GEOLOGY OF BAINE HARBOUR (1M/7) AND POINT ENRAGEE (1M/6) AREAS, NEWFOUNDLAND

by Sean O'Brien and Sid Taylor

INTRODUCTION

1:50,000 geological mapping on the Burin Peninsula continued during the 1978 field season with the completion of the Baine Harbour (1M/7) and Point Enragée (1M/6) map areas. Reconnaissance geological mapping of the area had been previously undertaken by Anderson (1965), Allied Chemical Corporation (Fitzpatrick and Howse, 1972), and Serem Ltée (Schrijver, 1972, 1973).

A major fault of unknown displacement (the Paradise Sound Fault) divides the area into two contrasting gological terrains. The geology to the west of this fault is characterized by extensive subaerial volcanism, comagmatic plutonism and associated sedimentation whereas the geology to the east is characterized by submarine mafic volcanism and deep water marine sedimentation. The intensity of the regional deformaton increases with proximity to this fault.

GENERAL GEOLOGY

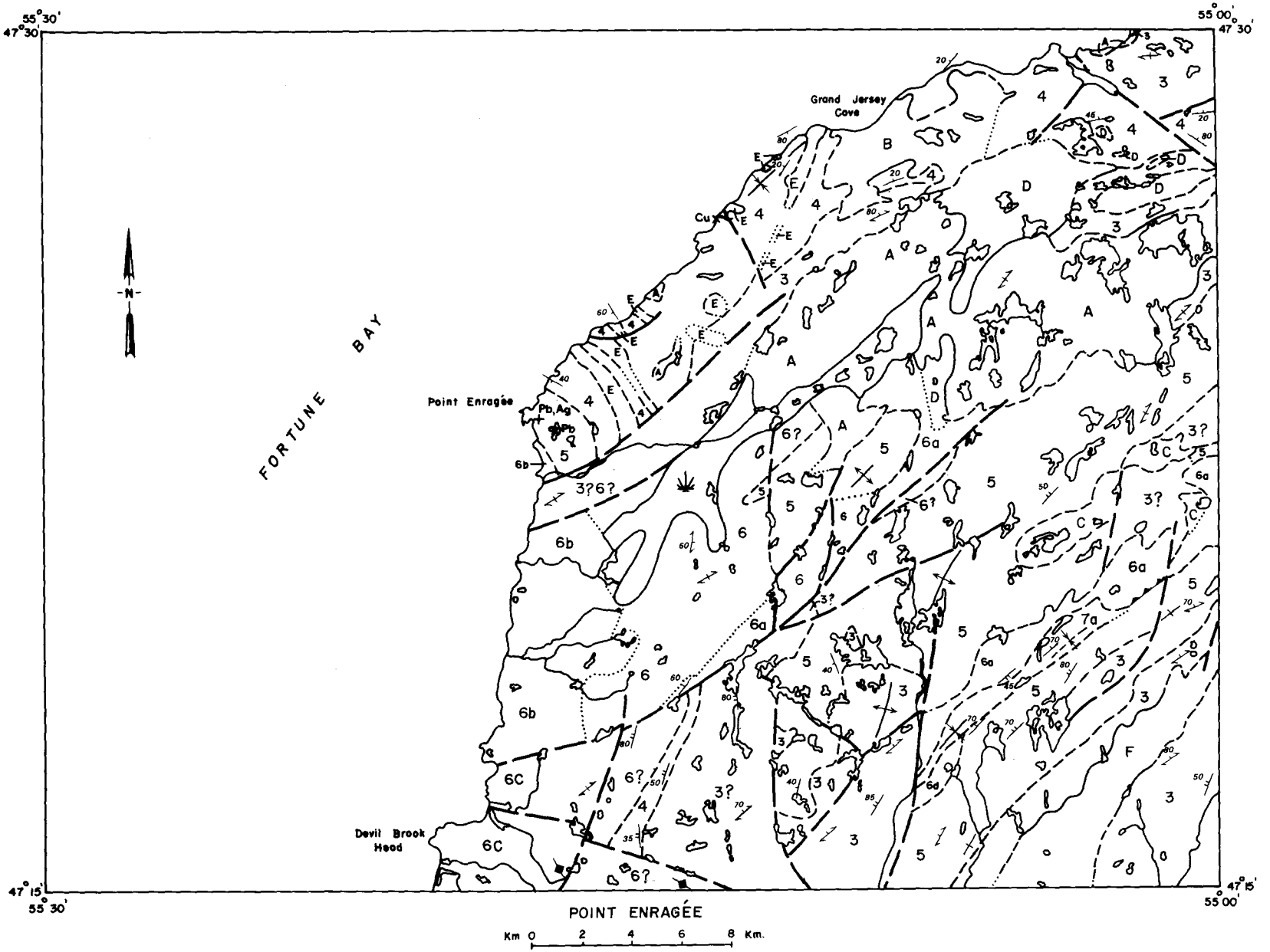
The two lowermost stratigraphic units, correlatives of the Rock Harbour (Unit 1) and Burin (Unit 2) Groups of Strong *et al.* (1978b), are restricted to the area east of the Paradise Sound Fault. The contact of units 1 and 2 is invariably fault modified. However, relationships in the Flat Islands area (O'Brien, 1978) suggest interdigitation of these two units. Strong *et al.* (1978b) suggest that the Burin Group conformably overlies the Rock Harbour Group, but it does not appear possible to establish such a relationship in the present map area.

