GEOLOGICAL MAPPING OF PARTS OF THE EDDIES COVE, SALMON RIVER AND ADJACENT MAP AREAS

by

I. Knight

INTRODUCTION

1:50,000 scale mapping of the Eddies Cove map area begun in 1977 (Knight and Edwards 1978a) continued during the summer of 1979 and mapping commenced on the northwestern part of the Salmon River area (12P/1). Mapping also extended into adjacent areas of the Brig Bay and Flowers Cove maps and led to some partial reassessment of earlier work in these areas (Knight and Edwards 1978b, Knight and Snow 1979).

The area mapped underlies generally low lying topography. Extensive peat bogs cover large tracts of ground and are separated by hills and linear ridges of tight tuckamore spruce or open evergreen forest. In general, peat bogs mostly overlie nonporous Cambrian dolostones and forests overlie limestones and gradually become dominant in the east. Lakes are scattered throughout the area. Outcrop is poor in the peat bog areas but elsewhere good to broken outcrop occurs around edges of smaller marshes, on ponds, in streams and on the ridges and hills. The area is surprisingly free of glacial drift cover and many areas, particularly those underlain by Watts Bight dolomite and mixed lithologies of the "unnamed" formation are often barren of cover.

Geological Setting

The map area lies within the western platform of the Newfoundland Appalachians and includes predominantly carbonate rocks of Cambrian and Lower Ordovician age with minor siliciclastic rocks. Middle Ordovician strata previously thought to occur extensively in the area (Cumming, in Bostock *et al.*, 1976) has only been positively identified in a thrust bound slice in the east of the area. The strata has been subdivided using the litho-stratigraphic subdivisions proposed by Knight (1978) and the mapping is essentially a continuation of existing mapping partially completed to the north of the present area.

STRATIGRAPHY

Cambrian

Three rock units of Cambrian age were mapped in the area.

1) Hawke Bay Formation

This map unit of upper Lower Cambrian age (Knight, 1977) is poorly exposed. It outcrops in the southern part of the area east of Round Lake and in the vicinity of Rubes Steady. It consists of thick beds of white, coarse and very coarse grained quartz arenite with some interbedded units of thinly stratified green-gray, argillaceous, fine to medium grained sandstones and shales. Large scale crossbedding and planar stratification are common in the quartz arenites.

2) Micrite formation

Limestones and dolomitized limestone of the Micrite formation are exposed in scattered outcrops in the south and western parts of the map area. It is composed of blue-gray, stratified micritic limestones and argillaceous micrites. Bioturbation is variably developed and dolomitization of burrows

