MEMOIR 81

THE OIL AND GAS FIELDS

OF

ONTARIO AND QUEBEC

BY

WYATT MALCOLM

GEOLOGICAL SURVEY

DEPARTMENT OF MINES

OTTAWA

1915

CANADA
DEPARTMENT OF MINES
HON. LOUIS CODERRE, MINISTER; R. G. MCCONNELL, DEPUTY MINISTER
GEOLOGICAL SURVEY

MEMOIR 81

NO. 67, GEOLOGICAL SERIES

The Oil and Gas Fields of Ontario and Quebec

BY
Wyatt Malcolm

OTTAWA
GOVERNMENT PRINTING BUREAU
1915

No. 1561

CONTENTS.

	PAGE
Introduction	1
General statement	1
Location	1
History	2
Summary and conclusions	5
General character of the district	8
General geology	9
General statement	9
Table of formations	11
Description of formations	12
Pre-Cambrian	12
Potsdam	13
Beekmantown	15
Chazy	16
Black River group	18
Trenton	19
Utica group	23
Lorraine and Richmond	24
Medina	26
Clinton	30
Niagara	31
Guelph	33
Salina	34
Oriskany	39
Onondaga	39
Delaware	41
Hamilton	42
Huron shale	43
Port Lambton	44
Pleistocene and Recent	44
Structural geology	45
The oil and gas fields	56
Distribution	56
Relation of oil and gas reservoirs to rock structure	57
General status and future possibilities	58
Description of fields in Ontario	60
Brant county	60
Bruce county	62
Durham county	62
Elgin county	63

Essex county 64
Haldimand county 68
Halton county 70
Kent county 70
Lambton county 77
Manitoulin island 85
Norfolk county 85
Oxford county 86
Simcoe county 87
Welland county 88
Wentworth county 92
York county 92
Description of fields in Quebec 92
North of the St. Lawrence 93
South of the St. Lawrence 93
Gaspe 97
Bituminous shales 104
Anthraxolite 108
Analyses 109
Production 117
Logs 123
Province of Ontario 124
Province of Quebec 232
Index 239

The Oil and Gas Fields of Ontario and Quebec

INTRODUCTION.

GENERAL STATEMENT.

The object of the present compilation is to set forth concisely the geological conditions existing in the southern parts of Ontario and Quebec that are underlain by sediments that have suffered little disturbance. At various points these sediments have been found to contain natural reservoirs of petroleum or natural gas. Although boring has been carried on in Quebec and in eastern Ontario, and a small amount of gas has been found in Quebec, the important producing fields lie in southwestern Ontario. This section of country is fairly level and well adapted to agriculture. It is underlain by nearly horizontally disposed Palæozoic limestone, dolomite, and shale. The oil pools of Oil Springs and Petrolia, which were opened in the sixties and were for many years the only producing fields of the province, occur in the Onondaga (Corniferous) formation. Later investigations have proved the presence of several productive horizons and gas or oil or both have been found in the Salina (Onondaga), Guelph, Clinton, and Medina formations. There has been in recent years a rapid decline in the production of oil in spite of the discovery of new pools; but the gas production has been rapidly increasing and the fields have been widely extended.

LOCATION.

The gas and oil fields and prospects lie in the southern parts of the provinces of Ontario and Quebec, in areas underlain

by the less disturbed Palæozoic strata. In Ontario these sedimentary rocks underlie that part of the province lying to the west of a line drawn from the east end of Lake Ontario to the southeast part of Georgian bay; the large islands in the northern part of Lake Huron are also composed of little disturbed sediments. The southwestern peninsula of Ontario embraces practically all the producing fields of the two provinces, and within this area nearly the total yield of gas and oil has been from that part lying south of a line drawn from the west end of Lake Ontario to the south end of Lake Huron.

Another section of Ontario and Quebec in which some prospecting has been done and in which small amounts of gas have been struck lies between a line drawn north from the Thousand islands and a line drawn from Quebec city to the foot of Lake Champlain, and extends from the International Boundary north to a short distance beyond the Ottawa and St. Lawrence rivers.

The basins of the York and St. John rivers in the eastern end of Gaspe peninsula have received considerable attention and this area is also briefly described.

HISTORY.

The excitement occasioned by the discovery of petroleum in Pennsylvania spread to Canada. The result was that in the early sixties wells were drilled at nearly every point in the country where petroleum springs were known, and at a great many points where there were not the slightest indications of oil. Attention was directed to the springs of Enniskillen township, Ontario, of Tillsonburg, Ontario, of Manitoulin island, and of Gaspe peninsula, and boring operations were conducted at all these places. Numerous wells were sunk throughout the southwestern portion of Ontario from the county of Wentworth west; most of these did not reach a depth of 600 feet and very few exceeded 1,000 feet.

The only borings that led to the discovery of petroleum in commercial quantities were those made in the township of Enniskillen and in the township of Mosa near Bothwell. The three fields known as Oil Springs, Petrolia, and Bothwell were opened.

The field near Bothwell was abandoned in 1866; but the other two have continued steady producers up to the present. Many of the first wells sunk in Oil Springs and Petrolia were flowing wells and numbers of them produced several thousand barrels each per day. These soon ceased to flow and the pools have since been pumped. The production has declined greatly and now averages only a few gallons per well per day.

The Petrolia and Oil Springs fields continued until within recent years to be the only important producers. The decrease in the yield has been checked occasionally by the opening up of new pools; but this has been only temporary, as the newly-discovered pools have been either very small or have declined very rapidly in production.

In the eighties the small pool in Euphemia was discovered, and explorations in the township of Zone led to the opening of the new Bothwell field in 1896. This is one of the more important pools and has continued a steady producer to the present time. The Dawn pool was opened in 1897 and the Dutton and London Road pools in 1898. The small pool in Raleigh, in which the Gurd gusher was struck, was opened in 1902. The Moore oil field was opened in 1904; some of the wells of this field had an initial production of 40 to 100 barrels per day. Oil was first struck in the Tilbury field in December, 1905, boring operations were actively conducted in 1906, and the production in 1907 was 344,358 barrels or 44 per cent of the total production of the province. Unfortunately there has been a very rapid decrease in the yield. Other small fields that have been opened in recent years are the Kipp field in the north part of Raleigh township, the Mersea field, the Romney field, discovered in 1906 in the eastern part of Romney township, the Wheatley field in the southwestern part of Romney, the Plympton field, and the Onondaga field southeast of Brantford. A small quantity of oil was obtained from a few wells in Brantford and vicinity, and from Pelee island. Some of these smaller pools are now exhausted.

Explorations for oil have been conducted in other parts of Ontario and in Quebec. Small quantities of oil have been found in wells sunk on Manitoulin island and on the Gaspe peninsula; but no producing fields have been opened.

A bounty of 1½ cents per gallon paid by the Dominion Government on crude petroleum produced in Canada became effective on June 8, 1904, and served as a stimulus to operators, leading to increased activity in boring operations and resulting in a temporary increase in production.

Late in the eighties attention was directed to testing the gas producing possibilities of the strata of southwestern Ontario. The result was that the gas fields in Gosfield, in Bertie, and at Port Colborne were opened. Heavy flows of gas were struck and preparations were made for procuring a market additional to that of the local demand. A pipe line was laid from the Bertie field to Buffalo in 1890 and gas was piped to that city until April 1, 1909. It is still supplied to the Canadian towns of the vicinity. A line from the Gosfield section to Detroit was completed in December, 1894, and gas was exported until 1901. Walkerville and Windsor continued to be supplied until 1904, when the reservoir was practically exhausted.

After the supply to Detroit was cut off the production of gas for Ontario decreased in value to $196,535 in 1903. Since that year there has been a marked annual increase, until in 1913 the value of the gas produced in Ontario amounted to $2,362,021, and in 1914 to $2,347,737.

This increase is due chiefly to the discovery and development of important fields in Haldimand, Norfolk, Elgin, and Kent counties. In Haldimand and Norfolk the individual wells are not heavy producers, but the area drawn upon is large, so that the total production is large. The wells of the Kent field have a strong flow and furnish light and fuel for a large population. Numerous small reservoirs which have contributed much to the increase in production, have been struck at different times in recent years.

The total production of natural gas in Ontario for 1913 was 12,558·4 million cubic feet, of which Kent produced 63·5 per cent, Elgin 3·8 per cent, and the Welland-Haldimand-Norfolk group 32·7 per cent.

Explorations have been made in Quebec with a view to discovering gas in commercial quantities. Small flows were struck in a few wells sunk in the section of country some distance

to the west of Three Rivers and the gas was piped to the villages of the vicinity. In 1907 a pipe-line was laid to Three Rivers; but before the end of the year the supply was exhausted. Gas with a rock pressure of 275 pounds was also struck in 1910 in a well drilled in the parish of St. Barnabé, south of the St. Lawrence. The boring operations in Quebec have not met with the success desired.

Several wells have been sunk in eastern Ontario at different times, but without success so far as the discovery of oil and gas is concerned.

The value of natural gas for fuel and lighting is fully recognized, and Government regulations have been made aiming at conserving this natural resource for the use of the Canadians. In 1901 the Ontario government cancelled the agreement granting the use of the bed of Detroit river for the pipe-line by which gas was exported. The same government, by the Supplementary Revenue Act of 1907, imposed a tax of 2 cents per thousand cubic feet on natural gas, but 90 per cent of this tax is remitted on gas consumed within the province. The tax on gas allowed to go to waste is not subject to remittance. The Electricity and Fluid Exportation Act passed by the Dominion government and assented to on April 27, 1907, forbids the export of petroleum, natural gas, water, and other fluid, whether liquid or gaseous, without license. This license "may provide that the quantity of power or fluid to be exported shall be limited to the surplus, after the licensee has supplied for distribution to customers for use in Canada, power or fluid to the extent defined by such license, at prices and in accordance with conditions, rules and regulations prescribed by the Governor in Council." Inspection of the oil and gas fields of the province is carried out by the Ontario government, which compels the repairing of defective wells and the plugging of abandoned ones so as to prevent pools or reservoirs from being drowned out.

SUMMARY AND CONCLUSIONS.

The southwestern part of Ontario is underlain by limestone, dolomite, and shale of the Ordovician, Silurian, and Devonian systems. These rest upon formations of Pre-Cambrian age.

At the base are a few feet of sandstone and arkose which in places may belong to the Potsdam formation and in places may be the basal member of a later formation. This is followed above by 600 to 700 feet of limestone, consisting chiefly of the Trenton formation overlying a much smaller volume of older strata. The Trenton is overlain by the black bituminous Utica shale, which in turn is overlain by the grey Lorraine shale. The thickness of these two formations varies much and it is difficult for drillers to define the boundary between the two. The combined thickness varies from 900 feet at Thorold to about 300 feet on Manitoulin island, that of the Lorraine formation predominating.

Overlying these is a great thickness, about 1,000 feet, of red shale known as the Queenston shale. This in turn is succeeded by a body of sandstone and shale predominantly red in colour and 115 feet thick at Niagara river. This is the Medina formation. It is succeeded by the Clinton formation consisting of shale and dolomite, and having a thickness of 30 feet on Niagara river. Succeeding the Clinton are the Niagara, Guelph, and Salina (Onondaga) formations. The Niagara formation consists of shale overlain by dolomite and the Guelph consists of dolomite. In the Niagara peninsula drillers recognize about 60 feet of shale and 230 feet of dolomite belonging to the two formations. The shale thins out towards the north and disappears, while the dolomite increases in thickness. The Salina (Onondaga) formation consists of shale and dolomite with beds of salt and gypsum. The thickness in the Niagara peninsula is between 300 and 400 feet, but to the west and northwest it is much greater.

Between the Silurian and Devonian systems there is a recognizable disconformity. A few feet of Oriskany sandstone is found in places at the base of the Devonian. This is succeeded by the Onondaga (Corniferous) limestone, above which comes the Delaware limestone, succeeded by the Hamilton formation consisting of shale and limestone. Overlying the Hamilton formation is a black, bituminous shale designated the Huron shale, and north of Lake St. Clair this in turn is overlain by a series of black and green shales with thin arenaceous beds. These are the Port Lambton beds. The whole area is covered by glacial

deposits, some of which have been re-sorted and deposited in water.

The strata are nearly horizontal, but dip to the southwest a few feet per mile. The result is that the different formations are exposed in bands running in a northwest direction across the province, the base of the Ordovician running from the vicinity of Kingston to Georgian bay, the base of the Silurian from the Niagara peninsula to Bruce peninsula, and the base of the Devonian from the Niagara peninsula and to the vicinity of Goderich.

In eastern Ontario and in southwestern Quebec a somewhat similar succession of strata is found. Potsdam, Beekmantown, and Chazy formations are, however, found and the highest formation consists of red shales corresponding to the Queenston shales. In eastern Ontario the formations lie in a basin towards the centre of which the strata dip, while in Quebec they dip to the southeast.

In southwestern Ontario the strata have been very little disturbed, while in eastern Ontario and in Quebec there has been considerable faulting.

The main producing oil and gas fields lie south of a line drawn from the west end of Lake Ontario to the south end of Lake Huron. The oil pools are found chiefly in the western part of this area, while the gas reservoirs lie in the counties along the north shore of Lake Erie, extending a few miles back from the shore. Petrolia, Oil Springs, Bothwell, Moore, and Tilbury are the most important oil fields. The fields of Petrolia and Oil Springs were discovered in the sixties and are still producing; the others are of more recent discovery. In all the above-named fields, except Tilbury, the Onondaga (Corniferous) limestone is the productive horizon and in the Tilbury field the oil is found in the Guelph and Salina (Onondaga). There are several other small and less important pools.

The most important gas fields lie in Welland, Haldimand, Norfolk, Elgin, Kent, and Essex counties. Gosfield township in Essex county was at one time a very important gas field, but the production has ceased. In Welland, Haldimand, and Norfolk counties there are numerous disconnected fields, and in

these counties there is hardly a township bordering on Lake Erie that is not a producer of gas. The Kent field, opened a few years ago, has proved highly productive. In Welland, Haldimand, and Norfolk the Medina and Clinton are the productive formations, while in Kent the gas is obtained from the Salina (Onondaga).

The production of oil has declined rapidly in recent years. The gas industry is at present very active, and boring operations carried on during the last decade have done much towards extending the producing areas of old fields and opening new fields.

Considerable exploratory work has been done on the Gaspe peninsula and small quantities of oil have been obtained in several wells. The amount is not sufficient to place the industry on a commercial basis. A great thickness of sandstone overlies limestone beds, and all have been much folded and faulted. These are of Devonian age.

"The oil in Lambton county is dark brown in colour and has a gravity of 31° to 35° Beaumé. It differs very much from the oils of the United States, in that its sulphur-content is much higher. The United States crude oil does not usually contain more than five-tenths per cent of sulphur, whereas the Canadian oil runs as high as two and a half. This makes it much more difficult to refine; but by modern methods it is claimed that the complete elimination of the sulphur can be effected, and that the oil may be made equal in quality to the United States product."[1]

The refining companies are: Imperial Oil Company, Sarnia; Canadian Oil Companies, Petrolia; Canadian Oil Producing and Refining Company, Petrolia; Empire Company, Wallaceburg; British American Company, Toronto.

GENERAL CHARACTER OF THE DISTRICT.

The area underlain by the Palæozoic rocks of southern Quebec and Ontario is in general flat or gently undulating. The soil is fertile and the precipitation adequate, so that the country is well adapted to agriculture. It was once well wooded; but in the development of the agricultural industry the forests

[1] Denis, T., Geol. Surv., Can., Vol. XI, p. 135 S.

have been almost completely removed. This is the most densely populated part of the provinces, the easy accessibility by water, the fertility of the soil, and the favouring topographic features conducing to early settlement. The facilities for communication and transportation are excellent. The postal, telegraph, and telephone services are good, and the network of railways connected with important seaports and the chief ports on the chain of large inland lakes and rivers furnishes adequate means of transportation. It is quite patent that in a settled country where there are numerous towns, where manufacturing has become well established, and where there is a considerable railway mileage the demand for oil and natural gas for lighting, heating, and power purposes will be very brisk. The natural gas, therefore, finds a ready market, and the production of oil in Canada so far fails to equal the demand that large quantities are imported.

GENERAL GEOLOGY.

GENERAL STATEMENT.

The northern part of Ontario and Quebec is underlain by a great mass of altered Pre-Cambrian sediments and igneous rocks, forming part of what is known as the Canadian shield. Resting upon these Pre-Cambrian rocks to the south and dipping in a general southerly direction is a thick column of Palæozoic sediments. Long continued erosion of these sediments has bevelled them so that the different formations are exposed in long narrow belts more or less parallel with the line of contact between the lowest Palæozoic beds and the Pre-Cambrian rocks.

From the Canadian shield a narrow neck of Pre-Cambrian rocks extends southeast, crosses the St. Lawrence at the Thousand islands, and spreads out in New York, occupying a great deal of the northeastern part of that state. This is commonly designated the Frontenac Pre-Cambrian axis. It divides the area under study into two parts, since the problem of oil and gas in Ontario and Quebec involves only the Palæozoic rocks.

West of the Frontenac axis and occupying all of southwestern Ontario beyond a line running from Kingston to Georgian bay

is a mass of almost wholly conformable sediments represented by formations from the Black River group of the Ordovician system at the base, to the Port Lambton beds of the Devonian system at the top. A slight unconformity has been detected between the Silurian and Devonian. These sediments have suffered from no intrusions by igneous bodies; there has been very little faulting and only very gentle folding. To the southwest they pass into the low Cincinnati anticline. A saddle crosses this anticline southeast from the foot of Lake Huron.

East of the Frontenac axis the Palæozoic formations occupy the triangular area between the Ottawa and St. Lawrence rivers and an area extending from a few miles north of the St. Lawrence in Quebec southeast to the St. Lawrence-Champlain fault. This fault runs from the foot of Lake Champlain to the vicinity of the city of Quebec, and forms the dividing line between two very different series of rocks. The rocks on the east side were deposited under different conditions from those on the west, are much folded, and have suffered more or less alteration. West of the fault the strata have suffered little from folding, but there has been some faulting.

An anticline crosses the area a little west of Montreal and runs in a north-northwest direction. East of this the strata dip towards the St. Lawrence-Champlain fault and west of it the strata lie in a circular depression with formations outcropping in concentric circles.

There is a conformable series of formations from the Potsdam to the Queenston. These are intruded at a few points by igneous bodies forming a series of small hills extending from Montreal eastward.

It is probable that some of the sediments were deposited in a continuous sea extending across the Frontenac Pre-Cambrian axis, and have been subsequently eroded, exposing the Pre-Cambrian rocks.

TABLE OF FORMATIONS.

System.	Formation.	Lithological character.
Pleistocene....		Till, stratified sands, and clays, etc.
	Port Lambton beds.....	Black and green shales with arenaceous beds.
	Huron shale.....	Black, bituminous shale.
	Hamilton.....	Soft blue shale and limestone.
Devonian.....	Delaware.....	Limestone.
	Onondaga.....	Limestone.
	Oriskany.....	Sandstone.
	Helderbergian (Wanting, or possibly represented, in part, by the Detroit River Series.[1])	
	Detroit River Series.....	Limestone and sandstone.
	Cobleskill.....	Dolomite.
Silurian.....	Salina.....	Shale and magnesian limestone.
	Guelph.....	Dolomite.
	Niagara.....	Dolomite and shale.
	Clinton.....	Limestone and shale.
	Medina.....	Sandstone and shale.

[1] Stauffer, C. R., The Devonian of southwestern Ontario: Geol., Surv., Can., Memoir 34. In press.

TABLE OF FORMATIONS—*Continued.*

	Richmond	Shale.
	Lorraine	Shale.
	Utica	Shale.
	Collingwood	Shale and limestone.
Ordovician	Trenton	Limestone.
	Black River group	Limestone.
	Chazy	Sandstone, shale, and limestone.
	Beekmantown	Magnesian limestone.
Cambrian	Potsdam	Sandstone.
Pre-Cambrian.		Igneous and metamorphic rocks.

DESCRIPTION OF FORMATIONS.

In the descriptions given of the different formations particular emphasis is laid on the lithological character of the rocks, as it is chiefly on this that the driller depends for their identification. Tables are given containing data derived from the logs of wells. As many of the logs have been compiled from information furnished by drillers and as all drillers are not equally acute in detecting lithological distinctions nor equally careful in making their measurements, some discrepancies are likely to be observed. The sign + follows the figures representing the thickness of the formation when the drilling operation began or ended in the formation in question.

PRE-CAMBRIAN.

The Pre-Cambrian formations consist of igneous rocks and metamorphosed sediments. They are usually quite granular

and extremely difficult to penetrate with the drill. Dark green rocks are found carrying minerals like mica and hornblende, the fragments of which show smooth cleavage faces. White crystalline limestone is also found, but pink granites and gneisses predominate. They are recognized in borings by the angular character of the fragments of quartz and feldspar. The quartz particles are glassy and of uneven fracture, while the feldspar particles show smooth glistening cleavage faces.

Data Regarding the Pre-Cambrian Formations.

County.	Municipality.	No. of log.	Depth in feet.	Elevation.
Bruce.....	Amabel, lot 1, con. 10..	14	1,600	— 650
Grey.....	Osprey, lot 10, con. 11. .	78	1,800	— 250
Ontario.....	Whitby.....	216	728	
Oxford.....	Beachville.....	217	2,789	—1,896
Peel.....	Clarkson.....	222	1,461	—1,195
Welland.....	Bertie, lot 6, con. 15....	245	3,255	—2,650
"	Humberstone, lot 9, con. 2.....	250	3,300	
"	Willoughby, lot 4, con. 3.	261	3,030	—2,440
Wentworth...	Hamilton.....	272	1,960	—1,670
York.....	Swansea.....	277	1,245	— 898
"	Toronto.....	278	1,200	
"	York, lot 11, con. 3.....	280	1,119	— 822

POTSDAM.

The Potsdam formation forms the outer rim of the basin lying in the angle formed by the Ottawa and St. Lawrence rivers. East of Ottawa it runs in a discontinuous narrow belt north of Ottawa river and parallel with it, reaching into the county of Two Mountains. Thence it runs southward, spreading to the west and occupying the greater part of Vaudreuil county, then narrowing to a few miles at some distance south of Lake St. Louis, but widening again on approaching the International

Boundary. Passing westward through New York it enters Canada at Brockville and follows an irregular broken course westward into Bedford township, then northward through Lanark and Carleton counties. From Two Mountains a narrow band runs northeast parallel with the St. Lawrence to a point north of Three Rivers.

This formation, which is the lowest of the Palæozoic rocks in the area under study, rests directly on the Pre-Cambrian. It consists at the base of conglomerate and arkose composed of debris from the underlying rocks. This passes upward into red and white sandstones which in turn pass by transition beds into the overlying Beekmantown (Calciferous). The sandstone is quite quartzitic in places. A few small exposures of sandstone found in the Kingston district west of the Frontenac axis are considered by some geologists as Potsdam. Others regard them as the basal members of younger formations. In Storrington this rock is for the most part red and green in colour, and generally fine-grained, but passes into a coarse quartz conglomerate. West of Kingston the limestones pass downward into shale, sandstone, and arkose, which vary considerably in thickness, filling hollows in the old Pre-Cambrian surface, but frequently being absent from the ridges and knobs. Such sandstone and arkose beds are recognized in many of the deep wells of southwestern Ontario.

The thickness of the Potsdam in Ontario rarely reaches 100 feet; but on approaching New York state south of Lake St. Louis, it increases rapidly and near the boundary is more than 540 feet.

Data Regarding the Sandstone and Arkose Beds.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Bruce.....	Amabel, lot 1, con. 10.....	14	1,570	30	— 620
Grey.....	Osprey, lot 10, con. 11.....	78	1,753	47	— 203
Lincoln.....	Louth, lot 4, con. 3..	188	2,173	27	—1,876
Ontario.....	Whitby.....	216	720	8	
Welland....	Bertie, lot 6, con. 15	245	3,210	45	—2,605
"	Willoughby, lot 4, con. 3.....	261	2,998	32	—2,408
Wellington	Glen Allan.....	265	2,522	51	—1,277
"	Pilkington, lot 6, con 5.....	266	2,380	5+	—1,005
York.....	New Toronto.....	276	1,240	72	
"	Toronto.....	278	1,180	20	
"	York, lot 11, con. 3.	280	1,109	10	— 812

BEEKMANTOWN (CALCIFEROUS).

The Beekmantown (Calciferous) formation runs from the townships of Lacolle and Hemmingford northwest into Chateauguay, crosses the west ends of the islands of Montreal, Bizard, and Jesus, and passing into the east end of the county of Two Mountains turns northeast and runs in a narrow belt parallel to St. Lawrence river to a little beyond the foot of Lake St. Peter. On account of the drift covering, its exact boundaries are not known.

In the Ottawa basin this formation runs in a narrow belt down the river from the city of Ottawa into the county of Two Mountains, lying chiefly on the north bank of the river. It runs south into Soulanges, Beauharnois, and Huntingdon counties, where it assumes considerable width. Then running westward on the south side of the St. Lawrence it enters Canada, occupying

Grenville county and the eastern part of Leeds and extending in a wide belt north through Carleton county and east Lanark to Ottawa river. There are also a few outliers to the west.

The rock varies somewhat in character. It is usually a dark grey, semi-crystalline magnesian limestone. Geodes of calcite, quartz, and other minerals are frequently found, as well as irregular streaks and patches of black chert. In some places the upper part of the formation is a calcareous argillite with a bituminous odour. At the base are 20 to 30 feet of transition beds by which the formation passes gradually into the Potsdam below. In some places it overlaps the Potsdam and rests directly on the Pre-Cambrian.

From surface measurements the thickness of the formation seems to vary from 350 to 400 feet. Quite different figures are, however, obtained from the Montreal Gas Company's well at Hochelaga. Specimens taken between the depths of 2,200 and 2,375 feet proved to be from the Beekmantown (Calciferous) formation, and at a depth of 2,550 feet the Potsdam sandstone had not been reached. Allowing 600 feet and 785 feet for the maximum thickness of the Trenton and Chazy respectively, the Beekmantown (Calciferous) would have a thickness of over 1,000 feet. This discrepancy may be due to faults having obscured the relations of the rocks in the field, or there may be an increase in the thickness of the formations with distance from the old Pre-Cambrian shore. It seems probable from the thickness of the Utica in the harbour at Montreal that a fault occurs along the east side of the island, between the Trenton and Utica formations. This belief is strengthened by the results of a boring at Laprairie, where 1,000 feet of shale was traversed and no limestone encountered.[1]

CHAZY.

On account of the thick mantle of loose material the exact boundaries of this formation cannot be determined. It is mapped as entering Quebec a little west of Richelieu river, passing north several miles, swinging to the west through the county of Napier-

[1] Adams and LeRoy, Geol. Sur., Can., Vol. XIV, Part O, p. 74.

ville, thence northwest through Laprairie to the lower end of Lake St. Louis. It passes through the west end of the island of Montreal, through the islands of Bizard and Jesus; from the latter a spur runs southeast towards the city of Montreal, and crossing to the north shore of the St. Lawrence runs in a narrow band parallel to the river and at some distance from it to a little below Lake St. Peter.

In the basin in the angle formed by the Ottawa and St. Lawrence rivers the formation is exposed in a narrow belt, which is somewhat circular in shape. From Ottawa eastward it skirts the south shore of the Ottawa to the eastern part of the county of Prescott, then turning southward reaches the St. Lawrence in Glengarry county, and follows the north shore of the river into Dundas county, where it turns again to the north. There is a considerable exposure in Torbolton, and another in Goulbourn, Huntley, and Ramsay townships. There are also some outliers farther to the west.

The Chazy formation consists of sandstone, shale, and limestone. The sandstone is not well exposed around Montreal; the limestone, occurring in the upper part of the formation, is well developed at Montreal, but thins westward so that at Ottawa it is very unimportant. At the latter place Raymond finds between the Beekmantown and Black River formations a section of 250 feet. The lower 125 to 135 feet, consisting chiefly of sandstone and shale, are characterized by Chazy fossils, while the upper 115 to 125 feet, consisting of limestone with a subordinate amount of shale, are characterized by fossils more nearly akin to those found in the Black River formation. Of the upper section the top 50 feet are regarded as Lowville; the remaining 65 to 75 feet resemble lithologically the Pamelia of northwestern New York,[1] which is considered by Cushing to cross into Ontario at Kingston and to wedge out before reaching the Simcoe district.

In the vicinity of Montreal field relations show a thickness of 300 feet, but boring operations have revealed a much greater thickness, and in a well at the Turkish Bath hotel, 140 Ste. Monique street, a thickness of 785 feet was passed through.[2]

[1] Ottawa Naturalist, XXIV, p. 196.

[2] Adams and LeRoy. Geol. Sur., Can., Vol. XIV, Part O, p. 55.

BLACK RIVER GROUP.

Black River is a term applied to that group of rocks lying between the Chazy and Trenton formations, and includes the Black River formation and the Birdseye or Lowville.

The Black River group has been recognized at different places in Quebec at the base of the Trenton. In the eastern Ontario basin between the Ottawa and St. Lawrence rivers, the group forms a narrow belt extending east from the city of Ottawa through Russell and Prescott counties a short distance from Ottawa river. In the southern syncline of this basin the group forms a belt that takes a semi-circular course to the south of the Trenton through Glengarry and Stormont counties. It forms an elliptical belt in Goulbourn, Huntley, and Fitzroy townships farther west, and there are also a few outliers beyond this. In the basin west of the Frontenac axis it is exposed in a steep escarpment at or near its contact with the Pre-Cambrian rocks. This escarpment varies from a few feet to about 100 feet in height and can be traced more or less continuously from Kingston to Georgian bay.

The group consists almost completely of limestone. In the Simcoe district there is a limestone series that is older than the typical Trenton, but for mapping purposes cannot be separated from it. This is provisionally known as the Kirkfield limestone group.[1] Below this group is the following series:

Dark blue to grey nodular and cherty limestone generally in massive beds 1 to 3 feet thick	10–20 feet
Dove-coloured, fine-grained, even-bedded limestone, in beds averaging 1 foot in thickness	20 "
Greenish grey impure magnesian limestone	6– 8 "
Fossiliferous, blue to dove-coloured limestone	6–10 "
Impure magnesian limestone, greenish-grey on fresh fracture	8–10 "
Red and green shales and sandstones with thin local intercalations of dove-coloured limestone, and at the base locally a few feet of coarse grit or arkose resting unconformably on the Pre-Cambrian rocks	10–20 "

[1] Johnston, W. A., Geol. Sur., Can., Summary Report, 1910, p. 190.

The upper 10 to 20 feet are provisionally named the Coboconk limestone, while the lower beds carry Lowville fossils.[1] In the vicinity of Ottawa the Lowville formation has a thickness of about 50 feet. On the islands to the north of Manitoulin, Lowville shales and Leray and Black River limestones occur.[2]

The thickness of the Black River group in the southwestern part of Ontario is not known as the drillers make no attempt to subdivide the limestones below the Utica shale.

TRENTON.

The Trenton formation is found in the basins both to the east and west of the Frontenac axis. From Montreal a narrow belt extends south a few miles then east to the vicinity of St. Johns; a wider belt reaches westward to the Lake of Two Mountains; the formation also extends in a narrow belt down the north side of the St. Lawrence at a short distance from the shore to beyond the city of Quebec. On account of the great depth of drift covering, it is impossible to determine the exact boundaries. The strata dip to the southeast at a very low angle beneath the Utica and probably extend to the St. Lawrence-Champlain fault. In the angle formed by the St. Lawrence and Ottawa rivers there are two main synclines. In the more northerly of these the Trenton extends in an irregular belt east from the city of Ottawa through Russell and Prescott counties at a short distance south of the Ottawa, and dips southward beneath the overlying shales. With the exception of one or two very small areas it is the highest formation in the southerly syncline and underlies large parts of Glengarry and Stormont counties. Farther to the west it underlies parts of Nepean, Goulbourn, and Huntley townships, and outliers occur still farther west.

West of the Frontenac axis there is a wide belt of this formation. It extends in width from Kingston to a mile south of Oshawa on Lake Ontario and runs in a northwest direction

[1] For a discussion of the different formations of the group see — Geol. Surv., Can., Summary Report 1910, p. 191.

[2] Foerste, Aug. F., The Ordovician section in the Manitoulin area of Lake Huron: Ohio Naturalist, Vol. 13, No. 2, pp. 37-48.

to Georgian bay, where it reaches from Collingwood east to beyond Penetanguishene. It also occurs on the northeast of Manitoulin island, as well as on some of the islands to the north. It underlies the Utica shales in the southwestern part of Ontario and is recognized in the deep wells.

At some points the Trenton overlaps the older Palæozoic formations and rests directly upon the Pre-Cambrian rocks. This is more particularly noticeable at some distance down the St. Lawrence.

The formation consists of granular, semi-crystalline, dark grey limestone, which is rather bituminous and argillaceous. In places the limestone beds are separated by layers of shale, which increase in thickness on approaching the overlying formation.

Section in the Vicinity of Montreal.

Black bituminous compact limestone, containing about 10 per cent argillaceous matter; beds 3 to 10 inches thick separated by brown or black bituminous shaly partings	350 feet.
Black and dark grey bituminous nodular limestone, the nodular character being due to unequal distribution of argillaceous material; beds 2 to 8 inches thick separated by brown to black bituminous shale	150 "
Grey granular bituminous limestone in beds 10 inches to 2 feet thick	10 "
Grey granular bituminous limestone in beds 3 to 18 inches thick at the bottom, passing into black nodular bituminous limestone at the top interstratified with black bituminous shale	10 "
Black bituminous nodular limestones in beds 2 to 4 inches thick, separated by layers of black bituminous shale	10 "
	530 feet.

"It is probable that above the foregoing section there are additional beds, in which the layers of shale gradually increase in thickness, so that the total volume of the formation may be regarded as approaching about 600 feet."[1]

[1] Geology of Canada, 1863, p. 139.

Section on Moira River.

Bluish limestone in thin beds and often nodular, interstratified with layers of shale, increasing towards the top near Belleville.....	594 feet.
Grey limestone of a crystalline texture in beds 6 to 8 inches thick..	20 "
	614 feet.

This section does not include Prince Edward peninsula which is probably underlain by this formation.

The limestone intervening in the southwestern part of Ontario between the basal sandstone or arkose and the Utica shale is classed by the drillers as Trenton, and by them no attempt has been made to break up the Trenton group into its different formations. A thickness of over 600 feet is usually noted for this limestone. On Manitoulin island and the islands to the north the Trenton group occurs, and in a well sunk many years ago a thickness of 340 feet of limestone was found lying between the black shale above and the red sandstone below.

This is the formation in which small quantities of oil were found on Manitoulin island. Small cavities filled with petroleum have been found at various points, and a small quantity of gas was struck in a deep well on lot 2, concession 4 of Willoughby township. Wells have been sunk into this formation at a number of points throughout southwestern Ontario, but with unsatisfactory results, in so far as petroleum and natural gas are concerned.

Data Regarding the Trenton Formation.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Brant	Brantford	4	1,950	210+	−1,220
Bruce	Amabel, lot 1, con. 10	14	945	625	5
Essex	Colchester, South, lot 64, con. 1	45	2,150	270+	−1,502
"	Mersea, lot 239, north Talbot road	62	2,488	408+	−1,858
Grey	Keppel, lot 38, con. 2, north Centre Diagonal	77	1,032	468+	
"	Osprey, lot 10, con. 11	78	1,160	593	390
"	Northwest corner Sarawak	79	735	469+	
Lambton	Inwood	156	3,000	380+	−2,310
"	Petrolia	173	3,210	567+	−2,543
Lincoln	Louth, lot 4, con. 3	188	1,506	667	−1,209
Manitoulin Island	Two miles southeast of Wekwemikong	189	383	137+	
Norfolk	Simcoe	214	2,544	158+	−1,869
"	Vittoria	215	2,690	392+	−2,032
Ontario	Whitby	216	120	600	
Oxford	Beachville	217	2,260	529	−1,367
Peel	Clarkson	222	804	657	− 538
Perth	Stratford	228	2,346	40+	−1,166
Welland	Bertie, lot 6, con. 15	245	2,525	685	−1,920
"	Thorold	255	1,800	683+	−1,300
"	Willoughby, lot 4, con. 3	261	2,313	685	−1,723
Wellington	Glen Allan	265	1,817	705	− 572
"	Pilkington, lot 6, con. 5	266	1,685	695	− 310
York	Highland Creek	274	248	434+	
"	Mimico	275	723	337+	
"	New Toronto	276	645	595	
"	Swansea	277	643	602	− 296
"	Toronto	278	595	585	
"	York, lot 11, con. 3	280	478	631	− 181

UTICA GROUP.

The Utica group overlies the Trenton and probably forms a belt extending northwest from the vicinity of Bowmanville and Whitby to Georgian bay. Exposures are seen at Whitby, Oshawa, and Bowmanville where the beds dip north and occupy a basin-shaped area concealed by drift. Exposures occur also in the township of Collingwood. In this township this group is exposed along the shore in the third and fourth ranges. It also forms a narrow belt in the northern part of the east end of Manitoulin island and on neighbouring islands to the north.

In the angle formed by the Ottawa and St. Lawrence rivers the Utica forms a belt about 10 miles wide extending east from Ottawa about 50 miles. Another belt enters Canada at the west of Missisquoi bay, extends north some distance beyond St. Johns, then westward to Montreal. From this point it follows both sides of the St. Lawrence to Verchères where it passes to the north side of the river and extends some distance below the city of Quebec. On account of the lack of exposures the boundaries cannot be very definitely determined.

The Utica group consists of two formations, the Collingwood and the Utica. The Collingwood formation is not present at Montreal, but at Ottawa and in southern Ontario it consists of 25 to 50 feet of alternate beds of limestone and shale, each a foot or so in thickness.[1] The Utica formation consists of brownish-black and black, brittle, bituminous shales. There are occasional beds of black bituminous limestone. In some places the shales are very highly bituminous and a layer about 7 feet thick exposed on lot 23, concession 3, Collingwood, was used 50 years ago for distillation.[2] This rock is highly calcareous.

The Utica shales pass gradually into the Lorraine formation, and it is frequently impossible to fix the dividing line between the two. Especially is this the case when one has to depend on the fine fragments obtained by boring. Owing to this difficulty many drillers attempt no separation and merely give the total thickness of the Lorraine and Utica shales.

---

[1] Raymond, P. E., Geol. Surv., Can., Guide Book No. 3, p. 144.
[2] Geology of Canada, 1863, p. 784.

LORRAINE (HUDSON RIVER) AND RICHMOND.

The Lorraine (Hudson River) formation is exposed on almost all the streams flowing into Lake Ontario between the River Rouge in Pickering on the east and Credit river on the west. North of this it is concealed by drift, but is seen again near Collingwood. Farther northwest it is exposed at points on the southwest shore of Georgian bay. It also forms a belt running west through the northern part of Manitoulin island. A great body of shales found in borings throughout the southwestern part of the province is also assigned to this and the underlying formation.

In the basin east of the Frontenac axis there is a large area over which this formation is exposed. In addition to occupying a small area lying to the southeast of the city of Ottawa, it extends into that portion of the province of Quebec reaching from the St. Lawrence-Champlain fault northwest to a short distance beyond the St. Lawrence river. Opposite Montreal, however, it does not extend quite to the river. Good exposures are seen on Becancour and Nicolet rivers and on the St. Lawrence from the St. Lawrence-Champlain fault to the Grande Rivière du Chêne.

The formation consists of grey and bluish-grey shales enclosing bands of calcareous sandstone and impure limestone at irregular intervals.

The thickness of the Lorraine formation varies greatly. In the basin east of the Frontenac axis it has been exposed, throughout the greater part of the area, to the action of erosive agencies and consequently much variation is to be expected. The maximum thickness probably exceeds 2,000 feet. The whole thickness of the formation between Lake Ontario and Georgian bay is exposed in the east part of the township of Collingwood, where it forms 770 feet of nearly horizontal strata in the flank of a hill overlooking the Utica shales. In the vicinity of Cape Rich the thickness is about 500 feet, while on Manitoulin island it is thinner, being near Cape Smith 300 feet, south of Little Current about 250 feet, and at Maple point 220 feet.

Recent investigations show that the upper part of what has heretofore been described as the Lorraine formation in Canada is of Richmond age.[1] The Richmond as exposed in Ontario consists of marine limestones and shales that are well exposed on Manitoulin island and can be traced with diminishing thickness to the vicinity of Streetsville.[2]

Overlying the marine type of the Richmond is a great mass of red shales that in earlier literature were designated the Medina shales, but are now commonly known as the Queenston shales. Fossils of Richmond age have been found in these and they are, therefore, regarded by many as of Richmond age and included in the Ordovician system. All palæontologists are, however, not agreed as to the position of the Ordovician-Silurian boundary and some include the Queenston shales in the Silurian.[3]

The Queenston shales are exposed at the base of the Niagara escarpment and extend several miles eastward. A thickness of about 1,000 feet has been recognized in wells drilled in Welland county. They thin rapidly toward the north and a thickness of about 50 feet has been observed on Bruce peninsula. They do not occur on Manitoulin island.

A few small patches of red shales overlie the Lorraine formation in the eastern part of Ontario. Red shale and sandstone also overlie a wide extent of Lorraine formation south of St. Lawrence river between Montreal and Quebec, and are well exposed on Nicolet river.

---

[1] Foerste, A. F., The Ordovician in the Manitoulin area of Lake Huron: Ohio Naturalist Vol. 13, No. 2, pp. 37-48. Lorraine faunas of New York and Quebec: Bull. Sc. Lab. Denison University, Vol. 17, pp. 247-340.

[2] Parks, W. A., Geol. Surv., Can., Guide Book No. 5, p. 16.

[3] Ulrich, E. O., The Ordovician-Silurian boundary: Congres Géologique International, Compte-rendu de la XIIe session, 1913, pp. 593-667.

Data Regarding the Lorraine (Hudson River) and Utica Formations.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Essex.....	Colchester, South, lot 64, con. 1.....	45	1,565	585	— 917
"	Mersea, lot 239 north Talbot road.....	62	1,880	608	—1,250
Grey.....	Osprey, lot 10, con. 11	78	530	530+100	1,020
Lambton....	Inwood.....	156	2,550	275+175	—1,860
Lincoln.....	Louth, lot 4, con. 3....	188	638	868	— 341
Manitoulin Island	Two miles south east of Wekwemikong.....	189	50	333	
Middlesex...	London.....	198	2,100	150+	—1,220
Norfolk.....	Simcoe.....	214	1,775	625+144	—1,100
"	Vittoria.....	215	1,700	765	—1,267
Ontario.....	Whitby.....	216	50	70+	
Peel.....	Clarkson.....	222	4	650+150+	262
Welland.....	Bertie, lot 6, con. 15..	245	1,624	730+171	—1,019
"	Thorold.....	255	895	905	— 395
"	Willoughby, lot 4, con. 3.....	261	1,529	784	— 939
Wellington ..	Glen Allan.....	265	1,198	572+ 47	47
" ..	Pilkington, lot 6, con. 5	266	1,035	565+ 85	340
York.....	Highland Creek.....	274	48	200+	
"	Mimico.....	275	7	493+223+	
"	New Toronto.....	276	5	640+	
"	Swansea.....	277	107	536+	240
"	Toronto.....	278	40	555+	
"	York, lot 11, con. 3...	280	38	440+	259

MEDINA.

The Medina formation is exposed in the Niagara escarpment, extending from Queenston on Niagara river to the west end of Lake Ontario and then running in a northwest direction to the Bruce peninsula and through Manitoulin island. Sections may be

seen in the Niagara gorge and along streams flowing from the escarpment to Lake Ontario. The formation dips southwest at a slight angle under sediments of later deposition.

The Medina formation consists of the following members in descending order: Thorold sandstone, Grimsby sandstone, Cabot Head shale, Manitoulin beds, and Whirlpool sandstone.[1]

Whirlpool Member. This is a white sandstone composed of medium-sized quartz grains; some red beds occur. The beds are thickest near the base and cross-bedding is common. This sandstone, which is 25 feet thick in the Niagara gorge, thins gradually towards the northwest and is last seen at Glen Huron (about 12 miles south of Collingwood) where it is 4 feet thick. It rests directly on the Queenston shales.

Manitoulin Member. This is a fine-grained, hard, light blue-grey dolomite in beds less than 10 inches thick. Its thickness on Manitoulin island is 50 feet, at Credit Forks 40 feet, and at Stony Creek 8 feet. "Farther south, the dolomite is represented by calcareous shales, which measure 25 feet in thickness at Niagara gorge, and have a 3-foot bed of arenaceous limestone, or calcareous sandstone at the top. From Collingwood, west and north, the dolomite rests on Queenston shale with a sharp even contact. To the southeast, it rests on Whirlpool sandstone."

Cabot Head Member. Two miles west of Cabot head this member consists, in ascending order, of 37 feet of grey shale, 8 feet of limestone, and 3 feet of grey shale, while slabs of red sandstone near Cabot head indicate the presence of a red horizon at that point. From Owen Sound, east and south, red sandy beds occur in the upper half of the member. "From Hamilton, south, the upper beds are sandy, sandstone and shale being commonly interbedded. At Niagara gorge about 4 feet of firm grey shales are referred to the Cabot Head member."

Grimsby Member. At Grimsby this consists of 12 feet of thick-bedded, mottled red and grey sandstone overlain by 6 feet of grey shale. In the Niagara gorge it consists of 5 feet of grey sandstone with shale partings followed upward by 35 to 40 feet of thin-bedded red sandstones with red shale partings and

[1] Williams, M. Y., Geol., Surv., Can., Summary Report 1913, pp. 178-188.

occasional beds of red shale; above this are 12 to 15 feet of red to greyish massive sandstones in beds from one to several feet thick. The Grimsby member extends as far west as Dundas, where it is about 14 feet thick, but is not easily differentiated from the underlying shales.

Thorold Member. This is also known as the "Grey Band." It is a light grey, thin to thick-bedded sandstone; at Thorold it is indurated, approaching quartzite. At the Niagara gorge it is 7 feet thick, at De Cew falls 12 feet, at Stony creek 6 feet, and at Hamilton and northward is not differentiated, if present, from the Grimsby member.

The Medina formation is one of the most productive gas formations of Ontario. The greater proportion of the gas of the Selkirk, Port Dover, and Delhi fields is derived from the red Medina sandstone (Grimsby member), although small quantities are found also in the white Medina sandstone (Whirlpool member), and in the Clinton formation. The White Medina sandstone is the productive horizon for the gas of the Bertie-Humberstone, Wainfleet, Attercliffe, Bayham, Onondaga, and Brantford fields and for the oil of Onondaga. Some of these fields derive a portion of their gas also from the red Median sandstone and the Clinton formation.

Data Regarding the Medina Formation, Including the Queenston Shale.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Brant	Brantford	1	425	245+	
Elgin	Port Burwell	39	1,443	112+	
Essex	Colchester, South, lot 64, con. 1	45	1,280	285	— 632
"	Mersea, lot 239 north Talbot road	62	1,470	410	— 840
Grey	Osprey, lot 10, con. 11	78	275	255	1,225
Haldimand	Canborough, lot 18, con. 2	81	486	132+	
"	Cayuga	83	568	142+	32
"	Dunnville	84	640	132+	
"	Rainham, lot 25, con. 1	104	765	100+	
"	Rainham, lot 12, con. 1	102	774	125+	
"	Walpole, lot 22, con. 1	100	866	129+	
"	Walpole, lot 9, con. 2	97	878	132+	
Lambton	Inwood	156	2,110	440	—1,420
Lincoln	Louth, lot 4, con. 3	188	90	548+	207
Middlesex	London	198	1,600	500	— 720
Norfolk	Lynedoch	209	1,336	95+	
"	Port Dover	210	934	136+	— 350
"	Port Ryerse	212	1,042	133+	
"	Simcoe	214	995	780	— 320
"	Vittoria	215	1,114	811	— 456
Welland	Bertie, lot 6, con. 15	245	660	964	— 55
"	Crowland, lot 12, con. 6	247	558	102+	
"	Humberstone, lot 12, con. 3	249	660	124+	
"	Thorold	255	125	770	375
"	Wainfleet, lot 31, con. 5	256	555	107+	
"	Willoughby, lot 4, con. 3	261	503	1,026	87
Wellington	Glen Allan	265	831	367	414
"	Pilkington, lot 6, con. 5	266	642	393	733

CLINTON.

The Clinton formation is exposed between the Medina and Niagara in the escarpment that enters Ontario at Queenston, on the Niagara river. In this escarpment it can be traced west and northwest as far as Limehouse, where it has a thickness of 6 feet.

The formation consists of the following members in descending order: Irondequoit limestone, Williamson shale, Wolcott limestone, and Sodus shale.

Sodus Member. A dark grey shale, of fine, even grain, and thinly laminated, lies at the base of the Clinton formation and rests upon the Thorold sandstone. In the Niagara gorge it is 4 feet thick, and at De Cew falls 1 foot. It may be that the correlation with the Sodus member at Rochester is incorrect.[1]

Wolcott Member. This is a dark grey, hard, compact limestone, rather thin-bedded. It is 12 feet thick at Niagara river, 14 feet at De Cew falls, and 6 feet at Limehouse, north of which place it is not seen.

Williamson Member. At Niagara river and De Cew falls a few inches of shale occupy the position of the Williamson shale of New York state and separate the two limestone members of the Clinton formation.

Irondequoit Member. This is a crinoidal limestone of crystalline texture and is generally massive. It is light grey in colour, here and there showing pink or other shades. It has a thickness of 10 to 15 feet at Niagara river, but thins to 5 feet at Dundas, and disappears between Waterdown and Kelso.

Gas is derived from the Clinton formation in the Onondaga, Caledonia, and Cayuga fields, and this formation is the most productive horizon at Port Colborne west of the canal.

---

[1] Schuchert, Charles, Geol. Soc. Am., Bull., Vol. 25, p. 309.

