Current Research (1987) Newfoundland Department of Mines and Energy,
Mineral Development Division, Report 87-1, pages 271-281

GEOLOGY OF THE WEST HALF OF THE WEIR'S POND (2E/1) MAP AREA

Pat O'Neill
Newfoundland Mapping Section

ABSTRACT

The map area is located northeast of Gander and provides an important geological cross section through the contact between two major tectonic zones of the Newfoundland Appalachians. The Dunnage Zone to the northwest is represented by the Davidsville Group of Ordovician age, and southeastward lies the undated Gander Group of the Gander Zone; these two zones are separated by the (Ordovician) Gander River Ultrabasic Belt. Limestone, conglomerate and sandstone that form the basal unit of the Davidsville Group are structurally interleaved with the ultrabasic belt. A relatively sharp contact between limestone and ultrabasic rocks observed on the northwest shore of Weir's Pond is a presumed nonconformity. Tectonic interleaving of the Gander Group metasedimentary rocks and the ultrabasic belt does not occur and their contact is abrupt, implying large-scale movement between the units.

Deformational histories of the Gander and Davidsville groups are not closely correlatable in this map area. The Gander Group does not exhibit the ubiquitous heterogeneity of deformation observed in the Davidsville Group (and Gander River Ultrabasic Belt), and also has a more clearly defined two phase history.

Metamorphic grade across much of the area is in the greenschist facies. A sharp increase in grade occurs south of Ocean Pond where biotite and garnet isograds are defined.

Rocks of the Gander River Ultrabasic Belt remain the most prospective in the map area for mineralization, particularly gold for which they are being actively explored. One noteworthy mineralized quartz vein in the northern part of the Gander Group yielded an assay of 2.6 percent Pb, 11 ppm Ag and 210 ppb Au.

INTRODUCTION

The Weir's Pond map area is centred 30 km northeast of the town of Gander in northeastern Newfoundland. Access to the western and northwestern parts of the area is provided by the Gander Bay Highway (Route 330) and a system of old logging roads. The east and central parts were mapped along traverses from fly camps on Weir's Pond and Indian Bay Pond. Mapping at a scale of 1:50,000 was completed in the west half of the map area; Figure 1 illustrates the general geology of the area and Figure 2 shows the detailed geology northwest of Weir's Pond.

Regional Relationships

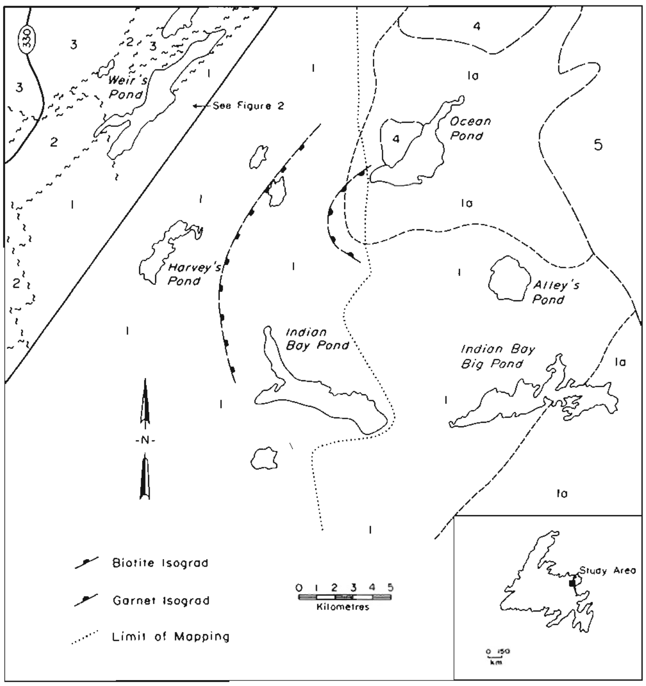
Three principal tectonostratigraphic divisions are recognized, the Gander Group (Unit 1), the Gander River Ultrabasic Belt (Units 2-5) and the Davidsville Group (Units 6, 7 and 8). The strong northeast–southwest topographic linear defined by Weir's Pond parallels a major tectonic break between rocks of the Gander River Ultrabasic Belt (Jenness, 1958) and the Gander Group (McGonigal, 1973; Blackwood, 1982).

The Gander Group comprises psammitic, semipelitic and pelitic rocks, which continue northeastward along strike to the Carmanville (2E/8) map area (Currie and Pajari, 1977) and southeastward to the Baie d'Espoir area (Colman-Sadd, 1980). Farther east, the Square Pond Gneiss (Figure 1) and Hare Bay Gneiss have been described as higher grade equivalents of the Gander Group (Blackwood, 1978); these rock units underlie the Gander Zone (Williams, 1976).

An undated complex package of ultramafic, mafic and felsic rocks, the Gander River Ultrabasic Belt, bounds the Gander Group to the west and extends northeastward to the coast, but occurs sporadically south of Gander Lake (Blackwood, 1982). The Gander River Ultrabasic Belt (given the acronym GRUB by Blackwood, 1980) is structurally juxtaposed with the basal unit of the Middle Ordovician Davidsville Group; both of these rock packages lie within the Dunnage Zone (Williams, 1976).

Farther west, the Middle Ordovician Davidsville Group comprises conglomerate, sandstone, siltstone and limestone in a basal unit that passes up to the northwest into monotonous grayish-black siltstone. Sandstone, siltstone and shale of the Botwood Group (Silurian age) outcrop to the west of the Davidsville Group and are in presumed conformable contact (Blackwood, 1982).

This project is a contribution to the Canada–Newfoundland Mineral Development Agreement, 1984–1989



LEGEND

DEVONIAN(?)

5 *Deadmans Bay Granite*

4 *Two-mica granite*

MIDDLE ORDOVICIAN

3 *Davidsville Group*

MIDDLE ORDOVICIAN OR OLDER

2 *Gander River Ultrabasic Belt*

ORDOVICIAN? OR OLDER

1 *Gander Group;* 1a, *Square Pond Gneiss*

Figure 1: *General geology of the Weir's Pond (2E/1) map area.*

The Davidsville Group and the ultrabasic belt exhibit a northeast-trending penetrative foliation, whereas the regional foliation in the adjacent Gander Group strikes approximately north-northeast. Metamorphic grade is in the greenschist facies in the map area.