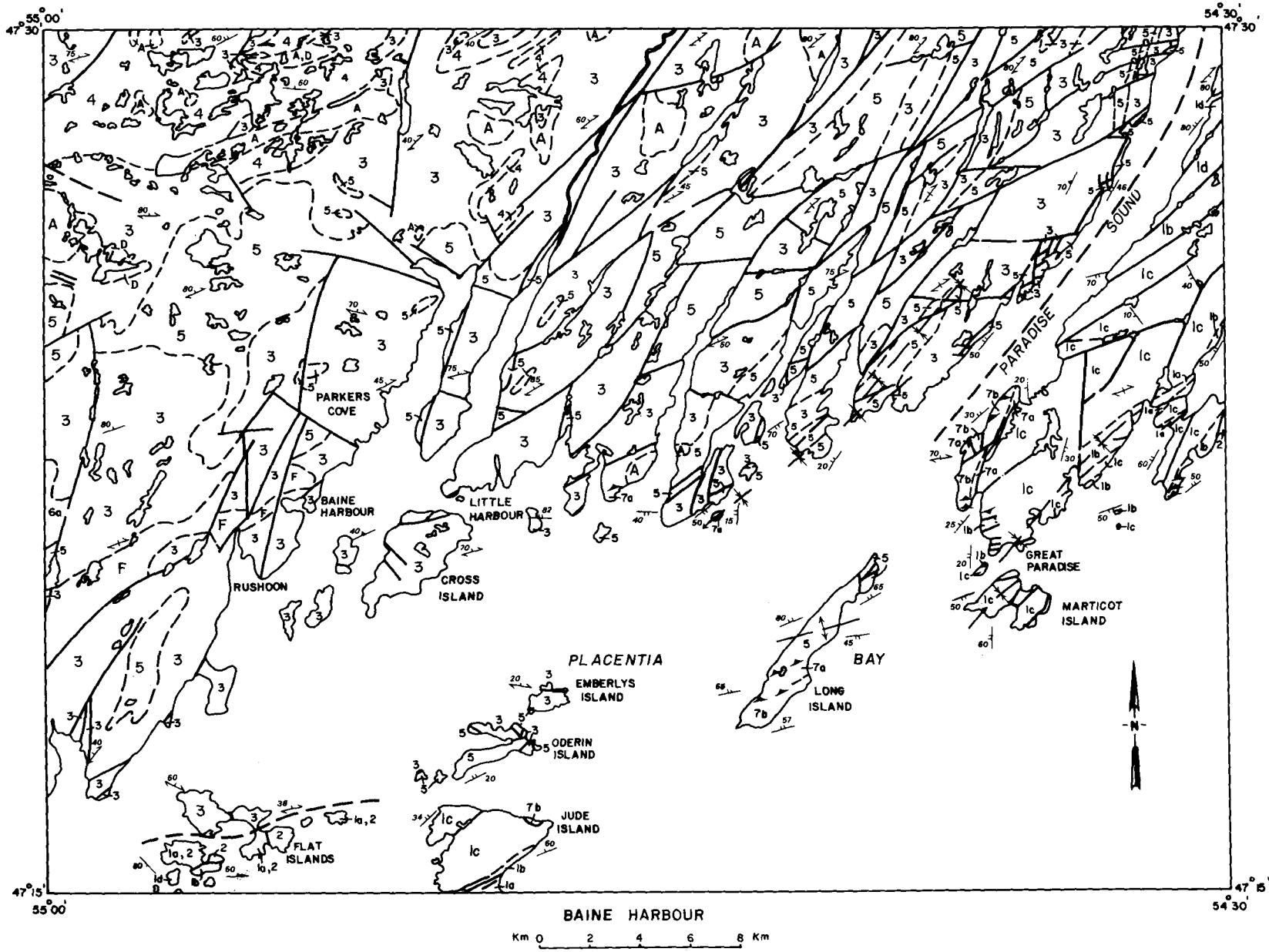
Unit 1 can be subdivided into three lithostratigraphic divisions which are traceable along strike for approximately 50 km. Unit 1a is characterized by a sequence of finely laminated gray and black, locally convoluted, fine to coarse grained siltstone, interbedded gray and green sandstone, and dark gray siltstone. Lesser amounts of pebbly mudstone, massive and thickly bedded gray sandstone, and fine to medium grained cross-bedded sandstone and conglomerate occur in unit 1a.

