GEOLOGY AND SCENERY

PETERBOROUGH, BANCROFT AND MADOC AREA

GEOLOGICAL GUIDEBOOK No. 3 — REPRINT 1988

The following changes in roads and conditions should be noted:

PETERBOROUGH TRIP 2

Figure 6, p. 23 — Point of Interest 3 is now inside Petroglyphs Provincial Park with road access.
Photo 11, p. 31 There is also a road along the northern shore of Stony Lake.
— Highway 134 is shown, but is not labelled.

BANCROFT TRIP 1

Photo 27, p. 59 — This mine is closed and most of the buildings have been removed. It is also private property.

BANCROFT TRIP 2

Figure 10, p. 64 — Highway 127 is now Highway 62.
— The road between Points of Interest 4 and 5 is too poor. Go via Hybla.

BANCROFT TRIP 3

Figure 11, p. 68 — Highway 500 is now Highway 28.
— From Stop 11, Craigmont Corundum Mine, to Combermere, take Highway 517; the road as illustrated in red no longer exists.

Photo 39, p. 74 — This rock is no longer visible. Also, the hill where the rock was found is private property.

Electronic Capture, 2004

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GEOLOGY AND SCENERY

PETERBOROUGH, BANCROFT AND MADOC AREA

by D. F. Hewitt

Geological Guide Book No. 3

ONTARIO DEPARTMENT OF MINES

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Much of the country away from the roads is not public property. Visitors must respect the rights of property owners and permission should be obtained from them before entering private property.

In respect to unpatented or unleased mining claims, permission should be obtained from the recorded holder of the claims. Without such permission, the visitor could be charged with trespassing.

Please do not smoke or light fires in the bush because of the hazard of forest fire.

Publications of the Ontario Ministry of Northern Development and Mines and price list are available through the Public Service Centre, Queen's Park, Toronto, and the Ontario Government Bookstore, 880 Bay Street, Toronto. Orders for publications should be accompanied by cheque or money order, payable to the Treasurer of Ontario.

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Cover: A beryl pegmatite outcrop showing massive quartz core, near Quadeville.

2000-1988-Ainsworth

PREFACE

In recent years rock and mineral collecting has aroused the interest of hobbyists in all parts of Canada and the United States. At the same time many people have become increasingly aware of our scenic attractions, and their attention has been directed to the part geology has played in the development of the landscape. Others have recognized the impact of the mining industry on our national economy, and have requested geological information to help them understand better the nature of our mineral resources. The Ontario Department of Mines has undertaken the publication of geological guidebooks to various areas of the province, in the hope that these guidebooks will help to satisfy the needs of amateur geologists and, at the same time, stimulate similar interests amongst the public generally. This guidebook is the third of the series.

The region covered in this guidebook lies roughly 100 miles northeast of Toronto and 150 miles west of Ottawa. The countryside is of great scenic beauty with rolling rocky hills up to about 500 feet in relief. Altitudes in the Peterborough area are about 700 feet above sea level, and increase northward on the Precambrian shield to a maximum of about 1,600 feet in the Bancroft area.

Excellent motels and lodges are available for summer and winter accommodation throughout the district. There are many lakes, and fishing is good.

Many of the mines and quarries listed in this guidebook are on private property, and permission should be sought from the owners before entering.

A glossary is given in the back of the guidebook to explain some of the technical terms used.

The reader interested in more detailed information on rocks and minerals can obtain a copy of "Rocks and Minerals of Ontario" from the Publications Office, Department of Mines, Queens Park, Toronto 2, Ont. Descriptions of over 100 minerals and rocks are given in this book. Other Dept. of Mines publications referred to in this book may be obtained from the same address.

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FIGURES

Photo 1 Large cavern of Genesee No. 2 mine exposing coarse granite pegmatite, Monteagle township north of Bancroft.

PART 1

Geology of the Peterborough – Bancroft Madoc Area

Geological History

Rocks are classified into eras and periods depending on their geologic age. Radio active age-determinations indicate that the oldest rocks of the earth's crust (early Pre cambrian) are about 4 million years old. Fossils, indicative of plant and animal life, are common from Cambrian times (500 million years ago) to the present; but, fossils are almost entirely absent in rocks of Precambrian age (550 to 4,000 million years old).

ERA	PERIOD	AGE IN YEARS
Cenozoic		
	Recent	
	Pleistocene	1,000,000
	Tertiary	70,000,000
Mesozoic		
	Cretaceous	135,000,000
	Jurassic	180,000,000
	Triassic	220,000,000
Paleozoic		
	Permian	275,000,000
	Pennsylvanian	330,000,000
	Mississippian	355,000,000
	Devonian	410,000,000
	Silurian	430,000,000
	Ordovician	490,000,000
	Cambrian	550,000,000
Precambrian		
Proterozoic		2,000,000,000
Archean		4,000,000,000

O.D.M. 6223

About 1000 million years ago there was a period of mountain building which affected all of eastern Ontario. The sedimentary and volcanic rocks of the area were highly folded, compressed, metamorphosed by heat and pressure and faulted. They were intruded by a series of molten magmatic rocks ranging in composi-

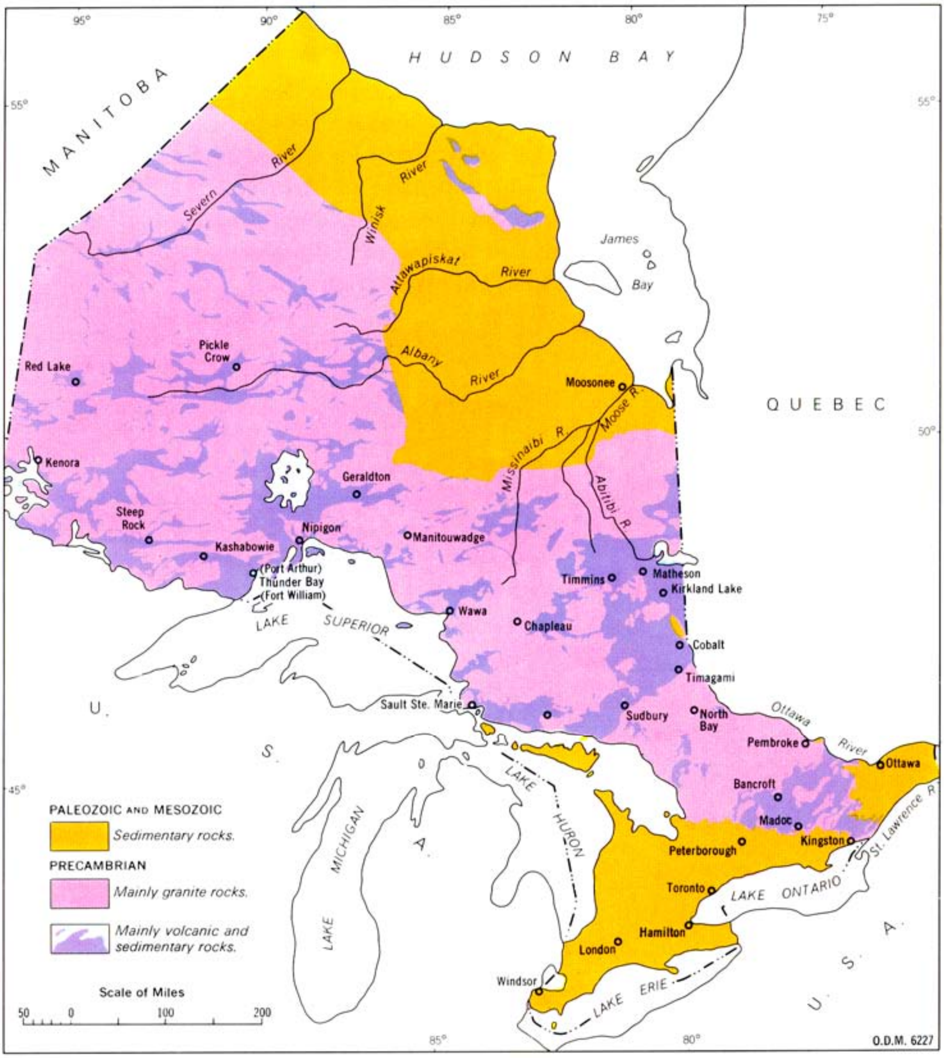


Figure 1 Generalized geological map of Ontario.

tion from gabbro and diorite to granite, syenite and nepheline syenite. The sedimentary rocks were altered to marble, amphibolite, paragneiss and quartzite, and the volcanic rocks principally to amphibolite.

The Bancroft region, which was deeply buried to a depth of about 10 miles, suffered the highest degree of alteration and gneissic rocks are characteristic of this area, which is called the Hastings Highland gneiss complex. Farther to the south in the Hastings basin, the rocks were not so deeply buried and metamorphic grade, or index of change, is low. Madoc is located in the Hastings basin and has been less affected by the Grenville orogeny than the Bancroft region.

After the period of mountain building, which we call the "Grenville orogeny", there was a long period of erosion during which the land was worn down almost to a plain. In fact, by the end of Precambrian times, 550 million years ago, the relief and general geology of the Madoc and Bancroft areas was much as we see them today. In Ordovician times, seas covered eastern Ontario and the Black River and Trenton limestones now present in the Peterborough, Marmora and Madoc areas were laid down on the Precambrian basement rocks, some 460 to 480 million years ago. Geologists believe that the early Paleozoic sediments once covered most of eastern Ontario, but were later removed, by erosion in Mesozoic and Cenozoic times, to their present extent.

About 1 million years ago the great epoch of ice ages began and continental glaciers, centred in the highlands of Quebec and Labrador, spread westward and southward to cover eastern Ontario. At least four times the ice advanced across southern Ontario and then retreated again to the north. The last advance of the Wisconsin glacier, the youngest of the glacial stages, took place about 27,000 years ago, and by 20,000 years ago ice covered the whole of Ontario. All southern Ontario was covered by ice until about 14,000 years ago when the Wisconsin glacier began its last retreat. The surficial glacial features common in the Peterborough area were formed during this Wisconsin glaciation.

General Geology

The Peterborough-Bancroft-Madoc region is one of the most attractive to the geologist and mineral collector in Ontario due to the abundance of fine mineral samples and the many interesting geological features to be seen. Peterborough, Bancroft and Madoc are three areas of contrasting geological settings. Peterborough is located on the Paleozoic plain of southern Ontario where one can study the Ordovician limestone strata laid down in the sea some

460 million years ago. There is an abundance of good fossil collecting localities; caves may be explored. Peterborough is also situated in the centre of an interesting area of glacial features left by the retreating ice some 10,000 to 15,000 years ago. Visitors can examine the Peterborough drumlin field and such other glacial features as eskers and spillways.

Bancroft is located on the ancient Precambrian shield, an area of crystalline rocks over 1 billion years old, which form the basement, primary, or earliest formed rocks known in this part of the province. The area has been deeply buried within the earth's crust and the rocks have been highly metamorphosed or changed by intense heat and pressure. It is calculated that the rocks of the Bancroft area are those characteristic of the catazone, or zone of deep burial, and have been buried in the earth to a depth of at least 10 miles. The 10 miles or 50,000 feet of overlying strata have been stripped off and these deeply buried rocks are now exposed to our view. These are the rocks of an ancient mountain chain.

Bancroft is well known as mineral collecting country, with localities such as the Princess sodalite mine, the York River nepheline rocks, Cancrinite hill, and the uranium mines. Nearby at Wilberforce there are uranium, fluorspar and molybdenite prospects. At Tory Hill there is good apatite, titanite, hornblende and feldspar in excellent crystals. At Gooderham there are interesting nepheline pegmatites with large zircon crystals, corundum, nepheline, magnetite, and biotite. At Hybla, north of Bancroft, there is a small pegmatite mining area where there is an abundance of rare element and radioactive minerals. Craigmont and Burgess mountain are famous corundum mining areas, and blue corundum, sometimes of sapphire quality, has been found along the York River. Quadeville is well known for its beryl pegmatites, rose quartz, columbite and lyndochite. For those interested in alkaline rocks, the Wolfe nepheline belt in Lyndoch township is well worth visiting. Nepheline-scapolite gneisses of an unusual type are found at Rosenthal and Rockingham, together with corundum and allanite. At Madawaska, some 40 miles from Bancroft, is another pegmatite mining area where rare elements, radioactive minerals, peristerite and sunstone are found.

Madoc is also located on the Precambrian shield, but is in an area of moderate metamorphic grade and indications are that it was buried only to a depth of about 5 miles within the earth's crust before being exhumed and exposed to our view. These are the rocks of the mesozone, or middle zone of the earth's crust.

However, they are just as old as those at Bancroft, but have not been subjected to such intense heat and pressure.

Madoc has been the centre of a small but flourishing mining industry for over 100 years. In 1837 Uriah Seymour erected a furnace for smelting iron ore and opened the Seymour iron mine which operated from 1837 to 1845. Besides iron mining, the area has produced fluorspar, talc, pyrite, gold, lead and marble. The talc and marble industries continue to operate today. The first gold mine to be discovered in Ontario was found at Eldorado, just north of Madoc on Highway 62, in 1866.

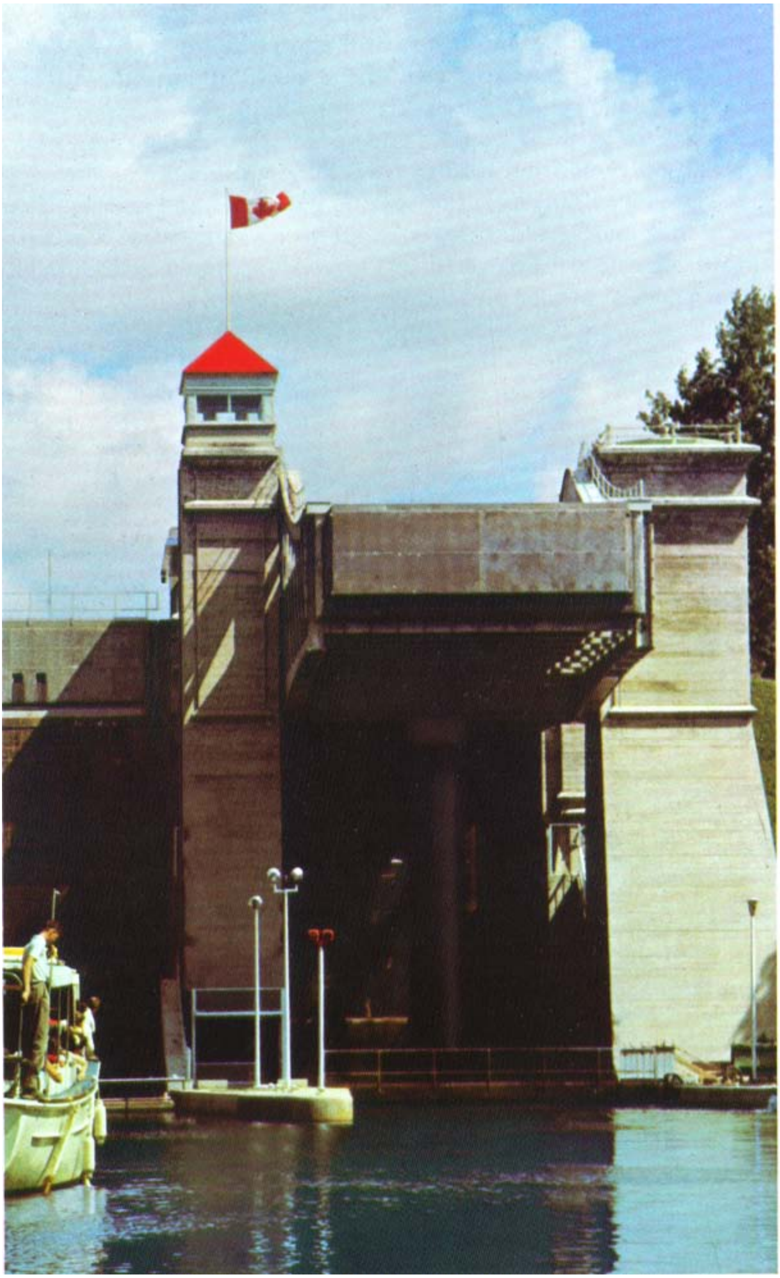


Photo 2 The lift lock on the Trent Canal at Peterborough. (Courtesy Ont. Dept. of Tourism and Information)

PART 2

The Peterborough Area

Peterborough

The city of Peterborough, with a population of over 52,000 is located on the Otonabee River and Trent Canal, a few miles south of the Kawartha Lakes. A feature of the architecture of many Peterborough buildings is the use of Black River and Trenton limestone, much of it from the Longford quarry at Longford Mills on Lake Couchiching. The customs house, Peterborough collegiate, court house and jail, St. Peter's Catherdral, and St. Andrews United Church are built from Black River and Trenton limestone.

Peterborough's Little Lake was formerly the site of a “Carrying Place” where the Indians portaged their canoes from the Otonabee River to Chemung Lake a distance of 6 miles to avoid the 9 miles of rapids on the Otonabee between Peterborough and Lakefield. Champlain used this route in 1615 with a war party of Huron and Algonquin Indians en route to the Iroquois country in New York state.

One of the interesting sights at Peterborough is the famous lift lock on the Trent Canal (Photo 2). This lift lock, opened in 1904, lifts boats 65 feet to overcome the drop between Nassau Mills on the Otonabee River and Little Lake in Peterborough. The distance from Lake Ontario at Trenton to Port Severn via the Trenton-Severn waterway is 240 miles with a total of 43 locks.

Paleozoic Section

The bedrock in the Peterborough area is Sherman Fall limestone of Middle Trenton age. The Paleozoic geology of the area is described by Winder (1954), and the following description follows Winder's report and nomenclature. The Paleozoic section at Peterborough is shown in figure 2. The Sherman Fall limestone consists of thin to medium bedded, aphanitic to medium crystalline limestone and interbedded grey-green shale. The Sherman Fall limestone is very fossiliferous and there are several good collecting localities in the Peterborough area. The thickness of the Sherman Fall is from 200 to 250 feet in the area. The formation outcrops along the banks of the Otonabee and Indian Rivers. Quarry sections may be seen at the abandoned Canada Cement Company quarry at Lakefield and in a small quarry on the east side of Highway 28, 4 miles north of Peterborough in lot 25, concession V, Smith township.

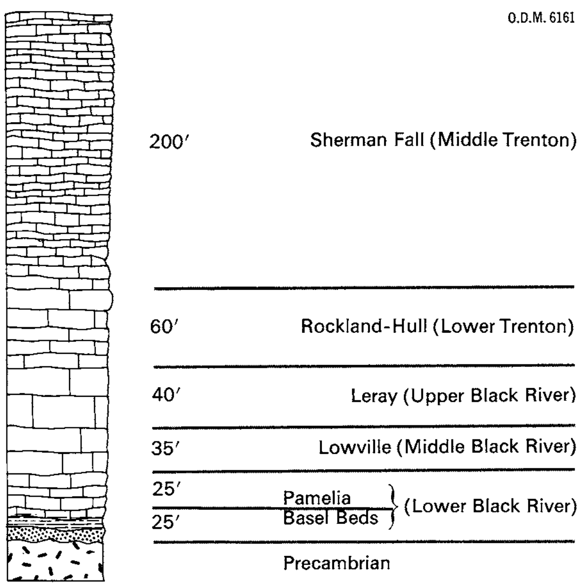


Fig. 2 Paleozoic section at Peterborough. (after Winder, 1954)

The Sherman Fall limestone is underlain by 60 feet of Rockland and Hull beds of Lower Trenton age consisting of thin to medium-bedded, medium brownish-grey, fine to medium crystalline limestone, with prominent blue-grey shale partings. The Rockland beds are generally fossiliferous with abundant brachiopods, especially Dalmanella, Strophomena, Rafinesquina and Sowerbyella. The contact of the Sherman Fall and underlying Hull beds is exposed below the road bridge on Highway 28 at Lakefield. The Rockland beds are exposed along the Indian River at Warsaw.

The Leray beds, which are upper Black River in age, lie below the Hull, and have a thickness of approximately 40 feet. These consist of medium to thick bedded, medium grey, fine to medium crystalline limestones which form limestone plains crossed by numerous joints. The massive beds form abundant outcrops. These beds are exposed north of Warsaw along the Indian River and in the Warsaw Caves Conservation Area.

The Lowville beds, underlying the Leray, are about 35 feet in thickness, and consist of thin to massive-bedded, medium grey, microcrystalline to fine crystalline limestone. The upper beds often carry abundant Tetradium corals, the nautiloids Actinoceras, Spyroceras and Michelinoceras, some gastropods, brachiopods and trilobites (Winder 1954, p. 5).

The Pamelia beds, which underlie the Leray, consist of about 25 feet of buff dolomite, often sandy or silty, interbedded with medium-bedded grey lithographic limestone and buff dolomitic limestone. Underlying the Pamelia there is up to 25 feet of "basal beds" consisting of red shale, red or green arkose, and red lithographic limestone. These basal clastics are referred to as the Shadow Lake formation.

Pleistocene Geology

The principal physiographic divisions in the Peterborough area formed during the Pleistocene ice age are shown on figure 3 (Gravenor 1957). The ice of the Lake Simcoe lobe, which lay to the north, advanced in a southwesterly direction as indicated by the orientation of the drumlins which are hills of sandy clay till formed beneath the moving ice sheet.

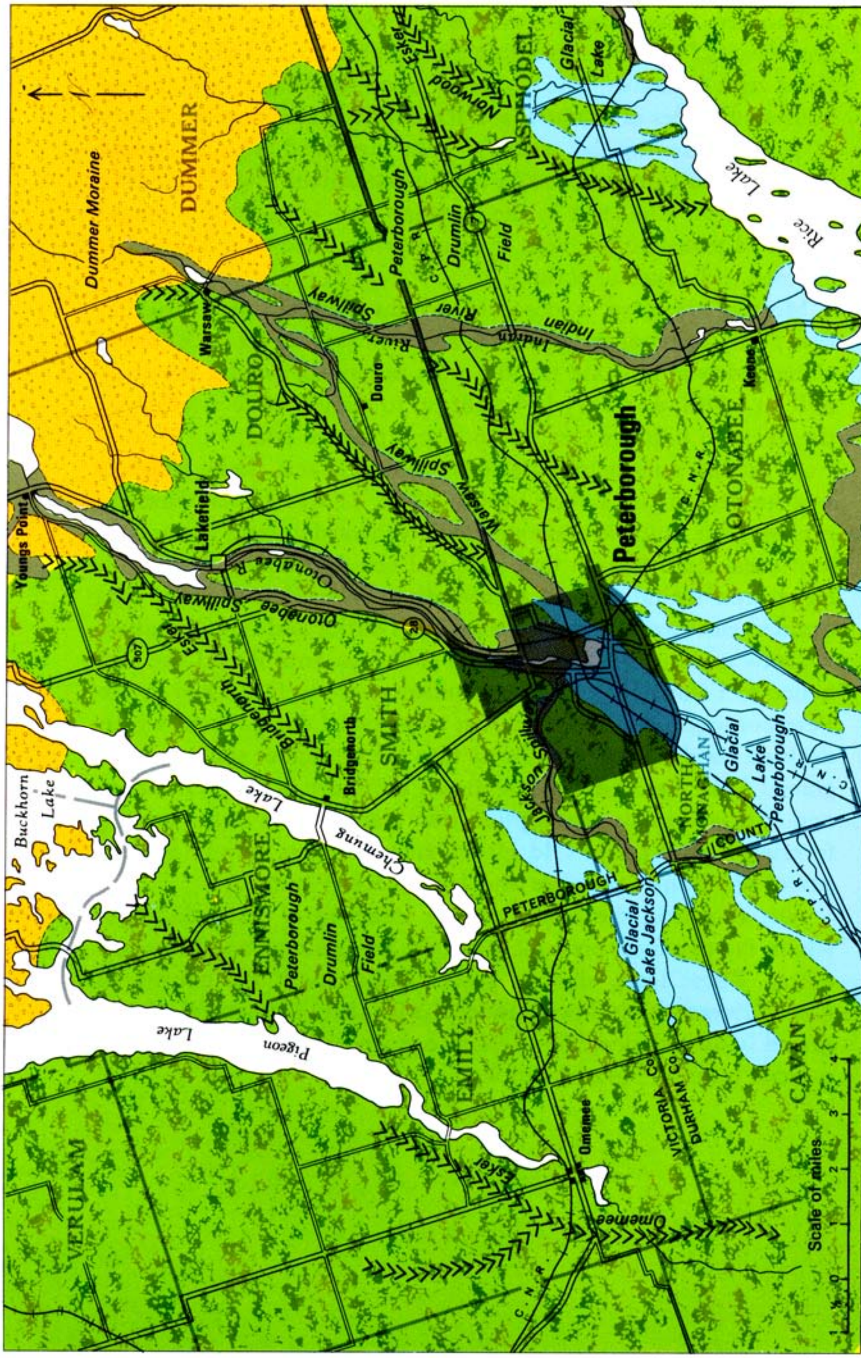


Figure 3 Pleistocene physiographic divisions in the Peterborough area.

The first physiographic area is the Dummer moraine in the north part of the area extending through Buckhorn Lake, Youngs Point and Warsaw. The Dummer moraine mainly consists of hummocky piles of coarse Black River limestone boulders. Many of the pastures in the moraine area are filled with limestone boulders of all sizes moved in by the last advance and retreat of the ice sheet. The land in the moraine area is rough and stony, and is ill suited to farming. Frequently the limestone bedrock is exposed in limestone plains.

