

GEOLOGICAL MAPPING OF THE CARBONATES OF THE BRIG BAY MAP AREA, NEWFOUNDLAND

by G. Snow and I. Knight

INTRODUCTION

1:50,000 mapping of part of the Brig Bay (12P/2 and 12P/3) and the northwest edge of the Castor River (12I/15) map areas was completed during the summer of 1978. The mapping concentrated upon an area known to be underlain by Cambro-Ordovician carbonate rocks located northwest and west of Ten Mile Lake. The remaining area of the Brig Bay map area to the east of Ten Mile Lake is underlain mainly by Lower Cambrian sedimentary rocks and was not mapped except for reconnaissance spot checks to confirm previous mapping by Cumming (*in Bostock et al.*, 1976).

The area mapped underlies a generally flat to rolling topography of low elevation. Marsh areas and ponds interspersed in thick spruce forest typify this area and very few rock outcrops are exposed. Streams in the area were generally in flood in 1978 so that stream outcrops were frequently under water and inaccessible. The carbonate rocks are well exposed and accessible along the coast, the Northern Peninsula highway and other roads, and on the shore of Ten Mile Lake.

GEOLOGICAL SETTING

The map area lies within the western platform of the Newfoundland Appalachians and includes Precambrian basement, sedimentary rocks of the Lower Cambrian Labrador Group, and a thick sequence of carbonate rocks of Upper Cambrian to Lower Ordovician age. The area is subdivided by a major northeast trending fault system which strikes along Ten Mile Lake. Southeast of the fault, Precambrian basement and mixed clastic-carbonate rocks of the Bradore and Forteau Formations (Schuchert *et al.*, 1934) and the Hawkes Bay quartzite formation (Knight 1977a, b, 1978) occur. Northwest

and west of the fault, the area is underlain by gently dipping, predominantly dolomitic carbonates of Upper Cambrian to Lower Ordovician age. The latter have been mapped using the lithostratigraphic subdivisions established by Knight (1978) in adjoining areas to the north.

STRATIGRAPHY

Southeast of the Ten Mile Lake fault

Precambrian basement (Unit 1)

This occurs in a fault bounded block at the southwest end of Ten Mile Lake. It consists of granitic gneisses which have a poorly defined, vertical gneissic banding.

Forteau Formation (Unit 2)

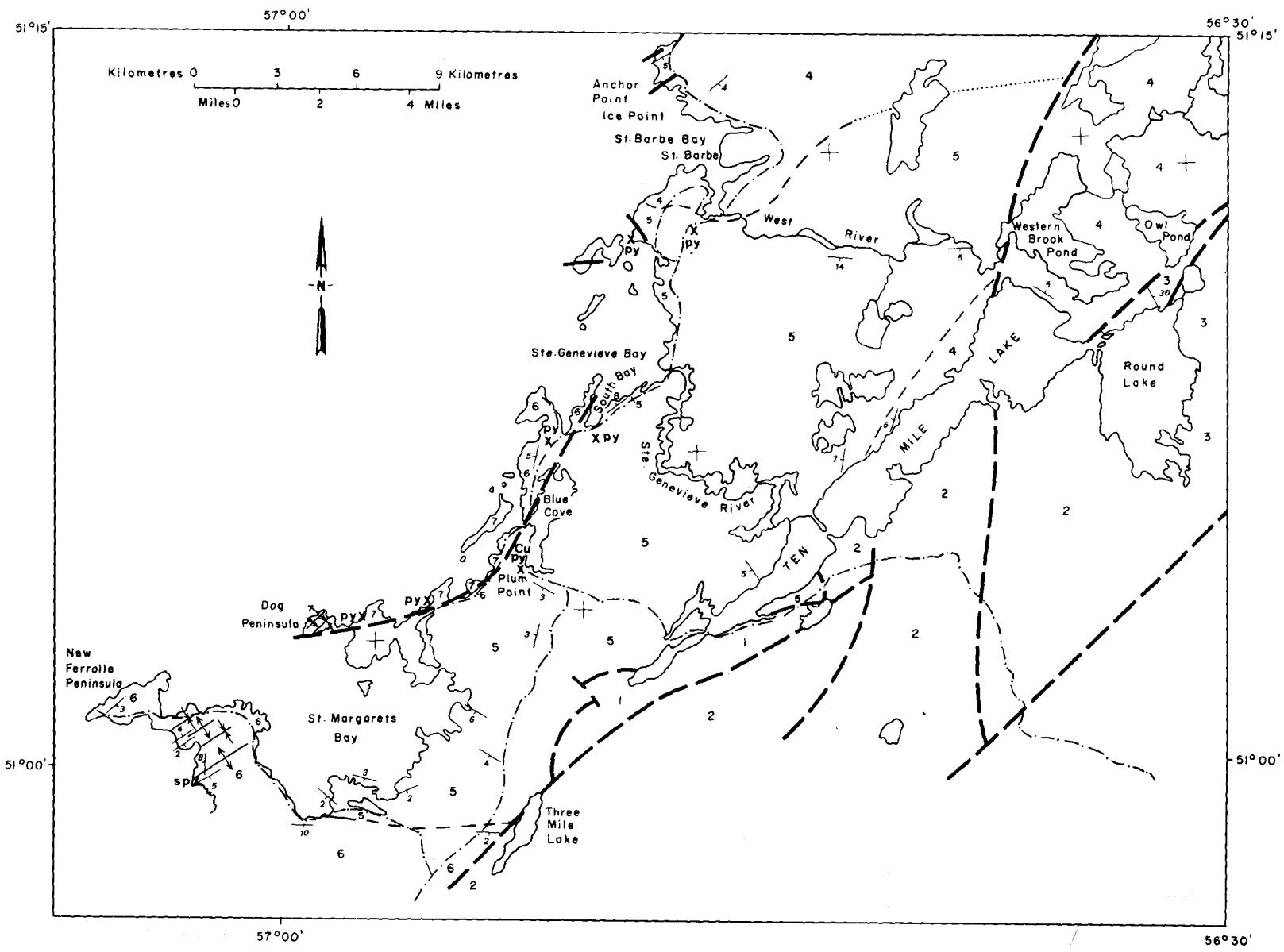
Scattered outcrops of Forteau Formation occur along the southeast shore of Ten Mile Lake and include *archeocyathid* reefs, calcareous sandstones and siliceous dolomites.

