

GEOLOGICAL SURVEY DEPARTMENT  
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR

---

# REPORT

ON

# NATURAL GAS AND PETROLEUM

IN ONTARIO

PRIOR TO 1891

BY

H. PEARRETH H. BRUMELL, F.G.S.A.

*Assistant to the Division of Mineral Statistics and Mines*



OTTAWA

PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST  
EXCELLENT MAJESTY

1892

This document was produced  
by scanning the original publication.

Ce document est le produit d'une  
numérisation par balayage  
de la publication originale.



OTTAWA, 7th July, 1891.

To ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., &c.,  
Director, Geological Survey, Ottawa.

SIR,—I have the honour to submit herewith a report on natural gas and petroleum operations throughout the province of Ontario, bringing down the history of such to the close of 1890.

Accompanying the report are illustrative sections, plans, and a sketch map showing the extent of boring operations in Ontario.

I have the honour to be, sir,  
Your obedient servant,

H. PEARETH H. BRUMELL.

## INTRODUCTION.

The object of this report is to give in a concise form a description and narrative of boring operations undertaken in the province of Ontario, up to and inclusive of the year 1890. All wells sunk, whether searching for salt, petroleum, natural gas or water, have been included. These operations show that there is in southern Ontario, *i.e.*, that part lying south-west of a line drawn from Georgian Bay to Kingston, a possible thickness of Palæozoic rocks, and including the drift, of 4,200 feet as follows:—

	Drift.....	0— 150 feet = 75 feet		Introduction.
Devonian.....	{ Portage and Chemung..	25— 200 “ = 100 “		
	{ Hamilton .....	about 350 “ = 350 “		
	{ Corniferous .....	160— 300 “ = 230 “		
	{ Oriskany .....	6— 25 “ = 15 “		
Silurian .....	{ Lower Helderberg..	300—1000 “ = 650 “		
	{ Onondaga .....			
	{ Guelph.....	140— 160 “ = 150 “		
	{ Niagara .....	100— 130 “ = 115 “		
	{ Clinton .....	30— 150 “ = 90 “		
Cambro-Silurian.	{ Medina .....	600— 800 “ = 700 “		
	{ Hudson River. ....	500— 900 “ = 700 “		
	{ Utica .....	300— 400 “ = 350 “		
	{ Trenton.....			
	{ Black River.....	600— 750 “ = 675 “		

Thickness of  
Palæozoic  
rocks.

The question of the origin of the hydrocarbons has not been gone into to any extent, though in Part I. of this report the salient points in the many theories advanced are given. It is now earnestly requested that drillers and others interested in boring operations throughout Canada should enter into correspondence with this office, that the information thus available may be made as complete as possible. For this purpose blank forms for records of boring will be supplied, as well as bottles or boxes for the preservation of samples of drillings.

Throughout this report the term petroleum (rock oil, mineral oil, etc.), is understood to refer to that mineral in its broadest commercial sense, and to include all varieties of the mineral in its fluid or semi-fluid state. The petroleum of Lambton, the only oil-producing county in Ontario, is a dark brown and heavy oil, ranging in gravity from 31½° to 35° Beaume, the heavier oil being obtained in the Petrolea field, while the latter is produced in that of Oil Springs and the smaller pool

Definition of  
petroleum.



of Euphemia. The oil, as produced, has a very pungent odour of sulphur, which it contains in a form as yet undetermined, differing in this respect very materially from the oils of most of the United States fields. I have been unable to obtain any accurate analysis of Canadian oil, but its composition is approximately, carbon 85, hydrogen 15, the proportions varying with any variation in gravity, *e.g.*, the heavier the oil the greater the proportion of carbon. The actual commercial contents of Canadian oil, according to the returns of refiners during 1889, were :—

Illuminating oils .....	38.7
Benzine and naphtha .....	1.6
Paraffine and other oils (including gas, paraffine, black and other lubricating oils and paraffine wax) .....	25.3
Waste, not returned (including coke, tar and heavy residuum) .....	34.4
	<hr/> 100.0

Definition of  
natural gas.

Natural gas is understood to consist essentially of marsh gas with small quantities of hydrogen, nitrogen, etc., and to have a gravity compared with air of from .560 to .850. According to Prof. Ed. Orton,\* the natural gas of Findlay, Ohio, is composed of :—

Hydrogen .....	2.18	per cent by volume.
Marsh gas .....	92.60	“ “
Carbonic oxide .....	0.50	“ “
Olefiant gas .....	0.31	“ “
Carbonic acid .....	0.26	“ “
Nitrogen .....	3.61	“ “
Oxygen .....	0.34	“ “
Hydrogen sulphide .....	0.20	“ “

---

100.00

Specific gravity compared with air, .585.

First dis-  
covery.

As previously stated, the only oil-producing territory in Ontario is in Lambton county, to which district attention was first drawn in 1860 or 1861 by a Mr. Tripp, who owned a farm where now stands the village of Oil Springs. This gentleman, on excavating a well on his property for water, was struck by the appearance of an inspissated petroleum—known locally as “gum beds”—and also by the fact that black “rock oil” accumulated in considerable quantity on the surface of the water. The attention of Mr. J. H. Williams, of Hamilton, was drawn to the spot, and work in search of the oil than began in earnest. It was

\* Geological Survey of Ohio, vol. VI., page 538.

found that the deeper the wells were sunk into the Erie clay (which constitutes in a great measure the surface deposits of the district), the greater was the accumulation of oil. Drilling was then resorted to, and wells were bored into the rock. Through lack of experience, drilling was a very tedious operation, the only appliance then in use being the old-fashioned "kicking-rig," operated by the weight of the human body.

The first flowing well was struck on the 19th February, 1862, when Mr. James Shaw, of Oil Springs, found oil at a depth of 160 feet in what is now known as the "Upper Vein." Following closely upon this discovery was a rush to the new oil field, and the business passed through the various stages of speculation and finally reached a solid business steadiness in 1867, when the celebrated "King Wells" were sunk in Petrolea. On the discovery of these wells oil at once fell to 20 cents per barrel, but means were found to store the surplus and prevent the almost criminal waste which had attended the discovery of large wells sunk but a few years previously in Oil Springs.

Dr. Alex. Winchell has given a vivid description of the early workings at Oil Springs.\* He also gives † the following list of 33 flowing wells in Enniskillen township and their capacity prior to 1867 :

List of large  
flowing wells.

Depth in feet.	Situation.	Daily flow, barrels.
104.. Salis .....	Lot 18, Con. II.....	600
108.. Purdy .....	" 19 " II.....	1,000
115.. Evoy Bros.....	" 19 " II.....	600
116.. Jewry & Evoy.....	" 19 " II.....	300
116.. Fairbanks .....	" 17 " II.....	500
130.. Campbell.....	" 19 " II.....	200
132.. Bennett Bros.....	.....	500
136.. Chandler .....	" 18 " II.....	100
155.. Jewry & Evoy (same as above, bored deeper)...		2,000
157.. Sifton, Gordon & Bennett. Lot 18, Con. II.....		150
158.. J. W. Sifton .....	" 18 " II.....	800
158.. Shaw .....	" 18 " II.....	3,000
160.. Wanless .....	" 18 " II.....	200
160.. McLane .....	" 18 " II.....	3,000
160.. Ball .....	" 18 " II.....	250
160.. Rumsey .....	" 18 " II.....	250
160.. Whipple .....	" 18 " II.....	400
163.. Sanborn & Shannon....	" 18 " II.....	2,000

\*Sketches of Creation, 1870. Chap. XXV.

†Ibid, note VIII., page 443. Appendix.

Depth in feet.	Situation.			Daily flow, barrels.
163..	Campbell & Forsyth....	Lot 18, Con. II.....		1,000
163..	Wilkes.....	" 18 " II.....		2,000
164..	Bradley.....	" 18 " II.....		3,000
167..	Webster & Shepley....	" 18 " II.....		6,000
170..	Leavenworth.....	" 18 " II.....		500
170..	Culver.....	" 18 " II.....		200
173..	Allen.....	" 17 " II.....		2,000
175..	Barnes.....	" 17 " II.....		300
178..	Petit.....	" 19 " II.....		3,000
180..	George Gray.....	" 17 " II.....		150
180..	Holmes.....	" 19 " II.....		500
187..	McCall.....	" 17 " II.....		1,200
188..	Swan.....	" 18 " II.....		6,000
212..	Fiero.....	" 19 " I.....		6,000
237..	Black & Mathewson....	" 17 " I.....		7,500

Efforts on part  
of prospectors  
to find gas.

There are several points in connection with the production and utilization of natural gas, which may perhaps be here usefully referred to, especially the ill-directed efforts on the part of prospectors to procure it and the many thousands of dollars thus spent in regions where the geological conditions preclude all possibility of success and through a knowledge of which this useless expenditure might have been avoided.

In writing on the *anticlinal theory*, Prof. I. C. White states:—"The first explorers assumed that gas could be obtained at one point as well as another, provided that the earth be penetrated to a depth sufficiently great; and it has required the expenditure of several hundred thousand dollars in useless drilling to convince capitalists of this fallacy, which even yet obtains general credence among those not interested in successful gas companies."\*

The words "several hundred thousand dollars" do not yet, fortunately, apply to those already spent in useless drilling in Ontario, though that there have been large sums uselessly spent will be acknowledged. Where in a district rocks elsewhere known to be gas-bearing have been proved to be "flooded," and the geological structure is that of a syncline rather than anticlinal, the chances of obtaining gas in paying quantity will be small, and again, in any district where the rocks have, through disturbance, been greatly fissured, it would be useless to expect to find gas, as it would long ago have escaped, or so lessened its pressure as to afford but meagre flows. The value of a

\*"Science," 26th June, 1885.

knowledge of geology, it seems, is not recognized by the average practical driller, who is influenced more by a "promising" (?) contour than by geological facts.

Attention has time and again been called by United States writers on the subject, to the almost criminal waste of gas by consumers and by owners of wells, the production of which is consumed only by themselves. For instance, many owners think it necessary to consume the *whole* daily flow of their well, never recognizing the fact that the rocks so long the reservoir of the gas contain only a limited supply that may with due economy be made to last the longer. Lime burners and brick manufacturers particularly allow much more fuel to be consumed than is necessary, because they think it costs nothing. The fact that the supply is diminishing may cause them to be more careful in the future, though the loss will then be irreparable, as a well has a certain life which can be prolonged only by care and economy. The indiscriminate lighting of towns and villages by torches is another danger to any gas district, as great quantities are thereby consumed with no better result than would be obtained through the use of a small pressure burner. Experience, however, will be the only teacher, and it is to be hoped that the lesson will be learned as cheaply and as soon as possible.

Waste of gas.

There are many other points of interest to the gas producer, information on which may be found in the reports of the Geological Surveys of Ohio, Pennsylvania and other states wherein gas is an important product. Attention is particularly directed to the report of the Geological Survey of Ohio, vol. VI., by Prof. E. Orton.

With the present report the following appendices are given :—

Appendices.

A.—Table for the conversion of specific gravities into their corresponding gravities according to Beaume's hydrometer ;

B.—Cost of "drilling-rig" complete, at Petrolea, Ont., F. O. B. ;

C.—Bibliography.

My acknowledgments are due to the many drillers and gas and oil producers throughout Ontario, who have so kindly assisted in the preparation of this report, more especially to Mr. Jas. Kerr, Secretary Oil Exchange, Petrolea ; E. Coste, Manager Provl. Nat. Gas Co., Buffalo ; D. A. Coste, Buffalo ; J. C. McRae, Port Colborne ; J. S. Hyland, Walkerville ; Peter McEwen, Goderich ; M. J. Woodward, Major Savage, Wm. Harris, Jas. McCort and E. Rawlings, of Petrolea.

Acknowledgments.

## PART I.

BRIEF EXTRACTS FROM WRITINGS REGARDING THE ORIGIN OF THE HYDRO-CARBONS, MORE ESPECIALLY PETROLEUM AND NATURAL GAS.

*Theories of Inorganic Origin.*

Theories of  
inorganic  
origin.  
M. Berthelot.

Among the principal writers on the theories coming directly under this heading may be mentioned M. Berthelot, and later, M. Mendeljeff. In December, 1886, M. Berthelot published a paper\* wherein he says:—

“If in accordance with an hypothesis recently announced by M. Daubré, it is to be admitted, that the terrestrial mass contains free alkali metals in its interior, this hypothesis alone, together with experiments that I have lately published, furnishes almost of necessity a method of explaining the formation of carbides of hydrogen. According to my experiments, when carbonic acid, which everywhere infiltrates the terrestrial crust, comes in contact with the alkali metals at a high temperature, acetylides are formed. These same acetylides also result from contact of the earthy carbonates with the alkali metals even below a dull-red heat.

“Now, the alkaline acetylides thus produced could be subjected to the action of vapour of water; free acetyline would result if the products were removed immediately from the influence of heat and of hydrogen (produced at the same time by the reaction of water upon the free metals) and the other bodies which are found present. But in consequence of the different conditions the acetyline would not exist, as has been proved by my recent experiments.

“In its place we obtain either the products of its condensation, which approach the bitumens and tars, or the products of the reaction of hydrogen upon those bodies already condensed; that is to say, more hydrogenated carbides. For example, hydrogen reacting upon the acetyline, engenders ethylene and hydride of ethylene. A new reaction of the hydrogen either upon the polymeres of acetyline or upon those of ethylene would engender formenic carbides, the same as those which constitute American petroleum. An almost unlimited diversity in the reaction is here possible, according to the temperature and the bodies present.

“We can thus imagine the production by a purely mineral method of all the natural carbides. The intervention of heat, of water, and the alkali metals, together with the tendency of the carbides to unite with each other to form matters more condensed, are sufficient to

---

\*“*Les Annales de Chimie et de Physique.*”

account for the formation of these curious compounds. Their formation could thus be effected in a continuous manner, because the reactions which give birth to them are continually renewed. This hypothesis is susceptible of further development, but I prefer to dwell within the limits authorized by my experiments without wishing to announce other than geological possibilities."

In 1871 M. H. Byassan, in a paper read before the French Academy, on the origin of pétroleum, states that "by causing carbonic acid and water to react under very simple conditions, (he) obtained a small quantity of an inflammable liquid nearly indifferent to sulphuric acid, and with an odour analogous to that of carbides of pétroleum." M. H. Byassan.

In 1877 M. Mendeljeff read a paper before the Chemical Society of St. Petersburg, wherein he puts forth views very similar to those of M. Berthelot. A résumé of his paper was, in the same year, published,\* from which the following is an extract:—"These reflections have led the author to the supposition that pétroleum is in no place of organic origin. In speaking of the hypothesis of La Place upon the origin of the earth, in applying Dalton's law to the gaseous state in which all the elements constituting the terrestrial globe ought to be found, and taking into consideration their relative densities, M. Mendeljeff recognizes the necessity of admitting a condensation of metals at the centre of the earth. Among these it is natural to presume iron would predominate, because it is found in great abundance in the sun, in meteorites and basalts. Admitting further the existence of metallic carbides, it is easy to find an explanation not only for the origin of pétroleum, but also for the manner of its appearance in the places where the terrestrial strata, at the time of their elevation into mountain chains, ought to be filled with crevices to their centre. These crevices have admitted water to the metallic carbides. The action of water upon the metallic carbides at an elevated temperature and under a high pressure has generated metallic oxides and saturated hydrocarbons, which, being transported by aqueous vapour, have reached those strata where they would easily condense and impregnate beds of sandstone, which have the property of imbibing great quantities of mineral oil." M. Mendeljeff.

"This explanation of the origin of pétroleum finds support from the following facts: The predominance at the surface of the earth of elements having a small atomic weight; the appearance of pétroleum in directions corresponding to great circles; the relation remarked by several naturalists, particularly by M. Abich, between pétroleum and volcanic manifestations.

---

\*"Bulletin de la Société Chimique de Paris."

"In order to make this question clear, it is indispensable to study the different transformations of petroleum, its decomposition into marsh-gas and non-saturated hydrocarbons; of determining the chemical nature of mineral oils of different origin; also that of the saline water that ordinarily accompanies petroleum. Researches of this kind, in connection with profound geological studies, can alone render justice to the hypothesis stated above."

Other writers. Following closely upon these statements of research and opinion, may be mentioned the investigations of Messrs. Friedel and Crafts, Clœz, Landolph, Coquand, Grabrowski and others, all of whose experiments show rather the possibilities than the probabilities regarding the origin of hydrocarbons.

Prof. R. C. Taylor. Prof. R. C. Taylor,\* while not expressing himself regarding the origin of petroleum, cites many instances wherein oil occurs intimately connected with rocks of eruptive or highly metamorphosed character. Of the Island of Havana, he writes: "Petroleum leaks out in numberless places in this delightful island from amid the fissures of the serpentine, and perhaps has deep-seated sources."

Tar Point, Gaspé. The occurrence of petroleum, in the amygdulæ of a trap dyke at Tar Point, Gaspé, is mentioned as follows:—"This dyke, which does not occur in the centre of the fold, but about 200 yards to its north-east or precipitous side, has a breadth of ten or twelve yards, with a direction N. 83° W. Its colour is dark grey, weathering to a rusty red, and it is traversed by numerous horizontal and vertical joints, and abounds in large and small druses, which, as well as the joints, are often lined with chalcedony; sometimes, in the case of the druses, presenting botryoidal surfaces, and at others, encrusted with crystals of quartz and calcite. These cavities as well as others which are not thus lined with chalcedony, are filled with petroleum; this, in some instances, has hardened to the consistency of pitch."