Most of the area is occupied by the Peterborough drumlin field; only a few of the drumlins are indicated on figure 3. These elongated oval hills are up to a mile in length, usually about ¼ mile in width, and vary in height up to about 200 feet. Many of the drumlin hills are cleared and form pasture land.

As the last continental glacier retreated, glacial Lake Iroquois was formed in the Lake Ontario basin. It was larger than the present Lake Ontario and extended northward into the Campbellford area. At the same time glacial Lake Algonquin occupied a large area including and surrounding Lake Simcoe. This lake drained eastward via the Fenelon FaIls outlet and the Otonabee, Warsaw and Indian River glacial spillways, into Rice Lake and hence to Lake Iroquois. These spillways are well marked in the Peterborough area. The location of glacial Lake Jackson which drained via the Jackson spillway into the Otonabee spillway, and glacial Lake Peterborough is shown on figure 3. The Otonabee and Warsaw spillways emptied into glacial Lake Peterborough forming a sand plain. Old glacial river terraces may be seen in places along the Otonabee and Indian River spillways.

Also shown in the figure are the locations of esker ridges, of which the two most prominent are the Bridgenorth and Norwood eskers. These long, sinuous gravel ridges mark the courses of glacial rivers which flowed under the ice sheet carrying sand and gravel in abundance. These eskers are worked as sources of commercial sand and gravel supplies.

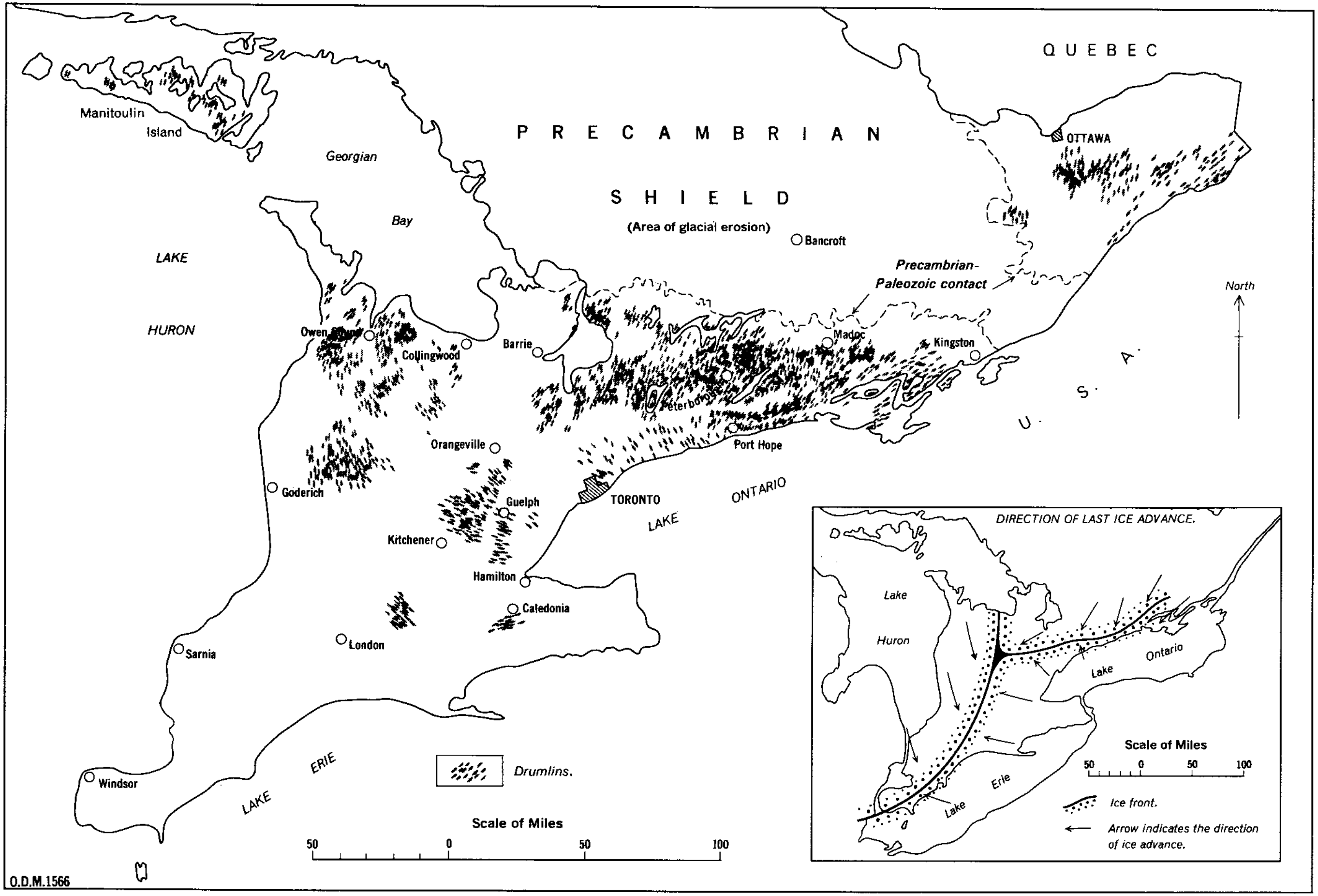


Figure 4 Drumlin fields of southern Ontario. (After Chapman and Putnam; courtesy W. M. Tovell).

Figure 5 Geological and route map of Peterborough Trip 1.

Peterborough Trip 1

PETERBOROUGH TO SERPENT MOUNDS PROVINCIAL PARK

This trip gives an excellent opportunity to cross one of the best sections of the Peterborough drumlin field and observe many drumlin hills. These oval hills are composed of sandy clay till carrying many limestone boulders. An esker and the Indian River glacial spillway are also seen. At Serpent Mounds Provincial Park more drumlins are seen as well as an ancient Indian burial mound. The size of the park is 70 acres and offers excellent camping and swimming facilities.

Mileage	
0	Junction of Highway 7B and George Street, Peterborough. Proceed east on Highway 7B.
0.6	Trent canal, lock No. 19.
1.1	Junction of 7B and Armour Street, Beavermead trailer park and campsites are ½ mile north on Armour Road. The Lift Lock is 1.2 miles north on Armour Road.
1.9	Junction of Highways 7 and 7B.
2.5	Mark S. Burnham Provincial Park on left.
3.7	Road curves to left. Note the drumlin hill ¼ mile south and another drumlin hill ahead to the east.
5.9	Observe the gravel pit in the esker on the south side of the road. There are good exposures of stratified gravel carried in by a glacial stream under the ice sheet. There is a good view of drumlin hills to the north. The steeper end of these hills is usually at the north end, indicating movement of the ice, which formed the hills from the north.

6.4 Leave Highway 7, turn south on paved road to Keene on the sixth line of Otonabee township. Follow signs for Serpent Mounds Provincial Park.

8.6 There is an excellent drumlin on the right, west of the road (Photo 3).

9.9 The village of Lang, a quarter mile east of the road, is in the Indian River glacial spillway into which the road is descending. The hill on the east side of the valley is a drumlin truncated by the spillway valley.

10.4 Railroad crossing.

10.7 A good drumlin appears to the west of the road.

11.7 Keene village outskirts.

12.1 Keene Corners, proceed straight ahead, south, on paved road. There is a drumlin hill just south of Keene. Roadcuts expose the stony clay till which make up the drumlins. From the crest of the drumlin there is a panoramic view of the mouth of the Indian River and Rice Lake.

14.3 Serpent Mounds Provincial Park. The hill on entering the park is a drumlin. East Sugar Island which can be

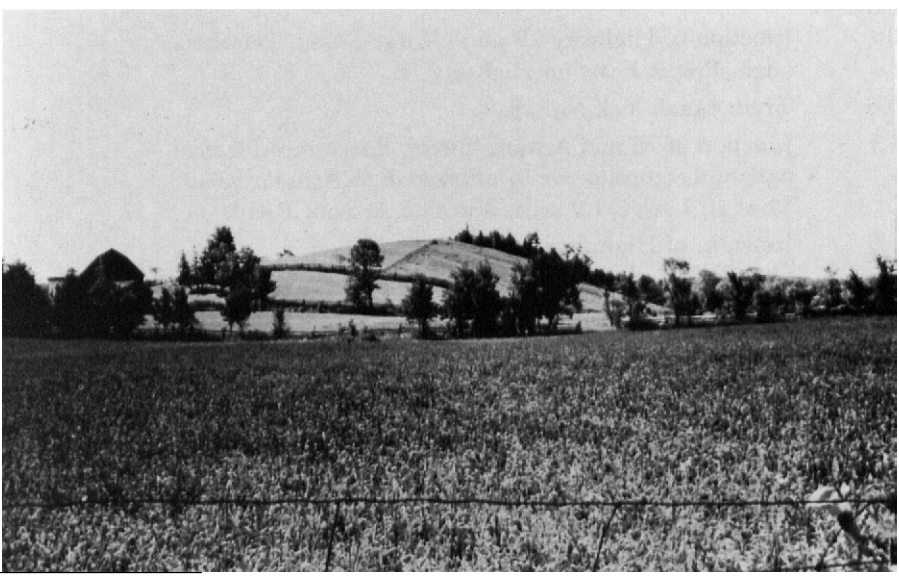


Photo 3 Drumlin near the village of Lang.

Photo 4 Excavations being carried out at Serpent Mounds Provincial Park, (Courtesy Ont. Dept. Tourism and Information)

seen in Rice Lake just east of the park is a submerged drumlin whose steep face faces north. The Serpent mounds are ancient Indian burial mounds (Photo 4). They are located at the south end of the park. The mound group consists of eight mounds, seven of which are small and conical. The eighth mound is a serpentine mound some 200 feet long and is the only known example in Canada of a serpentine mound. Skeletal remains and artifacts including adzes, gouges, pipe and pottery fragments were found. The Trent Waterway was an important travel route for the Indians for thousands of years.

Radiocarbon age dating indicates that the mounds were built during a period of about 170 years, beginning about 128 AD, by Indians of the Point Peninsula culture who occupied parts of southern Ontario and New York state.

Return to Keene Corners.

16.5 Keene Corners. Turn left (west) along North Rice Lake Road.

17.0 Drumlin to left.

18.6 Climb drumlin hill.

19.1 Mathers Corners; proceed straight ahead, many drumlins.

20.7 Climb drumlin hill.

20.8 Turn right (north) following paved road on concession XI of Otonabee township.

22.7 A roadcut exposes very stony till in a drumlin. The abundant stones are Black River and Trenton limestone (Photo 5).

24.1 The stony moraine hill to the left is a drumlin composed of very stony till.

24.9 Roadcuts expose very stony till in a drumlin section.

26.3 Highway 7, proceed west to Peterborough.

Photo 5 Roadcut exposing stony till in a drumlin in Otonabee township.

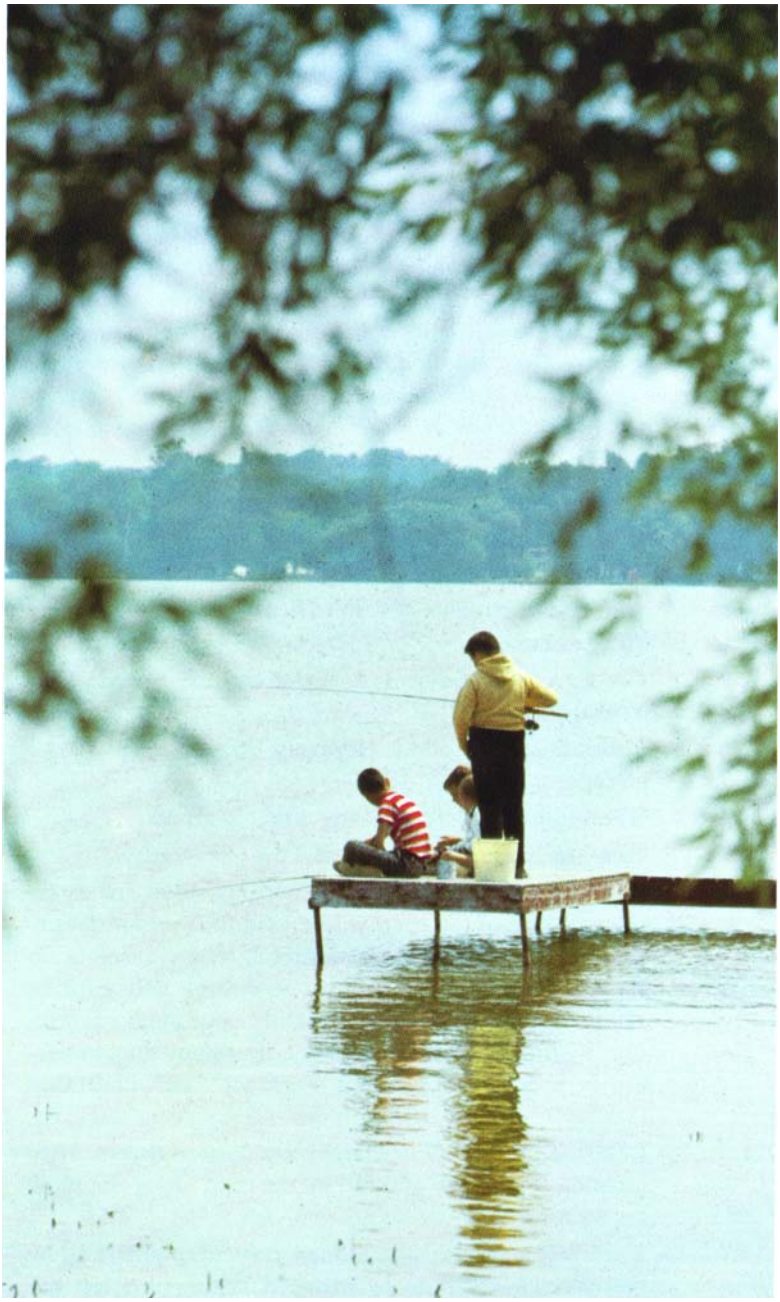


Photo 6 Young anglers, Rice Lake. (Courtesy Ont. Dept. of Tourism and Information)

Peterborough Trip 2

PETERBOROUGH TO LAKEFIELD, BLUE MOUNTAIN AND WARSAW CAVES

This trip visits two excellent quarries for fossil collecting in the Middle Trenton of Middle Ordovician age. A wide range of brachiopods, gastropods, bryozoa, molluscs and trilobites may be found. Blue Mountain, a famous nepheline syenite locality, is visited. The route crosses the Dummer moraines and the Peterborough drumlin field where numerous drumlins and eskers can be observed and examined. The Warsaw caves are visited and examination can be made of the Indian River glacial spillway. A visit to an Indian petroglyph site can be made to see Indian rock carvings on ancient marble.

Peterborough to Canada Cement Quarry, Lakefield

Mileage	
0	Junction of Highway 28 and 7B, Peterborough. Follow 28 to north.
2.9	Corner of Charlotte and Water streets, turn left up Water Street.
3.8	Parkhill road. Follow Highway 28 north up Water street.
4.4-4.7	The hill on the left of Water street is an esker.
6.7	Road to Nassau Mills, site of Trent university.
8.5	Fifth line of Smith township. There is a small quarry on the east side of the road where Middle Trenton (Sherman Fall) beds can be examined. The quarry is on lot 25, concession V, Smith township and exposes about 20 feet of limestone, mainly coquinoid calcarenite with shaly interbeds. Some limestone conglomerate is present. This is an excellent fossil collecting locality.
12.2	Lakefield bridge. Turn right on Water Street after crossing the bridge and follow the road along the river for ½ mile.
12.7	Turn left past the abandoned cement plant. Follow this road for 1 mile to surfaced road; turn left for 0.1 mile.

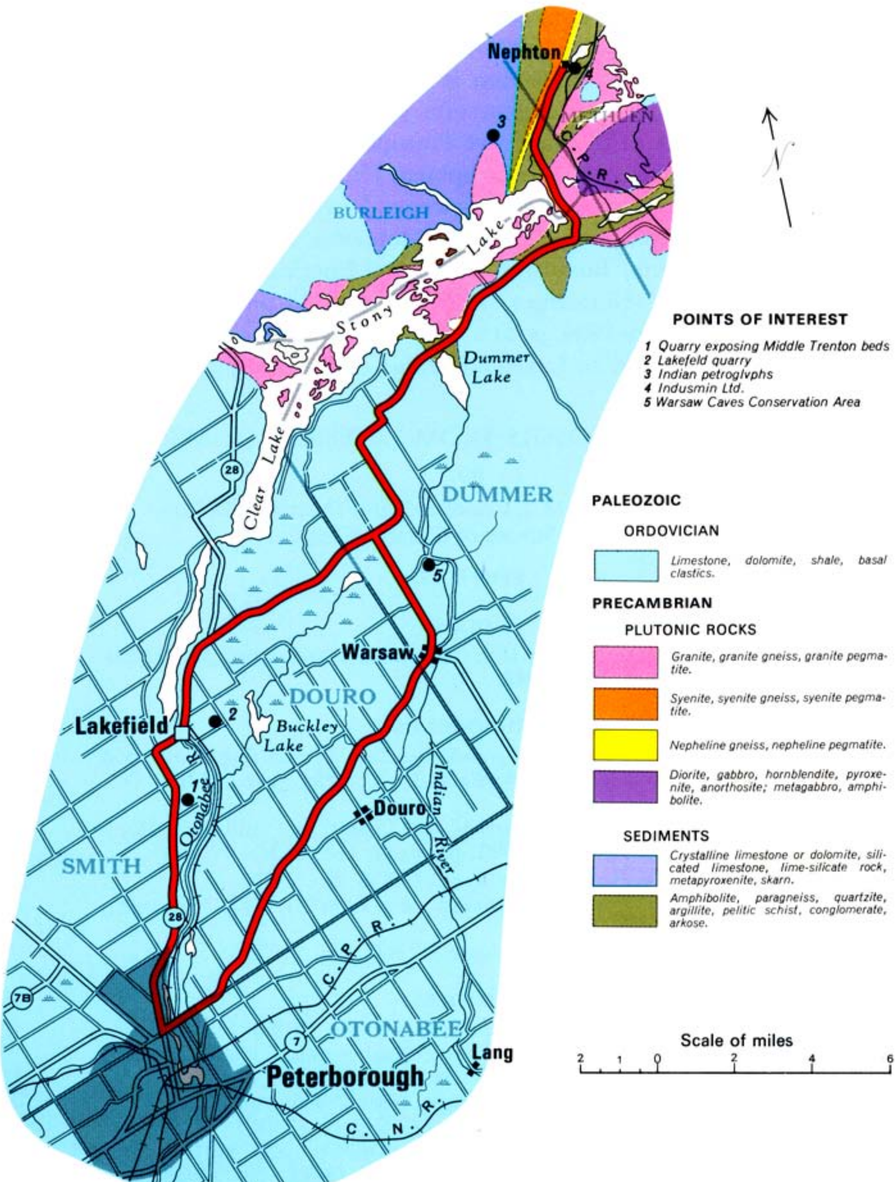


Figure 6 Geological and route map of Peterborough Trip 2.

13.8 Park car. Walk west to the abandoned Lakefield quarry of the Canada Cement Company. This is a very good fossil collecting locality, one of the best in the Middle Ordovician period in Ontario (Photos 7, 8, 9). Forty feet of Middle Trenton (Sherman Fall) beds are exposed. The section is composed of shaly limestone ranging from calcarenite to calcirudite. Among the fossils to be found are Prasopora, Dalmanella, Dinorthis, Lingula, Parastrophina, Pholidops, Platystrophia, Rafinesquina, Rhynchotrema, Sowerbyella, Zygospira, Hormotoma, Sinuites, Cleidophorus, Ctenodonta, Cyrtodonta, Bumastus, Ceraurus, Encrinurus, Flexicalymene, Hemiarges, Illaenus, Isotelus and Conularia (Liberty 1964, p. 31).

Return to Lakefield bridge on Highway 28.

ORDOVICIAN FOSSILS FROM LAKEFIELD QUARRY

By

G.Winston Sinclair, M. J. Copeland, and Thomas E. Bolton
Geological Survey of Canada, Ottawa.

PHOTO 7

Corals

1, 2. *Streptelasma corniculum* Hall. View of side and calyx, X1. Hypotype, G.S.C. No. 21948.

Echinoderms

Glyptocystites sp. cf. *G. grandis* Sinclair. (Small flat brachiopod bottom left — *Sowerbyella* sp.); X1. Fig. spec., G.S.C. No. 21949.

4, 11. *Syringocrinus sinclairi* Parsley and Caster. X1 and X2. Holotype, G.S.C. No. 17520; paratype, G.S.C. No. 17522a.

5. *Dendrocrinus* sp. X2. Fig. spec., G.S.C. No. 21950.

6. *Lichenocrinus* sp. (the holdfast of a crinoid). X3. Fig. spec., G.S.C. No. 21951.

10. *Cremacrinus* sp. X2. Fig. spec., G.S.C. No. 21952.

Bryozoans

7. *Rhinidictya* sp. X2. Fig. spec., G.S.C. No. 21953.

8, 9. *Mesotrypa angularis* Ulrich and Bassler. Basal view, X1, and vertical section, X10. Fig. spec., G.S.C. No. 21954.

12, 13. *Prasopora simulatrix* var. *orientalis* Ulrich. Tangential and vertical sections, X10. Fig. spec., G.S.C. No. 21955.

14-16. *Hallopora multitabulata* (Ulrich). Colony, X1, vertical and tangential sections, X10. Fig. spec., G.S.C. No. 21956.

17, 18. *Stictoporella* sp. Surface, X4, and colony, X1. Fig. spec., G.S.C. No. 21957.

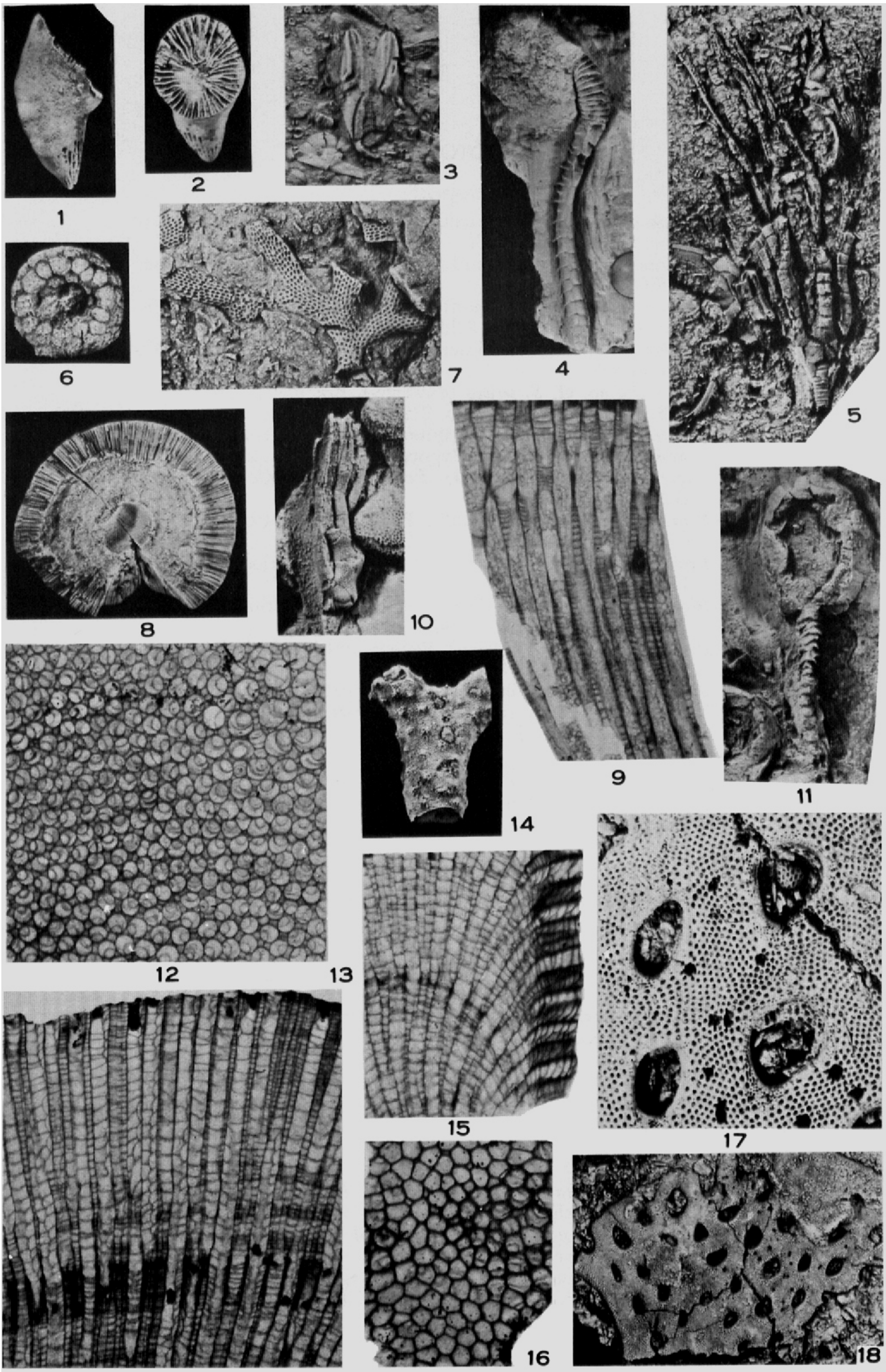


Photo 7 Coral, Echinoderm and Bryozoan fossils from Lakfield quarry.

