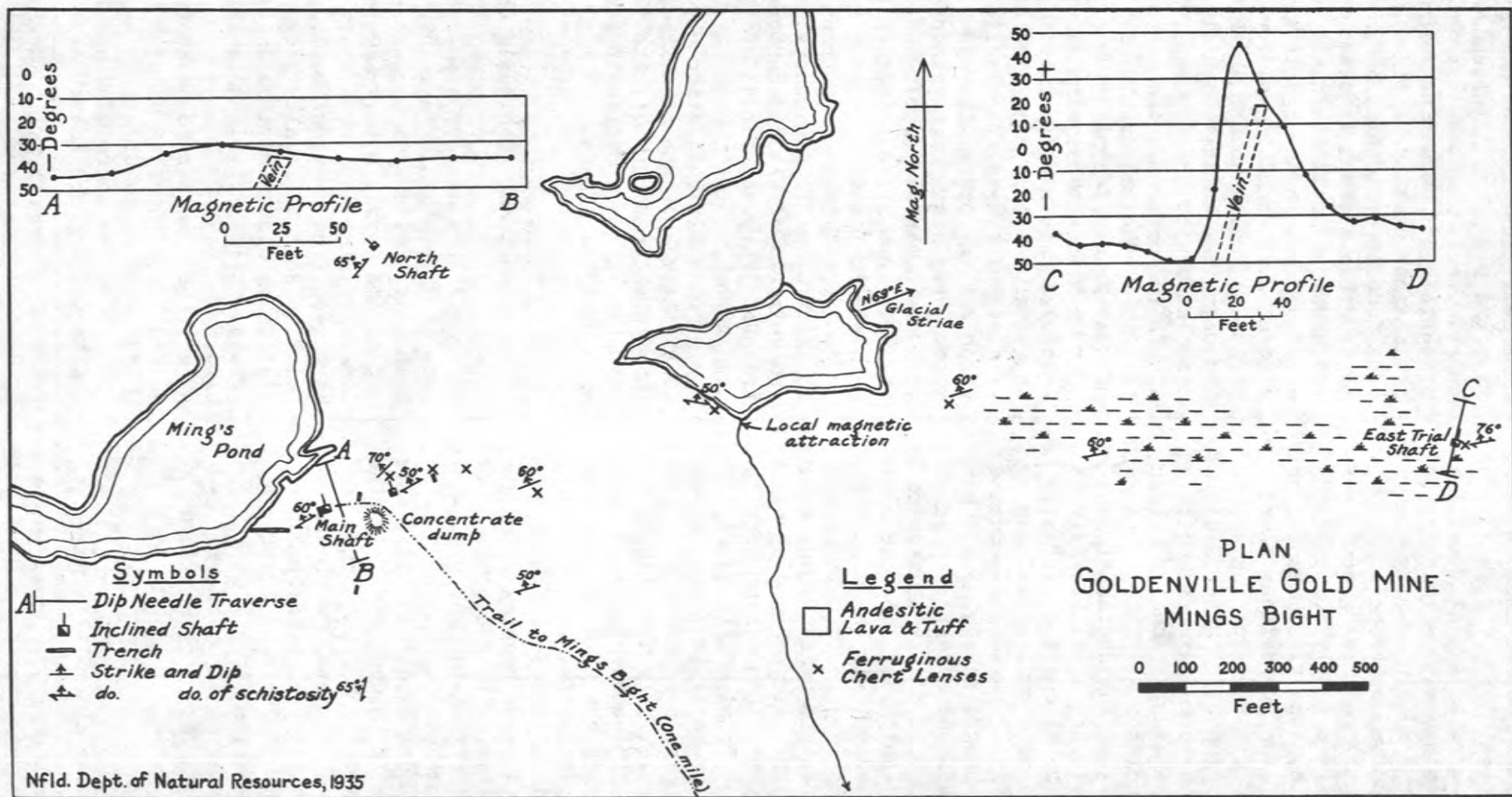
#### GOLDENVILLE CLAIM

##### Character of Deposit

The main mineralized zone at

1. Geology and Ore Deposits of the Betts Cove-Tilt Cove Area; Bull. Can. Inst. of Min. and Met., April, 1951.





Nfld. Dept. of Natural Resources, 1935

Fig. 8. Plan, Goldenville Gold Mine, Mings Bight



Goldenville lies on the southeast side of Mings Pond, approximately 400 feet above tidewater. The area is a gently rolling drift-covered plateau with a thick second growth of forest, in which marshy open spaces are of common occurrence.

The country rock is "greenstone" which here comprises finely porphyritic pyroxene andesite, some finely bedded chloritic tuff, and also ferruginous chert lenses (see Fig. 8), all striking approximately northeast and dipping northwest at angles of from 50 to 76 degrees. With this general direction, a locally strong schistosity coincides.

Beginning at the southeast side of Mings Pond and exposed intermittently as far as the East Trial Shaft a half mile to the east, is the main mineralized zone consisting chiefly of magnetite-hematite schist and interbanded ferruginous chert; and chloritic tuff and andesite in varying small proportions, in places transected by sulphide, quartz-sulphide, and quartz-carbonate-sulphide veins. In the vicinity of the collar of the main shaft this mineralized zone is 9 feet in width, about a third of which is quartz. At the surface of the shaft next adjacent, iron oxides are absent; in the East Trial Shaft, quartz is rare but magnetite-hematite schist is exposed over a thickness of about five feet, with magnetite relatively abundant. Not all of the ferruginous chert lenses shown on the accompanying map (Fig. 8) contain magnetite and specularite.

This mineralized zone dips 50° to 75° northwestward (true bearing), and lies approximately parallel to the contact of the "greenstone" with meta-gabbro one-half mile to the northwest.

Pending more detailed study, this mineralized zone is interpreted as a sedimentary chert<sup>1</sup> and "iron formation" in which hydrothermal quartz, carbonate, sulphides and gold have been deposited.

The North Shaft is evidently on an independent mineralized zone.

The present examination was restricted to the surface, the workings being filled with water.

#### Mineralogy

In the main mineralized zone the

commonest minerals are fine-grained magnetite and hematite, interbanded with red chert. Replacing the iron oxides, pyrite of cubic habit occurs as veins and disseminations usually of fine texture, but occasionally up to half an inch in diameter. Replacement is commonly incomplete, and numerous small residuals of magnetite are found within the pyrite crystals. Pyrite also is found in and bordering veins of coarse, milky quartz which transect the magnetite-hematite schist. In part associated with the pyrite, in tuff beds within the ore zone, and likewise evidently of hydrothermal origin, is a chlorite of the variety daphnite (Ng = 1.656).

Within the pyrite also, along fractures, are minute quantities of chalcopyrite. Chalcopyrite also occurs in veinlets of coarse specularite plates which cut the other minerals of the ore zone. Very rarely fine grains of native gold are observed in polished sections of the ore, in a silicate matrix which forms veinlets in pyrite.

Small amounts of brown and pink dolomite occur in the quartz veins; barren veinlets of similar carbonate also traverse the country rock of the mineralized zone.

The mineralization exposed at the North Shaft consists of milky quartz veinlets in chlorite schist; the veinlets contain fine-grained pyrite in part associated with sericitic bands.

#### BARRY AND CUNNINGHAM CLAIM

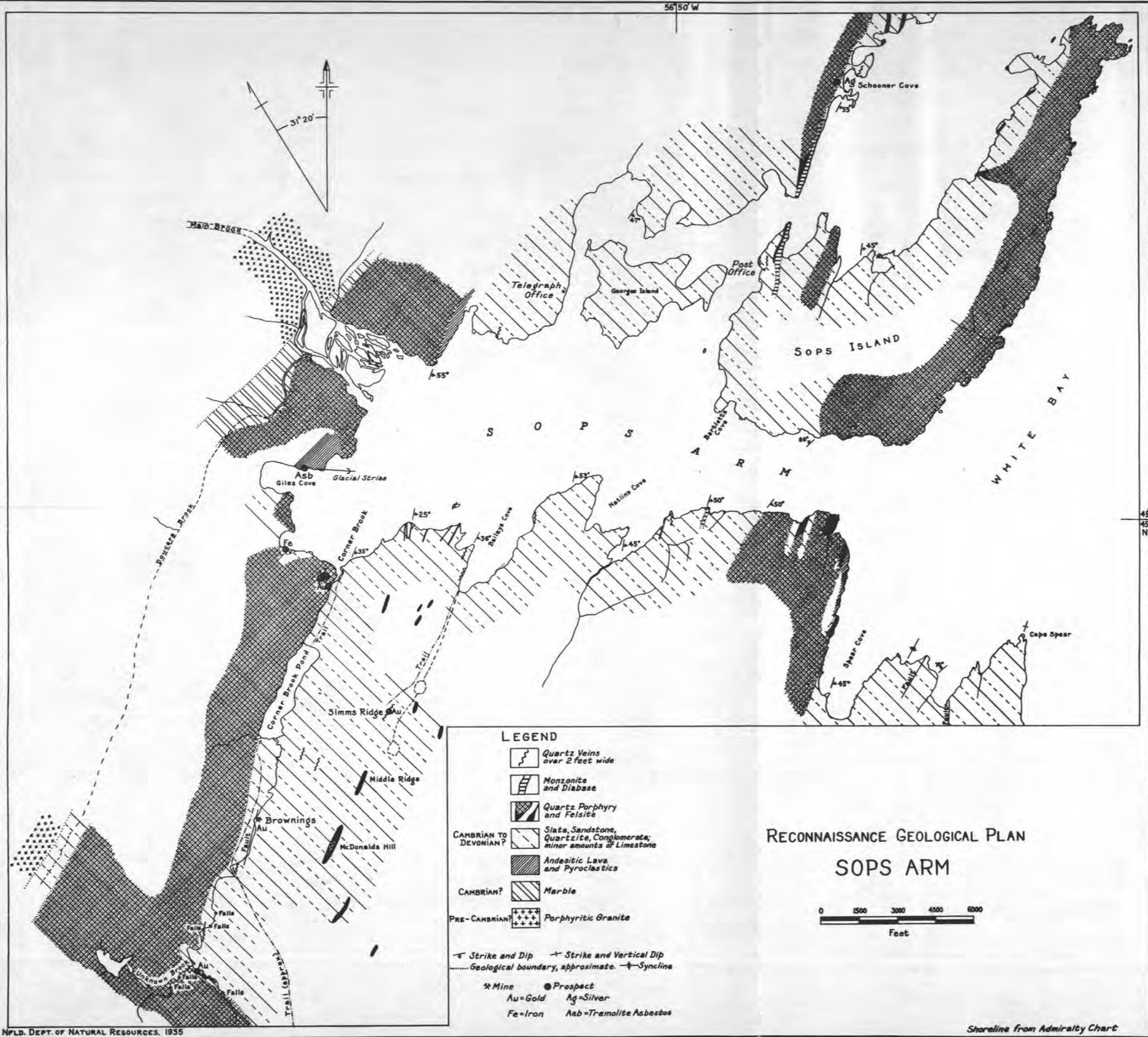
A very cursory examination was made of this claim. In a thick growth of bush half a mile from the shore at Mings Bight, and approximately 250 feet above tidewater, the dump of a shaft, said to have been sunk previous to 1891, reveals chlorite schist (locally known as "killas") containing disseminations and veinlets of pyrite, chalcopyrite, and a little magnetite.

