LA POILE RIVER MAP AREA (11O/16), NEWFOUNDLAND

by Lesley Chorlton

INTRODUCTION

Geological mapping of the La Poile River map area on a 1:50,000 scale, begun in 1977, was completed during the 1978 field season. Most of the area was previously mapped on a 1:63,360 scale by Cooper (1954).

The area is located inland from the southwest coast of Newfoundland, and can be reached by boat along its southern margin via East and North Bays. Rapid access to most of the area can only be provided by helicopter.

GENERAL GEOLOGY

The La Poile River map area, with the La Poile map area (110/9) to the south, constitutes a section through the western end of the eastern crystalline belt of the Newfoundland Appalachians (Kennedy, 1976). The geology can be briefly described as a terrain of polydeformed and metamorphosed schists and gneisses intruded by several generations of granitoid rocks.

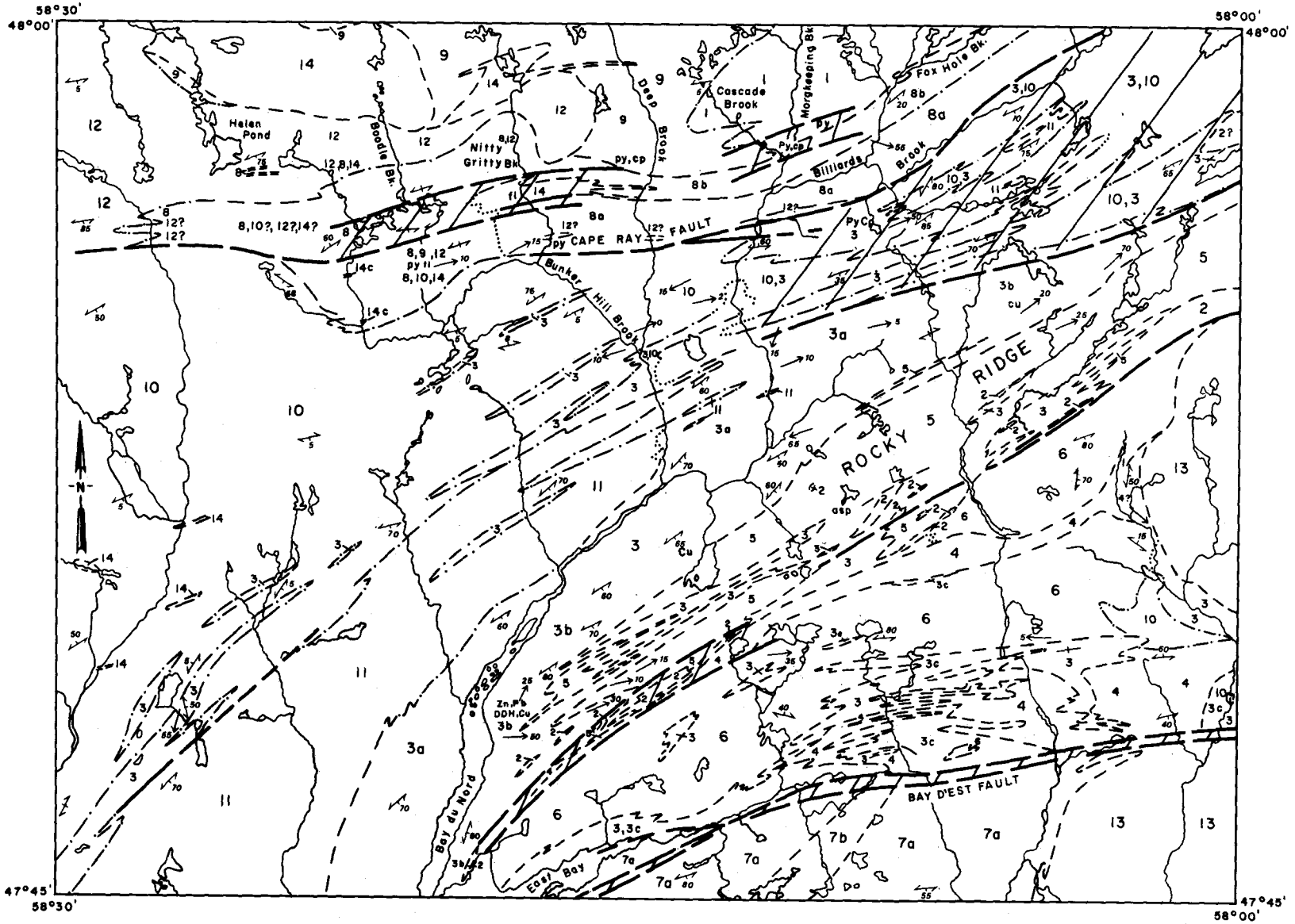
The Keepings Gneiss (1) is composed mainly of felsic paragneiss, and is exposed along Morg Keeping's Brook. The Bay du Nord Group (3) consists of metasedimentary and metavolcanic rocks exposed in a broad, east-northeast trending belt across the central part of the map area. The Dolman formation (6), a distinctive felsic metavolcanic unit, occupies a narrower belt extending northeastward from Dolman Cove. The Georges Brook Formation (7a), which consists of felsic and mafic volcanic and associated sedimentary rocks, and the Hawk's Nest Pond Porphyry (7b), a porphyritic microgranite, both belong to the La Poile Group, and are exposed in the southeast corner of the area. The Billiards Brook complex (8), comprising a volcanic and sedimentary unit (8a) and a mafic intrusive unit (8b), is situated along the east-trending Cape Ray Fault zone, across the northern part of the map area.

