GEOLOGICAL MAPPING IN THE DAVIS INLET-MISTASTIN LAKE CORRIDOR, LABRADOR

by J.D. Hill

INTRODUCTION

This is the third report on a continuing geological mapping project in the area between Davis Inlet and Mistastin Lake, Labrador. Initial mapping was begun in 1977 by a two person field crew and was continued in 1978 by a five person field crew which was supported by a helicopter for two weeks during the summer. Snow and ice conditions restricted the field season to the period between July 1 and August 26, of which only 34 days were usable for geological traversing.

Mapping at a scale of 1:50,000 has been completed in the four most eastern N.T.S. map areas (13N/10, 11, 14,15). The geology of this area is shown in the accompanying map. In addition to the above, parts of three other N.T.S. map areas (13M/9,16, and 13N/12) were mapped in 1978.

The general geology of the area has been described in two preceding reports (Hill, 1978 a and b). Subsequent work during 1978, which has resulted in only minor modifications and additions to the geology of the area, is reported here. Previous mapping in the area has been reported by Wheeler (1955), Taylor (1972), Collerson *et al.* (1974), and Ryan (1974). The nomenclature used in the current report is described in Hill (1978b).

GENERAL GEOLOGY

The area is underlain by Archean gneisses to the east and undeformed Helikian igneous rocks to the west. Gneisses of uncertain age also form discrete screens between different plutons within the igneous terrain.

The Archean gneisses are subdivided into five lithologic units, the oldest three of which have undergone at least two ages of deformation and contain amphibolite grade metamorphic mineral assemblages. The two youngest Archean units are less deformed and display relict primary textures in places. The gneisses contain granulite grade metamorphic mineral assemblages where they lie adjacent to Helikian gabbroid plutons.

The Helikian igneous rock suite is divided into four main units which follow a general sequence of crystallization of increasingly felsic magmas with decreasing age. Structures and textures in the igneous rocks indicate emplacement occurred at a shallow crustal level.

Occurrences of economic minerals have been found in all of the lithologic units in the mapped area. Fluorite is the most widespread of these and is confined to the felsic igneous rocks of Units 3, 4 and 5.

ARCHEAN ROCKS (Unit 1)

The age relationships between the five units of Archean rocks are not well known. Units 1a and 1b are believed to be the oldest because inclusions similar in composition to the rocks of these units occur in Units 1c and 1d. Units 1d and 1e are considered to be younger than Units 1a, 1b and 1c since the former contain only one tectonic fabric whereas the latter are strongly deformed and possess at least two tectonic fabrics.

Biotite-feldspar-quartz gneiss (Unit 1a)

Unit 1a consists of thinly banded biotite-feldspar-quartz gneiss which locally contains garnet and amphibole. The more mafic bands, which typically contain amphibole, locally occur as discontinuous strips oriented parallel to the banding. Crosscutting dikes and lenses of granitoid material form a conspicuous part of most outcrops. The mineralogy of the rocks in Unit 1a

suggests they are enriched in aluminum, and thus they are believed to be paragneisses.

Amphibole and plagioclase-amphibole gneiss (Unit 1b)

Unit 1b consists of amphibole and plagioclase-amphibole gneisses which locally contain pyroxene where they lie adjacent to gabbroid plutons of Unit 2. These rocks are relatively massive compared to Unit 1a, although a fine lensoid banding is developed in some outcrops. Granitoid gneiss and undeformed pegmatite form large parts of some outcrops. Where granitoid gneiss is abundant, the rocks appear to be similar to those in Unit 1c. The mineralogy of the amphibole and plagioclase-amphibole gneisses suggests that these rocks are basaltic in composition and probably igneous in origin.

Banded tonalite to granodiorite gneiss (Unit 1c)

Banded tonalite gneisses which locally tend to granodiorite in composition form the dominant Archean lithology. They are regularly banded with individual layers ranging from less than 1 cm to about 1 m in width. Although some outcrops are composed of only tonalite gneiss, most are marked by the occurrence of inclusions of mafic gneiss arranged in trains parallel to the gneissosity. The inclusions are similar in lithology to the rocks of Unit 1a and 1b (mainly 1b) and the least mafic inclusions approach the composition of the most mafic bands in the enclosing tonsalite gneiss. These rocks are similar to those described by Kranck (1953) and Gandhi *et al.* (1969) as the Hopedale gneiss in the area immediately southeast of the presently mapped area.

