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PAPER 51-13

GEOLOGY OF THE SOUTHERN COAST OF LABRADOR FROM FORTEAU BAY TO CAPE PORCUPINE, NEWFOUNDLAND

(Report and map)

By

A. M. Christie

OTTAWA

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Illustration

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INTRODUCTION

General Statement

The area mapped is the southern part of the Labrador coast from the Quebec border near Forteau Bay as far north as Cape Porcupine, near Cartwright. Field work on which this report is based was done during the 1950 field season. The work was confined to the coast, but, as the coastline is irregular and is bordered by numerous islands, it was commonly possible to observe a considerable width of terrain.

Transportation and accommodation for the party were provided by a chartered fishing schooner, the Effie E. Frederick, built and owned by Mr. Emmanuel Vokey of Little Harbour, Trinity Bay, Newfoundland. Traverses were made by motor boat, or by canoe in shallow bays or rivers where use of the motor boat was not practicable.

M. G. Atkinson, R. A. Crouse, George Marsh, and Frederick Vokey rendered efficient service as members of the writer's field party. Mr. Charles Leate was skipper of the boat. The kindness and hospitality of many residents of the area are gratefully acknowledged.

Previous Geological Work

In spite of the accessibility of the southern Labrador coast, few geologists have visited it, and, with few exceptions, these have limited their observations to the harbours where their vessels were anchored.

The first geologist to visit the area was Lieber (5)[1] in 1860.

[1] Numbers in parentheses are those of references listed at end of this report.

In 1861, Richardson examined the Cambrian formations on the Labrador side of the Strait of Belle Isle and collected specimens of fifteen fossil species from these rocks. The results of Richardson's work were presented by Billings (1) in 1862 and by Logan (6) in 1863. In 1872, T. C. Weston (12) made a further collection of Cambrian fossils from this area.

In 1891, Packard (7) published his work on the geography of the Labrador coast, which includes some geological observations. Daly (2) visited this part of the coast in 1900, and made some scattered observations. In 1910, Schuchert and Twenhofel, and in 1920, Dunbar and Lovering, examined the Cambrian strata near the Strait of Belle Isle. The fossils collected in 1910 were described by Walcott (10, 11), but the most complete description of these Cambrian measures was published in 1934 in a memoir on the stratigraphy of western Newfoundland by Schuchert and Dunbar (8).

The most recent and most comprehensive summary of the geology of the entire Labrador coast is by Kranck (4).

Topography and Glaciation

The greater part of the area mapped is underlain by granites and granitoid gneisses. Most of this part has a moderate to low relief, and shows the rounded and polished forms typical of a glaciated terrain. The bays, although deeply indented, are shallow, and contain many rocks and islands. Areas underlain by gabbro, anorthosite, and amphibolite are characterized by a much more pronounced relief due to differential erosion of these more resistant and massive basic rocks and the adjoining or contained granitic bands. On the northwest coast of the Strait of Belle Isle, the flat-lying, Cambrian sedimentary beds and basalt flows form conspicuous cliffs at or near the shore.

In general, the southern part of the Labrador coast presents those features associated with a drowned coastline that has been undergoing emergence since Glacial time, namely, one with numerous raised and dissected river deltas or raised beaches. North of the Strait of Belle Isle the mouths of the larger rivers are at the landward ends of long inlets; the only exception is North River, which has built an extensive delta deposit at its mouth, now elevated to form a sand plain on which sand dunes have formed. Along the north shore of the strait, the coast is not notably indented, doubtless due in part to the small size of the rivers that reach the sea there. The well-defined lineament represented on the map from Henley Harbour to Pinware Bay is parallel with the lineament that marks the southeast coast of the Strait of Belle Isle, and is parallel with several faults or fractures observed near Marys Harbour. It appears probable, therefore, that the position of the north shore of the strait is determined by a fault-line scarp.

