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MARGINAL NOTES

Mapping of the Paleozoic rocks on Manitoulin Island formed part of the Manitoulin Island Limestone-Dolomite Assessment Project. This project was funded by the Ontario Ministry of Northern Affairs through Ontario Geological Survey (NGS) program. The principal objective of this project was to produce maps showing the distribution of the limestones and dolostones on the island according to their quality and usefulness as construction and metallurgical processing materials. In collecting data for this purpose, new information on the Paleozoic stratigraphy of the island became available, thus allowing production of new geological maps. These new maps constitute revisions to earlier maps prepared by Dr. E.A. Liberty and published in 1972, based on field work made during the period 1954 to 1957 (Liberty 1972a, 1972b, 1972c, 1972d, 1972e, and 1972f).

The Little Current map area displays considerable topographic relief (146 m) due to a series of north and east facing escarpments. Between the escarpments the topography is flatting or moderately rolling. The escarpments were formed by differential erosion of the Paleozoic bedrock and are mainly coincident with the Georgian Bay Formation which forms the 52 m escarp at Little Current (U.T.M. 423750E-508080N) and the Manitoulin Formation which forms the scarp south of Columbus Mountain (U.T.M. 424500E-5086850N). West of Sheguiandah Bay are several ridges and knolls of Precambrian basement material, protruding into or through the Paleozoic strata. These Proterozoic remnants have a pronounced east-west trend and continue to the northeast across the North Channel as a series of islands (map in Card 1978).

Glacial drift cover is thicker in this map area than in the adjacent sheets to the south (Manitowaning P.2672) and west (Kagawong P.2685), this being indicated by the decreased bedrock exposure. Topographically high plateaus in the map area have very thin or no glacial cover due to scouring.

Land areas east of Manitowaning Bay comprise the northern half of the Wikwemikong Unceded Indian Reserve (R. 28). Mapping was permitted on the reserve during 1979. Mapping of the Sheguiandah Indian Reserve (R. 24) west of Manitowaning Bay was permitted during 1980.

PRECAMBRIAN/PALEOZOIC CONTACT

The only exposed Precambrian/Paleozoic contacts on Manitoulin Island are found at Sheguiandah Village where Proterozoic quartzite knolls project through the Paleozoic strata. These quartzites represent the Bar River and Lorrain Formations of the Cobalt Group (Card 1978) and are in unconformable contact with shales of the Blue Mountain Formation or carbonates probably equivalent to the Lindsay Formation. The contact at Sheguiandah is sharp with the Proterozoic surface often showing smoothing produced by Paleozoic water action. Where the Proterozoic rocks are found in contact with limestones, the latter are rich in reworked quartzite pebbles, crinoid debris and have frequent green glauconitic sandy partings (e.g. U.T.M. 428400E-5082400N). Shales that directly overlie the quartzite display very high bedding dip angles (e.g. U.T.M. 424050E-5081800N).

PALEOZOIC STRATIGRAPHY

ORDOVICIAN

Verulam Formation

The oldest Paleozoic unit exposed on Manitoulin Island, and in this map area, is the Middle Ordovician Verulam Formation. This unit is composed of an alternation of bluish-grey, coarsely crystalline to sublitographic limestones, separated by thin partings of blue-grey shales and claystones. The unit is in part bioclastic and argillaceous with some fossils present and tends to coarsen (in crystallinity) upwards. The Verulam Formation, having a thickness of about 18 m, is well exposed on Goat Island, the first island north of Manitoulin Island. The only probable occurrence of the formation on Manitoulin Island is a mound or dome-shaped outlier at MacKays Point (U.T.M. 424000E-5092000N).

Lindsay Formation

The contact between this unit and the underlying Verulam Formation is not exposed on Manitoulin Island, although the outcrop adjacent to the swing bridge (U.T.M. 423100E-5091950N) at Little Current displays characteristics of both units. The Lindsay Formation has 2 members (as recently named by Russell and Telford 1983); the Lower Member consists of 15.25 m of grey to grey-brown, finely crystalline to sublitographic limestone and dolostone. This member has moderate amounts of shale and has a characteristic "mottling" or nodular appearance. The Upper or Collingwood Member is a black, calcareous, petrifoliferous shale, some 7.62 m thick. The contact between the members is not exposed on the island. Both members are fossiliferous, with the Collingwood Member being richly fossiliferous in graptolites, brachiopod, conularid and trilobite remains. The Lower Member contains a brachiopod/bryozoan assemblage.

