GEOLOGY OF THE ROSE BLANCHE, PORT AUX BASQUES, AND PART OF THE CODROY MAP SHEETS, SOUTHWEST NEWFOUNDLAND

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Introduction

During the 1975 field season the Port aux Basques sheet (110/11), the Rose Blanche sheet (110/10), and the southeastern portion of the Codroy sheet (110/14), were mapped on a scale of 1:50,000. Part of the Port aux Basques and Rose Blanche sheets had previously been mapped on a scale of 1:20,000 (Brown, 1972, 1975). Phair (1949) mapped part of the southeastern portion of the Codroy sheet.

General Geology

A northeast-striking zone of mylonitisation, the Cape Ray Fault, divides the map-area into two totally contrasting geologic terranes. The area to the south of the fault consists of well banded paragneisses and migmatites of the Port aux Basques Gneiss. To the southeast these gneisses are reworked, i.e., further deformed and metamorphosed. Two possibly equivalent sequences of supracrustal rocks, the Harbour le Cou and Bay du Nord Groups, are infolded into the gneisses during this reworking. North of the fault the dominant rock type is a megacrystic granite, the Cape Ray Granite. This intrudes a tonalitic gneiss complex, the Long Range Gneiss. Mafic - ultramafic thrust sheets overlie the gneiss and granite.

The Cape Ray Fault is a zone of intense mylonitisation up to 1 km. wide. The mylonitisation affects both gneiss complexes. It is, in part, overlain by a sequence of acid volcanics and conglomerates, the Windsor Point Group. Further movements on the fault mildly deform this Group.

Port aux Basques Gneiss

The Port aux Basques Gneiss is a well-banded complex of leucocratic and melanocratic bands intruded by granitic phases. The banding, which occurs on all scales from 2 mm. to 50 m., strikes northeast and dips steeply to the southeast. The leucocratic bands show a variation in composition from a quartz-feldspar to a garnet-biotite rock. Garnet, staurolite, kyanite, and sillimanite are locally well developed within these bands. The melanocratic bands consist of hornblende (50% - 95%) and plagioclase.

The Port aux Basques Granite occurs as sheets within the gneiss complex. These sheets, which may be up to 100 m. in width, are conformable with the gneissic banding. The igneous texture has been extensively modified by deformation. On fold limbs the development of large potassium

LEGEND

CARBONIFEROUS:

11 ISLE AUX MORTS BROOK GRANITE: Undeformed, coarse-grained, equigranular granite.

10 SEARSTON BEDS: Red sandstone and conglomerate.

DEVONIAN OR EARLIER?

9 LA POILE BATHOLITH: Megacrystic, K feldspar-rich granite deformed with the Bay du Nord Group.

8 PETITES GRANITE: Coarse-grained, equigranular granite deformed with the Bay du Nord Group.

7 ROSE BLANCHE GRANITE: Leucocratic, garnetiferous granite deformed with the Harbour Le Cou and Bay du Nord Groups.

6 WINDSOR POINT GROUP: Metasedimentary and metavolcanic rocks overlying the Cape Ray Fault. Deformed by late movements on the Fault.

5 BAY DU NORD GROUP: Sequence of shales and sandstones. Equivalent to the Bay du Nord Group north of La Poile.

4 HARBOUR LE COU GROUP: Pelitic schists with interbedded psammites. High grade equivalents of the Bay du Nord Group.

ORDOVICIAN?

3 LONG RANGE MAFIC - ULTRAMAFIC COMPLEX: Banded and massive gabbro with subordinate anorthositic gabbro, feldspathic dunite and dunite. In thrust contact with the underlying gneiss and granite.

2a CAPE RAY GRANITE: Megacrystic to fine-grained, equigranular quartz monzonite.

PRECAMBRIAN

2 LONG RANGE GNEISS: Tonalitic gneiss with inclusions of earlier paragneiss and amphibolite gneiss.

1b PORT AUX BASQUES GRANITE: Coarse-grained, highly deformed granite. Intrudes the Port aux Basques gneiss.