As shown on the accompanying map, glacial ice moved in general from west to east, with many local variations controlled by topography and the nearest route to the sea. Rarely two sets of striations were observed, as on the southwest side of Sandwich Bay.

Sand and gravel terraces are common in the area mapped, but are mostly small, the most extensive occurring at the mouths of the larger rivers. The alluvial deposits of St. Lewis Inlet afford an example. Where St. Lewis River reaches tidewater, it is flanked by a fairly extensive terrace 10 feet above mean sea-level and composed of bedded and crossbedded sand, with a few pebbles and cobbles. One-half mile up the river from its mouth, the banks of the river are sand and gravel terraces 40 feet above the river bed and probably about 50 feet above mean sea-level. The terraces have almost flat tops, but the well-bedded and crossbedded sands and gravels dip 22 degrees downstream. Undoubtedly these are the foreset beds of a delta deposit formed when the level of the river, and, therefore, of the sea, was 50 to 60 feet above its present level with respect to the land. Seven miles northwest of Marys Harbour, on the north side of St. Lewis Inlet and in such a position that it would be protected from glacial ice moving down the inlet, is a band of alluvium composed of bedded and crossbedded sands, pebbles, and boulders, the top of which is 80 feet above mean sea-level.

The top has a drumlinoid form, and is covered with boulders. Two miles northwest of Marys Harbour is a similar area of alluvium in which a terrace has been cut at an elevation of 23 feet above mean sea-level.

Delta terraces were noted at the mouths of all the sizable rivers in the area; they commonly occur at more than one elevation in each locality, but although reasonably careful measurements were made of the altitudes of many of them, the writer could make no acceptable correlations between the terraces at one locality and another.

In general, the larger the river, the greater the amount of alluvium deposited near its mouth, and the more extensive the alluvial terraces.

Three sizable rivers, the Eagle, Paradise, and White Bear, enter Sandwich Bay. Detritus from these rivers has been, and is being, deposited in the bay, which is very shallow and has a sandy bottom. An elevation of the land of 10 feet would convert most of Sandwich Bay into a large sand plain similar to that at the mouth of North River. Several terraces estimated to be as much as 200 feet above sea-level occur on the northwest side of Sandwich Bay.

Apart from the alluvial deltaic deposits, many raised beaches occur at various heights. Several of these are composed of large boulders, and their shape and position indicate that they have been formed by the action of sea waves. Beaches in areas more sheltered from the sea contain abundant sand. The formation of these beaches was controlled by local conditions, and little hope is held that they can be correlated from place to place.

GENERAL GEOLOGY

The following table indicates the probable geological succession in the area mapped.

Table of Formations

Era	Epoch	Formation		Lithology
Palaeozoic	Lower Cambrian	Labrador 'series'	Forteau	Limestone and shale
			Bradore	Arkose, conglomerate, sandstone, and basalt flows

Unconformity

Archaean	Late gabbro dykes
	Granites and granitoid gneisses
	Gabbro, anorthosite, and amphibolite
	Quartzite and metamorphosed carbonate rocks

Quartzites and Metamorphosed Carbonate Rocks

On Battle Island and adjoining islands, northwesterly striking bands of quartzite, with minor amounts of metamorphosed carbonate rocks, occur in the gneiss. The continuation of these bands of meta-sediments is found on the mainland on the north shore of St. Lewis Inlet, where the strike is westerly and the dip 50 degrees to the north. These bands, which have an average thickness of about 700 feet, comprise the only positively identified sedimentary rocks in the Precambrian terrain of the area mapped. They are intimately intruded by granitic and pegmatitic material.

