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Geological Notes for Map 2117

Paleozoic Geology of Southern Ontario

By
D. F. HEWITT

Geological Circular 15

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Geological Map
(back pocket)

GEOLOGICAL NOTES FOR MAP No. 2117

Paleozoic Geology of Southern Ontario
Showing
Bedrock Industrial Mineral Producers

By
D. F. HEWITT[1]

Introduction

The accompanying map indicates the extent of the exposed Precambrian basement rocks in southern Ontario, and the Paleozoic geology by formation or group for southern Ontario. Also shown are the bedrock industrial mineral producers in the Paleozoic of southern Ontario. In 1964 industrial mineral production in Ontario amounted to approximately $191,000,000, of which over 63 percent, or about $121,000,000 came from the Paleozoic of southern Ontario. This industrial mineral production includes gypsum, salt, limestone, shale, sandstone, lime, and portland cement.

Paleozoic Geology

The Paleozoic rocks of southern Ontario are divided geographically into two parts by the Precambrian rocks of the Frontenac axis which extend across the St. Lawrence River between Gananoque and Brockville. The Paleozoic area to the east of the Frontenac axis is called the Ottawa–St. Lawrence Basin. The Paleozoic area to the west of the Frontenac axis is here referred to as central and southwestern Ontario.

OTTAWA–ST. LAWRENCE BASIN

The Ottawa–St. Lawrence Basin is occupied by Cambrian sandstone and Ordovician dolomite, limestone, sandstone, and shale. The geology of the area has been described by Wilson (1946).

Potsdam or Nepean Formation

The Potsdam or Nepean Sandstone of Cambro-Ordovician age outcrops along the western margins of the Ottawa–St. Lawrence Basin, and rests unconformably on the underlying Precambrian rocks. This formation is a cream, white, grey, brownish-red, or purple medium-grained sandstone to orthoquartzite. Ferruginous, rusty sandstone is common in places. The formation is described in detail by M. L. Keith (1949). Wilson (1946, p.11) states that the maximum thickness of the formation yet found in wells at Ottawa is 280 feet, but thicknesses up to 500 feet are reported in Quebec.

[1]Senior Geologist, Ontario Dept. Mines, Toronto.

The Potsdam Sandstone of the Ottawa–St. Lawrence Basin was formerly quarried for use as a building stone at Brockville, Westport, Perth, and Ottawa. It was used in the construction of the Parliament Buildings at Ottawa. The sandstone has also been investigated as a source of silica sand (Keith 1946; Hewitt 1963), and has been quarried near Almonte and Smiths Falls as silica sand for sand-lime brick manufacture.

Beekmantown Group

The dolomite and sandstone of the Beekmantown Group of Lower Ordovician age outcrop in a wide area on the west flank of the Ottawa–St. Lawrence Basin in Leeds, Lanark, Carleton, Grenville, and Dundas counties. Wilson (1946, p.12–17) has divided the Beekmantown Group of the Ottawa–St. Lawrence Basin into the March Formation, which overlies the Potsdam Sandstone, and the Oxford Formation, which overlies the March Formation.

The March Formation overlies the Potsdam Sandstone conformably and interfingers with the Potsdam Sandstone. The March Formation consists of alternating beds of grey sandstone, sandy dolomite, and dolomite, which weather rusty-brown; they are transition beds from the Potsdam Sandstone to the Beekmantown Dolomite. Wilson (1946, p.13) gives a thickness of 25 to 30 feet for the March Formation.

The Oxford Formation overlies the March Formation and consists of medium- to thick-bedded, dark-grey, rusty-weathering dolomite. Wilson (1946, p.15) gives the maximum thickness of the Oxford and March formations together as 350 feet. The Oxford Dolomite is quarried for concrete aggregate and road stone at Ottawa, Iroquois, Brockville, Athens, Jasper, Harlem, and Smiths Falls.

Chazy Group

The limestone, shale, and minor sandstone of the Chazy Group outcrop in narrow bands overlying the Beekmantown Dolomite in Dundas, Glengarry, Prescott, Russell, and Carleton counties. Wilson (1946, p.17–21) has divided the Chazy Group of Middle Ordovician age into the Rockcliffe and St. Martin formations.

