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GEOLOGY ALONG THE COULONGE AND BLACK RIVERS, PONTIAC COUNTY, PART D

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BUREAU OF MINES

Honourable J. E. PERRAULT, Minister of Mines

J. L. BOULANGER, Deputy-Minister A. O. DUFRESNE, Director

ANNUAL REPORT

OF THE

QUEBEC BUREAU OF MINES

FOR THE CALENDAR YEAR

1932

PART D

QUEBEC

PRINTED BY R. PARADIS

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RECONNAISSANCE ALONG THE COULONGE AND BLACK RIVERS, PONTIAC COUNTY

by J. A. Retty

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RECONNAISSANCE ALONG THE COULONGE AND BLACK RIVERS, PONTIAC COUNTY

by J. A. Retty

INTRODUCTION

The rocks occurring along the Ottawa river in the county of Pontiac have been examined at various times by officers of the Geological Survey of Canada, but most of these investigations have been confined to the territory immediately adjacent to the river. Much remains unknown regarding the region between the Ottawa river and the gold-bearing districts of northern Quebec.

In order to explore part of this region and to delineate, if possible, favourable ground for prospecting, the writer undertook, during the field season of 1932, a reconnaissance survey of the geology along the Coulonge and Black rivers, the results of which are contained in this report.

Acknowledgments

The writer acknowledges with thanks the aid rendered by many individuals throughout the district, and more especially by officials of the Ottawa River Forest Protective Association and of J. R. Booth, Limited, whose generous co-operation at all times greatly expedited the work.

The Department of Lands and Forests, Quebec, and the Topographical Survey of Canada, furnished the plans that were used in the compilation of the base-map.

The Water-power and Hydrometric Bureau of the Department of the Interior supplied information on the surveyed power-sites.

Miss Alice E. Wilson and Dr. L. S. Russell, of the Geological Survey of Canada, and Mr. A. Larocque identified collections of fossils.

Mr. Demmon Libby conducted the writer about his prospect; and Mr. J. J. Harris of McGill University rendered valuable assistance in the field.

To the above mentioned organizations and individuals, the writer is deeply grateful.

Location, Extent, Access

The area dealt with is 80 miles northwest of the city of Ottawa. It is bounded on the east by the Coulonge river, on the south by the Ottawa river, and on the west by the Black river. It has a length of 75 miles in a north-northwest direction from the Ottawa river, and a width of from 12 to 16 miles. The territory mapped thus comprises approximately 1,000 square miles.

The south part of the area is divided into the townships of Mansfield, Pontefract, Waltham, and Bryson.

Mansfield and Waltham, which are side by side directly north of the Ottawa river, are traversed by the Ottawa-Waltham branch of the Canadian Pacific railway and by the Hull-Chapeau highway. The southern part of the area is thus easily accessible. The northern part may be reached by a system of improved waggon roads, which are suitable for automobiles to a distance of ten miles north of the highway. The points of departure are either Waltham or Fort Coulonge, villages situated close to the mouth of Black river and Coulonge river, respectively. The choice of route and point of departure depend upon the destination desired.

Owing to their swift current and the many rapids and chutes along their course, the rivers are generally unfit for navigation.

Previous Work

The earliest geological work in the area was in 1845, when Sir William Logan examined the rocks along the Ottawa river in the course of a reconnaissance between Ottawa and lake Témiscamingue ①.

In 1876, H. G. Vennor studied the geology of the southern part of the area, along the Ottawa river and the lower reaches of the Coulonge and Black rivers②.

In 1896, R. W. Ells made a reconnaissance trip up the Black river to Foran creek and thence across to the Coulonge river, returning to the Ottawa along this tributary ③.

① Geol. Surv. Can., Rep. of Prog., 1845-46; Geology of Canada, 1863.
② Geol. Surv. Can., Rep. of Prog., 1876-77, pp. 277-285, 292.
③ Geol. Surv. Can., Pub. No. 977, 1907, pp. 2-12, 34, 50, 64-66.

Methods of Work

Much of the work last season was done by canoe along the watercourses, but traverses by pace and compass were also made along the roads. Inasmuch as the examination was preliminary, the studies made were of a very general nature, except in the vicinity of mineral occurrences of possible economic value, where detailed mapping was done.

The routes followed and points at which observations were made are indicated on the accompanying map.

DESCRIPTION OF THE AREA

Population, Industries, Settlements

The only settled parts within the area are local tracts along the lower reaches of the Coulonge and Black rivers and a narrow strip of land directly north of the Ottawa river. The people are descendants of French and Irish settlers who came there during the latter half of the nineteenth century.

Lumbering is the chief industry. Mixed farming is carried on to some extent on the arable land, but the majority of the population depend upon lumbering, either directly or indirectly, for a livelihood. The inhabitants of the villages find employment in the lumber camps, and these camps afford a market for farm products raised locally.

There are three villages and one summer resort in the area, all along the Ottawa river. Fort Coulonge, with a population of 1,200, is the most important village. It is in the township of Mansfield, situated on a narrow strip of land between the Coulonge and Ottawa rivers, one mile east of their junction. It has three churches, two schools, and such improvements as waterworks and electricity. Formerly, it was the centre of a flourishing lumber industry.