Good exposures of the Lower Member occur in the vicinity of Little Current, at Turner Cove (U.T.M. 423400E-5091950N), and adjacent to the road leading to Gibson's Point (U.T.M. 428000E-5081800N). The Collingwood Member is well exposed in the road allowance of Highway 6 immediately south of Little Current. A good section through this member is also exposed at Sheguiandah Village (U.T.M. 426330E-5082300N).

Blue Mountain Formation

The overlying Blue Mountain Formation consists of about 40 m of soft blue-grey shale. The unit is poorly fossiliferous with graptolite, trilobite and brachiopod remains, and is not petrifoliferous. These strata have been formerly termed the Sheguiandah Formation of the Whitby Formation, but are being renamed here in accordance with the nomenclature now in use in southern Ontario (Russell and Telford 1983).

The formation is recessive and only poorly exposed in the map area. Outcrops occur in the village of Sheguiandah where the shales directly overlie Proterozoic quartzites (e.g. U.T.M. 424210E-5081750N). The contact between the Blue Mountain and underlying Lindsay Formation is not exposed on the island although it has been reported elsewhere to be sharp (Russell and Telford 1983).

Georgian Bay Formation

The Georgian Bay Formation conformably overlies the Blue Mountain Formation. The contact between these units is not exposed on the island, but the base of the Georgian Bay is usually placed at the first appearance of carbonate hardbands in the dominantly shale sequence.

Liberty (1972a) divided the Georgian Bay Formation into 3 subunits: 1) a Lower Member (Wikwemikong), an alternating sequence of blue-grey shale with carbonate hardbands; 2) an Upper Member, Lower Submember (Meaford), a bluish-grey, fine grained, argillaceous limestone, with shaly partings; and 3) an Upper Member, Upper Submember (Kagawong), a brown and grey, finely crystalline limestone and dolostone. The total thickness of the Georgian Bay Formation is about 127 m with the lower member accounting for at least 48 m of the formation. Contacts between the subunits are poorly exposed on the island, making field identification of the subunits difficult. Due to these and other constraints, delineation of the subunits within the formation was not attempted and detailed consideration was given only to the upper and lower contacts.

