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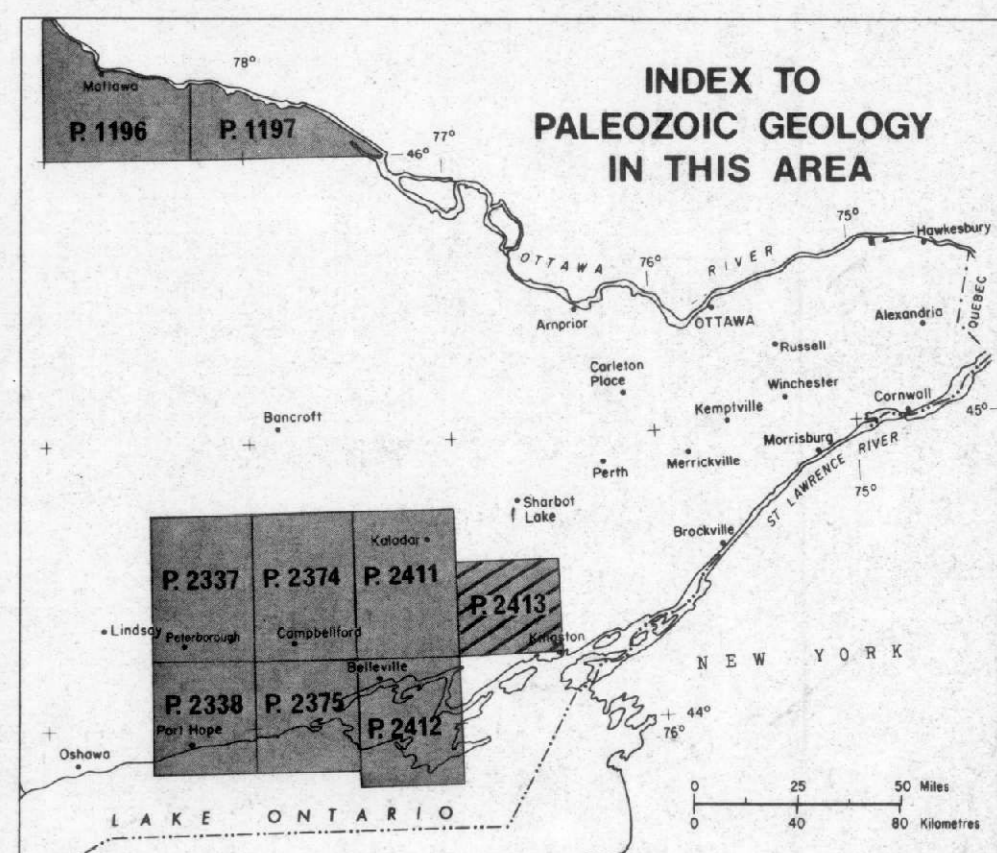
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ONTARIO GEOLOGICAL SURVEY
PRELIMINARY MAP P 2413
GEOLOGICAL SERIES
**PALEOZOIC GEOLOGY OF THE
TICHBORNE - SYDENHAM
AREA**
SOUTHERN ONTARIO

Scale 1:15 840
NTS Reference: 31 C/10, 7
ODM-GSC Aeromagnetic Map: 8380 G, 8392 G

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LEGEND

- PALEOZOIC**
- MIDDLE ORDOVICIAN**
 - 5 Venium Formation: interbedded limestone and shale
 - 4b Bobocaygon Formation (upper member): crystalline limestone and calcarenite
 - 4a Bobocaygon Formation (lower member): crystalline limestone and calcarenite
 - 3c Gull River Formation (upper member): brown lithographic and sublitographic limestone
 - 3b Gull River Formation (middle member): buff and green siltstone, dolomitic limestone, and crystalline limestone
 - 3a Gull River Formation (lower member): brown lithographic to finely crystalline limestone
 - 2 Shadow Lake Formation: arkosic sandstone, siltstone, and shale
 - CAMBRIAN**
 - 1 Potdam Formation: evenly bedded limestone and shale
- UNCONFORMITY**
- PRECAMBRIAN
 - PE Undifferentiated Precambrian Rocks
- SYMBOLS**
- Bedrock outcrop
 - Geological boundary, observed
 - Geological boundary, position approximate
 - Geological boundary, position interpreted
 - Fault, observed
 - Fault, position approximate
 - Fault, position interpreted
 - Quarry