The village of Davidson, also in the township of Mansfield, is on the north bank of the Ottawa river, just west of the point where the Coulonge enters it. The lumber mill of James Davidson and Sons is located here, and, during the summer months, ordinarily gives employment to 100 men.

The village of Waltham, in the township of the same name, is about half a mile east of Black river close to its junction with the Ottawa. It has a population of about 100. It is the terminus of the Ottawa-Waltham branch of the Canadian Pacific railway.

Devonshire Park is a summer resort on the shore of Coulonge lake (Ottawa river) about six miles west of the village of Fort Coulonge and a quarter of a mile south of the Hull-Chapeau highway.

Throughout the area north of the settled district, stopping places and depôts are maintained by private individuals and lumbering firms for the accomodation of travellers. Moose Creek depôt and Schyan depôt each have a post office, and a weekly mail service is maintained between Fort Coulonge and Moose Creek depôt.

At intervals, to the northernmost part of the area and beyond, observation towers, with telephone connections, have been constructed by the Ottawa River Forest Protective Association.

Topography

From the viewpoint of its topography, the area falls naturally into two divisions: the uplands and the lowlands.

The Uplands:

With the exception of a narrow strip varying in width from one to three miles, adjacent to the Ottawa river, the area consists almost entirely of rocky uplands. They contrast strikingly with the low-lying land along the river and form the southern margin of the great Laurentian plateau.

As in other parts of the plateau, a general uniformity of relief prevails. The land surface, though rocky and hummocky, nowhere rises to a height greater than 300 feet above the surrounding country. The concordance of summit levels, as seen from the observation towers that are situated on prominent hills throughout the district, suggests an old peneplaned surface.

Although a thin veneer of glacial boulders is characteristic and locally there are flat tracts occupied by sand, bedrock is generally well exposed.

Ridges are a feature of this upland area. Their orientation is variable and is generally controlled by the foliation of the gneissoid rocks of which they are composed. Thus, along the Coulonge and Black rivers, there are steep ridges having an approximately north-south trend. But while such ridges are common, there is no line of hills standing out as a distinct and continuous topographic feature within the plateau. Along its southern margin, however, at the boundary between the upland and the lowland, there is a line of hills having a northwest trend that extend right across the area. They stand out very conspicuously on the horizon.

It has been noted by previous workers that the boundary between the Laurentian highlands and the St. Lawrence lowlands is everywhere marked by an abrupt change in topography, and that in some places this is due to faulting①. Adjacent to the Ottawa river in the area examined, the hills along the boundary locally assume the appearance of small escarpments, but there is no definite evidence of faulting. That some movement has taken place in the lowland area close to the Ottawa river is evidenced by the disturbed Palæozoic strata at Devonshire Park; but this is quite local.

THE LOWLANDS:

The strip of land, in width up to three miles, that borders the Ottawa river, belongs to the physiographic unit called the 'St. Lawrence region'②. In the present map-area, the only consolidated deposits to be seen in this lowland region are at two localities on the Ottawa river. At both places, the rock is a Palæozoic limestone.

The most outstanding topographic feature of the lowland is the succession of well developed marine terraces that begin a short distance from the Ottawa river and continue northward to the lower reaches of the Coulonge and Black rivers.

The first terrace is not conspicuous, but the second is very prominent and extends continuously across the map-area, being known locally as 'the ridge'. A still higher terrace is to be seen at Beauchamp's hill on the Black River road, and close to the mouths of the tributaries of the Ottawa.

① Wilson, M. E., *Arnprior-Quyon and Maniwaki Areas*, Geol. Surv. Can., Mem. 136, pp. 7, 56-59.

② Young, G. A., *Geology and Economic Minerals of Canada*. Geol. Surv. Can., Econ. Geol. Series No. 1, 1926, p. 68.

The lowermost narrow strip along the Ottawa represents the old flood plain of the river. It has been formed by the lowering of the river-bed through downward cutting. The small islands at the mouth of both the Coulonge river and Black river are typical delta deposits, formed of material carried by these tributary streams and deposited where their speed is retarded on entering the Ottawa.

Drainage

The area is drained by the Coulonge and Black rivers, both of which flow in a southeasterly direction into the Ottawa river.

The Coulonge forms the eastern boundary of the area examined. It is much the larger of the two streams. It rises in the region southeast of Grand Lake Victoria and flows into the Ottawa river one mile above the village of Fort Coulonge and four miles above the head of Calumet island. The total length is approximately one hundred miles and its drainage area some 2,100 square miles.

The basin of the river is long and narrow and its course is generally straight, except along those stretches where it flows through sand deposits and meanders considerably. The current is swift, and along the entire length of the river there are numerous falls and rapids. The largest of these is Coulonge chute, situated about four miles north of the village of Fort Coulonge, at the southern margin of the Laurentian plateau. The main fall has a drop of approximately 80 feet, and this is followed by a narrow, steep-walled gorge 2,800 feet long. The total drop from the head of the falls to the foot of the rapids is 141 feet.