PHOTO 8

Brachiopods

1, 2. *Lingula scutum* Sinclair. Brachial and pedicle views, X2. Holotype, G.S.C. No. 11249.

3, 4. *Paucicura* sp. Brachial and pedicle views, X2. Hypotype, G.S.C. No. 21958.

5, 6. *Onniella whittakeri* (Raymond). Pedicle and brachial views, X1. Hypotype, G.S.C. No. 21959.

7. *Strophomena* sp. Brachial interior view, X1. Fig. spec., G.S.C. No. 21960.

8. *Sowerbyella* sp. cf. *S. sericea* (Sowerby). Brachial interior view, X2. Hypotype, G.S.C. No. 21961.

9, 10. *Plaesiomys (Dinorthis) meedsi* (Winchell and Schuchert). Brachial and pedicle views, X1. Hypotype, G.S.C. No. 21962.

11. *Zygospira recurvirostris* (Hall). Pedicle views, X2. Hypotype, G.S.C. No. 21963.

14. *Parastrophina hemiplicata* (Hall). Pedicle view, X2. Hypotype, G.S.C. No. 21964.

15. *Rafinesquina trentonensis* (Conrad). Brachial interior view, X1. Hypotype, G.S.C. No. 21965.

16, 17. *Rhynchotrema increbescens* (Hall). Pedicle and anterior views, X2. Hypotype, G.S.C. No. 21966.

18, 19. *Pseudolingula iowensis* (Owen). Pedicle and brachial views, X2. Hypotype, G.S.C. No. 11099.

20. *Trematis ottawaensis* Billings. Pedicle valve, X2. Hypotype, G.S.C. No. 21967 (in addition, *Rhynchotrema increbescens* and *Sowerbyella* sp. cf. *S. sericea).*

Gastropod

12. *Fusispira planulata* (Ulrich and Scofield). Apertural view, X1. Hypotype, G.S.C. No. 21968.

Nautiloid

13. *Whitfieldoceras gracile* Flower. X3. Holotype, G.S.C. No. 12352.

PHOTO 9

Pelecypods

1, 2. *Ctenodonta levata* (Hall). Left and posterior views, X2. Hypotype. G.S.C. No. 21969.

7, 8. *Ctenodonta* sp. cf. *C. nasuta* (Hall). Right and dorsal views, X1. Hypotype, G.S.C. No. 21970.

11, 12. *Ctenodonta* sp. Right and dorsal views, X1. Fig. spec., G.S.C. No. 21971.

Gastropods

3. *Clathrospira conica* Ulrich and Scofleld. Abapertural view, X1. Hypotype, G.S.C. No. 21972.

4, 5. *Tetranota bidorsata* (Hall). Adapertural and right side; views, X1. Hypotype, G.S.C. No. 21973.

9. *Bucinia* sp. Adapertural view, X1. Fig. spec., G.S.C. No. 21974.

10. *Lophospira* sp. Abapertural view, X1. Fig. spec., G.S.C. No. 21975.

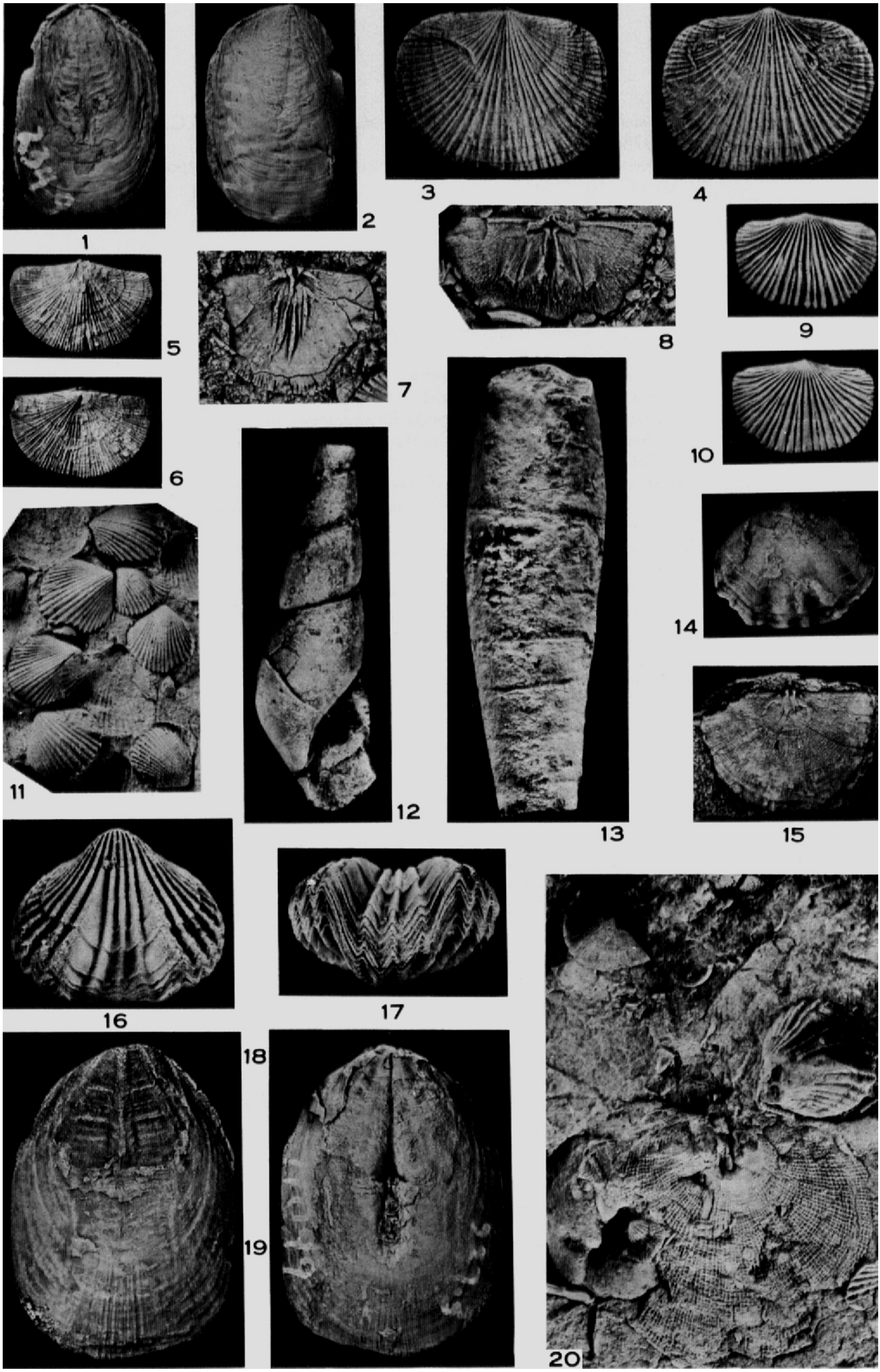


Photo 8 Brachiopod, Gastropod and Nautiloid fossils from Lakefield quarry.

13. *Phragmolites* sp. Right side view, X3. Fig. spec., G.S.C. No. 21976.

14. *Pterotheca attenuata* (Hall). Abapertural view, X2. Hypotype, G.S.C. No. 21977.

Trilobites

15. Proetid tail, X4. Fig. spec. G.S.C. No. 21978.

16. *Dimeropyge gibbus* Sinclair. Incomplete thorax and pygidium, X4. Paratype, G.S.C. No. 6701.

17. *Illaenus americanus* (Billings). Cephalon, X1. Hypotype, G.S.C. No. 21979.

18. *Ceraurus pleurexanthemus* Green. Cephalon, X1. Hypotype, G.S.C. No. 21980 (in addition, part of trilobite cephalon *Flexicalymene* sp.; brachiopods *Rhynchotrema increbscens*).

19. *Hypodicranotus striatulus* (Walcott). Hypostome, X2. Hypotype, G.S.C. No. 21981.

21, 22. *Calyptaulax* sp. Oblique and dorsal views of cephalon, X2. Fig. spec., G.S.C. No. 21982 (in addition, two cephalons of trilobite *Flexcalymene senaria*).

24. *Hemiarges aeolus* Sinclair. Cephalon, X2. Holotype, G.S.C. No. 13276.

26, 27. *Fleicalymene senaria* (Conrad). Dorsal and left lateral views of an enrolled specimen, X2. Hypotype, G.S.C. No. 21983.

28. *Isotelus gigas*. DeKay. Hypostome, X1. Hypotype, G.S.C. No. 21984.

29. *Achatella billingsi* Sinclair. Cephalon, X2. Holotype, G.S.C. No. 13275.

Miscellaneous

6. *Conularia trentonenris* Hall. X1. Hypotype, G.S.C. No. 21985.

20. *Cornulites* sp. (worm tubes) on *Rajinesquina trentonensis* (brachiopod). X1. Hypotype, G.S.C. No. 21986.

23. Trail — these are often interpreted as "feeding trails" of trilobites. X1. Fig. spec., G.S.C. No. 21987.

25. *Lepidocoleus* sp. (plate of a problematic animal). X10. Fig. spec., G.S.C. No. 21988.

Alternate Scenic Route from Peterborough to Lakefield via the River Road.

Mileage	
0	Corner of Water Street and Parkhill Road. Proceed east on Parkhill Road.
0.5	Turn left and proceed north on Armour Road. The River Road runs along the east bank of the Otonabee

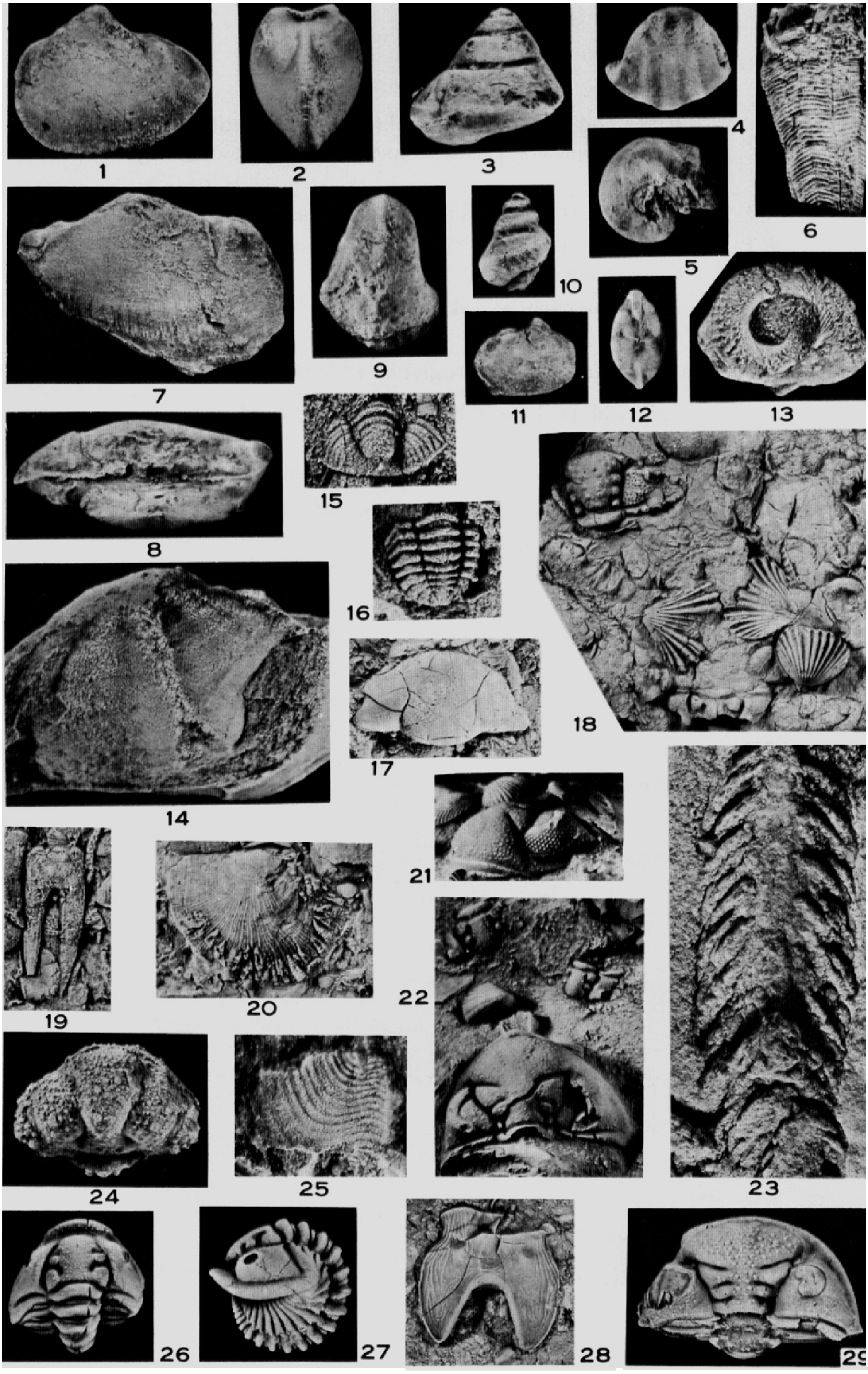


Photo 9 Pelecypod, Gastropod, Trilobite and miscellaneous fossils from Lakefield quarry.

River and passes several locks along the Trent Canal. Good sections of Trenton limestone are exposed along the river.

3.3 Cross the Trent Canal at Nassau Bridge.

8.7 Road to right goes to Lakefield quarry of Canada Cement Company.

9.2 No. 28 highway at Lakefield.

Lakefield to Indian Petroglyphs and Nephton

0 Lakefield bridge on Highway 28; proceed north on Highway 28.

2.6 South Stoney Lake Road; follow this road to the right.

5.2 Black River limestone rests unconformably on pink Precambrian biotite granite. This is an excellent example of an unconformity (Photo 10).

5.4 Black River limestone outcrop.

7.3 Dummer moraine.

8.0 Warsaw turnoff for Warsaw caves.

10.6 Limestone pavement on right.

Photo 10 An example of unconformity showing Black River limestone resting on Precambrian biotite granite 5 miles north of Lakefield on Highway 28.

Photo 11 Indian petroglyphs carved on white marble north of Stony Lake. (Courtesy Ont. Dept. Tourism and Information)

Photo 12 Picnicking on an outcrop of granite gneiss at Stony Lake. (Courtesy Ont. Debt. Tourism and Information)

14.3 Descend from limestone scarp.

14.4 Precambrian outcrops of pink granite gneiss, and dark green pyroxene amphibolite cut by granite.

16.4 Ascend Black River scarp.

17.7 There is a good view of Blue Mountain and Stoney Lake from this hill top.

19.3 Turn north; the contact of the Ordovician limestones and the underlying Precambrian rocks is here, but the actual contact is not exposed.

19.9 There is a small quarry in red biotite granite porphyry on the west side of the road.
Crossing a granite batholith.

23.1 Here is the Petroglyph Trail in to the site of Indian petroglyphs carved on white marble (Photo 11). The distance to the site is about 3 miles. The carvings include birds, beasts and human beings. Their origin is not known and estimates of their age vary from 500-3,500 years old.

23.9 Nephton, townsite of Indusmin Limited which operates the quarries and mill for nepheline syenite at Blue Mountain (Photo 13).

Blue Mountain

Blue Mountain is made up of nepheline syenite which stands up in relief 150 to 200 feet above the granite and amphibolite country rock surrounding it. This nepheline syenite, composed of nepheline, albite and microcline feldspar, with accessory biotite and magnetite, is unique, as it is the only nepheline syenite body in Canada being commercially quarried. The nepheline syenite is used in the manufacture of glass and ceramics.

Nepheline syenite is an alkaline intrusive rock which is deficient in silica and carries no quartz, but carries the feldspathoid mineral nepheline, instead. Nepheline syenites, compared to other intrusive rocks such as granite, syenite, diorite and gabbro, are relatively rare, and are of much interest to the geologist. Some interesting zeolites are occasionally found in the quarries at Blue Mountain. The nepheline syenite deposits are described in Nepheline Syenite Deposits of Southern Ontario, Ontario Department of Mines, Vol. LXIX, part 8 by D. F. Hewitt (1960).

Over $40,000,000 worth of nepheline syenite has been quarried from Blue Mountain since 1936 by two companies.

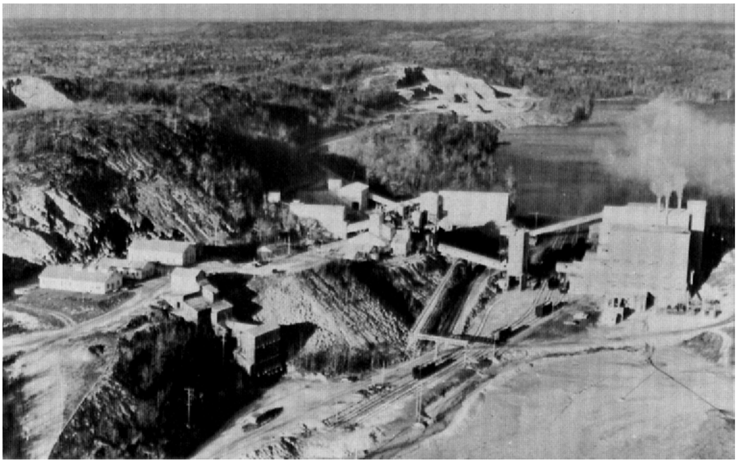


Photo 13 Mill and plant of Indusmin Ltd. quarrying nepheline syenite at Blue Mountain (Courtesy K. Wyatt)

To Warsaw Caves

	Return 16.6 miles to the Warsaw turnoff on the South Stoney Lake Road (mileage 8.0).
0	Warsaw turnoff for Warsaw caves. Proceed south on Warsaw Road.
1.4	Turn left and proceed east on gravel road to Warsaw caves. You are crossing the Dummer limestone moraine.
2.0	Warsaw Caves conservation area, turn right. There are abundant exposures of Black River limestone containing fossils and black chert. Pot holes may be observed along the Indian River on limestone outcrops (Photo 14); this is part of the old Indian River glacial spillway. Paths to the falls and to the caves are marked. The caves are undeveloped and entrances are sometimes narrow and restricted. The caves range from 100 to 300 feet in length.
2.0	Leave Warsaw Caves conservation area, return west to the Warsaw Road.
2.6	Warsaw Road, turn left and proceed south on paved road.
3.2-4.5	A stony esker follows the road south on the west side of the road.
4.1	Entering Warsaw village, settled in 1831.

Photo 14 Pot holes on limestone outcrops beside the Indian River at Warsaw Caves Conservation Area. (Courtesy Ont. Dept. Tourism and Information)

4.6	Warsaw corners; follow paved road to right and proceed southwest to Peterborough.
5.2	Climb drumlin hill. There is a good view to the south of the drumlinized till plain.
7.2	Drumlin on right.
9.1	Gravel pit in esker on the right.
11.2	Gravel pit in esker on the left.
12.6-13.4	You are driving along the crest of a small esker.
13.2	There are gravel pits in the esker on the left and right sides of the road. You are passing through one of the best sections of the Peterborough drumlin field.
14.2	Drumlins.
14.5	Drumlins.
14.6	Cross Trent canal, entering Peterborough on Parkhill Road.
15.2	Cross Otonabee river.
15.5	Intersection of Parkhill Road and Water Street.

Peterborough Trip 3

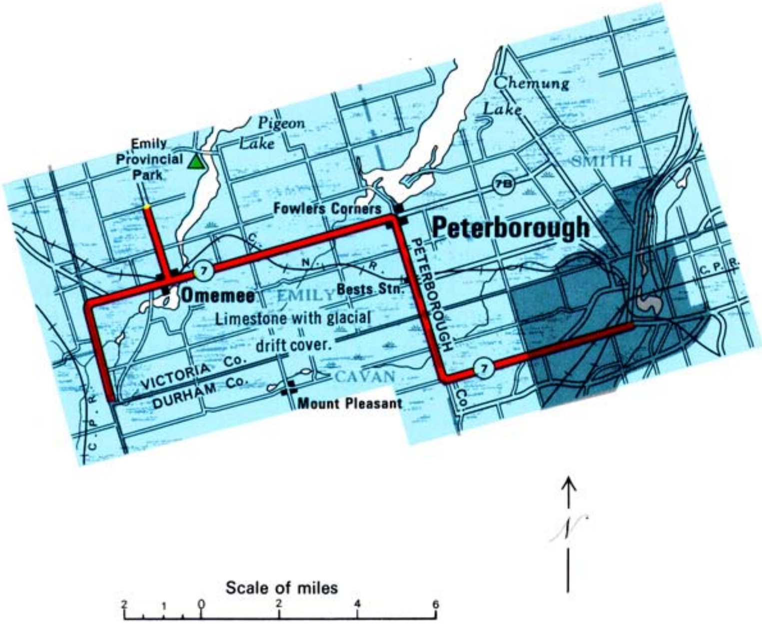


Figure 7 Geological and route map of Peterborough Trip 3.

PETERBOROUGH TO THE OMEMEE ESKER

The Omemee esker is one of the larger eskers in the Peterborough area. It has a length of approximately 12 miles, extending from the south end of Pigeon Lake southward through Emily township, crossing Highway 7 a mile and a half west of Omemee. It extends a further 6 miles into Manvers township. West of Omemee the esker forms a prominent 75 to 100 foot ridge, locally known as the Hogsback. The road down the Manvers-Emily township line runs along the crest of the esker for over a mile. There are several gravel pits in the esker (Photo 16). A branch of esker from Downeyville joins the main esker just a mile north of Highway 7.

Mileage	
0	Junction of Highway 7B and George Street, Peterborough. Proceed west on Highway 7B.
5.1	Junction of 7 and 7B. Turn north on Highway 7.
7.8	Climb a drumlin hill at Bests station.
8.5	Fowlers Corners, turn left and proceed west on Highway 7.
10.5	Climbing onto an area of kame sand and gravel for the next two miles.
14.5	Omemee village.
16.0	Omemee esker, the "Hogsback", crosses Highway 7. The esker can be examined further by driving west on the gravel road a distance of 0.7 miles to the Emily township line. Turn south and drive 1.5 miles and you will climb onto the crest of the esker and follow along it for a mile. Return to Omemee. The esker crosses the Omemee-Downeyville road 1.9 miles north of Omemee.

Photo 15 Pigeon River at Emily Provincial Park (Courtesy Ont. Dept. Lands and Forests)

Emily Provincial Park is situated 1 mile further north and 2 miles east of this point. The park lies along the Pigeon River and offers excellent camping facilities as well as good fishing. Return to Peterborough via Highway 7.

Photo 16 Gravel pit exposing the interior of the Omemee esker.

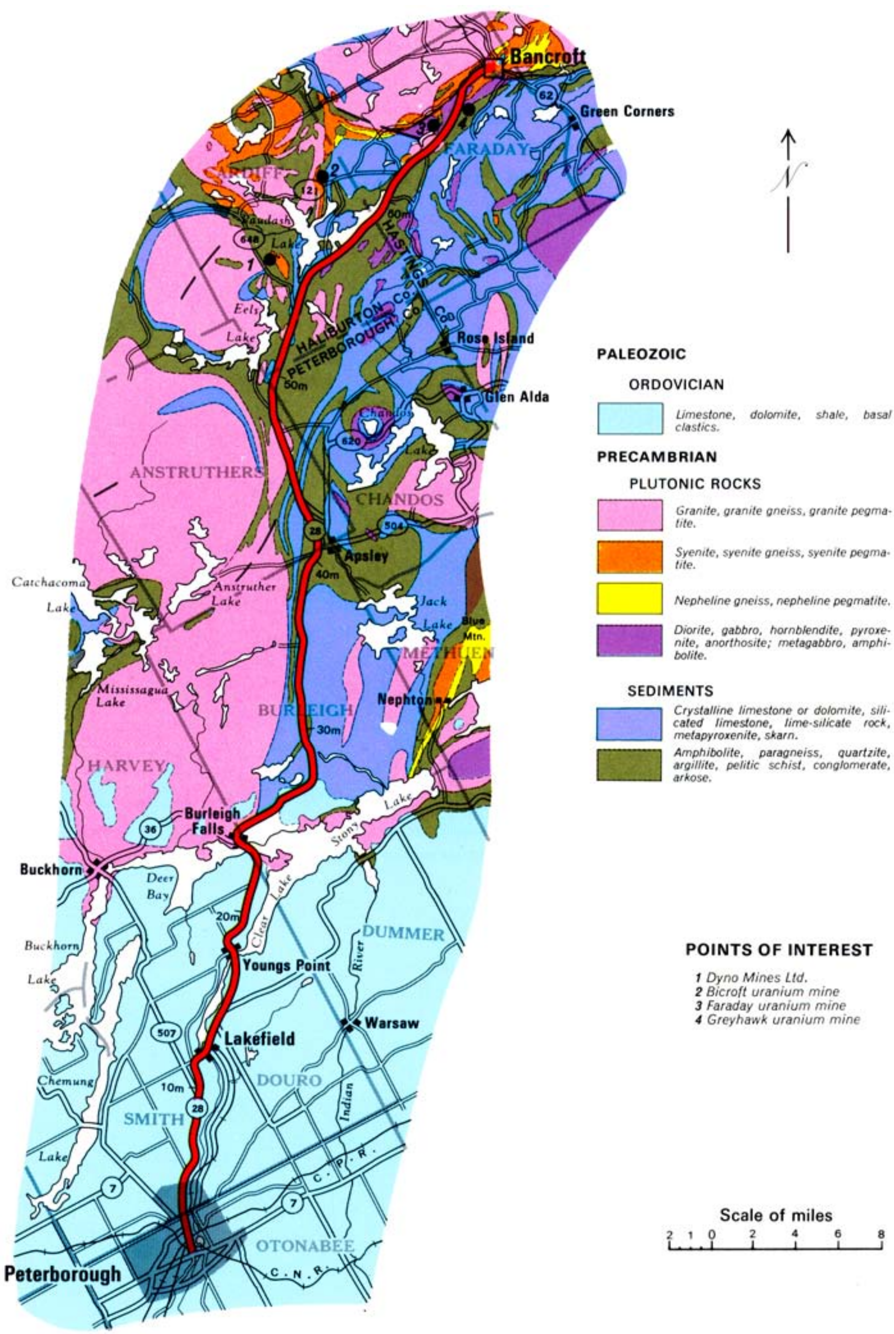


Figure 8 Geology and route of Highway 28, between Peterborough and Bancroft.

