LOWER PALEOZOIC GEOLOGY OF SOUTHWESTERN WHITE BAY

by

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INTRODUCTION

A reconnaissance mapping program of the southwestern White Bay region began in 1980 as part of a 1:50,000 scale compilation of previous work on the Cambro-Ordovician and Silurian sequences in the area. Four weeks field work was completed, mainly on the Cambro-Ordovician rocks.

The geology of the southern White Bay can be summarized as:

1. Precambrian granites and gneisses of the Grenville Long Range inlier. These rocks will not be studied in this project.

2. Cambro-Ordovician clastic-carbonate sequence, named the Coney Arm Group, that forms a narrow belt bordering the Grenville basement.

3. A granitoid complex named the Coney Head Complex that is unconformably overlain by Silurian strata.

4. The Silurian Sops Arm Group of bimodal volcanics, conglomerates, fluviatile sandstones, marine sandstones and calcalenites.

5. A Devonian (?) granitoid named the Gull Lake Granite.

6. Fluviatile sandstones and conglomerates of the Carboniferous Anguille Group. These were recently mapped in detail by Hyde (1979) and are not described here.

A major north-south trending fault system traverses the area and separates the Cambro-Ordovician sequence from the Coney Head Complex and the Sops Head Group. It shows evidence of early strike slip movements followed by later vertical displacements.

The area is of economic interest, as quartz veins cutting sediments and felsic volcanic rocks of the Sops Arm Group are auriferous and hosted the first gold mine in Newfoundland in 1903. A thin dolomite unit in the lower part of the Sops Arm Group hosts two lead prospects.

PREVIOUS WORK

The pioneering geological reconnaissance of the area was made by Murray (1881) who recognized the main geologic subdivisions. Howley (1918) later verified Murrays stratigraphy in the region of Sops Arm that was, at that time, being actively prospected for gold. Snelgrove (1935) investigated the gold prospects in detail and noted the association of the mineralization with quartz porphyry intrusives. Heyl (1937) produced the first geologic map of the area north of Sops Arm and proposed a nomenclature for the stratigrahpic units. Heyl considered the stratigrahpic sequences to be continuous and conformable, a view since shown to be incorrect by Lock (1969a) and Williams (1977). Betz (1948) mapped the area southeast of Sops Arm and provided a useful correlation with the Cambro-Ordovician and Carboniferous rocks of northern White Bay.

A fundamental revision of the stratigraphy was described by Lock (1969a, 1972a) who mapped the area from

Taylor's Pond to Coney Arm for a Ph.D. thesis. Lock showed that a major structural event, the Taconic Orogeny, separated deposition of the Silurian sequence from the Cambro-Ordovcian sequence. He modified Heyl's stratigraphy and proposed the nomenclature that has been essentially adopted by later workers. He described the volcanic stratigraphy of the Silurian Sops Arm Group in detail and demonstrated that many units previously described as intrusive are, in fact, welded ash flow tuffs (ignimbrites). He pointed out the possible association of the gold mineralization with volcanic activity.

Williams (1977) continuing his astute observations and synthesis of Newfoundland geology noted that the migmatites and greenschists described by Lock (1969a) in the northern part of the area were especially out of geologic context with the nearby Cambro-Ordovician platformal carbonate rocks. He discovered that the Silurian strata sit unconformably on igneous rocks of the misnamed "migmatite complex", which he interpreted as another Taconic allochthon in western Newfoundland.

Noranda Exloration, (summarized in Dimmell, 1979) following up stream sediment geochemical anomalies on the west side of the Gull Lake granite, discovered lead mineralization in a dolomitic limestone unit in the Silurian Sops Arm Group. They cut over 260 km of grid over this unit which lies close to the faulted Ordovocian-Silurian contact. Their detailed mapping has shown the complex nature of the fault system, and the stratigraphic control of the mineralization.

With this background information, it was thought that the geology could be reliably compiled on 1:50,000 scale maps augmented by limited field work. However, reconnaissance has shown the previous maps to be locally inaccurate, especially in inland areas, and further mapping is required which will be undertaken in 1981.

