

ECONOMIC GEOLOGY OF THE EASTERN HERMITAGE FLEXURE

by
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INTRODUCTION

This report summarizes the initial results of a project designed to investigate the regional geology and mineral deposits of the Hermitage flexure. The objectives of this study are to classify the various mineral deposits in 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.

Work during the 1979 field season was centered in the Bay d'Espoir area where numerous mineral occurrences have previously been reported (Douglas and Hsu, 1976) and where recent mapping by Colman-Sadd (1974, 1976), Colman-Sadd *et al.* (1979) and Falconbridge Nickel Mines Staff (1976) has provided a geologic framework for evaluating the significance of the various occurrences. Of central interest in this area was the Isle Galet Formation, a volcano-sedimentary sequence which forms the eastern limit of the Ordovician Baie d'Espoir Group. In this unit, rhyolitic flows, ash flows and pyroclastics and minor mafic volcanic rocks are interbedded with a variety of pelitic schists, psammitic and conglomeratic tuffaceous sediments and graphitic schists along a strike length in excess of 100 km. A number of mineral occurrences have previously been reported from this unit (Douglas and Hsu, 1976) and particular emphasis was placed on evaluating their significance with respect to regional volcanic stratigraphy in the Isle Galet Formation.

In addition, numerous showings of molybdenite, galena, pyrite, arsenopyrite and stibnite have been

reported from other levels of the Baie d'Espoir Group and most of these were visited during the course of the program.

Both the Isle Galet Formation and the adjacent Riches Island Formation of the Baie d'Espoir Group were found to be host to a number of apparently stratabound sulfide occurrences, which appear to be synvolcanic in origin. In addition, epigenetic deposits of molybdenite, galena, barite, stibnite and associated metallic minerals are present which are probably related to the intrusion of nearby granites.

GENERAL GEOLOGY

The regional geology of the Baie d'Espoir area has previously been described by Colman-Sadd (1974, 1976, 1978). It is most conveniently considered in terms of three major components, *viz*; the Precambrian (?) Little Passage Gneisses and equivalents, sedimentary and volcanic rocks of the Ordovician Baie d'Espoir Group, and various granitoid intrusive rocks of early to mid-Paleozoic age.

The oldest rocks of the Bay d'Espoir area are dominantly psammitic to semipelitic gneisses assigned to the Little Passage Gneisses in southern Bay d'Espoir (Colman-Sadd, 1974) and unnamed elsewhere. They include lesser amounts of amphibolitic and tonalitic gneiss, were deformed prior to deposition of the Baie d'Espoir Group and are suggested by Colman-Sadd (in press) to be of late Precambrian to early Paleozoic age.

The gneissic rocks are overlain by metasedimentary and metavolcanic rocks of the Baie d'Espoir Group. The contact is commonly a thrust fault (the Day Cove Thrust of Colman-Sadd, 1974, 1976) which

has been traced from southwestern Bay d'Espoir to the eastern edge of the St. Alban's map area. The Baie d'Espoir Group has been divided into five formations, three of which (the North Steady Pond, St. Joseph's Cove and Salmon River Dam Formations) display features characteristic of turbidite deposits (Colman-Sadd, 1976, 1979). Sediments of the two most southeasterly formations, the Riches Island and Isle Galet Formations, do not show evidence of turbidite deposition, the former comprising mainly green-gray pelite with minor interbedded siltstone and the latter consisting of dominantly green to gray pelite, tuffaceous graywacke and conglomerate and graphitic schist. Pebble lithologies in the graywacke and conglomerate are both volcanic and gneissic suggesting derivation from both the volcanic rocks of the Isle Galet Formation and from the deformed terrain to the southeast. The Isle Galet Formation contains considerable amounts of volcanic rocks, generally felsic in composition, which are described more fully below. Minor amounts of intermediate to felsic tuffs and flows are present within the Riches Island Formation and a single major felsic pyroclastic unit is found within the St. Joseph's Cove Formation. This latter unit is termed the Twillick Brook Member (Colman-Sadd, 1979) and appears to be a large ash flow which can be traced from near Twillick Brook on the Bay d'Espoir highway to east of Kepenkeck Lake over 60 km to the northeast.