Previous Work

The work of Jenness (1958), which was the first significant attempt to map and describe rocks of the ultrabasic belt, concentrated on evaluating the economic potential of the ultrabasic rocks. This mapping outlined northeast-trending linear belts of volcanic, volcaniclastic and plutonic rocks within slate, sandstone, limestone, phyllite and conglomerate of the Middle Ordovician Gander Lake Group. Jenness (1963) later subdivided the Gander Lake Group into conformable lower, middle and upper units. The Gander Lake Group was later redefined to include only the lower unit, and the new term Davidsville was proposed for the middle and upper units (Kennedy and McGonigal, 1972). They proposed that deformation and metamorphism of their Gander Lake Group occurred prior to deposition of the Davidsville Group, and cited, as evidence, the presence of detrital biotite and garnet, and mafic schist and psammite fragments in basal conglomerate and graywacke of the Davidsville Group. The term Gander Lake Group was informally amended to Gander Group by McGonigal (1973) and formally proposed by Blackwood (1982).

Rocks in the Weir's Pond area were briefly examined by Blackwood (1978) who noted that the nature of the contact between the Gander and Davidsville groups is enigmatic where the Gander River Ultrabasic Belt is present. In areas where the Gander River Ultrabasic Belt is absent, as in Carmanville (Currie and Pajari, 1977) and south of Gander Lake (Blackwood, 1982), conformable relationships between the Davidsville and Gander groups have been described.

Kennedy (1975) first suggested that the ultrabasic belt may represent remnants of an ophiolite suite; however a complete ophiolite stratigraphy has yet to be documented.

Prior to the 1970's, much of the exploration work in the area focused on chromite and asbestos occurrences in ultramafic rocks (Snelgrove, 1933; Baird *et al.*, 1951; Dunlop, 1955; Jenness, 1958); however, no economic concentrations of these minerals were discovered.

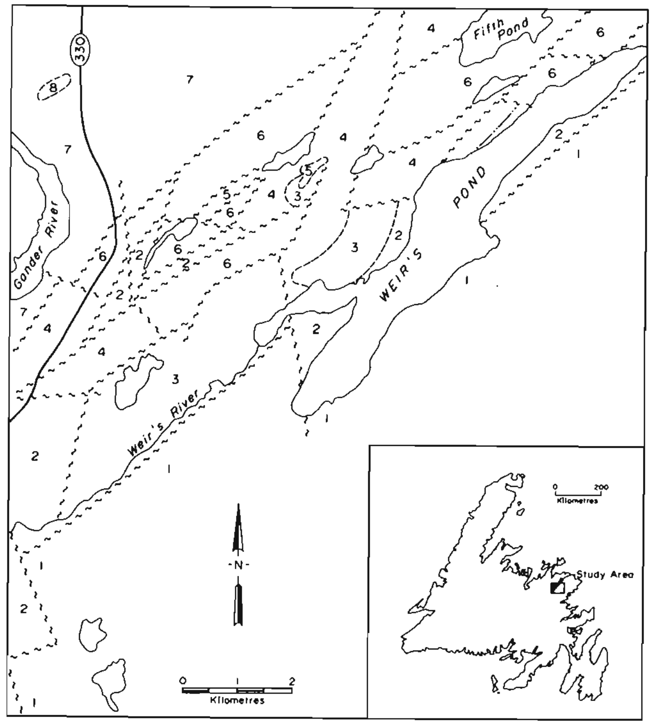
In the 1970's and 1980's, International Mogul Mines Limited, Minorex, Westfield Minerals, Noranda, Duval Corporation and Esso Minerals conducted geological, geophysical and geochemical surveys over the ultrabasic belt as part of their exploration program. Details and results of their findings are given near the end of this report.

GEOLOGY OF THE WEIR'S POND AREA

Gander Group (Unit 1)

Southeast of Weir's Pond, interbedded psammite and semipelite are the major rock types in the Gander Group, a metasedimentary sequence of Lower Ordovician or older age. Pelite, quartz-granule conglomerate, quartzose sandstone, and mafic and felsic sills or dikes, in descending order of abundance, form the remainder of the group.

The sandstone is a gray, fine to medium grained, quartz-dominated psammite in which feldspar typically forms less than 10 percent of the rock. Quartz-granule sandstone, which contains 60 to 90 percent quartz, shows a bimodal size distribution of quartz grains; larger grains range from 1 to 3 mm across and are commonly blue, whereas smaller grains are less than 0.2 mm across. The rocks are immature to



LEGEND

ORDOVICIAN OR YOUNGER

8 *Muscovite granite*

MIDDLE ORDOVICIAN

DAVIDSVILLE GROUP

7 Upper Unit: *Gray to grayish-green, rarely purple, siltstone; minor thin sandy beds and conglomerate*

6 Lower Unit: *Interbedded laminated siltstone, immature sandstone–locally crossbedded, fossil-rich sandstone, bioclastic limestone, calcarenite, graphitic black shale and polymictic boulder, cobble and pebble conglomerate*

MIDDLE ORDOVICIAN OR OLDER

GANDER RIVER ULTRABASIC BELT

5 *Aphanitic, porphyritic and coarse grained equigranular trondhjemite*

4 *Mafic volcanic and volcaniclastic rocks*

3 *Gabbro*

2 *Ultrabasic rocks including their alteration products, i.e., serpentine-, magnesite-, and talc-rich rocks*

ORDOVICIAN OR OLDER

GANDER GROUP

1 *Pelite, semipelite, quartzofeldspathic psammite; minor quartz-granule sandstone, felsic and mafic sills and/or dikes*

Figure 2: *Detailed geology of the area northwest of Weir's Pond.*

moderately mature, containing 10 to 30 percent matrix, much of which is recrystallized to varying degrees to white mica, and to chlorite and biotite at higher metamorphic grade. Sorting is typically poor and grains are angular to subangular. Incipient to locally complete polygonization of quartz grains is common.

Bedding is neither clearly nor ubiquitously observed because of the well developed foliation, lack of marker beds, and similar composition and color of the rock types. However, where lithological layering can be defined (Plates 1 and 2), individual beds are thin, ranging from a few millimetres to approximately 1 m. Bed thickness also varies because of intense deformation. Quartz-rich sedimentary rocks, which have a poor foliation, locally contain delicate millimetre-thick heavy-mineral layers.