CONEY ARM GROUP (UNITS 2-4)

The Cambro-Ordovician clastic-carbonate sequence that unconformably overlies the Grenville basement is called the Coney Arm Group (Lock, 1969a; 1972a). It has been revised to include three formations (Williams, 1977), the Beaver Brook, Doucers, and Taylors Pond.

Beaver Brook Formation (Unit 2)

The Beaver Brook Formation (Heyl, 1937; Neale and Nash, 1963) forms the lowest formation and consists of quartzites and sandstones at the base, overlain by a white dolomite limestone unit, which is followed by a sequence of phyllites, mica schists and minor limestones.

Doucers Formation (Unit 3)

Phyllites of the Beaver Brook Formation pass transitionally upwards into a thick, previously undivided sequence of limestones, dolomites and orthoquartzites referred to as the Doucer's Formation (Heyl, 1937; Neale and Nash, 1963). Four members were recognized north of Little Coney Arm and the upper three are delineated in Figure 1.

The basal member consists of a sequence of thinly bedded, dark gray, limestones with interbedded, brown weathering, oolitic limestones and distinctive, brown-red weathering, gray dolomite beds from 0.5 to 1 m thick.

A fault of unknown displacement separates this member from a member containing limy slates, slates, dolomitic sandstones, calcareous sandstones, oolitic and oncolitic limestones and orthoquartzites, (Unit 3a). This sequence is well exposed in the coastal section from 1 km south of Cobbler Head to 0.8 km north of Little Coney Arm (Figure 1). Tops, determined from graded dolomitic sandstones, indicate that the steeply dipping to slightly overturned sequence youngs to the east. The quartzites occur in beds

LEGEND

CARBONIFEROUS

DEER LAKE GROUP

15 Undivided red conglomerate, sandstone and siltstone.

ANGUILLE GROUP

14 Undivided gray and red sandstone, conglomerate and gray to red siltstone.

DEVONIAN OR YOUNGER

13 **Gull Lake Granite:** Biotite, alkali feldspar granite.

SILURIAN (Middle to Late)

SOPS ARM GROUP (8-12)

12 **Natlins Cove Formation: 12a,** Fine grained argillaceous sandstone, gray siltstone, and limestone; **12b,** felsic and minor mafic volcanic rocks.

11 **Simms Ridge Formation:** Gray siltstone and mudstone,minor calcareous mudstone.

10 **Frenchmans Cove Formation:** Bedded polymictic conglomerate and sanddstone.

9 **Jackson's Arm Formation:** Massive, cobble to boulder, polymictic conglomerate; minor volcanic rocks.

8 **Lower volcanic formations: 8a, White Iron Hills Formation:** rhyolite flows, and breccias; **8b, Main River Formation:** rhyolites, rhyolite breccias, mafic volcanics, minor polymictic conglomerate. **8c, Stony Hill Formation:** welded ash flow tuff, mafic volcanics, minor conglomerate. Undivided felsic and mafic volcanic rocks and minor sandstone, conglomerate, and dolomitic limestone.

PRE SILURIAN

7 **Coney Head Complex:** Tonalite granodiorite, diorite and gabbro. Intruded by composite dikes.

6 **Murrays Cove Schist:** Greenschist, mafic tuff and chert.

MIDDLE ORDOVICIAN TO CAMBRIAN

5 **Second Pond Melange:** Serpentinite and graywacke blocks in black shale matrix.

CONEY ARM GROUP (2-4)

4 **Taylors Pond Formation:** Slate, phyllite, and minor sandstone.