No ore was found on the dumps of a long tunnel located a few hundred feet inland from Mings Bight.

On the shore of Mings Bight two shafts and a short tunnel explore narrow

1. Cf. The Ferruginous Chert Formation of Notre Dame Bay, Nfld., Sampson, E., Jour. Geol., vol. 31, No. 7, pp. 571-598 (1923).





**LEGEND**

- Quartz Veins over 2 feet wide
- Monzonite and Diabase
- Quartz Porphyry and Felsite
- CAMBRIAN TO DEVONIAN?** Slate, Sandstone, Quartzite, Conglomerate, minor amounts of Limestone
- Andesitic Lava and Pyroclastics
- CAMBRIAN?** Marble
- PRE-CAMBRIAN?** Porphyritic Granite

Strike and Dip    Strike and Vertical Dip  
 Geological boundary, approximate.    Syncline  
 Mine    Prospect  
 Au=Gold    Ag=Silver  
 Fe=Iron    Asb=Tremolite Asbestos

RECONNAISSANCE GEOLOGICAL PLAN  
SOPS ARM





replacement zones consisting of pyrite and a little chalcopyrite in chloritic schist.

Near the northeast corner of the Barry and Cunningham claim, three lenses of ferruginous chert, containing magnetite and specularite and veined by quartz, are exposed in the andesitic lavas of shore cliffs. This occurrence is of similar character to that found at Goldenville east trial shaft and appears to form a corresponding horizon in the "greenstone" series (see Fig. 7).

The old workings on this claim were not entered during the present examination, and no trace was found of native gold in quartz and dolomite, associated with telluride (?) and arsenopyrite, referred to by Howley as being derived presumably from this claim.<sup>1</sup>

#### OTHER PROSPECTS, MINGS BIGHT AREA

At Deer Cove (see Fig. 7) the "greenstone" schists are stained shamrock green, possibly due to chromium compounds derived from the near-by ultramafic rocks. These schists are replaced over thicknesses up to 10 feet by pyrite which on analysis fails to yield gold.

At a point 50 feet inland from the shore of Penney Cove, Baie Verte, five miles southwest of Deer Cove, chalcopyrite occurs sparingly in a quartz vein up to 12 feet in width; a sample from this outcrop yielded no gold on assay. Nearer tidewater at Penney Cove, a 1-foot lens containing pyrite, sphalerite and chalcopyrite in schist gave a trace of gold on assay.

#### Development and Production

On the Barry and Cunningham claim three shafts have been sunk. Two of these are located on the shore of Mings Bight. Nearest tidewater is a shaft 19 feet deep; adjacent is another 60 feet deep. A tunnel 25 feet long, has been driven 25 feet in a direction north 5 degrees west (magnetic) at a point 50 feet east of these shafts.

Inland about one half mile is an inclined shaft, sunk at an angle of 50 degrees north to a depth of about 75 feet. Between this point and the coast is a long tunnel.<sup>2</sup>

On the Goldenville claim, an inclined trial shaft was first sunk 50 feet on the eastern extremity of the deposit, and then an inclined working shaft was sunk at a point half a mile west to a depth of 100 feet. At a point 80 feet below the surface of this main shaft, drifts were run 80 feet east and 51 feet west.<sup>3</sup>

Figure 8 shows two other shallow, inclined shafts which were later sunk on this property, as well as four trenches.

In 1904, the Goldenville property produced 11 ozs. of gold valued at \$209. from a sample shipment of 23 tons made when the main shaft had attained a depth of 17 feet, and sent to Brookfield, Nova Scotia. This was recovered by amalgamation and cyanidation.<sup>4</sup> In the four months during which the local plant was in operation<sup>5</sup> gold bullion to the value of \$1,500. was produced, and also concentrates to a similar amount. Thus the total gold production recorded from Goldenville is 158 ozs.

#### Assays

Assay results on twenty-eight samples taken during the sinking of the main Goldenville shaft, are said to have ranged in value between \$0.62 and \$50.80 in gold per ton, and to have averaged \$12.44 per ton (based on gold at \$20.67 per ounce).<sup>6</sup>

In Information Circular No. 1, (1934), of this department are listed assay returns on nine samples collected from the Goldenville claim, and on two samples from the Barry and Cunningham claim. A channel sample 3 feet in width from a trench 10 feet west of the main Goldenville shaft yielded 1 oz., 4 dwts., 19.84 grs. of gold per long ton. A sample from the Goldenville concentrate dump, consisting of two-thirds iron oxides and one-third pyrite yielded 1 oz., 19 dwts., 4.8 grs. of gold per long ton; a test of the same sample for tellurium, made by

1. Geol. Surv. of Nfld., Report for 1892, p. 226 (1918).
2. According to information supplied in the field by a son of the late caretaker, John Crotty, this tunnel is nearly 800 feet long. From the same source, it is understood that native gold on the claim was discovered in the 19-foot shaft nearest the coast. Depths of shafts, as quoted, are from the same authority.
3. Geol. Surv. of Nfld., Report for 1906, p. 583 (1918).
4. Geol. Surv. of Nfld., Report for 1904, p. 539.
5. Geol. Surv. of Nfld., Report for 1906, pp. 580, 583.
6. Geol. Surv. of Nfld., Report for 1906, pp. 583-584 (1918).



Messrs. Ledoux and Co., Inc., New York, gave negative results. A selected sample from Goldenville North Shaft dump contained 1 dwt. of gold per long ton.

Surface samples from the Barry and Cunningham interior and shore shafts and also from the ferruginous chert on the shore yielded only minute traces of gold.

#### Prospecting Criteria

In the Mings Bight area the conclusion appears to be warranted that the chief zone of gold deposition owes its origin to a combination of stratigraphical, structural and mineralogical factors. Stratigraphical control is strikingly shown by the practical confinement of higher grade gold mineralization to ferruginous chert and "iron formation", both probably of sedimentary origin, as on the Goldenville property. Structurally, this Goldenville zone approximately parallels the contact between the "greenstone" series and the meta-gabbro; it is, however, doubtful if the gabbro is to be regarded as the source of the thermal solutions which deposited the later ore minerals in the cherty "iron formation."<sup>1</sup> The Goldenville zone merits close prospecting along its strike east to the shore of Mings Bight where similar "iron formation" occurs, and also westward.

Mineralogically, a close connection is evident between gold and pyrite-quartz mineralization in assays made during the working of the Goldenville mine and also during the present investigation. The pyritic replacement deposits in chlorite schist in this area seem to be distinctly less favorable for gold deposition, as are also the quartz-chalcopyrite veins.

In tracing "iron formation" in the "greenstone" series, dip needle traverses are of considerable aid, as shown by the magnetic profiles of the Goldenville property (Fig. 8). The magnetic anomaly appears to be proportional to the magnetite content of the "iron formation." A strong magnetic disturbance was noted in the Goldenville area in the drift at the outlet of a small pond between the Main Shaft and east trial shaft. This is approximately along the strike of the main ore zone.

#### (6) MORTONS HARBOUR

##### Location

The town of Mortons Harbour is situated on the northwest side of New World Island, Notre Dame Bay, on the northwest coast, (latitude 49° 35' N., longitude 54° 51' W.).

On the shores of this harbour are three gold prospects, viz., Taylor's Room Gold-Arsenic deposit, Cross (or Frost) Cove Gold-Antimony deposit, and Little Harbour Gold-Arsenic deposit. (For location see Fig. 9.)

Mortons Harbour offers good, natural facilities for shipping. It is a port of call for the coastal steamship service from the Lewisporte terminus of the Newfoundland Railway.

##### Geology<sup>2</sup>

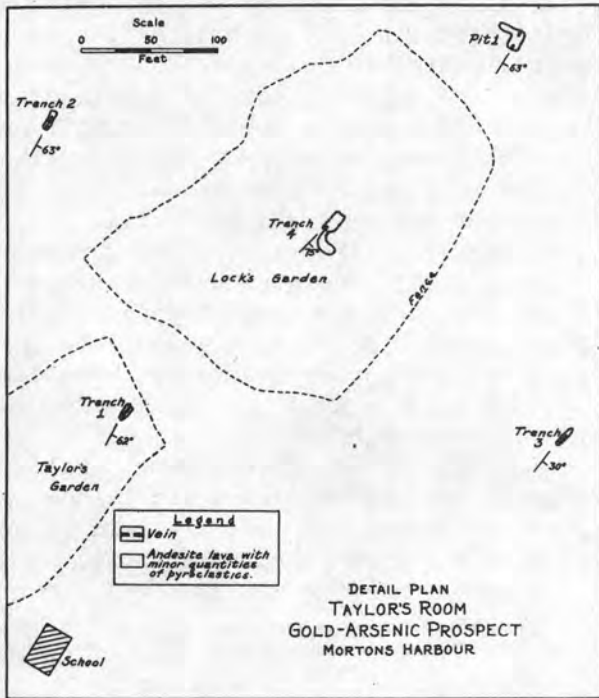
That portion of New World Island in the vicinity of Mortons Harbour is underlain by thick flows of andesite and dacite of Ordovician age. In some cases the thicker flows become fairly coarse grained and may be classified as acidic diabase. Finely disseminated pyrite is quite common in these flows. In places, pillow structure is seen, but it is not characteristic of the series. Amygdaloidal horizons are quite frequent, and are especially common in the pillow lavas.

In the lavas are numerous zones of agglomerate and tuff, some of which are over a hundred feet in thickness. They occur as lenses in the flows and are never very persistent along the strike. Associated with these pyroclastics are some thinly laminated, irregular, blue-gray chert beds; these also occur in the flows.

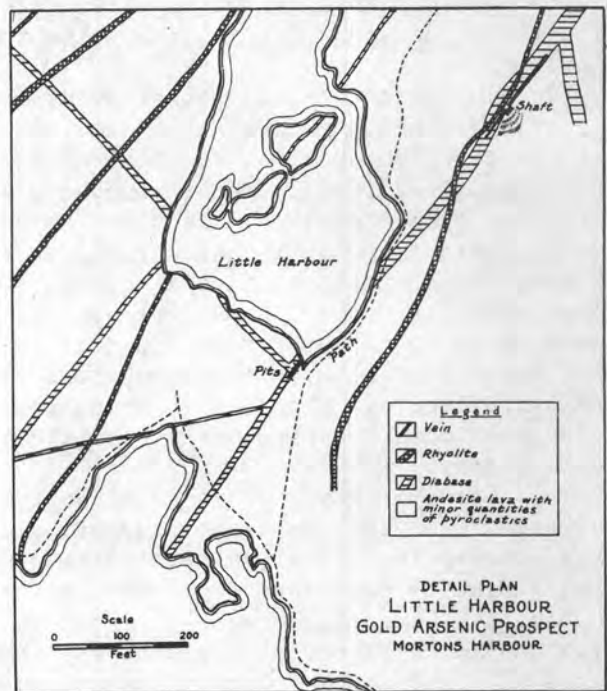
These volcanic rocks have been extensively chloritized, and have undergone epidotization and carbonatization to a less extent. Although frequently all of the mafic minerals have been chloritized, in other instances much of the pyroxene remains. Chloritization is always accompanied by some carbonatization. Much of the calcite has been introduced, but some of it results from the decomposition of plagioclase and mafic minerals. Extreme carbonatization is very often found in the

1. Cf. Correlation of Kinds of Igneous Rocks with Kinds of Mineralization; Buddington, A. F., in "Ore Deposits of the Western States" (Lindgren Volume), pp. 362-363, 1933.
2. Adapted from "Geology and Mineral Deposits of the Bay of Exploits Area", by Heyl, G. R., v. Bull. Geol. Section, Dept. Natural Resources (in press).

