6. MINERAL POTENTIAL EVALUATION IN THE MAKKOVIK AND HOPEDALE AREAS, LABRADOR

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Introduction

The excellent coastal exposures in the Nain Province between Makkovik and Davis Inlet (Figs. 1 and 2) are providing a unique opportunity for the study of:

1. The structural, petrological, chemical and metallogenic evolution of the Archean basement rocks.

2. The geology and metallogenic potential of the "anorthosite" intrusions and associated plutons of gabbro, diorite, monzonite, alkali syenite, adamellite and alkali granite in the Davis Inlet-Flowers Bay area.

3. The petrology, tectonic significance and economic potential of supracrustal meta-basic and meta-ultrabasic rocks inland from Hopedale.

4. The geology of lamprophyric carbonatite and kimberlitic dykes and their associated fenite zones in the Aillik-Makkovik area, and their possible bearing on the metallogenic evolution of the area.

Field work was undertaken between June and September 1973 in the Davis Inlet-Hopedale area (K.D.C., C.W.J. and A.B.R.) and in the Aillik-Makkovik area (K.D.C. and D.W.H.). Maps on a scale of 1:50,000 were produced for the former area and on a scale of 1:18,000 for the latter.[1]

1. Davis Inlet-Flowers Bay Area

The area mapped in the vicinity of Flowers Bay (Fig. 2) consists predominantly of a large post-tectonic troctolite-norite-anorthosite pluton, which intrudes a repeatedly deformed basement quartzo-feldspathic gneisses and amphibolites (the Hopedale Gneiss). Contacts are well exposed in the east, where the pluton displays a prominent chilled margin composed essentially of fine-grained diabase and troctolite. In places the pluton is compositionally and texturally banded (flow banded?) and frequently contains cognate xenoliths of basic igneous aspect.

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[1] Copies of these maps are given by Collerson et al. 1974.

Contact rocks adjacent to the chilled zone are commonly extensively fragmented and have been locally intruded by medium grained pods of granite and syenite. Petrographic studies suggest that rocks adjacent to the pluton have been thermally metamorphosed producing rocks with assemblages typical of the pyroxene hornfels facies.

The troctolite-norite-anorthosite pluton is extremely variable in grain size, with feldspar and pyroxene crystals ranging from less than 0.5 x 0.5 cm. to greater than 20 x 5 cm.

Ilmenite is widely distributed as either (1) an intercumulus phase, (2) a concentration localized marginal to granite veins and anorthositic xenoliths, (3) pegmatitic pods and veins associated with abundant apatite and coarse grained skeletal pyroxenes, and (4) a major constituent of an extensive outcrop of cumulus olivine-ilmenite-plagioclase rock which crops out on the north shore of Flowers Bay.

Pyrrhotite and chalcopyrite are found as intercumulus phases in certain of the leuconoritic units.

Field evidence suggests that the body is layered on a megascopic, and in places a mesoscopic scale. Where accurate orientations could be obtained the layering was predominantly oriented east-west and dips were generally at a shallow angle to the north.

Younger plutons of biotite rich gabbro, diorite, monzonite, alkali syenite, adamellite and alkali granite, which are probably genetically related, display intrusive relationships to rocks of the "anorthosite complex". As a result of topographic effects, roof pendants of the anorthositic rocks frequently overlie these later intrusions.

The discovery of this extensive suite of alkali plutonic rocks in the Flowers Bay area has important geological implications. Rocks of the suite are similar in many respects to alkaline plutonic rocks of the Gardar Province in south Greenland (Upton, 1969). This discovery may therefore be direct evidence for Gardar plutonic igneous activity in Labrador.