Hawkes Bay quartzite formation (Unit 3)

This formation outcrops along the north and east shores of Round Lake. Outcrops include white, coarse grained, thick bedded quartzites and units of red and green, muddy sandstones which are extensively burrowed. Some bioturbated gray calcareous sandstones and minor intraclastic conglomerates also occur. Local concentrations up to 15 percent of weathered pyrite occur in these sediments.

The carbonate sequence northwest of the Ten Mile Lake fault

Four rock units occur in this sequence. They include



BRIG BAY MAP AREA (12P/2), NEWFOUNDLAND

LEGEND

LOWER ORDOVICIAN

St. George Group

- 7 Unnamed unit
- 6 Watt's Bight formation

CAMBRIAN-LOWER ORDOVICIAN

- 5 Unfortunate Cove formation


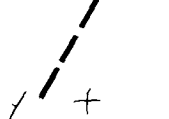

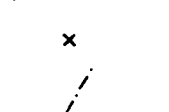

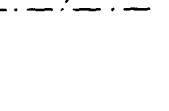
CAMBRIAN

- 4 Dolomite formation
- 3 Hawke's Bay Quartzite formation
- 2 Forteau Formation

PRECAMBRIAN

- 1 Precambrian granite gneiss basement

SYMBOLS

- Geological boundary (defined, approximate, assumed)..... 
- Faults 
- Bedding (dip shown, horizontal) 
- Anticline, syncline 
- Mineral occurrence 
- Highways 

3

the upper dolostone member of the Dolomite formation, the Unfortunate Cove formation, the Watts Bight formation and the "unnamed unit" of Knight (1978).

Dolomite formation (Unit 4)

Rocks of the upper dolostone member of the Dolomite formation outcrop in the north of the area. They consist predominantly of thinly bedded, yellow, tan and gray weathering, pale gray dolostones, thin black shales, gray dolomitic shales, burrowed dolomites and some spectacular stromatolite horizons. The member is dominated near the base by the thin bedded dolostones with thin shales. These dolostones contain mudcracks and rippled surfaces as well as smooth bedding planes and lenticular and flaser bedding. Intraclast pavements are also common. A number of thin interbeds of dark gray, oolitic dolarenite and thicker bedded dolostones also occur. The latter exhibit planar cross-bedding and horizontal lamination and are bioturbated by vertical and U-shaped burrows. All these features are typical of tidal flat sedimentation.