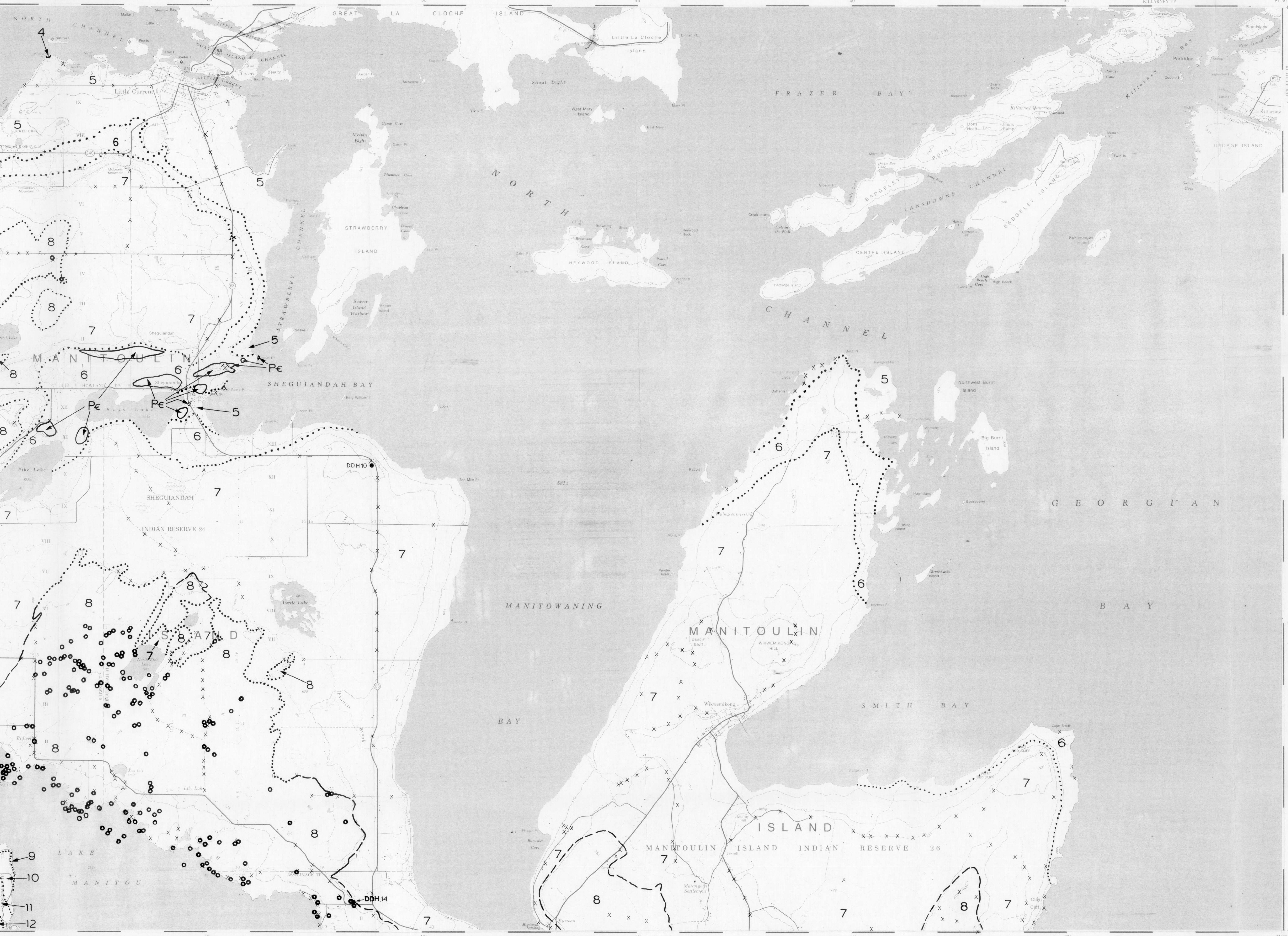
The Georgian Bay Formation is quite fossiliferous throughout, particularly in its upper member in which several biostromes have been reported (Liberty 1968). Fauna common in this formation include brachiopods, bryozoans, pelecypods, gastropods and corals. As mentioned earlier, the Georgian Bay Formation predates the Manitoulin Formation. The contact between these formations is not exposed within the map area, although elsewhere on the island (ice Lake Road-Cut, Kagawong map area, N.T.S. 41G/16, U.T.M. 390250E-5083400N) it is very sharp. The Wingfield Formation is poorly fossiliferous with only occasional ostracod-rich horizons. It often has shallow water depositional features such as ripple marks, desiccation cracks and occasional rain pits. This unit only subsurfaces beneath glacial deposits in the west shore of Lake Manitoulin.

SILURIAN

Manitoulin Formation

The Lower Silurian Manitoulin Formation disconformably overlies the Georgian Bay Formation. The only exposed contact in the map area between these units was found in a road-cut northeast of Peach Lake (U.T.M. 424600E-5080800N). The contact is marked by the change from the brown and grey finely crystalline limestone of the uppermost Georgian Bay Formation to blue-grey, buff grained, argillaceous limestone, with shaly partings, and 3) an Upper Member, Upper Submember (Kagawong), a brown and grey, finely crystalline limestone and dolostone. The total thickness of the Manitoulin Formation is about 127 m with the lower member accounting for at least 48 m of the formation. Contacts between the subunits are poorly exposed on the island, making field identification of the units difficult. Due to these and other constraints, delineation of the subunits within the formation was not attempted and detailed consideration was given only to the upper and lower contacts.

The Manitoulin Formation is sparsely fossiliferous, bearing a brachiopod-coral assemblage. South of Peach Lake and north of Pike Lake, the formation is anomalously thick. However, these are probably only apparent thicknesses caused by draping of the Paleozoic strata over buried ridges of Precambrian rocks.