The unnamed gabbros (2), the Baggs Hill Granite (5), and unnamed mafic dikes (not shown) are pretectonic intrusions. The granite and mafic dikes, at least, were emplaced within the depositional cycle of the Bay du Nord Group. The Northern Granite (9), the Rose Blanche Granite (10), and the La Poile Batholith (11) were emplaced before the cessation of the main regional deformation, whereas the Helen Pond granite (12), the Chetwynd complex (13), and several late pink granite bodies (14) were emplaced largely posttectonically.

Field relations indicate that the La Poile Group and the Dolman formation may be stratigraphic equivalents, slightly younger than most of the Bay du Nord Group in the map area; also, the Billiards Brook complex may be correlative with the Windsor Point Group, a younger cover sequence defined in the Rose Blanche and Port aux Basques areas (Brown, 1975). The Keepings Gneiss, which was considered Precambrian, but possibly younger, by Cooper (1954), is exposed on the north side of the extension of the Cape Ray Fault. Rafts of metasedimentary rocks in the Rose Blanche granite are lithologically similar to the presumed Precambrian reworked Port aux Basques gneiss (Brown, 1976, 1977), but at present no field criteria have been found for distinguishing the reworked gneiss from the Bay du Nord Group.

Keepings gneiss (1)

The Keepings Gneiss (Cooper,1954; Chorlton, 1978b) includes both massive and banded felsic amphibolite facies schists with intermediate to mafic lenses. Although the unit is commonly migmatitic, sedimentary structures are preserved locally, indicating a partially



LA POILE RIVER

METRES 0 2000 4000 METRES

LEGEND

CARBONIFEROUS

14 — *Equigranular, pink granite.*

13 — **Chetwynd complex:** *Anorthositic gabbro; quartz diorite; porphyritic granodiorite; equigranular, pink, biotite granite; rapikivi granite; rhyolite dikes.*

DEVONIAN

12 — **La Poile Batholith:** *Megacrystic granite; porphyritic granodiorite; pegmatite; aplite.*

11 — **Helen Pond granite:** *Porphyritic granite, granodiorite, monzodiorite.*

10 — **Rose Blanche Granite:** *Equigranular, garnetiferous, biotite-muscovite granite, granodiorite.*

9 — **Northern Granite:** *Medium to fine grained granodiorite.*

8 — **Billiards Brook complex (Windsor Point Group): 8a,** *Mafic flows, mafic and felsic pyroclastics, mudstone, siltstone, sandstone, and conglomerate with minor limestone;* **8b,** *diabase, gabbro, and diorite.*

DEVONIAN OR OLDER

7 — **La Poile Group: 7a,** Georges Brook Formation: *Rhyolite, rhyolite tuff;* **7b,** Hawk's Nest Pond Porphyry: *porphyritic microgranite.*

6 — **Dolman formation (La Poile Group?):** *Rhyolite tuff, rhyolite porphyry.*

5 — **Baggs Hill Granite:** *Equigranular granite, quartz porphyry, granophyre.*

4 — *Pink rhyolite, rhyolite injection.*

3 — **Bay du Nord Group: 3a,** *Metasedimentary schist, graywacke, siltstone, shale, tuff; injected gneiss;* **3b,** *rhyolite, rhyolite tuff, agglomerate;* **3c,** *conglomerate rich sedimentary rocks;* **3d,** *amphibolite.*

2 — *Gabbro.*

PRECAMBRIAN OR YOUNGER (?)