Unit 1b consists of medium to coarse grained conglomerate with minor interbedded coarse grained sandstone. Its stratigraphic position is unclear as it underlies equivalents of 1a on Jude Island but overlies similar rocks on the east side of the Paradise Peninsula.

The dominant rock types of unit 1c are sedimentary breccias which contain disrupted blocks of sandstone, siltstone, fossiliferous limestone and lesser mafic volcanic rocks in a black shaly matrix. These breccias are associated with a megabreccia containing large (<2 m) chaotic blocks of bedded gray and green sandstone, siltstone and argillite in a sandy to silty matrix. The megabreccia horizons are bounded above and below by conglomerate and thixotropically deformed siltstones. This association of conglomerates and breccias suggests that units 1b and 1c may be in part facies equivalents. It also lends credence to the resedimented origin of the conglomerates of the Rock Harbour Group suggested by Strong *et al.* (1978).

The main rock types of unit 2 are pillowed and massive basaltic flows and associated mafic aquagene tuffs, which are best exposed in the southern parts of the Baine Harbour map area (*e.g.* Flat Islands, Davis Islands). A narrow (<1 km) fault wedge of massive mafic flows and tuffs which outcrop on the eastern coast of White Sail Head is tentatively included in this unit. The pillowed basalts are fine grained to slightly porphyritic, locally variolitic, with phenocrysts of clinopyroxene and lesser amounts of olivine in an intergranular groundmass of plagioclase, chlorite and magnetite. The main





LEGEND

VOLCANIC AND SEDIMENTARY ROCKS

EOCAMBRIAN-LOWER CAMBRIAN

7 — **7a,** *Red, green and gray micaceous sandstones, quartz rich sandstones, quartzites;* **7b,** *red shale with pink limestone nodules, pink limestones, red and green shales.*

LATE PROTEROZOIC

6 — **6a,** *Red, welded ash-flow tuffs;* **6b,** *fine grained felsic agglomerates and monolithologic volcanic breccias;* **6c,** *laharic breccias;* **6d,** *rhyolite porphyry and rhyolite tuffs.*

5 — *Subaerial, amygdaloidal basalt flows, mafic tuffs and tuffaceous sedimentary rocks, minor felsic tuffaceous rocks.*

4 — *Tuffaceous sandstones, graywackes and graywacke conglomerates; minor red sandstones and green siltstones.*

