ECONOMIC GEOLOGY OF THE WESTERN HERMITAGE FLEXURE, NEWFOUNDLAND

by

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INTRODUCTION

Investigation of mineral occurrences of the Hermitage Flexure and their regional geologic setting was continued during the 1980 field season. This is the second year of a project designed to classify the various mineral deposits of the area, evaluate their economic significance in terms of the regional geology, and provide a model of metallogeny throughout the Flexure that will prove useful in the search for economic mineral deposits.

A limited amount of work was carried out during 1980 in the Bay d'Espoir area to supplement work completed during 1979 (Swinden, 1980). Most of the season, however, was spent in the western Hermitage Flexure area between La Poile Bay and Grandys Brook (Figure 1). Of primary interest in this area were the Bay du Nord and La Poile Groups (Cooper, 1954; Chorlton, 1978, 1979a), volcano-sedimentary sequences of probable Lower-Middle Ordovician age which are host to a number of previously reported mineral occurrences (Cooper, 1954; Douglas and Hsu, 1976). In addition, investigations were carried out on the Keepings Gneiss and the Northern Granite near Prospectors Pond and the headwaters of Morg Keepings Brook, where pyritic sulfide occurrences have been previously reported.

Regional mapping in the area was first carried out by Cooper (1954), who mapped the area between La Poile Bay on the west and Couteau Bay on the east at a scale of one inch to one mile. Much of the stratigraphic nomenclature presently in use dates from his work; he also provided the first comprehensive descriptions of the mineral occurrences in the area. 1:250,000 mapping of the southwest coast was carried out in the Burgeo-Ramea area (11P) by Riley (1959) and in the Port aux Basques area (110) by Gillis (1972) for the Geological Survey of Canada. 1:50,000 mapping of the southwest coast was started by the Mineral Development Division in 1977 and to date has been completed in the La Poile (110/16), La Poile River (110/9) and Peter Snout, west half (11P/13) map areas (Chorlton, 1978, 1979b, 1980, in press), where most of the present work was carried out.

The 1980 field work in the western Hermitage Flexure was equally divided between the La Poile Group, where work was concentrated in the area of Cinq Cerf Brook and west of Grandys Brook, and the Bay du Nord Group northeast of La Poile Bay. A brief period at the end of the season was spent in the Keepings Gneiss and the Northern Granite north of the Cape Ray Fault.

GENERAL GEOLOGY

The oldest rocks in the area appear to be sheared, foliated units of metagabbro, layered metagabbro, metapyroxenite and related volcanic rocks of Ordovician or older age, which occur as disrupted lenses in the Bay du Nord and La Poile Groups (Chorlton, 1978, 1980).

The oldest stratified successions in the western Hermitage Flexure consist of Ordovician volcanic, subvolcanic and sedimentary rocks (and their metamorphosed equivalents) assigned to the La Poile and Bay du Nord Groups. Both sequences have been traced from the area of La Poile Bay north and east to Grandys Brook, and regional geologic compilations by Smyth (1979, 1980)

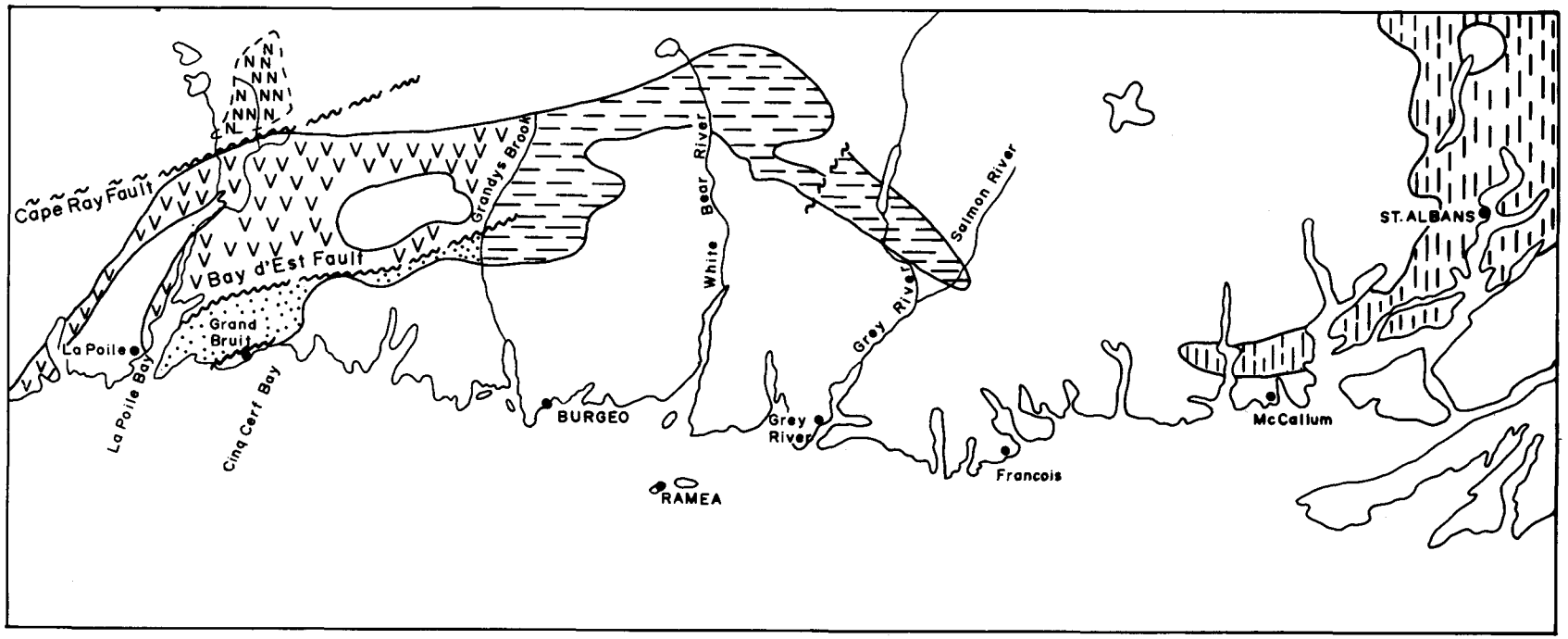
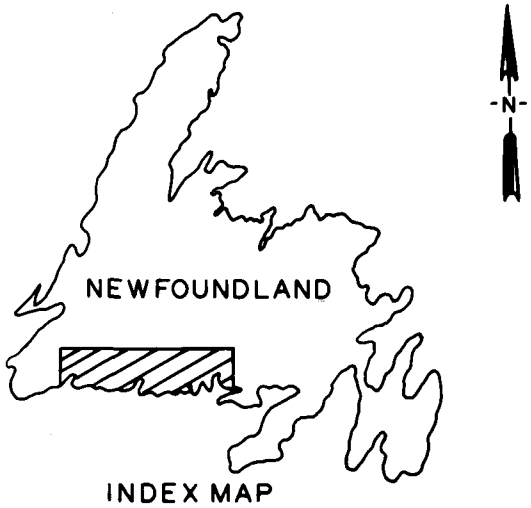


