GEOLOGY OF THE GRAND BANK (1M/4) AND LAMALINE (1L/13) MAP AREAS

S.J. O'Brien, P.G. Strong, and J.L. Evans

INTRODUCTION

This report is based on field investigations of the Grand Bank (1M/4) and Lamaline (1L/13) map areas. Geological mapping on a scale of 1:50,000 was carried out by the authors from May 15 to September 1, 1976.

GENERAL GEOLOGY

Most of the map area is underlain by the dominantly volcanic rocks of the Late Proterozoic Marystown Group (Strong et al., 1976). Uppermost Hadrynian (?) to Middle Cambrian sedimentary rocks outcrop in the westernmost portion of the Burin Peninsula and in discontinuous fault bounded belts in the central and southeastern parts of the 1L/13 area. In the west the contact between the Marystown Group and the Cambrian sedimentary rocks is interpreted as a fault modified disconformity. The nature of this contact in the east has been obscured by more intense folding and faulting.

Intrusive rocks in the area range in age from Late Proterozoic to Carboniferous.

The extrusive facies of the Grand Beach Complex may represent the youngest (Carboniferous?) volcanic rocks in the area.

The structural history of the region is dominated by upright and isoclinal folding with a steep northeast-trending schistosity and associated thrusting and transverse faulting. Intensity of deformation varies from west to east.

Most of the mineral occurrences in the area are associated with the St. Lawrence Granite.

Late Proterozoic Rocks

The oldest rocks exposed in the map area are pillow basalts of the Burin Group (1). They occur in a narrow (1 km) fault bounded zone on the southern part of the Ragged Head Peninsula. Strong (1976) correlated these rocks with the Pardy Island Formation of the Burin Group (Taylor, 1976) on the basis of their lithology and alkalic nature. The contact of the Burin Group and the younger Marystown Group is not exposed at this locality.

Acidic lithic lapilli tuffs, subaerial basalts and rhyolite flows (2) (Mt. Ste. Anne and Mt. Lucy Anne Formations of Strong et al., 1976) form the structural base of the Marystown Group.

The coarse grained porphyritic basalt flows, felsic agglomerates and felsic and mafic tuffs (3) of the Tilt Hills Complex (Strong et al., 1976) appear to lie structurally above the Mt. Ste. Anne and Mt. Lucy Anne Formations. However, interbedding of coarse grained porphyritic basalt and subaerial mafic flows and felsic tuffs near Taylors Bay suggests that these two units may be lateral facies equivalents.

The schistose ash flow tuffs, bedded tuffs and minor epidotized basaltic flows (10) of the

LEGEND

QUATERNARY

17 undivided alluvium

CARBONIFEROUS(?)

16 undivided Grand Beach Complex: quartz-k-feldspar porphyry, ash-flow tuffs and volcaniclastic breccias

CAMBRIAN

15 a: undivided Cambrian rocks; b: hornfelsed sediments

14 undivided Upper Lower Cambrian and Middle Cambrian: black and grey shale, pink and grey limestone, red mudstone

13 undivided Blue Pinion Formation: white cross bedded quartzite, brown and red quartz-rich sandstone

UPPER HADRYNIAN TO CAMBRIAN

12 undivided Chapel Island Formation: grey and green thinly bedded siltstone, red siltstone, pink and grey limestone

11 Rencontre Formation: red micaceous fine grained sandstone

LATE(?) PROTEROZOIC

MARYSTOWN GROUP (2-10)

10 undivided Marystown group: ash flow tuffs, vitrophyres, mafic tuffs, minor waterlain tuffs and volcanogenic sediments

9 a: siliceous waterlain tuffs; b: ash flow tuffs and mafic to felsic agglomerates; c: fluviatile red sandstone

8 maroon to red, strongly welded, lithic ash flow tuff (Hare Hills Tuff)

7 a: felsic agglomerates and volcanogenic breccias; b: conglomerate and laharic breccias

6 amygdaloidal basalt, mafic waterlain tuffs, fluviatile red sandstone and conglomerate

5 undivided subaerial basalt

4 undivided basalt and felsic tuff

3 felsic lithic lapilli tuffs, ash flow tuffs and minor rhyolite flows; a: hornfelsed equivalents