Data Regarding the Clinton Formation.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Brant	Brantford	1	405	20	
Elgin	Port Burwell	39	1,417	26	
Essex	Colchester, South, lot 64, con. 1	45	1,125	155	— 477
Grey	Osprey, lot 10, con. 11	78	227	48	1,323
Haldimand	Canborough, lot 18, con. 2	81	463	23	
"	Cayuga	83	548	20	52
"	Dunnville	84	612	28	
"	Rainham, lot 25, con. 1	104	740	25	
"	Rainham, lot 12, con. 1	102	754	20	
"	Walpole, lot 22, con. 1	100	841	25	
"	Walpole, lot 9, con. 2	97	860	18	
Lambton	Inwood	156	2,075	35	—1,385
Norfolk	Lynedoch	209	1,315	21	
"	Port Dover	210	924	10	— 340
"	Port Ryerse	212	1,020	22	
Welland	Bertie, lot 6, con. 15	245	628	32	— 23
"	Crowland, lot 12, con. 6	247	528	30	
"	Humberstone, lot 12, con. 3	249	635	25	
"	Thorold	255	95	30	405
"	Wainfleet, lot 31, con. 5	256	520	35	
"	Willoughby, lot 4, con. 3	261	473	30	117
Wellington	Glen Allan	265	802	29	443
"	Pilkington, lot 6, con. 5	266	600	42	775

NIAGARA

The Niagara formation forms the top of the high escarpment that enters Ontario at Queenston, opposite Lewiston, runs in a westerly direction as far as Dundas, swings to the northeast for a few miles and then takes a northwesterly course across the province, through the eastern part of Bruce peninsula and through Manitoulin, Cockburn, and Drummond islands. The formation extends back from this escarpment several miles; but its western boundary cannot be definitely determined on account of the covering of drift.

In Manitoulin island, it extends from the south shore more than halfway across the island.

The Niagara formation consists of two members, the Rochester shale and the overlying Lockport dolomite.

The *Rochester shale* is dark grey in colour, is soft and thinly laminated. It is more than 60 feet thick at Niagara river, and is nearly 70 feet at De Cew falls, but thins to 2½ feet at Waterdown, beyond which it has not been observed.

The *Lockport* member consists of the dolomite and limestone lying between the Rochester shale and the Guelph dolomite. In general it consists of thin to thick-bedded or massive dolomite, dark grey-blue on fresh fracture. In the Niagara peninsula the Lockport member rests upon the Rochester shales; but at Cataract and northward it rests directly on the Cabot Head shale, the Clinton formation and the Rochester member of the Niagara formation being absent.

The Lockport member is 105 feet thick at Ancaster and 240 feet at Cabot head. Logs of wells show between 200 and 250 feet of dolomite between the Niagara shale and the Salina (Onondaga) shale. The upper portion of these beds may be of Guelph age. Owing to the close resemblance between the Guelph and Niagara dolomites drillers rarely attempt to make a division between the two. The thickness of the combined Guelph and Niagara formations is fairly uniform over the southern part of the province as is shown by the following table:

	Dolomite.	Shale.
Lot 35, con. 3, Bertie	240 feet	50 feet
Lot 12, con. 6, Crowland	233 "	55 "
Welland	225 "	65 "
Cayuga	232 "	41 "
Port Dover	280 "	34 "
Port Ryerse	212 "	58 "
Inwood	225 "	15 "

GUELPH.

The Guelph formation extends from Wentworth county northwest to the extreme north end of Bruce peninsula and east into New York state.[1] From the county of Wentworth northward the belt increases in width until it extends nearly across the county of Grey. Northwest of this it narrows and extends into Bruce peninsula; it is exposed on Fitzwilliam island and on the east part of the south shore of Manitoulin island.[2] Good exposures are to be seen on Grand river and its tributaries. It is not known how far it reaches westward beneath the younger sediments; but it probably forms a part of the dolomitic beds recognized beneath the Salina (Onondaga) shale in the deep wells in the southwestern portion of the province.

The formation consists of grey and buff coloured, thick-bedded to massive dolomite. It is more or less crystalline and in places is porous and contains small drusy cavities.[3]

Its maximum thickness is estimated at about 160 feet; but it is probably lenticular in shape and thins towards the southeast and northwest.

The Guelph is the gas-bearing formation of Gosfield, Mersea, and Wheatly, and along with the Salina (Onondaga) yields the oil of the Tilbury field.

---

[1] New York State Museum, Memoir 5.
[2] Bell, R., Geol. Sur., Can., IX, 24 I.
[3] Geology of Canada, 1863, p. 338.

Data Regarding the Guelph and Niagara Formations.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Essex.....	Colchester, South, lot 64, con. 1.....	45	910	215	— 262
"	Gosfield, lot 7, con. 1.....	53	1,020	11+	— 362
"	Mersea, lot 239 north Talbot road.....	62	1,095	?	— 465
"	Tilbury West, lot 7, con. 3	69	1,315	18+	— 712
"	Rochester, lot 28, con. 2..	72	1,305	25+	— 685
Haldimand..	Cayuga.....	83	275	273	325
" ..	Rainham, lot 25, con. 1.....	104	400	340	
" ..	Rainham, lot 12, con. 1.....	102	434	320	
" ..	Walpole, lot 22, con. 1.....	100	521	320	
" ..	Walpole, lot 9, con. 2.....	97	554	306	
Norfolk.....	Port Dover.....	210	610	314	— 26
"	Port Ryerse.....	212	750	270	
Welland.....	Bertie, lot 6, con. 15.....	245	338	290	267
"	Crowland, lot 12, con. 6...	247	240	288	
"	Humberstone, lot 12, con. 3	249	345	290	
"	Willoughby, lot 4, con. 3..	261	196	277	394
Wellington ..	Glen Allan.....	265	552	250	693
" ..	Pilkington, lot 6, con. 5....	266	355	245	1,020

SALINA (ONONDAGA).

The Salina formation, designated in earlier Canadian geological reports, the Onondaga, enters Ontario from New York state in a belt extending in width from the foot of Navy island up Niagara river to Fort Erie. This belt runs west into Brant and Oxford counties, then north-northwest to Southampton in Bruce county. From this point it swings southward and extends to Goderich. Exposures are to be seen on the Canadian side of the Niagara river, and on Grand and Saugeen rivers. Boring operations show that the formation extends westward throughout

the southwest portion of Ontario. Throughout nearly the whole of this area it is overlain by the Oriskany or the Onondaga (Corniferous) formation.

In the Buffalo quadrangle, New York, the rocks between the Guelph dolomite and the Oriskany sandstone have been subdivided as follows:

Cobleskill dolomite.
Salina formation.

The Salina formation consists of a great thickness of interbedded bluish-grey shale and argillaceous magnesian limestone overlain by grey to buff limestone containing less magnesia and argillaceous material and constituting the Bertie limestone member.[1]

In the portion consisting of shales and dolomite, gypsum beds occur and beds of salt of great thickness underlie that part of the province extending eastward from Lake Huron, St. Clair river, Lake St. Clair, and Detroit river. The upper 5 to 6 feet of the Bertie member has been quarried extensively at Buffalo for natural cement. In the Buffalo quadrangle of New York state from 7 to 9 feet of a dark dolomitic limestone in uneven layers, usually only a few inches thick, is found overlying the Salina formation. This is the Cobleskill dolomite.

Very little detailed work has been done recently in Ontario on the strata lying between the Guelph and the Oriskany formations. The upper beds, however, are known to consist of grey and drab dolomite and the Bertie member and Cobleskill formation occur in Welland and Haldimand counties.

The average thickness of the lower member of the Salina formation, as determined from 10 wells in the Buffalo quadrangle, is 333 feet, the thickness of the Bertie member is 53 feet, and of the Cobleskill dolomite 7 to 9 feet.[2] Sections of dolomite are found in the townships of Bertie and Cayuga, Ontario, from 20 to 45 feet in thickness. The results of borings show that the total thickness of rocks between the Guelph and the Onondaga (Corniferous) increases greatly towards the west and northwest.

[1] Kindle, E. M., U. S. Geol. Surv., Niagara Folio, No. 190.
[2] Luther, D. D., New York State Museum, Bulletin 99, pp. 8-10.

In the Detroit River district the Monroe formation occurs in Michigan and extends into Canada.[1] It consists of dolomite, limestone, and sandstone. The upper beds included by Grabau and Sherzer in the Monroe formation and designated the Detroit River series by Stauffer are regarded by some as possibly of Devonian age. The Detroit River series is overlain by the Onondaga formation and is exposed at the Amherstburg quarries, at Beachville and a few other points.[2] The sandstone member of the Munroe, known as the Sylvania sandstone, is a remarkably pure, sparkling, snow-white aggregation of incoherent quartz grains, and by drillers it is often likened to snow, flour, salt, or granulated sugar. It has been recognized in many wells in the southwestern part of the province, but has been generally interpreted by the drillers as Oriskany, while the overlying formation has been regarded as Onondaga (Corniferous) and the underlying as Salina (Onondaga). A strict conformity with the results of more recent investigations would, therefore, necessitate a revision of the interpretation of many of the logs of Essex and Kent. There are, however, few good horizon markers easily recognized by the drillers and the logs are consequently published as first interpreted.

The Salina (Onondaga) is the gas-bearing formation of the Kent gas field and one of the oil-bearing formations of the Tilbury oil field.

---

[1] Grabau and Sherzer, Mich. Geol. and Biol. Surv., Pub. 2, Geol. Ser. 1, 1909.

[2] Stauffer, Clinton R., The Devonian of Southwestern Ontario, Geol. Surv., Can., Memoir 34. In press.

Data Regarding the Salina (Onondaga) Formation.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Essex	Colchester, South, lot 64, con. 1	45	110	800+	538
"	Gosfield, lot 7, con. 1	53	120	900+	538
"	Mersea, lot 239 north Talbot road	62	89	1,006+	541
"	Tilbury West, lot 7, con. 3	69	300	1,015	303
"	Rochester, lot 28, con. 2	72	268	1,037	352
Haldimand	Cayuga	83	23	252+	577
Lambton	Petrolia	173	575	1,545	92
"	Bertie, lot 6, con. 15	245	38	300+	567
Welland	Bertie, lot 35, con. 3	246	25	390	593
"	Crowland, lot 12, con. 6	247	120	120+	
"	Humberstone, lot 12, con. 3	249	72	273+	
"	Willoughby, lot 4, con. 3	261	61	135+	529
Wellington	Glen Allan	265	35	517+	1,210
"	Pilkington, lot 6, con 5	266	103	252+	1,272

Data Regarding Certain Sandstone Beds, Probably the Sylvania Sandstone.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Bruce.....	Kincardine.....	18	296	29	311
Essex.....	Maidstone, lot 12, con. 6..	43	275	25	
"	Colchester, South, lot 64, con. 1.....	45	177	10	471
"	Tilbury West, lot 7, con. 5	50	283	20	321
"	Same well.....	50	503	10	101
"	Same well.....	50	612	35	— 4
"	Comber, 1½ miles southwest of M.C.R. station.....	51	360	10	240
"	Malden, lot 4, con. 2.....	60	258	84	
"	Malden, lot 2, con. 1.....	61	260	60	
"	Sandwich	67	525	100	
"	Tilbury West, lot 7, con. 3.	68	283	20	
"	Tilbury West, lot 7, con. 3.	69	250	50	353
"	Windsor.....	70	485	55	
"	Rochester, lot 28, con. 2...	72	228	40	392
Kent.....	Camden, lot 2, con. 5.....	121	559	10	
"	Camden, lot 3, con. 2.....	123	431	46	
"	Dresden.....	129	482	44	
"	Orford, lot 10, con. 11.....	134	555	75	185
"	Same well.....	134	915	85	— 175
"	Orford, lot 23, con. 14.....	135	410	30	
Lambton....	Petrolia	173	525	50	142
"	Courtright.....	152	1,062	32	
Middlesex...	Glencoe.....	197	962	38	

Drillers have also recognized a sandstone formation at some points in Norfolk county; at Port Ryerse, St. Williams, and Vittoria with thicknesses respectively of 70, 115, and 45 feet and at depths respectively of 280, 455, and 355 feet.

ORISKANY.

The Oriskany formation overlies the Salina (Onondaga). Outcrops have not been seen west of the township of Windham and the best exposures are found in the townships of Oneida and North Cayuga. It varies in thickness up to 25 feet, and in places it is entirely absent. "It consists of heavily bedded, coarse-grained, white to yellowish sandstones lying unconformably on the Silurian."[1]

Although exposures have not been recognized farther west than Windham, yet there are several wells in Kent and Essex counties from which a sandstone formation is recorded. This, however, is probably the Sylvania sandstone.

ONONDAGA (CORNIFEROUS).

The Onondaga formation, designated by earlier Canadian geologists the Corniferous, enters Ontario at Niagara river. It forms a belt skirting the north shore of Lake Erie in Welland and Haldimand counties, and continues west through the northern half of Norfolk county into Oxford. Here it bends to the northwest and passes through Perth and Huron counties into Bruce. It dips to the southwest beneath sediments of later deposition, but comes to the surface again in Essex county. It rests upon the Oriskany sandstone or, where the latter is absent, on the Silurian limestone. In Essex county and at some other points it rests unconformably upon the Anderdon limestone, a formation regarded by some as Silurian and by others as Devonian.

The formation consists of a limestone, compact in texture and varying in colour from drab and light grey to different shades of blue to black. Organic remains are common and some parts of the formation contain an abundance of chert, in nodules or in beds from 1 to 4 inches thick. A thin sandstone occurs at the base in some places.

In many of the logs of wells the "big lime" met by the drillers in the Lambton oil fields just below the "lower soap" is indicated as belonging to the Onondaga (Corniferous). The

[1] Stauffer, C. R., Geol. Surv., Can., Summary Report 1911, p. 271.

upper part of this "big lime", however, belongs to the Delaware formation.[1] The contact between the Delaware limestone and the underlying Onondaga formation, cannot be recognized by drillers and the top of the "big lime" is, therefore, usually taken as the datum plane.

There is usually much difficulty in fixing the contact between the Onondaga (Corniferous) and the underlying Salina (Onondaga), the drillers recognizing little or no lithological distinction between the limestone of the former and the limestone and dolomite of the latter. The difficulty vanishes, however, when there is an intervening bed of Oriskany sandstone.

"The outcrops of Welland county are not so connected that the entire thickness of the formation can be obtained, but the indications are that it is about 100 feet."[2] At Goderich the thickness is about 32 feet.[3] The "flint," named in many of the logs of Haldimand and Norfolk counties, may include the upper part of the Salina (Onondaga) formation in addition to the Onondaga (Corniferous). So also the limestone beds overlying the sandstone in certain wells in Essex and Kent counties probably include more than the Onondaga.

The Onondaga (Corniferous) limestone is the most important oil-producing formation of Ontario, the pools of Petrolia, Oil Springs, and Moore, and other small pools of Lambton as well as those of Bothwell, Dutton, Romney, Thamesville, and the northern and southern parts of Raleigh being located in it.

[1] Stauffer, C. R., Geol. Sur., Can., Summary Report 1911, p. 272.
[2] Stauffer, C. R., Geol. Sur., Can., Summary Report 1911, p. 271.
[3] Stauffer, C. R., Geol. Sur., Can., Summary Report 1910, p. 195.

Data Regarding the Onondaga (Corniferous) Formation, Including the Delaware Limestone.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Essex	Tilbury West, lot 7, con. 3	68	120	163+	
"	Tilbury West, lot 7, con. 3	69	120	130+	483
"	Rochester, lot 28, con. 2	72	144	84+	476
Kent	Bothwell	119	222	148+	
"	Camden, lot 6, con. 4	120	360	55+	
"	Camden, lot 2, con. 5	121	398	161	
"	Raleigh, lot 23, con. 8	137	241	158+	
"	Raleigh, lot 18, con. 12	140	275	185+	
"	Thamesville	144	296	146+	
"	Tilbury East, lot 6, con. 9	145	242	158	358
Lambton	Inwood	156	420	115	270
"	Warwick	157	460	44+	
"	Moore, lot 4, con. 6	164	443	57+	
"	Enniskillen, lot 3, con. 6	159	382	113+	
"	Petrolia	173	338	187	329
"	Sarnia	178	515	170+	100
"	Sarnia, lot 5, con. 6	183	353	117+	
"	Wyoming	187	336	144+	361
Middlesex	Metcalfe, lot 24, con. 13	201	396	104+	
"	Mosa, lot 5, con. 7	202	290		
Welland	Bertie, lot 35, con. 3	246	2	23+	616

In the above table the thicknesses given include the Delaware limestone immediately overlying the Onondaga, and probably in some cases the upper part of the Silurian.

DELAWARE.

The Delaware formation consists of blue and brownish limestone grading downward into black shale of Marcellus age or interbedded with it.[1] The formation occurs in Elgin and in the

[1] Stauffer, C. R., The Devonian of southwestern Ontario: Geol. Sur., Can., Memoir 34. In press.

southern part of Norfolk and extends northward through eastern Middlesex and western Perth into Huron county.

In the vicinity of Port Burwell and westward 10 to 30 feet of black shale is found. The Delaware limestone is best seen along the Thames and in quarries at St. Marys. In samples from wells it is difficult to distinguish it from the underlying Onondaga. Its thickness is probably about 50 feet.

HAMILTON.

The Hamilton formation rests upon the Delaware in the southwestern part of Ontario, and forms a belt extending through the eastern part of Kent and western part of Middlesex. It also occurs in western Kent and at a few places in Lambton. The distribution has been determined to a great extent by information obtained from borings.

The formation is composed of the following members:

Ipperwash limestone.
Petrolia shale.
Widder beds.
Olentangy shale.

The Olentangy member is a soft blue shale with lenses of limestone, and corresponds to the "lower soapstone" of drillers. The Widder beds consist of bluish limestone alternating with grey shale. The upper part consists of 8 to 10 feet of limestone that doubtless corresponds to the "middle limestone" of drillers. The total thickness of the Widder beds is about 50 feet. Overlying these is a body of 100 to 130 feet of soft blue shale, the Petrolia shale, or the "upper soapstone." Above this is the Ipperwash limestone or "top lime," the thickness of which at Petrolia is 40 feet.[1]

From the logs of wells it is seen that the same succession of beds is generally found throughout the extent of the formation; but the thickness of each member varies a great deal. This may be due, to a certain degree, to inaccuracies in the measurements made by drillers.

---

[1] Stauffer, C. R., The Devonian of southwestern Ontario: Geol. Sur., Can., Memoir 34. In press.

Data Regarding the Hamilton Formation.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Kent	Bothwell	119	155	67+	
"	Camden, lot 6, con. 4	120	131	229	
"	Camden, lot 2, con. 5	121	196	202	
"	Camden, lot 8, con. 2	122	253	167+	
"	Gore of Chatham, lot 5, con. 1	125	685	165	
"	Raleigh, lot 23, con. 8	137	110	131+	
"	Raleigh, lot 18, con. 12	140	160	115+	
"	Thamesville	144	79	217	
"	Tilbury East, lot 6, con. 9	145	128	114+	472
Lambton	Corunna	151	333	17+	
"	Courtright	152	192		396
"	Warwick, Kingstone Mills	157	64	396	
"	Moore, lot 4, con. 6	164	173	270	
"	Enniskillen, lot 3, con. 6	159	137	245	
"	Petrolia	173	98	240+	569
"	Sarnia	178	215	300	400
"	Sarnia, lot 5, con. 6	183	112	241	
"	Wyoming	187	108	228	589
Middlesex	Metcalfe, lot 24, con. 13	201	123	273	
"	Mosa, lot 5, con. 7	202	60	230	

HURON SHALE.

Underlying a great part of Lambton county and the middle of Kent is a thin-bedded, black, bituminous shale containing large spheroidal concretions. It is exposed at Kettle point and on Sydenham river and is designated by E. M. Kindle the Huron shale.[1]

[1] Geol. Sur., Can., Summary Report 1912, pp. 287-288.

PORT LAMBTON.

In wells in the western part of Lambton and in the northwestern part of Kent county is recognized a varying thickness of black and greenish shales with thin arenaceous layers. These overlie the black Huron shales and may be of Portage and Chemung age. As they lie beneath 120 feet of drift nothing very definite can be said regarding them.[1]

Data Regarding the Formations above the Hamilton.

County.	Municipality.	No. of log.	Depth in feet of top of formation.	Thickness in feet.	Elevation.
Kent.....	Camden, lot 6, con. 4.....	120	33	98	
"	Camden, lot 2, con. 5.....	121	50	146	
"	Camden, lot 8, con. 2.....	122	53	200	
"	Chatham.....	124	60	118	
"	Gore of Chatham, lot 5, con. 1.....	125	140	545	447
"	Harwick, lot 9, con. 4.....	130	163	75	471
"	Thamesville.....	144	69	10	
Lambton....	Corunna.....	151	120	213	
"	Courtright.....	152	160	32	428
"	Warwick, Kingstone Mills	157	14	50	
"	Moore, lot 4, con. 6.....	164	123	50	
"	Enniskillen, lot 3, con. 6...	159	72	65	
"	Sarnia.....	178	200	15	415
"	Wyoming.....	187	104	4	593
Middlesex...	Metcalfe, lot 24, con. 13...	201	48	75	
" ...	Mosa, lot 5, con. 7.....	202	50	10	

PLEISTOCENE AND RECENT.

Overlying the Palæozoic sediments is a mantle of unconsolidated Pleistocene material. This consists of clay, sand, gravel, and boulders deposited by glaciers or re-sorted in the waters of lakes or arms of the sea. It varies greatly in thickness, averaging about 100 feet, but in places exceeding 200 feet.

[1] Stauffer, C. R., The Devonian of southwestern Ontario: Geol. Surv., Can., Memoir 34. In press.

STRUCTURAL GEOLOGY.

On account of the great extent and depth of the mantle of drift and the consequently small number of rock exposures, our knowledge of the structural features of the sedimentary rocks of Ontario and Quebec is not as complete as could be desired. This is particularly regrettable, as the conditions favourable for the accumulation of oil or gas are intimately bound up with the structure of the geological formations.

The Palæozoic rocks of southwestern Ontario are characterized by the small amount of disturbance they have suffered since deposition. There has been little pronounced faulting and the folding had been of a very subdued type so that the anticlines and synclines are broad and diffuse.

The broad, predominant structural feature is a dipping of the strata away from the Pre-Cambrian axis towards the southwest. This does not exceed a few feet per mile, but results in the exposure of the different formations in long belts with a northwest trend across the province, so that in travelling from Kingston to Sarnia, one passes over the bevelled edges of successively younger formations from the Black River group to the Port Lambton beds. The southwesterly dip of the strata continues to that part of the province lying between Lake Erie and the south end of Lake Huron. From this section there is a gradual rise of the strata towards the southwest and the Onondaga (Corniferous) formation, which had disappeared beneath the eastern edge of the Delaware, reappears in Essex county.

Another important broad structural feature of the southwestern part of the province is the Cincinnati anticline. In Ontario the anticlinal structure is not nearly so pronounced as in Ohio, but the general trend appears to continue towards the northeast. The axis of the main anticline is described in the Geology of Canada, 1863, as forming a gentle curve running from the west end of Lake Ontario, through Woodstock, along the Thames, and through Chatham to the southern part of Essex county. This diffuse fold is possibly composed of subordinate folds, none of which are pronounced or have limbs dipping at more than a few feet per mile.

The Cincinnati anticline is crossed by a depression or saddle running from the south end of Lake Huron in a southeasterly direction to Lake Erie. It is in this depression that the various formations find their minimum elevation. The saddle is occupied by the Hamilton formation, the Huron shale, and the Port Lambton formation.

The following notes, which treat of the more minute folding, are necessarily disconnected and are made as brief as is consistent with clearness.

In the Trenton group between Kingston and Georgian bay there is a series of gentle undulations running north-northeast nearly at right angles to the general strike. Along these the lower rocks come to the surface in long narrow ridges, sometimes extending several miles southward. Escarpments are usually seen on each side. "These features are more particularly observable in Loughborough, Camden and Sheffield, and in Hungerford, Madoc and Marmora, extending thence on the Crow river into Seymour. The most conspicuous of these undulations are between the townships of Camden and Belmont.[1]" The Moira, draining Stucco lake, the Crow and Otonabee rivers flow along the crests of small undulations, and there seems to be at least one slight undulation on the east and west stretch of the Trent on the townline between Murray and Seymour.

Numerous small anticlines cross Manitoulin island in a north-northeast direction. These have been laid down on the map of that island published by the Geological Survey.

In the southern part of Durham and Ontario counties a syncline causes an easterly swing in the geological boundaries.

In the vicinity of Rockwood on the Eramosa, a tributary of Speed river, a small undulation is seen in the Niagara formation, running nearly west. On the one side of this fold the strata dip north 10 degrees, and on the other, south 12 degrees. The Guelph formation exhibits an undulation transverse to this, running a little east of north and passing through Eden, Rockwood, and Everton, and thence to Orangeville. The existence of a broad syncline is indicated by the extension of the Onondaga and Delaware formations northward into Huron and Bruce counties.

[1]Geology of Canda 1863, p. 185.

Small undulations are observable at several points in the Onondaga (Corniferous) formation between Niagara river and Windham. One is near Point Abino; one crosses the Welland canal in concession 2 of Humberstone; one runs nearly northwest through lot 13, concession 1 of Rainham; and another runs southwest in the exposure of Oriskany sandstone on the townline between Oneida and North Cayuga.

We have not sufficient data to locate the subordinate folds farther to the southwest. It is claimed that the oil fields are situated on domes and that careful measurements have more or less definitely determined some of these, such as the one at Bothwell,[1] one in the southern part of Raleigh,[2] and one in the eastern part of the township of Moore.[3]

The following table, showing the inclination of the strata between various points in southwestern Ontario, may be of service to drillers in estimating the depths at which different formations may be met. The logs have in nearly all cases been compiled from information furnished by drillers and are based chiefly on lithological evidence. In the preparation of this table, therefore, such horizons have been taken as datum planes as would most likely be recognized by drillers, such as the passage from the black Utica shale to the Trenton limestone, from the Clinton limestone to the red Medina sandstone, and from the lower Hamilton shale to the underlying limestone. The datum plane is the top of the formation mentioned in the table. The result obtained by taking one horizon as datum plane is in some cases quite different from what would be obtained if another horizon were chosen. This may be due to a variation in thickness in certain intervening strata, but is more apt to be due to different interpretations of the borings obtained from the two wells, especially if the wells are not widely separated. While the table gives in a general way the inclination of the strata it must be recognized that between any two given points there may be more or less variation in structure. This is most likely to be the case when the wells are a great distance apart.

---

[1] 6th Rep. Bur. Mines, Ont., 1896, p. 20.
[2] 12th Rep. Bur. Mines, Ont., p. 41.
[3] 14th Rep. Bur. Mines, Ont., p. 112.

Table Showing the Inclination of the Strata Between Various Points in the Southwestern Portion of Ontario.

Location of wells.	Nos. of logs.	Datum plane, top of formation.	Inclination in feet per mile.
Beachville and Brantford....	217 and 4	Trenton.....	W. 5·1
" " Inwood.....	217 " 156	"	W. 15·9
" " Simcoe.....	217 " 214	"	S.E. 15
" " Stratford.....	217 " 228	"	S. 10·5
Bertie, lot 6, con. 5, and Cayuga.....	245 " 83	Medina.....	E. 2·3
Bertie, lot 6, con. 5, and Point Abino.....	245 " 252	"	S. 33
Bertie, lot 6, con. 5, and Willoughby, lot 4, con. 3.....	245 " 261	Trenton.....	S. 43·8
Brantford and Beachville.....	4 " 217	"	W. 5·1
" " Cayuga.....	4 " 83	Medina.....	S.E. 11
" " Clarkson.....	4 " 222	Trenton.....	S.W. 15·7
" " Louth, lot 4, con. 3.....	4 " 188	"	Nearly horizonta
Brantford and Pilkington, lot 6, con. 5.....	4 " 266	Medina.....	S. 10·8
Brantford and Simcoe.....	4 " 214	Trenton.....	S. 32·1
" " Stratford.....	4 " 228	Medina.....	N.W. 11·5
Cayuga and Bertie, lot 6, con. 15.....	83 " 245	"	E. 2·3
Cayuga and Brantford.....	83 " 4	"	S.E. 11
" " Port Dover.....	83 " 96	"	S.W. 18·6
" " Simcoe.....	83 " 214	"	W. 14·8
" " Thorold.....	83 " 255	"	S.W. 9·7
Chatham and Gore of Chatham, lot 5, con. 1.....	124 " 125	Onondaga*	N.W. 23·3
Chatham and Inwood.....	124 " 156	"	S.W. 3·9
" " Raleigh, lot 1, con. 5.....	124 " 142	"	N.E. 20·4
Chatham and Raleigh, lot 18, con. 14.....	124 " 141	"	N. 23·8
Clarkson and Brantford.....	222 " 4	Trenton.....	S.W. 15·7
" " Louth, lot 4, con. 3.....	222 " 188	"	S.E. 22

* Including Delaware limestone.

Location of wells.	Nos. of logs.	Datum plane, top of formation.	Inclination in feet per mile.
Clarkson and Osprey, lot 10, con. 11	222 and 78	Trenton	S.E. 13·5
Clarkson and Pilkington, lot 6, con. 5	222 " 266	"	E. 5
Clarkson and Simcoe	222 " 214	"	S.W. 22·8
" " Swansea	222 " 277	"	S.W. 22
Colchester, South, lot 64 ,con. 1, and Gosfield, lot 7, con. 1	45 " 53	Guelph	E. 9·3
Colchester, South, lot 64, con. 1, and Inwood	45 " 156	Trenton	N.E. 11
Colchester, South, lot 64, con. 1, and Rochester, lot 28, con. 2	45 " 72	Guelph	N.E. 22·6
Courtright and Gore of Chatham, lot 5, con. 1	152 " 125	Onondaga*	S. 18·7
Courtright and Petrolia	152 " 173	"	W. 16·8
" " Sarnia at tunnel	152 " 180	"	S. 9·8
Glen Allan and Pilkington, lot 6, con. 5	265 " 266	Medina	W. 33·6
Glen Allan and Stratford	265 " 228	Medina	S.W. 21·4
Gore of Chatham, lot 5, con. 1, and Chatham	125 " 124	Onondaga*	N.W. 23·3
Gore of Chatham, lot 5, con. 1, and Courtright	125 " 152	"	S. 18·7
Gosfield, lot 7, con. 1, and Colchester, South, lot 64, con. 1	53 " 45	Guelph	E. 9·3
Gosfield, lot 7, con. 1, and Mersea, lot 239 north Talbot road	53 " 62	"	E. 17·8
Gosfield, lot 7, con. 1, and Rochester lot 28, con. 2	53 " 72	"	N. 27·6
Hepworth and Osprey, lot 10, con. 11	14 " 78	Medina	N.W. 12·8

* Including Delaware limestone.

Location of well.	Nos. of logs.	Datum plane, top of formation.	Inclination in feet per mile.
Inwood and Beachville.....	156 and 217	Trenton.....	W. 15·9
" " Chatham.....	156 " 124	Onondaga*	S. 3·9
" " Colchester, South, lot 64, con. 1.....	156 " 45	Trenton.....	N.E. 11
Inwood and Mersea, lot 239 north Talbot road.....	156 " 62	"	N.E. 7·6
Inwood and Petrolia.....	156 " 173	Onondaga*	S.E. 5·9
" " Simcoe.....	156 " 214	Trenton.....	W. 5·2
" " Wyoming.....	156 " 187	Onondaga*	S.E. 8·2
London and Port Rowan.....	198 " 211	Medina.....	N.W. 0·5
" " Simcoe.....	198 " 214	"	W. 8·2
" " Stratford.....	198 " 228	"	S. 20
Louth, lot 4, con. 3, and Brantford.....	188 " 4	Trenton.....	Nearly horizontal
Louth, lot 4, con. 3, and Clarkson.....	188 " 222	"	S.E. 22
Louth, lot 4, con. 3, and Thorold.....	188 " 255	"	S.E. 18·2
Louth, lot 4, con. 3, and York, lot 11, con. 3.....	188 " 280	"	S. 26
Mersea, lot 239 north Talbot road, and Gosfield, lot 7, con. 1.....	62 " 53	Guelph.....	E. 17·8
Mersea, lot 239 north Talbot road, and Inwood.....	62 " 156	Trenton.....	N.E. 7·6
Mersea, lot 239 north Talbot road, and Rochester, lot 28, con. 2.....	62 " 72	Guelph.....	N.W. 18·6
Mersea, lot 239 north Talbot road, and Tilbury East, lot 6, con. 9.....	62 " 145	"	N.E. 18
Mersea, lot 239 north Talbot road, and Tilbury West, lot 7, con. 3.....	62 " 69	"	N. 17·4
Osprey, lot 10, con. 11, and Clarkson.....	78 " 222	Trenton.....	S.E. 13·5

* Including Delaware limestone.

Location of wells.	Nos. of logs.	Datum plane, top of formation.	Inclination in feet per mile.
Osprey, lot 10, con. 11, and Hepworth	78 and 14	Medina	N.W. 12·8
Osprey, lot 10, con. 11, and Pilkington, lot 6, con. 5	78 " 266	"	S. 11·8
Petrolia and Courtright	173 " 152	Onondaga*	W. 16·8
" " Inwood	173 " 156	"	S.E. 5·9
" " Sarnia	173 " 179	"	N.W. 16
" " " at tunnel	173 " 180	"	N.W. 13·2
" " Wyoming	173 " 187	"	S. 8
Pilkington, lot 6, con. 5, and Brantford	266 " 4	Medina	S. 10·8
Pilkington, lot 6, con. 5, and Clarkson	266 " 222	Trenton	E. 5
Pilkington, lot 6, con. 5, and Glen Allan	266 " 265	Medina	W. 33·6
Pilkington, lot 6, con. 5, and Osprey, lot 10, con. 11	266 " 78	"	S. 11·8
Point Abino, Bertie, and Bertie, lot 6, con. 15	252 " 245	"	S. 33
Point Abino, Bertie, and Port Dover	252 " 96	"	W. 2·3
Port Dover and Cayuga	96 " 83	"	S.W. 18·6
" " Point, Abino, Bertie	96 " 252	"	W. 2·3
Port Dover and Simcoe	96 " 214	"	S.E. 5
Port Rowan and London	211 " 198	"	N.W. 0·5
" " Vittoria	211 " 215	"	S.W. 21
Raleigh, lot 1, con. 5, and Chatham	142 " 124	Onondaga*	N.E. 20·4
Raleigh, lot 1, con. 5, and Tilbury East, lot 6, con. 9	142 " 145	"	N. 8
Raleigh, lot 18, con. 14, and Chatham	141 " 124	"	N. 23·8
Raleigh, lot 18, con. 14, and Tilbury East, lot 6, con. 9	141 " 145	"	Nearly horizontal
Rochester, lot 28, con. 2, and Colchester, South, lot 64, con. 1	72 " 45	Guelph	N.E. 22·6

* Including Delaware limestone.

Location of well.	Nos. of logs.	Datum plane, top of formation.	Inclination in feet per mile.
Rochester, lot 28, con. 2, and Gosfield, lot 7, con.1	72 and 53	Guelph	N. 27·6
Rochester, lot 28, con. 2, and Mersea, lot 239, north Talbot road	72 " 62	"	N.W. 18·6
Rochester, lot 28, con. 2, and Tilbury West, lot 7, con. 3	72 " 69	"	N.E. 3·5
Sarnia and Petrolia	179 " 173	Onondaga*	N.W. 16
" " Sarnia at tunnel	179 " 180	"	N. 30
Sarnia, at tunnel and Courtright	180 " 152	"	S. 9·8
Sarnia, at tunnel and Petrolia	180 " 173	"	N.W. 13·2
Sarnia, at tunnel and Sarnia	180 " 179	"	N. 30
Simcoe and Beachville	214 " 217	Trenton	S.E. 15
" " Brantford	214 " 4	"	S. 32·1
" " Cayuga	214 " 83	Medina	W. 14·8
" " Clarkson	214 " 222	Trenton	S.W. 22·8
" " Inwood	214 " 156	"	W. 5·2
" " London	214 " 198	Medina	W. 8·2
" " Port Dover	214 " 96	"	S.E. 5
" " Vittoria	214 " 215	"	S. 24·7
Stratford and Beachville	228 " 217	Trenton	S. 10·5
" " Brantford	228 " 4	Medina	N.W. 11·5
" " Glen Allan	228 " 265	"	S.W. 21·4
" " London	228 " 198	"	S.W. 20
Swansea and Clarkson	277 " 222	Trenton	S.W. 22
" " York, lot 11, con. 3	277 " 280	"	S.W. 13
Thorold and Cayuga	255 " 83	Medina	S.W. 9·7
" " Louth, lot 4, con. 3	255 " 188	Trenton	S.E. 18·2
Thorold and Willoughby	255 " 261	"	S.E. 36·5
Tilbury East, lot 6, con. 9, and Mersea, lot 239 north Talbot road	145 " 62	Guelph	N.E. 18
Tilbury East, lot 6, con. 9, and Raleigh, lot 1, con. 5	145 " 142	Onondaga*	N. 8

* Including Delaware limestone.

Location of wells.	Nos. of logs.	Datum plane, top of formation.	Inclination in feet per mile.
Tilbury East, lot 6, con. 9, and Raleigh, lot 18, con. 14...	145 and 141	Onondaga*..	Nearly horizontal
Tilbury East, lot 6, con. 9, and Tilbury West, lot 7, con. 3	145 " 69	Guelph.....	E. 8·5
Tilbury West, lot 7, con. 3, and Mersea, lot 239 north Talbot road.....	69 " 62	"	N. 17·4
Tilbury West, lot 7, con. 3, and Rochester, lot 28, con. 2..	69 " 72	"	N.E. 3·5
Tilbury West, lot 7, con. 3, and Tilbury East, lot 6, con. 9	69 " 145	"	E. 8·5
Vittoria and Port Rowan.....	215 " 211	Medina.....	S.W. 21
" " Simcoe.....	215 " 214	"	S. 24·7
Willoughby, lot 4, con. 3, and Bertie, lot 6, con.15.....	261 " 245	Trenton.....	S. 43·8
Willoughby, lot 4, con. 3, and Thorold.....	261 " 245	"	S.E. 36·5
Wyoming and Inwood	187 " 156	Onondaga*	S.E. 8·2
" " Petrolia	187 " 173	"	S. 8
York, lot 11, con. 3, and Louth, lot 4, con. 3.....	280 " 188	Trenton.....	S. 26
York, lot 11, con. 3, and Swansea.....	280 " 277	"	S.W. 13

* Including Delaware limestone.

The Ottawa-Montreal area is divided by an anticline running a little west of north and bringing up the Potsdam formation in the counties of Chateauguay, Beauharnois, and Two Mountains.

The strata to the east of this anticline dip at a slight angle to the southeast, so that in going from the Potsdam formation or from the Pre-Cambrian rocks north of the St. Lawrence towards the St. Lawrence-Champlain fault one passes over outcrops of successively younger beds from the Potsdam to the Lorraine, and in places to the Queenston. The Queenston red

shales lie in a line of broad synclinal basins in Nicolet, Yamaska, and St. Hyacinthe counties to the west of and approximately parallel with the Champlain fault. The area is very much concealed by drift; but exposures are in sufficient number to show that the strata have suffered considerable disturbance. Folding and faulting along the north shore of the St. Lawrence are frequently marked by southward projecting spurs of Pre-Cambrian rocks.

A table of the most important of the known anticlines is given.

Location.	Direction.	Remarks.
West side of the Richelieu.	North from International Boundary into Chambly.	Indicated by northerly sweep of belts of formations.
Islands of Montreal and Jesus.	Northwest from Mount Royal.	A low anticline.
Island of Montreal.	Northeast from the preceding.	
Island of Jesus.	Parallel to the preceding.	
Deschambault.	Southwest.	Dip on the west side is 3 degrees to 5 degrees, on the east side 23 degrees.
On Jacques Cartier river.	Southwest.	Dips towards the northwest are at a lower angle than that towards the southeast. Evidence of faulting.
Pointe aux Trembles.		Strata on the west side dip at low angles, but on the east side at higher angles. A fault here brings the shales in contact with the Pre-Cambrian.

Location.	Direction.	Remarks.
Between Lorette and St. Foy.		Two or three folds.
Charlesbourg.		Dips varying from 43 degrees to 80 degrees indicate a small fault.
Montmorency.		Folds and normal faults.
Chateau Richer.		Folds and normal faults.
Ste. Anne river.		Dips on the southeast side are at a higher angle than on the northwest.

There is probably much faulting throughout the whole area. There may also be numerous low anticlines and the different belts of Queenston red shales are probably separated by such.

The Monteregian hills consist of igneous rocks intrusive in the sediments. Numerous dykes and sills are associated with these.

The area in Ontario lying between the Ottawa and St. Lawrence rivers consists of a large irregularly circular basin in which the strata dip from the circumference toward the centre. This basin is very much faulted. The most important line of fault is that which runs from Rigaud mountain west through the whole basin into the township of Fitzroy. There is evidence of more or less elevation along this line at its eastern end and the north and south divisions of the great basin are spoken of as synclines. From the Rigaud-Fitzroy fault a second important fault branches off and runs northwest from the eastern part of Osgoode through the west part of the city of Ottawa. To the north of the main fault and east of the Ottawa branch there is a considerable downthrow, resulting near Rigaud mountain in a horizontal displacement of several miles. Along the Ottawa branch the Calciferous

formation west of the break abuts upon the Utica shales on the east. In Nepean, March, and Fitzroy the downthrow is on the south side.

The strata are thrown here and there into gentle undulations; but the dip rarely exceeds a few degrees, except in the vicinity of a fault. A few gentle folds cross the Ottawa in a southeast direction. Four have been noted, namely, from Templeton into East Gloucester, from Buckingham to Cumberland, from Buckingham to Clarence, and from Lochaber to Plantagenet. Some and perhaps all of these are accompanied by dislocations. An anticline has been observed about lot 15, concession 5, Osgoode; one has been traced 10 miles from Merrickville past Oxford mills; and another disturbance 4 miles long in the township of Mountain brings the Potsdam formation to the surface.

THE OIL AND GAS FIELDS.

DISTRIBUTION.

The oil and gas fields lie almost wholly in the southwestern part of Ontario, south of a line drawn from the west end of Lake Ontario to the foot of Lake Huron. Gas in small amounts has been found in Quebec and at two or three points south of Georgian bay, and traces of oil on Manitoulin island, but the chief producing gas fields lie in Welland, Haldimand, Norfolk, Elgin, Kent, and Essex counties and the chief oil fields in Lambton, Kent, Essex, and Elgin. A few wells have been sunk in the eastern part of Ontario, but without success.

The productive horizons are not confined to one formation. The traces of oil found in Manitoulin island are in the Trenton; the gas of Welland, Haldimand, and Norfolk occurs in the Medina and to a less extent in the Clinton formation; the oil and gas of Kent and Essex are chiefly from the Guelph and Salina (Onondaga); and the oil pools of Lambton, Elgin, and parts of Kent lie in the Onondaga (Corniferous).

RELATION OF THE OIL AND GAS RESERVOIRS TO ROCK STRUCTURE.

Our knowledge of the structural conditions of the strata in the Ontario fields is too limited to enable us to make any very definite assertions regarding the dependence of the gas and oil accumulations on rock structure. Owing to lack of exposures and the very slight dip of the strata small variations are not readily recognized, and great accuracy in the measurement of the depths of good datum planes and careful levelling seem necessary to enable one to obtain clear ideas of the details of structure. Work of this nature has been very limited.

There is, however, a general belief that the oil and gas have accumulated in anticlines, and some of these have been more or less definitely determined, as at Petrolia, at Bothwell, in the eastern part of Moore, and in the southern part of Raleigh.

The belief in the accumulation of gas and oil in anticlines is, however, not universal. Eugene Coste, who has a wide experience in the gas fields of Ontario and who has made a close study of the geology, claims that gas has accumulated in fault zones, and that sharp anticlines and faults are much more common in southwestern Ontario than is generally believed. In this connexion it is held that the results of borings show the presence of a fault in southeast Gosfield running west-northwest between concessions 1 and 2, and another running at right angles to this just west of lot 7 concession 1[1]. The downthrow of these is on the north and west respectively and measures about 100 feet. Mr. Coste also claims that a fault extends north from Leamington about 20 miles.

The porosity of the productive strata is thought to vary considerably within short distances and this variation is believed to account for many of the dry holes in the producing areas.

It is not deemed advisable to enter here upon a discussion of the theories of the origin of these economic products. It is a question that has received a great deal of attention from scientists, but about which there is no unanimity of opinion. Although

---

[1] Jour. Can. Min. Inst., Vol. 3, p. 74.

the theory of their organic origin is the one that is more generally accepted, there are many who maintain, and not without some force of argument, that they are of deep seated and inorganic origin.

GENERAL STATUS AND FUTURE POSSIBILITIES.

The production of oil is now less than 250,000 barrels per year and is on the decrease. The Oil Springs and Petrolia fields, which have been operated for 50 years, are still among the most important producers. Although the average yield per well in these fields is only a few gallons per day, strict economy, careful management, and the receipt of the Government bounty render possible a continuance of production. Several new pools have been discovered in recent years; but the production from the most of these has decreased rapidly, and some have been abandoned.

A great deal of prospecting has been carried on throughout Ontario. After the opening of the Oil Springs and Petrolia fields a great many borings were made in other localities to test the Onondaga (Corniferous) formation. In more recent years a number of wells have been sunk to the Medina and Guelph formations and to the Trenton limestone. The following table gives the location of many of the wells that have been sunk to or through the Trenton formation:

County.	Town or township.	Log. No.	Remarks.
Brant.....	Brantford.....	4	210 feet into the Trenton.
Bruce.....	Amabel, lot 6, con. 11.....	12	415 feet into the Trenton.
"	Amabel, lot 4, con. 6.....	13	586 feet into the Trenton.
"	Amabel, lot 1, con. 10.....	14	Through the Trenton.
Essex.....	Colchester, South, lot 64, con. 1..	45	270 feet into the Trenton.
"	Mersea, East, lot 239 north Talbot road.....	62	408 feet into the Trenton.

County.	Town or township.	Log. No.	Remarks.
Grey	Keppel, lot 38, con. 2, north centre diagonal	77	468 feet into the Trenton.
"	Osprey, lot 10, con. 11	78	Through the Trenton.
"	Sarawak, northwest corner	79	469 feet into the Trenton.
Lambton	Inwood	156	380 feet into the Trenton.
"	Petrolia	173	Probably through the Trenton.
Lincoln	Louth, lot 4, con. 3	188	Through the Trenton.
Manitoulin island	Various points		Into and through the Trenton.
Norfolk	Simcoe	214	158 feet into the Trenton.
"	Vittoria	215	392 feet into the Trenton.
Ontario	Whitby	216	Through the Trenton.
Oxford	Beachville	217	" " "
Peel	Clarkson	222	" " "
Perth	Stratford	228	40 feet into the Trenton.
Simcoe	Collingwood	236	Through the Trenton.
"	Orillia	240	" " "
Welland	Bertie, lot 6, con. 15	245	" " "
"	Humberstone, lot 9, con. 2	250	" " "
"	Thorold	255	683 feet into the Trenton.
"	Willoughby, lot 4, con. 3	261	Through the Trenton.
"	Willoughby, lot 2, con. 4	262	" " "
Wellington	Glen Allan	265	" " "
"	Pilkington, lot 6, con. 5	266	" " "
Wentworth	Hamilton, Clyde ave. West	272	" " "
York	Highland Creek	274	434 feet into the Trenton.
"	Mimico	275	337 feet into the Trenton.
"	New Toronto	276	Through the Trenton.
"	Swansea	277	" " "
"	Toronto, Copelands' brewery, Parliament street	278	" " "
"	York, lot 11, con. 3	280	" " "

The southwestern part of Ontario may thus be considered to have been fairly well prospected; but as the pools that have so far been discovered do not underlie very extensive areas it cannot be said that other small pools do not occur in sections intervening between these deep wells. There are, however, no surface indications that point to one locality rather than another as most likely to reward the driller for his pains.

The natural gas industry is in a very healthy condition. After the abandonment of the field in Gosfield township the production fell off for a year or two; but with the extension of the field in Haldimand county and the discovery of the Kent and other smaller fields the value of the production has greatly increased. As the chief natural gas areas lie along Lake Erie and extend a few miles back from the shore it seems that it might be advisable to carry on further exploration in those counties bordering on this lake and also in the areas lying north of the known fields. The results of boring operations in eastern Ontario and Quebec have not been very encouraging.

DESCRIPTION OF FIELDS IN ONTARIO.

BRANT COUNTY.

Brantford.

Operations in the city of Brantford and vicinity appear not to have met with any great measure of success. In a well drilled in 1888 to a depth of 1,118 feet in the yard of the Waterous Engine Company on Dalhouise street only a very small flow of gas was struck and sulphur water was encountered at 200 and 300 feet. Another well was sunk the same year in Brantford township to a depth of 2,160 feet, or 210 feet into the Trenton limestone. Water was struck at 200 and 300 feet accompanied by a small quantity of gas, and there was a small flow of gas at 1,950 feet, but not in economic quantities.

In 1903 drilling was again undertaken and six or seven wells were put down in the city of Brantford, four being on the Cockshutt property. A strong flow of gas was struck; but the pressure

rapidly diminished and in one well the flow fell off from 775,000 cubic feet per day to 12,000 or 15,000 cubic feet.[1] With decrease in gas production these wells began producing oil in small quantities. The Medina sandstone is the horizon at which gas and oil were found.

Operations were also conducted at Bow Park farm, 2 miles southeast of the Cockshutt wells, and several wells were sunk, with the result that gas was struck in the Clinton formation at a depth of 420 to 440 feet and in the white Medina sandstone at a depth of 530 to 550 feet, the chief flow being from the latter. A small quantity of oil was struck in some of the wells. The gas was piped to Brantford. One of the wells sunk on Bow Park Farm was carried down to a depth of 1,930 feet, where the Trenton limestone was reached.