2. Area Inland from Hopedale

The map area (Fig. 2) comprises a lineate belt of amphibolitic gneisses and schists (approximately 16 km x 2.5 km in size) within a basement complex of banded quartzo-feldspathic gneisses

(the Hopedale Gneiss). Detailed structural analysis shows that the deformational history of the area involved many stages of folding, faulting and dyke emplacement. However, only the more recent folding deformations appear to have influenced the amphibolite belt. The belt has been repeatedly folded on a large scale and megascopic interference patterns are well developed. As a result of intense isoclinal folding and possibly transposition, contact relationships with the surrounding banded gneisses appear to be conformable.

The amphibolites show considerable variation in both mineralogy and texture, which may be the result of original igneous differences in the protoliths, rather than metamorphic differences.

Ultrabasic lenses, often highly folded, sheared and serpentinized are common in certain areas of the belt. In places these lenses display well preserved intergrowths of coarse skeletal olivine which is remarkably similar to the spinifex textures found associated with less deformed Archean ultrabasic lava flows (Nesbitt, 1971).

Thin but discrete pelitic and semipelitic units (garnetiferous and staurolite-bearing schists and quartzo-feldspathic semi schists and gneisses) crop out along the greater part of the belt and appear to represent original sedimentary differences.

The intimate association of nickel sulphides with rocks displaying spinifex textures in other Archean terrains should make a study of the numerous rusty zones within the map-area extremely interesting from an economic point of view. In the course of field mapping traces of chalcopyrite, pyrrhotite, pentlandite(?), pyrite, galena and molybdenite were observed in some of these zones.

Results of the study at present suggest that the amphibolite belt is a meta-volcanic supracrustal sequence deposited on a polydeformed gneissic basement. The whole complex has subsequently been subjected to several deformation periods destroying the original discordant relationships.

3. Aillik-Makkovik Area

Excellent exposures of a wide range of dykes intruding basement quartzo-feldspathic gneiss (the Hopedale Gneiss), metasedimentary and meta-igneous units of the Aillik Group and post

tectonic igneous intrusives are found in the map area. Lamprophyric carbonatites, carbonatites and rocks of kimberlitic affinity are the youngest of these dykes. They have distinct concentrations on East Turnavik Island, Cape Aillik and Cape Makkovik. There is a marked decrease in abundance towards the south in the map area.

The dykes range in width from less than 1 cm. to almost 1 m. Some dykes are traceable along strike for 100 to 300 metres. Other dykes are discontinuous along strike and commonly bifurcate or display an en echelon outcrop pattern.

Dyke emplacement has been localized along (1) well developed joint sets, (2) pre-existing igneous intrusive contacts and (3) in rare cases along schistosity traces. Although dyke orientations range through 360 degrees there appear to be distinct modes; (1) between 335 and 000, and (2) between 025 and 080. These orientations correspond closely with the most commonly observed trend of joints throughout the map area. Cross cutting relationships between dykes suggest that there were at least two periods of lamprophyre dyke emplacement.

The dykes generally display a distinct compositional and textural banding which in some cases is traceable for considerable distances along strike. This banding is interpreted to be either the result of (1) successive injections of "lamprophyric, carbonatite or kimberlite magma" into an active joint system, (2) flow differentiation, or (3) rapid chilling.

Most of the dykes contain carbonate either in the matrix or as subrounded ocelli, while others are composed almost entirely of dolomite or calcite.

In the field fourteen varieties of dykes were distinguished, ranging in composition from carbonatite to kimberlite on the basis of the following criteria:

1. Mineralogical composition.
2. Presence or absence of ocelli.
3. Phenocryst (and xenocryst) type.
4. Morphology of compositional and textural banding.
5. Presence or absence of nodules.
6. Mineralogical composition of nodules[2]

[2] Detailed descriptions of these are given in Collerson et al. 1974.

Traces of pyrite, chalcopyrite, fluorite and molybdenite occur in feldspathised quartzites of the Aillik Group in a narrow zone between Cape Makkovik and Banana Lake. The mineralization occurs either as discontinuous narrow veinlets transgressive to the regional schistosity or as disseminated pods up to 1 cm. long parallel to the schistosity.