3 — *Crystal, crystal-lithic and lithic lapilli tuffs; massive, flow-banded and autobrecciated rhyolites; heterolithologic volcanic breccias, felsic agglomerates, minor mafic flows and mafic to intermediate tuffs and tuffaceous sedimentary rocks; minor red sedimentary rocks.*

2 — *Massive and pillowed basalt, mafic aquagene tuffs.*

1 — **1a,** *Gray and black siltstone; gray and green sandstone and pebbly mudstone;* **1b,** *conglomerate;* **1c,** *sedimentary breccias and black shales.*

INTRUSIVE ROCKS

A — *Medium grained, pink, hornblende granite; minor alaskite, syenite, monzonite and quartz diorite, felsite dikes.*

B — *Coarse grained, locally leucocratic, hornblende granite; coarse grained hornblende gabbro.*

C — *Porphyritic alaskite, hornblende granite, gabbro, monzonite.*

D — *Quartz-feldspar porphyry.*

E — *Plagioclase-pyroxene porphyry.*

F — *Quartz porphyry (includes undivided porphyritic rhyolite and rhyodacite).*

alteration phases are actinolite, epidote, chlorite and hematite. The massive flows are fine grained to porphyritic and are petrographically similar to the pillowed flows. The mafic tuffs are typically structureless but bedding features are locally preserved.

The dominantly pyroclastic and epiclastic volcanic rocks of unit 3 are restricted to the area west of the Paradise Sound Fault. Its contacts with units 1 and 2 in this area are either faulted or unexposed. However, Strong *et al.* (1978) suggested that correlatives of unit 3 (Marystown Group) unconformably overlie the Burin and Rock Harbour Groups in the southern Burin Peninsula.

The main rock types of unit 3 are fine to medium grained plagioclase and potash feldspar porphyritic crystal tuffs, crystal-lithic and lithic lapilli tuffs. Massive, flow banded and autobrecciated rhyolites, heterolithologic volcanic breccias and felsic agglomerates are less (areally) abundant in this unit. Mafic to intermediate tuffaceous sedimentary rocks are most common in the upper parts of unit 3, where they are intercalated with thin, discontinuous mafic flows.

In areas where the regional deformation is relatively strong, the fine grained felsic volcanic rocks of unit 3 have been metamorphosed to quartz-sericite schists and the mafic rocks to chlorite schists.

Unit 4 is only exposed in the northwestern parts of the Point Enragée and Baine Harbour map areas, where it locally overlies felsic volcanic rocks of unit 3. The major rocks types of unit 4 are tuffaceous sandstone, graywacke and conglomerate. Lesser amounts of red arkosic sandstone are exposed sporadically throughout the sequence, the greatest thickness of which occurs at the stratigraphic top of unit 4, north of Point Enragée.

The typical rock types of unit 5 are subaerial basaltic flows with associated mafic tuffs and mafic tuffaceous sedimentary rocks. The basalts are fine to coarse grained, amygdaloidal, dominantly plagiophyric, with phenocrysts of altered pyroxene and iddingsitized olivine in a plagioclase-magnetite-chlorite groundmass. The main metamorphic phases are albite, epidote, chlorite, quartz, carbonate, hematite, pumpellyite and prehnite. Lesser amounts of mafic pyroclastic and epiclastic rocks and associated red clastic sedimentary rocks are intercalated with the mafic flows. Unit 5 attains a thickness of <500 m in the westernmost parts of the map area.

The contact of units 4 and 5 is best exposed on the east shore of Fortune Bay, between Wood Cove and Point Enragée. At this locality, mafic flows, tuffs and breccias of unit 5 conformably and gradationally (within 5 m) overlie red sandstones of unit 4. In areas where unit 4 is not deposited, basaltic rocks of unit 5 lie directly on felsic volcanic rocks of unit 3. This contact is conformable in local outcrops but the absence of unit 4 suggests regional disconformity.