Road Log

HIGHWAY 28: PETERBOROUGH TO BANCROFT

Mileage	
0	Junction of Highways 28 and 7B, Peterborough. Follow 28B north. See Peterborough Trip 2 for log to Lakefield bridge.
12.2	Lakefield bridge, follow Highway 28 north.
14.8	South Stoney Lake Road.
16.6	Esker crosses road.
17.4	Youngs Point.
17.5	Trent Canal and locks.
19.0-19.3	Crossing the Dummer stony moraine; this is composed of many blocks of Black River limestone eroded by glacial action from the adjacent limestone plains.
19.7	Excellent Dummer stony moraine.
20.5	Boulder field of stony moraine.
20.9	Black River limestone pavement on the right.
22.0	Black River limestone ledge on the left side of the highway.
22.7	Descend from the Black River scarp.
23.0	Precambrian granite gneiss.
23.4	Burleigh Falls bridge. At Burleigh Falls (Photo 17) we leave the flat lying Paleozoic limestone terrain of central Ontario and cross the southern edge of the great Canadian Shield, an area of ancient Precambrian crystalline rocks, which in this region were formed some 1,000 million years ago, before and during the Grenville orogeny or period of mountain building which affected this area. Rock exposures are abundant behind the Park Hotel and along the shores of the river below the bridge. There are excellent exposures of granite migmatite, a granitized gneissic rock formed by the injection and permeation of granitic material and granite pegmatite into the country rock, which here consists of paragneiss and amphibolite. Minor faulting of amphibolite bands

Photo 17 Burleigh Falls at Highway 28 in the Kawartha Lakes region (Courtesy Ont. Dept. Tourism and Information)

can be seen, and some bands of amphibolite are broken up and "floating" in a granitic matrix. Several granite pegmatite dikes, a few feet in width, cut the migmatite gneisses. This is a classic exposure to view the effects of granitization.

24.2 Amphibolite and biotite amphibolite are granitized and intruded by dikes of granite pegmatite.

24.4 Here are good exposures of hybrid granite gneiss—a migmatite complex. Outcrops are cut by narrow granite pegmatite dikes. Some of the gneiss bands are rich in epidote.

24.6 Excellent exposures of typical granite migmatite.

25.6 Silicated marble is cut by granite pegmatite. This is a good locality to see serpentinized marble containing diopside, tremolite, actinolite and salmon calcite.

25.9 Exposures of pyroxene granulite and amphibolite.

26.0 White coarsely crystalline marble is cut by a basic dike now altered to amphibolite.

26.7 Green diopside marble is transitional to calcareous pyroxene granulite.

27.2-28.1	Here is an outlier of Paleozoic Black River limestone resting on the Precambrian crystalline rocks.
28.8	The Pamelia formation of the Black River Group is exposed. This is a good exposure to see variegated red and green shales and the basal clastics which rest on the Precambrian surface.
30.4	Here is a silicated marble roadcut. Excellent exposures show granite dikes up to 10 feet wide cutting silicated marble with little or no contact metamorphism. On the west face of the roadcut toward the north end, the relative ages of the basic and granitic dikes are shown. The granite dikes cut the basic amphibolite dike which itself cuts the marble.
30.7	Haultain Creek.
31.0	A roadcut exposes layered silicated marble cut by granite dikes.
32.4	Eels Creek park.
36.5	Exposures of bedded amphibolite and paragneiss.
38.1	Here is a marble tectonic breccia with fragments of paragneiss and amphibolite.

Photo 18 Aerial view of Paudash Lake, Highway 28 can be seen in the northeast corner. (Coutesy Ont. Dept. Tourism and Information)

40.5 Apsley turnoff.

40.6 Exposures of rusty paragneiss.

42.8 Exposures of hornblende paragneiss.

47.3 Amphibolite and paragneiss are cut by pink granite pegmatite with some granitization.

47.4 Eels Lake road.

48.5 Hornblende paragneiss of the Hermon Formation is exposed.

49.0 The Hermon paragneiss is cut by granite.

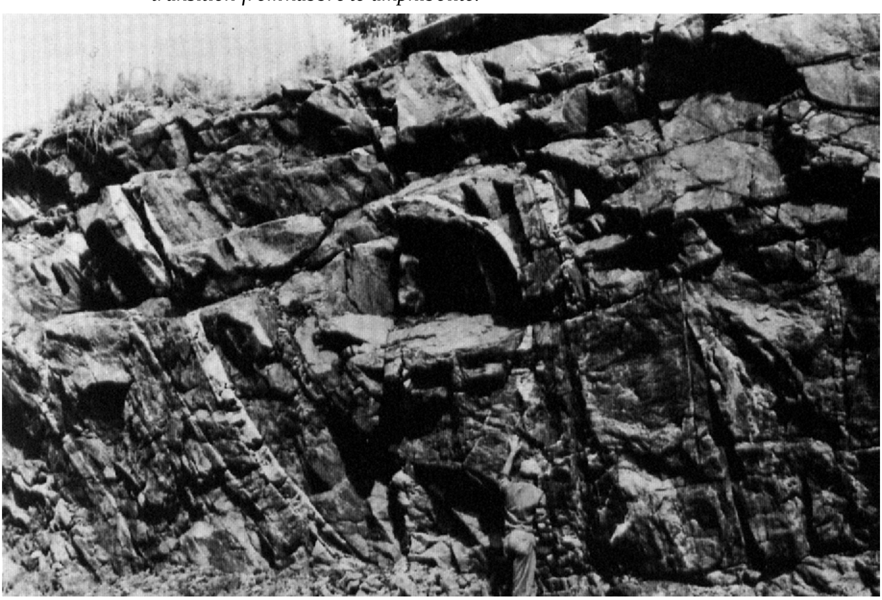
52.6 Dyno turnoff.

53.6 To the left of the road lies Paudash Lake, a large expanse of water with over 100 miles of shore line. The lake is good for bass, walleye and trout fishing (Photo 18).

54.9 Here is a very good exposure of marble showing secondary calcite-filled fractures. Lineation on the bedding surface has a regional southeasterly plunge.

59.7 Bicroft mine turnoff, Highway 121.

Photo 19 Faraday metagabbro roadcut on Highway 28 near Bancroft showing transition from nabbro to amphibolite.



60.1 Pink arkose of the Hermon formation is exposed.

60.8 A lane here runs south ¼ mile to extensive outcrops of pink arkose of the Hermon formation.

62.3 Blue scapolite occurs in biotite-scapolite gneiss. The scapolite, which is grey-green when freshly broken, turns bright blue on exposure to sunlight. The associated skarn assemblage includes calcite, garnet and epidote.

62.9 Faraday Uranium mine. Many fine specimens have come from this mine including uraninite, uranothorite, betauranophane, calcite and selenite. See p. 70, Geology of Cardiff and Faraday Townships by D. F. Hewitt 1957 listed under references.

63.6 Flinty crush rock is developed in this roadcut where the mylonite zone which forms the westward extension of the McArthurs Mills fault cuts amphibolite and granite. The fault is a slide or gravity fault on which the upper or south side has moved down towards the Hastings Basin to the southeast.

64.1 Nephelinized gabbro outcrops near Siddon Lake, ¼ mile northwest of the highway.

64.5 Another good exposure of epidotized mylonite is exposed along the fault zone.

64.7 Greyhawk uranium mine.

64.8 Here is an interesting exposure of marble tectonic breccia with fragments of quartzite in white marble.

65.5 The Faraday metagabbro outcrops in this roadcut (Photo 19). This is an excellent exposure to show the transition from fresh gabbro, with purple feldspar and fresh pyroxene, to metagabbro composed of an aggregate of recrystallized hornblende and plagioclase, and finally to amphibolite through the agency of dynamic metamorphism and shearing. Some mylonitization can be noted. Granite stringers cut the gabbroic amphibolite. Gravity faulting can also be observed. Metamorphic banding in the metagabbro is seen in an exposure on the north side of the road near the southwest end of the roadcut.

66.0 Monck Road turnoff.

67.8 Bancroft Hotel corner.

Photo 20 York River below Baptiste Lake (Courtesy Ont. Dept. Tourism and Information)

PART 3

The Bancroft Area

Bancroft and Vicinity

The Bancroft area is situated in the Madawaska Watershed just east of the Haliburton Highlands. The area lies between 1,000 and 1,800 feet above sea level and is noted for its scenic beauty and vacationing. Most of the area is accessible by road. Panoramic views of the hilly countryside and lakes can be had from the many lookouts that abound in the area. Lakes and rivers are noted for fishing and the region also offers good canoeing and hiking.

The village of Bancroft is located on the York river and with a population of 2,275 is the largest settlement in the northern part of Hastings county. It is a lumbering and farming centre, and is the market town for north Hastings. It is an important tourist centre in the summer months.

The village was developed in the 1850's and a water-powered woollen mill built around the same time, said to be the only one of its kind in Canada, is still operating in Bancroft (Photo 22). A log house also built around 1850 has been turned into a museum and stands on the bank of the York River within the town.

Bancroft is often referred to as the "Capital of the Rock Hounds". Every year it sponsors the Gem-Boree, a four day event which draws thousands of people who come to exhibit rocks and gems and comb the surrounding hills and old mine sites.

Bancroft is also an important uranium mining area but lack of markets caused a closure of mines in the early 1960's. However some mines are now being re-opened in readiness for further production.

MINING ACTIVITY

Iron

Prospecting and mining has been carried out in the area for over 80 years. The earliest mining in the area was for iron. The Coe Hill iron mine opened in 1880 and shipments were made from 1884 to 1887. The mine was responsible for the settlement of the village of Coe Hill and for the railway line to the village. Further small shipments of iron ore were made in 1900 and 1909, but the property has been inactive since 1910. In 1902 the Bessemer mine was opened in Mayo township, and was operated intermittently until 1913, with a total production of about 100,000 tons of magnetite ore. A small production of magnetite came from the Childs mine in 1913 and the Rankin property was also opened up at this time. In 1941 and 1942 these properties were re-examined by Frobisher Exploration Company and some exploration work was carried out. Further diamond drilling and magnetometer surveys were carried out by Ventures Limited in 1956 and a low grade body of over 20,000,000 tons of magnetite ore was outlined.

Corundum

Corundum was discovered in Carlow township in 1898 and in 1900 the Canada Corundum Company began production of corundum at Craigmont. Craigmont, the Burgess mines area in Carlow township, and the Jewellville area in Raglan township, were the centre of a flourishing Canadian corundum industry from 1900 to 1918. There was a small production of corundum from Craigmont mine during World War II.

Graphite

In 1880 a graphite showing on lots 1 and 2, concession II, Lyndoch township, was opened by Dan Moriarty of Eganville and was worked for a short time in 1917 by Beidelman and Lyall. In 1910 the Virginia Graphite Company opened a property in Cardiff and Monmouth townships near Wilberforce and built a mill which operated until 1913 when the property was taken over by Tonkin-Dupont Graphite Company. This mill was closed in 1914. In 1912 the New York Graphite Company developed a property near Harcourt and built a mill. This company was succeeded by the National Graphite Company which operated the mill with feed from its property near Maynooth in Monteagle township until 1916. The mill was operated again in 1919 but has remained idle since. In 1951 the Black Donald Division of Frobisher Limited drilled the National Graphite property near Harcourt and outlined an orebody of 1,440,000 tons grading 4.1 percent carbon. The Maynooth property of National Graphite and Tonkin-Dupont Graphite Company was dewatered and drilled in 1952 and 1953 and again in 1962.

Molybdenum

In 1907 molybdenite was discovered at Mining Mountain in Lyndoch township and the Jamieson mine was opened up on lot 5, concession VIII. There was a small production from this mine in 1915 and 1916 by the International Molybdenum Company. The McCoy molybdenite mine on lot 34, concession II, Lyndoch township was worked in 1916-17 and again in 1937-38. From 1939 to 1942 Edgemont Molybdenite Mines Limited explored a molybdenite deposit in lot 27, concessions IX and X, Raglan township, near the village of Schutt. A shipment of molybdenite was made in 1942.

Several small molybdenite properties in Cardiff township were opened up between 1910 and 1917. The Orr-Kidd property was active in 1914 and 1915; the Paudash Lake property in 1917; and the Evans property, discovered in 1907, was operated by M. J. O'Brien from 1910 to 1914. The Joiner property was opened in 1917, passed into the hands of Cardiff Molybdenite Mines in 1920 and was acquired in 1922 by United Molybdenite Corporation. In 1935 the property was acquired by Shallberg Molybdenite Company and in 1936 it was optioned and tested by Ventures Limited. Some further exploration was done on the property in 1965. The Brough Lake molybdenite mine was opened by Brough Lake Molybdenite Limited in 1937.

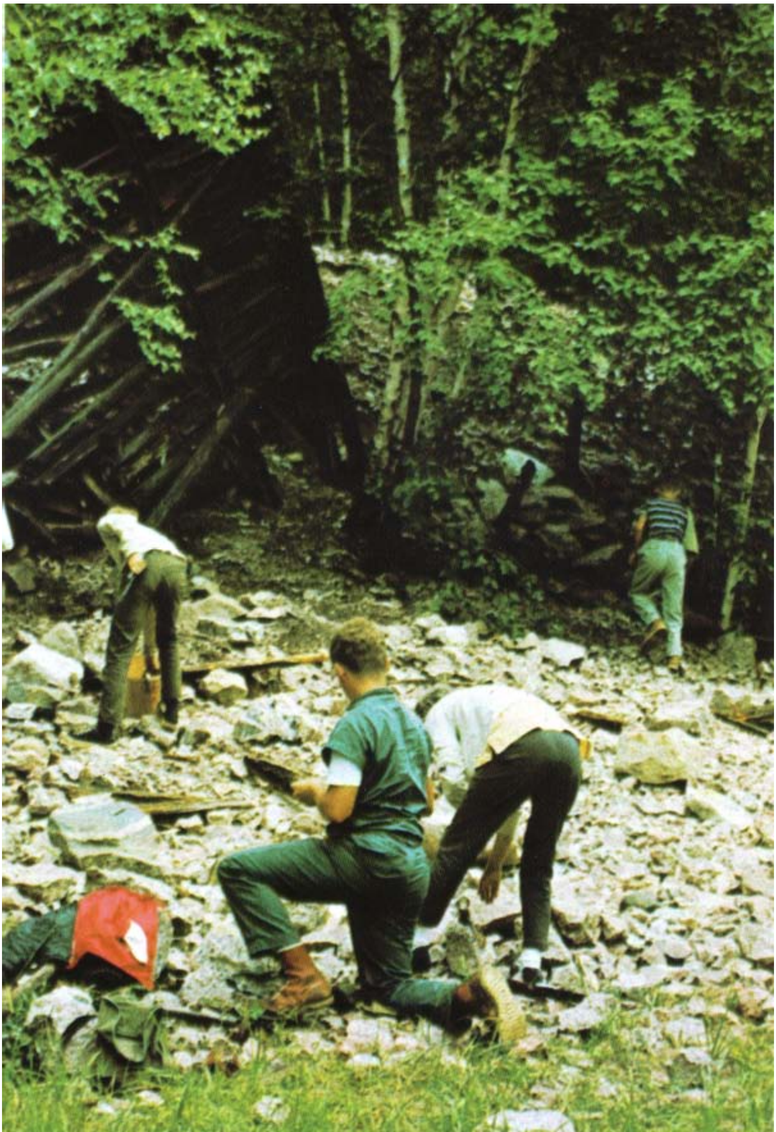


Photo 21 Young rockhounders in the Bancroft area. (Courtesy Ont. Dept. Tourism and Information)

Feldspar and Beryl

Two interesting granite pegmatites carrying beryl and feldspar as the principal commercial minerals were mined in northern Lyndoch township. These occurrences were first described by Willet G. Miller in 1897, but no work was done until 1926 when T. B. Caldwell of Perth opened the pegmatite on lot 23, concession XV, Lyndoch township and produced a small amount of beryl. Feldspar was mined from the beryl pegmatite on lot 30, concession XV, Lyndoch township, in 1935 and 1936 by Renfrew Minerals Limited. Beryl and feldspar were produced from both these properties intermittently from 1937 to 1950 by Canadian Beryllium Mines and Alloys Limited.

In the 1920's the Hybla area of Monteagle township became the centre of a flourishing feldspar mining industry with 14 small mines within a 2 mile radius of the large MacDonald feldspar mine. The MacDonald mine, located on lots 18 and 19, concession VII, Monteagle township, produced 35,048 tons of feldspar from 1919 to 1935. Feldspar mining continued intermittently in the area until the early 1950's, but no mines are now active. These feldspar pegmatites carry an interesting assemblage of rare elements and radioactive minerals.

Nepheline Syenite

From 1937 to 1942 there was considerable mining activity in nepheline syenite and nepheline syenite pegmatites in Dungannon township. The Golding-Keene quarry on lot 12, concession XI on the York River was opened in 1937 and operated intermittently until 1942 by the Golding-Keene Company of Keene, New Hampshire. In 1937 this company also opened the Vardy quarry on lot 23, concession XIV, Dungannon township, and over 11,000 tons of nepheline syenite was shipped from these two properties.

In 1939 Temagami Development Company opened the Morrison quarry on the east side of the York River near Egan Chute and in 1939 and 1940 produced over 1600 tons of nepheline pegmatite. This property was purchased by Ventures Limited and in 1941 and 1942 considerable trenching and diamond drilling was done.

In 1940 the Canadian Flint Spar Company opened the Davis quarry on the east side of the York River, 2½ miles north of Highway 500. A small quantity of nepheline pegmatite was quarried in 1940 and 1942.

Fluorspar

A number of fluorspar deposits were opened up in northern Cardiff township. In 1918 P. J. Dwyer mined 180 tons of fluorspar ore from the Dwyer property. Topspar Fluorite Mines, Cardiff Fluorite Mines, Fission Mines and F. K. Montgomery also opened calcite-fluorite veins in the area but there was little production.

Photo 22 Water-powered woolen mill at Bancroft. (Courtesy Ont. Dept. Tourism and Information).

Marble and Sodalite

Ontario Marble Quarries operated four marble quarries in Dungannon and Faraday townships for many years and supplied marble for several public buildings including the parliament buildings at Ottawa and Toronto. These quarries were opened in 1908 and operated intermittently until the late 1930's. Sodalite decorative stone was produced from the Princess quarry in lot 25, concession XIV, Dungannon township in 1906. The quarry was reopened by Carl Bosiak about 1961.

Photo 23 Sodalite from the Princess sodalite mine near Bancroft (Courtesy Ont. Dept. Tourism and Information)

Photo 24 Granite gneiss cliffs leading up to Eagles Nest lookout just outside Bancroft. (Courtesy P. A. Wisbey)

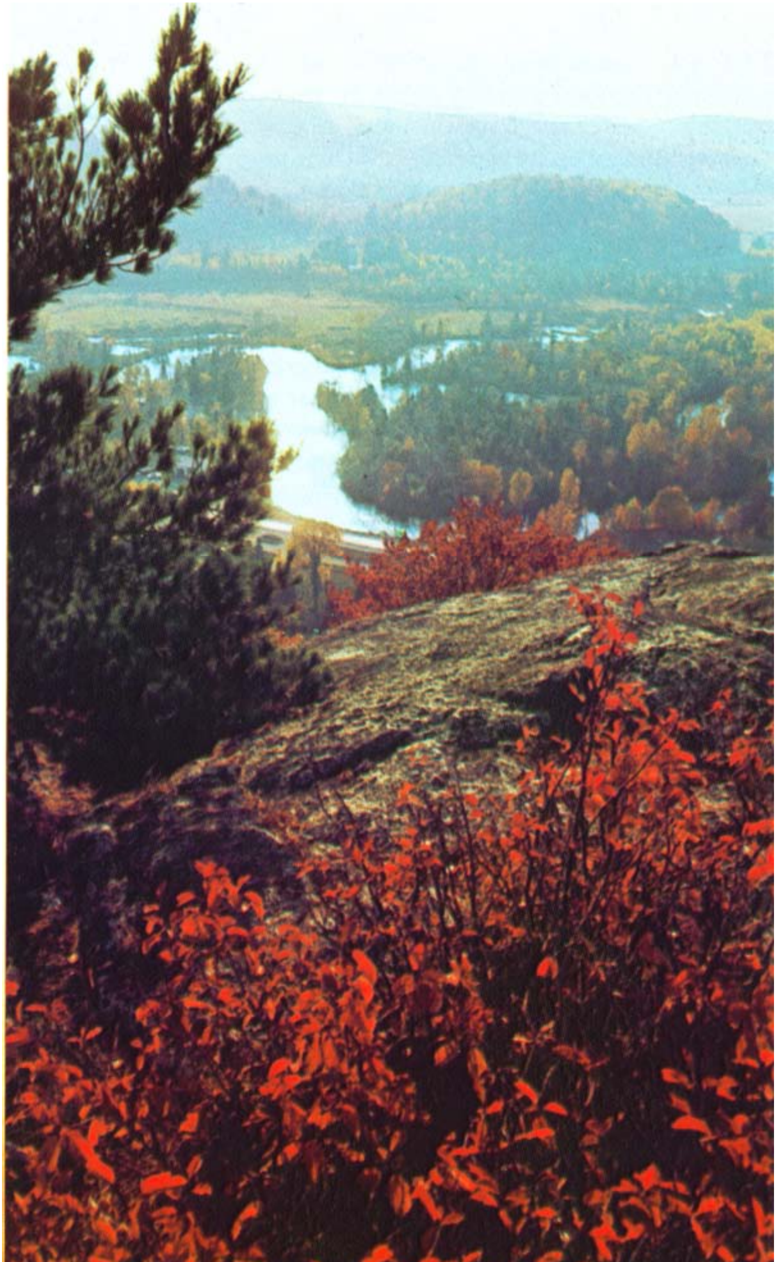


Photo 25 View from Eagles Nest lookout showing the meandering York River. (Courtesy Ont. Dept. Tourism and Information)

Mica

There was a small production of black mica from Bancroft Mica and Stone Products property on lot 31, concession XV, Faraday township, in 1927 and from 1946 to 1951 when there was a small mica trimming shop set up at Bancroft. The property later became famous to mineral collectors as the Silver Crater betafite locality.

Uranium

Radioactive minerals have been known in the Bancroft area for many years. In 1922 W. M. Richardson discovered uraninite on what became the Fission property at Wilberforce in Cardiff township. From 1929 to 1931 this property was operated by Ontario Radium Corporation and its successor, International Radium and Resources Limited. They did extensive underground development from an adit and built a 150 ton mill which never operated successfully. The property was reopened in 1947 by Fission Mines and exploration was carried on until 1949. Further exploration was done in 1954 and 1955. This was the first explored uranium property in the area.

From 1932 to 1936 and from 1939 to 1942 Canada Radium Mines carried on underground exploration and development on a property at Cheddar in Cardiff township. In 1939 and 1940, a 100 ton mill was built on the property but closed after test runs. In 1954 and 1955 further exploration and diamond drilling was carried out.

Although these two operations were pioneers of uranium exploration in the area, it was not until 1953, when Centre Lake Uranium Mines began underground development that the Bancroft area became the scene of a major uranium prospecting rush. Between the years of 1953 and 1956 a large number of uranium prospects were opened up in the area. Satterly's 1957 report describes 125 of these prospects and details of these operations may be obtained from the report.

Of the 125 uranium prospects in the area, four became producers and only two produced substantial amounts. These two were Bicroft Uranium Mines and its successor, Macassa Gold Mines, Bicroft Division, and Faraday Uranium Mines and its successor, Metal Mines Limited, Bancroft Division. The Bicroft mine produced from 1956 to 1963 and the Faraday mine from 1957 to 1964. Canadian Dyno Mines produced from 1958 to 1960, and Greyhawk Uranium Mines produced from 1957 to 1959.

Total production of uranium oxide in the Bancroft area from 1956 to 1964 was 11,030,368 pounds valued at $105,503,124.

The Faraday uranium property was discovered in 1948 by Arthur Shore. Sampling and surface work was carried out and diamond drilling began in 1952 under the management of Newkirk Mining Corporation. Underground workings were started in 1954 and production began in April, 1957.

