PRELIMINARY INVESTIGATION OF THE ANORTHOSITE-ADAMELLITE IGNEOUS SUITE IN THE DAVIS INLET AREA, LABRADOR

by J. Hill

INTRODUCTION

This is the first report on a five year geological mapping project in the area between Davis Inlet and Mistastin Lake, Labrador. Mapping in 1977 by a two man field party covered parts of N.T.S. sheets 13N/10, 11, 14 and 15 at a scale of 1:50,000 (see figure 1). The purpose of this study is to outline the geology of the area and to evaluate the economic potential of the peralkaline granitic rocks reported by Collerson and others (1974). Previous mapping in the area has also been reported by Wheeler (1968), Taylor (1972) and Ryan (1974).

Rock names are used according to Streckeisen (1976). Peralkaline is used as an adjective to indicate the presence of sodic pyroxene and amphibole.

GENERAL GEOLOGY

The study area is underlain by undeformed igneous rocks of the Helikian anorthosite-granite suite first reported in detail by Wheeler (1942). These are intrusive into polydeformed and metamorphosed gneisses of Archean age (Taylor, 1972).

The Helikian igneous rocks display sufficient cross-cutting relationships to indicate a general sequence of crystallization of increasingly felsic magmas with decreasing age. However, quartz feldspar porphyry and flow banded felsite (Unit 2) are of uncertain age and may oppose this trend. Contact structures and rock textures indicate crystallization occurred at a relatively shallow crustal level.

Occurrences of fluorite, galena, chalcopyrite and radioactive minerals were found associated with the more felsic igneous rocks. These occurrences are located exclusively in the southern part of the map area.

ARCHEAN BASEMENT

Archean gneisses border the Helikian igneous rocks to the east and also form rare screens between separate intrusions. Cursory mapping of the gneiss terrain revealed two distinct lithologic groups. The older group consists of amphibolite and related mafic gneisses (Unit 1a), locally interlayered with granitoid material. The younger group comprises granitoid gneisses (Unit 1b) which commonly intrude the amphibolites, locally forming agmatite. The younger gneisses range in composition from tonalite to granite and are a heterogeneous assemblage of at least three different ages. However, they have not been sufficiently delineated in the field to partition further. The gneisses of both groups are intruded by altered diabase dikes and pegmatite (Ryan, 1974).

The Archean rocks have been subjected to polyphase deformation and metamorphism that probably reached granulite grade (Wheeler, 1955; Ryan, 1974).

HELIKIAN ANORTHOSITE-GRANITE IGNEOUS SUITE

Quartz-feldspar porphyry and aphyric felsite (Unit 2)

Quartz and quartz-feldspar porphyry with minor aphyric felsite, agglomerate and breccia outcrop in a large zone in the southern part of the map area. They are intruded by both monzonite and adamellite but their age relationships with the dioritic and anorthositic rocks of

unit 3 are unknown. This unit has been called the Nuiklavik volcanics by Brinex (Brinex, Naskaupi geology map).

The porphyries are usually massive, containing quartz and perthite phenocrysts embedded in an aphanitic to glassy groundmass. The aphyric felsites generally display well developed flow banding with northerly strikes and gentle dips. Columnar jointing, oriented vertically, was found in one locality. Fragmental felsites are abundant in some places. These consist of rounded and angular blocks of several varieties of felsite in an aphyric matrix. Breccias occurring in tabular bodies and associated with alteration veinlets appear to be related to late stage fluidization. Other breccias possess a flow banded groundmass and may be agglomeratic in origin.

The columan jointing, brecciation, flow banding and very fine grain size indicate that these rocks crystallized in a surface or near surface environment. Although flow banding is present in granites of Unit 5 in the area, it occurs exclusively within about 10 m of overlying roof pendants. The wide occurrence of flow banded felsite in the porphyry unit without the presence of any upper contacts strongly suggests an extrusive origin for those rocks. In contrast, the massive porphyries may represent subvolcanic intrusions.