A variety of plutonic granitoid rocks are present in the area. North of Lampidoes Passage, the North Bay Granite, a locally garnetiferous leucocratic granite, intrudes the Baie d'Espoir Group. Aplites, pegmatites and quartz veins near the margin of this granite are locally mineralized with pyrite, molybdenite and beryl. The Little Passage Gneisses in southern Bay d'Espoir are cut by a variety of plutonic rocks ranging from tonalite to megacrystic biotite granite and garnetiferous muscovite granite. These

granites have not been seen cutting the Baie d'Espoir Group. Northeast of Bay d'Espoir, Little Passage Gneiss equivalents and the Baie d'Espoir Group are cut by granitoid rocks of the Ackley Granite and adjacent older granitoid intrusions (Dickson *et al.*, this volume).

THE ISLE GALET FORMATION

The Isle Galet Formation contains the bulk of the volcanic rocks found within the Baie d'Espoir Group and as such is a potential host for volcanogenic massive sulfide deposits. Considerable time during the present program was spent in an attempt to interpret the relationship between known mineral occurrences in this unit and its volcanic stratigraphy; the objectives were to determine which of these occurrences were synvolcanic and to identify favourable environments for further massive sulfide deposition. In doing this, the formation was traced beyond its previously mapped extent (Colman-Sadd, 1974, 1976) west to the area of Facheux Bay and northeast to Kaegudeck Lake.

Three distinct volcanic facies, which are mutually gradational and which appear to represent variations in water depth and proximity to centers of volcanic activity, are developed in the Isle Galet Formation. These are herein termed the western, central and eastern facies.

The western facies is developed between Lampidoes Passage and the termination of the Baie d'Espoir Group west of Facheux Bay. Its volcanic component comprises more than 50% of the section and includes an extensive unit up to 1.5 km thick of massive to quartz-feldspar porphyritic ash flows and some probable rhyolitic flows interbedded with fine grained felsic tuff and quartz-crystal tuff. Associated sediments include gray to green pelite and psammite (tuffaceous graywacke) and a few lenses of pebbly conglomerate, the

LEGEND

DEVONIAN OR YOUNGER

6 Granitoid intrusive rocks

ORDOVICIAN

Baie d'Espoir Group

4 Undivided: 4a, dominantly chloritic and graphitic schist. Minor felsic tuff, amphibolite; 4b, massive, blocky micaceous graywacke.

3 Riches Island Formation: Interbedded pelite and siltstone, psammite, minor intermediate to felsic volcanic rocks.

2 Isle Galet Formation

2a Dominantly gray to black argillite, lesser green chloritic fine grained schist and pelite, graphitic schist. Minor psammite, mafic and felsic tuff.

2b Dominantly fine grained green chloritic schist and pelite. Medium grained bedded amphibolite, lesser gray argillite, minor felsic tuff.

2c Fine grained felsic tuff, quartz crystal tuff.

2e Massive amphibolite, pillow lavas.

2f Dolerite/gabbro sills.

2g Coarse grained, immature conglomerate, quartz-pebble conglomerate.

2h Rhyolitic flow (?) and ash flow, coarse volcanic breccia and conglomerate, fine to medium grained felsic tuff and lapilli tuff.

2i Red to purple mudstone, pink arkose.