The Rockcliffe Formation disconformably overlies the Oxford Formation of the Beekmantown and consists of friable olive-green shale with lenses of fine-grained grey sandstone. The average thickness of the Rockcliffe Formation is 150 to 160 feet (Wilson 1946, p.18).

The St. Martin Formation conformably overlies the Rockcliffe Formation and consists of grey limestone with some interbeds of dark shale and sandstone. Wilson (1946, p.20) states that the St. Martin Formation is thickest in the east part of the Basin and thins to the west towards Ottawa. Thicknesses vary from 20 feet near Ottawa to 155 feet near Alexandria.

Trenton and Black River Groups

The limestones of the Trenton and Black River groups outcrop extensively in the Ottawa–St. Lawrence Basin in Carleton, Russell, Prescott, Dundas, Stormont, and Glengarry counties. The rocks of these groups are dominantly limestone, shaly limestone, and dolomitic limestone ranging from medium- to thick-bedded. In colour the limestones range from grey to black. Chert is occasionally present in some beds. The limestones range from microcrystalline to crystalline in grain size. The maximum thickness of combined Black River and Trenton limestones in the Ottawa area is about 700 feet.

These limestones are quarried for crushed stone at Ottawa, Rockland, L'Orignal, Apple Hill, and Cornwall. The limestone makes a good aggregate and is used for the manufacture of portland cement at Hull, Quebec.

Billings Formation

The Billings Formation, which correlates with the Collingwood in central southern Ontario, outcrops east of Ottawa in a narrow band extending across Carleton and Russell counties. The formation consists of black fissile shale. It rests conformably on the Trenton Limestone or, where present, on the thin Eastview Limestone, which is not widespread. The Billings Formation probably has a thickness of 260 to 300 feet (Wilson 1946, p.27).

Carlsbad and Russell Formations

These formations correlate with the Meaford-Dundas and Blue Mountain formations of central southern Ontario. The Carlsbad Shale conformably overlies the Billings Shale and outcrops east of Ottawa in Carleton and Russell counties. The formation is composed of grey shale with some bands of impure limestone and dolomite. The maximum thickness of the shale is estimated at 500 to 550 feet (Wilson 1946, p.29).

The Russell Formation conformably overlies the Carlsbad Shale and consists of grey shale and interbedded rusty-weathering dolomitic limestone. The formation occupies a small area north and west of Russell village in Russell township, marginal to the Queenston Formation. The thickness of the formation is not known (Wilson 1946, p.30).

Queenston Formation

The Upper Ordovician Queenston Formation outcrops in a small area east of Ottawa straddling the Carleton-Russell county boundary. The formation consists of red shale with some green mottling. The combined thickness of the Russell and Queenston formations is about 100 feet. The Queenston Shale is quarried for the manufacture of brick in the Ottawa plant of Domtar Construction Materials Limited.

CENTRAL AND SOUTHWESTERN ONTARIO

South-central and southwestern Ontario are underlain by Cambrian, Ordovician, Silurian, Devonian, and Mississippian rocks. The table of formations is given below.

SYSTEM	FORMATION OR GROUP	LITHOLOGY
Mississippian	Port Lambton Formation	Grey to black shale, sandstone
Devonian	Kettle Point Formation	Black shale
	Hamilton Formation	Grey shale and argillaceous limestone
	Delaware (Dundee) Formation	Limestone
	Columbus Formation	Sandy limestone and dolomite
	Detroit River Group	Brown limestone and dolomite
	Bois Blanc Formation	Limestone, dolomite, chert, sandstone
	Oriskany Formation	Sandstone
Silurian	Bertie-Akron (Bass Is.) Formation	Buff dolomite
	Salina Formation	Dolomite, shale, gypsum, salt
	Guelph-Lockport-Amabel Formations	Dolomite
	Clinton-Cataract Groups	Shale, sandstone, dolomite, limestone
Ordovician	Queenston Formation	Red shale
	Meaford-Dundas Formations	Grey shale
	Collingwood Formation	Grey to black shale
	Trenton-Black River Groups	Limestone
Cambrian	Potsdam (Nepean) Formation	Sandstone

Potsdam Formation

The principal outcrops of Potsdam Sandstone on the west side of the Frontenac axis are along the Rideau River and St. Lawrence River in Pittsburgh and Storrington townships. The Potsdam Sandstone rests unconformably on the Precambrian basement rocks. The lithology is the same as previously described. The maximum thickness of the Potsdam Sandstone in this area is about 150 feet.

