

## THESE TERMS GOVERN YOUR USE OF THIS DOCUMENT

**Your use of this Ontario Geological Survey document (the “Content”) is governed by the terms set out on this page (“Terms of Use”). By downloading this Content, you (the “User”) have accepted, and have agreed to be bound by, the Terms of Use.**

**Content:** This Content is offered by the Province of Ontario’s *Ministry of Northern Development and Mines* (MNDM) as a public service, on an “as-is” basis. Recommendations and statements of opinion expressed in the Content are those of the author or authors and are not to be construed as statement of government policy. You are solely responsible for your use of the Content. You should not rely on the Content for legal advice nor as authoritative in your particular circumstances. Users should verify the accuracy and applicability of any Content before acting on it. MNDM does not guarantee, or make any warranty express or implied, that the Content is current, accurate, complete or reliable. MNDM is not responsible for any damage however caused, which results, directly or indirectly, from your use of the Content. MNDM assumes no legal liability or responsibility for the Content whatsoever.

**Links to Other Web Sites:** This Content may contain links, to Web sites that are not operated by MNDM. Linked Web sites may not be available in French. MNDM neither endorses nor assumes any responsibility for the safety, accuracy or availability of linked Web sites or the information contained on them. The linked Web sites, their operation and content are the responsibility of the person or entity for which they were created or maintained (the “Owner”). Both your use of a linked Web site, and your right to use or reproduce information or materials from a linked Web site, are subject to the terms of use governing that particular Web site. Any comments or inquiries regarding a linked Web site must be directed to its Owner.

**Copyright:** Canadian and international intellectual property laws protect the Content. Unless otherwise indicated, copyright is held by the Queen’s Printer for Ontario.

It is recommended that reference to the Content be made in the following form: <Author’s last name>, <Initials> <year of publication>. <Content title>; Ontario Geological Survey, <Content publication series and number>, <total number of pages>p.

**Use and Reproduction of Content:** The Content may be used and reproduced only in accordance with applicable intellectual property laws. *Non-commercial* use of unsubstantial excerpts of the Content is permitted provided that appropriate credit is given and Crown copyright is acknowledged. Any substantial reproduction of the Content or any *commercial* use of all or part of the Content is prohibited without the prior written permission of MNDM. Substantial reproduction includes the reproduction of any illustration or figure, such as, but not limited to graphs, charts and maps. Commercial use includes commercial distribution of the Content, the reproduction of multiple copies of the Content for any purpose whether or not commercial, use of the Content in commercial publications, and the creation of value-added products using the Content.

### Contact:

FOR FURTHER INFORMATION ON	PLEASE CONTACT:	BY TELEPHONE:	BY E-MAIL:
<b>The Reproduction of Content</b>	MNDM Publication Services	Local: (705) 670-5691 Toll Free: 1-888-415-9845, ext. 5691 (inside Canada, United States)	<a href="mailto:Pubsales@ndm.gov.on.ca">Pubsales@ndm.gov.on.ca</a>
<b>The Purchase of MNDM Publications</b>	MNDM Publication Sales	Local: (705) 670-5691 Toll Free: 1-888-415-9845, ext. 5691 (inside Canada, United States)	<a href="mailto:Pubsales@ndm.gov.on.ca">Pubsales@ndm.gov.on.ca</a>
<b>Crown Copyright</b>	Queen’s Printer	Local: (416) 326-2678 Toll Free: 1-800-668-9938 (inside Canada, United States)	<a href="mailto:Copyright@gov.on.ca">Copyright@gov.on.ca</a>

**LES CONDITIONS CI-DESSOUS RÉGISSENT L'UTILISATION DU PRÉSENT DOCUMENT.**

***Votre utilisation de ce document de la Commission géologique de l'Ontario (le « contenu ») est régie par les conditions décrites sur cette page (« conditions d'utilisation »). En téléchargeant ce contenu, vous (l'« utilisateur ») signifiez que vous avez accepté d'être lié par les présentes conditions d'utilisation.***

