THE ALEXIS BAY - SNUG HARBOUR REGION OF SOUTHERN LABRADOR

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Introduction

A geological mapping-mineral potential evaluation program was initiated by the Mineral Development Division in the poorly known Grenville structural province of southern Labrador. A belt of reported paragneiss, gabbro, and granite gneiss intersecting the coast in the Alexis Bay - Snug Harbour region was selected for study on the basis of excellent shoreline exposure and known sulfide showings in the reported paragneiss unit. The Francis Harbour (3/D 12 WE) and Snug Harbour (3/D 13 E) map sheets were mapped for publication on 1:100,000 scale.

Principle Results

1. A structural, metamorphic sequence was established for the area (see Figure 1). The White Bear Arm Gabbro, the oldest unit exposed in the area, was intruded syntectonically by a series of migmatitic granodiorite-tonalite and granite gneisses, converting the margins of the gabbro to amphibolite gneiss.

2. The area of the Alexis Bay region reported to be underlain by paragneiss, was instead found to be underlain by granite, granite gneiss and minor amphibolite.

3. Zones of gossan occurrence at Cape Bluff were found to be developed within amphibolite pods and lenses in granite gneiss, rather than in infolds of rusty paragneiss as reputed by previous workers.

4. A previously unrecognized late leucogranite (Gilbert Bay Leucogranite) was discovered in the Gilbert Bay area.

Early work in southern Labrador was confined to examinations of the narrow coastal strip, e.g., Kranck (1939), Christie (1951), and Douglas (1953). Piloski (1955) provided the first account of the geology of the interior of the region and reported the existance of an arcuate belt of paragneiss between Sandwich Bay and Alexis Bay. Regional mapping by Eade (1962) further delineated this belt of paragneiss and also the outline of the White Bear Arm Gabbro. Since then, the area has received little attention apart from mining company reports by Donohoe (1966) and Bradley (1966) on the Cape Bluff and Occasional Harbour gossan occurrences.

General Geology

Unit 1 The White Bear Arm Gabbro

This is a coarse, grey leucogabbro with large, euhedral plagioclase

	PLUTONIC EVENT	STRUCTURAL/METAMORPHIC EVENT
	late gabbro dyke (8)	N.E. fracturing; minor faulting
D_5	---------------	major open folds; minor E-W faulting
	late mafic dykes	
D_4	---------------	Production of weak S_4 biotite cleavage in granite
	Intrusion of Gilbert Bay leucogranite (7)	
D_3M_3	---------------	Tight folding; mylonitisation; formation of augen gneiss fabric; development of muscovite S_3 fabric
D_2	---------------	Minor F_2 folds
↑	Intrusion of porphyritic granite (6)	granite produces syn-late D_1 migmatisation in aureole-flasar gneiss (4); schlieric gneiss (5)
Waning D_1M_1	Intrusion of granodiorite veins; intrusion of amphibolite dykes	Syntectonic fabrics developed in veins and dykes
	Intrusion of tonalite-granodiorite gneiss (3)	
D_1M_1	---------------	Upper amphibolite facies metamorphism; development of amphibolite gneiss (2) and S_1 fabric
	Intrusion of White Bear Arm Gabbro (1)	

Figure 1: Summary of geological history.

crystals up to 5 cm in length set in a groundmass of coarse, altered pyroxene. The plagioclase is of dark grey-brown colour and slightly schillered, though the irredescence typical of labradorite is never developed. The dark colour of the plagioclase masks the relatively leucocratic nature of the gabbro. Megacrysts of a bronze hued pyroxene (bronzite?) are scattered throughout the unit.

The gabbro is largely undeformed in its internal regions, metamorphic effects being limited to partial alteration of the pyroxene groundmass.

In St. Michaels Bay, rhythmically layered gabbro occurs as relict zones in amphibolite gneiss. Layered units are on average 15 cm thick with thin basal cumulate zones of pyroxenite grading into anorthositic gabbro. This zone lacks the coarse plagioclase typical of the main gabbro body. Associated with the layered gabbro is a thin unit of pyroxenite in which phenocrysts of pyroxene are set in a green-black altered groundmass of pyroxene, amphibole, and pale brown mica. Plagioclase comprises less than 10% of the rock.

Unit 2 - Amphibolite Gneiss

The gabbro of Unit 1 has been deformed and metamorphosed around its margins to amphibolite gneiss (D_1M_1). Contacts are transitional, generally over 40-60 m.