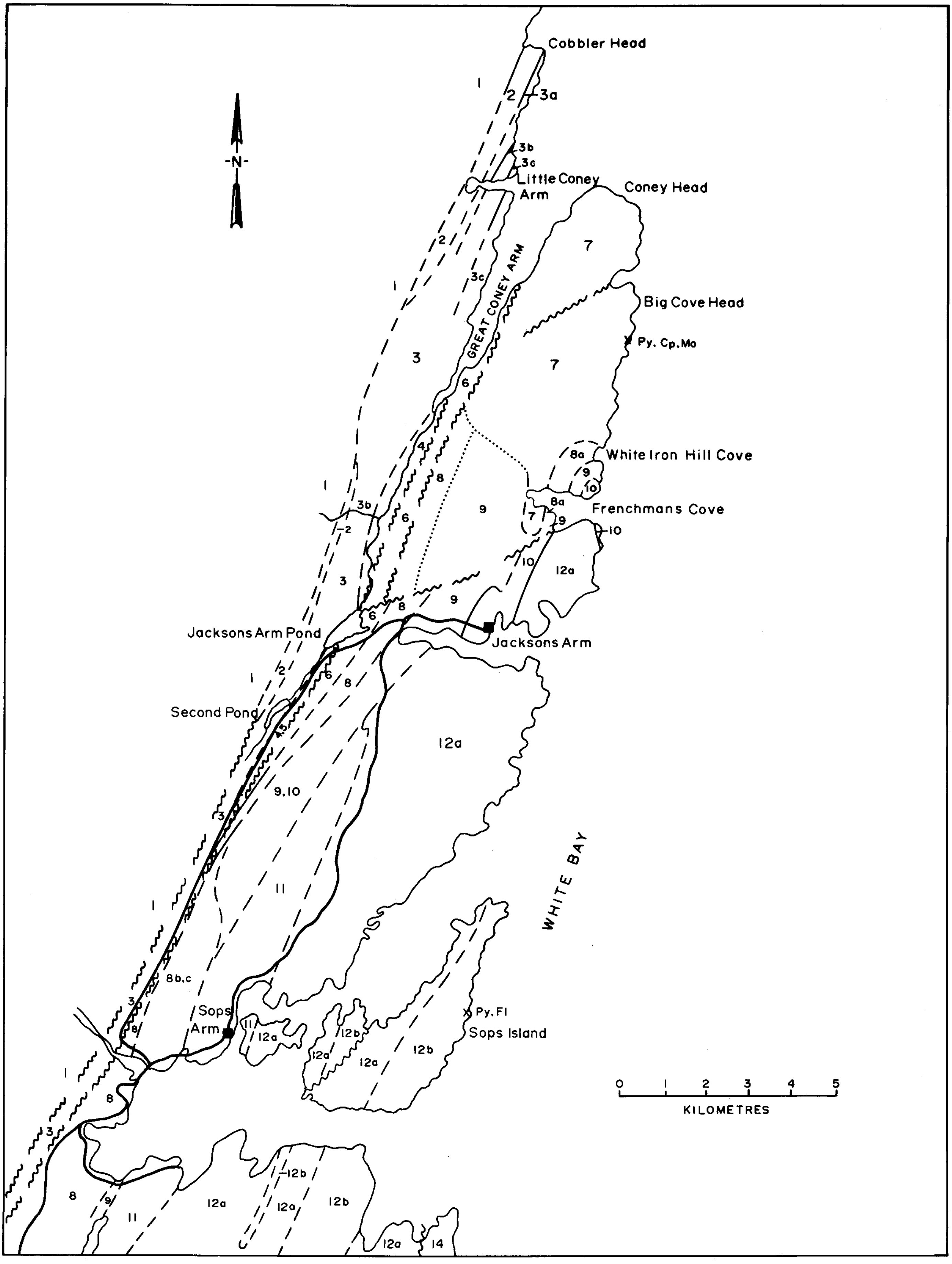
3 **Doucers Formation: 3a,** Calcareous slate, oolite and oncolitic limestone, orthoquartzite; **3b,** white dolomite, minor black limestone; **3c,** dark gray limestone, chert beds and nodules and marbles; **3,** undivided limestone, dolomite and marble.