1 PORT AUX BASQUES GNEISS: High grade, well-banded paragneiss, in part migmatitic (1a).

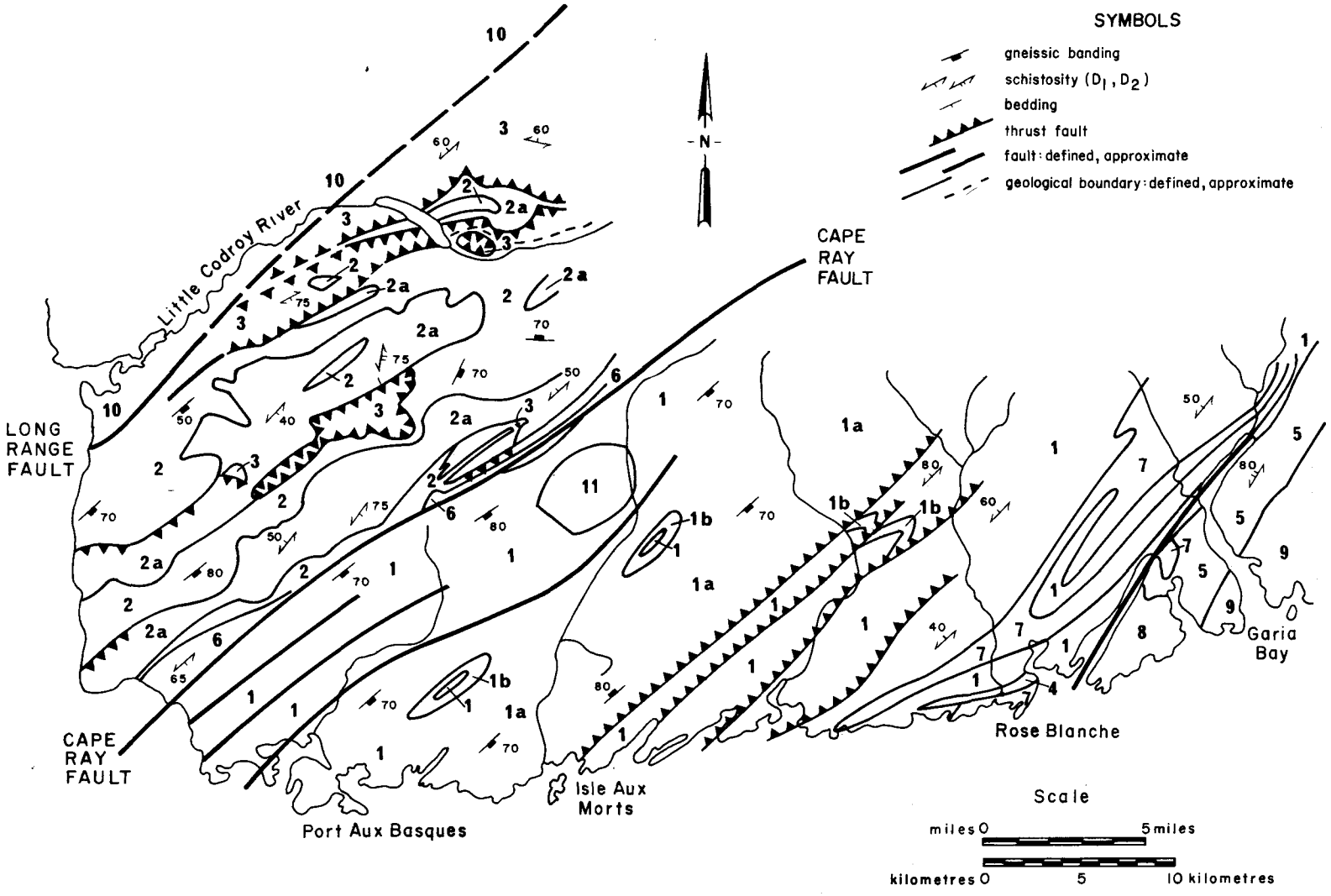

Fig. 1 - Geological map of the Port aux Basques area

feldspar porphyroblasts gives the rock an augen gneiss aspect. In fold cores the texture is fine-grained equigranular. Arfvedsonite occurs as an accessory mineral.

