NOTES ON THE GEOLOGY OF THE GREAT BEND AND PIPESTONE POND ULTRAMAFIC BODIES

B.F. Kean

INTRODUCTION

Two ultramafic bodies in the 'Gander Lake zone' of ultramafics in the Central Mobile Belt of Newfoundland were examined over a four week period during the summer of 1973. They were investigated to determine their economic potential and relationship to mineralized ophiolites at Betts Cove, Tilt Cove and Baie Verte in Notre Dame Bay.

The ultramafics of the 'Gander Lake zone' have been interpretated by Dewey and Bird (1971) and Strong (1973) as obducted ophiolites. However, there is now evidence that the ophiolites in western Notre Dame Bay form the base of a sequence of rocks of island arc affinity (Strong, 1972; Smitheringale, 1972; Kean, 1973). The recognition of zoned ultramafic complexes in Alaska that are intrusive feeders to island arc volcanism (Murray, 1972), and the recent interpretation of small isolated ultramafic bodies elsewhere as peridotitic mantle diapirs above subduction zones (e.g. Karig, 1971) raises the possibility that the ultramafics of the 'Gander Lake zone' may have a similar origin.

GREAT BEND

Abstract

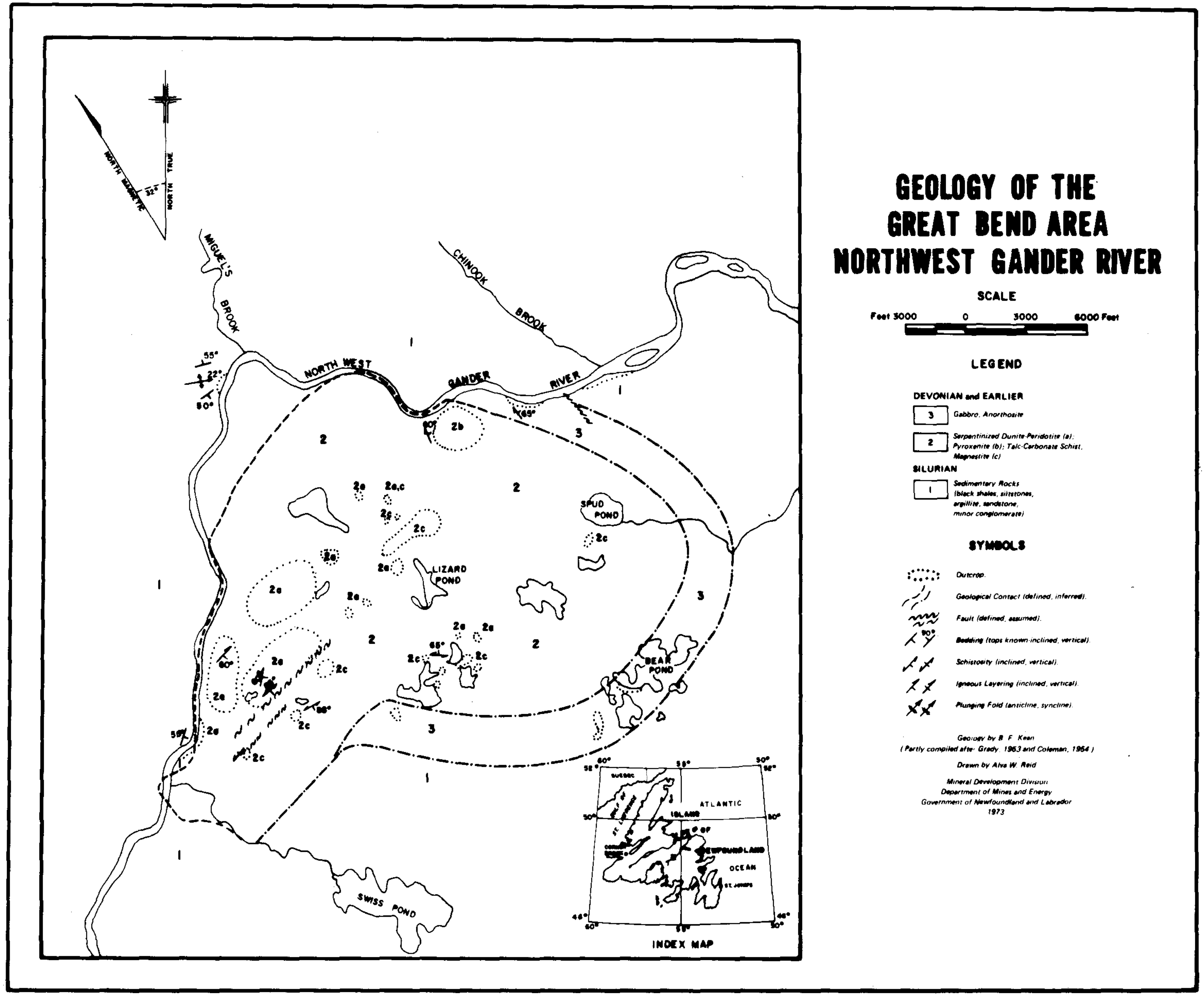
The Great Bend ultramafic body in central Newfoundland forms part of 'Gander Lake zone' of ultramafic rocks. The body is circular in outline with a diameter of five miles (Fig. 1).

