PART 2: GABARUS BAY AREA

INTRODUCTION

The area west and south of Gabarus Bay was selected for study because it is on strike from the Deep Cove polymetallic mineral prospect and related occurrences (Bingley, 1969; Riddell, 1973; Sangster, 1977b) and it includes a number of small Fe-Cu occurrences (Figs. 0-1 and 2-1, in map pocket).

Purposes of this study were (1) detailed stratigraphic and petrologic subdivision of the Fourchu Group across one of the best available transects (the north side of Gabarus Bay is partly obscured by contact metamorphic overprinting in the vicinity of Deep Cove), (2) determination of the nature and setting of the occurrences of Fe-Cu mineralization within these rocks and (3) comparison of this stratigraphy and mineralization with those on the north side of Gabarus Bay between Deep Cove and Kennington Cove.

A narrow strip, 18 km long, extending around Gabarus Bay from Deep Cove to Cape Gabarus was mapped at a scale of 1:4800. This was extended inland from the west side of Gabarus Bay as far as Hardy Lake in order to include the Irish Brook Fe-Cu occurrence (Leslie, 1969) and additional exposures along the Marion Bridge-Gabarus road. The area mapped is primarily coastal in character with numerous long exposures, locally obscured by till banks (eroding drumlins) and interrupted by sand spits and associated lagoons. Relief behind the shoreline is relatively subdued, especially to the south of Gabarus Bay where elevation rarely exceeds 30 m, in contrast with the north side of the bay where elevation increases rapidly to about 60 m behind the shoreline. Exposures inland are generally poor except along incised streams, such as Irish Brook, and in roadcuts along the Marion Bridge - Gabarus highway.

Previous work around the west and south sides of Gabarus Bay has been limited to regional mapping (1:63 360) by Weeks (1954), a report of exploration work in the Irish Brook-Hardy Lake area (Leslie, 1969), and a geological engineering report on the Gabarus area as a potential site for a new steel plant (Oldale, 1975). In contrast, the north side of Gabarus Bay, because of the mineralization at Deep Cove, Eagle Head and Kennington Cove Brook, has been much more intensively investigated (Bingley, 1969; Riddell, 1973 and 1979; Forgeron, 1974; Chatterjee, 1976; Murphy, 1977; Sangster, 1977b). In addition, the Deep Cove deposit has been described as 'porphyry-type' and compared with similar deposits in the Appalachians (Hollister et al., 1974; Kirkham and Soregaroli, 1975).

LITHOLOGICAL DESCRIPTIONS

FOURCHU GROUP

A wide variety of metamorphosed volcanic, volcaniclastic and related intrusive rocks are exposed around the shoreline of Gabarus Bay, providing one of the better available sections across strike of the Fourchu Group. The relative percentages of intrusive, volcanic, pyroclastic-volcaniclastic and epiclastic rocks are estimated to be approximately 5%, 20%, 70% and 5% respectively. Pyroclastic and volcanic rocks thus predominate and are readily subdivided into mappable units (Fig. 2-1). The apparent repetition of these units could be due either to folding (see section on Structure), or as appears equally likely, to cyclical volcanic activity.

Volcanic Rocks

Three main volcanic units, approximately 400-600 m thick, were distinguished from west to east in the vicinities of Lever Lake, Harris Lake and Cape Gabarus (Fig. 2-1). These are separated by thick sequences of mainly mixed volcaniclastic and pyroclastic rocks.

The volcanic units consist mainly of mafic flows with local occurrences of intermediate flows. The mafic flows are dark grey, purplish-grey or dark greenish, generally fine grained and more or less porphyritic. They are rarely vesicular or amygdaloidal and are generally uniformly massive, although locally they appear strongly flow-brecciated (e.g. at Harris Lake) or even agglomeratic (e.g. in the vicinity of Cape Gabarus). A weak internal tectonic foliation (S_1) is commonly visible, together with locally developed narrow schistose zones. Typically, the flows are strongly fractured with distinctive hematite coatings on the fracture surfaces. Locally, they are interbedded with layers and lenses of intermediate to mafic tuffs.

In thin section, they consist of plagioclase phenocrysts partially altered to epidote and sericite, mafic phenocrysts(?) crudely pseudomorphed by chlorite and(or) epidote and opaques. The matrices consist of fine grained intergranular, often flow-textured albitic plagioclase laths, chlorite, epidote and hematite or leucoxene, together with varietal quartz, calcite and pyrite (Fig. 2-2f, g). In some samples, incipient very fine grained tremolite-actinolite appears to have developed in the matrix. The plagioclase phenocrysts were found to be mostly oligoclase-andesine (An_{27-37}).

Minor amounts of intermediate volcanic rock occur as flows locally associated with the more abundant mafic flows. They are dark grey to blue-grey, sparsely porphyritic aphanitic rocks, commonly with green epidotic spots, streaks and diffuse veins. In thin section they are more or less epidotized, with highly altered plagioclase phenocrysts in matrices of plagioclase laths, granoblastic quartz, chlorite, epidote, sericite and iron oxides (Fig. 2-2e).

Pyroclastic-Volcaniclastic Rocks

Three compositional groups of lithic tuffs were distinguished in the field: felsic, felsic-intermediate and intermediate-mafic, estimated to be present in percentages of about 25%, 35% and 40% respectively. While most of the tuffs can be classed as lapilli tuffs, they vary considerably in the sizes of their contained fragments and range from ash to agglomerate. The bulk of these rocks appear to have been deposited in thick massive layers, as compositional banding and grading of the tephra are very weakly developed and can only be discerned locally. In a few localities, unconformable contacts are developed between such layers. It is thought that the tuffs include debris flows as well as air-fall deposits.

Fragment sizes are mostly 1-5 cm but may include larger blocks up to 1 m across. The smaller fragments are generally crudely ellipsoidal in shape, presumably due largely to greater flattening and stretching within the pervasive tectonic foliation.

Occasional very thick units, up to several tens of metres, of more uniformly fine grained tuffs of felsic and intermediate compositions were found to contain closely packed, strongly flattened fragments which appear welded. These tuffs are considered to be ash-flow tuffs. The sequence therefore appears to be dominated by coarser air-fall and debris-flow material but also to include a number of ash-flow units.

Felsic tuffs form two map units approximately 300 m and 1300 m thick.

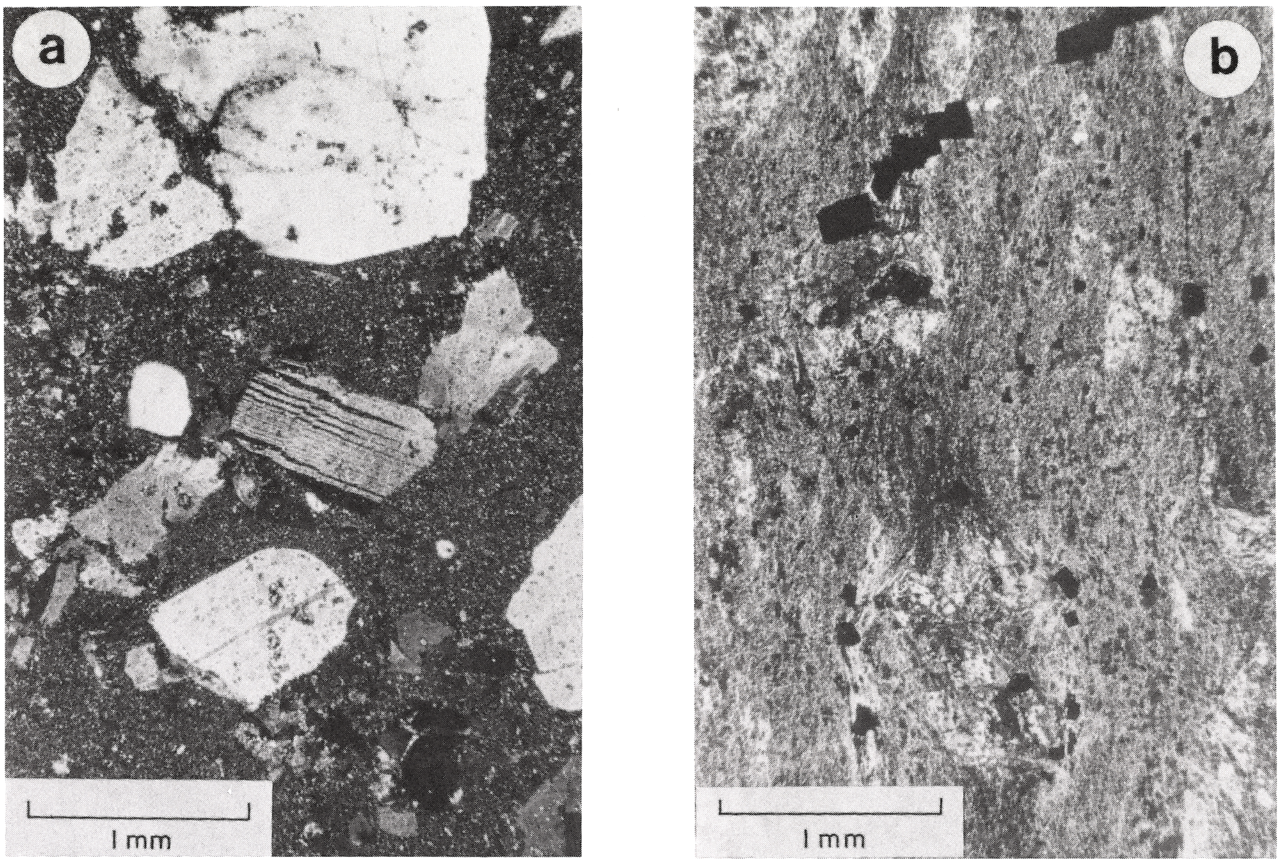
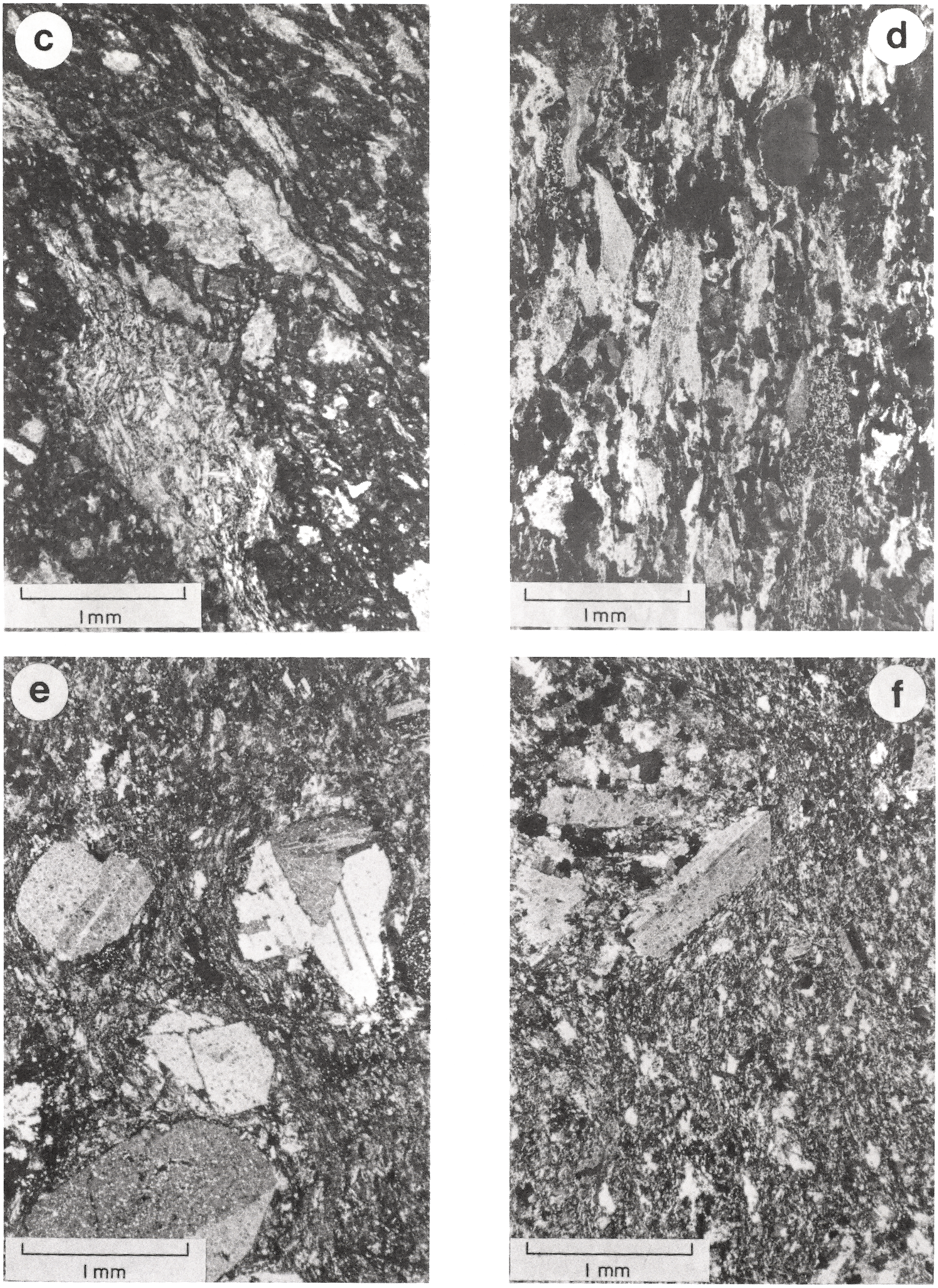