Stromatolites and highly bioturbated dolostones become important in dark gray to black, crystalline dolomites of the upper part of the member which outcrops around the coast of St. Barbe Bay. Large stromatolites occur in the vicinity of Anchor Point and Ice Point on the north shore of St. Barbe Bay. These are several metres in diameter, domal in shape and include many 3-10 cm layers of small SH-C, SH-V and LLH growth forms (Logan *et al.*, 1964) as well as thicker beds of longer, branching, digitate stromatolites. These forms are overlain by a bed of very vuggy, stromatolitic, pale gray dolomite. The stromatolites are associated with and often individually surrounded by highly burrowed dark gray dolomites, with shaly lenses and partings. The characteristics of these rocks suggest that subtidal to intertidal environmental conditions prevailed.

Fauna are scarce in the member except for some inarticulate brachiopods and some rare trilobite fragments. However, the succession is stratigraphically higher than the dolostones of Deadmans Cove, where trilobites of lower Upper Cambrian age (Boyce, 1978; Knight, 1978) are known.

Unfortunate Cove formation (Unit 5)

This rock unit consists of yellow weathering dolostones and gray and black cherts and underlies approximately 65 percent of the carbonate terrain in the map area. It is characterized by gray to blue-gray, finely crystalline, nonporous dolostones which are thin to thick bedded and frequently bioturbated. A number of thick beds of stromatolites occur. These include SH-C and digitate SH-V types (Logan *et al.*, 1964) composed of coarsely crystalline, vuggy, gray and white colored

dolomite. In many cases, these stromatolitic dolomites resemble rocks of the overlying Watts Bight Formation. Some columnar stromatolites, up to 1 m in length and 10 cm in diameter, occur along the southwest shore of Ten Mile Lake near the Roddickton highway. The sediments of this unit were probably laid down in a fluctuating subtidal to inter/supratidal environment.

Silicified, low spired gastropods were found on Mutton Island and in bedded dolostones on a hill just west of Ten Mile Lake. These have been tentatively identified as *Sinuopea sp.*, of probable uppermost Upper Cambrian age (Boyce, personal communication).

A similar Upper Cambrian age for this rock unit and the Dolomite formation suggests that yellow weathering dolostones found in both the Dolomite formation and the Unfortunate Cove formation represent a continuous upper Cambrian sequence.

Watts Bight formation (Unit 6)

The Watts Bight formation of sugary weathering dolomites forms a major outcrop area in the New Ferolle Peninsula and the northwestern part of the Caster River map area, where it appears to overlie conformably the Unfortunate Cove formation. The formation also outcrops near Pond Cove and Blue Cove, where it is downthrown against the Unfortunate Cove formation along a normal fault. A small wedge of the formation also occurs along the same fault between Brig Bay and Plum Point.

The formation is characterized by a dark gray to black, bituminous, medium to coarsely crystalline, sugary weathering dolomite. Large stromatolite mounds and extensively burrowed lime muds formed the original sediments. The burrowing produced a characteristic cream to pale gray mottling of the dark dolomites. Porosity can be high with large vugs, interburrow and intercrystal types common. Brown, laminated and drab, pale gray, nonlaminated geopetal material locally fills the pores. Black to gray chert is common as nodules and streaks; it also replaces stromatolites. It is also well developed along bedding planes in some well bedded, bioturbated deposits.

Silicified and ghost remains of gastropods and cephalopods are common in the burrowed dolomites. Stromatolite mounds are well developed near the junction of the New Ferolle Peninsula road and the Northern Peninsula highway and on New Ferolle Peninsula. Columnar, SH-V, SH-C and laminar LLH forms (Logan *et al.*, 1964) form the mounds, which are 80 cm thick and 1-2 m in diameter.

Large spherical mounds, probably originally stromatolites, occur on the south side of the New Ferolle Peninsula. The tops of the mounds were extensively burrowed and subsequently dolomitized. Solution then

removed unburrowed carbonate leaving an intertwined meshwork of pale gray dolomite burrows with well developed interburrow porosity. Generally, the pores were then filled by drab gray geopetal muds.

In the type section of the formation at Lower Cove and Watts Bight outside the present map area, three lithofacies were delineated (Knight 1978); namely, lower and upper stromatolite mound facies and a middle burrowed limestone facies. However, in the map area, the lower half of the formation consists of dominantly well bedded, burrowed dolomites; stromatolites become more abundant upward in these burrowed sediments.

The formation was probably deposited in a shallow subtidal shelf environment with some intertidal sedimentation.

