GEOLOGY OF THE COLD SPRING POND MAP AREA (West Part) 12A/1, NEWFOUNDLAND

by

S.P. Colman-Sadd
Newfoundland Mapping Section

Abstract

The western half of the Cold Spring Pond area was mapped during 1983. Parts of it have previously been explored by mining companies and all of it has been included in regional geological and geochemical surveys.

Ultramafic rocks and a volcanic-sedimentary sequence form the westward extension of the Lower to Middle Ordovician Baie d'Espoir Group and its supposed ophiolitic basement. These rocks are in fault contact with quartzite and pelite similar to the Lower to Middle Ordovician Spruce Brook unit outcropping to the northeast. The quartzite and pelite have associated felsic volcanic rocks and conglomerate and are cut by mafic dikes.

An isolated outcrop of sandstone, shale and conglomerate in the southwest of the area resembles Silurian rocks in north-central Newfoundland.

An area of high grade metasedimentary, migmatitic and granitic rocks is mainly in fault contact with older units, but does contain xenoliths of ultramafic and Baie d'Espoir Group rock types. Younger granites which are intrusive into the Baie d'Espoir Group, the Spruce Brook unit and the migmatites, are all deformed, some of them intensely. A large intrusion of gabbro and diorite is only locally deformed and was probably unaffected by major fault systems. The major intrusions are most likely to be Devonian.

Minor sulfide mineralization has been found in felsic volcanic rocks of the Baie d'Espoir Group and the Spruce Brook unit.

Introduction

The Cold Spring Pond area is located about 40 km northwest of St. Alban's. The eastern part of it is accessible from the road which links St. Alban's to the Godaleich Pond hydroelectricity station and the northwest corner can be reached from Millertown by way of the road to Ebbegumbaeg dam and Meelpaeg Lake. The remainder is only accessible by aircraft.

The eastern part of the area was mapped at 1:20,000 and 1:50,000 scales in previous years by Swinden and Collins (1982) and Colman-Sadd (1983). The accompanying map (Figure 1) shows the whole NTS area, but only units that occur in the western part and have been the subject of mapping during 1983 are discussed below. The boundary between the 1983 work and the earlier work coincides with a line running south through Cold Spring Pond and, south of the gabbro intrusion, with the easterly extent of the Spruce Brook unit. The 1:50,000 scale geological map of the Cold Spring Pond area is available on open file (Colman-Sadd and Swinden, 1983).

Previous work in the western part of the area consists of detailed surveys by mining companies and regional surveys by government agencies. Phendler (1950, 1951) mapped the northwestern quadrant for the Buchans Mining Company. Sander and Heshka (1970) did geological, geophysical and geochemical work north of Cold Spring Pond as part of a larger exploration project by the Hansa Syndicate in the southern part of the Great Burnt Lake volcanic belt (Colman-Sadd and Swinden, 1982). Anomalies identified during this survey were subsequently staked by Consolidated Morrison Exploration, and further geological and geophysical work was done in a joint venture with Rio Tinto Canadian Exploration (Bucknell et al., 1976). Two holes were drilled northwest of Cold Spring Pond as part of this program.

Two regional surveys have included the Cold Spring Pond area. It forms part of the Red Indian Lake (east half) 1:250,000 scale geology map of Williams (1970), published by the Geological Survey of Canada. It was also included in a lake sediment geochemistry survey conducted by the Newfoundland

Contribution to the Canada-Newfoundland co-operative minerals program 1982-84. Project funded by the Newfoundland Department of Mines and Energy.