The sedimentary strata consist dominantly of grey to white quartzite in which the bedding is generally determinable. Occasional crossbedding was seen. Banding, with alternating quartzite and lime-rich layers, is common, the limy layers being rarely more than a few inches thick. The lime-rich layers in themselves are rudely banded, narrow, pistachio-green, epidote-rich bands alternating with bands of pink calcite, light green bands containing actinolite, or dark, biotite-rich bands. Their average composition, as estimated from three representative thin sections from specimens obtained on Battle Island, is 20 per cent calcite, 30 per cent microcline, 23 per cent quartz, 20 per cent epidote, 7 per cent actinolite, and minor amounts of sphene and iron oxide minerals. The calcite occurs in grains averaging about 3 mm. in diameter; the microcline is abundant, unaltered, and shows clearly the characteristic twinning; the quartz is fresh, and shows no sign of strain lamellae; and the epidote occurs commonly in crystals 1 mm. to 4 mm. in diameter. Light green actinolite occurs as needle-like or feather-like crystals in the rock.

The abundance and freshness of the microcline feldspar are the most striking features of these rocks when viewed under the microscope, and are probably due to addition of potash from the granite.

Gabbro, Anorthosite, and Amphibolite

The basic intrusive rocks occur principally in two areas, in the vicinity of Square Island, and on the islands between Domino and Cape Porcupine. It is believed, however, that most of the amphibolite inclusions in the granitoid gneisses of the area also represent metamorphosed basic intrusions.

Rocks underlying most of the areas mapped as gabbro and anorthosite include rock types varying in composition from gabbro to norite, anorthosite, garnetiferous gabbro, amphibolite, diorite, quartz diorite, hypersthene-quartz diorite, and granite. Variations in composition are most common across the regional strike of the rocks. One rock type may grade into another, or may be in sharp, intrusive or faulted contact with it. Along certain belts, the mineral constituents are fine grained, and appear to have been crushed and ground down in size; in such rocks the pyroxenes are lacking, their place being taken by amphibole and biotite. It is believed that all the various rock types are related genetically.

The most abundant minerals in these basic intrusive rocks are plagioclase feldspars and various ferromagnesian minerals. The plagioclase of the gabbros, norites, and anorthosites is labradorite, and is commonly coarsely crystalline. The crystals may be fresh and unfractured, bent and fractured but otherwise fresh, or they may be altered to saussurite or lawsonite, a hydrous calcium aluminium silicate. The plagioclase of the diorite, quartz diorite, and hypersthene-quartz diorite is andesine. Where quartz is present, myrmekitic intergrowths of feldspar and quartz may occur. This plagioclase may be fresh or much saussuritized, and may be associated with a little potash feldspar.

The ferromagnesian minerals are, roughly in order of abundance, amphibole, monoclinic pyroxene, hypersthene, biotite, garnet, iron oxides, and olivine. Where the ferromagnesian minerals form sizable aggregates, they most commonly have a pronounced zonal arrangement; augite, which may show diallage- or salite-structure, may be mantled by an aggregate of amphibole crystals, and hypersthene may be similarly mantled by amphibole crystals. Olivine is commonly mantled by hypersthene crystals, which in turn are surrounded by amphibole crystals; opaque iron oxide minerals may be mantled by a thin zone of hypersthene, and the latter, in turn, be surrounded by amphibole; and omphacite, a green monoclinic pyroxene, is commonly mantled by a green amphibole, presumably smaragdite. Biotite may occur adjoining and penetrating the other ferromagnesian minerals, and elsewhere throughout the rock.

The following are typical mineral associations in the various basic intrusive rock types. The gabbro is composed of augite or diallage, commonly mantled by amphibole, and labradorite. The anorthosite is composed essentially of labradorite, with minor amounts of other minerals. The norite is composed of hypersthene, commonly mantled by amphibole, and labradorite; and a noritic gabbro contains augite, hypersthene, amphibole, and labradorite. The garnetiferous gabbro contains garnet, the green monoclinic pyroxene omphacite, the green amphibole smaragdite, and labradorite. Where labradorite is minor or lacking, the rock is an eclogite in composition. The diorites are composed essentially of andesine feldspar and most commonly contain amphibole; biotite may be abundant. The quartz diorite contains considerable quartz in small separate crystals and as small myrmekitic intergrowths in the feldspars. Potash feldspar may occur in minor amounts in the dioritic rocks.

