GEOLOGY OF MERASHEEN (1M/8) AND HARBOUR BUFFETT (1M/9 E1/2), NEWFOUNDLAND

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INTRODUCTION

Geological mapping at a scale of 1:50,000 of the Merasheen (1M/8) and Harbour Buffett (1M/9 E½) map areas was carried out during the 1978 field season. The map areas are located in central Placentia Bay and include the numerous islands as well as an eastern coastal section of the Burin Peninsula. The four largest islands are Merasheen Island, Long Island, Red Island and King Island. At present there are no permanent communities and the area is accessible only by boat and aircraft.

Previous work in the area includes the reconnaissance mapping by Anderson (1965) and McKillop (1953) and exploration work by Nalco (DeZoysa and Fogwill, 1966; Hogg and Hawkins, 1953). Detailed mapping of Red Island has been done by Hogg (1954). Part of this area was also included in a regional geochemical survey of eastern Newfoundland granitoid rocks (Strong *et al.*, 1974).

GENERAL GEOLOGY

The map area is underlain by a thick succession of late Precambrian sedimentary rocks (Connecting Point Group) which are presumed to be overlain by a mixed volcanic and sedimentary assemblage (Musgravetown Group). Rocks of Lower to Middle Cambrian age outcrop on a number of islands and are faulted against the older volcanics. All of these rocks are intruded by plutonic rocks of presumed Devonian age (Red Island Granite, Ragged Islands intrusions).

Connecting Point Group (Units 1-2)

The Connecting Point Group was named by Hayes (1948) for a thick sequence of sedimentary rocks exposed around Clode Sound, Bonavista Bay. Jenness (1963), Anderson (1965) and McCartney (1967) extended the boundaries of this group southwards from Bonavista Bay to Placentia Bay.

Within the map area rocks of the group are exposed on Long Island and the small islands in the Central Channel. The group consists of a steeply to gently dipping, southerly to southwesterly facing succession of sedimentary rocks. It is subdivided into two formations within the map area.

The maximum exposed thickness of the Connecting Point Group on Long Island is about 1500 m. Thicknesses up to 7500 m have been reported by Jenness (1963) in the Bonavista Bay area.

Unit 1

This unit forms the lower formation of the Connecting Point Group within the map area. It is in part a turbidite sequence consisting of well bedded, gray to brown sandstones, siltstones and interbedded shales. Graded and cross-bedded beds, 3 to 10 cm thick, are exposed in repetitious successions. Complete Bouma sequences are common. This sequence is overlain by gray to brown sandstone beds up to 1 m thick and "interrippled" shale and sandstone beds typical of those in a deltaic environment. Ripple marks are common in this part of the formation.

Unit 2

Rocks of unit 1 coarsen upwards through medium grained sandstones to unit 2, which consists of brown to green pebbly sandstone and medium to coarse grained green conglomerate. The clasts in the conglomerate are dominantly sedimentary and consist of black to dark gray shale, green sandstone and gray chert. Minor granitic and volcanic clasts occur locally. The minimum thickness of the conglomerate is 800 m, but the top is not exposed in the area. Conglomerate and sandy conglomerate underlie most of the islands in the Central Channel and are exposed as far west as Rose au Rue Island.

Musgravetown Group (Units 3-9)

The name Musgravetown was proposed by Hayes (1948) for a thick succession of clastic sedimentary and volcanic rocks overlying the Connecting Point Group and underlying the Random Formation in Bonavista and Trinity Bays. McCartney (1967), Jenness (1963) and Anderson (1965) traced rocks of the group from Bonavista Bay to Placentia Bay and southwards along the Burin Peninsula. Rocks on the north side of Fortune Bay have also been correlated with this group (Williams, 1971; O'Driscoll, 1977).

Within the map area rocks assigned to this group underlie Merasheen and King Islands and the eastern part of the Burin Peninsula. It has been subdivided into seven formations, many of which may be lateral equivalents.

In the Bonavista Bay area the Musgravetown Group overlies the Connecting Point Group with angular unconformity (Jenness, 1963; Younce, 1970); McCartney (1967) reports possible conformable relationships between the two groups on the Isthmus of Avalon. Thicknesses of the group have been estimated at 3000 to 5000 m (Jenness, 1963; McCartney, 1967).