The banding in the tonalite gneiss bends around the mafic inclusions and is locally deformed into mesoscopic isoclinal folds with axial planes oriented parallel to the regional trend of the gneissic banding. The gneissosity within the mafic inclusions is only weakly developed and is typically oriented parallel to the gneissosity in the tonalite gneiss. However, some of the larger inclusions, which are generally more angular in shape, possess an internal fabric that is oriented at an angle to the enclosing gneissosity. In many places, the mafic inclusions within single trains obviously fit together and must have originally been part of single layers. This interpretation is supported by the occurrence of interlayered tonalite gneiss and amphibole gneiss which form regularly spaced layers 1 to 20 m thick in a coastal exposure on the northwest side of Ukasiksalik Island. Inclusion trains of mafic gneiss in the tonalite gneiss are conspicuously absent from this area. Similar variations in structure are described by Myer (1977) for Archean gneisses in western Greenland.

Granodiorite and granite augen gneiss (Unit 1d)

Unit 1d consists of granodiorite and granite augen gneiss possessing only one tectonic fabric. Biotite is the dominant mafic mineral and typically amounts to less than 5 percent of the rock. The augen consist of rounded feldspar and quartz grains. The unit is fairly homogeneous in outcrop and, in many places, displays a relict plutonic igneous texture. The augen gneiss contains a few scattered xenoliths of rocks similar to those in Units 1a and 1b. The presence of only one tectonic fabric indicates the unit is also younger than the tonalite gneiss of Unit 1c.

Gneissic biotite granite (Unit 1e)

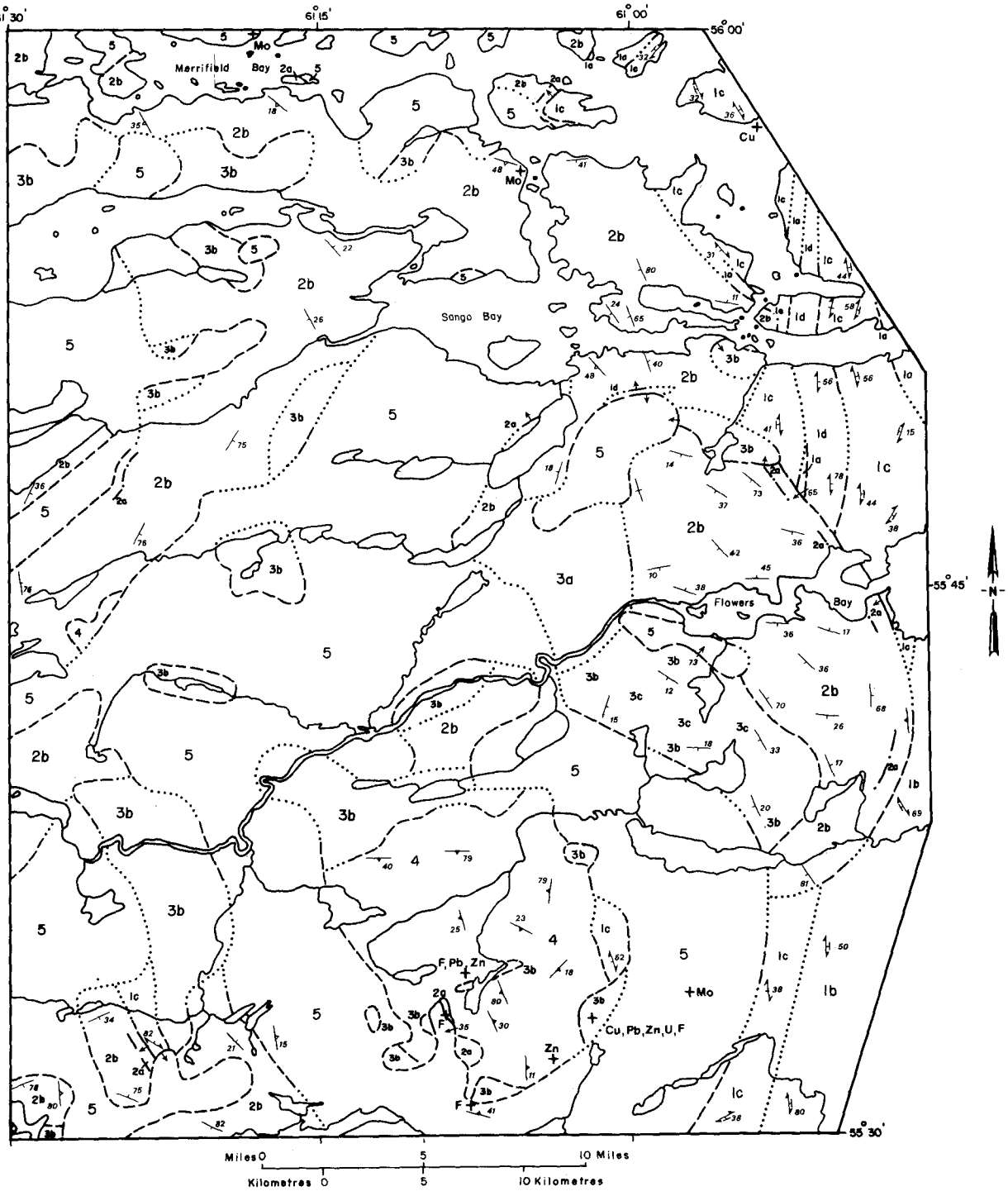
Unit 1e consists of relatively undeformed, leucocratic biotite granite. It is veined by aplite in most outcrops and contains variably oriented and diffuse schlieren of slightly more mafic material. The small degree of deformation of the rock suggests it is the youngest unit in the Archean terrain. Although the character of the unit indicates it is older than any of the undeformed and unaltered Helikian igneous rocks, it may be younger than Archean in age.