1 — **Keepings Gneiss:** *Predominantly felsic paraschist and gneiss.*

clastic origin (Chorlton, 1978b). The gneissic banding was folded at least once before being refolded and sheared as a result of movements on the Cape Ray Fault. The Keepings Gneiss is intruded posttectonically by the Northern Granite and the Billiards Brook diabase in the south.

Gabbro (2)

Several dissected bodies of gabbro are exposed in a wide northeast trending belt across the east-central part of the area. They are mafic to ultramafic in composition, and almost completely altered to assemblages of green hornblende and plagioclase, with accessory apatite, opaques, garnet, and tourmaline. Some exposures show prominent mineral lineations, parallel to linear elements in the surrounding rocks.

Many large rafts of gabbro are included in the Baggs Hill granite, which cuts the Bay du Nord Group, whereas the observed contacts with the Bay du Nord Group metasedimentary schists are tectonic. clasts were observed in the Bay du Nord conglomerates.

The gabbros were originally thought to postdate the Baggs Hill Granite (Chorlton, 1978a, 1978b), when they were assumed to be coeval with similarly metamorphosed mafic dikes that cut the Baggs Hill Granite.

Bay du Nord Group (3)

The Bay du Nord Group (Cooper, 1954) is an assemblage of polyphase deformed and metamorphosed sedimentary and volcanic rocks which underlies much of the central and eastern parts of the map area. The volcanic rocks are largely felsic, and consist of bands of rhyolite, lapilli. tuff, and agglomerate (2b) intercalated with tuffaceous graywacke and minor siltstone. In areas devoid of volcanic rocks, the sedimentary rocks consist of sandstone, siltstone, and shale, with minor pebbly lenses and amphibolite bands. The latter may represent either thin dikes or mafic tuff layers. Mafic dikes crosscut the Bay du Nord schists and Baggs Hill Granite. More extensive areas of garnet and clinopyroxene bearing amphibolite (2d) are exposed in the northeast corner of the area. A continuous band of graphitic shale and siltstone extends between the mouth of Bay du Nord and the southeast tip of Mouse Pond. Lenses of polymictic conglomerate (2c) are abundant in the sedimentary rocks in the southeast. These contain clasts of Bay du Nord rhyolite, siltstone, Baggs Hill granophyre and porphyry, and pink rhyolite, but none derived from the neighboring Dolman formation. Hence, the conglomerates are assigned to the upper part of the Bay du Nord series, below the Dolman formation.

The Bay du Nord Group has been affected by three phases of folding, with additional shearing and faulting. The schists possess one to three tectonic fabrics. The first two consist of well developed micaceous schistosities, the earlier of which commonly parallels bedding. The third is a locally developed crenulation cleavage. Maximum metamorphic grade (upper greenschist to middle amphibolite facies) occurred between the first and second deformations; staurolite, garnet, hornblende, actinolite, biotite, and kyanite porpyroblasts overprint the first schistosity, but are deformed by the second or third fabrics. Retrogression caused by the second deformation is locally pronounced; all but minor remnants of the amphibolite facies assemblages are altered to greenschist facies minerals in the Bay du Nord area.

In the Gunflap Hills-Otter Pond area the above rock types contain profuse granitic injections. They could represent an older migmatite terrain. However, there is no sharp contrast in metamorphic grade or deformation history; therefore, they are tentatively included in the Bay du Nord Group.

Pink rhyolite (4)

A distinctive equigranular pink rhyolite, first described by Cooper (1954), is exposed around the contact between the Dolman formation and Bay du Nord Group, and is deformed and metamorphosed with these units. Although persistent, it is uncertain whether it was emplaced concordantly or discordantly. Fragments of this rock occur locally in the Bay du Nord conglomerate near the contact with the Dolman formation.