FIGURE I. Location of Ordovician Volcano-Sedimentary sequences in the Hermitage Flexure

- Bay du Nord Group
- La Poile Group
- Undivided
- Baie d'Espoir Group
- Keepings Gneiss

km 0 25 50 km



suggest that they may continue along strike to the area east of Grey River. The two sequences are considered to be contemporaneous (Chorlton, 1979, in press).

The La Poile Group, as redefined by Chorlton (1978), comprises a thick sequence of volcanic and sedimentary rocks bounded to the north by the Bay d'Est Fault and to the south by granitoid rocks along both faulted and intrusive contacts. The La Poile Group has been subdivided into two units: the Georges Brook Formation (which includes all the stratified rocks of the La Poile Group) and the Roti Granite. The stratigraphically lower parts of the Georges Brook Formation consist of both mafic and felsic volcanic rocks interbedded with lesser clastic sedimentary (probably epiclastic) rocks. These pass upwards (*i.e.* to the north and northwest) into a thick pile of dominantly subaerial felsic volcanic rocks consisting of rhyolitic flows, ash flows, crystal-lithic tuff, volcanic breccia and minor epiclastic rocks. These rocks have been polydeformed and regionally metamorphosed to a peak grade in the greenschist facies. No fossils have been discovered in the Georges Brook Formation, but mafic and felsic volcanic rocks have yielded a Rb/Sr whole rock age of 459 $\pm$ 18 Ma (Wanless, personal communication, quoted in Chorlton, 1980). The Georges Brook Formation is intruded by the Hawks Nest Pond Porphyry, which has yielded a U/Pb age of 410 $\pm$ 20 Ma (Anon, 1980).

The Roti Granite (Cooper, 1954) occupies the basal part of the La Poile Group in the La Poile and parts of the Peter Snout map areas. It is dominantly a medium grained granodiorite but locally displays both porphyritic and leucogranitic phases. The Roti Granite occurs as fine grained dikes within the lower part of the Georges Brook Formation, clearly intrudes the volcanic rocks along their mutual contact, and also appears as boulders in conglomerates higher up in the La Poile Group. It is deformed and metamorphosed with the volcano-sedimentary rocks of the La Poile Group and is interpreted as being subvolcanic to them (Chorlton, 1978, 1980).

The Bay du Nord Group consists of a succession of metasedimentary, metavolcanic, and subvolcanic rocks bounded to the south by the Bay d'Est Fault and to the north by the Cape Ray Fault and various syntectonic granitoid rocks. Volcanic rocks within the Bay du Nord Group are mainly felsic in composition, consisting of rhyolite, felsic tuff and lapilli tuff and occasional volcanic breccia. Clastic sedimentary rocks ranging from siltstone and shale to graywacke and conglomerate are commonly interbedded with the volcanics and, in many areas, comprise most of the succession.

Two stratified rock units have been informally included in the Bay du Nord Group: the Piglet Brook Rhyolite and the Dolman Formation. The Piglet Brook Rhyolite (Chorlton, 1980, in press) consists of pink to cream-colored, massive rhyolite which can be traced from south of Big Pond to the Blue Hills of Couteau. The Dolman Formation (Chorlton, 1978, 1980, in press) comprises mainly felsic crystal tuff and crystal-lithic tuff with lesser interbedded clastic sedimentary rocks. The Dolman Formation is thought to be the uppermost exposed unit of the Bay du Nord Group as it does not appear as clasts in conglomerates which are widespread throughout the other parts of the succession (Chorlton, in press).

The Baggs Hill Granite (Chorlton, 1979a, 1980, in press) is a name given to several subvolcanic intrusive bodies which are included in the Bay du Nord Group (Chorlton, 1979). It ranges from medium grained granite to granophyre and quartz-feldspar porphyry; although it intrudes the Bay du Nord Group, it is also present as clasts in intraformational conglomerates and, hence, is interpreted to be subvolcanic in origin (Chorlton, 1979, in press).

The Bay du Nord Group has been polydeformed and has attained a peak regional metamorphic grade of upper greenschist to middle amphibolite facies (Chorlton, 1979a). It has yielded no fossils to date, but volcanic rocks of the Dolman Formation have been dated by U/Pb in zircons as 449 + 20 Ma (Anon, 1980), suggesting contemporaneity with the La Poile Group.