Unit 3

This unit consists of sedimentary rocks and forms the lowermost unit of the Musgravetown Group within the map area. It is exposed in a tight anticline on Merasheen Island east of King Island and underlies Slatey Point on the southeast side of Merasheen Island. The unit comprises gray, green and black, fine to medium grained, thinly laminated siltstone and sandstone with minor pebble conglomerate. The contact of these rocks with the underlying Connecting Point Group is not exposed. However, conformity is suggested by bedding attitudes indicating agreement with McCartney's (1967) interpretation to the northeast.

Unit 4

This unit underlies the southern half of Merasheen Island and is also exposed along the coast of the Burin Peninsula in the vicinity of Presque Harbour. It has been subdivided into three members.

Unit 4a on Merasheen Island consists mainly of dark green purple and red basalts and andesites. Massive vesicular and amygdaloidal flows are predominant, followed in abundance by tuffs and agglomerates. Dark green flows commonly have bright red oxidized zones, possibly indicating flow tops. Amygdules are generally filled with calcite, quartz, or epidote. Large epidote pods are common. These rocks conformably overlie sedimentary rocks of unit 3 at Slatey Point.

Unit 4b extends along the east side of Presque Harbour and northeastwards to Isle Valen. It consists predominantly of hematitic red and purple mafic agglomerate and tuff. In the agglomerate, red to buff basaltic bombs up to 30 cm long are enclosed in a red, medium to coarse grained, crystal-lithic tuffaceous matrix. Green and purple mafic tuffs and flows are exposed on the peninsula southeast of Presque Harbour and are included in this unit.

Unit 4c is exposed on the western side of Presque Harbour and extends northwards along the Burin Peninsula into the Harbour Buffett (1M/9) map area.It consists of massive to amygdaloidal, light green, epidote-rich mafic flows, agglomerates and tuffs.

The relationships between 4a, 4b and 4c are not known but they are believed to be lateral equivalents.

Unit 5

This unit is exposed on the northern half of Merasheen Island and part of King Island. It is a mixed volcanic assemblage that is subdivided into two members. Unit 5a consists of a wide variety of silicic volcanic rocks. It includes fine to coarse grained purple, green to gray crystal, lithic, and crystal-lithic tuff, breccia and agglomerate. Coarse grained laharic breccias are exposed in places. Also included in this member are purple, pink and gray to green rhyolitic flows and quartz-feldspar porphyries. Minor tuffaceous sedimentary rocks and mafic pyroclastics and flows also occur within this unit. Unit 5b is interbedded with unit 5a and consists of massive, vesicular to amygdaloidal basaltic flows, tuffs and agglomerates.

Unit 5a in part conformably overlies mafic volcanic rocks of unit 4a. Both units conformably overlie rocks of unit 3. Because of this relationship, units 4a and 5a are assumed to be penecontemporaneous.

Unit 6

This unit underlies the central part of King Island and the smaller islands to the north and south. It is a distinctive unit of feldsparphyric basalt with white to green plagioclase phenocrysts up to 1 cm in length. It also contains pyroxene and/or amphibole phenocrysts. The contact of this unit with the surrounding volcanic rocks appears to be both intrusive and extrusive. On central King Island, a chilled margin is developed along the contact with the country rocks. On the southern part of King Island tuffaceous sediments of unit 5a are in depositional contact with the plagioclase porphyry.

MERASHEEN (1M/8) and HARBOUR BUFFETT (1M/9 East), NEWFOUNDLAND

LEGEND

DEVONIAN (?)

14	**Red Island Granite: 14a,** *Pink to orange, fine to medium grained granite and granodiorite;* **14b,** *fine to medium grained diorite and gabbro.*
13	**Ragged Islands Intrusions:** *Pink, fine to medium grained granite and granodiorite; white to gray quartz diorite.*

MIDDLE CAMBRIAN

12	*Fossiliferous gray to black sandstone and shale; in part hornfelsed to garnet-amphibolite grade.*

LOWER CAMBRIAN AND EARLIER

11	*Red, brown and green shale and slate with nodules and beds of pink algal limestone; hornfelsed in part.*
10	**Random Formation:** *White cross-bedded orthoquartzite and quartz sandstone with interbedded gray to green micaceous siltstone.*