Figure 2-2. Petrographic features of intrusive, volcaniclastic, and volcanic rocks of Fourchu Group.

a. Quartz-feldspar crystal tuff of rhyodacitic composition from Gull Cove, showing strained quartz and kinked plagioclase.
b. Foliated felsite sheet of dacitic composition with epidotized feldspar augen and pyrite cubes (black), disseminated and fracture controlled.
c. Foliated lithic tuff of intermediate-mafic composition (over).
d. Foliated welded tuff of felsic composition (over).
e. Porphyritic intermediate flow (over).
f. Mafic flow (over).
g. Fine-grained mafic flow, amygdaloidal and flow-textured (over).
h. Porphyritic mafic sheet (over).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Typically, they are pale greenish or pinkish rocks which contain distorted lapilli of aphanitic rhyolite, aphanitic to fine grained pophyritic dacite, and white pumice (?), together with plagioclase and quartz crystals in more or less schistose matrices of quartz, feldspar, sericite, epidote and chlorite. The crystal:lithic ratio in most of these tuffs is very low, although in some it reaches 50:50. In the rarer ash-flow tuffs, similar lithic fragments and crystals, commonly together with fragments of dark vesicular aphanitic lava, occur in very closely packed, flattened arrangements (Fig. 2-2d). These ash-flow tuffs appear to occur only in the western part of the area on the west side of Gabarus Bay and along Irish Brook. Fine grained laminated ashes which contain only sparse dacitic fragments, and quartz and feldspar crystals set in more or less foliated quartzo-feldspathic matrices are locally associated with some of the felsic tuffs.

Felsic-intermediate lithic tuffs form two map units within the area, approximately 800 m and 1200 m thick (Fig. 2-1). Typically, they are medium grey-green or purple lapilli tuffs, banded to massive, occurring either in thick, relatively uniform sequences or interbedded with more felsic tuffs including ash-flow tuffs. They consist of abundant tephra of flow-textured, sparsely porphyritic dacite, together with variable amounts of quartz and plagioclase crystals in fine- to medium-grained foliated matrices rich in chlorite and epidote.

Intermediate-mafic tuffs are the most abundant of the three compositional groups occurring as several units between 300 and 500 m thick. In Gull Cove, they form a unit flanking the Gull Cove porphyry intrusion, and on the northwest side of Gabarus Bay, they also form one or two units flanking the mafic-intermediate volcanic unit. Another unit of intermediate-mafic tuffs occurs within felsic tuffs between Gabarus and Gabarus Barachois. Typically, these are medium to dark greenish chloritic and schistose fragmental rocks containing abundant aphanitic to fine grained vesicular to amygdaloidal tephra of mafic volcanics in fine grained matrices of chlorite, epidote and oxidized magnetite together with varietal tremolite-actinolite, biotite and pyrite (Fig. 2-2c). Hematite is characteristically developed on fracture surfaces in these rocks.

A quartz-feldspar crystal tuff unit which occurs at Gull Cove is a massive, variably foliated body, cut by mafic sheets similar to those in the surrounding volcanic rocks and lithic tuffs. The unit parallels the main structural trend but has slightly chilled margins which are locally irregular and crosscutting. It is of rhyodacitic composition, slightly more felsic than, but otherwise similar in composition to, the felsite sills in the surrounding rocks. No felsic sheets were observed within the crystal tuff itself. In thin section, the tuff has a hiatal porphyroclastic texture with large strained crystals of resorbed quartz, some with sutured grain boundaries or overgrowths and altered albitic plagioclase (An_{5-10}) with small chlorite-epidote pseudomorphs after biotite(?) in a very fine grained matrix of quartz, feldspar, chlorite, sericite and hematite (Fig. 2-2a). Foliation is variably developed and the crystals are commonly strained, fractured and have developed pressure shadows.

Epiclastic Rocks

Thin beds of epiclastic material, interbedded mainly with tuffs, are found at only a few localities: on the west side of Gabarus Bay, near Rams Head, and between Gull Cove and Cape Gabarus. They are generally thinly bedded or laminated, grey, green or purple rocks locally displaying graded bedding and scour and slump structures. The bulk of the rocks are volcanic mudstones and siltstones with only a few layers and individual beds of volcanic wacke. They consist mainly of quartz, feldspar, epidote, sericite and chlorite with coarse clastic grains of subangular quartz and plagioclase.

Intrusive Rocks

Three groups of foliated meta-igneous rocks which intruded the Fourchu Group are believed to be essentially comagmatic with the volcanic and pyroclastic rocks. They comprise two suites of sills (one felsic and the other mafic) and several andesite porphyry plugs(?).

Felsite sills are widespread and locally are very closely spaced, particularly between Lighthouse Point and Rouse Point near Gabarus Barachois (Fig. 2-3). In general, they are more or less conformable with layering and schistosity (S_{0-1}) in the host rocks, but locally they branch and crosscut irregularly. They range from a few cm to 10-20 m thick. Greenish to brownish in colour, they are typically aphanitic, fine- to medium-grained feldspar porphyritic rocks which are not obviously foliated, but are closely fractured and veined with quartz $\pm$ epidote $\pm$ hematite.

In thin section, the felsite sills display small plagioclase phenocrysts set in very fine grained foliated matrices. The plagioclase phenocrysts are usually altered to sericite and epidote, and are deformed into augen, some of which show pull-apart structures. The schistose matrices consist of quartz, feldspar, sericite, chlorite and epidote. Pale greenish-

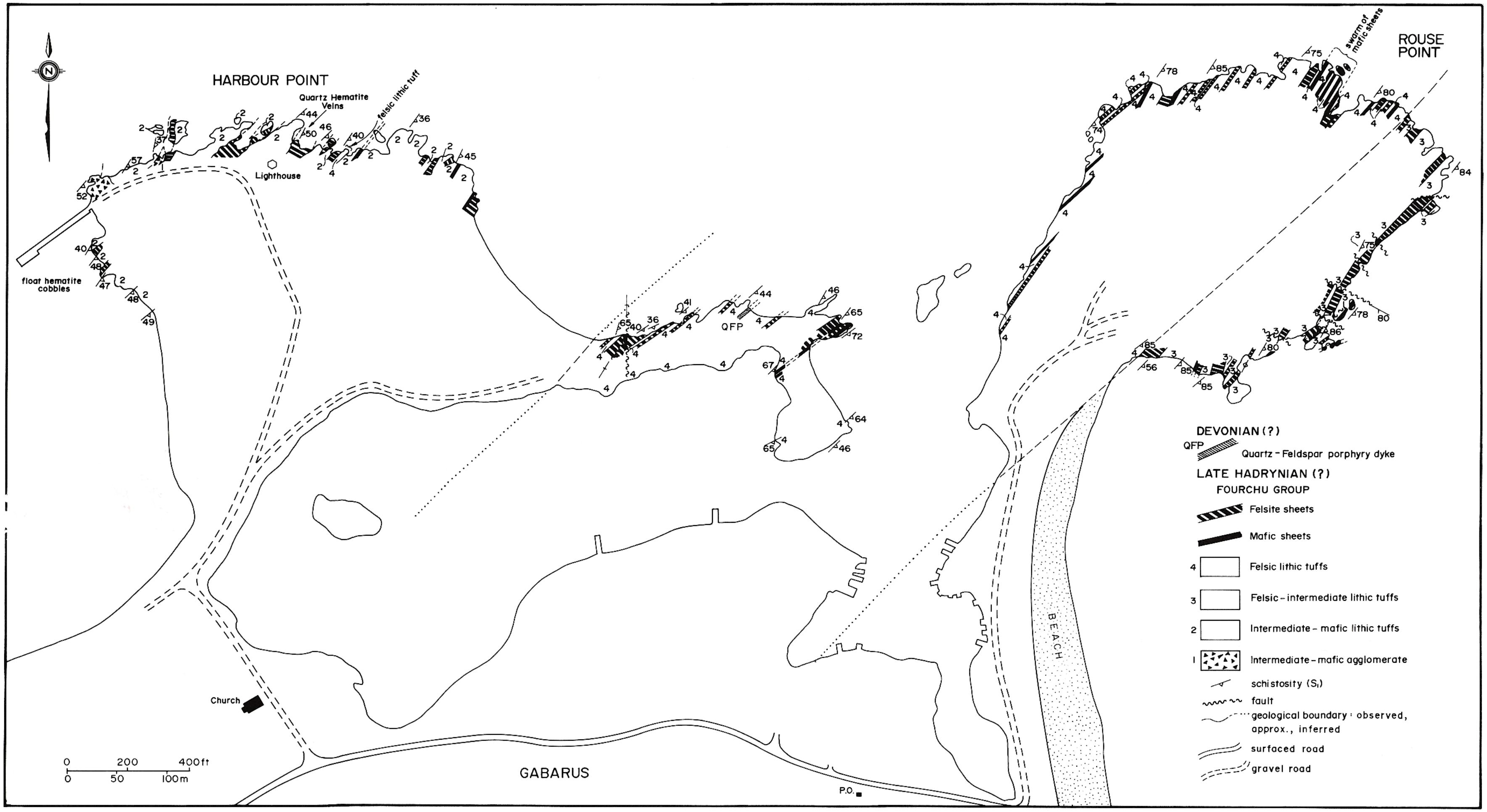


Figure 2-3. Detailed geological map showing the distribution of intrusive sheets and dykes in the vicinity of Gabarus Harbour.

brown biotite may occur in some laminae. Anhedral aggregates of epidote are common as are quartz-epidote-pyrite disseminations and veinlets (Fig. 2-2b).

Mafic sills are also widespread and are particularly abundant at Rouse Point where they constitute a swarm (Fig. 2-3). Being typically dark green in appearance they resemble the mafic flows, but are in general more pervasively foliated and are perhaps best described as greenstones or greenschists. They form sheets up to several metres thick generally conformable with bedding and foliation (S_{0-1}) in the country rocks, but they also branch locally and hence may be obliquely crosscutting.

In thin section, it can be seen that the original igneous fabric of these rocks has been largely destroyed. They consist of more or less foliated assemblages of plagioclase, chlorite, epidote, actinolite-tremolite, hematite or limonite or both, together with varietal biotite and quartz (Fig. 2-2h). The original plagioclase phenocrysts appear to have been replaced by sprays of prismatic actinolite-tremolite, whereas the more abundant plagioclase (An_{6-11}) laths look fresh and are presumably recrystallized.

Age relations between the felsic and mafic suites are commonly ambiguous where seen in contact because of their coplanarity and the obscuring of any chilled contacts by metamorphic recrystallization. However, at one locality east of Gabarus lighthouse, a 3 m thick mafic sill is clearly and extensively veined by felsite.

Foliated andesite porphyry forms two poorly exposed bodies occurring within felsic to intermediate tuffs north of Irish Brook (Fig. 2-1). These bodies are thought to be plugs, intrusive into the tuffs, although direct evidence of such a relationship is lacking. The rocks are yellowish-green to dark green in colour, massive, and commonly quartz veined. At several localities (Fig. 2-1), pyrite and rare pyrrhotite occur in patchy disseminations in fractures and in quartz veins within and adjacent to one of these bodies. In thin section, the porphyries consist of plagioclase phenocrysts (An_{33}) altered to sericite and epidote, and chloritic pseudomorphs after mafic phenocrysts in fine- to medium-grained matrices of plagioclase, chlorite, epidote and rarely actinolite. The opaques are oxidized to hematite and(or) goethite.

YOUNGER INTRUSIVE ROCKS

Three groups of younger intrusions cut the Fourchu Group: a gabbro body, basalt dykes and quartz-feldspar porphyry dykes. None of these are foliated, nor do they appear to have been metamorphosed although some are moderately altered. Age relationships among these three groups are unknown.

The gabbro is a crudely elliptical mass extending about 600 m southeastward from Irish Brook. It is a dark greenish, coarse grained rock composed of sericitized plagioclase, large poikilitic hornblende much altered to chlorite, skeletal opaques and accessory quartz.