LEGEND

MIDDLE ORDOVICIAN

8 Table Head Formation

LOWER ORDOVICIAN

St. George Group

6 Catoche Formation

5 'Unnamed' formation

4 Watts Bight Formation

7 Limestone and dolomitic limestones in thrust slice, probably equivalent to units 5 and 6.

CAMBRIAN

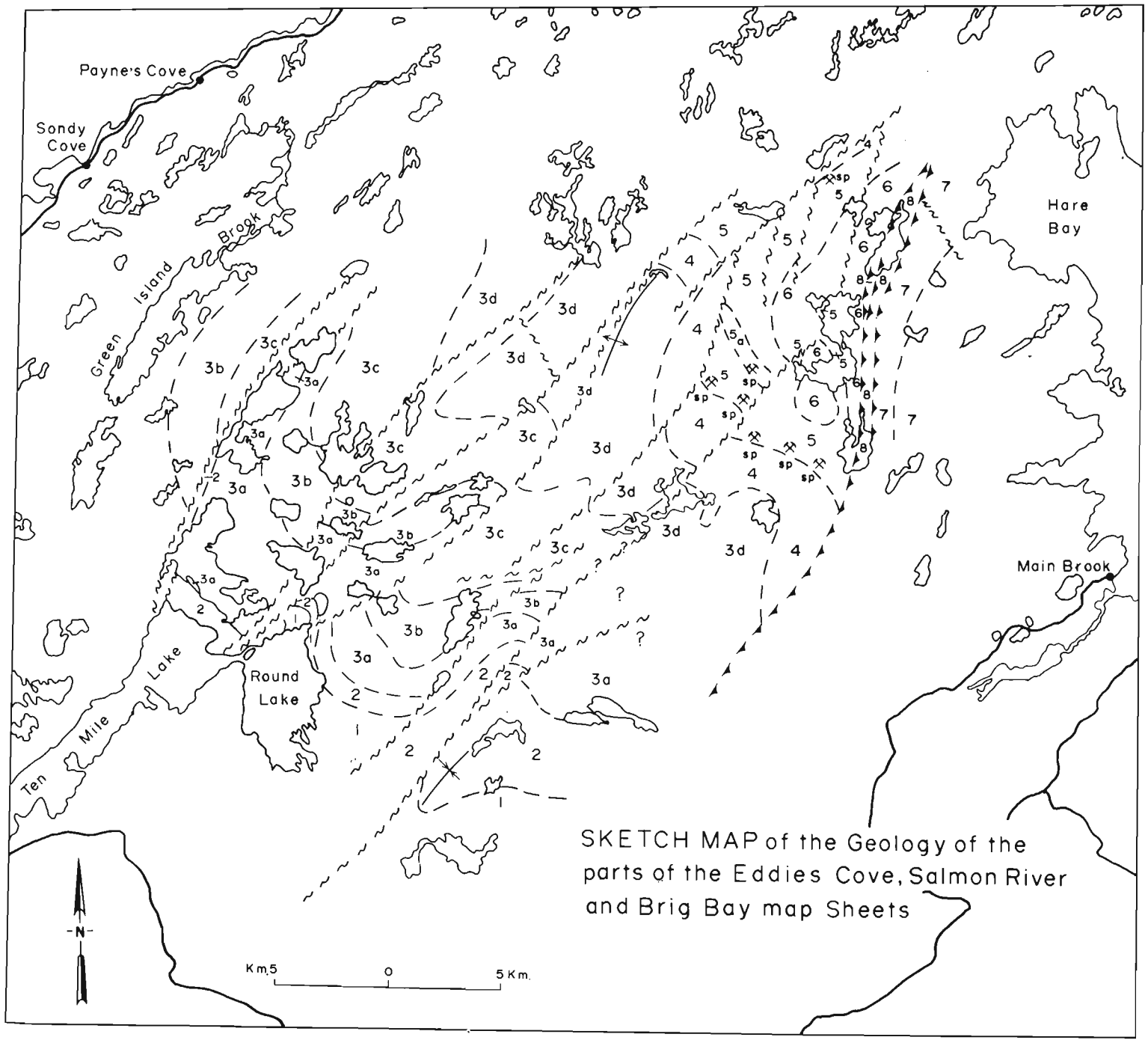
3 Dolomite formation

- 3d Cherty dolostone member
- 3c Upper dolostone member
- 3b Stromatolite member
- 3a Lower dolostone member

2 Micrite formation

Labrador Group

1 Hawke Bay formation



SKETCH MAP of the Geology of the parts of the Eddies Cove, Salmon River and Brig Bay map Sheets

and along bedding is common. The upper part of the formation is dolomitized to form a rusty weathering, finely crystalline, black to dark gray dolomite. Intercrystal and fenestral porosity (Choquette and Pray, 1970) is well developed and the strata retains its original thin, wavy to planar stratification. The formation is Middle Cambrian in age (Boyce, 1978).

3) Dolomite formation

A very widely distributed assemblage of dolomite strata, the Dolomite formation, overlies the limestones. The formation is composed of light gray to gray dolostones and gray, black, buff and white, finely crystalline dolomites.

In previous studies, the Dolomite formation was defined to include three lithological members (Knight, 1977, 1978). However, it is now proposed to include the overlying Unfortunate Cove formation (Knight, 1977, 1978) in the formation and to refer to it as the cherty dolomite member.