Black river bounds the map-area on its western side. It rises to the south of Grand Lake Victoria and joins the Ottawa river near the foot of Culbute channel, north of Allumette island. It is about seventy-five miles long, drains an area of 1,000 square miles, and falls nearly 1,000 feet.

Its basin is west of and adjacent to that of the Coulonge river, and is quite similar in character to that of the latter. The distance between the two rivers varies from three and a half miles to ten miles.

Rapids, falls, and sandy stretches occur along the Black river, as along the Coulonge. The largest fall is situated at the point where the river descends from the Laurentian plateau to the lowland, three-quarters of a mile from Waltham and one and a half miles from the mouth of the river. It is known locally as 'Black River chute', and has a total drop of 128 feet in about a quarter of a mile.

There are many lakes within the area. The largest are St. Patrick, Bryson, Lynch, and Moose.

The Ottawa river constitutes the south boundary of the area. It varies in width from one to three miles. Coulonge lake, which is a broadening of the river, is its most outstanding feature along this section of its course.

Water-Powers

The numerous falls and rapids within the area afford many sites for the development of hydro-electric power. Up to the present, only one site has been developed. This is Black River chute, the location of which has been given above. The plant is owned by the Pembroke Electric Light Company and supplies current to the town of Pembroke, 14 miles distant, and to the village of Chapeau, 10 miles distant. The power is used both for lighting and for industrial purposes.

The most important undeveloped power site is Coulonge chute. It has a greater potential capacity than Black River chute.

The following data concerning these and other surveyed power sites was obtained from the Dominion Water-power and Hydrometric Bureau, Department of the Interior:

POWER SITES ON BLACK AND COULONGE RIVERS

Location of Power Site	Head (feet)	Drainage Area (square miles)	Est. Capacity in h.p. at 80% Efficiency		Installed h. p.
			At ordinary minimum flow	At ordinary six months' flow	
Black r. (Ottawa drainage):					
7 miles from mouth..	7	920	136	270	....
1 m. from Waltham..	128	1,000	3,608	7,098	3,600
			3,744	7,368	3,600
Coulonge r. (Ottawa drainage):					
First fall, 12 miles above Devil chute	7	1,362	250	767	....
Devil chute.....	25	1,500	990	1,943	....
Ragged chute①....	12	1,574	497	980	....
Grand fall①.....	141*	2,100	7,820	15,250	....
			9,577	18,940	

① The writer is of the opinion that the names of these sites are confused. Galarneau chute is omitted entirely, although it is less than a mile from Ragged chute.

* Head of 141 feet is total descent in reach of 2,800 feet.

For the sake of completeness, the writer offers the following additional information on unsurveyed sites. The figures given for 'estimated drop in feet' are based on measurements made at the falls and rapids at low water level, and it should be kept in mind that they are only approximations. The sites above Red rapid on the Black river are not included, as the geological work beyond this point was carried on along the road. The rapids and chutes are listed in their order, going upstream.

Black River	*Estimated drop, in feet*
Long Rapids	30 (in 7 miles)
Jam Rock	3
Above Jam Rock	2
Big Manitou	5
Little Manitou	2
Shannon	4
Little Bear	1½
Big Bear chute	10
Cascades and Long Portage	15

McLachlin	2	
Mountain chute	15	
Lethargie	6	
McDonald	3	
Floodwood	5	
Red	4	

COULONGE RIVER

Mi-Charge rapid	2	
Long	35	(in 9 miles)
Three Portage	6	
Bear chute	8	
Poplar	3	
Galarneau chute	12	
Ragged chute	20	
Little Devil	2	
Devil chute	7	
Gauthier	10	
Flat	3	

FORESTS, GAME

The Ottawa valley has long been a fertile source of the finest quality of merchantable timber. White pine, red pine, and spruce are abundantly distributed throughout the region.

Although the reserves have been considerably depleted by logging operations and forest fires, valuable timber berths still remain in many sections of the area, and within a few years their value will be greatly increased by the maturing of stands of second growth.

The limits in the district are held by J. R. Booth, Limited, the Canadian International Paper Company, McLachlin Bros., James Davidson and Sons, and Gillies Bros.

Fur-bearing animals are to be found throughout the area. Deer are especially plentiful, but moose are scarce. Fish are abundant in the lakes.

The proximity of this region to transportation facilities makes it exceptionally well suited to the establishment of hunting lodges, and many of these have been constructed within the area.

GENERAL GEOLOGY

PRELIMINARY OUTLINE

The area is underlain almost entirely by pre-Cambrian rocks. They fall in three groups: The first group comprises a series of metamorphosed sedimentary rocks, now crystalline limestone, together

with paragneisses of variable composition which are intimately associated with metamorphosed plutonic rocks such as granite gneiss and syenite gneiss. These altered sedimentary rocks are probably remnants of originally extensive beds that have for the most part been removed by erosion.

The second group consists entirely of metamorphosed batholithic intrusive rocks, sedimentary types being completely absent. They may represent one period of intrusion or several successive concordant intrusions. Because of the absence of younger unmetamorphosed rocks, this must remain largely a matter of speculation.