All these basic intrusive rocks are cut by pegmatitic and aplitic dykes. The pegmatites examined consist of abundant white albite, showing fine twinning striations, quartz, large flakes of biotite or muscovite, and minor microcline or microcline-perthite. The aplites consist of small, equigranular crystals of quartz, microcline, and minor albite.

Near the contacts of the gabbroic masses with the granitoid gneisses, the basic rocks are metamorphosed to amphibolites. Small dykes or dykelets of granitic material cut the basic rocks near the contacts, indicating that the granites are the younger.

On and near Long Island (latitude, 53°48'; longitude, 56°38') is a dyke of gabbro that strikes north and dips vertically, unmistakably crossing the foliation of the gneisses, which strikes easterly and dips about 40 degrees to the south (See accompanying map). No sign of the east-striking foliation could be observed in the gabbro dyke, indicating that the foliation cannot be a secondary feature induced after the intrusion of the dyke. The foliation of the gneisses must, therefore, antedate the intrusion of the gabbro dyke. At the contact with the granitoid gneisses, however, small dykes of granitic material penetrate the gabbro, and near their contacts the gabbro is metamorphosed to a biotite-hornblende schist or gneiss. A granitic phase of the gneiss, therefore, intrudes the gabbro.

Kranck (4) concluded that the gabbro of the northern region was intruded as dykes and sills into quartz- and feldspar-rich rocks, probably altered sandstones and related sedimentary strata. After the intrusion, these rocks were granitized, and the gabbro contemporaneously metamorphosed. The writer is in agreement with these conclusions.

Elsewhere in the area mapped, for example near St. Lewis Inlet, amphibolite inclusions were observed to cross the foliation of the enclosing gneisses, yet to be cut by the dykes of aplitic or granitic material that form an important part of the gneiss.

Granites and Granitoid Gneisses

Granites and granitoid gneisses are by far the most abundant rocks in the area mapped. A great variety of rock types are included, and the following is a general summary of their more prominent features. A more detailed description of some localities within the area is given by Kranck (4).

Rarely these rocks are massive; commonly they show a foliation that varies from weak to strong, and in some localities the gneiss has strong compositional banding. The attitude of the foliation varies from flat-lying, to gently dipping, to steep. Linear structures may be well developed, being especially marked where the foliation is flat or has a gentle dip.

In detail, most of the gneisses appear to be of composite (migmatitic) origin. Banded rocks, composed of quartz, plagioclase, microcline, biotite, and hornblende, and varying from granite to granodiorite in composition, are commonly cut by pegmatitic, aplitic, or granitic dykes and irregular masses, which are rich in quartz and microcline and contain lesser plagioclase and minor quantities of muscovite or biotite. The gneisses commonly contain inclusions of amphibolite or biotite schist, more rarely inclusions of a basic rock enclosing crystals of green pyroxene resembling diopside. Garnetiferous gneiss occurs in many localities, and rare sillimanite has been recognized under the microscope.

In four areas — northwest of Williams Harbour, south of Murray Harbour, on Stoney Island, and south of Batteau — large, euhedral crystals of microcline occur in a relatively fine-grained, grey to green, foliated matrix of quartz, feldspar, biotite, and chlorite. The large crystals occur both in the granitoid gneisses and in the dark mafic inclusions; they must have formed later than the groundmass in which they occur, and, consequently, represent porphyroblastic crystals rather than phenocrysts.

About 4 miles northwest of Williams Harbour, greenish grey gneiss containing large microcline crystals is in contact with a lighter coloured, more massive, aplitic granite, many dykes of which intersect the gneiss. This granite, which is composed of microcline, quartz, biotite, and minor sodic plagioclase, extends 6 miles to the west-northwest. To the southwest, it is involved in the shearing and crushing that accomapnied movement along the west-northwest-striking regional faults in the vicinity of Gilbert Inlet, and cannot be distinguished from the greenish grey gneiss in that locality. The southwest contact of the granite body was not located.