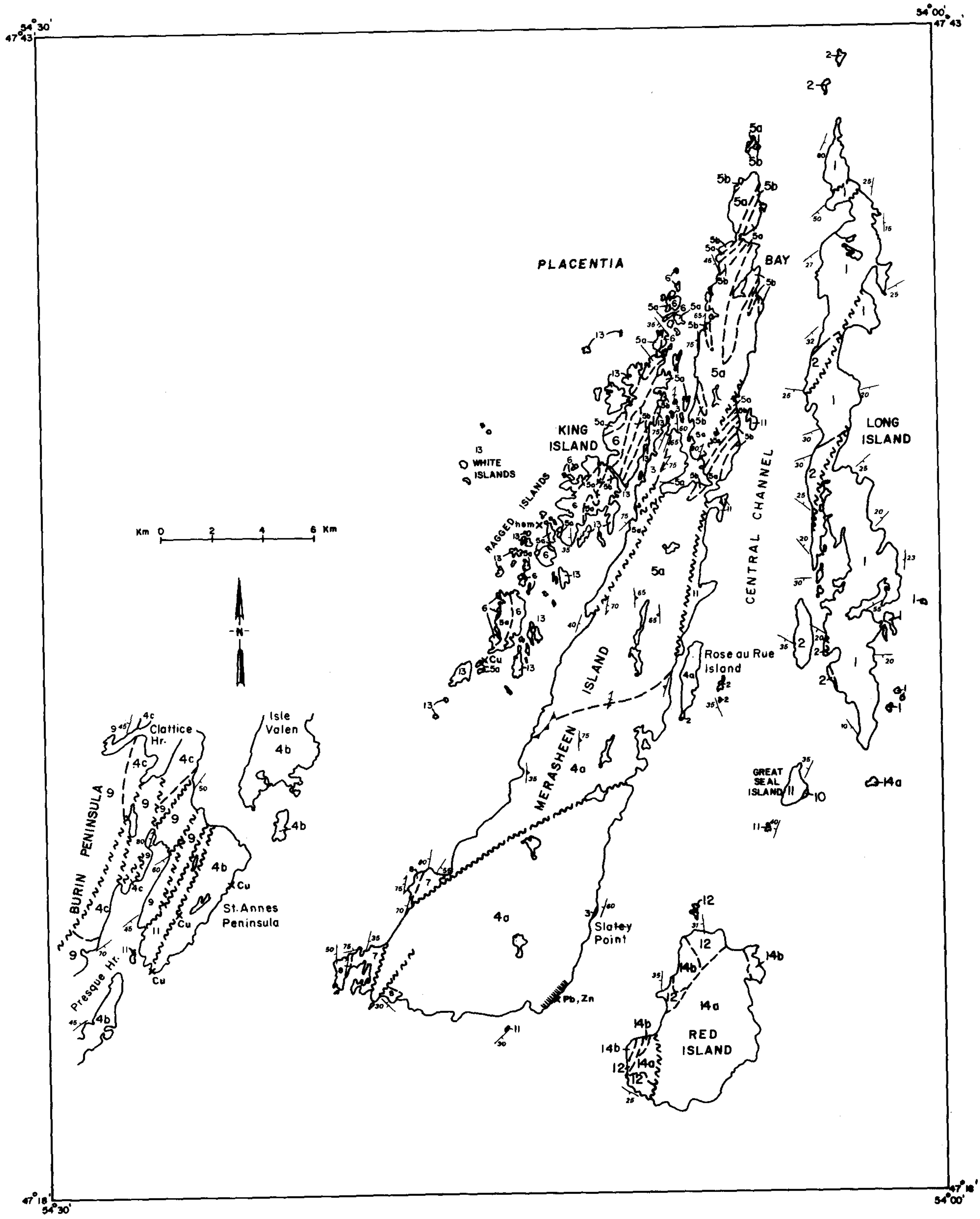
PRECAMBRIAN

Musgravetown Group

9	*Green, fine grained, thinly laminated argillite; gray fine to coarse grained arkosic sandstone, gray pebbly mudstone with abundant intrusive, volcanic and limestone clasts and rare bedding.*
8	*Red and green medium to coarse grained conglomerate, graded and cross-bedded sandstone, minor red shale.*
7	*Gray, fine grained, thinly laminated, well cleaved siltstone and sandstone.*
6	*Gray to green and purple, fine to coarse grained, intermediate to mafic plagioclase porphyry.*
5	**5a,** *Silicic pyroclastics and flows; minor tuffaceous sediments;* **5b,** *massive vesicular to amygdaloidal mafic flows and pyroclastics.*
4	**4a,** *Purple, green and red, vesicular, amygdaloidal, massive and flow banded basaltic and andesitic flows and pyroclastics;* **4b,** *hematitic red, purple and green mafic pyroclastics;* **4c** *massive to amygdaloidal, green, epidote-rich mafic flows and pyroclastics.*
3	*Gray, green and black, fine to medium grained, well cleaved, thinly laminated and bedded siltstone and sandstone; minor pebble conglomerate.*