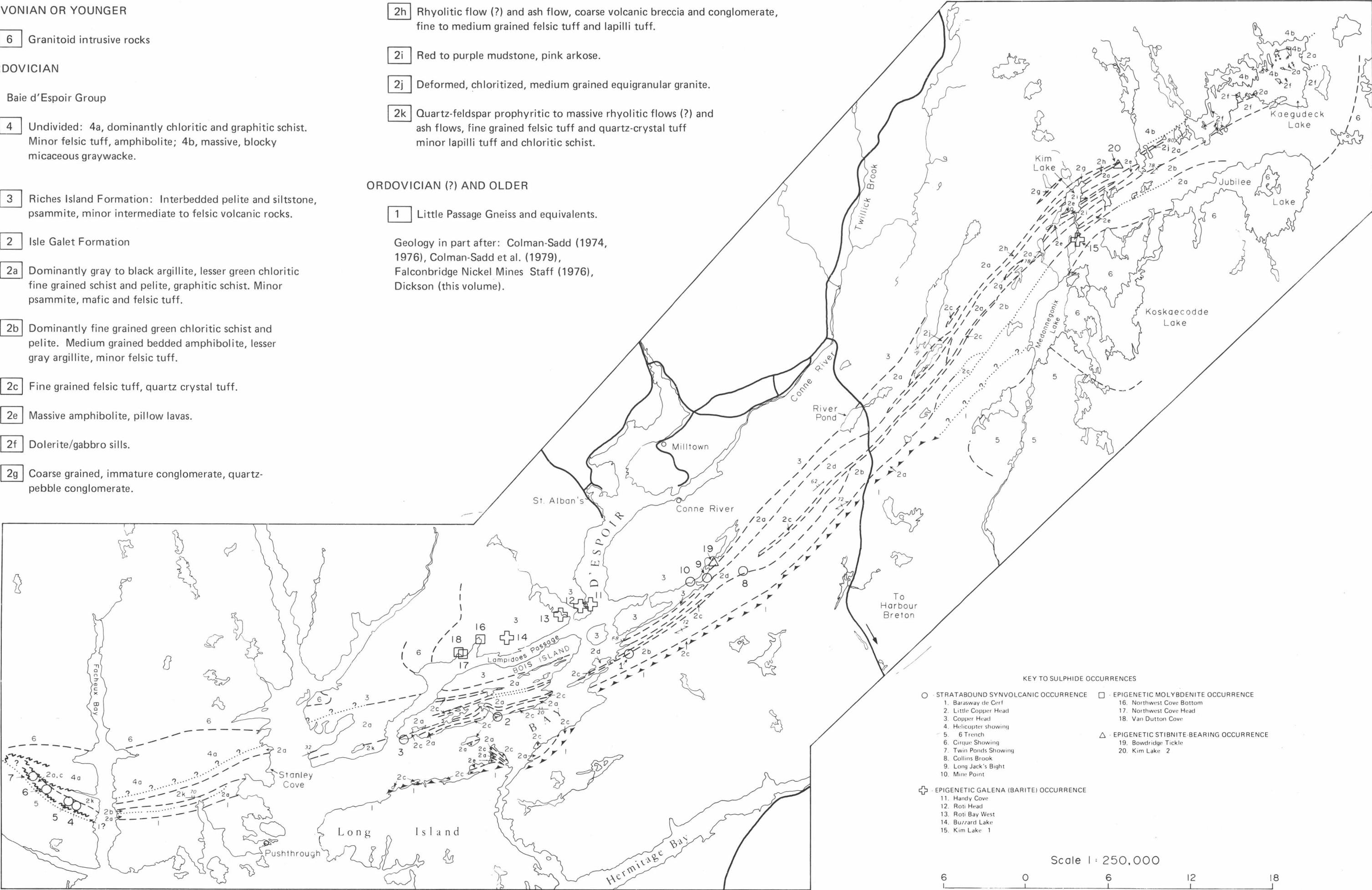
2j Deformed, chloritized, medium grained equigranular granite.

2k Quartz-feldspar prophyritic to massive rhyolitic flows (?) and ash flows, fine grained felsic tuff and quartz-crystal tuff minor lapilli tuff and chloritic schist.