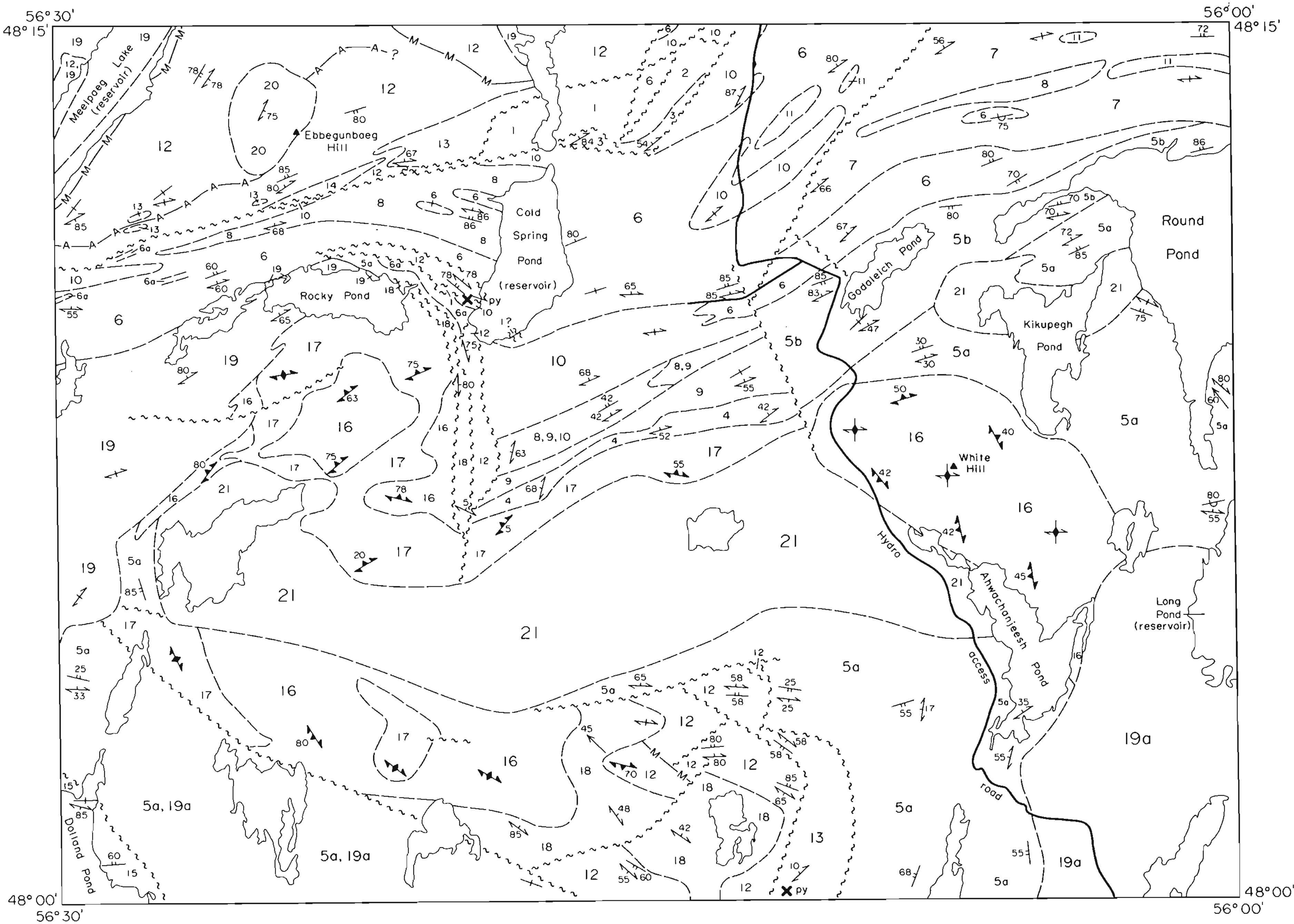

Figure 1: *Geological map of the Cold Spring Pond area (12A/1), simplified from Colman-Sadd and Swinden (1983). Only the western part of the area is described in this report.*

LEGEND

DEVONIAN or older

21 *Gabbro, diorite and minor granodiorite.*

20 *Medium to fine grained, equigranular, lineated or foliated biotite granite.*

19 *Equigranular to porphyritic, medium to coarse grained, moderately foliated biotite or biotite-muscovite granite. Includes* **North Bay Granite (19a).**

18 *Strongly foliated, megacrystic biotite granite.*

17 *Diffusely banded, medium to fine grained muscovite-biotite granite, with abundant xenoliths of schist and psammite.*

16 *Well foliated, medium to coarse grained migmatite, with schlieren structure; locally includes nonmigmatitic sillimanite schist.*

SILURIAN (?)

