Ontario Ministry of Natural Resources

Hon. Alan W. Pope, Minister
W. T. Foster, Deputy Minister

ONTARIO GEOLOGICAL SURVEY
PRELIMINARY MAP P. 2412
GEOLOGICAL SERIES

PALEOZOIC GEOLOGY OF THE

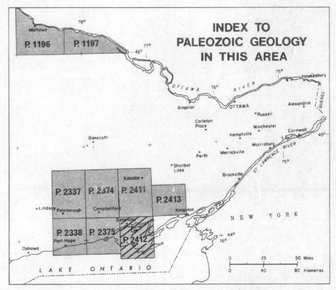
BELLEVILLE – WELLINGTON AREA

SOUTHERN ONTARIO

Scale 1:50 000

Mile 1 0 1 Mile
Metres 1000 0 1 Kilometre

NTS Reference: 31 C/3; 30 N/14
ODM-GSC Aeromagnetic Map: 8402 G



LEGEND

PALEOZOIC

MIDDLE ORDOVICIAN

- 6b — Lindsay Formation (upper member): nodular limestone and shale.
- 6a — Lindsay Formation (lower member): crystalline limestone with shaly partings.
- 5 — Verulam Formation: interbedded limestone and shale.
- 4b — Bobcaygeon Formation (upper member): crystalline and bioclastic limestone.
- 4a — Bobcaygeon Formation (lower member): crystalline limestone and calcarenite.
- 3 — Gull River Formation: lithographic to sublithographic limestone.
- 2 — *Shadow Lake Formation: arkosic sandstone, siltstone, and shale.

? CAMBRIAN

- 1 — *Potsdam Formation: evenly textured sandstone.

UNCONFORMITY

PRECAMBRIAN

- Pe — Undifferentiated Precambrian Rocks

*Not present in Kaladar-Tweed map-area.

SYMBOLS

- Bedrock Outcrop
- Geological Boundary, observed
- Geological Boundary, approximate
- Geological Boundary, position interpreted
- Fault, observed
- Fault, approximate
- Fault, position interpreted
- Quarry

MARGINAL NOTES

Mapping of the Belleville-Wellington area involved the re-examination of part of an area previously mapped by B.A. Liberty (1961) for the Geological Survey of Canada. This area was re-examined in light of new exposures of bedrock, and other information which has become available since the original mapping. Paleozoic bedrock outcrops are abundant along the Moira River, and in the valley of the Salmon River, occur intermittently along the Lake Ontario shoreline, and are moderately abundant throughout Prince Edward County.

The main physiographic features of the area include Prince Edward Peninsula, a large tract of land virtually separated from the rest of southern Ontario by the Bay of Quinte; and the Moira and Salmon Rivers which flow southward into the Bay of Quinte. Only a thin veneer of soil covers the limestone bedrock in this area, while thick glacial sediments are present only in some of the deeper stream valleys (Chapman and Putnam, 1973). The sand banks separating Lake Ontario from East Lake and West Lake have not been given a Paleozoic bedrock designation as they are Recent fluvio-lacustrine features which are not bedrock controlled.

STRATIGRAPHY

Precambrian

Precambrian rocks of the Canadian Shield outcrop within three discrete inliers in the present map-area. Two of these inliers occur 3.5 and 2.0 km northwest of Shannonville (U.T.M. References: 319400E, 4898050N; and 321125E, 4897100N respectively), and are predominantly granitic in composition. Both are surrounded by strata of the upper and lower members of the Bobcaygeon Formation. Granitic rock also outcrops about 4 km northeast of Ameliasburg (U.T.M. Reference: 307400E, 4884300N). Liberty (1961) reported that this inlier stands 150 m above the normal Precambrian surface.

Simcoe Group

Gull River Formation (Middle Ordovician): The Gull River Formation is the oldest unit in the Simcoe Group. It outcrops primarily along the Salmon River, and to a lesser extent, north of Foxboro, and on the floor of the limestone quarry at Point Anne, where possible topographic highs in the Precambrian basement have caused doming of the Paleozoic strata. In the present map-area, the Gull River Formation consists of massive, medium grey or medium to dark brown, lithographic to sublithographic limestone that generally weathers light grey. Locally, these strata may display birdseye texture. Although fossils are rare, those present include cephalopods, gastropods, and small colonial corals. No complete sections of the Gull River Formation occur in the Belleville-Wellington map-area, but its estimated thickness in the area is about 20 m.

The lower boundary of the Gull River Formation with the Shadow Lake Formation is not present in this map-area, but does occur in the Kaladar-Tweed map-area immediately to the north (Carson 1981). There, the boundary is defined as the last appearance of clastic sedimentary units and the beginning of virtually continuous carbonate units. A commonly occurring transition zone of interbedded limestone and shale is included in the upper part of the Shadow Lake Formation. Therefore, the Shadow Lake-Gull River boundary essentially represents a change from unstable to stable conditions. The upper boundary of the Gull River Formation with the Bobcaygeon Formation is defined as the point at which lithographic to sublithographic limestone changes to a generally darker, finely crystalline limestone or fine-grained calcarenite.

Bobcaygeon Formation (Middle Ordovician): The Bobcaygeon Formation occurs as a broad belt along the Salmon River, and as narrow bands surrounding Precambrian inliers near Shannonville. It is assumed to underlie an area surrounding outcrops of Gull River strata south of the hamlet of Foxboro. In the Belleville-Wellington map-area, the Bobcaygeon Formation is divisible into two discrete members. The lower member generally consists of pale to dark brown or pale to dark grey, finely to medium crystalline limestone and pale brown, fine- to medium-grained calcarenite. The unit generally weathers pale brown or pale grey, and occurs in beds up to 20 cm thick. The total thickness of the unit is about 10 m. The upper member of the formation consists predominantly of medium brown or medium grey-brown, finely crystalline to sublithographic limestone that is thin-bedded and weathers pale grey. Shale and bioclastic limestone are locally present in the upper member, and increase in abundance toward the top of the fomation. The upper member is less than 3 m in thickness. The contact between the two members is somewhat gradational, but is primarily based on bedding thickness and the presence or absence of bioclastic limestone and calcarenite. In general, the lower member of the Bobcaygeon Formation is the most resistant. Common fossils found in the formation include brachiopods and crinoids, while bryozoans, gastropods, and large colonial corals are somewhat less abundant.