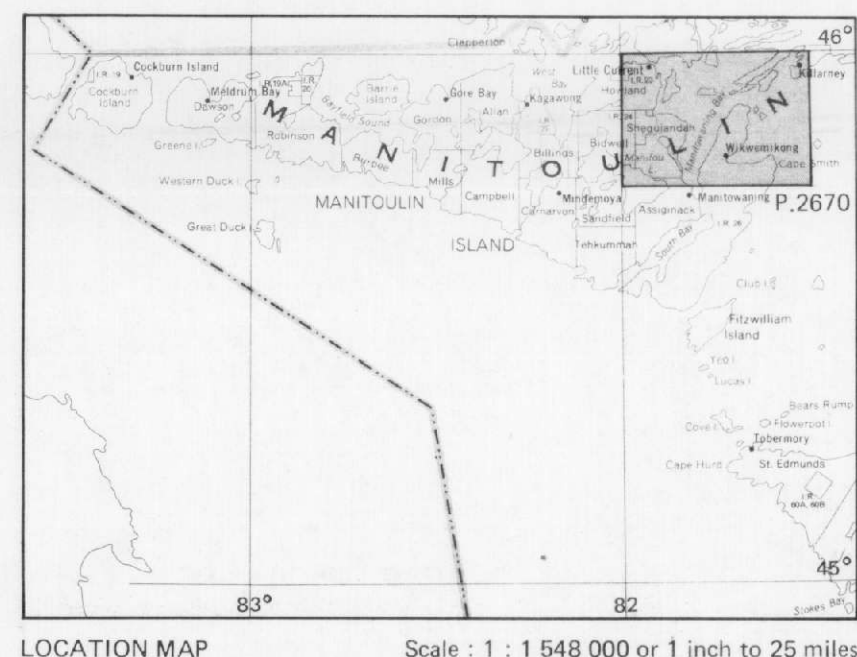


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PALEOZOIC GEOLOGY
LITTLE CURRENT AREA
 DISTRICT OF MANITOULIN

Scale 1:50 000
 NTS Reference: 41 H/13
 ODM-GSC Aeromagnetic Map: 2270G
 OGS Geological Compilation Map: 2441

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LEGEND

PHANEROZOIC PALEOZOIC	
MIDDLE SILURIAN	
17'	Amabel Formation (Facies IV) Dolostone, granular, soft, white, massive
16'	Amabel Formation (Facies III) Dolostone, medium to finely crystalline, blue-grey, massive to thickly bedded
16c'	Facies III, abundant crinoid debris
16b'	Facies III, abundant pentamerid brachiopods
15'	Amabel Formation (Facies II) Dolostone, medium to finely crystalline, blue-grey to buff, massive, minor thinly bedded, lenticular bodies forming hummocky topography
15c'	Facies II, abundant crinoid debris
14'	Amabel Formation (Facies I) Dolostone, finely crystalline, brown, thinly bedded
14b'	Facies I, richly fossiliferous
14a'	Facies I, abundant nodular chert
13'	Fossil Hill Formation: Dolostone, fine to coarsely crystalline, fossiliferous, buff-brown, thin to bedded; chert-rich in upper part
12	St. Edmund Formation: Dolostone, very fine to fine crystalline, pale grey to buff-brown, thin to medium bedded
11	Wingfield Formation: Interbedded dolostone and shale
10	Dyer Bay Formation: Dolostone, fine to medium crystalline, buff to grey-brown, thin bedded, fossiliferous
LOWER SILURIAN	
9	Cabot Head Formation: Shales, red and green
8	Manitoulin Formation: Dolostone, fine to medium crystalline, buff bedded, locally massive (biohermal)
DISCONFORMITY	
UPPER ORDOVICIAN	
7	Georgian Bay Formation: Interbedded limestone, dolostone, and shale; shale increasing to base
6	Blue Mountain Formation: Soft, blue-grey, argillaceous shale
MIDDLE-UPPER ORDOVICIAN	
5	Lindsay Formation: Limestone, finely crystalline to sublitographic, partly argillaceous, minor dolostones, thinly bedded, fossiliferous, overlain by black petrifoliferous shale
MIDDLE ORDOVICIAN	
4	Verulam Formation: Limestone and shale interbedded, limestone is blue-grey, coarsely crystalline to sublitographic, partly bioclastic and argillaceous, fossiliferous
3'	Bobcaygeon Formation: Limestone, sublitographic and very finely crystalline, thinly bedded, moderately fossiliferous
2'	Gull River Formation: Limestone, dark grey, finely crystalline to granular, grading into lithographic, pale grey, fossiliferous
1'	Basal Beds: Shales and sandstones, red and green
UNCONFORMITY	
PRECAMBRIAN PROTEROZOIC	
pc*	Bar River and Lorrain Formation (Huronian Supergroup, Cobalt Group) quartzite and orthoquartzites
* Not present in this map area	