The third group is represented by a number of diabase dykes that were intruded after the foliation of the sedimentary rocks and batholithic intrusive rocks.

The only consolidated rocks within the area that are later than the above are certain beds of limestone of Palæozoic age.

All younger deposits are unconsolidated. They consist of glacial drift which has been deposited on the surface of the pre-Cambrian and Palæozoic rocks, and of post-glacial marine clay and sand.

Alluvial deposits of recent age occur along the Ottawa river.

TABLE OF FORMATIONS

QUATERNARY	Recent..... Champlain..... Pleistocene.....	Alluvium, marl Sand, clay Boulders, gravel, sand, clay
PALÆOZOIC	Ordovician (Black River).....	Limestone
PRE-CAMBRIAN	Keweenawan.....	Diabase
	Metamorphosed batholithic intrusives	Pegmatite ① Syenite gneiss Granite gneiss
	Grenville series.....	Paragneiss Garnetiferous gneiss Amphibolite Metamorphic pyroxenite Crystalline limestone

① Some of the pegmatite is not metamorphosed.

DESCRIPTION OF FORMATIONS

Grenville Series

Crystalline Limestone:

Crystalline limestone occurs in discontinuous bands and sporadic masses closely associated with paragneiss and orthogneiss in the southern part of the area. It is found almost continuously along the Coulonge river from the mouth of Corneille river to Coulonge chute, and along Black river from the head of Long rapids to Black River chute. On the shores of almost every lake examined between these two rivers in the south part of the area, either small or large bands of limestone were seen. Two isolated bands were observed at the north margin of the area: one at the outlet of lake Perdrix, and the other at a point inland to the northeast of Callaghan lake. Another isolated band crops out at the mouth of Hogan creek, which flows into lake St. Patrick on its south shore.

It would appear that these bands are the remnants of a formerly extensive series which elsewhere has been removed by erosion.

The limestone is generally white, weathering pale yellow or light brown, but salmon coloured varieties also occur. It breaks down on weathering into loose, sand-like material. The grain varies from medium to coarse. Besides the calcite of which it is essentially composed, the rock may contain more or less muscovite, phlogopite, serpentine, pyroxene, amphibole, orthoclase, and, less frequently, chondrodite and pyrite. In many places, the rock has a banded appearance due to the distribution of these accessory minerals in parallel lines or planes. Nowhere was definite evidence of bedding seen within the individual bands of limestone. Siliceous material in the form of nodules and irregular masses is of common occurrence. Coarse amphibole and apatite were observed in the rock at the head of Coulonge chute. One crystal of apatite removed from the limestone by the writer has almost perfect crystal outline and measures ten inches long by two and a half inches in diameter. Graphite-bearing varieties of the rock were noted at Poplar rapid on the Coulonge river, and at Turcotte lake, two miles northeast of Black River chute.

The limestone is very irregular in its mode of occurrence. It is found in bands which vary in width from six inches to twenty feet and which may be separated from adjacent bands by a layer of dark paragneiss from one inch to five feet wide. Because of differential weathering, the bands of gneiss always stand out in relief. Again, the limestone may occur as irregular ovoid or lenticular masses completely surrounded by orthogneiss or paragneiss. In either case, the foliation of the limestone always parallels that of the gneiss with which it is associated. In some instances the gneiss occurs as a series of angular fragments strung out along a straight line, possibly representing what was once a continuous band.

At the head of Coulonge chute is a complex zone composed in part of limestone in which the latter rock has been invaded to such an extent by pink granite-gneiss that the whole has the appearance of a fragmental rock, especially on weathered surfaces. Were it not for the known relation of the crystalline limestone and gneiss, and the uniformity of composition of the fragments, the rock would be mistaken very easily for a conglomerate.

METAMORPHIC PYROXENITE:

Inasmuch as the name 'pyroxenite', as most commonly used, refers to a rock that is igneous and of intrusive character, Wilson has proposed the term 'metamorphic pyroxenite' as a designation for the metamorphic rocks, composed predominantly of pyroxene, that are in places associated with Grenville limestone ①.

Small occurrences of this type of rock are found locally within the district, in the vicinity of pegmatite dykes. The rock can always be identified readily by its granular appearance and lack of coherence. It is usually green, though white varieties also occur. In thin section, it is seen to be composed predominantly of diopside, with minor quantities of quartz, calcite, and talc.

AMPHIBOLITE:

Occasional masses of amphibolite occur, but they are small and of little importance.

① Wilson, M. E., Geol. Surv. Can., Mem. 136, 1922, pp. 32-33.

GARNETIFEROUS GNEISS:

Some doubt exists as to the true nature of this rock. Certain bands of it are definitely of sedimentary origin, inasmuch as they are associated with beds of crystalline limestone and paragneiss. In other places, however, the garnetiferous gneiss is associated with granite and syenite gneiss. The rocks in both types of occurrence are almost identical in mineral composition and general appearance, so that, where field relations do not afford conclusive evidence one way or the other, the original nature of the rock must remain a matter of conjecture.