Towards the contact pyroxene in the gabbro becomes progressively aligned and pseudomorphed by hornblende. Simultaneously, the euhedral plagioclase (labradorite?) is replaced and overgrown by aggregates of white plagioclase (oligoclase-andesine?). The final product is an amphibolite gneiss with stubby prisms of black hornblende (approximately 1 cm long) set in a foliated matrix of euhedral white plagioclase and minor biotite. A common lithology developed within this unit is a blotchy amphibolite gneiss, formed by the segregation of hornblende into elipsoidal aggregates.

The amphibolite gneiss is homogeneous on a local scale but is intruded by amphibolite dykes, and a later series of granodiorite dykes that emanate from Unit 3. Together, they account for between a quarter and a third of the volume of the unit.

Both the amphibolite and granodiorite dykes can be traced into the gabbro. The amphibolite dykes are less metamorphosed within the gabbro and can be seen to be metadiabases in origin. Both sets of dykes show strong internal foliations. The gabbro is largely unaffected by this deformational event; however, a foliation is locally developed close to the dyke margins. The dykes are interpreted as late syntectonic intrusions of the first structural-metamorphic event (D_1M_1).

Within the amphibolite gneiss intrafolial migmatite structures (intrafolial leucozones of pegmatite and granodiorite) are found in association with the granodiorite dykes and veins. The amphibolites are commonly garnetiferous close to the migmatitic structures.

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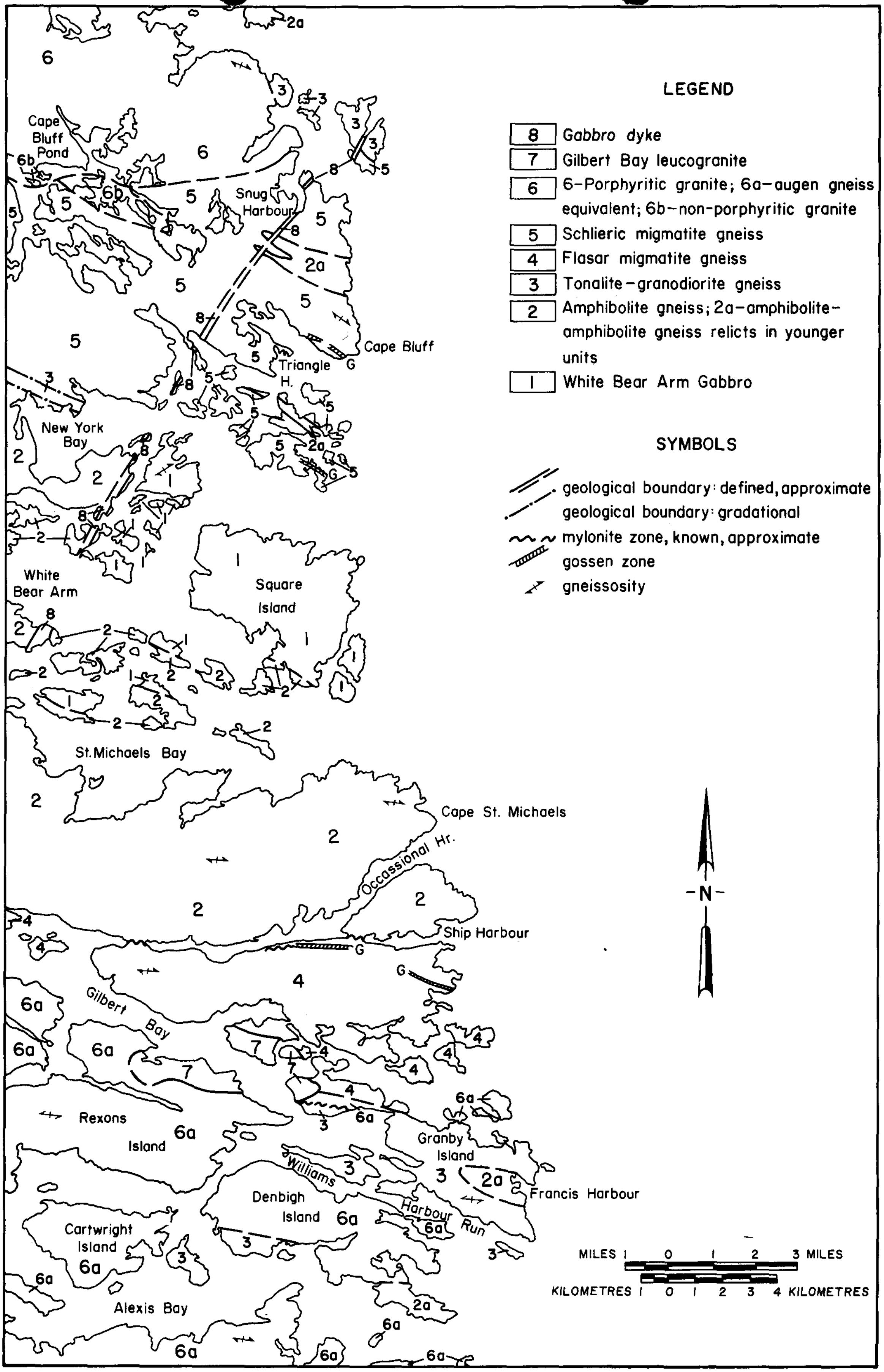