**Contenu :** Ce contenu est offert en l'état comme service public par le *ministère du Développement du Nord et des Mines* (MDNM) de la province de l'Ontario. Les recommandations et les opinions exprimées dans le contenu sont celles de l'auteur ou des auteurs et ne doivent pas être interprétées comme des énoncés officiels de politique gouvernementale. Vous êtes entièrement responsable de l'utilisation que vous en faites. Le contenu ne constitue pas une source fiable de conseils juridiques et ne peut en aucun cas faire autorité dans votre situation particulière. Les utilisateurs sont tenus de vérifier l'exactitude et l'applicabilité de tout contenu avant de l'utiliser. Le MDNM n'offre aucune garantie expresse ou implicite relativement à la mise à jour, à l'exactitude, à l'intégralité ou à la fiabilité du contenu. Le MDNM ne peut être tenu responsable de tout dommage, quelle qu'en soit la cause, résultant directement ou indirectement de l'utilisation du contenu. Le MDNM n'assume aucune responsabilité légale de quelque nature que ce soit en ce qui a trait au contenu.

**Liens vers d'autres sites Web :** Ce contenu peut comporter des liens vers des sites Web qui ne sont pas exploités par le MDNM. Certains de ces sites pourraient ne pas être offerts en français. Le MDNM se dégage de toute responsabilité quant à la sûreté, à l'exactitude ou à la disponibilité des sites Web ainsi reliés ou à l'information qu'ils contiennent. La responsabilité des sites Web ainsi reliés, de leur exploitation et de leur contenu incombe à la personne ou à l'entité pour lesquelles ils ont été créés ou sont entretenus (le « propriétaire »). Votre utilisation de ces sites Web ainsi que votre droit d'utiliser ou de reproduire leur contenu sont assujettis aux conditions d'utilisation propres à chacun de ces sites. Tout commentaire ou toute question concernant l'un de ces sites doivent être adressés au propriétaire du site.

**Droits d'auteur :** Le contenu est protégé par les lois canadiennes et internationales sur la propriété intellectuelle. Sauf indication contraire, les droits d'auteurs appartiennent à l'Imprimeur de la Reine pour l'Ontario.

Nous recommandons de faire paraître ainsi toute référence au contenu : nom de famille de l'auteur, initiales, année de publication, titre du document, Commission géologique de l'Ontario, série et numéro de publication, nombre de pages.

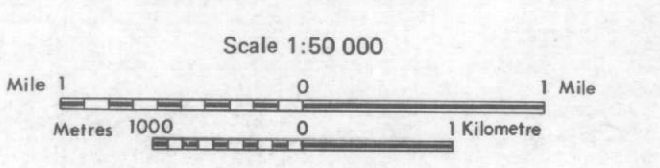
**Utilisation et reproduction du contenu :** Le contenu ne peut être utilisé et reproduit qu'en conformité avec les lois sur la propriété intellectuelle applicables. L'utilisation de courts extraits du contenu à des fins *non commerciales* est autorisée, à condition de faire une mention de source appropriée reconnaissant les droits d'auteurs de la Couronne. Toute reproduction importante du contenu ou toute utilisation, en tout ou en partie, du contenu à des fins *commerciales* est interdite sans l'autorisation écrite préalable du MDNM. Une reproduction jugée importante comprend la reproduction de toute illustration ou figure comme les graphiques, les diagrammes, les cartes, etc. L'utilisation commerciale comprend la distribution du contenu à des fins commerciales, la reproduction de copies multiples du contenu à des fins commerciales ou non, l'utilisation du contenu dans des publications commerciales et la création de produits à valeur ajoutée à l'aide du contenu.

**Renseignements :**

<b>POUR PLUS DE RENSEIGNEMENTS SUR</b>	<b>VEUILLEZ VOUS ADRESSER À :</b>	<b>PAR TÉLÉPHONE :</b>	<b>PAR COURRIEL :</b>
<b>la reproduction du contenu</b>	Services de publication du MDNM	Local : (705) 670-5691 Numéro sans frais : 1 888 415-9845, poste 5691 (au Canada et aux États-Unis)	<a href="mailto:Pubsales@ndm.gov.on.ca">Pubsales@ndm.gov.on.ca</a>
<b>l'achat des publications du MDNM</b>	Vente de publications du MDNM	Local : (705) 670-5691 Numéro sans frais : 1 888 415-9845, poste 5691 (au Canada et aux États-Unis)	<a href="mailto:Pubsales@ndm.gov.on.ca">Pubsales@ndm.gov.on.ca</a>
<b>les droits d'auteurs de la Couronne</b>	Imprimeur de la Reine	Local : 416 326-2678 Numéro sans frais : 1 800 668-9938 (au Canada et aux États-Unis)	<a href="mailto:Copyright@gov.on.ca">Copyright@gov.on.ca</a>