HELIKIAN IGNEOUS SUITE

The Helikian igneous suite is described in some detail by Hill (1978b) and only additions and changes to the geology are given here. The volcanic rocks were previously thought to be older than the monzonites since a contact zone southwest of Char Lake contains blocks of quartz-feldspar porphyry embedded in quartz bearing monzonite (Hill, 1978b). However, the exact affinity of the quartz bearing monzonite was uncertain. Additional sampling in 1978 indicates the quartz bearing monzonite was misidentified in the field and is actually part of the granites of Unit 5. Concurrent chemical investigations suggest the volcanic rocks may be genetically related to the granites. Although this problem requires additional work, the volcanic rocks are designated as Unit 4 in the stratigraphic column, older than the granites but younger than the monzonites.

Gabbroid Plutons (Unit 2)

Rocks belonging to gabbroid plutons occur in at least nine isolated areas surrounded by younger igneous rocks. In general, the gabbroid plutons are comprised of



FLOWERS BAY AREA, NORTH–CENTRAL LABRADOR

LEGEND

HELIKIAN

5 — *Medium to coarse grained, massive, undivided granite, composed of arfvedsonite-riebeckite, aegirine, fayalite, clinopyroxene, hornblende and biotite bearing varieties; minor associated pegmatite and aplite dikes.*

4 — *Massive quartz-feldspar porphyry, flow banded felsite, lithic tuff and minor breccia and agglomerate.*

3 — **3a**, *Olivine-pyroxene syenite;* **3b**, *olivine-pyroxene monzonite and monzodiorite;* **3c**, *foliate plagioclase cumulate with intercumulus clinopyroxene.*

2 — **2a**, *Fine to medium grained olivine gabbro and leucogabbro;* **2b**, *coarse to very coarse grained plagioclase and plagioclase-olivine cumulate; locally contains thin layers of olivine-oxide and plagioclase-apatite cumulates.*

ARCHEAN

1 — **1a**, *Banded biotite-feldspar-quartz gneiss;* **1b**, *plagioclase- amphibole, plagioclase-pyroxene and amphibole gneiss, locally mixed with granitoid gneiss and pegmatite;* **1c**, *interlayered, banded tonalite, granodiorite and minor granite gneiss, locally with abundant inclusions of 1b;* **1d**, *coarse grained granodiorite and granite augen gneiss;* **1e**, *massive to faintly gneissic biotite granite.*

SYMBOLS

Geologic boundary (observed, approximate, assumed, gradational, dip indicated, observed intrusive contact with younger unit indicated) .....

Primary igneous lamination (inclined, vertical) 15

Primary igneous layering (inclined, vertical) .....

Igneous flow banding (inclined, vertical) .....