The garnetiferous gneiss is very general in its distribution. It is well developed along the Hull-Chapeau highway at a point two miles west of Black River chute, and occurs abundantly in the vicinity of Dorion tower and on the road from Coughlin creek to Pitchoff creek.

The rock varies in appearance. At some localities it is light-coloured with a high proportion of acidic constituents, and at others ferromagnesian minerals predominate. Crystals of garnet always stand out conspicuously on the weathered surface.

PARAGNEISS:

There are many different types of paragneiss in the southern part of the area. They are very heterogeneous in composition, some being rich in quartz and feldspar, others in biotite and hornblende. The size of the grain is variable. The rock is always banded, either finely or coarsely. The colour varies from white to dark grey, and may change abruptly from band to band due to difference in mineral composition. In places, the rock has a perfectly stratiform appearance. Very commonly, weathered surfaces are rusty, a feature that was used in the field as a criterion for the identification of the rock. Striking exposures of these rocks may be seen on Bryson lake and in the vicinity of the Larivière place to the east of Black river. At other localities the rock is intimately associated with granite gneiss and in many places might very aptly be termed 'migmatite'①, inasmuch as it has been greatly modified by the invading intrusives. *Lit-par-lit* injection is a common feature within the gneisses and in places they have been thoroughly granitized.

① J. J. Sederholm, Bull. Com. Geol. Fin., No. 77, p. 316.

Metamorphosed Batholithic Intrusives

For convenience of descriptive treatment, the paragneisses have been considered above as a group separate from the orthogneisses, but in the field no such distinction exists or can be made, since they grade into one another.

Like the paragneisses, the orthogneisses are characterized by heterogeneity of composition and appearance. They are pink to dark grey in colour and are uniformly foliated. The texture varies from fine to medium. A porphyritic variety is found on an island in lake St. Patrick, with phenocrysts ranging from half an inch to one inch across.

The most common type is a biotite-hornblende pink granite gneiss of medium grain which in places grades into a granodiorite and a hornblende syenite gneiss. Dioritic and alaskitic varieties also occur, but they are rare. Pegmatitic and aplitic injection gneisses are very widely distributed.

Pegmatite in the form of dykes was observed by the writer at several points. It is not foliated. Quartz, biotite, muscovite, garnet, albite, orthoclase and hematite are the only minerals observed in the pegmatite.

Keweenawan Diabase

A system of east-west trending diabase dykes occurs within the area. These dykes, generally about one hundred feet in width, were observed at thirty different points.

The rock is brownish on the weathered surface. At the margins of the dykes it is aphanitic due to chilling, but otherwise it is medium-grained and possesses a well-defined ophitic texture. Under the microscope, it is seen to be a typical diabase, with laths of labradorite penetrating or more or less enclosed in augite grains. Some quartz is also present micrographically intergrown with the feldspar. The latter is slightly kaolinized and the augite is altered in part to chlorite.

Microdiabase in six-inch dykes, identical in composition with the wider ones, was noted at two points: on the Black river at Long rapids in the vicinity of one of the larger dykes, and at Galarneau chute.

These dykes are remarkable in that they have not been subjected to stress, and hence were intruded after the foliation of the enclosing gneisses.

Palæozoic

Black River Limestone ①:

At the south margin of the map-area, along the Ottawa river, there are two localities in which Palæozoic limestone is found. One of these is at Pointe Sèche, or Lighthouse point, the other at Devonshire Park.

The limestone at Pointe Sèche is a greyish, finely bedded rock of generally uniform appearance. One of the beds, however, about six inches thick, is buff-coloured and slightly siliceous. The outcrop covers the whole point. The beds are flat-lying.

On the basis of fossils collected by the writer, Miss Alice E. Wilson, of the Geological Survey of Canada, has determined that these beds are the Leray member of the Black River limestone, indicative of the transition zone between the Black River and the Trenton formations.

At Devonshire Park, on the shore of lake Coulonge, there is an exposure of limestone about 150 feet wide and 400 feet long, striking N.85°E. and dipping 30°S. The rock is similar in appearance to that at Lighthouse point, except for a 6-foot band of a brown-weathering type along the shore of the lake. Mud cracks were observed in one of the beds, and some fracturing was noted in the limestone close to its contact with the pre-Cambrian gneisses.

Detailed work was not done by the writer at this point, but the thickness of the section exposed suggests that the upper beds are of Trenton age. Ami drew a similar conclusion from the study of fossils collected in these beds by Ells ②.

The following fossils, collected by the writer at Pointe Sèche and Devonshire Park, were identified by Miss Wilson:

Pointe Sèche:

Anthozoa:

Columnaria halli Nicholson

Brachiopoda:

Strophomena filitexta Hall
Strophomena sp.
Camarella sp.
Eygospira recurvirostris Hall

① The name 'Black River' is applied to an age division of the geological column. It is merely a coincidence that there is a Black river in the present map-area.

② Geol. Surv. Can., Pub. No. 977, 1906, p. 65.

Cephalopoda:
Endoceras sp.—endocone

Trilobita:
Isotelus gigas de Kay
Isotelus (2 large forms)
Bumastus milleri (Billings)

DEVONSHIRE PARK:
Stromatoporoid
Columnaria halli Nicholson
Streptelasma corniculum Hall
Cameroceras (?) sp.