ONTARIO GEOLOGICAL SURVEY  
 PRELIMINARY MAP P. 2412  
 GEOLOGICAL SERIES  
 PALEOZOIC GEOLOGY OF THE  
**BELLEVILLE - WELLINGTON**  
**AREA**

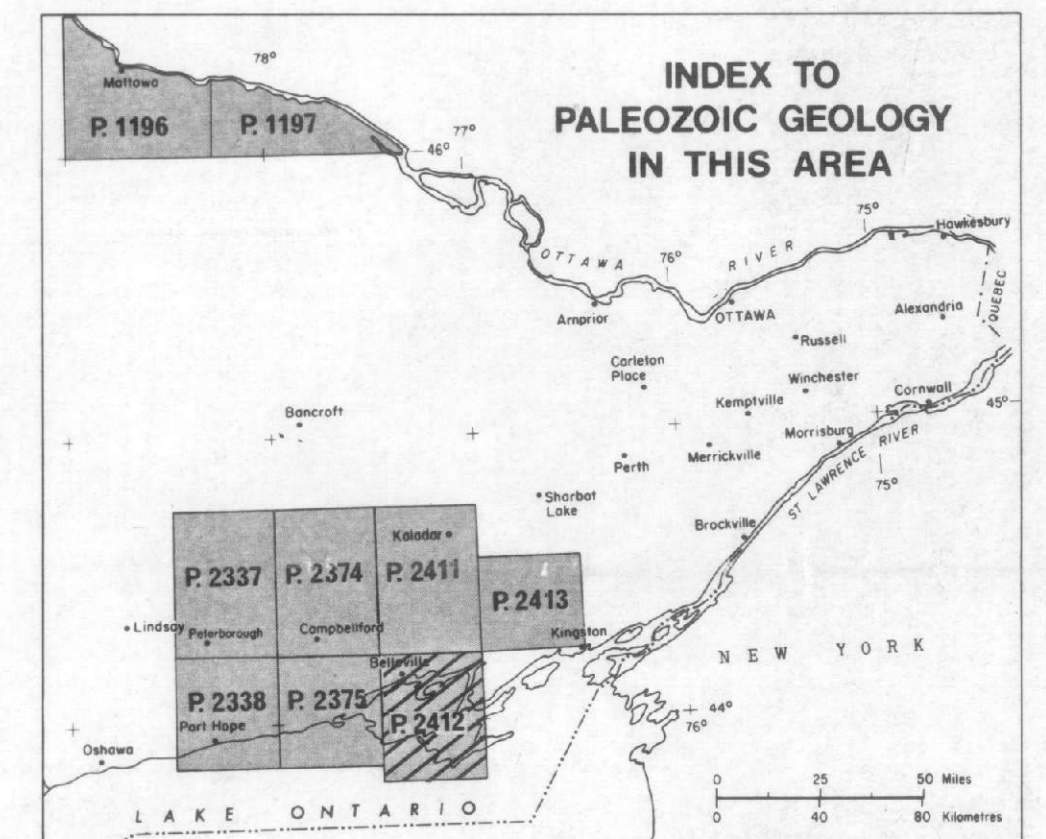
Southern Ontario  
 Scale 1:50 000



NTS Reference: 31 C2:30 N1/4  
 ODM GSC Aeromagnetic Map: 8402 G

© OMNR-OGS 1981

Parts of this publication may be quoted if credit is given and the material is properly referenced.  
 This map is published with the permission of E. G. Pye, Director, Ontario Geological Survey.