The Bicroft mine was discovered by G. W. Burns in 1952. Late in 1952 C. C. Huston took charge of the exploration and underground work began in 1953. Production began in late 1956.

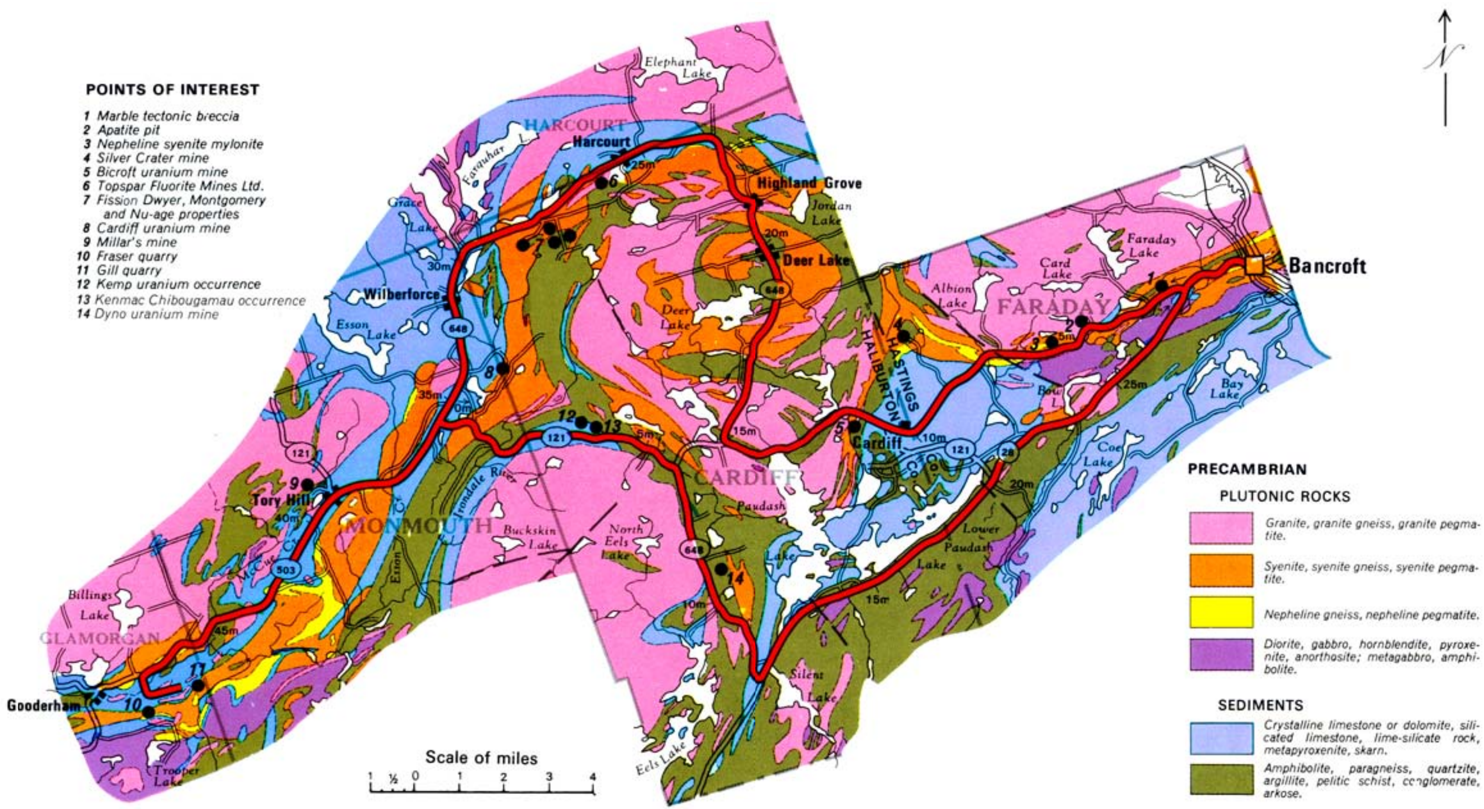


Figure 9 Geological and route map of Bancroft Trip 1.

Bancroft Trip 1

BANCROFT TO MINERAL COLLECTING LOCALITIES WEST OF HIGHWAY 28

This trip goes west from Bancroft to cover parts of Faraday, Cardiff, Monmouth and Glamorgan townships visiting such mineral collecting localities as Harcourt, Wilberforce, Tory Hill and Gooderham.

Mileage	
0	Bancroft Hotel corners. Proceed west on Highway 28.
1.8	Monck Road turnoff, turn right and follow Monck road to west. This is part of the military and colonization road built by General Monck in the early 1860's.
2.3	On the north side of the road there is a hill with beautiful exposures of marble tectonic breccia (Photo 26). These are in a field a few hundred feet north of the road. Weathering causes fragments of paragneiss, amphibolite and granitic rocks to stand up in relief above the marble.

Photo 26 Marble tectonic breccia on Monck Road.

4.1 The Faraday granite stands up in a high ridge north of the road. The farm belongs to Miner Card and an apatite pit near the house has crystals of apatite up to 1 foot long, with calcite, pyroxene, hornblende and zircon in a fissure vein in the granite.

5.5 There is a house on the right. On lot 20, concession B, Faraday township about 1000 feet north of this house there are some excellent exposures of nepheline syenite mylonite (Photo 29). The nepheline syenite is strongly sheared and characterized by streaky banding. Undestroyed eyes of nepheline syenite occur in a streaky, banded, grey to black cherty mylonite matrix. Along certain narrow veins and streaks parallel to planes of movement, the mylonite has fused or fritted into black vitreous ultramylonite which is isotropic in thin section.

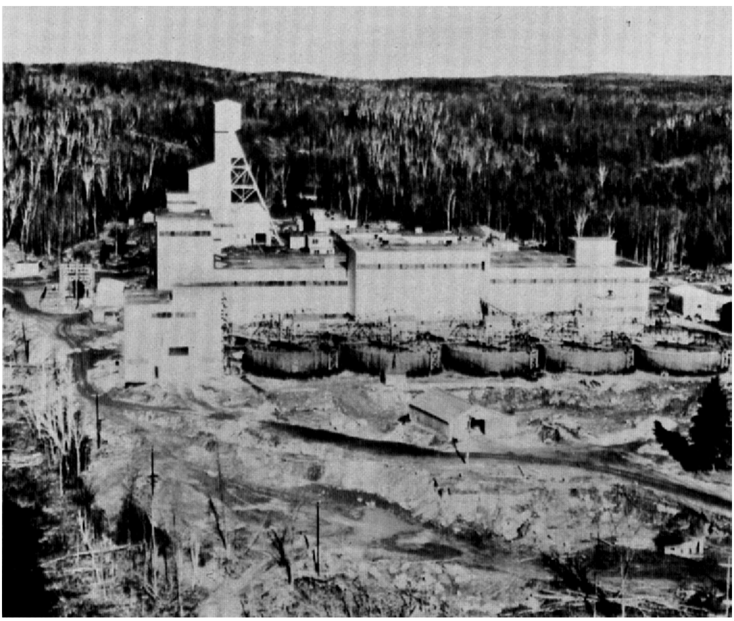
7.4 You are crossing the Littlefools Lake nepheline syenite band. There are good exposures of the nepheline syenite gneiss beside the road.

8.4 Turnoff to Silver Crater mine. The mine is two miles by poor road north from the Monck road. Black mica was produced by Bancroft Mica and Stone Products from an open pit in a carbonate body in lot 31, concession XV, Faraday township in 1927, and from 1947 to 1951. Mica valued at $28,189 was shipped. In 1953 radioactivity was discovered on the property and betafite crystals were identified in the carbonate body. The property was taken over by Silver Crater Mines Limited (Basin property). An adit with 435 feet of drifting and crosscutting was driven and an abundance of carbonate rock carrying betafite, apatite, mica, hornblende, fluorite, titanite and feldspar was excavated. The deposit is a well known collecting locality for betafite crystals, (Photo 30) some as large as 3 to 4 inches having been found. More details are given in the report on Cardiff and Faraday townships by D. F. Hewitt 1957 listed under references.

10.0 Cardiff townsite

10.4 Highway 121. Bicroft uranium mine is a mile west of Highway 121 at this point (Photo 27). Granite and

Photo 27 Bicroft uranium mine about 1956.

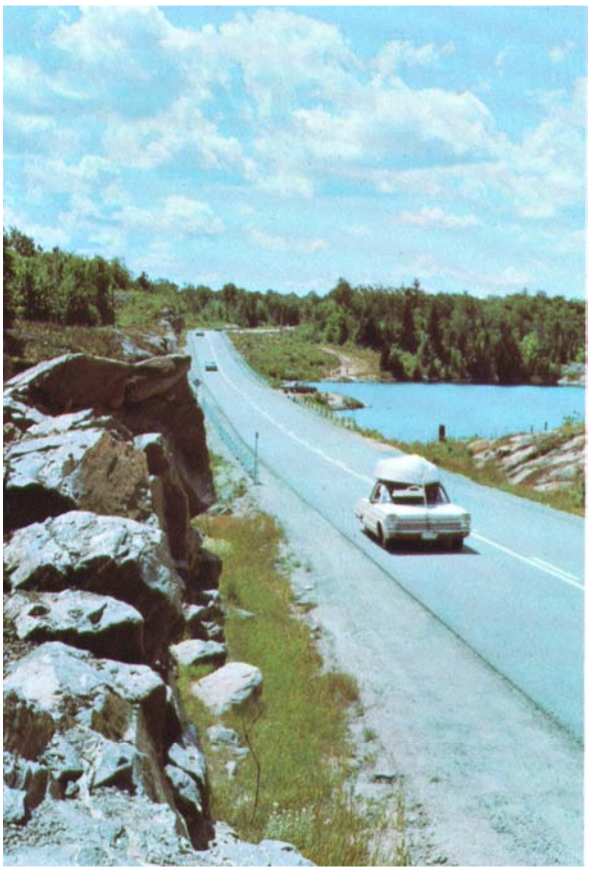


syenite pegmatite dikes carrying uranothorite, uraninite, allanite and pyrochlore. Apatite, fluorite, calcite and zircon are also found. Some of the dikes cut an interesting garnet-sillimanite gneiss. (Hewitt, 1957, p. 58). Follow Highway 121 west.

11.6 Some of the original discovery pits on the Bicroft property are on the hill to the right of the road. Uraninite crystals were found in a mica pit at this locality.

11.9 Centre Lake granite sheet. Pink leucogranite gneiss. This is the granite footwall for the uranium-bearing sedimentary zone.

Photo 28 Highway 121 near Cardiff. (Courtesy Ont. Dept. Tourism and Information)



15.0 Junction of Highways 121 & 648. Turn right and follow Highway 648 north.

17.1 Crossing outcrops of Deer Lake syenite.

21.0 Highland Grove.

26.0 Harcourt. The Clark property, later Topspar Fluorite Mines Limited, is just south of the road on lot 13, concession XXII, Cardiff township. Lenses of calcite and fluorite fill a fissure vein in syenite pegmatite. Excellent large crystals of scapolite, apatite, pyroxene and feldspar line the vein. Some optical grade fluorspar was produced from the property.

28.0 Side road on south side of road leads to the Fission, Dwyer, Montgomery, and Nu-Age properties. These properties are calcite-fluorite-apatite veins with associated uraninite and uranothorite. These well known mineral collecting localities are fully described in the Cardiff and Faraday report.

31.0 Wilberforce. Follow Highway 648 south.

33.0 Turnoff at Wilbermere Lake. Proceed 1 mile east on gravel road to Cardiff uranium mine. Here a calcite-fluorite-apatite vein carrying uraninite crystals has been mined and good mineral specimens have been obtained. A mile north there are other workings in syenite pegmatite where zircon crystals are abundant.

35.2 Junction of Highways 648 and 121.

37.0 Otter Creek sill. A sill of nepheline syenite crosses the road. Much of the nepheline is altered to pink hydronephelite and green “gieseckite”. Remarkably good syenitization of the nepheline syenite along joints can be seen on the hill to the north of the road.

39.0 Tory Hill. A good collecting locality for apatite, feldspar, hornblende and titanite crystals is Millar's mine on lot 15, concession XI, Monmouth township, on the hill north of McCue Lake. This is a fissure filling calcite vein carrying apatite, with hornblende, feldspar and titanite lining the vein walls, as described in Mineral Occurrences in the Haliburton Area by J. Satterly 1943.

47.0 Road goes south from Highway 503 to Fraser and Gill nepheline pegmatites. Proceed south for ½ mile

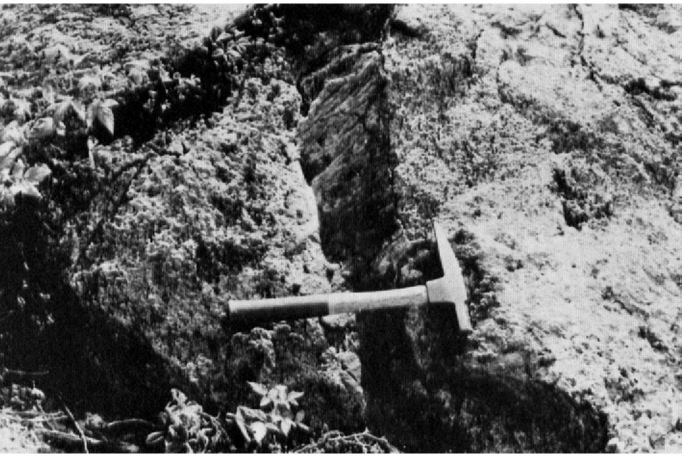


Photo 29 Nepheline syenite mylonite near Monck Road.

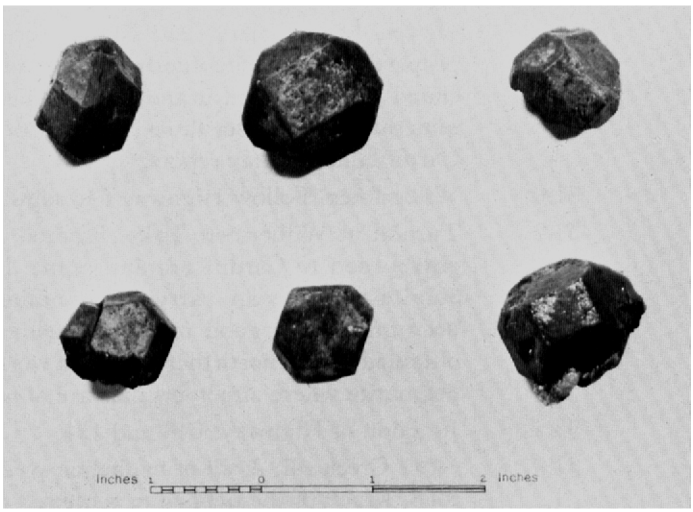


Photo 30 Betafite crystals, Silver Crater mine, Faraday township.

Photo 31 Large terminated apatite crystal from the carbonate body, Silver Crater mine. Note the biotite books (black) scattered through the carbonate.

to the point where the road turns east. A trail proceeds south to the Fraser quarry, which is in a nepheline pegmatite composed of nepheline, albite, biotite, hornblende, and calcite with minor zircon, sodalite and corundum. The quarry is on lots 29 to 31, concession IV, Glamorgan township.

The Gill quarries are reached by proceeding east on the road to its termination and walking 1000 feet by wagon road to a hill overlooking Laronde Creek on lot 34, concession IV, Glamorgan township. There are 2 nepheline pegmatite quarries composed of nepheline, cancrinite, albite, biotite and calcite with accessory zircon, cancrinite, apatite and sodalite. Zircons over 1 inch in size have been found at these quarries. Further descriptions on the Fraser and Gill quarries may be found in Nepheline Syenite Deposits of Southern Ontario by D. F. Hewitt 1960. Return via Highway 121 to junction of Highways 648 and 121.

0 Junction 648 and 121. Follow 121 towards Bancroft. Two interesting mineral collecting localities may be found near this road. These are the Kemp uranium occurrence and the Kenmac Chibougamau occurrence.

The Kemp uranium occurrence is on lot 5, concession XIV, Cardiff township. Uranothorite and doubly terminated thorite crystals in pyroxene carbonate skarn are found in one trench.

At the Kenmac Chibougamau mine on lot 6, concession XIV, Cardiff township, an adit and several test pits have been put into the side of the hill. Some excellent tabular shaped crystals of uranothorite up to 4 inches long occur with apatite and biotite in syenite pegmatite.

6.0 Highway 648, turn right towards Dyno mine on Highway 648.

9.1 Dyno uranium mine. Uraninite and uranothorite occur in granite pegmatite dikes composed of peristerite, perthite and quartz, with pyroxene, titanite, zircon, allanite and magnetite.

12.1 Junction Highways 648 and 28. Return north to Bancroft.

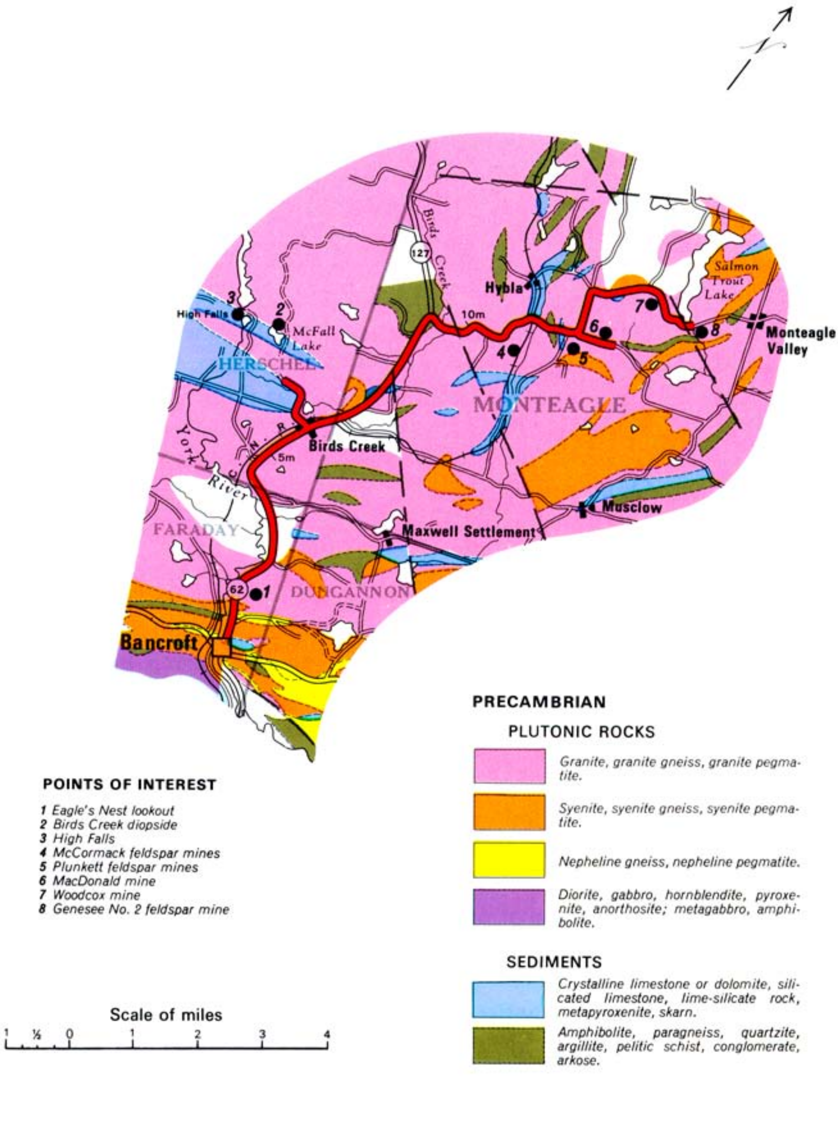


Figure 10 Geological and route map of Bancroft Trip 2.

Bancroft Trip 2

BANCROFT TO HYBLA PEGMATITE DISTRICT

This trip goes north of Bancroft to Monteagle townshiip to visit the well-known Hybla pegmatite district. Many of these pegmatites carry amazon-stone, and a variety of rare element and radioactive minerals.

Mileage

0	Bancroft Hotel corners. Follow Highway 62 north.
1.3	To the east a winding road leads off to "Eagles Nest" a 600 ft. rock formation which overlooks the town of Bancroft and the York River basin. The view from the top is spectacular; there is also picnic facilities. (Photos 24, 25).
3.3	Roadcut exposes metamorphic pyroxenite and silicated marble. Vugs have yielded good crystals of hornblende, apatite, calcite and pyroxene.
6.0	Birds Creek. The Birds Creek diopside locality is described by A. P. Sabina (1964, p. 81) as follows: "Green, stubby, doubly-terminated crystals of diopside

Photo 32 High Falls on the York River at Baptiste Lake. (Courtesy Ont. Dept. Tourism and Information)

are associated with pink calcite in crystalline limestone. The crystals measure up to 3 inches in length. Some are reported to be transparent and of gem quality. The deposit is exposed by a small pit on the side of a cliff overlooking McFall Lake. Proceed west from Birds Creek to the first road leading north (a distance of ¼ mile). Follow this road across Birds Creek and beyond two farmhouses where the road ends. From here a trail leads north along the east side of McFall Lake. Follow this trail to the north end of the lake. At this point where fragments of calcite are noted in the bush, leave the trail and proceed up the hill to the main deposit. The total distance from Birds Creek on Highway 62 is 2 miles."

High Falls may be visited by proceeding west from Birds Creek 1¼ miles, turning north at the intersection and continuing a further 1½ miles to the dam. (Photo 32).

9.0 Hybla turnoff. Turn right off Highway 62.

10.3 Road intersection. McCormack feldspar mines: Two small feldspar mines are located on the west side of the railroad 1600 and 2000 feet south of the road intersection. The north dike contains amazonstone, graphic granite, biotite, hornblende, magnetite, titanite, allanite and ellsworthite. More detailed information on the occurrences described in this trip is given in the report on Monteagle and Carlow townships listed under references.

11.1 Turn right and proceed east on gravel road.

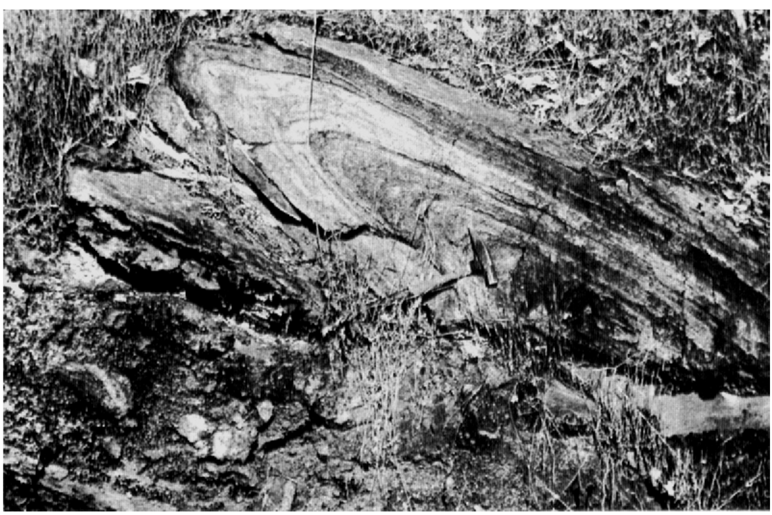
11.8 Road intersection, turn left.

11.9 Road intersection, turn right and park. Plunkett feldspar mines: Two small feldspar pits are on lot 20, concession VI, Monteagle township. Some amazonstone, ellsworthite, euxenite, titanite, garnet and purple fluorite occur in the granite pegmatite.

12.3 MacDonald mine on left. The mine is located on lots 18 and 19, concession VII, Monteagle township. Between 1919 and 1935 it produced over 35,000 tons of feldspar. This is an excellent example of a zoned granite pegmatite. The chief constituents are microcline microperthite, albite and quartz. Accessory minerals include ellsworthite, cyrtolite, allanite, garnet, titanite, pyrite and pyrrhotite. Some peristerite and amazonstone have been reported. This was the locality where ellsworthite was first discovered, and is one of the largest pegmatite mines in Ontario. Turn around and return west on gravel road to the first intersection. Turn right and proceed ⅝ of a mile to a road intersection. Turn right and proceed one mile to the Woodcox mine.

This granite pegmatite is 500 feet south of the road on lot 17, concession VIII, Monteagle township. This granite pegmatite has yielded amazonstone, peristerite, hornblende, magnetite, biotite, titanite, pyrite, columbite, ellsworthite, allanite and epidote. Proceed 1 mile east on the road to the foot of Salmon Trout Lake. The Genesee No. 2 feldspar mine is on the right side of the road. A large cavern has been excavated in the side of the hill exposing coarse granite pegmatite (Photo 1). The most abundant rock is graphic granite, with some albite, sericite, ellsworthite and pyrite. A limestone tectonic breccia occurs over the mouth of the pit. A dragfold truncated by a breccia-filled fault can be seen a few hundred feet north of the mine on a wagon road up the hill. (Photo 33). Return to Bancroft.

Photo 33 Dragfold truncated by a breccia filled fault in Monteagle township.