Miss Wilson adds the following comment on these fossils:

"The *Columnaria halli* is confined to a narrow horizon at the top of the Leray member of the Black River. The *Streptelasma corniculum* is usually considered to be typical of the Trenton, though some forms are found at the very top of the Leray intermediate between *Streptelasma corniculum* and *Streptelasma profundum* which is typical of the Black River. It is suggested here, that while all the collection comes from the same locality, some of it is several feet above the rest, that is, the outcrop may be Black River (Leray) with a thin capping in spots of basal Trenton".

Inasmuch as the work of the writer was primarily a reconnaissance examination of the area farther north, little time was spent at these Palæozoic limestone localities. For more complete details concerning them, the reader is referred to Ells' report on the region①.

STRUCTURE

With the exception of the Keweenawan dykes and pegmatite dykes, the pre-Cambrian rocks throughout the area are all foliated. The intensity and direction of the foliation varies from place to place. Even within a single outcrop, the strike and dip may change. Owing to the absence of horizon markers, it is impossible to determine whether or not faults exist, but it is extremely probable that such a topographic feature as the gorge below the Coulonge chute is due to faulting.

The trend of the foliation is usually northeast-southwest, but deviations from this direction are common. Well-developed jointing is a feature of the orthogneisses.

① Geol. Surv. Can., Pub. No. 977, 1907, pp. 64-65.

The orientation and configuration of the lakes and rivers is controlled in great part by the structure of the gneiss, but glacial deposition has likewise been effective in this respect.

The only persistent structural feature noted is a variable monoclinal dip to the east in the rocks along the upper reaches of the Coulonge river, and on Bryson lake. In addition to this feature there are, on Bryson lake, small local east-west folds that impart a wavy appearance to exposures along the southeast portion of the lake.

The small local escarpment along the boundary between the uplands and the lowlands may be due to local down-faulting of the Palæozoic rocks, but there is no definite proof of this.

The Palæozoic limestone at Devonshire Park has been subjected to considerable disturbance, the beds being tilted to the south with dip of 30°. Also, there has been fracturing in the beds close to their contact with the pre-Cambrian gneisses. That these features are only local, however, is shown by the horizontal attitute of the corresponding limestone beds at Pointe Sèche, only two miles to the east.

Pleistocene and Recent

Glacial:

Glacial boulders and till are present throughout the area, except in the vicinity of the Ottawa river, where they are covered by later unconsolidated marine deposits and alluvium.

Large areas occupied by sand are especially prominent along the upper reaches of the Black river in the vicinity of Schyan depôt, and from Forans creek to Hope stopping-place. There are similar deposits along the Coulonge river between the Perley road and Bryson creek, and occurrences of smaller extent at a number of points in the area between the two rivers.

Stratified clay is seen underlying the sand at a point about one mile above the Duval road on the Black river.

Glacial striæ were noted at only one point within the area, on Stubbs lake. They have a trend of S.20°W.

One small kettle-lake was observed on the Bois Franc road, six miles above Fort Coulonge.

CHAMPLAIN:

The 'lowland' portion of the map area is occupied by deposits of sand and clay, laid down during the Champlain period of marine submergence. Sand forms by far the greater proportion of these deposits. They occur in the form of a series of terraces, approximately parallel to the Ottawa river, which extend to a distance of three miles from the river, and are almost continuous across the area.

The lowermost terrace consists entirely of clay, while the uppermost is chiefly sand. Clay may be seen at Bonin's hill, on the Hull-Chapeau highway. Sand is common along the entire length of the highway. At Armour's farm, the fine sand is blown into small dunes.

These terraces extend up the Coulonge river to a distance of approximately six miles, and up the Black river three miles. That they are of marine origin has been definitely proved by the finding of marine fossils in the clays on Coulonge lake①. One fossil was found by the writer in the clay at Bonin's hill. Dr. L. S. Russell, of the Geological Survey of Canada, has kindly supplied the following report on this fossil:

> "The specimen is a small gastropod of the genus *Cylichna*, probably *Cylichna alba* (Brown). This species occurs along the north Atlantic coast from New England to Greenland. It has been recorded previously from the Champlain beds. I interpret it as indicative of marine but near-shore conditions".

RECENT:

Marl.—Marl occurs at a small lake half a mile southeast of Coulonge chute and situated partly in lot 6 and partly in lot 7 of range III, township of Mansfield. The lake lies in a depression in Champlain sand, 600 feet west of the road leading from the village of Fort Coulonge to Coulonge chute, and it drains west into the Coulonge river.

The lake has a northeast-southwest trend, with length and breadth about 500 feet and 175 feet, respectively. Its shores are steep on the northwest side, but elsewhere have a gradual slope.

① Logan, W. E., *Geology of Canada*, 1863, p. 915.

The marl occurs as a thin mantle on the upper part of the sloping sides and gradually increases in thickness down the slope to where it disappears beneath the surface of the lake. Borings along a distance of 40 feet at the northeastern end of the lake showed thicknesses of from one to three feet. On the lake bottom, the thickness is greater than this.