To the southeast and northeast of the main granite sheets the gneisses become migmatitic and the distinction between leucocratic gneiss and granite becomes exceedingly difficult. The margins of melanocratic bands commonly show signs of resorption. This is most pronounced where fragments of these bands are found 'floating' in granite. Leucocratic granite 'soaks' become abundant and may form part of the banding. Magnetite, which may constitute up to 10% of the rock, is commonly associated with these 'soaks'.

The gneisses have been deformed at least three times. The earliest deformation, D_1, is only locally preserved but, where observed, is defined by a composite schistosity. D_2, which is responsible, in part, for the formation of the gneissic banding, results in large scale recumbent folds which close to the northwest. D_3 isoclinally folds this banding. The axial planar fabric strikes northeast and dips steeply to the southeast. The Port aux Basques Granite was intruded in post D_1 - pre D_2 times and contains the D_2 and D_3 fabrics.

The main metamorphic event is temporally related to the D_2 deformation and spatially related to the Port aux Basques Granite. This results in a zonation of garnet, garnet-staurolite, garnet-staurolite-kyanite, garnet-kyanite, and garnet-sillimanite from the Cape Ray Fault towards the Port aux Basques Granite. Sillimanite is only locally developed within the migmatites. The metamorphic event related to D_3 results in partial recrystallisation of the D_2 minerals and the new growth of garnet and kyanite.

Southeast of the migmatites the gneisses pass gradationally into 'normal' Port aux Basques Gneiss. However, in this area they are progressively reworked, i.e., further deformed and metamorphosed. The reworking results in a recrystallisation of the gneiss and the growth of muscovite, biotite, garnet, and sillimanite. This new growth is on a much finer scale than originally present within the gneisses. There is thus a tendancy towards reduction in grain size. The recrystallisation and reduction in grain size is such that at Rose Blanche the reworked gneisses are lithologically indistinguishable from a sequence of semi-pelitic schists, the Harbour le Cou Group.

Long Range Gneiss

The Long Range Gneiss is mainly a tonalitic gneiss with amphibolite and paragneiss pods. It is a coarse-grained, poorly banded, but highly deformed rock, composed essentially of blue quartz, plagioclase and hornblende. The amphibolite pods vary from fine-grained to coarsely banded and all contain fabrics which are earlier than those developed in the tonalitic gneiss. Some of the fine-grained amphibolites contain

relic pyroxenes. Paragneisses are dominant in the northern part of the area. These are biotite-garnet gneisses with abundant glassy quartz. A composite biotite schistosity forms augen around garnets, which may be up to 5 mm. in diameter. Calc-silicate bands, which also contain garnets, are locally well developed.

Due to the lack of outcrop and the fact that the entire complex has been intensely retrogressed, a detailed structural and metamorphic history could not be determined. A sequence of events can, however, be outlined. Amphibolites appear to form the oldest part of the gneiss complex. These locally show a coarse gneissic banding. Relic pyroxenes may indicate that metamorphism was in the granulite facies during the early deformational events. The relationship between the paragneiss and the amphibolite gneiss is nowhere exposed. However, the presence of a well developed composite fabric and the occurrence of garnet indicates that they are possibly equivalent in age to the amphibolites, or at least have been subjected to the same deformational and metamorphic events. The paragneiss and amphibolite gneiss were subsequently intruded by tonalite and the entire complex further deformed and metamorphosed.

Cape Ray Granite

The Cape Ray Granite intrudes the Long Range Gneiss. The 'granite' varies in composition from granite to quartz monzonite and is generally leucocratic. Texturally it varies from megacrystic (potassium feldspar crystals up to 2 cm. in length) through coarse-grained equigranular to fine-grained equigranular. The majority of the body is a medium-grained, equigranular, mafic-poor quartz monzonite.

