THE GEOLOGIC SETTING OF ONTARIO

The Precambrian Canadian Shield arches across Ontario separating Phanerozoic basinal accumulations of sedimentary rocks. Based on age, degree of metamorphism, and structural differences the Canadian Shield has been subdivided into geological provinces. Three of these geological provinces exist within Ontario. The oldest, largest, and most northerly is the Superior Province. South of the Superior Province exist the relatively unmetamorphosed rocks of the Southern Province and the generally highly metamorphosed rocks of the Grenville Province. Within the northern portion of the Canadian Shield lie the Hudson Bay and Moose River Basins. On the western, southern, and southeastern margins lie, respectively, the Williston, Michigan, and Allegheny Basins.

Within the area of the *Geological Highway Map Southern Ontario* are the Precambrian rocks of the Southern Province and Grenville Province of the Canadian Shield. Overlapping onto these rocks, are the almost exclusively sedimentary Paleozoic rocks deposited within the Michigan and Allegheny Basins.

Map 2441
Ontario Geological Survey

LEGEND

- *Grenville Front*
- *Fault or Lineament*
- PROVINCIAL HIGHWAYS
  - *Multilane*
  - *Paved/Gravel*
- OTHER ROADS
  - *Paved multilane*
  - *Paved or gravel*

For additional information refer to Ontario/Canada Official Road Map

Scale 1:800 000

Kilometres 10 0 10 20 30 40 Kilometres

Miles 10 0 10 20 30 Miles

SOURCES OF INFORMATION

Geology compiled from published and unpublished maps of the Ontario Geological Survey and the Geological Survey of Canada. Additional geological information from S. B. Lumbers, Curator of Geology, Royal Ontario Museum.

The following references contain general information about the geology and landforms of southern Ontario.

Chapman, L. J. & Putnam, D. F. (1966) The Physiography of Southern Ontario; Univ. Toronto Press.
A 4 map set (scale 1" to 4 mi.) accompanies this text and is available from the Ontario Ministry of Natural Resources.

Chapman, L. J. (1975) The Physiography of the Georgian Bay-Ottawa Valley Area; Ontario Ministry of Natural Resources, GR 128.

Guillet, G. R. (1969) Geological Guide to Highway 60, Algonquin Provincial Park; Ontario Ministry of Natural Resources, MP 29.

Hewitt, D. F. (1969) Geology and Scenery; Peterborough, Bancroft and Madoc Area; Ontario Ministry of Natural Resources, GB 3.

Hewitt, D. F. & Freeman, E. B. (1972) Rocks and Minerals of Ontario; Ontario Ministry of Natural Resources, GC 13.

Douglas, R. J. W., ed. (1970) Geology and Economic Minerals of Canada; Geological Survey of Canada, Econ. Geol. Rept. 1.

Cartography and design by M. J. Colman, Surveys and Mapping Branch, Ontario Ministry of Natural Resources, 1978. Revised 1979.

Highway basemap supplied by Surveys and Plans Office, Ontario Ministry of Transportation and Communications, 1977. Revised to June, 1979.

THE GEOLOGIC COLUMN OF TIME AND ROCK UNITS

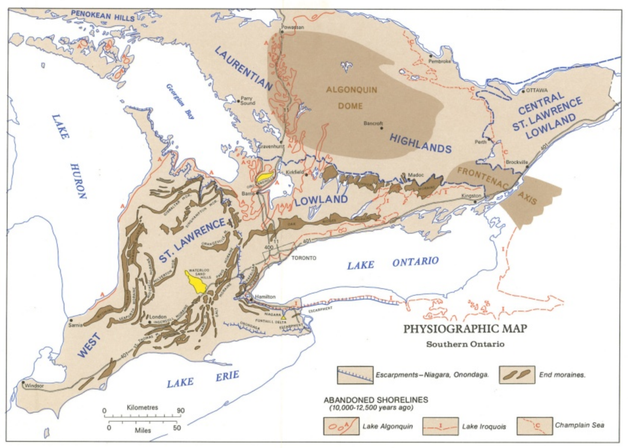
Colours and numbers are used here to represent rocks of a particular type or age. However, it should be noted that these colours usually bear no relation to the actual colour of the rock in its outcrop. Each colour has been given a number. These numbers reflect the general sequence of rock formations with 1 being the oldest (first formed) and 38 being the youngest (last formed) rock unit shown on the map. Note that some of the rock units of the Precambrian Era may have formed simultaneously.

Where possible, ages in millions of years as determined by isotopic (radiometric) methods are listed in the column of time and rock units. The time relationships are best understood within the Phanerozic rock sequence and a special time column appears for these rocks. The Phanerozoic rocks are not only more recent, but contain abundant fossil life forms. From analysis of fossils and other data these rock layers have been separated into units (normally called *Formations*) that can be identified within widely separated outcrops.