ORDOVICIAN (?) AND OLDER

1 Little Passage Gneiss and equivalents.

Geology in part after: Colman-Sadd (1974, 1976), Colman-Sadd et al. (1979), Falconbridge Nickel Mines Staff (1976), Dickson (this volume).



clasts of which are dominantly volcanically derived. No coarse pyroclastic rocks or other evidence of proximal volcanic activity were noted and the environment is interpreted to be one which was moderately distal to a center of dominantly rhyolitic volcanism.

The central facies, which is developed between the western end of Bois Island and the area immediately northeast of River Pond, generally contains less than 30% volcanic rocks in the section. The transition between the western and central facies across Lampidoes Passage is quite abrupt suggesting that the change represents in part a major structural discontinuity. Rhyolitic flows and ash flows are essentially absent and their place in the stratigraphy is occupied by quartz-crystal felsic tuffs and fine grained felsic tuffs. A proportionally greater part of the section is occupied by green and gray pelitic rocks and by thick lenses of water-lain tuffaceous graywacke and conglomerate. Graphitic schist is common throughout the section. This facies appears to represent a more basinal environment than its western equivalents, and is considered to have been farther removed from the centers of volcanism.

The boundary between the central and eastern facies is extremely gradational with the latter facies becoming gradually more developed to the northeast. The transition starts in the area of the Harbour Breton Highway and is essentially complete in the area northwest of Medonnigonix Lake. Mafic volcanic rocks are more prevalent in this region and a few outcrops of poorly-preserved pillow lava were noted as were several outcrops of massive amphibolite which appear to represent mafic flows. The nature of the associated sedimentary rocks changes to the northeast with rhythmically bedded turbidites becoming interbedded with the volcanics at Kim Lake and giving way to mainly massive micaceous graywacke

northwest of Kaegudeck Lake. Graphitic schist, which is characteristic of the sequences to the south and west, is essentially absent in this area. A unit of red to purple mudstone and pink arkose outcrops in a belt up to 400 m wide south and east of Kim Lake and several lenses of very coarse grained, immature volcanic conglomerate are present in the upper parts of the sequence. A thick (maximum 500 m) unit of rhyolite flows, ash flows, volcanic breccia and conglomerate, can be traced from the vicinity of the Harbour Breton highway northeast to near Kaegudeck Lake. At its extremities, this unit comprises massive rhyolite and fine grained tuffs but in its central portions northwest of Medonnigonix Lake, considerable volumes of volcanic breccia and volcanically-derived conglomerate are present, suggesting relative proximity to a volcanic center. Northwest of River Pond, the complex is intruded by a highly chloritized, deformed granite which appears to be a roughly conformable body approximately 5 km by 500 m and which may be related to the volcanic activity.

All of the above features are suggestive of a relatively more proximal volcanic environment than those to the southwest, characterized by abnormal amounts (for the Isle Galet Formation) of mafic volcanics, explosive volcanic activity, shallower water sedimentation, and areas of higher relief.

VOLCANOGENIC SULFIDE OCCURRENCES IN THE BAIE D'ESPOIR GROUP

Both the central and western facies of the Isle Galet Formation are host to base metal prospects, none of which is presently known to be of economic proportions. The best known of these, the Barasway de Cerf prospect, occurs in the central facies in southeastern Bay d'Espoir and has previously been described by Jewell (1939) and Doiron (1979). It comprises two stratabound horizons of argentiferous pyrite-galena-sphalerite mineralization which are 15

to 40 cm wide and separated by approximately 15 m of barren to sparsely mineralized rock (Figure 2). The mineralization occurs within a dominantly graphitic schist unit which forms part of an overall sequence of felsic to mafic tuff, pelite, tuffaceous graywacke and graphitic schist of the central facies. In detail, both horizons are seen to lie at the top of thin felsic tuff units within the shale sequence with the mineralization being dominantly within but not restricted to the felsic tuff. The mineralized zone can be traced on the ground along a strike length in excess of 1.5 km, is demonstrably stratabound and probably represents a fairly distal example of synvolcanic exhalative sulfide deposition.