2 ash flow tuffs and minor rhyolite flows, mafic tuffs

BURIN GROUP

1 Pardy Island Formation: pillow basalt

INTRUSIVE ROCKS

CARBONIFEROUS

A St. Lawrence Granite: undivided peralkaline alaskite and associated granitic rocks

PROTEROZOIC

B granodiorite

C gabbro

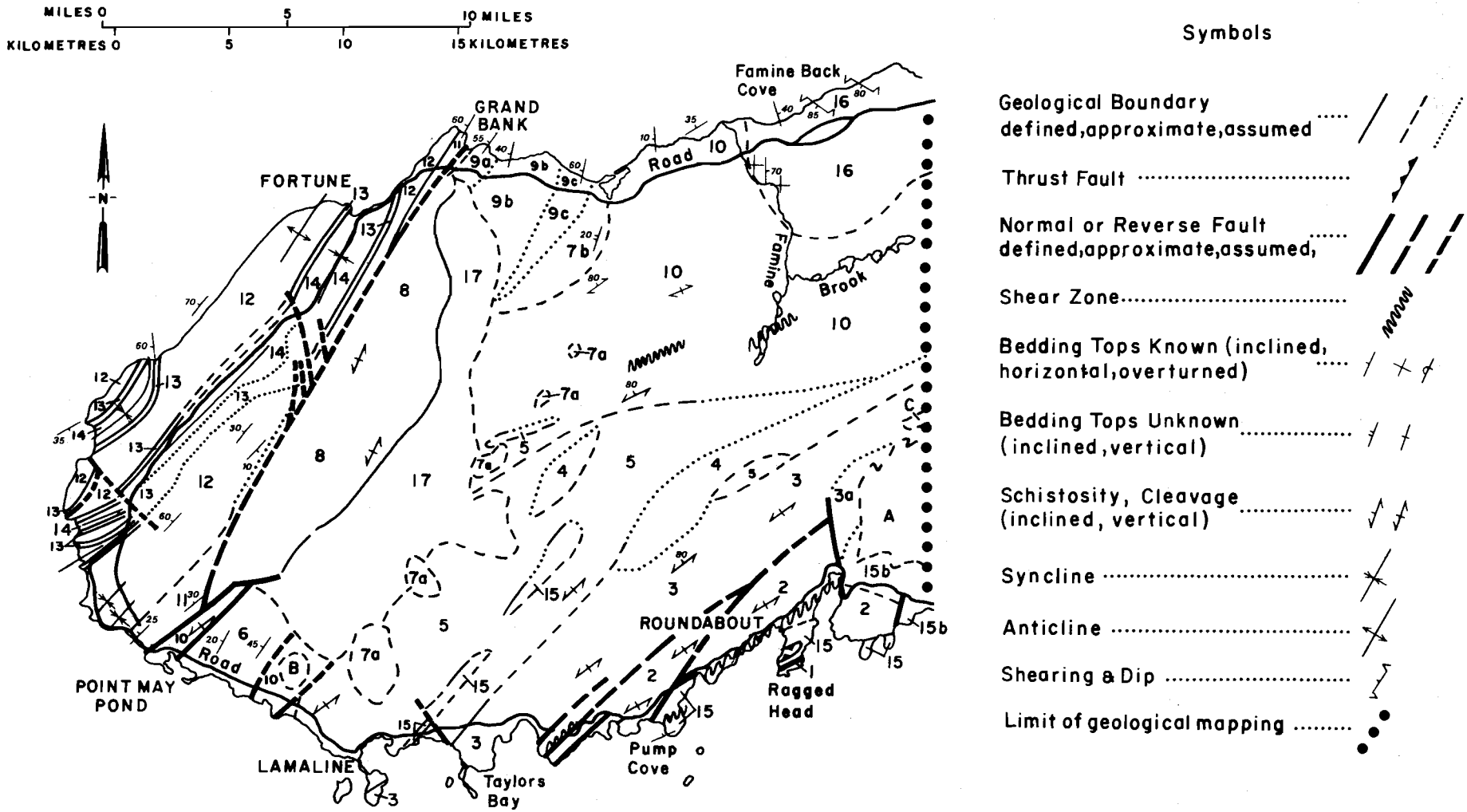
MILES 0 5 10 MILES
KILOMETRES 0 5 10 15 KILOMETRES
N
FORTUNE
GRAND BANK
Famine Back Cove
Road
Famine Brook
ROUNDABOUT
Ragged Head
POINT MAY POND
Road
LAMALINE
Taylors Bay
Pump Cove
Symbols
Geological Boundary defined, approximate, assumed
Thrust Fault
Normal or Reverse Fault defined, approximate, assumed,
Shear Zone
Bedding Tops Known (inclined, horizontal, overturned)
Bedding Tops Unknown (inclined, vertical)
Schistosity, Cleavage (inclined, vertical)
Syncline
Anticline
Shearing & Dip
Limit of geological mapping