15 *Thin to medium bedded, moderately cleaved, dark greenish gray sandstone and shale.*

LOWER to MIDDLE ORDOVICIAN

Baie d'Espoir Group *(Units 4-11) (no stratigraphic order implied by sequence)*

North Steady Pond Formation *and related units (Units 6-11).*

11 *Mafic pillow lava, massive basalt, pillow breccia. Includes considerable fine grained chloritic tuff and lesser fine grained sediments.*

10 *Silicic pyroclastic rocks: dark green, gray or black siliceous tuff with abundant quartz crystals and local concentrations of feldspar crystals and/or lithic fragments; locally associated with limestone.*

9 *Dark green, thinly bedded phyllite.*

8 *Conglomerate: polymictic, unstratified to poorly stratified boulder and pebble conglomerate; commonly matrix-supported and poorly sorted.*

7 *Silicic tuff and reworked tuff, quartz and feldspar crystal tuff and crystal-lithic tuff; commonly unstratified but locally shows evidence of reworking.*

6 *Sedimentary rocks: includes gray to green, thick to thin bedded arkosic sandstone, siltstone and laminated phyllite, with local black graphitic argillite* **(6a).**

Salmon River Dam Formation

5 *Dark purplish gray siltstone and very fine grained sandstone with minor calc-silicate, pelitic and quartzitic beds;* **5a**, *mainly medium to thick bedded;* **5b**, *thin bedded.*

4 *Psammitic schist with quartz and granite sweats.*

Spruce Brook *and related units (Units 12-14) (no stratigraphic order implied by sequence).*

14 *Conglomerate composed mainly of quartzite clasts.*

13 *Felsic crystal tuff and subvolcanic(?) granite.*

12 *Interbedded quartzite and pelite; metamorphic grade varies from greenschist facies to migmatite; ----A----A, first appearance of andalusite; ----M----M, beginning of melting.*

CAMBRIAN to LOWER ORDOVICIAN

3 *Basalt, pillowed to massive flows, commonly variolitic; pillow breccia; minor tuff.*

2 *Coarse to medium grained gabbro and trondhjemite, with minor pyroxenite.*

1 *Peridotite, fine grained, commonly with pyroxene phenocrysts and disseminated chromite.*

Department of Mines and Energy (Butler and Davenport, 1978).

The geology of the area is most easily discussed in terms of five tectonostratigraphic components:

(1) Ophiolitic rocks (Units 1 to 3) and volcanic and sedimentary rocks of the Baie d'Espoir Group (Units 4 to 11). These rocks probably span the time interval from Cambrian to Middle Ordovician.

(2) Sedimentary and volcanic rocks of the Spruce Brook (?) and related units (Units 12 to 14) of probable Early to Middle Ordovician age.

(3) Sedimentary rocks at Dolland Pond, possibly of Silurian age (Unit 15).

(4) Granite, migmatite and associated high grade metamorphic rocks. The time of intrusion was probably Devonian (Units 16 to 20).

(5) Gabbro/diorite, possibly of Devonian age (Unit 21).

The separation of components (1) and (2), despite their similar ages, results from a structural interpretation derived from work in the Burnt Hill (2D/5), Miguels Lake (2D/12) and Great Burnt Lake (12A/8) areas. The interpretation, outlined by Colman-Sadd and Swinden (1982), proposes that rocks of component (1), representing typical Dunnage Zone sequences, occur as an allochthonous sheet on rocks of component (2) (Spruce Brook and related units) and probably also on the less mobilized parts of component (4) (granites and migmatites). The map pattern in the Cold Spring Pond area is consistent with this interpretation but does not require it.

General Geology

Component 1: Ophiolitic Rocks and the Baie d'Espoir Group (Units 1-11)

Ophiolitic rocks west of Cold Spring Pond consist exclusively of peridotite altered principally to serpentine and magnesite. There are three outcrop areas.