S. F. Peckham's review of Berthelot's theory. Mr. S. F. Peckham reviewing the theory advanced by M. Berthelot, writes: †"The theory of M. Berthelot appears to me to derive less support from observed facts than any which has been proposed. It was doubtless formed with reference to the petroleum of Pennsylvania, which are among the purest mineral hydrocarbons of any found in large quantities. The very small proportion of nitrogen existing in these oils might perhaps be accounted for as an accidental constituent of the limestone, or as being mechanically mingled with the watered vapour. Neither supposition is at all probable, since nitrogen possesses

\*"Statistics of Coal," Philadelphia, 1885.

\*Geology of Canada, 1863, p. 402.

†Proceedings of the American Philosophical Society, vol. X., 1867, pp. 455.

such slight affinities. It adds nothing to its support to admit that the alkali metals do exist in the interior of the earth in the free state. The very great difference observed between the varieties of the petroleum cannot be explained upon any hypothesis that regards them as the results of the same process acting upon light materials; neither should it be expected that a process yielding an almost 'unlimited diversity' of products, under slightly varying circumstances, would furnish a uniform result over a very wide area. Samples of Pennsylvania petroleum of the same density, when gathered from widely separated localities, furnish identical results upon analysis; so, too, do California petroleum, though gathered from localities fifty miles apart; and yet the two varieties of oil are exceedingly unlike. 'It is, moreover, altogether erroneous to attempt to explain the causes of geological facts by the aid of supposed analogies with the complex apparatus of physical cabinets, whose existence in nature could scarcely be conceived by the boldest and most unrestrained imagination.' (a).

### *Theories of Organic Origin.*

The organic origin of hydrocarbons is at the present time conceded by the majority of geologists and chemists, but an inorganic origin may, perhaps, be admitted in certain exceptional cases. Theories of organic origin

Theories under the above heading must again be divided; many adhering to the opinion that hydrocarbons are the result of (1) the primary distillation of vegetable or animal remains, while others contend that they are the products of (2) a secondary distillation or decomposition of organic remains made at some period subsequent to their deposition.

Dr. E. Orton,\* thus defines these different opinions: "The first view is, that petroleum is in large part derived from the *primary decomposition of organic matter* that was stored in, or associated with, the strata that now contain it. According to this view, the decomposition was mainly effected *in situ*, and the product resulting is, therefore, mainly indigenous to the rock in which it is found. The last feature is seized upon in most popular statements, and a *theory of indigenous origin* is made to include most beliefs of this class. It must be borne in mind, however, that no author is to be found who holds strictly and consistently to such indigenous origin, but the name can still be used as a general designation without harm."

(a) Quotation from Bischof: "Chemical and Physical Geology."

\* Geological Survey of Ohio, vol. VI.



"The second view is, that petroleum is derived from the *secondary decomposition of organic matter* stored in the rocks. It supposes the original vegetable and animal matter to have suffered a partial transformation and to be now held in the rocks as hydrocarbon compounds, from which, *by a process of distillation*, oil and gas are derived. The so-called bituminous shales are counted the chief sources of these products. After distillation it is held that the gas and oil are mainly carried upward by hydrostatic pressure to some overlying porous stratum that serves as a reservoir. This class can be conveniently grouped under the name of the distillation theory."

*Theory of Origin by Primary Decomposition.—Hunt's Theory.*

Theory of  
primary dis-  
tillation.—  
Hunt's theory.

Among the most prominent exponents of the former or indigenous theory may be mentioned Dr. T. Sterry Hunt, who, in a long series of articles on the subject, endeavours to prove that gas and oil are, with few exceptions, indigenous to limestones alone, though also found adventitiously in sandstones, shales, and conglomerates. Among the most important producing strata he includes the limestones of the Trenton and Corniferous formations.

He writes : \* "The fact that intermediate porous strata of similar mineral character are destitute of bitumen, shows that this material cannot have been derived from overlying or underlying beds, but has been generated by the transformation of organic matters in the strata in which it is met with."

And again : † "It has already been shown that the petroleum of Canada occurs in two district horizons ; the one in the limestones of the Trenton group, and the other in those of the Corniferous formation. To this it must now be added, that the petroleum of Gaspé probably belongs to an intermediate position, and is to be referred to limestones of Upper Silurian age."

Also : ‡ "In opposition to the generally received view, which supposes the oil to originate from a slow destructive distillation of the black pyroschists, belonging to the middle and upper Devonian, I have maintained that it exists, *ready formed*, in the limestones below."

He writes : § "Concretionary nodules holding petroleum have also been observed in the Marcellus and Genesee slates, while the higher Devonian sandstones in New York and Pennsylvania are often impregnated with petroleum, and from these, and from still higher

\* Canadian Naturalist, Vol. VI., p. 242.

† Geology of Canada, 1863, p. 786.

‡ American Journal of Science, Vol. XLVI., 1868, p. 360.

§ American Journal of Science, Vol. XXXV., 1863, p. 167, 168.

strata, issue the oil springs of those regions. It is probable, however, that the source of the oil in these superior strata is to be found in the Corniferous limestone, from which the petroleum of Western Canada is undoubtedly derived. \* \* \* In the township of Rainham, on Lake Erie, the shells of *Pentamerus aratus* are sometimes found to have an inner cavity, lined with crystals of calcite, and filled with petroleum. Coralline beds impregnated with petroleum are found in Wainfleet and in Walpole, in the latter instance immediately beneath a layer of chert, but I have more particularly examined them in the township of Bertie, which is on the Niagara River, opposite Buffalo. Here, in a quarry are seen massive beds, slightly inclined, composed of a solid crystalline encrinal limestone, which appears not only destitute of petroleum, but from the water, by which it is impregnated, to be impermeable to it. In some of these beds are large corals of the genus *Heliophyllum*, the pores of which are open, but contain no oil. Two beds, however, one of three, and one of eight inches, which are interstratified with these, are in great part made up of species of *Heliophyllum* and *Favosites*, the cells of which are full of petroleum. This is seen, in freshly broken masses, to be absent from the solid limestone, which forms the matrix of the corals, and resembles in texture the associated beds. As the fractured surfaces of the oil-bearing beds become dry, the oil spreads over them, and thus gives rise to the appearance of a continuous band of dark oil-stained rock, limited above and below by the lighter limestone, from which, however, it is separated by no planes of bedding. The layer of three inches was seen to be twice interrupted in an exposure of a few feet, thus presenting lenticular beds of the oil-bearing rock. Besides the occasional specimens of *Heliophyllum* without oil, disseminated in the massive limestone, a thin and continuous bed of *Favosites* is met with, which is white, porous, and free from oil, although beds both above and below are filled with it. \* \* \* The facts observed at this locality appear to show that the petroleum, or the substance which has given rise to it, was deposited in the beds in which it is now found, at the formation of the rock. We may suppose in these oil-bearing beds an accumulation of organic matters, whose decomposition in the midst of a marine calcareous deposit, has resulted in their complete transformation into petroleum, which has found a lodgment in the cavities of the shells and corals immediately near. Its absence from the unfilled cells of corals in the adjacent and interstratified beds, forbids the idea of the introduction of the oil into these strata either by distillation or by infiltration. The same observations apply to the petroleum of the Trenton limestone, and if it shall hereafter be shown that the source

of petroleum (as distinguished from asphalt) in other regions, is to be found in marine fossiliferous limestones, a step will have been made towards a knowledge of the chemical conditions necessary to its formation. \* \* \* It would appear that the Devonian sandstones of Pennsylvania and North-eastern Ohio are filled with oil, which has risen from the limestone beneath, while, over a great portion of Western Canada, this limestone was ages ago denuded, and has lost the greater part of its petroleum."

Chicago limestone.

Again, in writing of a dolomite of the Niagara formation, met with near Chicago, Illinois ("Chicago limestone"), he again very plainly states his views, as follows:—"A layer of this oleiferous dolomite, one mile square and one foot thick, will contain 1,184,832 cubic feet of petroleum, equal to 8,850,069 gallons of 231 cubic inches, and to 221,247 barrels of 40 gallons each. Taking the minimum thickness of 35 feet assigned by Mr. Worthen to the oil-bearing rock at Chicago, we have in each square mile of it 7,743,745 barrels, or in round numbers, 7,750,000 barrels of petroleum. \* \* \* With such resources existing ready formed in the earth's crust, it seems to me, to say the least, unphilosophical to search elsewhere for the origin of petroleum, and to suppose it to be derived by some unexplained process from rocks which are destitute of the substance."

Other writers on theory of primary distillation.

In Dr. Hunt's voluminous writings on the subject, much more may be found showing him to have been consistent in his assertions, but the above extracts have been thought sufficient to illustrate the views held by him. Similar opinions are held by many other American and European geologists, among whom may be mentioned Messrs. Stafford, Lesley, Binney, Aiken, Bright, Prestwich, Winchell, White, Whitney, Jones and Wall.

The last named writes\*:

Wall on Trinidad asphalt.

"The asphalt of Trinidad is almost invariably disseminated in the upper group of the "Newer Parian." When *in situ* it is confined to particular strata, which were originally shales containing a certain proportion of vegetable *debris*. The organic matter has undergone a special mineralization, producing bituminous in place of the ordinary anthraciferous substances. This operation is not attributable to heat, nor of the nature of distillation, but is due to chemical reaction at the ordinary temperature and under the ordinary conditions of the climate. The proofs that this is the true mode of generation of the asphalt repose not only on the partial manner in which it is distributed

\* "Geology of a part of Venezuela and Trinidad." Q.J.G.S., Vol. XVI., p. 467.

in the strata, but also on numerous specimens of the vegetable matter in process of transformation and with the organic structure more or less obliterated. After the removal, by solution, of the bituminous material, under the microscope a remarkable alteration and corrosion of the vegetable cells becomes apparent, which is not presented in any other form of the mineralization of wood. A peculiarity attending the formation of the asphalt results from the assumption of a plastic condition, to which property its frequent delivery at the surface is partly referable. \* \* \* Sometimes the emission is in the form of a dense oily liquid, from which the volatile elements gradually evaporate, leaving a solid residue. \* \* \* The phenomenon of salses or mud-volcanoes, consisting of the solution of inflammable gas, accompanied by the discharge of a muddy fluid and asphaltic oil, is perhaps closely related to the activity just described, as carburetted hydrogen may be disengaged in the direct formation of asphalt."

*Theory of Origin by Secondary Decomposition or Distillation.*

Among those intimately connected with the second or distillation theory are Messrs. J. S. Newberry and S. F. Peckham, both of whom advance somewhat different opinions, acknowledging, however, the great principle of a secondary distillation of organic remains stored in the rocks of the earth's crust. The former contends that the distillation is continuous and at a low temperature, while the latter equally strongly maintains it to be the result of distillation accomplished of a necessity by heat; citing as an example of this, the oil and gas of Pennsylvania, whose origin he accounts for by distillation through the agency of heat generated during the elevation of the Appalachian Mountains.

Theory of secondary decomposition or distillation.

*J. S. Newberry's Theory.*—In 1859, in a paper on the "Rock Oils of Ohio\*," Newberry states his views very distinctly in the following words: "The precise process by which petroleum is evolved from the carbonaceous matter contained in the rocks which furnish it is not yet fully known, because we cannot in ordinary circumstances inspect it. We may safely infer, however, that it is a distillation, though generally performed at a low temperature. \* \* \* When, however, carbonaceous organic tissue is buried in moist earth or submerged in water, oxidation does not at once ensue, or at least takes place to a limited extent, measured by the amount of oxygen present. In these circumstances bituminization takes place. This pro-

Newberry's theory.

\* "Ohio Agricultural Report," 1859.

cess consists mainly in the union of hydrogen, from the tissue itself or its surroundings, with a portion of the carbon, to form carburetted hydrogen, which perhaps escapes, and the hydrocarbons constituting the bitumen, which usually remains as a black, pitch-like mass, investing the fixed carbon. By this process peat, lignite, and coal are formed, which are solids, and doubtless some liquid and gaseous hydrocarbons which escape. Now, when we heat these solid bitumens artificially at a sufficiently high temperature, if in contact with oxygen, combustion ensues, and water and carbonic acid are formed from them. At a lower temperature they are converted into gaseous hydrocarbons; still lower, to oils."

Again he says\*: "The origin of the two hydrocarbons is the same, and they are evolved simultaneously by the spontaneous distillation of carbonaceous rocks. \* \* \* \*

\* \* \* \* Where the oil and gas-producing rocks, and those overlying them, are solid and compact, decomposition of the organic matter they contain takes place very slowly and the escape of the reacting hydrocarbons is almost impossible. Where they are more or less shaken up, decomposition takes place more rapidly; reservoirs are opened to receive the oil and gas, and fissures are produced which serve for their escape to the surface. Near the Alleghanies all the rocky strata are more or less disturbed, and here along certain lines, the liquid and gaseous hydrocarbons are evolved in enormous quantities. As we come westward, however, we find the rocks more undisturbed, and the escape of oil and gas, through natural or artificial orifices, gradually diminished." Again, in the same volume, page 158, he says: "We have in the Huron shale a vast depository of solid hydrocarbonaceous matter, which may be made to yield from ten to twenty gallons of oil to the ton by artificial distillation. Like all other organic matter this is constantly undergoing *spontaneous* distillation, except where hermetically sealed deep under rock and water. This results in the formation of oil and gas, closely resembling those which we make artificially from the same substance; the manufactured differing from the natural products only because we can not imitate accurately the processes of nature. \* \* \*

A line of gas and oil springs similar to that already referred to, follows the outcrop of the Cleveland shale; a carbonaceous stratum in the overlying Waverley group, but the quantity of liquid and gaseous hydrocarbons generated here is much less than that evolved from the Huron shale, because one is 50, the other 300 feet in thickness. Again, the emanations of oil and gas from the Lower Silurian rocks at Collingwood, Canada, and on the upper

---

\*Geological Survey of Ohio, Vol. I., 1873, pp. 192-193.

Cumberland River, Kentucky, are associated with similar deposits of black shale which represent the Utica slate of New York."

The foregoing extracts have been thought sufficient to illustrate Mr. Newberry's theory, which may be summarized as follows:—Oil and gas are the result of a *continuous and spontaneous distillation* of the bituminous matter of certain shales, from which the greater part of the two hydrocarbons is obtained.

He acknowledges, however, that the bitumen of the Chicago limestone is indigenous to the rocks in which it is stored. Of the Corniferous formation, he states, very distinctly,\* that from the limestones of this formation but little oil has ever been obtained. This statement is evidently a mistake, as it is from wells in this limestone that the oil of Enniskillen township has been obtained for the past twenty-seven years; while efforts to find it in the underlying strata have not proved successful, though test-wells have been sunk at several points in both the Petrolea and Oil Springs fields.

*S. F. Peckham's Theory.*—The following extracts from S. F. Peckham's report on Petroleum† have been made with the intention of placing before the reader this gentleman's view regarding the origin of hydrocarbons. That his statements are to a certain extent contradictory, or in need of further explanation, is evident. He writes in the above-mentioned report: Peckham's theory.

"It is not the effects of heat, as represented by volcanic action, that have produced petroleum \* \* \* Bitumens are not the product of the high temperatures and violent action of volcanoes, but of the slow and gentle changes at low temperature due to metamorphic action upon strata buried at immense depths. \* \* \* The alteration, due to the combined action of heat, steam and pressure, that involved the formations of the Appalachian system from Point Gaspé, in Canada, to Lookout Mountain, in Tennessee, involving the Carboniferous and earlier strata, distorting and folding them, and converting the coal into anthracite and the clays into crystalline schists along their eastern border, could not have ceased to act westward along an arbitrary line, but must have gradually died out farther and farther from the surface."

"The great beds of shale and limestone containing fucoids, animal remains, and even indigenous petroleum, must have been invaded by this heat to a greater or less degree, and that 'chronic evaporation' of Prof. Lesley must have been the inevitable consequence."

\* Geological Survey of Ohio, Vol. I.

† "Tenth census of the United States." Vol. X.

"Too little is known about petroleum at this time to enable any one to explain all the phenomena attending the occurrence of petroleum on any hypothesis; but it seems to me that the different varieties of petroleum, from Franklyn dark oil, near the surface, to Bradford and Clarendon amber oil, far beneath the surface, are the products of fractional distillation, and one of the strongest proofs of this hypothesis is found in the large content of paraffine in the Bradford oil under the enormous pressure to which it is subjected."

"The fact that the eruptive rocks of Lake Superior and the metamorphic rocks farther east prevail to such an extent that that vast inland sea has been supposed to be the crater of an extinct volcanic lake lends the strongest support to an hypothesis that regards the vast accumulations of petroleum in western Canada as due to the invasion of strata on the borders of this heat-centre, in which the petroleum is indigenous, by a sufficiently elevated temperature to cause its distillation."

"It appears to me that mud volcanoes and hot springs are properly regarded as the phenomena attending the gradual subsidence of metamorphic action in the crust of a cooling earth, and that petroleum or maltha is but the accident of such phenomena, when strata containing organic matter are still invaded at a great depth by a temperature sufficient to effect the distillation of their organic content."

Prof. J. D.  
Dana.

The explanation of the origin of petroleum given by Prof. J. D. Dana\* adds considerable weight to the evidence adduced in support of the theory of secondary decomposition or distillation. He says:

"The conditions favourable to the formation of naphtha, as shown by the characteristics of the deposits in which it is found native, are the following: (1) The diffusion of organic material through a fine mud or clay; (2) the material in a very finely divided state; and (3) as a consequence of the preceding, the atmosphere excluded as far as possible from the material undergoing decomposition. There is reason to believe that no more heat was required than what was afforded by the natural climate or temperature of the region and the process of fermentation."