The Provincial Natural Gas Company drilled three holes northeast of Bow Park Farm, but without success.[2]

Onondaga.

The following information was furnished by Clinton R. Stauffer in a letter dated May 18, 1911:

"The Onondaga oil field lies in Onondaga township, Brant county, 4 miles east-southeast of Cainsville and 7 miles east of Brantford along Fairchild creek, near Grand river. The field as at present known covers an area which is approximately 1½ miles long by 1 mile wide. There are about twenty-two producing wells and three or four others approaching completion that will probably be producing in a few days. Four rigs are drilling in the field.

"The production under the present stage of development is about 200 barrels per day, while the best well has yielded as high as 50 barrels per day.

"The field was originally explored for gas, the first well being completed about 2 years ago. Last November one well struck oil and by the close of the season three oil wells had been obtained."

---

[1] Corkill, E. T., Fourteenth Report of the Bureau of Mines, Ontario, p. 106.
[2] Corkill, E. E., Fourteenth Report of the Bureau of Mines, Ont., p. 108.

Oil is found in the white Medina sandstone, which is here about 20 feet thick and lies at a depth of 500 feet. There are two gas horizons, the Clinton, 430 feet deep, and the white Medina.

A gas-producing territory adjoins the oil field to the south.

According to the statement of the supervisor of petroleum bounties the production of oil from the Onondaga field was 1,005 barrels for 1910, 13,501 barrels for 1911, 7,115 barrels for 1912, 4,172 barrels for 1913, and 2,437 barrels for 1914.

For information regarding borings in other parts of the county see logs.

BRUCE COUNTY.

Hepworth.

In 1900 the Grey and Bruce Oil and Gas Company, Ltd., was organized and boring operations were carried on in the township of Amabel near the village of Hepworth, Bruce county. At least five wells were sunk to depths of between 1,400 and 1,650 feet and gas was struck in some of them at a pressure, it is said, of 425 pounds. This pressure is said to have decreased very little after a year's drain on the wells, during which gas was supplied to the village for lighting and heating. The gas stratum is in the Trenton formation about 350 feet from its top.[1]

A number of wells were sunk in this county in exploring for salt deposits.

DURHAM COUNTY.

Borings for oil or gas were made at the corner of Cavan and Barrett streets, Port Hope,[2] by a syndicate called the Port Hope Oil and Gas Fund. At 596 feet the drill struck what was thought by the driller to be granite, but which may have been the Potsdam sandstone. Small quantities of gas were struck at a depth of 100 feet and at 20 feet from the bottom. Water was struck at 30 feet. In a second well, sunk some distance away, small flows of gas were obtained and salt water was struck at a depth of 574 feet.

[1]Chalmers, R., Geol. Surv., Can., XIV, 165A.
[2]Eleventh Report Bureau of Mines, Ont., p. 45.

ELGIN COUNTY.

The Bayham Gas Field.

[1]This field, which has not yet been delimited, extends north from Port Burwell about 3¾ miles. Gas was first struck in Vienna in 1910 and operations were continued in 1911. Gas occurs in the white Medina sandstone at a depth of a little over 1,300 feet. The rock pressure was about 725 pounds. The largest open flow reported from any of the wells is 3,000,000 cubic feet and the smallest from the productive wells is about 250,000 cubic feet per day. In all the wells a heavy flow of mineral water is encountered at a depth of 300 feet. The field is operated by the Dominion Natural Gas Company and the Medina Natural Gas Company. In 1912, 456,000,000 cubic feet of gas was produced by this field and in 1913, 467,000,000 cubic feet, or about 3·8 per cent of the production of Ontario for each year.

The Dutton Oil Field.

This is a small oil pool lying about 5 miles southeast of the village of Dutton in Elgin county. It occupies about 400 acres on or in the vicinity of lots 13, 14, and 15, concession 10, Dunwich. The thickness of the mantle of drift is about 200 feet on the level. This rests in some places on a few feet of shales succeeded by limestone. In other places the drift rests directly on the limestone. A flow of gas was struck in some wells in a gravel bed overlain by clay, and some surface oil was found at the bottom of the drift. The main oil-bearing stratum, however, lies in the Onondaga (Corniferous) limestone about 160 to 170 feet from the top. The average yield per day is low, although some wells were sunk that had an initial capacity of one barrel or more per hour. The best wells are those in which the limestone is overlain by 25 to 30 feet of shale.

This field was discovered by a farmer boring for water on lot 15, concession 9, Dunwich. In 1898 several wells were sunk and 28 carloads of petroleum were shipped. Operations continued,

[1] Mickle, G. R., Twentieth Report of the Bureau of Mines, Ont., Part I, p. 41.

and in all 154 wells had been drilled by the end of 1904. Of these 68 were drilled by the Elgin Field Oil and Gas Developing Company, 73 by the Beaver Oil Company, and 13 by the Talbot Oil Company.[1] The production for 1906 was 19,376 barrels; for 1907, 14,977 barrels; for 1908, 13,743 barrels; for 1909, 9,513 barrels; for 1910, 7,752 barrels; for 1911, 6,732 barrels; for 1912, 4,335 barrels; for 1913, 4,610 barrels; and for 1914, 2,190 barrels.

For information regarding borings in other parts of the county see well records.

ESSEX COUNTY.

The county of Essex has been pretty well prospected and two important fields have been opened. One of these, lying in the south part of Gosfield township, was one of the most productive gas fields of the province, and the other, lying in Mersea township, produced both oil and gas.

Belle River.

There is a small oil pool at Belle River and in 1913 there was a production of 465 barrels, and in 1914, 1,191 barrels.

The Gosfield Gas Field.

[2]This field lies in the southeastern part of South Gosfield between Kingsville and Leamington. It embraces a narrow strip along the lake shore about a mile wide and 5 miles long.[3] Gas was found in the porous dolomite of the Guelph formation at depths of from 900 to 1,000 feet. It is claimed that the results of borings show the presence of a marked fault running west-northwest between concessions 1 and 2, with the downthrow on the north side, and another at right angles to this just west of lot 7, concession 1, with the downthrow on the west side. This was one of the most productive fields of the province and there

[1] Fourteenth Report of the Bureau of Mines, Ont., p. 108.
[2] Coste, Eugene, Natural Gas in Ontario, Jour. Can. Min. Inst., Vol. 3, pp. 68-89.
[3] Chalmers, Robert, Geol. Sur., Can., Vol. XIV, p. 163A.

were numerous wells with a capacity of several million cubic feet per day.[1] The Coste well No. 1 on the northwest corner of lot 7, concession 1, struck a flow of 10,000,000 cubic feet at a depth of 1,020 feet. The rock pressure was 460 pounds. The well sunk on the road by the Citizens' Gas, Oil, and Piping Company of Kingsville had a capacity of 7,000,000 cubic feet. A well on lot 6, concession 1, struck a flow of 6,422,000 cubic feet at 1,030 feet; one on lot 7, concession 1, a flow of 5,877,500 cubic feet at a depth of 900 to 955 feet; one on lot 8, concession 1, a flow of 5,700,000 cubic feet at a depth of 965 to 990 feet; and one on lot 9, concession 1, a flow of 7,000,000 cubic feet at a depth of 950 feet.

The opening of this field is due to Mr. Eugene Coste. Through his instrumentality a company was formed in 1888, drilling was started in the same year on lot 7, concession 1, and in January, 1889, a heavy flow of gas was struck. This is the well known as Coste No. 1. A number of other wells were drilled in the succeeding years. In December, 1894, a pipe-line to Detroit was completed and gas was supplied to that city, as well as to Windsor and Walkerville, and to villages in the vicinity of the field. For a time it was piped even to Toledo, advantage being taken of an unused pipe-line lying between Detroit and Toledo. In 1901 the United Gas and Oil Company of Ontario, which was the chief operator, owned 95 wells, of which 52 were producing, 21 were abandoned, and 22 were dry holes; 5 wells were in process of drilling. The field was apparently not as well managed as it should have been and many of the wells became badly choked with salt water. The decrease in pressure during the winter of 1900-01 alarmed the citizens of Essex and petitions were sent to the Government to prohibit the export of gas. An Order-in-Council was passed in October, 1901, revoking the licence of occupation by virtue of which the gas was exported, and the supply to Detroit was accordingly cut off. After this the supply rapidly fell off. The company's customers in Windsor and Walkerville were notified that their supply would cease on April 1, 1904, and in this year the pool was practically ex-

[1]Brumell, H. P. H., Geol. Sur., Can., Vol. 5, p. 82 Q.

hausted. Between February, 1895, and July, 1901, this field exported to Detroit 9,639,355,600 cubic feet of gas.

The Mersea Field.

[1]This field, which produced both oil and gas, is long and narrow, with a width of about 1,000 feet. It lies chiefly in lots 9 and 10, concessions 1 to 9, Mersea, and in lot 238 on the Talbot road. The oil was struck in the Guelph formation at a depth of about 1,040 feet in the southern end of the field and about 1,125 feet in the northern end. Some of the wells had a large initial flow; the Jackson well started with a flow of 400 barrels a day after it was shot, but fell off in a few days to 100 barrels per day, and the Hickey No. 4 started with a flow of 1,200 barrels and fell off to about 200 barrels per day. There was a considerable production of gas from some of the wells and one, known as No. 3 Rymal, had an initial flow of 1,300,000 cubic feet per day. This was brought in, in February, 1904.

The small oil pool at Comber in West Tilbury is directly north of this field and may be considered as the northward prolongation of the Mersea field.

The Mersea oil field was discovered in 1902 and was producing in 1903. Boring was continued and on March 20, 1905, twenty-one wells had been drilled by the Leamington Oil Company, the oldest company in the field. Of these twenty-one wells, eighteen were producers. The heaviest producers, however, were not struck until 1905.

The production of Leamington from 1906 to 1910 as given by the supervisor of petroleum bounties is given in column 1 of the following table and that of Leamington (Staples, Comber, and Blytheswood) according to the estimate of the Imperial Oil Company, is given in column 2:

[1] Corkill, E. T., Fourteenth Report of Bureau of Mines, Ont., p. 116.

Year.	1.	2.
	Barrels.	Barrels.
1906	39,655	35,957
1907	6,135	16,210
1908	9,334	18,117
1909	5,929	9,367
1910	141	

Pelee Island.

[1]Several test wells have been sunk on Pelee island and a small oil pool was struck. Oil was found at a depth of 750 feet in two wells on the west side of the island and in one of these there was a small flow of gas. The production as given in the reports of the Bureau of Mines was 1,023 barrels in 1904, and 378 barrels in 1906.

Borings in Other Parts of the County.

The discovery of natural gas in Gosfield in 1889 led to exploratory work in various parts of the country, and numerous wells were sunk. Small flows of oil were struck in several wells in the township of Colchester, but the quantity was too small to be remunerative. In a well on lot 8, concession 6, a small show of oil was got at 1,100 feet; on lot 11, concession 6, sulphur water, accompanied by oil, was struck at 1,000 feet and it is said that 5 barrels of oil per day was pumped; and on lot 11, concession 5, small quantities of oil and gas were reported. Wells sunk on lot 17, concession 7, on lot 16, concession 6, and on lot 19, concession 9, respectively to depths of 1,175, 1,154, and 1,135 feet proved unproductive. A well sunk at Essex Centre on lot 283 south Talbot road to a depth of 1,200 feet struck neither gas nor oil.

In Malden township the Colwell well on lot 2, concession 1, and the Parks well on lot 4, concession 2, respectively 1,418 and

[1] Corkill, E. T., Fourteenth Report of the Bureau of Mines, Ont., p. 117.

1,004 feet deep were dry holes, and in the township of Anderdon, the Fraser well sunk near the townline between Anderdon and Malden about half a mile east of the Detroit river, produced neither oil nor gas. Some surface gas was struck in a well drilled on lot 12, concession 2, Maidstone, and some oil in the upper part of the Onondaga (Corniferous) formation at a depth of 115 feet on lot 1, concession 1, of the same township. A well sunk to a depth of 1,465 feet on lot 12, concession 6, of Maidstone, proved to be a dry hole and the wells sunk at Windsor and Sandwich to the salt beds of the Salina (Onondaga) formation proved the absence of oil and gas in that locality.

For the results of boring operations in other parts of the county see records of wells.

HALDIMAND COUNTY.

In Haldimand county there are a number of gas fields separated from one another by more or less non-productive areas, and there is hardly a township in the county that has not some producing wells. The gas-bearing formations are the Clinton and Medina.

The Attercliffe Field.

The Attercliffe field lies 4 or 5 miles north of Dunnville in the north part of Moulton and Canborough townships. The gas-bearing stratum is the white Medina sandstone, which lies at a depth of about 660 feet and is 10 to 20 feet thick. The wells produce from 25,000 to 75,000 cubic feet each per day.[1]

Gas is piped to Hamilton, Dundas, and Dunnville.

Dunnville.

There is a small gas pool at Dunnville and three wells were sunk in 1891. Gas was struck in the Clinton limestone and in the white Medina sandstone at depths of about 612 and 740 feet respectively. The average daily capacity of the three wells was said to be about 150,000 cubic feet.[2]

---

[1] Fourteenth Report of the Bureau of Mines, Ont., p. 91.
[2] Geol. Sur., Can., VI, 105 S.

The Selkirk Field.

This is one of the most important gas fields of the province. The wells as a rule are not heavy producers, having capacities varying from 100,000 to 1,000,000 cubic feet per day, but the field is of wide extent and its boundaries have not yet been delimited. It lies along the lake shore in the southern part of Rainham and Walpole townships, extending from the eastern end of the former to Nanticook in the latter, a distance of about 20 miles. It extends back from the shore 2 or 3 miles and at the east end runs north into Cayuga township. The productive strata reach southward beneath the lake, and wells have been sunk in the shallow water along the shore.

In several wells gas is found in the Clinton formation and in the white Medina sandstone, but in the great proportion of the wells the productive stratum is the red Medina sandstone. This lies at a depth varying from 785 feet in the eastern end of Rainham to about 900 feet near Nanticook. The dry holes of the field have no recognized order of distribution and are probably not related to any peculiarity in the structure of the strata, but rather indicate variations in the porosity of the gas-bearing stratum.

Gas is piped from the Haldimand fields to Hamilton, Dundas, Brantford, Galt, Paris, and other towns and villages of that part of the province.

Other Fields.

In Caledonia the Clinton formation is the productive horizon and in the village of Cayuga the Clinton and Medina formations.[1] In North Cayuga also, gas is obtained from the Clinton and Medina. During 1912 two new gas fields were discovered in the county, one in the township of Sherbrooke and the other in the township of Dunn on the east and west sides respectively of the mouth of Grand river. "These wells are within 5 miles of he first wells drilled in the county of Haldimand. The wells are

[1] Geol. Surv., Can., Vol. 5, p. 106 SS.

the most productive of any in the county, six of them yielding over a million cubic feet each per day. Two other fields have been developed, one in Canborough, Haldimand county, and the other in Binbrook, county of Wentworth[1]."

HALTON COUNTY.

Some drilling has been done at Milton and it is claimed that traces of oil were discovered.

KENT COUNTY.

Bothwell Oil Field.

This field lies in the southern part of the township of Zone just to the southwest of the town of Bothwell, and stretches for a length of about 5 miles with a width of one-half to three-quarters of a mile between the Grand Trunk railway and Thames river[2].

Oil is found in the Onondaga (Corniferous) limestone at a depth of 375 to 400 feet. This formation is overlain by the Delaware limestone, which is succeeded by the Hamilton formation. Accurate levelling has been done by at least one of the operators in this field and it is claimed that the information obtained by getting the elevation of the top of the Onondaga (Corniferous) limestone in a great number of wells proves that the oil has accumulated in anticlines, and this information has resulted in reducing the number of dry holes to a minimum.

An interesting discovery made in this field is described as follows on page 20 in the Sixth Report of the Bureau of Mines, Ontario:

"In certain localities, as on lots 6, 7, and 8 in the seventh and eighth concessions of Zone, Mr. Carman discovered from the records of borings, evidence of a pre-glacial river channel in the shale or soapstone. Across the lots named the general course of this river bed is east and west, with a north and south bend on

[1] Ontario Bureau of Mines, Twenty-second Annual Report, p. 46.
[2] Chalmers, Robert, Geol. Sur., Can., Vol. 14, p. 161 A.

lot 7 in the seventh concession, but the observations have not been careful enough to indicate the way in which the water had flowed. The channel is cut through the soft shales into the underlying hard limestone and has a breadth of about 250 yards, with a bed sloping from both banks towards the middle, where in places the river gravel has a thickness of 100 feet."

[1]The Bothwell field was discovered early in the sixties and some very good wells were opened, but attention became centred on Oil Springs and Petrolia and this field was abandoned in 1866. This field lay in the township of Mosa. Thirty years later explorations were again directed to this part of the country and in 1896 a pool was opened in Zone a little to the southwest of the one that had been drawn on in the sixties. This field has been producing constantly up to the present time.

The statement of production from 1906 to 1911 as furnished by the supervisor of petroleum bounties is given in the following table:

Year.	Barrels.
1906	44,827
1907	42,727
1908	39,228
1909	38,092
1910	36,998
1911	35,244
1912	34,486
1913	34,348
1914	33,961

The Kipp Oil Field.

[2]This field lies 2 miles south of Chatham in lots 23, 24, and 25, concession 8, Raleigh, and in lots 23 and 24 to the north of these.

[1] Denis, T., Geol. Sur., Can., Vol. II, p. 137 S.
[2] Knight, C. W., Sixteenth Report of the Bureau of Mines, Ont., p. 104.

Oil is found in the Onondaga (Corniferous) limestone at a depth of 360 to 370 feet and gas flows in quantity sufficient to operate the field.

This pool has been drawn on for several years.

Raleigh Oil Field.

This lies on lot 18, concession 12, of Raleigh, and in the vicinity. Oil was struck in the Onondaga (Corniferous) limestone. It is claimed that there is an anticline in which the oil had accumulated.[1] Oil was first discovered in a well sunk for water on lot 18. This discovery led to drilling operations through which a strong flow of oil was struck in November, 1902. This well became known as the Gurd gusher from the name of the man who located it. The initial flow was 1,000 barrels per day. The yield declined rapidly and in April the following year the well was pumping 25 barrels per day. The discovery led to great activity and in January, 1903, twenty-five wells had been drilled in this vicinity, while in April of the same year there were sixty wells. Apart from the Gurd gusher the wells were not very productive, and pumping in this field had ceased by the beginning of 1905. There has been more recent work in this part of the township, but this has met with no great measure of success.

The Romney Oil Field.

[2]This field comprises the eastern ends of concessions 4, 5, and 6 of Romney township and a few adjacent lots in East Tilbury.

This is sometimes spoken of as the shallow pool. Oil is found in the Onondaga (Corniferous) limestone at a depth of 200 to 270 feet. The top of this formation lies at a depth of 180 feet and is overlain by a few feet of the Hamilton formation. The Romney oil is described by refiners as a dead oil. The percentage of sulphur is high and the density is about 28 to 30 degrees Baumé.

---

[1] 12th Rep. Bur. Mines, Ont., p. 41.

[2] Knight, C. W., Sixteenth Rep. Bur. Mines, Ont., p. 100.

This pool was discovered at the close of 1906. Some of the wells had an initial production of 100 barrels per day, but the yield rapidly decreased.

The production as estimated by the Imperial Oil Company amounted to 49,783 barrels in 1907; 11,165 in 1908; and 1,082 in 1909.

Thamesville Oil Field.

[1]A small pool was opened at Thamesville in the township of Zone. The oil is found in the Onondaga (Corniferous) limestone, and the succession of strata passed through in boring, is very similar to that of Petrolia and Oil Springs. The production in recent years at Thamesville according to the supervisor of petroleum bounties was 175 barrels in 1906 and 237 barrels in 1907, while the estimate of the Imperial Oil Company was 1,584 barrels in 1906; 1,139 in 1907; 853 in 1908; and 710 in 1909.

The Tilbury Oil and Gas Field.

This field embraces the eastern half of the township of East Tilbury, the eastern point of Romney, and a small portion of the western part of Raleigh. It reaches from concession 5 of Raleigh south to Lake Erie. Its length north and south is about 9 miles and its greatest width, which lies along the shore of Lake Erie from lot 160 to lot 189 on the Talbot road, is 8 miles. The oil-producing area lies in the northeastern part of the field, while the gas-producing area extends to the lake shore and passes out beneath the lake. The area of the gas field, including a strip lying parallel to the lake shore and extending one mile out beneath the lake, is given by G. R. Mickle as 34.6 square miles.[2] Some gas is obtained in the oil area and a rock pressure of 650 pounds was obtained at a depth of 1,417 feet in the Halliday well on lot 1, concession 6, Raleigh.

The loose surface material in this field is from 100 to 150 feet thick and is underlain by the Hamilton formation. In drilling operations the upper soap, the middle line, and the lower

[1] Corkill, E. T., Fourteenth Report of the Bureau of Mines, Ont., p. 110.
[2] 19th Rep. Bur. Mines, Ont., p. 150.

soap of the Hamilton formation are passed through, followed below by the Delaware, Onondaga (Corniferous), Salina (Onondaga), and Guelph formations.

Gas and oil are found in the lower part of the Salina (Onondaga) formation and in the upper part of the white dolomitic limestone of the Guelph formation. E. Coste in describing the northern half of the field, which had been opened at the time of writing, says:

[1]"The gas and the two upper oil pays in the southern part of the field are found in the lower brown dolomites and gypsum of the Onondaga (Salina, W.M.), while the lower oil pay is struck in the upper beds of the Guelph and Niagara. In the north end of the field, north of the Michigan Central railway, the lower beds of the Onondaga are barren of oil, which is there altogether found in the Guelph, but the gas is still found there in the lower beds of the Onondaga in the strata which form the first and second oil pays of the south end of the field. In the east middle part of the field on the other hand, the oil is struck in the Onondaga strata which constitute the gas pays in many of the wells of the middle western part of the field. . . .

"A little gas is also often found in the sand or gravel at the bottom of the drift, also in the upper part of the Corniferous in some of the wells, while in other wells some gas and a little oil were found in the upper beds of the Onondaga between 500 and 600 feet. There is also another vein of gas in some of the wells at about 1,250 to 1,280 feet in the Onondaga." In a well sunk on lot 10 of the Middle road, north range of East Tilbury a rather strong flow of gas was struck at 1,360 feet, another at 1,375 feet, oil and gas at 1,385 feet, and oil at 1,410 and 1,430 feet. In a well sunk half a mile southeast of this, gas was struck at 1,363 feet and oil at 1,393, 1,418, and 1,430 feet. The gas of the gas area proper occurs usually in four pay streaks in the Salina (Onondaga) formation. In three wells, which may be taken as typical of the southern or most productive part of the field, gas was found as follows:

---

[1] Journal of the Canadian Min. Inst., Vol. X, 1907, p. 82.

	1.	2.	3.
First gas	1,120 feet.	1,145 feet.	1,145 feet.
Second gas	1,210 "	1,240 "	1,305 "
Third gas	1,305 "	1,355 "	1,375 "
Fourth gas	1,345 "	1,380 "	1,380 "

The oil of the Tilbury field contains some sulphur; it is dark green in colour, has a specific gravity of 38 to 41 degrees Baumé, and belongs to the same class as the Petrolia and Oil Springs oils.

The discovery of the Tilbury oil field gave a great impetus to the oil industry of Ontario. In 1907 this field produced 44 per cent of the total production of the province, and considerably more than Petrolia and Oil Springs combined. The A. Simard well of the Central Oil and Gas Company had an initial flow of 300 barrels of oil and 1,200 barrels of salt water per day. Unfortunately the yield from this field has decreased very rapidly.

In this field a number of gas wells had an open flow of 7,000,000 cubic feet per day and there were at least seventeen wells with an average flow of 2,500,000 cubic feet each per day.

Gas is piped from this field to Chatham, Windsor, Sarnia, London, Woodstock, Brantford, and Hamilton.

Oil was first struck in the Tilbury field in December 1905, in a well drilled by the Acme Oil Company on lot 10 of the Middle road north range, East Tilbury. Interest was quickly aroused and it is said that there were 55 drilling outfits in the field in the latter part of 1906 and the early part of 1907. In March, 1907, there were 150 wells, and on July 1 of the same year there were 235 wells. In December, 1906, the first well was drilled in the area near the lake. Operations continued throughout 1907 and 1908 and by May, 1909, the field was pretty well delimited.

The oil production of Tilbury and Romney, as furnished by the supervisor of petroleum bounties, is given in the following table:

Year.	Barrels.
1906	106,992
1907	411,588
1908	201,286
1909	124,003
1910	63,058
1911	48,708
1912	44,727
1913	26,824
1914	18,530

The production of gas from the Kent field up to the end of 1911 was 15,379,000,000 cubic feet.[1] In 1912 the production was 7,752,500,000 cubic feet, or 62·2 per cent of the total production of Ontario, and in 1913 it was 7,975,800,000 cubic feet or 63·5 per cent of the total production.

The Wheatley Field.

This[2] lies in the southwestern part of the township of Raleigh. Oil is found in the Guelph formation at a depth of 1,290 to 1,300 feet. About 400 feet of salt is said to have been passed through in the drilling. Gas was discovered at a depth of 1,100 feet in a well sunk at Wheatley in 1901 or 1902. Explorations were continued and oil was struck in Romney township about 2½ miles east of Wheatley. The United Gas and Oil Company in 1904 had four wells on lot 11, concession 2, producing 40 barrels per day and there were also other wells in the vicinity. The production as given in the Report of the Ontario Bureau of Mines was about 4,490 barrels in 1904 and 775 barrels in 1906.

Surface Gas.

Surface gas has been struck in different parts of the county. This has been found chiefly on each side of the high ridge that

[1] Mickle, G. R., Twenty-first Annual Report of the Bureau of Mines, Ontario, p. 39.
[2] Corkill, E. T., 14th Rep. Bur. Mines, Ont., p. 111.

extends in a southwesterly direction through the townships of Orford, Howard, and Harwich. It occurs in a fine-grained white sand underlying an impervious clay. It has been used locally for domestic purposes for more than twenty years.

LAMBTON COUNTY.

The oil fields of Lambton county are the oldest and most productive of the province. The first flowing well was drilled at Oil Springs in 1862 and during the sixties the Petrolia field was also opened. These two are the most important fields in the county. Each had its period of flowing wells, but this was not of long duration; pumping was soon resorted to and has been carried on constantly up to the present time. The production has been steadily declining, but by drilling new wells as the old ones became exhausted, by utilizing for pumping operations the small amount of gas that accompanies the oil, and by joining a great number of wells to one engine by means of the jerker system the operation of the fields has been so economical as to prove remunerative even though the average yield per well per day is measured only in gallons. Other smaller fields have been opened in more recent years in different parts of the county.

The supervisor of petroleum bounties furnishes the following figures of production of Lambton county:

1906.	1907.	1908.	1909.
377,286 barrels.	304,212 barrels.	265,368 barrels.	243,123 barrels.
1910.	1911.	1912.	1913.
205,456 barrels.	184,450 barrels.	150,272 barrels.	155,747 barrels.

1914.
154,186 barrels.

Dawn Oil Field.

[1]This is a small field lying in the township of Dawn about 2 miles northwest of the village of Florence. The pool was

[1] Denis, T., Geol. Sur., Can., Vol. XI, p. 137 S.

discovered in 1897, and the initial production of some of the wells was very encouraging.

Euphemia Oil Field.

[1]This small oil field lies in the township of Euphemia about 2 miles northeast of the village of Shetland, and the producing area is limited to lots 26 and 27, concession 4. Oil is found in the Onondaga (Corniferous) formation at a depth of 370 feet from the surface. This field was discovered in the eighties and the initial production was several barrels per well per day, but the yield fell off in a short time to an average of less than one-half barrel per day.

London Road Oil Field.

This field lies in the eastern part of Sarnia township on lots 1 to 4 of concession 6 and lots 3 to 6 of concession 7. Oil was found in the Onondaga (Corniferous) limestones at depths of 400 to 475 feet. This field was opened in 1898, but has since been abandoned.

The Moore Oil Field.

This oil field lies in the eastern part of the township of Moore and comprises approximately lots 1 to 5 in concessions 9, 10, and 11 of Moore. The best wells are located on lots 3 and 4 in concessions 9 and 10.[2] Some wells sunk at some distance farther north are also productive.

Oil is found at various horizons in the upper part of the Onondaga (Corniferous) limestone. In some wells there is only one productive horizon, but in many wells two such horizons are found and these are separated by 15 to 40 feet of strata. Gas is obtained in sufficient quantity to operate the field and accompanies the oil, especially in those wells in which there is only one productive horizon. In other wells a gas stratum is found at a higher level than the oil.

---

[1] Denis, T., Geol. Sur., Can., Vol. XI, p. 137 S.
[2] E. T. Corkill, 14th Rep. Bur. Mines, Ont., p. 112.

The "lower lime" is overlain by the Hamilton formation, and to the east, south, and west of the field the Hamilton formation is overlain by black shale. Oil is seldom struck in those wells in which this black shale is encountered, so that the field is pretty well limited to an area that probably represents the crown of an anticline.

This field was opened in 1904 and some of the best wells pumped initially from 40 to 100 barrels per day. The production has, however, fallen off considerably. The following figures of production are from estimates furnished by the Imperial Oil Company.

1906.	1907.	1908.	1909.
53,029 barrels.	32,720 barrels.	25,667 barrels.	18,033 barrels.

1910.
14,614 barrels.

Oil Springs.

The Oil Springs petroleum field lies in lots 16, 17, 18, and 19 of concessions 1 and 2 of the township of Enniskillen. Oil is produced at the present time from a stratum lying at a depth of 370 feet from the surface or about 130 feet in the "lower lime," which is overlain by the Hamilton formation.

In connexion with the early history of this and the Petrolia field the following notes by Hunt[1] in 1861 are of interest:

"The existence of liquid bitumen in the Corniferous limestone in western Canada was pointed out as long ago as 1844 by Mr. Murray, who tells us that this rock is generally bituminous, and that cavities in it are often filled with petroleum; the quarries near Gravelly Bay in Wainfleet are cited as an example (Report of Geol. Survey, 1846, p. 87). In the report for 1850 we find a notice of what are called oil springs, in which petroleum rises to the surface of the water near the right bank of the Thames in Mosa, and in two places on Bear Creek in Enniskillen. Subsequently Mr. Murray described a considerable deposit of solid

[1] The Canadian Naturalist and Geologist, Vol. VI, 1861, p. 247.

bitumen or mineral tar, which occurs in the same township, extending over about half an acre, and in some places two feet in thickness, doubtless formed by the drying-up of petroleum springs (Report for 1851, p. 90). I had already in the Report for 1849, p. 99, described this bitumen from specimens in the Museum of the Geological Survey, and called attention to its economic application.....About the year 1853 the attention of speculators was turned to the deposits of bitumen in Enniskillen just described; but it was not till 1857, that Mr. W. M. Williams of Hamilton, with some associates undertook the distillation of this tarry bitumen, when they soon found that by sinking wells in the clay beneath, it was possible to obtain great quantities of the material in a fluid state. Large numbers of wells were subsequently sunk by Mr. Williams and others in the southern part of the township of Enniskillen along the borders of Black Creek, and also about ten miles farther north on Bear Creek. Nearly one hundred wells had been sunk when I visited the place in December last, and many more have since been bored. Of these but a small proportion furnish available quantities of oil, but the whole amount already obtained from the district is perhaps not less than 300,000 or 400,000 gallons. Owing to the difficulties of communication and of procuring casks sufficient for the oil, these wells have not yet been wrought in a continuous manner; large quantities of oil are however taken out at intervals of some days, and it is probable that if continuously worked the supply would be still greater. Here as in Pennsylvania considerable variations are found in the quality of the oil; that from the wells on Black Creek is more liquid and less dense than the oil from Kelly's wells on Bear Creek, and it is said that wells recently sunk to a considerable depth in the rock have yielded an oil still thinner, lighter coloured and less dense, which is prized as being more profitable for refining. The present wholesale price of the crude oil from Kelly's wells, delivered at Wyoming station on the Grand Trunk Railway, is about thirteen cents a gallon. The oil obtained by Mr. Williams is refined in Hamilton, while that from the northern part of the township has hitherto been sent to Boston, though refining works are now being erected at the wells.....

The oil doubtless rises from the Corniferous limestone, which as we have seen contains petroleum; this being lighter than the water which permeates at the same time the porous strata, rises to the higher portion of the formation, which is the crest of the anticlinal axis, where the petroleum of a considerable area accumulates and slowly finds its way to the surface through vertical fissures in the overlying Hamilton shales, giving rise to the oil springs of the region. The oil is met with at various depths; in some cases an abundant supply is obtained at forty feet, while near by it is only met with at three or four times that depth, and sometimes only in small quantities."

The first flowing well was struck by James Shaw early in 1862 on lot 18, concession 2. Enthusiasm ran high and before October of the same year there were no less than thirty-five flowing wells. The following list of early flowing wells at Oil Springs was made by Dr. Alexander Winchell from personal examination and research.[1]

[1] Sketches of Creation, p. 443.

Depth in feet.	Name and location.	Yield in bls. per day.
104	Solis—lot 18, con. 2	600
108	Purdy—lot 19, con. 2	1,000
115	Evoy Brothers—lot 19, con. 2	600
116	Jewry and Evoy—lot 19, con. 2	300
116	Fairbanks—lot 17, con. 2	500
130	Campbell—lot 19, con. 2	200
132	Bennett Brothers	500
136	Chandler—lot 18, con. 2	100
155	Jewry and Evoy—Same as above, bored deeper.	2,000
157	Sifton, Gordon and Bennett—lot 18, con. 2	150
158	J. W. Sifton—lot 18, con. 2	800
158	Shaw—lot 18, con. 2	3,000
160	Wanless—lot 18, con. 2	200
160	McLane—lot 18, con. 2	3,000
160	Hall—lot 18, con. 2	250
160	Rumsey—lot 18, con. 2	250
160	Whipple—lot 18, con. 2	400
163	Sanborn and Shannon—lot 18, con. 2	2,000
163	Campbell and Forsyth—lot 18, con. 2	1,000
163	Wilkes—lot 18, con. 2	2,000
164	Bradley—lot 18, con. 2	3,000
167	Webster and Shepley—lot 18, con. 2	6,000
170	Leavenworth—lot 18, con. 2	500
170	Culver—lot 18, con. 2	200
173	Allen—lot 17, con. 2	2,000
175	Barnes—lot 17, con. 2	300
178	Petit—lot 19, con. 2	3,000
180	George Gray—lot 17, con. 2	150
180	Holmes—lot 19, con. 2	500
187	McColl—lot 17, con. 2	1,200
188	Swan—lot 18, con. 2	6,000
196	Nelson—lot 17, con. 2	
212	Fiero—lot 19, con. 1	6,000
237	Black and Mathewson—lot 17, con. 1	7,500

No preparations had been made to care for such a flow and it is estimated that in the spring and summer of 1862 no less than 5,000,000 barrels of petroleum floated away on Black creek.

Flowing soon ceased and wells had to be pumped; but Oil Springs is still a steady producer. Although the wells to-day produce on an average less than a barrel per day, the economical methods of pumping these makes their operation profitable.

In 1913 and 1914 deeper drilling was done in the Oil Springs field and one well was carried to a depth of 3,065 feet. This deep drilling resulted in the discovery of a gas-bearing stratum, and there are now several wells of moderate capacity. In 1914 great excitement was produced by striking in the Fairbanks well a flow of gas greatly exceeding that of any other well in the province. Unfortunately the pressure dropped off very rapidly.

The following figures of oil production for a few years are from estimates made by the Imperial Oil Company.

1906.	1907.	1908.	1909.
68,099 barrels.	55,813 barrels.	61,252 barrels.	60,868 barrels.

1910.	1911.
55,508 barrels.	56,248 barrels.

The Petrolia Oil Field.

The Petrolia oil field lies in the township of Enniskillen. It is in the form of an ellipse, the major axis of which runs in west-northwest direction through the town of Petrolia.

Oil is obtained from the Onondaga (Corniferous) limestone at a depth of 460 to 480 feet. Several wells have been sunk to greater depth, but without encouraging results. One of these, on lot 11, concession 11, was carried to a depth of 3,777 feet in 1900.

The succession of strata is similar to that of Oil Springs, the drift resting directly on the Hamilton formation, which in turn overlies the Onondaga (Corniferous) probably with some intervening Delaware limestone. "The crown of the dome which forms the Petrolia field seems to be located at the northwest corner of Petrolia city, at which place the surface of the Hamilton formation, overlying the petroliferous strata, has been eroded away, forming a plateau underlying the drift, of about two-thirds of a mile in diameter from the edges of which the rock dips on all sides."[1] There is a distinct syncline between Petrolia

[1] Denis, T., Geol. Sur., Can., XI, 136 S.

and Oil Springs; and at Oil City, which lies between the two, the black shales overlying the Hamilton formation have a thickness of 40 feet.[1]

Reference is made to the early history of this field in the description of the Oil Springs field. Operations carried on in 1867 at a point a little west of the present town resulted in a number of flowing wells known as the King wells. Some of these yielded as much as 400 barrels per day. Although the average yield of the wells at the present time is only a few gallons per day the application of economical methods permits of their successful operation. The field is still one of the most productive of the province.

Plympton Oil Field.

A small field was opened in the southwestern part of Plympton township a number of years ago.[2] The gas that was struck in the wells was sufficient to operate the field and provide fuel for the farmers of the vicinity.

Other Fields.

A little oil and gas were found in block A of the Indian Reserve, Sarnia township, and traces of oil have been found in other localities; but no important fields other than those already described have been opened. A flow of 20,000 cubic feet of gas per day was struck in the Dickens well in the south end of the town of Sarnia and used for a time for lighting street lamps and houses in the vicinity. In recent years two small groups of wells in Brooke township have produced oil. In the early days of the oil industry several wells were sunk along the north branch of the Sydenham river in the township of Sombra, and on lot 12, concession 7, 100 feet of black shale was found underlying 112 feet of drift. Logs are given of wells sunk in other parts of the county.

---

[1] H. P. H. Brumell, Geol. Sur., Can., V, 61 Q.

[2] Chalmers, Robert, Geol. Sur., Can., Vol. 14, p. 164 A.

MANITOULIN ISLAND.

The Trenton limestone of Manitoulin island has received considerable attention at different times. Oil springs are said to have been found at Bob portage on the east side of Manitowaning bay, in Sheguiandah bay, on Strawberry island, and on one of the islands north of Maple point. Some of the wells have struck small quantities of gas accompanied by a little oil, but nothing of economic importance has yet been found.

In the sixties three or four wells were sunk on the south side of Wekwemikong bay, where oil springs were found. These reached a depth of about 500 feet and it is said that 120 barrels of excellent petroleum was obtained from one of them. Bell mentions in 1897 that some years prior to writing, wells had been sunk at Cape Smith and at Bass lake behind Sheguiandah, and small quantities of oil reported.[1]

It was claimed that gas was struck on the farms of Robert Morphet and John Lynch near Little Current in 1890, and at a point 4 miles southwest of the town in 1891.[2] In 1905 the Northern Oil and Gas Company drilled several holes about 2 miles southeast of Wekwemikong and a small amount of petroleum was obtained from some of these, 500 barrels altogether, it is claimed.

The oil is struck in the upper part of the Trenton formation at a depth of about 400 feet. There are several anticlines crossing the island. These are indicated on the map of the island published by the Geological Survey.

NORFOLK COUNTY.

Delhi.

Gas was struck in a well drilled in the yards of the Darby hotel in the village of Delhi, Norfolk county, in 1908-09 and is used for light and fuel. The gas comes from the Clinton and the red and white Medina sandstones, but the chief yield is from the red Medina. Further drilling was carried on just south of the village, and a small field opened.

[1] Geol. Sur., Can., IX, 28 I.
[2] First Report Bureau of Mines, Ont., p. 140.

Port Dover.

A natural gas reservoir at Port Dover has been drawn on for several years. This lies in the southern part of Woodhouse township and includes the village of Port Dover and an area extending 2 or 3 miles to the west and the same distance to the north of the village. Gas has also been struck at Port Ryerse, a short distance farther west.

A small amount is found in the Clinton formation, but the chief production is from the upper part of the Medina.

Port Rowan.

There is a small gas field at Port Rowan, which has been drawn on for several years. The wells have capacities ranging from 40,000 to 60,000 cubic feet. One well at least was carried to a depth of 1,460 feet.

OXFORD COUNTY.

Innerkip.

Six wells were sunk in or near the village of Innerkip, Oxford county, in 1908. One of these reached a depth of about 1,500 feet, but the others were shallow. Gas was struck in small quantities and was used by some in the village for heating and lighting. A gas sand is said to have been penetrated between 430 and 460 feet.

Tillsonburg.

[1]This is not an oil or gas field, but deserves a few words on account of the work that has been done in the area. The attention of oil producers was directed to a well-known oil spring a short distance southwest of the town, and as early as 1861 drilling operations were begun. In 1865 and 1866 several

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, p. 45 Q.

companies sank wells in Dereham and adjoining townships without success, though traces of oil were obtained. In 1873 one of these wells was deepened to 1,450 feet and in 1877 to 1,750 feet. In 1888 and 1889 drilling was again carried on and four wells were sunk, one 400 feet and three 200 feet deep. In 1900 two or three other shallow wells were sunk. These were drilled in the valley of Big Otter creek near the Grand Trunk Railway bridge, a short distance south of the town, but resulted in no discovery of economic importance.

A few wells have been sunk in other parts of the county. Logs of some of these are given.

SIMCOE COUNTY.

Collingwood.

In Collingwood, Simcoe county, four wells were sunk during 1887 and 1888, but with little success. "The well known as 'The West Well,' had a flow of 4,000 c. ft., the gas being utilized in two private residences immediately adjoining its site. An attempt was made to make use of that from 'McDonell's well,' but it was found that the flow was too meagre to be of economic benefit. At Delphi, a summer resort about five miles west of Collingwood, a well was sunk which gave a flow of about 5,000 c. ft. per diem. No use has as yet been made of the gas obtained from this well, notwithstanding the fact of its being within a very short distance of a large summer hotel."[1]

A number of years later operations were renewed at Collingwood and in 1902 some houses were being heated and lighted by the gas. It was also used for generating power in some shops. The gas was found in the Trenton limestone at two or three different horizons, at a depth of 135 to 300 feet. The pressure was from 20 to 30 pounds. The greatest number of productive wells was along a line running northeast through the town, though a few sunk to the south of this line were also productive. In the town of Collingwood the surface deposits rest directly on the Trenton.

[1] Brumell, H. P., Geol. Sur., Can., Vol. IV, 71 S.

Three wells were sunk in 1901 on the high ground west of the Blue Mountain escarpment and one of them yielded a trace of gas, the two others yielding neither gas nor oil.[1]

WELLAND COUNTY.

The Bertie-Humberstone Field.

This field lies in the eastern part of Humberstone, the western part of Bertie, and the southern part of Willoughby township in Welland county. This is one of the most productive fields of Ontario and numerous wells had an initial flow of several million cubic feet per day. Well No. 63 of the Provincial Natural Gas and Fuel Company yielded initially 10,014,000 cubic feet and No. 16, 12,500,000 cubic feet. Small quantities of gas are struck in the Clinton dolomite and in the red Medina sandstone, but the white Medina sandstone, lying at a depth of 820 to 860 feet, is by far the most productive. In many of the wells of this field there are found two strata of white Medina sandstone separated by a few feet of shale. A small amount of gas was struck in the Trenton limestone at a depth of 2,940 feet in a deep well sunk on lot 2, concession 4, Willoughby.

The following notes on this field by Eugene Coste[2] are of interest:

"The strata dip to the south and southeast uniformly at the rate of about 35 feet to the mile except for a small syncline (about one mile wide and 30 feet deep) the axis of which is about one mile north of No. 22 well at Point Abino.

"Salt water was struck in every well in large quantities toward the middle of the Guelph and Niagara formation. A little salt water is also found in the Clinton, in the White Medina Gas rock and in the Calciferous at No. 14, but in none of these formations below the Guelph and Niagara is there anything like a continuous body of salt water, which on the contrary lies there in disconnected small bodies of water.

---

[1] Chalmers, R., Geol. Sur., Can., Vol. XV, 272 A.

[2] Journal of the Canadian Mining Institute, Vol. 3, p. 77.

"Besides being found in the strata indicated in the above logs gas was also found in some other wells in large quantity, 5 feet in the Clinton limestone, 10 feet in the red Medina sandstone and in the upper white sandstone of the Medina. Some amber-green colour oil of a gravity of 42½ degrees Baumé was also found in the last few feet of the lower white Medina sandstone at wells Nos. 20, 28 and 62. The gas in that sandstone is generally found 3 feet in from the top of it, but often also another vein is found 9 to 10 feet in."

[1]The following table sets forth information regarding a number of the earlier wells drilled by the Provincial Natural Gas and Fuel Company:

No.	Location.	Depth of the top of the Medina.	Capacity in cu. ft. per day.
1.	Lot 35, con. 3, Bertie.....	735 feet.	2,050,000
2.	Lot 2, con. 2, Humberstone.....	735 "	375,000
3.	Lot 1, con. 15, Bertie.....	715 "	600,000
4.	Lot 3, con. 1, Humberstone.....	760 "	2,200,000
5.	Lot 34, con. 3, Bertie.....	725 "	8,500,000
6.	Lot 1, con. 1, Humberstone.....	770 "	70,000
7.	Lot 3, con. 2, Humberstone.....	725 "	3,000,000
8.	Lot 27, con. 3, Bertie.....	715 "	Abandoned
9.	Lot 7, con. 2, Humberstone.....	730 "	3,500,000
10.	Lot 6, con. 1, Humberstone.....	750 "	4,500,000
11.	Lot 4, con. 14, Bertie.....	695 "	300,000
12.	Lot 9, con. 2, Humberstone.....	730 "	5,500,000
13.	Lot 9, con. 1, Humberstone.....	745 "	300,000
14.	Lot 6, con. 15, Bertie.....		Abandoned

Although several companies have been interested in this field the chief work of opening and developing it has been done by the Provincial Natural Gas and Fuel Company. Drilling began in 1889 and a good flow of gas was obtained. Operations continued in 1890, a pipe line connexion was made with Buffalo,

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, p. 37 Q.

and gas was supplied to that city in 1891. By the end of 1893 the Provincial Natural Gas and Fuel Company had finished sixty-nine wells, the greater number of which were producing, and had acquired about thirty others from the Erie County Natural Gas and Fuel Company. In 1899 the field was extended into the southern part of Willoughby and at the close of 1904 there were one hundred and seventy-six producing wells. The pressure has diminished greatly since the field was opened; but careful management has prolonged its productive life. Exportation ceased on April 1, 1909; but gas is supplied to St. Catharines, Niagara Falls, and the villages of the district.

Crowland.

The Crowland gas field occupies an area 2 miles long and 1½ miles wide about the middle of Crowland township. Gas is found in the Clinton formation. This field was opened by the Provincial Natural Gas and Fuel Company in 1904 and a pipe was laid to Niagara Falls.[1]

Port Colborne.

The gas field at Port Colborne extends 5 or 6 miles north of the village and 2 to 3 miles east and west. Gas is struck in the white Medina sandstone, but the greater proportion comes from the Clinton limestone. The following table, for which data were furnished by Mr. C. E. Steele of the Sterling Gas Company, Ltd., shows the depth at which the Clinton formation is struck in different parts of the field, and as this section of country is very level these figures serve to indicate the approximate dip of the strata:

[1] Corkill, E. T., Fourteenth Report of the Bureau of Mines, Ont., p. 104.

Depth in Feet of the Top of the Clinton Formation in the Township of Humberstone.

Lot.	30	29	28	27	26	25	24	23	22
Concession 4.....		572		575	584		578	587	
Concession 3.....	666	635	634	620			611	608	
Concession 2.....	690								590
Concession 1.....								726	

In 1866 a well was bored for oil on lot 31, concession 1, Humberstone, and gas was struck at various depths; but the value of this kind of fuel was not appreciated at the time and no attempt was made for a long time to utilize it. Finally, about 1888, it was piped to several houses and used as fuel; but the well was abandoned in 1891 owing to decrease of pressure in the winter.[1]

The first company to bore for natural gas in Canada was organized in 1885 in Port Colborne. This was the Port Colborne Gas, Light, and Fuel Company. A well was bored 400 yards west of the canal, a depth of 1,500 feet was attained, and gas was struck in small quantities and utilized for domestic purposes. Two other wells were sunk in the village in 1886, and a yield of 16,000 cubic feet per day was obtained from one. In 1889 John Reeb sank a well on lot 6, concession 1, Wainfleet, and struck a good flow in the Clinton limestone at 685 feet. Boring operations were conducted at Port Colborne and in the village of Humberstone in 1890 and 1891, and in subsequent years. About 1903 the northern part of the field was opened and proved the most productive.[2]

The field is now supplying light and fuel to the towns and villages of the vicinity.

[1] First Report of the Bureau of Mines, Ont., p. 128.
[2] Fourteenth Report of the Bureau of Mines, Ont., p. 91.

The Wainfleet Field.

This field includes lots 25 to 31, concessions 4 and 5, Wainfleet. Gas with a rock pressure of 260 pounds is found in the white Medina sandstone at a depth of 640 feet. The wells average 665 feet in depth and the gas sand is 12 feet thick. This field was opened in 1903 and gas was first utilized in January, 1904.[1]

Wells have been drilled in other parts of the county and logs of some of these are given.

WENTWORTH COUNTY.

There has been some prospecting for oil and gas in this county, and a gas field has been opened in Binbrook township.

YORK COUNTY.

A number of wells have been sunk at various times in York county, and in some of them small flows of gas have been struck in the surface deposits and in the Trenton limestone, but not in sufficient quantity to be of economic importance. Several wells were sunk at New Toronto and vicinity early in the nineties by the New Toronto Oil and Natural Gas Company. A number of logs are given.