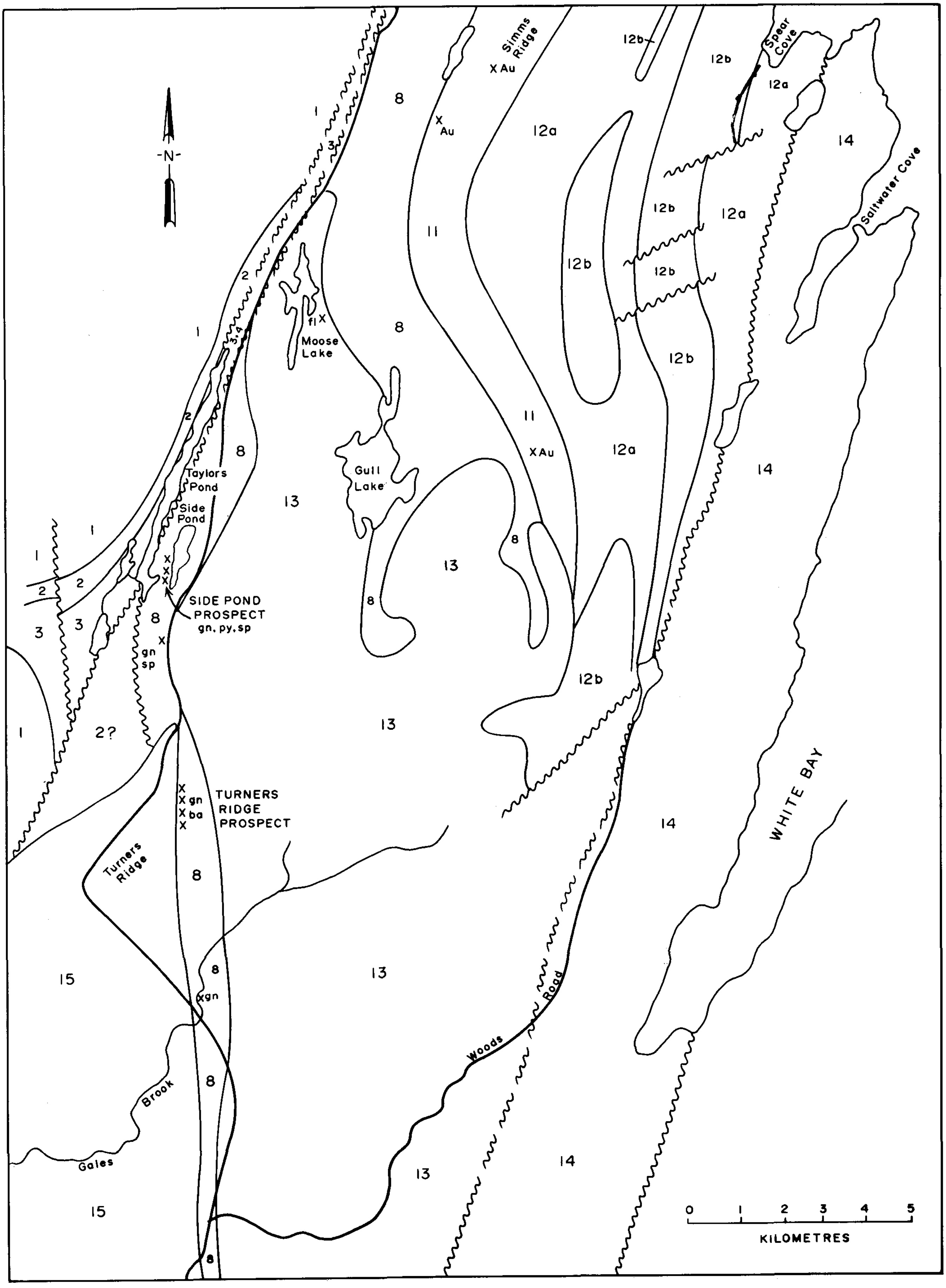
2 **Beaver Cove Formation:** Quartzite, sandstone, dolomitic limestone, phyllite and mica schist.