"Shales, the most common oil-bearing rocks, were originally the fine mud of deep or shallow seas; and the limestones were the same, only the mud was calcareous in nature, like the coral mud of many a coral lagoon, as the author has elsewhere described, after personal examination. These shales ordinarily contain few fossils of any kind, and very rarely distinct vegetable remains. It may be questioned

---

\*"System of Mineralogy," 5th edition, page 725.

whether tough fucoids (sea-weeds), or the branches and leaves of ordinary plants imbedded in such clays, would ever become so subdivided or disorganized as to make the requisite emulsion with the mud free from any vegetable forms; and it is more probable that the vegetable material present was either delicate water-plants or was derived from abundant infusorial or microscopic vegetable life. The limestones, on the contrary, are sometimes full of fossils, but these are animals; and, as the solid parts which make the fossils are to a large extent ground up to make the mud that becomes the limestone, the organic material these hard parts contain, as well as that of the fleshy parts and oils, would be diffused through the mud or earth in the very condition demanded.

"The light native oils do not occur in coal beds, which were made from thick beds of vegetable debris.

"In the above-mentioned circumstances, with the deposits under pressure from superincumbent beds, the atmospheric air almost totally excluded, the organic material might undergo decomposition through the reactions of its own elements alone."

## PART II.

### RECORD OF BORING OPERATIONS AND NOTES ON THE DISTRIBUTION OF NATURAL GAS AND PETROLEUM IN ONTARIO, UP TO THE CLOSE OF THE YEAR 1890.

^ ———

#### WELLS IN EASTERN ONTARIO.

##### *Well near Bainsville, Glengarry County.*

Throughout that part of Ontario, east of Whitby on Lake Ontario, Bainsville, and Pembroke on the Ottawa River, several wells have been fruitlessly sunk for gas or oil.

The most easterly of these borings was made near Bainsville during the years 1865 and 1866, on lot 21, concession 2, Lancaster township, Glengarry county. It was sunk to a depth of 500 feet in search of oil and was unsuccessful, though small flows of gas were said to have been met with. The surface deposits, thirty feet thick, consisted of clays and sands overlying a gravel bed from which a copious flow of very pure, fresh water was obtained. I am indebted for information regarding the well to Mr. Alex. Campbell, of Bainsville, who was,



unfortunately, unable to supply data regarding the rocks encountered ; it is, however, presumed that they consisted chiefly of limestones of the Trenton formation.

*Wells at Caledonia Springs, Prescott County.*

Caledonia  
Springs.

Since 1805 gas has been known to occur in the mineral springs of this neighbourhood, though no deep borings have as yet been made in quest of it. In connection with "The Grand Hotel" (Sanitarium) are several springs from which the mineral water used in the hotel is obtained. These springs have been opened up and the water is now taken from tanks into which it constantly flows. One of these, known as the "Gas Spring," is seen to be in a constant state of ebullition caused by the escape of gas.

Dr. Sterry Hunt describes this spring as follows\*:—"One of these is known as the Gas Spring, from the quantity of carburetted hydrogen gas which it evolves, and which is roughly estimated at 300 cubic inches per minute." About 3,000 cubic feet per diem.

No search has yet been made in the neighbourhood for larger quantities of gas, though several drive wells have been sunk, in a number of which gas has been observed. The surface deposits are about 100 feet thick, resting immediately on the Trenton limestone.

*Well at Ottawa, Carleton County.*

Ottawa.

During 1888 two companies applied for the franchise from the city of Ottawa to lay pipes to transport natural gas for lighting and other purposes. The claims of the rival companies were vigorously upheld till the spring of the following year, when the controversy was finally settled by the action of the Premier Gas Co., which in May, 1889, commenced boring operations on the north side of Patterson's Creek near the southern limit of the city. In April, 1890, the company, after many reverses, had succeeded in sinking a well 1,005 feet deep ; but neither gas nor oil having been obtained the work was then suspended. It is said that oil in small quantities was observed at 900 feet. Sulphurous water was struck at 320 feet and salt water in great quantity at 550 feet. Casing was carried to a depth of 820 feet, though, owing to some defect, the water was never effectually shut off, but rose to the surface and flowed over in a weak stream.

No very accurate record of the boring was kept, and but few specimens were obtained, those available being as follows :—

---

\* Geology of Canada, 1863, p. 535.

Specimen from 30 feet—Limestone, light blue.

“ “ 35 “ “ shaly, dark blue.

“ “ 82 and 110 feet—Limestone, light blue.

“ “ 120, 140 and 150 feet—Limestone, shaly, dark blue.

“ “ 160, 180 and 185 “ “ light blue.

“ “ 190 feet—Limestone, soft, shaly (thin laminæ)  
arenaceous.

Specimen from 195 to 220 feet—Limestone, light grey.

“ “ 225 feet—Limestone, dark blue.

“ “ 230 “ “ light grey.

“ “ 240 “ “ “ with chert.

“ “ 250 “ “ “ “

Between 250 and 310 feet a streak of sandstone similar to that at 310 feet is said to have been traversed, though of what thickness is unknown.

Specimen from 310 feet—Sandstone, fine grained, highly calcareous.

“ “ 315 “ Limestone, with pyrite and fragments of  
*Leptaena sericea* and *Orthis*, sp.

Specimen from 335 feet—Limestone.

“ “ 350 “ “ dark blue, with pyrite and  
*Orthis*, sp.

Specimen from 380 feet—Limestone, blue, with quartz.

“ “ 475 “ “ light blue, with pyrite in abundance.

Below this point, it is said that nothing but light blue limestone was found, which may possibly be of the Black River formation.\*

#### *Well at North Gower—Carleton County.*

Some twenty years ago an unsuccessful attempt was made to obtain North Gower oil near this village. No data are at hand regarding this well, beyond the fact that neither gas nor oil was found.

#### *Well near Pembroke—Renfrew County.*

During the summer of 1888, a well was sunk some four miles Pembroke west of Pembroke, in the township of McKay. The enterprise was unsuccessful, however, neither gas nor oil being obtained. No information is at hand regarding this boring, the precise position of which is uncertain, as the township has not yet been surveyed.

---

NOTE.—I informed persons connected with the undertaking, before operations were commenced, that there was no probability of their getting either petroleum or natural gas, but almost certainly saline water.—A. R. C. SELWYN.

*Well at Deseronto—Hastings County.*

Deseronto.

While drilling in the yard of the hotel owned by W. Jamieson, Esq., of Deseronto, gas in small quantities was found in the limestone at a depth of thirty feet; the well is only sixty feet deep. At fifteen feet, the thickness of the surface deposits, there was a strong odour of gas, and from the lower thirty feet a sufficient quantity was obtained to support a small flame at the mouth of the casing.

*Well at Whitby—Ontario County.*

Whitby.

A well was sunk in 1888 in the town of Whitby by a company composed of citizens of that place under the title of "The Whitby Gas and Water Company," with a capital stock of \$10,000. The boring was made on lot 28, 7th double range, west of Brock street, and was carried to a depth of 728 feet as follows:—

Surface.....	50 feet.
Shale.....	70 " Utica.
Limestone.....	600 " Trenton.
" Arkose " beds .....	8 " to granite.

Small quantities of gas were found at 400 and 700 feet. At the time of my visit the well was flooded to the top of the casing and it was found impossible to get an accurate measurement of the flow; it is, however, safe to estimate it as being under 2,000 cubic feet per diem.

## WELLS IN YORK COUNTY.

*Well at Highland Creek.*Highland  
Creek.

I have been unable to obtain any authentic account of operations at this point, and give the following as the result of inquiries made at different times and of various persons. The information obtained shows that a well was sunk near this village, during either 1866 or 1867, to a depth of 682 feet, penetrating the Trenton limestone to a depth of 434 feet, in which formation it is reported that large quantities of gas were struck.

The record of the well is reported as follows:—

Surface (blue clay) ..	48 feet.
Shale (black) .....	200 " Hudson River and Utica.
Limestone.....	434 " Trenton.

The fact that the well was at once abandoned shows that there was, as is usual in this district, but a small flow of gas.

*Well at Copland's Brewery, Toronto.*

In 1882 a well was sunk for water in the yard at Copland's brewery Toronto, on Parliament street, Toronto, where, at a depth of 1,200 feet, granite was struck. No good water was found.

The record is as follows:—

Surface.....	40	feet.	
Limestone.....	150	"	Hudson River.
Shale.....	405	"	Hudson River and Utica.
Limestone.....	585	"	Trenton.
"Arkose" beds...	20	"	to granite.

The driller, Mr. W. Harris, of Petrolea, reports that neither gas nor oil was found.

*Well at Ontario Bolt Works, Swansea, Toronto.*

An unsuccessful attempt to obtain gas was made during 1888, or Swansea. 1889, on the east side of the Humber River, about three-quarters of a mile from the lake shore, and about the same distance north of the bolt works. The well, sunk by the Ontario Bolt Company, reached a depth of 703 feet; sixty feet below the summit of the Trenton limestone. During the winter of 1890-91 this well was continued to a total depth of 1,261 feet, or 16 feet into the Archean rocks, the drillings showing these to consist of crystalline limestone with mica, pyrite and a serpentinous mineral. Throughout the first 700 feet considerable flows of saline and other mineral waters were noted; neither gas nor oil was found.

The record shows the following section:—

Sand.....	65	feet	} Surface deposit, 107 feet.
Quicksand .....	15	"	
Hardpan.....	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	"	Archean.

Elevation above tide, 347 feet.

Several other wells have been sunk to and into the Trenton limestone in and around Toronto, from none of which has gas been reported, though it is known to occur in small quantities about eight miles west, and at Highland Creek, about fifteen miles east of Toronto.

*Well at Mimico.*

Mimico.

During the summer of 1889, a well was sunk by the Ontario Government at Mimico, a village some eight miles west of Toronto. The well, begun in search of water, was carried as an eight-foot shaft to a depth of fifty feet, or forty-three feet into the blue shaly limestones of the Hudson River formation. A four-inch boring was then begun, in anticipation of finding gas. It reached a total depth of 1,060 feet, only small quantities of gas being obtained at the depths of 425, 575 and 1,052 feet. A flow of water was struck at twenty-five feet, but too small, however, to be of economic importance; the well was then cased to a depth of 100 feet, beneath which point it was quite dry. The record, according to the driller, is as follows:—

Surface	.....	7 feet.	
Blue shale	.....	493 "	} Hudson River and Utica.
Brown "	.....	223 "	
Limestone	.....	337 "	
			Trenton.

## WELLS IN SIMCOE COUNTY.

*Wells at and around Collingwood.*

Collingwood.

At Collingwood the Trenton limestones outcrop and constitute the entire series of measures through which the various wells were sunk, the total thickness being in the neighbourhood of 600 feet; these rocks are to the south capped by Utica shale, which forms the base of the Blue Mountains, a range of hills lying to the south-west of the town. The limestones on the shore and throughout the town show little or no dip, though on approaching the Blue Mountains they have a slight dip to the S.S.W. The Utica shales, at a point a few miles west of Collingwood, cover the Trenton and further west are succeeded in turn by the Hudson River and Clinton formations.

*No. 1 Well.*—This well, on lot 16, west side of Peel street, was bored during the spring of 1888, to a depth of 553 feet, at which point granite was reached immediately underlying the limestone, which was 543 feet thick, under ten feet of surface deposits. Gas was struck in small quantities at 140 and 160 feet from the surface, but on being torpedoed the well rapidly filled with water. This inflow was ineffectually contended with and the well finally abandoned.

*No. 2 Well.*—This well is also within the town site on lot 21, east side of Oak street. It is 542 feet deep; soil two feet, Trenton limestone, 540 feet. Gas was struck at 160 feet, having a daily flow of 4,000 cubic feet. Two dwelling-houses, those of Messrs. Carpenter and Stewart, were at the time of my visit being lit and partly heated by it. The well was practically free from water.

*No. 3 Well.*—About half a mile to the south-east of No. 2 a well was sunk to a depth of 464 feet, penetrating the Trenton limestone to the depth of 460 feet and affording but a small quantity of gas, which was struck at 175 feet. Like No. 2 it was almost entirely free from water.

The above-mentioned three wells were sunk at the expense of a syndicate of residents for the purpose of obtaining gas to illuminate the streets. They were sunk at but small cost, there being no casing necessary.

*Well at McDonell's Mill.*—In the rear of the Hurontario flouring mill, in the eastern part of Collingwood, Mr. Charles McDonell, the owner, bored for gas in the Trenton limestone, to a depth of 351 feet; at 150 feet, a small quantity of gas, about 2,000 cubic feet per diem, was obtained.

### *Oil Shale near Collingwood.*

It may not be amiss to mention here the shale distilling works at one time in successful operation near Collingwood, the ruins of which may still be seen near the road a few miles to the west of the town. On lot 23, concession 3, township of Collingwood, Grey county, there is an exposure of Utica shales, consisting of a bed of pyro-schists of about seven feet in thickness, which afforded some three per cent of crude oil. Dr. Sterry Hunt, writes in the following terms of the enterprise: \*

Oil shale and  
works near  
Collingwood.

"This rock is highly calcareous, containing more than one-half its weight of carbonate of lime. When ignited in a closed vessel it loses 12·4 per cent of volatile and combustible matter; of which from three to four per cent are condensable into an oily liquid. This, when rectified, yields oils fitted for burning and for lubricating purposes, and probably also a portion of paraffine.

"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 crude oil, corresponding to about three per cent of the rock. By further continuance of the heat, a small additional proportion of oil was

\* *Geology of Canada*, 1863, pp. 784-85.

obtained from the rock ; 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 works, 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 40 to 50 per cent of burning oil, and from 20 to 25 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."

*Well at Orillia.*

Orillia. An ineffectual attempt was made, some years ago in Orillia, to obtain water by means of an artesian well. At a depth of 300 feet granite was struck and operations ceased ; the surface deposits measured 170 feet, the remaining 130 feet being in the Trenton limestone. No gas was encountered in this well and but small quantities of water.

*Wells in Barrie.*

Barrie. Numerous "drive" wells have been sunk in this town, in all of which an abundance of fresh water has been found ; it rises to a height of about twenty feet above the level of Lake Simcoe. These wells have an average depth of 250 feet, the deepest being 276 feet ; in none of them has gas been noticed.

*Wells at Beeton.*

Beeton. In either 1882 or 1883, "The Lilley Well" was sunk, in the northern part of the village of Beeton, to a depth of 1,400 feet, of which but a very imperfect log has been obtained ; it is presumed, however, that the drilling pierced the Trenton limestone.

Considerable quantities of gas were obtained from a soft sand rock at the base of the surface deposits, and smaller quantities throughout the rock to a total depth of 500 feet, none being found, however, below that point. The well was cased into the harder rock, thus shutting off the larger flow of gas ; no water was struck till near the bottom of the boring where there was a small flow of salt water, probably from the Trenton.

The well was ultimately plugged and abandoned.

The log as reported by the driller is as follows :—

Surface..... 321 feet.

Soft sand-rock .... 25 “ “Medina,” from which was greatest flow of gas.

Limestone..... 850 “

Shale..... 204 “ Probably Utica and lower part of Hudson River.

### *Gas at Beeton.*

For many years gas has been known to exist, in and around Beeton, though no well-directed efforts have as yet been made to obtain it beyond the sinking of several drive-wells, which in every instance showed the existence of a more or less useful flow of gas. One, known as “Jones’s Well,” was sunk in Jones’s brickyard adjoining the railway station to a depth of 190 feet, where a bed of gravel, three feet thick, was found immediately overlying the rock. In this well the flow of gas was so great as to blow the pipe out of the hole, rendering the well practically useless. The flow has for some years been unremitting, boiling up through a pool of water, where being ignited, the gas burns fiercely.

In many places throughout the neighbourhood, water-wells sunk in the surface clay, to even a small depth, have been rendered useless by the influx of carburetted hydrogen gas.

### WELLS IN GREY COUNTY.

#### *Well at Delphi.*

During the month of July, 1888, a well was sunk at this place on Dephi lot 5, concession 26, Collingwood township, about six miles west of Collingwood and close to the shore of Georgian Bay. The boring was commenced in the Utica shales, which immediately underlie the drift deposits, and continued to a depth of 587 feet or 539 feet into the Trenton limestone, the record being as follow :—

Surface, red clay..... 8 feet.

Black shale..... 40 “ Utica.

Blue limestone..... 539 “ Trenton.

Gas was met with at a depth of 95 feet from the surface, having a daily flow of about 6,000 cubic feet; a flow considerably in advance of that of any other well in the district. It has, however, not yet been utilized, notwithstanding the fact that the well is but one hundred yards distant from Field’s Hotel, a large summer resort.



*Well at Thornbury.*

Thornbury.

A well was sunk at this place during the year 1888, of which unfortunately but few data are at hand. The facts ascertained are that a well was sunk at Andrews' mill to a depth of about 550 feet, in which was encountered a very considerable quantity of water, which was not shut off and the well was finally abandoned. A small show of gas was reported from this boring.

## WELL IN HALTON COUNTY.

*Well near Milton.*

Milton.

The following mention by Dr. T. S. Hunt, is made of a well sunk near Milton :—

"A well near Milton, on the tenth lot of the first concession of Trafalgar, was sunk through soil, 47 feet; red shale, 200 feet, then through bluish shales, with hard layers, 159 feet, making in all 406 feet, and probably ending in the Hudson River formation."

From inquiries made in Milton it was ascertained that neither gas nor oil was noted.

## WELLS IN WENTWORTH COUNTY.

*Well in Flamborough Township.*

Flamborough.