Several basalt dykes, up to 2 m wide, outcrop on the southern and western shores of Gabarus Bay. They trend east-northeastward to southeastward, crosscutting the main structural trend of the Fourchu Group and paralleling important fault and joint directions. They are dark grey to grey-brown, fine- to medium-grained feldspar porphyritic basalts, generally rather altered and locally amygdaloidal. They consist of sericitized plagioclase phenocrysts in an intergranular groundmass of plagioclase laths, chlorite, calcite and hematite with accessory quartz and apatite. From their petrographic similarities, the dykes may be related to the gabbro previously described.

A number of unfoliated feldspar and quartz-feldspar porphyry dykes, up to 3 m thick, intrude the Fourchu Group, trending north-northeastward to east-northeastward. These are grey-pink to brownish and porphyritic-aphanitic. Locally, they contain disseminated pyrite and appear moderately altered. In thin section, they consist of strongly zoned plagioclase phenocrysts, with or without quartz phenocrysts, and smaller biotites in very fine grained groundmasses of plagioclase, biotite, chlorite and quartz-K-feldspar intergrowths. They closely resemble minor intrusive phases associated with the Deep Cove Pluton and may therefore be of the same Devono-Carboniferous age.

GRANTMIRE FORMATION(?)

The only layered rocks, other than those of the Fourchu Group, which occur within the mapped area are several isolated occurrences of immature clastic rocks. These unconformably overlie and are in fault contact with rocks of the Fourchu Group (Fig. 2-1). They consist of very coarse sedimentary breccia and minor interbedded brown lithic sandstone. Clasts in the breccia are angular to subangular blocks of Fourchu volcanic and pyroclastic rocks up to 1 m across. Because their general similarity to the cobble conglomerate, grit and brown limestone which unconformably overlie the Fourchu Group at MacIntyre Lake, some 10 km to the southwest, these rocks are tentatively assigned to the Grantmire Formation. The distribution of these clastic rocks around the edge of the bay suggests that Gabarus Bay may represent an exhumed Carboniferous basin.

STRUCTURE

Given the predominance of coarse volcaniclastic rocks and of related volcanic and intrusive rocks in the area, primary layering and bedding are neither widely nor well developed and are generally obscured by intrusion of felsic and mafic sheets or by the development of subparallel tectonic foliation or both. Thus the primary control required to clearly define the location and geometry of any large-scale fold structures within the area is weak.

DUCTILE DEFORMATION

Minor Structures

The dominant minor structure observed in the Gabarus area is a penetrative schistosity (S_1). Its intensity in outcrop varies widely, but it can always be clearly observed in thin section. Where contacts within the various volcanic and pyroclastic units can be observed, the schistosity is usually subparallel to them, except in the vicinity of rare minor folds. This schistosity has a very uniform orientation (Fig. 2-4c) striking north-northeast to northeast and dipping at moderate to steep angles toward the east, except near Cape Gabarus where a local reversal of dip occurs. Most intrusive contacts and rare bedding have orientations very similar to the schistosity (Fig. 2-4a, b). Thus the felsic and mafic sheets are probably either pre- or syntectonic and any early folding is tight to isoclinal. Given the volcaniclastic nature of most of the rocks, lineations are poorly developed. However, in the lithic tuffs, fragments which are generally crude flattened ellipsoids within S_1 are locally also distinctly elongated in a steeply plunging south-southeast direction (Fig. 2-4d). This crude stretching lineation (L_1) parallels the axis of the only early minor fold recognized in the area.

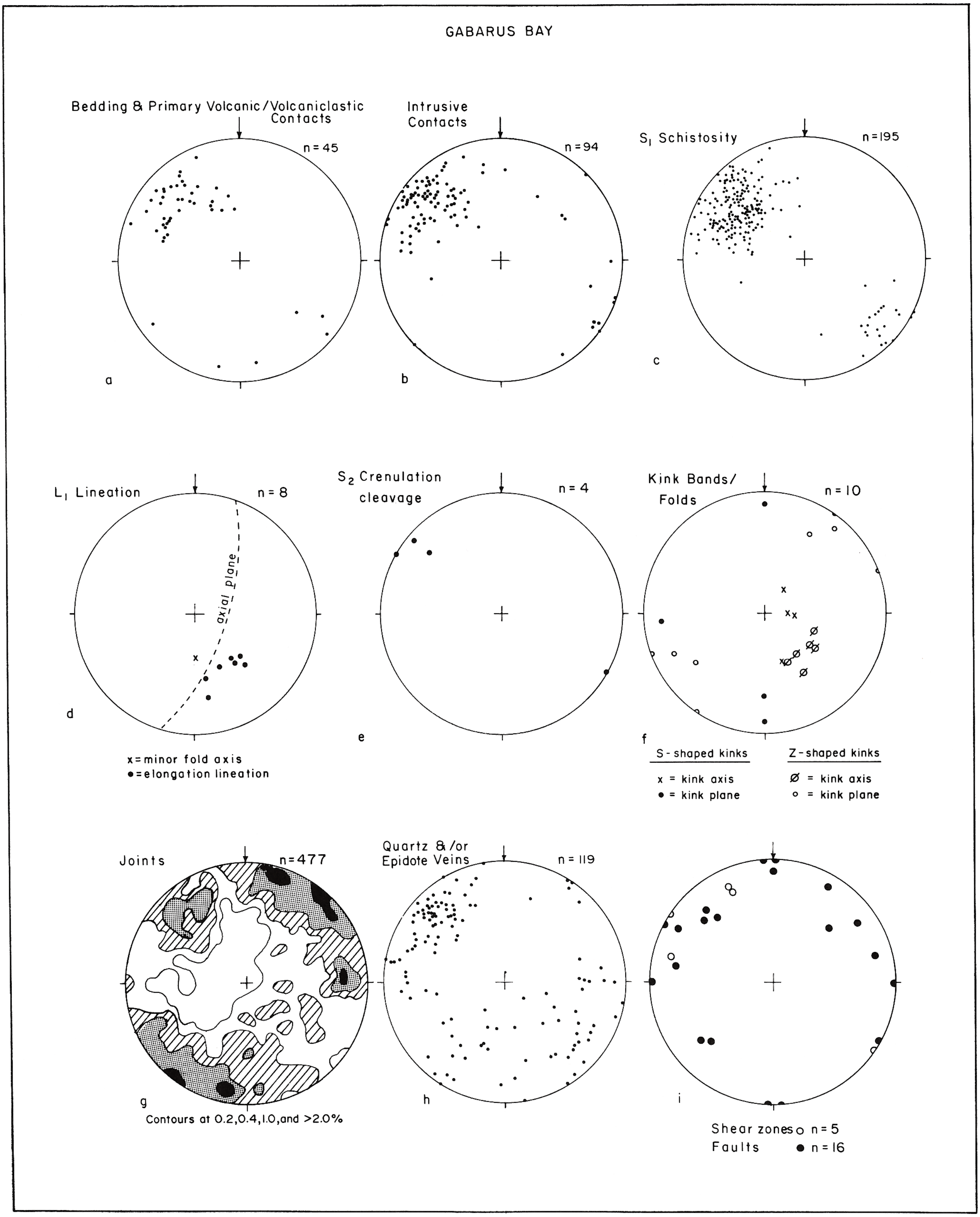


Figure 2-4. Summary of structural data from Gabarus Bay area.

A second foliation (S_2) can be detected locally in fine grained rocks both in outcrop and in thin section. This foliation is a weakly developed crenulation cleavage which, from the few measurements made, strikes northeast and dips subvertically (Fig. 2-4e). No minor folds were found directly associated with this second cleavage.

Ubiquitous, but sparsely developed, kink bands and minor kink folds with associated weak fracture cleavages (S_3) also occur within fine grained rocks. Insufficient numbers of these were available to clearly separate them into sets according to their orientations and asymmetries. However, the most common orientations (Fig. 2-4f) appear to be:

(1) east-trending, steeply plunging S-shaped kinks

(2) southeast-trending, moderately plunging Z-shaped kinks

Comparison with Louisbourg Area

The structural history of the Fourchu Group in the Gabarus area broadly resembles that in the Louisbourg area defined by Murphy (1977) (Table 2-1). However, in the latter area, where bedding is better developed in laminated ash units, F_1 minor folding is more common and has been described as open, upright folding (mainly Class 1B) plunging at low angles to the east-northeast. In addition, no kink bands and related minor folds (F_3) have been described at Louisbourg.

Major Structure

No major structure, such as the anticline shown by Weeks (1954), could be confirmed within the Gabarus area even though the general coplanarity of bedding and schistosity, and the steeply plunging L_1 elongation lineations and rare minor F_1 folds suggest that tight to isoclinal folding has occurred. Only in a few places could bedding be clearly distinguished from the S_1 schistosity. Near Rams Head, in the central part of the area, bedding dips more steeply southeastward than foliation, indicating that structural overturning has occurred. Elsewhere to the northwest and southeast, sparse evidence shows that beds are facing upward. This is compatible with large-scale asymmetric folding (F_1) verging toward the northwest, however there are insufficient data to precisely define the number and positions of major fold closures (no hinge areas were detected in the course of mapping). One possible structural interpretation is shown on the cross-section on Figure 2-1. According to this interpretation, the structure is dominated by a large synform occupied by volcaniclastic rocks, flanked by antiforms cored by volcanic and volcaniclastic rocks.

Near Cape Gabarus there is a general reversal in the directions of dip of both S_0 and S_1 planar structures (Fig. 2-1). This is probably due either to major upright synformal folding (F_2?) or simply to broad warping (F_3?). While the orientation of the S_2 crenulation cleavage tends to support the former hypothesis, the relative lack of late minor structures precludes confident identification of this structure.

BRITTLE DEFORMATION

Joint patterns around Gabarus Bay are relatively systematic: plots from individual subareas correlate closely with the synoptic plot for the whole area (Fig. 2-4g). The latter plot indicates the existence of four main joint sets:

(1) north-south strike, steep dips to the west;

(2) northeast-southwest strike,

Table 2-1. Comparison of minor structures recognized in Gabarus and Louisbourg areas.

Event	Element	Gabarus area (this study)	Louisbourg area (Murphy, 1977)
D_1	S_1	penetrative schistosity, striking NE to NNE and dipping steeply east	penetrative cleavage/schistosity striking ENE, and dipping steeply NNW or SSE
	F_1	rare tight folds plunging steeply	open to close folds plunging gently ENE
	L_1	elongation of lithic clasts, plunging steeply to moderately SSE	S_0/S_1 intersections plunging gently ENE
D_2	S_2	sporadic weak crenulation cleavage, striking NE, and dipping steeply SE	nonpenetrative slip/crenulation cleavages striking NE, dipping steeply SE
	F_2	no minor folds recognized	no minor folds recognized
	L_2	no lineations recognized	S_1/S_2 intersections plunging gently ENE
D_3	S_3	weak fracture cleavage(s)	
	F_3	more than one set of kink bands and related kink folds plunging steeply to moderately E and SE	not described

steep dips to the southeast;

(3) west-northwest to east-southeast strike, subvertical dips; and

(4) northwest-southeast strike, subvertical dips.

While the age relationships are unknown, sets (2) and (4) are subparallel and subperpendicular respectively to the dominant structural trend and therefore probably represent longitudinal and cross joints formed during the release of regional stresses. Sets (1) and (3) are possibly related to younger faulting.

Faults in the area were observed mainly in the well-exposed coastal sections. Three main sets were distinguished (Fig. 2-4i):

(1) north to northeast striking, steep dips to the east;

(2) west-east striking, subvertical dips; and

(3) northwest-southeast striking, steep dips to the northeast or southwest.

The movement on at least some of the north to northeast striking faults post-dates deposition of the coarse clastic rocks (Grantmire Formation?) which unconformably overlie the Fourchu Group. The east- and southeast-trending sets of faults are parallel to a suite of mafic dykes. However, the relative ages of these sets of faults are not known.

Veins of quartz, with or without epidote, hematite and minor sulphides, are common throughout the area, particularly in the more massive competent units (felsite sheets, welded tuffs, etc.). They range from isolated regular veins, through swarms, to irregular stockwork and gash systems. Orientations of more regular veins (Fig. 2-4h) closely parallel the common joint patterns: principally northeast-southwest, northwest-southeast, and north-south.

A few shear zones (Fig. 2-4i) were noted which generally subparallel the regional northeast trend. From their retrograde features they are thought to post-date regional metamorphism and associated deformation and possibly to pre-date faulting.

METAMORPHISM

The rocks of the Fourchu Group are clearly metamorphic, but are of low metamorphic grade as indicated by the metamorphic mineralogy, the fine grain sizes of metamorphic minerals and the survival of detailed primary structures.