The youngest stratified rocks in the area are mafic and felsic volcanic rocks, clastic sedimentary rocks and mafic to ultramafic intrusive rocks of the informally named Billiards Brook complex (Chorlton, 1979a). These occur only within the trace of the Cape Ray Fault zone and have been strongly deformed by late movements on the fault. Plant fossils in clastic sedimentary rocks of the Billiards Brook complex suggest a Lower Devonian age (Chorlton, 1979a; Dorf and Cooper, 1946).

A wide variety of syn- and posttectonic granitoid rocks are found in the western Hermitage Flexure area ranging in composition from gabbro to granodiorite and granite (Chorlton, 1978, 1980, in press). Variably deformed granitoid rocks include coarse grained porphyritic biotite granite, equigranular leucogranite, and granodiorite, probably Devonian or older, as well as crosscutting monzonite to quartz diorite and granite which are considered to be Devonian or younger in age.

MINERALIZATION IN THE LA POILE GROUP

Two principal areas of mineralization have been recognized in the La Poile Group; the first in the vicinity of Cinq Cerf Brook and the second in the area west of Grandys Brook. These are treated separately below.

Mineralization in the Cinq Cerf Brook area has been known since approximately 1902, when John and Samuel Billiard of Grand Bruit discovered sulfides on what is now the Chetwynd Property (Snelgrove, 1935). Three shafts were sunk on the property at that time but by all accounts, no ore was ever shipped. Work in the area since has been concentrated on five principal showings; the Chetwynd, Copper Shaft, Iron Hat, Hope Brook and Woodmans Droke prospects. Accounts of the work performed can be found in Reading (1933), Snelgrove (1935), Douglas *et al.* (1940), Cooper (1954), Pouliot (1957) and Chorlton (1978). The most detailed and exhaustive lithologic descriptions and an excellent map at a scale of 1:15,840 (1" = 1320') of the area can be found in Pouliot (1957).

The Cinq Cerf Brook area is underlain mainly by volcanic and sedimentary rocks of the Georges Brook Formation. In this area, the lower part of the formation consists of a thick sequence of mafic volcanic flows and pyroclastics with interbedded metagraywacke and slate and minor felsic tuff. The exposed base of the sequence is intruded by the Roti Granite and dikes related to this granite are found throughout the lower part of the Georges Brook Formation. The dominantly mafic volcanic-sedimentary sequence passes upwards into a thick sequence of dominantly subaerial rhyolitic flows which form the Highlands of Grand Bruit and the whole package is intruded by dikes and sills related to the Hawks Nest Pond Porphyry (Pouliot, 1957). Northeast of Cinq Cerf Brook, the Georges Brook Formation is truncated by the Chetwynd Granite, a posttectonic, medium grained, biotite granite.

Of particular interest in the Cinq Cerf Brook area are two, apparently conformable horizons of silicified, sericitized and pyritized felsic rocks, each of which has a strike length of over 3 km and which, between them, host four of the five showings mentioned above (Figure 2). Lithologically, they range from highly sheared, altered, pyrophyllitic, siliceous schist to hard, aphanitic rock which appears to be rhyolite. Scattered faint bluish quartz eyes and small feldspar laths are

LEGEND

DEVONIAN (?) EARLIER

5 **CHETWYND GRANITE:** Pink biotite granite

4 **CINQ CERF COMPLEX:** Equigranular granodiorite

3 **HAWKS NEST POND PORPHYRY:** Quartz-feldspar porphyry

ORDOVICIAN (?)

LA POILE GROUP

2 **ROTI GRANITE:** Equigranular to porphyritic subvolcanic leucogranite

GEORGES BROOK FORMATION

1F - Dominantly flow banded rhyolite, felsic crystal-lithic tuff

1E - Graywacke; lesser argillite, conglomerate

1D - Coarse, polymictic boulder conglomerate

1C - Laminated, fine grained felsic tuff

1B - Mafic volcanic rocks, green chloritic metasediments, lesser felsic volcanics

1A - Silicified, sericitized, pyrite rhyolite (?)