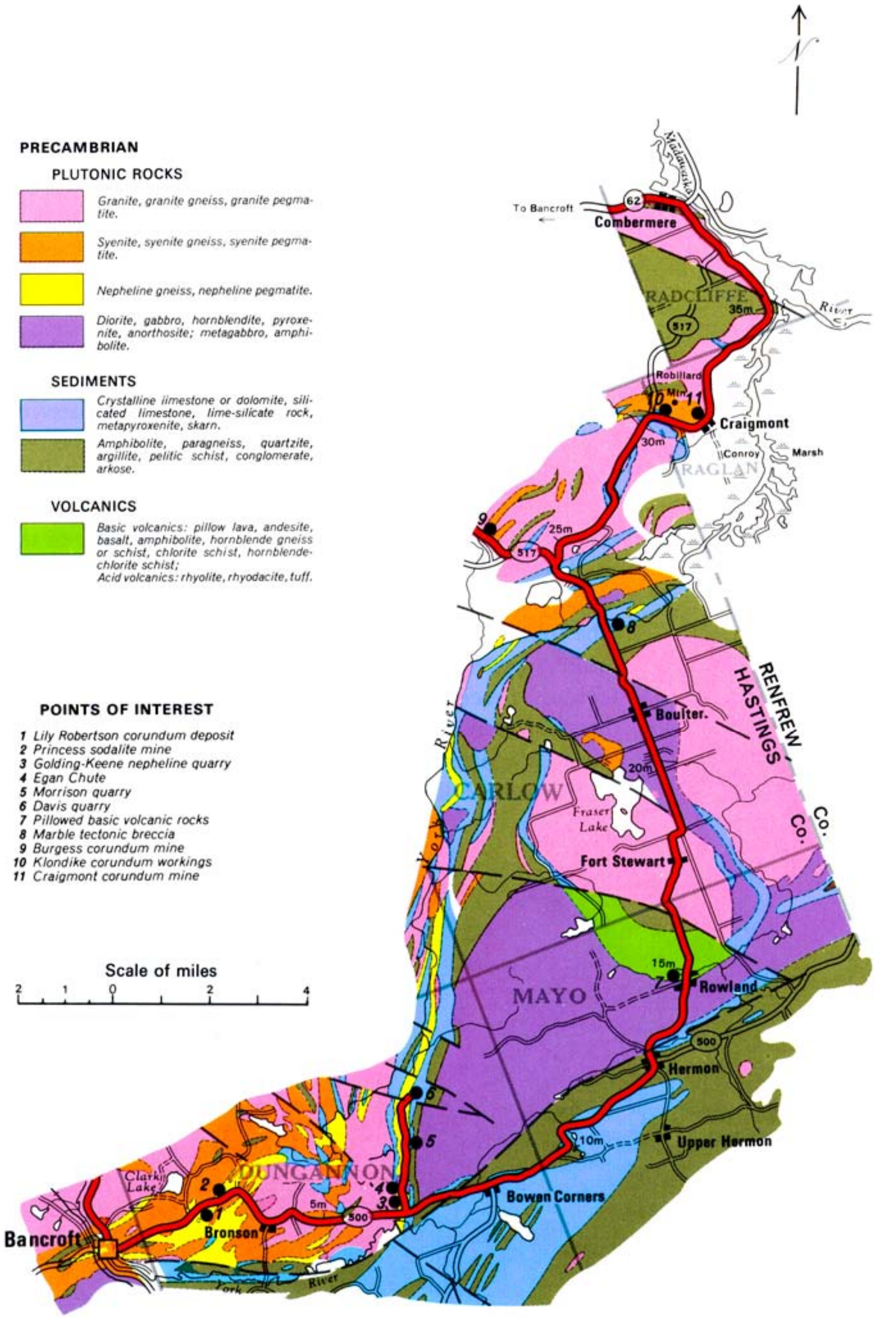


Figure 11 Geological and route map of Bancroft Trip 3.

Bancroft Trip 3

BANCROFT TO THE PRINCESS SODALITE MINE AND THE CRAIGMONT MINE

This trip covers the nepheline rocks of Dungannon township, the metamorphic and metavolcanic rocks of Mayo township, and the corundum ranges in north Carlow and northeast Raglan townships.

Mileage	
0	Bancroft Hotel corners. Proceed east on Highway 500.
2.3	Turn right into farm lane. Lily Robertson Cooney farm. Lily Robertson corundum deposit: walk west through the field and follow path to exposures on the north face of the hill. (Photo 35). Here in trenches is a good sequence of nepheline gneiss, pink syenite and paragneiss. Pegmatitic patches of corundum-nepheline-albite rock occur as replacement pods in the gneiss sequence. Very rich exposures of corundum-nepheline pegmatite are exposed. Nepheline mantles the corundum crystals which are up to 2 inches in size. These exposures are more fully described in Nepheline Syenite Deposits by Hewitt 1960. Return to farmhouse. Walk south on path ¼ mile to Cancrinite Hill. On the northwest face of Cancrinite Hill some blasting has exposed nepheline-albite gneiss altered to cancrinite and sodalite syenite gneiss. Return to car. Drive east to mileage 2.5.
2.5	Princess sodalite mine. Perhaps the best known and most visited mineral locality in the Bancroft area is the Princess sodalite mine operated since 1961 by Carl Bosiak on lot 25, concession XIV, Dungannon township. The mineral sodalite has a beautiful deep blue colour and is prized by lapidaries as an ornamental stone (Photo 23, 36). It is often found with yellow cancrinite and pink hydronephelite. As sodalite usually occurs along fractures in nepheline syenite as a secondary alteration product, it is difficult to obtain in large blocks.

The Princess quarry was opened in 1906 and 130 tons of sodalite rock were shipped to England for use as a decorative stone. There is an open cut about 200 feet long on a ridge consisting of medium-grained nepheline gneiss. Good nepheline crystals occur on some joint faces. Proceed east on Highway 500 to the York River.

6.8 York River. Turn left on the west side of the bridge and park in the clearing. York River section: This is a well-known and intensively studied section of nephelinized gneiss outcropping in the York River valley and striking northward with a steep easterly dip. Proceed north 100 feet up the road on the west side of the river to the Golding-Keene quarry: this qarry was operated from 1937 to 1939 and has been idle since. The quarry is in coarse nepheline pegmatite (Photo 34) consisting predominantly of nepheline and albite, with minor biotite, zircon, calcite, apatite, sodalite, cancrinite and hydronephelite. Walk north down the west bank of the York River to Egan Chute. About ¼ mile north of the Golding-Keene quarry

Photo 34 Contact of the nepheline gneiss with nepheline pegmatite (white) at the Goldinn-Keene quarry on the York River.

Photo 35 Corundum at Lily Robertson Cooney farm.

Photo 36 Sodalite in its natural state at Princess sodalite mine, Dungannon township. (Courtesy G. R. Guillet)

there is a small outcrop on the west side of the path which carries blue-grey corundum crystals up to two inches in size in nehpeline albite muscovite gneiss. Most of the corundum is mantled by silvery muscovite. Flecks of galena can be seen in the rock. Egan Chute: The nepheline gneiss-marble-paragneiss sequence is well exposed in the river bed at Egan Chute (Photos 37-38). Here is perhaps the best easily accessible series of outcrops to show the type of field evidence that has led many of the geologists examining these nepheline gneisses to conclude that replacement has played a part in their origin and emplacement. Return to car. Cross the river and turn left up narrow road to Morrison and Davis quarries. Skarn zone: About 200 yards north of Highway 500 there is a small pit on the hillside in a marble skarn zone overlying the nepheline gneisses. Crystals of essonite, diopside, vesuvianite, wollastonite, zircon, spinel, forsterite and chlorite, as

Photo 37 Dragfolding in gneiss at EganChute on the York River.

Photo 38 Folding in gneiss at Egan Chute.

well as masses of blue calcite and feldspar have been reported from this locality by Louis Moyd. Morrison Quarry: 1½ miles north on the road is the Morrison quarry in nepheline pegmatite. Some sodalite and cancrinite are present. Davis quarry: The road ends 2.2 miles north of Highway 500 at the Davis quarry. This nepheline pegmatite was opened in 1940. Zircon crystals up to 3 inches in size have been found here. It is a well known locality for hackmanite. From the Davis quarry an old trail runs west for 1 mile to the well-known blue corundum occurrences on a nepheline gneiss ridge overlooking the York river. Further information on this area may be found in Geology of Dungannon and Mayo townships by D. F. Hewitt 1955 listed under references. Return to Highway 500.

6.8 York River bridge. Proceed east on Highway 500.

11.8 Hill on north side of road is composed of sillimanite-bearing paragneiss.

12.8 Hermon.

14.8 Rowland Hill. Pillowed basic volcanic rocks may be seen on the hill to the west of the road. (Photo 39).

16.8 Climbing a ridge of grey Boulter granite.

17.8 Fort Stewart. Note the large outcrops of grey Boulter granite.

21.0 Boulter.

23.0 York River crossing. Outcrop of sheared grey Grenville marble on the west side of the road. Walk ¼ mile east along the south river bank to see marble tectonic breccia carrying fragments of nepheline gneiss. A few feet south of the river bank is an outcrop of Boulter gabbro cut by nepheline-albite stringers indicating a younger age for the nepheline rock.

24.5 Fork in road. Take left fork to Burgess corundum mine.

25.5 Road to Burgess mine on right. It is ⅝ of a mile on a poor road to the Burgess corundum mine. Large bronze-brown crystals of corundum occur in pink syenite pegmatite. This was one of the first corundum

Photo 39 Pillowed basic volcanic rocks at Rowland Hill.

Photo 40 View of Robillard Mountain and Craigmont.

Photo 41 Papineau Creek at Maple Leaf along Highway 62.

mines in the area, being discovered in 1896. A small townsite formerly existed at the mine. More details are given in the report on Monteagle and Carlow townships by D. F. Hewitt.

25.5 Turn around and proceed east to Craigmont.

26.5 Road forks, take left fork.

29.5 Klondike corundum workings are visible straight ahead on the southwest face of Robillard Mountain. Burgess Mountain is on the left.

30.2 Turn right at abandoned schoolhouse.

30.6 Park car. Climb hill to Klondike workings.

In 1900 this mine was opened to produce the first corundum mined in Ontario. The village of Craigmont, named after the vice-president of the company, came into being at the foot of Robillard Mountain. Mining continued intermittently until 1913. See Hewitt (1953, p. 56). The mining at Robillard Mountain is dealt with more fully in the report on Brudenell-Raglan Area by D. F. Hewitt listed under references.

At the Klondike and Craigmont corundum workings evidence is seen of the replacement of early nepheline-plagioclase gneisses by pink and buff syenites, and the development of corundum in these replacement syenites. Evidence of the relative ages of the nepheline-plagioclase gneiss, the grey oligoclase-andesine-scapolite gneiss, and the pink and buff syenites and syenite gneiss is well shown in these workings. Corundum, scapolite, nepheline, garnet and magnetite are among the minerals to be collected. Return to car. Proceed east to Craigmont mine.

32.0 Craigmont mine.

From 1900 to 1913, 1919 to 1921 and 1944 to 1946, Craigmont mine produced corundum valued at $1,971,691. Corundum was mined from more than 20 open cuts on the side of Robillard Mountain.

Along the east wall of cut no. 1, the lowermost cut at Craigmont mine, we see massive, mottled pink and buff leucosyenite with abundant accessory magnetite, cutting and replacing a medium-grained granular grey scapolite-plagioclase gneiss. The grey scapolite gneiss contains about 2% corundum. Scattered corundum crystals from ¼ to 1 inch in size also occur in the pink syenite (Photo 42).

Climb to the lower pond cut, no. 2. The west wall above the pond shows a typical sequence of pink syenite gneisses. Just north of the pond, hybrid grey and buff corundum syenites appear in the section. Purple anhydrite occurs in vugs in the fractures just north of the pond.

The east wall of the cut exposes oligoclase-andesine gneiss grading northward into scapolite gneiss over a length of 200 feet. About midway up this cut there is a wide dike of pink granite pegmatite cutting the syenite sequence. The top of Robillard Mountain is an excellent site for viewing the surrounding countryside. To the southeast Conroy marsh spreads out along the York River for over 8 miles and is reported to be excellent for duck hunting and fishing. Return to car. Drive north on the river road to Combermere.

38.1 Combermere village and the Madawaska River. Return to Bancroft via Highway 62.

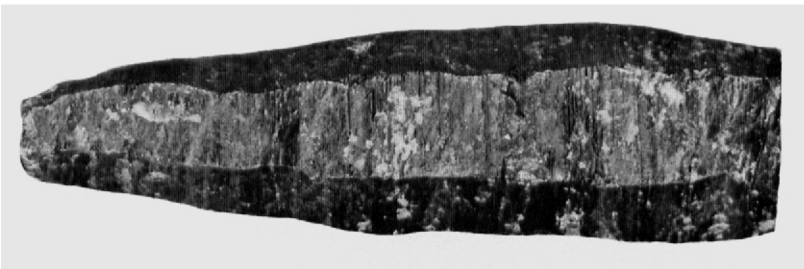


Photo 42 Hexagonal crystal of corundum from Craigmont, Renfrew township. (Courtesy of Geological Survey of Canada)

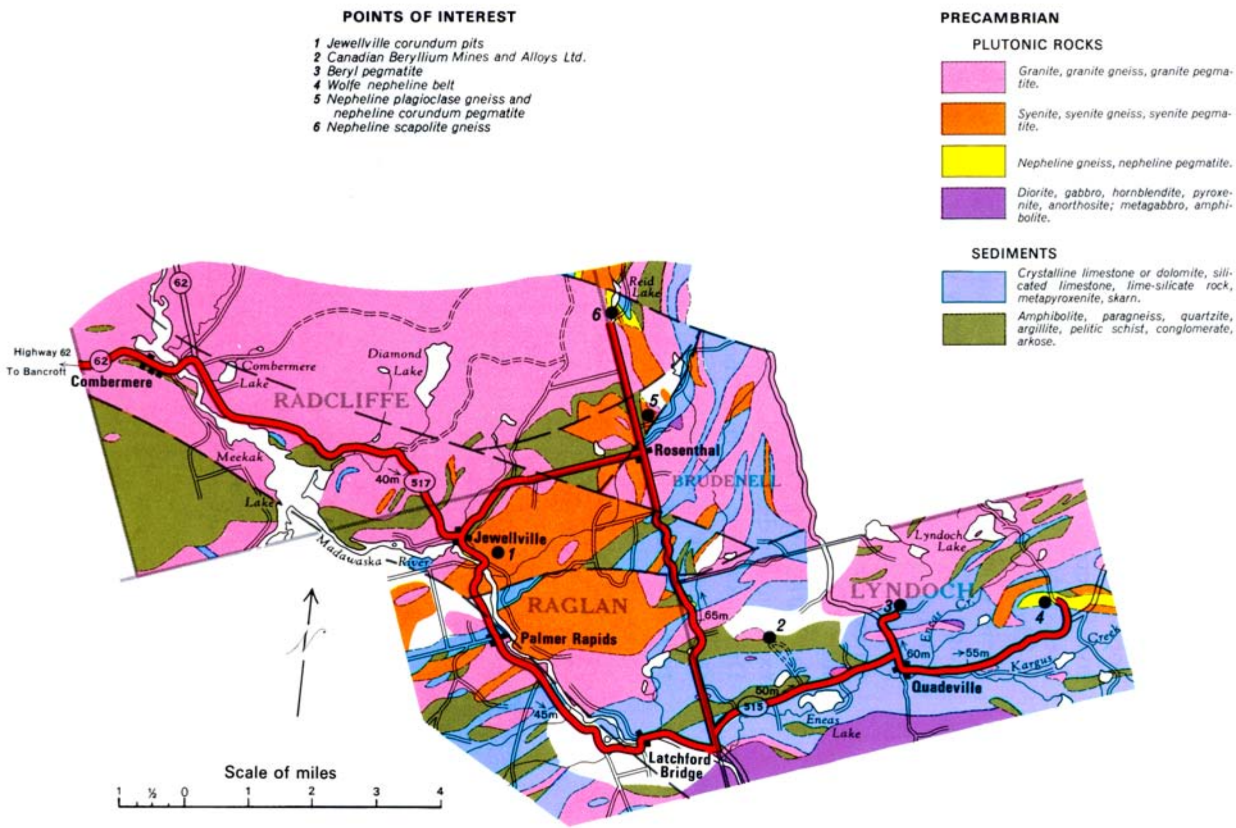


Figure 12 Geological and route map of Bancroft Trip 4.

Bancroft Trip 4

BANCROFT TO QUADEVILLE VIA COMBERMERE

This trip starts at Combermere and localities visited include the Jewellville corundum deposits, the Quadeville pegmatites, the Wolfe nepheline belt, and the corundum and nepheline deposits at Rosenthal and Rockingham.

Mileage	
0	Bancroft Hotel corners. Drive to Combermere on Highway 62.
35.0	Combermere village bridge.
35.2	Turn right and proceed east on Highway 515 to Jewellville.
42.1	Palmer Rapids bridge. Park car on road southeast of bridge on northeast side of the river. Jewellville corundum pits: The Jewellville corundum pits are located on a range of syenite ridges rising from the Madawaska River and extending northeast for a mile from the Palmer Rapids bridge. These mines were worked in 1917 and 1918. There are nine groups of pits on these ridges and all were connected to the mill site on lot 24, concession XVIII, Raglan township by tote roads.

The corundum deposits are of two types; corundum syenite pegmatite and corundum syenite. Some narrow bands of nepheline gneiss are present. For these, and other deposits in Lyndoch township more details may be found in the author's report on the Brudenell-Raglan Area listed under references. Return to car. Proceed on Highway 515 toward Quadeville.

43.1 Palmer Rapids.

47.1 Latchford bridge.

50.1 Eneas L. Turnoff for Canadian Beryllium Mines and Alloys Ltd. lot 30, concession XV, Lyndoch township.

Photo 43 Beryl crystal in feldspar from Quadeville, Lyndoch township. (Courtesy of Geological Survey of Canada)

The mine is about 1 mile by poor road north of Highway 515. lot 30, concession XV. This granite pegmatite has good rose quartz, microcline, microperthite, albite, muscovite, biotite, beryl, columbite and euxenite. Other minor accessory minerals are present. The dike is zoned. Proceed east on Highway 515.

51.6 Road intersection at Quadeville. Turn left and proceed north on gravel road.

52.8 Road on right at foot of hill leads ¼ mile to a beryl pegmatite on lot 23, concession XV, Lyndoch township. Lot 23, concession XV: This zoned granite pegmatite carries quartz, microcline perthite, amazonstone, cleavelandite, tourmaline, beryl, euxenite, columbite, cyrtolite, magnetite, garnet, fluorite, apatite and several other minerals. Return to Quadeville. Proceed east on gravel road to Wolfe.

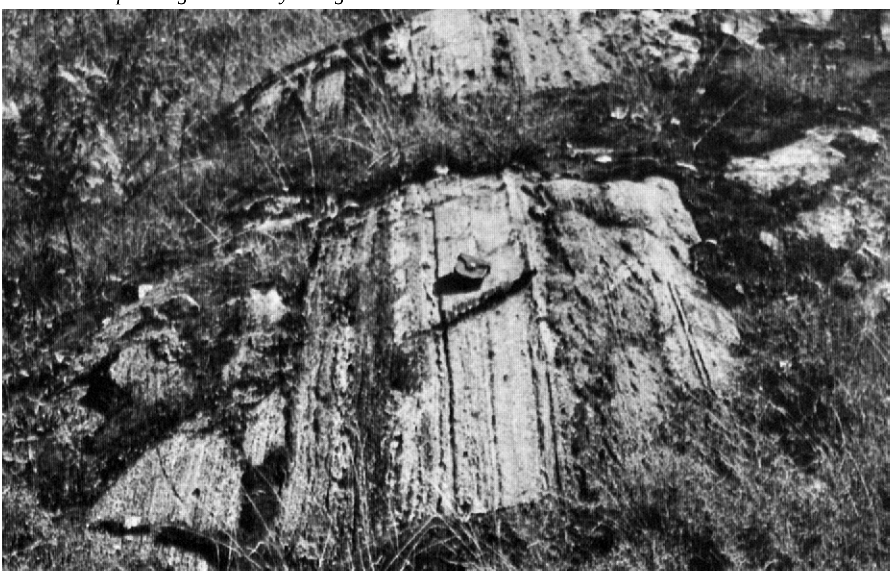
54.0 Quadeville.

57.0 Take road to left to Kargus farm. The hill ahead is the Wolfe nepheline belt which extends for 3 miles from the Kargus farm to Heiderman Lake. Two rock units are present on the ridge: nepheline-plagioclase gneiss and hornblende-plagioclase-garnet-scapolite rock. These rocks and the associated nepheline pegmatites are of great interest to the geologist. Return to Quadeville.

60.0 Quadeville. Proceed west on Highway 515.

63.0 Schoolhouse corners, turn right and proceed north on gravel road to Rosenthal.

Photo 44 Reid Lake nepheline scapolite showing the differential weathering of alternate scapolite gneiss and syenite gneiss bands.



68.0 Rosenthal.

68.6 Gutz farm. Park car.

Just south of the farmhouse on the top of the hill there is a 20 foot band of nepheline-plagioclase gneiss striking north-south and dipping 20° east. To the south along strike it is altered to pink syenite containing corundum. This is one of the best places to see this alteration along strike within a few feet.

Just south of the farm driveway a small pit exposes nepheline corundum pegmatite with long slender tapering crystals of grey-brown corundum up to eight inches in length.

At the bottom of the hill on the south side of the concession road there is a small corundum pit which shows good exposures of the pink, buff and grey facies of the corundum-bearing series. These rocks are cut by pink allanite granite pegmatite and yellow-brown hornblende-titanite pegmatite. Return to car. Drive north to Reid Lake.

70.1 Reid Lake nepheline-scapolite gneiss band.

Here at the south end of Reid Lake, between the

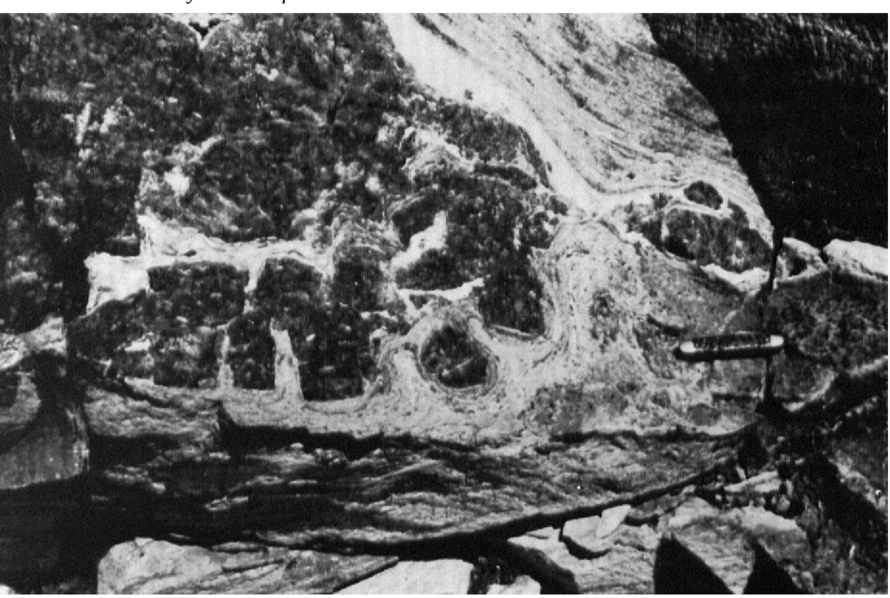
Photo 45 Fall colours near Quadeville. (Courtesy Ont. Dept. Tourism and Information)

Photo 46 Highway 60 approaching Carson Lake, 4 miles west of Barrys Bay (Courtesy Ont. Dept. Tourism and Information)

lake and the road, two bands of nepheline-scapolite gneiss strike north-south and dip eastward. These bands are from 100 to 200 feet wide and are separated by a band of pink syenite gneiss. Tracing these nepheline gneiss bands to the south they are syenitized and pass into pink syenite gneiss.

These rocks are of an unusual type and consist predominantly of interbanded nepheline, scapolite and nepheline-scapolite gneiss. Zircon, muscovite, corundum, magnetite, apatite and carbonate occur as accessories. Plagioclase is a common constituent of some of these bands, but is absent in others. On fresh surfaces the scapolite has a greasy, yellow-grey appearance, while after exposure to the sunlight for a day or two the scapolite turns deep sapphire blue. On weathered surfaces the scapolite weathers grey or blue-grey and is distinguished with difficulty from nepheline. Where scapolite-rich bands occur in a normal pink syenite sequence, differential weathering gives the rock a ribbed appearance. (Photo 44) On outcrop surfaces just north of the road fracture cleavage is well pre-

Photo 47 Feather amphibolite dike in marble showing boudinage structure, Highway 62 at Umfreville.



served in the scapolite-rich bands but lacking in the adjacent feldspathic bands.

Return to car. Turn around and return south to Rosenthal.

72.4 Rosenthal, Turn right and proceed west to Highway 515.

Return to Combermere and Bancroft.