DESCRIPTION OF FIELDS IN QUEBEC.

Investigations have been carried on in different parts of Quebec; but they have resulted in no important discoveries. Numerous wells have been sunk on the Gaspe peninsula in search of oil, and several wells have been drilled north and south of the St. Lawrence between Montreal and Quebec to investigate the gas possibilities.

---

[1] Corkill, E. T., Fourteenth Report of the Bureau of Mines, Ont., p. 104.

NORTH OF THE ST. LAWRENCE.

Wells have been sunk at and in the vicinity of Louiseville, Yamachiche, St. Barthelemi, St. Justin, and St. Barnabé north of the St. Lawrence and a small quantity of gas has been obtained.

In 1887 three wells were bored at Louiseville. [1]M. L'Abbe Laflamme gives records of these wells as follows:

	No. 1.	No. 2.	No. 3.
Depth	260 feet.		645 feet.
Top of shale at	125 feet.	165 feet.	160 feet.
Gas at	210-260 feet.	220-295 feet.	216 and 260 feet.

The gas was only in small quantity. Interest was aroused in this district again in 1905, and a number of wells were sunk in the vicinity of Louiseville, Yamachiche, and St. Barnabé, thirteen of which produced gas in merchantable quantity.[2] Gas was obtained at a depth of 225 to 300 feet, that is at about the top of the solid rock. Pipes were laid to supply the villages of St. Barnabé, Yamachiche, and Louiseville, and in 1907 an 8-inch pipe-line was laid to Three Rivers, although Mr. Obalski expressed the opinion that the supply was not inexhaustible and should be carefully dealt with. The demand was too great and the field was exhausted before the end of 1907. Subsequent operations in this district have not met with satisfactory results.

A pocket of surface gas was struck in sinking for water in July, 1899, in Champlain township, Champlain county.

SOUTH OF THE ST. LAWRENCE.

Several wells have been sunk at different points south of the river.

[1] Royal Society of Canada, Vol. VI, 1888, Sec. IV, p. 15.
[2] Mining Operations in the Province of Quebec for 1907.

In 1885 a well known as the Trudel well was sunk for oil near St. Gregoire on lot 501, concession of Beauséjour, Nicolet county. It was carried to a depth of 1,115 feet and gas was struck at the depths of 316, 370, 580, 640, and 842 feet. The flow was not controlled and gas issued from the well in considerable quantities for three years. A well drilled in 1895 just back of Nicolet college failed to strike gas in a depth of 1,100 feet. In 1904 another well was sunk near the old Trudel well, but without success.

The following notes on the operations of the Quebec and Fuel Company, although not authoritative, are believed to be correct in the main.

[1] "Well No. 1.—On lot No. 566, Parish of Yamaska. Commenced in 1908; stopped in 1909 at depth of 3,060 feet, in shales. Did not reach limestone.

"Well No. 2.—In the Parish of St. Roch, on Joseph Perron's farm, county of Richelieu. Drilled in 1909 to a depth of about 2,950 feet; finished in limestone, presumably Trenton.

"Well No. 3.—On lot No. 27, Grande Côte, Parish of Verchères, county of Verchères. Drilled in 1909-1910 to a depth of 2,450 feet. Reached Trenton limestone. Struck a little gas.

"Well No. 4.—On lot 202, Grande Côte, Parish of Verchères, county of Verchères, to a depth of 2,300 feet. Drilled in 1910. Struck a little gas. Reached Trenton limestone."

Surface gas has been found for many years in wells sunk at different points in St. Hyacinthe county. Interest was aroused in this district in 1910 and a well was sunk to a depth of 1,880 feet, at a point 7½ miles north of St. Hyacinthe, in the parish of St. Barnabé, range St. Amable north, lot 164.[2] "Gas was struck at a depth of 1860 feet in a band of rock composed of dark shale, crystalline calcite, and quartz. The boring was extended 20 feet deeper without noticeably increasing the flow of gas. Consequently, it seems probable that the band of rock containing calcite and quartz carries, rather than covers, the gas, and that as these are secondary minerals, it is a fracture zone in the dark

[1] Denis, T. Report on Mining operations in the Province of Quebec during the year 1914, p. 63.

[2] Dresser, J. A., Summary Rep., Geol. Sur., Can., 1910, p. 219.

grey shales which form compact beds above and below it." The rock pressure was 275 pounds per square inch.

In 1914 two other wells were drilled, one about 1,000 feet from that drilled in 1910 and the other about 1½ miles to the southwest in Point du Jour range. The former was carried to a depth of 2,907 feet and the latter to a depth of 2,050 feet. In both of these wells approximately the upper 1,000 feet of rock consisted of red shale; this was succeeded downward by grey shale in which the borings ended. Gas from the well sunk in 1910 was used in boring operations in 1914, and in the wells sunk during the latter year small flows of gas were obtained, but in none of them has any important quantity been struck.[1]

The encountering of the red shales in these wells shows that the borings were made in one of a series of broad synclinal basins that lie a few miles to the west of a great fault extending from Lake Champlain to Quebec city. The axes of these synclines run northeast nearly parallel to the strike of the fault. The red shales occupying these basins probably correspond to the Queenston shale of Ontario and overlie a great thickness of grey Lorraine shales. Drillers, in carrying on boring operations with a view to testing the possibilities of the lower geological horizons, should avoid these synclinal basins and thus obviate the necessity of penetrating the beds of red shale. Unfortunately rock exposures are rare and the boundaries of these shales are not definitely known. Preliminary prospecting by means of a light drilling rig and the abandoning of all holes in which red shale is struck, might be suggested.

A great number of wells have been sunk in Montreal in search of water, and descriptions of these are given by Adams and LeRoy in their report, "The Artesian and Other Deep Wells on the Island of Montreal"[2], and by C. L. Cumming in Memoir 72 of the Geological Survey, "The Artesian Wells of Montreal."

Following are brief notes on those sunk to a depth of 1,000 feet or over:

---

[1] Files of the Water and Borings Division.
[2] Geol. Sur., Can., Vol. XIV, Part O.

Name of owner.	Location.	Depth in feet.	Remarks.
The Canada Malting Company	"Abattoir Site," near St. Henri	1,281	Water highly saline, 18,000 gallons per day.
Dawes and Co	Lachine	1,003	Saline water, abundant.
The Fenlin Leather Co.	141 Frontenac st	1,025	Quantity of water very small.
The Gould Cold Storage Company	Grey Nun and William sts	1,301	Good water, 10,000 gallons per day.
Longue Pointe asylum.	Longue Pointe	2,000	Good water, 9,600 gallons per day.
Montreal Cold Storage Company	610 St. Paul st	1,020	Water sulphurous. Pocket of gas struck.
The Montreal Gas Co.	Hochelaga	1,850	No water.
The Montreal Gas Co.	Hochelaga	2,550	No water.
The Montreal Gas Co.	Ottawa st	1,050	No water.
Shawinigan Water and Power Company	Maisonneuve	1,017	Very small quantity of water.
Stanley Dry Plate Co.	613 Lagauchetière st.	1,300	Good water, 8,400 gallons per day.
Turkish Baths	140 Ste. Monique st.	1,550	Water soft and slightly sulphurous, 4,000 to 5,000 gallons per day.
Viau et Frères	Maisonneuve	1,500	Water saline and sulphurous, 5,000 gallons per day.
The Wire and Cable Co.	233-241 Guy st	1,055	Hard water, 72,000 gallons per day.

A number of deep wells have been sunk at various other points in Quebec, but neither gas nor oil has been discovered in commercial quantities. Logs of some of these are given.

GASPE.

An area on Gaspe peninsula has attracted a great deal of attention. The occurrence of numerous oil springs and the discovery of traces of petroleum in a number of wells have served as inducement sufficient for the expenditure of large sums of money in the sinking of deep wells. Although exploratory work has been very extensive it has not resulted in the opening of any commercial field.

The area explored extends from Tar point on the south shore of Gaspe bay as far west as Falls brook, a tributary of York river, and lies in that part of the peninsula drained by the York and St. John rivers.

[1]"The surface of the country, a short distance inland, is usually very rugged, with high ranges of hills, reaching in places elevations of 1,200 to over 1,500 feet. The country itself is generally densely wooded and except along the lower portion of the several rivers entirely unopened for settlement. Owing to forest covering, and the heavy deposits of drift, which are found over much of the area, good rock exposures are rarely met with off the lines of the principal streams."

The district is underlain by a great thickness of folded sediments. These consist largely of grey sandstones, interstratified with greyish and sometimes reddish or brown shales and occasional beds of conglomerate. The whole thickness of this formation is given in the Geology of Canada, 1863, as about 7,000 feet. There are presumably fault lines parallel to the anticlinal axes; it is impossible, however, to arrive at any conclusion as to the deduction that should as a consequence be made in the estimated thickness of the strata. The sandstone formation is underlain conformably[2] by a series of limestones about 2,000 feet in thickness.

The age of the sandstone and of the greater proportion of the limestones was believed by Dr. Ells to be Devonian. Referring to the Gaspe limestones he says "it is now considered that only the two lower members, representing a thickness of 160

[1] Ells, R. W., Geol. Sur., Can., XV, 343 A.
[2] Geology of Canada, 1863, p. 394.

feet, can with propriety be assigned to this system(the Silurian), while the preponderance of fossils of Devonian aspect, even in the basal bed, renders it probable that the whole may ultimately be transferred to the Devonian system."[1]

Later work in this section has resulted in confirming this view and the limestones as well as the sandstones are regarded as Devonian.[2]

The whole series has been folded into anticlines having a northwest trend. The most northerly, known as the Haldimand anticline, comes to the coast at Cape Haldimand. The next one to the south runs northwest from the vicinity of Tar point and is known as the Tar Point anticline. The third, known as the Point St. Peter anticline, comes to the sea at a point between Mal bay and Gaspe bay, while a fourth comes to the shore at or near Percé. The limestone formations underlying the great mass of sandstones have been brought up along these anticlines and exposed in places by denudation. The strata are tilted at high angles, in some places as much as 65 to 70 degrees.

The country has been much faulted. Several well defined faults are seen along the shore and the broken character of the strata is observable at several points inland.

Numerous oil springs are found throughout the district and a number of thin layers of the sandstone outcropping on the York and St. John rivers and their tributaries are highly bituminous. The limestones are found in places to be impregnated with petroleum and drusy cavities in an igneous dyke at Tar point are also filled with petroleum. The district has for these reasons attracted much attention. A great many wells have been sunk and from some of them a few barrels of oil were obtained.

The occurrence of oil springs in this district was noted by W. E. Logan in the Report of Progress of the Geological Survey for 1844. Drilling operations were conducted here during the sixties and at least three wells were drilled, as follows: Douglastown, 1860, 200 feet; Silver brook, 1861-2, 1,200 feet; Sandy

---

[1] Geol. Sur., Can., Rep. of Progress, 1880-82, 15 DD.

[2] New York State Museum, Memoir 9. Early Devonic History of New York and Eastern North America, by John M. Clarke.

Beach, 1862, 400 feet. At Silver brook a pocket of oil was struck at 900 feet, and salt water at 1,200 feet.[1]

Operations were again begun in 1889 and were continued during the nineties and later. Drilling was carried on chiefly by the Petroleum Oil Trust and the Canada Petroleum Company. Some of the wells were pumped for a short time in the nineties and during 1901 and 1902, but the yield per well seldom exceeded a few gallons per day. The total yield for these two years was only 10,611 gallons, according to pumping logs shown to Ells. This is exclusive of the different amounts claimed to have been lost by fire and otherwise. In 1900 and 1901 a refinery was erected by the Canada Petroleum Company on York river, 8 miles from Gaspe, and connected with wells by 15 miles of 2-inch pipe. Upwards of fifty wells have been sunk. These are mainly in two groups, both to the north of York river and extending back from the river about 2 miles. The east group is about 8 miles west of Gaspe and the west group is 10 miles farther west, at the mouth of Mississippi brook.

The following table records the most important data concerning the borings.

No.	Location.	Date.	Depth in feet.	Remarks.
	Wells of the Petroleum Oil Trust.			
1.	South of Lobster cove.....	1889–91	2,430	Small shows of oil at 2,048 and 2,400 feet.
2.	South of Lobster cove.....	1890	2,582	Traces of oil at 500, 965, and 2,582 feet.
3.	At the Douglastown beach	1890	2,225	Salt water at 1,304 feet. No oil.
4.	Near Tar point, on anticline	.....	2,970	Show of oil at 2,215 feet.
5.	East group on York river..	1891–2	2,640	Show of oil at 1,850 and 2,360 feet. Limestone at 2,360 feet.

[1] Ells, R. W., Geol. Sur., Can., Vol. IV, 84 K.

No.	Location.	Date.	Depth in feet.	Remarks.
6.	Near mouth of Merlin brook	1892	3,640	Show of oil at 2,950 ft. Salt water at various horizons. Close to ridge of lime stone, but no lime-stone struck in the well.
7.	East group on York river...	1892–3	2,867	Limestone at 2,385 ft. Traces of oil at 2,385, 2,589, and 2,650 ft., was pumped for a time.
8.	South of Lobster cove.....	1892	.....	No oil. Salt water at several horizons down to 1,450 ft.
9.	Near Dartmouth river, 4 miles west of Gaspe.....	1894	2,719	No oil. No limestone struck.
10.	East group on York river ..	1895	1,400	Shows of oil at 1,108 and 1,170 ft. No limestone.
11.	East group on York river...	1893–5	2,957	Limestone at 2,080 ft. Gas and a flow of oil at 2,220 ft. Show of oil at 2,485 ft.
12.	East group on York river ..	1894	3,002	Limestone at 2,550 ft. Small show of oil at 2,075 and 2,837 ft.
13.	East group on York river...	1894	2,050	No oil. Limestone not struck. Salt and sulphur water at 2,050 ft.
14.	East group on York river...	1895–7	2,775	Limestone at 2,265 ft. No oil.
15.	East group on York river...	1895	2,012	Limestone at 1,880 ft. Pumped 7 to 8 gallons per day for several months.

No.	Location.	Date.	Depth in feet.	Remarks.
16.	Two miles west of Silver brook.....	1895	2,995	Limestone at 2,880 ft. Show of oil at 2,664 feet.
17.	West group on York river..	1895–7	2,550	Limestone at 2,000 ft. Traces of oil at 1,013, 1,045, 1,200, and 1,286 ft.
18.	West group on York river..	1895–6	1,960	Limestone at 1,865 ft. Small shows of oil at 990 and 1,095 ft.
19.	West group on York river..	1895–6	2,340	Limestone at 2,340 ft. Oil at 1,185, 1,792, and 2,050 ft. Pumped half a barrel per day for a time.
20.	West group on York river..	1896	2,173	Oil and gas at 2,050. Limestone at 2,050 ft. Pumped 5 gals. per day for a time.
21.	West group on York river..	1896–7	1,830	Limestone at 1,555 ft. Small trace of oil at 1,555 ft.
22.	Two miles northwest of east group on York river.....	1896–7	3,130	Limestone at 2,750 ft. Show of oil at 2,945 ft., gas and oil at 3,105 ft. Results from pumping were irregular.
23.	South of St. John river, 7 or 8 miles from its mouth...	1896	1,790	Limestone at 1,480 ft. No oil.
24.	One mile west of No. 23 ..	1896	1,230	Sandstone thin. No oil.
25.	At Fourth lake.....	1895–7	1,230	Limestone at 605 ft. No oil.
26.	On St. John river, south of Second lake.....	.....	2,900	Limestone at 2,200 ft. No oil.

No.	Location.	Date.	Depth in feet.	Remarks.
27.	In west group on York river.....	1897	2,200	Estimated to have produced several hundred barrels of oil, which was destroyed by fire. Pumped 2 gallons per day in 1902.
28.	On Narrows brook.....	1897–8	3,525	No limestone. No oil.
29.	In west group on York river	1897	2,600	No limestone. A little gas and oil at 2,180 ft.
30.	In west group on York river	1898–9	1,580	Whole depth in sandstone. No oil or gas.
31.	In west group on York river	1898–9	2,815	Limestone at 2,450 ft. Reported to have had a total yield of 23 barrels.
32.	In west group on York river	1899	1,925	Limestone at 1,825 ft. Oil at the contact. Reported to have pumped about 10 gallons per day.
33.	One and one half miles west of the west group on York river.....	1899–1901	2,607	Limestone not reached. No oil.
34.	In west group on York river	1900	1,677	Limestone not reached. Small quantity of oil and salt water at 1,600 ft. Pumped half a barrel per day for some time.
35.	In west group on York river	1901	1,810	Limestone at 1,800 ft.
36.	In east group on York river	1901	1,950	Contact with limestone probably between 1,780 and 1,825 ft. No oil.
37.	In south part of block 31, near Silver brook.....	1901–2	2,600	Small show of oil at 2,218 ft.

No.	Location.	Date.	Depth in feet.	Remarks.
38.	One mile east of No. 37....	1901–2	2,089	Small show of oil at 2,030 ft.
39.	Not yet drilled in 1902, although the rig was set up on Tar Point anticline in east group on York river.			
40.	On Fall brook.....	.....	2,305	Whole depth in sandstone.
	Wells of the Canada Petroleum Company.			
1.	In west group on York river	1899	1,582	Limestone not reached. Oil and gas at 1,550 ft. Total yield recorded, 1,024 gals.
2.	In west group on York river	1901	1,591	Small show of oil and gas at 1,570 ft.
3.	In east group on York river	1899	2,240	Limestone at 2,230 ft. No oil.
4.	In west group on York river	1901	2,100–2,200	Limestone at bottom. No oil.
5.	In west group on York river	.....	2,200	Show of oil at 1,349 and 2,140 ft.
6.	In west group on York river	.....	2,360	Trace of oil at 2,340 ft.
7.	In east group on York river	.....	2,063	Limestone at 2,046 ft. A little oil at 1945 ft.
8.	In west group on York river	.....	2,394	Limestone at 2,340 ft. Small trace of oil at contact.
9.	In east group on York river	.....	2,226	Limestone at 2,212 ft. No oil.
10.	In east group on York river	.....	2,383	Limestone at 2,360 ft. No oil found in boring, but three barrels were reported to have been obtained in July, 1901.

No.	Location.	Date.	Depth in feet.	Remarks.
11.	In west group on York river	.....	1,924	Limestone at 1,900 ft. Trace of oil at 1,490 ft.
12.	Near the mouth of Narrows brook	.....	1,500..	No oil.
	Well of The International Oil Company.			
	North of York river in east part of block 41	.....	1,700	Whole depth in sandstone. No oil.

Regarding the possibilities of the district Dr. Ells writes: "From a careful consideration of all the data at present to hand regarding this field as a producer of oil in economic quantities, it must be said that the outlook can scarcely be regarded as favourable. There are no well defined oil sands, such as are recognized in the true oil territory, and where oil has been obtained in reported large quantities it would seem to occur in isolated pockets only . . . The expenditure of such large sums of money as have been made during the last fourteen years, and the absolute lack of results in finding oil in paying quantity, may well be taken as conclusive that no satisfactory results will be obtained from such further expenditure in this direction."[1]

BITUMINOUS SHALES.

Closely related to the petroleum industry is the distillation of oil-bearing shales. A few notes, therefore, on the bituminous shales of Ontario and Quebec may not be out of place.

On lot 23, concession 3, Collingwood, there is a 7-foot layer of highly calcareous shale that was employed for distillation 50

[1] Geol. Sur., Can., Vol. XV, 362 A.

years ago. "When ignited in a close vessel, it loses 12.4 per cent of volatile and combustible matters; of which from three to four per cent are condensable to an oily liquid. This, when rectified, yields oils fitted for burning and for lubricating purposes, and probably also a portion of paraffin.

"In 1859, works for obtaining these oils were erected on the locality of this shale, near the town of Collingwood. Twenty-four longitudinal cast-iron retorts were set in two ranges, and heated by means of wood; of which twenty-five cords are said to have been required weekly. The shale, broken into small fragments, was heated for two or three hours; from eight to ten charges being distilled in twenty-four hours. In this way, it is said from thirty to thirty-six tons of shale were distilled daily, and made to yield 250 gallons of crude oil, corresponding to about three per cent of the rock. By a further continuance of the heat, a small additional proportion of oil was obtained from the shale; but it was found more economical to withdraw the charge after two hours and a half. The bed of shale available for the purpose, adjoins the work and was furnished, ready broken, at twenty cents the ton. The cost of the crude oil from the shale, was stated by the manufacturers to be fourteen cents the gallon. When rectified and deodorized, it gave from forty to fifty per cent of burning oil, and from twenty to twenty-five per cent of pitch and waste, the remainder being a heavy oil fitted for lubricating purposes. After two or three unsuccessful trials, and the repeated destruction of the works by fire, they were at last, in 1860, got into successful operation, and a ready market was found for the oils. Data are however wanting to show whether the enterprise was remunerative; and it was after some time abandoned, partly, it is probable, on account of the competition of the petroleum of Enniskillen, which was about that time brought into the market in large quantities, and at a very low price."[1]

Some experiments were also made on the black bituminous shales of Bosanquet. A specimen when heated in a covered crucible lost 12·4 per cent of volatile and inflammable matter and

[1]Geology of Canada, 1863, p. 784.

left a black residue. "Another portion, in fine powder, was digested for several hours with heated benzole, which dissolved 0·8 per cent of bituminous matter. The residue, carefully dried at 200° F., then gave off by ignition in a close vessel, 11·3 of volatile matter, and by calcination lost 11·6 more; equal to a total of 23·7 per cent of combustible and volatile substances. The calcined residue was grey in color. By distillation in an iron retort, there were obtained from the shale, in two experiments, 3·7 and 4·2 per cent of volatile liquid hydrocarbons; besides a large quantity of inflammable gas, and a portion of ammoniacal water."

In the summer of 1909 R. W. Ells made an examination of the reported oil-shales of the Gaspe peninsula. In all he examined about 300 square miles in the vicinity of the village of Gaspe and along the York and St. John rivers. The sediments here are of Devonian age and consist of greyish sandstones with a subordinate amount of shale.

Certain layers of this formation are highly bituminous. The resinous matter that forms the cementing material of these layers "appears on the fractured edges of the beds, as in the form of irregular laminæ, rarely an eighth of an inch in thickness, and generally much less. It has a vitreous lustre, a conchoidal fracture, and is tough, with a hardness nearly equal to calc-spar. Its color is deep reddish-brown, but it gives a fawn-colored powder; and when in thin plates or fragments, is translucent, and has an orange-red color..... The portions of sandstone impregnated with this resin, burn, when kindled, with a brilliant flame and much smoke; and the residue, which consists chiefly of silicious sand, has very little coherence."[1]

These bituminous beds are found on the York and St. John rivers and their tributaries, and some twenty-three were found ranging in thickness from 1 inch to 5 inches.[2] The greatest thickness observed was about 14 inches. These beds unite in places to form zones, and on St. John river near Flat rock zones of 5 to 8 feet carry numerous beds of the resin-bearing shale separated by sandy partings. The beds are very irregular in

[1] Geology of Canada, 1863, p. 791.

[2] Ells, R. W., Geol. Sur., Can., Summary Report, 1909, p. 215.

thickness and in longitudinal extent. They are lenticular in shape and fully one-half of those observed pinch out within a distance of 150 feet.

The results of the analyses of three samples are as follows:[1]

Locality.	Crude oil, imperial gallons per ton.	Specific gravity of oil.	Sulphate of ammonia, lbs. per ton.
No. 1. St. John river, Law brook, 14-inch band.....	30·0	0·962	42·20
No. 2. St. John river, Law brook, 5-inch band. Oil tarry....	31·5	0·977	40·00
No. 3. Loose piece on York river, pieces large and numerous.	36·0	0·953	59·50

On Lake St. John there is a small area of Ordovician rocks consisting of limestones of the Trenton group overlain by Utica shales. These shales are found to be quite bituminous, so much so that their black colour and their inflammability have led the farmers of the vicinity to mistake them for coal.

A survey of Abitibi river was made in 1877 by A. S. Cochrane, one of Dr. Robt. Bell's assistants, and from his notes and verbal description the latter reports: "A finely granular buff-colored dolomite occurs in the rapids at the mouth of the river. No rock *in situ* was observed from this point for twenty-nine miles at which distance a brownish-black carbonaceous shale is met with in the west bank. It has a low specific gravity, splits with a conchoidal fracture, is easily cut with a knife, yielding a brown powder, and is capable of a high polish. On being sufficiently heated it burns for a short time, and emits a sulphurous odour."[2] He mentions that the limestones on this river are more or less bituminous. These carbonaceous rocks were examined by J. M. Bell and W. A. Parks, but these men

[1] Geol. Sur., Can., Summary Report, 1909, p. 213.
[2] Geol. Sur., Can. Rep. of Progress for 1877-78, C, p. 36.

found nothing indicative of petroleum other than a faint odour resembling that of petroleum on breaking a fresh piece of shale.[1]

A bituminous limestone is described as occurring at the head of Grand rapid on Mattagami river.[2]

ANTHRAXOLITE.

As this mineral is probably a product of bituminous matter it may not be inappropriate to describe here a deposit found in Ontario. A vein of anthraxolite found on lot 10, concession 1, of Balfour township, about 17 miles west of Sudbury and 5 miles southwest of Chelmsford, was described by A. P. Coleman in Bulletin No. 2 of the Bureau of Mines, Ontario, in 1896, and in the Sixth Annual Report of the Bureau of Mines.

The anthraxolite lies in a vein cutting black slate. The vein runs north and south, pinches out towards the north, and is concealed by drift at the south end. The length exposed is 70 feet. The maximum width exposed is 12 feet, but as the dip of the vein varies from vertical to 55 degrees towards the east the real thickness is probably from 6 to 9 feet. Diamond drilling showed that at a vertical depth of over 100 feet the thickness of the vein is apparently 4 feet. It is in no sense to be regarded as a bed of coal since it lies in a fissure cutting the beds of slate and does not conform to the bedding planes as true coal seams do.

"The pure mineral is lustrous black, resembles anthracite or albertite in appearance, and forms small plates or irregular cubic blocks, the largest observed being three-quarters of an inch square. Between the plates or cubes there is generally more or less quartz, and in some weathered portions on the surface the quartz remains as a porous, cellular mass. The quartz varies much in amount, specimens from the bottom of the small pit containing less than those from the surface. The only other important mineral present is iron pyrites, which is scattered through parts of the vein, accounting for the sulphur found in some analyses of the material." Mr. W. W. Roche, who was in charge of drilling operations says: "While drilling we used

[1] Bell, J. M., Thirteenth Rep. of the Bureau of Mines, Ont., p. 159.
[2] Bell, Robt., Geol. Sur., Can., Rep. of Progress for 1875-76, p. 316.

County and well.	H_2S	C_2H_4	CO	H	CO_2	O	CH_4	C_2H_6	C_3H_8	N	Condensate.	Lbs. on wells.
Essex No. 1	0·3	None	None	None	None	None	87·6	7·3	None	4·8	.....	50
Kent No. 1	trace	"	"	?	0·1	"	76·1	18·0	"	5·8	.....	565
Kent No. 2	0·3	"	"	none	none	"	84·4	10·8	"	4·5	10·6	522
Kent No. 3	0·6	"	"	"	0·1	"	86·0	8·5	"	4·8	.....	436
Kent No. 4	0·5	"	"	"	0·05	"	86·8	7·9	"	4·8	.....	400
Kent No. 5	0·4	"	"	"	0·3	"	83·4	10·6	"	5·3	.....	450
Kent No. 6	0·8	"	"	"	none	trace	78·2	15·7	"	6·1	.....	418
Kent No. 7	0·8	"	"	"	?	none	84·1	8·5	"	5·8	.....	519
Kent "Surface" Tp. Howard	none	"	"	"	none	"	83·0	none	"	17·0	.....	50?
(a) Kent "Surface" Tp. Raleigh	"	"	"	"	0·1	0·3	92·9	"	"	6·7	.....	?
Lambton No. 1	"	"	"	"	none	none	68·3	12·5	3·4	15·8	11·6	830
Lambton No. 2	"	"	"	"	"	"	69·0	15·7	1·8	13·5	9·1	830?
Lambton No. 3	"	"	"	"	"	"	80·2	11·7	none?	8·1	.....	?
Elgin No. 1	"	"	"	"	"	"	84·1	10·8	"	5·1	.....	350
Norfolk No. 1	"	"	"	"	"	"	84·4	6·8	"	8·8	.....	400
Norfolk No. 2	"	"	"	"	"	"	83·8	7·7	"	8·5	.....	545
Norfolk No. 3	"	"	"	"	"	"	75·8	14·2	"	10·0	.....	?
Haldimand No. 1	"	"	"	"	"	"	67·8	16·0	3·5	12·7	17·6	275
Haldimand No. 2	"	"	"	"	"	"	79·7	11·4	none	8·9	10·8	300
Haldimand No. 3	"	"	"	?	"	"	76·7	14·6	"	8·7	.....	10
Haldimand No. 4	"	"	"	"	"	"	81·4	11·7	"	6·9	.....	140
Haldimand No. 5	"	"	"	"	"	"	79·4	14·3	"	6·3	.....	225
Haldimand No. 6	"	"	"	"	"	"	81·8	11·8	"	6·4	.....	250
Haldimand No. 7	"	"	"	"	"	"	76·6	16·3	"	7·1	10·8	285
Haldimand No. 8	"	"	"	"	"	"	76·3	15·4	"	8·3	.....	250
Haldimand No. 9	"	"	"	"	"	"	84·9	8·3	"	6·8	.....	87
Haldimand No. 10	"	"	"	"	"	"	77·6	15·4	"	7·0	.....	100
Haldimand No. 11	"	"	"	"	"	"	77·8	14·7	"	7·5	.....	100
Haldimand No. 12	"	"	"	"	"	"	80·0	11·4	"	8·6	.....	?
Wentworth No. 1	"	"	"	"	"	"	80·2	13·1	"	6·7	.....	186
(b) Brant No. 1	"	"	"	"	"	0·1	76·9	8·0	1·2	13·8	7·8	20
Brant No. 2	"	"	"	"	"	none	68·6	19·0	none	12·4	14·7	?
Brant No. 3	"	"	"	"	"	0·05	74·6	15·4	"	10·0	.....	?
Welland No. 1	"	"	"	"	"	none	74·8	17·3	"	7·9	15·6	50
Welland No. 2	"	"	"	"	"	0·2	80·0	12·9	"	7·1	.....	100
Welland No. 3	"	"	"	"	"	none	82·1	13·5	"	4·4	.....	100
Welland No. 4	"	"	"	"	0·05	0·05	83·6	12·0	"	4·3	.....	120
Welland No. 5	"	"	"	"	0·15	0·05	93·7	3·3	"	2·8	.....	50
Welland No. 6	"	"	"	"	none	none	75·6	15·5	"	8·9	.....	185
Welland No. 7	"	"	"	"	"	"	85·9	8·7	"	5·4	.....	6
York No. 1	Result	given se	parately	below.								
York, Scarborough tp. "surface"	none	none	none	none	1·65	"	85·15	0·0	"	13·2	.....	5

principally anthraxolite for fuel in the furnace, and it gave very good results. After getting up a good fire it gave a brilliant blue flame and also great heat, but the waste was considerable. It took close attention by the fireman to keep the ashes away, and I should judge that fully one-half was waste."

W. H. Ellis gives the following proximate analysis of an average and of a selected sample:

	Average.	Selected.
Moisture	4·00	4·00
Volatile matter	1·30	1·80
Fixed carbon	74·20	90·10
Ash	20·50	4·10
	100·00	100·00

Coleman expresses the opinion that "the source of this fuel is probably to be looked for in bituminous matter contained in the adjoining beds of slate, which carry 6·8 per cent of carbon. By metamorphic action most of the volatile matter has been removed from the once fluid or plastic bitumen, leaving the solid carbon."

Carbonaceous matter of a similar nature is found in traces at various other points in Ontario and Quebec, for example, on Thunder bay, from the Ordovician near Kingston, at Quebec, Island of Orleans, Pointe Levis, Sillery, St. Nicholas, Lotbinière, Drummondville, Acton, and in the vicinity of Chatte river in Gaspe. At none of these places, however, is it of economic importance.

ANALYSES.

Careful sampling and analyses have been made of gases from a great number of wells in Ontario, the results being published in the Twenty-third Annual Report of the Ontario Bureau of Mines, 1914, pages 237-273. The analyses were made by Professors W. H. Ellis, J. W. Bain, and E. G. R. Ardagh, chemists.

"(a) As this gas was probably in contact with water and might have taken oxygen from that, we cannot assume the O was due to sampling; no correction is, therefore, made. The sample was taken by displacing water.

"(b) This is the highest O in any sample taken with water. The rubber tubing was blown off during operation; no correlation made.

"(c) Corrected to air free sample. Taken "dry."

Analysis of York No. 1 by Prof. E. G. R. Ardagh.

Carbon dioxide	0·1
Carbon monoxide	1·2
Ethane	3·1
Hydrogen	none
Hydrogen sulphide	none
Methane	86·0
Olefines	1·3
Oxygen	none
Nitrogen	8·3
	100·0

"NOTE.—The carbon monoxide and olefines appear in the analysis at the expense of the methane and ethane, but the relative proportions in which this took place are not known."

The wells of Essex, Kent, and Lambton counties were sampled by G. R. Mickle except in one or two cases as indicated below, and those of Elgin, Norfolk, Brant, Haldimand, Welland, and Wentworth were sampled by Donald Sharpe, gas inspector, except where otherwise stated. The following notes are taken from G. R. Mickle's report on "The Chemical Composition of Natural Gas Found in Ontario":

Essex No. 1. Well on the Fox farm, lot 7, con. 1, Gosfield South; original pressure said to have been about 500 pounds and depth 1,020 feet; present pressure about 50 pounds; sampled May 1, 1914.

"*Kent No. 1.* Well on the L. S. Baker farm, lot 161, Raleigh Tp. This well is 1,424 ft. deep. Gas was found at intervals from 1,310 ft.–1,420 ft. Capacity 450,000. Original pressure 566 lbs. Pressure now 565. Drilled Jan., 1912. Check sample for H_2S. taken in glass holder, March 3rd, 1914. General sample taken 11th April. Tested with lead acetate 23rd March and 11th April; on latter date gave faintly perceptible coloration in about 5 seconds whereas No. 2, with 0·3 per cent H_2S. gave a strong color practically instantly.

"*Kent No. 2.* Well on J. W. Askew farm, lot 173 Tilbury East Tp.

Depth 1,372 ft; capacity 2,000,000 feet; drilled March, 1914; pressure 522 lbs. Sample for H_2 S. and general sample taken March 23rd.

"*Kent No. 3.* Well on H. Baldwin farm, lot 185, Romney Tp. Depth 1,387 ft; gas found from 1,140 ft.–1,380 ft.; capacity 3,500,000; drilled July, 1911; original pressure 585 lbs.; pressure now when closed 5 minutes, 436 lbs. Sampled for H_2S April 11th; general sample, taken May 30th by Mr. L. Near, Field Supt. of Union Natural Gas Co.

"*Kent No. 4.* Well on D. W. Lee farm, lot 31, Romney Tp. Depth 1,380 ft.; gas found 1,260 ft.–1,375 ft.; capacity 1,800,000; drilled Dec., 1913; original pressure 483 lbs.; present pressure when closed 5 minutes, 400 lbs. Sampled 23rd March; H_2S sample taken 11th April.

"*Kent No. 5.* Well on Jas. Halliday farm, lot 10, Con. 13, Tilbury East Tp. Gas found 1,260 ft.–1,383 ft.; capacity 221,000; drilled early in 1913; original pressure 510 lbs.; now, 450 lbs. Sampled 23rd March for H_2S and general sample.

"*Kent No. 6.*—Well on R. & E. Graham farm, lot 12, Middle Rd. South. Depth 1,365 ft.; gas 1,303 ft.–1,325 ft.; capacity 500,000 ft.; drilled April, 1907, for oil and bought from the oil operators. Original pressure not known; when purchased several years ago was 415 lbs.; now 418 (due no doubt to shutting off waste of gas in vicinity). Sampled 19th March (general) and 3rd March for H_2S.

"*Kent No. 7.* Well on the Dawson farm, lot 6, Con. 15, Tilbury East. Capacity 2,000,000; drilled in 1909; original pressure 595; present 519; general sample taken 23rd March, for H_2S on 11th April."

Kent "Surface" Howard Tp. From a well drilled for water on lot 7, con. 12, Howard township, on F. Fenningsdorf's farm. The well is said to be 186 feet deep, and to have had a pressure of 56 pounds at the time it was drilled. The drift is said to be 240 feet deep. The well has been supplying gas over 20 years for all purposes in Mr. Fenningsdorf's house. Sampled March 2.

Kent "Surface," Raleigh Tp. From a water well 156 feet deep on lot 1, con. 12, Raleigh township. Sampled April 3 by Mr. L. Near, field superintendent of the Union Natural Gas Company.

"*Lambton No. 1.* Fairbanks well, lot 18, Con. 2, Enniskillen Tp. Depth 1,912 ft.; gas found first at 1,898 ft. Capacity said to be 15,000,000 ft. (Tube used only capable of measuring 11,000,000 feet); pressure 830 lbs. This well was drilled in only a few days before it was sampled by the writer on 21st March. Lead acetate test showed no trace of H_2S.

"*Lambton No. 2.* Well drilled by the Oil Springs Co. This well was sunk in the summer of 1913. It is only about 700 feet distant from Lambton No. 1 (easterly in direction) consequently it could not be shown on the scale used on the map. Pressure probably same as No. 1, not measured. Sampled by the writer on 21st March. Lead acetate showed no trace of hydrogen sulphide.

"*Lambton No. 3.* Well on east 1-2 of lot 26, Con. 4, Euphemia Tp. This well was still being drilled when sampled. Owners stated it was about 1,700 feet deep and the gas was coming from about 1,600. Capacity not known. Well not entirely closed when sample was taken by the writer from pipe leading from top of casing. Lead acetate showed no trace of H_2S." . . . . .

"*Elgin No. 1,* from R. Balcom well No. 1, Vienna village. Depth 1,330 ft.; original pressure 710 lbs.; present pressure 350 lbs.; drilled in Sept., 1910; gas in the Clinton. Sampled by Mr. Donald Sharpe, gas inspector for that district, April, 1914." . . . .

"*Norfolk No. 1.* J. R. Buck well, west part of Village of Port Rowan; depth 1,420 ft.; pressure 450 lbs. originally; present, 400 lbs. Gas in Red Medina. Sampled 15th April.

"*Norfolk No. 2.* E. Foster well at Port Royal. Depth 1,410 ft.; pressure now 400 lbs. Gas in Red Medina; sampled 15th April.

"*Norfolk No. 3.* Well in Port Dover. Drilled Jan., 1912; depth 1,043 ft. Mostly White Medina. Sampled 15th April.

"*Haldimand No. 1.* Well on lot 25, Con. 3, Dunn Tp., in Port Maitland, Depth 880 ft.; original pressure 350 lbs.; capacity 1,000,000; pressure now 275 lbs. Gas in White Medina. Sampled 12th March by Donald Sharpe and the writer.

" *Haldimand No. 2.* Well on H. P. Docker farm, lot 18, Con. 4, Dunn, south of Dover Road. Depth 930 ft.; original pressure 465 lbs.; now 300 lbs.; capacity 470,000; drilled Nov., 1912. Gas in Red Medina. Sampled 8th April.

"*Haldimand No. 3.* Well in Caledonia village. Depth 400 ft.; original pressure 245 lbs.; now 10 lbs. Gas in Clinton. Drilled in 1894. Sampled 3rd April.

"*Haldimand No. 4.* The Wm. Carpenter well about one mile from No. 3. Gas at 390 ft; pressure 245 lbs. originally; now, 140; drilled 1908. Sampled April 3rd.

"*Haldimand No. 5.* Joseph King's well, north of the Grand River, North Cayuga Tp. Depth 725 ft; pressure now 225 lbs. Gas in White Medina. Sampled 17th April.

"*Haldimand No. 6.* Well on Wm. Pridmore farm, lot 22, Con. 5, South Cayuga Tp. Pressure now 250 lbs.; depth 785 ft. Gas in Red Medina. Sampled 18th April.

"*Haldimand No. 7.* Well on Jas. Topp farm, South Cayuga Tp. Pressure now 285 lbs.; depth 700 ft. Gas in Red Medina. Sampled 18th April.

"*Haldimand No. 8.* Well on R. Windecker farm, lot 8, River Rd., North Cayuga Tp. Depth 735 ft. Gas in White Medina. Pressure now 250 lbs. Sampled 17th April.

"*Haldimand No. 9.* Well on Joseph Steele farm, lot 18, Con. 1, Walpole Tp. Depth 960 ft.; original pressure 450 lbs.; now 87 lbs. Gas in Red Medina. Sampled 21st April.

"*Haldimand No. 10.* Well in Lake Erie on water lot No. 1, Crown lease, opposite Rainham Tp. Drilled 1909; original pressure 500 lbs.; now 100 lbs. Gas in Clinton and Red Medina. Sampled 20th April.

"*Haldimand No. 11.* Well in lake Erie water lot No. 5, Crown lease, opposite Rainham Tp. Original pressure 500 lbs.; now about 100. Clinton gas. Sampled 20th April.

"*Haldimand No. 12.* Well on S. McLeod farm, lot 13, Con. 4, Seneca Tp. Gas in Clinton at 397 ft. and White Medina at 497 ft. Drilled July, 1913. Sampled May 1st.

"*Wentworth No. 1.* Well on David Hall farm, lot 23, Con. 9, Binbrook Tp. Depth 500 ft.; pressure 186 lbs.; drilled Dec., 1913, and shut in. Gas in Clinton and White Medina. Sampled May, 1914.

"*Brant No. 1.* Well in yard of Cockshutt Plow Works, Brantford. Depth 550 ft. in Medina—some gas from Clinton too. Original pressure 310 lbs.; now 20 lbs. Capacity 775,000 at first, but dropped quickly, now very small, less than 10,000. Drilled in 1903. Sampled 4th April by Donald Sharpe and the writer.

"*Brant No. 2.* Well on Wm. Macdonald farm, part lots 6, 7, 8, in 2nd Con., Onondaga Tp. Gas at 400 in Clinton and 515 in White Medina. Capacity 70,000, half from Clinton. Well not finished when sampled (partly open) April 4th by Donald Sharpe and writer.

"*Brant No. 3.* Well on Wm. Brette farm, part of lots 6, 7, 8, in 3rd Con., Onondaga Tp. Gas in Clinton at 400; nothing in Medina. Depth 590 ft. Sampled April 4th by Donald Sharpe and writer. No. 3 is about half a mile from No. 2.

"*Welland No. 1.* Well on south end lot 13, Con. 2, Humberstone Tp. Depth 830 ft. Original pressure 500 lbs.; now about 50 lbs. Capacity originally 500,000. Gas in White Medina. Drilled 1891. Sampled 8th April.

"*Welland No. 2.* Well on lot 34, Con. 1, Bertie Tp. Depth 888 ft. Capacity 1,000,000. Original pressure 400 lbs.; now 100 lbs. Drilled April, 1910. Gas in White Medina. Sampled 11th March by Donald Sharpe and writer.

"*Welland No. 3.* Well on east side of lot 12, in the 14th Con., Bertie Tp. Depth 578 ft.; original pressure about 360 lbs.; capacity 430,000 originally. Pressure now 100. Drilled July, 1897. Gas in Clinton. Sampled May 1st.

"*Welland No. 4.* Well on lot 15, in the 5th Con., Bertie. Depth 565 ft.; original pressure 350 lbs.; now 120 lbs.; capacity 250,000; drilled Nov., 1907. Sampled 23rd March.

"*Welland No. 5.* Well on lot 2, Con. 4, Willoughby. Gas at 2,940 ft. in the Trenton limestone. Well was continued to the Archæan at 3,030 ft. Capacity 250,000 originally and pressure 1,000 lbs. Present pressure 100. Drilled in July, 1893. This is the deepest gas well in Ontario, and the only one in Trenton. Sampled 23rd March. Another well was sunk through the

Trenton to the Archæan at 3,257 ft. This well was about two miles south-westerly from Welland No. 3, but no gas was found in the Trenton. These notes are taken from 'Natural Gas in Ontario.' quoted above.

"*Welland No. 6.* Well on J. J. Dickenson's lot in Port Colborne. Pressure now 185 lbs. Drilled in 1907. Sampled 10th April. Gas in White Medina.

"*Welland No. 7.* Well on G. Jenkinson's farm, lot 7, Con. 4, Crowland Tp. Depth 550 ft.; original pressure 100 lbs.; now 6 lbs. Gas in Clinton and White Medina. Sampled May 2nd."

York No. 1. Sample taken by G. R. Mickle in December, 1913, from a well sunk to a depth of 1,066 feet at the Dominion Bank building, King and Yonge streets, Toronto. The well had been filled with cement and the sample taken was leaking through the cement. This was not analysed in the same way as the other gases, but by the ordinary explosion method. The results are, therefore, given separately.

York, Scarboro Tp. "Surface." From a well drilled for water at the St. Augustine seminary, lot 25, con. B, Scarborough township. Well is 330 feet deep and ended in the Lorraine shale, although the gas came from the surface deposits chiefly at a depth of 290 feet. Sampled March 28, 1914, by G. R. Mickle.

The following notes by G. R. Mickle are of interest.

GENERAL DISCUSSION OF RESULTS OF ANALYSES.[1]

INFLUENCE OF GEOLOGICAL FORMATION.

"The analyses as far as the evidence goes do not appear to show that the geological formation in which the gas is found has any influence on the composition. In taking the samples from Welland County a special effort was made to ascertain this. Gas is found in four different rocks in that county, viz: the Clinton, average depth about 700 ft., Red Medina 765 ft., White Medina 810 ft., and Trenton. As many wells derive their gas from two or more of these sands, the drilling records were examined carefully to select wells which yielded gas in only one formation. Accordingly 1 and 2 were taken to represent the White Medina and 3 and 4 the Clinton, and 5 the Trenton. Red Medina was left for Haldimand County. But it is seen that No. 2 is similar to 3 and 4 and different from 1. Afterwards two more samples were taken in Welland—No. 6 in White Medina and 7 a mixture of Clinton and White Medina gas.

[1] Twenty-third Annual Report of the Ontario Bureau of Mines, 1914, pp. 265-266.

If we conclude that the White Medina gas is higher in ethane than the Clinton basing that on 1 and 6, then the results of 2 are inconsistent with this. Moreover, No. 7 is lower in ethane than either of the other Clinton or White Medina gases, although it is a mixture of the two. No. 5, as explained before, is from the only well in the Trenton, consequently we cannot say whether the low ethane and nitrogen is due to the influence of the rock or its position. Coming into Haldimand, No. 1, the highest ethane is in White Medina; 7 and 8 are the next highest and are in Red and White Medina respectively. The lowest ethane in Haldimand is No. 9 in Red Medina, and so on—no definite differences.

"In the western fields the gas is all obtained from one formation in the same field.

INFLUENCE OF DECLINING PRESSURE ON THE COMPOSITION.

"In the old field of Welland-Haldimand, etc., a number of wells which were almost exhausted were sampled purposely to see if there was any difference between the low and high pressure wells. The viscosity of a gas, or the measure of the difficulty with which it flows through an orifice of any kind, is supposed to vary directly with the square of the specific gravity, that is, the one with the higher density would find its way less readily through the pores and consequently we should expect the low specific gravity constituents to escape first, and, therefore, there would be a concentration of the higher density gases in wells that are nearly exhausted. Taking the specific gravities of the gases constituting natural gas, and it will be sufficient to use approximations, we have 0·6 for methane, 1·0 for ethane, 1·0 for nitrogen, and 1·5 for carbon dioxide; then the square of methane density is ·36 and carbon dioxide 2·25 or methane should escape about six times as readily as carbon dioxide. Hence there should be a concentration of carbon dioxide in an old well. Unfortunately this latter gas which would be our best indicator is practically absent in the Ontario gases. Welland No. 5 is the only one in the eastern part showing more than

a trace. Since this well has experienced the greatest drop in pressure of all—from 1,000 lbs. to less than 100—we should expect to see it higher in carbon dioxide, as indeed, it is, and also, higher in ethane and nitrogen. Actually it is lower in these latter two than any other of the gases in that vicinity. A careful scrutiny of the list of analyses of gas from Haldimand will show that there is no apparent concentration of ethane and nitrogen in the nearly exhausted wells. Of course we have no proof that all of them are not higher in these two gases than they were originally. This brings us back to the necessity of systematic sampling of the wells in any given field at different periods of its productive life if we are to acquire a complete knowledge of the composition.....

UNIFORMITY OF COMPOSITION OF NATURAL GAS IN ONTARIO.

"The most striking feature in the whole set of analyses is the wonderful uniformity of the gas derived from widely separated, and as far as the information from drilling goes, totally disconnected areas. For instance, the sample from the small field in Elgin which is 80 miles from the Kent field is almost identical with the normal gas from the latter area, the ethane being only 1·5 per cent higher than the mean of normal Kent gas and the nitrogen agreeing within ·1 per cent. If a dash of hydrogen sulphide were added to this gas it would agree exactly with the Kent product, or conversely remove that fraction of one per cent from the Kent and Essex gas and all these three would agree. Yet Kent is separated from Essex by twenty miles and Elgin from Kent by eighty. By the addition or subtraction of a very few per cent of one or more constituents most of the apparently quite separate areas would be yielding the same gas. The almost complete absence of carbon dioxide in the Ontario gases is peculiar, only one sample in all the 27 examined from Elgin eastwards showing the small quantity of 0·15 per cent and one a few hundredths of a per cent. An examination of the analyses quoted from other territories shows that carbon dioxide is more often present than not. When we consider that there are more than a hundred ways in which two dry commercial gases can

differ and only one in which they can agree, this uniformity is surprising. It seems to be incompatible with a local and separate origin for each field. We can understand why the oyxgen and nitrogen of the atmosphere are found in constant proportions in all parts of the world. There is only one atmosphere. Those who have theories to defend may be left to adjust them to the observed facts."