The formation is generally poorly exposed. However, definition of the stromatolite member between the lower and upper dolostone members and the location of a marker bed of dark gray to black, cherty stromatolite and bioturbated dolomite at the base of the cherty dolomite member (see Knight, 1978; Snow and Knight, 1979) allow ready mapping of the subdivisions of the formation.

The lower and upper dolostone member (map units 3a & 3c) consist essentially of buff to brown, slabby weathering, gray to pale gray, thin to thick bedded dolostones with minor shale partings. Lamination, dessicated disrupted lamination, flat pebble conglomerates, structureless bedding and small stromatolite heads are common. Fenestral porosity and styolites are also common. Some dolarenites composed of well sorted, rounded carbonate sand grains occur in the upper member.

The stromatolite member (map unit 3b) is characterized by yellow colored, blocky weathering, gray, dolostones. Domal stromatolites, formed of large spherical heads with faint crinky lamination and styolites parallel to the domal morphology of the mounds, are characteristic of the member. Other thick stromatolite beds are composed of flat lying crinkly lamination, again rich in styolites and some fenestral porosity. The stromatolites were built up in vertical, flat topped, pillars, 40 to 100 cm wide and up 100 cm high. These are separated by narrow 10 cm wide intermound areas filled with intraclastic dolostones and crossed at intervals by algal laminae. Red, iron rich, finely laminated crusts cap many of the stromatolite heads. Mudcracks have been observed on tops of some domal stromatolite mounds. Intraformational edgewise conglomerates, dolarenite and thinly stratified dolostones are associated rock types. Flaser and lenticular bedding (Reineck and Singh, 1975) and quartz sand lenses and laminations are common in the stratified dolostones.

The uppermost cherty dolostone member (map unit 3d) consists of buff weathering, gray to blue-gray dolostones and dark gray weathering white, dark gray and black, finely crystalline dolomites. Rusty weathering, gray chert is widespread in the member. Bedding is variable in thickness and internal structures vary from lamination, lenticular and flaser bedding, to mottled, bioturbated textures with black shale drapes. Stromatolitic mounds form a basal marker horizon such as that observed at Anchor Point in the Brig Bay map area (see Snow and Knight, 1979). Digitate to columnar SH-V stromatolite forms (Logan *et al.*, 1964) are common in this unit and in other stromatolite beds in the member. Porosity may be open in some of these stromatolites but overall the member is generally nonporous. A tan-gray weathering, bioturbated, fine crystalline dolomite unit forms a widespread unit at the very top of the

formation. It is equivalent to a unitdescribed by Knight (1977,1978) in coastal exposures near Watts Bight and Lower Cove in the Big Brook map area to the north of the present map area.

Ordovician

Both Lower and Middle Ordovician strata have been identified in the area. However, the sequence is structurally dissected. The complete sequence of the Lower Ordovician St. George Group as defined on the western side of the Northern Peninsula (see Knight 1978) is incomplete in the map area. Only three lithostratigraphic units were defined. Middle Ordovician strata consisting of uppermost limestones of the Table Head Formation and overlying shales occur in a thrust bound slice.

Lower Ordovician - St. George Group

The base of the St. George Group begins at a major change in character and lithology from the Upper Cambrian dolostones of the Dolomite Formation. The contact is sharp and apparently conformably throughout the Northern Peninsula. Three units have been identified in the group in the map area.

Watts Bight formation (map unit 4)

This is an important and easily identified rock unit consisting of black to gray bituminous, medium to coarse crystalline dolomites with abundant black chert. The most characteristic feature of the unit is a light gray to cream colored mottling of the black dolomite because of extensive bioturbation in the dolomitized carbonates. The dolomites are interrupted by a thin limestone unit in the middle of the formation and above this limestone the dolomites tend to be slightly lighter in color and in places are a honey-brown color. The dolomites weather tan to black and decompose to a friable, sugary dolomite sand. The unit is generally composed of massive, thick beds with expansive, flat bedding planes. The beds are cut by well developed joints along which solution weathering and frost heaving contribute to produce massive blocky outcrops. Large and small stromatolite mounds and heads, mostly of SH-C and SH-V growth forms occur in the dolomites. Laminated and stratified dolomite beds also occur. Intercrystal and fine fracture porosity now closed by white sparry dolomite, is common as well as larger cavities and megapores (Choquette and Pray, 1970). Brecciation may fill the cavities which are lined by spar and in places filled by cream colored geopetal mud. Other solution breccias especially associated with the stromatolites also occur.