Baggs Hill Granite (5)

Several elongate bodies of subvolcanic granite, named the Baggs Hill Granite by Cooper (1954), were incorrectly referred to in a previous report as the Rocky Ridge granite (Chorlton, 1978b). This granite (*sensu stricto*) grades in texture from a medium grained equigranular phase in the centre of the thickest body to granophyric, porphyritic, and aphanitic phases near the margins and in apophyses. Severely sheared, originally medium grained, granite is difficult to distinguish from primary aphanitic granite or rhyolite. The Baggs Hill granite generally intrudes the Bay du Nord Group with which it is deformed and metamorphosed. However, the presence of Baggs Hill porphyritic granite and granophyre cobbles in conglomerate lenses in the upper part of the Bay du Nord Group indicates that the granite was emplaced and unroofed during the deposition of the Bay du Nord Group.

Dolman formation (6)

The Dolman formation (Chorlton, 1978b) consists of deformed and metamorphosed felsic volcanic and subvolcanic rocks, mostly crystal-lithic tuff with a few lenses of pebbly, black siltstone and rhyolite agglomerate. Intrusive quartz-feldspar porphyry was recognized in the centre of the highland plateau north of East Bay.

Volcanic rocks with primary textures are transformed eastward into massive light gray intermediate to felsic schists in which mafic clots have been recrystallized to black micaceous streaks, and large feldspar grains to elongate polycrystalline feldspar aggregates. The unit is deformed and metamorphosed to the same degree as the Bay du Nord Group.

Tightly folded siltstone and conglomerate inliers of the Bay du Nord Group are exposed within the boundaries of this unit. However, the lack of Dolman formation clasts in the Bay du Nord conglomerate suggest that the Dolman formation is the younger of the two units.

La Poile Group (7)

This group, as redefined by Chorlton (in press), comprises a thick sequence of partly subaerial felsic and mafic volcanic and sedimentary rocks, the Georges Brook Formation (7a), and two subvolcanic felsic intrusions, the Hawk's Nest Pond Porphyry (7b) and the Roti Granite. The Roti Granite is not exposed in the present map area. Massive felsic to intermediate crystal-lithic tuff is the most abundant rock type in the south-central part of the area, whereas welded tuff, flow banded rhyolite, and epiclastic rocks are more common to the southeast. The Hawk's Nest Pond Porphyry, a quartz-feldspar porphyry, cuts the pyroclastic rocks south of East Bay Brook.

The La Poile Group, deformed and metamorphosed under middle greenschist facies conditions south of the Bay d'Est Fault, is thought to be equivalent in its upper part to the higher grade Dolman formation exposed north of the fault (Chorlton, in press).

Billiards Brook complex (8)

The Billiards Brook complex (Chorlton, 1978b) is exposed in an east trending belt which coincides with the trace of the Cape Ray Fault zone. This unit can be divided into two major components, one composed of largely extrusive volcanic and sedimentary rocks (8a), the other of intrusive diabase and gabbro (8b).

The volcanic rocks of the first unit consist of mafic flows, and mafic and felsic pyroclastic and epiclastic rocks. The mafic flows are locally vesicular, with interflow breccia, conglomerate, and slate interbeds. Laminated chlorite-carbonate schists may represent waterlain mafic tuffs. Felsic members include large volumes of felsic grit and sheared quartz porphyry or phenoclastic tuff, intercalated with siltstone, coarse sandstone, conglomerate, and carbonaceous shale. The conglomerates contain fragments of rhyolite, quartz-phyric granite, shale, siltstone, and basalt or diabase. A sheared quartz-phyric granite (11?), exposed along the length of the belt, may be related to these rocks, and thus provide a source for some of the granite clasts. A band of quartzose graywacke, grit, conglomerate, and black shale, underlying mafic flows in Billiards Brook, contains traces of Lower Devonian plant fragments (Dorf and Cooper, 1946).

The intrusive rocks display a continuous range in texture from very fine grained diabase and medium grained gabbro to very coarse grained pyroxenite, peridotite, and pegmatitic diorite. Many textural varieties may occur in one outcrop because of both internal variation and the inclusion of finer and/or coarser grained cognate xenoliths. Angular blocks of very coarse gabbro, fine diabase, and deformed granitic country rock are found in a basaltic intrusion breccia which passes laterally into crudely bedded agglomerate. Only fine grained clasts of mafic igneous rock are found in conglomerates further away from the breccia.