Serpentinized and steatitized dunite forms the base and central mass of the body. Peridotite occurs in the eastern parts of the body and an outer belt of gabbro and minor anorthosite extends around the eastern half of the body. Layering is present but is disrupted or poorly preserved in most places.

The internal stratigraphy of the ultramafics and the contact relations suggest that the body is intrusive into the country rocks and may be the relict of a mantle diapir.

Magnesite, chromite and rare asbestos occur in the body.

Figure 1.


GEOLOGY OF THE
GREAT BEND AREA
NORTHWEST GANDER RIVER
SCALE
Feet 3000 0 3000 6000 Feet
LEGEND
DEVONIAN and EARLIER
3 Gabbro, Anorthosite
2 Serpentinized Dunite-Peridotite (a); Pyroxenite (b); Talc-Carbonate Schist, Magnestite (c)
SILURIAN
1 Sedimentary Rocks (black shales, siltstones, argillite, sandstone, minor conglomerate)
SYMBOLS
Outcrop.
Geological Contact (defined, inferred).
Fault (defined, assumed).
Bedding (tops known-inclined, vertical).
Schistosity (inclined, vertical).
Igneous Layering (inclined, vertical).
Plunging Fold (anticline, syncline).
Geology by B. F. Kean
(Partly compiled after Grady, 1963 and Coleman, 1964)
Drawn by Alva W. Reid
Mineral Development Division
Department of Mines and Energy
Government of Newfoundland and Labrador
1973
NORTH MAGNETIC
TRUE NORTH
32°
MIGUEL'S BROOK
CHINOOK BROOK
NORTH WEST GANDER RIVER
SPUD POND
LIZARD POND
BEAR POND
SWISS POND
ATLANTIC
OCEAN
NEWFOUNDLAND
INDEX MAP

Introduction

The Great Bend refers to a large meander on the northwest Gander River in Central Newfoundland, latitude 48°33'N. longitude 55°28'W. The area is accessible by a paved highway (Route 2) from the Trans Canada Highway (Route 1) at Bishops Falls.

The Great Bend area has a gently rolling topography with locally some low rock and boulder ridges. The ultramafic rocks are well exposed, but the associated gabbros and critical contact areas are poorly exposed.

The area is part of Reid Lot 238 and has been extensively prospected by Newfoundland and Labrador Corporation (Nalco) for magnesite, chromite and asbestos (Grady, 1953; Harrison, 1953; Coleman, 1954).

Country Rocks

The exposed country rocks consist of shales, siltstones and interbedded sandstones of the Silurian Botwood Group. The sediments have been folded into open synclines and anticlines with axial planar cleavage, and have undergone metamorphism to lower green-schist facies.

The eastern contact between gabbro and hard, siliceous-looking, baked sediments is faulted with shearing and brecciation of the gabbro. On the west contact, the ultramafics truncate the sedimentary rocks without any evidence of shearing or brecciation. However, the ultramafic body itself is often highly sheared and brecciated. The siltstones in contact with dunite have been indurated to form a hard, black, basalt-like rock.