Metamorphic minerals most commonly include sericite, epidote, chlorite and pyrite, but minor amounts of very fine grained biotite, tremolite-actinolite and plagioclase occur locally. The phyllosilicates possess a very strong preferred orientation which creates the penetrative S_1 cleavage/schistosity. Epidote occurs as fine granular material disseminated throughout rocks, or within layers of appropriate composition, or as concentrations pseudomorphing mafic phenocrysts and partially replacing plagioclase phenocrysts in volcanic rocks and rock fragments. Very fine grained stubby biotite and sprays of tremolite-actinolite are apparently restricted to the more schistose mafic rocks. Pyrite appears to be the only true porphyroblastic mineral, locally forming abundant cubic porphyroblasts up to 2 cm across in chloritic schists and intermediate to mafic meta-tuffs. The common association of pressure shadows indicates that some deformation, perhaps late D_1 or D_2, followed their crystallization.

As the phyllosilicates parallel the S_1 schistosity and have been rotated and bent during the development of the S_2 crenulation cleavage, it can be deduced that regional metamorphism accompanied the D_1 deformation, but had waned prior to the D_2 and D_3 deformations.

From the mineralogies of the various rock types, the facies of regional metamorphism can be deduced as lower greenschist facies, transitional between quartz-albite-muscovite-chlorite and quartz-albite-epidote-biotite subfacies (Winkler, 1967). No garnet porphyroblasts were observed, such as those reported from the Fourchu Group in the Louisbourg area (Murphy, 1977) which, although retrograded, indicated the peak of regional metamorphism attained quartz-albite-epidote-almandine subfacies. Hence it may be that there is a slight decrease in metamorphic grade across the Fourchu Group from east to west.

This regional metamorphic event occurred under medium pressure and low to medium temperature Barrovian conditions.

PETROCHEMISTRY OF VOLCANIC AND RELATED INTRUSIVE ROCKS

Samples from nine flows, one mafic sill, two felsic sills and the Gull Cove crystal tuff were analyzed for major oxides and for eighteen minor and trace elements (Table 2-2). Although all of these rocks have experienced low grade metamorphism and penetrative deformation, the volatile contents are relatively low with H_2O ranging from 0.5 - 3.2% and CO_2 less than 0.1%. The Fe_2O_3/FeO ratios range from 0.2-2.8%,

Table 2-2. Geochemical analyses of volcanic and related intrusive rocks of the Fourchu belt.

MAJOR OXIDES (%)	BASALT SHEET	BASALT AND ANDESITE FLOWS						DACITE FLOWS			FELSITE SHEETS (DACITE)		QUARTZ-FELDSPAR CRYSTAL TUFF (RHYODACITE)	
SAMPLE NUMBER	F16-8555	F16-8171	F16-8105	F16-8079	F16-8078	F16-8077	F16-9054	F16-9121	F16-9025	F16-8101	F16-9070	F16-9005	F16-9076	F16-9058
Silica	46.85	48.59	52.66	53.05	54.73	54.84	56.07	60.72	63.15	67.67	69.03	69.85	71.73	74.47
TiO_2	1.75	1.02	1.29	1.67	1.54	1.19	1.00	0.67	0.85	0.62	0.72	0.80	0.27	0.17
Al_2O_3	15.87	17.92	19.98	15.76	15.06	16.61	15.27	18.19	16.07	14.16	14.60	13.36	14.03	11.74
Fe_2O_3	5.12	1.54	3.46	4.29	5.94	3.05	5.49	4.24	2.25	2.77	1.01	1.32	1.35	1.44
FeO	7.10	7.09	3.93	7.20	5.61	6.95	5.74	2.71	3.13	1.00	2.37	2.07	0.80	0.68
MnO	0.27	0.26	0.15	0.23	0.28	0.20	0.25	0.07	0.17	0.10	0.12	0.11	0.04	0.04
MgO	4.89	7.53	2.81	4.18	3.81	3.50	3.70	1.79	1.69	1.13	0.92	1.08	0.60	0.31
CaO	9.43	9.35	7.00	8.65	6.60	5.16	7.41	2.37	3.05	5.83	2.18	3.05	1.87	3.35
K_2O	0.30	1.15	0.40	0.62	0.73	0.67	0.66	1.47	0.96	1.61	1.51	0.43	2.60	1.15
Na_2O	2.93	2.55	4.81	3.11	4.87	4.18	3.14	3.54	5.80	2.64	5.20	5.15	4.33	4.33
H_2O^+	3.01	1.19	2.32	1.26	1.06	3.09	1.42	2.11	1.43	0.81	1.24	1.08	0.69	0.53
H_2O^-	0.14	0.08	0.00	0.07	0.06	0.06	0.00	0.01	0.04	0.06	0.00	0.00	0.02	0.00
P_2O_5	0.53	0.19	0.26	0.53	0.52	0.44	0.25	0.20	0.25	0.18	0.14	0.18	0.09	0.09
CO_2	0.20	0.05	0.07	0.04	0.07	0.05	0.02	0.05	0.02	0.05	0.02	0.05	0.04	0.02
TOTAL OXIDES	98.39	98.52	99.14	100.70	100.88	99.99	100.42	98.14	98.86	98.63	99.06	98.53	98.46	98.32
TOTAL IRON AS Fe_2O_3	13.01	9.42	7.83	12.94	12.17	10.77	11.87	7.25	5.73	3.88	3.64	3.62	2.24	2.20
TRACE ELEMENTS (ppm)														
Ba	190	400	155	205	450	260	395	498	395	340	538	187	638	395
Rb	7	59	2	32	22	7	8	39	13	54	26	4	73	20
Sr	435	350	495	472	560	330	320	270	220	740	200	308	180	280
Zr	86	70	145	90	75	90	86	105	100	155	260	190	225	200
F	460	280	600	430	430	450	340	690	290	240	340	290	250	220
Li	16	21	9	9	9	20	13	39	18	13	8	6	13	4
Y	25	16	30	28	20	35	18	22	27	38	39	30	14	10
Sn	1	1	3	7	6	5	2	2	2	4	3	3	2	1
Cu	41	62	39	14	12	17	160	10	4	5	-1	1	-1	1
Mo	3	4	7	4	3	3	3	3	3	4	3	4	3	3
Pb	8	4	10	12	10	8	22	2	8	76	6	8	8	15
Zn	150	87	77	98	109	180	155	104	103	143	101	64	44	22
Ag	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bi	0.3	0.1	0.3	1.1	1.1	1.4	0.2	0.1	0.1	0.3	0.1	0.1	0.1	0.2
S	80	160	680	100	120	280	1360	60	80	120	60	60	40	60
Co	25	38	10	19	18	13	27	15	4	1	1	1	1	-1
Ni	195	133	100	22	45	12	22	50	7	1	1	4	3	2
Cr	380	450	390	22	36	24	38	175	35	30	22	20	20	34

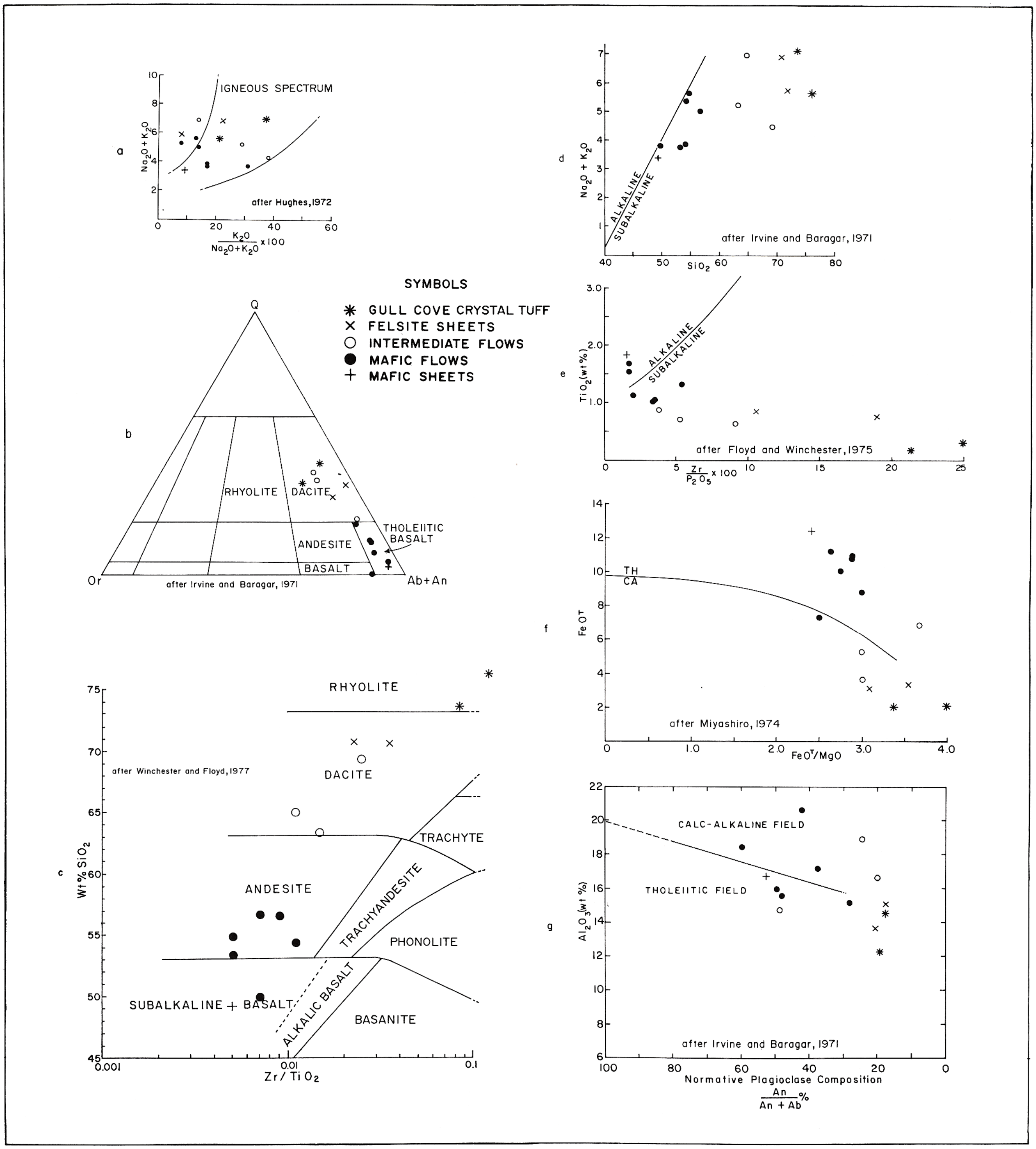


Figure 2-5. Geochemical discrimination diagrams for Fourchu Group volcanic and related intrusive rocks.

with the majority being less than 1%. Plotted on Hughes' (1972) igneous spectrum (Fig. 2-5a), two thirds of the samples fall within the normal igneous spectrum for Na_2O and K_2O values, but the other one third fall within the spilitic spectrum (i.e. enriched in Na_2O), suggesting that caution be exercised in using the more mobile elements for classification.

Based on SiO_2 contents (volatile-free), normative quartz-K-feldspar-plagioclase proportions (Fig. 2-5b) and a plot of SiO_2 vs. Zr/TiO_2 (Fig. 2-5c), the volcanic rocks range from basalt through andesite to dacite, whereas the mafic sill is basaltic and the felsic sill and quartz-feldspar crystal tuff are dacitic to rhyodacitic.

Plotted on $Na_2O + K_2O$ vs. SiO_2 and $TiO_2:Zr/P_2O_5$ diagrams, the samples are seen to be essentially subalkaline on both diagrams (Figs. 2-5d, e). The same pattern is incidentally shown by the plot of $SiO_2:Zr/TiO_2$ (Fig. 2-5c).

Based on the major oxide chemistry and specific subalkaline character, these rocks appear to be transitional from tholeiitic into calc-alkaline as shown by plots of total FeO: total FeO/MgO (Fig. 2-5f) and Al_2O_3: normative plagioclase (Fig. 2-5g). However, plots involving total FeO and MgO may not be very reliable for characterizing metavolcanic rocks (Garcia, 1978). The tectonic setting of the more mafic members can be deduced using discrimination diagrams involving less mobile major oxides such as MgO-total FeO-Al_2O_3 (Pearce et al., 1977), and relatively immobile minor trace elements such as Zr-Ti-Y (Pearce and Cann, 1973). In the former diagram (Fig. 2-6a) the samples are scattered, but tend to straddle the boundary between the orogenic and continental fields. However, in the latter (Fig. 2-6b) they fall mainly within the overlapping fields of calc-alkaline basalts, low-K tholeiites and ocean-floor basalts.