PRECAMBRIAN

LONG RANGE COMPLEX

1 Granite gneiss, granite and amphibolite.


Cobbler Head
-N-
Little Coney Arm
Coney Head
GREAT CONEY ARM
Big Cove Head
Py. Cp. Mo
White Iron Hill Cove
Frenchmans Cove
Jacksons Arm Pond
Jacksons Arm
Second Pond
WHITE BAY
Sops Arm
Py. Fl
Sops Island
0 1 2 3 4 5
KILOMETRES



-N-
Simms Ridge
X Au
12b
Spear Cove
12a
14
Saltwater Cove
11
12b
fl X
Moose Lake
8
Taylors Pond
Side Pond
Gull Lake
13
X Au
SIDE POND PROSPECT
gn, py, sp
gn
sp
2?
X gn
X ba
TURNERS RIDGE PROSPECT
Turners Ridge
15
xgn
WHITE BAY
Woods Road
Brook
Gales
0 1 2 3 4 5
KILOMETRES

up to 4 m thick, are fine grained, thinly laminated, and rarely cross-laminated. One bed, 1.5 m thick, exhibits abundant soft sediment slumps. Similar quartzites and interbedded limestones outcrop in White Bottom Pond Brook north of Taylor's Pond (Figure 2).

Unit 3b of white, massive, well bedded dolomites overlies Unit 3a and is excellently exposed in the sea cliffs in Little Coney Arm. The dolomites occur in beds up to 1 m thick and display rare ripple marks and mudcracks. Minor interbeds of black limestone and black limy shales are present. Near the top of the dolomite unit, thin lenses (6 - 10 cm thick) of dolomite breccia occur along the tops of some beds. These were interpreted by Lock (1969a, 1973) as channel fills but are here considered to be the product of erosion over an indurated surface.

Lock (1973) described another 12 m thick channel fill in Unit 3b, exposed in a tibutary to Coney Arm River 3 km south of Great Coney Arm (Figure 1), which he interpreted as a channel feeder to the Cow Head Breccias. The breccia was largely inacessable in 1980 due to high water levels. It contains angular clasts of foliated white limestone and dolostone set in an dolomitized argillaceous limestone matrix. The haphazard arrangement of the foliation in the clasts indicates the host was deformed prior to breccia formation. Hence, the breccias are reinterpreted as either fault breccias or collapse breccias that formed after the regional penetrative deformation.

The dolomites pass transitionally up into a sequence of dark gray limestones with chert beds and nodules near its base (Unit 3c). The limestones are extensively burrowed. Single stromatolite mounds were observed in this unit in Little Coney Arm (Figure 1). Stouge (personal communication) recovered conodonts from samples of this unit collected at the southeast entrance to Little Coney Arm that indicate a Lower Ordovician (Canadian) age. From Little Coney Arm southwards, the dark gray limestones become highly tectonised, bedding is obscure, and small scale folds are common.

Taylor's Pond Formation (Unit 4)

Lock (1969a, 1972a) assigned the name Taylor's Pond Formation (Unit 4) to a sequence of slates, phyllites, micaceous schists and minor limestones that borders the carbonate belt on its eastern side. The phyllites underlie a linear valley that runs south from Great Coney Arm (Figure 1) and are poorly exposed. They are best seen in roadcuts on the Jackson's Arm - Sops Arm Road (Figure 1) where they are interbedded with a conspicuous 2 m thick limestone bed. The age and stratigraphic relations of the formation are unknown. Lithologically it resembles the Cambrian slates of the Beaver Brook Formation and also parts of the Middle Ordovician Goose Tickle Formation. Williams (1977) correlated the formation with the Goose Tickle Formation on the assumption that its present structural position at the top of the carbonate sequence is also its stratigraphic position. However, 60 km along strike to the north in Canada Bay the clastic - carbonate sequence occurs in a zone of imbricate thrusting (Smyth, 1973). Thus, in the White Bay area it is possible that the formation could be Cambrian in age and be in thrust contact with the underlying limestones.