Connecting Point Group

2	*Fine to coarse grained green conglomerate with predominantly sedimentary clasts.*
1	*Gray to black, evenly bedded, graded and cross-bedded sandstone and interbedded shale; thickly bedded green-gray sandstone and interrippled green to gray sandstone and shale.*



54°30'
47°43'
54°00'
47°43'
PLACENTIA
BAY
KING ISLAND
WHITE ISLANDS
RAGGED ISLANDS
CENTRAL CHANNEL
LONG ISLAND
MERASHEEN ISLAND
Rose au Rue Island
GREAT SEAL ISLAND
Isle Valen
Clattice Hr.
BURIN PENINSULA
St. Annes Peninsula
Presque Hr.
Slatey Point
RED ISLAND
Pb, Zn
Km 0 2 4 6 Km
N
47°18'
54°30'
47°18'
54°00'

Unit 7

This unit is exposed at the southwest corner of Merasheen Island. It consists of gray, fine grained, thinly laminated and bedded, siltstone and sandstone. It is in fault contact with the mafic volcanics but is presumed to overlie them. These rocks have been sheared and tightly folded especially along the main fault zone which separates them from the volcanic rocks.

Unit 8

This sequence conformably overlies unit 7 on the southwest side of Merasheen Island. It consists of red and green, medium to coarse grained conglomerate, graded and cross-bedded sandstone and minor red shale. On the southern end of Merasheen Island, similar rocks occur and a basal contact with unit 4a is well exposed. Here, the underlying unit 7 is missing and presumably unit 8 has overstepped unit 7 and rests upon volcanic rocks of unit 4a.

Unit 9

This unit comprises mixed sedimentary rocks which conformably overlie the volcanic rocks of unit 4c. It consists of three distinctive subunits: (1) green, fine grained, thinly laminated siltstone, sandstone and argillite; (2) well bedded, graded and locally cross-bedded, gray to green, fine to coarse grained sandstone and conglomerate; these contain well sorted clasts of rhyolite, granite, basalt, chert, siltstone, and abundant quartz and feldspar; (3) dark gray to black mudstones with rare bedding and abundant pebbles and boulders scattered throughout; the clasts are subangular to rounded and consist of intrusive rock, volcanic rock, sandstone, argillite and abundant limestone. Subunit (3) may represent possible downslope slumping or a glaci-omarine environment.

Contacts between units 9 and 4 are exposed north of Presque, west of Isle Valen and in Clattice Harbour. Also the contact is excellently exposed in the west half of the Harbour Buffett map area (O'Driscoll, 1978). Near Presque and west of Isle Valen, green laminated sandstone and siltstone (subunit 1) overlie mafic volcanic rocks (unit 4c). At Clattice Harbour, bedded and unbedded pebbly mudstone and sandstone (subunit 3) overlie mafic agglomerates of unit 4c. In the Harbour Buffett (west half) map area, green sandstone overlies mafic tuff and grades upwards into the unbedded black pebbly mudstone. Apparently the laminated green siltstones and sandstones and the black pebbly mudstone are lateral equivalents overlying the volcanic terrain. The fine to coarse grained, graded and crossbedded sedimentary rocks (sub-unit 2) which form the third part of Unit 9 overlie the laminated green siltstones in Presque Harbour and black pebbly mudstone north of Presque. If all members of unit 4 are lateral equivalents, then units 7, 8 and the lower part of unit 9 are also contemporaneous since all conformably overlie or are interpreted to overlie the volcanic terrain.

The sequence of sedimentary rocks (unit 9) which outcrops at Clattice Harbour can be traced northwards into the Harbour Buffett (1M/9) map area. Faulting occurs in the sequence, but relationships across faults can be established. The upper part of the sequence grades into ripple marked micaceous siltstone and sandstone which are overlain by interbedded quartzite and micaceous sandstone beds similar to the Eocambrian Random Formation (Walcott, 1900). If this is the Random Formation, then a late Precambrian age for units 3 to 9 and their assignment to the Musgravetown Group are acceptable.