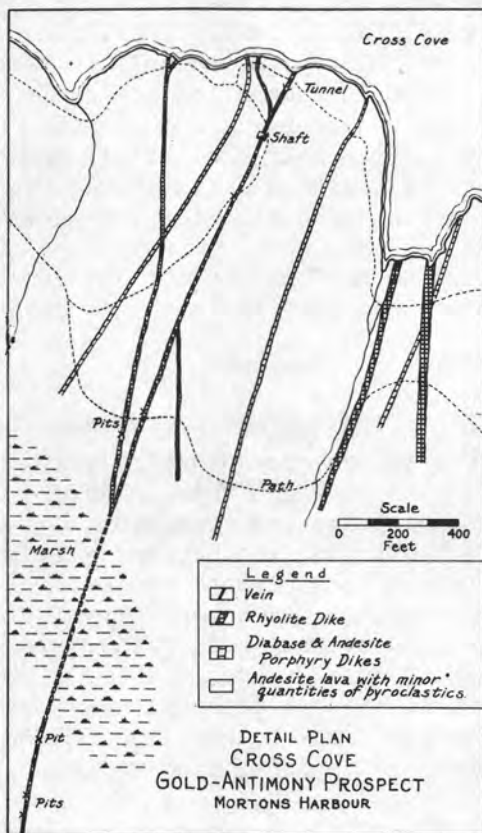




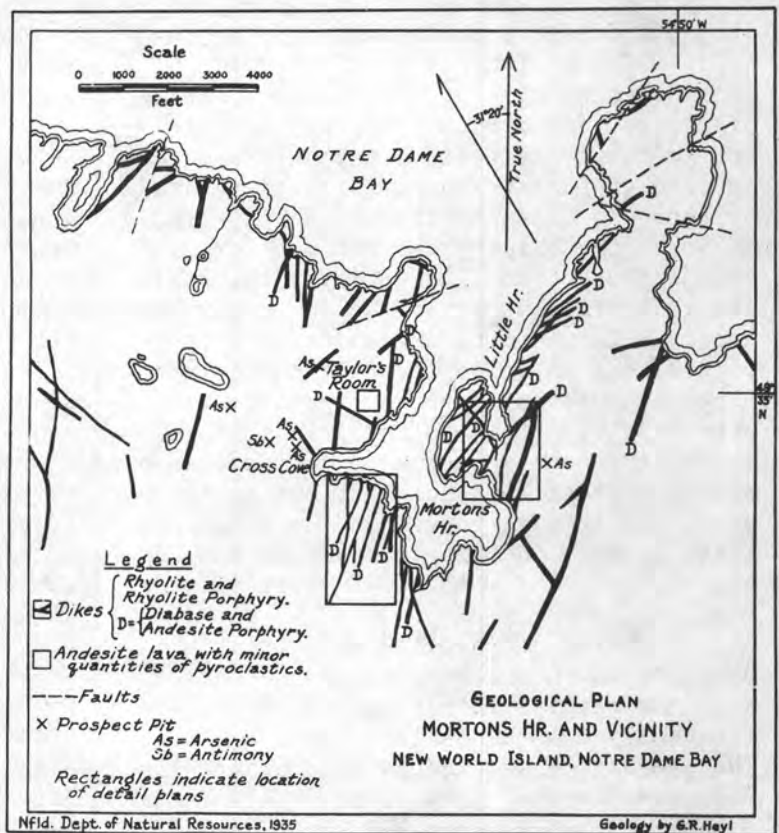
(A) Detail Plan, Taylor's Room, Mortons Hr.



(B) Detail Plan, Little Hr., Mortons Hr.



(C) Detail Plan, Cross Cove, Mortons Hr.



(D) Geological Plan, Mortons Hr. and Vicinity

Fig. 9



pillow lava horizons, in which case calcite fills the amygdules and permeates the rock.

Epidotization is manifested most commonly as small, irregular nodules of epidote distributed erratically through the chloritized flows. Their abundance varies from place to place. In size they are usually less than six inches across, but in rare cases five-foot masses of epidotized andesite occur. Sometimes epidote forms veins along shear zones, and it is then associated with calcite and, less often, with quartz. Minute dark green crystals of epidote are frequently seen along joint planes.

Structurally, the rocks of Mortons Harbour lie on the southeast side of a large, irregular anticlinal rise; the general strike is northeast, and the dip southeast. However, because of great variations in thickness of horizons and because of minor local folds and numerous faults, the strike and dip often change markedly within short distances. Brecciation along shear zones is quite common, and the coarser grained rocks sometimes show effects of granulation.

The region has been intruded by many dikes of diverse character. Diabase dikes are very common; they are usually ten to thirty feet wide, and have a medium to fine-grained texture. Closely related to them are dikes of diabase porphyrite, in which the plagioclase becomes more abundant and forms larger crystals, giving the rock a lighter color and a porphyritic aspect. Less common are andesite porphyrite dikes, in which the feldspar is andesine and does not form such prominent phenocrysts. It is believed that these mafic dikes are essentially contemporaneous with the great sequence of flows in the area, and in part represent the feeders to these flows. On the accompanying map, Fig. 9, all of the above dikes are classified as diabase.

Dikes of rhyolite and rhyolite porphyry which are genetically connected with the granite intrusions of the region frequently cut the earlier diabase dikes. The nearest large exposed mass of granite (or granodiorite) is at Twillingate Island,

five miles northwest of Mortons Harbour. Hydrothermal solutions originating in the granodiorite are believed to have been the source of the mineral deposits of Mortons Harbour; these deposits usually occur in close proximity to rhyolite dikes. In the vicinity of Mortons Harbour the majority of the acidic dikes strike in a northeasterly direction. They generally contain small, inconspicuous crystals of feldspars, and sometimes rounded quartz phenocrysts. Both types grade into rhyolite without any phenocrysts. These dikes weather light pink to white and are usually quite conspicuous.

Ice of the Wisconsin glacial stage strongly eroded the New World Island region. Evidences of this are seen on every side in the form of rounded hills, roches moutonnées, hanging valleys, and occasional striae.

#### CROSS COVE GOLD-ANTIMONY MINE

##### History

Antimony ore at Cross Cove was first mined in 1889 or 1890. Operations were suspended chiefly on account of the low price and small demand for the ore,<sup>1</sup> In 1906, the mine reopened, and 25 men were employed, evidently for a short time.<sup>2</sup> The property has been idle since 1916, according to Mr. Richard Stuckless, a local miner.

In 1934, Mortons Harbour Antimony Mining Company acquired title to the property.

##### Character of Deposit<sup>3</sup>

The mineralization in this deposit is restricted to the contacts of a six-foot rhyolite dike, which cuts andesitic flows. Slickensiding has occurred along both the footwall and the hanging wall of the dike, but it is somewhat more extensive along the footwall. Dark gray clayey fault gouge occurs along both these surfaces. Much of this movement is definitely earlier than the ore deposition period. The dike strikes N 20° E, and dips 80° NW. A map of this ore deposit is shown in Fig. 9 C.

1. Geol. Surv. of Nfld., Report for 1906, p. 581 (1918).

2. *Ibid.*

3. Heyl, G. R.; *op. cit.*



In a narrow zone along the foot-wall, and to a less extent along the hanging wall, the rhyolite has been extensively chloritized; this chloritization marked the beginning of the ore deposition period and is distinct from that in the country rock. The stibnite veins are limited to these two zones. The rhyolite has been silicified in the vicinity of the veins, with the quartz replacing the chloritized rock. The remainder of the dike, though slightly silicified in places, is relatively unaltered. It varies from pinkish white to gray in color. At the mine entrance no phenocrysts are present, but southward along the strike, where the dike crosses the road, occasional rounded quartz phenocrysts occur scattered through the dike. At the southernmost prospect pits, the dike is again without phenocrysts, and has a greenish-gray color.

The country rock adjacent to the hanging wall in the mine is amygdaloidal andesite. The amygdules are calcite, and very often contain pyrite, particularly around their margins. To the east of the dike, the country rock is andesite with numerous flow-breccia zones.

The main ore vein runs along the east wall (footwall) of the dike. The average width of the vein in the mine is about four inches, but it reaches a maximum of one foot in places. At the prospect pit where the dike crosses the path to the south, this same vein is reported to be three inches wide. In the southernmost prospect pit, the vein along the footwall of the dike was again seen in place, and was there two inches wide. Loose fragments of stibnite were observed at several intermediate points located along the east side of this rhyolite dike, and it is believed that this vein persists along the strike from the mine entrance to the southernmost prospect, a distance of 2600 feet.

Along the hanging wall of the dike, a thinner and less persistent vein occurs. This vein varies from two inches to zero in width, and has been seen only in the mine. Both of the veins are regular and have comparatively few offshoots.

#### Mineralogy

In both veins, stibnite is by far the most abundant metallic mineral, but arsenopyrite, pyrite, sphalerite, galena, and a little chalcopyrite also are present.

Of the gangue minerals, quartz predominates, but calcite is common. The vein along the footwall sometimes shows a rude banding, with quartz, arsenopyrite, and pyrite on the outside, and the other minerals towards the center. Calcite, when present, is always in the center of the vein. In many places the vein is entirely made up of stibnite, bordered by silicified rhyolite. Locally sphalerite or galena, or both, are predominant in the vein, but this is unusual. The vein along the hanging wall is largely stibnite with some quartz.

The stibnite often occurs in large compact masses showing a well developed bladed cleavage. Under the microscope it is commonly in the form of sharply defined linear grains which frequently show very distinct twinning. Less often it is present as small masses with irregular boundaries in the calcite, which is replaced by it. Stibnite sometimes cuts through the sphalerite in irregular thin veinlets formed by replacement; it also replaces galena.

Galena becomes abundant in local masses throughout the vein. It is generally associated with sphalerite, which always contains small specks of chalcopyrite, probably a result of ex-solution. Except for this mode of occurrence, chalcopyrite is a comparatively rare mineral in the deposit. Occasionally, however, it is seen in masses large enough to be observed in the hand specimen. It replaces calcite to a limited extent, and, near the vein edges, replaces pyrite.

Both arsenopyrite and pyrite replace the chloritized rhyolite, and are usually present as euhedral crystals. The pyrite is in the form of cubes, and arsenopyrite commonly shows a rhombic cross section and is highly anisotropic. The thicker vein carries appreciable amounts of gold and silver, as shown by assay.

The two important gangue minerals of the deposit are quartz and calcite. The quartz sometimes occurs in euhedral crystals, and rarely it shows a crude comb structure, but in general it is present as ordinary massive vein quartz. It replaces the chloritized rhyolite to a large extent. Calcite is restricted to the central portion of the vein. Some ankerite is also present.