Schistosity, slaty cleavage (inclined, vertical) 10

Augen gneissosity (inclined, vertical) 63

Gneissic banding (inclined, vertical) 45

Mineral showing, mineral occurrence (F - fluorine, Mo - molybdenum, Cu - copper, U - uranium, Zn - zinc, Pb - lead) ..... + Cu

coarse grained plagioclase and plagioclase-olivine cumulates with narrow chilled margins of fine grained olivine gabbro. Minor phases which are locally cumulus in origin include apatite, pyroxene, ilmenite and titaniferous magnetite.

The occurrence of rhythmic layering is more common than previously believed (Hill, 1978b). This reflects the greater proportion of clean coastal exposures examined in 1978. The more common type consists of 1 to 30 cm thick layers enriched in olivine, ilmenite and titaniferous magnetite; these layers are spaced at 10 cm to 10 m intervals where they occur. The layering is typically sharply bounded and planar but trough layering, transection and density grading are present locally. In some outcrops, rhythmic layering of plagioclase and plagioclase-olivine cumulates also occur.

Miarolitic cavities containing euhedral quartz crystals up to 30 cm across occur in numerous coastal exposures of gabbroid rocks in Merrifield Bay. These suggest a relatively shallow level of consolidation for the gabbroid plutons and support the geobarometric data of Berg (1977), who found that the crustal level of consolidation of the gabbroid rocks in the Nain complex decreased towards the Davis Inlet area.

Syenite, monzonite, monzodiorite (Unit 3)

Unit 3 consists of relatively homogeneous plutons of pyroxene-olivine syenite, monzonite and monzodiorite in addition to the Char Lake monzonite intrusion, which contains differentiates ranging from gabbroid cumulates to granite. In a few of the plutons of Unit 3, the quartz content is variable from 0 to about 20 percent. It reaches its maximum values in small lenses that are gradational with the host rock. The plutons of Unit 3 intrude the gabbroid plutons of Unit 2 in several outcrops and are, in turn, intruded by dikes of granite of Unit 5. No contact between the rocks of Unit 3 and Unit 4 have been observed.

Felsic volcanic rocks (Unit 4)

Unit 4 consists of quartz and quartz-feldspar prophyry, flow banded felsite and minor lithic tuff and volcanic breccia. All of these rocks are rhyolitic in composition; the only deviation consists of a single outcrop of porphyry containing plagioclase phenocrysts in addition to quartz and alkali feldspar.

The origin of these rocks was previously reported to be uncertain (Hill, 1978b). However, during 1978, two areas underlain by lithic tuff were found. The tuffs contain flattened fragments of felsite that define an excellent foliation. Scattered bombs or blocks of quartz-feldspar porphyry up to 40 cm long also occur locally. These rocks appear to lie topographically and stratigraphically above the massive porphyries and attest to the extrusive origin of the felsites. The massive nature of the underlying porphyries suggests those rocks may be part of shallow level intrusions.

The relative age of the volcanic rocks is uncertain. A small area 30 km west of Flowers Bay is underlain by quartz-feldspar porphyry (Unit 4) in contact with coarse grained plagioclase cumulates (Unit 2b). Xenoliths of the cumulate rocks occur in the porphyry and dikes of porphyry crosscut the cumulates at this locality. The granites of Unit 5 invariably cut the volcanic rocks wherever the two are in contact.

Granite (Unit 5)

Unit 5 comprises coarse grained massive granite which is the dominant lithology in the mapped area. At least three varieties of granite can be recognized on the basis of the constituent mafic minerals. The most widespread of these is a peralkaline granite which contains arfvedsonite-riebeckite, aegirine, aenigmatite and astrophyllite. Nearly all of the granitic rocks south of Sango Bay are of this type. Although the area underlain by peralkaline granite is large, no internal contacts have been found.

Pyroxene-fayalite granite is present in some outcrops along the extreme western edge of the mapped area. Cursory examination outside the mapped area suggests this type of granite predominates farther west. Wherever peralkaline granite has been found in contact with pyroxene-fayalite granite, the former is intrusive into the latter.

A third type of granite occurs on a small island immediately west of Napaktotok Island in Merrifield Bay. It is more mafic than either the peralkaline or pyroxene-fayalite granite and contains hornblende and biotite. This type of granite was also found in one outcrop just south of Sango Bay. The age relationship of this granite with the other two types of granite is unknown.

ECONOMIC GEOLOGY

Occurrences of fluorite, molybdenite, chalcopyrite, galena, sphalerite and radioactive minerals found during 1977 and 1978. The most important of these are associated with the felsic igneous rocks in the southern part of the mapped area. A list of the occurrences is given in Appendix I.