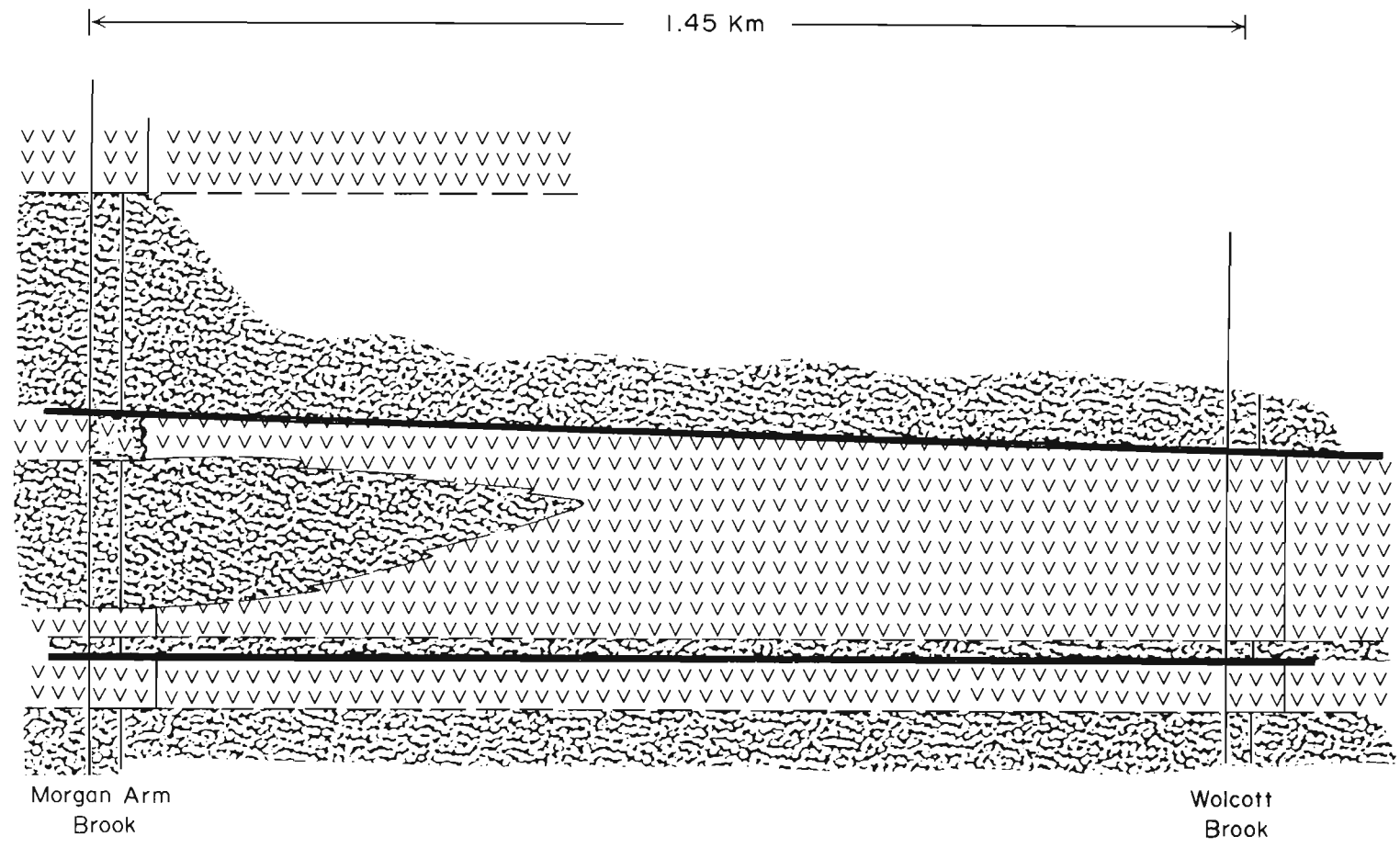
An exhalative pyritic horizon outcrops in the bed of Collins Brook approximately 9.8 km northeast of Barasway de Cerf and at about the same stratigraphic level as the previously described occurrence. It ranges from 1.6 to 5 m in thickness and consists of a number of massive pyrite beds carrying minor disseminated chalcopyrite and sphalerite within an altered silicic tuff unit. The mineralized silicic tuff is interbedded with amphibolitic mafic tuff and is overlain by dark gray graphitic schist.