Considering all the evidence from both the major oxide data and from the minor and trace element data (especially those involving the less mobile elements), the suite of volcanic and associated intrusive rocks from Gabarus Bay appears to be mainly a comagmatic suite, transitional between low-K tholeiites and calc-alkaline magmatic types, presumably generated in an orogenic, ensialic magmatic arc. The transitional nature of this suite could indicate a locus of generation on the side of the arc proximal to the paleotrench, or on relatively thin continental crust or both. Such a conclusion is consistent with that of Keppie et al. (1979) for the Fourchu Group in the Louisbourg area.

MINERALIZATION

To date, the most important mineralization found in the vicinity of Gabarus Bay is the polymetallic sulphide mineralization at Deep Cove with its satellite occurrences at Eagle Head and on Kennington Cove Brook. This mineralization appears to be hydrothermal epigenetic in type, genetically and spatially associated with an altered granitic stock which has intruded and hornfelsed rocks of the Fourchu Group (Bingley, 1969; Riddell, 1973; Sangster, 1977b).

Other showings and occurrences of base metal mineralization have been reported from the general area (Fig. 0-1). These are perhaps best described as Fe-Cu occurrences consisting mainly of Fe sulphides, and(or) oxides and hydroxides with associated minor to trace amounts of Cu minerals. Of these occurrences, only those in the vicinity of Irish Brook and MacIntyre Lake have been investigated in any detail: the former by soil and stream sediment geochemistry and limited diamond-drilling

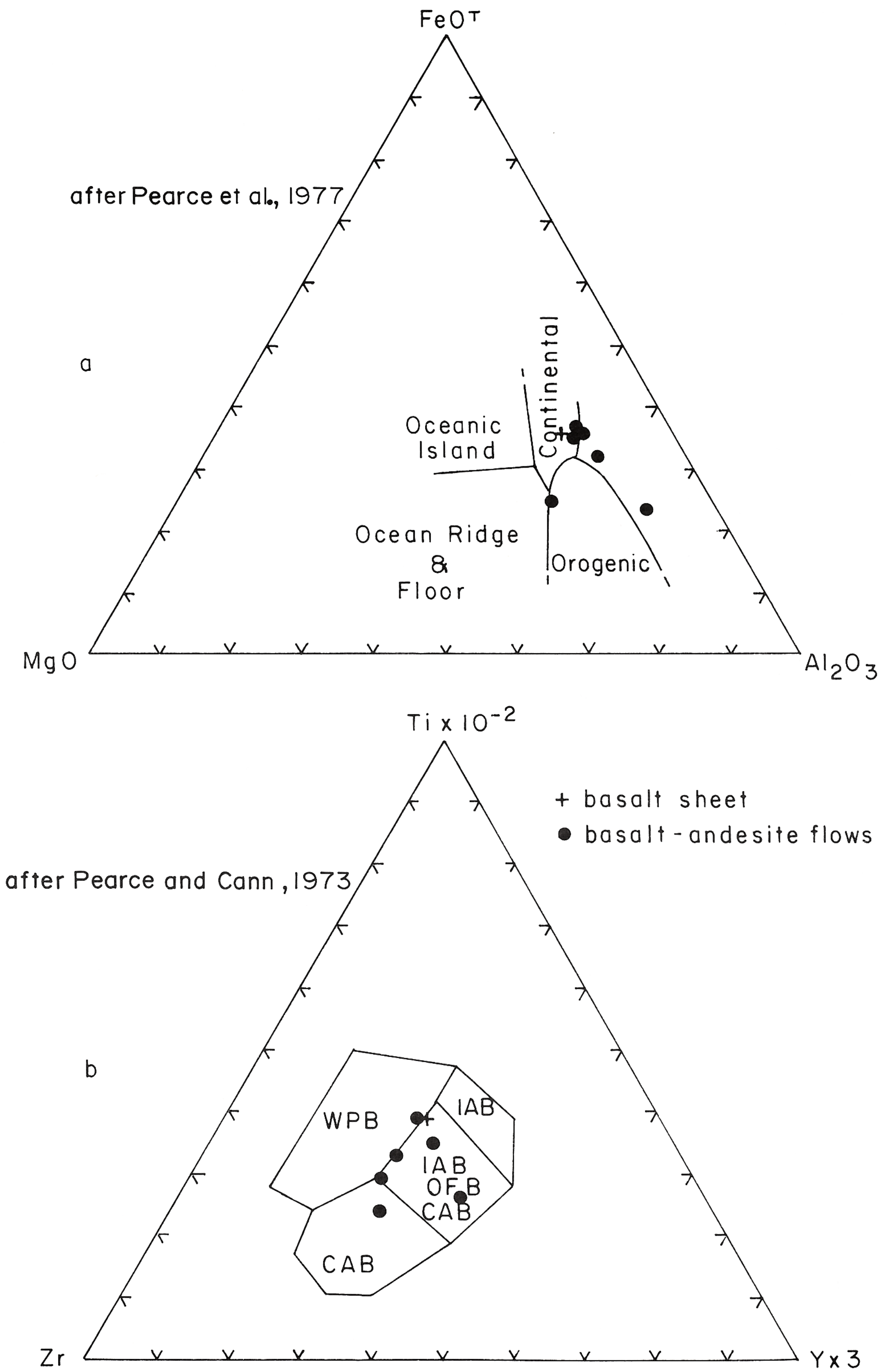


Figure 2-6. Tectonic setting diagrams for Fourchu Group mafic volcanic and related intrusive rocks.

(Leslie, 1969) and the latter by pitting, trenching and diamond-drilling (Perusse, 1960).

In addition to the above reported occurrences, several other occurrences or showings in roadside outcrops along the Gabarus-Marion Bridge road, near Gull Cove, were observed and sampled during mapping.

DEEP COVE

For comparison with other occurrences of mineralization in the area of Gabarus Bay, the Deep Cove property (Fig. 2-7) was briefly examined and 1840 m of core were logged. The core had been drilled in 1976 by St. Joseph Explorations Limited and in 1979 by Louisbourg Mines Limited. A total of 30 thin sections were also studied to help establish some of the more obvious effects of alteration on both the host granite and the older volcanic rocks of the Fourchu Group, and its relationship to mineralization.

The granitic intrusion is a small, roughly elliptical stock with a faulted western margin and a more shallowly dipping eastern margin (Fig. 2-7). The western margin is in part sheeted, and granitic sheets also intrude the Fourchu Group at several localities along the shore. Petrologic studies (O'Beirne, 1979; Barr et al., 1982) have shown these intrusive rocks to be variably porphyritic granites of calc-alkalic affinity. The Rb/Sr age of the stock is 342 $\pm$ 20 Ma (Cormier, 1972; Keppie and Smith, 1978), but a K/Ar mica age of 387 Ma (M. Zentilli, personal communication, 1983) suggests perhaps that the Rb/Sr age has been disturbed by pervasive alteration.

The mineralization has been described as being of two main types (Riddell, 1973; Forgeron, 1974):

(1) simple molybdenite mineralization, as veins and disseminations, best developed along the faulted western contact of the stock; and

(2) polymetallic (Cu, Zn, Mo, Bi and Ag) mineralization in several zones within the east-central part of the stock. Pyrite, chalcopyrite, sphalerite, molybdenite and bismuthinite are the sulphides present. The mode of occurrence of Ag has not yet been described, but a strong correlation with Zn values has been reported (Riddell, 1973).

The stock is extensively altered and there has been considerable speculation as to the types of alteration present, their distribution in space, zoning patterns (if any), and their relationship and significance with respect to mineralization (cf. Riddell, 1973; Chatterjee, 1976; Sangster, 1977b).

Logging of available core (see representative logs on Fig. 2-7) shows that alteration is pervasive and extends to depths of at least 150-250 m beneath the surface before fading into very weakly altered or essentially unaltered grey granite (Fig. 2-8a). Superimposed on this pervasive alteration are numerous zones of more localized, intense, essentially reconstructive alteration, which are apparently most extensively developed within 60-90 m of the present surface. Much of this intense alteration appears to be closely associated with fracturing and veining, although some diffuse zones were also observed.

Pervasive Alteration

The pervasively altered granite ranges from pale pink to pink and dull green. In the slightly altered pale pink granite, the plagioclase phenocrysts are sericitized, and anhedral biotites (3-10%) are partially altered to chlorite with or without minor

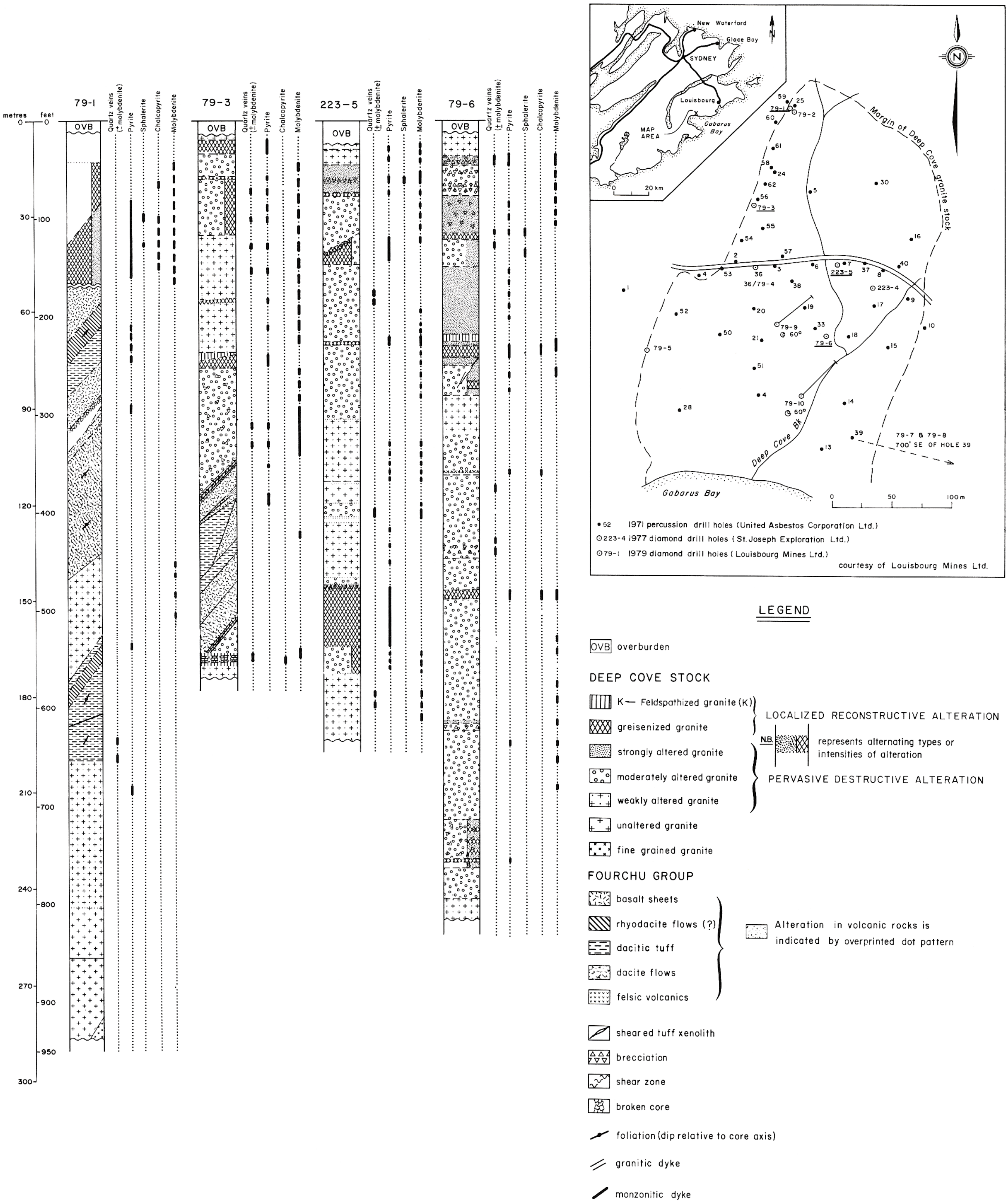


Figure 2-7. Drillhole location map and representative drill core sections, Deep Cove Brook, Gabarus Bay.

sericite. With increasing alteration, the plagioclase becomes dull green due to extensive alteration to saussurite and hydromicas(?), whereas the biotite becomes dull bronze due to extensive alteration to sericite and chlorite (Figs. 2-8b, c).

Localized Alteration

Two distinctive types of localized reconstructive alteration are recognized, namely greisenization and K-feldspathization.