Oxidation products are uncommon.



Rarely, kermesite ( $\text{Sb}_2\text{S}_2\text{O}$ ) is present as pseudomorphs after stibnite. It is also seen as thin coatings on some of the specimens. Cervantite ( $\text{Sb}_2\text{O}_4$ ) in small amounts was observed under the microscope in several polished sections, and always occurs along a contact between stibnite and calcite.

#### Development and Production

No maps of the old workings are available. The drifts are still partly accessible.

According to a report made in 1897 and furnished by the owners, the two tunnels which have been driven along the vein are each 202 feet long; the lower is 10 feet above high water mark, and the upper 55 feet above tidewater. The portal of the lower tunnel is practically on the shore of Cross Cove; the upper portal is 37 feet inland. A winze was sunk from the upper tunnel, at 71 feet from the inner end, to a depth of 20 feet below the lower tunnel. A shaft was later sunk from the surface. One of the pits on the southwestern extension of the vein inland is reported to be 30 feet deep; it is now filled with debris.

According to the Customs' returns antimony ore to the value of \$1,200. was exported in 1890, and \$1,000. in 1891.<sup>1</sup> In 1906, about 100 tons of picked ore were produced; of this, 81 tons, valued at approximately \$50.00 per ton, were shipped to New York.

#### Assays

A channel sample taken across one foot of vein matter and four inches of footwall, in the upper drift assayed as follows: 11 dwts., 18.24 grs. of gold, and 11 dwts., 18.24 grs. of silver, each per long ton; 5.39% antimony, trace of lead, 4.59% sulphur, and 48.6% silica.

### LITTLE HARBOUR GOLD-ARSENIC PROSPECT

#### History

This prospect, known as Stewart's mine, was worked in the last decade of the past century by Capt. Stewart, since when it has been idle.

#### Character of Deposit<sup>2</sup>

The mineral vein is located in a brecciated zone near the eastern margin of a thirty-five foot diabase dike which strikes N. 40° E. and has a dip of 80° SE. to vertical. This dike outcrops at the shaft, and as it is traced southwestward it becomes thinner, so that it is only 25 feet wide at the shore of Little Harbour. Just south of Little Harbour there are two prospect pits in the same dike, along a quartz-arsenopyrite vein which is the continuation of the vein exposed at the mine shaft.

About 200 feet northeast of Little Harbour, the diabase is cross-cut by a six-foot rhyolite dike which bends around and re-enters the diabase within a hundred feet, then parallels the vein in the vicinity of the mine shaft before again bending northward to leave the diabase. These relations can be seen on the map (Fig. 9B). The general strike of the rhyolite dike is N 25° E, and the dip 75° SE. Movement and shearing have taken place along the margins of the dike.

The vein is best seen at the shaft. It is located in a mineralized zone of silicified diabase. At the shaft this zone is four and three-quarter feet wide and forms the eastern margin of the diabase dike, although to the north and the south it no longer follows the dike contact. The mineral vein, which is largely quartz and arsenopyrite, is located six inches from the west wall of the mineralized zone or about three and one-half feet from its eastern contact with the volcanics. The dip of both the vein and the mineralized zone is about vertical.

The rock of the mineralized zone is brecciated diabase which has been silicified, and is cut by many thin veins and veinlets of quartz and arsenopyrite. In addition it contains numerous small euhedral crystals of arsenopyrite scattered through the rock. The diabase which is not within the mineralized zone is chloritized but is otherwise unaltered.

The main mineral vein is nine inches thick, and where exposed near the shaft, it strikes N. 38° E. and is approximately vertical. It shows a fairly well

1. Geol. Surv. of Nfld., Reports, pp. 405, 581 (1918).  
2. Heyl, G. R.; op. cit.



developed banding, with quartz predominating near the outer margins, and formed almost entirely of arsenopyrite towards the center. At the center of the vein an imperfect comb-structure is often formed by euhedral arsenopyrite and quartz crystals pointing in a somewhat random fashion towards the center, and embedded in white calcite. These crystals undoubtedly grew along the walls of narrow vugs which were filled by calcite in a late stage of the mineralization. In some places there is evidence of a small amount of shearing in the vein since the time of mineral deposition.

In the oxidized portions of the vein or of the smaller veinlets in the mineralized zone, some of the calcite has been dissolved out of this central zone, and in places it is filled with secondary products, largely scorodite ( $\text{FeAsO}_4 \cdot 2\text{H}_2\text{O}$ ) and realgar ( $\text{AsS}$ ). Fragments of greenish-black, leached gossan were seen on the dump.

#### Mineralogy<sup>1</sup>

The predominant mineral is arsenopyrite which often forms over half of the vein material. It frequently occurs as euhedral crystals, and under the microscope the massive portions of the vein show a coarse idiomorphic texture. Assays of the ore indicate an appreciable gold content, but none was seen under the microscope.

The arsenopyrite in specimens collected from the vein outcrop is very often crossed by numerous replacement veinlets of scorodite. This is the result of supergene replacement in the oxidized zone. Another oxidation product of the arsenopyrite is realgar, which occurs in small amounts in the leached portion of the vein at the surface. It is often associated with scorodite, and sometimes replaces quartz.

Pyrite is present in relatively small quantities and is associated with quartz gangue. Sphalerite is sparsely distributed through the vein and always

contains small amounts of unmixed chalcopyrite. In addition chalcopyrite occurs very sparingly as small irregular masses in the quartz.

A small amount of stibnite is present in the vein in the prospect pits just south of Little Harbour. This stibnite is crossed by microscopic replacement veinlets of kermesite and cervantite. Kermesite first replaced the stibnite, and then, as the erosion surface approached its present position more closely, cervantite replaced both the kermesite and the stibnite. Thus the sequence was:

Stibnite → Kermesite → Cervantite

$\text{Sb}_2\text{S}_3$                        $\text{Sb}_2\text{S}_2\text{O}$                        $\text{Sb}_2\text{O}_4$

Quartz is the main gangue mineral, and predominates towards the vein walls. Well formed crystals of quartz are present with those of arsenopyrite near the vein center, and both are embedded in calcite which characteristically fills the center of the vein.

#### Development and Production

The outcrop of the vein has been trenched for a length of 100 feet and to a depth of 6 feet. The depth of the shaft and prospect pits shown on the accompanying plan is unknown.

In 1897, the property produced 125 tons of arsenical ore.<sup>2</sup>

In 1900, it was reported that the shaft on the prospect was about 110 feet in depth, and the vein was said to average 18 inches of solid ore throughout.<sup>3</sup>

#### Assays

The following assays of Little Harbour ore are taken from the literature mentioned in the Table on the following page.

\* \* \* \* \*

1. Heyl, G. R.; *op. cit.*

2. Geol. Surv. of Nfld., Report for 1898, p. 405 (1918).

3. Geol. Surv. of Nfld., Report for 1900, p. 456 (1918).



TABLE III

## ANALYSES OF LITTLE HR. ORE

Silica	3.98% <sup>1</sup>	----- <sup>2</sup>	----- <sup>3</sup>
Lime	0.97	-----	-----
Phosphoric anhydride	0.14	-----	-----
Manganese dioxide	2.39	-----	-----
Metallic iron	47.64	-----	14.76%
Sulphur	29.11	-----	7.8
Metallic arsenic	15.717	-----	12.14
Zinc	-----	-----	0.85
Copper	-----	-----	Nil
Loss	0.053		
Gold, per ton	7 dwts., 14 grs.	6 dwts., 12.8 grs.	11 dwts., 18.24 grs.
Silver, per ton	18 dwts., 9 grs.	19 dwts., 14.4 grs.	1 dwts., 7.36 grs.

## TAYLOR'S ROOM GOLD-ARSENIC PROSPECT

History

Trenches 4 and Pit 1 (Fig. 9 A) were sunk many years ago and were uncovered and dewatered for the present examination.

In 1933, Rev. A. Pittman sampled the outcrop upon which trench 1 has since been sunk in Taylor's Garden. In 1934, additional trenching was done by the holders.

In 1934, the Mortons Harbour Antimony Mining Company acquired title to the property.

Character of Deposit

In the immediate vicinity of this prospect, bedrock consists of massive andesitic lava. Between trenches 3 and 4 is a pyroclastic bed with clasts of andesitic composition, up to 5 inches in diameter. No intrusive rocks are exposed in the detail map area (Fig. 9 A).

As shown by the map, three veins, roughly parallel in strike, have been discovered. Trenches 1 and 4 and Pit 1 appear to be along the same central vein zone, but this zone has not yet been traced beneath the thin overburden which lies between exposures.

The central vein zone is about 85 feet above sea level; it strikes be-

tween north 27 degrees east and northeast (true bearing) and dips from 62 degrees to 75 degrees southeast. In Trench 1 is a banded milky quartz fissure vein 4.5 inches in width, well mineralized with arsenopyrite and sphalerite, with minute quantities of pyrrhotite and chalcopyrite. In the sheared footwall at the northeast of this trench, disseminations and veinlets of sulphides occur over a width of 14 inches.

In Trench 4, the vein is 7 inches wide; sphalerite is less abundant. Impregnations of sulphides are present in the sheared lava wall rock.

Pit 1 exposes a milky quartz fissure vein varying from 8 inches to 1 foot in width, mineralized with arsenopyrite, sphalerite, pyrrhotite, and small quantities of pyrite and chalcopyrite. The sheared lava wall rock contains sulphides as disseminations and in quartz veinlets. For a thickness of approximately 11 feet the footwall is uniformly disseminated and minutely veined by pyrrhotite and sphalerite together with very small amounts of chalcopyrite, galena, pyrite, and arsenopyrite.

The northwest vein<sup>4</sup> is 125 feet above sea level and is opened upon by trench 2; it consists of lenses of quartz up to 7 inches wide, mineralized with sphalerite, arsenopyrite, pyrite,

1. Geol. Surv. of Nfld., Report for 1900, pp. 455-456, (1918); Martin and Pellybridge, London, England, analysis.
2. Dept. of Nat. Resources, Nfld., Geol. Sect., Inf. Cir. No. 1, p. 9 (1934). Bulk sample from half-foot vein.
3. *Ibid.*, dump sample.
4. This vein was discovered by the Geological Section.



chalcopyrite, galena, and a little pyrrhotite. The sheared wall rock contains sparse disseminations and veinlets of these sulphides.

The southeast quartz vein, 70 feet above sea level, is 6 inches wide and has a minimum dip of 30 degrees southeastward. It is mineralized with sphalerite, arsenopyrite, and pyrite; minor quantities of these minerals are also found in the sheared walls of andesitic lava.

Mineralogy.

Mineralogically, the Taylor's Room banded veins and replacements are very similar to those of the Little Harbour deposit.

Taylor's Room differs only in the presence of some galena, and pyrrhotite, and the absence of stibnite, calcite, and supergene antimony and arsenic minerals. The pyrrhotite occurs in part as an ex-solution product from sphalerite.

Assays

Assay results on 14 samples collected from this prospect are given on page 16 of Information Circular No. 1 of this department, issued in December, 1934.

A small bulk sample from the vein in Trench No. 1 yielded 10 dwts., 10.88 grs. of gold per ton; 2 ozs., 1 dwt., 19.52 grs. of silver per ton; 14.98% arsenic; 4.09% zinc, and 1.34% copper.