Building-stone quarries are operated in Pittsburgh and Storrington townships. Attractive sandstone ashlar of buff and brownish-red hues are produced. Silica sand was formerly produced by Kingston Silica Mines Limited near Joyceville.

Black River and Trenton Groups

The lowermost formations of Ordovician age are the limestones of the Black River and Trenton groups. They extend in a wide band from Kingston on Lake Ontario, to Midland and Collingwood on Georgian Bay. Where no Potsdam Sandstone is present, the limestones rest with unconformity on the Precambrian basement rocks. The lowermost formation of the Black River usually contains arkose, basal clastics, shale, and shaly limestone. The Black River Group is divided into the Shadow Lake, Gull River, and Coboconk formations; the Trenton Group is divided into the Kirkfield, Sherman Fall, and Cobourg formations. These are described by Sanford (1961). The thickness of the Black River Group varies from 80 feet at Lake Simcoe to more than 500 feet at Lake St. Clair. The thickness of the Trenton Group varies from about 500 feet in York County to less than 300 feet at Point Pelee (Sanford 1961, p.5–9).

The Black River and Trenton limestones are quarried for crushed stone at Kingston, Napanee, Roblin, Picton, and Uhthoff and for the manufacture of portland cement at Picton, Belleville, and Colborne (Hewitt 1960, 1964a). The Black River Limestone was formerly quarried extensively as a building stone at Kingston, Napanee, and Longford, and is at present being quarried at Nogies Creek (Hewitt 1964b). The Black River Limestone was formerly quarried at Coboconk for the production of lime.

Collingwood Formation

The Collingwood Shale rests on the Trenton Limestones and is the bedrock formation in portions of Durham, Ontario, York, and Simcoe counties in a band extending from Lake Ontario in the vicinity of Whitby to Collingwood on Nottawasaga Bay. The Collingwood Formation consists of dark-brownish to olive-grey to black shale, in part bituminous and pyritiferous. It varies in thickness from about 95 feet on the Bruce Peninsula to about 200 feet in Essex County (Sanford 1961, p.12). The shale is not utilized commercially, but recent test work by the Mines Branch at Ottawa has indicated that some samples of Collingwood Shale will produce a good bloated light-weight aggregate.

Meaford-Dundas and Blue Mountain Formations

The Meaford-Dundas and Blue Mountain formations outcrop in the Toronto area from Streetsville on the west to Scarborough in the east, and extend north to the Bruce Peninsula. Sanford (1961, p.12, 13) has pointed out that the grey and blue-grey shales of the Blue Mountain Formation, which rests on the Collingwood Shale, are very similar in lithology to the overlying Meaford-Dundas grey and grey-green shales and are best mapped as a single lithological unit in the subsurface. The Meaford-Dundas Formation consists predominantly of grey and grey-green shale with some hard interbeds of calcareous siltstone and impure limestone. The combined thickness

of these shale formations varies from about 250 feet in the Bruce Peninsula to 600 feet near Hamilton.

The Dundas Shales are used extensively for brick manufacture at Toronto and Cooksville. The shale is used to make expanded aggregate at Cooksville.

On Manitoulin Island these formations are represented by the Wekwemikongsing Formation, a grey-blue shale with interbeds of grey fine crystalline limestone, and the Meaford Formation, a grey fine-grained argillaceous limestone, dolomitic limestone, and dolomite (G.S.C., map 20-1957).

Queenston Formation

The Queenston Formation, which is a red shale, outcrops in a wide band at the base of the Niagara Escarpment from St. Catharines through Hamilton, Milton, and Brampton to the Bruce Peninsula. It is about 800 feet thick at St. Catharines, but thins northward to about 200 feet in the Bruce Peninsula.