Long Range Mafic - Ultramafic Complex

The Long Range Mafic - Ultramafic Complex occurs in thrust sheets overlying the Long Range Gneiss and Cape Ray Granite. Nowhere is it observed south of the Cape Ray Fault. The contact relationships between the sheets and the surrounding gneiss and granite are poorly exposed but, where observed, are always thrusts or schuppen zones. The mafic - ultramafic rocks are nowhere observed to intrude the gneiss and granite.

A composite statigraphy of all the sheets is outlined below:

Fine grained massive gabbro
Massive gabbro
Banded gabbro
Anorthositic gabbro
Feldspathic dunite $\pm$ clinopyroxene $\pm$ orthopyroxene
Dunite + chromite $\pm$ clinopyroxene $\pm$ orthopyroxene

The dunite and feldspathic dunite are generally rather massive and have been extensively serpentinised. Where banded the layering is

defined by 1 cm. to 10 cm. wide clinopyroxene - ± orthopyroxene - rich bands. These do not show grading. Chromite generally occurs scattered throughout the rock in individual crystals, but pods up to 10 cm. in length are locally developed. Within the feldspathic dunite the feldspar crystals are usually dispersed throughout the rock. They do, however, also occur in lonzenge-shaped aggregates up to 1 cm. in diameter. Thin orthopyroxene (altered to bastite) and clinopyroxene veins are not uncommon. Asbestos - talc veins are rare and generally discontinuous. Thin veins of a fibrous carbonate were found at one locality.

The contact between the feldspathic dunite and the overlying anorthositic gabbro and banded gabbro is always, where observed, sheared. At the base of the gabbroic sequence anorthosite bands, from 1 cm. to 20 cm. in width, are dominant over clinopyroxene bands. Where graded bedding and slump textures are preserved the sequence always appears to be the right way up. The grading is defined by clinopyroxene-rich bases and plagioclase-rich tops. Towards the top of the sequence clinopyroxene dominates over plagioclase. The gabbro sequence is cross-cut by pegmatite dykes up to 50 cm. in width. They vary in composition from pyroxene - plagioclase through hornblende - plagioclase to biotite-plagioclase. These are cross-cut by gabbro dykes which in turn are cut by diabase dykes. The diabase dykes have chilled margins.

The transition from banded gabbro to massive gabbro appears to be gradational but is often marked by pods of pegmatitic pyroxene and plagioclase. The massive gabbro is coarse-grained at the base and becomes fine-grained upwards.

Harbour le Cou Group

The Harbour le Cou Group is a sequence of pelitic to semi-pelitic schists with interbedded psammites. The psammites are common in the western part of the section but rare in the east. Garnets are developed throughout the sequence. Sillimanite occurs close to tectonic slides. These slides define the contacts between the group and reworked Port aux Basques Gneiss.

Bay du Nord Group

The Bay du Nord Group consists essentially of slates and phyllites with interbedded psammites, grits and conglomerates. The slates and phyllites comprise the greater part of the sequence. The psammites are derived from very fine to fine sands and often show cross bedding and graded bedding. The coarse grits and conglomerates form a minor part of the succession.

Windsor Point Group

The Windsor Point Group consists of a sequence of ignimbrites, tuffs, conglomerates, shales and rhyolites which overlie the Cape Ray Fault, and are a result of re-activation of the fault. All sedimentary detritus is derived from the north side of the fault indicating that the re-activation resulted in uplift of the northern, i.e., Long Range, block. Further movements along the fault deformed these rocks.

Rose Blanche Granite

The Rose Blanche Granite is a medium-grained, equigranular, garnetiferous, leucocratic granite. Most of the body is a biotite $\pm$ hornblende granite. Garnets are very poorly developed in this early phase. The later phases are muscovite - garnet rich and biotite poor. The granite intrudes the gneisses and the Harbour le Cou Group prior to the reworking of the gneiss and infolding of the sediments. It thus provides a valuable marker horizon in the determination of the reworking deformation.