PRODUCTION.

NATURAL GAS.

The following table giving the value of the natural gas produced in Ontario, is compiled from the reports of the Ontario Bureau of Mines:

Year.	Value.	Year.	Value.
1892.....	$160,000	1903.....	$196,535
1893.....	238,200	1904.....	253,524
1894.....	204,179	1905.....	316,476
1895.....	282,986	1906.....	533,446
1896.....	276,710	1907.....	746,499
1897.....	308,448	1908.....	988,616
1898.....	301,600	1909.....	1,188,179
1899.....	440,904	1910.....	1,491,239
1900.....	392,823	1911.....	2,186,762
1901.....	342,183	1912.....	2,268,022
1902.....	199,238	1913.....	2,362,021
		1914.....	2,347,737

The total production of natural gas in Ontario for the last three years was approximately as follows:

1912.....12,454·9 million cubic feet.
1913.....12,558·4 " " "
1914.....13,223 " " "

In 1912 and 1913 the yield according to fields was:

	1912	1913
Welland-Haldimand-Norfolk, etc.	4,246·0 million cub. ft.	4,115·8 million cub. ft.
Kent	7,752·5 " "	7,975·8 " "
Elgin	456·4 " "	466·8 " "
Total	12,454·9 " "	12,558·4 " "

PETROLEUM.

The notes on the production of petroleum in Ontario are taken from the "Annual Report of the Mineral Production of Canada during the Calendar Year 1913" and the "Preliminary Report on the Mineral Production of Canada during the Calendar Year 1914" by John McLeish. These were published by the Mines Branch of the Department of Mines.

"The total production of crude petroleum in Canada in 1913 was 228,080 barrels of 35 imperial gallons each, valued at $406,439, or an average of $1.782 per barrel, as compared with a production of 243,336 barrels, valued at $345,050, or an average price per barrel of $1.418 in 1912, and 291,092 barrels, valued at $357,073, or an average of $1.22½ per barrel in 1911.

"With the exception of 73,899 gallons in 1913, 93,765 gallons in 1912, 86,139 gallons in 1911, and 51,975 gallons in 1910 produced in New Brunswick, the output is entirely from Ontario oil fields. The production has steadily declined during the past six years, although in 1913 a decrease in the quantity of oil produced, was accompanied by an increase in the total valuation, because of an increased average price obtained for the oil.

"The statistics of production as given herewith since 1904, are based on claims made for the bounty paid by the Dominion

Government which was first provided for in 1904 by an act passed by the Dominion Government authorizing the payment of a bounty of 1½ per cent per gallon on crude petroleum produced from wells in Canada. The bounty has been continued under the "Petroleum Bounty Act, 1909," which provides for the payment of bounty on crude petroleum produced from oil-shales mined in Canada as well as on oil from wells in Canada. Payments are made on claims submitted by the producers of crude oil to the Minister of Trade and Commerce. These claims have to be substantiated as to quantity by the certificate of the receiving stations, tanking companies, refiners or other purchasers, as well as by the supervising officers of the Department of Trade and Commerce.

"The bounty paid on the crude petroleum produced gives, therefore, as accurate a basis as is available for a reliable statement of the annual production.

"Table 1 following, shows the production of crude oil in Canada since 1901, in barrels of 35 gallons, together with the total value and average price per barrel.

Petroleum—Table I.

Annual Production of Crude Petroleum since 1901.

Year.	Barrels of 35 gallons.	Value.	Average price per barrel.
		$	$ cts.
1901	622,392	1,008,275	1·620
1902	530,624	951,190	1·792
1903	486,637	1,048,974	2·155
1904	503,474	935,895	1·858
1905	634,095	856,028	1·350
1906	569,753	761,760	1·337
1907	788,872	1,057,088	1·340
1908	527,987	747,102	1·415
1909	420,755	559,604	1·33
1910	315,895	388,550	1·23
1911	291,092	357,073	1·225
1912	243,336	345,050	1·418
1913	228,080	406,439	1·782

"Statistics of the production of crude petroleum from 1901 to 1904, were based on direct returns received from refineries and producers."

"The record of production of crude oil for the years previous to 1901, as shown in Table 2, was deduced from Government inspection returns by assuming a ratio of crude to refined oil.

PETROLEUM—Table 2

Canadian Oils and Naphtha Inspected, and Corresponding Quantities of Crude Oil.

Calendar year.	Refined oils inspected.	Crude equivalent calculated.	Ratio of crude to refined.	Equivalent in barrels of 35 gallons.	Average price per barrel of crude.	Value of crude oil.
	Gals.	Gals.			$ cts.	$
1881	6,457,270	12,914,540	100:50	368,987	.....	.....
1882	6,135,782	13,635,071	100:45	389,573	.....	.....
1883	7,447,648	16,550,328	100:45	472,866	.....	.....
1884	7,993,995	19,984,987	100:40	571,000	.....	.....
1885	8,225,882	20,564,705	100:40	587,563	.....	.....
1886	7,768,006	20,442,121	100:38	584,061	0.90	525,655
1887	9,492,588	24,980,494	100:38	713,728	0.78	556,708
1888	9,246,176	24,332,042	100:38	695,203	1.02⅖	713,695
1889	9,472,476	24,664,144	100:38	704,690	0.92¾	653,600
1890	10,174,894	26,776,037	100:38	795,030	1.18	902,734
1891	10,065,463	26,435,430	100:38	755,298	1.33¾	1,010,211
1892	10,370,707	27,291,334	100:38	779,753	1.26¼	984,438
1893	10,618,804	27,944,221	100:38	798,406	1.09½	874,255
1894	11,027,082	29,018,637	100:38	829,104	1.00¾	835,322
1895	10,674,232	25,414,838	100:42	726,138	1.49⅖	1,086,738
1896	10,684,284	25,438,771	100:42	726,822	1.59	1,155,647
1897	10,434,878	24,844,995	100:42	709,857	1.42½	1,011,546
1898	11,148,348	26,543,685	100:42	758,391	1.40	1,061,747
1899	11,927,981	28,399,955	100:42	808,570	1.48⅗	1,202,020
1900	13,428,422	24,867,449	100:54	710,498	1.62	1,151,007

"The production of crude oil in the province of Ontario, by districts, since 1909, is shown in the following table. The record has been furnished by the Supervisor of Petroleum Bounties and agrees very closely, although not identically, with the statistics used in compiling the record of production for the whole of Canada.

Production by Districts.

Field	1909	1910	1911	1912	1913
	Bls.	Bls.	Bls.	Bls.	Bls.
Lambton	243,123	205,456	184,450	150,272	155,747
Tilbury and Romney	124,003	63,058	48,707	44,727	26,824
Bothwell	38,092	36,998	35,244	34,486	34,348
Leamington	5,929	141	.....	.....	.....
Dutton	9,513	7,752	6,732	4,335	4,610
Onondaga (Brant county)	.....	1,005	13,501	7,115	4,172
Belle River	.....	.....	.....	.....	464
Total	420,660	314,410	288,634	240,935	226,165

The production in Ontario during 1914 was 212,693 barrels. The production by districts, as furnished by the Supervisor of Petroleum Bounties, at Petrolia, was as follows: Lambton, 154,186 barrels; Tilbury, 18,530 barrels; Bothwell, 33,961 barrels; Dutton, 2,190 barrels; Onondaga, 2,437 barrels; and Belle River, 1,191 barrels.

Following are statistics of exports and imports for Canada:

"Exports of petroleum entered as crude mineral oil in 1914 were 3,996 gallons valued at $362, and of refined oil 3,922 gallons valued at $826. There was also an export of naphtha and gasoline of 43,023 gallons valued at $11,607.

"The total value of the imports of petroleum and petroleum products in 1914 was $11,174,763, as against a value of $13,348,326 in 1913.

"The total imports of petroleum oils, crude and refined, in 1914 were 244,487,973 gallons valued at $11,072,362 in addition

to 1,594,236 pounds of wax and candles valued at $102,401. The oil imports included: crude oil, 195,207,210 gallons valued at $5,750,971; refined and illuminating oils, 12,833,065 gallons valued at $970,481; gasoline, 24,396,401 gallons valued at $2,747,360; lubricating oils, 5,767,676 gallons valued at $940,143, and other petroleum products, 6,282,621 gallons valued at $663,407.

"The total imports in 1913 were 222,779,028 gallons of petroleum oils, crude and refined, valued at $13,238,429, in addition to 1,628,837 pounds of paraffin wax and candles valued at $109,897. The oil imports included: crude oil, 162,061,926 gallons, valued at $5,250,835; refined and illuminating oils 19,393,627 gallons, valued at $1,394,440; gasoline, 29,525,180 gallons, valued at $4,822,941; lubricating oils, 6,789,451 gallons, valued at $1,172,986, and other petroleum products, 5,008,844 gallons, valued at $597,227.

"There was thus in 1914 an increased importation of crude oils and a decrease in imports of refined illuminating oils, lubricating oils and gasoline."

LOGS.

A great many of the logs here printed have already been published by the Geological Survey or by the Bureau of Mines, Toronto. A number of those not previously published have been obtained by the Water and Borings Division of the Geological Survey under the charge of E. D. Ingall, while operators in the various fields have generously furnished the writer with many. The writer is also under obligations to C. W. Knight, Assistant Provincial Geologist of Ontario, for a number. For purposes of reference it has been thought advisable to reassemble these in one volume.

In the logs the term Medina has been used to include the Queenston red shales, and the terms Onondaga and Corniferous are equivalent to Salina and Onondaga respectively, as noted in the descriptions of formations.

PROVINCE OF ONTARIO.

BRANT COUNTY.

1-9. Brantford.

1. [1] Drilled by Gould, Shapley, and Muir Company on Wellington street.

	Thickness.	Depth.	Formation.
Surface	61 feet	61 feet	
[2]Limestone, etc	299 "	360 "	Guelph and Niagara.
Black shales	45 "	405 "	Niagara.
Dolomite	20 "	425 "	Clinton.
Red sandstone	35 "	460 "	Medina.
Blue shales	30 "	490 "	"
Sand rock	15 "	505 "	"
White sandstone	10 "	515 "	"
Red shales	155 "	670 "	"

Gas at 610 feet and, according to the driller's record, in the Medina red shales. Rock pressure at first 265 pounds. Yield in 1905 was 15,000 cubic feet.

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 107.

[2] Probably includes a portion of the Onondaga.

2. [1]Cockshutt well No. 3.

	Thickness.	Depth.	Formation.
Sandy loam	7 feet.	7 feet.	
Wash gravel	3 "	10 "	
Clay	40 "	50 "	
Quicksand	21 "	71 "	
Hard pan	11 "	82 "	
[2]Limestone, etc	283 "	365 "	Guelph and Niagara.
Black shales	45 "	410 "	Niagara.
Dolomite	12 "	422 "	Clinton.
Red shales	45 "	467 "	Medina.
Grey shales	45 "	512 "	"
Sandstone	20 "	532 "	"
Red shales	88 "	620 "	"

Gas and oil in the Medina sandstone at 512 feet.

3. [3]Drilled by the Waterous Engine Company in 1888 on Dalhousie street. Elevation, 707 A. T.

	Thickness.	Formation.
Surface	63 feet.	
Limestone, etc	457 "	Lower beds Onondaga and Guelph, Niagara and Clinton, if present.
Blue shale	5 "	Medina.
Red shale	25 "	"
Sandstone	40 "	"
Red slate	460 "	"
Dark red and blue shale	68 "	Probably to summit of Hudson River.
	1,118 feet	

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 106.
[2] Probably includes a portion of the Onondaga.
[3] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 43 Q.

4. [1] Drilled in 1888. Contractor, W. H. Curtis. Elevation, about 730 A. T.

	Thickness.	Depth.	Formation.
Drift.....	45 feet.	45 feet.	
Limestones, dolomites, and shales.....	370 "	415 "	Onondaga, Guelph. Niagara and Clinton.
Red sandstone, red and blue shales, and white sandstone.....	100 "	515 "	Medina.
Red, blue, and black shales.....	1,435 "	1,950 "	Medina, Hudson River, and Utica.
Limestone.....	210 "	2,160 "	Trenton.

A little gas struck on top of Trenton.

5-9. [2]Wells on Bow Park farm.

	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.
Surface.....	72 feet.	87 feet.	45 feet.	91 feet.	97 feet.
Onondaga, Guelph, and Niagara limestone...	293 "	292 "	276 "	300 "	290 "
Niagara black shales...	50 "	45 "	45 "	45 "	45 "
Clinton dolomite.....	15 "	20 "	15 "	23 "	23 "
Medina red shales.....	45 "	30 "	30 "	31 "	35 "
Medina blue shales....	30 "	30 "	35 "	30 "	35 "
Medina grey sand.....	20 "	20 "	25 "	30 "	15 "
Medina white sandstone	7 "	13 "	10 "	.....	11 "
Medina red shales.....	92 "	111 "	135 "	203 "	80 "
	624 "	648 "	616 "	753 "	631 "

[1]Coste, E., Fifteenth Rep. Bur. Mines, Ont., 1906, p. 112.
[2] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 107.

Well No. 5. Gas at 420 in the Clinton and 530 in white Medina sandstone. Oil at 542 in red Medina shales.

Well No. 6. Gas at 430 in the Clinton and at 538 in white Medina sandstone. Oil at 590 in red Medina shales.

Well No. 7. Small flow of gas at 479 in the Clinton.

Well No. 8. Gas at 439 in the Clinton. No white Medina sandstone.

Well No. 9. Gas at 436 in the Clinton and at 549 in the white Medina sand stone. Oil came in 60 days after the well was drilled.

10. [1]*Cathcart.*

Clay	140 feet.
Shale and gypsum	260 "
	400 "

10a, Lot 5, Con. 1, Onondaga.

Well on Mortimer Hunter's farm, completed May 15, 1915; T. J. McCutcheon, Contractor.

	Thickness
Surface	72 feet.
Limestone and shale	71 "
Niagara limestone	205 "
Shale	30 "
Clinton limestone	25 "
Red Medina	35 "
Grey shale	50 "
White Medina	12 "
Red shale	600 "
Grey shale	675 "
Utica black shale	125 "
Trenton limestone	695 "
Potsdam sand	30 "
Granite	"
Total	2,625 feet.

A very small flow of gas was secured in the Clinton limestone.[2]

[1] Hunt, T. S., Geol. Sur., Can., 1866, p. 251.

[2] Log obtained from C. W. Knight, Assistant Provincial Geologist, Ontario.

11. [1]*Paris.*

Drilled in 1865.

	Thickness.	Formation.
Soil	10 feet.	
Thin-bedded limestones with shales and gypsum	146 "	Probably Onondaga.
White granular rock, a specimen of which was found to be dolomite	99 "	Probably Guelph.
	255 feet	

BRUCE COUNTY.

12. [2]*Lot 6, Con. 2, Amabel.*

Log furnished by the Imperial Oil Company. Drilled in 1901-02. Driller John Hortenstein.

Surface	15 feet.
Limestone	225 "
Slate	10 "
Red rock	50 "
Slate	20 "
Limestone	60 "
Slate	10 "
Red rock	90 "
Slate	60 "
Red rock	35 "
Shale	481 "
Trenton	415 "
Total depth	1,471 feet

A small quantity of gas at 1,471 feet.

[1] Hunt, T. S., Geol. Sur., Can., 1866, p. 250.
[2] Files of the Water and Borings Division.

13. [1]*Lot 4, Con. 6, Amabel.*

Log furnished by the Imperial Oil Company. Drilled in 1901. Driller, W. H. Smith.

Surface	33 feet.
Limestone	220 "
Slate	10 "
Red rock	60 "
Slate	40 "
Limestone	50 "
Slate	15 "
Red rock	85 "
Slate	70 "
Red rock	20 "
Shale	489 "
Trenton	586 "
Total depth	1,678 feet

No oil, gas, nor salt water.

14-16. Hepworth.

14. [2]Well No. 2 of the Grey and Bruce Oil and Gas Company Limited. Lot 1, con. 10, Amabel. Elevation, 950 A.T.

	Thickness.	Depth.	Formation.
Soil	4 feet.	4 feet.	
Limestone, shales, and limestone	191 "	195 "	Niagara and Clinton.
Shales	750 "	945 "	Medina, Hudson River, and Utica.
Limestone	625 "	1,570 "	Trenton.
Sandstone	30 "	1,600 "	Calciferous.
Granite	50 "	1,650 "	Archæan.

A little salt water at 760 feet. Gas at 1,405 feet.

[1] Files of the Water and Borings Division.

[2] Coste, E., Fifteenth Rep. Bur. Mines, Ont., 1906, p. 109.

15-16. In Amabel township. [1]Sunk by the Grey and Bruce Oil and Gas Company, Limited.

	No. 3.	No. 4.
Drift	28 feet.	16 feet.
Top lime, Niagara and Clinton	225 "	200 "
Green shale, Niagara and Clinton	7 "	9 "
Red rock, Medina	60 "	60 "
Slate (blue shale)	40 "	40 "
Lime	40 "	40 "
Slate	25 "	25 "
Red rock	85 "	85 "
Slate	70 "	70 "
Red rock	20 "	20 "
Slate, soft	467 "	467 "
Top of black shale, Utica	1,067 feet	1,032 feet
Top of Trenton	1,092 "	1,057 "
Gas	1,505 " (dry hole)	1,421 "

Pressure of gas in No. 4 about 425 pounds, diminished but little after a year's use.

17. [2]*Inverhuron.*

Driller, J. S. McEwan. Sunk in 1872. At 1,007 feet hard limestone was struck.

[1] Eleventh Rep. Bur. Mines, Ont., p. 45.
[2] Smith, J. L., Geol. Sur., Can., 1874-75, p. 287

18. [1]*Kincardine.*

Sunk by Messrs. Gray and Scott in 1873. Driller, J. S. McEwan Elevation, 607 A.T.

Surface	89 feet.
Sandstone and limestone, alternate layers	28 "
Limestone	179 "
Sandstone, white, fine grained	29 "
Limestone, dark coloured	276 "
Shale, red	14 "
Shale, blue	115 "
Limestone, hard blue	164 "
"Cherty rock"	5 "
Rock salt	12 "
Shale, blue, clay and salt in alternate layers	36 "
Rock salt	60 "
	1,007 feet

19. [2]*Port Elgin.*

Unsuccessful attempt to find salt in 1869 or 1870. In red shales at 890 feet.

20. [3]*Southampton.*

Record furnished by the driller, Wm. Morrison. Sunk in 1868. Elevation, 587 A. T.

Surface	233 feet.
Sand rock	18 "
Sandstone and limestone	150 "
Limestone, dark grey and white	200 "
" soft, light-coloured	99 "
Shales, blue and red	96 "
Limestone, white	34 "
Shale, blue and red	225 "
Shale, blue	200 "
	1,255 feet

[1] Smith, J. L., Geol. Sur., Can., 1874-75, p. 286.
[2] Hunt, T. S., Geol. Sur., Can., 1866-69, p. 213.
[3] Brumell, H. P. H., Geol. Sur., Can.,Vol. V, 59 Q.

21. [1]*Teeswater.*

Depth 1,180 feet. No rock salt.

CARLETON COUNTY.

22-27. Ottawa.

[2]Sunk by the Premier Gas Company in 1889 and 1890 on the north side of Pattersons creek. No accurate record.

Specimen.	Depth.
Light blue limestone	30 feet.
Shaly dark blue limestone	35 "
Light blue limestone	82 and 110 ft.
Shaly dark blue limestone	120, 140 " 150 "
Light blue limestone	160, 180 " 185 "
Soft shaly, arenaceous limestone	190 feet.
Light grey limestone	195 to 220 ft.
Dark blue limestone	225 feet
Light grey limestone	230 "
Light grey limestone with chert	240 "
Light grey limestone	250 "
Fine-grained, highly calcareous sandstone. A streak of similar sandstone said to have been cut between	310 "
	250 and 310 ft.
Limestone with pyrite and fragments of *Leptaena sericea* and *Orthis*, sp	315 feet.
Limestone	335 "
Dark blue limestone with pyrite and *Orthis*, sp	350 "
Blue limestone, with quartz	380 "
Light blue limestone, with pyrite in abundance	475 "
Below this point to the total depth of 1,005 feet it is said that light blue limestone was found.	

No gas or oil. Sulphur water at 320 and salt water at 550 feet.

23. [3] At the works of the Ottawa Dairy Company at the corner of Bank and Somerset streets. Depth, 850 feet. Pumps 2,000 gallons of water per hour. Water carries mineral salts and is slightly sulphurous.

[1] Smith, J. L., Geol. Sur., Can., 1874-75, p. 287.
[2] Brumell, H. P. H., Geol. Sur. Can., V, 22 Q.
[3] Memorandum by E. D. Ingall.

24. [1] At the works of the Capital Brewery Company at the corner of Bay and Wellington streets. Depth, 700 feet. Pumps 4,000 gallons of water per hour. Water carries a good deal of mineral salt.

25. [1] At the Y.M.C.A. building, corner of Metcalfe street and Laurier avenue west. Depth, 1,189 feet. Sunk to the Potsdam sandstone. At first pumped 1,900 gallons of tasteless and odourless water per hour; now practically dry.

26. [1] On Nicholas street. Sunk by the Cold Storage Company. Depth, 500 feet. Water, 5,000 gallons per hour. Not in use for about 7 years; was probably mineral water.

27. [1] At the Ottawa Hunt Club, about 6 miles south of the city. Depth, 255 feet. Pure drinking water.

27 (a-j). Following is a list of a number of wells in Ottawa that were bored for water:[2]

	Location.	Elevation.	Depth.
a.	Anglesea square	193·6	170 feet.
b.	Cathcart square	186·8	342 "
c.	Queen and Lloyd streets	181·4	265 "
d.	Fourth avenue and Lyon street	231·8	371 "
e.	Evelyn school	218·7	323 "
f.	Osgoode Street school	228·6	250 "
g.	Rosemount Avenue school	219	203 "
h.	Hopewell Avenue school	215·7	398 "
i.	Elgin Street school	231·5	900 "
j.	Bay and Somerset streets	261·8	1,377 "

a, *b*, *c*, *d*, and *f* were in the Trenton group of rocks; *e* and *h* started in the Utica and ended in the Trenton group; *g* started in the base of the Trenton group; *i* started at the top of the Trenton and penetrated to the Chazy; *j* was carried to the Pre-Cambrian and penetrated it about 10 feet.

28. Gloucester.

A well was bored by diamond drill on lot 8, concession 5, of Gloucester township, to a depth of 469 feet. Another well was sunk 3 or 4 miles east of this to a depth of at least 460 feet.

[1] Memorandum by E. D., Ingall.

[2] Files of Water and Borings Division.

29. [1]*North Gower.*

Well drilled many years ago. No gas or oil.

DUNDAS COUNTY.

29a. [2]*Chesterville.*

Well sunk by W. Bell to a depth of 821 feet into the top of the Potsdam formation. Reported that water pumping 4,000 gallons per hour was struck at depths of 235 and 600 feet.

ELGIN COUNTY.

30. [3]*Bayham Township, near Vienna.*

Drilled in 1910. Contractor, Wm. Lauffer.

	Thickness.	Depth.
Drift	193 feet	193 feet
Black shale	5 "	198 "
Flint, very hard	280 "	478 "
Lime, very hard	447 "	925 "
Niagara, very hard	290 "	1,215 "
Dark shale, soft	70 "	1,285 "
Clinton	22 "	1,307 "
White Medina	23 "	1,330 "
Red Medina, very soft	45 "	1,375 "

Strong flow sulphur water and some gas at 200 feet. Salt water at 725 feet and 1,095 feet. Small quantity of gas at 725 feet. First gas at 1,309 feet.

31. [4]*Bayham Township.*

One-half mile east of Port Burwell, on the Drake farm. Drilled by the Dominion Natural Gas Company, Limited.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol V, 23 Q.
[2] Files of the Water and Borings Division.
[3] Twentieth Rep. Bur. Mines, Ont., p. 42.
[4] Twentieth Rep. Bur. Mines, Ont., p. 42.

	Thickness.	Depth.
Drift	250 feet	250 feet
Black shale	45 "	295 "
Flint, very hard	260 "	555 "
Limestone, very hard	440 "	995 "
Niagara	280 "	1,275 "
Dark shale	60 "	1,335 "
Clinton	22 "	1,357 "
Red shale, mud	15 "	1,372 "
White limestone	20 "	1,392 "
White Medina	5 "	1,397 "

Heavy flow of sulphur water with very light showing of oil at 300 feet. Salt water and some sulphur gas at 725 feet. Sulphur gas and small quantity of salt water at 1,225 feet. Heavy flow of gas in the Clinton.

32. [1] *Bayham Township, Lot 14, Con .2.*

On the Wilkins farm. Finished March 13, 1911. Contractor, William Lauffer.

	Thickness.	Depth.
Drift	255 feet	255 feet
Black slate	20 "	275 "
Flint	50 "	325 "
Slate	25 "	350 "
Lime	30 "	380 "
Flint	300 "	680 "
Lime	395 "	1,075 "
Niagara	245 "	1,320 "
Slate	64 "	1,384 "
Clinton	30 "	1,414 "
Red shale	7 "	1,421 "

First gas at 300 feet. Salt water and sulphur gas at 1,080 feet. Small quantity of salt water at 1,135 feet. Heavy flow of gas at 1,398 feet. Showing of oil at 1,414 feet.

[1] Twentieth Report Bur. Mines, Ont., p. 43.

33-36. Dutton.

33. [1]Log of a well of the Elginfield Oil and Gas Company.

	Thickness.	Depth.	Formation.
Surface	200 feet.	200 feet.	
Black shales	7 "	207 "	Hamilton.
Hard pan Blue clay	25 "	232 "	"
Limestone	170 "	402 "	Corniferous.

Oil at 392 feet.

34-36. [2]Logs of wells of the Beaver Oil Company.

	No. 34.	No. 35.	No. 36.	Formation.
Surface	228 feet.	208 feet.	183 feet.	
Lime (grey shales)	25 "	27 "	...	Hamilton.
Limestone	187 "	172 "	167 "	Corniferous.
	440 feet	407 feet	350 feet	

37. Eden.

A few miles south of Tillsonburg. It is reported that a well was sunk here in 1910 to a depth of 2,200 feet, but no gas was struck.

38. [3]*Malahide.*

Near Aylmer.

Surface clay, sand and gravel	247 feet.
Corniferous lime	169 "
	416 feet

A little oil at 247 and 278 feet and at 386 feet oil was struck with a yield of three barrels per day.

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 108.
[2] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 108.
[3] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 109.

39. Port Burwell.

Well sunk by the Dominion Natural Gas Company in 1911. Driller, A. R. Craise. On the Weaver farm, one mile west of the village. Driller's log:—

	Thickness.	Depth.
Surface	287 feet.	287 feet.
Black shale	30 "	317 "
Flint	280 "	597 "
Limestone and shale	490 "	1,087 "
Niagara limestone	270 "	1,357 "
Niagara shale	60 "	1,417 "
Clinton limestone	26 "	1,443 "
Red Medina, chiefly sand	25 "	1,468 "
Blue shale	65 "	1,533 "
White Medina sandstone	5 "	1,538 "
Red shale	17 "	1,555 "

A small flow of gas 13 feet in the Clinton formation. No gas in the Medina. Casing pulled.

40. [1]Port Stanley.

Sunk many years ago. Elevation, about 20 feet above Lake Erie.

	Thickness.	Depth.
Clay	172 feet.	172 feet.
Black and brown shale	30 "	202 "
Light shale	16 "	218 "
Limestone	80 "	298 "

41. St. Thomas.

A well was sunk several years ago. Depth 3,030 feet. A little gas was struck in the Medina formation.

[1] Hunt, T. S., Geol. Sur., Can., 66-69, p. 245.

42. Vienna.

[1]Sunk many years ago. Elevation not more than 40 feet above the level of Lake Erie. Limestone was met beneath 240 feet of clay.

ESSEX COUNTY.

43. [2]Belle River.

Lot 12, con. 6, Maidstone. Elevation, about 600 A.T.

Surface, blue clay.....	92 feet.
" hard-pan.....	3 "
Limestone, blue.....	90 "
Shale, dark.....	90 "
Sandstone, white.....	25 "
Limestone.....	925 "
Sandstone (?) grey.....	25 "
?	215 "
	1,465 feet

Water at 275 feet; a strong flow of salt water at 1,300. Gas in small quantities was noted. Another well was drilled on this lot and reached a depth of 1,010 feet.

44. [3]Lot 16, Con. 6, Colchester.

Well No. 2 of the Union Gas Company. Log furnished by E. Coste.

	Thickness.	Formation.
Surface.....	93 feet.	
Limestone, white and grey.....	92 "	Corniferous.
Dolomites and gypsum with blue-black shales towards bottom.....	740 "	Onondaga.
Dolomites.....	217 "	Guelph and Niagara.
Limestone.....	2 "	Clinton.
	1,144 feet	

[1] Hunt, T. S., Geol. Sur., Can., 1866, p. 250.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 78 Q.
[3] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 81 Q.

45. [1]Lot 64, Con. 1, Colchester South.

Well drilled by the Provincial Natural Gas and Fuel Company on the Woodbridge farm. Elevation, 648 A.T.

	Thickness.	Depth.	Formation.
Sand	20 feet.	20 feet.	Drift.
Quicksand	90 "	110 "	"
Grey and brown dolomitic limestone with flint and gypsum	67 "	177 "	Onondaga.
White sharp sand	10 "	187 "	"
White, grey, and brown dolomites with white and black flint and gypsum	203 "	390 "	"
Grey, blue, and brown dolomites (mostly shaly with considerable gypsum), shaly group	370 "	760 "	"
Dark grey and brown dolomite with gypsum	150 "	910 "	"
Blue, white, grey, and brown dolomite, quite crystalline and very porous	215 "	1,125 "	Guelph and Niagara.
White and blue white limestone	155 "	1,280 "	Clinton.
Grey blue shale	7 "	1,287 "	Medina.
Grey blue limestone	5 "	1,292 "	"
Green shales	8 "	1,300 "	"
Red pink shales	5 "	1,305 "	"
Grey blue unctuous shales	88 "	1,393 "	"
Grey blue and white sandy limestones	62 "	1,455 "	"
Red pink shales	110 "	1,565 "	"
Grey blue lime shales with shells of lime	350 "	1,915 "	Hudson River.
Brown and black shales	235 "	2,150 "	Utica.
White and dark grey limestones	270 "	2,420 "	Trenton.

Sulphur water at 910 and 1,010 feet. Salt water at 910, 1,010, and 1,232 feet. A little gas and oil at 2,150 feet.

[1] Coste, E., Jour. Can. Min. Inst., III, 73.

46. [1]*Lot 8, Con. 6, Colchester.*

Walker's No. 1. Drilled by Walker and Sons. Driller, Mr. Hyland.

Surface, clay	35	87 feet
" sand	52	
Limestone, grey	113	"
" white	70	"
" grey	70	"
" grey and white	10	"
" brown	10	"
" brown and grey	5	"
" fine grey	5	"
" dark brown	270	"
" brown and white	20	"
" " "	10	"
Shale, dark grey, and limestone	10	"
Limestone, light pink	40	"
" dark pink	35	"
" grey	75	"
Shale, dark grey and limestone	100	"
Limestone, grey and white	10	"
" brown and white	130	"
" fine white	10	"
" and sandstone, brown	200	"
	1,280	feet

Water at 180 and 1,100 feet; a small show of oil accompanied by a very small quantity of gas at 1,000 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., V, Vol. 80 Q.

47. [1]*Lot 17, Con. 7, Colchester North.*

No. 1 of Union Gas Company. Elevation, 598 A. T.

	Thickness.	Depth.	Formation.
Drift, mostly clay.....	65 feet	65 feet	
White grey limestones and brown dolomitic limestones with gypsum below 260 feet.....	610 "	675 "	Corniferous and Onondaga.
Grey blue dolomitic shales and shaly dolomites and drab brown dolomites with a good deal of gypsum.....	300 "	975 "	Onondaga
Dark grey and brown dolomites with gypsum.....	200 "	1,175 "	"

Sulphur water at 582 and 613 feet. Salt water at 1,172 feet.

48. [2]*Lot 11, Con. 6, Colchester.*

Walker's No. 2. Depth 1,016 feet. Sulphur water accompanied by oil at 1,000 feet. Is said to have pumped five barrels of oil per day.

49. [3]*Lot 19, Con. 9, Colchester.*

Premier Oil Company. Driller, R. E. Menzies. Depth 1,135 feet. No oil or gas. Salt water at 1,135 feet.

50-51. Comber.

50. [4]Lot 7, con. 5, Tilbury West. Well No. 2. Drilled for M. J. Woodward of Petrolia. Elevation, 604 A. T.

[1] Coste, E., Jour. Can. Min. Inst., III, 71.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 81 Q.
[3] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 82 Q.
[4] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 77 Q.

Driller's record:

Surface	120 feet
"Hard rock" (limestone?)	53 "
Limestone, white	110 "
Sandstone	20 "
Limestone	200 "
Sandstone	10 "
Limestone, soft	76 "
" hard	23 "
Sandstone	35 "
Limestone, soft	27 "
" hard	12 "
" soft	34 "
" hard	22 "
Shale	100 "
Limestone, soft	12 "
" hard	125 "
" white, with shale	50 "
" blue	10 "
" hard, with shale	55 "
"Very hard rock," with pyrites	20 "
Limestone, hard	156 "
"	10 "
	1,280 feet

At 1,213 feet a small quantity of oil.

51. [1]Well No. 3, one mile south and half a mile west of the M. C. R. station. Drilled for M. J. Woodward. Driller, J. R. Minhinnick, London. Elevation, 600 A.T.

Surface (clay)	124 feet
Limestone	136 "
" white	100 "
Sandstone	10 "
Limestone, in alternate soft and hard layers	370 "
Shale, with streaks of hard lime	100 "
Limestone	135 "
" white, with shale	50 "
" with shale	53 "
" hard	128 "
" very hard	100 "
	1,306 feet

[1] Brumell, H. P. H., Geol. Sur. Can., Vol. V, 78 Q.

Fresh water at 150; sulphur water at 260; strong flow of saline water at 1,127; gas in small quantities at 260 and 1,078 feet.

52. [1]*Essex Centre.*

Lot 283 South Talbot road, Colchester. Drilled by the Central Gas and Oil Company. Depth 1,200 feet. No gas or oil. Fresh water at 130, 155, and 190 feet; sulphur water at 310 and 565 feet and salt water at 800 and 1,130 feet.

53. [2]*Lot 7, Con. 1, Gosfield.*

Coste well No. 1. Completed 1889. Elevation, 658 A.T.

	Thickess.	Depth.	Formation.
Soil	5 feet	5 feet	
Grey sand	115 "	120 "	
Brown and grey dolomitic limestones with gypsum, and white and black flint	380 "	500 "	Onondaga.
Grey, blue, and shaly dolomites and drab brown dolomites with a good deal of gypsum	360 "	860 "	"
Dark brown dolomites and gypsum	160 "	1,020 "	"
Grey blue crystalline vesicular dolomite	11 "	1,031 "	Guelph.

A little gas at 910 and 930 feet. Large quantity of gas at 1,020 feet.

54. [3]*Lot 8, Con. 2, Gosfield.*

No. 3 of Ontario Natural Gas Company, Limited. Elevation, 663 A.T.

	Thickness.	Depth.	Formation.
Drift, mostly sand	141 feet	141 feet	
Grey, drab, brown, and blue dolomites with gypsum	960 "	1,101 "	Onondaga.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 82 Q.
[2] Coste, E., Jour. Can. Min. Inst., III, 70.
[3] Coste, E., Jour. Can. Min. Inst. III, 70.

55. [1] *Lot 18, Con. 3, Gosfield South.*

Messrs. Walker and Sons. Depth 1,184 feet. Small flow of gas at 1,020 feet. Salt water at lower depth.

56. [2] *Lot 5, Con. 2, Gosfield.*

Isaac Wigle well. Depth 1,095 feet. Surface deposits 117 feet. Small quantities of gas at 1,090 feet and salt water at 1,095 feet.

57. [3] *Lot 3, Con. 1 of Eastern Division, Gosfield South.*

No. 1 of Citizens' Gas, Oil, and Piping Company. Drilled 1889. Depth 1,126 feet. Gas in small quantities at 750 feet. Water at 68 feet; salt water at 1,100 and 1,121 feet.

58. Lot 7, Con. 1, Gosfield South.

Citizens No. 2. On road allowance about 55 yards west of Coste No. 1 on lot 7, con. 1, Gosfield. Depth 1,020 feet. Gas yield 7,014,000 cubic feet.

59. Lot 4, Con. 1, Gosfield South.

Citizens No. 3. Depth 1,085 feet. A small quantity of gas at 980 feet, and salt water at 1,085.

60. [4] *Lot 4, Con. 2, Malden.*

The Parks well, drilled by the Great Southwestern Gas and Oil Company of Amherstburg. Log furnished by John Savage, Petrolia.

Surface (sand and gravel)	30 feet
Limestone	228 "
Sandstone	84 "
Limestone	182 "
Gypsum	12 "
Limestone	468 "
	1,004 feet

At 987 feet a heavy flow of salt water accompanied by a little gas.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 84 Q.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 83 Q.
[3] Brumell, H. P. H., Geol. Sur , Can., Vol. V, 83 Q.
[4] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 80 Q.

61. [1]*Lot 2, Con. 1, Malden.*

The Colwell Grove well sunk by the Great Southwestern Gas and Oil Company of Amherstburg. Log furnished by John Savage, Petrolia.

Surface (clay)	8 feet
Limestone	252 "
Sandstone	60 "
Limestone	180 "
Shale and gypsum	16 "
Limestone, hard	320 "
" soft	297 "
"	265 "
Grey shale	20 "
	1,418 feet

Heavy flow of salt water at 1,115 feet.

62. [2]*East Lot 239, North Talbot Road, Mersea.*

Drilled by the Leamington Oil Company, 1905. Elevation, 630 A.T.

	Thickness.	Depth.	Formation.
Drift	89 feet	89 feet	
Limestone and dolomites with gypsum	1,006 "	1,095 "	Onondaga.
Limestone and dolomites	375 "	1,470 "	Guelph, Niagara and Clinton.
Red shales	410 "	1,880 "	Medina.
Blue and black shales	608 "	2,488 "	Hudson River and Utica.
Limestones, grey and dark	408 "	2,896 "	Trenton.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 79 Q.
[2] Coste, E., Fifteenth Rep. Bur. Mines, Ont., 1906, p. 112.

63. [1] *Lot 5, Con. 2, Mersea.*

Sunk in 1889 by the Leamington Citizens Natural Gas Company. Depth 1,030 feet. Surface deposits 128 feet. Water at 135, 410, 425, and 500 feet, and gas in small quantity at 965 feet.

64. [2] *Lot 7, Con. 9, Mersea.*

Sunk in 1889. Depth 1,200 feet. Small flow of gas at 1,050; salt water at 1,150 feet.

65-66. [3] *Pelee Island.*

65. On the farm of John Finlay. Sunk 1895. Samples of drillings were examined by Dr. Coleman and described as follows:

Bluish grey, effervesces a little with cold and more with hot acid, impure clayey limestone or dolomite	93–204	feet
Brownish grey dolomitic limestone, apparently a little bituminous	450–500	"
Brownish grey dolomite, gypsiferous	660	"
Pale brownish yellow, effervesces somewhat with cold acid, magnesian limestone; also grey particles, a little gypsum	710	"
Pale brownish and white; brownish is magnesian limestone without gypsum; white is gypsum	730	"
Pale brownish grey, dolomite and some gypsum	740	"
Buff magnesian limestone or dolomite	749	"
Greyish brown sand, dolomite, no gypsum	755	"
Brown magnesian limestone, bituminous, no gypsum, a calcite crystal	759	"
Brown magnesian limestone, bituminous, no gypsum	761	"
Pale grey dolomite, not bituminous, no gypsum	764	"

Yield two barrels oil per day of eight hours.

---

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 84 Q.
Brumell, H. P. H., Geol. Sur., Can., Vol. V, 84 Q.
[3] Sixth Rep. Bur. Mines, Ont., p. 18.

66.[1] Borings examined by H. M. Ami of the Geological Survey of Canada.

	Thickness.	Depth.	Formation.
Surface drift	58 feet	58 feet	
Mostly impure limestone with corals, shells, and carbonaceous matter	222 "	280 "	Corniferous and Oriskany.
Measures unrecorded	44 "	324 "	Probably Oriskany sandstone.
Gypsum and gypsiferous dolomites, light yellow, dark grey, and bluish grey	458 "	782 "	Lower Helderberg and Onondaga.

67. Sandwich.

Drilled by the Saginaw Lumber and Salt Company. Driller, J. J. Mason. Driller's log:

	Thickness.	Depth.
Surface deposits	82 feet	82 feet
Lime rock	443 "	525 "
Sandstone	100 "	625 "
Lime rock	425 "	1,050 "
Salt	40 "	1,090 "
Lime rock	200 "	1,290 "
Salt, thick bed.		
Depth of well		1,565 "

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 117.

68-69. Lot 7, Con. 3, Tilbury West.

68[1].

	Thickness.	Depth.	Formation.
Surface	120 feet	120 feet	
Limestone	163 "	283 "	Corniferous
Sandstone	20 "	303 "	Oriskany.
Limestone and shale	897 "	1,200 "	Onondaga.
Crystalline limestone	183 "	1,383 "	Guelph.

Oil was struck at 1,200 feet and nearly 100 feet of oil rock was passed through.

69. [2]On Desjardin's farm. Elevation, 603 A. T.

	Thickness.	Depth.	Formation.
Drift, boulder clay	120 feet	120 feet	
White and yellow brown limestones	130 "	250 "	Corniferous.
White yellowish fine sandstone	50 "	300 "	Oriskany.
Yellow white and brown dolomites; with gypsum 450-550; with flint 550-650; darker brown with gypsum 650-800	500 "	800 "	Onondaga.
Blue and brown, mostly quite shaly dolomites with a good deal of gypsum	330 "	1,130 "	"
Dark grey and brown dolomites with gypsum	185 "	1,315 "	"
White grey crystalline limestone	18 "	1,333 "	Guelph.

Salt water at 1,315 feet.

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 117.
[2] Coste, E., Jour. Can. Min. Inst. III, 72.

70 and 71. Windsor.

70. [1] Canadian Salt Works, Well No. 1.

	Thickness.	Depth.
Surface	132 feet	132 feet
Dolomite	118 "	250 "
Limestone, petroliferous	25 "	275 "
Dolomite, marly	85 "	360 "
Limestone, dark petroliferous	30 "	390 "
Dolomite, crystalline	20 "	410 "
Limestone, drab	75 "	485 "
Sandstone, pure quartzose	55 "	540 "
Dolomite, with some gypsum	50 "	590 "
" shaly	30 "	620 "
" grey and fawn	170 "	790 "
" with scales of carbonaceous matter	40 "	830 "
" grey	190 "	1,020 "
" shaly, argillaceous	57 "	1,077 "
Rock salt	40 "	1,117 "

71. [2] Canadian Salt Works, Well No. 4.

	Thickness.	Depth.
Drift	133 feet	133 feet
Limestone	922 "	1,055 "
Salt	30 "	1,085 "
Limestone	25 "	1,110 "
Break in record	35 "	1,145 "
Salt	75 "	1,220 "
Limestone	100 "	1,320 "
Salt	70 "	1,390 "
Limestone	30 "	1,420 "
Salt	252 "	1,672 "
Limestone		

[1] Geol. Sur., Can., Vol. XV, 225 S.
[2] Sixth Rep. Bur. Mines, Ont., p. 33.

72. [1] *Woodslee.*

Lot 28, con. 2, Rochester. Drilled 1903. Elevation by barometer, 620 A.T.

	Thickness.	Depth.	Formation.
Boulder clay	144 feet	144 feet	
Limestone	84 "	228 "	Corniferous.
Sandstone	40 "	268 "	Oriskany.
Dolomite and limestone with gypsum	1,037 "	1,305 "	Onondaga.
Blue white crystalline limestone	25 "	1,330 "	Guelph.

Gypsum bed, 1,260 to 1,270; salt water at 1,325.

FRONTENAC COUNTY.

73. [1] *Kingston.*

At the hospital for the insane. Drilled by the Provincial Government. Depth 171 feet. A little gas and salt water.

[1] Coste, E., Fifteenth Rep. Bur. Mines, Ont., 1906, p. 111.
[1] Geol. Sur., Can., Vol. V, 108 SS.

GLENGARRY COUNTY.

74. [1]*Alexandria.*

On north bank of Garry river.

	Thickness.	Depth.	Formation.
Dark grey impure fossiliferous limestone.....	470 feet	470 feet	Trenton, 470 feet or more.
Dark grey impure limestone, softer than the preceding.....	100 "	570 "	Black River, 100 feet assumed thickness.
Dark grey impure limestone underlain by greenish-grey calcareous arenaceous shales—at times fine-grained, at others coarse and more highly arenaceous.....	185 "	755 "	Chazy.
Hard, compact, dark chocolate-coloured limestone, probably magnesian.....	31 "	786 "	Calciferous, 31 feet or more.

Saline water at 730 and in the last 25 feet.

75. [2]*Lot 21, Con. 2, Lancaster.*

Near Bainsville, 1865 and 1866. Depth 500 feet. No oil or gas. Fresh water from gravel at bottom of surface deposits 30 feet thick.

[1] Geol. Sur., Can., Vol. VIII, 69 A.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 21 Q.

76. [1] *Delphi.*

Sunk in 1888 on lot 26, con. 5, Collingwood.

	Thickness.	Formation.
Surface, red clay	8 feet	
Black shale	40 "	Utica.
Blue limestone	539 "	Trenton.

Gas at 95 feet; 6,000 cubic feet.

77. Keppel.

Lot 38, con. 2, North Centre diagonal. Log furnished by the Imperial Oil Company. Drilled in 1902.

Surface	14 feet
Limestone	190 "
Slate	10 "
Red rock	50 "
Slate	20 "
Limestone	60 "
Slate	20 "
Red rock	90 "
Slate	60 "
Red rock	45 "
Shale	473 "
Trenton	468 "
Total depth	1,500 feet

No oil or gas.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 29 Q.

78. [1] *Lot 10, Con. 2, Osprey.*

Drilled 1900. Elevation, 1550 A.T.

	Thickness.	Depth.	Formation.
Soil and clay	6 feet	6 feet	
Gravel	6 "	12 "	
Limestone with mud seams; white crystalline porous limestone from 130 to 170 feet; grey limestone with spathic iron and a little shale from 170 to 195	183 "	195 "	Guelph and Niagara.
Grey blue shales	32 "	227 "	Niagara.
Dark grey, hard limestone	48 "	275 "	Clinton.
Red shales	255 "	530 "	Medina.
Blue shales and lime shells	530 "	1,060 "	Hudson River
Black shales	100 "	1,160 "	Utica.
Limestone and shales in thin layers	30 "	1,190 "	Trenton.
Solid, compact, dark grey limestone, mostly shaly	563 "	1,753 "	"
White sandstone	12 "	1,765 "	Calciferous.
Purple micaceous iron shales	10 "	1,775 "	"
Arkose or coarse sandstone	25 "	1,800 "	"
Granite	1 "	1,801 "	

Water struck in Clinton. Fresh water at 285 feet; salt water at 295 feet; gas at 1,361 feet, about 25,000 cubic feet; odour of oil in Trenton, especially at 1,650 feet; a small quantity of oil between 1,760 and 1,765 feet.

[1] Coste, E., Fifteenth Rep. Bur. Mines, Ont., 1906, p. 109.

[1] *78a. Lot 25, Con. 7, St. Vincent.*

	Thickness.
Clay and gravel	18 feet.
Blue shale	162 "
Dark blue shale	70 "
Black shale	10 "
Grey rock	5 "
Black shale	2 "
Grey rock	2 "
Black shale	2 "
Grey rock	3 "
Black shale	2 "
Grey rock	5 "
Trenton	423 "
Total	704 feet.

79. [2] *Northwest Corner of Sarawak Township.*

On Goodfellow's farm.

	Thickness.	Depth.
Surface	6 feet	6 feet
Rock	29 "	35 "
Blue shale	7 "	42 "
Red shale	90 "	132 "
Middle limestone	17 "	149 "
Soap rock	556 "	705 "
Black shale	30 "	735 "
Trenton limestone	469 "	1,204 "

80. [3] *Thornbury.*

Sunk in 1888 at Andrew's mill to a depth of about 550 feet. A small flow of gas and a considerable quantity of water.

[1] Log obtained from C. W. Knight, Assistant Provincial Geologist, Ontario.
[2] Files of the Water and Borings Division.
[3] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 30 Q.

HALDIMAND COUNTY.

81. [1] *Lot 18, Con. 2, Canborough.*

	Thickness.	Depth.	Formation.
Surface (clay)	100 feet	100 feet	
[2] Shale and rock	318 "	418 "	Guelph and Niagara.
Grey shale	45 "	463 "	Niagara.
Dolomite	23 "	486 "	Clinton.
Red sandstone	48 "	534 "	Medina.
Blue shale	48 "	582 "	"
White sandstone	10 "	592 "	"
Red shale	26 "	618 "	"

Gas in the white Medina sandstone at 582 feet. Yield 12,000 to 13,000 cubic feet per day.

82. [3] *Canborough.*

Well No. 2 one-half mile south of Darling Road station on the Wabash railway.

	Thickness.	Depth.	Formation.
Surface	56 feet	56 feet	
Limestone, shale, and gypsum	290 "	346 "	Onondaga.
Grey dolomite	160 "	506 "	Guelph and Niagara.
Blue shale	40 "	546 "	Niagara.
Dolomite	18 "	564 "	Clinton.
Grey shale	15 "	579 "	"
Red sandstone	40 "	619 "	Medina.
Grey shales	30 "	649 "	"
White sandstone	20 "	669 "	"
Red shales	56 "	725 "	"

Gas in white Medina at 665 feet. Yield 72,000 cubic feet. Water in the Onondaga and Niagara.