Elsewhere in the map-area, as at Fox Harbour, west of Stoney Island, and south of Porcupine Bay, are bodies of a massive-looking hornblende granite, which in thin section is seen to be composed of microcline feldspar, quartz, sodic plagioclase, hornblende, and biotite.

Extensive areas of gneiss, with a pronounced flat or gently dipping foliation, were observed on the north shore of the Strait of Belle Isle, north of Hawke Island, and between Domino and Cape Porcupine. These rocks are commonly more finely banded than the more steeply dipping gneisses. They are composed of microcline, quartz, plagioclase, biotite, epidote, and amphibole in roughly that order of abundance. Rarely, thin bands of quartz and epidote, or of quartz and biotite, with little or no feldspar occur, suggesting a derivation from sedimentary rocks: in every thin section examined, however, some microcline was seen, and commonly was abundant. These rocks are cut by pegmatite and aplite dykes. It has been suggested (See page 8) that some of these rocks are derived from the granitization of banded sedimentary formations.

Near Alexis Bay and Gilbert Bay, the gneisses are affected by shearing and crushing caused by earth movements along west-northwest-striking faults, which are indicated by linears on topographic maps. Among these is the one on the south side of Gilbert Bay, those of Gilbert River and Shinneys Waters River, and probably those of Alexis River and St. Lewis Inlet. Subsidiary faults strike roughly northeast. Near the mouth of Gilbert Bay, the rocks near one of these faults were seen to be intensely crushed to mylonite or protomylonite, and the fault zone and adjoining rocks are reddened by hematite stain. Chlorite, epidote, and carbonate occur in the sheared zone close to the fault. As these faults parallel the strike of the gneisses, no idea of the relative movements involved could be obtained.

Late Gabbro Dykes

Throughout the area mapped are small, fine-grained, dark-coloured, basic dykes. Although gabbroic in composition these rocks are distinguished from the older gabbro by the fact that they cut the pegmatite and aplite dykes. Although widely distributed they are relatively few, and their widths seldom exceed 10 feet. Kranck (4) states that these rocks are more abundant farther north.

In thin section, these gabbro dyke rocks are seen to consist of labradorite feldspar, which may be fresh to completely saussuritized; augite, in large part altered to chlorite; and minor amounts of iron oxide minerals and carbonate. Commonly they possess an ophitic texture.

Because these dykes are relatively young intrusions, they are probably correlative with some of the Late Precambrian diabases elsewhere in the Canadian Shield. There is the possibility, however, that some may be the equivalent of the Cambrian basalt flows of Table Head and Henley Harbour.

Labrador 'Series'

On the north shore of the Strait of Belle Isle, flat-lying, Lower Cambrian arkose, sandstone, limestone, shale, and basalt rest unconformably on the folded Precambrian gneisses. They are exposed along the coast from the Quebec border almost to West St. Modeste. As they dip gently (1 degree to 3 degrees) to seaward, and as their thickness is not great, they probably do not extend inland for more than a few miles at most. Outliers of Cambrian rocks occur at Henley Harbour, the St. Peter Islands, and Table Head.

Schuchert and Dunbar (8) described the Lower Cambrian rocks of the Blanc Sablon-Anse au Loup vicinity, and named them the Labrador series. This 'series' they divided into two formations, the basal Bradore formation composed of reddish arkose and sandstone and small-pebble conglomerate, and the overlying Forteau formation composed of variegated shales, reef limestones, and sandy and oolitic limestones. Table II shows the succession of these rocks as observed at Forteau, West St. Modeste, Henley Harbour, and Table Head.