At some time previous to 1866, a well was sunk on lot 8, concession 8, of Flamborough East, reaching a depth of 465 feet, the boring at that depth being in the Medina formation. In a thin layer of sandstone at a depth of 340 feet from the surface, and eighty-five feet in the red shales, a small quantity of petroleum is said to have been obtained. The drilling was begun in either the base of the Guelph or summit of the Niagara formation, the whole of which, with the underlying Clinton, was probably traversed.†

*Well at Insane Asylum, Hamilton.*

Hamilton.

This well, sunk some years ago at the Asylum for the Insane, south of Hamilton, is on lot 17, concession 5, township of Barton, at an elevation of about 300 feet above Lake Ontario. The bore was commenced on the Niagara limestones, and reached a depth of 1,318 feet, being then near the summit of the Utica formation.

---

\* Progress Rept. Geol. Surv. of Can., 1866, p. 252.

† Ibid. p. 251.

The driller's record is as follows :—

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.

Neither gas nor oil was noticed in this well.

*Well in Hamilton.*

A well was sunk in the yard of the Royal Hotel, Hamilton, about 1,000 feet deep, of which, unfortunately, no record or information is available. The formations penetrated are, however, assumed to be the same as in the well at the Insane Asylum mentioned above, the difference in elevation being about 250 feet, while the rocks rise at a slight angle towards the city and from the last mentioned well.

*Well at Dundas.*

During 1874 a well was sunk in the valley below the railway station at this place to a depth of 1,500 feet, and was, during the following year, carried to a total depth of 1,650 feet. The boring was made in search of oil, but was unsuccessful; small quantities of gas were, however, found at various points throughout the boring. The record of it, kindly furnished by Mr. James Kerr, of Petrolea, is as follows :—

Surface .....	80	feet.
Red shale.....	400	"
Blue " .....	550	"
Black " .....	400	"
Limestone.....	220	"

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.

It is to be regretted that samples of drillings were not obtained, as this well, on account of its depth and position, would give an excellent record of the details of the formations in this part of the province.

*Well in Barton Township.*

Barton.

During the years 1864 and 1865 a company known as "The Barton Oil Co.," was formed to prospect for oil, which project was carried out by drilling a well on lot 11, con. 7, township of Barton, unfortunately, however, without success. At 873 feet the drill was in bluish shale, which probably represents the upper beds of the Hudson River formation. The boring was begun in the Niagara limestones, which, with the underlying Clinton limestones and shales, continued for 250 feet.

The record was as follows:—

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	"

Small quantities of oil were obtained at 700 and 780 feet, as well as a considerable flow of water from the latter depth.

*Well at Mount Albion.*

Mount Albion.

Some years ago an incorporated company, known as the Emerson Natural Gas Light and Fuel Co., presided over by Mr. E. O. Emerson, of Olean, Pa., drilled for gas at Mount Albion. The boring was carried to a depth of 1,500 feet without finding gas or oil, and was finally abandoned.

## WELL IN LINCOLN COUNTY.

*Well near St. Catharines.*

St. Catharines.

This well was sunk by the St. Catharines Natural Gas Co. during the year 1888, on "Broderick's farm," lot 4, con. 3, township of Louth, the record being as follows:—

Surface.....	90 feet.	
Red shale.....	548	" Medina.
Blue ".....	700	"
Black to blue shale.....	168	" } Hudson River and Utica.
Limestone.....	667	" Trenton.
White quartzose sandstone..	27	"

---

2,200 feet.

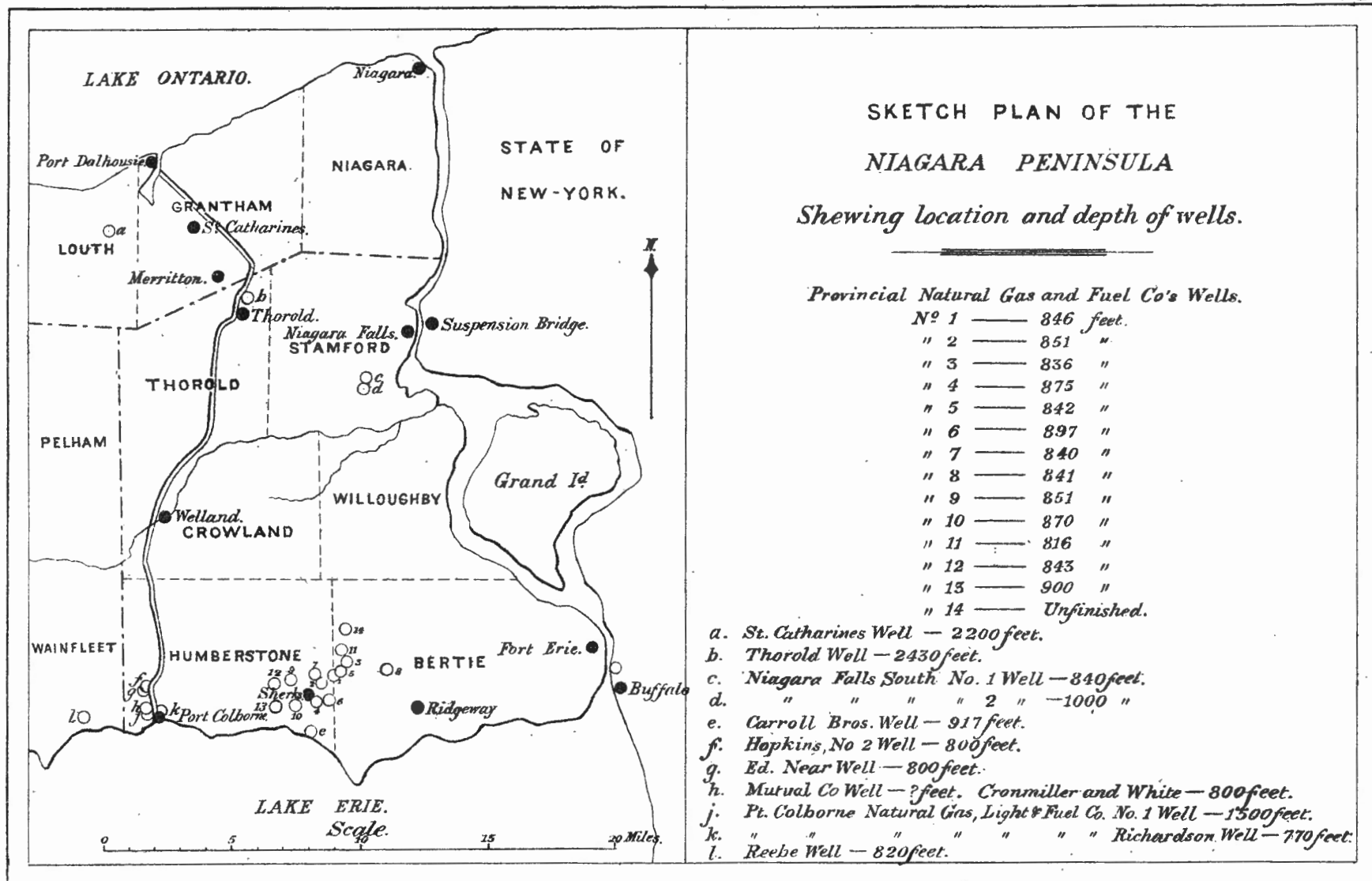
Large quantities of fresh water were met with in a bed of gravel seven or eight feet thick at a depth of fifty-seven feet from the surface, and at 220 feet saline waters were met with, below which point



# Geological Survey Department. Canada.

ALFRED R.C. SELWYN, C.M.G., LL.D. F.R.S. &c. DIRECTOR.

Plate 1.



Drawn for photo-lithography by L. N. Richard. B.A. Sc.

To illustrate report on Gas and Oil operations in Ontario by H. P. Brunell.

Vol. V, Part G.

the hole was found to be dry, though the casing was carried to 272 feet. A small pocket of gas was opened at 275 feet or 185 feet in the Medina, from which formation further south, in the townships of Humberstone and Bertie, are drawn the great supplies of the Provincial Natural Gas and Fuel Co. This small flow of gas soon ceased, and no more was found till the sandstone underlying the Trenton was pierced, where, at a depth of 2,185 feet a flow of about 4,000 cubic feet per diem was obtained. The well was eventually torpedoed with two hundred pounds of nitro-glycerine without beneficial results.

The derrick-house floor stood about 297 feet above mean tide level, the Trenton being, therefore, 1,209 feet below.

#### WELLS IN WELLAND COUNTY.

##### *Well at Thorold.*

During the spring of 1888 a company was formed of citizens of Thorold. Thorold, under the title of "The Thorold Natural Gas Company," the object being to bore for natural gas. In furtherance of this intention a well was begun and finished in the same year, reaching a point 525 feet into the Trenton limestone, and 2,430 feet from the surface, traversing in this distance the Clinton, Medina, Hudson River and Utica formations.

The record of boring is as follows :—

Surface .....	43 ft.		
Dark brown limestone .	7 "	} Clinton .....	77 ft.
Shale .....	70 "		
Red sandstone.....	30 "	} Medina .....	930 "
Shale .....	57 "		
Grey sandstone .....	30 "		
Shale .....	813 "		
Shale .....	700 "	Hudson River...	700 "
Shale .....	155 "	Utica.....	155 "
Limestone .....	525 "	Trenton.....	525 "
<hr/>			
2,430			2,430

Brine was met with at 284 feet, and was cased off, the casing extending to 312 feet, below which water was not found in sufficient quantity to necessitate further casing. A very small flow of gas, not sufficient to be of use commercially, was struck at 2,430 feet, which would be near the base of the Trenton.

This well is 517 feet above tide, making the summit of the Trenton, therefore, about 1,388 feet below. The Medina formation, which is

generally in Ontario the most productive of gas, is here found to be barren.

*Wells at Port Colborne.*

Port Colborne *No. 1 Well.*—Port Colborne was the first town in Canada to use natural gas. Early in 1885 a company was formed under the title of "The Port Colborne Natural Gas, Light and Fuel Company," of which Mr. C. McNeal, of that place, was president, and Mr. D. Hughes, secretary and treasurer. Boring was at once begun at No. 1 well, on Charlotte street, in the village, and in August, 1885, the gas was lighting Mr. D. McGillivray's store. The boring reached 1,500 feet, or 770 feet into the Medina formation, in the upper shales and sandstone of which the principal flow of gas was obtained.

The record of boring shows:—

Surface . . . . .	12 feet.	
Grey limestone . . . . .	13 "	Corniferous.
" " . . . . .	7 "	
Dolomite . . . . .	3 "	Onondaga and Lower Helderberg; small flows of gas at 150, 252 and 415 feet.
Shale and dolomite ..	55 "	
Dolomite and gypsum.	57 "	
Dolomite . . . . .	108 "	
Shales and dolomite with gypsum ....	185 "	Guelph and Niagara
Shaly dolomite . . . . .	30 "	
Brown dolomite and dark blue shales towards bottom ..	188 "	
Marls and dolomite ..	72 "	Clinton.
Red shales with thin bands of white sand- stone . . . . .	50 "	Medina; main flow of gas 764 feet.
Red and white sand- stone . . . . .	53 "	
Soft red shales with bands of grey and green . . . . .	667 "	

Casing was not used except as a conductor through the surface deposits. Fresh water was struck at twenty-six feet and strong saline water with sulphuretted hydrogen at 452 feet, the water being eventually shut off by means of an inch and a-quarter pipe resting in a rubber packer some distance below the lower water seam and above the main gas seam, which affords a daily flow of about 25,000 cubic feet. This well has been drawn on steadily since August, 1885, the gas being used to light a number of shops and in McNeal's hotel.

*No. 2 Well.*—This well, drilled by Mr. M. Richardson, is in Port Colborne rear of his factory, east of the Welland canal, in the village of Port Colborne, and distant about one mile from No. 1 well. The boring reached a depth of 770 feet, being then in the red shales of the upper part of the Medina. Gas was struck at 762 feet, having a daily flow of about 25,000 cubic feet per diem. This gas is used to heat and light several private residences in the immediate vicinity. I believe that this well has since been connected with the company's mains. Salt water was not met with in this boring.

*No. 3 Well.*—This well, drilled by Mr. S. Hopkins, and known also as "Hopkins's well," is in the village, a short distance north of No. 1. The depth reached was 771 feet, gas being struck at 765 feet. Water has given great trouble here, and at the time of my visit had so far gained on the gas as to render the well useless and cause its abandonment. I was informed that the great trouble arose from the water having been imperfectly shut off, the packer having stuck in the casing. This well, which had probably as large a flow as either of the other two, has, however, I believe, been since resuscitated and connected with the company's mains.

It will be seen on reviewing the above that Port Colborne has, from three wells, a daily flow of gas of about 70,000 cubic feet, all of which is obtained from the upper beds of the Medina at a depth of from 762 to 765 feet below the surface, and about 175 feet below tide level.

*Mutual Co.'s Well.*—This well was sunk on lot 29, concession 1, township of Wainfleet, in conjunction with the Port Colborne Natural Gas and Fuel Co., for the purpose of increasing the supply of gas for the village. No data are available beyond the fact that the flow of gas obtained was small, amounting to only 5,000 cubic feet per diem.

#### *Well west of Port Colborne.*

During 1866 a well was sunk about one mile west of Port Colborne by a company under the direction of Mr. L. G. Carter, of Port Colborne, of which, however, I was unable to obtain reliable information but was led to believe that the boring was made to a depth of about 800 feet when the tools were lost and the hole abandoned. At the time of drilling, the well is reported to have afforded large quantities of gas, Mr. Jefferson Steele, on whose property the well was sunk having used it for some years in his dwelling. The company was formed to explore for oil, for which purpose the well was sunk, no oil was obtained. At 800 feet the drill would be in the Medina sandstone from which the gas probably comes.



*Wells at Niagara Falls South.*

Niagara Falls South. During 1888 two wells were sunk near this place by a local company from which small flows of gas were reported.

*No. 1 Well.*—This well was sunk on McGlashan's farm, lot 158, Stamford township to a depth of 840 feet; the following section shows that this was 490 feet below the summit of the Medina formation:—

Surface.....	43 feet.	
Limestone.....	143 "	} Niagara.
Shale.....	24 "	
Shale.....	140 "	Clinton.
White quartzose sandstone.....	24 "	} Medina.
Shale and sandstone.....	466 "	

Casing was carried 117 feet into the Niagara limestone or to a depth of 160 feet from the surface effectually shutting off all water. Gas, having an estimated flow of 4,000 cubic feet per diem, was struck at 215 feet, in the upper beds of the Clinton formation.

*No. 2 Well.*—This boring was made immediately south of No. 1, on lot 172 of the same township and was carried to a depth of 1,000 feet. Unfortunately no record of the rocks traversed was obtained. The boring was cased to a depth of 280 feet and gas in similar quantity to that obtained at No. 1, was found at 380 feet presumably in the upper sandy strata of the Medina formation.

*Wells of the Provincial Natural Gas and Fuel Company.*

Provincial  
Natural Gas  
and Fuel Com-  
pany.

During the spring of 1890 the above company was incorporated with a capital stock of \$500,000, with Mr. Peter Maclaren, of Perth, president, and Mr. Eugene Coste, manager. This company had existed during the previous year under the provisional title of the Lincoln and Welland Natural Gas Company, and while under the latter title the company commenced operations. On the 15th of July, 1889, drilling was begun on what was to be known as No. 1 well, after which drilling was carried on steadily until thirteen wells were completed, from the smallest of which the flow was 47,000 cubic feet, and from the largest a flow of 8,500,000 cubic feet per diem.

The log and elevation of No. 1 well are an index to those which followed, the rocks traversed and the elevation of each being almost identical.

*No. 1 Well* is on lot 35, concession 3, township of Bertie, county of Welland, and is 371 feet above Lake Ontario, and 618 feet above tide level. The boring was begun in the Corniferous limestone and

continued to a depth of 846 feet, at which point the drilling was 111 feet in the Medina sandstones and shales.

Provincial  
Natural Gas  
and Fuel Co.

The drillings show the following record:—

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 " .....	5 "	
White sandstone .....	5 "	
Blue shale .....	20 "	
White sandstone "Gas rock." ..	16 "	

Fresh water was cased off at 284 feet, and at 548 feet salt water was met with; the hole was afterwards cased to a depth of 596 feet, below which point there was no water.

Gas to the extent of 1,000,000 cubic feet was struck at 836 feet, though on the well being "shot" the flow increased to 2,050,000 cubic feet per diem, at which figure it now stands.

It will be seen on referring to the log that the source of supply lies in the second streak of white sandstone in the upper beds of the Medina formation.

*No. 2 Well.*—This well is on lot 2, concession 2, township of Humberstone, and was sunk to a depth of 851 feet. As the record of the rocks in this well is almost identical with that of No. 1, it has not been thought necessary to give it in detail. A summary of it is: surface deposits, 6 inches; depth to summit of Medina, 735 feet; gas struck, 842 feet; salt water struck, 550 feet; casing, 600 feet; capacity of well, 375,000 cubic feet per diem.

*No. 3 Well.*—On lot 1, concession 15, township of Bertie, was drilled to a depth of 836 feet and affords gas to the extent of 600,000 cubic feet per diem. Surface deposits, 5 feet; summit of Medina, 715 feet; gas struck, 820 feet; salt water struck, 540 feet; casing, 590 feet.

*No. 4 Well.*—On lot 3, concession 1, township of Humberstone; 875 feet deep; capacity, 2,200,000 cubic feet per diem; surface deposits, 17 feet; summit of Medina, 760 feet; gas struck, 863 feet; salt water struck, 565 feet; cased to summit of Medina, 760 feet.

*No. 5 Well.*—On lot 34, concession 3, township of Bertie; 842 feet deep; capacity, 8,500,000 cubic feet per diem; surface deposits, 8 feet; summit of Medina, 725 feet; gas struck, 833 feet; salt water struck, 550 feet; cased to 582 feet.