In the northern outcrop, peridotite is associated with other ophiolitic rock types northeast of Cold Spring Pond (Swinden and Collins, 1982). Northwest of the pond, in the part of the outcrop mapped during 1983, only four exposures have been found. Three of these consist of massive serpentinized peridotite with disseminated crystals of chromite and only minor fracturing. The fourth is composed, in large part, of magnesite and talc, and consists of massive blocks of altered peridotite in a well foliated matrix. The contacts of the peridotite body are presumed to have been faulted. The southern contact zone is probably represented by an exposure of brecciated graphitic slate in a stockwork of quartz on the shore of the pond north of Cold Spring Pond. Boulders of this breccia can be traced westward towards a strong topographic lineament that is interpreted as a fault between the Baie d'Espoir Group of Component 1 and the Spruce Brook unit of Component 2. The northern boundary between the peridotite and felsic crystal tuff is unexposed, but presumed to be faulted. It was probably intersected by diamond drill hole GBL2 of Bucknell et al. (1976). The hole was collared in felsic crystal tuff and drilled at an angle of 45° to the south. It penetrated 90 feet (28 m) of tuff and below that continued in interlayered graphitic shale and talc schist. It bottomed at 543 feet (167 m) in a 170 feet (52 m) layer of talc schist.

The central outcrop of ophiolitic rocks consists of a narrow zone exposed in the brook between Rocky and Cold Spring Ponds. An extension of this zone may be present on the southeast shore of Cold Spring Pond where ultramafic boulders are common but no *in situ* exposures have been observed. In Rocky Pond brook, the peridotite is mostly sheared to form a talc-serpentine schist, but in places where the ultramafic zone widens there are also exposures of more massive peridotite. Exposed contacts of the peridotite with the surrounding rocks reveal that not only are its boundaries faulted, but also that it is emplaced along a significant structural discontinuity between the rocks on either side of it. Exposures to the north of the peridotite are typical of the Spruce Brook unit (Component 2) and those to the south are formed of Baie d'Espoir Group rock types (Component 1).

The southern outcrop of ophiolitic rocks occurs to the southwest of Cold Spring Pond and is formed of a single exposure of massive serpentinized peridotite in excess of 150 m in diameter (Plate 1). The peridotite is entirely surrounded by granite and migmatite exposures and appears to form a xenolith within these rocks. The contacts are not exposed, but the peridotite contains porphyroblasts of a white phyllosilicate and is cut by coarse grained veins of the same phyllosilicate with probable tremolite and a variety of other minerals. The veining and porphyroblast growth probably indicate postserpentinization progressive metamorphism, which could have been achieved during migmatization of the country rocks. The original emplacement

Plate 1: *Peridotite exposed southwest of Cold Spring Pond and entirely surrounded by exposures of migmatitic gneiss. Man in left center for scale.*

of the peridotite before metamorphism may well have been along "cold" faults as in the cases of the two peridotite bodies to the north, but these contacts are now presumed to have been completely remobilized.

Rocks of Units 4 to 11 are here provisionally assigned to the Salmon River Dam and North Steady Pond Formations of the Baie d'Espoir Group, although it should be noted that a revision of stratigraphic nomenclature is presently being prepared by H.S. Swinden in a Mineral Development Division Report, and that this will propose the reassignment of some of these units. The Baie d'Espoir Group, in the Cold Spring Pond area, is thought to have been deposited, at least in part, on oceanic crust, represented by the ophiolitic rocks of Units 1 to 3. All the contacts are now faulted and the supposed relationship is based on the regional geology of the Central Mobile Belt, as discussed by Colman-Sadd and Swinden (1982). The lithologies of the Baie d'Espoir Group units are briefly described in the legend; the following paragraphs are mainly concerned with structural and stratigraphic relationships.

The Salmon River Dam Formation (Unit 5a) occurs as medium to thick bedded purplish sandstone. Southwest of Ahwachenjeesh Pond exposures at the western edge of the formation's extent contain metamorphic biotite and are separated from the andalusite- and sillimanite-bearing Spruce Brook unit by marked topographic lineaments. In several localities the lineaments are exposed as steeply dipping fault zones. Northeast of Dolland Pond, a few scattered exposures of the formation are present and most of these are intruded by sills and dikes of muscovite-biotite granite, apparently related to the North Bay Granite. Between Cold Spring and Rocky Ponds, the Salmon River Dam Formation may pass conformably eastward into graphitic argillite (Unit 6a), but is faulted on the west against sheared and mylonitized biotite granite (Unit 18). Nebulous screens and xenoliths of rock types typical of the Salmon River Dam Formation occur as unseparated parts of the granite and migmatite terranes of Units 16 and 17, but they do not appear to have formed the principal protolith of these units.