Plate 1: *Interbedded psammite and pelite of the Gander Group; note the fine layering in the psammites.*

East of Harvey's Pond, one outcrop of psammite contains many pink bands (1 cm or less thick) that consist of quartz and a myriad of tiny garnet crystals less than 25 microns in diameter. Such garnet–quartz layers are coticules (Renard, 1878), and the pink garnets are typically spessartine rich. Farther east within the biotite zone, several psammitic exposures contain 3-cm-thick black layers and crosscutting veins containing tourmaline and lesser amounts of quartz and muscovite.

Mafic bands, generally 0.5 to 2 m thick, form less than one percent of total rock exposures. In places, they crosscut the sedimentary layering, but typically, they are conformable. Felsic bands are generally 5 to 25 cm thick and are more common in the eastern part of the map area. They characteristically weather pink in the western part of the area,

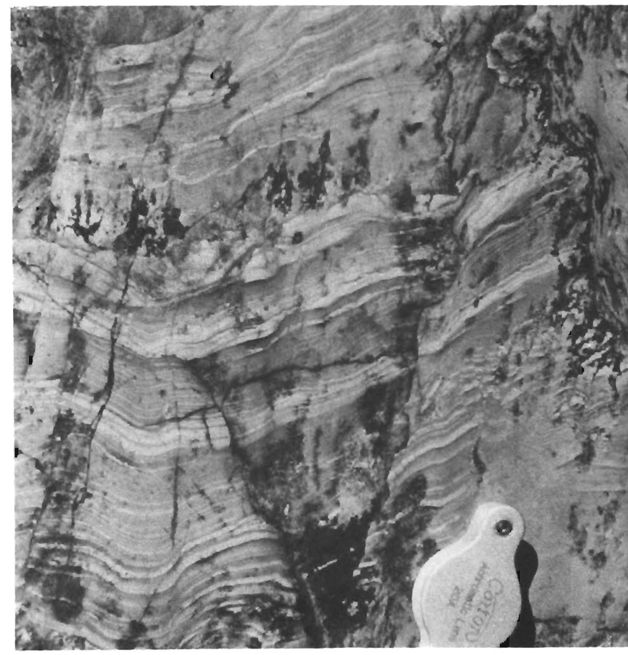


Plate 2: *Parallel laminations in sedimentary rocks of the Gander Group are defined by pelitic and sandy layers.*

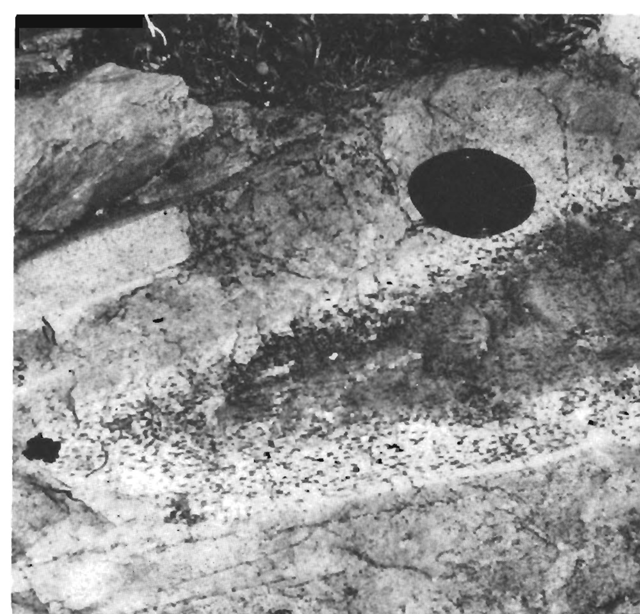


Plate 3: *Lensoid felsic intrusive body in the biotite–garnet zone of the Gander Group; the variation in composition from rim to core may reflect an original chilled margin.*

but in the higher grade rocks to the east, their margins weather white whereas the interior is much darker (Plate 3). This contrast is thought to reflect variation caused by chilling, and both the mafic and felsic bands are interpreted as pretectonic intrusives.

Quartz veining is ubiquitous and locally intense. Several 10- to 20-m-thick quartz veins containing fragments of psammitic rock (Plate 4) cut across the structural grain, and appear on colour airphotos as strong white linear features. Within the biotite and garnet zones, muscovite pegmatites occur, and are characterized by beryl prisms 2 to 3 cm long.

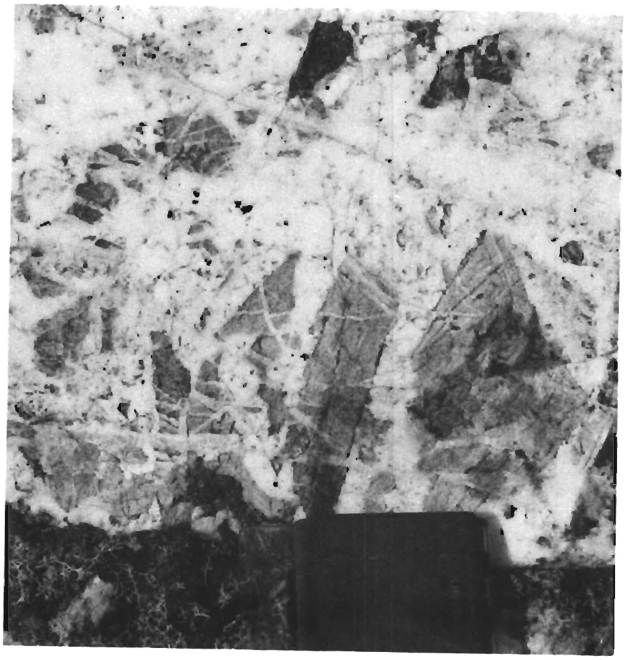


Plate 4: *Quartz vein containing angular fragments of psammitic (Gander Group) host rock.*

Deformation. A penetrative foliation, striking north to north-northeast, is developed in all rock types in the Gander Group. Dips of the fabric vary from steep, east and north of Weir's Pond, to moderate farther east and horizontal around the eastern half of Indian Bay Pond. This foliation is the earliest tectonic fabric recognized and is therefore designated S_1. It is axial planar to megascopic and microscopic isoclinal and tight folds (Plates 1 and 5) in multilayer sequences. The refraction of S_1 is strong due to sharp contacts between beds and lack of grading in the metasedimentary rocks. Cleavage fans are locally well developed in semipelite layers.