LEGEND

PALEOZOIC	
MIDDLE ORDOVICIAN	
6b	Lindsay Formation (upper member): nodular limestone and shale.
6a	Lindsay Formation (lower member): crystalline limestone with shaly partings.
5	Vermilion Formation: interbedded limestone and shale.
4b	Bobcaygeon Formation (upper member): crystalline limestone and calcarenite.
4a	Bobcaygeon Formation (lower member): crystalline limestone and calcarenite.
3	Gull River Formation: lithographic to sublitographic limestone.
2	Shadow Lake Formation: arkosic sandstone, siltstone, and shale.
1	PRECAMBRIAN
Pe	Unconsolidated Precambrian Rocks
UNCONFORMITY	
PRECAMBRIAN	
Pe	Unconsolidated Precambrian Rocks
SYMBOLS	
X	Bedrock Outcrop
—	Geological Boundary, observed
- - -	Geological Boundary, approximate
· · · · ·	Geological Boundary, position interpreted
~	Fault, observed
~	Fault, approximate
~	Fault, position interpreted
Q	Quarry

MARGINAL NOTES

Mapping of the Belleville-Wellington area involved the re-examination of part of an area previously mapped by D.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 Mohawk 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 Mohawk and Salmon Rivers which flow generally westward into the Bay of Quinte. Only a thin veneer of soil covers the limestone bedrock in the area, while thick glacial sediments are present only in some of the deeper stream valleys (Chapman and Pomeroy, 1972). The sand and gravel deposits along the western shore of Lake Ontario and West Lake have not been given a Precambrian bedrock designation as they are Recent fluvio-glacial features, which are not bedrock controlled.

**STRATIGRAPHY**  
 Precambrian rocks of the Canadian Shield outcrop within three discrete belts in the present map area. Two of these belts occur 2.5 and 2.0 km northwest of Shannonville (U.T.M. References: 319400E, 489500N; and 32120E, 489700N) 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 Amabelville (U.T.M. Reference: 327400E, 488400N). Liberty (1961) reported that this latter strata 150 m above the normal Precambrian surface.

**Shadow Lake Formation (Middle Ordovician):** The Shadow Lake Formation is the oldest unit in the Simcoe Group. It outcrops primarily along the Salmon River, and to a lesser extent, north of Forbes, and on the floor of the limestone quarry at Point Anne, where considerable topographic heights in the Precambrian basement have caused doming of the Paleozoic strata. In the present map area, the Shadow Lake Formation consists of massive, medium grey to medium to dark brown, lithographic to sublitographic limestone that generally weathers light grey. Locally, these strata may display sandstone texture. Although fossils are rare, those present include brachiopods, gastropods, and small colonial corals. No complete sections of the Shadow Lake 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 on the Kladar-Tweed map area immediately to the north (Carson 1981). There, the boundary is defined as the base of the massive, medium to dark brown, lithographic to sublitographic limestone and shale. 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 sublitographic 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 outcrops in the vicinity of Point Anne, and in the area surrounding outcrops of Gull River strata south of the hamlet of Forbes, 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 calcarenite, and generally weathers pale brown or pale grey, and occurs in beds up to 20 m thick. The total thickness of the unit is about 10 m. The upper member of the formation consists predominantly of medium brown to medium grey-brown, finely crystalline to sublitographic limestone that is thin-bedded and weathers pale grey. Shale and biotactic limestone are locally present in the upper member, and increase in abundance toward the top of the formation. The upper member is less than 3 m in thickness. The contact between the two members is somewhat gradational, but is primarily based on bedrock thickness and the presence of biotactic 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 trilobites, 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 Vermilion Formation is a gradational to thicker bedded biotactic 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 adjacent thickness.

**Vermilion Formation (Middle Ordovician):** The Vermilion 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 biotactic 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 80 m (Liberty 1963).

SOURCES OF INFORMATION

Topography from Map 31 C2 (Belleville) and Map 30 N7/4 (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.

The upper boundary of the Vermilion Formation with the Lindsay Formation is normally defined at the point where brownish calcarenite and biotactic limestones are directly overlain by bluish grey, finely crystalline limestone. However, in the present map area, approximately 7 m of bluish, finely crystalline material, overlying typical Vermilion strata, are in turn overlain by two massive beds of brownish biotactic limestone, above which the bluish crystalline limestone is continuous. The contact in the case is placed at the top of the two massive, somewhat biotactic beds.