Greisenization has produced common, generally narrow zones (2-3 cm to 20 m thick) of quartz-sericite-pyrite greisen. Typically, this is a yellowish-grey to grey, subporphyritic to aplitic rock consisting of subporphyritic quartz, commonly with sutured grain boundaries, in a fine- to medium-grained allotriomorphic inequigranular groundmass of quartz, sericite, orthoclase, calcite and pyrite (Fig. 2-8d) within which may still be recognized some ghostly outlines of plagioclase and biotite, completely pseudomorphed (respectively) by saussurite, hydromicas(?), sericite and calcite, and by sericite, chlorite, calcite, rutile(?) and leucoxene(?). Such greisens are locally cut by veinlets of calcite and(or) quartz with varying amounts of fine grained pyrite. Some of these greisen zones have subsequently been sheared or brecciated and these display highly strained quartz and kinked sericite. The greisens may either grade through

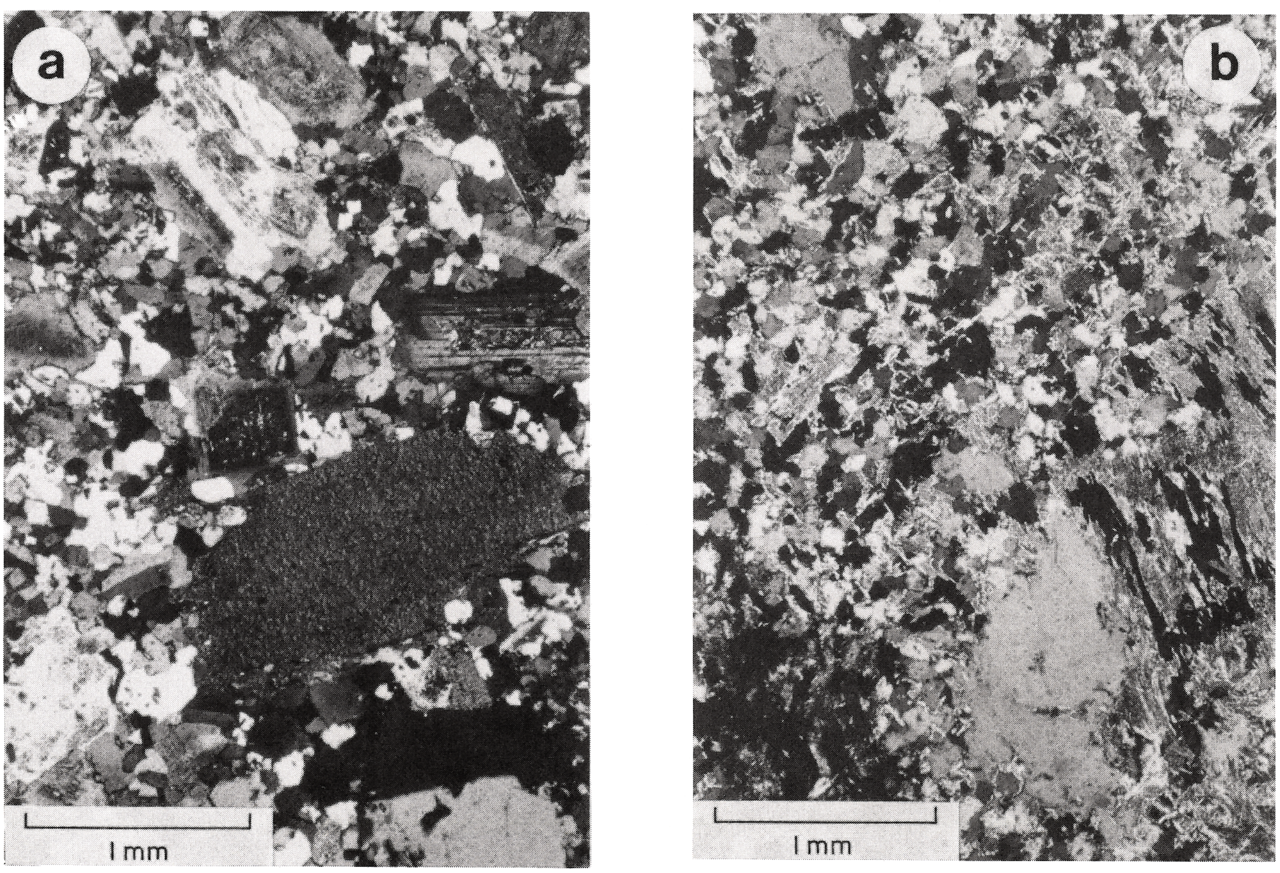
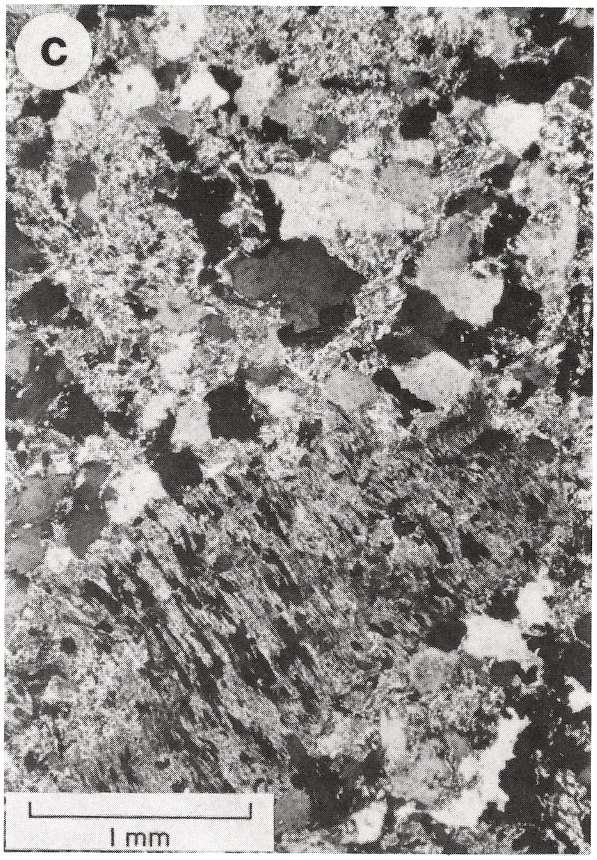
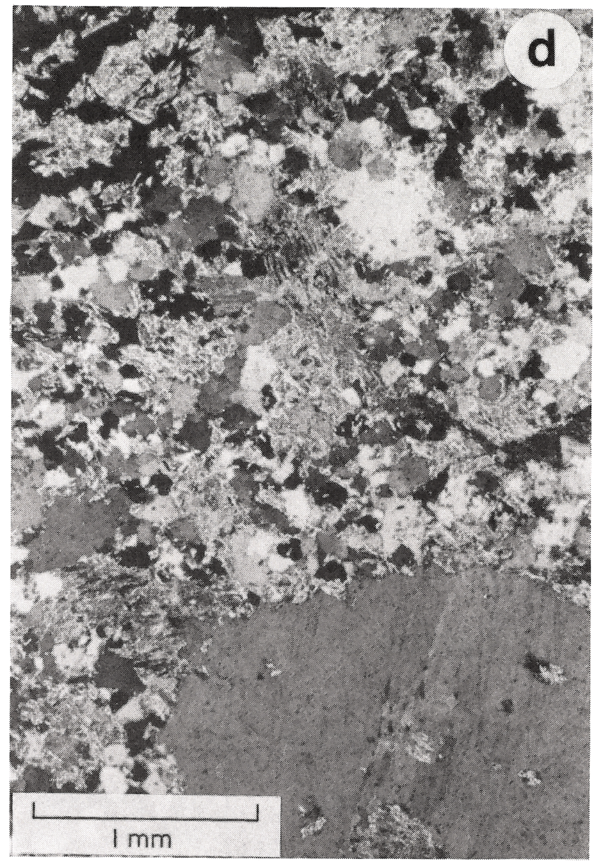


Figure 2-8. Alteration of Deep Cove granite.
a. Relatively fresh biotite granite.
b, c. Highly altered granite with chloritized and sericitized biotite phenocrysts (c over).
d. Greisenized granite with relict quartz phenocryst (over).





greisenized granite into altered granite or they may be flanked by relatively distinct K-feldspathized zones.

Narrow zones of K-feldspathization up to 30 cm thick usually flank fractures, veins and greisen zones; less commonly they form diffuse zones up to 1 m wide lacking any obvious focus, and rarely they flank narrow biotite-rich zones. In appearance, these zones are intensely pink and range in texture from normal porphyritic to more equigranular aplitic. Typically these rocks consist of quartz, microcline, plagioclase and fresh biotite (hydrothermal?) with hypidiomorphic to allotriomorphic granular textures.

The relationships between these two types of alteration are somewhat ambiguous in the sense that greisen zones are locally, but not ubiquitously, flanked by K-feldspathized zones but the latter commonly occur in the absence of greisen zones (Fig. 2-7). Where measurable, orientations of these zones are variable relative to the drill core axes, but most generally fall in the range 30-55°, indicating that they are moderately to steeply dipping. Their strikes could not be directly determined from the core but Riddell (1973) has shown that the granite has been cut by two principal directions of veins, fractures and shears: (1) striking 030-050° and dipping 30-50° northwest (veins and fractures) and (2) striking 090-110° and dipping 60-70° south (shears and fractures).

Association with Mineralization

Mineralization observed in the core has several modes of occurrence:

(1) a quartz veins (<5 cm) with coarse molybdenite ± pyrite cutting all rock types

b calcite ± quartz veinlets (<1 cm) with fine pyrite ± molybdenite cutting greisen zones

(2) dry fracture coatings of pyrite ± molybdenite

(3) sparse disseminations:

common — molybdenite, pyrite
rare — chalcopyrite, sphalerite, bismuthinite(?)

in weakly altered granite
in strongly altered granite
in greisen zones

In general, these sulphides are widely, if sparsely, distributed throughout the core. However, some broad patterns of distribution can be discerned in the core:

(1) more common occurrences of molybdenite in quartz veins and in disseminations in altered granite above the footwall volcanic rocks along the western margin of the stock (Drillholes 79-1 and 3 in Fig. 2-7). Two holes, DC-2 and DC-25, percussion drilled in 1971, averaged 0.22% and 0.32% MoS_2 over 26 m and 40 m respectively (Forgeron, 1974).

(2) sphalerite and(or) chalcopyrite with traces of bismuthinite(?) usually associated with molybdenite and more abundant pyrite appear to occur more commonly in the central and eastern parts of the stock - a pattern that was described by Riddell (1973) and Forgeron (1974) on the basis of geochemistry derived from the 1971 percussion-drilling program. Whereas the sphalerite (and bismuthinite?) appears to be restricted to greisenized and intensely altered zones occurring within about 75 m of the surface, chalcopyrite is apparently more widely distributed and is found disseminated within both greisenized and pervasively altered granite reaching greater depths.

Alteration and Mineralization in Fourchu Group Rocks

In general, alteration and mineralization are much less obvious in drill core from the Fourchu Group rocks occurring along the western contact of the Deep Cove stock and farther away from the stock to the north and east. The rocks are primarily metamorphosed dacites, dacitic tuffs (some waterlain) and lesser rhyolites cut by metabasalt and rarer feldspar porphyry sills and by altered granitic sheets.

Pervasive alteration is apparently absent, with only localized alteration occurring over distances of a few cm, rarely up to 30 cm, adjacent to quartz veins, fractures, occasional breccia zones and a few intensely altered, usually K-feldspathized(?) granitic sheets. The most common type of alteration appears as a flesh-coloured bleaching of the Fourchu rocks, although in some places this is preceded by a narrower zone of pink K-feldspathization associated with such alteration, but also extending beyond it, are common quartz-calcite ± pyrite ± hematite veinlets, lesser molybdenite and pyrite fracture coatings and patchy disseminations of pyrite.