MINERAL OCCURRENCES

A - Chetwynd Propect: Cu, Au, Py

B - Copper Shafts: Cu, Py

C - Iron Hat: Py

D - Hope Brook: Py

E - Woodmans Droke: Pb, Zn, Py

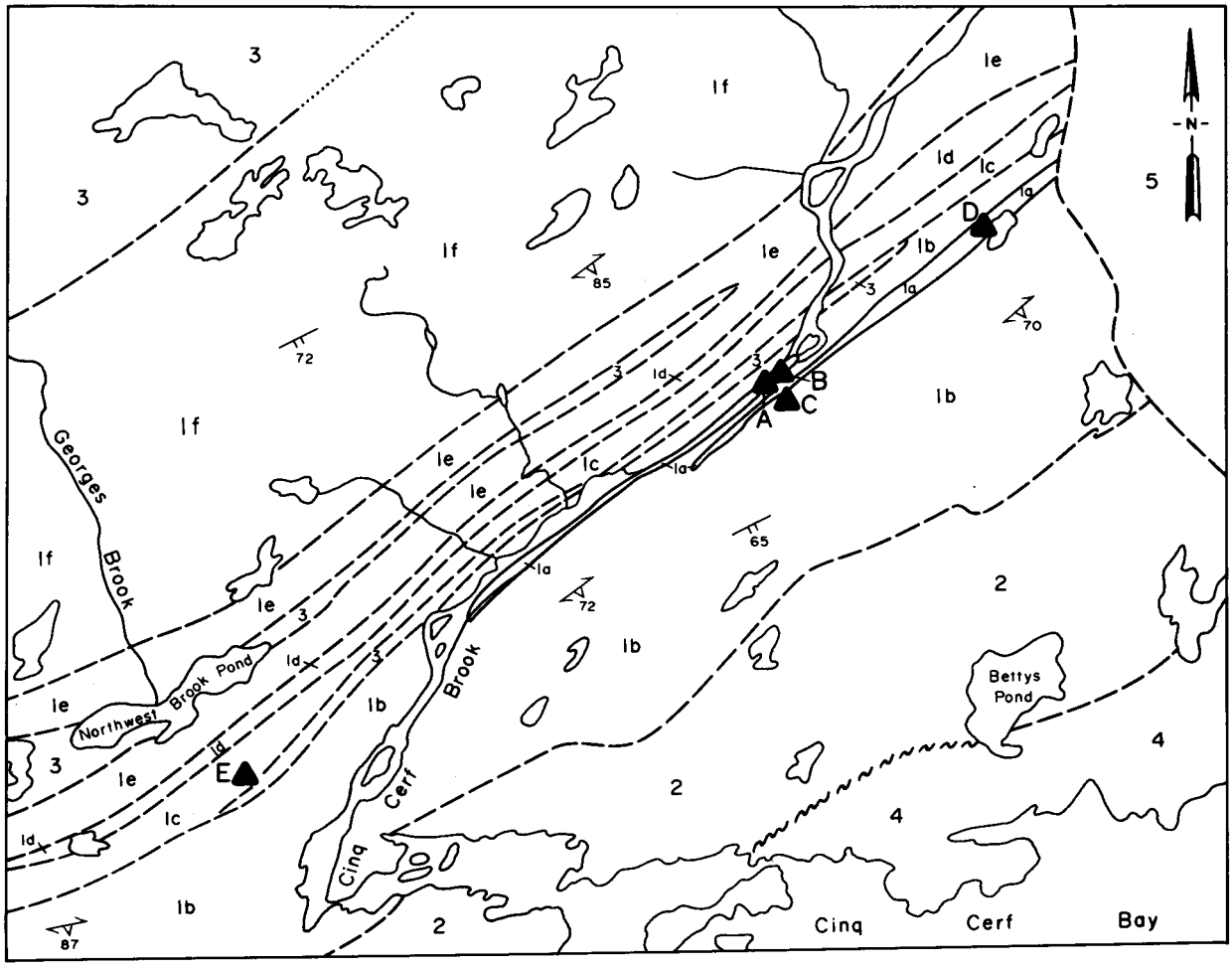


Figure 2. Geology and mineral deposits of the Cinq Cerf Brook area

Scale

0 1 2

Km

present and the two horizons are heavily iron stained and deeply leached along their exposed strike lengths. They may have formed as either high level granitic sills or rhyolite flows; field evidence is not conclusive for either interpretation. The mineralized horizons are hosted by fine grained chloritic schist of the lower division of the La Poile Group in this area. Their distribution is shown in Figure 2 and, because of their economic significance, they are discussed separately below. For convenience in the following discussion, the northwesterly horizon is referred to as "A horizon" and the southeasterly horizon as "B horizon".

The mineralized "A horizon" outcrops in the bed of Cinq Cerf Brook over a strike length of approximately 4 km. Where relatively fresh (unweathered), it generally consists of buff to gray, cherty, aphanitic rhyolite, but much of the horizon has been sheared and altered so that it commonly has the aspect of a fine grained, rhyolitic tuff. The northeast end of this horizon is not exposed but, in the southwest end, there is a gradual feathering out of the felsic horizons and the most southwesterly exposures comprise thin beds and lenses of altered felsic tuff in the chloritic schist host. The horizon is iron stained along its entire length although, in surface exposures, most of the pyrite has been weathered out, leaving cubic vugs. Two principal showings containing copper and gold are known within the "A horizon", the Chetwynd and Copper Shaft prospects, both of which occur near the northeast end of the horizon (Figure 2). The mineralization is presently exposed in the banks of Cinq Cerf Brook and in an open cut across the mineralized zone. At the Chetwynd Prospect, a shaft 27-30 metres deep, was sunk in the early 1900's with a southerly directed crosscut at between 10 and 15 metres and a northerly directed crosscut near the bottom of the shaft. 150 m northeast at the Copper Shafts, two shallow (7.5-9 metre) shafts were sunk at about the same time (Snelgrove, 1935). The dumps from these shafts have been well picked over by three generations of geologists and rock hounds and little mineralized material from the subsurface remains.

The mineralization presently exposed at the Chetwynd prospect consists mainly of moderately to heavily disseminated pyrite occasionally accompanied by bornite and chalcocite. The host rocks are intensely sheared and altered to a pyrophyllite-sericite-quartz assemblage (Snelgrove, 1935). Occasionally, veins of almost massive bornite up to 2 cm wide parallel the shearing. Reading (1933) reported visible gold from quartz veins around the showing and in panned concentrates from the stream bed. Snelgrove (1935) noted that microscopic gold was seen in a specimen from a quartz vein near the showing and Cooper (1954) later reported the presence of gold in polished sections of several specimens. No previous workers, however, have reported ore grades of gold over significant widths. Accessory minerals seen in outcrop include purple fluorite and barite, which fill vugs and veinlets. Tetrahedrite was reported by both Cooper (1957) and Snelgrove (1935) but was not seen in outcrop during the present investigation. Mineralization encountered underground appears from published reports to have been more impressive; Snelgrove (1935) reported that local men who had worked underground described "lenses of bornite and other sulfides, several feet in thickness... near the bottom of the workings". Likewise, Reading (1933) reported from similar but independent investigations that "lenses of bornite from two to three feet in thickness were found on the 100 foot level, and I was shown immense pieces of chalcopyrite which were said to be from a lens 5 to 7 feet wide, which was exposed in the fifty foot crosscut". Considering the highly leached condition of surface outcrops, it is not surprising that sulfide mineralization appears to be more widespread at depth. The mineralized zone is over 10 m wide in the Chetwynd open cut although copper is

most common in a 2-3 m zone near the centre of the cut. Copper mineralization is known to occur at the Copper Shafts 150 m to the northeast, suggesting that at least this much strike length is well mineralized in the subsurface, and the extensions along strike have not been tested in any manner. The potential for extending the mineralized zones in all directions appears to be excellent, with the possibility of finding significant quantities of copper and/or gold.