Rocks of unit 9 can be traced southwestwards into the Baine Harbour (1M/7) map area (O'Brien, this volume). These lie along strike and are similar to rocks which have been assigned to the Rock Harbour Group (Strong *et al.*, 1978; O'Brien, 1978). If this correlation is valid, then the Rock Harbour Group is likely of latest Precambrian age.

Random Formation (Unit 10)

The Random Formation was named by Walcott (1900). Rocks of this formation are not widespread within the map area and are exposed only on Great Seal Island. They consist of graded and cross-bedded white quartzite and quartz sandstone with interbedded gray to green micaceous siltstone and fine grained sandstone. The siltstone members contain worm trails, burrows and other trace fossils. The Random Formation conformably overlies rocks of the Musgravetown Group outside the map area and is of late Precambrian to Eocambrian age (Jenness, 1963; McCartney, 1967).

Lower Cambrian (Unit 11)

This unit overlies the Random Formation on Great Seal Island and consits of three previously named formations; namely, the Bonavista, Smith Point, and Brigus Formations of early Cambrian age. They have been included in the Adeyton Group (Jenness, 1963) in the Trinity Bay area. The three formations can be readily subdivided in the field but are not separated on the map in this report. The rocks are exposed on the St. Anne's Peninsula, the eastern side of Merasheen Island and some of the islands in the Central Channel.

The name Bonavista was proposed by Van Ingen (1914) for the lowest formation of Cambrian rocks around Conception and Trinity Bays. Within the map area they are characterized by red, brown and green shales and slates with nodules and nodular beds of pink algal limestones. The limestones contain fossils, mainly of the shelly fauna hyolithids. On Great Seal Island rocks of this formation have been hornfelsed slightly and now consist of dark gray shale and slate with buff limestone nodules. Some of the limestone has been altered to epidote.

The name Smith Point Limestone was first used by Walcott (1900) for a prominent bed of pink limestone on the northwestern shore of Smith Sound, Trinity Bay. The limestone has a thickness of 7-10 m and separates the lithologically similar but faunally different Brigus and Bonavista Formations. Within the map area the Smith Point Limestone consists of pink to red, well bedded, dense limestone with thin layers of interbedded red shale. In some localities it contains concentrically layered algal structures. The uppermost bed consists of buff dense limestone about 30 cm thick. The Smith Point Limestone is abundantly fossiliferous, containing mostly inarticulate brachiopods and hyolithids. According to Hutchinson (1962), the uppermost beds contain fragmentary trilobites and are referable to the *Callavia* zone, while the lower part is referable to the pre-trilobite *Coleoloides* zone. The Smith Point Limestone conformably overlies the Bonavista Formation.

The name Brigus Formation was proposed by Van Ingen (1914) for red and green shales and nodular limestone containing *Callavia broeggeri* and *Strenuella strenua* which he believed to be below the Smith Point Limestone. Hutchinson (1962) redefined the formation and showed that it lies above the Smith Point Limestone. Within the map area, the Brigus Formation is lithologically similar to the Bonavista Formation and consists of red, pink and green shale and slate with nodules and nodular beds of pink and gray limestone. According to Hutchinson (1962), the lower part of the Brigus Formation contains a typical early Cambrian *Callavia* zone fauna while the upper part of the formation probably represents the latest lower Cambrian *Protolenus* zone.

Middle Cambrian (Unit 12)

Rocks of this unit are exposed on the western side of Red Island and were first described by Hogg (1954). They consist of gray to black thinly bedded shale, sandstone and limestone. They contain *Paradoxides davidis* fauna, thus placing them in the upper Middle Cambrian. These rocks have been correlated with and included in the Manuels River Formation (Hutchinson, 1962). The rocks of this formation on Red Island have been intruded by granite and diorite and have a well developed thermal aureole. They grade from relatively unmetamorphosed shale and slate to a dense, compact rock made up mostly of garnet and hornblende.

Ragged Islands Intrusions (Unit 13)

The name Ragged Islands intrusions is used informably for a number of intrusions located in the Ragged Islands area. These have been previously called the Tacks Beach pluton (Strong *et al.*, 1974) but current mapping shows they are not exposed at Tacks Beach. The rocks range from fine to medium grained pink biotite granite in the southeast to buff-gray granodiorite in the west and white quartz-biotite diorite at White Islands. These may represent separate intrusions or different phases of the same intrusion. The granite intrudes the granodiorite southwest of King Island, but the contact with the diorite is not exposed. The granite and granodiorite intrude rocks of the Musgravetown Group. The age of these intrusions is not known but is assumed to be Devonian. Preliminary studies of their geochemistry show that they differ slightly from other Devonian intrusions nearby (Strong *et al.*, 1974).