The Queenston Shale is widely used for brick and tile manufacture at St. Catharines, Grimsby, Hamilton, Palermo, Milton, Streetsville, and Brampton.

On Manitoulin Island this formation is represented by the Kagawong Formation consisting of brown and grey fine crystalline limestone and dolomite.

Clinton and Cataract Groups

The Clinton and Cataract groups outcrop along the face of the Niagara Escarpment from Niagara Falls to Manitoulin Island. The formations present in these groups are given in the accompanying table; after Bolton (1957, p.5).

NIAGARA PENINSULA TO MILTON	MILTON TO MANITOULIN ISLAND
Clinton Group:	
Upper: Decew Dolomite	
Rochester Shale	
Irondequoit Limestone	
Lower: Reynales Dolomite	Fossil Hill Dolomite
Neagha Shale	St. Edmund Dolomite
Thorold Sandstone and Shale	Wingfield Shale and Domomite
	Dyer Bay Dolomite
Cataract Group:	
Grimsby Shale and Sandstone	Cabot Head Shale
Power Glen Shale	Manitoulin Dolomite
Whirlpool Sandstone	Whirlpool Sandstone

The combined thickness of the Clinton and Cataract groups in the Niagara Pensinsula is about 200 feet.

The Whirlpool Sandstone is quarried for building stone under the name "Credit Valley Sandstone" at Limehouse, Glen Williams, and Inglewood. It was formerly quarried at Thorold, Grimsby, Hamilton, Milton, Orangeville, and Duntroon (Hewitt 1964c). The sandstone is quarried at Milton as a source of silica (Hewitt 1963, p.25).

Guelph-Lockport-Amabel Formations

The Guelph-Lockport Dolomites form the cap rock of the Niagara Escarpment and outcrop in a wide band from Niagara Falls, through Dundas and Guelph, to the Bruce Peninsula. In the vicinity of Waterdown the Lockport Formation undergoes a

facies change and is known from Waterdown north to the Bruce Peninsula as the Amabel Formation (Bolton 1957).

The Lockport Dolomite, which overlies the Clinton Group, is divided into three members in ascending order: Gasport Dolomitic Limestone, Goat Island Dolomite, and Eramosa Dolomite. The Amabel Formation is 131 feet thick at the type section at Wiarton and consists of a dense blocky dolomite at the base called the Lions Head Member; a massive, sugary dolomite, the Colpoy Bay Member; a blue-grey mottled, fine- to coarse-grained dolomite, the Wiarton Member; and a thin-bedded brown bituminous dolomite, the Eramosa Member (Bolton 1957, p.51).

The Guelph Formation, which overlies the Lockport and Amabel, is a buff-coloured, fine-grained sugary dolomite usually of high purity. The combined thickness of Guelph-Lockport and Guelph-Amabel dolomites ranges from about 200 feet in the Niagara Peninsula to over 400 feet in the Bruce Peninsula.

These formations are extensively quarried for crushed stone and fluxstone at Thorold, St. Catharines, Vineland, Vinemount, Stoney Creek, Dundas, Nelson, Milton, Georgetown, Acton, and Duntroon. They are quarried for building stone at Queenston and Wiarton, and for the manufacture of dolomitic lime at Guelph, Hespeler, and Rockwood (Hewitt 1960, 1964a, 1964b). The formation ranges in thickness along the outcrop belt from 300 to 900 feet.

Salina Formation

At Sarnia, where extensive beds of salt are present, the Salina has a thickness of 1500 feet (Hewitt 1962). Gypsum beds in the Salina from 4 to 11 feet thick are mined at Hagersville and Caledonia (Guillet 1964). Salt beds in the Salina are mined at Ojibway and Goderich, and salt is produced from brine wells at Amherstburg, Windsor, Sarnia, and Goderich by a number of companies (Hewitt 1962).