The wide-spread development of transgressive veinlets of alkali feldspar, alkali pyroxene and alkali amphibole in the feldspathised quartzites suggests that they may be the result of fenitization. Fluids responsible for this metasomatism and also possibly for the mineralization may have been derived from the alkaline igneous activity in the area.

Further Studies

Detailed petrographic and geochemical studies on material collected in the three map areas during the 1973 field season are being undertaken during 1974. A final report will be submitted in June 1974.

Discussion

There is a strong similarity between geological relationships in coastal Labrador and south western Greenland (Bridgewater, 1969; Sutton et al, 1972). This similarity on either side of the Davis Strait is readily explained by the accepted hypothesis that Labrador and south western Greenland were juxtaposed before the development of the Labrador Sea spreading centre (Wilson, 1965; Laughton, 1972).

These investigations in the Nain Province are therefore providing a critical link with the relatively well studied rocks of south and south western Greenland (Bridgewater et al, 1973; Windley, 1973) where considerable mineral exploration activity is currently being undertaken (Prast, 1973).

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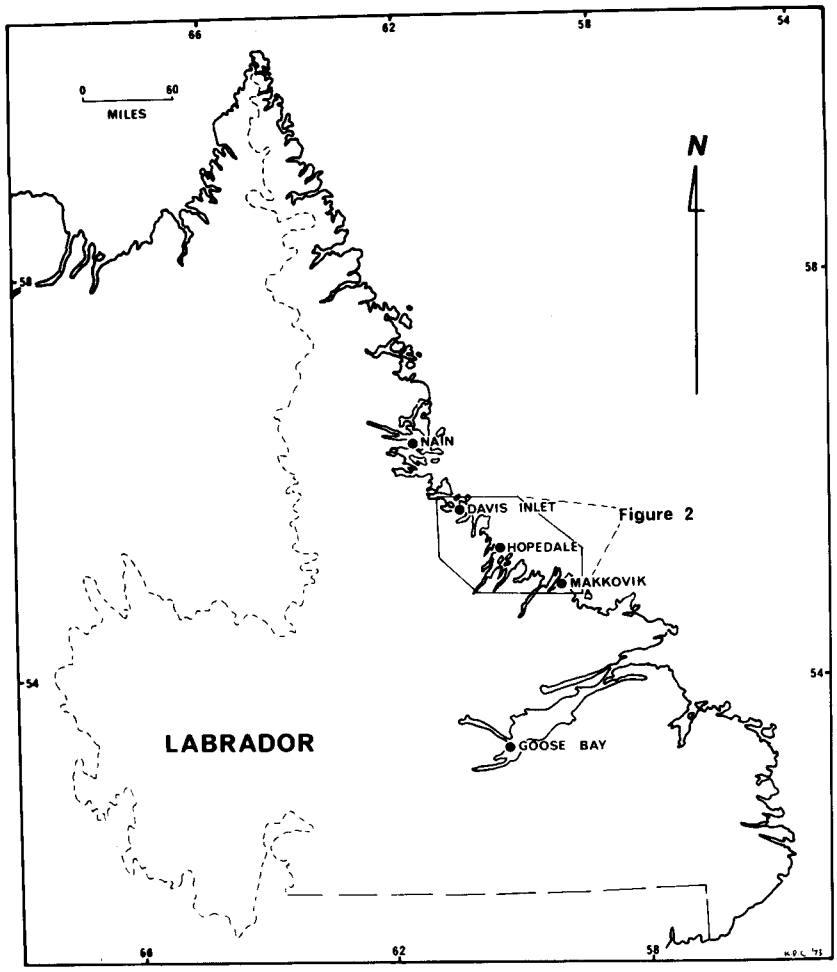

Figure 1. Locality map of Labrador showing the area under investigation.