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 105.
[2] Upper shales probably Salima.
[3] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 105.

83. [1] *Cayuga.*

Lot 19, east side of Ouse street. The Cayuga Natural Gas Company Limited. Elevation, about 600 A.T.

	Thickness.	Depth.	Formation.
Drift	23 feet	23 feet	
Limestone	120 "	143 "	Onondaga.
Bluish shale	132 "	275 "	"
Very hard limestone with salt water	232 "	507 "	Guelph and Niagara.
Bluish shale	41 "	548 "	"
Limestone	15 "	563 "	Clinton.
Light blue shale	5 "	568 "	"
Red sandstone	35 "	603 "	Medina.
Red shale	62 "	665 "	"
White sandstone	15 "	680 "	"
Red shale	30 "	710 "	"

Gas at 563, 603, and 680 feet. Yield 250,000 cubic feet.

[1] Geol. Sur., Can., Vol. V, 106 SS.

84-85. Dunnville.

84. [1] Well of the Dunnville Natural Gas Company, 1891. Eastern end of village on north side of Welland canal feeder. Drillers, Carmody Bros.

	Thickness.	Depth.
Drift	76 feet	76 feet
Brown limestone and thin layers of gypsum	74 "	150 "
Hard shale, with gypsum	205 "	355 "
Hard Niagara limestone	210 "	565 "
Soft shale or slate	47 "	612 "
Clinton limestone	24 "	636 "
Slate or shale	4 "	640 "
Red Medina sandstone	45 "	685 "
Hard shale or slate	40 "	725 "
White Medina sandstone and shale	15 "	740 "
White Medina sandstone	12 "	752 "
Red shale	20 "	772 "

Sulphur water at 85; salt water at 500 feet. Gas was struck in the Clinton formation at 612 feet and in the white Medina sandstone from 740 to 752 feet. The yield was estimated at 150,000 to 200,000 feet.

85. [2] Well of the Dunnville Natural Gas Company, 1891. On left hand of Grand river.

	Thickness.	Depth.
Drift	70 feet	70 feet
Limestone	80 "	150 "
Shale and slate	190 "	340 "
Hard limestone	227 "	567 "
Shale or slate	45 "	612 "
Clinton limestone	22 "	634 "
Shale or slate	1 "	635 "
Red Medina sandstone	45 "	680 "
Slate and shale	50 "	730 "
White Medina sandstone	20 "	750 "
Reddish shale	30 "	780 "

Yield about 150,000 cubic feet per day.

[1] First Rep. Bur. Mines, Ont., 1891, p. 137.
[2] First Rep. Bur. Mines, Ont., 1891, p. 137.

Jarvis, Nelles Corners, and York.

Wells have been sunk at these points to a depth of 2,800 feet, but all three were practically dry.[1]

86-87. Moulton.

Logs obtained from C. W. Knight, Assistant Provincial Geologist, Bureau of Mines, Ontario.

86. Lot 13, con. 1.

	Thickness.	Depth.
Surface	80 feet	80 feet
Shale	210 "	290 "
Niagara	140 "	430 "
Shale	55 "	485 "
Clinton	25 "	510 "
Red Medina	37 "	547 "
Grey shale	55 "	602 "
White Medina	12 "	614 "
Red shale	50 "	664 "

Gas at 520 feet.

87. Lot 6, con. 1.

	Thickness.	Depth.
Surface	48 feet	48 feet
Shale	260 "	308 "
Niagara limestone	160 "	468 "
White limestone	20 "	488 "
Shale	60 "	548 "
Clinton	25 "	573 "
Red Medina	40 "	613 "
White shale	60 "	673 "
White Medina	15 "	688 "

Gas at 552 and 681 feet.

[1] Twenty-second Report of the (Ontario) Bureau of Mines, 1913, p. 46.

88-92. North Cayuga.

Logs obtained from C. W. Knight, Assistant Provincial Geologist, Bureau of Mines, Ontario.

88. Lot 35, con. 1.

	Thickness.	Depth.
Surface	18 feet	18 feet
Flint	137 "	155 "
Lime and shale	295 "	450 "
Niagara	200 "	650 "
Clinton	30 "	680 "
Red Medina	40 "	720 "
White shale	102 "	822 "

Gas at 670 and 685 feet.

89. Lot 35, con. 2.

	Thickness.	Depth.
Surface	22 feet	22 feet
Flint	80 "	102 "
Lime and shale	305 "	407 "
Niagara	243 "	650 "
Shale	50 "	700 "
Clinton	24 "	724 "
Red Medina	45 "	769 "
White shale	63 "	832 "
White Medina	15 "	847 "
Red shale	5 "	852 "

Gas at 744 feet.

90. Lot 43, con. 1.

	Thickness.	Depth.
Surface	12 feet	12 feet
Flint	88 "	100 "
Lime and shale	180 "	280 "
Grey lime	200 "	480 "
Niagara	160 "	640 "
Shale	90 "	730 "
Clinton	30 "	760 "
Red Medina	45 "	805 "
Shale	22 "	827 "

Some gas at 750 feet.

91. Lot 44, con. 2.

	Thickness.	Depth.
Surface	14 feet	14 feet
Flint	86 "	100 "
Lime	590 "	690 "
Shale	50 "	740 "
Clinton	30 "	770 "
Red Medina	45 "	815 "
Shale	5 "	820 "

92. [1]No. 1 well on farm of K. S. Robbins, 1½ miles southwest of Darling Road station on the Wabash railway.

	Thickness.	Depth.	Formation.
Clay	58 feet	58 feet	
Limestone and shale	300 "	358 "	Onondaga.
Grey dolomite	160 "	518 "	Guelph and Niagara.
Blue shales	40 "	558 "	Niagara.
Dolomite	15 "	573 "	Clinton.
Grey shales	10 "	583 "	"
Red sandstone	40 "	623 "	Medina.
Grey shales	40 "	663 "	"
White sandstone	17 "	680 "	"
Red shale	110 "	790 "	"

Gas at 667 feet in the white Medina. Yield 60,000 cubic feet.

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 105.

HALTON COUNTY.

105. [1] *Milton.*

Lot 10, con. 1, Trafalgar.

Soil	47 feet
Red shale	200 "
Bluish shales, with hard layers	159 "
	406 feet

No gas or oil.

105a. Trafalgar Township, New Survey, East Half Lot 15, Con. 1.

	Thickness.	Depth.
Red Medina	285 feet	285 feet
Hudson River shale	795 "	1,080 "
Utica shale	120 "	1,200 "
Trenton	265 "	1,465 "

105b. Esquesing Township, West Half Lot 2, Con. 2.

	Thickness.	Depth.
Gravel	40 feet	40 feet
Medina sand	166 "	206 "
Hudson shale	728 "	934 "
Utica shale	114 "	1,048 "

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 30 Q.

RAINHAM, WALPOLE, AND WOODHOUSE, HALDIMAND AND NORFOLK COUNTIES.

93-104. Logs furnished by the Dominion Natural Gas Company, Limited. Wells arranged in order from west to east. The figures represent the depths of the bottom of the formations.

Location.	*South Part Lot 5, Con. 1, Woodhouse.* *No. 93.*	*West Half, Lot 9, Con. 1, Woodhouse.* *No. 94.*	*Lot 10, Con. 1, Woodhouse. South of Road.* *No. 95.*	*Anderson Lot, Port Dover.* *No. 96.*	*South Half, Lot 9, Con. 2, Walpole.* *No. 97.*	*North Part Lot 13, Con. 1, Walpole.* *No. 98.*	*Southwest Part Lot 22, Con. 4, Walpole.* *No. 99.*	*Lot 22, Con. 1, Walpole.* *No. 100.*	*Southwest Part Lot 3, Con. 1, Rainham.* *No. 101.*	*South Part Lot 12, Con. 1, Rainham.* *No. 102.*	*Southwest Part Lot 17, Con. 1, Rainham.* *No. 103.*	*South Part Lot 25, Con. 1, Rainham.* *No. 104.*	*Formation.*
Date of boring	1907	1907	1907	1906	1907	1909	1907	1909	1908	1907	1908	1906	
Elevation by barometer	651 A.T.	622 A.T.	614 A.T.	584 A.T.									
Surface deposits	114	82	80	28	32	30	5	16	18	14	11	15	
Flint	306	272	270	246	182	140	130	175	138	104	116	85	Probably Onondaga and Salina.
Lime and shale	670	622	620	610	554	515	480	521	513	434	436	†400	Salina.
Niagara	977	920	920	890	820	775	730	781	753	710	685	675	Probably Guelph and Niagara.
Shale	1,008	974	958	924	860	820	780	841	813	754	745	740	Niagara.
Clinton	1,020	998	970	934	878	845	805	866	828	774	770	765	Clinton.
Red Medina	1,048	1,013	1,011	974	923	895	845	900	868	819	815	800	Medina.
White shale	1,133	1,095	1,081	1,050	987	951	915	965	938	879	875	855	"
White Medina	*1,145	1,107	1,094	1,062	1,000	971	945	980	948	894	885	863	"
Red shale	1,160	1,141	1,139	1,070	1,010	976	952	995	963	899	890	865	Queenston
Gas horizon	1,030	988 and 1,100	1,085	Dry hole	865, 893–898	865–880	795, 825–830	888–893, 973–975	838–843		750, 785–790	755, 785	

* Shale.
† Shale, gypsum, and lime.

105c. Nassagaweya Township, East Half of Lot 3, Con. 7.

	Thickness.	Depth.
Sand and gravel	73 feet	73 feet
Red Medina shale	217 "	290 "
White Medina shale	69 "	359 "
"Sand"	9 "	368 "

105d. Another well was drilled about 1,000 feet west of this well; the record of it is as follows:

	Thickness.	Depth.
Sand and gravel	63 feet	63 feet
Red Medina shale	240 "	303 "
White Medina shale	15 "	318 "
Hudson shale	835 "	1,153 "
Trenton	667 "	1,820 "
Slate	5 "	1,825 "
Pre-Cambrian red granite	30 "	1,855 "
Pre-Cambrian coarse-grained mica schist	45 "	1,900 "

Logs 105 a-d were obtained from C. W. Knight, Assistant Provincial Geologist, Ontario. From 105a oil was reported at a depth of 1,447 feet; from 105c gas at a depth of 368 feet; and from 105d gas (5,000 cubic feet per day) at 1,710 and 1,725 feet.

HASTINGS COUNTY.

106-108. [1]*Belleville.*

The Belleville Natural Gas and Oil Company.

106. No. 1. Near Grand Trunk Railway station. Depth, 252 feet, the lower 11 feet being in arkose or granite.

107. No. 2. On the bay a short distance west of the river. Depth 280 feet. Mineral water.

108. No. 3. On Massasauga point. Depth, 280 feet. This passed through yellow sandstone into the granite.

[1] Geol. Sur. Can., Vol. V, 108 SS

109. [1]*Deseronto.*

Well 60 feet deep in yard of hotel owned by W. Jamieson. Surface deposits 15 feet. Small quantities of gas at 15 feet and at 30 to 60 feet.

HURON COUNTY.

110. [2]*Blyth.*

Operated by F. C. Rogers. Sunk in 1879. Elevation, 1080 A.T. Driller's record:

Surface	104 feet
Limestone	300 "
?	346 "
Shale, black	100 "
Hard rock	170 "
Shale	105 "
Rock salt	90 "
	1,215 feet

Considerable gas was obtained in the black shales at a depth of 850 feet.

111. [3]*Brussels.*

Log as given by J. Gibson in American Journal of Science, Vol. V, 3rd Series. Sunk in 1872. Elevation, 1120 A.T.

Surface	16 feet
Limestone	100 "
Limestone, magnesian	266 "
Limestone, with chert	180 "
Soapstone	353 "
Dolomite, grey	97 "
Dolomite	168 "
Sandstone, dark brown	64 "
	1,244 feet

Saline waters at 1,012 feet and traces of oil and gas at 1,200 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 24 Q.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 57 Q.
[3] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 56 Q.

112 and 113. Clinton.

[1]The Stapleton well operated by Henry Ransford.

112. Sunk in 1867. Elevation, 927 A.T.

Surface	67 feet
Limestone	413 "
Limestone, cherty and dolomite	204 "
Limestone	176 "
Limestone, cherty and dolomite	36 "
Shale, limestone, gypsum, and marls	255 "
Rock salt, first bed	15 "
Shale, gypsum, and salt	48 "
Rock salt, second bed	25 "
	1,239 feet

113. [2]Log by J. Gibson.

	Thickness.	Depth.
Clay, gravel, sand, and boulders	70 feet	70 feet
Grey, cherty, non-magnesian limestone (Corniferous	108 "	178 "
Water-lime beds (Tentaculite limestone)	24 "	202 "
Hard, magnesian limestones, with chert beds	283 "	485 "
Hard, arenaceous limestones, with beds of shale and gypsum	470 "	955 "
Coarse limestones and gypsiferous shales with a mud vein, 3 inches thick	147 "	1,102 "
Very porous limestone, containing salt	14 "	1,116 "
Rock salt	20 "	1,136 "

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 57 Q.
[2] Am. Jour. Sc., V, 3rd series, p. 367.

114 and 115. Goderich.

114. [1]Attrill's well. Sunk 1876.

	Thickness.	Depth.
Clay, gravel, and boulders	78 ft. 9 in.	78 ft. 9 in.
Dolomite, with thin limestone layers	278 " 3 "	357 " 0 "
Limestone, with corals, chert, and beds of dolomite	276 " 0 "	633 " 0 "
Dolomite, with seams of gypsum	243 " 0 "	876 " 0 "
Variegated marls, with beds of dolomite	121 " 0 "	997 " 0 "
Rock salt, 1st bed	30 " 11 "	1,027 " 11 "
Dolomite, with marls towards the base	32 " 1 "	1,060 " 0 "
Rock salt, 2nd bed	25 " 4 "	1,085 " 4 "
Dolomite	6 " 10 "	1,092 " 2 "
Rock salt, 3rd bed	34 " 10 "	1,127 " 0 "
Marls, with dolomite and anhydrite	80 " 7 "	1,207 " 7 "
Rock salt, 4th bed	15 " 5 "	1,223 " 0 "
Dolomite and anyhdrite	7 " 0 "	1,230 " 0 "
Rock salt, 5th bed	13 " 6 "	1,243 " 6 "
Marls, soft, with anhydrite	135 " 6 "	1,379 " 0 "
Rock salt, 6th bed	6 " 0 "	1,385 " 0 "
Marls, soft, wth dolomite and anhydrite	132 " 0 "	1,517 " 0 "

The above log was obtained from diamond-drill cores.

[1] Hunt, T. S., Geol. Sur., Can., Rep. of Prog., 1876-77, p. 226.

115. [1]International well sunk in 1874 by Joseph Kidd. Log by P. McEwen, driller.

Blue clay, with a few limestone boulders	100	feet.
Limestone boulders and gravel	40	"
Alternate beds of sandstone and limestone	510	"
Hard, flinty limestone	300	"
Blue shale, with thin streaks of red shale	84	"
Gypsum	6	"
Brown limestone, soft	14	"
Rock salt	19	"
Brown limestone, very hard	30	"
Rock salt	24	"
Blue shale and blue clay	3½	"
Rock salt	32	"
Brown limestone, rather lighter in colour than the preceding	8	"
	1,170½	feet.

Following are notes on a few other wells sunk at Goderich and vicinity:

The Dominion well, sunk about 1868, depth 1,120 feet.

Ogilvie and Hutchison well, sunk in 1882 on the lake shore, depth 1,100 feet. It is stated that the third salt bed was reached.

The Ontario well, sunk in 1867, depth 1,127 feet reaching 2 feet below the base of the first salt bed.

Platt's well, sunk about 1875, depth 1,075 feet, salt struck at 990 feet.

The Saltford well, sunk in 1865 by P. McEwen, the first well sunk in Ontario for the production of salt, depth 1,000 feet, sunk to base of first salt bed.

116. [2]*Hensall.*

Sunk in 1880. Driller, George McEwan. Elevation, 900 A.T.

Surface	88	feet.
Limestone, hard	150	"
" soft	75	"
Dolomite	25	"
Limestone (magnesian ?)	462	"
Shale	230	"
Marly shale	60	"
Salt and shale	116	"
	1,206	feet.

Drilling stopped in salt.

[1] Smith, J. L., Geol. Sur., Can., Rep. of Prog., 1874-75, p. 285.

[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 58 Q.

117. [1]*Seaforth.*

Coleman and Gowinlock's well. Sunk in 1870. Elevation, 1009 A.T.

	Thickness.	Depth.
Gravel, sand, and clay	25 feet.	25 feet.
Stratified, dark grey limestone	400 "	425 "
Stratified magnesian limestone, followed by a very hard bed of chert	200 "	625 "
Crystalline siliceous limestone, containing magnesia	110 "	735 "
Blue clay, shale, and limestone	250 "	985 "
Gypsum, shale, and salt	50 "	1,035 "
Rock salt	100 "	1,135 "

118. [2]*Wingham.*

Lot 41, con. 13, East Wawanosh. Gray, Young, and Sparling Company, operators. Elevation, 1012 A.T.

Surface	96 feet.
Grey limestone	100 "
Dolomite	250 "
Dolomite with gypsum and limestone	275 "
Limestone with blue shale and dolomite	369 "
Rock salt	30 "
Limestone	65 "
	1,185 feet.

KENT COUNTY.

119. [3]*Bothwell.*

	Thickness.	Formation.
Surface	155 feet.	
Soapstone	31 "	Hamilton.
Shale, black	4 "	"
Soapstone	32 "	"
Limestone	148 "	Corniferous.
	370 feet.	

[1] Gibson, J., Am. Jour. Sc., V, 3rd Series, p. 368.
[2] Brumell, H. P. H., Geol. Sur., Can , Vol. V, 56 Q.
[3] Corkill, E. T., 14th Rep. Bur. Mines, Ont., p. 109.

120. [1]*Lot 6, Con. 4, Camden.*

	Thickness.	Depth.
Clay	33 feet.	33 feet.
Black shale	98 "	131 "
Soapstone, etc	229 "	360 "
Limestone	55 "	415 "

121. [2]*Lot 2, Con. 5, Camden.*

	Thickness.	Depth.
Clay	50 feet.	50 feet.
Black shale	146 "	196 "
Soapstone, etc	202 "	398 "
Limestone	161 "	559 "
Sandstone	10 "	569 "

122. [3]*Lot 8, Con. 2, Camden.*

	Thickness.	Depth.
Clay	53 feet.	53 feet.
Black shale	200 "	253 "
Soapstone, etc.	167 "	420 "

[1] Hunt, T. S., Geol. Sur., Can., 66-69, p. 245.
[2] Hunt, T. S., Geol. Sur., Can., 66-69, p. 245.
[3] Hunt, T. S., Geol. Sur., Can., 66-69, p 244.

123. [1]*Lot 3, Con. 2, Camden.*

Driller, Major Savage of Petrolia.

Sand	13	
Clay	40	60 feet.
"Hard-pan"	7	
Shale, black		20 "
Limestone		30 "
Soapstone		204 "
Limestone		117 "
Sandstone		46 "
Hard rock (limestone)		23 "
Depth		500 feet.

Salt water at 431 feet.

124. [2]*Chatham.*

About a mile northwest of the Grand Trunk Railway station. Elevation, 583 A.T.

Surface clay	60 feet.
Shale, black	118 "
Soapstone	200 "
Limestone	18 "
Soapstone	37 "
Limestone	567 "
	1,000 feet.

Heavy flow of salt water at 700 and a small show of oil at 475 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 72 Q.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 73 Q.

125. [1]*Lot 5, Con. 1, Gore of Chatham.*

Sunk in 1896 by D. A. Gordon. Log by H. M. Ami. Elevation, 587 A.T.

	Thickness.	Depth.	Formation.
Sands, clays, and boulder clays...	140 feet.	140 feet.	
Limestones and shales.....	545 "	685 "	Chemung.
Shales and limestones.....	165 "	850 "	Hamilton.
Limestone, light coloured.....	150 "	1,000 "	Corniferous.
Fine-grained dolomites and gypsiferous dolomites.....	700 "	1,700 "	Lower Helderberg, Onondaga, and Salina.
Dolomite.....	120 "	1,820 "	Guelph.
Limestone.....	105 "	1,925 "	Niagara.
Shales, calcareous and arenaceous..	95 "	2,020 "	Clinton.
Sandstone sand shales.....	65 "	2,085 "	Medina.

Well was sunk to 2,365 feet.

126. [2]*Seventh Concession of Chatham, on Line of Camden.*

	Thickness.	Depth.
Clay.....	48 feet.	48 feet.
Black shale.....	100 "	148 "
Soapstone, etc.....	252 "	400 "
Limestone.....	195 "	595 "

127. [3]*Clearville.*

	Thickness.	Depth.	Formation.
Surface.....	167 feet.	167 feet.	
Shales.....	183 "	350 "	Hamilton.
Limestone.....	165 "	515 "	Corniferous.

Salt water was struck.

[1] Geol. Sur., Can., Vol. XI, 138 S.
[2] Hunt, T. S., Geol. Sur., Can., 66-69, p. 244.
[3] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 109.

128. [1]*Lot 19, Con. 5, Dover.*

	Thickness.	Depth.	Formation.
Sand	15 feet.	15 feet.	
Clay	50 "	65 "	
Shale	60 "	125 "	Hamilton.
Top rock	40 "	165 "	"
Soap	120 "	285 "	"
Middle lime	15 "	300 "	"
Lower soap	35 "	335 "	"
Lower lime	105 "	440 "	Corniferous.
White sand rock	45 "	485 "	"
Dark sand rock	17 "	502 "	"

Salt water at 350 feet and 400 feet.

129. [2]*Dresden.*

Sunk in 1888 by Major Savage of Petrolia.

Surface	43 feet.
Shale, black	180 "
Limestone	12 "
Soapstone	172 "
Limestone	75 "
Sandstone	44 "
Limestone, hard	79 "
	605 feet.

130. [3]*Lot 9, Con. 4, Harwich.*

Drilled prior to 1866. Elevation, 634 A.T.

Clay	163 feet.	
Shale	17 "	Portage.
Shale, black	58 "	
Soapstone	192 "	Hamilton.
Limestone	70 "	
	500 feet.	

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 110.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 73 Q.
[3] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 74 Q.

131. [1]*Harwich.*

Near the village of Harwich, and on the line between Howard and Harwich townships. Log furnished by Richard Ransford of Clinton.

Surface	78 feet.
Shale, black	60 "
" white	23 "
Soapstone	10 "
Limestone, white	15 "
Shale	70 "
Limestone, grey	20 "
Shale, white	100 "
Soapstone	20 "
Limestone, white	24 "
Shale, white	20 "
Limestone, white	5 "
" grey	110 "
" blue	15 "
	570 feet.

[2]"At Stoddard's mills, at the Rondeau and near the level of the lake, the clay was 104, followed by about 60 feet of black shale, and 200 feet or more of soapstone with layers of black shale, below which the well was sunk in limestone to a total depth of 520 feet. No correct record of the boring of this well had been kept, but this approximative statement was obtained from what seemed a trustworthy source."

132. [3]*Con. 4, Howard.*

In con. 4, Howard, on the line of Orford.

Clay	95 feet.
Soapstone and light shales, with a black band near the base	255 "
Limestone, bluish	160 "
Limestone, grey sandy	197 "
Depth	707 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 74 Q.
[2] Hunt, T. S., Geol. Sur., Can., 1866, p. 245.
[3] Hunt, T. S., Geol. Sur., Can., 1866, p. 245.

133. [1]*Lot 23, Con. 14, Orford.*

	Thickness.	Depth.
Soil, quicksand, and clay	240 feet.	240 feet.
Limestone, grey	70 "	310 "
Limestone, pink	100 "	410 "
Limestone, grey	160 "	570 "
Shale, dark	2 "	572 "
Limestone, grey to black	628 "	1,200 "
Shale, black	3 "	1,203 "
Limestone, grey	60 "	1,263 "
Slate or shale, white	237 "	1,500 "
Limestone, grey	10 "	1,510 "
Salt, clear white	171 "	1,681 "
Limestone, pink	19 "	1,700 "
Limestone, grey	240 "	1,940 "
Shale, black	48 "	1,988 "
Limestone, grey and pink	212 "	2,200 "

Oil and water were found in the upper beds of limestone to a depth of 400 feet, and a small showing of oil from 1,681 to 1,700 feet.

134. [1]*Lot 10, Con. 11, Orford.*

Ravey well. Drilled by Hiram Walker and Sons in 1890. Driller, J. S. Hyland. Elevation, 740 A.T.

Surface	160 feet.
Broken limestone	81 "
Shale, white	70 "
Limestone, grey	90 "
Limestone, pink	154 "
"Sandstone," fine white	30 "
"Sandstone," grey	45 "
Limestone, grey	285 "
"Sandstone," fine	85 "
	1,000 feet.

Strong flow of sulphur water at 630; salt water at 965; a show of oil at 470.

[1] 1st Rep. Bur. Mines, Ont., 1891, p. 124.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 75 Q.

135. [1]Lot 23, Con. 14, Orford.

Grant well. Drilled by Hiram Walker and Sons. Driller, J. S. Hyland. Elevation, 691 A.T.

Surface	240 feet.
Broken limestone	10 "
Limestone, pink and grey	140 "
Limestone, white	20 "
"Sandstone," fine grey	30 "
"Sandstone," and limestone, grey and white	60 "
	500 feet.

Oil in small quantities accompanied by water at 318 and 410 feet.

136. [2]Lot 20, Con. 16, Orford.

Bored by M. Woodward in 1896 for Messrs. Whitman and Brinton.

Clay and hard-pan	110 feet.
Gravel and quicksand	102 "
Soapstone; show of oil at bottom	50 "
Limestone	103 "
Soft cutting porous limestone, showing oil	10 "
	375 feet

Yield is claimed to be 50 barrels per day.

137. Lot 23, Con. 8, Raleigh.

Log furnished by W. McIntosh, Petrolia. Driller, T. Drope.

	Thickness.	Depth.
Surface deposits	110 feet.	110 feet.
Top rock	5 "	115 "
Top soapstone	75 "	190 "
Middle lime	5 "	195 "
Lower soapstone	46 "	241 "
Lower lime	158 "	399 "

Gas at 320; oil at 362 to 367 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 76 Q.
[2] Sixth Rep. Bur. Mines, Ont., p. 22.

138. Lot 24, Con. 8, Raleigh.

Log furnished by W. McIntosh, Petrolia. Driller, T. Drope.

	Thickness.	Depth.
Surface deposits	138 feet.	138 feet.
Top soapstone	70 "	208 "
Middle lime	10 "	218 "
Lower soapstone	37 "	255 "
Lower lime	155 "	410 "

Gas at 265; oil at 370 feet.

139. [1]Lot 15, Con. 12, Raleigh.

Elevation by barometer, 627 A.T.

Alluvium	140 feet.
Portage shale	45 "
Hamilton shale	193 "
	378 feet.

140. [2]Lot 18, Con. 12, Raleigh.

The Gurd well. The thickness of the middle lime is less than usual and may be due to error of observation on the part of the driller.

Boulder clay	160 feet.	
Shale	40 "	Hamilton.
Middle lime	2 "	Hamilton.
Shale	73 "	Hamilton.
Lower lime	185 "	
	460 feet.	

Oil yield about 1,000 barrels per day at first, falling in a few months to 25 barrels per day.

[1] Twelfth Rep. Bur. Mines, Ont., p. 41.
[2] Twelfth Rep. Bur. Mines, Ont., p. 41.

141. Lot 18, Con. 14, Raleigh.

Bored in 1909 on the John Millar farm. Well No. 2. Log furnished by the East Tilbury (Canada) Oilfields, Limited. Elevation by barometer, 638 A.T.

	Thickness.	Depth.
Surface deposits	167 feet.	167 feet.
Soapstone	73 "	240 "
Limestone	6 "	246 "
Soapstone	32 "	278 "
Limestone	144 "	422 "

A little gas at 280. Oil at 308 and 344 feet. Yield 5 barrels per day.

142. South Half, Lot 1, Con. 5, Raleigh.

Log furnished by the East Tilbury (Canada) Oilfields, Limited. Bored in 1909. Elevation, about 596 A.T.

	Thickness.	Depth.
Surface deposits	85 feet	85 feet
Soapstone	177 "	262 "
Limestone	628 "	890 "
Gypsum	7 "	897 "
Limestone	564 "	1,461 "
White limestone	6 "	1,467 "

Well 1,473 feet deep. Gas at 1,423; oil at 1,428 feet.

143. Lot 22, Con. 6, Romney.

Bored in 1909 on the Moses Labontie farm. Log furnished by the East Tilbury (Canada) Oilfields, Limited.

	Thickness.	Depth.
Surface deposits	142 feet	142 feet
Soapstone	30 "	172 "
Limestone	144 "	316 "

144. [1] *Thamesville.*

Drilled by Messrs. Fairbank and Company of Petrolia.

	Thickness.	Depth.	Formation.
Sand	4 feet	4 feet	
Blue clay	50 "	54 "	
Stones	15 "	69 "	
[2]Black shale	10 "	79 "	Hamilton.
Top rock	40 "	119 "	"
Soap	130 "	249 "	"
Middle lime	14 "	263 "	"
Soap	33 "	296 "	"
Lower lime	146 "	442 "	Corniferous.

Oil and gas at 356 and 427.

[1]Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 110.
[2] Probably Portage-Chemung.

145. [1] *Lot 6, Con. 9, East Tilbury.*

Elevation, 600 A.T.

	Thickness.	Depth.	Formation.
Boulder clay	95 feet	95 feet	
Grey sand	5 "	100 "	
Clay and gravel	28 "	128 "	
Blue clay shale (upper soap)	37 "	165 "	Hamilton.
Middle lime	10 "	175 "	"
Blue clay shale (lower soap)	67 "	242 "	"
Yellow limestone	158 "	400 "	Corniferous.
Grey, drab, brown, and blue dolomites with gypsum and flint. Shaly series with darker shaly dolomites and more gypsum from 835 to 1,185	1,020 "	1,420 "	Onondaga.
Blue white dolomitic limestone	9 "	1,429 "	Guelph.

Gas at 1,250, 1,362, 1,370, 1,376, 1,382 feet.
Oil at 1,392 to 1,400 and at 1,416 and 1,426 feet.
A little surface gas.

146. South Half, Lot 2, Con. 8, East Tilbury.

Bored in 1909. Well No. 2 on David Fletcher's home farm. Log furnished by the East Tilbury (Canada) Oilfields, Limited.

	Thickness.	Depth.
Surface deposits	101 feet	101 feet
Soapstone	135 "	236 "
Limestone	599 "	835 "
Gypsum	5 "	840 "
Limestone	600 "	1,440 "
Fine white limestone	10 "	1,450 "

Gas at 1,404 feet. Oil at 1,419 and 1,435 feet.

[1] Knight, C. W., 16th Rep. Bur. Mines, Ont., 1907, p. 103.

147. North Half, Lot 3, Con. 15, East Tilbury.

Bored in 1909. Well No. 1 on the John Joyce farm. Log furnished by the East Tilbury (Canada) Oilfields, Limited.

	Thickness.	Depth.
Surface deposits	141 feet	141 feet
Soapstone	69 "	210 "
Limestone	610 "	820 "
Gypsum	5 "	825 "
Limestone	525 "	1,350 "

Gas at 1,212 feet; yield 5,000,000 cubic feet.
Oil at 1,325 feet.

148. [1] *Lot 23, Con. 9, East Tilbury.*

The Romney pool.

	Thickness.	Depth.	Formation.
Drift	148 feet	148 feet	
Soapstone	44 "	192 "	Hamilton.
Big lime			Corniferous.

Oil at 250 to 270 feet in the Corniferous.

149. [2] *Lot 7, Con. 8, Zone.*

Drilled by F. J. Carman. Samples of drillings examined by Dr. Coleman.

Drift	180 feet.
Hamilton shale	33 "
Bluish, grey, calcareous shale	6 "
Bluish, grey limestone	6 "
Pale bluish, or brownish grey to white limestone	158 "
Brown dolomite or dolomitic sandy limestone	5 "
Brown sandstone	11 "
	399 feet.

Small flow of oil at 373-378 feet. Strong flow of salt water at 399 feet.

[1] Knight, C. W., Sixteenth Rep. Bur. Mines, Ont., 1907, p. 103.
[2] Sixth Rep. Bur. Mines, Ont., p. 19.

LAMBTON COUNTY.

150. [1] *Lot 12, Con. 10, Bosanquet.*

The Grand Trunk well.

	Thickness.	Depth.
Clay	90 feet	90 feet
Hard black shale	95 "	185 "
Soft shales	350 "	535 "

151. [2] *Corunna.*

Lot 68, con. 1, Moore.

	Thickness.	Formation.
Clay.....54 Shingle of black shale.....56 Clay.....10	120 feet	Surface deposits.
Shale, black	8 "	Portage and Chemung.
Sandstone, greenish	20 "	
Shale black, with pyrites	185 "	
Grey shale and lime	17 "	Hamilton.
	350 feet	

[1] Hunt, T. S., Geol. Sur., Can., 66-69, p. 248.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 67 Q.

152. [1] *Courtright.*

Courtright Salt Company's well. Sunk in 1884. E. Rawlings, driller. Elevation, 588 A.T.

	Thickness.	Formation.
Surface (sand, etc)..... 132 Hard-pan..... 28	160 feet	
Shale, black.....	32 "	Portage.
Limestone.....	40 "	Hamilton.
Shale and limestone.....	310 "	
Limestone, white.....	50 "	
" grey.....	100 "	Corniferous.
" white, hard.....	370 "	Onondaga, including lower part of Corniferous.
Sandstone.....	32 "	
Limestone,.....	400 "	
" and gypsum.....	136 "	
Salt.....	22 "	
Gypsum.....	13 "	
	1,665 feet	

Salt water at 680 feet. A considerable amount of gas in a few feet of quicksand immediately underlying the hard-pan.

153. [2] *Lot 32, Con. 10, Dawn.*

Log furnished by the driller, W. Harris of Petrolia.

Surface.....	50 feet.
Shale, black.....	70 "
Limestone.....	70 "
Shale and limestone.....	285 "
Limestone.....	225 "

No oil. Salt water at 625 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 68 Q.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 66 Q.

154-155. [1] *Euphemia.*

154. Wilson and Bennett's well.

	Thickness.	Formation.
Surface	53 feet.	
Shales, etc	224 "	Hamilton.
Limestone	93 "	Corniferous.
	370 feet	

Oil, one barrel per day.

154a. Another, The Parson's well, gave the following section:

	Thickness.	Formation.
Surface	58 feet	
Shales, etc	265 "	Hamilton.
Limestone	37 "	Corniferous.
	360 feet	

No oil was found, the only product being salt water, which was struck in a heavy flow at 360 feet.

155. [2] Well drilled by Fairbanks and Carman.

	Thickness.	Depth.	Formation.
Surface clay	48 feet	48 feet	
Top rock	50 "	98 "	Hamilton.
Soap	130 "	228 "	"
Middle lime	20 "	248 "	"
Soap	18 "	266 "	"
Lower lime	120 "	386 "	Corniferous.

Oil at about 366 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 66 Q.
[2] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 114.

156. [1]*Inwood.*

Drilled by the Ohio Oil Company on lot 5, con. 4, Brooke, in 1900. Elevation by barometer about 690 feet.

	Thickness.	Depth.	Formation.
Clay	60 feet.	60 feet.	
Gravel	5 "	65 "	
Shales	85 "	150 "	Hamilton.
Upper lime	15 "	165 "	"
Upper soap	205 "	370 "	"
Middle lime, dark brown	25 "	395 "	"
Lower soap	25 "	420 "	"
Limestone	115 "	535 "	Corniferous.
Dolomites, limestones, and marls with gypsum and salt	1,300 "	1,835 "	Onondaga.
Limestones and dolomites	225 "	2,060 "	Guelph and Niagara.
Dark shales	15 "	2,075 "	Niagara.
Limestone	35 "	2,110 "	Clinton.
Red shales	440 "	2,550 "	Medina.
Light grey shales, with limestone shells	275 "	2,835 "	Hudson River.
Dark shales	175 "	3,000 "	Utica.
Limestone	380 "	3,380 "	Trenton.

Sulphur water at 500. Rock salt at 1,410 to 1,655 with only three small layers of limestone; also at 1,810 to 1835. No oil, gas, nor salt water.

157. [2]*Kingstone Mills, Warwick.*

Clay	14 feet.	
Black shale	50 "	Portage.
Shales, soft, and limestone	396 "	Hamilton.
Limestone, hard	44 "	Corniferous.
	504 feet	

[1] Coste, E., Fifteenth Rep. Bur. Mines, Ont., 1906, p. 111.
[2] Hunt, T. S., Geol. Sur., Can., 1866, p. 247.

159-163. Moore.

Logs furnished by John D. Noble of Petrolia. Wells arranged in order from south to north for each township.

Location.	*West half lot 3, con. 6, Enniskillen.* *No. 159.*	*Lot 5, con. 7, Enniskillen.* *No. 160.*	*East half lot 3, con. 8, Enniskillen.* *No. 161.*	*West half lot 2, con. 9, Enniskillen.* *No. 162.*	*Lot 5, con. 13, Enniskillen.* *No. 163.*
Date of drilling	1905		1904		1905
Driller	A. Forsyth	A. Forsyth	A. Forsyth	A. E. Randall	Geo. Ferguson
Surface	72	74	52	105	130
Black shale	65	65	35	20	0
Top rock	70	75	85	90	50
Upper soapstone	120	120	120	114	130
Middle lime	15	15	15	12	15
Lower soapstone	40	40	45	54	50
Depth to lower lime	382	389	352	395	375
Depth of well	495	500	510	490	490
Gas horizon	450	None	None	416 and 460	450
Oil horizon	None	None	None	416	450

164-169. Moore.

Logs furnished by John D. Noble of Petrolia. Wells arranged in order from south to north for each township.

Location.	*Northeast quarter lot 4, con. 6, Moore.* *No. 164.*	*Northeast part lot 1, con. 8, Moore.* *No. 165.*	*West half lot 1, con. 9, Moore.* *No. 166.*	*East half lot 2, con. 10, Moore.* *No. 167.*	*North half lot 3, con. 11, Moore.* *No. 168.*	*East half lot 4, con. 12, Moore.* *No. 169.*
Date of drilling	1904	1905–06	1907	1907		
Driller	A. Forsyth	A. Fair	A. Forsyth	E. H. Balls	Geo. Ferguson	R. Rainsberry
Surface	123	118	132	150	160	145
Black shale	50	0	0	0	0	0
Top rock	90	90	65	55	50	55
Upper soapstone	120	119	125	125	130	120
Middle lime	10	15	15	12	10	8
Lower soapstone	50	40	45	45	40	50
Depth to lower lime	443	382	382	387	390	378
Depth of well	500	485	491½	499	490	499
Gas horizon	None	447	445	420, 425	410	430
Oil horizon	None	447, 460	445	420, 425	420, 465	445

158. [1]*Lot 3, Con. 10, Moore.*

Drilled by the Moore Oil and Gas Company.

	Thickness.	Depth.	Formation.
Surface	148 feet.	148 feet	
Top rock (upper lime)	45 "	193 "	Hamilton.
Shale (upper soap)	125 "	318 "	"
Limestone (middle lime)	15 "	333 "	"
Shale (lower soap)	47 "	380 "	"
Limestone (lower lime)	111 "	491 "	

Gas at 400 feet. Oil at 445 to 450 feet. Initial production 100 barrels per day.

170 and 171. [2]*Oil Springs.*

170. (East side of field.)

Surface	60 feet.	
Limestone (upper lime)	35 "	Hamilton
Shale (upper soapstone)	101 "	
Limestone (middle lime)	27 "	
Shale (lower soapstone)	17 "	
Limestone (lower lime)	130 "	

171. (West side of field.)

Surface	80 feet.	
Shale (upper soapstone)	116 "	Hamilton.
Limestone (middle lime)	27 "	
Shale (lower soapstone)	17 "	
Limestone (lower lime)	130 "	

Oil is found in both wells at 370 feet, and salt water at 252 feet.

---

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 112.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 62 Q.

172. Lot 18, Con. 2, Enniskillen.

March, 1914.

[1]Fairbanks gas well No. 1.

Surface	75 feet.
Top soap	106 "
Lime	17 "
Lower soap	34 "
Limestone and dolomite	998 "
Salt	35 "
Dolomite	57 "
Salt and hard streak	238 "
Brown dolomite	166 "
Salt	40 "
Dolomite	127 "
Dolomite (light)	5 "
Dolomite gas rock	14 "
Total depth	1,912 feet

[1] Twenty-third Report of the Ontario Bureau of Mines, 1914, p. 36.

173 and 174. Petrolia.

173. Lot 11, con. 11, Enniskillen. Drilled by F. J. Carman in 1900. [1]Log by E. Coste. Elevation, 667 A.T.

	Thickness.	Depth.	Formation.
Clay drift	98 feet.	98 feet.	
Upper lime..... 40 feet Upper soap.....127 " Middle lime..... 18 " Lower soap..... 45 "	240 "	338 "	Hamilton.
Limestone	187 "	525 "	Corniferous.
Sandstone	50 "	575 "	Oriskany.
Limestone and dolomite, grey and brown	630 "	1,205 "	1,545 feet Onondaga
Rock salt mixed with a little dolomite	680 "	1,885 "	
Brown and sandy dolomite	145 "	2,030 "	
Rock salt	90 "	2,120 "	
Limestone	225 "	2,345 "	Guelph and Niagara.
Shales and limestone	50 "	2,395 "	Niagara and Clinton.
Red shales	440 "	2,835 "	Medina.
Blue and black shales	375 "	3,210 "	Hudson River and Utica.
Limestone, grey and dark	567 "	3,777 "	Trenton.

Heavy flow of water from brown soft limestone at 970 feet.

[2]Log of same well by E. T. Corkill.

[1] Fifteenth Report of the Bureau of Mines, Ont., p. 111.

[2] Fourteenth Rep. Bur. Mines, Ont., p. 113.

	Thickness.	Depth.	Formation.
Surface blue clay	90 feet.	90 feet.	
Streaks lime and shale	240 "	330 "	Hamilton.
	190 "	520 "	Corniferous.
Streaks brown, grey, and black dolomite	690 "	1,210 "	Onondaga.
Salt	65 "	1,275 "	"
Dolomite	20 "	1,295 "	"
Salt and thin streaks dolomite	140 "	1,435 "	"
Dolomite	30 "	1,465 "	"
Salt	90 "	1,555 "	"
Salt with light and dark streaks dolomite	50 "	1,605 "	"
Salt	25 "	1,630 "	"
Grey dolomitic lime	10 "	1,640 "	"
Salt	67 "	1,707 "	"
Streaks dolomite and salt	40 "	1,747 "	"
Salt	138 "	1,885 "	"
Grey dolomitic lime and shale	130 "	2,015 "	"
Salt	90 "	2,105 "	"
Dolomitic lime	275 "	2,380 "	Guelph and Niagara.
Shale, red and dark	60 "	2,440 "	Niagara.
	90 "	2,530 "	Clinton.
	275 "	2,805 "	Medina.
Light shales	205 "	3,010 "	Hudson River.
Dark shales	165 "	3,175 "	Utica.
	170 "	3,345 "	Trenton.
	115 "	3,460 "	Birdseye.
	317 "	3,777 "	Chazy.

Thirteen-inch conductor, 98 feet; 7⅝-inch casing, 186 feet; 6¼-inch casing, 1,015 feet.

Log of the same well by W. A. Parks.[1]

	Thickness.	Depth.	Formation.
Blue shale	90 feet.	90 feet.	Hamilton.
Shale and limestone	240 "	330 "	"
Limestones (oil horizon)	190 "	520 "	Onondaga.
Banded grey, brown, and black dolomites	690 "	1,210 "	Monroe?
Salt	65 "	1,275 "	Salina.
Dolomite	20 "	1,295 "	"
Salt and dolomite	140 "	1,435 "	"
Dolomite	30 "	1,465 "	"
Salt	90 "	1,555 "	"
Salt and dolomite	50 "	1,605 "	"
Salt	25 "	1,630 "	"
Grey dolomite	10 "	1,640 "	"
Salt	67 "	1,707 "	"
Dolomite and salt	40 "	1,747 "	"
Salt	138 "	1,885 "	"
Dolomite, limestone, and grey shales	130 "	2,015 "	"
Salt	90 "	2,105 "	"
Dolomites	275 "	2,380 "	Guelph and Niagara.
Red and dark shales	60 "	2,440 "	Cataract (?)
Limestones	90 "	2,530 "	"
Red shales	275 "	2,805 "	Richmond (Queenston).
Grey shales and limestone	205 "	3,010 "	Richmond and Lorraine.
Dark shales	165 "	3,175 "	Collingwood and Utica.
Limestones, etc	170 "	3,345 "	Trenton and Black River.
Limestones	115 "	3,460 "	Lowville (?)
Shale and limestone	317 "	3,777 "	Chazy.

[1] Geol Sur., Can., Guide Book No. 4, p. 100.

174. [1]Test well near the Imperial refinery.

E. Rawlings, driller. Elevation, 667 A.T.

	Thickness.	Formation.
Surface	104 feet.	
Limestone	40 "	Hamilton.
Shale	130 "	"
Limestone	15 "	"
Shale	43 "	"
Limestone	68 "	"
Limestone, soft	40 "	Corniferous.
" grey	25 "	"
" "	135 "	"
Limestone hard, white, with hard streaks of sandstone from 2 to 5 feet in thickness	500 "	Onondaga
Gypsum	80 "	(Including
Salt and shale	105 "	the
Gypsum	80 "	Oriskany
Salt and shale	140 "	if present.)
Total depth	1,505 feet.	

175. [2]*Port Franks, Bosanquet.*

Sunk and operated for salt by Joseph Williams. Elevation, 590 A.T.

Fine sand	60 feet.	260 feet.
Gravel	16 "	
Clay and gravel	178 "	
Gravel	6 "	
Limestone	940 "	
Shale	45 "	
Salt and shale	110 "	
	1,355 feet.	

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 62 Q.
[2] Brumell, H. P. H., Geol. Sur., Can., V, 65 Q.

176. Port Lambton[1].

Depth 1,720 feet.

Blue clay	1– 140	feet
Hard pan and boulders	140– 190	"
Slate and shale	190– 460	"
Limestone. This is the first rock struck at Petrolia	460– 560	"
Calcareous clay rock and gypsum; resembles blue clay	560– 710	"
Hard fine-grained limestone	710– 760	"
Soft porous limestone	760 –830	"
Grey dolomite; very small residue anhydrite, silica, and black pieces of shale	830– 990	"
Grey dolomite; small residue	990–1,030	"
Grey arenaceous limestone; large residue of white sandstone	1,030–1,130	"
Yellowish arenaceous limestone; large residue of white sandstone	1,130–1,200	"
Light grey calcareous sandstone; large residue of white sandstone	1,200–1,220	"
Dirty yellow calcareous sandstone; large residue of white sandstone	1,220–1,250	"
Dark yellow buff ferruginous dolomite; very small siliceous residue	1,250–1,370	"
Bluish grey dolomitic limestone; small residue silica and anhydrite	1,370–1,410	"
Calcareous gypsum, large residue of turbid gypsum, also crystals of anhydrite and silica	1,410–1,450	"
Greyish drab to buff dolomite; medium residue of silica and anhydrite	1,450–1,550	"
Gypseous limestone; large residue of gypsum, anhydrite, and silica	1,550–1,560	"
Calcareous gypseous clay; large residue of clay	1,560–1,570	"
Argillaceous (limestone) dolomite	1,570–1,670	"
Calcareous sandstone	1,670–1,710	"
Calcareous clay shale. Salty taste	1,710–1,720	"
Soft bluish grey limestone	1,720–	"

[1] Geological Survey of Michigan, Vol. 5, pl. 58, 1895.

177-180. [1]*Sarnia.*

At King's grist mill. Sunk in 1875. Driller, E. Rawlings. Elevation, 589 A.T.

	Thickness.	Formation.
Surface sand..... 9 Blue clay..... 109 "Hard-pan"..... 2	120 feet.	
Shale, black.....	36 "	Portage.
Limestone.....	30 "	Hamilton
Shale.....	263 "	"
Limestone.....	5 "	"
Shale.....	40 "	"
Limestone.....	60 "	"
Limestone, grey.....	100 "	Corniferous.
Limestone, hard.....	546 "	Onondaga, including
Limestone, hard and flinty.....	200 "	lower part of
Limestone, with gypsum.....	105 "	Corniferous.
	1,505 feet.	

Fresh water at 120 feet beneath the hard-pan, salt water at 654 feet, and gas in small quantities at 400 feet.

178. [1]Sunk in 1887 by N. C. Peterson and Sons. Driller, H. Mitchell. Elevation, about 615 A.T.

Surface.....	200 feet.	
Shale, black.....	15 "	Portage.
Limestone.....	150 "	Hamilton, including upper part of Corniferous.
Shale.....	85 "	
Limestone.....	5 "	
Shale.....	60 "	
Limestone.....	170 "	
	685 feet.	

Small flows of gas at 330 and 515 feet. Salt water in the last few feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V 69 Q.

179. [1]Agricultural works well.
Driller, H. Mitchell. Elevation, about 615 A.T.

Surface	130 feet.	
Shale, black	80 "	Portage.
Limestone	80 "	
Shale	160 "	
Limestone	5 "	
Shale	60 "	
Limestone	150 "	
Depth	665 feet.	

Gas in small quantities at 515 and salt water at 645.

180. [2]The Dickens well, near the corner of Rose and Tecumseh streets, in the southern part of the town. Driller, H. Mitchell. Elevation, 607 A.T.