The colours on the map do not represent uniform rock compositions. Changes occur related to the rate of cooling (in igneous rocks) and to the distance from the source area (in sedimentary rocks). For example, the Lower Silurian Clinton and Cataract Groups change from dominantly sandstone-shale units in the Niagara Peninsula area to dominantly dolostone units in the Bruce Peninsula area.

The distribution pattern of the coloured units (= rock units) shown on the map have been influenced by several factors:
1) the dip (tilt) of the rock layers and their thickness
2) the hardness of the rock units and their resistance to erosion
3) the topography of the land surface.

Faulting (the cracking and movement of the Earth's crust that often produces earthquakes) has affected Ontario throughout its history. Locations of the major faults within southern Ontario are shown by blue dashed lines. Faulting in Ontario has affected human history as well as geological history. For example, subsidence of the land associated with faulting created the valley lowlands of the Ottawa, Mattawa, and French Rivers. It was this fault induced river and lake lowland system that provided the access, settlement, and historical development of North America's interior. Fortunately faulting is presently infrequent and of small scale within Ontario. Thus, property damage from faulting has been slight in comparison with other areas of the Earth.



PHYSIOGRAPHIC MAP

Physiographic maps subdivide the landscape on the basis of geology and landforms. Two major physiographic regions exist in southern Ontario: the *Canadian Shield Region* composed of Precambrian-age rock units, and the *St. Lawrence Lowlands* underlain by rock units younger than 570 million years (Phanerozoic age). The Shield Region is subdivided into *Provinces* based upon age, degree of metamorphism, and structural variation. In turn, these provinces are subdivided on the basis of landform characteristics. The following subdivisions occur within southern Ontario:

CANADIAN SHIELD
- Southern Province
- Penokean Hills
- Grenville Province
- Laurentian Highlands

ST. LAWRENCE LOWLANDS
- Central St. Lawrence Lowland
- West St. Lawrence Lowland

Southern Ontario's major landforms are due to either erosion (lakeshores, escarpments) or glacial deposition (moraines, drumlins, eskers).

GENERALIZED GEOLOGIC COLUMN OF TIME AND ROCK UNITS

Time (million years)		
	PHANEROZOIC	
	CENOZOIC	
	QUATERNARY	
1.8 →	MESOZOIC[a]	
100	PALEOZOIC[a]	
200	UPPER DEVONIAN	
360	38	PORT LAMBTON GROUP: *grey shale and sandstone.*
	37	KETTLE POINT FORMATION: *black shale.*
	MIDDLE DEVONIAN	
	36	HAMILTON GROUP: *grey shale and limestone.*
	35	MARCELLUS FORMATION: *grey shale.*
	34	DUNDEE FORMATION: *limestone.*
	33	DETROIT RIVER GROUP:[b] *limestone and dolostone.*
	LOWER DEVONIAN	
	32	BOIS BLANC FORMATION: *cherty limestone.*
415 →	31	ORISKANY FORMATION: *sandstone.*
	UPPER SILURIAN	
	30a	BASS ISLANDS FORMATION: *dolostone.*
	30b	BERTIE FORMATION: *dolostone.*
	29	SALINA FORMATION: *dolostone, shale, gypsum, salt.*
	MIDDLE AND LOWER SILURIAN	
	28	GUELPH FORMATION: *dolostone.*
	27	AMABEL FORMATION: *dolostone.*
	26	LOCKPORT FORMATION: *dolostone.*
445 →	25	CLINTON AND CATARACT GROUPS: *sandstone, shale, dolostone.*[c]
	UPPER ORDOVICIAN	
	24	QUEENSTON FORMATION: *red shale.*
	23	GEORGIAN BAY (*Carlsbad & Russel*[d]) FORMATION: *grey shale with limestone interbeds.*
	22	WHITBY (*Eastview & Billings*[d]) FORMATION: *grey and black shale.*
	MIDDLE ORDOVICIAN	
	21	TRENTON AND BLACK RIVER GROUPS (*unsubdivided*)[e]: *limestone, minor dolostone, shale.*
	20	CHAZY GROUP[d]: *limestone, shale.*
	LOWER ORDOVICIAN	
	19	BEEKMANTOWN GROUP: *dolostone, sandstone.*
515 →	CAMBRIAN	
	18	POTSDAM or NEPEAN FORMATION: *sandstone.*
	LOWER CAMBRIAN	
590 →	17	ALKALIC ROCK–CARBONATITE COMPLEXES: *carbonatite, fenite, alkalic syenites, and associated mafic and ultramafic rocks.*
	PRECAMBRIAN	

PRECAMBRIAN

NOTE: *Many of these rock units exist as metamorphosed equivalents of the rock types listed.*

LATE PRECAMBRIAN (570-1600 million years)

ALKALIC COMPLEXES
- 16 — *Nepheline and alkalic syenites, and associated mafic and ultramafic rocks.*