Two minor sulfide occurrences are hosted by felsic tuff of the central facies on the south shore of Bois Island. The Copper Head occurrence consists of disseminated and vein-filling pyrite in a strongly silicified felsic tuff. The zone is more than 30 m thick, is exposed along the shore for more than 100 m, and is faulted against pelitic sediments at its eastern end. The Little Copper Head occurrence occupies a slightly lower stratigraphic position approximately 7.5 km northeast of Copper Head. It comprises minor disseminated pyrite and chalcopyrite in a strongly silicified, reworked felsic tuff horizon approximately 2 m wide. Considerable malachite has washed down

the cliff face at this locality making the occurrence look rather more impressive than it actually is. Both of these occurrences appear to be stratabound and are probably synvolcanic in origin.

A number of sulfide occurrences located by NALCO prospectors in the early 1950's west of Facheux Bay (Dunlop, 1954) in rocks of the western facies were re-examined during the present program. Most contain mainly pyrite with very minor galena, sphalerite and chalcopyrite and occur as veinlets and disseminations in a highly deformed, silicified and sericitized felsic tuff horizon (these include the Helicopter showing and trenches 2 - 6 inclusive). The country rocks are dominantly chloritic and graphitic schist although quartz-porphyritic ash flows are present 100 m north of the mineralized horizon. Sporadic mineralization occurs in this horizon along a strike length in excess of 2.5 km, the best of which is found in trench #6 where 45 cm of heavily disseminated galena-pyrite-sphalerite is present. Two other showings in the area, the Cirque and Twin Ponds showings, are in more mafic-looking schist and are probably hosted by slightly different stratigraphic intervals (Figure 3). The Cirque showing is mainly massive pyrrhotite up to 0.5 m thick which contains lesser sphalerite and is exposed over a strike length of roughly 5 m. The Twin Ponds showing comprises a horizon of dominantly massive galena approximately 20 cm wide which has been repeated several times by minor folds resulting in a mineralized width on the ground in excess of 1 m. Both of these showings are structurally conformable to the enclosing country rocks.

In a regional sense, it may be significant that the showings at Facheux Bay, Bois Island and southeastern Bay d'Espoir all appear to occupy a similar stratigraphic position within the Isle Galet Formation. This may be indicative of a relatively widespread period of