Figure 1.

Beacon Hill and Branching Rivers Formations (which structurally overlie the Tilt Hills Complex) cannot be accurately subdivided in the area.

Basaltic flows in the Lamaline area (5) cannot presently be accurately correlated with any known subdivision of the Marystown Group. It is possible that these rocks are a facies variation of the Mortier Bay Group (Strong et al., 1976).

A west facing and dipping sequence of amygdaloidal basalts, mafic agglomerate , waterlain mafic tuffs and fluviatile sandstone and conglomerate (6) is well exposed in the region north of Point May Pond. These rocks are in fault contact with the Hare Hills Tuff to the north and undivided Marystown Group to the east and west.

A series of felsic agglomerates and volcaniclastic breccias (7) outcrops in a discontinuous belt trending northeastwards from the vicinity of Lamaline. Their stratigraphic position within the Marystown Group is unknown. The presence of blocks and bombs similar in lithology to the St. Lawrence granite and the Blue Pinion quartzite suggests a post-Cambrian age for these rocks.

Outcrops of the Hare Hills Tuff (8) typically consist of welded, lithic ash flow tuff. Variations in lithology do not occur on a mappable scale. The age of these tuffs is unknown; however, they are tentatively included within the uppermost structural levels of the Marystown Group.

A sequence of waterlain felsic tuffs, undivided felsic pyroclastics, and fluviatile sandstones (9) which outcrops near Grand Bank is presently interpreted as the stratigraphic top of the Marystown Group. The disconformable contact of these rocks with the basal Rencontre Formation is exposed on the coast immediately west of Grand Bank.

Upper Hadrynian and Cambrian Sedimentary Rocks

The total thickness of the Upper Hadrynian and Cambrian sedimentary rocks in the southwestern Burin Peninsula is slightly in excess of 1200 m.

The Recontre Formation (11) is a $\approx$130 m thick sequence of red micaceous sandstones and mudstones with a red basal conglomerate which disconformably overlies the Marystown Group at Grand Bank, Pump Cove and Lamaline. Ripple marks, mud cracks, channel scouring and intraformational conglomerates are common features in these rocks.

The Chapel Island Formation (12) is a 740 m thick sequence of green and grey, thinly bedded siltstones (with calcareous sandstone nodules), red siltstones and pink and grey limestones which conformably overlie the Rencontre Formation in the western portion of the map area. Potter (1949) recognized three individual facies within the formation.

The top of the second facies (630 m above the base of the formation) is marked by a 1 m thick limestone bed which contains hyolithids and algal structures such as Collenia (Potter, 1949) and Epiphyton (Greene and Williams, 1974).

The Blue Pinion Formation (13) is a sequence of red and brown massive sandstones and white quartzite which conformably overlies the Chapel Island Formation and lies conformably below red shales of upper Lower Cambrian age. Trace fossils are common in the sandy facies. Rusophycus are present and Cruziana have been reported (Greene and Williams, 1974). The formation is thought to be Lower Cambrian in age. The thickness and age of the Blue Pinion

Formation prevents accurate time-stratigraphic correlation with possible Random equivalents in the Burin Bay Arm section (Taylor, 1976).

In the Fortune Valley syncline, the Brigus Formation consists of $\approx$17 m of red shale, pink limestone, and red shales with limestone nodules.