Rocks of the North Steady Pond Formation, in the west part of the map area, are restricted to a belt extending west from Cold Spring Pond along the north side of Rocky Pond. They consist of various sedimentary rock types with intercalated lenses of quartz-feldspar crystal tuff. The tuff (Unit 10) occurs at three localities. Between Rocky and Cold Spring Ponds it is light gray and locally impregnated with quartz veins and segregations that contain disseminated pyrite. At least two beds of tuff are present, separated by graphitic slate and limestone. A similar light gray rock occurs at the west edge of the area in a lens that appears to be about 500 m thick, although exposure is not sufficiently good to show whether the tuff is actually interbedded with other rock types. Black, poorly cleaved crystal tuff, similar to rocks found between Cold Spring and Godaleich Ponds, occurs in a small exposure at the bottom of the valley marking the presumed fault between components 1 and 2. The absence of this rock type immediately along strike and its presence in a possible fault zone suggests that it may have been emplaced as a fault slice.

Sedimentary rocks of the North Steady Pond Formation are mainly green-gray arkosic sandstone (Unit 6) and conglomerate (unit 8). Identifiable clasts consist of sedimentary rocks, felsic and mafic volcanics, and granite, together with monomineralic clasts derived from these rock types. The sandstone commonly has thin interbeds of green-gray pelite and also contains thick beds of strongly folded black graphitic argillite (unit 6a). Limestone has been found at one locality between Rocky Pond and Cold Spring Pond. It is a light brown quartzose calcarenite and occurs in a single massive lens about 2 m thick, enclosed between beds of felsic crystal tuff and graphitic slate.

Rocks of Component 1 were subject to one regional deformation, which formed a penetrative cleavage and isoclinal folds. A second deformation is indicated in many exposures by crenulation of the first cleavage, and this deformation may have been responsible for some of the faulting. Metamorphism is generally in the greenschist facies. Exceptions are where peridotite and rocks of the Salmon River Dam Formation are present as xenoliths and screens in the migmatitic rocks of Units 16 and 17. Exposures of the Salmon River Dam Formation that are intruded by granite northeast of Dolland Pond may also be at a higher grade, but the psammitic composition of the rock prevents easy identification of metamorphic grade.

Component 2: Spruce Brook (?) and Related Units (Units 12-14)

Rocks provisionally included in the Spruce Brook unit in the Cold Spring Pond area consist mainly of interbedded quartzite and pelite at various grades of metamorphism (Plate 2). They are similar to rocks exposed in the Burnt Hill (2D/5), Miguels Lake (2D/12) and Great Burnt Lake (12A/8) areas (Colman-Sadd and Swinden, 1982), which contain Lower to Middle Ordovician fossils. The unit outcrops in four separate parts of the Cold Spring Pond area.

Plate 2: *Interbedded quartzite and pelite of the Spruce Brook Formation near Meelpaeg Lake. An isoclinal, first deformation fold closes near the bottom of the photograph, and is refolded by open second deformation folds.*