*No. 6 Well.*—On lot 1, concession 1, township of Humberstone; 897 feet deep; capacity, 70,000 cubic feet per diem; surface deposits, 30 feet; summit of Medina, 770 feet; gas struck, 880 feet; salt water struck, 570 feet; cased to summit of Medina, 770 feet.

*No. 7 Well.*—On lot 3, concession 2, township of Humberstone; 840 feet deep; capacity, 3,000,000 cubic feet per diem; surface deposits, 18 feet; summit of Medina, 725 feet; gas struck, 824 feet; salt water struck, 540 feet; cased to summit of Medina, 725 feet.

*No. 8 Well.*—On lot 27, concession 3, township of Bertie; 840 feet deep; capacity, 47,000 cubic feet per diem; surface deposits, 4 feet; summit of Medina, 715 feet; gas struck, 819 feet; salt water struck, 540 feet; cased to summit of Medina, 715 feet. This well, with the exception of No. 14, has the smallest capacity of all those sunk by the company, and was immediately plugged and abandoned.

*No. 9 Well.*—On lot 7, concession 2, township of Humberstone, reached a depth of 851 feet. Capacity, 3,500,000 cubic feet per diem; surface deposits, 32 feet; summit of Medina, 730 feet; gas struck, 836 feet, or four feet in the second white sandstone which was 19 feet thick; salt water struck, 550 feet; cased to summit of Medina, 730 feet. A slight change in the thickness of the beds is noticeable in this well. The first white sandstone which, in No. 1 well, is five feet thick, has in this instance a thickness of twenty feet, beneath which is found twelve feet of dark shale instead of twenty feet as in No. 1.

*No. 10 Well.*—On lot 6, concession 1, township of Humberstone, 870 feet deep. Capacity, 4,500,000 cubic feet per diem; surface deposits, 12 feet; summit of Medina, 750 feet; gas struck, 855 feet; salt water struck, 560 feet; cased to summit of Medina (750 feet).

*No. 11 Well.*—On lot 4, concession 14, township of Bertie, 816 feet deep. Capacity, 300,000 cubic feet per diem; surface deposits, 14 feet; summit of Medina, 695 feet; gas struck, 800 feet; salt water struck, 495 feet; cased to 709 feet.

*No. 12 Well.*—On lot 9, concession 2, township of Humberstone, 843 feet deep. Capacity, 5,500,000 cubic feet per diem; surface deposits, 20 feet; summit of Medina, 730 feet; gas struck, 828 feet; salt water struck, 525 feet; cased to 732 feet. The Clinton dolomite was struck at 695 feet and continued to a depth of 732 feet, showing thereby a thickness of thirty-seven feet, a slight thickening when com-

pared with that as shown in No. 1 well. The gas-rock or second bed of white sandstone in which the well finished was met with at 825 feet, being therefore penetrated a distance of eighteen feet. Provincial Natural Gas and Fuel Co

*No. 13 Well.*—On lot 9, concession 1, township of Humberstone, 900 feet deep. Capacity, 300,000 cubic feet per diem; surface deposits, 15 feet; summit of Medina, 745 feet; gas struck, 855 feet; salt water struck, 570 feet; cased to 749 feet.

*No. 14 Well.*—This well, on lot 6, concession 15, township of Bertie, was at the time of my last visit—13th March, 1891—not completed, having reached a depth of only 1,600 feet, the drill being then in the shales of the Hudson River formation. A small flow of gas was noted at 705 feet in the red sandstone at the summit of the Medina formation. The gas-rock of the district, struck at 762 feet, continued for a distance of sixteen feet and was found to be barren.

This well indicates very closely the probable boundary of the gas-field on its north-eastern side, and will be watched with considerable interest as it is the intention of the company to carry it to the Trenton limestone, and thereby test at this point the gas-producing properties of that formation.

It will be seen on reference to the foregoing that this company has an available supply of 30,895,000 cubic feet of gas per diem, made up as follows:—

No. 1 Well	2,050,000	cub. ft.
" 2 "	375,000	"
" 3 "	600,000	"
" 4 "	2,200,000	"
" 5 "	8,500,000	"
" 6 "	70,000	"
" 7 "	3,000,000	"
" 9 "	3,500,000	"
" 10 "	4,500,000	"
" 11 "	300,000	"
" 12 "	5,500,000	"
" 13 "	300,000	"

---

30,895,000 cub. ft.

A contract having been made between the above-mentioned company and a certain Buffalo gas company, mains were being laid during the latter part of 1890, and it is confidently expected that before many months Buffalo will be largely supplied from this field. Gas will also probably be supplied to those Canadian towns and villages in the immediate vicinity of the latter company's wells.

Since the discovery of so large a gas field, many individuals throughout the county have drilled for and obtained gas in quantity, in nearly all instances from the same strata as in the company's wells. The most important of these independent wells are: The Carroll, Edward Near, Hopkins's No. 2, Cronmiller and White, and Reebe.

*Carroll's Well.*

Carroll's.

This well, on lot 4, concession 1, township of Humberstone, was begun on the 19th March, 1890, and reached a depth of 917 feet, or twenty-two feet into the red shales immediately underlying the productive white sandstone bed. Gas was struck at 883 feet, having a daily flow of 990,000 cubic feet. This supply is used in the firing of limekilns operated by Messrs. Carroll Bros., as well as for general heating and illuminating purposes in and around the lime works.

*Edward Near Well.*

Edward Near.

A well was sunk by Mr. Edward Near on lot 29, concession 2, township of Humberstone, to a depth of 800 feet, wherein, at 675 feet, and in the white sandstone, gas to the extent of 415,000 cubic feet per day, was found. It is being drawn upon for the lighting and heating of the village of Humberstone.

*Hopkins's No. 2 Well.*

Hopkins's  
No. 2.

This well, on lot 28, concession 2, township of Humberstone, reached a depth of 800 feet, gas to the extent of 400,000 cubic feet per day being obtained at 670 feet.

*Cronmiller and White Well.*

Cronmiller  
and White.

Near the village of Port Colborne and close to the brewery operated by Messrs. Cronmiller and White, a well was sunk by that firm to a depth of 800 feet, the drilling terminating in the red shales immediately underlying the gas-bearing sandstone. Gas having a flow of 6,000 cubic feet per diem was found at 675 feet.

*Reebe's Well.*

Reebe's.

On lot 6, concession 1, township of Wainfleet, a few miles west of Port Colborne, a well was sunk by Mr. John Reebe to the depth of 820 feet, and just into the red shales beneath the gas-bearing sandstones of the wells in the two townships to the east. Drilling was com-

menced at the base of the Corniferous, when the following series of rocks were traversed :—

Drab and grey dolomites, shales and gypsum.....	390 feet.	Onondaga,
Dolomite, grey.....	240 "	Guelph & Niagara.
Shale, black.....	55 "	Niagara.
Dolomite .....	30 "	Clinton.
Sandstone, red.....	45 "	} Medina.
Shale, red and blue.....	40 "	
Sandstone, white .....	20 "	

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. The gas produced at the well is being used for burning lime in kilns operated by the owner.

It will be seen on reference to the above "log" that the strata in the upper part of the Medina differ somewhat from those in wells further east, where there are shown to be two beds of white sandstone separated by twenty feet of blue shale. It is to be regretted that more accurate records or specimens of the drillings are not available from wells drilled at intermediate points to indicate which of these beds is missing. It is presumed, however, that the white sandstone at the bottom of this well corresponds with the "gas rock" of the wells east of Port Colborne.

Several other wells of minor importance have been drilled throughout this county, of which no information is available.

#### WELLS IN WATERLOO COUNTY.

##### *Well at Waterloo.*

This well, in the town of Waterloo, was sunk during 1867 to a Waterloo depth of 1,120 feet, of which the record is as follows :—

	Feet.	
Surface.....	130	
Limestone.....	40	} Onondaga, 77 feet.
Gypsum.....	17	
Shale.....	20	
Limestone.....	340	Guelph, Niagara and Clinton.
Shale, blue.....	114	Clinton and Medina.
Shale, red.....	459	Medina.

This well sunk for salt was very unsuccessful, only bitter saline water being met with at 800 and 900 feet. These depths would indicate that the water seams were contained in the red shales of the Medina, which elsewhere in Ontario are noted for these peculiar saline waters.

Elevation of the well above tide about 800 feet.

A well in Waterloo, presumably this one, was afterwards deepened to 1,800 feet by Mr. John McEwen, the record of which is, unfortunately, not available.

In 1883 another well was sunk at this place by Mr. John Savage, of Petrolea, whose record and papers regarding it have been mislaid. He, however, assured me that neither gas, oil nor salt was met with.

#### *Well in Berlin.*

Berlin.

In the town of Berlin and about half a mile east of the Grand Trunk Railway station, a well was unsuccessfully sunk for water to the depth of 1,250 feet, by the gentleman last named. The rocks traversed are, according to the driller, as follows:—

Surface.....	187 feet.
Limestone.....	320 “
“Hard rock”.....	40 “
Limestone.....	200 “
Shale, red.....	180 “
Shale, green.....	160 “
Slate, blue.....	170 “

The casing was carried to a depth of 303 feet, and at the depth of 540 feet there was a strong flow of mineral water; whether saline or otherwise, I was unable to ascertain; neither gas nor oil was noted.

I have found it impossible to correlate the rocks said to have been met with in this well with those traversed in the well at Waterloo, but a short distance to the north-west. The drilling was, however, undoubtedly begun in the Onondaga formation, represented by the upper part of the 320 feet of limestone, and, like at Waterloo, terminated in the Medina.

Elevation 1,080 feet above tide.

#### WELLS IN WELLINGTON COUNTY.

##### *Well at Erin.*

Erin.

A well was sunk at this place in 1888 by Mr. John Fraser, of Petrolea, which reached a depth of 800 feet and of which the following record, only, is available:—

Limestone.....	95 feet.	Niagara.
Shale .....	100 "	Clinton.
" blue, and sand .....	25 "	} Medina.
" red .....	480 "	
" blue.....	100 "	Hudson River.

The lower 100 feet of shales are ascribed to the Hudson River formation, though of this there can be no certainty, from the fact that between the shales ascribed to the Clinton and those presumed to be the Hudson River there is but 505 feet of shales to represent the Medina formation which, further south, has an average thickness of 750 feet.

Neither gas nor oil was found in this well.

Elevation above tide 1,038 feet.

*Well at Eden Mills,*

Regarding this well Dr. T. S. Hunt, writes as follows :—\* Eden Mills.

"Another boring, at Eden Mills, on the first lot of the first range of Eramosa, was sunk 159 feet in limestone and shales, before encountering the red strata of the Medina, which were penetrated 350 feet, making a depth of 509 feet. Some white or light coloured bands were met with in the upper part of the red rocks, and at 250 feet from the surface, in what was described as a layer of black slate, a spring of saline water was encountered."

WELLS IN BRANT COUNTY.

*Well at Brantford.*

During 1888 a well was drilled 1,118 feet deep by the Waterous Brantford. Engine Company in the yard at their works on Dalhousie street, Brantford. The boring was made in search of gas but was unsuccessful, a very small flow, only, being obtained, though at what depth I was unable to ascertain. The boring commenced in the Onondaga, or rather in the drift immediately overlying that formation. Only an imperfect record of this well was obtained, the interpretation of which is probably as follows :—

Surface.....	63 feet.	
Limestone, &c.....	457 "	Lower beds Onondaga and Guelph, Niagara and Clinton, if present.
Blue shale .....	5 "	} 530 Medina.
Red " .....	25 "	
Sandstone.....	40 "	
Red slate.....	460 "	
Dark red and blue shale..	68 "	probably to summit of Hudson River.

\*Geol. Surv. of Can., Rept. of Progr., 1866, p. 251.



There was a small flow of sulphurous water, at 200 feet, and at 300 feet the same was found in large quantities; it was, however, effectually cased off and no further water was met with.

Elevation 707 feet above tide.

*Well in the Township of Brantford.*

Township of  
Brantford.

In the year 1888 a well was sunk on lot 16, concession 15, township of Brantford, in search of gas, which however, was unsuccessful, small quantities only being obtained. The boring reached a depth of 2,160 feet, or 210 feet beneath the summit of the Trenton limestones. Only an incomplete log, as below, and very little information was obtained respecting it:—

Surface.....	45 feet.	
Limestone.....	400 "	} To base of Medina.
"    shales, &c....	525 "	
Blue shale.....	980 "	Hudson River and Utica.
Limestone.....	210 "	Trenton.

Heavy flows of water were found at points between 200 and 300 feet, accompanied by small quantities of gas, and a small flow of the latter was again obtained, unaccompanied by water, at about 1,950 feet, undoubtedly from the upper beds of the Trenton. The quantity was not, however, sufficient to be of economic importance. Casing was carried to a depth of 520 feet, beneath which the hole was comparatively dry.

Elevation above tide, about 672 feet.

*Well at Paris.*

Paris.

During the year 1865 a drilling was made at Paris in search of petroleum. I have been unable to obtain any later information regarding this well, of which Dr. Sterry Hunt, writes as follows:—\*

"One of these (borings) is in the town of Paris, where, after 10 feet of soil, there were met 146 feet of thin bedded limestones, with shales and gypsum, beyond which, in August last, they had penetrated 99 feet in a white granular rock, a specimen of which was found to be pure dolomite, probably belonging to the Guelph formation."

Assuming that the lower ninety-nine feet be dolomite of the Guelph formation, the record to 255 feet would be as follows:—

Surface.....	10 feet.	
Limestone, &c.....	146 "	Onondaga.
Dolomite.....	99 "	Guelph.

What the result of this boring was is not stated.

---

\* Geol. Surv. of Can., Rept. of Progr., 1866, p. 250.

*Well at Cathcart (Sydenham).*

At the time that the last described boring was accomplished a well had been sunk at Sydenham (now Cathcart), of which Dr. T. S. Hunt,\* writes as follows:—

“A few miles to the south-west of this (Paris), at Sydenham, a boring was said to have been sunk through clay 140 feet, shale and gypsum 260 feet, after which a harder rock, doubtless the same as at Paris, was encountered.”

## WELLS IN OXFORD COUNTY.

*Wells at Tilsonburg.*

During 1861 and the succeeding years numerous wells were sunk in and around Tilsonburg in search of oil, with, unfortunately, but little success. Oil was met with in the Corniferous limestone immediately underlying the drift deposits, but never in sufficient quantities to be considered of economic importance. In the township of Dereham, near Tilsonburg, two wells were sunk during 1861, the record kept of one of them showing, surface (clay) thirty feet, succeeded by ninety-six feet of Corniferous limestone. Oil was first found on the surface of the rock, and again at fifty-five and sixty-eight feet beneath the surface, oil from the latter depth being accompanied by water and, at intervals, by large quantities of gas.

In 1865 and 1866 a well was sunk by Messrs. Hibbard and Avery, of Tilsonburg, to the depth of 854 feet. It was reopened in 1873, and the drilling carried to a depth of 1,450 feet in the vain hope that the bore would penetrate the thick salt beds found to the north-west. Mr. Lionel Smith † says: “A brine of increasing gravity was the result, which is now, I am informed, 50° to 60° by salometer; but no salt bed was reached, as they are evidently near its edge, but not over it.” In 1877 the drilling was carried, by the same company, to a depth of 1,750 feet.

Dr. Sterry Hunt examined specimens from this well, of which he writes as follows:§—“The rock, beginning at 36 feet from the surface, is a pure limestone, and specimens from 97, 100, 150 and 196 feet have a similar character. One from 210 feet is a granular dolomite, while others from 261, 273, 290 and 305 are limestones. At 365 feet is a granular dolomite, while specimens from 420 and 454 feet, are compact varieties of the same rock. At 560 feet a limestone is again met with,

---

\* Geol. Surv. of Can., Rept. of Progr., 1866, p. 251.

† Ibid., 1874-75.

§ Ibid., 1866, p. 250.

and a dolomite at 600, while the latest obtained specimen, at 890 feet, has the same composition."

The record of this well may be rendered as follows—the first 890 feet being on the authority of Dr. Hunt and the remainder as given to me by the driller :—

Surface.....	36 feet	
Limestone.....	160	" Corniferous.
Dolomites and limestones	694	" Probably Onondaga.
Red marl.....	35	" Onondaga.
Dark shale.....	825	"

The Corniferous is evidently traversed in the first 160 feet of rock, and is succeeded by the Onondaga, having a thickness of about 890 feet. That this is the case is evidenced by the fact that at 890 feet there were met with thirty-five feet of red marls, which, according to Dr. Hunt, form the basis of this formation. The succeeding 825 feet, termed by the driller "dark shale," probably includes all those rocks comprising the Guelph, Niagara, Clinton and part of the Medina. specimens are, unfortunately, not available, and the record of the lower part of this well must, of necessity, remain a matter of conjecture.

The Hamilton shales are wanting at Tilsonburg, though it is reported that in drilling a well about two miles south-west of the town "soapstone" was found to overlies the Corniferous for a depth of eleven feet.

During 1865 and 1866 several companies sank wells in Dereham and adjoining townships without success, though, in several of the wells, small quantities of oil were obtained. One of these, the "Lyn-dop and Chandler," afforded some seventy-five barrels of oil before being abandoned. Oil and water are still flowing from this well, and a specimen, collected by the writer during 1890 shows the oil to be very dark and of heavy gravity.

In all some twelve or thirteen wells were sunk, averaging, with the exception of the "Hibbard and Avery," a depth of about 500 feet.