The style of the F_1 folds is variable depending on composition, e.g., Plate 5 illustrates transposition developed by shearing along limbs of folds in thin quartzitic layers enveloped by pelitic layers. F_1 fold hinges are then preserved as elongate (parallel to S_1) knots. Thicker beds are deformed generally by similar-type folding.

A second phase of deformation has folded S_1 around open to tight microscopic and megascopic folds (Plate 6). An L-S fabric is ubiquitously developed in association with the folds; the lineation is well defined by a horizontal or shallow southward-plunging crenulation (Plate 7), best developed in pelitic layers. Locally, and only in pelitic to semipelitic layers, a crenulation cleavage is present that appears to intensify eastward; however, this may be an effect of increasing grain

Plate 5: *Thin psammitic layer in pelite exhibits more intense deformation and subsequent transposition than the thick psammite bed to the right.*

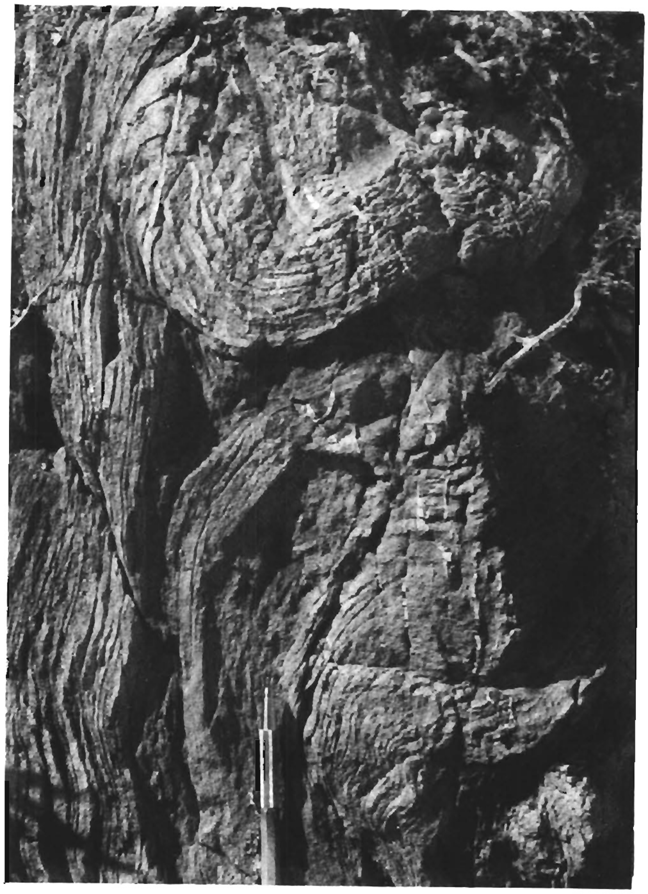


Plate 6: *Early isoclinal folds (F_1) folded about open F_2 folds in psammite of the Gander Group.*

size accentuating the cleavage as metamorphic grade increases. S_2 strikes northward and has a vertical to sub-vertical dip.

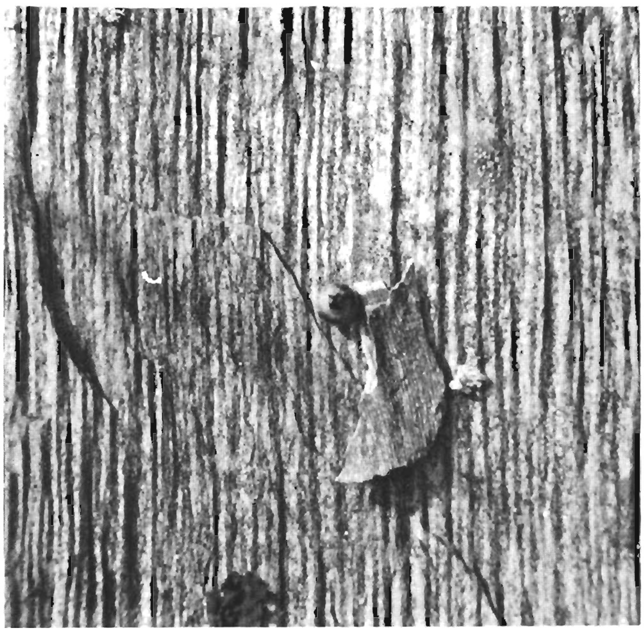


Plate 7: *A ubiquitous L_2-S_2 fabric in the Gander Group is dominated by this strong crenulation lineation in pelites; blueberry for scale.*

Brittle-deformation effects are ubiquitously represented by kink bands; chevron folds are sporadically developed.

Metamorphism. Limited bulk compositional variation in the Gander Group metasedimentary rocks has resulted in simple low-grade metamorphic assemblages. In the west, the assemblage muscovite–chlorite–quartz–plagioclase in pelitic and semipelitic rocks and chlorite–calcite–epidote–plagioclase in amphibolite, is indicative of low greenschist facies metamorphism (Winkler, 1979). Farther east, biotite becomes a stable phase co-existing with muscovite and chlorite. The incoming of biotite coincides with the gradual disappearance of chlorite, although chlorite does persist up to the garnet zone. The assemblage garnet (almandine?)–biotite–muscovite–chlorite–quartz present in the extreme east is characteristic of greenschist facies metamorphism. The biotite overprints S_1 but is kinked by F_2 crenulations.

Davidsville Group

The Davidsville Group has been divided into two units, a lower unit outcroping west of Weir's Pond and mostly east of Route 330, and an upper unit to the northwest of, and probably gradational with, the lower unit.

Lower Unit. On the northwest side of Weir's Pond, bedded bioclastic limestone overlies serpentinized ultrabasic rock. The contact is not tectonic and major brecciation or shearing is absent.