The origin of the mineralization is still somewhat enigmatic. The copper minerals are both disseminated and filling veins in surface outcrops, and descriptions of the underground workings suggest this was true at depth as well. The mineralogy of the occurrence (tetrahedrite-bornite-chalcopyrite-gold-fluorite-barite) suggests that the mineralization is epithermal or hypothermal and it is tentatively suggested that mineralization was originally the product of late magmatic events associated with the La Poile Group volcanism. The alteration which accompanies the mineralization is considered to have been contemporaneous although later chemical changes related to metamorphism and deformation have probably occurred. The restriction of the mineralization to the distinctive host horizons suggests that these may be high level granitic sills and the mineralization a product of the outgassing related to their crystallization. Further resolution of this question awaits geochemical and petrographic studies.

The southeast "B horizon" is exposed along approximately 3 km of strike length parallel to and partially overlapping the "A horizon". It reaches a maximum thickness of over 250 m at its northeast end where it is truncated by the Chetwynd Granite. Like the A horizon to the northwest, the B horizon feathers out at its southwest end approximately 800 m southwest of the Chetwynd prospect. The rocks which make up this horizon are more massive and less sheared and altered than those of the A horizon, consisting of buff to cream, aphanitic, cherty-looking rock which is commonly deeply leached and heavily iron stained on the outcrop surface. Occasional faint bluish quartz eyes and white feldspar phenocrysts are visible. This rock has been variously described as "granite porphyry" (Snelgrove, 1935), "siliceous intrusive related to the Roti Granite" (Pouliot, 1957), "silicified and otherwise altered shear zone" (Cooper, 1954), and "altered felsic volcanic bands" (Chorlton, 1978); the nature of the protolith is still in some doubt.

Two showings, the Iron Hat and Hope Brook prospects, have been identified in this horizon. The Iron Hat is a low rocky hill of altered rhyolitic-looking material located approximately 120 m southeast of the Chetwynd shaft. Minor pyrite associated with hematite and tourmaline are present in a 10 m long trench across the southwest end of the outcrop. No base or precious metals have been previously reported and none were seen during the present investigation. The Hope Brook prospect occurs in the canyon of Hope Brook approximately 1.9 km northeast of the Chetwynd shaft. Here, the brook has cut a gorge approximately 15 m deep into the bedrock and the B horizon is well exposed in the third dimension. The altered felsic rock is exposed across approximately 250 m in the canyon bottom and walls. Phenocrysts of quartz and feldspar are common and the rock is impregnated with pyrite, disseminated and concentrated along cleavage planes and fracture surfaces in amounts ranging from 3 to 7%. A little chalcopyrite was seen at one locality. Previous workers report no gold or base metals at this locality and, with the exception of the above mentioned chalcopyrite, none were seen during the present program. The rocks in surface outcrops above the gorge, while being heavily iron stained, contain little or no pyrite and are in all respects similar to those exposed along the entire strike length of this horizon. It

is significant that the only two sulfide localities in the horizon are also the only two places were the unleached subsurface rocks have been exposed - by trenching at Iron Hat and by the stream-cut at Hope Brook - and it seems likely that, in the subsurface, similar amounts of pyrite may be present along the entire 3 km of strike length. The origin of the mineralization is uncertain, but its proximity to the A horizon and similarity of their host rocks, alteration and geologic setting suggest a common genesis with the copper-gold mineralization at Chetwynd. It seems possible that base and precious metal concentrations may also be present in the B horizon, and their surface expression obscured by the extensive outcrop leaching which has taken place.

The only other showing of any consequence in this area is the Woodmans Droke prospect, located approximately 1.2 km west of Cinq Cerf Bay. This prospect was discovered at about the same time as the Chetwynd and received minor attention, including trenching, shortly after its discovery. The mineralization consists of sparse patches of coarse pyrite, chalcopyrite and sphalerite in anastomosing, flat-lying quartz lentils and veins. Galena has been reported from the prospect (Cooper, 1954; Chorlton, personal communication). Host to the veins is sheared, silicic tuff which occupies a somewhat higher stratigraphic position than the showings on Cinq Cerf Brook. This showing is of limited extent and probably of no economic importance.

The only evidence of possible volcanogenic mineralization in the La Poile Group is found in the Peter Snout map area, where Chorlton (1980) reported massive and disseminated magnetite on a high hill overlooking Grandys Brook. The Georges Brook Formation in this area consists mainly of mafic volcanic rocks and volcanogenic sedimentary rocks with lesser rhyolite and felsic tuff. The volcano-sedimentary package is much attenuated here compared to the Cinq Cerf Brook area; it is bounded to the north by the Bay d'Est Fault and to the south by a later intrusion of megacrystic biotite granite.

The magnetite-rich horizon is approximately 10 m thick, appears to strike approximately east-west, and is exposed for approximately 80 m along strike. It is bounded to the south by fine grained felsic rocks which are either felsic volcanics or fine grained phases of the Roti Granite and to the north by medium to coarse grained volcanically derived conglomerate. It is closely associated as well with a distinctive cordierite - andalusite meta-argillite which carries significant amounts of apatite and tourmaline, providing evidence of at least one period of magnesium metasomatism. The magnetite is associated with dark gray, silicic rock which may be chert and appears to be a magnetite iron formation.