Bertie-Akron Bass Island Formation

The Bertie-Akron Dolomites form the bedrock in a narrow band extending from Fort Erie through Hagersville, New Hamburg, Harriston, and Walkerton to Southampton on Lake Huron. The formation consists of medium-bedded to massive-bedded aphanitic brown dolomite with minor thin-bedded shaly dolomite (Hewitt 1960, p.127). Along the outcrop area the thickness varies from 35 to 60 feet. In the subsurface in southwestern Ontario the formation thickens to 200 feet. It is correlated with the Bass Island Formation in Michigan.

The Bertie-Akron Dolomite is quarried for crushed stone at Fort Erie, Port Colborne, Dunnville, Cayuga, and Hagersville. It is the uppermost formation of the Silurian System in Ontario.

Oriskany Formation

The only deposit of Oriskany Sandstone in Ontario is in Oneida and North Cayuga townships, Haldimand county, 4 miles west of the town of Cayuga. Oriskany Sandstone underlies an area of less than a square mile. The formation is a medium light grey to white, medium-grained, irregularly thick-bedded sandstone. In places, brown iron staining is present. The formation rarely exceeds 15 feet in thickness.

The sandstone has been quarried for building stone, and as a source of silica and glass sand (Hewitt 1963, p.27).

Bois Blanc Formation

The Bois Blanc Formation is of Middle Devonian age and rests unconformably

on the Upper Silurian Bertie-Akron Dolomite. The formation extends in a band, 3 to 10 miles wide, from Fort Erie through Hagersville, Woodstock, Milverton, and Listowel, to Port Elgin on Lake Huron. The Bois Blanc Formation consists of medium brownish-grey, medium crystalline, medium- to thin-bedded cherty limestone. The Springvale Sandstone Member frequently occurs at the base of the formation. The thickness varies from 90 to 240 feet (Best 1953).

The Bois Blanc Limestone is quarried for crushed stone at Fort Erie, Port Colborne, Cayuga, and Hagersville.

Detroit River Group

The Detroit River Group, consisting of limestone and dolomite, forms a northwest-trending band extending from Norwich through Beachville, Stratford, and Wingham, to Kincardine on Lake Huron. The dip is southwest. Southeast of Norwich the Detroit River Group pinches out, and in Norfolk county between Norwich and Lake Erie, the overlying Delaware Limestone rests directly on the underlying Bois Blanc Formation. Southeast of St. Marys the Detroit River Group is mainly limestone; north of St. Marys it is mainly dolomite; in the St. Marys area the dolomite and limestone facies interfinger. The thickness of the Detroit River Group increases from zero southeast of Norwich to 110 feet at Beachville, 197 feet at St. Marys, and 350 feet at Clinton (Best 1953).

The Detroit River Limestones are quarried for production of high-purity calcium limestone for lime, crushed stone, and fluxstone at Beachville, and for manufacture of portland cement at Zorra Station and St. Marys.

The Detroit River Group also outcrops on the west side of the Chatham syncline in Essex county, where it is quarried at Amherstburg for crushed stone and lime manufacture (Hewitt 1960, p.146–168).

Columbus Formation

The Columbus Formation is restricted in areal extent. In the Ingersoll area up to 20 feet of Columbus sandy brownish-grey, thick-bedded limestone rests on the Detroit River Limestone. A good section can be seen at the Chemical Lime quarry at Ingersoll. North and south of Ingersoll, the Columbus Limestone is absent and the overlying Delaware Formation rests directly on the underlying Detroit River Group.

The Columbus Formation is exposed on Pelee Island and in a narrow band in Essex county west of Leamington. Here the formation is a brown, thick-bedded limestone. Sections up to 30 feet in thickness are exposed. The formation is quarried for crushed stone and armour stone on Pelee Island.

Delaware (Dundee) Formation

The Delaware Limestone occupies a wide belt extending from west of Port Stanley to east of Port Dover on Lake Erie, northwest to Lake Huron, where it outcrops from southwest of Grand Bend to north of Goderich. The Delaware Limestone rests on the sandy Columbus Limestone where present or, where absent, directly on the underlying Detroit River Group. The formation consists of light-brown, medium-grained limestone; some chert is occasionally present. The formation has a thickness of 85 to 160 feet. The Delaware Formation also outcrops in Essex county. It is quarried near Port Dover for the production of crushed stone, at St. Marys for the manufacture of portland cement, and at Amherstburg for crushed stone.