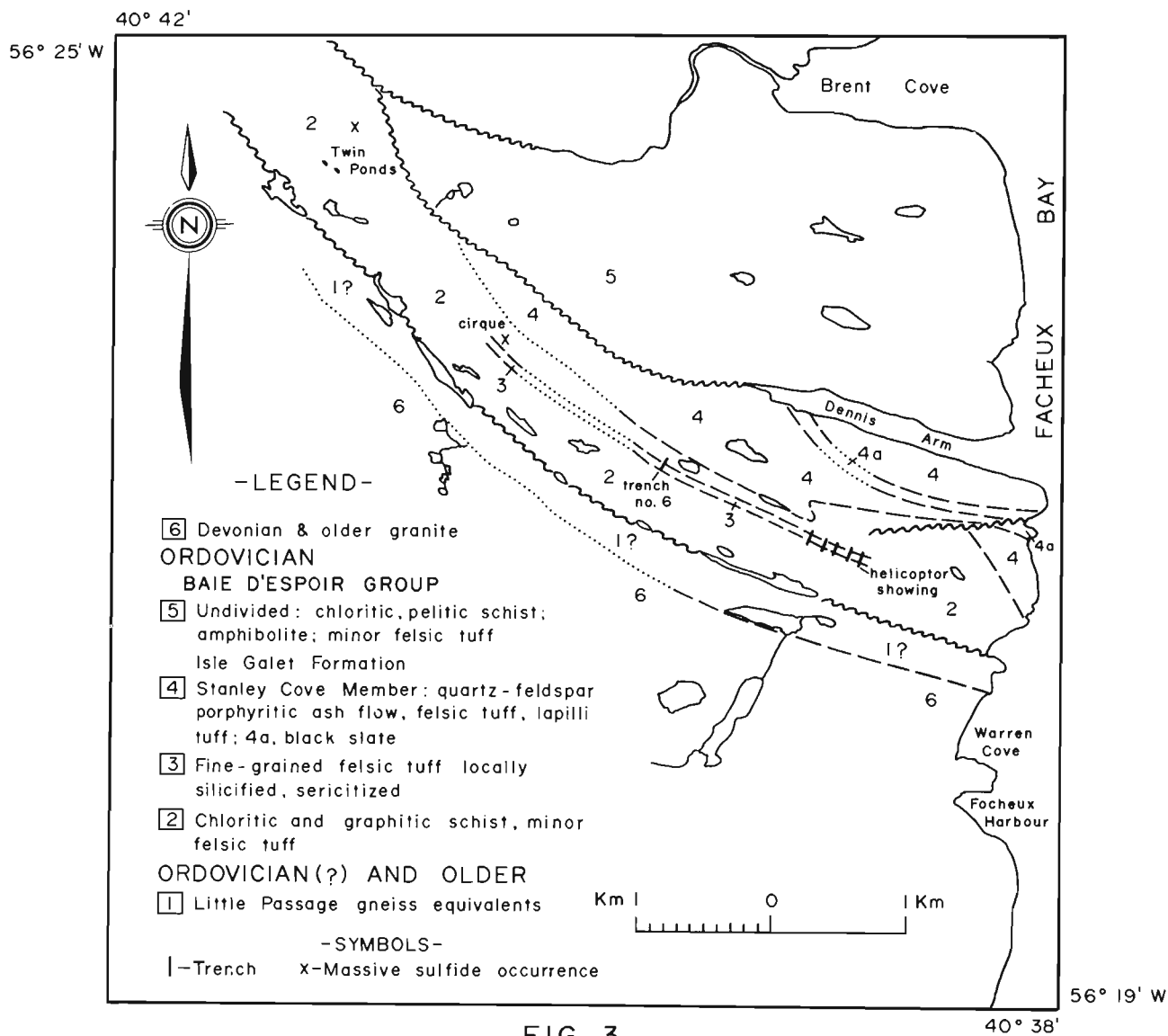


LEGEND

- felsic tuff, quartz-crystal tuff
- dominantly black shale; lesser chloritic schist
- massive galena-sphalerite-pyrite horizon

Fig. 2

Barasway de Cerf Prospect
Schematic Cross-section
Vertical Scale 1:500



General geology and mineral occurrences of the Isle Galet Formation west of Facheux Bay

mineralization which, in the presence of a favourable environment, could have produced a more favourable facies elsewhere in the area.

Two apparently stratabound sulfide occurrences are hosted by basal units of the Riches Island Formation in the Little River Basin, referred to as the Long Jacks Bight and Mine Point showings respectively (Jewell, 1939; Meikle, 1955). The showings at Long Jacks Bight (Long John's Lip of Meikle, 1955) comprise a weakly mineralized horizon within graphitic and quartz-sericitic schists which is 15-20 cm wide, strongly silicified and carries disseminated pyrite, pyrrhotite, arsenopyrite and galena. The zone appears to be conformable and can be traced along a strike length of approximately 100 m. One assay of 12.34g/t (0.36 oz/T) Au and 17.15g/t (0.50 oz/T) Ag was reported by Meikle (1955) but most other assayed samples were essentially barren.

The Mine Point occurrence is hosted by a 6.5 m thick limestone-calc-schist unit within a dominantly graphitic schist sequence. Several beds of pyrite concretions up to 1 cm across accompanied by beds and veinlets of massive pyrrhotite occur in the lower 3 m of this horizon. No economic minerals are reported from this occurrence and its economic potential is probably nil.