"Unnamed" formation (Unit 7)

Sediments of this formation are found along the north shore of the Dog Peninsula and on some of the offshore islands near Plum Point. The unit is characterized by thin bedded, drab gray, finely crystalline dolomites which exhibit lamination, mudcracks and some ripple marks. However, dolomitized domal stromatolites similar in shape to forms preserved in this unit at Eddies Cove West were observed. Patches of bedded and burrowed, fossiliferous, blue-gray limestones and "pseudobrecca" (Cumming 1968) also occur. The limestones are locally rich in planispiral gastropods, and trilobites were found at a number of localities. The latter are identified as *Hysticurus cordai* (Billings), *Hysticurus H. oculilunatus* Ross and *Parabellefontia* sp. (Boyce, personal communication). The sequence is of Lower Arenig age and can thus be correlated with the "unnamed unit" at Boat Harbour and Eddies Cove West.

The pseudobreccia exhibits good channel porosity (Choquette *et al.*, 1970) parallel to bedding. The pores are often lined and filled by white sparry dolomite. The pseudobreccia is associated with the limestones and transitions are sharp.

Breccias

True breccias which lie within or crosscut bedding are well developed in all the carbonate units. They contain angular fragments, a few to tens of centimetres in size, in a dolomitic to cherty matrix. Sparry dolomite lines vugs and veins. Rotation of rock fragments is common. The breccias can be less than 1 m to as much as 100 m in areal or linear extent. They commonly terminate within beds and at bedding plane surfaces when crosscutting bedding. Some of the breccias occur along faults, for example, at Brig Bay; others trend parallel to faults but show no evidence of movement.

Breccias not related to faulting are thought to be

produced by solution and collapse. Breccias within undisturbed bedded sediments suggest solution along selective beds. Linear vertical breccias not related to faulting probably formed with some possible fracture control.

STRUCTURE

Structurally, the map area is simple and is principally controlled by two major northeast trending, high angle, normal faults. The faults have downthrows to the northwest and are paralleled by small faults. The major fault along Ten Mile and Three Mile Lakes is a continuation of the Hawkes Bay fault of Williams (1978). Precambrian basement and the Lower Cambrian Forteau and Hawkes Bay quartzite formations are upthrown to the southeast against the Upper Cambrian Unfortunate Cove formation. The throw is probably about 350-400 m. A major fault strikes through the north side of the Dog Peninsula and trends into South Bay near Pond Cove. A fault breccia is well exposed along this fault near the navigation light between Plum Point and Brig Bay. A downthrow of 100-130 m brings the Lower Ordovician Watts Bight formation and the "unnamed" formation against the Unfortunate Cove formation. Bedding is locally steepened close to these faults and some open northeast trending folds also occur.

Between the two major faults, the structure is simple with rocks trending east and dipping at 0° to 4° to the south. Minor northeast trending folds occur on the New Ferolle Peninsula.

Some small northwest trending normal and reverse faults with downthrows to the southwest also occur and can be seen on the shore southwest of the community of St. Barbe.

MINERALIZATION

A small sphalerite showing was found on the south side of the New Ferolle Peninsula in burrowed stromatolite mounds of the Watts Bight formation. The sphalerite occurs as small red crystals in drab gray geopetal carbonate mud. Small angular rock chips also fill the interburrow porosity.

Malachite stains were observed at the top of a stromatolite mound which is capped by a thin shale in a quarry close to Plum Point. The host rock unit is the Unfortunate Cove dolostones. Pyrite is also common in the quarry.

Pyrite is the most common mineralization in the area and occurs in matrices of both collapse and fault breccias. The pyrite locally seems to replace matrix and/or surrounds fragments in the breccias. Some breccia matrices contained up to 40 percent massive pyrite.

Acknowledgements: *The authors would like to thank L. Greene, assistant and boatman, W.D. Boyce, who collected and identified fossils, and John Allan, who gave logistical support.*

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. Mineral Development Division, Newfoundland Department of Mines and Energy, Report 78-1, pages 80-84.
- 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.
- Knight, I.
1976: The Cambro-Ordovician platformal rocks of the Northern Peninsula. *In* Report of Activities for 1976. *Edited by* R.V. Gibbons. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 77-1, pages 27-34.
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.
- Logan, B.W., Rezak, R., and Ginsburg, R.N.
1964: Classification and environmental significance of algal stromatolites. *Journal of Geology*, **72**, pages 68-83.
- Schuchert, C., and Dunbar, C.O.
1934: Stratigraphy of Western Newfoundland. *Geological Society of America, Memoir* 1, 123 pages.
- Williams, H.
1978: Tectonic lithofacies map of the Appalachian orogen. Memorial University of Newfoundland, Map No. 1.