The limestone unit in the middle of the formation was mapped at the northwestern part of the map area. It consists of bioturbated, bedded micrite associated with a bioturbated, black dolomite bed with shaly drapes.

"Unnamed" formation (map unit 5)

The "unnamed formation" (Knight, 1978) appears to disconformably overlie the Watts Bight formation in the map area. A dolomite-chert breccia horizon cemented by chert and fine crystalline dolomite overlies the Watts Bight dolomites at a number of localities just west of Vee Pond. Remaining porosity is filled by white sparry dolomite. Breccia-filled fractures penetrating vertically into the upper strata of the Watts Bight formation were also observed in the same area. This breccia and fracture feature is interpreted as a "disconformity" although it may represent a stratabound collapse breccia possibly related to solution of evaporites (see James, 1979). A similar breccia horizon was also discovered in the Roddickton map area (see Knight and Saltman, this volume) at the same contact. A breccia zone is also recorded on Boat Head (S-10, figure 5, Knight, 1977) above the uppermost Watts Bight dolomites. It may also represent a disconformity but has not been

re-examined in the light of the recent discoveries.

Overlying the basal breccia, the formation consists of interstratified units of pale gray weathering, dark gray, platy stratified micritic limestones, bioturbated micritic limestones, yellow weathering laminated dolomitic limestone, laminated and stromatolitic limestones and secondary dolomites.

A well stratified, buff weathering, pale gray dolostone containing rusty chert layers forms an important unit in the middle of the formation from the western edge of Vee Pond to the vicinity of the Round Pond zinc deposit. The dolostones are mostly laminated but also include crosslamination and lenticular bedding and some small stromtolite heads. It overlies a ridge composed of black Watts Bight type dolomite.

Above these units, bioturbated bioclastic and stromatolitic limestones become common. These become interbedded with several units of laminated and mudcracked dolomitic limestone and siliceous dolostones which mark the top of the formation.

The "pebble bed" disconformity described at Boat Harbour (Knight, 1978) near the top of the formation occurs at a number of localities on Middle and Whale Ponds. Siliceous sand and pebble sized detritus consists of chert and chalcedony grains set in a buff weathering, fine crystalline dolomite matrix. The detritus is angular to rounded and usually poorly sorted. A thick breccia, composed of large clasts of mixed dolomite lithologies and some chert occurs at approximately the same horizon west of Commodore Pond and may be related to the disconformity. The disconformity is now known to be of regional importance being identified lithologically on the Port au Port Peninsula (Pratt, personal communication, 1979) and identified biostratigraphically in western Newfoundland (Boyce, 1979; Stouge, in press).

Secondary dolomitization is especially common in the lower part of the formation where limestones are replaced by black gray and honey colored mottled to vuggy dolomites, salt and pepper textured dolomites and pseudobreccias. Porosity was opened as elongate channel to irregular shaped vug porosity and as megapores (Choquette and Pray, 1970). White sparry dolomite partially to almost completely fills the porosity. Where infill is complete the rock has been generally called a "pseudo breccia" (Cumming, 1968; Rhodes, 1970, 1971).

Catoche Formation (map unit 6)

The Catoche Formation consists of rubbly weathering, dark gray limestones and lies conformably above the last laminated and mudcracked dolomitic limestone of the "unnamed formation". The Catoche Formation consists essentially of well bedded, bioturbated micrites and biomicrites with lenses of bio- and intraclastic calcarenites and calcrudite. Beds vary in thickness and are composed of thin, lenticular stratification which is usually heavily bioturbated to give a knobbly form to the bedding. Dolomitization of burrows is widespread. Fossil debris is seen in the limestones but only planispiral gastropods are readily identified.