In thin-section, the sandstones consist of angular to subrounded, irregular and unoriented quartz and feldspar grains in a granoblastic-type texture. Most of the quartz and feldspar grain boundaries are embayed and sutured and possess a recrystallization-type growth. The matrix consist of fine-grained sericite and epidote. Since the main constituents of the sandstones, quartz and minor feldspar, are stable within the temperature ranges embraced by the pyroxene hornfels and amphibolite facies, high temperature thermal metamorphism of sandstones produces hornfels consisting essentially of a granoblastic mosaic of quartz and feldspar (Williams, Turner and Gilbert, 1954, p. 186).

In thin section, the shales display extremely fine-grained intergrowths of sericite and expidote with minor quartz and feldspar. Locally lenses and zones of recrystallized quartz and feldspar are present that obliterate the cleavage.

Ultramafic Rocks

The Great Bend ultramafic body is a circular body approximately 5 miles in diameter. The complex has a disrupted and poorly preserved layering trending generally NE-SW and dipping steeply to the east (50^{o}). Weathered surfaces generally show layering, which may be indistinguishable on fresh surfaces and in extensively serpentinized outcrops.

Serpentinized and steatitized dunite form the western and central mass of the body. It weathers brick red and in places has pronounced layering. Peridotite and its serpentinized equivalent occur in the eastern parts of the body overlying and interlayered with dunite. The peridotite weathers greenish to reddish brown and has a coarsely crystalline texture. An outer belt (rim) of gabbro and anorthosite extends around the eastern half of the body. Gabbro is the predominant rock type; gabbro and anorthosite form thin (1"-3"), discontinuous, alternating dark (gabbro) and light (anorthosite) bands that parallel the layering in the ultramafics.

Faulting and brecciation are extensive and often form zones of localized magnesite enrichment. The brecciation gives a conglomeratic and/or 'pillow' appearance in places with sub-angular to well-rounded blocks of dunite and peridotite from 3 inches to 2 feet across in a schistose matrix of serpentine and talc-carbonate.

Economic Geology

Three commodities of economic interest occur within the Great Bend ultramafics. They are, in order of importance, magnesite, chromite and asbestos.

Magnesite:

Magnesite occurs in the area as a result of carbonatization of peridotite and dunite along zones of shearing and brecciation. It grades imperceptibly into carbonatized peridotite.

Magnesite is present in very large tonnages but because of its highly variable grade and high iron and silica (quartz and fine-grained silicate minerals) content its quality does not appear to be very good.

Chromite:

Most of the chromite occurs as disseminations in the dunite, peridotite and magnesite; however there are lenses of massive chromite up to 1 foot thick and 3 feet long in the dunite. Such occurrences are rare on the surface and work by mineral exploration companies has failed to extend these or find new ones.

Asbestos:

Small amounts of cross-fibre asbestos occur as short veinlets approximately 1/16 inch wide in the dunite and peridotite.

Conclusion

The Great Bend ultramafic body intrudes the country rocks and the petrology and stratigraphy is suggestive of ultramafic mantle diapirs. Zoned ultramafics complexes in Alaska acted as feeders to island arc type volcanism. However, since the Great Bend body cuts Silurian rocks, a similar relationzhip is unlikely.

PIPESTONE POND

Abstract

The Pipestone Pond ultramafic rocks in Central Newfoundland form a north-south trending arcuate body to the west of the linear 'Gander Lake zone' of ultramafics (Fig. 2).