SOURCES OF INFORMATION

Topography from Map 31 C/10 (Tichborne) and Map 31 C/7 (Sydenham) of the National Topographic Series.
Metric Conversion Factor: 1 foot = 0.3048 m.

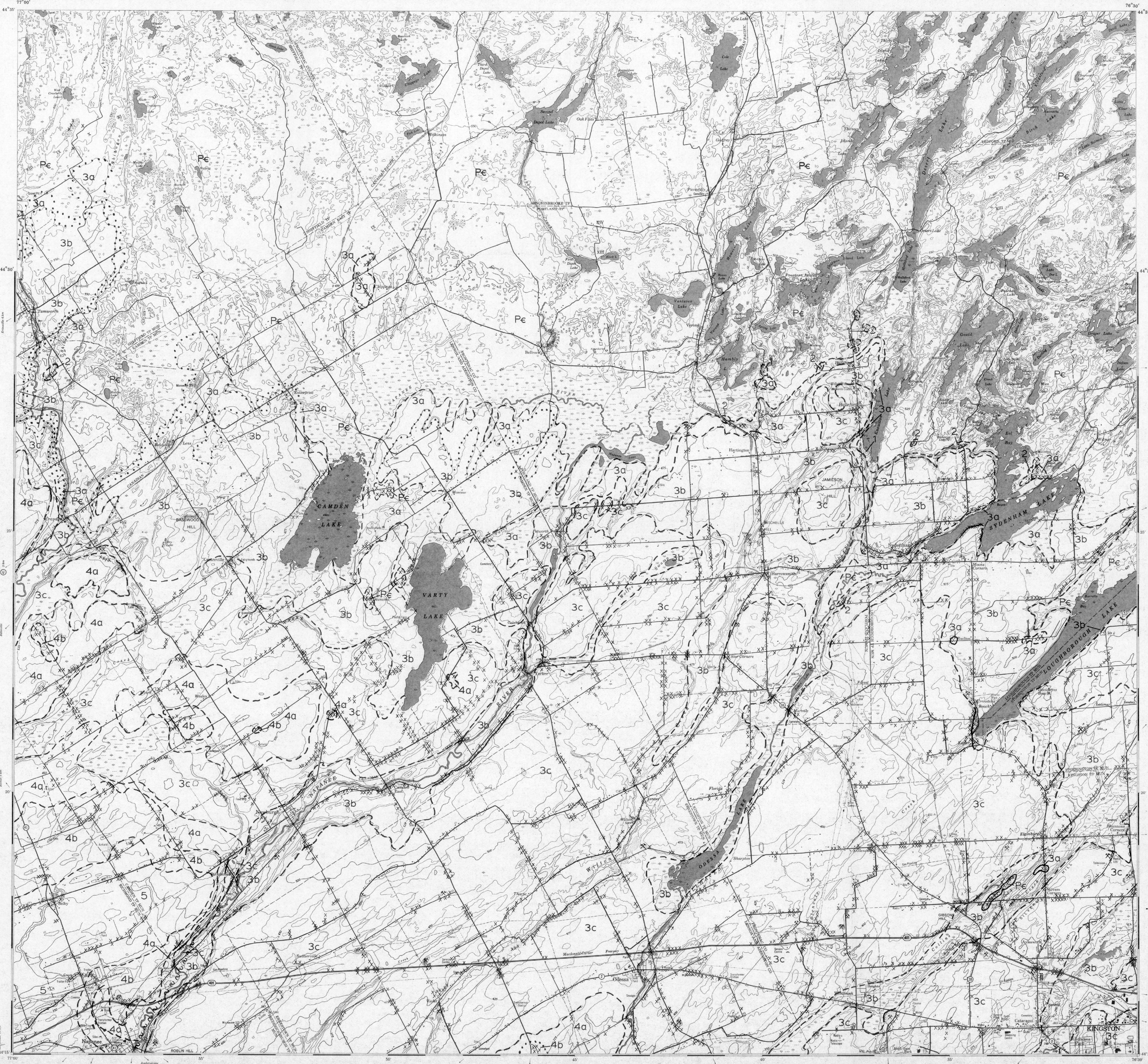
CREDITS

Geology by D. M. Carson and assistants, 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.

The work reported here was equally funded by the Federal Department of Regional and Economic Expansion and the Ontario Ministry of Natural Resources under the Minerals Program of the Eastern Ontario Subsidary Agreement.

Issued 1981

Information from this publication may be quoted if credit is given. It is recommended that reference to this map be made in the following form:
Carson, D.M.
1981: Paleozoic Geology of the Tichborne-Sydenham Area, Southern Ontario; Ontario Geological Survey Preliminary Map P. 2413, Geological Series, Scale 1:50 000, Geology 1980.



MARGINAL NOTES

Mapping of the Tichborne-Sydenham area involved the re-examination of part of an area previously included in the compilation map of Hewitt (1964). The Sydenham map sheet was previously mapped by B. A. Liberty (1971) for the Geological Survey of Canada. This area straddles the Precambrian-Paleozoic boundary, and was re-examined in light of new exposures and other information which has become available since the original mapping. Paleozoic bedrock outcrop is abundant throughout the central and southern parts of the map-area. In the northern part of the map-area, bedrock outcrop is predominantly Precambrian and granitic rock of Precambrian age, however, a small ridge of Paleozoic limestone occurs about 12 km east of the hamlet of Tamworth (U.T.M. Reference: 363800E, 492200N). This is the only Paleozoic outcrop in the Tichborne map-area.