		Thickness.	Formation.
Surface	130	200 feet	Surface deposit.
Hard-pan	55		
Gravel	15		
Limestone		90 "	Hamilton.
Shale		100 "	"
Limestone		5 "	"
Shale		68 "	"
Limestone		77 "	"
		540 feet	

Gas at 473 feet. Yield about 20,000 cubic feet, used for lighting.

181. [3] *Lot 15, Block A, Indian Reserve, Sarnia Township.*

	Thickness.	Formation.
Surface	124 feet	
Shale, with hard streaks	32 "	Portage.
Shale, and limestone	324 "	Hamilton.
Limestone	15 "	"
	495 feet	

At 480 feet gas accompanied by oil and salt water; gas estimated at 20,000 cubic feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 70 Q.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 70 Q.
[3] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 68 Q.

182. [1] *West Half, Lot 2, Con. 6, Sarnia.*

Log furnished by the Imperial Oil Company. Drilled 1898. Driller, H. McCort.

	Thickness.	Depth.	Formation.
Surface deposits	104 feet	104 feet	
First lime	43 "	147 "	Hamilton.
First soapstone	129 "	276 "	"
Middle limestone	7 "	283 "	"
Soapstone	58 "	341 "	"
Lower lime	136 "	477 "	

Oil at 430 feet.

183. [2] *Lot 5, Con. 6, Sarnia.*

Log furnished by the Imperial Oil Company. Drilled 1898. Driller, Jas. McCort.

	Thickness.	Depth.	Formation.
Surface deposits	112 feet	112 feet	
First lime	30 "	142 "	Hamilton.
First soapstone	143 "	285 "	"
Second lime	8 "	293 "	"
Second soapstone	60 "	353 "	"
Lower lime	117 "	470 "	

Oil at 412 feet.

[1] Files of Water and Borings Division.
[2] Files of Water and Borings Division.

184. [1] *South ½, Lot 3, Con. 7, Sarnia.*

Log furnished by the Imperial Oil Company. Drilled in 1897. Driller, H. Bevans.

	Thickness.	Depth.	Formation.
Surface deposits	100 feet	100 feet	
First lime	25 "	125 "	Hamilton.
First soap	150 "	275 "	"
Second lime	5 "	280 "	"
Second soap	50 "	330 "	"
Lower lime	156 "	486 "	

Oil at 437 feet.

185. [1] *Lot 7, Con. 7, Sarnia.*

Log furnished by the Imperial Oil Company, Drilled 1898.

	Thickness.	Depth.	Formation.
Surface deposits	124 feet	124 feet	
Top rock	51 "	175 "	Hamilton.
Top soap	122 "	297 "	"
Middle lime	5 "	302 "	"
Lower soap	60 "	362 "	"
Lower lime	123 "	485 "	

Oil at 475 feet.

[1] Files of Water and Borings Division.

186. [1] *Widder Station.*

	Thickness.	Depth.
Clay	34 feet	34 feet
Soft shale, etc	196 "	230 "
Limestone	120 "	350 "

A little oil at 196 feet.

187. [1] *Wyoming.*

Lot 15, con. 1, Plympton. Elevation, about 697 A.T.

	Thickness.	Formation.
Surface	104 feet	
Black shale	4 "	Portage.
Limestone	40 "	Hamilton.
Shale	130 "	"
Limestone	15 "	"
Shale	43 "	"
Limestone	68 "	"
Limestone, soft	40 "	Corniferous.
" grey	36 "	"
	480 feet	

Oil in small quantities accompanied by a copious flow of saline water.

[1] Hunt, T. S., Geol. Sur., Can., 66-69, p. 248.
[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 64 Q.

LINCOLN COUNTY.

188. [1] *St. Catharines.*

Sunk by the St. Catharines Natural Gas Company, in 1888, on lot 4, con. 3, Louth. Elevation, 297 A.T.

	Thickness.	Formation.
Surface	90 feet	
Red shale	548 "	Medina.
Blue shale	700 "	Hudson River
Black to blue shale	168 "	and Utica.
Limestone	667 "	Trenton.
White quartzose sandstone	27 "	
	2,200 feet	

Large quantities of fresh water were met in a bed of gravel 7 or 8 feet thick at a depth of 57 feet from the surface, and at 220 feet saline waters were met with. A small pocket of gas was struck at 275 feet and about 4,000 cubic feet per day in the Trenton at 2,185 feet.

[2] MANITOULIN ISLAND.

Wells drilled by the Northern Oil and Gas Company in 1905 about 2 miles southeast of Wekwemikong. The wells are 500 or 600 feet apart.

189. No. 1.

	Thickness.	Formation.
Limestone	50 feet	Niagara.
Light shale	250 "	Hudson River
Grey shale	62 "	and Utica.
Black shale	21 "	
Limestone	137 "	Trenton.
	520 feet	

Gas at 398 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 32 Q.
[2] Fifteenth Rep. Bur. Mines, Ont., 1906, p. 72.

190. No. 2.

	Thickness.	Formation.
Surface	34 feet	
Limestone and shales	90 "	Niagara and Hudson River
Light shale	161 "	Hudson River and Utica.
Grey shale	65 "	
Black shale	9 "	
Limestone	50 "	Trenton.
	409 feet	

Gas and oil at 380 feet.

191. No. 4.

	Thickness.	Formation.
Sand	15 feet	
Limestone	50 "	Niagara.
Light shale	250 "	Hudson River
Dark shale	70 "	"
Black shale	22 "	Utica.
Limestone	.....	Trenton.

Trenton limestone was struck at 407 feet and salt water at 438 feet.

192. No. 5.

	Thickness.	Formation.
Sand	14 feet	
Limestone	50 "	Niagara.
Light shale	250 "	Hudson River and Utica.
Dark shale	94 "	
Black shale	12 "	

Limestone was struck at 420 feet and oil at 437 feet.

193. Hunt gives the following log of a well sunk in the sixties on the island south of Wekwemikong bay.

	Thickness.	Depth.
Surface	32 feet	32 feet
Black shale	100 "	132 "
Limestone	340 "	472 "
Red siliceous sandstone, the lower 20 feet very hard	52 "	524 "

Saline water at 192 feet. Veins of oil at 193, 248, and 270 feet. It is said that 120 barrels of oil were obtained from this well.[1]

MIDDLESEX COUNTY.

194 and 195. [2]*Ailsa Craig.*

194. Drilled in 1866.

	Thickness.	Depth.
Clay	75 feet	75 feet
Soft shale, etc	185 "	260 "
Limestone	113 "	373 "

At 15 feet in the limestone a little oil was met.

195. Another well, near the above, showed, according to the driller, the following section:

Surface	65 feet.
Limestone	5 "
Soapstone	6 "
Limestone	80 "
Soapstone	50 "
Limestone	144 "
	350 feet.

[1] Geol. Sur., Can., 1863-66, p. 253.
[2] Hunt, T. S., Geol. Sur., Can., 1866-69, p. 248.

196. [1]*Biddulph.*

About 5 miles northeast of Lucan. Surface deposits 100 feet thick rest on limestone which was penetrated 260 feet. Abundant supply of fresh water from the limestone. No oil or gas.

197. [2]*Glencoe.*

Log furnished by John Savage of Petrolia.

	Thickness.	Formation.
Surface	134 feet.	
Limestone	100 "	Hamilton.
Soapstone	162 "	"
Limestone, white	80 "	"
"	486 "	Corniferous and Onondaga, probably 200 feet of Corniferous.
Sandstone	38 "	Onondaga.
Limestone, hard	260 "	"
Gypsum	5 "	"
"Hard rock"	15 "	"
Gypsum	3 "	"
"Hard rock"	7 "	"
Salt and shale	104 "	"
"Hard rock"	116 "	Probably terminating in the Guelph.
Total depth	1,510 "	

"Hard rock" means dolomite, and "Soapstone" means the shales of the Hamilton formation. A strong flow of mineral water in the so-called sandstone

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 53 Q.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 51 Q.

198 and 199. [1]*London.*

198. On the grounds of the hospital for the insane. Log furnished by W. Harris of Petrolia. Elevation, about 880 A.T.

	Thickness.	Formation.
Surface	130 feet.	
Limestone, hard	200 "	Corniferous.
" soft	270 "	Onondaga with Guelph and Niagara, if present.
" hard	100 "	
"	600 "	
Salt and shale	100 "	
Black shale	200 "	Clinton.
Red shale	500 "	Medina.
Limestone and shale	150 "	Hudson River.
	2,250 "	

199. [2]Well at sulphur spring. Sunk prior to 1865.

Surface clay	70 feet.
Soft grey shale, including a band of hard black bituminous shale	20 "
Limestone	600 "
Soft magnesian marl	75 "
	765 "

Sulphur water at 114 feet with a flow of about 1,000 gallons per hour.

200. [3]*Lot 13, Con. 4, London.*

The Sunnyside well. Clay 103 feet; followed by a few feet of soft shale reposing on limestone. Depth 400 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 49 Q.
[2] Brumell, H. P. H., Geol., Sur., Can., Vol. V, 50 Q.
[3] Hunt, T. S., Geol. Sur., Can., 1866, p. 249.

201. [1]*Lot 24, Con. 13, Metcalfe.*

	Thickness.	Formation.
Surface (clay)	48 feet.	
Black shale	75 "	Portage.
Soapstone, etc	273 "	Hamilton.
Limestone	104 "	Corniferous ?
	500 feet.	

202. [1]*Lot 5, Con. 7, Mosa.*

	Thickness.	Formation.
Surface (clay)	50 feet.	
Black shale	10 "	Portage.
Soapstone, etc	230 "	Hamilton.
Limestone	262 "	Corniferous ?
	552 "	

203. [1]*Lot 3, Con. 4, Mosa.*

	Thickness.	Formation.
Surface (clay)	88 feet.	
Black shale	6 "	Portage.
Soapstone, etc	243 "	Hamilton.
Limestone	177 "	Corniferous ?
	514 "	

204. [1]*Parkhill.*

Sunk in 1884 by the Parkhill Salt Works Company. Depth 1,300 feet. Surface deposits 170 feet thick, underlain by limestone. The well passed through one salt bed and 20 feet into another.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 52 Q.

205. [1]*Strathroy.*

Lot 20, con. 5, Adelaide.

Surface.....	100 feet.	
Soft shale.....	50 "	Hamilton.
Hard limestone.....	150 "	Corniferous?
	300 "	

206. [2]*Lot 15, Con. 15, West Williams.*

Sunk in 1888. Depth 200 feet. Surface deposits 175 feet thick. Gas in small quantities at 180 to 195 feet.

NORFOLK COUNTY.

207. [3]*Delhi.*

At the Darby hotel near the Grand Trunk Railway station. Drilled in 1908. Driller, J. F. Carmody. Depth, 1,218 feet. Elevation, 756 A.T. Water at 200 and 205 feet. Gas in Clinton, Red and White Medina, but chief yield is from the top of the Red Medina.

208. [4]*Lynedoch.*

Sunk on Big creek in 1869 or 1870. Depth 600 feet. Surface deposits 100 feet thick; below which black shales were found. Sulphur water and a small quantity of gas at 600 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 51 Q.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 53 Q.
[3] Files of Water and Borings Division.
[4] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 48 Q.

209. Lynedoch.

Well drilled by the Dominion Natural Gas Company in 1910. Driller, A. R. Craise.

Driller's log:

	Thickness.	Depth.
Surface	195 feet.	195 feet.
Slate (black)	10 "	205 "
Limestone	60 "	265 "
Shale	140 "	405 "
Limestone	225 "	630 "
Shale and limestone	390 "	1,020 "
Niagara limestone	240 "	1,260 "
Niagara shale	55 "	1,315 "
Clinton limestone	21 "	1,336 "
Red Medina	35 "	1,371 "
Blue shale	60 "	1,431 "

No white Medina was struck and the well finished in red shale. Gas at 18 feet in the Clinton.

210. Port Dover.

On the Anderson lot. Log furnished by the Dominion Natural Gas Company, Limited. Sunk in 1906. Elevation, 584 A.T.

	Thickness.	Depth.
Surface deposits	28 feet.	28 feet.
Flint	218 "	246 "
Lime and shale	364 "	610 "
Niagara	280 "	890 "
Shale	34 "	924 "
Clinton	10 "	934 "
Red Medina	40 "	974 "
White shale	76 "	1,050 "
White Medina	12 "	1,062 "
Red shale	8 "	1,070 "

Dry hole.

211. [1]*Port Rowan.*

Elevation, about 622 A.T.

	Thickness.	Depth.	Formation.
Surface clay	300 feet.	300 feet.	
Grey limestone	63 "	363 "	Corniferous.
Greyish blue limestone	77 "	440 "	"
Dark brown limestone	30 "	470 "	"
Bluish grey limestone	94 "	564 "	"
White and blue granular limestone	21 "	585 "	Corniferous or Oriskany.
Greyish blue dolomite	435 "	1,020 "	Onondaga.
White sugary limestone	290 "	1,310 "	Niagara.
Drab and argillaceous limestone	10 "	1,320 "	Clinton
Red and blue sandstone	140 "	1,460 "	Medina.

212. Port Ryerse.

The Smith well. Log furnished by the Dominion Natural Gas Company, Limited. Sunk in 1909.

	Thickness.	Depth.
Surface deposits	112 feet.	112 feet.
Flint	168 "	280 "
Sand	70 "	350 "
Lime	90 "	440 "
Lime and shale	310 "	750 "
Niagara	212 "	962 "
Shale	58 "	1,020 "
Clinton	22 "	1,042 "
Red Medina	16 "	1,058 "
White shale	83 "	1,141 "
White Medina	18 "	1,159 "
Red shale	16 "	1,175 "

Gas at 1,053 feet.

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 108.

213. St. Williams.

Southeast part lot 24, con. 1, South Walsingham. Log furnished by the Dominion Natural Gas Company, Limited.

	Thickness.	Depth.
Surface deposits	284 feet.	284 feet.
Flint	171 "	455 "
Sand	115 "	570 "
Lime and shale	330 "	900 "
Niagara	320 "	1,220 "
Shale	43 "	1,263 "
Clinton	22 "	1,285 "
Shale	3 "	1,288 "
Red Medina	22 "	1,310 "
Shale	75 "	1,385 "
White Medina	27 "	1,412 "
Red shale	8 "	1,420 "

Dry hole.

214. [1]*Simcoe.*

Simcoe Natural Gas Company. Drillers, Carmody Bros. Log furnished by drillers. Elevation by barometer, 675 A.T.

	Thickness.	Depth.	Formation.
Surface deposits.....	98 feet.	98 feet.	
Hard rock.....	102 "	200 "	Corniferous and Onondaga.
Limestone.....	70 "	270 "	" "
Shale and gypsum...	70 "	340 "	" "
Limestone.....	60 "	400 "	" "
Shale.....	3 "	403 "	" "
Limestone.....	42 "	445 "	" "
Shale.....	5 "	450 "	" "
Limestone.....	95 "	545 "	" "
Shale.....	5 "	550 "	" "
Limestone.....	315 "	865 "	Lower Onondaga, Guelph
Shale.....	80 "	945 "	and Niagara.
Limestone.....	45 "	990 "	Clinton.
Shale.....	5 "	995 "	"
Red sandstone.....	20 "	1,015 "	Medina.
Shale.....	65 "	1,080 "	"
White sandstone....	5 "	1,085 "	"
Red shale.....	690 "	1,775 "	"
White shale.....	625 "	2,400 "	Hudson River.
Brown shale.....	144 "	2,544 "	Utica.
Limestone.....	158 "	2,702 "	Trenton.

A little gas at 98 feet; sulphur water. Another well was drilled in this town in 1909, but without striking gas.

[1] Geol. Sur., Can., Vol. VI, 104 S.

215. Vittoria.

Lot 21, con. 3, Charlotteville. The R. W. McColl well. Log furnished by the Dominion Natural Gas Company, Limited. Elevation, 658 A.T.

	Thickness.	Depth.
Surface	137 feet.	137 feet.
Flint	218 "	355 "
Sand	45 "	400 "
Lime	70 "	470 "
Shale and lime	250 "	720 "
Niagara lime	300 "	1,020 "
Shale	82 "	1,102 "
Clinton sand	12 "	1,114 "
Red Medina sand	16 "	1,130 "
White shale	80 "	1,210 "
White Medina	10 "	1,220 "
Red shale	480 "	1,700 "
White slate and lime	125 "	1,825 "
Red slate	100 "	1,925 "
White slate and lime	350 "	2,275 "
Brown slate	415 "	2,690 "
Trenton	392 "	3,082 "

Small flow of gas at 1,120 feet; 137 feet of 8-inch drive pipe and 1,037 feet of 5⅝-inch casing. Well abandoned.

ONTARIO COUNTY.

216. [1] *Whitby.*

Sunk in 1888 by the Whitby Gas and Water Company on lot 28, 7th double range, west of Brock street.

	Thickness.	Formation.
Surface	50 feet	
Shale	70 "	Utica.
Limestone	600 "	Trenton.
"Arkose" beds	8 "	To granite.
	728 feet	

Small quantities of gas were found at 400 and 700 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 24 Q.

OXFORD COUNTY.

217. [1] *Beachville.*

South half, lot 18, con. 2, North Oxford, 1 mile west of the village. Sunk in 1908-09 by the Standard White Lime Company, Limited. Elevation, 893 A.T. Driller's log:

	Thickness.	Depth.	Formation.
Surface deposits	8 feet	8 feet	
Limestone, grey, blue, and light brown	232 "	240 "	Corniferous.
Dark coloured limestone or dolomite, gypsum, and blue shales	500 "	740 "	Onondaga.
Dolomite, grey, light brown, and blue	226 "	966 "	Guelph and Niagara.
Soft blue shales	34 "	1,000 "	Niagara.
Light brown dolomite	25 "	1,025 "	Clinton.
Blue to greenish, and soft shale	65 "	1,090 "	Medina.
Calcareous sandstone	35 "	1,125 "	"
Red shales	440 "	1,565 "	"
Blue shales	610 "	2,175 "	Hudson River
Black bituminous shales	85 "	2,260 "	Utica.
Limestone, light brown to whitish	529 "	2,789 "	Trenton.

Granite at 2,789 feet. Fresh water at 42 feet; sulphur water at 90 and 150 feet; salt water at 665 feet.

218. [2] *Burgessville.*

Sunk in 1887. Depth 605 feet. No log. Drift 165 feet thick.

Light blue shale, slightly calcareous	280 feet.
Same as preceding, with gypsum	300 "
Cream coloured dolomite	367 "
Light brown dolomite	400 "
Dark blue shale	550 "

No gas or oil. Sulphur water at 185 feet.

[1] Files of Water and Borings Division.
[2] Brumell, H. P. H., G.S.C., Vol. V, 47 Q.

219. [1] *Norwich.*

Well on property of Geo. A. Cook drilled by Duncan Sinclair; depth 2,000 feet. Fresh water at 800 feet. Another well 500 feet deep. Drift 80 feet. A trace of oil at 150 feet.

220. [2] *Tillsonburg.*

Sunk to 854 feet in 1865-66 by Messrs. Hibbard and Avery; reopened in 1873 and carried to a depth of 1,450 feet and in 1877 continued to a depth of 1,750 feet.

	Thickness.	Formation.
Surface	36 feet	
Limestone	160 "	Corniferous.
Dolomites and limestones	694 "	Probably Onondaga.
Red marl	35 "	Onondaga.
Dark shale	825 "	
	1,750 feet	

The 825 feet termed by the driller "dark shale" probably includes the Guelph, Niagara, Clinton, and part of the Medina. Several wells have been bored in and around Tillsonburg and from nearly all of them small quantities of gas arose from the Corniferous limestone.

PEEL COUNTY.

221. [3] *Brampton.*

Sunk by E. Hayden in 1909-10 to a depth of 1,575 feet. No gas or oil.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 47 Q.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 46 Q.
[3] Files of Water and Borings Division.

222. [1] *Clarkson.*

On Lake Ontario about 18 miles west of Toronto. Elevation, about 266 A.T. Driller's log:

	Thickness.	Depth.	Formation.
Surface deposits	4 feet	4 feet	
Shale	650 "	654 "	Hudson River
Shale	150 "	804 "	Utica.
Limestone	657 "	1,461 "	Trenton.
Granite	11 "	1,472 "	Archæan.

223. [2] *Cooksville.*

Sunk by R. Roumegon in 1909. Depth 1,010 feet. Gas in small quantity.

PERTH COUNTY.

224. [3] *Dublin.*

Sunk in 1873. Depth 1,396 feet. Surface about 75 feet, beneath which was limestone 520 feet thick. At 600 feet gypsiferous marls were met. No salt bed.

225. [4] *Listowell.*

Driller, John McEwan. Depth 1,200 feet. No salt bed.

226. [5] *Mitchell.*

Depth 2,008 feet. At 1,570 feet red shale 300 feet thick and probably of Medina age was met. No salt bed struck.

227. [6] *St. Marys.*

Sunk about 1863. Depth 700 feet. Traces of petroleum at 700 feet are said to have been observed.

---

[1] Files of Water and Borings Division.
[2] Files of Water and Borings Division.
[3] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 60 Q.
[4] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 60 Q.
[5] Smith, J. Lionel, Geol. Sur., Can., 1874-75, p. 288.
[6] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 60 Q.

228. [1] *Stratford.*

Drilled in 1890. Elevation, about 1180 A.T.

	Thickness.	Depth.	Formation.
Drift	143 feet	143 feet	
Limestones and dolomites	1,159 "	1,302 "	Onondaga, Guelph, Niagara, and Clinton.
Red, blue, and black shales	1,044 "	2,346 "	Medina, Hudson River, and Utica.
Limestones	40 "	2,386 "	Trenton.

Strong smell of oil in Utica shales above the Trenton. Salt water at 2,385 feet.

PETERBOROUGH COUNTY.

229. [2] *Peterborough.*

On the Kinrade farm. Driller, Jas. Peat and Sons. Depth 312 feet.

PRESCOTT COUNTY.

230. [3] *Fournier.*

Boring in 1903 for gas or oil. In August, the well had reached a depth of 800 feet, and a small flow of gas was reported as struck at 185 feet. According to H. M. Ami, black bituminous shales were found at the following depths; 645, 675, 680, 685, 690, 695, 700, 705, and 710 feet, and Trenton limestone at 790 feet.

RENFREW COUNTY.

231. [4] *McKay Township.*

Sunk in 1888 some 4 miles west of Pembroke. No gas or oil.

[1] Coste, E., 15th Rep. Bur. Mines, Ont., 1906, p. 110.
[2] Files of Water and Borings Division.
[3] Files of Water and Borings Division.
[4] Brumell, H. P. H., G.S.C., Vol. V, 23 Q.

232. [1] *Renfrew.*

Drilled by J. Jameson in 1907-8. Driller, Jas. Peat and Sons. Depth, 709 feet. Water at 600 feet.

RUSSELL COUNTY.

Some boring has been done at Carlsbad Springs, but without the discovery of gas or oil.

SIMCOE COUNTY.

233. [2] *Barrie.*

Numerous drive wells, average depth 250 feet. Abundance of fresh water rising to a height of 20 feet above the level of Lake Simcoe. No gas.

234-235. [3] *Beeton.*

234. The Lilley well sunk in 1882 or 1883 in the north part of Beeton. Depth 1,400 feet. Gas from a soft sand rock at the base of the surface deposits, and smaller quantities throughout the rock to a depth of 500 feet. A small flow of salt water near the bottom of the well.

235. Jones' well, sunk in Jones' brick-yard struck gas in a bed of gravel 3 feet thick at a depth of 190 feet.

236-239. [4] *Collingwood.*

All the wells are in the Trenton formation, which here has a thickness of about 600 feet.

236. Well on lot 16, west side of Peel street, sunk 1888.

	Thickness.	Formation.
Drift	10 feet	
Limestone	543 "	Trenton.
Granite		

Gas in small quantities at 140 and 160 feet; on torpedoing, the well filled with water.

[1] Files of Water and Borings Division.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 28 Q.
[3] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 28 Q.
[4] Brumell, H. P. H., Geol., Surv., Can., Vol. V, 26 Q.

237. Well on lot 21, east side of Oak street.

Depth 542 feet, 2 feet of which was drift. Gas at 160 feet; yield 4,000 cubic feet. Free from water.

238. Well about half a mile to the southeast of the preceding.

Four feet of drift and 460 feet of limestone. Small quantity of gas at 175 feet. Almost entirely free from water.

239. Well in rear of the Hurontario flour mill in east part of Collingwood, bored by Chas. McDonell.

Depth, 351 feet. Gas at 150 feet; about 2,000 cubic feet.

240. [1] *Orillia.*

Surface deposits.....	170 feet.
Trenton limestone.....	130 "
Granite.	

No gas; small quantities of water.

241. [2] *Lot 14, Con. 14, Tiny.*

Sunk by John Evans. Driller, Thos. B. Keeling.

	Thickness.	Depth.
Clay.....	162 feet	162 feet
Sand.....	45 "	207 "
Hard clay.....	190 "	397 "
Boulders.....	12 "	409 "
Gravel.....	3 "	412 "

STORMONT COUNTY.

242. Moncklands.

Sunk by the Canadian Pacific railway near the station to a depth of at least 1,000 feet.

[1] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 28 Q.
[2] Files of Water and Borings Division.

WATERLOO COUNTY.

243. [1]*Berlin.*

Elevation, 1080 A.T. · Driller's record:

Surface	187	feet.
Limestone	320	"
"Hard rock"	40	"
Limestone	200	"
Shale, red	180	"
" green	160	"
Slate, blue	170	"
	1,270	feet

Mineral water at 540 feet.

244. [2]*Waterloo.*

Sunk in 1867. Elevation, about 800 A.T.

	Thickness.	Formation.
Surface	130 feet.	
Limestone	40 "	Onondaga.
Gypsum	17 "	"
Shale	20 "	"
Limestone	340 "	Guelph, Niagara, and Clinton.
Shale, blue	114 "	Clinton and Medina.
Shale, red	459 "	Medina.
	1,120 feet	

Bitter saline water at 800 and 900 feet. A well in Waterloo, presumably this one, was afterwards deepened to 1,800 feet by John McEwen.

[1] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 42 Q.
[2] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 41 Q.

WELLAND COUNTY.

245. [1]*Lot 6, Con. 15, Bertie.*

Provincial Natural Gas and Fuel Company. Elevation, 605 A.T.

	Thickness.	Depth.	Formation.
Clay	38 feet.	38 feet.	Drift.
Dolomites, grey and drab, black shale and gypsum	300 "	338 "	Onondaga.
Grey dolomite	230 "	568 "	Guelph and Niagara.
Blue shales	60 "	628 "	Niagara
White and grey limestones	32 "	660 "	Clinton.
Red sandstone	83 "	743 "	Medina.
Blue shale	15 "	758 "	"
White sandstone	16 "	774 "	"
Red shales	850 "	1,624 "	"
Blue shales	730 "	2,354 "	Hudson River.
Black shales	171 "	2,525 "	Utica.
White and grey limestones	685 "	3,210 "	Trenton.
Yellowish sandstone	45 "	3,255 "	Calciferous.
Mica schist	2 "	3,257 "	Archæan.

A little gas in red Medina sandstone. Salt water at 470 feet.

[1] Coste, E., Jour. Can. Min. Inst., III, 76.

246. [1]*Lot 35, Con. 3, Bertie.*

Well No. 1 of the Provincial Natural Gas and Fuel Company. Sunk 1889. Elevation 618 A.T.

	Thickness.	Formation.
Surface	2 feet.	
Dark grey lime	23 "	Corniferous.
Grey and drab dolomites, black shales, and gypsum	390 "	Onondaga.
Grey dolomite	240 "	Guelph and Niagara.
Black shales	50 "	Niagara.
White crystalline dolomite, grey towards bottom	30 "	Clinton.
Red sandstone	55 "	Medina.
Red shales	10 "	"
Blue shales	5 "	"
White sandstone	5 "	"
Blue shale	20 "	"
White sandstone "Gas rock"	16 "	"
	846 feet	

Fresh water cased off at 284 feet; salt water struck at 548 feet, and a little salt water in the Clinton. Gas at 836 feet in the second bed of white Medina sandstone; yield 2,050,000 cubic feet.

247. [2]*Lot 12, Con. 6, Crowland.*

	Thickness.	Depth.	Formation.
Surface	120 feet.	120 feet.	
Dolomites and shales	120 "	240 "	Onondaga.
Grey dolomites	233 "	473 "	Guelph and Niagara.
Blue shales	55 "	528 "	Niagara.
White limestone	30 "	558 "	Clinton.
Red sandstone and shales	61 "	618 "	Medina.
White sandstone	12 "	631 "	"
Blue shales	11 "	642 "	"
White sandstone	18 "	660 "	"

Casing to 475 feet. Gas at 538 feet.

[1] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 37 Q.
[2] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 104.

248, 249. [1]*Con. 3, Humberstone.*

No. 20 on lot 11 and No. 28 on lot 12. Provincial Natural Gas and Fuel Company.

	Thickness.		Formation.
	No. 20.	No. 28.	
Surface deposits	63 feet.	72 feet.	Drift.
Drab and grey dolomites	282 "	273 "	Onondaga.
Grey dolomite	240 "	240 "	Guelph and Niagara.
Black shale	50 "	50 "	Niagara.
White crystalline dolomite	30 "	25 "	Clinton.
Red sandstone	55 "	55 "	Medina.
Red shale	10 "	10 "	"
Blue shale	5 "	5 "	"
White sandstone	5 "	5 "	"
Blue shale	20 "	20 "	"
White sandstone	22 "	29 "	"
	782 feet	784 feet	

No. 20. Gas and oil at 761 and 764 feet, gas 300,000 cubic feet, oil 2 barrels. Salt water at 540 feet.

No. 28. Oil and a very little gas at 768 feet; oil two barrels. Salt water was cased off at 580 feet.

250 [2]*Lot 9, Con. 2, Humberstone.*

Granite was struck at 3,300 feet.

[1] Geol. Sur., Can., Vol. V, 122 SS.
[2] Geol. Sur., Can., Vol. XIV, 165 A.

251. [1]*Niagara Falls South.*

Lot 158, Stanford. Sunk, 1888.

	Thickness.	Formation.
Surface	43 feet.	
Limestone	143 "	Niagara.
Shale	24 "	"
Shale	140 "	Clinton.
White quartzose sandstone	24 "	Medina.
Shale and sandstone	466 "	"
	840 feet	

Gas, estimated at 4,000 cubic feet, was struck at 215 feet in the Clinton formation. Immediately south of this well another was sunk on lot 172 to a depth of 1,000 feet.

252. [2]*Point Abino, Bertie.*

Provincial Natural Gas and Fuel Company. Elevation, 580 A.T.

	Thickness.	Depth.	Formation.
Sand	10 feet.	10 feet.	Drift.
Grey limestones with flint	82 "	92 "	Corniferous.
Grey and drab dolomite, blue shales, and gypsum	388 "	480 "	Onondaga.
Grey dolomites	235 "	715 "	Guelph and Niagara.
Blue shales	55 "	770 "	Niagara.
White limestone	30 "	800 "	Clinton.
Red sandstone	80 "	880 "	Medina.
Blue shale	13 "	893 "	"
White sandstone	17 "	910 "	"

Gas in large quantities at 500, 530, and 580 feet. Gas at 902 feet. Salt water at 600 to 630 feet.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 36 Q.
[2] Coste, E., Jour, Can. Min. Inst., III, 76.

253. [1]*Port Colborne.*

Well No. 1 of "The Port Colborne Natural Gas, Light, and Fuel Company" sunk in 1885 on Charlotte street.

	Thickness.	Formation.
Surface	12 feet.	
Grey limestone	13 "	Corniferous.
" "	7 "	Onondaga and Lower Helderberg.
Dolomite	3 "	"
Shale and dolomite	55 "	"
Dolomite and gypsum	57 "	"
Dolomite	108 "	"
Shales and dolomite with gypsum	185 "	"
Shaly dolomite	30 "	Guelph and Niagara.
Brown dolomite and dark blue shales towards bottom	188 "	" "
Marls and dolomite	72 "	Clinton.
Red shales with thin bands of white sandstone	50 "	Medina.
Red and white sandstone	53 "	"
Soft red shales with bands of grey and green	667 "	"
	1,500 "	

Fresh water at 26 feet; strong saline water with sulphuretted hydrogen at 452 feet. Small flows of gas at 150, 252, and 415; main flow at 764 feet; yield, 25,000 cubic feet.

[1] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 34 Q.

254. [1]*Ridgeway.*

Well of the Bertie Natural Gas Company. Driller, Carmody Bros.

	Thickness.	Depth.
Flinty limestone	60 feet.	60 feet.
Shale and gypsum	90 "	150 "
Hard shale	5 "	155 "
Shaly rock	30 "	185 "
Slate and gypsum	15 "	200 "
Slate and shale	230 "	430 "
Limestone	115 "	545 "
Siliceous limestone, salt water	15 "	560 "
Hard limestone	110 "	670 "
Slate	50 "	720 "
Clinton limestone	10 "	730 "
Shale	10 "	740 "
Red Medina sandstone	70 "	810 "
Sandstone, salt water	5 "	815 "
Light coloured sandstone	5 "	820 "
Dark shale	20 "	840 "
White Medina sandstone	12 "	852 "
Red shale	18 "	870 "

Gas was struck at 725 feet in the Clinton limestone and at 785 feet in the red Medina sandstone, but the best flow was obtained at 840 to 850 feet in the white Medina.

255. [2]*Thorold.*

Sunk, 1889. Elevation about 500 A.T.

	Thickness.	Depth.	Formation.
Drift	43 feet.	43 feet.	
Limestone and shales	52 "	95 "	Niagara.
Limestone	30 "	125 "	Clinton.
Red sandstone and shales	82 "	207 "	Medina.
Grey sandstone	30 "	237 "	"
Red shales	658 "	895 "	"
Dark blue and black shales	905 "	1,800 "	Hudson River and Utica.
Light and dark limestone	683 "	2,483 "	Trenton.

A little gas at 2,400 and a little salt water at 2,450 feet.

[1] First Rep. Bur. Mines, Ont., 1891, p. 135.

[2] Coste, E., Fifteenth Rep. Bur, Mines, Ont., 1906, p. 113.

256. [1] *Lot 31, Con. 5, Wainfleet.*

Well No. 4.

	Thickness.	Depth.	Formation.
Surface	144 feet.	144 feet.	
Limestone and shale	171 "	315 "	Onondaga.
Grey dolomite	160 "	475 "	Guelph and Niagara.
Blue shales	45 "	520 "	Niagara.
White limestone	35 "	555 "	Clinton.
Red sandstone	60 "	615 "	Medina.
Grey shales	25 "	640 "	"
White sandstone	22 "	662 "	"

Cased off water at 490 feet. Gas at 640 feet in white Medina sandstone, with 12 feet of gas sand. Rock pressure 260 pounds.

257. [2] *Lot 6, Con. I, Wainfleet.*

Bored by John Reeb 1889-90. Log furnished by the contractor, S. E. Humphrey.

	Thickness.	Depth.
Drift	2 feet.	2 feet.
Corniferous limestone	16 "	18 "
Lower Helderberg limestone, fair cement rock	5 "	23 "
Lower Helderberg limestone, cement rock and shale	7 "	30 "
Impure limestone with shale and gypsum (Onondaga)	390 "	420 "
Niagara limestone	185 "	605 "
Niagara shale	79 "	684 "
Clinton limestone and shale	30 "	714 "
Mottled Medina stone	46 "	760 "
Shaly Medina sandstone	40 "	800 "
White Medina sandstone	23 "	823 "
Medina shale	31 "	854 "

Salt water at 468 feet. The principal flows of gas were from the Clinton limestone at 685 feet and the white Medina sandstone at 800 to 815 feet.

[1] Corkill, E. T., Fourteenth Rep. Bur. Mines, Ont., p. 104.

[2] First Rep. Bur. Mines, Ont., p. 132.

258. [1]*Lot 6, Con. 1, Wainfleet.*

Sunk by John Reeb. Drilling was commenced at the base of the Corniferous when the following series of rocks were traversed:

	Thickness.	Formation.
Drab and grey dolomites, shales, and gypsum...	390 feet.	Onondaga.
Dolomite, grey.....	240 "	Guelph and Niagara.
Shale, black.....	55 "	Niagara.
Dolomite.....	30 "	Clinton.
Sandstone, red.....	45 "	Medina.
Shale, red and blue.....	40 "	"
Sandstone, white.....	20 "	"
	820 feet.	

Casing was carried to a depth of 630 feet, effectually shutting off all water; and gas, having a daily flow of 400,000 cubic feet, was obtained at 685 feet at the summit of the Clinton dolomite. Although this well was carried down to and through the usual gas-bearing sandstone, no further supply of gas was obtained.

259, 260. Welland.

259. [2]Sunk by the Welland Natural Gas Company in 1891 on Alexander Asher's farm a quarter of a mile southeast of the town. Driller, Carmody Bros.

	Thickness.	Depth.	Formation.
Surface deposits.....	100 feet	100 feet	
Shale.....	80 "	180 "	Onondaga,
Limestone.....	225 "	405 "	Guelph, and
Blue shale.....	65 "	470 "	Niagara.
Limestone.....	20 "	490 "	Clinton.
Shale.....	5 "	495 "	"
Red sandstone.....	55 "	550 "	Medina.
Shale.....	10 "	560 "	"
White sandstone.....	5 "	565 "	"
Shale.....	20 "	585 "	"
White sandstone.....	20 "	605 "	"
Red shale.....	97 "	702 "	"

A little gas at 300 and 512 feet; sulphur water at 220.

[1] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 41 Q.

[2] Geol. Surv., Can., Vol. VI, 108 S.

260. Sunk in 1891 by the Welland Natural Gas Company on the Leitch farm half a mile northeast of the Welland station on the Michigan Central railway.

	Thickness.	Depth.	Formation.
Surface deposits	112 feet	112 feet	
Shale	118 "	230 "	Onondaga,
Limestone	240 "	470 "	Guelph, and
Shale	50 "	520 "	Niagara.
Limestone	13 "	533 "	Clinton.
Red sandstone	45 "	578 "	Medina.
Shale	25 "	603 "	"
White sandstone	20 "	623 "	"
Red shale	82 "	705 "	"

261. [1] *Lot 4, Con. 3, Willoughby.*

No. 143 of the Provincial Natural Gas and Fuel Company. Elevation 590 A.T.

	Thickness.	Depth.	Formation.
Clay and gravel drift	61 feet	61 feet	
Dolomites	135 "	196 "	Onondaga.
Dolomites	227 "	423 "	Guelph and Niagara.
Dark shales	50 "	473 "	Niagara.
White limestone	30 "	503 "	Clinton.
Red sandstone and shales	91 "	594 "	Medina.
White sandstone	20 "	614 "	"
Red shales	915 "	1,529 "	"
Blue and black shales	784 "	2,313 "	Hudson River and Utica.
Limestone	685 "	2,998 "	Trenton.
Sandstone	32 "	3,030 "	Calciferous.
Granite	2 "	3,032 "	

Gas at 2,998 and 3,003 feet; 60,000 cubic feet per day. Salt water at 3,030 feet.

[1] Coste, E., Fifteenth Rep. Bur. Mines, Ont., 1906, p. 113.

262. [1] *Lot 2, Con. 4, Willoughby.*

Well No. 61 of the Provincial Natural Gas and Fuel Company. Elevation, 610 A.T.

	Thickness.	Depth.	Formation.
Clay	18 feet	18 feet	Drift.
Dolomites and shales with gypsum	202 "	220 "	Onondaga.
Grey dolomites	220 "	440 "	Guelph and Niagara.
Blue shales	50 "	490 "	Niagara.
White limestone	30 "	520 "	Clinton.
Red sandstone and shales	73 "	593 "	Medina.
White sandstone	10 "	603 "	"
Blue shale	12 "	615 "	"
White sandstone	18 "	633 "	"
Red shales	830 "	1,463 "	"
Blue shales	717 "	2,180 "	Hudson River
Black shales	160 "	2,340 "	Utica.
White and grey limestones	670 "	3,010 "	Trenton
Grey coarse sandstone	19 "	3,029 "	Calciferous.
White quartz	1 "	3,030 "	Archæan.

Salt water at 330 feet and 495 feet. A little gas at 495 feet. Gas at 2,940 feet, rock pressure 1,000 pounds.

WELLINGTON COUNTY.

263. [2] *Eden Mills.*

Lot 1, con. 1, Eramosa.

	Thickness.	Formation.
Limestone and shales	159 feet	
Red sandstone and shale	350 "	Medina.

Some white or light coloured bands were met in the upper part of the Medina. Salt water at 250 feet.

[1] Coste, E., Jour. Can. Min. Inst., III, 77.
[2] Hunt, T. S., Geol. Surv., Can., 1866, p. 251.

264. [1] *Erin.*

Sunk in 1888 by John Fraser. Elevation, 1038 A.T.

	Thickness.	Formation.
Limestone	95 feet	Niagara.
Shale	100 "	Clinton.
Shale, blue, and sand	25 "	Medina.
Shale red	480 "	"
Shale, blue	100 "	Hudson River
	800 feet	

265. [2] *Glen Allan.*

Drilled by the Ohio Oil Company on lot 5, con. 3, Peel, in 1900. Elevation by barometer, about 1245 A.T.

	Thickness.	Depth.	Formation.
Gravel with pieces of limestones	35 feet.	35 feet.	
Dolomite and limestone	517 "	552 "	Onondaga.
Dolomite and limestone	220 "	772 "	Guelph and Niagara.
Shales	30 "	802 "	Niagara.
Limestone	29 "	831 "	Clinton.
Red shales	367 "	1,198 "	Medina.
Drab and blue shales	572 "	1,770 "	Hudson River.
Dark shales	47 "	1,817 "	Utica.
Limestone	705 "	2,522 "	Trenton.
Pink sandstone, very hard	51 "	2,573 "	Calciferous.

Strong flow of sulphur water at 140; sulphur water at 275; gas for two stoves at 2,506 feet.

[1] Brumell, H. P., Geol. Surv., Can., Vol. V, 43 Q.
[2] Coste, E., Fifteenth Rep. Bur. Mines, Ont., 1906, p. 110.

266. [1]*Lot 6, Con. 5, Pilkington.*

Elevation by barometer about 1375 A.T.

	Thickness.	Depth.	Formation.
Drift	103 feet.	103 feet.	
Dolomite and limestone	252 "	355 "	Onondaga.
Light coloured and yellow limestone and dolomite	215 "	570 "	Guelph and Niagara.
Shales, red first 5 feet	30 "	600 "	Niagara.
Hard limestone	42 "	642 "	Clinton.
Red shale	393 "	1,035 "	Medina.
Light blue shale	565 "	1,600 "	Hudson River.
Black shales	85 "	1,685 "	Utica.
Limestone	695 "	2,380 "	Trenton.
Arkose sandstone	5 "	2,385 "	Calciferous.

A little gas at 2,335 feet.

WENTWORTH COUNTY.

267. [2]*Lot 2, Con. 7, Barton.*

The Barton Oil Company. 1864 and 1865.

	Thickness.	Formation.
Limestone with a little shale	250 feet.	Niagara and Clinton.
White sandstone	5 "	Grey band?
Red shale with bluish bands	595 "	Medina.
Bluish and greyish shales	23 "	
	873 feet.	

Small quantities of oil were obtained at 700 and 780 feet, as well as a considerable flow of water from the latter depth.

[1] Coste, E., Fifteenth Rep. Bur. Mines, Ont., 1906, p. 110.
[2] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 32 Q.

268. [1]*Dundas.*

In the valley below the railway station. Sunk in 1874 and 1875. Log furnished by James Kerr.

Surface	80 feet.
Red shale	400 "
Blue "	550 "
Black "	400 "
Limestone	220 "
	1,650 feet.

"It is difficult to correlate the various strata, mentioned above, with the formations that must have been passed through in this well, at least, as these formations are at present known in Ontario. The 400 feet of red shales are undoubtedly of Medina age, which probably also includes a part of the 550 feet of blue shales next met with while the lower 220 feet are undoubtedly Trenton, leaving 400 feet and part of the 550 feet to represent the Hudson River and Utica."

Small quantities of gas at various points.

269. [2]*Lot 8, Con. 8, Flamborough East.*

Sunk at some time prior to 1866. Depth 465 feet. Began at base of Guelph or top of Niagara and ended in the Medina. At depth of 340 feet and 85 feet in the red shales a small quantity of petroleum is said to have been obtained.

270-272. [3]*Hamilton.*

270. At the hospital for the insane, lot 17, con. 5, Barton. Elevation, about 300 feet above Lake Ontario.

The driller's record is as follows:

	Thickness.	Formation.
Surface	14 feet.	
Limestone	70 "	Niagara and Clinton.
Sandstone	7 "	"Grey band."
Red shale	634 "	Medina.
Blue "	593 "	Hudson River and Utica, with probably the lower part of the Medina.
	1,318 feet.	

Neither gas nor oil was noticed in this well.

[1] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 31 Q.
[2] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 30 Q.
[3] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 31 Q.

271. Well in yard of Royal hotel. Depth about 1,000 feet.

272. [1]Clyde avenue west, 1893. Elevation about 290 A.T.

	Thickness.	Depth.	Formation.
Red, blue, and black shale....	1,250 feet.	1,250 feet.	Medina, Hudson River, and Utica.
Limestone.....	.....	.....	Trenton.
Bottom of well in Archæan at	.....	1,960 "	

Gas at 1,860 feet, 7,000 cubic feet per day.

273. [2]*Mount Albion.*

Sunk by the Emerson Natural Gas, Light, and Fuel Company. Depth 1,500 feet. No gas or oil.

YORK COUNTY.

274. [3]*Highland Creek.*

Sunk 1866 or 1867. Record as reported:

	Thickness.	Formation.
Surface (blue clay).....	48 feet.	
Shale (black).....	200 "	Hudson River and Utica.
Limestone.....	434 "	Trenton.
	682 feet.	

But a small flow of gas.

275. [4]*Mimico.*

Sunk by the Ontario Government in 1889. Driller's record:

	Thickness.	Formation.
Surface.....	7 feet.	
Blue shale.....	493 "	Hudson River and Utica.
Brown "	223 "	" " " "
Limestone.....	337 "	Trenton.
	1,060 feet.	

A small flow of water at 100 feet and small quantities of gas at 425, 575, and 1,052 feet.

[1] Coste, E., Fifteenth Rep. Bur. Mines, Ont., 1906, p. 112.
[2] Brumell, H. P. H. Geol. Surv., Can., Vol. V, 32 Q.
[3] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 24 Q.
[4] Brumell H. P. H., Geol. Surv., Can., Vol V, 26 Q.

276. [1]*New Toronto.*

Sunk by the New Toronto Oil and Natural Gas Company, Limited, on the west side of Seventh street, behind McDonald's tin works.

	Thickness.	Depth.
Surface deposits	5 feet.	5 feet.
Black shale	640 "	645 "
Limestone	595 "	1,240 "
Sandstone and arkose	72 "	1,312 "

Gas in small quantities at 780, 885, and 1,089 feet; water at 75 and 353 feet, and salt water at 1,250 feet.

277. [2]*Swansea.*

On east side of Humber river about three-quarters of a mile from the lake. Sunk by the Ontario Bolt Company 703 feet in 1888 or 1889; continued to 1,261 feet in 1890-91. Elevation, 347 A.T.

	Thickness.	Formation.
Sand	65 feet.	Surface deposit.
Quicksand	15 "	" "
Hard-pan	27 "	" "
Grey shale	440 "	Hudson River and Utica.
Black "	40 "	" " " "
Grey "	56 "	" " " "
Limestone	107 "	Trenton.
Soapstone	5 "	"
Limestone	480 "	"
Fossil rock	10 "	"
Crystalline rocks	16 "	Pre-Cambrian.
	1,261 feet.	

Saline and other mineral water throughout the first 700 feet. No gas or oil.

[1] Geol. Surv., Can., Vol. VI, 109 S.
[2] Brumell, H. P. H., Geol. Sur., Can., Vol. V, 25 Q.

278. [1]*Toronto.*

At Copeland's brewery on Parliament street. Sunk in 1882. Driller, W. Harris.

	Thickness.	Formation.
Surface	40 feet.	
Limestone	150 "	Hudson River.
Shale	405 "	Hudson River and Utica.
Limestone	585 "	Trenton.
"Arkose" beds	20 "	To granite.
	1,200 feet.	

Neither gas, oil, nor good water.

279. [2]*Near Thornhill.*

Drilled by the Page Oil and Gas Company in 1908. Contractor, Wright Bros. Driller's log:—

	Thickness.	Depth.
Surface	641 feet.	641 feet.
Shale, grey, hard	85 "	726 "
Limestone, grey, hard	119 "	845 "
Shale, black, hard	96 "	941 "
Limestone, grey, soft	90 "	1,031 "
Limestone, dark grey, hard	159 "	1,190 "
Shale, soft	8 "	1,198 "
Granite, red hard	2 "	1,200 "

Flowing water.

[1] Brumell, H. P. H., Geol. Surv., Can., Vol. V, 25 Q.
[2] Files of Water and Borings Division.

280. [1]*Lot 2, Con. 3, York.*

Sunk by Messrs. Taylor Bros. Elevation, about 297 A.T.

	Thickness.	Depth.	Formation.
Surface deposits	38 feet.	38 feet.	Drift.
Shale	440 "	478 "	Hudson River and Utica.
Limestone, hard	300 "	778 "	Trenton.
" soft, with shale	185 "	963 "	"
" hard	146 "	1,109 "	"
Arkose	10 "	1,119 "	
Granite	8 "	1,127 "	Pre-Cambrian.

A small flow of gas at 700 to 750 feet.

PROVINCE OF QUEBEC.

281. Beloeil, Verchères.

Drilled by the Hamilton Powder Company in 1905. Drillings interpreted by H. M. Ami.