Rocks of the Billiards Brook complex possess a strong penetrative schistosity probably related to movement on the Cape Ray Fault. Greenschist facies metamorphism either accompanied or postdated the earliest deformation. This fabric is commonly crosscut at small angles by late fracture cleavages, and refolded locally by steeply plunging folds with concordant axial planes. The strong schistosity was later refolded in chevron and box folds about irregular, generally north striking, axial planes. The latter structures are concordant with the third generation folds in the Bay du Nord Group.

The contact between the Billiards Brook extrusive rocks and the Bay du Nord schists is a mylonite zone exposed in Billiards Brook. Billiards Brook diabase dikes posttectonically cut the Rose Blanche Granite in Boodle Brook, and the Keepings gneiss and Northern granite around Fox Hole and Cascade Brooks. As the Rose Blanche Granite intrudes the Bay du Nord Group synkinematically (see below), the Billiards Brook complex must be younger than the Bay du Nord Group.

Some members of the Billiards Brook complex are lithologically similar to rocks of the Windsor Point Group, described by Brown (1976, 1977). Moreover, both are volcanic and sedimentary sequences deposited along the Cape Ray Fault zone after its initiation. Hence, the Billiards Brook complex is tentatively correlated with the Windsor Point Group.

INTRUSIVE ROCKS

Northern granite (9)

The Northern granite (Cooper, 1954) consists of medium grained equigranular granodiorite to quartz monzonite which intrudes the Keepings gneiss on the north side of the Cape Ray Fault lineament. Biotite and hornblende are the dominant mafic minerals. Injections of Northern granite appear to crosscut early fabrics in the Keepings gneiss, but the relationship is obscured to some extent by injections of younger unfoliated leucogranite in the same outcrops.

Rose Blanche Granite (10)

The Rose Blanche Granite was first described in the Rose Blanche map area (110/10) by Brown (1975, 1976). This granite, although highly variable in composition, consists of two main phases; namely, an equigranular, garnet bearing, biotite-muscovite granite and an equigranular biotite hornblende granodiorite. Late stringers of coarse grained equigranular granite and pegmatite are muscovite rich and locally contain tourmaline.

This granite pervades the Bay du Nord schists, forming injection migmatites from already deformed amphibolite facies semipelitic and mafic schists in the central part of the map area. The injections and the early schistosity are folded around gently plunging F_2 folds in this zone. The prominent foliation of the granite is axial planar to these folds.

The Rose Blanche Granite is cut by Billiards Brook diabase, the Helen Pond granite, and an equigranular pink granite in Boodle Brook. In Nitty Gritty, Bunker Hill, and Garia Brooks, deformed mafic rocks, probably of the Bay du Nord Group, occur as screens in the granite.

La Poile Batholith (11)

The La Poile Batholith (Cooper, 1954; Brown, 1976; Chorlton, in press) is an elongate northeast trending intrusion exposed in the western half of the map area. The widest part of the batholith, exposed to the south in the La Poile map area (11O/9), consists of coarse grained biotite-hornblende quartz monzonite with plagioclase and orthoclase microperthite phenocrysts, whereas its elongate extension in the present area consists of biotite granite with large microcline megacrysts and fewer small plagioclase phenocrysts. Aplite and pegmatite associated with this granite usually contain garnet, apatite, and tourmaline.

The granite is foliated at its margins, but the concordant alignment of megacrysts in the core of the batholith may have resulted from its emplacement. Injections of the granite and associated pegmatite in the Bay du Nord Group form boudins in the second foliation planes of the schists. Patches of Rose Blanche Granite are included by the La Poile Batholith on Northwest and Salmon Hole Brooks.

Helen Pond granite (12)

This is an informally named and newly defined unit, exposed as a large batholith surrounding Helen Pond in the northwest corner of the map area. Extreme variations in composition and texture make it hard to correlate outcrops in poorly exposed areas. Around the southern and eastern margins, it consists of medium to coarse grained, weakly foliated, biotite granite with sparsely to moderately abundant feldspar porphyroblasts. A continuous transition into quartz-phyric granite was observed in Garia Brook. In the northwest, it consists of quartz monzodiorite.

The Helen Pond granite has been mildly affected by deformation on the Cape Ray Fault, and biotite in the matrix is partly chloritized near the fault zone.

A porphyroblastic medium grained phase of this granite intrudes the Billiards Brook diabase and gabbro on Garia, Boodle, and Nitty Gritty Brooks. A quartz-phyric phase intrudes the Billiards Brook volcanic rocks between Nitty Gritty and Billiards Brooks.