The limestone subunit consists of fine to medium grained calcarenite and bioclastic limestone. Interstitial material in the calcarenite is partly calcite cement and partly matrix. Quartz grains form approximately 70 percent of some calcarenite; volcaniclastic material and chromite grains occur sporadically. A mixed provenance is therefore implied, including continental and ocean-island or island-arc environments. Brachiopods from the bioclastic limestone have been previously identified (Blackwood, 1978) as *Orthambonites* (sp.) of Early to Middle Ordovician age. Conodonts extracted from the same rock indicate an Upper Llanvirnian–Lower Llandeilian age (Stouge, 1979). The fossils are relatively well preserved and probably proximal to their source. Elsewhere, near Route 330, limestone is interbedded with grayish-green siltstone.

In several exposures northwest of Weir's Pond, graphitic black shale, typically not more than several metres thick, occurs close to or in contact with limestone.

The most distinctive subunit within the lower unit is a polymictic, matrix-supported conglomerate (Plate 8) containing clasts ranging from pebble to boulder size. Trondhjemite, the largest and most typical clast type, occurs in three textural varieties: aphanitic, quartz and feldspar porphyritic, and coarse grained. Gabbroic clasts are common, and, unlike trondhjemite some are foliated (Plate 8). Clasts from mafic volcanic and ultrabasic rocks are also present, but are more difficult to distinguish. The proportion of different rock types varies dramatically with trondhjemite ranging between 30 and 70 percent of the rock. Fragments of jasper, up to 20 cm across, occur in a few places, whereas sedimentary clasts are relatively common. Bedding, on a decimetre scale, was noted in one exposure of conglomerate; clasts are completely unsorted and the rock is immature. Locally the conglomerate is interbedded with sandstone and siltstone, and more rarely with cherty layers that may represent vitric tuff. The most reasonable source region for the majority of clasts is the Gander River Ultrabasic Belt.

Plate 8: *Polymictic conglomerate near the base of the Davidsville Group; note well defined foliation in some gabbro clasts (centre of plate).*

Near Fifth Pond (Figure 2), however, pebble conglomerate in which most if not all clasts are of psammite and siltstone suggests a quite different source region, possibly the Gander Group.

The diverse nature of these conglomerate types in a small area, although attributable partly to structural juxtaposition, suggests a rapidly evolving source area, and/or small (semi-) isolated basins. Quartz-rich calcarenite and psammite-rich conglomerate suggest a possible spatial link with the Gander Group.

Gray to grayish-green sandstone, gray shale, siltstone and minor white cherty layers occur in the upper part of the lower unit. In one exposure by a logging road northwest of Weir's Pond, sandstone is clearly cross-bedded on a decimetre scale, and intercalated with pebble conglomerate and siltstone. One outcrop of gray sandstone southwest of Weir's Pond is fossil rich; a preliminary study of the brachiopod fauna indicates the presence of *Orthambonites* (sp.) (Doug Boyce, personal communication, 1986).

Upper Unit. Monotonous, gray, grayish-green, grayish-black siltstone and shale, and interbedded, thin (less than 5 cm), sandy layers characterize the upper member. The sandy beds typically weather to a rusty color due to their Fe-carbonate content. Sedimentary structures are generally absent from the rocks but a plane-parallel lamination is common. However, in one road cut on Route 330, near the north edge of the area, some beds contain a good fining-upward sequence defined by sandy layers (up to a centimetre thick) that have a sharp base and undulating top, followed upward by sand-dominated and finally mud-dominated lenticular layering. Intrafolial folds are rare and are thought to be slump generated. Most of the beds in the outcrop are massive or show variably developed plane-parallel laminations. Commonly, lack of grain-size variation precludes clear bed definition, but individual layers are generally less than 10 to 15 cm thick.

Graphitic black shale occurs rarely in the upper unit. One exposure on a logging road in the northern part of the map area contains elongate limestone clasts, internally fragmented, up to approximately 0.8 m in length, in a shaly matrix.

A foliated, felsic body, approximately 1 m thick and several hundred metres long, occurs intercalated with graphitic, black shale east of Route 330. Phenocrysts of quartz and plagioclase, up to 3 mm in diameter, occur dispersed in a fine grained matrix of quartz, plagioclase and minor white mica. Some grains in the matrix are actually radial acicular aggregates, partly recrystallized. This body appears to be a felsic intrusion that predates the deformation.

Northwest of Route 330, a small, elliptical, equigranular, quartz–feldspar–muscovite granite is exposed within the upper unit. Aeromagnetic and gravity maps show no obvious geophysical signature for this massive granite. It's contacts are not exposed and it's relationships to the Davidsville Group is unknown.

Deformation. Sedimentary rocks of the Davidsville Group group contain one well developed penetrative slaty cleavage, axial planar to tight folds, which strikes northeast and generally dips steeply to the northwest. Patchy exposure in the area does not allow proper evaluation of structure. However, F_1 fold plunges appear to vary, reflecting either later nonpenetrative deformation or original variation in bed attitude (e.g., due to slump folds). This slaty cleavage is folded by heterogeneously developed small-scale brittle folds that have no axial planar foliation. Kinks are sporadically developed.

Although the principal foliation is ubiquitous, it is poorly developed in some exposures (Plate 5) and strongly developed in others. A pebble lineation is present in the more strongly foliated rocks, plunging shallowly southwestward.

Gander River Ultrabasic Belt

Ultrabasic, mafic and felsic rocks of the Gander River Ultrabasic Belt are exposed between Route 330 and Weir's Pond, and exhibit complexities in deformation, lithologic variation, and the nature of their contacts.

Ultrabasic Rocks. Structurally, the lowermost unit exposed is an ultrabasic rock, principally exposed on or near Weir's Pond and in the central-east margin of the map area. Its contact with the rocks of the Gander Group is nowhere exposed.