Fig. 1 - Geological map of the Alexis Bay-Snug Harbour area, southern Labrador

Although it can be demonstrated that the granodiorite veins locally cross-cut and post-date the S_1 fabric of the amphibolite gneiss, the deformation and metamorphism of the gabbro margins to amphibolite gneiss is so closely linked with the intrusion of granodiorite-tonalite dykes that all are regarded as part of an extended, predominantly thermal, D_1M_1 migmatisation event.

Numerous inclusions of amphibolite and amphibolite gneiss ranging up to 1 km in width are incorporated within the gneisses of Units 3-6. The larger bodies often have agmatite textures due to net veining by the host gneiss. The frequency of these inclusions increases towards the amphibolite gabbro complex and it seems possible that they may be relics of the gabbro protolith that were separated from it during migmatisation. The presence of a meta-pyroxenite inclusion within the gneisses of Unit 5 at Cape Bluff would support this interpretation. However, many of the smaller units, are finer-grained and more melanocratic than the Unit 2 amphibolite gneisses and they have outlines suggesting they were originally pre D_1M_1 mafic dykes.

Gossans are developed within the amphibolite inclusions. They occur in marginal zones up to 6 km. wide on the north and south sides of the amphibolite gneiss-gabbro complex. The development of the gossans, both in width and frequency, increases towards the amphibolite gneiss-granitoid gneiss contact.

Unit 3 - Tonalite - Granodiorite Gneiss

In its original state, this unit is a fine, grey, homogeneous orthogneiss, variable in composition between tonalite and granodiorite. In New York Bay, the unit is in gradational contact with the amphibolite gneiss of Unit 2. The contact is marked by a gradual transition from intensely veined amphibolite gneiss to a granodioritic gneiss with large aligned inclusions of the amphibolite gneiss. The tonalite-granodiorite gneiss is interpreted as a late stage intrusion of the D_1M_1 event. The complex vein system in Unit 2 is related to this intrusion.

Superimposed upon Unit 3 are varying effects of a later episode of migmatisation.

Unit 4 - Flasar Migmatite Gneiss

The tonalite-granodiorite gneiss of Unit 3 develops thin intrafolial lenticles of pink granite (flasar texture) and porphyroblasts of microcline and forms a distinct map unit. This migmatisation obscures much of the original tonalite gneiss texture. The unit grades into the augen gneiss of Unit 6a with an increase in the frequency of microcline porphyroblasts. D_2 and D_3 deformations produced tight crenulation of the flasar gneiss texture.

Unit 5 - Schlieric Migmatite Gneiss

A diffuse network of granite veins breaks the tonalite gneiss of

Unit 3 into small aligned rafts (schlieric texture). The later granite is characteristically spotted, the spots being felted intergrowths of biotite and magnetite, pseudomorphic after grains of amphibole.

Flasar texture is only sporadically developed in this unit and appears to have been a precursor to the development of schlieric texture.

Unit 6 - Porphyritic Granite and Augen Gneiss

Both the flasar migmatitic gneiss and the schlieric migmatitic gneiss units grade into a porphyritic granite (Unit 6). The granitic character of this unit is best developed in the north of the map area towards the interior parts of the unit. The porphyritic granite consists of random to weakly orientated microcline phenocrysts (average grain size 3 cm) set in a plagioclase-biotite-amphibole-quartz matrix. The microcline phenocrysts are euhedral and simply twinned. Towards the periphery of the nit, the granite becomes increasingly foliated and blends into Unit 5.

In the south of the area, Unit 6 is widespread but has been largely deformed to an augen gneiss (6a) by later deformation. Although the unit often has the characteristics of a granite, i.e., semi-random orientation of phenocrysts and numerous xenoliths of amphibolite gneiss, it is difficult to discern where intrusive granite ends and microcline porphyroblastesis in older rock types begins. The 'granite' matrix varies in composition from biotite-plagioclase-quartz to amphibole-biotite in border regions.