Other Prospects, Mortons Harbour Area

The accompanying map of Mortons Harbour and vicinity (Fig. 9 D) shows the location of several prospect pits in areas not included by the detail plans. In the few cases where the pits are not filled with debris, the veins exposed are approx-

imately of the same size as those described above. In most cases, the mineralization consists of arsenopyrite in a quartz gangue. In two pits, located just north of the road on Cross Cove hill at a place locally known as the "Barracks", the mineral assemblage is quite similar to that at Taylor's Room; it consists of arsenopyrite and sphalerite with smaller amounts of galena and chalcopyrite in a quartz gangue.

Assays of grab samples from some of these prospects are as follows (precious metals are stated in ounces per long ton: (Table IV, below.)

On the headland at the west of the entrance to Mortons Harbor several veins somewhat similar to those of Taylor's Room were noted; it is not known if these also contain precious metal values.

Prospecting Criteria

The mineralization of Mortons Harbour area is closely connected with a fracture system which trends slightly east of north. These fractures are in part occupied by rhyolite and diabase dikes. The rhyolite is genetically related to the granodiorite batholiths of the region, which are probably the source of the hydrothermal solutions from which the ores were deposited. Subsequent to the intrusion of the dikes, differential movements along the dikes, and also in the volcanic rocks, resulted in fracture channels and zones of brecciation in which the ores and gangue were deposited with some replacement of the wall rocks.

The prospector is primarily interested in tracing these fracture zones for mineralized quartz veins. The stibnite and the arsenopyrite type of veins are

TABLE IV

ASSAYS OF MORTONS HR. ORES

Gold	11 dwts., 18.24 grs. <sup>1</sup>	13 dwts., 1.6 gr. <sup>2</sup>	Trace <sup>3</sup>	10 dwts., 10.88 grs. <sup>4</sup>
Silver	3 ozs., 6 dwts., 15.36 grs.	1 oz., 19 dwts., 4.8 grs.	Nil	3 ozs., 18 dwts., 9.8 grs.
Arsenic	7.58%	26.98%	12.39%	14.77%
Zinc	2.48%			
Lead	1.28%			

1. Barracks Prospect, Cross Cove Hill.
2. Prospect pit along road about half a mile west of Cross Cove.
3. Prospect in swamp a third of a mile north of Cross Cove.
4. Prospect immediately east of Little Harbour detail plan area.



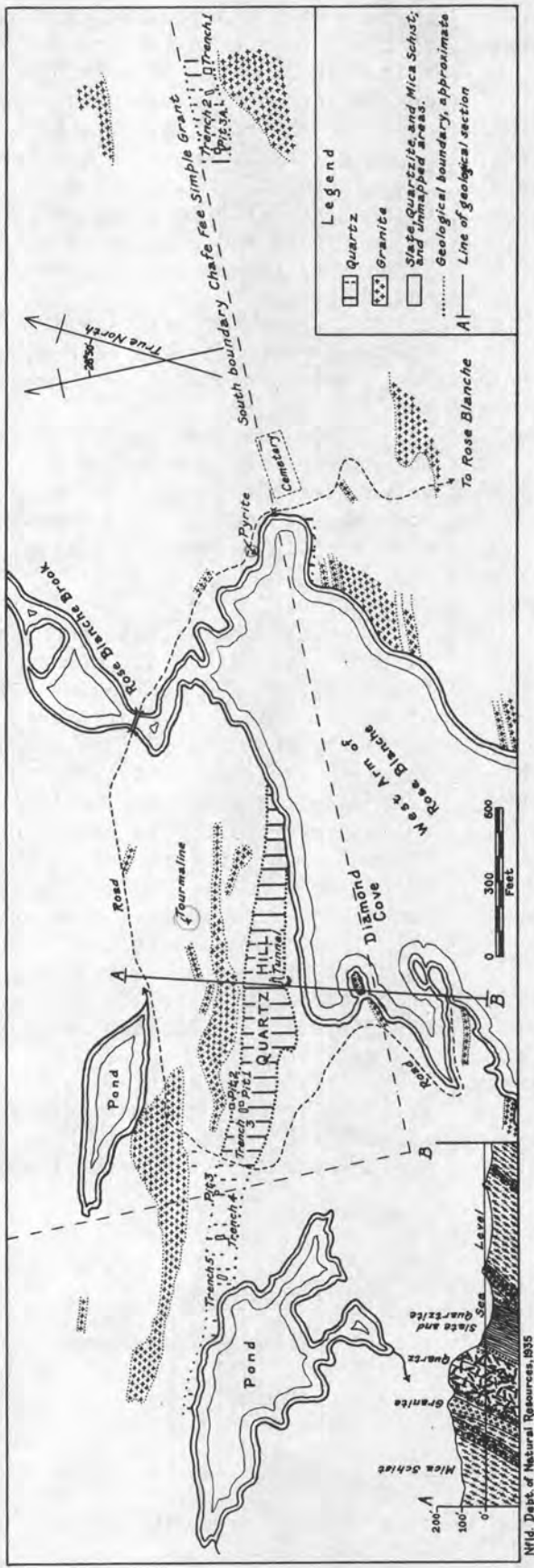


Fig. 10. Reconnaissance Geological Plan and Section Diamond Cove Gold Prospect, Rose Blanche

equally favorable in their precious metal content. It appears that veins carrying only quartz and arsenopyrite are not so auriferous as those which contain a variety of the other sulphides occurring in the area.

(7) ROSE BLANCHE

Location

The Diamond Cove gold prospect is situated about one mile north (magnetic) from the settlement of Rose Blanche (latitude 47° 37' N, longitude 58° 42' W), on the southwest coast.

Rose Blanche is a port of call for the government steamship service between Port aux Basques and Argentina.

The Diamond Cove auriferous quartz deposit is on tide-water (Fig. 10).

History

The report of the Geological Survey of Newfoundland for 1899 states that considerable excitement was caused by the discovery of large bodies of quartz at Rose Blanche, which were said to have yielded an average of some two pennyweights of gold per ton. The presence of pyrite and arsenopyrite in the quartz was reported. Several attempts were made later to develop the property, but only a small amount of work was accomplished and a few test samples shipped

In the autumn of 1934, following the release of Information Circular No. 1 of this department, showing high gold values in samples collected in trench 1 by the Geological Section, and also publication of high gold assays obtained from samples said to have been collected by a local resident from pyritic mineralization exposed near Rose Blanche cemetery (see Fig. 10), the area was extensively sampled by an engineer

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acting for Anthony Power, *et al.* of St. John's, who had received an option to purchase the fee simple grant belonging to Luke Chafe of Curling.

### Geology

The rugged coastline of Rose Blanche is composed chiefly of granite which is intrusive into a series of metamorphic rocks comprising chiefly mica schists and quartzites. On the coast, ridges covered by a thin mat of moss and scrub vegetation rise to a height of several hundred feet. Several miles north of Rose Blanche, ridges which trend slightly north of east attain elevations of over 500 feet.

The region is largely denuded of soil by glacial action; the observed direction of glacial striae is south 10 degrees west (true bearing).

Immediately north of Diamond Cove, on the northwest side of West Arm of Rose Blanche is a giant white quartz vein which forms a prominent ridge. This is the site of the Diamond Cove gold prospect.

As shown in Fig. 10, the Diamond Cove area comprises slates, quartzites and mica schist, with numerous elongated bodies of granite which are evidently cupolas of the large granite mass exposed along the Rose Blanche coastline.

The metamorphic rocks lie in belts striking east-west and underlie the valleys of the area. Black, carbonaceous slates and quartzites, with minor conglomerate facies, with a total approximate thickness

400 feet, lie in and immediately south of the quartz vein and along its projection, eastward and westward, in the map area. The mica schists are composed of muscovite, with subordinate biotite, quartz, orthoclase, and garnet.

The only intrusive rock noted is massive pink granite with varying proportions of muscovite and biotite from place to place. This is, at least in part, a sodic granite, with albite predominating over orthoclase and microcline. The rock also contains accessory pale brown garnet, apatite and zircon. Locally, the granite exhibits pegmatitic facies, with feldspar crystals approaching a foot in length.

The average regional dip of the schistosity and bedding of the metamorphic rocks in the map area is 60 degrees north. Adjacent to the granite, metamorphic rocks

show intricate twisting in several places. In general, the granite is conformable with the strike and dip of the country rocks.

### DIAMOND COVE GOLD PROSPECT

#### Character of Deposit

This prospect centers around a giant quartz mass composing Quartz Hill (Fig. 10). This ridge attains a height of 180 feet above tidewater, and is composed of approximately two-thirds of quartz over a maximum width of 220 feet and a length of 1,500 feet. The remainder of the ridge consists of inclusions of graphitic sedimentary rock and, to a less extent, of sericitic schist. For the greater part, these inclusions retain the orientation and dip of the surrounding country rock of the quartz, although in a few instances they show rotation. The included material has undergone varying degrees of silicification; the highly metamorphosed carbonaceous rocks yield residuals of almost pure graphite.

Both east and west of Quartz Hill, quartz exposures are found, but none of great extent, individual veins and lenses of quartz being separated by wider masses of carbonaceous slates and quartzites, less metamorphosed than those on Quartz Hill.

The above-described relations suggest that the giant quartz vein of Diamond Cove owes its origin to thermal solutions probably derived from the granite magma; the quartz appears to have been emplaced essentially by selective replacement of carbonaceous state and quartzite in preference to mica schist.

In mica schist lying north of the granite mass which parallels Quartz Hill, is a zone half a foot wide of schorl rock, composed of acicular, black tourmaline associated with quartz and a little muscovite. This is regarded as a transitional stage between the granite pegmatite and hydrothermal quartz of this area.

#### Mineralogy

The quartz of this area is chiefly massive, medium to coarse textured, and milky white in color. Less common are sugary, drusy, and chalcedonic varieties, and at only a few places was a variety noted with "multiple phantom" structure or





Fig. 11. View of giant vein, Quartz Hill, Diamond Cove, Rose Blanche, looking west

zonal markings by inclusions. Insufficient data are available to decide how many generations of quartz are present, but the presumption is strong that there are several, some evidently having been deposited in open spaces.

Locally, the quartz contains sparse metallic mineralization. These are the areas explored by the tunnel and surface workings shown in Fig. 10. The commonest sulphide is pyrite, usually accompanied by arsenopyrite and less often by sphalerite. These sulphides occur in the metamorphosed inclusions in the quartz, on the boundary between these inclusions and the quartz, and also in fractures and as disseminations in the less coarsely crystallized quartz. Graphite appears to have been effective as a precipitating agent. No native gold was observed, although the owner claims to have collected nuggets from the quartz.

The paragenesis of the hydrothermal mineralization is quartz, pyrite, arsenopyrite, sphalerite; with scorodite(?) and limonite as weathering products. Scorodite ( $\text{FeAsO}_4 \cdot 2\text{H}_2\text{O}$ ), an alteration product of arsenopyrite, is rare.

#### OTHER PROSPECTS, ROSE BLANCHE AREA

On the east side of West Arm of Rose Blanche (see Fig. 10) pyritic re-

placement deposits occur in slates dipping 75 degrees north. This type of mineralization, accompanied by little or no quartz, is found at several places in the small cove opposite the cemetery.