CONTINUING STUDIES

Mapping is expected to continue to the west in 1979 and should cover N.T.S. areas 13N/12 and 13 in

addition to parts of some areas farther west. The field work is being supported by thin section and chemical data of the rocks as well as microprobe analyses of the minerals. A radiometric age dating program is in progress in conjuntion with C. Brooks of the Université de Montréal. C.A. White of Memorial University of Newfoundland is undertaking rare earth analyses of the granites and volcanic rocks as part of an M.Sc. program.

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APPENDIX I

1) 628910E, 6158350N - Scattered grains of molybdenite in altered, green, coarse grained peralkaline granite exposed in a stream bed.

2) 624050E, 61581050N - Crystals of fluorite, galena, chalcopyrite and sphalerite were found associated with a radioactivity anomaly in medium grained, altered monzonite. Total count radioactivity varied irregularly from background (100 c.p.s.) to thirty times background over a distance of 100 m. Poor rock exposure prevented better delineation of the anomalous zone. Grab samples were found to contain up to 2321 ppm lead and 6260 ppm zinc.

3) 620860E, 6158160N - Pyritiferous zones were found in flow banded rhyolite with quartz phenocrysts on the side of a small hill in Unit 4. A grab sample contained 670 ppm zinc.

4) 621540E, 6155150N - An isolated outcrop of felsite with scattered quartz phenocrysts was found containing disseminated pyrite and crosscutting veinlets of pyrite. A grab sample yielded 4768 ppm zinc and 6003 ppm zirconium.

5) 618060E, 6154230N - A horizontal dike of peralkaline granite 50 cm thick cutting medium grained monzonite was found containing scattered crystals of purple fluorite.

6) 617000E, 6154000N - A prominent hill, originally described by Taylor (1972), comprises medium grained peralkaline granite at the base and grades upwards to flow banded aphanitic rhyolite (chilled granite) near the top. The hill is capped by a roof pendant of altered

gabbro. The contact is inclined at an angle of approximately 40° to the northeast. Small veinlets less than 1 cm thick and disseminated crystals of fluorite are widely scattered in the chilled granite along the contact beneath the gabbro.

7) 616600E, 6158000N - The upper contact of a peralkaline granite pluton lying beneath a roof pendant of altered gabbro is exposed along the west side of an elongate hill at this location. The granite displays a well developed chilled margin of flow banded rhyolite. Fluorite mineralization occurs in the chilled granite along the contact for a distance of approximately 400 m. The fluorite occurs in disseminations along flow band planes and in veinlets up to 3 cm thick. The maximum grade of fluorite reaches about 20 percent in some samples.

8) 617480E, 6159250N - A 10 to 50 m thick dike of medium grained peralkaline granite cutting fine to medium grained monzonite was found to contain sparsely disseminated fluorite, molybdenite, chalcopyrite and galena. The mineralization is associated in fractures and cavities in the granite. Choice samples contained up to 2205 ppm lead and 1010 ppm zinc.

9) 617100E, 6159500N - Crystals of fluorite, pyrite and galena are sparsely disseminated in quartz-feldspar porphyry breccia of uncertain origin. The mineralization occurs over a distance of 700 m along the top of a low hill.

10) 613240E, 6161380N - Disseminated fluorite crystals were found in fractures in altered quartz-feldspar porphyry.

11) 602820E, 6185420N - A fine to medium grained granite dike at least 30 cm thick crosscuts coarse grained plagioclase cumulates over an exposed distance of 2 m. The granite has a radioactivity anomaly of 10 to 15 times background.

12) 619070E, 6201210N - Coarse crystals of molybdenite are scattered throughout a 1 m thick dike of leucocratic syenite which crosscuts olivine gabbro in a coastal exposure. Several other dikes of syenite are present in the same area but no mineralization was located in them.

13) 606000E, 6207200N and 605710E, 6206000N - A few grains of molybdenite were found in amphibole granite in coastal exposures at these two locations.

14) 631290E, 6193680N - Several grains of chalcopyrite were found in one of five dikes of altered granite on a small island south of Davis Inlet. The dikes crosscut coarse grained plagioclase cumulates.

15)631500E, 6202950N - Pyritiferous bands occur in amphibole-plagioclase gneiss inclusions in tonalite gneiss of Unit 1c on a small island. One of the pyritiferous bands was found to contain disseminated chalcopyrite.