Anorthositic plutons (Unit 3)

Anorthositic plutons of Helikian age intrude the Archean gneisses in several areas. The contact zones are characterized by extensive brecciation of the country rocks and a thermal aureole that reaches pyroxene hornfels grade (Wheeler, 1955; Ryan, 1974). Basic rocks of at least three different ages are indicated by the presence of anorthosite xenoliths in the chill zone and dikes of olivine norite crosscutting the marginal rocks of the plutons.

Chilled margins of olivine gabbro gradational with the interior rocks were recognized in both anorthositic intrusions exposed in the map area. Plagioclase is the only phenocryst phase in the chilled rocks. This suggests that the anorthosites were the first differentiate of the parental olivine gabbro melt. Flat stage determinations of plagioclase in the chilled rocks indicate an average composition of An_{45-48}.

The interior rocks of the plutons are coarse grained and vary in composition from anorthosite to troctolite except for one small outcrop of layered olivine-oxide-plagioclase cumulate on the north shore of Flowers Bay. These ultramafic rocks occupy a troughlike structure in the crest of an anticlinal rise in the basal rocks of the pluton. They probably represent an accumulation of olivine and oxide grains similar to thin seams of dunite near the base of the Kiglapait intrusion (Morse, 1969). The cumulate phases in the interior rocks are usually plagioclase and olivine although cumulate apatite and oxides are concentrated locally. Poikilitic pyroxene is generally present as the main intercumulate phase.

A weakly developed plagioclase lamination is commonly present in the anorthositic rocks. In addition, discontinuous rhythmic layering is locally evident. These structures suggest the anorthosite body at Flowers Bay is a flatlying sheet with an undulating base and steep walls.

The anorthositic plutons are cut by younger intrusions of diorite, syenite and granite. Contacts between the later plutons and the anorthositic bodies are characterized by intrusive breccia and numerous dikes.

Biotite diorite (Unit 4)

One large pluton and two smaller bodies of biotite diorite outcrop in the map area. These are intrusive into anorthositic rocks but are cut by younger granite.

The diorites are somewhat variable in composition and are primarily composed of plagioclase, augite, hypersthene, hornblende and biotite. Quartz, microcline and opaques occur in accessory amounts.