Pyroxenite forms a major component of the ultrabasic rocks and a range from unaltered to completely altered pyroxenite can be defined. Coarse grained pyroxenite, in which pyroxene crystals are up to several centimetres across, occurs locally. Olivine is a less common mineral. Clinopyroxene is partially or completely altered to light-green hornblende. Much of the altered rock is a talc–magnesite assemblage containing disseminated chromite grains. Locally magnesite development is complete and the saccharoidal texture gives the rock a marble-like aspect on fresh surfaces, whereas exposed surfaces weather deep reddish-orange. Weathering color of the ultrabasic rocks is quite variable and dependent on degree and type of alteration. In some exposures, a layering is produced by alternating magnesite-rich and talc-rich bands. Compositional layering is locally preserved (Plate 9) and may represent primary mineralogical banding accentuated by selective serpentinization of alternate bands. Chromite and magnetite pods occur rarely in altered rocks. Centimetre-thick seams of fibrous antigorite occur in the ultrabasic rocks on the west and north sides of Weir's Pond. Locally, the ultrabasic rocks are brecciated on a microscopic scale, but contain little alteration. Complete or partial serpentinization is also common.

Gabbro. Textural, deformational and, to a lesser extent, compositional heterogeneities noted in ultrabasic rocks are also developed in gabbro. On a megascopic scale, grain-size variation from coarse to fine is typical. Gabbro pegmatites, hornblende rich in places, are abundant, and form either small diffuse patches or locally definable layers. Mineralogical banding defined by alternating feldspar- and pyroxene-rich layers, 0.5 to 4 cm thick, is best developed in a large gabbro outcrop on Weir's Hill southwest of Weir's Pond (Plate 10). Some thicker layers (up to 15 cm) contain a more subtle internal banding.

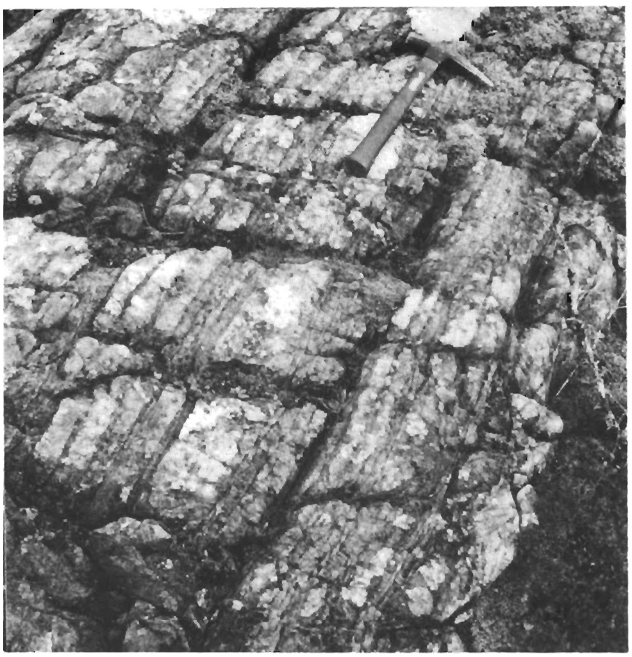


Plate 9: *Banded ultramafic rocks—this may reflect an original layering, possibly enhanced by alteration.*

Plate 10: *Layered gabbro (scale is 15 cm long), defined by alternating feldspar-rich and pyroxene-rich bands.*

Pyroxene pods up to a metre across are present in some gabbro exposures. These may represent disrupted cumulate layers. Serpentinized ultrabasic inclusions exhibiting intensely foliated margins (converted to talc) occur rarely. Locally, gabbro is transitional to a dioritic rock and elsewhere it is pyroxene rich. Contacts between gabbro and coarse-grained trondhjemite, which are typically intimately associated in many exposures, are generally sharp, and the gabbro is invariably intruded by the trondhjemite.

Gabbro locally intrudes mafic volcanic rocks, and in one exposure in a roadside (Route 330) quarry, numerous fine grained diabase dikes, having chilled margins 1 cm or less wide, intrude gabbro.

Calcite veins, 1 to 10 cm thick, form ubiquitous networks in many gabbro exposures.

Trondhjemites. Trondhjemite forms small bodies intrusive into gabbroic, mafic volcanic and volcaniclastic rocks (Plate 11). Plagioclase and quartz are the principal minerals, and chlorite, the mafic phase, varies from 0 to 1 percent of the rock.

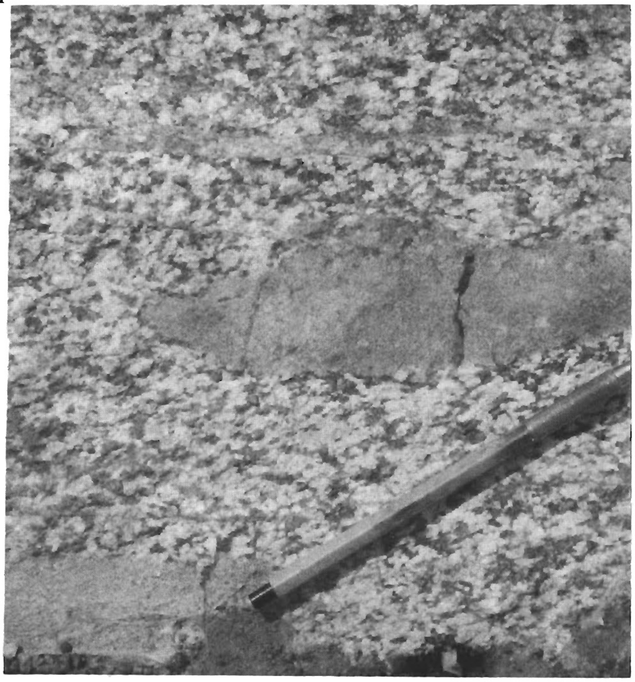


Plate 11: *Foliated coarse grained trondhjemite containing elongate fine grained mafic xenoliths.*

A coarse grained variety of trondhjemite, in which quartz and feldspar crystals are up to 1 cm across, occurs commonly. Quartz and feldspar crystals in a porphyritic variety range up to 0.5 cm across; the aphanitic variety is less common. Some exposures contain both porphyritic and coarse grained types but contact relations are equivocal.

Fine grained mafic xenoliths (Plate 11), commonly observed in coarse grained varieties, are partially assimilated locally, giving the trondhjemite a distinctive green color due to chlorite. Elsewhere, material interstitial to quartz and feldspar is black and microscopically unresolvable.

Mafic Volcanic Rocks. Fine grained, massive mafic volcanic rocks are foliated and contain feldspar, clinopyroxene and some olivine; an ophitic to sub-ophitic texture is ubiquitous. Pillowed mafic volcanic rocks have not been recognized in the map area, but are exposed along Route 330 road cuts immediately west of the area.