#### Development

Many years ago the five trenches and four pits shown in Fig. 10 were dug, and a 34-foot tunnel driven from the foot-wall. Some additional surface work was done in the east end of the map area and around the east shore of West Arm in the fall of 1934.

#### Assays

Of a total of twenty-one channel, selected, and grab samples collected during the present investigation only two yielded gold on assay. Both of these auriferous samples were collected from pyritic quartz with inclusions of graphitic slate in trench 1, at the east end of the map area, (see Fig. 10); a channel sample 4 feet 6 inches in length, from the north part of the trench gave 32 ounces, 13 pennyweights, 8 grains of gold per long ton; and a selected sample, relatively well mineralized with pyrite contained 3 ounces, 5 pennyweights, 8 grains of gold per ton. A check assay, made on part of the original high-grade sample, by Messrs. Ledoux and Co., Inc. of New York City, gave the following results: gold 10.75 grains per long ton, arsenic none,



iron 1.21 per cent. Ten check samples were later collected from various parts of this trench, with negative results on assay.

Three samples, described as pyritized slate from the east side of West Arm, Rose Blanche (see Fig. 10), submitted to the Government Laboratory at St. John's in October, 1934, by a local resident, yielded 26, 42, and 50 ounces of gold, respectively, per long ton. Twelve check samples from the same area yielded negative results.

#### Prospecting Criteria

Search for ore in the Rose Blanche area is made problematical by the extremely sporadic distribution of gold values. The absence of gold in most of the samples collected, all of which were pyritic, re-veals that there is no necessary association of sulphides and gold mineralization.

The tunnel opposite Diamond Cove gives a partial cross section of the giant quartz vein at a depth of 110 feet below the top of the outcrop. At this level, as well as on the surface, channel samples yielded negative results. This, however, affords only slight evidence on the absence of gold at depth.

A study of the literature<sup>1</sup> indicates that giant veins of this size are more likely to be unfavorable rather than advantageous for concentration of precious metals. Although this conclusion does not preclude the possibility of the occurrence of ore in the Diamond Cove vein, the importance of this mass as a source of gold production remains to be demonstrated.

#### (8) SOPS ARM AREA

#### Location

Sops Arm is situated on the west side of White Bay, on the north coast of Newfoundland (latitude 49° 45' N, longitude 56° 50' W). Along the shores and islands in this large arm of White Bay are several small fishing and lumbering settlements

which are served by the coastal steamship service from St. John's. White Bay can also be reached from the Newfoundland Railway at Howley by a trail which follows the telegraph line to Hampden, a distance of about thirty miles. Hampden, located at the south end of White Bay, is fifteen miles by water from Sops Arm. No roads exist in the area.

The chief gold mineralization so far discovered in the Sops Arm area is in the vicinity of Corner Brook at the southwest end of the arm. This is the location of Brownings Mine, Simms Ridge prospect, and several others.

#### History

Mining claims at Corner Brook, Sops Arm, were first staked by the late J. M. Jackman of Tilt Cove, in 1898. In the following two years, Mr. Jackman drove two tunnels: one an auriferous sulphide deposit located on the northwest bank of Corner Brook at a place 700 feet from the shores of Sops Arm (see Fig. 12); and another on a hematite deposit in quartz porphyry at the southwest corner of Sops Arm.

In 1900, Andrew Stewart, M. E., representing John Browning, et al. of St. John's, staked a claim adjoining Jackman's on the southwest; this is now known as the Browning Fee Simple claim. Mr. Stewart mined a series of quartz veins on the southeast bank of Corner Brook and is said to have erected a stamp mill. Owing to a boundary dispute between Messrs. Jackman and Stewart, which was settled by the courts largely in the former's favor, Mr. Stewart abandoned work and removed his mill. This mining activity attracted the attention of the Geological Survey in 1902, the report for that year by the late Government Geologist, J. P. Howley, being devoted to results of a "Geological Exploration in the District of White Bay."<sup>2</sup> In 1904, Mr. Howley reported that the yield of the Sops Arm Gold Mine had dropped to 3dwts.

1. Loughlin, G. F.; "The Gabbros and associated rocks at Preston, Conn." U.S.G.S. Bull. 492, pp. 137-153 (1912).  
Lindgren, W.; "Mineral Deposits", p. 169 (1933).  
Buddington, A. F.; "Mineral Investigations in Southeastern Alaska", U.S.G.S. Bull. 783, pp. 42-50 (1924).  
Jolliffe, F. T.; "The Beaver Lodge Lake Pitchblende Deposit and Associated Giant Quartz Veins, Northwest Territories, Canada", Geol. Surv. of Canada (in press).
2. Geol. Surv. of Nfld., Reports, pp. 484-501, 504, 511-512, 517, 521, 531, 538-539, 634; (1918).



per ton, and operations were suspended.

Since 1933 numerous claims have been staked in the Sops Arm area by Sops Arm Gold Mining Co.,<sup>1</sup> including and surrounding their discovery at Simms Ridge, and also by several other syndicates and prospectors. In 1935 the Simms Ridge prospect was optioned to The N. A. Timmins Corporation of Canada.

### Geology

The geological features of this part of White Bay were first investigated by Murray in 1864<sup>2</sup> and later by Hawley in 1902.<sup>3</sup> This work established the general succession of formations but left in doubt their exact correlations.

As interpreted by Howley, the local succession begins with the Pre-Cambrian "pinkish porphyritic syenite" exposed in upper Main Brook. Flanking the Pre-Cambrian is a great thickness of sedimentary rocks assigned by Howley to the Cambrian, "Lower Silurian" (Ordovician), Silurian, and Devonian systems. These sedimentary rocks dip fairly uniformly and steeply eastward and form the western limb of the White Bay syncline. They are intruded by large and small sills and dikes of felsites and some more basic intrusives.

Because the present field work was not concerned primarily with stratigraphy, the accompanying map, Fig. 12, does not show the boundaries of the various Paleozoic systems, which remain to be exactly determined; in the meantime, Howley's succession is adopted tentatively and the field data referred to his framework.

### Sedimentary Rocks

The "Cambrian" consists of white and buff-colored marble, with small amounts of marble breccia, as exposed for a thickness of 125 feet in Main Brook; and massive white quartzite as exposed in the headwaters of Doucers Brook, where the thickness could not be determined. The base of mica schists, and also a slate member, referred to by Howley as occurring in other parts of White Bay, were not observed at Sops Arm. The series is non-fossiliferous but on lithological and structural grounds was referred to the Cambrian by Howley.

The "Lower Silurian" (Ordovician) is exposed between Corner Brook and Baileys Cove, on the south shore of Sops Arm, and is also non-fossiliferous. It consists of conglomerate with clasts up to 1 foot in diameter at the base; this is represented by a metamorphosed inclusion in quartz porphyry immediately west of the mouth of Corner Brook. This conglomerate is overlain by grits which grade into calcareous, pearly slates. The slates contain metacrysts of rusty-weathering carbonate which, together with less common pyrite cubes, give the rock a spotted appearance. Intercalated with these slates are white and also green (chloritic) quartzite beds. This series has a total thickness of 2,600 feet (Howley). Adjacent to quartz porphyry and felsite intrusions, the slates are commonly sericitic; sericitization of the slates is especially pronounced at the Browning and Simms Ridge prospects in the inland extension of this series.

The "Silurian" series extends from Baileys Cove to the cove east of Spear Cove; to the east, it is invaded by felsite and monzonite dikes. At the base the "Silurian" is composed of grayish-green slates, in part calcareous, which, however, lack the spotted character observed in those of the Ordovician. They contain occasional beds of quartzite. Ascending in the section, sandstone, quartzite, and fine-grained conglomerate predominate, with a few beds of limestone. According to Howley, there may be some repetition of these formations adjacent to the intrusives. The following poorly preserved fossils were collected by Murray from this series at 1) the west side of Georges Island: crinoidal columns, *Syringopora*, *Favosites gothlandica*; 2) Bartletts Cove, at the southwest corner of Sops Island: fucoids, crinoidal stems, *Murchisonia*, *Orthoceras*, and a *Graptolithus*; 3) on the point halfway between Spear Cove and Cape Spear (the location of a minor fault shown on the accompanying map): fucoids, crinoidal stems and *Orthoceras*.

The "Devonian" system begins at a cove between Spear Cove and Cape Spear and forms the west side of White Bay south of Sops Arm. It is in faulted contact with the underlying "Silurian" in the cove mentioned. The rocks consist of reddish-brown

1. The author is indebted to Mr. W. F. Hutchings, manager of Sops Arm Mining Co., Ltd., for some details of the local history.
2. Geol. Surv. of Nfld., Reports, Chap. II, (1881).
3. *Ibid.*, Chap. XXII, (1918).



and dark gray slates and argillaceous sandstones. In places, cross bedding indicates that the original top of this now nearly vertical series lies to the east. Obscure fossil plants, discovered at Upper Head of Salt Water Pond, three miles south of Cape Spear, led Murray and Howley to correlate this series with a similar lithological series exposed at Cape Rouge and Cape Fox, 90 miles to the north along strike. On a small island 9 miles east of Cape Rouge, Murray found comminuted fossil plants in red and gray sandstones, presumably belonging to the same series. Dawson identified these remains as "1. *Psilophyton*; like *P. princeps*; 2. *Lepidodendron*, decorticated, resembling *L. chemungense*; 3. *Sigillaria*, a small portion of a stem not specifically determinable; 4. Striated stems, probably stipes of ferns; 5. *Sphenopteris*, a small and obscure leaflet." On this evidence, Dawson tentatively determined the age as Upper Devonian.

At Jacksons Arm, eight miles north of Sops Arm, Murray has described three normal faults with displacements of 200, 1000 and 1200 feet respectively, which affect measures roughly equivalent to those described above. In Sops Arm the detailed stratigraphy has not yet been worked out, but only two faults have been noted; one normal fault of unknown displacement at Browning's Mine, and another between Spear Cove and Cape Spear with small horizontal throw to the northward on the west side.

All the above-mentioned faults are approximately parallel to the strike of the sedimentary rocks which, in turn, follow closely the trend of the shore line of White Bay. The origin of many of the present features of the Sops Arm re-entrant in the White Bay shore line appears to be attributable to valley glaciation. Well-preserved glacial striae and grooves are found on the shore, striking south eighty-six degrees east; i.e., parallel to the length of the arm.

#### Igneous Rocks

The igneous rocks of the area comprise both volcanics and intrusives.

At the west end of the map area a chloritic and coarsely porphyritic granite, with orthoclase phenocrysts up to one inch in length, forms a ridge attaining an elevation of 1,130 feet. This rock appears to be part of the Archean series of Howley.

Its relations to the "Cambrian" is obscured by drift.

Both north and south of the mouth of Main Brook and also on the east side of Sops Island and the adjacent mainland, volcanic rocks of andesitic composition occur near quartz porphyry sills. The western exposure consists of schisted and chloritic rock in which andesine, zoisite, calcite, tremolite, and magnetite are recognizable in thin section. This rock contains calcite amygdules and epidote knots and is evidently a lava. On the hanging wall of the large dike of quartz porphyry which forms the east side of Sops Island, a similar lava is exposed together with agglomerate, with a total approximate thickness of 325 feet. The relation of these volcanics to the sedimentary rocks has not been determined; however, both are intruded by quartz porphyry.