On the west side of the same hill, an extensive zone of alteration characterized by chloritization, sericitization, silicification and introduction of pyrite is present. Any relationship between this alteration and the magnetite iron formation 500 m to the east has been obscured by intense deformation. However, the close association of this type of alteration with iron formation coupled with evidence of magnesium metasomatism and coarse volcanic conglomerate may indicate a relatively favorable environment for volcanogenic mineralization. The presence of magnetite rather than iron sulfides may, of course, mean that, in this locality at least, the depositional environment was not sufficiently reducing to have produced economically interesting deposits.

In this same area, the Bay d'Est Fault zone is mineralized along the approximately 12 km of strike length examined. Examination of the fault zone

was prompted by the discovery of sulfides in outcrop by Smyth (1979) and Chorlton (1980). Rocks of the fault zone are well exposed in the beds of streams which in this area flow in the trace of the fault. The rocks appear to be generally volcanogenic, are intensely sheared and altered, and appear to be derived from both the La Poile and Bay du Nord Groups. Widespread injection of pink pegmatite and aplite dikes, which commonly carry abundant tourmaline and, locally, minor sulfides, is found in the fault zone. Pyrite is concentrated at a number of localities where the host rocks are abnormally silicified and sheared. It is commonly disseminated in quantities up to 15% but generally less than 7%. A few specks of chalcopyrite were also noted at one location. The fact that this type of mineralization occurs exclusively within the fault zone seems to suggest that it is probably related to the fault rather than to the host rocks. The mineralization is closely associated with intensely silicified zones and the intense shearing may make it impossible to tell whether the sulfides were originally introduced prior to the shearing. The sulfides in this part of the Bay d'Est Fault zone may be genetically related to the fault, having been introduced during late movement and magmatic/hydrothermal activity in the fault zone. Alternatively, they may represent a prior concentration which has been remobilized by later activity in the fault zone.

MINERALIZATION IN THE BAY DU NORD GROUP

Base and precious metal mineralization has been known in the Bay du Nord Group since 1936 when Alex Strickland discovered the lead-zinc-silver showing which now bears his name on the highlands above La Poile Bay. Subsequent prospecting uncovered a number of sulfide occurrences along strike from the Strickland prospect for approximately 10 km (Cooper, 1954) between Carrot Brook and Big Pond Brook (Figure 3).

The most promising of these showings in the Bay du Nord Group remains the Strickland prospect. The nature of the deposits and summaries of previous work have been presented in some detail by Cooper (1954), Stackhouse (1976) and Chorlton (1978), and the deposit is the subject of an M.Sc. dissertation in progress at Memorial University by J. Wynn. The property on which the showings occur is a fee simple mining grant presently under exploration by Falconbridge Nickel Mines Ltd.

The principal economic mineralization at the Strickland prospect comprises conformable, massive sphalerite and galena; it is commonly argentiferous and occurs at the contact between a laterally extensive felsic pyroclastic unit to the southeast and laminated metasiltstones and phyllite to the northwest. The mineralized horizon strikes approximately 025°-035° Azimuth and dips at 55°-60° to the southeast. Cooper (1954) reported that, in addition, minor amounts of arsenopyrite, pyrite, tetrahedrite, chalcopyrite and native gold are present. The massive mineralization is spacially associated with strongly silicified and sericitized felsic volcanic rocks which range from fine grained tuff to coarse volcanic breccia and it commonly contains fragments of these felsic rocks. Pods of carbonate are closely associated with the mineralization. Cooper (1954) noted that lead-zinc-silver mineralization could be traced in trenches along a strike length of 500 m and that although the thickest exposure of massive mineralization seen on surface was 3.2 m it appeared to pinch out and swell considerably within short distances. Assays of the massive ore reported by Cooper (1954) contain expected good grades of lead and zinc and, in addition, show silver values ranging from 85 to 920 g/t and trace amounts of gold.

Approximately 540 m southwest of the massive lead-zinc-silver mineralization, a zone of intense chloritization and

LEGEND

DEVONIAN (?)

6 **LA POILE BATHOLITH:** Porphyritic granodiorite

ORDOVICIAN

BAY DU NORD GROUP

5 **BAGGS HILL GRANITE:** Equigranular granite, granophyre

4 **DOLMAN FORMATION:** Dominantly felsic metavolcanic rocks, lesser metasediments

3 **PIGLET BROOK RHYOLITE:** Massive pink to cream rhyolite

2 **UNDIVIDED STRATIFIED ROCKS: 2A,** mixed metavolcanics and metasediments, metavolcanics are dominantly felsic pyroclastics; **2B,** mainly felsic pyroclastic rocks; **2c,** mainly metasedimentary rocks.

1 Metagabbro

MINERAL OCCURRENCES

A - Strickland Prospect: Pb-Zn-Ag-Cu

B - Carrot Brook: Pb-Zn-Py ($\pm$ Cu)

C - Carrot Brook South (2 occurrences)