The Chamberlains Brook Formation consists of approximately 60 m of red, grey and green shale and grey limestone with trilobite fragments. The Manuels River Formation consists of black shale with limey concretions up to 60 cm in diameter. Fauna representing the P. hicksi and P. davidus zones of the Manuels River Formation have been recognized (Dale, 1927; Potter, 1949).

Carboniferous (?) Complexes

The Grand Beach Complex (16) (Grand Beach Porphyry and Clancey's Pond Complex of Strong et al., 1976) consists of a quartz-K-feldspar porphyritic granite with associated ash flow tuffs, rhyolites, agglomerates, volcaniclastic breccias and sediments. It underlies an area of 40 km^2.

A minimum of three phases of the intrusive can be recognized on the basis of textural variations. The temporal and spatial relationships of these phases are poorly understood as poor exposure makes it impossible to recognize these divisions in many parts of the interior of the complex.

The volcaniclastic breccias are best exposed in the vicinity of Famine Back Cove and Famine Brook. They consist of mud flow deposits, poorly sorted conglomerates, and interbedded fine grained red sandstones; they reach a maximum thickness of $\approx$30 m.

The ash flow tuffs, best exposed between Famine Back Cove and Grouse Point, display simple and compound cooling units with intercalated medium grained agglomerates and laharic breccias. The tuffaceous rocks are different in composition from ash flow tuffs of the Marystown Group.

As mentioned above, the discontinuous northeast trending pockets of agglomerates and volcanic-sedimentary breccias north of Lamaline may be the result of Carboniferous volcanic activity.

Intrusive Rocks

The outcrops of St. Lawrence Granite (A) in the map area are petrographically similar to those described by Strong et al. (1976), i.e.; quartz-K-feldspar, albite, riebeckite, aegirine, fluorite, astrophyllite, aenegmatite and opague oxides. Tuffisite veinlets and miarolitic cavities are not present in the granite in the study area. The fine grained chilled margin is well exposed in the vicinity of Lawn. Volcanic equivalents of the St. Lawrence Granite have not been recognized in the Lamaline or Grand Bank areas. The above features and the paucity of fluorite mineralization may indicate that deeper levels of the pluton have been exposed in the western portions of the St. Lawrence Granite.

Two pre-Carboniferous intrusive bodies of mappable scale were recognized in the map area. Contact relationships suggest that the granodiorite plug (B) which outcrops north of Lamaline is the intrusive equivalent of the Marystown Group volcanics in the area. A granitic plug which is intrusive into Cambrian sediments is present on the Lawn Islands (Willars, 1953).

Mafic dykes range in age from late Proterozoic to post-Carboniferous. Most of these dykes are diabase. Their homogeneous compositions prevent correlation with respect to age. However, degree of alteration does seem to be correlatable with age. Diabases which crosscut structures in the Cambrian sediments and late Proterozoic volcanics generally display little, if any, alteration. Pretectonic dykes (recognized only in the volcanic terrain) display a typical secondary mineralogy of chlorite, epidote and minor magnetite.

Composite dykes outcrop in several localities along the southern coast between Pump Cove and Roundabout. The mafic margins of these dykes contain plagioclase and pyroxene whereas the felsic cores consist primarily of orthoclase, quartz and minor plagioclase. Miarolitic cavities are well developed in the larger dykes. The composite dykes range in width from ≈ 0.5 m to ≈ 10 m. They are localized along the major shear zone which parallels the shore in this area. The dykes postdate all structures related to shearing in this zone.

STRUCTURAL GEOLOGY

The major recognizable deformational event which affected the area produced an inconsistent variation from north-northeast trending broad open folds in the west to a series of tight to isoclinal east-northeast trending folds in the east. These folds have a steep to vertical axial planar (where recognizable) schistosity. The major faults of the area have similar orientations. Thrust faults, transverse faults and high angle normal faults affect both the sedimentary and volcanic regimes.

The late Proterozoic volcanic rocks and the Cambrian sedimentary rocks generally display similar structural features. The contrasting competency of rock types causes slight differences in style of deformation.