Thick sills and dikes of reddish-brown quartz porphyry and felsite compose the foothills of the area, which have an average height of 800 feet and separate the low valleys underlain by sedimentary rocks. (Fig. 13.) The quartz porphyry contains phenocrysts of quartz and orthoclase, with very little plagioclase, in a fine-grained matrix; in the felsite, phenocrysts are less common. In addition to the prevalent massive, reddish-brown variety of this rock, a waxy sericitized and schistose phase is met with, especially near metallic mineralization. In the trenches at Simms Ridge, east of Corner Brook Pond, a sericitic schist, which is difficult to distinguish from the adjacent sericitized slates, proved on examination to be an altered keratophyre, made up chiefly of albite, with some orthoclase, in a felsitic matrix containing much sericite and carbonate, and a little apatite. The keratophyre appears to be closely related genetically to the quartz porphyry.

Smaller intrusive masses in the area, chiefly in the form of sills, include biotite monzonite which crosses the west end of Sops Island, and diabase which at several places cuts the Sops Island mass of quartz porphyry.

The geological age of the quartz porphyry and felsite appears to be post-Devonian, if the Devonian age determination of the sedimentary rocks at Cape Spear is authenticated. Although no intrusives occur in the "Devonian" of the



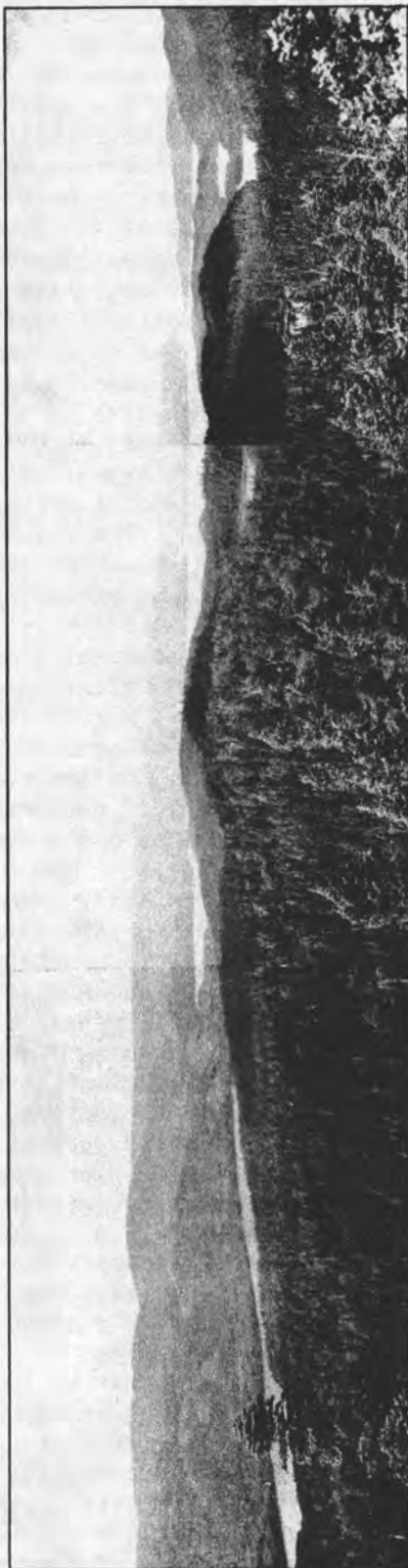


Fig. 15. Panorama of Sops Arm from McDonalds Hill. Corner Brook Pond at left, Simms Ridge in centre foreground, and Sops Island in the distance at right.

map area, Howley describes several "feld-site dykes, or elvans" in the same series further south in White Bay.

### † BROWNING'S MINE

#### Character of Deposit

Although it was not the first gold prospect to be worked in Sops Arm, Browning's Mine is the only one credited with any production in this area to date.

Located on the east bank of Corner Brook, above Corner Brook Pond, (see Fig. 12) are two shafts and a tunnel from which 1,000 tons of ore, containing approximately 149 ounces of gold, valued at \$3,000, were produced in 1903.<sup>1</sup> These workings are in Ordovician (?) slate and sandstone containing a series of milky quartz veins some of which are over 2 feet in width. Some of these veins and lenses are parallel to the bedding planes, and others are cross-cutting. The sedimentary rocks in the immediate vicinity of the workings dip rather uniformly to the southeast at angles less than 35 degrees.

At the edge of the river, below the tunnel portal, is exposed the plane of a slightly oblique, normal fault striking northeast and dipping 24 degrees southeast. This fault can be traced in the river bed for a distance of over 2,000 feet. The openings mentioned lie above this fault plane and should intersect it at shallow depth.<sup>2</sup> Both above and below the fault, thin sills of felsite occur in the slates which are sericitized and also spotted by rusty-weathering carbonate and pyrite. Approximately 500 feet northwest is a large sill of felsite.

According to Stewart, as reported by Howley, a belt of mixed quartz and slate 32 feet in thickness was encountered in sinking one of the shafts. "It was composed of irregular alternating layers of quartz and decomposed ferruginous slate, all of which was found to carry gold, from a mere sight up to several ounces to the ton."<sup>3</sup>

#### Mineralogy

The mineralization on the dumps of the two shafts consists of coarse milky

1. Geol. Surv. of Nfld., Reports p. 524 (1918).

2. The depth of the two shafts is not known.

3. Geol. Surv. of Nfld., Reports p. 493 (1918).



quartz containing a little calcite and a rusty, ferruginous carbonate, together with disseminations of the following minerals, both in the quartz and in the country rock: pyrite, chalcopyrite, galena, sphalerite, and specularite. No visible gold could be found.

#### Assays

Three samples collected from the shaft dumps and also from veins in the tunnel during the present investigation yielded no more than a trace of gold on assay. Howley, however, reported visible native gold in the quartz of this mine at the time it was being worked; and although it was mostly free-milling, he suggested that sphalerite and galena were the most auriferous of the ore minerals.

#### † SIMMS RIDGE PROSPECT

This prospect, named after William Simms, who located it in 1933, is situated one mile slightly west of south (magnetic) from the mouth of Corner Brook. It is most conveniently reached by a trail from Baileys Cove.

#### Character of Deposit

Simms Ridge rises to a height of approximately 300 feet above tidewater, and is one of a chain of low hills, composed of felsite, which trend north 35 degrees east (true), and stand above the rounding valleys developed on "Ordovician" calcareous slates. Along the west edge of Simms Ridge, near the summit, is a large body of quartz which constitutes the Simms Ridge prospect.

Because of the thickly wooded character of this area and the limited amount of trenching done at the time the deposit was examined, a clear picture of the geological relations is not yet available. It is nevertheless fairly well established that the main quartz vein is considerably over 300 feet in length in a north 35 degrees east (true) direction, that it occurs in part in a sericitic schist which represents a sill of keratophyre, that the general country rock is sericitic, calcareous slate, and that the average dip of the intrusive slates and vein is southeastward at an angle of less than 50 degrees. The indicated thickness of this main vein

is at least 10 feet, and probably wider. One hundred and twenty feet to the northwest is a parallel vein of much less extent.

At the time of examination, the Simms Ridge vein was explored by seven shallow trenches, which revealed coarse, milky quartz intermixed sericite schist, and with a spotted slate hanging wall. The quartz contains very little carbonate. In the quartz, and to some extent in the schist also, are sparsely disseminated grains, veinlets, and occasional fist-sized bunches of sulphides. These bunches of sulphides are found only in the deeper parts of the trenches; their former presence at the surface of the outcrop is indicated by cellular limonite. Work is now in progress to determine whether economically available concentrations of precious metals are present beneath the limonitic gossan.

#### Mineralogy

The quartz of the veins is for the most part milky, and very coarse-grained. Although it is considerably fractured, only rarely are the fractures filled with sulphides. A ferruginous carbonate is occasionally seen in the quartz. The characteristic alteration of the wall rock and inclusions is sericitization.

An optical study of the ore reveals the following minerals: pyrite, chalcopyrite, "Mineral X", galena, dyscrasite ( $\text{Ag}_3\text{Sb}$ , minute blebs in galena), anglesite, native gold, and native silver, covellite, hematite (earthy), limonite, malachite. The native silver appears to be of supergene origin. In the specimens studied, native gold, in some cases sufficiently coarse to be visible to the naked eye, was found only in anglesite veinlets which replace galena; insufficient data are available to determine whether the gold is a residual from galena or if it was introduced along with the supergene anglesite.

"Mineral X" occurs in chalcopyrite and contains blades of the latter mineral. Optical and etch tests indicate that this unknown is possibly luzonite ( $3\text{Cu}_2\text{S}\cdot\text{As}_2\text{S}_5$ , pinkish variety of energite), but it lacks the characteristic anisotropism of that mineral.

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Assays

Because of the leaching referred to above, assays of the weathered outcrop are of limited significance in indicating the average tenor of the precious metals, as are also selected samples of high grade ore from the bottom of the trenches.

In Information Circular No. 1 of the Geological Section (1934) are listed assay results on ten channel samples taken from several trenches, which ranged from nil to 1 dwt. of gold per long ton. A selected sample of weathered galena from one of the sulphide bunches yielded 5 ozs., 4 dwts., 12.8 grs. of gold, and 47 ozs., 19.2 grs. of silver, each per long ton.

## † WEST CORNER BROOK PROSPECTS

Included in this group are several prospects which occur in quartz porphyry immediately west of the mouth of Corner Brook. These prospects were explored some 35 years ago.

On the northwest bank of Corner Brook, 700 feet from the shores of Sops Arm, a tunnel has been driven 55 feet northwest (magnetic) with an 8-foot north drift at 20 feet from the portal. The quartz porphyry country rock is fractured and brecciated, and traversed by numerous coarse, glassy quartz veins each several inches in width. In the quartz veins and veinlets, and to a less extent in the quartz porphyry, are rather uniformly distributed bunches of sulphides. An assay of a selected sample of pyritic quartz veins from the walls of the tunnel yielded 2 dwts., 14.72 grs. of gold, and 1 oz., 16 dwts., 18.08 grs. of silver each per long ton. A selected sample containing quartz, dolomite, pyrite, chalcopyrite, galena, and sphalerite, from a dump on the opposite side of the river gave 1 dwt., 7.36 grs., of gold, and 2 ozs., 8 dwts., 19.68 grs. of silver, each per long ton.

Four hundred feet north 30 degrees west (true bearing) from this tunnel, the same sill of quartz porphyry contains a series of quartz veins up to 20 inches in width, forming a zone 4 feet wide, striking north 15 degrees west and dipping flatly southeast. A selected sample from the dump of a test pit on this zone, containing pyrite and specularite, yielded on assay traces of gold and no silver.

Within 300 feet west of the preceding outcrop, the quartz porphyry contains 1) A vein two and a half feet wide of coarse quartz striking north 30 degrees east and dipping vertically, very sparsely mineralized with pyrite and specularite, and 2) An almost parallel quartz-filled fracture zone on which a pit, trench and shallow shaft have been sunk. The width of this zone, before mining, seems to have been about six feet. A selected sample from the dump, sparsely mineralized with pyrite, galena, and sphalerite, yielded on assay 0.25 dwt. of gold, and 13 dwts., 1.6 grs. of silver, each per long ton.