In 1888 and 1889 drilling was again commenced, without, as in previous years, any economic result. Four wells were sunk, one to 400 feet and three reaching 200 feet, in all of which traces of oil were found, and from the 400 feet well, a strong flow of sulphur water was obtained.

More or less gas was noticed in all the wells bored, arising, in every instance, from the Corniferous limestone. The history of the rise and fall of the oil excitement at Tilsonburg is brief. It seems that, for

many years, the Indians of the district resorted to a well-known oil spring, a short distance south-west of the town, where they collected the black oil, for medicinal purposes. The attention of oil producers was directed to it and as early as 1861 drilling operations were begun in and around the town. The first well was sunk, in 1861, by Messrs. Watkins, Miles and Craigie, who drilled and soon after abandoned a well which afforded small quantities, only, of oil. In 1865 and 1866, Messrs. Hibbard and Avery, Lyndop and Chandler and others commenced operations, with what results has already been shown; after this operations ceased till 1873, when the Tilsonburg Salt Co. reopened the old Hibbard and Avery well, deepening it to 1,450 feet and afterwards in 1877 to 1,750 feet. Drilling was again undertaken, in 1888 and 1889, for what purpose I was unable to ascertain, though of the results there can be no doubt.

#### *Well at Burgessville.*

During the year 1887, a joint-stock company was formed at this Burgessville. place for the purpose of sinking wells in search of gas and oil. A well was begun and finished during the year which reached a depth of 605 feet. Neither gas nor oil was found. At the depth of 185 feet beneath the surface a strong flow of sulphur water was met with; this water has been flowing continuously ever since and with no apparent diminution in quantity. No record of the boring was kept beyond the fact that the surface deposits had a thickness of 165 feet. I am indebted to Mr. E. H. Snyder, of Burgessville, for several specimens, which, on examination, proved to be as follows:—

Specimen from . . . . .	280 feet.	Light blue shale, slightly calcareous.
“ “ . . . . .	300 “	“ with gypsum.
“ “ . . . . .	367 “	Cream coloured dolomite.
“ “ . . . . .	400 “	Light brown “
“ “ . . . . .	550 “	Dark blue shale.

All of these specimens are probably of rocks belonging to the Onondaga formation.

#### *Wells at Norwich.*

Two wells have been drilled at or near this place of which but scant Norwich. information is available. The deeper of the two sunk in 1885, on the property of Mr. George A. Cook, reached a depth of 2,000 feet; the drilling was done by Mr. Duncan Sinclair. Fresh water, which is now being utilized<sup>1</sup>, is said to have been struck at 800 feet.

The other well is much shallower, reaching a depth of only 500 feet, wherein at 150 feet from the surface a small flow of oil accompanied by water was noted. The surface deposits were eighty feet thick.

*Well at Harrington.*

Harrington. A well was, some years ago, sunk at the village of Harrington, but no particulars of the drilling could be obtained, beyond the fact that nothing of economic value was found.

*Well at Woodstock.*

Woodstock. It is reported that a well was also sunk at Woodstock, at about the same time as the above, though no information relating to it could be obtained.

WELLS IN NORFOLK COUNTY.

Norfolk  
County.

Numerous wells have, within the past twenty-five years, been sunk in this county, in every case, however, proving failures, when sunk in expectation of obtaining gas or oil in economic quantity. Small flows of gas were met with in several of those sunk in the northern part of the county, more especially in that drilled on Big creek, near Lyndoch. This well, was sunk in 1869 or 1870, and reached a depth of 600 feet, the surface deposits showing a thickness of about 100 feet, below which black shales, probably of Hamilton age, were found; beyond this no data have been obtained relating to the rocks pierced. From a depth of about 600 feet a strong flow of sulphur water, accompanied by a small quantity of gas, was obtained. This flow, of gas and water, has been continuous.

Among other wells, in this county, may be mentioned one sunk at Port Rowan, which reached a depth of 400 or 500 feet. No gas or oil was obtained.

WELLS IN ELGIN COUNTY.

*Well at Vienna.*

Vienna.

A well was sunk here, about twenty-five years ago, about which I have been unable to obtain direct information. Dr. Hunt states\* that this well was sunk at a point about forty feet above Lake Erie, and that the Corniferous limestone, was met with beneath 240 feet of clay. This is in the area supposed to be covered by the

---

\* Geol. Surv. of Can., Rept. of Progr., 1866, p. 250.

Hamilton series, the shales of which are, however, wanting at this point.

*Well at Port Stanley.*

At about the same time that the boring at Vienna was made, one Port Stanley. was also made at Port Stanley, to a depth of 298 feet. The record is as follows :—

Surface .....	172 feet.	
Black and brown shale..	30 "	} Probably all Hamilton.
Light coloured shale..	16 "	
Limestone .....	80 "	

What the result of this boring was has not been ascertained.

WELLS IN MIDDLESEX COUNTY.

*Well at the Insane Asylum, London.*

Some years ago a boring was made on the grounds of the Asylum Insane Asylum, London. which reached a depth of 2,250 feet, probably terminating in the upper portion of the Hudson River formation. The first rock met with is a limestone, at or near the summit of the Corniferous, as the shales, indicative of the Hamilton, found in the well at the sulphur spring in the western part of the city, are missing.

The record of the boring, kindly furnished by Mr. W. Harris, of Petrolea, is approximately as follows :—

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 " .....	500 "	Medina.
Limestone and shale.....	150 "	Hudson River.

In referring to the above log it will be seen that salt and shale, having a combined thickness of 100 feet were found, but how much of this was actually salt I have been unable to ascertain.

The elevation of the well is about 880 feet, above tide. In reply to numerous inquiries respecting the depth at which the Trenton limestone would be reached, it may be stated that assuming the base of the Medina here to be 1,220 feet below tide level and that the Hudson River and Utica have a thickness of 800 feet, the Trenton would

be reached at about a depth of 2,020 feet below tide or 2,900 below the surface.

The depth at which gas, if present, would be found, is probably not less than 2,900 feet, as the rocks to be traversed in that distance between the bottom of the above mentioned well, and the summit of the Trenton, are not usually gas-bearing.

*Well at Sulphur Spring, London.*

Sulphur  
Spring, Lon-  
don.

Previous to 1865 a well was sunk at this place which afforded, and to the present day affords a copious supply of sulphur water. The well was drilled to a depth of 765 feet, the rocks pierced being as follows :—

Surface, clay . . . . .	70 feet.	
Soft grey shale . . . . .	20 “	Including a band of hard black bituminous shale.
Limestone . . . . .	600 “	
Soft magnesian marl. .	75 “	

This boring was begun in the Hamilton shale which, as will be seen on referring to the above, has a thickness here of about twenty feet, beneath this the Corniferous was traversed, probably within a distance of 300 feet from the surface, as at that point the rock proved to be a true dolomite, probably of the Onondaga series ; assuming that such is the case the Corniferous here is, at the most, 210 feet thick.

Sulphur water was found at 114 feet, having a flow of about 1,000 gallons per hour.

*Sunnyside Well.*

Sunnyside  
well.

Of this well, on lot 13, concession 4, township of London, Dr. Sterry Hunt writes as follows\* :—“ Another—(well)—known as the Sunnyside well, on lot 13, range 4; of London, gave clay 103 feet, beneath which were a few feet of soft shale, reposing on limestone. This was bored for 400 feet, at which depth the rock is a pure limestone, as were several other specimens from various depths, although one from 371 feet was highly magnesian.”

*Well at Strathroy.*

Strathroy.

The following record is given of a well on lot 20, concession 5, in the township of Adelaide, known as the “ Strathroy Well.” \*

\* Geol. Surv. of Can., Rept. of Progr., 1866, p. 249.

Work was suspended at 300. feet, the record to that depth being:—

Surface.....	100 feet.	
Soft shale.....	50 "	Hamilton.
Hard limestone.....	150 "	Corniferous ?

Whether work was resumed, and what the result of this boring was, I have been unable to ascertain.

*Well at Glencoe.*

Some years ago a well was sunk at this village under the supervision of Major John Savage, of Petrolea, to whom I am indebted for the following log:—

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 "	} Probably terminating in the Guelph.
Salt and shale.....	104 "	
" Hard rock ".....	116 "	

Total depth..... 1,510 "

In the thirty-eight feet of so-called sandstone there was a strong flow of mineral water of what description I am, however, unable to state. At 1,290 feet salt and shale were pierced, having a combined thickness of 104 feet.

The drilling was, in all probability, begun in the so-called "upper lime" of the Hamilton formation, and terminated in the base of the Onondaga or summit of the Guelph. Throughout the log the term "hard rock" undoubtedly means dolomite, and "soapstone" the shales of the Hamilton formation.

*Wells in south-west part of Middlesex.*

Throughout the south-western portion of Middlesex numerous wells have been sunk to a depth of about 550 feet in search of oil, unfortunately, finding only very small quantities. South-western Middlesex.

\* Geol. Surv. of Can., Rept. of Progr., 1866, p. 248.



One well in the township of Metcalfe, lot 24, concession 13, gave the following record :—

Surface (clay).....	48	feet.
Black shale.....	75	" Portage.
Soapstone, etc.....	273	" Hamilton.
Limestone.....	104	" Corniferous?

Records of two wells sunk in the township of Mosa, have been preserved. One of these, on lot 5, concession 7, showed :—

Surface (clay).....	50	feet.
Black shale.....	10	" Portage.
Soapstone, &c.....	230	" Hamilton.
Limestone.....	262	" Corniferous?

Another, on lot 3, concession 4, gave :—

Surface (clay).....	88	feet.
Black shale.....	6	" Portage.
Soapstone, &c.....	243	" Hamilton.
Limestone.....	177	" Corniferous?

#### *Well at Parkhill.*

Parkhill.

In 1884 a well was sunk at Parkhill, by a syndicate of citizens of that place, under the title of the Parkhill Salt Works Company, to the depth of 1,300 feet, passing through one salt-bed and into the second to a depth of twenty feet. The surface deposits showed a thickness of about 170 feet, and were immediately underlain by limestone.

All the documents, etc., belonging to the company were destroyed by fire, and therefore no detailed record of the well could be obtained, a loss very much to be regretted as this well, by its relative position and depth, would have proved a useful factor in working out the details of the geology of the western peninsula of Ontario.

Owing to the decline in the price of salt the block, at the time of my visit, had not been completed, and the well, therefore, was not made use of.

#### *Wells in north-west Middlesex.*

North-west  
Middlesex.

During the earlier years of the oil excitement numerous wells were sunk throughout the townships of McGillivray, Williams (east and west), and Adelaide in Middlesex, and Bosanquet and Warwick in the county of Lambton. Of those in Middlesex few reached a depth of 500 feet, and but small quantities of oil were anywhere obtained.

The following record of a well sunk near Ailsa Craig station on the Grand Trunk Railway, is from the report of the Geological Survey for 1866 :—

Surface (clay).....	75 feet.	
Limestone, soft.....	185 "	} Hamilton.
Limestone.....	113 "	

A small quantity of oil was obtained at 275 feet from the surface.

Another well, near the above, showed, according to the driller, the following section :—

Surface.....	65 feet.	
Limestone.....	5 "	} Hamilton.
Soapstone.....	6 "	
Limestone.....	80 "	
Soapstone.....	50 "	
Limestone.....	144 "	

At a well recently sunk in Biddulph township, about five miles north-east of Lucan, 100 feet of surface deposits rested on limestone which was penetrated 260 feet, in all 360 feet. The limestone, probably of Corniferous age, afforded an abundant supply of fresh water.

Neither gas nor oil was met with.

#### *Well at Sylvan.*

A well was bored in 1888 on lot 15, concession 15, township of West Sylvan. Williams, to a depth of 200 feet, of which 175 feet was surface. At 180 and 195 feet from the surface gas was met with in large quantities, rendering the well, which was sunk for water, valueless. It was the intention, at the time of my visit, however, to bore deeper in expectation of finding a larger quantity of gas. I have not heard whether this has been done or not.

I have been informed by several drillers, who have operated in this district, that in nearly all the wells sunk in the townships of Williams, Bosanquet, Warwick and McGillivray, gas was obtained in no inconsiderable quantities. In these cases, as the wells are shallow, the gas would necessarily emanate from the base of the Hamilton or summit of the Corniferous formation.

#### WELLS OF THE SALT REGION.

##### *Wells at Goderich.*

Of the wells sunk at this place the most important is undoubtedly Goderich, that bored by Mr. Henry Attrill in 1876. Work was begun on the 10th of March of that year and bed rock reached on the 15th of April

at a depth of seventy-eight feet nine inches, the record of the superficial deposits being as follows:—

Gravel.....	14 feet 0 inches.
Blue clay.....	31 “ 0 “
Boulders.....	10 “ 0 “
Gravel.....	4 “ 0 “
Boulders.....	13 “ 0 “
Sand and clay.....	6 “ 9 “

The boring was then continued by means of a  $2\frac{1}{2}$  inch diamond drill to a depth of 365 feet from the surface to which point the well was cased, excluding all water. Below this the drilling was continued to a depth of 1,517 feet, a two inch diamond drill being employed. The drilling was completed on the 6th of December, 1876.

The record of the drilling has been summarized by Dr. Sterry Hunt, as follows:\*

Dolomite, with thin limestone layers....	278 feet 3 inches.
Limestone, with corals, chert, and beds of dolomite.....	276 “ 0 “
Dolomite, with seams of gypsum.....	243 “ 0 “
Variegated marls, with beds of dolomite.	121 “ 0 “
Rock-salt, 1st bed.....	30 “ 11 “
Dolomite, with marls towards the base..	32 “ 1 “
Rock-salt, 2nd bed.....	25 “ 4 “
Dolomite.....	6 “ 10 “
Rock-salt, 3rd bed.....	34 “ 10 “
Marls, with dolomite and anhydrite....	80 “ 7 “
Rock-salt, 4th bed.....	15 “ 5 “
Dolomite and anhydrite.....	7 “ 0 “
Rock-salt, 5th bed.....	13 “ 6 “
Marls, soft, with anhydrite.....	135 “ 6 “
Rock-salt, 6th bed.....	6 “ 0 “
Marls, soft, with dolomite and anhydrite.	132 “ 0 “

It will be seen on referring to the above that in a thickness of 388 feet, or from the top of the first salt bed to the base of the sixth, there is a thickness of rock-salt traversed amounting to 123 feet. This well is the deepest in the district, reaching, as it does, the sixth bed, while in the most of the other wells the bore ceases in either the first or third.

The other wells at Goderich and immediate vicinity are:—

Platt's Well, operated by Jno. S. Platt.

Ontario “ “ North American Chemical Company.

Saltford “ “ Peter McEwen.

---

\*Geol. Surv. of Can., Rept. of Progr., 1876-77.

Dominion Well, operated by Jos. Kidd, jr.

Ogilvie and Hutchison Well, operated by Ogilvie and Hutchison.

International Well, not in operation.

Star Salt           “                   “

*Platt's Well* was sunk about 1875, reaching a depth of 1,075 feet. Platt's well. Salt was struck at 990 feet from which depth the brine is now being pumped.

*The Ontario Well* was sunk in 1867, the depth attained being 1,127 Ontario well. feet or two feet lower than the base of the first salt bed.

*The Saltford Works Well*, drilled in 1865 by Mr. P. McEwen, was Saltford. the first well sunk in Ontario for the production of salt, and has been one of the most successful, having been operated continuously by the present owner. The “block” and well are situated in Saltford, a suburb of Goderich, on the north side of the Maitland river. The drilling was completed at the base of the first salt bed, a depth of 1,000 feet.

*The Dominion Well*, sunk about 1868, reached a depth of 1,120 feet. Dominion well.

*Ogilvie and Hutchison Well*, situated on the Lake shore in the harbour, is the most recently completed, the boring having been made in 1882. The depth attained was 1,100 feet, reaching, it is stated, the third salt bed. Ogilvie and Hutchison well.

*The International Well* was sunk in 1874 by Mr. Joseph Kidd, Sr., and has a depth of 1,170 feet. The well is on the Lake shore at the southern boundary of the town and the “block” was at one time the largest in Ontario, but owing to the failure of Mr. Kidd it has not been in operation for some years. The record of this boring is, according to Mr. P. McEwen, the driller, as follows:— International well.

Blue clay, limestone boulders.....	100 feet
Limestone boulders, and gravel.....	40 “
Sandstone and limestone alternate beds.....	510 “
Hard flinty limestone.....	300 “
Blue shale, thin streaks of red shale.....	84 “
Gypsum .....	6 “
Brown limestone, soft.....	14 “
Rock salt, 1st bed.....	19 “
Brown limestone, very hard.....	30 “
Rock salt, 2nd bed.....	24 “
Blue shales and clays.....	3 “
Rock salt, 3rd bed.....	32 “
Brown limestone, lighter than preceding.....	8 “

But little remains to be written of the salt wells in Ontario as there has been very little activity in the way of boring since that undertaken by Mr. Attrill at Goderich. In the report of the Geological Survey for 1866, page 263 may be found Dr. Sterry Hunt's article on "Brine springs," again in that for 1866-69 he reports on "The Goderich salt region" and in the report for 1876-77 there is an article by him on Mr. Attrill's exploration in the Goderich salt region. In the report of the survey for 1874-75, Mr. Lionel Smith writes on the Canadian salt industry.

## WELLS IN HURON COUNTY.

	Depth. Feet.	1st Salt. Feet.	Year sunk	Elevation above tide
Wingham . . . . .	1,185	1,090	(?)	1,012
Brussels . . . . .	1,244	..	1872	1,120
Brussels, $\frac{3}{4}$ mile south . . . . .	1,000	970	1873	1,095
Blyth . . . . .	1,215	1,125	1879	1,080
Clinton . . . . .	1,239	1,151	1867	927
Seaforth . . . . .	1,135	1,035	1870	1,009
Hensall . . . . .	1,206	1,090	1880	900
Exeter . . . . .	1,251	1,135	1881	875

Wingham.