SYMBOLS

- Bedrock outcrop from which a sample was taken and field data collected (N.S.)
- Geological Boundary, approximate
- Geological Boundary, interpreted
- Quarry
- O.G.S. Drillhole
- Location of bioherm, Manitoulin Formation

CREDITS

Geology by M.D. Johnson, P.G. Telford and assistants, 1979-1981.
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 Johnson, M.D. and Telford, P.G.
 1985: Paleozoic Geology of the Little Current Area, District of Manitoulin, Ontario Geological Survey, Geological Series- Preliminary Map P.2670, scale 1:50 000, Geology 1979 to 1981.

SOURCES OF INFORMATION

Topography from map 41H/13 of the National Topographic Series.
 Additional geological information from 29 drill cores taken on Manitoulin between 1978 and 1980. (Johnson and Telford 1981a, 198b).
 Locations of Manitoulin Formation bioherms provided by P. Copper (Laurentian University).

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ECONOMIC GEOLOGY

Although no recent petroleum exploration has taken place on Manitoulin Island, some 35 recorded exploration wells have been drilled in the map area (Johnson and Telford 1981a). Records for most of these wells are poor, but existing data suggest that 12 were dry with the rest being shows or very small producers. Most of the petroleum exploration wells were drilled south of Pike Lake.
 No limestone-dolomite quarries are located in the map area. Northeast of Sheguiandah Village (U.T.M. 429500E-5083500N) quartzite has been extracted from a small quarry in the Lorrain Formation (Proterozoic) used as a metallurgical flux.

Formations. The St. Edmund Formation consists of thin and evenly bedded, pale grey, lithographic dolostone, alternating with thicker beds of brown, finely crystalline dolostone. The formation is very poorly fossiliferous except for the "conchoidal bed", a bed of bulbous stromatolites, found near the top of the formation.
 The St. Edmund Formation conformably overlies the Wingfield Formation. The contact between these units is not exposed on the island although subsurface data suggest it is gradational in some places. The St. Edmund Formation is the youngest Paleozoic rock unit in the map area, but it only subsurfaces beneath glacial deposits in the extreme southwest corner.
ECONOMIC GEOLOGY
 Although no recent petroleum exploration has taken place on Manitoulin Island, some 35 recorded exploration wells have been drilled in the map area (Johnson and Telford 1981a). Records for most of these wells are poor, but existing data suggest that 12 were dry with the rest being shows or very small producers. Most of the petroleum exploration wells were drilled south of Pike Lake.
 No limestone-dolomite quarries are located in the map area. Northeast of Sheguiandah Village (U.T.M. 429500E-5083500N) quartzite has been extracted from a small quarry in the Lorrain Formation (Proterozoic) used as a metallurgical flux.

are common in the upper part. The Dyer Bay Formation does not outcrop within the map area and only subsurfaces beneath glacial deposits on the west shore of Lake Manitoulin (U.T.M. 422950E-5067900N).
Wingfield Formation
 Overlying the Dyer Bay Formation, the Wingfield Formation consists of 10.8 m of thinly bedded, brown dolostone interbedded with green shale. The contact between these formations is not exposed within the map area, although elsewhere on the island (ice Lake Road-Cut, Kagawong map area, N.T.S. 41G/16, U.T.M. 390250E-5083400N) it is very sharp. The Wingfield Formation is poorly fossiliferous with only occasional ostracod-rich horizons. It often has shallow water depositional features such as ripple marks, desiccation cracks and occasional rain pits. This unit only subsurfaces beneath glacial deposits in the west shore of Lake Manitoulin.
Dyer Bay Formation
 This unit disconformably overlies the shales of the Cabot Head Formation. The contact is not exposed within the map area but, where exposed elsewhere on the island (ice Lake Road-Cut, Kagawong map area, N.T.S. 41G/16, U.T.M. 390250E-5083400N), the contact is sharp. The Dyer Bay Formation consists of about 8 m of medium brown, thin bedded, highly fossiliferous, medocrystalline dolostone. The formation is characterized by an abundance of the brachiopod *Virgata* in the lower part; bryozoan