Table II

Lower Cambrian Rocks on the Labrador Side of the Strait of Belle Isle

'Series'	Formation	Locality			
		Forteau	West St. Modeste	Henley Harbour	Table Head
Labrador	Forteau	Variegated shales, reef limestone, sandy and oolitic lime-stone. 185+ feet (top not exposed)			
	Bradore	Reddish arkose, sandstone, and conglomerate 285 feet	Reddish arkose, sandstone, and conglomerate 350+ feet (top not exposed)	Basalt flows 80 feet Reddish arkose 0 - 10? feet	Basalt flows 12 feet Reddish arkose and conglom-erate 60 feet

Bradore Formation

The type locality of the Bradore formation is Bradore Bay just across the Newfoundland boundary in Quebec. At Forteau, the Bradore is composed of reddish arkose and sandstone, with some small-pebble conglomerates. In general, it is coarsest, reddest, and most arkosic toward the base, the upper members varying from feldspathic sandstone to fairly pure, pink or light grey, quartz sandstone. Crossbedding is common. Foresetting is predominantly toward the southeast, suggesting deposition by streams draining the Canadian Shield. Schuchert and Dunbar (8) report that this formation is unfossiliferous except for the vertical worm tubes Scolithus linearis, which appear at various levels.

Near West St. Modeste is a succession of 350 feet of the same rocks varying irregularly from reddish arkosic conglomerate and arkose at the bottom to feldspathic sandstone and sandstone at the top.

At Henley Harbour is an 80-foot section of fine-grained black basalt, showing good columnar jointing. This basalt rests directly on the Precambrian gneisses, except in one place where Kranck noted an underlying lens of reddish brown arkose. One of the two hills formed by the flat-lying basalt is called the Devil's Dining Table because of its peculiar flat top. In thin section, the basalt is seen to consist of augite and labradorite crystals and minor alteration products, set in a fine-grained opaque groundmass.

At Table Head, which takes its name from the flat-topped Cambrian formations exposed there, 60 feet of reddish arkose and conglomerate are surmounted by a basalt flow 12 feet thick. The arkose, though clearly bedded, commonly closely resembles a granite or crushed granite in the hand specimen, and is evidently derived directly from a granitic terrain with a minimum of decomposition.

The basalt flows of Henley Harbour and Table Head have been considered contemporaneous with the Bradore formation because of their close association with the basal arkose and conglomerate of the Cambrian System.

Forteau Formation

The Forteau formation is composed of red and variegated shales, archaeocyathid reefs, and sandy and oolitic limestones, with a maximum observed thickness of 185 feet near the type locality. The formation is exposed from the Quebec border to a point 3 miles northeast of Anse au Loup. In the lower part of the formation, irregularly distributed archaeocyathid reefs occur as lenses many yards long and 10 to 20 feet thick. They grade laterally into bedded and interbedded limestone and shale. In the upper part of the formation, the limestones are more regularly bedded, and are commonly crystalline or oolitic; more rarely, they are nodular and impure. Thin bands of shale occur throughout.

The following fossil forms have been identified from the Forteau formation, and indicate a Lower Cambrian age. The list is after Schuchert and Dunbar (8) with trilobite names revised by R. D. Hutchinson of the Geological Survey of Canada:

Trilobites

Olenellus logani Walcott
Olenellus thompsoni (Hall)
Bonnia parvula (Billings)
Bonnia senecta (Billings)
Labradoria misera Billings

Archaeocyathinae

Archaeocyathus profundus Billings
Spirocyathus atlanticus (Billings)
Protopharetra sp. undet.

Brachiopoda

Obolella chromatica Billings
Obolella crassa (Hall)
Micromitra (Paterina) bella (Billings)
Micromitra (Paterina) labradorica (Billings)
Kutorgina cingulata (Billings)
Nisusia (Jamesella) oriens Walcott

Gastropoda

Stenotheca sp. undet.
Helcionella elongata Walcott
Hyolithes billingsi Walcott
Hyolithes communis Billings
Hyolithellus micans Billings
Discinella sp. undet.

Cephalopoda (?)