*Wingham.*—This well, operated by the Gray, Young and Sparling Company, at Wingham, is on the south-east corner of lot 41, concession 13, East Wawanosh, and reached a depth of 1,185 feet. The record of boring is as follows:—

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 "

Brussels.

*Brussels.*—This well was described by Mr. J. Gibson in an article entitled "Salt Deposits of Ontario." \* The following is the log as given by him:—

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 "

\* *American Journal of Science*, vol. V., 3rd series.

The first limestone is probably of Corniferous age, beneath which is found the Onondaga series of magnesian limestones, dolomites and shales, and the sandstone—so-called—is, in all probability, referable to the Guelph series of dolomites which are usually light to dark brown and arenaceous in appearance.

Saline waters were met with at 1,012 feet, and at 1,200 feet traces of oil and gas were noticed.

This well is apparently just outside the edge of the salt basin and defines very closely its geographical limit at this point, as, at a distance of only three-quarters of a mile south-west of the town, salt was struck in considerable quantities in the well now being operated by Mr. F. C. Rogers.

*Blyth.*—The following is the driller's record of this well :

*Blyth.*

Surface.....	104 feet.
Limestone.....	300 "
(?) .....	346 "
Shale, black.....	100 "
Hard rock.....	170 "
Shale .....	105 "
Rock salt.....	90 "

Considerable gas was obtained in the black shales at a depth of 850 feet. No further information regarding the well has been obtained.

*Clinton.*—The "Stapleton Well," owned and operated by Mr Clinton. Henry Ransford, was drilled by the owner in 1867, and I am indebted to him for the following record of boring :—

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 "

*Seaforth.*—The following record of boring at Messrs. Coleman and Seaforth. Gouinlock's "block," is taken from Mr. Gibson's article, already referred to :—\*

\* *American Journal of Science*, vol. V., 3rd series.

Surface.....	25 feet.
Limestone, dark grey.....	400 "
"    magnesian.....	310 " with chert.
Shales, limestone and marls.....	250 "
Gypsum, salt and shale.....	50 "
Rock salt.....	100 "
	<hr/>
	1,135 "

Boring finished in salt.

Hensall.

*Hensall.*—I am indebted to the proprietor and driller, Mr. George McEwan, for the following information regarding his well. The boring was made in 1880, in the southern part of the village of Hensall, to a depth of 1,206 feet, drilling being stopped in the salt strata:—

Surface.....	88 feet.
Limestone, hard.....	150 "
"    soft.....	75 "
Dolomite.....	25 "
Limestone (magnesian ?).....	462 "
Shale.....	230 "
Marly shale.....	60 "
Salt and shale.....	116 "

#### WELLS IN BRUCE COUNTY.

—	Depth, feet.	First salt, feet.	Year sunk.	Elevation above tide.
Teeswater.....	1,180			
Kincardine.....	1,007	947		607
do.....	957		1868	607
Inverhuron.....	1,007		1872	587
Port Elgin.....	1,000			587
Southampton.....	1,255		1868	587

Inverhuron.

*Inverhuron.*—The following, taken by Mr. J. Lionel Smith, is all the information available: \* "A well has since been sunk at Inverhuron, nine miles north of Kincardine, on the shore between Port Elgin and the latter place. The driller, J. S. McEwan, reports that the strata for 895 feet were identical with those at the Kincardine well, and that they then encountered blue shale and gypsum, slightly impregnated with salt; after which came Niagara shales, and at 1,007 feet, hard limestone, holding black water with an offensive odour."

Port Elgin.

*Port Elgin.*—Fruitless attempts to obtain salt at this place were made in 1869 and 1870. No information is available beyond that to be found in "The Geology of Canada," 1866-69, wherein Dr. Sterry Hunt states that at a depth of 890 feet the boring was being carried

\*Geol. Surv. of Can., Rept. of Progr., 1874-75.

through red shales. These shales are probably of Medina age, as the well was begun in the base of the Onondaga, which appears on the surface at Southampton, five miles further north.

*Southampton.*—To the courtesy of the driller, Mr. Wm. Morrison, I Southampton, am indebted for the following record of this well:—

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 "
	<hr/>
	1,255 "

*Kincardine.*—The following record of a well at this point is furnished Kincardine. by Dr. Sterry Hunt\*:—

Sand and gravel.....	91 feet.
Limestone and hard strata.....	509 "
Shale, red.....	23 "
"    blue, with red bands.....	117 "
Limestone.....	30 "
Shale, blue and red.....	125 "
Rock salt.....	14 "
	<hr/>
	909 "

Another given by Mr. Lionel Smith † was that of a well sunk by Messrs. Gray and Scott. This well was completed in 1873, at a depth of 1,007 feet, as follows:

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

\* Geol. Sur. of Can., Rept. of Progr., 1866-69.

† Ibid., 1874-75, p. 286.



## WELLS IN PERTH COUNTY.

Three wells were sunk for salt in this county, at Dublin, Mitchell and Listowel, respectively, in none of which places, however, was the venture successful, brines of a low degree of saturation only being obtained, nor was rock salt noted.

Dublin.

*Dublin.*—This well, sunk in 1873, reached a depth of 1,396 feet. No record was kept of the operation, and the only facts ascertained are that, beneath a surface covering of about seventy-five feet, limestone, having a thickness of 520 feet, was pierced. At 600 feet gypso-saliferous marls were met with, after passing through which the Niagara limestone was reached.

Mitchell.

*Mitchell.*—At this place a boring was made of which Mr. Lionel Smith, writes as follows\* :—

“At Mitchell, eleven miles south-east of Seaforth, a well was bored to 2,008 feet. After passing through shales belonging to the base of the Onondaga formation, the Niagara limestone was reached, and at 1,570 feet, red shale 300 feet thick, belonging to the Medina formation.”

Listowel.

*Listowel.*—Some years ago a well was drilled at Listowel for salt by Mr. John McEwen, late of Goderich. The boring attained a depth of 1,200 feet, when, having reached a point below the usual salt horizon, the well was abandoned. Further data are not at hand beyond the fact that a copious supply of brine of a very low degree of saturation was encountered, though at what depth was not stated.

*Well at St. Mary's.*

St. Mary's.

A well was sunk at this place about the year 1863 which reached a depth of about 700 feet. At this point small traces of petroleum were said to have been observed. But little information has been obtained of this well, the only reliable data available being some notes by Dr. Sterry Hunt. † The bore was begun on the Corniferous limestone which outcrops at this place, and specimens were obtained from various points between 100 and 500 feet; these were found in every instance to be magnesian limestones approaching, at times, pure dolomites.

*Well at Stratford.*

Stratford.

During 1890 a well was sunk at this place in search of gas by the Stratford Natural Gas Company, a company composed princi-

\* Geol. Surv. of Can., Rept. of Progr., 1874-75, p. 288.

† Ibid., 1866, p. 249.

pally of citizens of the place, and of which Mr. Jas. Trow, M.P., was president. The drilling reached a depth of 2,386 feet without finding gas. Data regarding the rocks pierced are not at hand, the only information available being the fact that the Trenton limestone was struck at 2,360 feet and that salt water in considerable quantity was found at 2,384 feet, or twenty-four feet below the summit of the Trenton.

WELLS IN LAMBTON COUNTY.

It is not the intention to enter into the history or the extent of drilling operations in this county nor to enlarge upon the fact of its being and having been the only oil producing territory of the Dominion, but to give merely a brief account of some of the most typical and more important wells sunk.

The oil of Lambton county is, in the main, obtained from two distinct pools known as the Oil Springs and Petrolea fields, both in the township of Enniskillen. The larger of the two—the Petrolea field—with an approximate area of twenty-six square miles, extends W.N.W. about nine miles and E.S.E. about four miles from the village of Petrolea; while the Oil Springs field covers about two square miles and includes the south-eastern part of the village of Oil Springs. The pools are divided by a very distinct synclinal structure, the upper beds of the Hamilton being overlain by the black pyroschists of the Portage formation; these black shales have at Oil City, between Petrolea and Oil Springs, a thickness of forty feet, immediately beneath which is found the upper limestone of the Hamilton series.

*Wells at Petrolea.*

The oil horizon of Petrolea lies at a depth of from 450 to 480 feet Petrolea. beneath the surface of the main part of the town, the oil being pumped in all instances from what is known as the “lower vein” at a point about sixty-five feet in the Corniferous limestone. The following record may be taken as typical of the wells sunk in the Petrolea field.

*Well sunk near Imperial Refinery, Petrolea :—*

Surface.....	104 feet.	
Limestone (upper lime).....	40 “	} Hamilton.
Shale (upper soapstone).....	130 “	
Limestone (middle lime).....	15 “	
Shale (lower soapstone).....	43 “	
Limestone (lower lime).....	68 “	
Limestone, soft.....	40 “	} Corniferous.
“ grey.....	25 “	

Numerous deeper wells have been sunk in the expectation of finding deeper seated oil, unfortunately, however, in all cases proving to be failures, as no further oil-bearing rocks were found below those from which the present supply is drawn. The most important, on account of its greater depth, is undoubtedly that sunk near the Imperial refinery and known as the "Test Well," of which the following record has kindly been furnished by the driller, Mr. E. Rawlings:

*"Test Well," Petrolea.*

Surface.....	104 feet.	
Limestone.....	40 "	Hamilton.
Shale.....	130 "	
Limestone.....	15 "	
Shale.....	43 "	
Limestone.....	68 "	
" soft.....	40 "	Corniferous.
" grey.....	25 "	
" ".....	135 "	
" hard, white.....	500 "	With hard streaks of sandstone from 2 to 5 feet in thickness.
Gypsum.....	80 "	
Salt and shale.....	105 "	Onondaga. (Including the Oriskany, if present.)
Gypsum.....	80 "	
Salt and shale.....	140 "	
Total depth.....		1,505 "
Elevation above tide,		667 feet.

*Wells at Oil Springs.*

Oil Springs. The following record may, in the same way, be taken as illustrating the wells of the Oil Springs pool:—

*(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 "	

*(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 of these wells at 370 feet from the surface, or about sixty feet below the summit of the Corniferous limestone. Salt water occurs in each at 252 feet, beneath which point they are comparatively dry.

Of deep wells sunk in the Oil Springs field, no data are available beyond those found in the report of Dr. Sterry Hunt\* wherein he writes:—"At Oil Springs, on the second range of the same township (Enniskillen) we may cite a well on lot 19 which gave clay 42 feet, shale, etc., 182 feet, at which depth a copious flow of oil was obtained. After this became exhausted, the boring was continued for 595 feet further, through limestone, of which the inferior portion was tender and friable. Specimens from the bottom, and from fifty feet above, were found to be a granular dolomite, though regarded by the borers as sandstone. Another boring at Oil Springs, known as the "Test Well," was sunk in lot 18 of the second range, to a depth of one thousand feet. From the record it appeared that there were found, clay 77 feet, grey shale, etc., 300 feet, below which only hard rock was found, until near the bottom, when soft shales were again met with. In this well, small portions of oil were said to have been found by the sand-pump, at depths of 210 and 400 feet in the solid rock beneath the shales." Numerous descriptions of shallow wells, throughout this territory, may also be found in the above-mentioned report.

Operations have been carried on continuously since the sinking of the first deep well in Oil Springs by Mr. James Shaw, in 1862. During the first few months after the discovery of oil, wells of enormous capacity were struck, reaching in the case of the Black and Matthewson a daily flow of 7,500 barrels, other large wells being the Fiero, Swan, Webster and Shepley, Petit, and many others, a list of most of which will be found in Dr. Alexander Winchell's "Sketches of Creation." *Appendix, Note VIII.*

In a personal letter from Mr. Isaac Waterman, of Petrolea, I am informed that there are in the oil territory of Enniskillen township between 2,700 and 3,000 wells pumping and affording oil, the total output from which amounts to about 600,000 barrels of 35 imperial gallons per annum.

#### *Well at Wyoming.*

Eight miles to the north of Petrolea a well was sunk on lot 15 of Wyoming, the 1st range of the township of Plympton, near the village of Wyoming, of which the following record was obtained:—

---

\* Geol. Surv. of Can., Rept. of Progr., 1866, p. 246.

Surface.....	104 feet.	
Black shale.....	4 "	Portage.
Limestone.....	40 "	} Hamilton.
Shale.....	130 "	
Limestone.....	15 "	
Shale.....	43 "	
Limestone.....	68 "	} Corniferous.
" soft.....	40 "	
" grey.....	36 "	

Only small quantities of oil were noted accompanied by a copious flow of saline water.

Elevation above tide about 697 feet.

No records of other wells in this township have been received, though from information obtained from the drillers it is learned that none of the many borings made were of economic importance.

*Well at Kingstone's Mills.*

Kingstone's  
Mills.

In the township of Warwick, which lies east of Plympton, many wells were sunk, notably that at the Elarton salt works, which reached a depth of 1,400 feet, terminating in a hard rock, of unknown character. Salt was found, it is said, at 1,200 feet, continuing, interstratified with shale, for 130 feet or to a total depth of 1,330 feet, beneath which there was a hard rock (probably dolomite) seventy feet thick.

Another well, of which the following is, according to Dr. Sterry Hunt, the record, was also sunk at or near this place :—

Clay.....	14 feet.	
Black shale.....	50 "	Portage.
Shales, soft and limestone.....	396 "	Hamilton.
Limestone, hard.....	44 "	Corniferous.

Dr. Hunt speaks of this well\* as being important in showing the thickness, in Ontario, of the middle and upper Devonian. To the 396 feet of soft shales and limestone of the Hamilton formation shown above, he adds 213 feet of rocks of the Portage formation, known to exist through a boring made at Corunna, on the St. Clair River, making a total of 609 feet.

*Wells in Township of Bosanquet.*

Bosanquet,  
Port Franks.

The deepest well in this township is that at Port Franks which was sunk by Mr. Joseph Williams who for many years has used the brine

\* Geol. Surv. of Can., Rept. of Progr., 1866, p. 247.

obtained therefrom in the manufacture of salt. The boring is particularly remarkable owing to the great thickness of drift deposits traversed before reaching bed rock. The record, according to Mr. Williams, is as follows :—

Fine sand.....	60	} 260 feet.
Gravel.....	16	
Clay and gravel.....	178	
Gravel.....	6	
Limestone.....	940	"
Shale.....	45	"
Salt and shale.....	110	"

The limestone will probably include the lower part of the Hamilton the whole of the Corniferous and that part of the Onondaga overlying the salt beds. This supposition is borne out by the fact that, at 365 feet from the surface, or 105 feet in the rock, the driller reports having passed through four or five feet of soft marl-like beds ("soapstone"?) which would be utterly unlike the hard grey limestone so characteristic of the Corniferous, and at a point too high to allow of their belonging to the Onondaga formation. Elevation of well above tide, 590 feet.

Of other wells in this township Dr. Sterry Hunt, writes\* :— Widder.

"Another at Widder station, in Bosanquet, gave: clay, 34; soft shale, etc., 196; limestone, 120 = 350 feet. At 196 feet from the surface, some gallons of oil were obtained. A well, on the southern line of the township, on the third lot, not far from Arkona, was sunk in a valley, which showed, above the boring, the strata of the Hamilton shales, nearly as follows, in descending order : Arkona.

hard limestone, 8; shale, 40; limestone, 3; shale, 9; from which point a boring was carried 224; hard white limestone, yielding some oil, 18 = 242 feet, in August last. This shows 284 feet of the Hamilton formation at this point. To the west of this, at what is called the Grand Trunk Well, on the twelfth lot of the tenth range of Bosanquet, after Grand Trunk well.  
clay 90, hard black shale 95, 350 feet of soft shales were said to have been found = 535 feet, and the boring from this depth was in a very soft grey calcareous marl resembling the strata of the Hamilton: neither this nor the well near Arkona, however, represents the entire thickness, in the vicinity of the soft grey shales and so called soapstones of the Hamilton formation, which at Kingstone's Mills, in Warwick, measure, as we have seen, 396 feet, while in the valley of the Thames, as shown above, these strata do not measure over 250 or 290 feet, showing a rapid thickening to the northward."

\*Geol. Surv. of Can., Rept. of Progr., 1866, p. 248.

*Wells in Township of Brooke.*

Brooke.

Operations were also carried on in this township, unfortunately, however, without finding oil in economic quantities. No records have been kept of the work.

*Wells in Township of Euphemia.*

Euphemia.

In late years some forty wells have been sunk in this township and small quantities of oil shipped. The field is small and the largest flow from an individual well (the Wilson and Bennett) has been but one barrel per day. The record of this well is as follows :—

Surface.....	53 feet.	
Shales, etc.....	224	" Hamilton.
Limestone.....	93	" Corniferous.

Another, the Parson's well, gave the following section :—

Surface .....	58 feet.	
Shales, etc .....	265	" Hamilton.
Limestone.. .....	37	" Corniferous.

No oil was found, the only product being salt water, which was struck in a heavy flow at 360 feet.

All the oil from this field is shipped by Grand Trunk Railway from Newbury station, the greater part being consigned to London, Ontario, where it is refined.

*Wells in Township of Dawn.*

Dawn.

Explorations for oil have been carried southward from Oil Springs into this township, though with poor results. Of the many wells sunk, one record alone is available, namely, that on lot 32, concession 10, which reached a depth of 700 feet, and for which I am indebted to the driller, Mr. W. Harris, of Petrolea, who reports as follows :—

Surface.....	50 feet.	
Shale, black.....	70	"
Limestone.....	70	"
Shale and limestone.....	285	"
Limestone.....	225	"

The "middle lime," which is not shown in the record, consisted, according to the driller, of about two feet of soft limestone, though at what depth I was unable to ascertain. The driller also states that throughout the 285 feet of shales he noted several "streaks" of limestone from two to four feet thick.