MAFIC INTRUSIVE ROCKS
- 15 — *Diabase, gabbro, norite, and ultramafic rocks.*

FELSIC ANORTHOSITE SUITE
- 14 — *Granitic to syenitic rocks.*

MAFIC ANORTHOSITE SUITE
- 13 — *Anorthositic to tonalitic rocks.*

CARBONATE METASEDIMENTS[f]
- 12 — *Marble, calc-silicate rocks, skarn.*

METAVOLCANICS[f,g] *(ca. 1300 million years)*
- 11 — *Flows, tuff, agglomerate, breccia, minor iron formation and metasediments.*

LATE TO MIDDLE PRECAMBRIAN

FELSIC INTRUSIVE ROCKS
- 10 — *Granite, granophyre, granodiorite, quartz diorite, quartz monzonite, syenite, trondhjemite, and derived gneisses.*

CLASTIC METASEDIMENTS
- 9 — *Conglomerate, greywacke, arkose, calcareous sandstone and siltstone, shale, and derived metamorphic rocks.*

MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS
- 8 — *Gabbro, gabbroic anorthosite, norite, "Nipissing diabase" (2160 million years), diorite, ultramafic rocks, and derived metamorphic rocks.*

MIDDLE PRECAMBRIAN (1600-2600 million years)
HURONIAN SUPERGROUP (ca. 2200-2450 million years)
COBALT GROUP
- 7 — *Conglomerate, quartz sandstone, sandstone, siltstone, argillite.*

QUIRKE LAKE GROUP
- 6 — *Conglomerate, sandstone, siltstone, limestone, and dolostone.*

HOUGH LAKE GROUP
- 5 — *Conglomerate, greywacke, sandstone, siltstone, and argillite.*

ELLIOT LAKE GROUP
- 4 — *Sandstone, siltstone, greywacke, argillite, minor conglomerate, and volcanic rocks.*

EARLY PRECAMBRIAN (older than 2600 million years)

FELSIC INTRUSIVE ROCKS
- 3 — *Granitic, syenitic, and migmatitic rocks.*

METASEDIMENTS[f]
- 2 — *Greywacke, arkose, quartzite, siltstone, argillite, chert.*

METAVOLCANICS[f]
- 1 — *Mafic to intermediate flows with minor mafic pyroclastic rocks.*

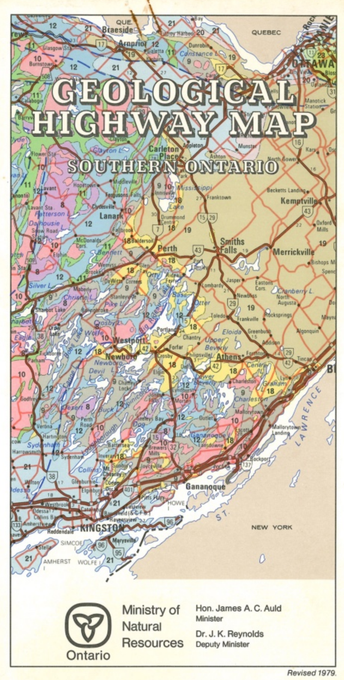
[a] *A few small intrusive bodies of this age have been identified by radiometric age dating methods.*
[b] *Referred to as the Onondaga Formation in the Niagara Peninsula.*
[c] *Dolostone predominates on Manitoulin Island.*
[d] *Formations in the Ottawa Valley region.*
[e] *The combined Trenton and Black River Groups are also known as the Simcoe Group which contains the Gull River, Bobcaygeon, Verulam, and Lindsay Formations.*
[f] *Rocks in these groups are subdivided lithologically and the order does not necessarily imply age relationships within or among groups.*
[g] *Rocks of this group in the vicinity of Parry Sound may be either Middle or Late Precambrian.*

PURPOSE OF MAP

The most travelled and populated portion of Ontario lies south of highway 17 and east of Sault Ste. Marie. The purpose of the *Geological Highway Map Southern Ontario* is to present the general geology of this part of Ontario in relation to the familiar reference points of our highways, lakes, rivers, and communities. It is hoped that the information shown here will be of interest to the general travelling public, to students of the earth sciences, and to professional geologists.

The *Geological Highway Map* shows by the use of colour the succession and distribution of rock units exposed at the surface. The oldest are metamorphosed volcanic rocks (unit 1) northeast of Blind River, and the youngest are the marine shales and sandstones of the Port Lambton Group (unit 38) south of Sarnia. The rock unit boundaries shown on the map have been determined or interpreted from mapping these rocks where they occur exposed in excavations or where they outcrop naturally at the surface. All of the rock units are partly covered by deposits laid down during the Quaternary glaciations, these surficial deposits consist of glacial tills and associated lake and stream deposits. They are not shown on the main map, although some are indicated on the physiographic map.

All landform features, such as escarpments, canyons, hills, and valleys reflect variations in the underlying rock units and the geological processes including glaciations which have acted upon them. It is hoped that the landforms seen on your travels become more meaningful as their relationship to bedrock or geological processes is noted.



Revised 1979.