Petites Granite

The Petites Granite is a coarse-grained, equigranular, potassium feldspar-rich granite. It intrudes the Bay du Nord Group, reworked Port aux Basques Gneiss, and Rose Blanche Granite, syntectonically with respect to the reworking deformations. It is, however, little affected by these deformations. Andalusite and cordierite are developed in phyllites close to the contact.

La Poile Batholith

The La Poile Batholith is a megacrystic, potassium feldspar-rich granite which syntectonically intrudes the Bay du Nord Group. A biotite hornfels is locally developed in phyllites close to the contact. Xenoliths of pelitic to psammitic rocks are quite common. Locally these contain large potassium feldspar porphyroblasts.

Searston Beds

The Searston Beds consist of red sandstone and fanglomerate, in part overlying the Long Range fault. They are openly folded into a synform close to the Fault. They form part of the Carboniferous succession of the Codroy Valley (see Knight, this report).

Isle aux Morts Brook Granite

The Isle aux Morts Brook Granite is a coarse-grained, equigranular, potassium feldspar-rich granite. It post-tectonically intrudes the Port aux Basques Gneiss. It also post-dates the formation of, and the late movements on, the Cape Ray Fault.

Structure and Metamorphism

The internal structural and metamorphic history of the gneisses has been described above. This section describes the late regional deformational and metamorphic events. The Cape Ray Fault is a zone of intense mylonitisation up to 1 km. wide which affects both gneiss complexes. Minor zones of mylonitisation are found up to 4 km. across strike from the main fault zone. North of the fault the Long Range Gneiss, the Cape Ray Granite and the mafic - ultramafic sheets all contain at least one fabric related to the fault. The accompanying metamorphism is retrogressive.

South of the fault the Port aux Basques Gneiss is locally mylonitised but is not extensively retrogressed. However, in the extreme southeast of the area the gneiss is reworked, i.e., further deformed and metamorphosed. These deformations (three are recognized) overprint the gneissic fabrics and result in the development, from west to east, of shear zones, recumbent folds, and tectonic slides. During the earliest event, which is the most penetrative, the gneisses were reconstituted to a finely schistose rock so that no lithological boundary is apparent between the gneisses and a sequence of pelitic to semi-pelitic schists, the Harbour le Cou Group, infolded, by this event, into the gneisses. A structural and metamorphic convergence towards the basement-cover contact zone resulted in the parallel alignment of lithological boundaries, schistosities, and intrusive rocks within it, and an apparent gradational metamorphic contact across it. Tectonic slides define the contact.

No correlation is possible between the formation of the Cape Ray Fault, the reworking of the Port aux Basques Gneiss and infolding of the Harbour le Cou Group.

Economic Geology

The Port aux Basques and Long Range Gneisses are poor in sulphide minerals. However, zones of mylonitisation contain pyrite and minor chalcopyrite. The main Cape Ray Fault contains localised pyrite, chalcopyrite and galena. One occurrence of chalcopyrite, galena and pyrite was found within the Cape Ray Granite. The ultramafic rocks contain podded and disseminated chromite. No large or extensive bands were found. Asbestos is rare and occurs in thin discontinuous veins. Disseminated chalcopyrite and pyrite is found throughout the massive and fine-grained gabbro.

Within the Port aux Basques Gneiss the shear zones, related to the reworking of the gneiss, are always sulphide-stained. Only pyrite was found. Local zones of shearing are haematite-stained. The tectonic slide at Diamond Cove is in part defined by the Diamond Cove quartz vein. This quartz vein contains trace gold and silver with small amounts of sphalerite, chalcopyrite, malachite and azurite (Howse, C.K., 1934). An assessment of the silica potential of the vein was carried out by the Mineral Development Division in 1967 (Butler, 1967).

Quartz-filled fractures within the Petites Granite locally contain molybdenite rosettes.

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