Unit 6b is a foliated, non-porphyritic granite that projects as a tongue from the main body of Unit 6 in Cape Bluff Pond. Compositionally it is identical to the granite veins in the schlieric gneiss.

Pink aplite and microgranite intrude the margins of the gabbro-amphibolite gneiss complex. In Ship Harbour and Occasional Harbour, the aplites mark the contact between flasar gneiss and amphibolite gneiss and are interpreted as late marginal phases of Unit 6.

Reconnaissance on the south side of Alexis Bay revealed that granite and augen gneiss of Unit 6 extend as far south as Spear Harbour; thus at least half the area of the supposed paragneiss unit of Eade (1962) is underlain by granite and granitic gneiss.

Unit 7 Gilbert Bay Leucogranite

A previously unrecognized late biotite leucogranite, the Gilbert Bay Leucogranite, intrudes the older rocks in Gilbert Bay and ramifies the surrounding gneisses with a network of thick granite veins, up to 5 km. away from the pluton. Large zenoliths of gneiss occur within the granite. The granite is only weakly cleaved and clearly post-dates the D_1-D_3 fabric elements present in the gneiss zenoliths.

Post tectonic mafic dykes

Scattered mafic dykes (1-2 m. wide) traverse the northern part of the area with an E-W trend. A 25 m. thick sill at Cape St. Michaels is of the same age and composition.

A thick (200 m.) northeast trending gabbro dyke (unit 8 on map) was mapped for over 18 km. in the north of the area. The gabbro is slightly altered, medium-grained and locally columnar jointed.

Structure and Metamorphism

The late stages of deformation and upper amphibolite facies metamorphism of the gabbro (D_1M_1) were associated with the intrusion of the migmatitic orthogneisses of Units 3 to 6. The porphyritic granite of Unit 6 produced syn-late D_1 migmatisation effects in its aureole but crystallised internally post D_1.

A minor phase of deformation (D_2) produced small folds of the S_1 gneissosity.

The third period of deformation and retrogressive metamorphism (D_3, M_3) produced minor, tight to isoclinal folds of S_1 and F_2. Interference with F_2 produced a variety of interference pattern types. F_3 folding was associated with narrow zones of intense cataclasis producing augen gneiss and mylonite fabrics in the granitic gneisses. The pronounced linears of Alexis Bay, Williams Harbour Run, etc., have developed along these zones.

Intrusion of the Gilbert Bay Pluton post-dates D_3 folding and cataclasis and is in turn itself weakly cleaved (S_4). A final period of deformation (D_5) produced major and minor S.E. trending open folds in St. Michaels Bay.

A late series of N.E. trending minor faults and fractures imparts a strong N.E. grain to the topography. The late gabbro dyke of Unit 8 has been intruded along one of these N.E. trending fractures.

Age of Events

Since so little is known of the surrounding geology, estimates of absolute age are at best tentative. The composition and texture of the White Bear Arm Gabbro, however, suggests that this body may be related to the Elsonian anorthosite event. In this case, all the main D_1M_1 events would belong to the Grenville Orogeny, there being no evidence of an earlier gnessic basement.

Economic Geology

Apart from two small occurrences of malachite staining in schlieric gneiss near Triangle Harbour, the area appears devoid of base metal mineralization.

No Ni-Cr mineralization was found associated with the pyroxenite or layered gabbro.

The gossan occurrences of Cape Bluff and Occasional Harbour were described by Donohoe (1966) and Bradley (1966) as being synformal infolds of rusty paragneiss in granite gneiss. However, this work has shown that the gossans are developed in amphibolite. The gossan weathering is due to finely disseminated pyrite within the amphibolite.

Individual gossan zones are between 1 m. and 100 m. wide and occur in sheet-like zones within the amphibolite, often near or at contacts with the granite gneiss. The gossan zones are always associated with veins of leucogranodiorite and pegmatite and the host amphibolites are characterized by retrogressive alteration. Only minor amounts of chalcopyrite are present in the gossans.

Numerous pegmatite occurrences of biotite and muscovite occur throughout the area. Muscovite crystals up to 5 cm. across occur in late pegmatites cutting the augen gneiss in the southern half of the area. Biotite pegmatites are more numerous and occur mainly within the amphibolite gneiss complex. Crystals are usually 5-10 cm. in diameter but occasionally, e.g., in New York Bay, reach 50 cm. in diameter. The biotite and muscovite crystals are often broken and bent by later deformation.

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