The main physiographic features in the map-area include Camden, Varty, Odessa, Sydenham, Knowlton, and Loughborough Lakes. The Napanee River flows in a southwesterly direction across the southern portion of the map-area as do numerous smaller creeks. The map-area comprises part of the Napanee Plain (Chapman and Putnam 1973) wherein only a thin veneer of unconsolidated sediment covers the limestone bedrock, and where thick glacial sediments are present only in some of the deeper stream valleys.

PRECAMBRIAN-PALEOZOIC BOUNDARY

The Precambrian-Paleozoic boundary in southern Ontario extends some 290 km from Midland on Georgian Bay to Kingston at the eastern end of Lake Ontario (Hewitt, 1964b). In the present map-area, it extends from north of the hamlet of Tamworth, south to the hamlet of Crofton, then roughly eastwards, forming a small, southerly trending re-entrant around Camden, Knowlton, Sydenham, and Loughborough Lakes. To the west, in the Bannockburn-Campbellford and Burleigh Falls-Peterborough map-areas, the Precambrian-Paleozoic boundary is generally marked by a three- to four-metre high, north-facing limestone scarp (Carson 1980a, 1980b). In the present map-area, this scarp is, for the most part, either absent or, if present, is buried by drift. The scarp is exposed at four localities (U.T.M. References: 363800E, 4922800N; 365800E, 4924000N; 364675E, 4922800N; and 366500E, 4923100N).

South of the boundary, outcrop and underlying bedrock consist of Paleozoic strata, with rare, small inliers of Precambrian rock, with which is associated localized doming of the surrounding Paleozoic strata. North of the boundary, the underlying bedrock is predominantly granitic or gneissic rock of Precambrian age, while Paleozoic outcrops are rare.