Black crystalline, bituminous dolomites replace the limestones at a number of localities near Middle Pond but no extensive dolomite units were traced, possibly because of inadequate exposure in that area.

Map unit 7

Rocks resembling the "unnamed formation" and the Catoche Formation were mapped east of a thrust fault trending from Commodore Pond south to Vee Pond. Lithologies strikingly similar to the upper part of the "unnamed formation" including bioturbated, bioclastic micrites and laminated dolomitic limestones and some beds of laminated siliceous dolostones occur.

These are overlain by bioturbated limestones possibly equivalent to the Catoche Formation.

Alternatively, the rocks could represent strata of upper lower and lower Middle Ordovician age. These could include rocks equivalent to the Siliceous Dolomite formation below the Table Head Formation (see Knight, 1977, figure 6, S-14), and transitional limestone which occur immediately below rubbly limestones of the Table Head Formation proper. Conodont studies supporting the present mapping program may resolve this problem.

Middle Ordovician

Middle Ordovician strata belonging to the Table Head Formation and the overlying Goose Tickle Formation (Tuke, 1968; Smyth, 1973) is only positively identified in the thrust slice lying along the trace of Commodore Pond to Vee Pond (figure 1).

Only 10-15 m of Table Head Formation is exposed in an outcrop at the south end of Commodore Road. It consists of shaly, nodular, blue-black, micritic limestone. Shale content increases upward towards the overlying black shales in which planar limestone beds (2-10 cm) occur. Float collected east of Commodore Pond suggests that green-gray, lithic arenites become interbedded with the shales upwards, typical of the Goose Tickle Formation (Tuke, 1968).

STRUCTURE

The map area is dominated by northeast trending normal faults that dissect and displace the gently dipping strata. The faults, which splay, join and sometimes disappear along their trends, lie parallel to a major fault zone which is known as the Ten Mile Lake Fault system. This system which extends from the northeast end of Ten Mile Lake consists of two faults. Rocks between the faults are uplifted and folded into a narrow anticline. The western fault and all faults west of it are consistently downthrown northwestwards; the eastern fault and all faults east of the system are downthrown southeastwards. The strata between the faults which are spaced at 4 to 8 km apart are usually folded into gently northeast plunging, open synclines. The overall effect of the fault systems is to swing north-trending eastward dipping strata in the west, to east-trending north dipping strata in the east. Beds are usually gently inclined between 2° to 15°. This easterly trend is truncated by a zone of north-trending thrust faults. Two main thrusts occur with associated minor thrusts. Above the lower thrust fault, Middle Ordovician strata is thrust over limestones of the St. George Group. Within this thrust slice Table Head limestones are thrust over black shales. The upper thrust fault carries rock units believed to be of Lower Ordovician age over the Table Head and Goose Tickle Formation. Cleavage and minor folds are developed within and close to the thrust zone.

MINERALIZATION

The map area contains many occurrences of sphalerite mineralization and includes the Round Pond sphalerite deposit estimated to contain 150,000 tons of 2.5% Zn (Rhodes, 1970, 1971). The sphalerite mineralization is stratabound and is restricted to the lower part of the "unnamed formation". Showings occur in the basal dolomite-chert breccia and consist of disseminated green sphalerite crystals. Sphalerite is, however, more widespread in porous dolomites, pseudobreccias and salt and pepper textured dolomites in strata above the basal unit. Rhodes (1970, 1971) also describes mineralization occurring in collapse breccias. The sphalerite is reddish brown to green-yellow and occurs as disseminations, clots, and large crystals within the secondary dolomites and rarely within adjacent limestones. White sparry dolomite fills much of the

porosity associated with mineralized and unmineralized dolomites. The showings weather to a rich ochre-yellow.