Several other types of mineralization occurring in and near this quartz porphyry sill in the vicinity of West Corner Brook may be mentioned at this point, although none of them appears to be of economic importance. Prospectors in 1934 found small dikes of pegmatite in this intrusive; a sample given to the writer consists of glassy quartz, pink feldspar, black tourmaline needles, and flakes of specularite. Near the shore of the cove immediately west of the mouth of Corner Brook, a tunnel has been driven south 40 degrees west for a length of twenty-five feet on quartz porphyry, the matrix of which is replaced by hematite. On the shore of Giles Cove, slightly more than half a mile north of the iron prospect, a pit has been sunk on a small deposit of tremolite asbestos, in andesitic lava.

## † UNKNOWN BROOK PROSPECTS

Near the junction of Unknown Brook with Corner Brook, at the southwest corner of the map area, quartz veins containing reddish dolomite and pyrite, a small quantity of galena, and specularite, occur near the contact between slate and felsite. The extent of this deposit remains to be determined. A selected sample on assay yielded 0.25 dwts. of gold per long ton.

On Unknown Brook, a quarter of a mile above its junction with Corner Brook, the felsite was discovered by the Geological Section to be sheared, carbonatized, and pyrophyllitized over a distance of several hundred feet.

It is of interest to note that Howley observed a similar pyrophyllitic alteration of the felsite dikes at



Jackson's Arm, eight miles north of Sops Arm and called attention to its resemblance to the "agalmatolite" near Manuels, Conception Bay.<sup>1</sup>

#### † SCHOONER COVE PROSPECT

Schooner Cove is located northwest of Sops Island at the northeast corner of the map area.

One hundred feet inland from the cove, a sill of felsite contains seven quartz veins each averaging three inches in width. A selected sample of quartz from these veins, containing pyrite and galena, yielded on assay no gold and 1 oz., 6 dwts., 3.2 grs. of silver per long ton. Near-by is another vein 16 inches wide containing several shoots of pyrite, chalcopyrite, galena, very little dyscrasite ( $Ag_3Sb$ ), and some anglesite, and covellite. A selected sample of this high grade mineralization gave, on assay, a trace of gold, and 2 ozs., 12 dwts., 6.6 grs. of silver per long ton.

These veins strike between north 19 degrees west and northwest (true bearing) and dip 55 degrees southwest.

#### OTHER PROSPECTS, SOPS ARM AREA

In the Sops Arm area are a large number of quartz veins other than those discussed above. The location of the large veins (over 2 feet wide) is shown on the accompanying map. These veins occur as fissure fillings and replacements both in sedimentary rocks and in felsite. As a rule they follow closely the stratification of the sedimentary rocks, but locally they are cross-cutting. All of these veins are of coarse-textured white quartz, individual interlocking crystals ranging up to five inches in length; minor quantities of one or more of the following minerals is commonly present: A chlorite (approximating prochlorite in composition), pink carbonate, specularite, pyrite, and sericite. The two largest bodies observed are at MacDonalds Hill where the quartz has an outcrop width

of approximately 60 feet, and immediately north of Schooner Cove where the outcrop is 60 feet wide. The dip of these bodies of quartz is indeterminate but probably moderate, and the true thickness considerably less than the figures stated.

Several miles south of the map area prospectors have recently located disseminated sulphides which are reported to be auriferous.

#### Prospecting Criteria

The accompanying Reconnaissance Geological Map reveals an intimate relation between quartz porphyry intrusives and the distribution of auriferous mineralization. This spatial relationship is considered as evidence of the genetic connection of the quartz porphyry and the gold deposits. The most favorable locus for ore deposition appears to have been the sheared, fractured, or brecciated hanging wall of quartz porphyry or felsite sills, or the adjacent sedimentary rocks.

In all cases observed, the gold occurs in quartz veins or in the near-by country rock. The precious metals appear to be most closely associated with galena, perhaps also with pyrite and chalcopyrite. Very coarse, glassy (high-temperature) quartz with only specularite mineralization seems to be distinctly less favorable for gold.

Howley<sup>2</sup> suggested that reddish-brown pits in the slates, due to the weathering of pyrite, might serve as a guide to ore, but it is now determined that these pits are more often caused by leaching of metacrysts of carbonate which are of regional distribution and not characteristic of igneous contacts or mineralized zones. Sericitization, however, is a common if not diagnostic type of alteration in the mineralized areas.

The pyrophyllitized felsite of Unknown Brook merits close prospecting for metallic mineralization because this type of hydrothermal alteration has been shown to be associated with auriferous ores at Cinq Cerf on the south coast of Newfoundland.

It seems unlikely that extensive

1. Geol. Surv. of Nfld., Reports, p. 491 (1918).

Cf. also Pyrophyllitization, etc., of Rocks around Conception Bay, Nfld.; Buddington, A. F., Jour. Geol., vol. 24, No. 2, pp. 130-152 (1916).

2. Geol. Surv. of Nfld., Reports, pp. 492-493, (1918).



placer gold deposits could be found in this glaciated region, but a close examination of the sands of rivers and lakes lying along the felsite-slate contacts, such as Corner Brook, might well prove the presence of some placer gold.

Prospecting of the map area and its north and south extensions for the favorable structural and mineralogical criteria enumerated above is desirable.

#### (9) MISCELLANEOUS OCCURRENCES

##### Aquaforte

The town of Aquaforte is forty miles south of St. John's and can be reached by motor road. Eight miles inland from the town is a gold prospect in Precambrian volcanic rocks. The mineralization occurs as fracture fillings in andesite and consists of veinlets of quartz from one to two inches in width over a total width of about one foot. It can be traced for a distance of thirty feet.

The mineralization is similar to that at the near-by Cape Broyle prospect (See p. 18): Galena and chalcopryrite, with minor amounts of pyrite, in quartz. There is, however, a much higher percentage of galena and chalcopryrite than at Cape Broyle. The andesite in the immediate vicinity of the veinlets has been somewhat silicified. Assays of two samples taken by the holders of the prospect gave 7 dwts. per long ton, and a trace of gold, respectively.

A shallow pit has been sunk in the prospect and the holders propose to deepen this as the vein system widens at the bottom of the pit.

##### Gander River

In 1894 Howley observed that "Distinct traces of this precious metal (gold) were ascertained in a quartz vein cutting the silky, bluish slates on the southwest branch of the Gander River",<sup>1</sup> in the interior of the island, and noted that "The innumerable quartz veins observed all along the route of the railway, but especially near Clode Sound, Thorburn Lake, N.W. River,

Terra Nova River, Maccles Pond, Gambo, Butt's Pond, Suley's Brook and Gander Lake, frequently look very promising for gold."

##### Gooseberry Island, Bonavista Bay

In 1869 Murray noted a series of parallel veins of quartz, varying in width from less than inch to upwards of two feet, filling fissures in slate, etc., at southern Inner Gooseberry Island, Bonavista Bay, east coast. Associated with the slate is "a mass of interstratified porphyry overlaid by a band of diorite." The veins "at some parts of their course are almost altogether constituted of a solid, dark gray, granular iron ore (probably arsenopyrite), together with copper pyrites, sprinkled through the adjoining quartz and calc spar." An assay of this mineralization by Messrs. Bath of Swansea gave: iron 39%, arsenic 3 sulphur 20%, copper 0.8%, silver 2.72 oz. per ton, gold a trace, silica 5%, lime 1%.<sup>2</sup>

##### Holyrood, Conception Bay

In his report for 1868,<sup>3</sup> Murray states: "While examining the coast of Conception Bay a small specimen of quartz, with minute specks of what appeared to be gold, was shown me by Mr. Fitzgerald, who was engaged in sinking a shaft in a copper lode near Holyrood, (Conception Bay, south-eastern Newfoundland) and I was informed by the same person that some quartz from the same locality, which had been sent to New York to be assayed, had been represented to have given a yield equal to nearly 2 ounces to the ton."

##### Humber Arm, Bay of Islands

In 1867, Murray collected samples of quartz from numerous veins which occur in the Ordovician formations of Humber Arm, Bay of Islands, west coast. Assays made by E. J. Blackwell of Montreal revealed traces of gold in samples taken at Brake's Landing, Meadow Point and Cook's Cove; these samples also contained silver in quantities ranging from 0.006 to 0.010 per cent.<sup>4</sup>

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1. Geol. Surv. of Nfld., Reports p. 307 (1918).
2. Geol. Surv. of Nfld., Reports pp. 195-196 (1881).
3. Geol. Surv. of Nfld., Reports p. 168 (1861).
4. Geol. Surv. of Nfld., Reports pp. 106-107 (1861).



Random Island, Trinity Bay

In 1869, a quartz crystal, with a small speck of gold adhering to it, said to have been found on Random Island, Trinity Bay, east coast, was shown to the officers of the Geological Survey.<sup>1</sup>

St. John's

In 1881, Howley reported the presence of native gold in quartz veins which intersect the Pre-Cambrian sedimentary rocks near St. John's, and noted the similarity of these occurrences to those of Brigus, Conception Bay.<sup>2</sup>

On the south side of St. John's Harbour, at the premises of Imperial Oil, Ltd., a sulphide veinlet was discovered several years ago in Signal Hill gray

sandstone (Pre-Cambrian). Assays of samples from this narrow veinlet yielded over a third of an ounce of gold per long ton. An oil tank has since been erected on the site of this outcrop. Samples of quartz from near-by veins yielded negative results on assay.

Tilt Cove

In 1892, Howley was informed that "Free gold in small quantities has been met with in thin quartz veins cutting the lode rock" at Tilt Cove copper mine, Notre Dame Bay.<sup>3</sup> The gold production from this mine, however, was derived almost exclusively as a by-product from the pyritic copper ore which averaged only one and a half dwts. of gold per ton of ore.



## Chapter IV

Conclusions

Although this report is based on only one season's field work in a number of small areas, sufficient data have been advanced to indicate promising fields for exploration and possible development of gold deposits.

Due to the fact that Newfoundland as yet has had no considerable gold mining industry, the present work is concerned largely with description and interpretation of surface features in known gold-bearing areas. This study shows that the chief potential sources of gold in the island are primary, quartz vein deposits, usually containing sulphide minerals and very little visible gold.

In so far as possible in the areas described, a relation between gold and particular sulphides has been established. The surest method of determining the presence and quantity of gold, however, is by assay; for this purpose a Government Lab-

oratory is maintained at St. John's in conjunction with the Geological Section.

The effect of glaciation on the concentration of gold in placer deposits in Newfoundland has, on the whole, been adverse. Nevertheless, the possibility of glacial or post-glacial placer deposits has been referred to at several places.

The Geological Section is now engaged in supplementing this preliminary report by detailed studies of selected larger areas which, on the basis of the present knowledge, appear to be favourable for the occurrence of gold deposits; and also by co-operating geologically with prospecting and mining development in all parts of the country.

It is hoped that as a result of the present activities, coupled with unusually advantageous governmental, physical and labour conditions, a Newfoundland gold mining industry may be established.