The lake probably assumed its present outline during the Champlain period and was gradually lowered by the retreat of the sea. The presence of the marl on the sloping lake-shore proves that the water formerly stood at a higher level.

Where pure, the marl is greyish-white in colour, but that on the sloping bank of the lake is buff coloured. If allowed to stand for a few days shells can be found on the surface of the exposed material. The air-dried variety is a greyish, slightly coherent mass in which all traces of shells have disappeared.

The following species from the marl were identified by Mr. A. Larocque:

Gyraulus altissimus F. C. Baker
Fossaria sp.
Helisoma antrosum cf. *striatum* F. C. Baker
Helisoma campanulatum (Say) var.
Gyraulus deflectus obliquus (De Kay)
Succinea retusa
Zonitid
Pisidium sp.
Sphaerium cf. *simile* (Say)

Alluvium:—The swift-flowing tributaries of the Ottawa river carry large quantities of silt in their waters. On reaching the main stream, this is dropped in part, and small delta deposits have been built up in this way at the mouths of the rivers.

The presence of a log fifteen feet underground, found in digging a well in the village of Fort Coulonge, proves that the land at this locality is of alluvial origin. The low-lying area between the Coulonge and Ottawa rivers north of the village, and the short distance between these rivers, suggest that the Coulonge formerly drained into the Ottawa at a point farther east. During high spring-floods, the river sometimes overflows its banks and follows such a course.

The lowermost level stretch which extends to variable distances from the Ottawa river probably represents its old flood-plain.

ECONOMIC GEOLOGY

Feldspar, graphite, marl, and limestone occur within the area. There has been a small production of some of these for local use.

The pegmatite dykes are a potential source of feldspar, mica, fluorite, and radioactive minerals, but, so far as observed, there is a general scarcity of such dykes within the area.

It is quite possible for metallic minerals to be associated with the diabase dykes, especially where they cut Grenville limestone, but the irregular mode of occurrence of the limestone and the absence of thick beds render it improbable that deposits of economic value are associated with it in this area. Where similar geological conditions have been observed elsewhere by the writer and others, there have been no associated mineral deposits①.

Considerable interest was aroused several years ago by reports of a find of placer gold in the northern part of the area, but the individual who is alleged to have made the discovery would not disclose its location. The deposits of glacial sand in the northern part of the area might well contain placer gold. However, it should be remembered that "comparatively few glacial deposits are valuable except where the material has been worked over by running water"②.

Feldspar

Mr. Demmon Libby, of Waltham, holds an option on a deposit of feldspar located on lot 29, range I, township of Waltham. Mr. James Sumner owns the mineral rights to the land.

The prospect is situated half a mile northwest of the Hull-Chapeau highway, two miles west of the power-plant of the Pembroke Electric Light Company, and two and three-quarter miles west of the village of Waltham. The surrounding country is hilly and heavily wooded, but a waggon road leads from the highway to the prospect. A small creek flows southeast past the deposit, which is on the side of a hill that rises from forty to fifty feet above the level of the creek. The country rock at this point is granite gneiss, with strike N.40°W. and dip 65°E.

① Wilson, M. E., Geol. Surv. Can., Mem. 136, 1924, p. 43.

② Emmons, W. H., *Principles of Economic Geology*, McGraw Hill, 1918, p. 416.

The feldspar occurs in a pegmatite dyke which strikes N.68°E. and varies in width from 60 feet in the southwestern portion to 40 feet at a point 100 feet up the side of the hill. Along one side of the dyke (the southeastern) green amphibole, to the extent of about ten per cent, is uniformly distributed through the feldspar, which is somewhat fractured. Small quantities of pyrite and molybdenite were also observed at one point within the dyke.

The feldspar is pink in colour, and, examined in thin section, is found to be typical perthite, with parallel shreds of albite intergrown with orthoclase. A chemical analysis made at the Provincial Assay Laboratory, Montreal, gave potash (K_2O) 8.75 per cent, and soda (Na_2O) 2.40 per cent.

Some development work has been done at the face of the cliff by the Rock Products Company, of Trenton, N. J. The dyke has been laid bare by stripping and blasting to a distance of 100 feet up the slope of the hill. A 50-foot trestle leading to the face of the cliff has been erected.

The feldspar, with width varying from five to fifty feet, was observed at six different points along a north-northeast direction to a distance of 725 feet from the face of the cliff, across the strike of the country rock. The density of the forest and lack of outcrops render it impossible to determine the exact nature of the occurrences. The feldspar is definitely not continuous for this distance, for at two points there are outcrops of gneiss directly between showings of feldspar. Probably there is a series of parallel dykes. Two of the sections exposed definitely belong to different, but parallel dykes.

The feldspar changes from pink to grey as one proceeds northward. Apart from that in the first exposure, the feldspar is clean, with no visible impurities. A sample of grey feldspar taken about 100 feet from the northernmost exposure yielded on analysis 7.55 per cent potash and 4.25 per cent soda.

A diabase dyke, 150 feet wide and striking N.55°W., crops out about 50 feet north of the most northerly of these exposures of feldspar. Its relationship to the feldspar could not be determined because of intervening drift.