Bancroft Trip 5

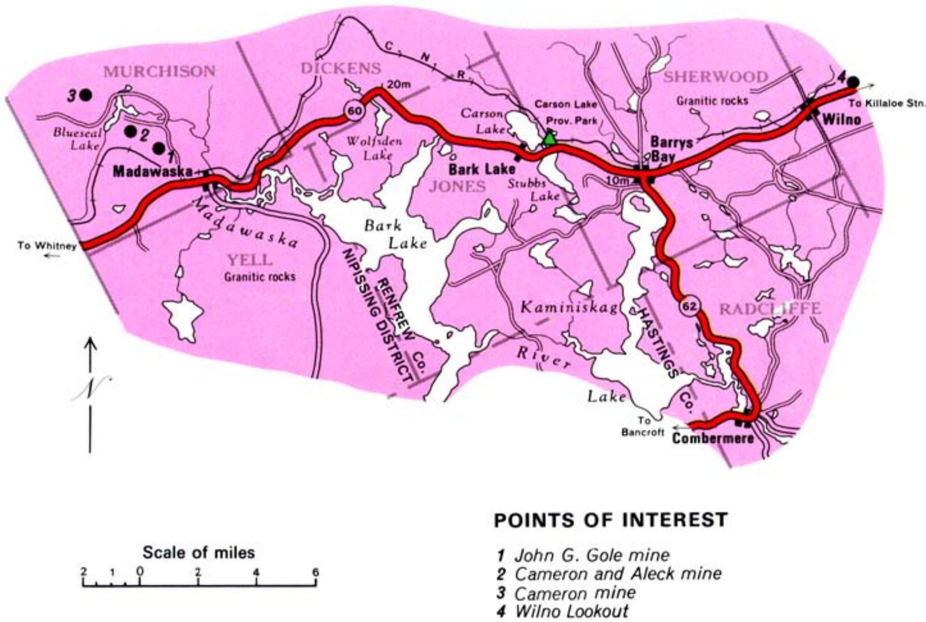


Figure 13 Geological and route map of Bancroft Trip 5.

COMBERMERE TO MADAWASKA

This trip starts at Combermere and goes to Madawaska, via Barrys Bay. Madawaska was the centre of a small pegmatite mining area active in the 1940's and early 1950's. A view of the Mount St. Patrick fault scarp is seen from the lookout east of Wilno on Highway 60.

Mileage	
0	Combermere. Follow Highway 62 north to Barrys Bay.
10.0	Barrys Bay. This picturesque village has a population of 2,000. It sits astride the century-old Opeongo colonization road that brought lumbermen and settlers to the interior from the Ottawa River. Follow Highway 60 west to Madawaska.

14.0 Carson Lake Provincial Park offering good camping facilities in a picturesque location.

27.0 Madawaska.

2½ miles from Madawaska.

John G. Gole mine: This granite pegmatite mine is located on lots 14 and 15, concession IV, Murchison township. It was opened in 1937 and worked until about 1944. The main working is an open cut 500 feet long on the southeast side of a hill.

The main minerals present are microcline, perthite, albite, quartz, biotite, and hornblende with accessory allanite, fergusonite in good crystals, zircon, titanite and magnetite. Some sunstone suitable for cutting can be found at this mine.

Cameron & Aleck mine: This feldspar mine is located on lot 17, concession VI, Murchison township. It was opened in 1949 and worked until 1953. Minerals present in the granite pegmatite include albite, microcline perthite, quartz, pyrite, zircon, titanite, fergusonite, allanite, hornblende and biotite.

7½ miles from Madawaska.

Cameron mine: This feldspar mine is located on lot 22, concession VIII, Murchison township. It operated between 1940 and 1951. There is an open cut 200 feet long and 15 feet wide, exposing granite pegmatite. Minerals present include albite, microcline perthite, quartz, cleavelandite, allanite, euxenite, titanite in radiating diamond-shaped crystal groups up to 8 inches in size, hornblende, pyroxene, biotite, muscovite, epidote, pyrite and hematite.

Return to Barrys Bay.

Drive east on Highway 60 to the lookout east of Wilno.

Lookout. This scarp is part of the Mount St. Patrick fault scarp which extends some tens of miles in a northwest-southeast direction. The block of ground to the north, many miles wide, moved down several hundred feet with respect to the block on which you are standing. This event occurred many millions of years ago, but minor earthquakes in the Ottawa valley indicate that some adjustment is still going on.

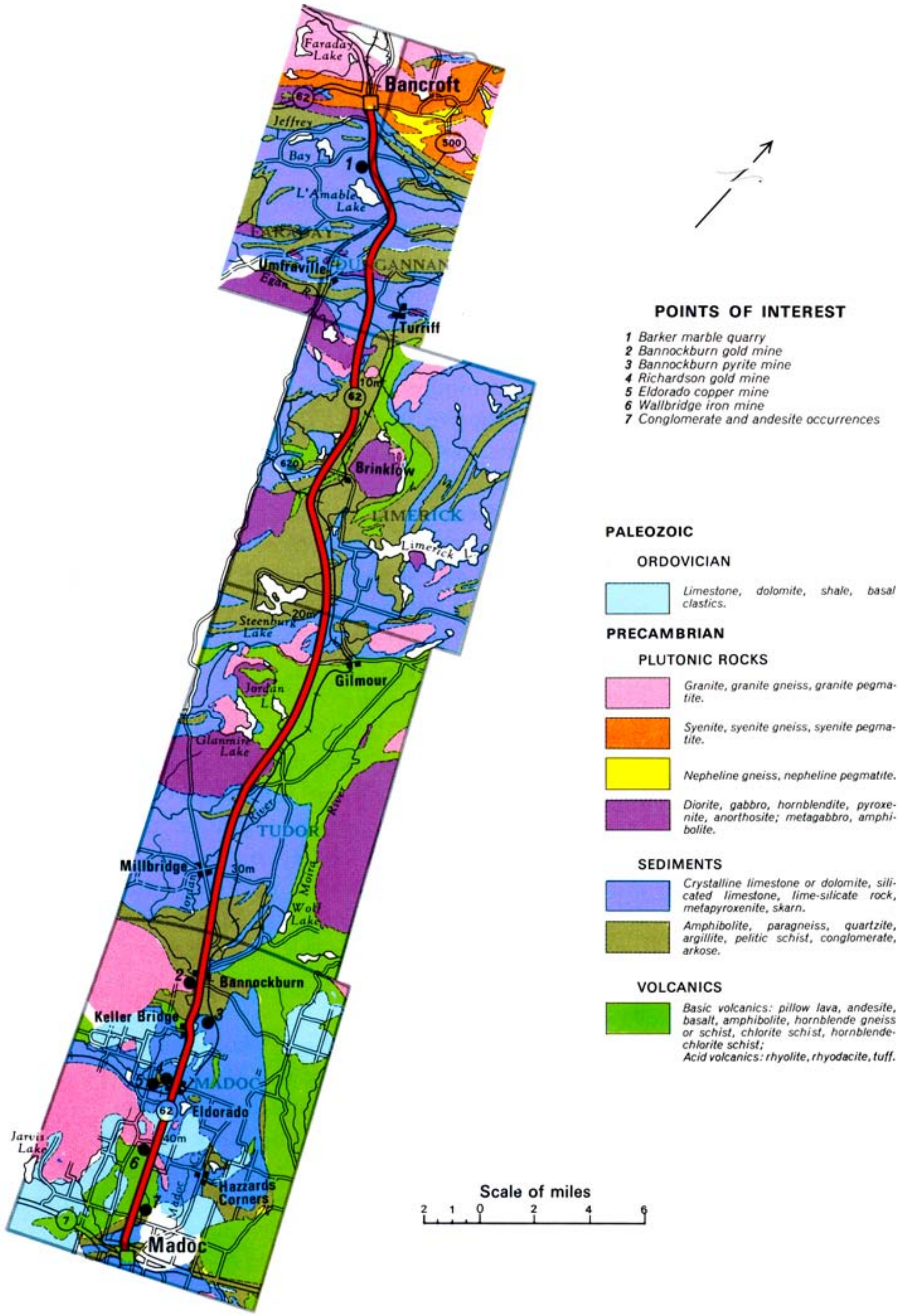


Figure 14 Geology, and route of Highway 62, between Bancroft and Madoc.

Road Log

HIGHWAY 62: BANCROFT TO MADOC

Mileage	
0	Bancroft, junction of Highways 62 and 28.
2.3	Marble breccia in roadcut.
2.5	Quarry Lake.
2.7	Road to Barker marble quarries on right. Walk ⅜ of a mile on this road to the Barker marble quarries where brecciated marble, rose marble and white marble were quarried. For more information see the report on Dungannon and Mayo townships by D. F. Hewitt 1955.
3.7	Lake L'Amable roadcut showing metasomatic alteration of marble of the Dungannon formation to a diopside rock.
4.0	Garnetiferous feather amphibolite occurs in a diorite dike cutting the marble.
5.7	Umfraville road junction. A feather amphibolite band in the marble shows boudinage structure (Photo 47).
6.7	Feather amphibolite dikelet cutting marble at an angle. Tongues of amphibolite occur along bedding planes in the marble.
7.6	Turriff turnoff.
9.2	Good roadside exposures of coarse-grained Umfraville syenite. This porphyritic biotite syenite may be an acid differentiate of the Umfraville gabbro.
9.6	Umfraville gabbro. A fresh, coarse-grained gabbro

Photo 48 Lake L'Amable on Highway 62 south of Bancroft.

with purple plagioclase.

12.1-19.2 From Spring Lake to St. Ola Station at mileage 19.2, a sedimentary sequence of rusty quartzo-feldspathic schists and limy amphibolites are exposed.

21.3 Here is a good outcrop of Hastings marble. It is grey, well-bedded, thinly-bedded, fine-grained marble. Recrystallized white coarse-grained marble can be seen in contact with the fine-grained grey marble. The difference in lithology is due entirely to recrystallization.

21.8-25.4 Basic volcanic rocks are exposed from Gilmour side-road for 3½ miles south. Pillowed volcanics may be seen.

26.8-27.0 Tudor gabbro body composed of coarse-grained gabbro, hornblendite and metagabbro.

30.0 Road to Millbridge.

30.8-31.2 Grey impure marble of low metamorphic grade. This was referred to as “Hastings marble”.

31.7-31.9 Black quartzite and quartzo-feldspathic sediments.

32.2 Feather amphibolite and marble sequence of the Dungannon formation.

32.8-33.2 Impure marble, feather amphibolite and amphibolite (intrusive) sills.

34.5 Bannockburn village.
Bannockburn gold mine is a few hundred yards off the highway west of the village on an old lumber road from Lloyd's mill.

35.5 Road to left leads to the Bannockburn pyrite mine. Good samples of massive granular pyrite are available. The mine is about ½ mile from the highway by road and trail.

36.5 Basic volcanic rocks, greenschist facies.

36.4 Moira River at Keller Bridge.

36.4-37.2 Paleozoic outlier.

37.9 Buff marble quarry on west side of road.

38.7 Railway crossing. Eldorado village.
The Richardson gold mine, the first gold mine discovered in Ontario, is located on a low hill just west of the road a few hundred yards. The mine was discovered in 1866 and caused a gold rush in this part of Ontario.

Half a mile west on this same ridge is the Eldorado copper mine which was first worked for iron. It occurs on the south contact of a small granite intrusive which cuts the marble.

39.4-40.1 Paleozoic outlier.

40.2 Wallbridge iron mine pit on west side of roadcut on south side of crossroad.

41.1 Pink Deloro granite.

41.6 Crossroad to east. Pink rhyolite and rhyolite tuff is exposed just north of this crossroad on the east side of the road. The tuffs strike north 60° west and dip 70° northeast.

41.7 Exposures of pink rhyolite and black andesite.

42.0 Intermediate agglomerate and volcanics, pinkish-weathering. Good agglomerate is exposed on the east side of the highway in the roadcuts.

43.0 Andesite.

43.0 An excellent exposure of volcanic agglomerate can be seen on the east side of the road at the fence line. Fragments of a great variety of rocks including vesicular andesite, tuff, greenstone, pink felsite, rhyolite and aplite occur in a grey dacitic matrix.

43.5 One hundred yards north of the Stoklosar marble mill on the east side of the road, east of the fence line, there is a good exposure of conglomerate resting on Madoc andesite. The conglomerate pebbles are chiefly marble and pink felsite. Near the contact the Madoc andesite is a black to grey vesicular lava. To the north in the roadcuts is a dense, fine to medium-grained amphibolitic andesite. Some feather amphibolite with hornblende feathers ¼ inch long occur in the roadcut to the north.

43.6 Dark grey slate outcrops in the roadcut south of the Stoklosar mill. One hundred yards east of the highway, just south of the crossroad is an abandoned slate quarry where the slate is well exposed. There are pebble beds in the slate.

44.8 A large hill of volcanic rocks occurs east of the road. It is grey vesicular dacite with some agglomerate.

45.3 Junction of Highway 7 and 62 in Madoc village.

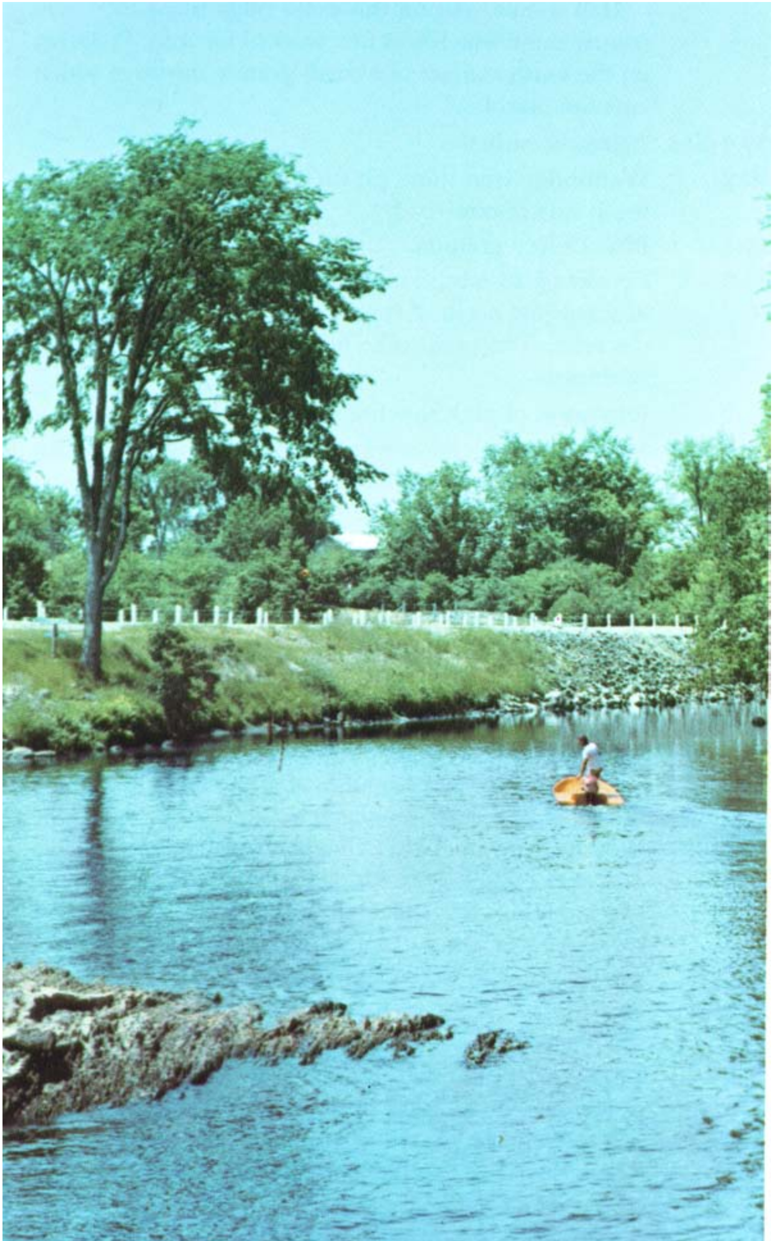


Photo 49 Black River east of Madoc on Highway 7. (Courtesy Ont. Dept. Tourism and Information)

PART 4

The Madoc Area

Mining Activity

The village of Madoc, with a population of 1,391, has been a centre of mining activity for over 100 years. In 1837 Uriah Seymour erected a furnace for smelting iron ore at Madoc, and opened the Seymour iron mine which operated from 1837 to 1845. Both hematite and magnetite ores were mined in this area and iron mines operated intermittently from 1837 to about 1910. Among the active iron mines in Madoc township were the McKenty which produced hematite as early as 1877, the Miller, St. Charles, Brennan, Wallbridge, Dufferin, 49 Acre, Sexsmith, Cook, Coe, Cameron, Nelson, Fox, Knot and Dominion mines. There was renewed interest in iron deposits in the 1950's when several properties were drilled.

In 1866 the first discovery of gold in Ontario was made at Eldorado. An interesting account of the ensuing "gold rush" is given by Gibson (1937, p. 3).

"The gold was discovered by Marcus Herbert Powell, clerk of the local Division Court. He states that "on the 18th of August, 1866, I discovered gold on the John Richardson lot, the east half of lot 18 in the 5th concession of Madoc. I was following a seam of copper when I struck ore carrying free gold. The seam was decomposed for six feet, then it was solid rock for 15 feet, where it suddenly opened out into a cave 12 feet long, 6 feet wide and 6 feet high, so that I could stand upright in it. The hanging wall was quartzite and the footwall granite, while the roof was composed of spar, talc and rocks of various kinds, and the floor of iron, talc, quartzite, black mica and other minerals. The gold was found in all these rocks in the form of leaves and nuggets, and in the roof it ran through a foot thickness like knife blades. The largest nugget was about the size of a butternut."

Gibson states that "the placer diggings of California and British Columbia were fresh in the popular recollection, and the news (of the discovery of gold) set the neighbourhood on fire. Gold-seekers and prospectors flocked to the scene. In the spring of 1867, four 4-horse coaches and two covered stages, left Belleville for Madoc every day, and a line ran from Brighton by way of Stirling and Trenton. Many came in private conveyances. A daily express was established. There were many boisterous spirits in the crowd. Skeptics refused to believe in the genuineness of the discovery, and putting a rope around the shack which had been erected over the opening threatened to pull it down. The government had taken the precaution to provide a squad of mounted police, 25 in number, and the timely arrival of three or four of these horsemen put a stop to the attempt. Two of the prospectors, "Cariboo" Cameron and another, were permitted by the manager to descend and make an investigation. Their report seems to have been favourable, for the disturbers shortly afterwards dispersed and the police were discharged."

The Bannockburn gold mine operated from 1894 to 1898 and a ten-stamp mill was erected on the property. Further exploration on this property was carried out in 1965. The Sophia or Diamond gold mine near Queensborough operated from 1896 to 1901. Several small gold-arsenic mines operated along the west side of the Deloro granite batholith near Deloro. The chief of these was the Deloro or Gatling mine at Deloro, operated by Canadian Goldfields Limited, from 1899 to 1903. Gibson (1937, p. 6) describes the mine as follows: "the ore deposits consisted essentially of quartz lenses in a schist containing visible gold and much mispickel. Near the surface the ore was comparatively rich, but the values steadily decreased as mining went on. At about 500 feet deep in the incline shaft, the gold yield was only $2.00 to $3.00 per ton, and massive mispickel was encountered. Two factors contributed to the closing of the mine in 1903, namely, a heavy flow of water, and the discovery of the rich arsenical ores of Cobalt. Deloro was the pioneer producer of arsenic, and for a time this mine provided a large proportion of the arsenic used on the continent. . . . During the five year period of operation from 1899 to 1903, 35,877 tons of ore were raised and milled, from which the total value of gold recovered was $181,907, and of arsenic $128,976, making a grand total of $310,883 or $8.67 per ton.

The only lead mine in Madoc township was the Hollandia mine 1½ miles north of Bannockburn, which operated from 1898 to 1906. The calcite vein was rich in galena, with some sphalerite and the vein was opened up for 250 feet in an east-west direction. The Katherine mine in Lake township contained much sphalerite.

The Eldorado copper mine produced from 1903 to 1907, and a copper smelter was opened at Eldorado to serve the mine. Pyrite mining began in Madoc township in 1901 with the opening of the Bannockburn pyrite mine which finally closed in 1919. The Queensboro or Blakely pyrite mine operated from 1905 to 1908 and the Canadian Sulphur Ore Company mine from 1906 to 1919.

Fluorspar mining began at Madoc in 1905 and a total of over 150,000 tons of fluorspar has been mined. The main periods of activity were 1916 to 20 and 1940 to 51. Thirty-one fluorspar deposits and a few barite deposits have been opened in the Madoc area and are described by G. R. Guillet 1964 listed under references.

Talc was discovered in the Madoc area in 1896 and talc has been produced continuously since that time with a total production of about 700,000 tons valued at $7,800,000. The principal producer has been Canada Talc Industries and its predecessors.

Photo 50 St. Peters church at Madoc, built in 1853, showing the use of local Black River limestone in the form of rock faced random ashlar.

Although marble was quarried at Madoc as early as 1900, it was not until 1936 that a permanent marble chip industry was established. Since that time marble production has increased until in 1964 four companies, operating about 20 marble quarries, were active in the Madoc area producing marble chips for the terrazzo industry. In 1964 marble production in the Madoc area amounted to about $300,000.

Slate was quarried at Madoc between 1932 and 1937. From 1940 to 1956 Building Products Limited operated five stone quarries in granite and rhyolite for the production of roofing granules.

Madoc Trip 1

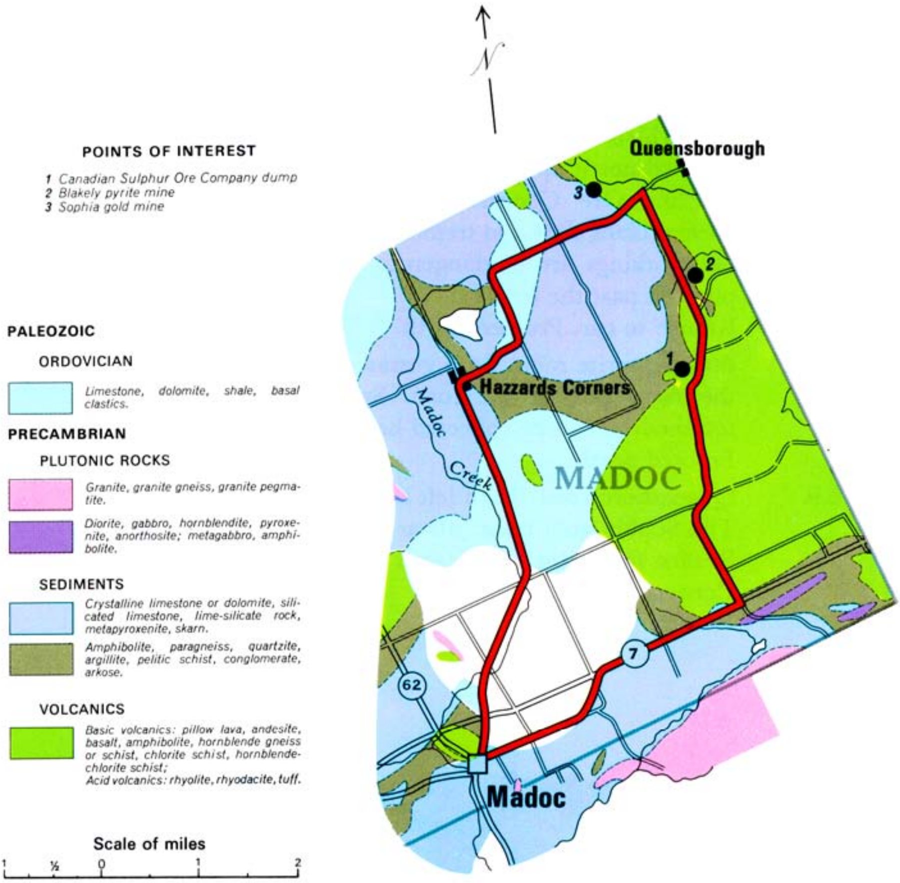


Figure 15 Geological and route map of Madoc Trip 1.

MADOC TO QUEENSBOROUGH

This trip visits the Queensborough area, a few miles northeast of Madoc, where the Blakely and Canadian Sulphur Ore Company pyrite mines and the Sophia gold mine are located.

Mileage	
0	Madoc main intersection. Proceed east on Highway 7.
3.0	Turn left and proceed north on gravel road.
4.0	Intersection, turn right.
4.1	Intersection, turn left.
5.1	Road to left. Park car and follow road ¼ mile to white rhyolite quarry. This white rhyolite cuts the country rock which is pelitic schist. Proceed north up the hill for ¼ mile to the Canadian Sulphur Ore Company dump. Pyrite, pyrrhotite, garnet, black slate and tremolite may be collected. The old workings are in dangerous conditions so do not proceed past the fence. Return to car. Proceed north.
6.1	Blakely pyrite mine. Iron gossan and pits are seen on the right side of the road. Sphalerite, pyrite and tetrahedrite can be collected here. Proceed north.
6.9	Queensboro road. Turn left and park. The Sophia gold mine pits are just north of the road. Return to Madoc on surfaced road through Hazzards Corners.

Photo 51 Fluorite crystals showing cubic habit, from Madoc.