STRATIGRAPHY

Potdam Formation (Cambrian): The Potdam Formation outcrops in the east-central part of the map-area on several small outcrops north of the hamlet of Hofferford, and along the southeast shore of Knowlton Lake. The unit consists of fine to medium grained, well sorted and rounded, red, orange, yellow, buff, and brown quartzose sandstone with minor siltstone, in irregular and uneven beds of medium thickness. Concretion is common and concretions up to 10 cm in diameter are present at one locality (U.T.M. Reference: 370900E, 4925900N). The greatest observed thickness of the formation is less than three metres, although Liberty (1971) estimated a total thickness in excess of 21 m. No fossils were recovered from the formation in the present area.

The lower contact of the Potdam Formation with the underlying Precambrian is marked by an abrupt change from granitic and gneissic, igneous and metamorphic rocks, to sandstone and minor siltstones. The upper contact of the Potdam Formation with the Shadow Lake Formation is marked by the change from uniformly textured brown, orange and red sandstones to red and green, poorly sorted arkosic sandstones, shale, and siltstones. Both contacts are unconformable.

Basal Group

Shadow Lake Formation (Middle Ordovician): Outcrops of the Shadow Lake Formation are rare in the present map-area, being confined to a few road cuts at the Precambrian-Paleozoic boundary. The formation consists of red and green arkosic sandstone, siltstone, and shale with clasts, less than 2 cm in diameter, of granite, quartz, and feldspar. The maximum observed thickness of the formation in the present map-area is four metres. No fossils were found in the formation in the present map-area. The upper boundary of the Shadow Lake Formation 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 depositional conditions.

Simon Group

Gull River Formation (Middle Ordovician): Outcrops of the Gull River Formation are abundant throughout the map-area, except in the extreme southwest portion. In the present map-area, the formation is divisible into three members. The lower member consists of medium to dark grey brown, lithographic to finely crystalline limestone that weathers medium to pale grey. The rocks are in medium to thick beds that may weather locally into thinner, more uneven beds. Pale pink to pale yellow, very coarsely crystalline calcite up to 15 cm in diameter are common. Total thickness of the lower member is 15 to 20 m. The middle member consists of up to 20 m of interbedded pale green and buff siltstone, pale grey green and buff, finely crystalline dolomitic limestone and medium to dark brown lithographic limestone. The unit is generally thin to medium-bedded and locally massive. The upper member consists of medium to dark brown, lithographic to sublitographic limestone, that weathers grey and is massive in character. The unit is up to 30 m in thickness. Common fossils in the Gull River Formation include brachiopods, small corals, and graptolites.

The upper contact of the Gull River Formation with the Bobocaygon Formation is defined as the point at which lithographic to sublitographic limestone changes to a generally finer, finely crystalline limestone or calcarenite. Black chert nodules found near this boundary in the Burleigh Falls-Peterborough and Bannockburn-Campbellford map-areas to the west (Carson 1980a, 1980b), are very rare in the present map-area.

Bobocaygon Formation (Middle Ordovician): Outcrops of the Bobocaygon Formation occur only in the southwestern portion of the map-area. The formation is divisible into two members. The lower member generally consists of pale to dark brown and grey crystalline limestone interbedded with pale brown, fine to medium-grained calcarenites. The crystalline limestone is predominantly fine to medium-bedded, but locally sublitographic limestone may be present. The rocks of the lower member are generally thin to medium-bedded and locally massive, and weather to pale grey, buff, or brown. The thickness of the lower member is approximately 10 m. The upper member of the formation includes medium to dark grey and brown, thinly bedded, finely crystalline to sublitographic limestone that weathers pale to medium grey and brown. Biostrophic limestone and shale also occur in the upper member and increase in abundance toward the top of the formation. The thickness of the upper member is less than 4 m. The contact between the two members is somewhat gradational, but is based primarily on bedding thickness, and the presence or absence of biostrophic limestone and calcarenite. In general, the upper member of the Bobocaygon Formation is the more easily weathered. Common fossils found in the formation include brachiopods and crinoids, while bryozoans, gastropods, and large colonial corals are somewhat less abundant.