EPIGENETIC MINERALIZATION IN BAY D'ESPOIR

Probably the best known epigenetic mineral occurrences in the Bay d'Espoir area are the molybdenite showings north of Lampidoes Passage (Winek, 1954). The mineralization consists of blebs, veins and disseminations of molybdenite with associated pyrite and minor chalcopyrite in pegmatite, aplite and quartz veins which intrude sedimentary rocks of the Baie d'Espoir Group. Beryl is also reported from some of these pegmatites (Winek, 1954) although it was not seen during the present investigation. Numerous minor molybdenite showings were

reported by NALCO prospectors along a zone approximately 10 km long parallelling the margin of the North Bay granite; the best of these is developed in and around Northwest Cove, Lampidoes Passage. Prospect locations at South Brook, West Brook, Grandy Pond and Woody Hill Pond reported by Winek (1954) were visited during the present program but no mineralization was noted at any of these localities.

Psammitic schists of the Riches Island Formation are host to a number of dominantly galena-barite occurrences in the vicinity of Roti Bay. Massive blebs and stringers of galena up to 0.5 m long occur in lenticular and crosscutting quartz veins and in veins of massive white crystalline barite. The best of these showings, located in Hardy Cove, comprises a branching barite vein varying from 0.3 to 1 m in width and carrying several blebs of massive galena up to 0.5 m long and 5 cm thick. A second showing on the hill southwest of Hardy Cove has been trenched and comprises a gently dipping quartz lentil which carries lenses of massive galena and lesser pyrite. The total extent of this occurrence on surface is of the order of 100 m². Minor amounts of chalcopyrite and sphalerite have been reported from these showings (Jewell, 1939) but were not seen in hand specimen.

A minor galena occurrence was reported by NALCO prospectors on the Bay du Nord River south of Kim Lake, referred to as the Kim Lake #1 showing (Wall, 1956). It comprises sparse galena and pyrite in a quartz vein in pelitic schists which appears to be of very limited extent and of no commercial importance.

Stibnite-bearing mineralization was seen in two localities. At Bowdridge Tickle (Jewell, 1939; referred to as Bower's Tickle by Meikle, 1955) in the Little River Basin, euhedral crystals of arsenopyrite, pyrite and pyrrhotite accompanied by up to 7% stibnite occur in

a quartz vein and in adjacent silicified country rock. Although the mineralized zone can be traced intermittently for up to 100 m, the stibnite is restricted to one outcrop at its northern end. Northeast of Kim Lake, a 6-10 cm wide quartz vein hosted by pink porphyritic rhyolite carries sparse blebs and disseminations of stibnite. This showing was referred to as the Kim Lake #2 prospect by previous workers (Wall, 1956) and is of no economic importance.

In addition to the previously mentioned occurrences, several other mineral prospects have been previously reported from the Bay d'Espoir area (e.g. Douglas and Hsu, 1976). Many of these localities were visited during the course of the present program but prospects could not be relocated. Most are thought to have been a few specks of sulfides in quartz veins and lentils and are probably of no economic significance.

SUMMARY

The Isle Galet Formation of the Baie d'Espoir Group comprises an Ordovician volcano-sedimentary sequence which has been traced along strike in excess of 110 km. It displays a facies variation along strike with a central facies of distal volcanoclastic and epiclastic rocks and tuffaceous sediments being flanked to the west and east by rocks representative of relatively proximal volcanic environments. The western and central facies are host to several minor stratabound sulfide occurrences which are probably synvolcanic in origin and which appear to occupy a mutually similar stratigraphic position. Stratabound mineralization is also found in basal units of the Riches Island Formation. Occurrences of epigenetic sulfides, dominantly molybdenite, galena, arsenopyrite, pyrite and stibnite, are found throughout the eastern Hermitage flexure and are probably related to intrusion of nearby granitoid rocks.

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