IRISH BROOK OCCURRENCES

Minor sulphide showings occur on Irish Brook and in roadside outcrops both to the north and south of the brook (Fig. 2-9). These occurrences are hosted by

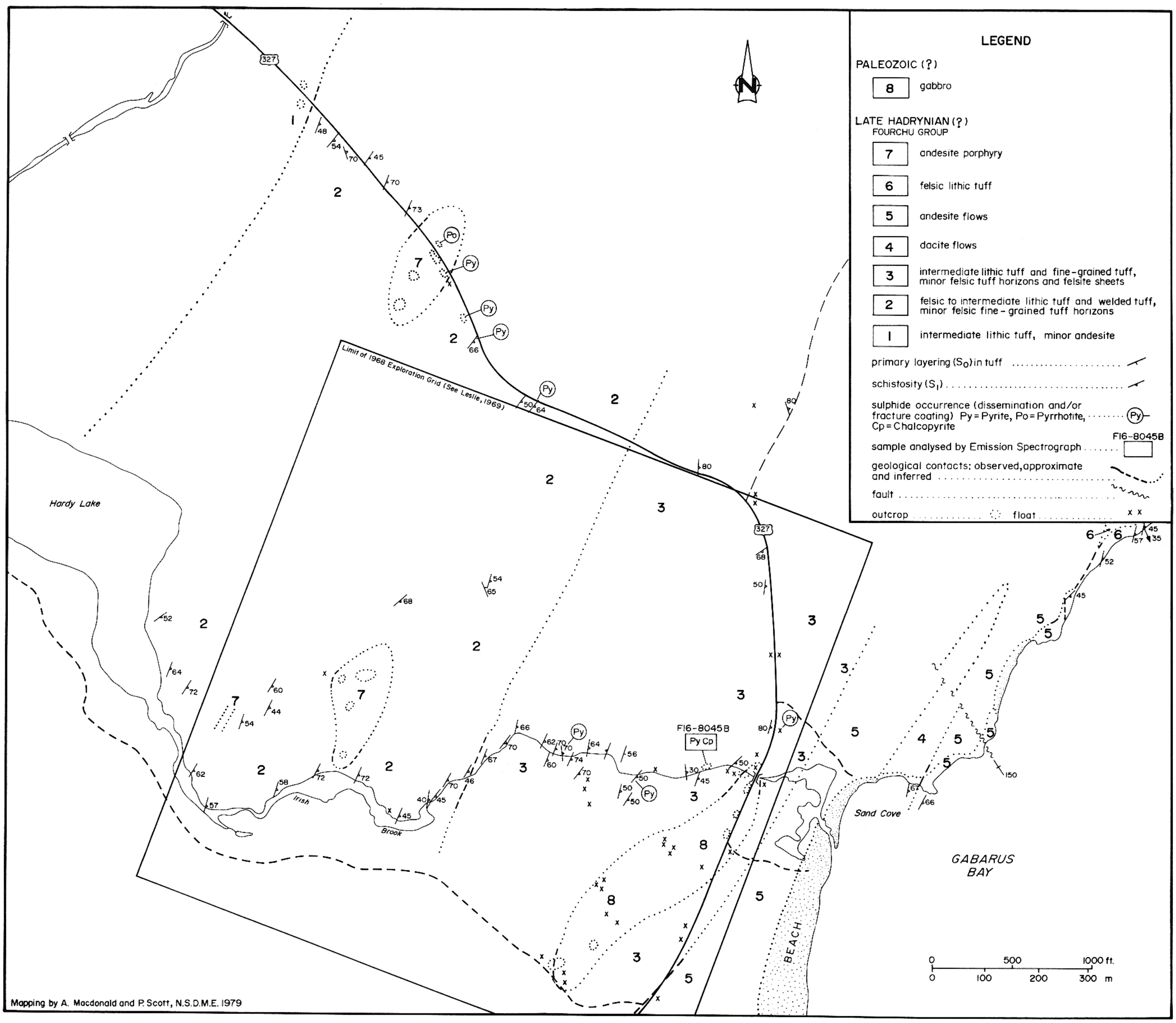


Figure 2-9. Detailed geological map of Irish Brook pyrite-chalcopyrite showings, Gabarus Bay, Fourchu belt.

a variety of metavolcanic and pyroclastic rocks of the Fourchu Group.

The main occurrence has been described as "a weakly mineralized copper zone about 20 feet wide in Irish Brook about 400 feet upstream from the highway", to the northeast of which a sizeable, but weak Cu anomaly with a peak value of 250 ppm has been defined by soil geochemistry (Leslie, 1969). An exploratory diamond-drill hole into this anomaly encountered tuffaceous andesite and andesite containing scattered sections of pyrite and pyrrhotite (2-3%) as fine disseminations and in veinlets. Scattered grains of chalcopyrite are associated with the veinlets within the more tuffaceous units. Copper values did not exceed 0.2% (Leslie, 1969).

For this study, pyritic showings at Irish Brook and in roadside outcrops to the north and south were sampled for ore microscopic and spectrographic studies.

The sulphides occur mainly as fine- to medium-grained sparse disseminations crudely conformable with layering and schistosity (S_{0-1}), as localized small aggregates and irregular masses, and as short (quartz-calcite) veinlets within intermediate to mafic lithic tuffs and andesites. Mineralogically the sulphides consist predominantly of pyrite with lesser magnetite, minor chalcopyrite, rare sphalerite and trace pyrrhotite.

Pyrite generally forms fine- to medium-grained subhedral to euhedral disseminated crystals, less than 2 mm in diameter, sufficiently concentrated locally to form irregular crystalline aggregates (Fig. 2-10a). Rarely, the crystals display skeletal habits. Magnetite occurs in fine grained anhedral to subhedral disseminations, rarely in aggregates or masses. Irregular to lamellar patches of hematite may occur within some magnetite grains. Chalcopyrite is generally found as small anhedral grains or patches occurring in localized sparse disseminations and in short veinlets, usually associated with pyrite. It also occasionally occurs as very small anhedral inclusions within pyrite, as narrow rims around pyrite, and as exsolved (?) emulsion blebs within rare sphalerite. Sphalerite occurs only rarely, as small anhedral patches adjacent to chalcopyrite (Fig. 2-10a). Pyrrhotite is found only as rare inclusions within some pyrite crystals.

Although the mineralization appears broadly conformable with layering and schistosity in the host rocks, the apparent lack of deformation and recrystallization features, together with its common occurrence in veinlets, suggest that it was introduced after deformation and metamorphism and is epigenetic. Source and conditions of deposition are as yet unknown.

Many of the samples show some alteration effects, presumably due to supergene weathering since they were collected from surface outcrops. Pyrite is commonly partially altered to goethite/limonite, and chalcopyrite displays thin rims of covellite.

A spectrographic scan of a single sample from the Irish Brook occurrence indicated a Cu concentration in the range 0.01-0.033% whereas a sample from a weakly mineralized roadside outcrop 0.5 km south of the brook contained 0.5-1.0% Cu (Table 2-3).

OCCURRENCES SOUTH OF GABARUS BAY

Minor pyritic occurrences are found along the southern shore of Gabarus Bay at Gull Cove (Figs. 2-2, 2-11) and Cape Gabarus (Fig. 2-1), and also farther to the south, outside of the mapped area, at Winging Point and on the Fourchu Road (Fig. 0-1). These occurrences show many similarities to those at

Irish Brook, except that chalcopyrite is either much rarer or absent. Typically, the occurrences are very fine- to medium-grained sparse disseminations ranging from dispersed to local irregular aggregates locally concordant with the S_{0-1} layering and foliation. Short veinlets may also be present, and in one example from Gull Cove, the mineralization occurs entirely within quartz veins. In these occurrences, the mineralization covers no more than a few square metres and the concentration is generally less than 2-3% sulphides by volume, except at the Cape Gabarus occurrence where mineralized boulders from the till bank on the east side of Gull Cove contain 10-15% pyrite.

The mineralogy consists predominantly of pyrite, with lesser magnetite and associated hematite, minor chalcopyrite and very rare bornite and pyrrhotite. Pyrite forms subhedral to euhedral cubes, octahedra and aggregates (Figs. 2-10b to d), except in some material from Gull Cove which is anhedral and inclusion-filled. Magnetite forms fine grained anhedral disseminations and rare coarser aggregates in which lamellar intergrowths of hematite can be seen (Fig. 2-10b). Chalcopyrite is quite uncommon and is found only as isolated small anhedra at or near pyrite grain boundaries, some possibly in weak pressure shadows, or as small inclusions within pyrite (Fig. 2-10c).

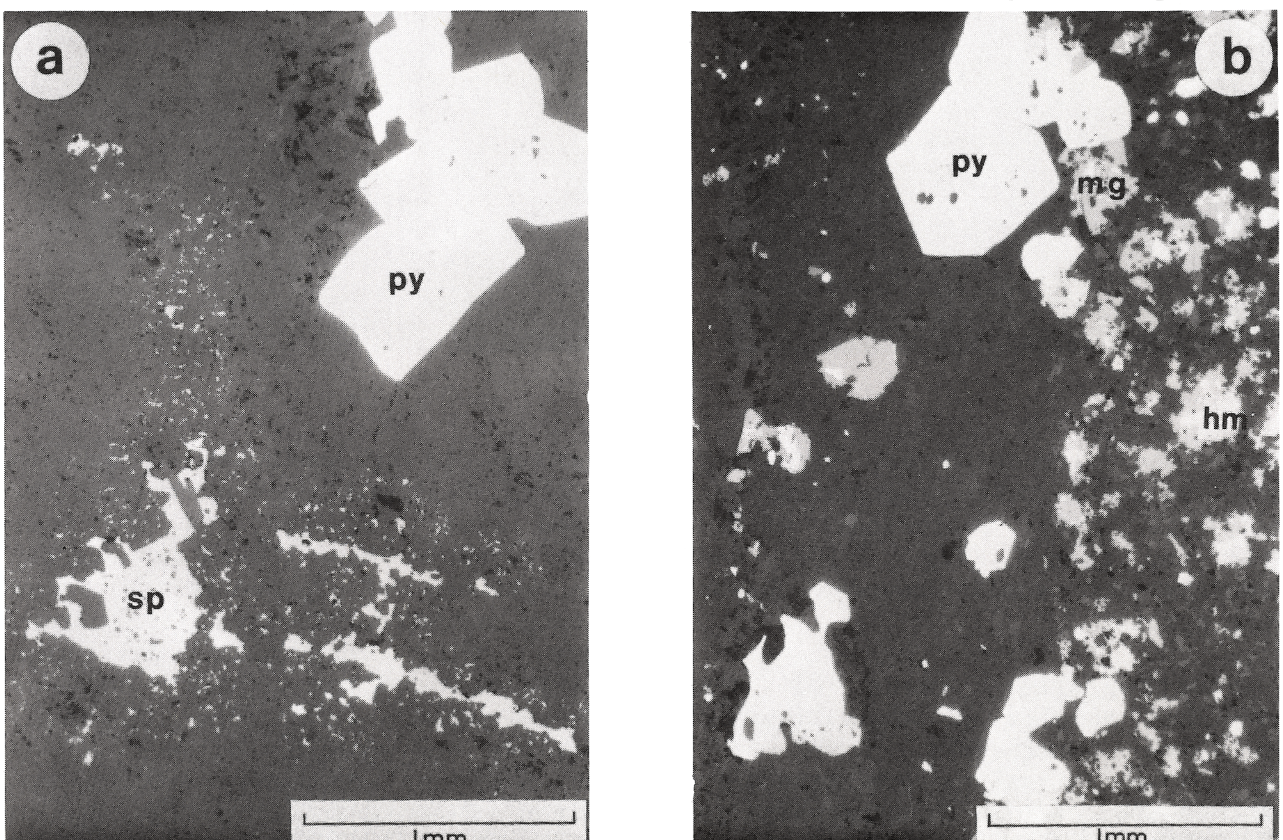


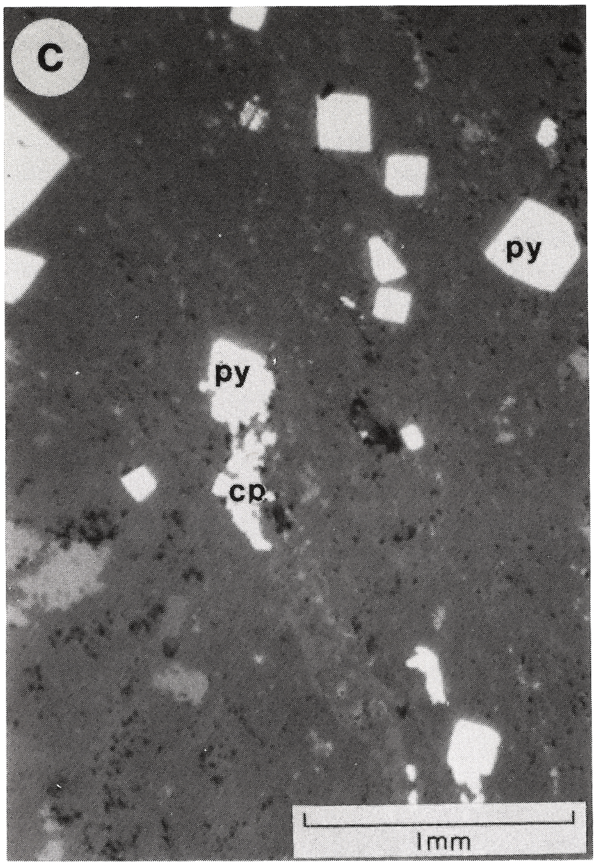
Figure 2-10. Some microscopic features of sulphide mineralization near Gabarus Bay (over).