Unit 6 is a series of welded and unwelded red ash-flow tuffs, fine grained felsic agglomerates, and coarse grained laharic breccias which overlie mafic flows and breccias of unit 5. The fine grained felsic volcanic rocks of unit 6 are typically red to maroon in color, densely welded, and locally flattened rhyolitic and rhyodacitic crystal, lithic and vitric ash and lapilli tuffs. The agglomerates are typically fine to medium grained, containing 3-5 cm blocks and bombs of red and pink rhyolite in an altered tuffaceous matrix. Most of the agglomerates are monolithologic; however, they locally contain isolated mafic volcanic fragments.

The most striking rock types of unit 6 are medium to very coarse grained heterolilitholgic breccias. They consist of unsorted, subrounded to subangular blocks of fine grained, locally porphyritic, felsic and lesser intermediate to mafic volcanic rocks and subvolcanic porphyries, *e.g.* flow banded and autobrecciated rhyolite, welded crystal tuffs, mafic and felsic lithic tuffs, and rhyolite and rhyodacite porphyry. Lesser amounts of fine grained epiclastic rocks occur as blocks in these breccia.

The matrix of the breccias consists of red to green, highly epidotized volcaniclastic sandstone and welded to unwelded ash and lapilli tuffs. The breccias are intercalated with 1 to 2 m thick beds of red volcaniclastic sandstone, similar to that which occurs in the breccia matrix. The internal features (*i.e.* poorly sorted, coarse grained) and bedded nature of the breccias suggest that they may represent laharic deposits.

The contact of the welded tuffs of unit 6 with the overlying Eocambrian sedimentary rocks of unit 7 in the south-central part of the Point Enragée map area is disconformable but has been locally fault modified.

Eocambrian to Cambrian clastic sedimentary rocks (Unit 7) also occur in fault bounded outliers in several localities in the Baine Harbour map area. The Eocambrian rocks (Unit 7a) are typically red, green and gray micaceous sandstones with minor quartz rich sandstone and quartzite. Lower Cambrian rocks (Unit 7b) are exposed as fault bounded belts on Jude and Long Islands and on the eastern shore of Paradise Sound, south of Southeast Bight. The Lower Cambrian sequence is typified by red shale with locally fossiliferous pink limestone nodules, pink limestone beds and red and green shale.

Intrusive rocks

The volcanic and sedimentary rocks to the west of the Paradise Sound Fault are intruded by a series of granitic to gabbroic stocks, bosses and sills which are

tentatively divided into six units. Most of the intrusions are localized in a 10 km wide belt in the northern part of the map area, the only exception being an elongate quartz-feldspar porphyry in the south. The absolute ages of the intrusions are not known, but all are pretectonic with respect to the regional deformation.

The most common intrusive rock is a medium grained, pink, hornblende granite which forms most of unit A. It is intrusive into units 3,4 and 5 in the northern part of the map area. The intrusive bodies are relatively homogeneous but alaskitic, syenitic, monzonitic and quartz dioritic phases were noted. Felsite dikes represent the latest phase of unit A. Extensive pyritiferous hornfelses are developed in rhyolitic tuffs at the margins of the intrusion. Basaltic rocks are also hornfelsed around the larger intrusions in the western part of the map area.

Unit B outcrops as an elliptical body, intrusive into unit 4, south of Grand Jersey Cove. This intrusion differs from unit A in being coarser grained (< 1 cm) and locally leucocratic. The dominant rock type is hornblende granite but coarse grained gabbro locally occurs as a marginal phase.

Unit C occurs as three small intrusive bodies approximately 10 km north of Red Harbour. Rock types vary from porphyritic alaskite in the southeast to equigranular gabbro, monzonite, and hornblende granite in the northwest. Unit C is intrusive into mafic and felsic volcanic rocks of units 3 and 5.

Unit D consists of a quartz-feldspar porphyry body which occurs along the northern margin of unit A. Locally, it is lithologically similar to the adjacent volcanic rocks of unit C but an intrusive relationship can be established between the two units. The contact of units A and D is unexposed but it appears possible that unit D is a fine grained phase of the unit A hornblende granite.