Red Island Granite (Unit 14)

Red Island is underlain chiefly by pink medium to coarse grained biotite granite (unit 14a). Associated with this granite are black to dark gray, fine to medium grained gabbro, diorite and buff to gray granodiorite (unit 14b). These rocks intrude and hornfels rocks of Middle Cambrian age. Most of the thermal metamorphism seems to be associated with the granite rather than the more mafic phases. The age of the granite is assumed to be Devonian.

STRUCTURAL GEOLOGY

Rocks of the map area are gently to steeply dipping and are involved in open to tight upright folds. The Connecting Point Group on Long Island is openly folded and exhibits a poorly developed cleavage. The folds in the Musgravetown Group on Merasheen Island and around the St. Annes Peninsula are tight to isoclinal with a pronounced axial planar cleavage. A schistosity defined by sericite is locally developed in the volcanic rocks. Fragments in the volcanic tuffs of unit 5a are flattened locally. This flattening is tectonic since it occurs along cleavage planes. The conglomerate of unit 8 is also flattened in places. This flattening is possibly associated with faulting since it becomes less intense away from known fault zones. Similarly, schistose zones in the volcanic rocks and the tight folds in the sedimentary rocks of the Musgravetown Group may be associated also with faults and shear zones.

Two thrust faults are recognizable in the field. One is a west dipping fault on the east side of Merasheen Island which thrusts the Lower Cambrian Bonavista Formation over the Lower Cambrian Brigus Formation.

The other is an east dipping fault on the west side of Merasheen Island which thrusts unit 4a over unit 5a. Normal faults occur on the St. Annes Peninsula, where a block of Cambrian rocks has been downfaulted against rocks of Late Precambrian age. Steeply dipping normal faults are also well exposed on Merasheen and Long Islands.

MINERALIZATION

Mineral showings in the map area include copper on the St. Annes Peninsula and the southern part of the Ragged Islands, hematite associated with granodiorite on the central part of the Ragged Islands, and lead and zinc on the southeast corner of Merasheen Island. Some mineralization has also been reported in the hornfelsed Middle Cambrian sediments on Red Island.

Copper showings on the St. Annes Peninsula occur at three localities. At the southern tip of the St. Annes Peninsula a 1 m wide quartz-epidote vein and breccia zone are exposed for 100 m and contain coarse grained chalcocite, which makes up about 10 percent of the vein. To the east the vein separates into many small veinlets which are contained in a zone about 15 m wide. The mineralization is best developed in the 1 m thick vein and decreases in abundance eastwards. On the eastern side of the St. Annes Peninsula a copper showing has been reported (Gillespie, 1951). This showing is exposed at the end of an old 10 m long adit. Since the adit was in an unsafe condition, the showing was not examined. It has been reported that the mineralization is chalcocite in a quartz-epidote vein similar to that at the southern tip of the St. Annes Peninsula. The copper showing in the interior of the St. Annes Peninsula has been examined by Gillespie (1951). It consists of native copper associated with quartz in two veins about 10 cm wide and 50 cm apart. The copper is found in vugs in the quartz and as thin sheets between the quartz and wallrock (Gillespie, 1951). A very small occurrence of copper is exposed on the southern end of Ragged Islands. This consists of chalcocite smeared along a fracture surface, now altered in part to malachite.

Specular hematite occurs in two narrow shear zones associated with granodiorite of the Ragged Islands intrusions. One zone is about 65 cm wide and is exposed over a distance of 8 m. The second zone varies in width from 5 cm to 20 cm over a distance of 1 m. In places the specular hematite is massive with some pyrite disseminated throughout.

On the southeast corner of Merasheen Island lead and zinc mineralization has been reported by McKillop (1953). Analyses have shown 0.20 percent lead and 0.63 percent zinc. The mineralization occurs in a zone of alteration which extends for 2 km along the coast and in cliffs up to 150 m high. The rocks are gray felsites with abundant disseminated pyrite and some galena and sphalerite grains.

Mineralization in the form of pyrite, chalcopyrite, pyrrhotite and pentlandite has been reported in sedimentary rocks on the northern part of Red Island. (Hogg and Hawkins, 1953). Although these sediments were examined, only abundant pyrite was found during the present study.

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