SECOND POND MELANGE (UNIT 5)

A narrow zone of chaotic rocks (Unit 5) named the Second Pond Melange (Williams, 1977) occurs between the Taylors Pond Formation and the Silurian Sops Arm Group south of Jackson's Arm Pond (Figure 1). It consists of green sandstone, graywacke and serpentinized peridotite in a black slate matrix. Graphitic slates with quartzite blocks that outcrop in roadside exposures at the north end of Taylor's Pond (Figure 2) are not part of the melange as described by Williams (1977) but are highly tectonized parts of the Sops Arm Group. An isolated block of serpentinized peridotite occurs near the south end of Taylor's Pond (Figure 2) and probably repesents the southerly continuation of the melange.

Melanges in western Newfoundland are associated with emplacement of Taconic allochthons and a similar origin was proposed for the Second Pond Melange by Williams (1977).

CONEY HEAD COMPLEX AND MURRAYS COVE SCHIST (UNITS 6 and 7)

Williams (1977) assigned the name Coney Head Complex to a complex of igneous and metamorphic rocks that lie to the east of the Coney Arm Group at Great Coney Arm. (Figure 1). The igneous rocks are bordered along their western margin by greenschists of the Murrays Cove Formation (Lock, 1969; 1972a), which Williams (1977) included in the complex. He stated that the "igneous rocks of the complex pass into the Murrays Cove Schist by structural and metamorphic gradation". The igneous rocks consist of gabbro, quartz diorite, granodiorite and tonalite.

A problem yet to be resolved in that area is the age and origin of the Coney Head Complex and the bordering schists. Williams (1977) discovered that the Silurian Sops Arm Group unconformably overlies the Coney Head Complex at White Iron Hill Cove (Figure 1). He noted the lithological similarities between the Murrays Cove Schist and other greenschists in western Newfoundland that occur structurally underpinned to transported ophiolites in the Hare Bay and Humber Arm Allochthons. This, and the discovery of ophiolite melange in the area, led Williams to suggest that the Coney Head Complex and the Murrays Cove schist were allochthonous and he correlated the igneous part of the complex with the transported Little Port Complex (Williams, 1975) in western Newfoundland.

However, there are a number of problems with such an interpretation.

1. A fault separates the Murrays Cove Schist from the Coney Head Complex, as first shown by Lock(1969a), and a gradation does not exist between them. For this reason the term Coney Head Complex (Unit 7) in this report is restricted to the intrusive part of the Complex and the Murrays Cove Schist (Unit 6) is excluded.

2. South of Jackson's Arm there is a gradation from weakly deformed mafic volcanic rocks at the base of the Sops Arm Group westwards into greenschists that are shown by Williams to be part of the Murrays Cove Schist. In this area the greenschists occur adjacent to a major fault, the Taylor's Pond Fault. Post-Silurian movements on this fault may have been responsible for the greenschist development.

The northern and western parts of the complex are extensively intruded by composite silicic and mafic dikes. The dikes are strongly sheared in contrast to the host which is weakly foliated to undeformed. Mafic dikes west of Coney Head have been converted to greenschists leading to the confusion in the distinction between the complex and the Murrays Cove Schist.

The Murrays Cove Schist consists predominantly of green to purple, laminated mafic tuffs with minor impure marbles and cherts. Red cherts in beds up to 7 cm thick were noted in Great Coney Arm. William's (1977) described lenses and pods of metagabbro in the greenschists in the same area.

The schists are cut by fine grained, buff coloured rhyolite dikes that in outcrop show the same strong penetrative schistosity as the host. Similar dikes also cut the Coney Head Complex and are probably related to acid magmatism of the Sops Arm Group. In this case the main deformation of the schists and the Complex would be post-Silurian (Acadian) and not Taconic as suggested by Williams (1977).

SOPS ARM GROUP (UNITS 8-12)

The geology of the Sops Arm Group is relatively well known from the work of Lock (1969a, b; 1972a, b) and more recently from detailed mapping in the lower part of the group south of Taylor's Pond (Fig. 2) by Noranda geologists (Dimmell, 1979).