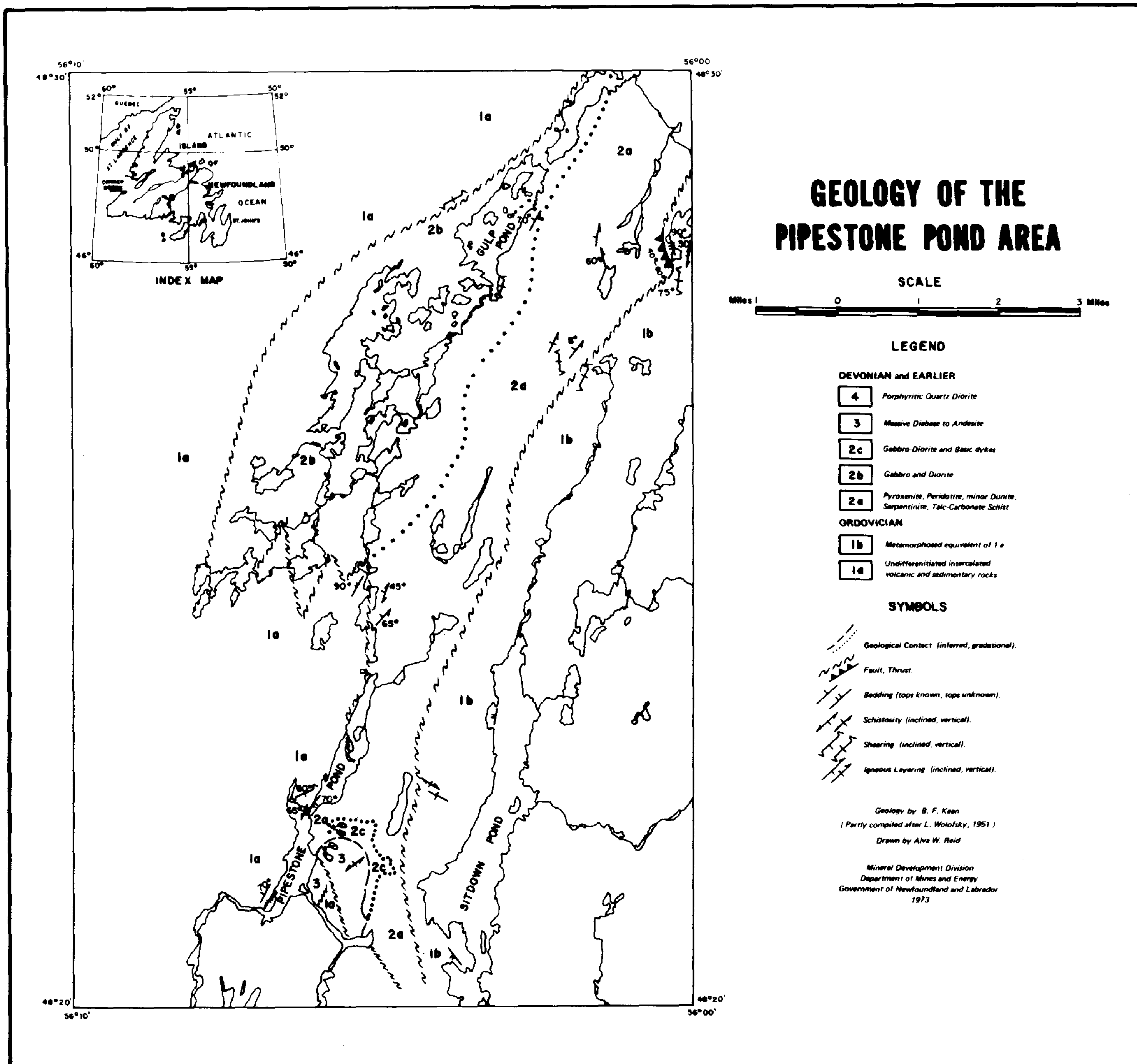
The most common rock type is pyroxenite with decreasing amounts of gabbro-diorite, peridotite and dunite. All phases are gradational into each other. Layering is locally quite pronounced but is discontinuous and/or disrupted.

The contacts with the country rock are fault bounded and evidence of thermal metamorphism is absent.

The internal stratigraphy of the body resembles the lower levels of an ophiolite suite, however the body may not be an ophiolite.

Chromite is the only mineral of economic interest in this body.

Figure 2.