In the northern outcrop area around Ebbegunbaeg Hill, two additional lithologic types are present. Quartz-feldspar crystal tuff (Unit 13) occurs as lenses in the quartzite and pelite. The lenses are sharply bounded and do not appear to have shed detritus into the neighboring sediments. They are particularly interesting because the Spruce Brook unit has hitherto been characterized as devoid of volcanic rocks (Colman-Sadd and Swinden, 1982). Conglomerate (Unit 14) occurs in two exposures just north of the contact with the Baie d'Espoir Group and, in contrast to the conglomerate of Unit 8, consists almost entirely of quartzite clasts. The clasts have apparently been derived from quartzite beds of the Spruce Brook unit. A similar conglomerate has been found by Dickson and Delaney (1984, in this volume) in the neighboring Wolf Mountain area (12A/2) to the west. A further feature of the northern outcrop area is the presence of mafic dikes which in the high grade rocks at the edge of Meelpaeg Lake are represented by sheets of amphibolite. The northern outcrop area is considered to be faulted against the Baie d'Espoir Group for the following reasons: (1) part of the contact is occupied by ultramafic rocks, (2) a marked topographic lineament extends west from the ultramafic outcrop, and (3) there is an inconsistency of units along the contact suggesting tectonic truncation. Metamorphism in the northern area varies from greenschist facies up to migmatite and shows a general increase in grade towards the granite of Unit 19. Isograds that can be easily mapped in the field are those at the first appearance of andalusite and at the inversion of andalusite to sillimanite (Colman-Sadd and Swinden, 1983).

The outcrop area just west of Cold Spring Pond has an exposed fault contact with ultramafic rocks on its south boundary, but its north boundary is unexposed. The outcrop area south of Cold Spring Pond cuts across the strike of the Baie d'Espoir Group rocks to the east and is bounded to the west by sheared and mylonitized granite. The unit in both areas is metamorphosed in the greenschist facies.

At the southern edge of the map area the Spruce Brook unit is in exposed fault contact with the Salmon River Dam Formation, and has probably been intruded by foliated granite of Unit 18. In this part of the area, it consists entirely of quartzite and pelite containing andalusite or sillimanite, and/or migmatitic sweats.

Felsic crystal tuff and granite of Unit 13 are tentatively included in the map legend as associates of the Spruce Brook unit. The contacts however are faulted, and the tuff and granite may actually form part of the Baie d'Espoir Group. One sample of the crystal tuff was found to contain disseminations of pyrite and other undetermined sulfide minerals.

The Spruce Brook and related units have a dominant penetrative cleavage. This cleavage, however, has irregular trends that strongly suggest the presence of important large scale second deformation structures, and in several exposures a second cleavage is visible.

Component 3: Sedimentary Rocks at Dolland Pond

Several exposures of dark green sandstone and shale (Unit 15) are associated outside the Cold Spring Pond area with polymict conglomerate. The conglomerate was likened by Williams (1970) to the Silurian Goldson Formation, and the sandstone and shale bears a striking resemblance to rocks of the Silurian Botwod Group in the West Gander Rivers area (2D/11) (Blackwood, 1981; Colman-Sadd, 1982). The rocks have a single penetrative cleavage and are metamorphosed in the greenschist facies. Their contacts with the Salmon River Dam Formation are assumed to be faulted because of the relatively low metamorphic grade and the absence of granite veins.

Component 4: Granites, Migmatites and Related Rocks

Granitoid rocks of the Cold Spring Pond area fall into four groups. The oldest of these displays a continuous variation (Units 16 and 17) from sillimanite schist through migmatite (Plate 3) to fine grained granite caused by partial melting of a sedimentary protolith. The granite end-member of these two units is a rusty weathering, medium to fine grained rock, crowded with xenoliths of biotite schist and psammite (Plate 4). Locally it also contains sheets and xenoliths of the Salmon River Dam Formation and peridotite.

Strongly foliated biotite granite of Unit 18 is coarse grained and in many places megacrystic. It has intruded migmatite of Unit 16 and the Spruce Brook unit, and has been emplaced along the fault south of Cold Spring Pond as a cataclastically deformed and locally mylonitized tectonic slice. In the southern part of the area, the strong first deformation fabric was tightly folded by a second deformation (Plate 5); the outcrop pattern may reflect this period of folding.