It is evident that there is, at this locality, a large deposit of feldspar, which may eventually prove of economic value. More complete analyses and firing tests will be necessary before the usefulness of the feldspar can be ascertained.

Graphite

Libby Prospect:

There is an occurrence of graphite on the south half of lot 36, range III, township of Waltham, at a point two miles northeast of the Hull-Chapeau highway. It was discovered several years ago by Mr. Demmon Libby.

The country rock in the vicinity of the prospect is granite gneiss enclosing the usual sporadic bands of quartz-rich paragneiss and crystalline limestone.

Where the graphite occurs, the rock is predominantly crystalline limestone, grading downward into a greenish paragneiss. A large trench having a trend of N.15°W. has been dug to explore the zone. On the west side of the trench, irregular masses of crystalline limestone, underlain by a quartz-rich paragneiss, occur. Both are injected by stringers of pegmatite. Also, intruding them, is a 30-foot dyke of pegmatite, striking approximately east-west. This is exposed in the trench. The rock is fractured, and on the fracture planes are coatings of graphite up to two inches wide and one foot long.

Another small pit was sunk 50 feet to the southwest, where small flakes of graphite occur in garnetiferous gneiss. Fifty feet to the south of this, there is a third pit. The rock here is a rust-stained, impure, quartz-rich paragneiss. This pit was filled with water at the time of the writer's visit, but a few flakes of graphite were seen in material on the dump.

The development work on the property was done by the Libby Graphite Mining Company, but the deposit was not found to be of sufficient value to mine.

Turcotte Lake:

Graphite also occurs about two miles northeast of Black River chute at a point 500 feet north of Turcotte lake, on lot 27, range III, of Waltham township. It occurs in flakes in crystalline limestone along a 400-foot ridge, striking northeast-southwest. Paragneiss and pegmatite are associated with the crystalline limestone.

Marl

Reference has already been made to the occurrence of marl at a small lake in lots 6 and 7, range III, of Mansfield township. The marl is used as a fertilizer.

It would require detailed work before an accurate estimate of the available tonnage could be made. Analysis of a sample submitted to the Provincial Assay Laboratory yielded 94.7 per cent of calcium carbonate.

Limestone

Quarrying operations have been carried on for a number of years in the limestone at Pointe Sèche. The stone is used locally in the construction of buildings and as road material. It covers an area half a mile long by 600 feet wide.

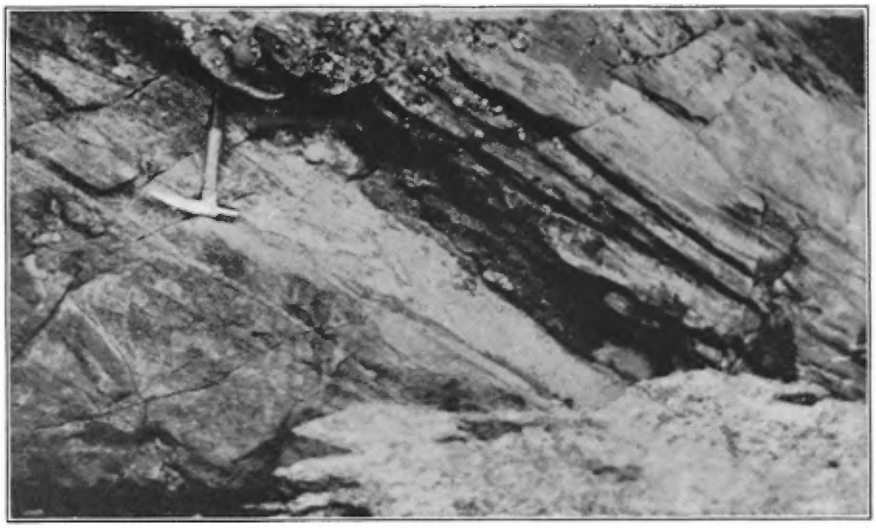
The band of limestone at Devonshire Park is very limited in extent, being approximately 400 feet long and 150 feet wide. Lime was produced here a number of years ago, and three of the old kilns may be seen at the present time. Quarrying on a small scale might be carried on, but it would entail some difficulty, as the area underlain by the limestone has been subdivided into lots, and several cottages have been built on it.

J. A. Retty

PLATE I—Front of Laurentian plateau, looking north from lowlands south of Hull-Chapeau highway. Six miles west of Fort Coulonge.

J. A. Retty

Plate II



A—Six inch band of crystalline limestone in pink granite-gneiss, Balsam lake, (N.E. of Shyan Depôt).

J. A. Retty

B—Interbedded crystalline limestone and paragneiss on Coulonge river, below mouth of Corneille river.

A—Differential weathering in complex mixture of pink granite-gneiss and crystalline limestone at foot of first fall, Coulonge chute. Conspicuous fragments are granite-gneiss; ground mass is crystalline limestone.

J. A Retty

B—Flat-lying Black River limestone on Ottawa river at Pointe Sèche.

A—First fall, Coulonge chute.

J. A. Retty

B—Gorge below main fall, Coulonge chute.