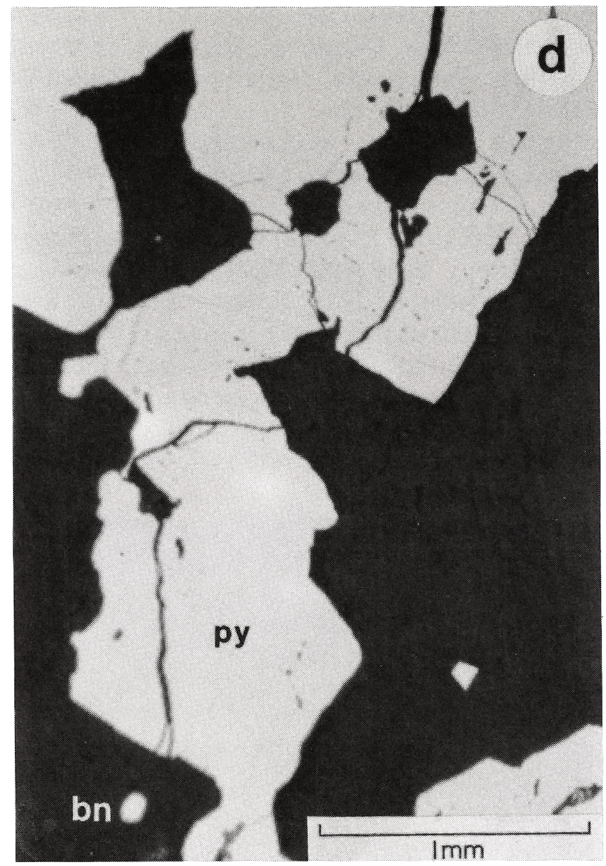
a. Pyrite (py) cubes plus anhedral-subhedral sphalerite (sp) containing exsolved(?) blebs of chalcopyrite (Irish Brook area).

b. Pyrite octahedra plus anhedral magnetite-hematite (mg-hm, Gull Cove).

c. Scattered pyrite cubes with localized anhedral chalcopyrite (cp, Gull Cove) (over).

d. Coarse pyrite with rare blebs of bornite (bn, Cape Gabarus) (over).





Bornite and pyrrhotite are extremely rare, with bornite occurring as occasional tiny inclusions within pyrite and gangue (Fig. 2-10d) and pyrrhotite as small rounded blebs within pyrite.

Spectrographic scans of six hand-picked samples of mineralization from these occurrences (Table 2-3) suggest that Cu values are generally less than about 0.03%, Mn is present in some samples in concentrations up to 0.5%, and trace amounts of Pb and possibly Mo are present in a few samples.

MACINTYRE LAKE

There is an interesting occurrence of mineralization at MacIntyre Lake which lies some 10 km southwest of Gabarus Bay (Fig. 0-1) and hence outside of the mapped area. However, as the host rocks resemble those around Gabarus Bay with patches of Carboniferous rocks resting unconformably upon the Fourchu Group, this occurrence was also briefly examined and sampled. Previous investigations included pitting, trenching and mapping by New Jersey Zinc Company (McNamee, 1957), and limited diamond-drilling by Kennco Limited (Pérusse, 1960). Thin pockets of conglomerate and grit, overlain by brown limestone assigned to the basal Windsor Group, which unconformably overlie schistose lithic tuffs of felsic and intermediate compositions belonging to the Fourchu Group, occur around the western and southwestern end of the lake (Fig. 2-12).

Table 2-3. Results of emission spectrographic scans of selected pyritic mineralization.

	%							
Sample	<.001	.001-.0033	.0033-.01	.01-.033	.033-.1	.1-.5	.5-1	>1
IRISH BROOK								
F16-8045B	Be,Yb	Ag	Y,Ni Co,Sc	V,Cr,Zr Cu,Sr	Ba	Mn	Ti	Si,Al,Fe Mg,Ca,Na
F16-8170B	Be,Yb Ag	Cr,Ni	Y,Co Sc	Zr,Ba	V Sr		Cu Ti	Si,Al,Fe,Mg Ca,Na
GULL COVE								
F16-9046B	Be	Yb,Ag Ni	Cr,Y,Co Sc	Zr,Cu	V,Sr Ba		Ti	Si,Al,Fe,Mg Ca,Na
F16-9048B	Be,Yb Ag	Y,Cu Ni	Cr,Co Sc	V,Zr Sr	Ba		Ti	Si,Al,Fe,Mg Ca,Na
CAPE GABARUS								
F16-8106A	Be,Yb V	Mn,Y Ag,Sc Sr	(In??) Cr,Ni	Mo?,Mg Pb,Zr,Sc Ba	Ca,Co	Al Ti		Si,Fe
F16-8106B	Be,Yb Ag	Y,Ni Co	(In??)Mo? V,Mn,Sc Sr	Cr,Cu Ba	Mg,Zr	Ca	Ti	Si,Al,Fe, Na
WINGING POINT								
F16-8107B	Be,Yb Ag	Cr,Cu Ni	Y,Co Sc,Ba	V,Zr	Sr	Mn	Ti	Si,Al,Fe,Mg, Ca,Na
FOURCHU ROAD								
F16-8164B	Be,Yb Ag,Co	Cr,Ni Sc	V,Y	Zr,Cu Sr	Mn Ba	Ti		Si,Al,Fe,Mg, Ca,Na
MACINTYRE LAKE								
F16-8200	Be,Yb Ag	Cr,Ni	Y,Co Sc	V,Zr	Sr	Cu	Ti Ba	Si,Al,Fe,Mg, Ca,Na
F16-8201	Be,Yb Ag	Cr,Ni	Y,Co Sc	V,Zr		Ti Zn Sr	Cu	Si,Al,Fe,Mg, Ca,Na,Ba

If not listed above not detected, but if present:

<1%	P, Na
<.1%	As, W, Ta
<.05%	U, Zn
<.033%	Tl, Th, Ce
<.01%	B, Ge, Sb, Nb, In, Pb, Nd, La
<.005%	Mo,Sn,Bi
<.0033	Ga

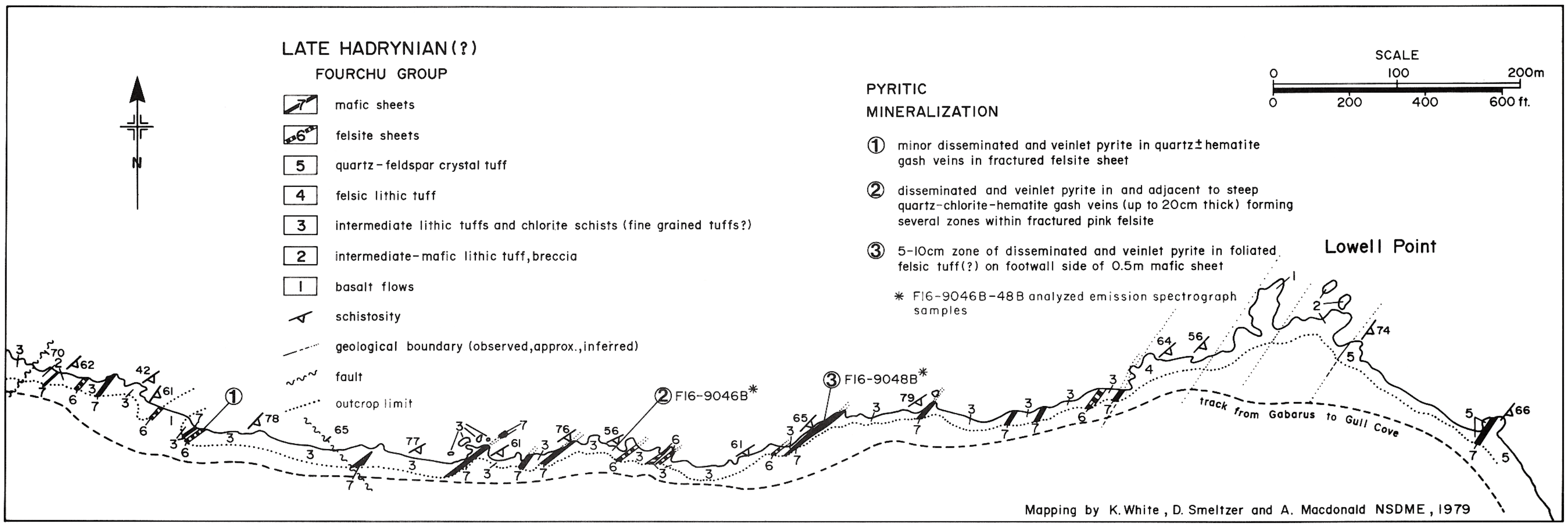


Figure 2-11. Detailed geological map of Gull Cove pyrite showings, Gabrus Bay, Fourchu belt.

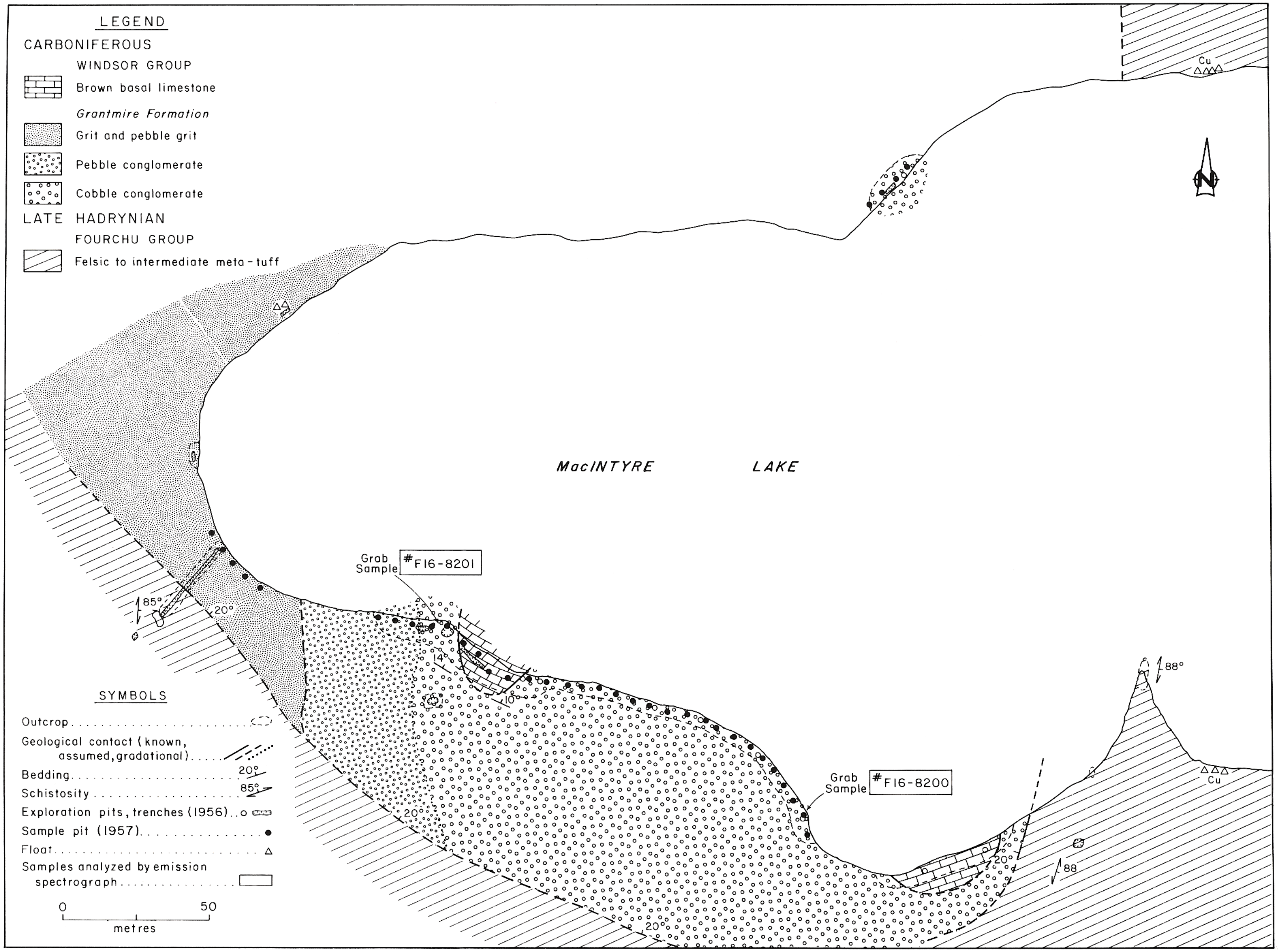


Figure 2-12. Detailed geological map of McIntyre Lake chalcopyrite showing (after Perusse, 1960), Fourchu belt.

The mineralization consists of disseminations of pyrite and lesser chalcopyrite and malachite, with small amounts of sphalerite and galena also having been reported (Perusse, 1960). It is essentially restricted to the matrix of the conglomerate, which is partly cemented by medium grained calcite. This calcite is a gangue mineral and the mineralization as a whole appears to be introduced, although Perusse (1960) suggested that it could have been sedimentary in origin. Spectrographic analyses of two samples of mineralized matrix material indicate Cu values about 0.5% and Ba values about 1%, and one sample contained, in addition, 0.1-0.5% Zn (Table 2-3).