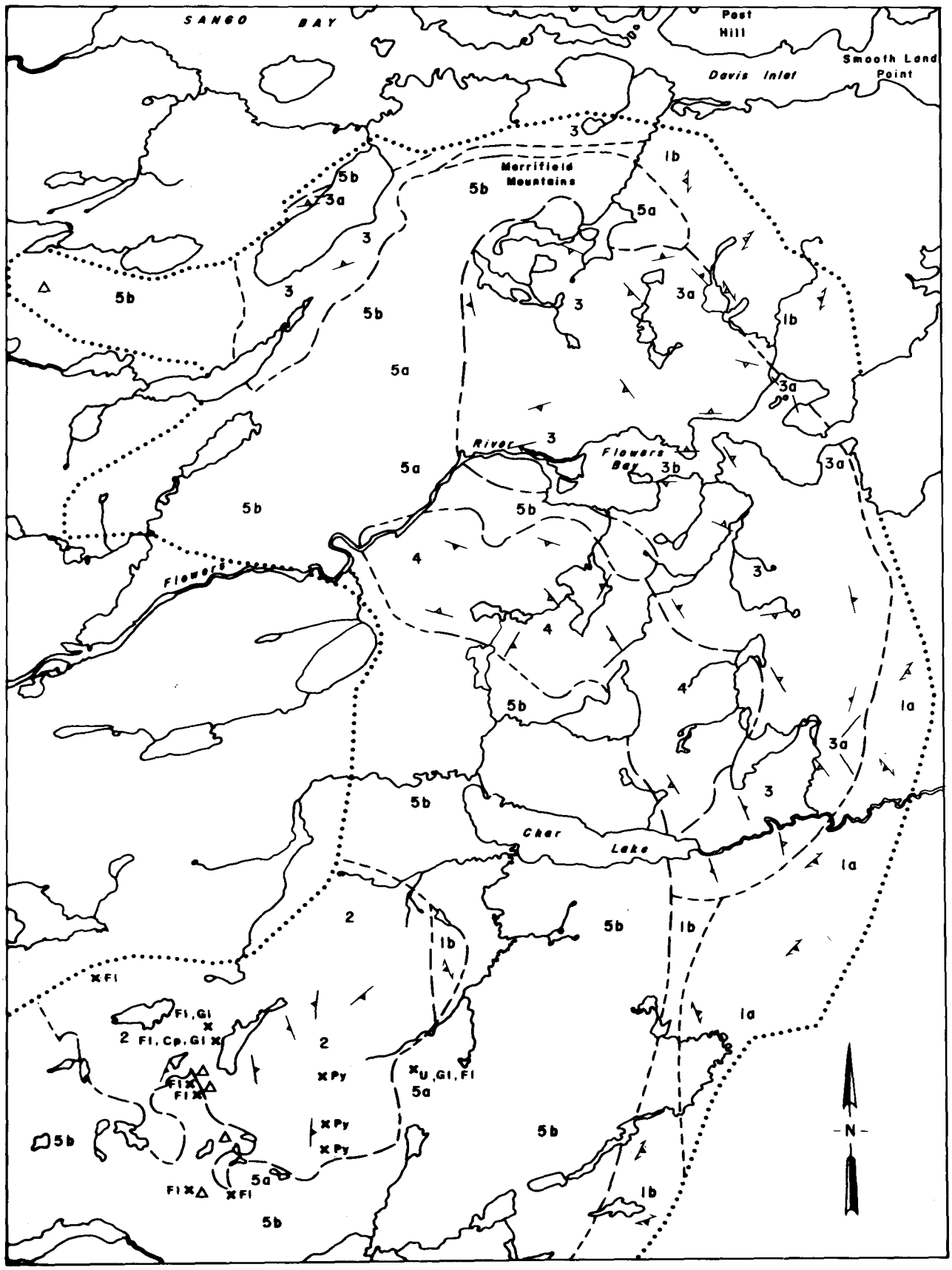
A pronounced plagioclase lamination in the diorite pluton south of Flowers Bay parallels the margins of the body and has gentle dips. This fabric suggests the pluton is a thin lopolithic sheet with tapering margins. North of Char Lake where the topography reaches elevations of 200 to 300 m, the upper parts of the pluton are exposed. There the rocks are fine to medium grained and amphibole and biotite are the main mafic minerals. At lower elevations near Flowers Bay, pyroxene is the dominant mafic phase.

Syenite and granite (Unit 5)

These rocks underlie most of the map area and are not divided in this report. They range in composition from mesocratic syenite with very little quartz to leucocratic granite containing abundant quartz. The most felsic types tend to be peralkaline in modal composition.

Syenite occurs both as distinct plutons and as thin gradational zones marginal to larger granite bodies. The separate plutons of syenite are intruded by apophyses of granite where the two lithologies are found together in outcrop. The syenite appears to be similar to the olivine and pyroxene bearing adamellites described by Wheeler (1955, 1968) from the Nain area except that the latter are subsolvus.

The granite tends to be medium to coarse grained and granular. It consist mainly of quartz, perthite and minor hornblende. Augite, apatite, opaque minerals and biotite are accessories. In the more quartz rich varieties



LEGEND

PROTEROZOIC

HELIKIAN

5 *Alkaline granitic intrusive rocks;* **5a,** *monzonite in part older than unit 5b;* **5b,** *adamellite, quartz syenite.*

4 *Hornblende-biotite diorite and gabbro*

3 *Anorthosite, troctolite and related intrusive rocks;* **3a,** *fine grained olivine norite and olivine gabbro;* **3b,** *olivine-ilmenite-plagioclase cumulate.*

2 *Quartz and quartz-feldspar porphyry; minor flow banded felsite and felsite breccia; probably extrusive in part.*

ARCHEAN

1 *Layered gneisses;* **1a,** *amphibolite;* **1b,** *quartzofeldspathic gneiss of various ages; intruded by undeformed pegmatite.*

SYMBOLS

Limit of mapping

Geological contact (defined, approximate, assumed)

Primary igneous foliation (dip less than 45°, dip greater than 45°)

Area with remnants of older igneous rock

Mineral occurrence (U = uranium, Gl = galena, Fl = fluorite, Cp = chalcopyrite, Py = pyrite)

Gneissic foliation (dip less than 45°, dip greater than 45°).

and especially in later dikes, the amphibole becomes arfvedsonite- riebeckite in composition and aegirine and aenigmatite appear as important accessories Collerson *et al.* (1974) have correlated these rocks with the alkaline plutonic province of Gardar in southern Greenland.