Volcaniclastic rocks are represented mainly by lapilli tuff containing clasts up to 1 cm across. Poor exposure obscures the relationships between volcanic flows and volcaniclastic units.

Deformation. The northeast-trending foliation regionally developed in the Davidsville Group is also developed in the ultrabasic belt. However, deformation in the belt is heterogeneous—ultrabasic and gabbroic rocks exhibit the greatest variation. Fabric development in the ultrabasic rocks reflects mineralogy to some extent, so that talc-, talc—carbonate- and serpentine-bearing rocks are especially well foliated.

Coarse to medium grained pyroxenite generally has a poorly developed fabric. This regional foliation is rarely folded; however some brittle folds and kink bands were noted in ultrabasic rocks near the central-west edge of the map area.

Gabbro typically contains a poorly developed, (an effect of coarse grain size) regional, northeast-trending fabric that postdates a locally developed, earlier foliation. The earlier fabric is a penetrative foliation that predates deposition of the Davidsville Group, as indicated by foliated gabbro clasts in conglomerate near the base of the group. Gabbro exposures that exhibit this foliation are commonly brecciated and individual blocks are rotated relative to each other. The regional foliation, as developed in gabbro exposed in a quarry along Route 330, is locally strongly cataclastic and the gabbro is reduced to fine grained material. Shear bands are present, the majority of which imply dextral shear. Diabase dikes cutting the gabbro are not obviously deformed.

Trondhjemite, mafic volcanic and volcaniclastic rocks also exhibit the regional foliation. Quartz and feldspar show some flattening, and mafic fragments or clots are commonly aligned parallel to the foliation in trondhjemite. Internal brecciation in trondhjemite is common, resulting in quartz and feldspar grains enclosed in a fine grained matrix exhibiting a generally clastic texture.

Metamorphism (Davidsville Group and Gander River Ultrabasic Belt). Pelitic units in the Davidsville Group are very fine grained and exhibit few metamorphic effects. White mica is present but is fine grained (less than 50 microns across). Calcite is a common mineral, but much of it, especially in ultramafic rocks, is of probable hydrothermal origin. Mineralogy in the Gander River Ultrabasic Belt is complex: primary igneous parageneses are preserved locally in mafic and ultramafic rocks; elsewhere hydrothermal alteration and/or greenschist-facies metamorphism has produced either magnesite-, talc—carbonate-, or serpentine-rich assemblages. Chlorite is common, however, as is epidote (and possibly zoisite) and a colorless amphibole. This assemblage implies greenschist-facies regional metamorphism affected the Davidsville Group and the Gander River Ultrabasic Belt.

MINERALIZATION

International Mogul Mines Limited, while exploring for base metals in the 1970's, carried out extensive airborne magnetometer surveys of the area. Ground follow-up (which included two diamond-drill holes near Weir's Pond) of anomalies revealed minor pyrrhotite, pyrite and chalcopyrite mineralization associated with mafic volcanic or gabbroic rocks, and numerous graphitic conductors (Zorowski, 1974, 1977). Minor work was also done by Minorex (Durocher, 1979); their exploration for base metals was not continued.

During the 1980's, exploration emphasis shifted from base metals to gold. In 1981, following the discovery (Blackwood, 1979) of arsenopyrite—pyrite in gabbro of the ultramafic belt, Westfield Minerals staked a property near Jonathan's Pond (immediately west of the map area) based on a high Au value (12.8 g/t) in a grab sample (Gagnon, 1981). Extensive quartz veining occurs in a deformed gabbro, which yielded assays of 1.2 g/t over 2.06 m and 1.5 g/t over 1.89 m. Noranda also staked a property between Route 330 and Gander River in 1981, and are actively involved in precious-metal exploration there (MacKenzie, 1985).

Duval International Limited acquired ground in 1984 several kilometres northeast of Westfield Minerals' Jonathan's Pond claims, based on anomalous gold values in stream sediments. Follow-up work involved geological mapping, geophysics, soil and till sampling, and analyses of panned concentrates. 'Wires and flakes of gold' were reported from silt samples but no bedrock source was defined (Stephenson, 1985). Duval conducted no further work and their ground was dropped in the fall of 1986.

Little work has been carried out between Route 330 and Weir's Pond, although Esso Minerals Limited has investigated an arsenopyrite—pyrite showing in this area. Gold values occur in quartz—pyrite—arsenopyrite veins and associated silicified zones in mafic volcanic rocks. The quartz veining appears to be late and is similar to the Jonathan's Pond showing in mineralization type and occurrence. The similarity of these two occurrences (several kilometres apart) implies good potential for more extensive gold mineralization in the ultrabasic belt.

Much hydrothermal activity has affected rocks of the ultrabasic belt as implied by ubiquitous networks of calcite, chlorite and quartz veins; conversion of primary igneous assemblages to talc—carbonate, serpentine and locally asbestos is almost complete in a few places, but relict chrome—spinel, indicative of their original ultramafic nature, is common. Such carbonate- and talc-rich rocks, termed listwaenites (Lobochnikov, 1936), occur commonly in ultramafic rocks, and have been identified as potentially gold-bearing (Buisson and LeBlanc, 1985). Pyrite is commonly disseminated throughout trondhjemite, and malachite stain occurs in places.

In the Davidsville Group, the small muscovite granite is noteworthy for significant (approximately 2 percent) pyrite disseminated through it—an assay sample returned 36 ppb Au.

Although much of the Gander Group is devoid of mineralization, several exposures of psammitic and semipelitic rock near the north edge of the map area contain profuse quartz veins. One quartz vein, which ranged in thickness from 1 to 10 cm due to pinch and swell structure, contained up to 20 percent pyrite and 1 to 6 percent galena. An assay sample of this returned 2.6 percent Pb, 0.17 percent Cu, 73 ppm Mo, 11.2 ppm Ag and 210 ppb Au. This mineralization may be related to a two-mica granite that outcrops several kilometres to the east. Farther south, beryl occurs in muscovite pegmatites close to a smaller granitic pluton.