Boulder clay with pebbles of shale	60 feet.
Non-calcareous shale	85 "
Dark grey or black shale	110 "
Volcanic ash beds or crystalline rocks of igneous origin	240 "
Dark grey shale and light grey igneous rocks	270 "
Dark or black shale	370 "
Shale similar to preceding	405 "
Black shale	460 "
Hard gritty and apparently igneous rocks	500 "
Igneous, crystalline rocks	520 "
Black shale, fine-grained	550 "
Black shale and green crystalline igneous rock	590 "
Crystalline igneous rock	610 "
Igneous rock	685 "
Dark grey shale and creamy white mineral	710 "
Dark grey to black shale and igneous rock	760 "
Chiefly shale	790 "
Dark grey shale and some igneous matter	807 "
Shale with a small amount of igneous rock	845 "
Same as preceding	875 "
Dark grey shale with traces of igneous matter	930 "
Shales, some of which are calcareous	942 "
Dark grey or brown shale	1,000 "

[1] Geol. Sur., Can., Vol. V, 107 SS.

Gaspe.

See page 99.

282. [1]*Granby, Shefford.*

Driller, Bell of Montreal. Depth, 500 feet. Water, 1,800 gallons per hour.

283, 284. [2]*Hull.*

283. At Messrs. Geo. Matthews and Company. Depth 803 feet. Water, about 2,000 gallons per hour, at first had a strong mineral taste and a smell of sulphur. Flow has somewhat decreased, but the quality has improved.

284. At the Sulphite Works of Messrs. Eddy and Company. Depth 503 feet. Pumps 3,000 gallons of water per hour. Water carries too much mineral matter to permit of its use for domestic purposes.

285. [3]*Laprairie, Laprairie County.*

The Laprairie Pressed Brick Company. A boring was made through 1,000 feet of shales without striking limestone. No water.

286. Louiseville.

[4]No. 4 well.

	Thickness.	Depth.
Drift	160 feet.	160 feet.
Shale	190 "	350 "
Limestone	295 "	645 "
Sandstone		

At 350 to 490 feet the limestone was coarse-grained; at 515 feet it became darker and less crystalline; at 545 to 575 feet it enclosed crystals of pyrite. At the bottom of the well a fine yellowish sandstone was struck which the drillers claim to have penetrated for a distance of 8 feet. Abbé Laflamme believes this is the Potsdam formation. Gas was struck at 216, 260, and 342 feet, salt water at 216, 260, and 290 feet, and mineral water at 644 feet. Gas was obtained with a rock pressure of 225 pounds.

[1] Files of Water and Borings Division.
[2] Files of Water and Borings Division.
[3] Adams and LeRoy, Geol. Sur., Can., Vol. XIV, 64 O.
[4] Laflamme, Trans. Roy. Soc. Can., Vol. VI (1888) Sec. IV, p. 20

287. [1]*Maisonneuve.*

	Thickness.	Depth.
Drift	76 feet.	76 feet.
Utica shales	80 "	156 "
Trenton limestone	249 "	405 "
Limestone interstratified with black shales	125 "	530 "
Limestone, brown	130 "	660 "
Shales with odour of petroleum	30 "	690 "
Limestone	15 "	705 "
Shales, less bituminous than the preceding	20 "	725 "
Limestone	20 "	745 "
Limestone and bituminous shale	55 "	800 "
Limestone	200 "	1,000 "
Limestone with crystals of pyrite	240 "	1,240 "
Limestone, pale, crystalline becoming slightly arenaceous at the bottom	260 "	1,500 "

Gas veins were struck at 270, 400, and 1,120 feet with salt water at 630 feet and sulphur water at 1,120 feet. Total depth over 2,000 feet.

288. [2]*Montreal.*

Turkish Bath hotel, 140 Ste. Monique street.

	Thickness.	Depth.	Formation.
Drift	50 feet.	50 feet.	Pleistocene.
Limestone	590 "	640 "	Trenton and Birdseye.
Limestone	785 "	1,425 "	Chazy.
Limestone	125 "	1,550 "	Calciferous.

See also page 96.

[1] Laflamme, Trans. Roy. Soc. Can., Vol. VI (1888) Sec. IV, p. 19.
[2] Adams and LeRoy, Geol. Surv., Can., Vol. XIV, 55 O.

289. [1]*Nicolet, Nicolet County.*

Sunk by Rev. Mr. Proulx of Nicolet college, just behind the college.

	Thickness.	Depth.	Formation.
Clay	120 feet.	120 feet.	
Sand	10 "	130 "	
Shales	970 "	1,100 "	Hudson River with possibly Utica at the base.

290. St. Barnabé.

Parish of St. Barnabé,[2] range St. Amable north, lot 164. Drilled in 1910 by W. H. Lauffer for La Compagnie Gaz et Petrole, St. Barnabé, Comte St. Hyacinthe. From inquiries it would appear that the log is somewhat as follows:[3]

	Thickness.	Depth.
Surface deposits	125 feet.	125 feet.
Reddish shales, slightly calcareous	775 "	900 "
Dark grey shales, calcareous	960 "	1,860 "
Harder rock, gas bearing	5 "	1,865 "
Dark shaly rock	15 "	1,880 "

Gas at 1,860 feet, rock pressure 275 pounds.

291. Saint Charles, Bellechasse.

Driller, Bell of Montreal. Depth, 1,843 feet. Water, 800 to 900 gallons per hour.

[1] Obalski, J., Rep. Com. Crown Lands, Quebec, 1885, p. 116.
[2] Geol. Surv., Can., Vol. VIII, 71 A.
[3] Report on Mining Operations in the Province of Quebec during 1910, p. 73.

292, 293. [1]*St. Grégoire, Nicolet County.*

292. Boring on Hilaire Trudel's land at the southeast end of the concession of Beauséjour.

	Thickness.	Depth.
Blue loam with thin layers of sand	47 feet.	47 feet.
White sand; emanations of gas	5 "	52 "
Gravel; emanations of gas and water	15 "	67 "
Black sand, dense; water, but no gas	7 "	74 "
Sandstone, somewhat calcareous, oily oozings	80 "	154 "
Same as preceding, but harder and finer-grained.	60 "	214 "
Red shale	75 "	289 "
Red shale, lighter colour	10 "	299 "
Shale, nearly black	16 "	315 "
Shale, blackish brown, not hard; abundant and sudden flow of gas, having a strong smell of kerosene	54 "	369 "
Red shale; emanation of gas	105 "	474 "
Red shale, somewhat greyish	50 "	524 "
Softer red shale	55 "	579 "
Red shale; another strong flow of gas	60 "	639 "
Impure calcareous rock apparently containing magnesia. Another vein of gas	20 "	659 "
Calcareous rock	60 "	719 "
Oily calcareous rock	100 "	819 "
Black shale; flow of gas	40 "	859 "
Black shale, compact	225 "	1,084 "
Depth of well	.....	1,115 "

Gas yield estimated at 250,000 cubic feet.

293. Bergeron well, concession Pointu, 2 miles from St. Grégoire.

	Thickness.	Depth.	Formation.
Drift	35 feet.	35 feet.	
Grey, calcareous, and arenaceous shale	25 "	60 "	Medina.
Fine-grained, chocolate-coloured shales more or less gritty and calcareous	540 "	600 "	"
Bluish shale	5 "	605 "	Probably Lorraine.
"Salt rock"	20 "	625 "	" "
Pinkish-grey calcareous shale	30 "	655 "	" "
Yellowish-grey calcareous shale	30 "	685 "	" "

294. [1]*Ste. Flavie, Rimouski.*

Log furnished by the Intercolonial Railway Company.

	Thickness.	Depth.
Drift	21 feet.	21 feet.
Red shale	291 "	311 "
Grey shale	60 "	371 "
Very hard streak	2 "	373 "
Red shale	70 "	443 "
Hard sandy rock	20 "	463 "
Red shale	442 "	905 "
Grey shale	95 "	1,000 "
Alternate streaks of grey and red shale	1,070 "	2,070 "
Broken rock	70 "	2,140 "
Water-bearing grey shale	360 "	2,500 "

Water at depth of 100 feet, 900 gallons per hour.

295. Yamaska, Yamaska County.

Notes given to H. M. Ami by E. Coste, December 1, 1908. Well 16 to 20 miles from outcrop of Trenton.

	Thickness.	Depth.
Surface	180 feet,	180 feet,
Red Medina	390 "	570 "
Lorraine blue shales	1,940 "	2,510 "

[1] Files of the Water and Borings Division.

INDEX.

A.

	PAGE
Abitibi river	107
Acme Oil Company	75
Adams, F	95
Agricultural works well	193
Ailsa Craig, log	199
Alexandria, log	151
Amabel township	62
" " logs	128
Ami, H. M...147, 171, 212,	237
Analyses, general discussion of results of	114
Analyses, of anthraxolite	109
" " gases	109
" " Gaspe oil-shales	107
Anderdon limestone	39
" township	68
Anthraxolite	108
Anticlines..45, 53, 56, 57, 70, 72,79 81, 85, 97, 98	
" table of.....54,	55
Ardagh, E. G. R	109
Attercliffe field	28, 68
Attrill's well	166

B.

Bain, J. W	109
Bainsville	151
Balfour township	108
Barrie log	213
Barton Oil Company	227
" township, log	227
Bass lake	85
Bayham field	28
" gas field	63
" township, log....134,	135
Beachville, log	209
Bear creek	79
Beauséjour	94
Beaver Oil Company	64
Beekmantown formation..7, 55,	88
" (Calciferous) formation, described....	15
Beeton, log	213
Bell, J. M	107
" R	85
" W	134
Belle River	64
" " log	138
Bellechasse, log	235
Belleville, "	163
" Natural Gas and Oil Company	163
Beloeil, log	232
Bergeron well	236
Berlin, log	215
Bertie member	35
" Natural Gas Company	221
Bertie township 4,	113
" " log.. 216 217,	219
Bertie-Humberstone field.... 28,	88
" " " list of wells	89
Bevans, H	195
Biddulph, log	200
Big creek	203
" Otter creek	87
Binbrook township... 70, 92,	113
Bituminous shales	104
Black Creek	80
Black River group, described	18
Blyth, log	164
Bob portage	85
Bosanquet, bituminous shales	105
" log..... 181,	190
Bothwell 2, 3, 7, 40,	70
" log	168
" oil field..... 70,	71
Bounty, Dominion Government..... 4,	118
Bow Park farm	61
" " " wells, log...	126
Brampton, log	210
Brant county	110
Brant County fields	60
" " logs	124
" No. 1	113
" No. 2	113
" No. 3	113
Brantford 3, 60,	113
" field	28
" logs	124
British American Company, Toronto	8
Brooke township	84
Bruce County fields	62
" " logs	128
Brussels, log	164
Burgessville, log	209

C.

Cabot Head member	27
Calciferous. See Beekmantown.	
Caledonia 69,	112
" field	30

PAGE

Camden, log.....169, 170
Canada Petroleum Company 99
Canadian Oil Companies, Petrolia..... 8
Canadian Oil Producing and Refining Company, Petrolia..... 8
Canadian Salt Works, well No. 1..... 149
Canadian Salt Works, well No. 4..... 149
Canborough township..... 68, 70
Canborough, log..... 155
Cape Smith..... 85
Carleton county, logs 132
Carman, F. J..... 70, 180, 187
Carmody Bros...157, 207, 221, 223
Carlsbad Springs..... 213
Cathcart, log..... 127
Cayuga field..... 30
" log..... 156
" Natural Gas Company, limited..... 156
" township..... 69
Central Oil and Gas Company..... 75, 143
Champlain fault. See St. Lawrence-Champlain fault.
Champlain township..... 93
Character of the district.... 8
Chatham 71
" log..... 170
Chazy formation..... 7
" " described.. 16
Chelmsford..... 108
Chesterville, log..... 134
Cincinnati anticline..... 10, 45
Citizens' Gas, Oil, and Piping Company..... 65, 144
Clarkson, log..... 211
Clearville, log..... 171
Clinton dolomite..... 88
" formation..6, 61, 62, 68, 69 85
" " data regarding.. 31
" " described.. 30
" " gas in..... 56
" limestone.....68, 89, 90
" log..... 165
Cobleskill dolomite..... 35
Coboconk limestone..... 19
Cochrane, A. S..... 107

PAGE

Cockshutt property..... 60
Cockshutt well No. 3, log... 125
Colchester, North, township, log..... 141
Colchester, South, township, log..... 139
" township 67
" Township log 138, 140, 141
Coleman, A. P..... 108, 146
" and Gowinlock's well..... 168
Collingwood 87
" bituminous shales 104
" log..... 213
Colwell well..... 67, 145
Comber 66
" log..... 141
Cook, Geo. A..... 210
Cooksville log..... 211
Copeland's brewery..... 231
Corniferous limestone..... 79, 81
" See Onondaga.
Corunna, log..... 181
Coste, Eugene..57, 65, 74, 88, 138, 187, 237
" well No. 1.....65, 143
Courtright, log..... 182
" Salt Company's well..... 182
Craise, A.R..... 137, 204
Crowland township 90, 114
" Township log..... 217
Curtis, W. H..... 126

D.

Darby hotel.....85, 203
Dawn log..... 182
" oil field..... 77
" pool..... 3
Delaware formation..... 6, 40
" " described 41
Delhi 85
" field..... 28
" log..... 203
Delphi 87
" log..... 152
Dereham township..... 87
Deseronto, log..... 164
Desjardin's farm..... 148
Devonian..... 5, 10, 98
Detroit River series..... 36
Dickens well.....84, 193

PAGE

Domes..... 47, 83
Dominion Natural Gas Company, Ltd..63, 134, 137, 204, 205, 206, 208
Dominion well..... 167
Douglastown..... 98
Dover, log..... 172
Dresden, log..... 172
Drope, T..... 175, 176
Dublin, log..... 211
Dundas county, logs..... 134
" log..... 228
Dunn township.....69, 112
Dunnville..... 68
" log..... 157
" Natural Gas Company..... 157
Dunnwich township..... 63
Durham County fields..... 62
Dutton log..... 136
" oil field..... 63
" pool..... 3, 40

E.

East Tilbury, log.....179, 180
" " (Canada)Oil-fields, Ltd177, 178, 179
Eden Mills, log..... 225
Eden, log..... 136
Elgin county..... 4, 56, 110
" County fields..... 63
" " logs..... 134
" Field Oil and Gas Developing Company..... 64
" No. 1..... 112
Elginfield Oil and Gas Company..... 136
Ellis, W. H..... 109
Ells, R. W..... 97, 104, 106
Emerson Natural Gas, Light, and Fuel Company..... 229
Empire Company, Wallaceburg..... 8
Enniskillen, log..... 186
" township 2, 79, 83 ,111
Erie County Natural Gas and Fuel Company..... 90
Erin, log..... 226
Esquesing, log..... 162
Essex Centre..... 67
" " log..... 143

PAGE

Essex county..... 56, 64, 110
" County logs..... 138
" No. 1..... 110
Euphemia, log..... 183
" oil field..... 78
" township..... 3, 112
Evans, John..... 214

F.

Fairbanks and Carman..... 183
" " Company.... 178
" gas well No. 1..... 186
" well..... 83
Faulting.....45, 55, 57, 64, 97
Finlay, John..... 146
Flamborough, East, log..... 228
Fletcher, David..... 179
Florence..... 77
Folding..... 45
Formations above Hamilton, data regarding..... 44
Formations, description of.. 12
Fournier, log..... 212
Fraser, John..... 226
" well..... 68
Frontenac county, logs..... 150
" Pre-Cambrian axis. 9

G.

Garry river..... 151
Gas fields..... 56
Gas formations..... 28, 30, 36
" Quebec..... 56
Gaspe field..... 97
" log..... 233
" oil-shales..... 106
" peninsula..... 2, 92
" wells, record table of..... 99 to 104
Geology, general..... 9
" structural..... 45
Gibson, J.....164, 165
Glen Allan, log..... 226
Glencoe, log..... 200
Glengarry county, logs..... 151
Gloucester, log..... 133
Goderich, log..... 166
Goodfellow's farm..... 154
Gordon, D. A..... 171

PAGE

Gore of Chatham, log..... 171
Gosfield gas field..... 64
" South..... 110
" " log..... 144
" township.... ..... 4, 64
" Township log. ... 143, 144
Gould, Shapley, and Muir Company..... 124
Granby, log..... 233
Grand rapid..... 108
" river..... 157
" Trunk well..... 181
Grant well..... 175
Gravelly bay..... 79
Gray, Young, and Sparling Company..... 168
Great Southwestern Gas and Oil Company.....144, 145
Grey and Bruce Oil and Gas Company, Ltd.. 62, 129, 130
Grey county, logs..... 152
Grimsby member..... 27
Guelph formation.6, 64, 66, 74, 88
" " data regarding..... 34
" " described .. 33
" " folding..... 46
" " oil and gas in..... 56
Gurd gusher.....3, 72, 176
Gypsum..... 6, 35

H.

Haldimand anticline..... 98
" county... 4, 56, 110
" County fields ... 68
" " logs..... 155
" No. 1..... 112
" No. 2..... 112
" No. 3..... 112
" No. 4..... 112
" No. 5..... 112
" No. 6..... 112
" No. 7..... 112
" No. 8..... 112
" No. 9..... 112
" No. 10..... 113
" No. 11..... 113
" No. 12..... 113
Halton County fields..... 70
" " logs.....162, 163
Hamilton formation..... 6, 79
" " data regarding..... 43
Hamilton formation described 42
" log..... 228
Harris, W.....182, 201, 231
Harwich, log..... 172, 173
Hastings county, logs..... 163
Hayden, E..... 210
Hensall, log..... 167
Hepworth..... 62
" logs..... 129
Hibbard and Avery, Messrs.. 210
Hickey No. 4..... 66
Highland Creek, log..... 229
History 2
Howard, log..... 173
Howard township..... 111
Hudson River. See Lorraine.
Hull, log..... 233
Humberstone, log..... 218
" township.....88, 113
Humphrey, S. E..... 222
Hunt, T. S.....79, 199
Huron county, logs..... 164
" shale 6, 46
" " described..... 43
Hutchison well..... 167
Hyland, J. S..... 140, 174, 175

I.

Imperial Oil Company, Sarnia..8, 152, 194, 195
" refinery..... 190
Indian Reserve, log..... 193
Ingall, E. D..... 123
Innerkip..... 86
Intercolonial Railway Company..... 237
Inverhuron, log..... 130
Inwood, log..... 184
Ipperwash limestone..... 42
Irondequoit member..... 30

J.

Jackson well..... 66
Jamieson, W..... 164
Jarvis, log..... 158
Jones' well..... 213
Joyce, John..... 180

PAGE

K.

Keeling, Thos. B..... 214
Kelly's wells..... 80
Kent county..... 4, 56, 110
" County fields..... 70
" " logs..... 168
" gas field..... 36
" No. 1..... 110
" No. 2..... 110
" No. 3..... 111
" No. 4..... 111
" No. 5..... 111
" No. 6..... 111
" No. 7..... 111
" surface..... 111
Keppel, log..... 152
Kerr, James..... 228
Kidd, Joseph..... 167
Kincardine, logs..... 131
Kindle, E. M..... 43
King well..... 84
Kingston, log..... 150
Kingstone Mills, log..... 184
Kinrade farm..... 212
Kipp oil field..... 3, 71
Kirkfield limestone..... 18
Knight, C. W..... 158, 159

L.

Labontie, Moses..... 178
Laflamme, M. L'Abbe..... 93
Lambton county.....40, 110
" County field..... 77
" " logs..... 181
" No. 1..... 111
" No. 2..... 111
" No. 3..... 112
Lancaster, log..... 151
Laprairie county, log..... 233
Laprairie Pressed Brick Company..... 233
Laprairie township, log..... 233
Lauffer, Wm..... 134, 135
Leamington Oil Company...66, 145
LeRoy, O. E..... 95
Lilley well..... 213
Lincoln county, log..... 197
Listowell, log..... 211
Little Current..... 85
Location..... 1

PAGE

Lockport member..... 32
Logan, W. E..... 98
Logs..... 123
" of wells,Ontario.....124 to 232
" " Quebec.... 232 to 237
London, log..... 201
" Road oil field..... 78
" " pool..... 3
Lorraine..... 53
" (Hudson River) described..... 24
Louiseville..... 93
" log..... 233
Lowville formation..... 19
Lucan..... 200
Lynch, John..... 85
Lynedoch, log.....203, 204

M.

McColl, R. W., well..... 208
McCort, H..... 194
" Jas..... 194
McDonell's well..... 87
McEwan, G..... 167
" John..... 211
" J. S..... 130
McEwen, P..... 167
McIntosh, W.....175, 176
McKay township, log..... 212
McLeish, John..... 118
Maidstone township..... 68
Maisonneuve, log..... 234
Malahide, log..... 136
Malden township..... 67
" Township log...144, 145
Manitoulin island..... 2, 56, 85
" Island, log..... 197
" member..... 27
Manitowaning bay..... 85
Marcellus beds..... 41
Mason, J. J..... 147
Massasauga point..... 163
Medina formation... 6, 62, 68, 88
" " data regarding..... 29
Medina formation described. 26
" " gas in..... 56
" Natural Gas Company..... 63
Medina sandstone..61, 63, 68, 69, 85, 88, 90, 92
Mersea field..... 3, 66

PAGE

Mersea township..... 64
" Township log 145, 146
Metcalfe, log..... 202
Mattagami river..... 108
Mickle, G. R.....73, 110
Middle Road South..... 111
Middlesex county, logs..... 199
Milton 70
" log..... 162
Mimico, log..... 229
Minhinnick, J. R..... 142
Mississippi brook..... 99
Mitchell, H.....192, 193
" log..... 211
Moncklands, log 214
Monroe formation..... 36
Monteregian hills..... 55
Montreal, log..... 234
" wells, list of..... 96
Moore 7, 40
" log..... 185
" Oil and Gas Company 185
" " field..... 3, 78
Morphet, Robert..... 85
Mosa township.....2, 71, 79
" Township log 202
Moulton township..... 68
" Township log 158
Mount Albion, log..... 229
Murray, Mr..... 79

N.

Nassagaweya township, log.. 163
Nelles Corners, log..... 158
New Toronto, log..... 230
" " Oil and Natural Gas Company... ..92, 230
Niagara Falls South, log..... 219
" formation..... 6, 74, 88
" " data regarding..... 34
Niagara formation described. 31
" " folding.... 46
Nicolet college..... 235
" county..... 94
" County log 235, 236
" log..... 235
Norfolk county..... 4, 56, 110
" County fields 85
" " log..... 203
" No. 1..... 112
" No. 2..... 112
" No. 3..... 112
North Cayuga, log..... 159
North Cayuga township.... 112
" Gower, log..... 134
" Talbot Road..... 145
Northern Oil and Gas Company.....85, 197
Norwich, log..... 210

O.

Obalski, Mr..... 93
Ogilvie well..... 167
Ohio Oil Company.....184, 226
Oil fields..... 56
" production of..... 8, 58
" Springs....2, 7, 40, 58, 77, 79
" " Company..... 111
" " list of wells..... 82
" " log..... 185
Oil-bearing formations..... 36, 40
Olentangy shale..... 42
Onondaga field.....3, 28, 30, 61
" formation.. 6, 68, 74, 78
" " oil in.... 56
" " see Salina.
" limestone 63, 70, 72, 73, 78, 83.
" (Corniferous) formation described..... 39
Onondaga (Corniferous) formation, folding 47
Onondaga (Corniferous) formation including Delaware limestone, data regarding..... 41
Onondaga log..... 127
" township..... 113
Ontario Bolt Company..... 230
" county, log..... 208
" logs..... 124
" Natural Gas Company, Ltd 143
" oil and gas fields, description of..... 60
" well..... 167
Ordovician..... 5, 10, 107
Orford, log.....174, 175
Orillia, log..... 214
Oriskany described..... 39
" sandstone..... 6
Osprey, log..... 153
Ottawa, logs..... 132
Oxford County field 86
" " logs..... 209

PAGE

P.

Page Oil and Gas Company.. 231
Paris, log..... 128
Parkhill, log..... 202
" Salt Works Company..... 202
Parks, W. A.....107, 189
Parson's well..... 183
Peat, Jas. and Sons 212, 213
Peel county, logs..... 210
Pelee island..... 3, 67
" Island log 146, 147
Perth county, logs..... 211
Peterborough county, log.... 212
" log..... 212
Peterson, N. C. and Sons.... 192
Petroleum Bounty Act, 1909. 119
" Oil Trust..... 99
Petrolia..... 2, 7, 40, 58
" log..... 187
" oil fields..... 77, 83
" shale..... 42
Pilkington, log..... 227
Platt's well..... 167
Pleistocene..... 44
Plympton oil field..... 3, 84
Plympton township..... 196
Point Abino, log..... 219
" du Jour..... 95
Point St. Peter anticline..... 98
Port Burwell, log..... 137
" Colborne 4, 90, 114
" " Gas, Light, and Fuel Company.....91, 220
Port Colborne, log 220
" Dover..... 86
" " field..... 28
" " log..... 204
" Elgin, logs..... 131
" Franks, logs..... 190
" Hope..... 62
" " Oil and Gas Fund. 62
" Lambton beds..... 6
" " formation..... 46
" Lambton formation described..... 44
" Lambton, log..... 191
" Rowan.....86, 112
" " log..... 205
" Royal..... 112
" Ryerse 86
" " log..... 205
" Stanley, log..... 137

PAGE

Potsdam, formation.....6, 7, 53
" " described 13
Pre-Cambrian..... 5, 9
" " data regarding 13
" " described.... . 12
Prescott county, log..... 212
Production of Attercliffe..... 68
" " Bayham gas
" " field..... 63
" " Belle River.... 64
" " Bertie-Humberstone field 89
" " Bothwell..... 71
" " Brantford..... 61
" " crude oil in Canada..... 119
" " Dutton field. . 64
" " gas in Ontario. 117
" " Gaspe..... 99
" " Gosfield..... 65
" " Kent county .. 76
" " Lambton county..... 77
" " Leamington... 66
" " Mersea..... 66
" " Moore..... 79
" " oil..... 8, 58
" " " by districts, table of... 122
" " " Springs.... 82
" " Onondaga field 61
" " Pelee island... 67
" " petroleum in Ontario..... 118
" " Port Rowan... 86
" " Raleigh..... 72
" " Romney..... 73
" " Thamesville... 73
" " Tilbury and
" " Romney.... 75
" " Wheatley..... 76
Provincial Government..... 150
" Natural Gas and Fuel Company..61, 88, 89, 90, 139, 216, 217, 218, 219, 224, 225

Q.

Quebec fields, description of 92
" logs..... 232
Queenston shales.....6, 25, 53

PAGE

R.

Rainham township..... 69
Raleigh, log.....175, 176, 177
" oil field..... 72
" township..3, 40, 71, 72, 73, 76, 110, 111
Ransford, Henry..... 165
" Richard..... 173
Ravey well..... 174
Rawlings, E.....182, 190, 192
Recent..... 44
Reeb, John.....91, 222, 223
Refining companies..... 8
Regulations, Government... 5
Renfrew county, logs..... 212
" log..... 213
Richmond described..... 24
Ridgeway, log..... 221
Rimouski, " 237
Robbins, K S..... 161
Roche, W. W..... 108
Rochester shale..... 32
Rogers, F. C..... 164
Romney, log..... 178
" oil field..... 3, 72
" township..40, 72, 73, 76, 111
Rondeau..... 173
Roumegon, R..... 211
Russell county, logs..... 213
Rymal No. 3..... 66

S.

St. Barnabé..... 5, 93, 94
" " log..... 235
" Barthelemi..... 93
" Catharines, log..... 197
" " Natural Gas Company..... 197
" Grégoire 94
" " log..... 236
" Hyacinthe county..... 94
" John lake..... 107
" " oil-shales..... 107
" " river.....98, 106
" Justin..... 93
" Lawrence, north of, fields 93
" " south of, fields 93
" " -Champlain fault..... 10, 53
" Marys, log..... 211
" Thomas, log..... 137

PAGE

St. Vincent, log..... 154
" Williams, log..... 206
Ste. Flavie, log..... 237
Saginaw Lumber and Salt Company..... 147
Saint Charles, log..... 235
Salina..... 74
" (Onondaga) formation 6, 74
Salina (Onondaga) formation data regarding..... 37
Salina (Onondaga) formation described..... 34
Salina (Onondaga) formation oil and gas in..... 56
Salt..... 6, 35
Saltford well..... 167
Sandwich..... 68
Sandy Beach..... 98
Sarawak township, log..... 154
Sarnia, log..... 192, 193, 194, 195
" township..... 78,84
Savage, John.....144, 145, 200
" Major..... 170, 172
Scarborough township..... 114
Seaforth, log..... 168
Section from the vicinity of Montreal..... 20
" in Simcoe district... 18
" on Moira river..... 21
Selkirk field..... 28,69
Seneca township..... 113
Shales, oil..... 104
Sharpe, Donald..... 110
Shaw, James..... 81
Sheguiandah bay..... 85
Shefford district, log..... 233
Sherbrooke township..... 69
Shetland..... 78
Silurian..... 5, 10
Silver brook..... 98
Simard, A., well..... 75
Simcoe County field 87
Simcoe county, logs..... 213
Simcoe, log..... 207
" Natural Gas Company..... 207
Sinclair, Duncan..... 210
Smith well..... 205
Sodus member..... 30
Sombra township..... 84
South Cayuga township..... 112
Southampton, log..... 131
Standard White Lime Company, Ltd..... 209
Stapleton well..... 165

PAGE

Stauffer, C. R..... 61
Steele, C. E..... 90
Stoddard's mill..... 173
Stormont county, log..... 214
Stratford, log..... 212
Strathroy, log..... 203
Strawberry island..... 85
Structure, relations of the oil and gas reservoirs to.. 57
Sulphite works..... 233
Sulphur spring..... 201
Summary and conclusion... 5
Sunnyside well..... 201
Surface gas..... 76
Swansea, log..... 230
Sydenham river..... 84
Sylvania sandstone..... 36
" " data regarding..... 38
Synclines..... 45, 83, 88, 95

T.

Table of anticlines..... 54, 55
" " formations..... 11
" showing inclination of the strata..... 48 to 53
Talbot Oil Company..... .. 64
Tar Point anticline..... 98
Taylor Bros..... 232
Thamesville..... 40
" log..... 178
" oil field..... 73
Thornbury, log..... 154
Thornhill, " 231
Thorold, " 221
" member..... 28
Three Rivers..... 5
Tilbury..... 7, 74
" , East, township.. 110, 111
" oil and gas field..... 73
" " field..... 3, 36
" , West, township, log 148
Tillsonburg..... 2, 86
" log..... 210
Tiny township, log..... 214
Toronto..... 114
" log..... 231
" Oil and Natural Gas Company..... 92
Trafalgar township, log..... 162
Trenton formation.....6, 62, 107
" " described. 19

PAGE

Trenton formation, folding.. 46
" " location of wells in... 58
" " oil in.... 56
" limestone..61, 85, 87, 88, 92
Trudel well..... 94
Turkish Bath hotel..... 234

U.

Union Gas Company.....138, 141
United Gas and Oil Company of Ontario..... 65, 76
Utica formation, data regarding..... 26
" group described..... 23
" shale..... 6, 56, 107

V.

Vercheres, log..... 232
Vienna..... 63
" log..... 138
" village..... 112
Vittoria, log..... 208

W.

Wainfleet field..... 28, 92
" log..... 222, 223
Walker and Sons 140, 144, 174, 175
Walker's No. 1 well..... 140
Walpole township.....69, 112
Warwick, log..... 184
Waterloo county, logs..... 215
" log..... 215
Waterous Engine Company..60, 125
Wekwemikong 197
" bay.....85, 199
Welland county.....56, 110
" County field..... 88
" " logs..... 216
" log..... 223
" Natural Gas Company..... 223, 224
" No. 1..... 113
" No. 2..... 113
" No. 3..... 113
" No. 4..... 113
" No. 5..... 113
" No. 6..... 114
" No. 7..... 114
Wellington county, logs..... 225

	PAGE
Wentworth county	110
" County field	92
" " logs	227
" No. 1	113
West well	87
" Williams, log	203
Wheatley field	3, 76
Whirlpool member	27
Whitby Gas and Water Company	208
" log	208
Whitman and Brinton, Messrs.	175
Widder beds	42
" station, log	196
Wigle, Isaac	144
Wilkins farm	135
Williams, W. M	80
Williamson member	30
Willoughby, log	224, 225
" township	88, 113
Wilson and Bennett's well	183
Winchell, Alex	81
Windsor	68
" log	149
Wingham, "	168
Wolcott member	30
Woodhouse township	86
Woodslee, logs	150
Woodward, M. J	141, 142, 175
Wright Bros	231
Wyoming, log	196

Y.

	PAGE
Yamachiche	93
Yamaska county, logs	237
log	237
York County field	92
" " logs	229
" log	158, 232
" No. 1	114
" river	98, 99, 106
" Scarborough township, surface	114

Z:

	PAGE
Zone township	3, 70, 73

LIST OF RECENT REPORTS OF GEOLOGICAL SURVEY

Since 1910, reports issued by the Geological Survey have been called memoirs and have been numbered Memoir 1, Memoir 2, etc. Owing to delays incidental to the publishing of reports and their accompanying maps, not all of the reports have been called memoirs, and the memoirs have not been issued in the order of their assigned numbers and, therefore, the following list has been prepared to prevent any misconceptions arising on this account. The titles of all other important publications of the Geological Survey are incorporated in this list.

Memoirs and Reports Published During 1910.

REPORTS.

Report on a geological reconnaissance of the region traversed by the National Transcontinental railway between Lake Nipigon and Clay lake, Ont.—by W. H. Collins. No. 1059.

Report on the geological position and characteristics of the oil-shale deposits of Canada—by R. W. Ells. No. 1107.

A reconnaissance across the Mackenzie mountains on the Pelly, Ross, and Gravel rivers, Yukon and North West Territories—by Joseph Keele. No. 1097.

Summary Report for the calendar year 1909. No. 1120.

MEMOIRS—GEOLOGICAL SERIES.

MEMOIR 1. *No. 1, Geological Series.* Geology of the Nipigon basin, Ontario —by Alfred W. G. Wilson.

MEMOIR 2. *No. 2, Geological Series.* Geology and ore deposits of Hedley mining district, British Columbia—by Charles Camsell.

MEMOIR 3. *No. 3, Geological Series.* Palæoniscid fishes from the Albert shales of new Brunswick—by Lawrence M. Lambe.

MEMOIR 5. *No. 4, Geological Series.* Preliminary memoir on the Lewes and Nordenskiöld Rivers coal district, Yukon Territory—by D. D. Cairnes.

MEMOIR 6. *No. 5, Geological Series.* Geology of the Haliburton and Bancroft areas, Province of Ontario—by Frank D. Adams and Alfred E. Barlow.

MEMOIR 7. *No. 6, Geological Series.* Geology of St. Bruno mountain, province of Quebec—by John A. Dresser.

MEMOIRS—TOPOGRAPHICAL SERIES.

MEMOIR 11. *No. 1, Topographical Series.* Triangulation and spirit levelling of Vancouver island, B.C., 1909—by R. H. Chapman.

Memoirs and Reports Published During 1911.

REPORTS.

Report on a traverse through the southern part of the North West Territories, from Lac Seul to Cat lake, in 1902—by Alfred W. G. Wilson No. 1006.

Report on a part of the North West Territories drained by the Winisk and Upper Attawapiskat rivers—by W. McInnes. No. 1080.

Report on the geology of an area adjoining the east side of Lake Timiskaming—by Morley E. Wilson. No. 1064.

Summary Report for the calendar year 1910. No. 1170.

MEMOIRS—GEOLOGICAL SERIES.

MEMOIR 4. *No. 7, Geological Series.* Geological reconnaissance along the line of the National Transcontinental railway in western Quebec—by W. J. Wilson.

MEMOIR 8. *No. 8, Geological Series.* The Edmonton coal field, Alberta—by D. B. Dowling.

MEMOIR 9 *No. 9, Geological Series.* Bighorn coal basin, Alberta—by G. S. Malloch.

MEMOIR 10. *No. 10, Geological Series.* An instrumental survey of the shore-lines of the extinct lakes Algonquin and Nipissing in southwestern Ontario—by J. W. Goldthwait.

MEMOIR 12. *No. 11, Geological Series.* Insects from the Tertiary lake deposits of the southern interior of British Columbia, collected by Mr. Lawrence M. Lambe, in 1906—by Anton Handlirsch.

MEMOIR 15. *No. 12, Geological Series.* On a Trenton Echinoderm fauna at Kirkfield, Ontario—by Frank Springer.

MEMOIR 16. *No. 13, Geological Series.* The clay and shale deposits of Nova Scotia and portions of New Brunswick—by Heinrich Ries assisted by Joseph Keele.

MEMOIRS—BIOLOGICAL SERIES.

MEMOIR 14. *No. 1, Biological Series.* New species of shells collected by Mr. John Macoun at Barkley sound, Vancouver island, British Columbia—by William H. Dall and Paul Bartsch.

Memoirs and Reports Published During 1912.

REPORTS.

Summary Report for the calendar year 1911. No. 1218.

MEMOIRS—GEOLOGICAL SERIES.

MEMOIR 13. *No. 14, Geological Series.* Southern Vancouver island—by Charles H. Clapp.

MEMOIR 21. *No. 15, Geological Series.* The geology and ore deposits of Phoenix, Boundary district, British Columbia—by O. E. LeRoy.

MEMOIR 24. *No. 16, Geological Series.* Preliminary report on the clay and shale deposits of the western provinces—by Heinrich Ries and Joseph Keele.

MEMOIR 27. *No. 17, Geological Series.* Report of the Commission appointed to investigate Turtle mountain, Frank, Alberta, 1911.

MEMOIR 28. *No. 18, Geological Series.* The Geology of Steeprock lake, Ontario—by Andrew C. Lawson. Notes on fossils from limestone of Steeprock lake, Ontario—by Charles D. Walcott.

Memoirs and Reports Published During 1913.

REPORTS, ETC.

Museum Bulletin No. 1: contains articles Nos. 1 to 12 of the Geological Series of Museum Bulletins, articles Nos. 1 to 3 of the Biological Series of Museum Bulletins, and article No. 1 of the Anthropological Series of Museum Bulletins.

Guide Book No. 1. Excursions in eastern Quebec and the Maritime Provinces, parts 1 and 2.

Guide Book No. 2. Excursions in the Eastern Townships of Quebec and the eastern part of Ontario.

Guide Book No. 3. Excursions in the neighbourhood of Montreal and Ottawa.

Guide Book No. 4. Excursions in southwestern Ontario.

Guide Book No. 5. Excursions in the western peninsula of Ontario and Manitoulin island.

Guide Book No. 8. Toronto to Victoria and return *via* Canadian Pacific and Canadian Northern railways; parts 1, 2, and 3.

Guide Book No. 9. Toronto to Victoria and return *via* Canadian Pacific, Grand Trunk Pacific, and National Transcontinental railways.

Guide Book No. 10. Excursions in Northern British Columbia and Yukon Territory and along the north Pacific coast.

MEMOIRS—GEOLOGICAL SERIES.

MEMOIR 17. *No. 28, Geological Series.* Geology and economic resources of the Larder Lake district, Ont., and adjoining portions of Pontiac county, Que.—by Morley E. Wilson.

MEMOIR 18. *No. 19, Geological Series.* Bathurst district, New Brunswick—by G. A. Young.

MEMOIR 26. *No. 34, Geological Series.* Geology and mineral deposits of the Tulameen district, B.C.—by C. Camsell.

MEMOIR 29. *No. 32, Geological Series.* Oil and gas prospects of the northwest provinces of Canada—by W. Malcolm.

MEMOIR 31. *No. 20, Geological Series.* Wheaton district, Yukon Territory—by D. D. Cairnes.

MEMOIR 33. *No. 30, Geological Series.* The geology of Gowganda Mining Division—by W. H. Collins.

MEMOIR 35. *No. 29, Geological Series.* Reconnaissance along the National Transcontinental railway in southern Quebec—by John A. Dresser.

MEMOIR 37. *No. 22, Geological Series.* Portions of Atlin district, B.C.—by D. D. Cairnes.

MEMOIR 38. *No. 31, Geological Series.* Geology of the North American Cordillera at the forty-ninth parallel, Parts I and II—by Reginald Aldworth Daly.

Memoirs and Reports Published During 1914.

REPORTS, ETC.

Summary Report for the calendar year 1912. No. 1305.

Museum Bulletins Nos. 2, 3, 4, 5, 7, and 8 contain articles Nos. 13 to 22 of the Geological Series of Museum Bulletins, article No. 2 of the Anthropological Series, and article No. 4 of the Biological Series of Museum Bulletins.

Prospector's Handbook No. 1: Notes on radium-bearing minerals—by Wyatt Malcolm.

MUSEUM GUIDE BOOKS.

The archæological collection from the southern interior of British Columbia—by Harlan I. Smith. No. 1290.

MEMOIRS—GEOLOGICAL SERIES.

MEMOIR 23. *No. 23, Geological Series.* Geology of the Coast and island between the Strait of Georgia and Queen Charlotte sound, B.C.—by J. Austin Bancroft.

MEMOIR 25. *No. 21, Geological Series.* Report on the clay and shale deposits of the western provinces (Part II)—by Heinrich Ries and Joseph Keele.

MEMOIR 30. *No. 40, Geological Series.* The basins of Nelson and Churchill rivers—by William McInnes.

MEMOIR 20. *No. 41, Geological Series.* Gold fields of Nova Scotia—by W. Malcolm.

MEMOIR 36. *No. 33, Geological Series.* Geology of the Victoria and Saanich map-areas, Vancouver island, B.C.—by C. H. Clapp.

MEMOIR 52. *No. 42, Geological Series.* Geological notes to accompany map of Sheep River gas and oil field, Alberta—by D. B. Dowling.

MEMOIR 43. *No. 36, Geological Series.* St. Hilaire (Beloeil) and Rougemont mountains, Quebec—by J. J. O'Neill.

MEMOIR 44. *No. 37, Geological Series.* Clay and shale deposits of New Brunswick—by J. Keele.

MEMOIR 22. *No. 27, Geological Series.* Preliminary report on the serpentines and associated rocks, in southern Quebec—by J. A. Dresser.

MEMOIR 32. *No. 25, Geological Series.* Portions of Portland Canal and Skeena Mining divisions, Skeena district, B.C.—by R. G. McConnell.

MEMOIR 47. *No. 39, Geological Series.* Clay and shale deposits of the western provinces, Part III—by Heinrich Ries.

MEMOIR 40. *No. 24, Geological Series.* The Archæan geology of Rainy lake—by Andrew C. Lawson.

MEMOIR 19. *No. 26, Geological Series.* Geology of Mother Lode and Sunset mines, Boundary district, B.C.—by O. Le Roy.

MEMOIR 39. *No. 35, Geological Series.* Kewagama Lake map-area, Quebec—by M. E. Wilson.

MEMOIR 51. *No. 43, Geological Series.* Geology of the Nanaimo map-area—by C. H. Clapp.

MEMOIR 61. *No. 45, Geological Series.* Moose Mountain district, southern Alberta (second edition)—by D. D. Cairnes.

MEMOIR 41. *No. 38, Geological Series.* The "Fern Ledges" Carboniferous flora of St. John, New Brunswick—by Marie C. Stopes.

MEMOIR 53. *No. 44, Geological Series.* Coal fields of Manitoba, Saskatchewan, Alberta, and eastern British Columbia (revised edition)—by D. B. Dowling.

MEMOIR 55. *No. 46, Geological Series.* Geology of Field map-area, Alberta and British Columbia—by John A. Allan.

MEMOIRS—ANTHROPOLOGICAL SERIES.

MEMOIR 48. *No. 2, Anthropological Series.* Some myths and tales of the Ojibwa of southeastern Ontario—collected by Paul Radin.

MEMOIR 45. *No. 3. Anthropological Series.* The inviting-in feast of the Alaska Eskimo—by E. W. Hawkes.

MEMOIR 49. *No. 4, Anthropological Series.* Malecite tales—by W. H. Mechling.

MEMOIR 42. *No. 1, Anthropological Series.* The double curve motive in northeastern Algonkian art—by Frank G. Speck.

MEMOIRS—BIOLOGICAL SERIES.

MEMOIR 54. *No. 2, Biological Series.* Annotated list of flowering plants and ferns of Point Pelee, Ont., and neighbouring districts—by C. K. Dodge.

Memoirs and Reports Published During 1915.

REPORTS, ETC.

Summary Report for the calendar year 1913, No. 1359.

Summary Report for the calendar year 1914, No. 1503.

Report from the Anthropological Division. Separate from Summary Report 1913.

Report from the Topographical Division. Separate from Summary Report 1913.

Report from the Biological Division: Zoology. Separate from Summary Report 1914.

Museum Bulletin No. 11. *No. 23, Geological Series.* Physiography of the Beaverdell map-area and the southern part of the Interior plateaus, B.C. —by Leopold Reinecke.

Museum Bulletin No. 12. *No 24, Geological Series.* On Eoceratops canadensis, gen. nov., with remarks on other genera of Cretaceous horned dinosaurs—by L. M. Lambe.

Museum Bulletin No. 14. *No. 25, Geological Series.* The occurrence of Glacial drift on the Magdalen islands—by J. W. Goldthwait.

Museum Bulletin No. 15. *No. 26, Geological Series.* Gay Gulch and Skookum meteorites—by R. A. A. Johnston.

Museum Bulletin No. 17. *No. 27, Geological Series.* The Ordovician rocks of Lake Timiskaming—by M. Y. Williams.

Museum Bulletin No. 6. *No. 3, Anthropological Series.* Pre-historic and present commerce among the Arctic Coast Eskimo—by N. Stefansson.

Museum Bulletin No. 9. *No. 4, Anthropological Series.* The glenoid fossa in the skull of the Eskimo—by F. H. S. Knowles.

Museum Bulletin No. 10. *No. 5, Anthropological Series.* The social organization of the Winnebago Indians—by P. Radin.

Museum Bulletin No. 16. *No. 6, Anthropological Series.* Literary aspects of North American mythology—by P. Radin.

Museum Bulletin No. 13. *No. 5, Biological Series.* The double crested cormorant (Phalacrocorax auritus). Its relation to the salmon industries on the Gulf of St. Lawrence—by P. A. Taverner.

MEMOIRS—GEOLOGICAL SERIES.

MEMOIR 58. *No. 48, Geological Series.* Texada island—by R. G. McConnell.

MEMOIR 60. *No. 47, Geological Series.* Arisaig-Antigonish district—by M. Y. Williams.

MEMOIR 67. *No. 49, Geological Series.* The Yukon-Alaska Boundary between Porcupine and Yukon rivers—by D. D. Cairnes.

MEMOIR 59. *No. 55, Geological Series.* Coal fields and coal resources of Canada—by D. B. Dowling.

MEMOIR 50. *No. 51, Geological Series.* Upper White River District, Yukon —by D. D. Cairnes.

MEMOIR 65. *No. 53, Geological Series.* Clay and shale deposits of the western provinces, Part IV—by H. Ries.

MEMOIR 66. *No. 54, Geological Series.* Clay and shale deposits of the western provinces, Part V—by J. Keele.

MEMOIR 56. *No. 56, Geological Series.* Geology of Franklin mining camp, B.C.—by Chas. W. Drysdale.

MEMOIR 64. *No. 52, Geological Series.* Preliminary report on the clay and shale deposits of the Province of Quebec—by J. Keele.

MEMOIR 57. *No. 50, Geological Series.* Corundum, its occurrence, distribution, exploitation, and uses—by A. E. Barlow.

MEMOIR 68. *No. 59, Geological Series.* A geological reconnaissance between Golden and Kamloops, B.C., along the line of the Canadian Pacific railway—by R. A. Daly.

MEMOIR 69. *No. 57, Geological Series.* Coal fields of British Columbia—by D. B. Dowling.

MEMOIR 72. *No. 60, Geological Series.* The artesian wells of Montreal—by C. L. Cumming.

MEMOIR 73. *No. 58, Geological Series.* The Pleistocene and Recent deposits of the Island of Montreal—by J. Stansfield.

MEMOIR 74. *No. 61, Geological Series.* A list of Canadian mineral occurrences—by R. A. A. Johnston.

MEMOIR 76. *No. 62, Geological Series.* Geology of the Cranbrook map-area—by S. J. Schofield.

MEMOIRS—ANTHROPOLOGICAL SERIES.

MEMOIR 46. *No. 7, Anthropological Series.* Classification of Iroquoian radicals and subjective pronominal prefixes—by C. M. Barbeau.

MEMOIR 62. *No. 5, Anthropological Series.* Abnormal types of speech in Nootka—by E. Sapir.

MEMOIR 63. *No. 6, Anthropological Series.* Noun reduplication in Comox, a Salish language of Vancouver island—by E. Sapir.

MEMOIR 75. *No. 10, Anthropological Series.* Decorative art of Indian tribes of Connecticut—by Frank G. Speck.

Memoirs and Reports in Press, July 29, 1915.

MEMOIR 70. *No. 8, Anthropological Series.* Family hunting territories and social life of the various Algonkian bands of the Ottawa valley—by F. G. Speck.

MEMOIR 71. *No. 9, Anthropological Series.* Myths and folk-lore of the Timiskaming Algonquin and Timagami Ojibwa—by F. G. Speck.

MEMOIR 34. *No. 63, Geological Series.* The Devonian of southwestern Ontario—by C. R. Stauffer.

MEMOIR 77. *No. 64, Geological Series.* Geology and ore deposits of Rossland, B.C.—by C. W. Drysdale.

MEMOIR 78. *No. 66, Geological Series.* Wabana iron ore of Newfoundland—by A. O. Hayes.

MEMOIR 79. *No. 65, Geological Series.* Ore deposits of the Beaverdell map-area—by L. Reinecke.

Museum Bulletin No. 18. *No. 28, Geological Series.* Structural relations of the Pre-Cambrian and Palæozoic rocks north of the Ottawa and St. Lawrence valleys—by E. M. Kindle and L. D. Burling.

Museum Bulletin No. 19. *No. 7, Anthropological Series.* A sketch of the social organization of the Nass River Indians—by E. Sapir.