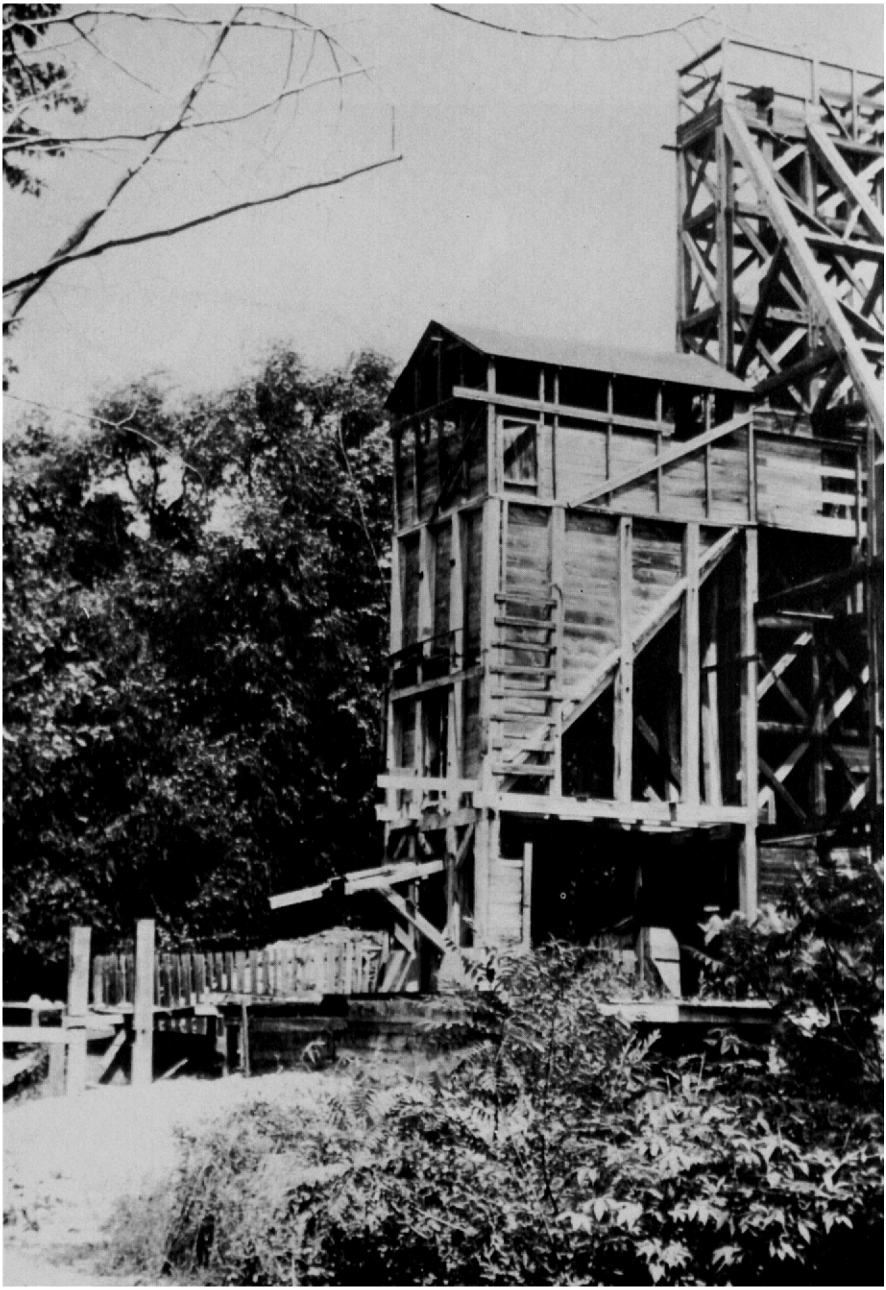


Photo 52 Abandoned Perry Lake fluorspar mine near Moira Lake.

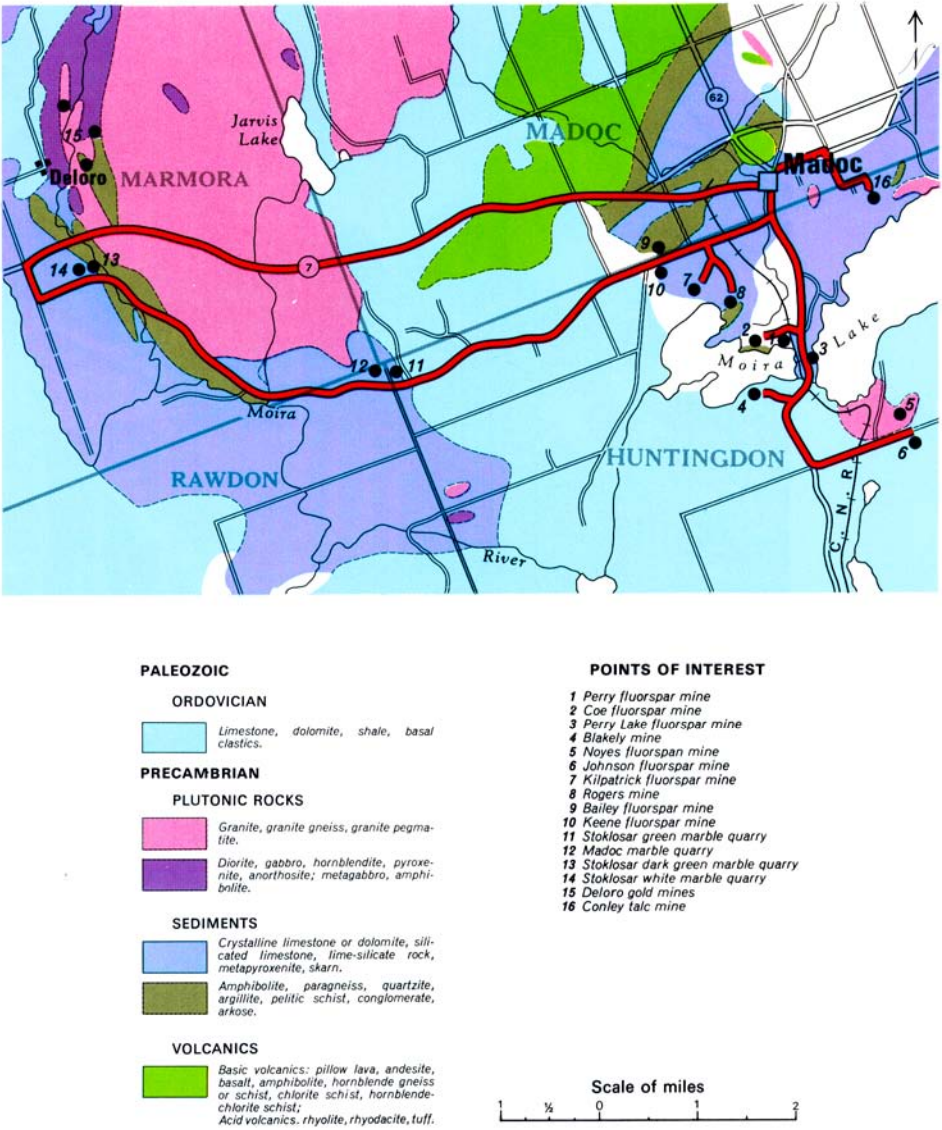


Figure 16 Geological and route map of Madoc Trip 2.

Madoc Trip 2

MADOC TO MOIRA LAKE AND DELORO

On this trip fluorspar mines are visited at Moira Lake and along the old Marmora Road. A talc mine is also visited.

Mileage	
0	Madoc main corners. Proceed south.
1.7	Road to right leads to Perry fluorspar mine and Coe fluorspar mine. Good fluorite crystals have been found at these properties. Barite, calcite, celestite and pyrite are also present.
1.9	Perry Lake fluorspar mine on left side of highway. (Photo 52).
2.1	Moira Lake.
2.3	Blakely mine road. Mine is 300 yards to right of highway. In addition to fluorspar, barite, celestite and calcite, sphalerite may be collected at this property.

2.7 Road intersection. Turn left and proceed east to Noyes fluorspar mine. The mine is a few hundred feet north of the road. Mineral assemblages similar to the others in the area are found at this mine.

2.9 Johnston fluorspar mine on south side of road. Return towards Madoc main corners.

5.5 Turn right and proceed west on Seymour Street, the old Marmora road.

6.1 Railroad crossing.

6.2 Road to Rogers and Kilpatrick fluorspar mines on the south side of the road. The Kilpatrick mine is about ½ mile via the right fork in the road. The Rogers mine is about ¾ of a mile via the left fork in the road. Both mines have fluorite crystals, massive fluorite, barite, calcite, tourmaline, pyrite and celestite.

6.8 Bailey fluorspar mine on right.
Keene fluorspar mine on left side of road.
Sabina, 1964 states that the Bailey mine has honey-yellow, pale green and red massive and crystalline fluorite interbanded with white massive and crystalline barite. Calcite, quartz and chalcocite are also present. Fluorite, barite, calcite and celestite are found at the Keene mine.

6.9 Road forks. Keep to the right.

7.4 Road north to the Lee Junior and McBeath fluorspar mines.

9.1 Road north to Lee Senior fluorspar mine.

9.8 Road north to Wallbridge fluorspar mine.

9.9 Road north 100 yards to the Stoklosar green marble quarry. This is an attractive light green dense fine grained marble.

10.1 Road to south; proceed straight ahead. The Madoc marble quarry is on the right. This is a light green fine-grained marble suitable for polishing.

10.3 Silicated marble on right side of road.

11.0 Grenville marble.

13.6 Cross Moira River bridge.

13.7 Road north 200 yards to Stoklosar dark green marble quarry.

Photo 53 Crystal Beach at Moira Lake. (Courtesy Ont. Dept. Tourism and Information)

13.8	Road north to Stoklosar white marble quarry. Tremolite is found at this quarry.
14.4	Road junction, turn right and proceed north to Highway 7.
14.7	Highway 7. Proceed north to Deloro if you wish to visit the Deloro gold mines. Otherwise return to Madoc via Highway 7.
22.9	Madoc main corners. Proceed east on Highway 7.
23.5	Turn right and follow road to Conley talc mine of Canada Talc Industries. Here and at the adjacent Henderson mine dolomite carries talc, tremolite, tourmaline, pyrite and arsenopyrite.

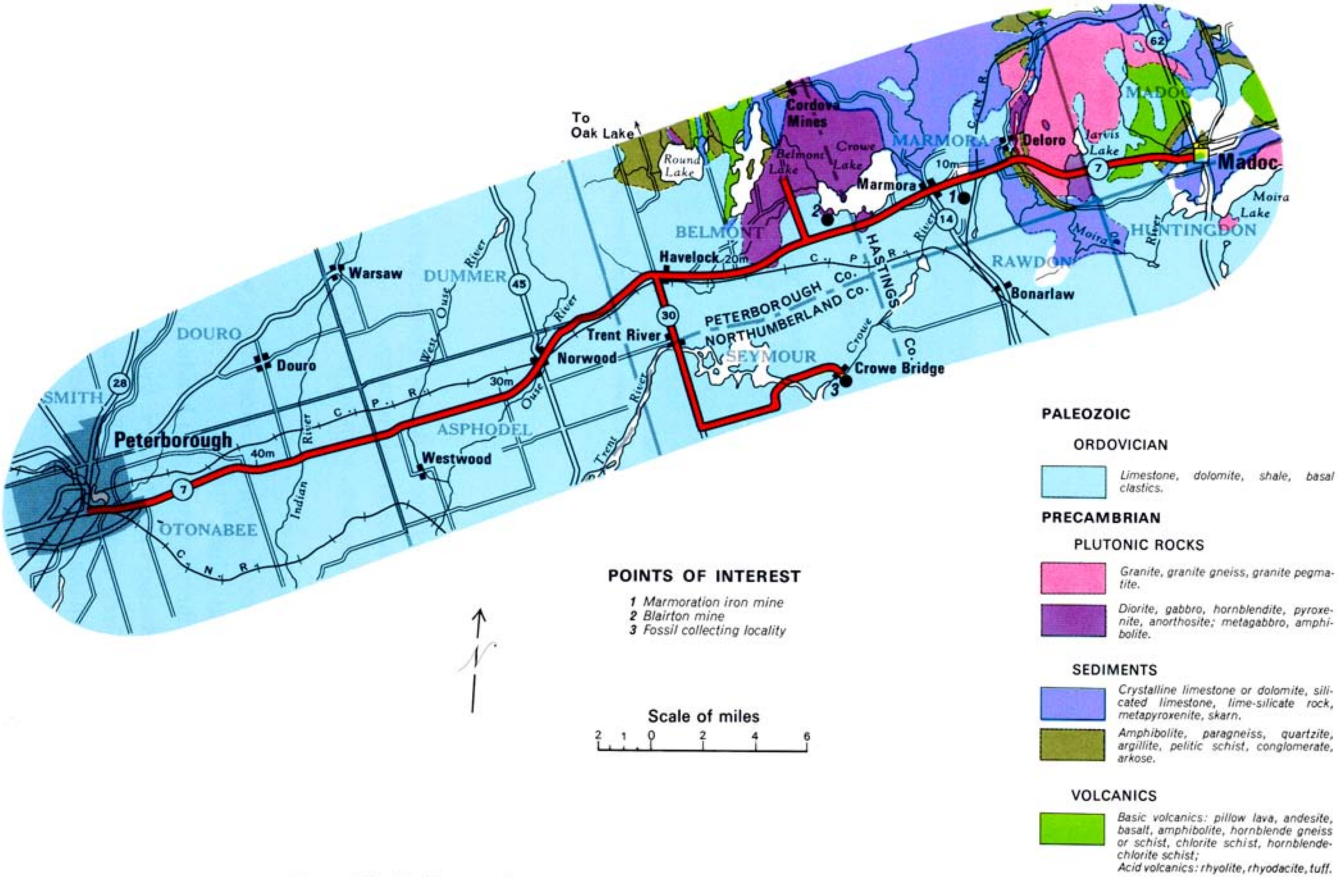


Figure 17 Geology, and route of Highway 7, between Madoc and Peterborough.

Road Log

HIGHWAY 7: MADOC TO PETERBOROUGH

Mileage	
0	Madoc main corners.
0.2	St. Peters Presbyterian church on the left was constructed in 1853. It is an excellent example of the use of Black River limestone in the form of rock faced random ashlar (Photo 50). Both buff and white weathering stone has been used. This stone was very widely used in the nineteenth century for churches, public buildings and homes.
1.1	Concession IV–V road, Madoc township. There is a slate quarry 100 yards north on the right side of this concession road. This quarry is in the trough of the Madoc syncline.
1.4	Roadcut in Madoc slate.
2.9	There are outcrops of Madoc andesite on the north side of the highway.
4.6	Paleozoic limestone.
4.7-7.0	Deloro granite batholith.
7.2-7.4	Marginal phase of Deloro granite batholith.
7.6	Moira River.
8.2	Deloro side road to Deloro mine.
8.7	Paleozoic limestone outcrop on south side of road.
9.6	Ascend Paleozoic scarp.
10.0	Marmoraton mine road to south. Drive south ½ mile to see the Marmoraton iron mine open pit (Photo 55). In 1949 the Ontario Department of Mines and the Geological Survey of Canada made an airborne magnetometer survey of this area. When the aeromagnetic map was published there was a prominent magnetic anomaly about a mile long and three quarters of a mile wide with a relief of about 8,500 gammas, southeast of Marmora. The presence of this anomaly led Bethlehem Mines Corporation to option the property, and diamond drilling carried out in 1950 and 1951 indicated the

presence of a large magnetite orebody under a capping of over 100 feet of Paleozoic limestone. The limestone was stripped away to expose the orebody—more than 20,000,000 tons of limestone were stripped in the first four years. The first shipments of pelletized magnetite concentrates were made in the spring of 1955. The mine has produced continuously since.

The lenticular body of magnetite ore is approximately 2,400 feet long, and 400 feet wide, and averages 37% iron (Rose 1958, p. 44-45 listed under References). Production is in excess of 500,000 tons of iron pellet concentrates per year.

The ore mineral is magnetite; pyrite, pyrrhotite, garnet and epidote are common accessories.

10.3 Black River limestone.

11.0 Marmora main corners.

Marmora Area

One of the earliest iron mining ventures in Ontario was at Marmora. A furnace was set up on the Crow River about 1820 by Charles Hayes to treat magnetite ore from the "Big Ore Bed" at Blairton mine in Belmont township. In 1847 Van Norman purchased the Hayes iron works and began operations in 1848. Some iron ore smelting continued in the Marmora area until 1875. The Blairton iron mine also operated intermittently during this period, and is said to have produced 100,000 tons of ore for export to the United States by 1875.

The Cordova gold mine, a few miles northwest of Marmora, was discovered in 1892 and produced in 1892 to 3, 1898 to 1903, 1912 to 1915, 1917 and 1939 to 40, producing gold valued at $474,548. The mine was over 400 feet deep. Gold, pyrite and pyrrhotite occur in veins of carbonate, feldspar and quartz.

11.2 Crow River bridge.

11.3-11.5 Marmora Black River limestone roadcut. This exposes an excellent section of 65 feet of Middle and Upper Black River beds. The section is described by Hewitt in the Limestone Industries of Ontario, listed under references.

11.5-12.7 Riding on a Paleozoic limestone plain.

13.8 Black River Paleozoic limestone scarp exposing a 20

Photo 54 Norwood esker ridge, near Norwood.

foot section.

14.0 Diorite and dioritic andesite roadcut.

14.4 Hastings county boundary.

15.0 Stony Dummer moraine on right, to north of road.

15.2 Gravel road to north goes to Blairton iron mine. This old iron mine is on the shore of Crow Lake about ¾ mile north of the highway.

16.2 Paved road goes north to Cordova Mines. 2.4 miles north on this road a powerline crosses the road at the top of a hill. Here are excellent exposures of dark green basalt with eyes of epidote and epidotized bombs. This is a good collecting locality for epidote which occurs in eyes up to 1½ inches in size.
Park at the bottom of the hill.

18.6 Black River limestone outcrops.

18.9 Railway crossing and road to basalt quarry of Minnesota Minerals Limited.

21.1 Black River limestone outcrops on highway.

22.2 Havelock. Junction of Highways 7 and 30. The road north goes to Oak Lake and Methuen township where the east end of Blue Mountain can be examined. The

Photo 55 Open pit of Marmoraton iron mine.

Road south goes to Campbellford and a side trip can be made from here to Crow Bridge on the Crow River, a good locality to observe fossils.

26.1 The Norwood esker forms a prominent ridge on the north side of the highway (Photo 54)

27.5 There is a gravel pit on the north side of the road in the Norwood esker. This esker is one of the largest in southern Ontario and contains very large quantities of sand and gravel suitable for the construction industry.

28.3 Norwood main corners. Junction of Highways 7 and 45. The Norwood esker is along the north side of the highway. The Norwood water tower is on the crest of the esker. The catholic church in Norwood is a fine example of the use of Black River limestone.

29.5 Gravel pit in the Norwood esker.

29.9 The highway crosses the Norwood esker which runs west, south of the road.

31.0 There is a drumlin ridge to the south of the highway just east of concession line V of Asphodel township.

34.5 Westwood turnoff.

36.8 There is pronounced northeast fluting due to glacial ice movement. The highway climbs a drumlin ridge.

38.1 This wide valley is the Indian River glacial spillway.

39.2 Drumlin ridge crosses the highway.

40.5 Road south to Keene.

41.0 Gravel pit in an esker on the south side of the highway. Note the stratified gravel in the esker. There is a good view of drumlin hills to the north.

43.2 Highway curves. There are drumlin hills to the south and east.

44.4 Mark S. Burnham Provincial Park.

45.8 Intersection of Armour Road. Drive north to see the lift lock.

46.3 Trent Canal, Lock No. 19.

46.9 Peterborough. Intersection of Highway 7B and George Street.

APPENDIX

1. References

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2. Glossary

Descriptions of rocks and minerals in this book are given in "Rocks and Minerals of Ontario" available from the Publications Office.

Agglomerate: a rock composed of unsorted volcanic debris resulting from explosive volcanic activity.

Alkaline rock: an igneous rock usually characterized by the presence of feldspathoid minerals such as nepheline.

Amphibolite: a metamorphic rock composed of amphibole. In the variety "feather amphibolite" the amphibole crystals are in the form of elongated feather-like crystals.

Andesite: a basic to intermediate volcanic rock which is the extrusive equivalent of a diorite.

Aplite: a fine-grained, light-coloured, usually sugary-textured igneous rock often occurring as dikes.

Arkose: a sedimentary rock composed of quartz and feldspar, usually formed by the disintegration of a granite.

Black River: a group of limestones of middle Ordovician age.

Calcarenite: a limestone composed of clastic calcite grains and fossil debris of sand size. The calcareous equivalent of a sandstone.

Calcirudite: a limestone composed of detrital calcium carbonate fragments predominantly larger than 4 millimetres in diameter.

Cenozoic: the latest era of geological time including the Tertiary and Quaternary periods.

Clastics: fragmental sedimentary rocks of variable size range.

Diorite: an intrusive igneous rock composed essentially of andesine or oligoclase feldspar and ferromagnesian minerals such as hornblende, biotite or pyroxene.

Drumlin: a smooth oval hill of glacial origin formed by the ice overriding stony clay till. Their long axes parallel the direction of ice movement.

Eskers: long narrow ridges of sand and gravel formed by streams of water flowing through crevasses and tunnels in glacial ice sheets.

Felsite: a light-coloured, fine-grained igneous rock.

Gabbro: dark-coloured igneous rock composed essentially of calcic plagioclase and ferromagnesian minerals, usually pyroxene. The extrusive equivalent is basalt.

Gneiss: a banded metamorphic rock usually composed of bands of quartzo-feldspathic and ferromagnesian minerals. A rock possessing gneissosity, which is a planar structure caused by alternate layers of contrasting mineralogical composition or texture.

Granite: a light-coloured igneous rock composed of quartz and feldspar with minor ferromagnesian minerals.

Granulite: a medium- or coarse-grained metamorphic rock of even, granular texture.

Hornblendite: an igneous rock composed predominantly of hornblende.

Kame: a glaciofluvial deposit of sand and gravel deposited by streams along the ice margin.

Lineation: a structure caused by parallelism of linear fabric elements such as elongated mineral grains, slickensides, etc.

Mesozoic: a geological era including the time between the end of the Permian and the beginning of the Tertiary period. It includes the Triassic, Jurassic and Cretaceous periods.

Metagabbro: a metamorphosed gabbro.

Metamorphic grade: this is a measure of the degree of alteration of a rock by metamorphism resulting from the action of heat and pressure.

Migmatite: a mixed rock composed of granitic material and metamorphic country rock.

Moraine: an accumulation of glacial drift produced by direct action of glacial ice.

Mylonite: a finely pulverized or crushed rock formed and recemented by dynamic metamorphism usually along a fault zone.

Nepheline syenite: an igneous rock composed of nepheline, albite and potash feldspar.

Ordovician: a period of geological time during the early part of the Paleozoic era.

Orogeny: the process of mountain building.

Outlier: an isolated mass of bedrock resting on older rock.

Paleozoic: a geological era including the time from the beginning of the Cambrian period to the end of the Permian period.

Paragneiss: a gneiss derived from a sedimentary rock.

Pegmatite: igneous dike rocks of very coarse grain size. Granite, syenite and nepheline syenite pegmatites are common.

Petroglyphs: ancient Indian rock carvings.

Porphyry: an igneous rock containing large crystals in a finer-grained groundmass.

Precambrian: a geological term referring to all rocks formed prior to the Cambrian period.

Quartzite: a metamorphosed sandstone.

Rhyolite: an igneous extrusive rock having essentially the composition of a granite.

Shale: an indurated sedimentary rock composed predominantly of clay minerals.

Skarn: a rock consisting predominantly of lime silicates with or without carbonates, and commonly containing magnetite or other iron-bearing minerals.

Syenite: an igneous intrusive rock composed predominantly of potash feldspar. Soda feldspar and ferromagnesian minerals are usually present.

Tectonic breccia: a marble tectonic breccia is formed of a matrix of marble in which are floating fragments of associated country rocks such as paragneiss, amphibolite, granite pegmatite, etc.

Trenton: a group of limestones of middle Ordovician age lying above the Black River group.

Tuff: indurated volcanic ash.

Unconformity: a surface separating an older group of rocks from an overlying younger group of rocks. It represents a period of erosion or non-deposition.

3. Mineral and Rock Check List

Seventy-one minerals and twenty-nine rocks are mentioned in this guidebook. The following check list lists these minerals and rocks for the collector.

Minerals

actinolite
albite
allanite
amazonstone
anhydrite
apatite
arsenopyrite
barite
beryl
betafite
biotite
calcite
cancrinite
celestite
chalcocite
chlorite
cleavelandite
columbite
corundum
cyrtolite
diopside
ellsworthite
epidote
essonite

euxenite
fergusonite
fluorspar
forsterite
galena
garnet
gieseckite
gold
graphite
hackmanite
hematite
hornblende
hydronephelite
lyndochite
magnetite
microcline
molybdenite
muscovite
nepheline
peristerite
perthite
pyrite
pyrochlore

pyroxene
pyrrhotite
quartz, rose
scapolite
selenite
sericite
sillimanite
sodalite
sphalerite
spinel
sunstone
talc
tetrahedrite
thorite
titanite
tourmaline
tremolite
uraninite
uranophane
uranothorite
vesuvianite
wollastonite
zeolites
zircon

Rocks

agglomerate
amphibolite
andesite
aplite
arkose
breccia
diorite
felsite
gabbro
gneiss

granite
granulite
hornblendite
limestone
marble
metagabbro
migmatite
mylonite
nepheline pegmatite

nepheline syenite
paragneiss
pegmatite
porphyry
quartzite
rhyolite
shale
slate
syenite
tuff

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