A number of sill-like bodies of plagioclase-pyroxene porphyry (Unit E) are exposed in the area northeast of Point Enragée. They are intrusive into unit 4 but relationships with other units are not exposed. The dominant rock type is a dark gray porphyry with euhedral phenocrysts (< 5 mm) of plagioclase and pyroxene in an aphanitic matrix.

Unit F consists of a series of fine grained "quartz-eye" porphyries containing undivided lenses of comagmatic porphyritic rhyolites and rhyodacites. The porphyries are locally intrusive into volcanic rocks of unit 3.

STRUCTURAL AND METAMORPHIC HISTORY

The two most obvious structural features in the map area are the large scale flexuring of the regional foliation and the increase in the amount of faulting from west to east across the area.

Trends of foliation vary from east-west in the extreme southwest, to northeasterly in the central portions, to east-west in the north-central parts of the area, and to northeast in the northeastern part of the area.

It appears that, in a general sense, this flexure controls the orientation of faulting thoughout the region. East to southeast trending faults and shear zones predominate in the central region between Grand John and Oderin Island. Northeasterly trending faults occur to the northeast and southwest of this area.

There is an increase in the intensity of deformation, marked by an increased amount of faulting within units 3 and 5 with proximity to the Paradise Sound Fault. In this area all recognizable first phase folds are tight isoclinal structures. The intensity of deformation decreases in the central parts of the area where the characteristic structural features are relatively open folds and weak and locally developed foliations. Further to the west, in the area south of Point Rosie, the rocks are gently dipping and no penetrative fabrics related to folding have been developed. Intensity of foliation is also lithologically controlled, with the fine grained and unwelded tuffaceous and epiclastic rocks being least resistant to deformation.

In the area to the southeast of the Paradise Sound Fault, units 1 and 2 are not penetratively deformed and locally developed schistosities are related to east-west and northeast-southwest trending faults. In this region folds are generally open, upright to asymmetric (steep east limbs) and doubly plunging.

The Eocambrian-Cambrian rocks are usually highly cleaved and tightly folded into upright doubly plunging structures. Overturned folds are locally developed in the Eocambrian outlier northwest of Red Harbour.

Metamorphism in the area ranges from prehnite-pumpellyite to lower greenschist facies. In areas of little deformation, the felsic volcanic rocks are unmetamorphosed whereas the mafic volcanic rocks display prehnite-pumpellyite facies mineralogy. These rocks are lowermost greenschist facies in the proximity of the major faults in this area. Most of the rocks in the central portion of the Baine Harbour map area are metamorphosed to greenschist facies. Some of the larger granitic intrusions south of Grand John have significant (< 1 km wide) contact aureoles. Magnetite is developed in the mafic volcanic rocks whereas the felsic volcanic rocks commonly contain pyrite, sericite and secondary quartz.

MINERALIZATION

Pyrite is the most common metallic mineral occurrence in the area. It is developed in the felsic volcanic rocks of unit 3 adjacent to the granitic intrusions in the north-central parts of the Point Enragée area. Pyrite and traces of chalcopyrite occur along northeast trending faults west of Point Rosie and in the westernmost parts of the Baine Harbour area.

A small chalcopyrite-galena showing is present in sedimentary rocks of unit 4 adjacent to a plagioclase-pyroxene porphyry near Grand John. Galena occurs as narrow veinlets in unit 4 sediments immediately east of Point Rosie.

Several boulders of altered granite containing galena were found approximately 0.5 km south of Point Rosie. The mineralized float assayed 59 g/t Ag and 0.1 ppm Au. A reconnaissance scintillometer survey of the area failed to outline any areas of significantly anomalous radioactivity.

The most favourable prospecting environment in the area appears to be along the margins of the granitoid intrusions and in the adjacent hornfelses of units 3 and 4 in the Point Enragée area. These rocks are a potential host for gold, silver and base metal mineralization. The possibility for gold mineralization is association with the larger pyritiferous fault zones throughout the area should also be investigated. Minor copper occurrences are found in the subaerial mafic flows (unit 5 equivalents) in the west half of the Baine Harbour area (O'Brien, 1978).

This unit is widespread in the east half of the Baine Harbour and Point Enragée areas and may contain similar styles of mineralization.

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