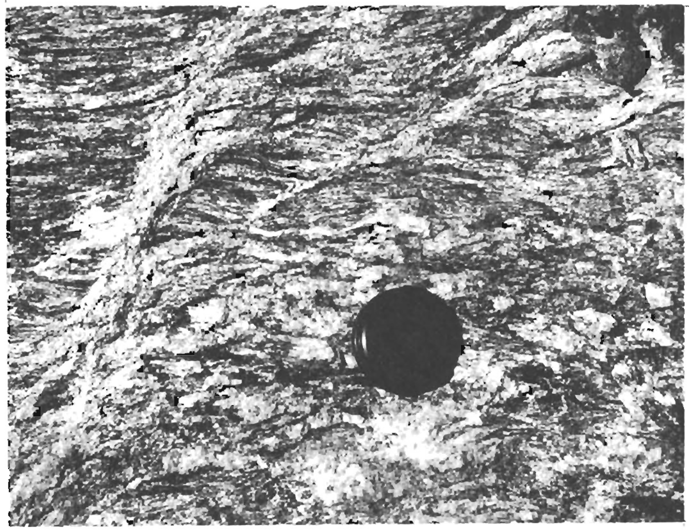

Plate 3: *Migmatized mica schist of Unit 16, northeast of Dolland Pond.*

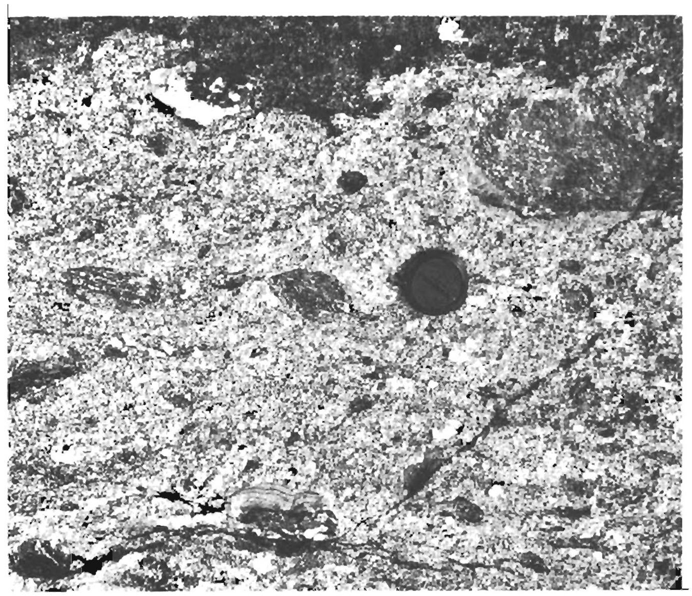

Plate 4: *Rusty weathering, fine to medium grained granite of Unit 17, south of Rocky Pond. The granite is crowded with xenoliths of psammite and sillimanite schist, and contains quartz segratations.*

Equigranular to porphyritic biotite or biotite-muscovite granite of Unit 19 forms part of the North Bay Granite batholith and associated intrusions. In contrast to granite of Unit 17, it contains few xenoliths and has sharply defined intrusive contacts. It has intruded rocks of the Baie d'Espoir Group and Spruce Brook unit, as well as the granite and migmatite of Units 16 and 17.

Biotite granite of Unit 20 is medium to fine grained, locally has quartz megacrysts, and is cut by a few quartz

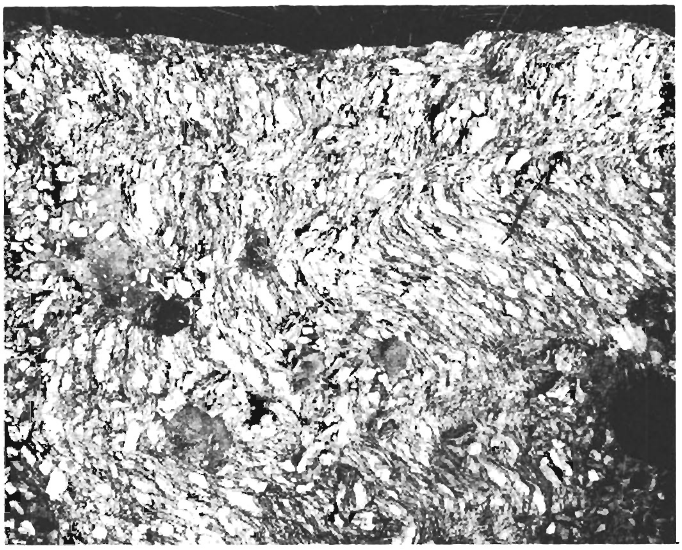

Plate 5: *Biotite granite of Unit 18, east of Dolland Pond. A strong first deformation fabric was refolded during a second deformation.*

porphyry dikes. Much of the intrusion has a strong steep lineation or foliation and it has deflected structures in the country rocks. It has not, however, had any metamorphic effect on the country rocks.