The plutonic rocks of Unit 5 are usually structureless. However, miarolitic cavities are common in granite in the southern part of the map area. In addition, roof pendants of gabbro and quartz-feldspar porphyry overlying chilled, aphanitic, flow banded granite are common. Felsite in contact with gabbro on a prominent hill north of Hunt River was interpreted by Taylor (1972) to be extrusive in his preliminary investigation of the area. More detailed mapping during the present study indicates that the felsite is the upper chilled margin of the granite lying beneath a roof pendant of gabbro. At the southern contact between quartz-feldspar porphyry and granite, the granite intrudes the porphyry as a thin, flatlying sheet whose upper and lower contacts are both exposed. These features indicate the plutons of Unit 5 were emplaced as thin sheets near the surface and that none of the exposed rocks are far removed from the original upper contact. This interpretation is similar to that reached by Wheeler (1968) for the Tessiarsuyungoakh adamellite west of Nain.

MINERAL OCCURRENCES

Occurrences of fluorite, chalcopyrite, galena and radioactive minerals were found in outcrop at several localities in the southern part of the map area (see figure 1). The mineralization occurs as secondary disseminations and vein fillings that appear to be related to late stage degassing of the younger, more felsic magmas. Scintillometer measurements ranged up to a maximum of 3000 counts per second over distances of several metres at the radioactive mineral showing.

The most concentrated mineralization lies along the upper contact of granite underneath a roof pendant of gabbro. Fluorite and sporadic galena and chalcopyrite occur over a distance of approximately 2 km at this locality.

In addition to these showings, several boulders of glacial float of feldspar-quartz-biotite-graphite paragneiss were found containing fluorite and chalcopyrite in proportions approaching one percent of the rock. The presence of fluorite suggests the float come from gneiss terrain lying adjacent to granite of Unit 5.

The mineralization associated with the upper contacts of granite plutons appears to offer the best potential. Most of the upper contact is unexposed. Any antiformal undulation in the upper contact would provide an excellent trap for late stage mineralizing fluids. In addition, bordering country rocks might provide good sites for mineral precipitation due to changing physical and chemical conditions.

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REFERENCES

Brinex

Naskaupi geology map; Scale 1 inch equals 8 miles.

Collerson, K.D., Jesseau, C.W., Ryan, A.B., and Hawkins, D.W.

1974: Mineral potential evaluation in the Makkovik and Hopedale areas, Labrador; *in* Report of Activities for 1973, W.R. Smyth (Editor); Newfoundland Department of Mines and Energy, Mineral Development Division, Report 74-1.

Morse, S.A.

1969: The Kiglapait layered intrusion, Labrador; Geological Society of America, Memoir 112.

Ryan, A.B.

1974: Metamorphic and structural investigation of the Hopedale gneiss, Flowers Bay, Labrador; B.Sc. thesis, Memorial University of Newfoundland, St. John's.

Streckeisen, A.

1976: To each plutonic rock its proper name; Earth Science Reviews, Volume 12, pages 1-33.

Taylor, F.C.

1972: Reconnaissance geology of a part of the Precambrian shield, northeastern Quebec and northern Labrador; Part III; Geological Survey of Canada, Paper 71-48.

Wheeler, E.P.

1942: Anorthosite and associated rocks about Nain, Labrador; Journal of Geology, Volume 1, pages 611-642.

1955: Adamellite intrusive north of Davis Inlet, Labrador; Geological Society of America Bulletin, Volume 66, pages 1031-1060.

1968: Minor intrusives associated with the Nain anorthosite; *in* Origin of Anorthosite and Related Rocks, New York State Museum and Science Service, Memoir 18, pages 189-206.