**Lindsay Formation (Middle Ordovician):** The Lindsay Formation is the youngest Paleozoic unit in the map area and underlies most of the southern half of the map area and underlies most of the northern 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 20 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 nodular, and may contain shaly limestone. Biotactic 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 is generally crystalline to sublitographic, nodular limestone, and shaly limestone. Common fossils include brachiopods, gastropods, bryozoans, and trilobites.

**STRUCTURAL GEOLOGY**  
 Strata in the map area are essentially flat-lying except where localized high, in the Precambrian basement have produced high angles of dip. Such phenomena occur at Amabelville (U.T.M. Reference: 319400E, 489500N), Shannonville (U.T.M. Reference: 319400E, 489500N), and 32120E, 489700N), and south of Forbes.

The valley of the Salmon River follows the topographic expression of a normal fault, the northwest side of which has been downthrown less than 20 m. This fault can be traced from the Kladar-Tweed map area (Carson 1981) across the Bay of Quinte to Massasaugua Point, where it may be related to angle 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 is tilted on the surface. The Precambrian is tilted at Shannonville and Amabelville, but currently there is not enough data to allow a confident interpretation.

Another normal fault trends southwest from Pictou and separates into two, possibly three, smaller faults. All feature the west block of the fault is downthrown by approximately 20 m as shown in the Kladar-Tweed map area. The youngest Lindsay Formation to the west of the fault, Bobcaygeon and Vermilion, are tilted on the surface, and the continuation of this fault northeast through Long Point. Recent investigations (Falconer et al., 1979) suggest that this fault may be a northern continuation of the Clevedon-Lindsay Fault system of western New York.

A small surface fault, possibly related to the release of high horizontal stress (Wheeler 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.

ECONOMIC GEOLOGY

At present, the Gull River and Bobcaygeon Formations are being quarried by Standard Aggregate Limited at Point Anne. The Lake Ontario Quarries Company operates a quarry in the Vermilion Formation at Pictou; material from this operation is used in construction. Other quarries in the area are located near Belleville, and near Mountain View, Marysville, Massasaugua, and near the intersection of the Ve Jam and Lindsay Formations. The larger of these quarries have been described by Hewitt and Vos (1972).

REFERENCES

Carson, D.M.  
 1981: Paleozoic Geology of the Kladar-Tweed Area, Southern Ontario. Ontario Geological Survey, Preliminary Map P. 2411, Geological Series, Scale 1:50 000.  
 Chapman, L.J. and Pomeroy, D.J.  
 1972: Physiography of Southern Ontario, Second Edition; Ontario Research Foundation, Toronto, 386 p.  
 Falconer, R.H., Myers, J.T., Pomroy, P.W., Pford, J.W. and Nowak, J.A.  
 1978: Structural Instability Features in the vicinity of the Clevedon-Lindsay Fault System, Western New York, and Lake Ontario, L.C. Thompson, ed. Advances in Analysis of Geotechnical Instability. Solid State Mechanics Division, Study No. 13, University of Waterloo Press, Waterloo, Ontario, p. 121-178.  
 Hewitt, D.F. and Vos, M.A.  
 1972: The Limestone Industries of Ontario. Ontario Division of Mines, MFR 39, 78 p.  
 Liberty, D.A.  
 1961: Belleville and Wellington Map-area, Ontario Geological Survey of Canada, Paper 63:1, 7 p.  
 1963: Geology of Tweed, Kladar, and Bannockburn Map area, Ontario Geological Survey of Canada, Paper 63:1, 10 p.  
 White, O.L., Karow, P.F. and Macdonald, J.R.  
 1974: Residual Stress Relief Phenomena in Southern Ontario. Proceedings of the 9th Canadian Rock Mechanics Symposium, Montreal, 1972, p. 223-248.

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 Belleville-Wellington Area, Southern Ontario. Ontario Geological Survey Preliminary Map P. 2412, Geological Series, Scale 1:50 000. Geology 1980.

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 Ministry Program of the Eastern Ontario Subsidary Agreement.