SUMMARY

The Weir's Pond map area provides a geological transect across the boundary separating two major tectonic zones in northeastern Newfoundland. This boundary is defined by the Gander River Ultrabasic Belt, which may represent remnants of the Iapetus ocean crust. Rocks at the base of the Davidsville Group in the northwest formed in very close spatial association with the ultrabasic belt, and also contain detritus that may provide a link to the Gander Group.

Tectonic interleaving of rocks of the ultrabasic belt with the basal division of the Davidsville Group, and the presence of the same regional foliation in both imply that all of these rocks were deformed contemporaneously after the deposition of the Davidsville Group. The abrupt contact between these rocks and the Gander Group, and the slight but significant non-parallelism of regional fabrics east and west of Weir's Pond suggest subsequent structural juxtaposition with the Gander Group. Although deformation within the Davidsville Group and the ultrabasic belt is complex and quite intense locally, it is not so clearly divisible into two events as that in the Gander Group. A preliminary study of metamorphic effects also suggests that grade of metamorphism may increase slightly (eastward) across the western contact of the Gander Group.

The Gander River Ultrabasic Belt continues to be the main focus of mineral exploration in the area, particularly for gold. A galena-rich quartz vein containing elevated Au and Ag values is the most interesting economic occurrence in the Gander Group.

ACKNOWLEDGEMENTS

Kerri Sparkes is thanked for his commitment to work despite difficult bush. Sean O'Brien and Steve Colman-Sadd are thanked for critically reading early drafts of this report.

REFERENCES

Baird, D.M., Moore, J.G.G., Scott, H.S. and Walker, W.
1951: Reconnaissance geology of east central Newfoundland between Sir Charles Hamilton Sound and Baie d'Espoir. Department of Natural Resources, Mineral Development Division, Newfoundland Geological Survey, Unpublished report, 155 pages. [Nfld (73)]

Blackwood, R.F.
1978: Northeastern Gander Zone. *In* Report of Activities for 1977. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 78-1, 8 pages.

1979: Gander River, Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Map 7929.

1980: Geology of the Gander (west) area (2D/15), Newfoundland. *In* Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 80-1, pages 53-61.

1982: Geology of the Gander Lake (2Dì5) and Gander River (2E/2) area. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 82-4, 56 pages.

Buisson, G. and LeBlanc, M.
1985: Gold in carbonatized ultramafic rocks from ophiolitic complexes. Economic Geology, Volume 80, pages 2028-2029.

Colman-Sadd, S.P.
1980: Geology of south-central Newfoundland and evolution of the eastern margin of Iapetus. American Journal of Science, Volume 280, pages 991-1017.

Currie, K.L. and Pajari, G.E.
1977: Igneous and metamorphic rocks between Rocky Bay and Ragged Harbour, northeastern Newfoundland. *In* Report of Activities, Part A. Geological Survey of Canada, Paper 77-1A, pages 341-346.

Dunlop, W.B.
1955: Evaluation of the area betwen Gander Lake and Sir Charles Hamilton Sound. Newfoundland and Labrador Corporation Limited. Unpublished report, 6 pages. [2E (71)]

Durocher, A.C.
1979: Mineral investigations in central Newfoundland. NALCO Lot 2, middle portion. Minorex Limited. Unpublished report, 26 pages. [2D (105)]

Gagnon, J.
1981: Report on geological, geochemical and geophysical exploration. Jonathan's Pond claims, Gander area. Westfield Minerals Limited. Unpublished report, 10 pages. [2E/2 (410)]

Jenness, S.E.
1958: Geology of the Gander River Ultrabasic Belt, Newfoundland. Geological Survey of Newfoundland, Report 11, 58 pages.

1963: Terra Nova and Bonavista map areas, Newfoundland. Geological Survey of Canada, Memoir 327, 184 pages.

Kennedy, M.J.
1975: Repetitive orogeny in the northeastern Appalachians'new plate models based on Newfoundland examples. Tectonophysics, Volume 28, pages 39-87.

Kennedy, M.J. and McGonigal, M.H.
1972: The Gander Lake and Davidsville groups of northeastern Newfoundland: new data and geotectonic implications. Canadian Journal of Earth Sciences, Volume 9, pages 452-459.

Lobochnikov, V.N.
1936: Ilchirsk and other serpentines and serpentinites: Tsentralnogo Geologo Razvedochnogo Institute, Trudy, number 38, pages 24-56.

MacKenzie, A.C.
1985: First year assessment report (geological, geophysical and geochemical) licence 2472. Noranda Exploration Company Limited. Unpublished Confidential report, 19 pages. [2E (532)]

McGonigal, M.H.
1973: The Gander and Davidsville groups: major tectonostratigraphic units in the Gander Lake area, Newfoundland. M. Sc. Thesis, Memorial University of Newfoundland, St. John's, 121 pages.

Renard, A.
1878: Sur la structure et la composition mineralogique du coticule. Membre Cour. et Membre des Savants Acadamie Royal de Belgique, 16.

Snelgrove, A.K.
1933: Geological report on Shoal Pond chrome area, near Carmanville, Sir Charles Hamilton Sound, northeast coast of Newfoundland, Geological Survey of Newfoundland, 20 pages. [2E/8 (26)]

Stephenson, L.
1985: Assessment report on Gander River claims, Gander River area. Duval International Corporation. Unpublished report, 11 pages. [2E/2 (521)]

Stouge, S.
1979: Conodonts from Davidsville Group of the Botwood zone, Newfoundland. *In* Report of Activities, Newfoundland Department of Mines and Energy, Mineral Development Division, Report 79-1, pages 43-44.

Williams, H.
1976: Tectonostratigraphic subdivisions of the Appalachian Orogen. Geological Society of America, northeastern section. Abstract with Programs, Volume 8, Number 2, page 300.

Winkler, H.G.F.
1979: Petrogenesis of metamorphic rocks. Fifth Edition, Springer-Verlag, New York, 348 pages.

Zurowski, N.
1974: Summary report on ground geophysical surveys in the Gander–Ragged Harbour ultramafic belt. International Mogul Mines Limited. Unpublished report, 19 pages. [2E (340)]

1977: Drillhole logs and location plan of holes drilled on the Gander Project during 1976. International Mogul Mines Limited. Unpublished report. [2E (370)]

Note: Mineral Development Division file numbers are included in square brackets.