Hamilton Formation

The Hamilton Formation, which rests conformably on the underlying Delaware Limestone, outcrops in Middlesex, Elgin, Lambton, Kent, and Essex counties of southwestern Ontario. In lithology it consists predominantly of grey shale with interbeds of grey crystalline cherty limestone. The thickness of the formation ranges from 80 to 300 feet (Caley 1945, p.45).

The Hamilton Shale is quarried at Thedford and Arkona for the production of brick and tile. One of the limestone bands in the formation is quarried for crushed stone at Thedford (Hewitt 1964a, p.70).

Kettle Point Formation

The Kettle Point Formation outcrops principally in Lambton and Kent counties. It is composed predominantly of thin-bedded, fissile grey to black bituminous shale, which at Kettle Point contains spherical concretions 8 inches to several feet in diameter. The thickness of the formation varies from 40 to 290 feet (Caley 1945, p.49).

Port Lambton Formation

"The Port Lambton beds form a narrow strip along the St. Clair river, from Port Lambton north through Sombra township into Moore township" (Sanford and Brady 1955, p.8). The formation consists of light-grey fissile shale, siltstone, and light-grey sandstone. The formation has a thickness of up to 200 feet or more.

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Map 1062A. Geological map of southwestern Ontario showing oil and natural gas producing areas. Scale 1 inch to 6 miles. Geology by J. F. Caley, 1937–1945, and B. V. Sanford, 1950–1957; Additional information: E. W. Best (unpublished thesis 1953); Compiled by B. V. Sanford, 1957; published 1958.

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LEGEND

PALEOZOIC

MISSISSIPPIAN

20 — *Port Lambton Formation: grey shale and sandstone.*

DEVONIAN

19 — *Kettle Point Formation: black shale.*

18 — *Hamilton Formation: grey shale and limestone.*

17 — *Delaware Formation: limestone.*

16 — *Columbus Formation: sandy limestone and dolomite.*

15 — *Detroit River Group: limestone and dolomite.*

14 — *Bois Blanc Formation: cherty limestone.*

13 — *Oriskany Formation: sandstone.*

SILURIAN

12 — *Bertie-Akron Formation: dolomite.*

11 — *Salina Formation: dolomite, shale, gypsum, salt.*

10 — *Guelph-Lockport-Amabel Formations: dolomite.*

9 — *Clinton and Cataract Groups: sandstone, shale, dolomite.†*

ORDOVICIAN

8 — *Queenston Formation: red shale; limestone and dolomite on Manitoulin Island.*

7 — *Meaford-Dundas and Blue Mountain (Carlsbad and Russell*) Formations: grey shale; some limestone on Manitoulin Island.*

6 — *Collingwood (Billings*) Formation: grey and black shale.*

5 — *Trenton and Black River Groups: limestone.*

4 — *Chazy Group: limestone and shale.*

3 — *Beekmantown Group: dolomite, sandstone.*

CAMBRO-ORDOVICIAN

2 — *Potsdam or Nepean Formation: sandstone.*

PRECAMBRIAN

1 — *Precambrian rocks.*

*Formations in Ottawa area.

†Dolomite predominates on Manitoulin Island.

SOURCES OF INFORMATION

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SYMBOLS

- *Fault.*
- *Limestone quarry.*
- *Cement plant and quarry.*
- *Cement plant.*
- *Lime plant and quarry.*
- *Lime plant.*
- *Salt.*
- *Gypsum.*
- *Shale quarry for brick manufacture.*
- *Sandstone quarry.*

ONTARIO
DEPARTMENT OF MINES
HON. G. C. WARDROPE, *Minister of Mines*
D. P. Douglass, *Deputy Minister* M. E. Hurst, *Director, Geological Branch*

Map 2117

PALEOZOIC GEOLOGY OF SOUTHERN ONTARIO

Showing

Bedrock Industrial Mineral Producers

Scale 1:1,013,760 or 1 Inch to 16 Miles

10 0 10 20 30 40 50 60 Miles

20 0 20 40 60 80 Kilometres

Published 1966