GEOLOGY OF THE
PIPESTONE POND AREA
SCALE
Miles 1
0
1
2
3 Miles
LEGEND
DEVONIAN and EARLIER
4 Porphyritic Quartz Diorite
3 Massive Diabase to Andesite
2c Gabbro-Diorite and Basic dykes
2b Gabbro and Diorite
2a Pyroxenite, Peridotite, minor Dunite, Serpentinite, Talc-Carbonate Schist
ORDOVICIAN
1b Metamorphosed equivalent of 1a
1a Undifferenitiated intercalated volcanic and sedimentary rocks
SYMBOLS
Geological Contact (inferred, gradational).
Fault, Thrust.
Bedding (tops known, tops unknown).
Schistosity (inclined, vertical).
Shearing (inclined, vertical).
Igneous Layering (inclined, vertical).
Geology by B. F. Kean
(Partly compiled after L. Wolofsky, 1951)
Drawn by Alva W. Reid
Mineral Development Division
Department of Mines and Energy
Government of Newfoundland and Labrador
1973
INDEX MAP
ATLANTIC
OCEAN
ISLAND
OF
NEWFOUNDLAND
QUEBEC
GULF OF ST LAWRENCE
GULF POND
PIPESTONE POND
SITDOWN POND
56°10'
56°00
48°30'
48°20'
1a
1b
2a
2b
2c
3

Introduction

The Pipestone Pond ultramafic body, also called the Mt. Cormack ultramafic body, is located in Central Newfoundland, within a quadrangle extending roughly from 48°20' to 48°28' north latitude and 56°02' to 56°06' west longitude. This area, about 40 square miles, was mapped on a scale of 1:50,000 during a two week period in the summer of 1973. The area is accessible by aircraft.

Exposure is fair to good in the ultramafics and related basic rocks, but elsewhere exposure is extremely poor and open scrub spruce covers most of the area.

Country Rocks

The ultramafic complex consisting of altered pyroxenite, peridotite, minor dunite, and associated basic rocks (diorite, gabbro, diabase) lies between metasediments to the east and relatively unmetamorphosed volcanic and sedimentary rocks to the west.

The metasedimentary rocks include interbedded mica schist, micaceous quartzites, andalusite schist and minor amphibolite. A schistosity, defined by micas and amphiboles, generally parallels bedding and is refolded by later folds.

Zones of amphibolitization intensify near the ultramafic contact at the southwestern end of Sitdown Pond. The contact is only exposed east of Gulp Pond where it is a thrust fault, dipping 40-60°W.

The sedimentary and volcanic rocks occur as an inter-fingered and intercalated pile west of the ultramafic complex. Greywackes are the predominant rock type with conglomerates, silt-stones, slates, and minor cherts occurring in lesser amounts. These rocks have been metamorphosed to the lower green-schist facies. Where exposed the contact with the ultramafics is fault bounded and marked by brecciation and steeply dipping shear and schist zones.

Ultramafic and Related Rocks

The Pipestone Pond, ultramafic body is approximately 10 miles long and ½-4 miles wide.

The ultramafic rocks have a north-south trending, steeply west dipping compositional layering; however, this layering has no regular or systematic pattern and is locally discontinuous and/or disrupted, and in places is not visible. In some outcrops, layers showing a change from chromite bearing dunite at the base, through peridotite, to pyroxenite are developed. This layering or banding is disrupted in many places and one type may cross-cut another as a result of remobilization.

Pyroxenite and its serpentinized equivalent is the most common rock type. The pyroxenite locally contains patches of coarse-grained pyroxene crystals up to 3 to 4 inches across.

Gabbros and diorites are the next most common rock types after pyroxenite. The gabbro and diorite represent differentiation products of the magma that produced the ultramafic phases. They have an irregular distribution and appear to be gradational from one to the other. The gabbro-diorite zone is widest at the mid-point of the complex and pinches out to the north and south. The zone ranges from fine to coarse-grained with pegmatitic patches, and from feldspar rich (25%) to non-feldspathic. Hornblende, locally altered to chlorite, is the most common mafic constituent in these rocks. Wolofsky (1951) reported quartz in some of these rocks and called them "quartz-bearing hornblende diorites". The only quartz observed by the writer was in association with clinozoisite as an alteration product.