D - Big Pond Brook (2 occurrences) Cu, Py

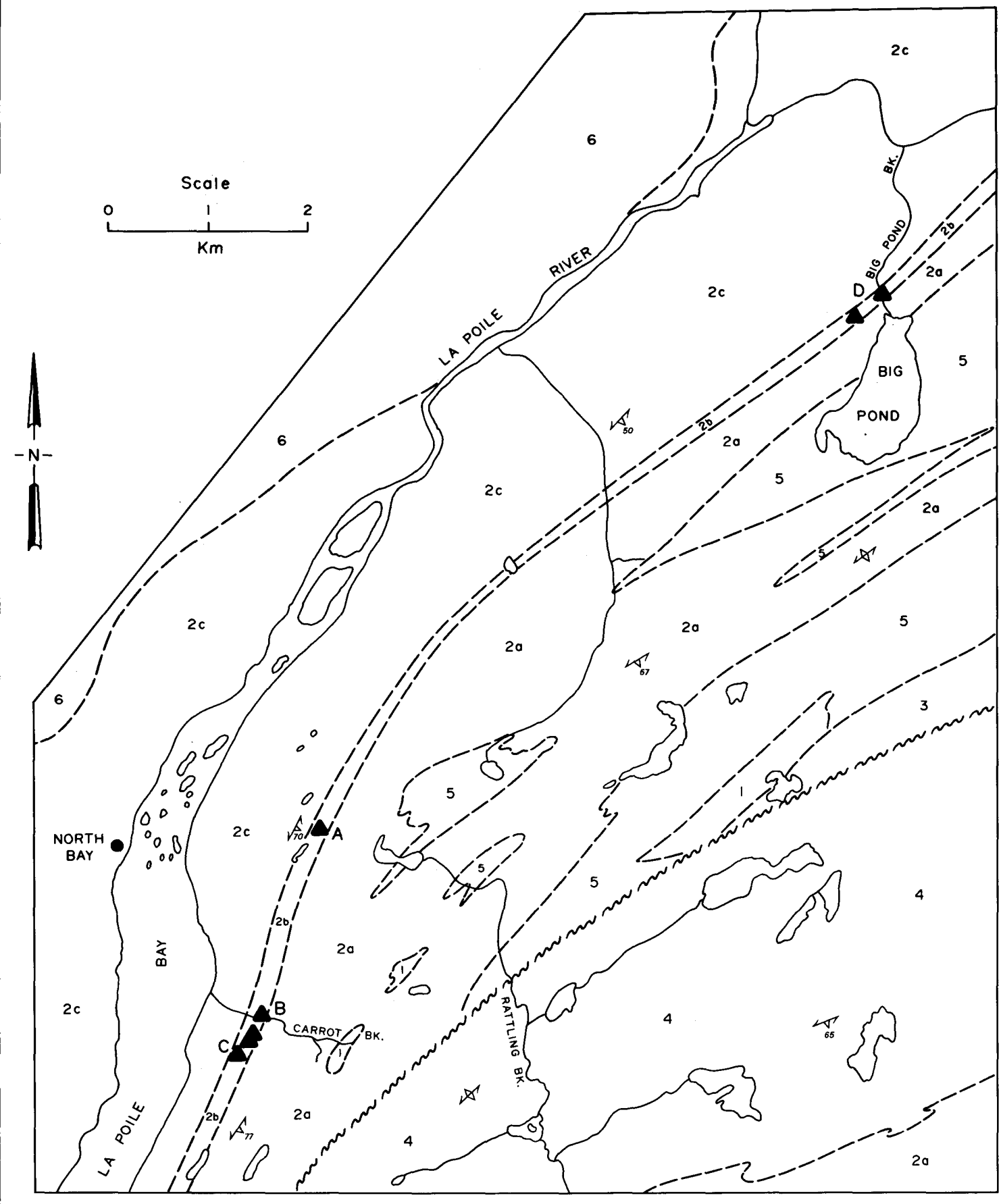


Figure 3. Geology and mineral deposits of the La Poile Group northeast of La Poile Bay

silicification carries minor amounts of chalcopyrite accompanied by pyrite and pyrrhotite as disseminated grains and in stringers. Minor galena and sphalerite are also present. Assays from this zone reported by Cooper (1954) range from 1.6 to 2.8% Cu, although judging from surface exposures, these figures are probably somewhat higher than average grades. One sample carried 170 g/t silver but the rest carried none; likewise, no gold was detected.

Mineralization at the Strickland prospect is almost certainly volcanogenic in origin. The massive lead-zinc-silver mineralization is clearly stratabound and predates deformation of the Bay du Nord Group. The bedding immediately northwest of the sulfide horizon has clearly been transposed and there is no conclusive direct evidence as to the younging direction of strata which host the deposit. By analogy with massive sulfide deposits in other areas, however, one might expect the mineralization to occur at the top of the volcanic pile and be overlain by clastic sediments. Further, in other similar deposits, chloritic, silicic, pyritiferous and cupriferous alteration closely associated with the massive sulfides commonly occurs in the footwall, having resulted from hydrothermal activity related to the mineralizing event. These lines of reasoning coupled with the presence in the massive sulfides of felsic volcanic fragments similar to those outcropping immediately to the southeast, suggest that the Strickland deposit is now overturned and faces to the northwest. A relatively proximal mineralizing environment is suggested by the presence of nearby, relatively coarse, pyroclastic rocks and subvolcanic granites as well as chloritic, cupriferous alteration in the footwall. Rhyolitic fragments in the massive ore are similar to altered felsic rocks in the footwall and may represent pyroclastic debris of nearby explosive activity. Alternatively, they may represent slumped fragments, suggesting that the massive ore has been transported (slumped) from its site of deposition.

There are a number of smaller sulfide occurrences along strike from the Strickland both to the southwest and to the northeast. Approximately 2 km to the southwest, sulfides are present in altered rhyolitic rocks in the bed of Carrot Brook. The best exposures are in an old trench where extensive iron staining signals the presence of pyrite accompanied by minor galena and sphalerite. The sulfides occur as blebs and stringers in the rock and their location appears to be fracture controlled. The host rocks are rhyolites which lie on strike with the felsic horizon that forms the footwall of the Strickland deposit.