The Chetwynd complex (13)

The Chetwynd complex (Chorlton, 1978b, in press) is a suite of plutonic rocks underlying the southeast corner of the map area. Porphyritic diorite, monzonite, granodiorite and equigranular biotite granite are the main phases found in this area, but the complex has not been studied further east where it is more extensively exposed.

These rocks intruded the Bay du Nord and La Poile Groups, and deformed granitoid intrusions exposed in the La Poile area, after the second phase of regional deformation. D_2 fabrics in the Bay du Nord and Dolman schists wrap around the margins of the complex in the north. To the south, the granite truncates strong planar fabrics of the older intrusive rocks and schists; xenoliths of highly deformed semipelitic schist, granite and/or granodiorite are found in most large outcrops. The Chetwynd complex was affected by the latest movement on the Bay d'Est Fault.

Equigranular pink granite (14)

Equigranular pink granite represents the latest magmatic activity in the map area. One large body,

north of Helen Pond, consists of a medium grained equigranular intergrowth of perthitic alkali feldspar, quartz, plagioclase, and biotite. It is unaltered and unfoliated. Another smaller body of alkali granite, exposed on Nitty Gritty Brook, consists of microperthite and quartz phenocrysts set in a granophyric matrix. Fractures in this granite, some of which extend into the host gabbro, are filled with fluorite, calcite, barite, and quartz. Some fractures are accompanied by yellowish alteration zones. Several other small bodies and dikes, which cut the Billiards Brook intrusive rocks and the Rose Blanche Granite, are accompanied by extensive zones of reddish alteration and potash feldspathization in their hosts. Rare fracture fillings of gypsum are found in these intrusions in Garia Brook.

REGIONAL STRUCTURE AND METAMORPHISM

Units 2 through 7 have been affected by three major phases of folding, accompanied by the development of shear zones and faults. Unit 8 was affected by the third phase, which postdated intense deformation on the Cape Ray Fault. Zones of structural weakness, once formed, tended to remain active during the subsequent tectonic history.

The first phase of folding produced tight, southeast facing, reclined folds with northeast striking axial planes, accompanied by slides (shear zones associated with folding) which are especially well developed south of Rocky Ridge and in the Big Otter-Lundregens Pond area. The second phase involved the refolding, shearing, and transposition of earlier fabrics. Early fold hinges that have been refolded were observed in outcrops on the tributaries to Round Hill Brook and on Northwest Brook. Northeast to southwest gently plunging folds of the early schistosity are prominent in the Gunflap Hills-La Poile River area, along Mitchells Brook, and east of Baggs Hill. Some of the second generation slides developed into small scale east-northeast striking faults with near vertical dip surfaces. Reactivation of an early slide along the rhyolite-slate horizon between the mouth of Bay du Nord and Mouse Pond may have taken place late in, or after, the second event. The third phase of folding, which produced chevron and box or kink drag folds, was responsible for the open warping of geological contacts and structural grain, and for small north-south fault displacements.

Metamorphism accompanying the first phase of folding resulted in a micaceous fabric which is subparallel to bedding in most cases. The peak of metamorphism was of upper greenschist to middle amphibolite facies in units 2 through 6, and occurred between the first and second deformations, resulting in the growth of porphyroblasts which crosscut the early schistosity. Staurolite, kyanite, biotite, and garnet, commonly with straight inclusion trails, are particularly well developed in pelitic and semipelitic schists north of Cross Gulch. Porphyroblastic green hornblende is found in some tuffaceous rocks. Hornblende-plagioclase-garnet and hornblende-plagioclase-clinopyroxene amphibolites and sillimanite-bearing felsic schists are found in the northeastern part of the area. In early shear zones such as those near Otter Pond and Mitchells Brook, metamorphic grains are particularly coarse. The second deformation produced a penetrative composite schistosity that forms augen around the post-D_1 porphyroblasts. The second fabric is associated with retrogressive metamorphism such that chlorite-biotite and sericite replace early fabric forming minerals, and almandine and staurolite are almost completely replaced by chlorite and white mica, respectively, in the semipelitic schists of the Bay du Nord area. Minor retrogression is associated with the formation of the crenulation cleavage developed during the final phase of folding.