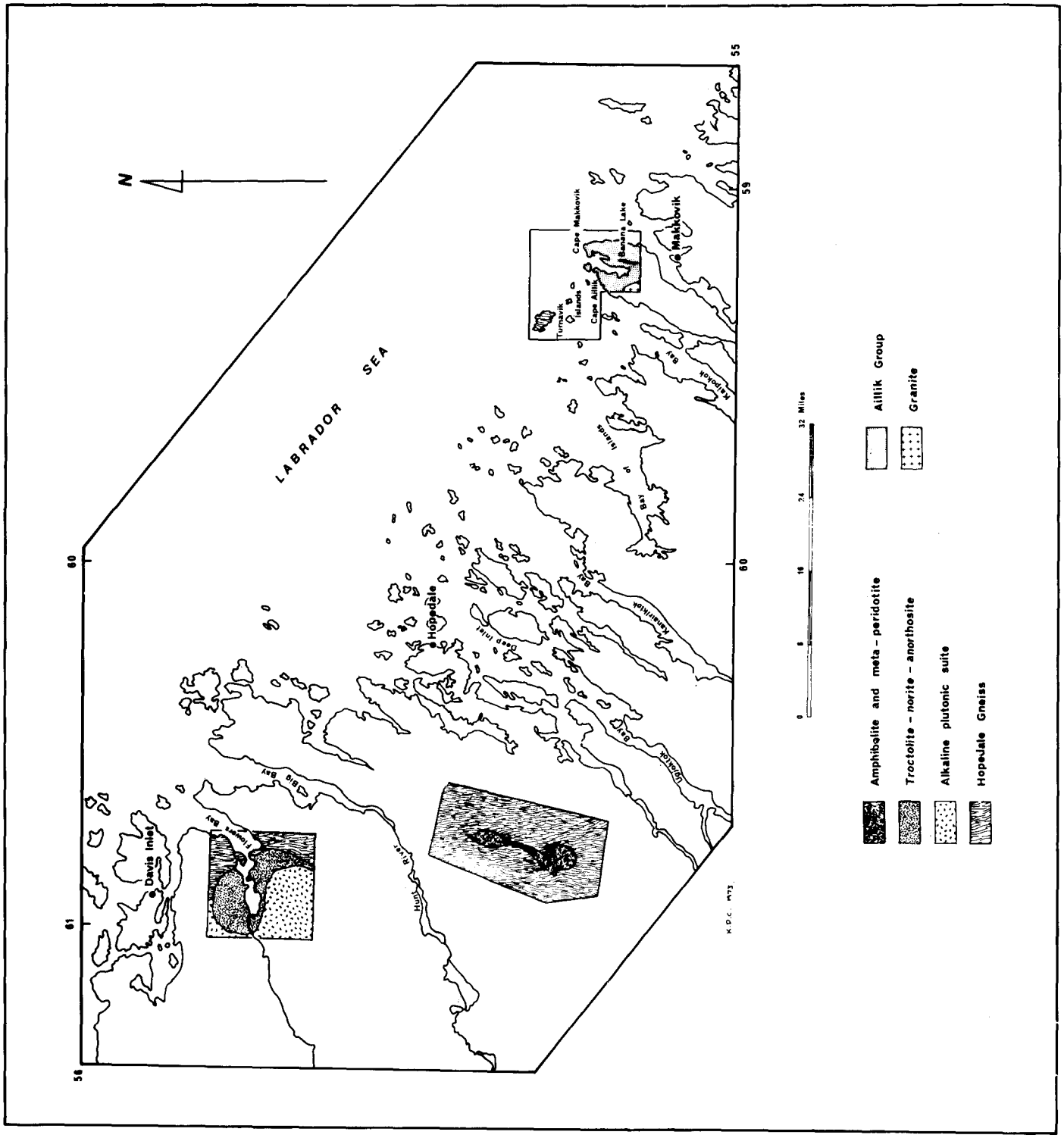

Figure 2. Map showing portion of the Labrador coast with the areas investigated.