Drill core from the Round Pond area suggests abundant solution collapse breccias occurred associated with the Round Pond deposit (Rhodes, 1970, 1971). Pyrite up to 1-2% but locally up to 95% over 30 cm occurs throughout the Round Pond area. Examination of drill logs indicates that pyrite-rich rock lies between unmineralized and zinc bearing strata.

No zinc mineralization was found in the dolomites replacing the Catoche Formation near Middle Pond although equivalent strata northeast of Commodore Lake includes Cominco showing No. 7 which assayed 1.6 to 14.7% zinc (Cajka, 1969). Here the sphalerite is reported to occur in pseudobreccia dolomites.

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REFERENCES

Bostock, H.H., Cumming, L.M., Williams, H. and Smyth, W.R.
1976: Geological map of the Strait of Belle Isle region. Geological Survey of Canada, Open File 347.

Boyce, W.D.
1978: Recent developments in western Newfoundland Cambro-Ordovician trilobite biostratigraphy. *In:* Report of Activities for 1977. *Edited by* R.V. Gibbons. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 78-1, pages 80-84.

1979: Further developments in western Newfoundland Cambro-Ordovician biostratigraphy. *In* Report of Activities for 1978. *Edited by* R.V. Gibbons. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 79-1, pages 7-10.

Cajka, C.J.
1969: Year end report - 1968, Great Northern Peninsula Concession, Newfoundland. Cominco Ltd. Report No. 2, Unpublished Report.

Choquette, P.W. and Pray, L.C.
1970: Geological nomenclature and classification of porosity in sedimentary carbonates. Bulletin of the American Association of Petroleum Geologists, 54, pages 207-250.

Cumming, L.M.
1968: St. George - Table Head disconformity and zinc mineralization, western Newfoundland. Canadian Institute of Mining and Metallurgy, Bulletin 61, pages 712-721.

James. N.P.
1979: Shallowing upward sequences in carbonates. *In* Facies Models. *Edited by* R.G. Walker. Geoscience Canada, Reprint Series 1, pages 109-119.

Knight, I.
1977: Cambro-Ordovician platformal rocks of the Northern Peninsula, Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 77-6. 27 pages.

1978: Platformal sediments on the Great Northern Peninsula: Stratigraphic studies and geological

mapping of the north St. Barbe District. *In* Report of Activities for 1977. *Edited by* R.V. Gibbons. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 78-1, pages 140-150.

Knight, I. and Edwards, J.
1978a: Geology of the Eddies Cove map area, Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Map 7867.

1978b: Geology of the Flower's Cove map area, Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Map 7868.

Knight, I. and Snow, C.
1979: Geology of the Brig Bay map area, Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Map 7957.

Logan, B.W., Rezak, R., and Ginsburg, R.N.
1964: Classification and environmental significance of algal stromatolites. Journal of Geology, 72, pages 68-83.

Reineck, H.E. and Singh, I.B.
1975: Depositional sedimentary environments with reference to terrigenous clastics. Springer-Verlag, Berlin, 439 pages.

Rhodes, D.
1970: Cominco Limited Annual Report 1970. G.N.P. concession, Newfoundland, Report 4.

1971: Diamond Drilling in the St. Barbe/White Bay area by Cominco, and Cominco Limited Annual Report 1971, G.N.P. concession, Newfoundland, Report No. 5.

Smythe, W.R.
1973: The stratigraphy and structure of the southern part of the Hare Bay allochthon, northwest Newfoundland. Unpublished Ph.D. thesis, Memorial University of Newfoundland, 172 pages.

Snow, G. and Knight, I.
1979: Geological mapping of the carbonates of the Brig Bay map area, Newfoundland. *In* Report of Activities for 1978, *Edited by* R.V. Gibbons. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 79-1, pages 1-6.

Stouge, S.
in press: Preliminary conodont biostratigraphy and correlation of Upper Canadian carbonates from the St. George Group, Great Northern Peninsula, Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Report.

Tuke, M.F.
1968: Authochthonous and allochthonous rocks of the Pistolet Bay area, in northernmost Newfoundland. Canadian Journal of Earth Sciences, Volume 5, pages 501-513.