Faults with major displacements are not common in the sedimentary sequence in the western portion of the area. However, in the eastern parts of the area major shear zones affect both Precambrian and Cambrian rocks with equal intensity.

The main structural features in the west are the Fortune River and Lee Beach Synclines. The Hare Hills Tuff and the upper units of the Marystown Group have been affected only by minor open folding and normal faulting.

In the central and eastern portions of the area, relatively intense deformation is interpreted as being localized along major faults and shear zones. The intensity of the single schistosity decreases with distance from these zones. The difficulty in recognizing fold structures in the volcanic rocks in the east prevents an accurate structural analysis of the area. Most of the folds seen were asymmetric isoclinal types. Similar folding is seen in the Hadrynian to Cambrian sequences near Lamaline, Pump Cove and the Ragged Head Peninsula.

Minor northwest trending shear zones cut the Carboniferous (?) Grand Beach Complex. Faults of similar orientations truncate earlier structures in the Cambrian sediments.

MINERALIZATION

There are no mines in the Lamaline and Grand Bank map areas. Most of the mineral occurrences present are within the St. Lawrence Granite or along its contact with undivided hornfelsed Cambrian sediments.

Chalcopyrite, galena, sphalerite and minor arsenopyrite occur in hornfelsed shales near Lawn (Walthier, 1948).

Molybdenite is present as disseminations in quartz veins associated with the St. Lawrence Granite north of Lawn.

The largest fluorite occurrence in the map area is the Big Meadow Woods vein. The size of this and its mineral potential have not yet been determined. Minor fluorite occurrences are associated along the margins of hornfelsed mafic inclusions in intrusive phases of the Grand Beach Complex. A scintillometer (non-discriminant) survey over the Grand Beach Complex outlined an area (near Famine Brook) with readings 3-4 times background for the Complex.

Minor occurrences of chalcopyrite are present in the Burin Group pillow lavas on Ragged Head, in the oxidized basaltic flows at Black Head, and in the amygdaloidal basalts of the High Beach formation.

Minor amounts of fluorite and barite are associated with mafic inclusions in an intrusive phase of the Grand Beach Complex.

Silica deposits in the Blue Pinion Formation near Fortune have been discussed by Butler and Bartlett (1967). Approximately 8.86 million tons of silica reserves have been proven in this area.

REFERENCES

Butler, J. and Bartlett, G.
1967: Silica assessment - southeastern Newfoundland; Nfld. Dept. Mines Agric. and Res., Min. Res. Div., 100 p.

Dale, N.C.
1927: Precambrian and Paleozoic geology of Fortune Bay, Newfoundland; Geol. Soc. Am. Bull., v. 38, p. 411-430.

Greene, B.A. and O'Driscoll, C.F.
1976: Gaultois map area; in Report of Activities for 1975, ed. B.A. Greene, Nfld. Dept. Mines and Energy, Min. Dev. Div., Report 76-1, p. 56-63.

Potter, D.B.
1949: Geology of the Fortune-Grand Bank area, Burin Peninsula, Newfoundland, Canada; Brown University, Unpubl. M.Sc. thesis.

Strong, P.G.
1976: Geology of the Lawn area, Burin Peninsula, Nfld.; Memorial University of Newfoundland, Unpubl. B.Sc. (hons.) thesis.

Strong, D.F., O'Brien, S.J., Strong, P.G., Taylor, S.W. and Wilton, D.
1976: Geology of the Marystown-St. Lawrence map sheets; Nfld. Dept. of Mines and Energy, Min. Dev. Div., Open File no. 895, 40 p.

Taylor, S.W.
1976: Geology of the Marystown (E/2) map sheet, Burin Peninsula; Memorial University of Newfoundland, Unpubl. M.Sc. thesis.

Walthier, T.N.
1948: Geology of the Lawn sulfide deposits, Burin Peninsula, Nfld.; Geol. Surv. of Nfld. (Unpubl.).

Willars, J.
1953: Field report of geological exploration, Burin Peninsula; Unpubl. report of Nfld. and Labrador Corp., St. John's.

Williams, H.
1971: Geology of the Belleoram map area, Newfoundland (1M/11); Geol. Surv. Can., Paper 70-65.