In the Belleville-Wellington map-area, the upper contact of the Bobcaygeon Formation with the Verulam Formation is somewhat gradational from thicker bedded bioclastic and crystalline limestone with shaly partings, to more thinly bedded, regularly interbedded limestone and shale. The boundary is defined as the base of the first appearance of regularly interbedded limestone and shale in subequal thickness.

Verulam Formation (Middle Ordovician): The Verulam Formation underlies most of the northern half of the map-area and all of the extreme eastern portion. It consists of medium brown and grey, finely crystalline, uniformly bedded with subequal thicknesses of pale to medium brown and grey bioclastic limestone, and grey and brown shale. The entire formation weathers pale grey and brown, and occurs in beds 3 to 15 cm in thickness. Common fossils include brachiopods and bryozoans. The thickness of the formation has been estimated to be in excess of 90 m (Liberty 1963).

The upper boundary of the Verulam Formation with the Lindsay Formation is normally defined at the point where brownish carcarenites and bioclastic limestones are directly overlain by bluish grey, finely crystalline limestone. However, in the presen map-area, approximately 2 m of bluish, finely crystalline material, overlying typical Verulam strata, are in turn overlain by two massive beds of brownish bioclastic limestone, above which the bluish crystalline limestone is continuous. The contact in this case is placed at the top of the two massive, somewhat bioclastic beds.

Lindsay Formation (Middle Ordovician): The Lindsay Formation is the youngest Paleozoic unit in the map-area and underliesmost of the southern half of the map-area and underlies most of the southern half of the map-area, forming 3 to 4 m high escarpments along the south shore of Prince Edward Peninsula, and 10 to 12 m high escarpments along the northern shore of Long Point. In the present map-area, the formation can be divided into two members. The lower member, approximately 30 m in thickness, consists of medium grey and bluish grey, finely to medium crystalline limestone in beds 3 to 10 cm in thickness separated by thin shaly seams and partings. These strata may locally be modular. The upper member of the Lindsay Formation is composed of pale to medium grey, sublithographic to finely crystalline, nodular and shaly limestone. Bioclastic limestone is locally common. Although no complete section of the upper member of the Lindsay Formation is present in the area, Liberty (1961) estimates the thickness to be about 60 m. The contact between the two members is defined as the point where grey, medium to finely crystalline limestone is overlain by grey finely crystalline to sublithographic nodular limestone. Common fossils include brachiopods, gastropods, bryozoa, and trilobites.

STRUCTURAL GEOLOGY

Strata in the map-area are essentially flat-lying except where localized highs in the Precambrian basement have produced doming of the Paleozoic strata and thus, anomalously high angles of dip. Such phenomena occur at Ameliasburg (U.T.M. Reference: 307400E, 4884300N), Shannonville (U.T.M. Reference: 319400E, 4898050N; 321125E, 4897100N), and south of Foxboro.

The valley of the Salmon River follows the topographic expression of a normal fault, the northwest side of which has been downthrust less than 30 m. This fault can be traced from the Kaladar-Tweed map-area (Carson 1981) across the Bay of Quinte to Massasaga Point, where it may be related to angles of dip of up to 18°, recorded in a small, abandoned quarry on the southeast side. Because of this localized tilting, the upper member of the Bobcaygeon Formation appears at the surface. There may be some relationship between the fault zone and the Precambrian inliers at Shannonville and Ameliasburg, but currently there is not enough data to allow a confident interpretation.

Another normal fault trends southward from Picton and separates into two, possibly three, smaller faults. At Picton, the west block of the fault is downthrust by approximately 30 m as shown by the Verulam Formation to the east, and the younger Lindsay Formation to the west of the fault. Submarine contours and stratigraphic evidence indicate the continuation of this fault northward through Long Reach. Recent investigations (Fakundiny *et al.* 1978) suggest that this fault may be a northern continuation of the Clarendon-Linden fault system of western New York State.

A small surface fault, possibly related to the release of high horizontal stress (White *et al.* 1974) occurs approximately 7.5 km east of Belleville on the north side of Highway 2. This feature may also be related to the Salmon River fault zone.

ECONOMIC GEOLOGY

At present, the Gull River and Bobcaygeon Formations are being quarried by Standard Aggregates Limited at Point Anne. The Lake Ontario Cement Company operates a quarry in the Verulam Formation at Picton; material from this operation is used in the production of cement. Other, smaller abandoned quarries north of Belleville, and near Mountain View, Marysville, Mount Caramel, and North Port occur in the Verulam and Lindsay Formations. The larger of these quarries have been described by Hewitt and Vos (1972).

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SOURCES OF INFORMATION

Topography from Map 31 C/3 (Belleville) and Map 30 N/14 (Wellington) of the National Topographic Series.

Metric Conversion Factor: 1 foot = 0.3048 m.

CREDITS

Geology by D. M. Carson and assistant, 1980.

Every possible effort has been made to ensure the accuracy of the information presented on this map; however, the Ontario Ministry of Natural Resources does not assume any liability for errors that may occur. Users may wish to verify critical information; sources include both the references listed here, and information on file at the Resident or Regional Geologist's office and the Mining Recorder's office nearest the map area.

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