Salterella rugosa Billings
Salterella pulchella Billings
Salterella obtusa Billings

ECONOMIC GEOLOGY

There are no mines or active prospects within the area mapped. During 1946 and 1947, Douglas (3) visited this part of the Labrador coast, and reported several mica occurrences and two minor copper-bearing deposits, none of which was considered to be of economic importance. During the 1950 field season, several occurrences of mica were seen by the writer, and, although not economically important in themselves, they incline the writer to believe that further explorations may reveal more significant deposits. There is also the possibility of finding economic deposits of ilmenite or titaniferous magnetite associated with the basic intrusive rocks.

Mica

Pegmatite dykes containing sizable crystals of mica occur both in the granitoid gneisses and in the gabbro, anorthosite, and amphibolite areas. Douglas (3) reports that a little mining was done, about 1910, on a mica prospect near Paradise River, at latitude 53° 17' and longitude 57° 34'. He examined the workings and considered the prospect to have no commercial value. Douglas (3) also examined a group of mica- (muscovite-, phlogopite-, and biotite-) bearing pegmatites on the Seal Islands, east of Henley Harbour, of which he says "it is very doubtful if the deposit is commercial". Neither of the above-mentioned deposits was visited by the writer.

Two pegmatite dykes, with abundant books of muscovite and biotite 1 inch to 6 inches in diameter, occur on the south side of a small bay north of White Bear Arm at latitude 52° 46.5' and longitude 55° 59'. The larger mica books are commonly broken, undoubtedly by late shearing movements. The dykes are up to 6 feet wide, but are irregular. The larger has an observed length of about 30 feet, but one end is drift-covered; however, the irregular form of the dyke and the lack of any strong controlling fractures suggest that this dyke is not of any great length or depth.

On the shore, at latitude 52° 48' and longitude 55° 56', a straight-walled and continuous pegmatite dyke, 5 to 8 feet wide, contains abundant dark-cloured mica in books up to 1 foot in diameter. The larger books are fractured.

Numerous other mica-bearing pegmatite dykes were observed, but the mica was too small, or too sparse, or in too small dykes to be considered of economic value.

Ilmenite, Magnetite, and Titaniferous Magnetite

Because of the discovery of the large ilmenite deposit in anorthosite near Allard Lake, Quebec, roughly 300 miles west of Forteau, it is suggested that the large anorthosite or gabbro bodies of the Labrador coast may be worth prospecting for this and other minerals.

No concentrations of iron or titanium minerals approaching economic deposits were observed in the area mapped. Rarely 5 per cent of a gabbroic rock is composed of opaque minerals, which are mainly magnetite, and ilmenite or titaniferous magnetite. Heavy mineral concentrates were made from gabbroic rocks near Triangle Harbour, from Gready Island, and from Huntingdon Island. Qualitative spectroscopic analyses of these concentrates show that they contain abundant iron and a moderate amount of titanium. Two samples, those from near Triangle Harbour and from Gready Island, also contained appreciable amounts of copper. Although examined under the microscope, no copper minerals were detected. The spectroscopic analysis failed to show any cobalt, nickel, or chromium in these concentrates.

Gneisses and pegmatite on Assizes Island and in some adjoining areas are rich in crystals of iron oxide minerals. These crystals are as much as $\frac{1}{2}$ inch or more in diameter, and are composed of hematite and ilmenite or titaniferous magnetite. A qualitative spectroscopic analysis of the ilmenite or titaniferous magnetite indicated abundant iron and titanium and considerable zinc.

Copper

A little copper was contained in the heavy mineral concentrates of gabbroic rock from near Triangle Harbour and from Gready Island. Douglas (3) reports that, east of Domino Harbour, a mass of amphibolite contains magnetite and minor amounts of malachite and azurite. On Eagle River, latitude 53° 35', longitude 57° 25', Douglas (3) reports a mineralized zone about 2 feet wide that contain chalcopyrite, bornite, and malachite. The length of this mineralized zone is not given, but the zone is stated to occur in a quartzite roof pendant, 100 feet long and about 14 feet wide, in gneiss.

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