The type section at Sops Arm contains four formations but there are considerable lateral facies variations within the group. The basal volcanic unit (Unit 8) was divided by Lock (1969b) into the White Iron Hill, Main River and Stoney Hill formations. They are all probably lateral equivalents and consist of mixed silicic and mafic volcanic flows, breccias and pyroclastic rocks with minor interflow conglomerate and sandstone horizons. Near Jackson's Arm Pond (Figure 1) and from Taylor's Pond southwards (Figure 2) Noranda mapped out a dolomite member within the lower volcanic unit (Unit 8) that is host to sub-economic lead mineralization over a strike length of 15 km.

The immediately overlying formations, consist of a lower unit (Unit 9) of massive, boulder and cobble conglomerate (Jackson's Arm Formation; Heyl, 1937; Lock, 1969b) overlain transitionally by an upper unit (Unit 10) of bedded conglomerates and sandstones (Frenchman's Cove Formation; Lock, . 1969b). The conglomerates are polymictic with clasts of rhyolite, porphyry, shale, mafic lava, chert, sandstone, granite and gneiss.

The uppermost formations of the group consist of shallow marine sandstones, shales and calcarenites named the Simms Ridge and Natlins Cove Formations (Hyel, 1937; Lock, 1969a,b, 1972b). Shales of the Simms Ridge Formation (Unit 11) show characteristic brown weathering spots caused by disseminated siderite. The Natlins Cove Formation (Unit 12) is the most extensive of the group and consists of a lower and upper sandstone member separated by five, mixed silicic and mafic volcanic members (Lock, 1969b; 1972b). Carbonate beds are common in the formation and are abundantly fossiliferous containing corals and brachiopods that indicate middle to late Silurian age (Lock, 1972a).

GULL LAKE GRANITE (UNIT 13)

The Sops Arm Group is intruded by a large Devonian (?) biotite, alkali feldspar granite named the Gull Lake Granite (Lock, 1969a). This is the most westerly upper Paleozoic granite in the Humber Zone of the Newfoundland Appalachians.

Lock 1969a described an area of amphibolite adjacent to the northeastern margin of the granite which he interpreted as an inlier of Grenville basement. The amphibolites display relict pillow structures and are overlain without any apparent break by a mixed sequence of mafic tuffs and rhyolites in which the metamorhpic grade transitionally decreases to greenschist within 0.5 km from the granite. The amphibolites possess a single cleavage like the rest of the Sops Arm Group to which they are here assigned. Their higher metamorphic grade is explained simply by contact metamorphism related to granite intrusion.

MINERALIZATION

Pegmatitic quartz gabbros of the Coney Head Complex south of Big Cove Head (Figure 1) contain small patches of interstitial chalcopyrite mineralization. In the same area, cross-cutting quartz-feldspar pegmatites contain minor molybdenite, pyrite, and chalcopyrite mineralization.

The first gold mining in Newfoundland took place in the Sops Head area (Figure 2) in 1903 when quartz veins cutting shales of the Simms Ridge Formation were exploited. This mine, known as the Browning Mine, only produced 149 ounces of gold. The quartz veins contain minor galena, pyrite and chalcopyrite but no visible gold (Snelgrove, 1935; Heyl, 1937). Another prospect, the Simms Ridge prospect, occurs in quartz veins and shear zones that cut a rhyolite flow. It has yet to be investigated in this study.

The Noranda lead prospects occur in a dolomite unit within the basal volcanic formation of the Sops Arm Group (Figure 2) In the Turners Ridge prospect the mineralization occurs as a network of galena-barite veins up to 5 cm wide cutting brecciated dolomite. The Side Pond Prospect consists of quartz-barite veins containing galena, pyrite and sphalerite cutting unbrecciated dolomite.

The Gull Lake Granite contains rare, narrow, fluorite veins near Moose Lake.

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