On the hills south of Carrot Brook, and at about the same stratigraphic horizon, several old trenches have exposed minor sulfide mineralization along a strike length of approximately 350 m. The host rocks are silicified felsic tuffs which are commonly highly iron stained and which carry minor disseminated pyrite. Quartz veins cut the mineralized rock and some sulfides have been remobilized into these veins. Cooper (1954) reported minor chalcopyrite from one of the trenches.

Approximately 6 km northeast of the Strickland prospect in the bed of Big Pond Brook, up to 5% disseminated pyrite plus chalcopyrite are found in silicified felsic tuff. The heavily mineralized zone is 2-3 m wide although alteration and sparse, disseminated pyrite are present over considerably greater widths. The host rocks appear to be the northeastward extension of the felsic volcanics forming the footwall to the Strickland deposit. Cooper (1954) reported that minor tetrahedrite, pyrrhotite and marcasite are also present. Minor disseminated pyrite and chalcopyrite are locally present along strike to the southwest of Big Pond Brook and Cooper (1954) reported a little sphalerite and galena from one locality in this area.

The sulfide occurrences in the Carrot Brook and Big Pond Brook areas are unlikely to be of economic significance in their own right. However, it is significant that virtually all of the volcanogenic mineralization in the Bay du Nord Group is restricted to a single felsic volcanic horizon and that this horizon forms the footwall to massive stratabound Pb-Zn-Ag mineralization at the Strickland prospect. It is likely that the ore-forming process which resulted in formation of the Strickland deposit (*i.e.* hydrothermal activity related to volcanism) was also responsible for the mineralization seen along strike. These minor occurrences, hosted by hydrothermally altered rocks at a single stratigraphic level, therefore signal the existence of fairly widespread hydrothermal activity during this stage of volcanism. It is not inconceivable that this activity, in the presence of favorable hydrodynamic and physicochemical environments, might have formed further, as yet undiscovered, massive sulfide deposits.

MINERALIZATION IN THE KEEPINGS GNEISS

Several pyritic sulfide occurrences have been previously reported in the Keepings Gneiss and the Northern Granite in the area of Morg Keepings Brook and Prospectors Pond (Douglas and Hsu, 1976), and Cooper (1954) reported discovery of widespread base metal-bearing float in south-flowing streams that drain this terrain. The mineralization described by Cooper (1954) was associated with quartz veins and one sample ran 5.86% Zn and 27 ppm Ag with minor Pb, Cu and Au. A brief examination was made of the Morg Keepings Brook watershed and the area west of Prospectors Pond to check the previously reported mineral occurrences and to determine whether they might indicate a potential for further base metal mineralization in this unit.

Several minor indications of sulfide mineralization were seen in Morg Keepings Brook; all consist mainly of disseminated pyrite with scattered specks of chalcopyrite and galena in quartz segregations in paragneisses. The Prospectors Pond occurrence comprises disseminated pyrite in a deeply weathered and altered granite (Northern Granite) and contains no base metals visible in hand specimen. Nothing seen during this investigation would suggest a potential for economic mineralization in this unit.

REGIONAL CONSIDERATIONS

The ages of the Bay du Nord and La Poile Groups are not known with any degree of certainty as, to date, no fossils have been discovered in these sequences. They are generally considered to be Middle Ordovician on the basis of radiometric dates previously cited; however, these data allow an age as old as Arenigian (Lower Ordovician) if one uses the van Eysinga (1975) time scale and as young as Wenlockian (Middle Silurian) if one uses the Ross *et al.* (1978) time scale. Clearly, temporal correlations of fossiliferous strata elsewhere in Newfoundland with rocks in southwestern Newfoundland dated by radiometric methods must be tenuous at best.

Smyth (1980) has shown that the volcano-sedimentary sequences of southwestern Newfoundland can be traced for a considerable distance around the Hermitage Flexure. Although the area east of Grandys Brook has not yet been mapped at a scale of 1:50,000, his compilations based on available company maps and limited field checking suggest that they outcrop continuously as far east as the Salmon River in the Dolland Brook (11P/15) map area. In this area, they are on strike with the western extension of the Baie d'Espoir Group west of Facheux Bay (Swinden, 1980) and separated from it by approximately 20 km of granite (Figure 1). It seems likely that prior to the granite intrusion, the Baie d'Espoir Group and the eastward equivalents of the Bay du Nord/La Poile Groups were continuous and it may be that volcanic rocks in the Isle Galet Formation of the Bay d'Espoir Group (Swinden, 1980) represent a distal

facies of the relatively more proximal volcanism which is widespread in southwestern Newfoundland. This correlation is supported by the similarity of the volcanic rocks in the two sequences. In both areas, volcanic rocks consist dominantly of laterally extensive, felsic rocks and, in both cases, mafic flows form a minor part of the sequence occurring in the lower stratigraphic levels. Mineralization in the two sequences is likewise similar. The Strickland prospect and the Barasway de Cerf prospect in Bay d'Espoir (Swinden, 1980) are similar in mineralogy, host rocks and general geologic setting. Their differences (*e.g.* larger size of Strickland, lack of footwall alteration at Barasway de Cerf) are features which may be attributed to the relatively more proximal environment occupied by the former deposit. If more deposits should be discovered along strike from Barasway de Cerf in more proximal environments of the Bay d'Espoir Group, they could be expected to look very much like the Strickland. According to Smyth (1979, 1980), the volcano-sedimentary rocks between Grandys Brook and Salmon River are dominantly sedimentary with lesser volcanic material; however, pockets of felsic volcanics are present along the entire belt. As part of a sequence which has a demonstrated potential for volcanogenic Pb-Zn-Ag deposits in both the La Poile Bay and Bay d'Espoir areas, these rocks must be considered as potentially favorable hosts for further similar deposits. Detailed mapping is needed in this area to fully evaluate this potential.

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