The Billiards Brook complex (unit 8) was metamorphosed to greenschist facies, probably during and after its deformation in the Cape Ray Fault zone. Where the rocks are not penetratively deformed, the recrystallization is not complete. Pre-D_2 greenschist facies metamorphism in the La Poile Group (Unit 7) is complete, and was locally retrogressed during late shearing (Chorlton, in press).

The Keepings Gneiss (unit 1) was metamorphosed to amphibolite grade prior to the retrogressive effects of shearing and folding close to the Cape Ray Fault. Much metamorphic differentiation along early foliation planes, particularly in the banded felsic gneiss, may be related to special conditions existing during the early structural and metamorphic history.

Faults

Two major faults occur in the area. The extension of the Cape Ray Fault, defined by Brown (1973) in the Port aux Basques area, is expressed topographically as a prominent linear depression, and structurally as a wide shear zone which appears to have been active since the onset of regional deformation. D_2 fabrics in the Bay du Nord Group schists and Rose Blanche Granite are drag folded in this zone, and the early Devonian Billiards Brook complex, which was emplaced within the fault zone, is itself deformed by the fault. The Bay d'Est Fault (Cooper, 1954) brings the greenschist facies La Poile Group against the amphibolite facies Bay du Nord Group. It cuts across the relatively young Chetwynd complex (unit 13).

MINERALIZATION

Metallic mineral occurrences are known in the La Poile Group, the Bay du Nord Group and related Baggs Hill granite, the Billiards Brook complex, and the Keeping gneiss. Of these, Pb-Zn-Ag and Cu showings on the Strickland property in the Bay du Nord Group, and Cu-Au mineralization at the Chetwynd Mine in the La Poile Group are the best known. For descriptions of the latter, the reader is referred to Howley (1917), Snelgrove and Howse (1934), and Cooper (1940a, 1954). Other showings in the La Poile Group have been noted (Chorlton, in press), but none were found in the map area.

The main showings on the Strickland property (Cooper, 1940a, 1940b, 1954) are hosted in sheared and altered Bay du Nord felsic volcanic rocks (Chorlton, 1978b). These showings can be divided into two main types; a Pb-Zn-Ag zone mineralized with a sphalerite-galena admixture with local pyrite-pyrrhotite and a Cu zone mineralized with chalcopyrite-pyrite-pyrrhotite and tetrahedrite. Summaries of assessment work on these occurrences is filed at the Newfoundland Department of Mines and Energy.

The sheared felsic volcanic horizon can be followed northeast and southwest along strike. Minor Pb-Zn mineralization was found in Carrot Brook, and Cu mineralization was found south of Carrot Brook and north of Big Pond in the same horizon (Cooper, 1940b, 1954). A small amount of pyrite and chalcopyrite was noted in 1978 in the same felsic volcanic horizon south of Mouse Pond. There are also many rusty weathering outcrops of refolded injected Bay du Nord schists, some of which may be equivalents of the pyroclastic rocks in the Bay du Nord area. Pyrite and chalcopyrite occur in quartz veins near the fault contact with the Billiards Brook complex.

The Baggs Hill Granite hosts minor disseminated arsenopyrite, especially in granophyric and/or variolitic phases, and in fractured outcrops.

Disseminated pyrite is common in sheared and fractured Billiards Brook gabbro and diabase. Such occurrences are found, for example, in Nitty Gritty Brook, Boodle Brook, and an east flowing tributary of Deep Brook. Veins containing chalcopyrite and magnetite have been reported in the gabbro on Fox Hole Brook. In Morg Keepings Brook, an outcrop of mafic rock consisting of bronze amphibole, biotite, pyrite, and quartz is heavily mineralized with pyrite and chalcopyrite. The latter is thought to belong to the Billiards Brook complex, although sheared and tightly infolded with the Keepings Gneiss. About 1 km from the mouth of Nitty Gritty Brook, felsic pyroclastic and sedimentary rocks of the Billiards Brook complex contain abundant disseminated pyrite, particularly several 10-30 cm thick beds of white weathering quartz-white mica- carbonate rock.

Quartz veins containing copper minerals occur in a late alkali granite (14) near its contact with Billiards Brook felsic volcanics in Nitty Gritty Brook. This granite also contains numerous fluorite filled fractures and zones of yellowish alteration.

Rusty weathering outcrops of highly altered silicic Keepings gneiss are found in a small tributary east of Morg Keepings Brook.

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