In the present map-area the upper contact of the Bobocaygon Formation with the Venium Formation is gradational from thicker bedded biostrophic and crystalline limestone with shaly stringers and 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.

Venium Formation (Middle Ordovician): Outcrops of the Venium Formation occur only in the extreme southwest. The unit consists of pale to dark brown and grey, medium to coarse-grained biostrophic limestone, in beds ranging from four to eight centimetres in thickness, interbedded with crystalline limestone and shale in beds of subequal thickness. Only the basal few metres of the formation are present in the Tichborne-Sydenham map-area. Brachiopod fragments and bryozoans are common in the present map-area, but undamaged specimens are rare.

STRUCTURAL GEOLOGY

Strata in the map-area are essentially flat-lying except where localized topographic highs in the Precambrian basement have produced doming of the Paleozoic strata, and thus anomalous high angles of dip.

The Napanee River follows the trend of a normal fault, the northwestern side of which has been downfaulted approximately 30 m. The movement on the fault is apparent because the Gull River Formation appears stratigraphically higher on the southeast side of the river than the Bobocaygon Formation on the northwest side. This is particularly evident at the point where Highway 401 crosses the Napanee River (U.T.M. Reference: 376600E, 4903200N). A possibly related series of four much smaller top-faults in the Gull River Formation occurs on the east side of the river in Napanee (U.T.M. Reference: 365700E, 4922700N). Again, the west side of each fault has been downfaulted, but the movement on each fault is less than one metre.

A small surface fold, less than one metre in relief, possibly caused by high horizontal stress (White et al. 1974), occurs in the upper member of the Gull River Formation on Highway 401 near the Sydenham Road interchange west of Kingston (U.T.M. Reference: 376600E, 4903700N). This feature trends approximately 140° but cannot be traced at the surface away from the road cut.

ECONOMIC GEOLOGY

Several small operations in the vicinity of Kingston currently quarry rock from the Gull River Formation for use as crushed stone. These include the quarries of Woods Sand and Gravel Limited of Kingston, McGinnis and O'Connor Limited of Elginburg, and W.J. McCordery and Sons Limited at Kingston, all of which were described by Hewitt and Vos (1972).

REFERENCES

Carson, D.M.
1980a: Paleozoic Geology of the Burleigh Falls-Peterborough Area, Southern Ontario; Ontario Geological Survey, Preliminary Map P. 2337, Geological Series, scale 1:50 000.
1980b: Paleozoic Geology of the Bannockburn-Campbellford Area, Southern Ontario; Ontario Geological Survey, Preliminary Map P. 2374, Geological Series, scale 1:50 000.
Chapman, L.J., and Putnam, D.J.
1973: The Physiography of Southern Ontario, Second Edition; Ontario Research Foundation, Toronto, 389p.
Hewitt, D.F.
1964a: Geological Notes for Maps Nos. 2053 and 2054, Madoc-Ganarquois; Ontario Division of Mines, GC 12, 126p (Revised 1974). Accompanied by Maps 2053 and 2054, scale: 1 inch to 2 miles.
1964b: Precambrian-Paleozoic Contact Relationships in Eastern Ontario; American Association of Petroleum Geologists, Guidebook, Geology of Central Ontario, Toronto Convention, 1964.
Hewitt, D.F., and Vos, M.A.
1972: The Limestone Industries of Ontario; Ontario Division of Mines, IMR 39, 76p.
Liberty, B.A.
1971: Paleozoic Geology of the Wolfe Island, Bath, Sydenham, and Ganarquois Map-areas; Ontario Geological Survey of Canada, Paper 70-35, 12 p.
White, O.L., Karrow, P.F., and Macdonald, J.R.
1974: Residual Stress Relief Phenomena in Southern Ontario; Proceedings of the Ninth Canadian Rock Mechanics Symposium, Montreal, 1973, p. 323-348.