Component 5: Gabbro/Diorite

Medium grained hornblende gabbro and quartz-biotite-hornblende diorite (Unit 21) form an intrusion that cuts the Salmon River Dam Formation and the granite and migmatite of Units 16 and 17. The gabbro is only very locally foliated and the outcrop does not appear to be offset by the fault south of Cold Spring Pond. For these reasons, the time of intrusion is considered to be relatively late in the development of the geology of the area.

Mineral Potential

Sulfide mineralization has been found in felsic pyroclastic rocks of Units 10 and 13, which probably have the greatest potential for economic mineral deposits of any of the five units described in this report. The occurrence in Unit 10 is located in the brook between Rocky Pond and Cold Spring Pond, and consists of disseminated pyrite in silicified felsic tuff and in quartz veins and segregations in the tuff. The tuff layer, which is no more than 2 m thick, is interbedded with pyritiferous, black, graphitic slate (Unit 6a). In Unit 13, a single sample from near the south edge of the map area contains a 1 cm patch of fine grained sulfide minerals, including pyrite and at least one other presently unidentified mineral. No other mineralization was found at this locality.

Granite of Unit 19 has yielded no indication of mineralization within the map area, but lake sediment surveys have identified tungsten anomalies just to the south, apparently within the same intrusion (Davenport and Butler, 1982).

Acknowledgements

I thank Anthony Benoit for able assistance in the field, and Scott Swinden and Lawson Dickson for critically reading the manuscript.

References

Note: Mineral Development Division file numbers, where available, are included in square brackets at end of each reference to an unpublished report.

Blackwood, R.F.
1981: Geology of the West Gander Rivers area, Newfoundland. *In* Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 81-1, pages 50-56.

Bucknell, W., McKenzie, C. and McCance, J.A.
1976: Consolidated Morrison joint venture, Cold Spring Pond area, report on geology and geophysics, parts I and II. Riocanex unpublished report, 20 pages [12A/1(187)].

Butler, A.J. and Davenport, P.H.
1978: A lake sediment geochemical survey of the Meelpaeg Lake area, central Newfoundland. Department of Mines and Energy, Mineral Development Division, Open File, Newfoundland 986, 36 pages.

Colman-Sadd, S.P.
1982: West Gander Rivers (2D/11, west part), Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Open File Map 82-59.

1983: Geology of the east half of the Cold Spring Pond map area (12A/1), Newfoundland. *In* Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 83-1, pages 16-25.

Colman-Sadd, S.P. and Swinden, H.S.
1982: Geology and mineral potential of south-central Newfoundland, Second edition. Newfoundland Department of Mines and Energy, Mineral Development Divison, Report 82-8, 102 pages.

1983: Cold Spring Pond (12A/1), Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Open File Map 83-108.

Davenport, P.H. and Butler, A.J.
1982: Tungsten in lake sediment over granitoids in south-central Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Open File Nfld. (1302).

Dickson, W.L. and Delaney, P.W.
1984: Geology of the Wolf Mountain (east half) and Dolland Brook (east half) map areas, south-central Newfoundland. *In* Current Research, Part A. Geological Survey of Canada, Paper 84-1A, pages . Also in this volume.

Phendler, R.W.
1950: Geology of the Lake Ebbegunbaeg area. Buchans Mining Company, unpublished report, 5 pages. [12A(65)].

1951: Unpublished geological map of Cold Spring Pond area. Buchans Mining Company.

Sander, G.W. and Heshka, W.
1970: The Hansa Syndicate, Buchans and south concessions, Newfoundland. Unpublished report. [12A(120)].

Swinden, H.S. and Collins, W.T.
1982: Geology and economic potential of the Great Burnt Lake area, central Newfoundland. *In* Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 82-1, pages 188-207.

Williams, H.
1970: Red Indian Lake (east half), Newfoundland. Geological Survey of Canada, Map 1196A.

S.P. Colman-Sadd