The thin sliver of gabbro-diorite at the south end of the ultramafic complex contains minor dykes of diabase and diorite trending roughly east-west. These dykes range from ½ to 3 feet in width. Wolofsky (1951, p. 39) described this area as follows: "Fine and coarse grained hornblende diorites occur together, with sharp contacts between them, in small dykelets which cross and branch irregularly. In some places there are dykes of fine in coarse; in others the reverse is the case. The same is true of the relations between these rocks and the pyroxenites."

Overlying and south of this zone is a thick zone (2,500 feet) of highly jointed fine-grained massive diabase and andesite. However, occassional east-west trending dykes of the same composition can be seen cutting it. There may be more but the jointing and weathering of the outcrops makes recognization difficult. Near the top of this zone there is a small outcrop of small, flattened, pillows or pillow-breccias. The pillows have low vesicularity and thin pillow rims. Because of the lack of outcrop, the relationship of this zone to the underlying rocks could not be determined, however, it could represent a phase of the complex.

All of the rocks in this area are cut by numerous shear, fault and breccia zones with extensive alteration concentrated along them.

Economic Geology

Chromite is the only mineral of economic interest in the area. It occurs as disseminations and as podiform lenses; the latter being the only type of possible economic importance. The best showing is located just east of Pipestone Pond, where four irregular lenses of nearly massive chromite occur in altered and foliated peridotite. The largest lens is about 20 feet long, varying in width from a few inches to four feet; however, the other lenses are of smaller dimensions.

The lenses have a sharp, cross-cutting relationship (i.e., dykelike) to the layering in the ultramafics, however, this may be a result of remobilization.

Conclusion

The stratigraphy and field relationships of the Pipestone Pond ultramafic body is suggestive of a tectonically emplaced ophiolite. Chemical analysis, currently being done, will hopefully confirm or refute this theory.

Areas of greatest economic potential in ophiolite sequences are the sheeted dyke - pillow lava contact and the overlying sediments. However, if the Pipestone Pond ultramafic body represents an ophiolite, this upper stratigraphic level is not preserved. However, the surrounding volcanic rocks (Unit la, Fig. 2) are favourable areas of mineralization as indicated by the Great Burnt Lake copper deposit to the west.

References

Coleman, L.C.
1954: The Great Bend Area Northwest Gander River; Private Report, Newfoundland and Labrador Corporation, 7p.

Dewey, J.F. and Bird, J.M.
1971: Origin and emplacement of the ophiolite suite; Appalachian ophiolites in Newfoundland; J. Geophysics Res., V. 76, 3179-3207.

Grady, J.C.
1953: The Geology of the Southern half of the Serpentine Belt in East-Centre Newfoundland; Unpub. rept., Geol. Surv. Nfld., 63p.

Harrison, W.D.
1953: The Northwest Gander River Area; Private rept., Newfoundland and Labrador Corporation, 3p.

Karig, D.E.
1971: Origin and development of marginal basins in the Western Pacific; Jour. Geophy. Res., v. 76, p. 2542-2561.

Kean, B.F.
1973: Stratigraphy, Petrology and Geochemistry of Volcanic Rocks of Long Island, Newfoundland; Unpub. M.Sc. thesis, Memorial University of Newfoundland. 154p.

Murray, C.G.,
1972: Zoned ultramafic complexes of the Alaskan type: Feeder Pipes of Andesitic volcanoes; Geoc. Soc. Am., Mem. 132 p. 313-334.

Smitheringale, W.G.
1972: Low potash Lush's Bight tholerites: ancient oceanic crust in Newfoundland?; Can. J. Earth Sci., v. 9, No.5, p. 574-588.

Strong, D.F.
1972: Sheeted diabases of central Newfoundland: - New evidence for Ordovician sea floor spreading; Nature, v. 235, p. 102-104.

Strong, D.F. and Payne, J.G.
1973: Early Paleozoic volcanism and metamorphism of the Moreton's Harbour-Twillingate Area, Newfoundland; Can. J. Earth Sci., v. 10, p. 1363-1379.

Williams, H., Turner, F., and Gilbert, C.M.
1954: Petrography - An introduction to the study of rocks in thin section; W.H. Freeman and Co., San Francisco, 460p.

Wolofsky, L.
1951: Geology of the Sit-down Pond area, Newfoundland; Unpub. B.A. thesis, McGill University, 50p.