No oil was obtained in this boring, and salt water was struck at 625 feet.

Mr. Lionel Smith states\* that he was informed that Mr. Peter McEwen, when boring for oil in this township, had struck rock salt at 1,100 feet. I have been unable to discover where this well is or any further data regarding it.

*Wells in the Township of Sombra.*

No records are at hand of wells bored in this township, though it is Sombra. supposed that considerable exploratory work has been done. Dr. Sterry Hunt writes† of the work done in this township:—

“Several wells sunk along the Sydenham river, in the townships of Sombra and Camden, present a considerable thickness of black shales overlying the soapstone, or grey Hamilton shales. One, on the north branch of the Sydenham, on the twelfth lot of the seventh range of Sombra, not more than ten feet above the river level, was sunk through 112 feet of quaternary clays, and then through 100 feet of black shale; after which it had, at the time of my visit in August last, been carried a little over 100 feet in the soapstone. Similar results were obtained in a well on an adjoining lot, while another on lot twelve, of the tenth range, gave, below 120 feet of clay, twenty feet of black shales, followed by sixty feet of soap stone at the time of my visit.”

A salt block has been erected at Port Lambton on a well the depth Port Lambton of and information regarding which I have been unable to obtain.

*Wells in Township of Moore.*

As in the case of the other townships surrounding Enniskillen, Moore. boring operations have been carried into this township in anticipation of an extension of the Petrolea and Oil Springs pools, unfortunately, however, with but slight success. Of the many wells sunk the records of but two are available, viz., a well on lot twenty-eight of the first range, at the village of Corunna, and that of the Courtright Salt Company.

Of the former the following has been preserved:—

Corunna.

Clay . . . . .	54	} 120 feet. Surface deposits.
Shingle of black shale. . .	56	
Clay . . . . .	10	
Shale, black . . . . .	8	} Portage and Chemung.
Sandstone, greenish . . . . .	20	
Shale black, with pyrites . . .	185	
Grey shale and lime . . . . .	17	Hamilton.

\* Geo. Surv. of Can., Rept. of Progr., 1874-75, p. 288.

† Ibid., 1866, p. 244.



What the results of the boring were is not stated, though it is presumed oil was not found.

Courtright.

*Courtright.*—At the works of the Courtright Salt Co. a well was sunk in June, 1884, to a depth of 1,665 feet. The following record of it has been kindly furnished by the driller, Mr. E. Rawlings, of Petrolea :—

Surface (sand, etc.)....	132	} 160 feet.
Hard-pan.....	28	
Shale, black.....	32	" Portage.
Limestone.....	40	"
Shale and limestone .....	310	" } Hamilton.
Limestone, white.....	50	"
" grey.....	100	" Corniferous.
" white, hard.....	370	"
Sandstone* .....	32	"
Limestone .....	400	"
" and gypsum.....	136	"
Salt.....	22	"
Gypsum .....	13	"

\*Probably dolomite.

Elevation above tide, 588 feet.

Salt water was met with at 680 feet, which was effectually cased off, by casing to a depth of 740 feet. A considerable quantity of gas was met with in a few feet of quicksand immediately underlying the "hard-pan." This was thought to be of such importance that a drive pipe was afterwards sunk near the salt well, and the gas utilized until cut off shortly after, when nearly exhausted, by the filling of the casing with sand and water.

#### *Wells in Township of Sarnia.*

Sarnia.

The productive oil territory of the Petrolea pool extends into the south-eastern corner of this township, in which part many successful wells have been and are being sunk. The records of none of these are available, though it is supposed that they would not differ much from those of wells nearer to Petrolea, and that typical of the Petrolea pool.

In the south-western part of the township several wells have been sunk, from which considerable flows of gas are recorded. Of one of these, on J. D. Simpson's farm, lot 15, block A, Indian reserve, the following has been obtained :—

Simpson's  
Farm.

Surface.....	124	feet
Shale, with hard streaks...	32	" Portage.
Shale and limestone.....	324	"
Limestone .....	15	" } Hamilton.

At 480 feet gas was found accompanied by oil and salt water ; the flow of gas being estimated at about 20,000 cubic feet per diem.

Wells in Town of Sarnia.

In the town of Sarnia are several wells, prominent among which is Sarnia. that at King's Grist-mill, drilled in 1875 by Mr. E. Rawlings, of King's grist-mill. Petrolea, to whom I am indebted for the following record :—

Surface sand.....	9	} 120 feet	
Blue clay.....	109		
" Hard-pan ".....	2		
Shale, black.....	36	"	Portage.
Limestone.....	30	"	} Hamilton.
Shale.....	263	"	
Limestone.....	5	"	
Shale.....	40	"	
Limestone.....	60	"	} Corniferous.
" grey.....	100	"	
" hard.....	546	"	
" hard and flinty.....	200	"	
" with gypsum.....	105	"	} Onondaga, including lower part of Corniferous.

Elevation above tide, 589 feet.

Fresh water was encountered at 120 feet beneath the "hard-pan" and a copious flow of salt water at 654 feet ; the casing, however, was carried to only 495 feet or just into the lower limestone of the Hamilton. Oil was not observed, but gas in small quantities was found at 400 feet and cased off.

Peterson's well.—During 1887, Messrs. N. C. Peterson and Sons Peterson's drilled at their works in the town for the purpose of obtaining a supply well. of gas for their boilers. The drilling was carried to a depth of 685 feet, in which two small flows of gas were obtained at 330 and 515 feet, the latter affording the greater supply. According to the driller, Mr. H. Mitchell, the log is as follows :—

Surface.....	200 feet.	
Shale, black.....	15	" Portage.
Limestone.....	150	"
Shale.....	85	"
Limestone.....	5	"
Shale.....	60	"
Limestone.....	170	"

In the last few feet bored there was a heavy flow of salt water which rose to a considerable height, flooding the gas-rock. The well was not packed, and after supplying fuel for some time to the boiler at the works, was finally abandoned.

Agricultural  
works well.

*Agricultural Works Well.*—This well, also drilled by Mr. Mitchell, gave the following record :—

Surface.....	130 feet.	
Shale, black.....	80 "	Portage.
Limestone.....	80 "	
Shale.....	160 "	
Limestone.....	5 "	
Shale.....	60 "	
Limestone.....	150 "	
<hr/>		
Depth.....	665 "	

Gas in small quantities was found at 515 feet, and salt water at 645 feet. The casing was carried to a depth of 140 feet, and the hole plugged at 640 feet, but owing to the water being ineffectually shut off the gas was never available and the well was finally abandoned.

Dickens we

*Dickens Well.*—Possibly the most important of the wells in Sarnia is the Dickens Well, sunk in the southern part of the town, near the corner of Rose and Tecumseh streets. It also was sunk by Mr. Mitchell, who furnishes the following record :—

Surface.....	130	} 200 feet. Surface deposit.	
Hard-pan.....	55		
Gravel.....	15		
Limestone.....	90	} Hamilton.	"
Shale.....	100		"
Limestone.....	5		"
Shale.....	68		"
Limestone.....	77		"

Gas was found in the lower shale at 473 feet, affording about 20,000 cubic feet per diem. This was used in the lighting of several private dwellings and street lamps in the immediate neighbourhood. The boring may be considered dry, no casing below the conductor being necessary.

#### WELLS IN KENT COUNTY.

Many wells have been drilled throughout this county in search of both gas and oil, principally during the years following immediately upon those marking the discovery of oil in large quantities in the Petrolea and Oil Springs pools. From none of these borings, however, has much oil been obtained, though found in many of them. Again, in later years, considerable energy has been evinced in sinking wells for gas, so far unsuccessfully, as only small quantities have been found, nowhere sufficient to warrant further trial.

Boring was first begun along the banks of the Sydenham river, and operations were carried on actively on lines gradually receding north and south from the river banks, till about 1867, when operations ceased. Since the finding of gas in large quantities near Kingsville, Essex county, drilling for gas has been indiscriminately carried on throughout the county. Unfortunately data regarding all these are not at hand, and it has therefore been found impossible to correlate the records received, with the rocks shown to exist by more correct logs.

*Wells at Bothwell.*

Of the many wells sunk in and around the village of Bothwell in Bothwell the township of Zone, only few records are available; among others that of the Clinton Oil Well. This, drilled in 1865 or 1866, reached a depth of only 370 feet, at which point a small show of oil is reported. The record is as follows :—

Surface.....	155 feet.
Soapstone .....	31 “
Shale, black.....	4 “
Soapstone .....	32 “
Limestone.....	148 “

Elevation above tide about 691 feet.

Of another well near Bothwell, Dr. Sterry Hunt gives the following record\* :—

Sand.....	25	} 90 feet.
Blue clay.....	45	
Boulder clay.....	20	
Shale, black.....	77	“
Soapstone, etc.....	193	“
Limestone.....	120	“

Again, in the same report, Dr. Hunt describes other borings as follows : † “ At Bothwell, one boring gave clay 90, shale, etc., 270, after which the well was sunk 120 feet in solid limestone, without yielding either oil or gas. Another, the Empire well, was sunk through clay 120 feet, shale 160 feet, after which oil was reached at a distance of 140 feet in the limestone. In another, the Pepper well, after about the same depth of clay, oil was found in great abundance at 210 feet in the rock, while the Chambers well gave a copious supply of oil at a depth of 385 feet from the surface. The Thames well was sunk to 618 feet, but met with a copious supply of salt and sulphuric water, and some oil, at 475 feet.”

\* Geol. Surv. of Can., Rept. of Progr., 1866, p. 245.

† Ibid., p. 247.

*Wells in Camden and Chatham Townships.*Camden and  
Chatham.

✓

Dr. Hunt writes as follows of several wells sunk in the townships of Camden and Chatham :\* “A well on lot eight of the second range of Camden offered clay 53, black shale 200, and soapstone, etc., 167 = 420 feet. Another, on the seventh range of Chatham, on the line of Camden, gave clay 48, black shale 100, soapstone, etc., 252, limestone 195 = 595 feet. One on lot six of the fourth range of Camden gave clay 33, black shale 98, soapstone, etc., 229, limestone 55 = 415 feet. Another, on lot two of range five of the same township, clay 50, black shale 146, soapstone, etc., 202, limestone 161, sandstone 10 = 569 feet.”

Another well, drilled more recently, on lot 3, concession 2, Camden, gave, according to the driller, Major Savage, of Petrolea:—

Sand .....	13	} 60 feet.
Clay .....	40	
“Hard-pan” .....	7	
Shale, black .....	20	“
Limestone .....	30	“
Soapstone .....	204	“
Limestone .....	117	“
Sandstone... ..	46	“
Hard rock (limestone).....	23	“
Depth .....	500	“

Salt water in considerable quantity was noted at 431 feet; neither oil nor gas was found.

*Wells at Thamesville.*

Thamesville.

✓

Of the wells in the neighbourhood of Thamesville, Dr. Hunt writes as follows†:—“At Thamesville, about a mile north from the railway station, a well was sunk through clay 60, grey shale, etc., 240', grey limestone 32' = 332 feet. At a depth of sixteen feet in the limestone oil was met with, and the well, at the time of my visit—in October, 1866—had yielded some thirty barrels, which had been dipped out, the well not having yet been pumped. Another well adjoining the railway station was sunk 615 feet without yielding oil. It gave clay 76', grey shales, etc., 207', the remainder being harder strata, of which the first 186 feet were described as hard limestone.”

\*Geol. Surv. of Can., Rept. of Progr., 1866, p. 244.

†Ibid., p. 247.

*Well at Dresden.*

During 1888, a well was sunk in the village of Dresden by Major Dresden. Savage, of Petrolea, who has kindly furnished the following record:—

Surface.....	43 feet.
Shale, black.....	180 “
Limestone.....	12 “
Soapstone.....	172 “
Limestone.....	75 “
Sandstone.....	44 “
Limestone, hard.....	79 “

What the economic results were was not stated.

*Wells at Chatham.*

Reference is again made to Dr. Hunt's report for information Chatham. regarding a boring at Chatham. This reached a depth of 1,000 feet, of which the first seventy feet consisted of clay, followed by soft shaly rocks for 294 feet, including near the base, or at about 360 feet from the surface, six feet of black shale. According to Dr. Hunt\*: “After this hard limestone was encountered in which, at a depth of 58 feet, a vein of salt water, with some oil, was found. Still lower, at about 600 feet from the surface, a copious source of sulphurous water was struck, which continued to flow for some months, filling a pipe of 3½ inches until stopped by a plug driven into the bore.”

Another well was drilled, during recent years, about one mile north-west of the Grand Trunk Railway station at Chatham, which reached a depth of 1,000 feet, as follows:—

Surface clay.....	60 feet.
Shale, black.....	118 “ Portage.
Soapstone.....	200 “
Limestone.....	18 “
Soapstone.....	37 “
Limestone.....	567 “

Casing was only carried to a depth of 260 feet, and a heavy flow of salt water was struck at about 700 feet. A small “show” of oil was noted at 475 feet. Elevation above tide, 583 feet.

*Well at Charing Cross.*

It is reported that a well was drilled here to a depth of 700 feet, in Charing Cross which a small “show” of gas was noted, though at what depth was not stated.

---

\*Geol. Surv. of Can., Rept. of Progr., 1866, p. 247.

*Wells in Harwich Township.*

Harwich.

On lot 9, concession 4, township of Harwich, a well was drilled, prior to 1866, of which the following record is given :—

Clay .....	163 feet.	
Shale .....	17 "	} Portage.
Shale, black .....	58 "	
Soapstone .....	192 "	} Hamilton.
Limestone .....	70 "	

What the results of the boring were is not stated.

Elevation, above tide, 634 feet.

Rondeau.

*Rondeau.*—A well at Rondeau, in the township of Harwich, is thus described by Dr. Hunt\* :—" 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 approximate statement was obtained from what seemed a trustworthy source."

Harwich.

*Near Harwich.*—I am indebted to Mr. Richard Ransford, of Clinton, for the following record of a well drilled for oil on the line between Howard and Harwich townships, and near the village of Harwich. No oil was found :—

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 "

*Well at Blenheim.*

Blenheim.

During 1890 a well was drilled at this place by a company composed chiefly of citizens of the place under the title of "The Citizens Gas

\* Geol. Surv. of Can., Rept. of Progr., 1866, p. 245.

Company." The depth reached was 900 feet, where the tools stuck and the hole was abandoned. Gas in small quantities is said to have been found at 700 and 800 feet.

Gas is said to have been found in a shallow well on the farm of Wm. Mead, in concession 7 of Harwich, and about three miles and a-half from Blenheim. Sufficient is said to be obtained for heating and lighting that gentleman's house.

*Wells in Howard Township.*

A well in concession 4 of Howard on the line of Orford township Howard. is described in the Geological Survey Report,\* and the following record given :—

Clay.....	95 feet
Soapstone and light shales, with a black band near the base.....	255 feet
Limestone, bluish.....	160 "
Limestone, grey, sandy.....	197 "
Depth.....	707 "

*Wells in Orford Township.*

*Ravey Well.*—This was drilled during 1890 by Messrs. Hiram Orford, Ravey Walker and Sons, of Walkerville, to whose driller, Mr. J. S. Hyland, I well. am indebted for the logs of both this and the Grant well. The drilling was made on lot 10, concession 11, Orford township, on the Ravey farm, and reached a depth of 1,000 feet as follows :—

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 "

The well was, in the upper part, comparatively free from water, only small seams being found to a depth of 630 feet where a strong flow of sulphur water was struck, and cased off, the casing afterwards being carried to a depth of 915 feet. At 965 feet a heavy flow of salt water was struck which rose to 100 feet from the

\* Geol. Surv. of Can., Rept. of Progr., 1866, p. 245.



surface, where it now stands. Gas was not noted, but a "show" of oil was reported at 470 feet.

Elevation, above tide, 740 feet.

Grant well.

*Grant Well.*—This was drilled by the same firm as the preceding, on the Grant farm, lot 23, concession 14, Orford township, and reached a depth of 500 feet, of which the following record was obtained:—

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 "

No gas was found; oil accompanied by water was struck in small quantities at 318 and 410 feet. Sulphur water was encountered in considerable quantities at several points, the greatest flow being from the lower sixty feet.

Elevation above tide, 691 feet.

It is to be regretted that specimens of drillings were not obtained from these two wells as the records furnished to this office afford little information regarding the rocks traversed.

#### WELLS IN ESSEX COUNTY.

The history of gas explorations throughout this county is somewhat recent, and may be considered as beginning during December, 1888, with the Coste Well No. 1, which had a measured flow of 10,000,000 cubic feet per day. Since that date about twenty-five wells have been sunk in search of gas, but in only one instance with success, namely, in the case of the boring made by the Kingsville Natural Gas and Oil Association, known as Citizens' No. 2, which has a daily flow of 7,000,000 cubic feet. The drilling of this latter well was the cause of considerable litigation between its owners and the Ontario Natural Gas and Fuel Company, the owners of the Coste No. 1. The right to bore on the road allowances of the municipality was granted by the county council to the Kingsville Citizens Company, who at once commenced drilling on the high road some fifty-five yards west of the Coste No. 1; an injunction was taken out by the proprietors of the latter, who were, however, eventually unable to restrain the operations. Except in these two wells all efforts to find gas in paying quantities have been unsuccessful, and many thousands of dollars have been spent, and the gas obtained has hitherto only been used to light the streets of the village of Kingsville.

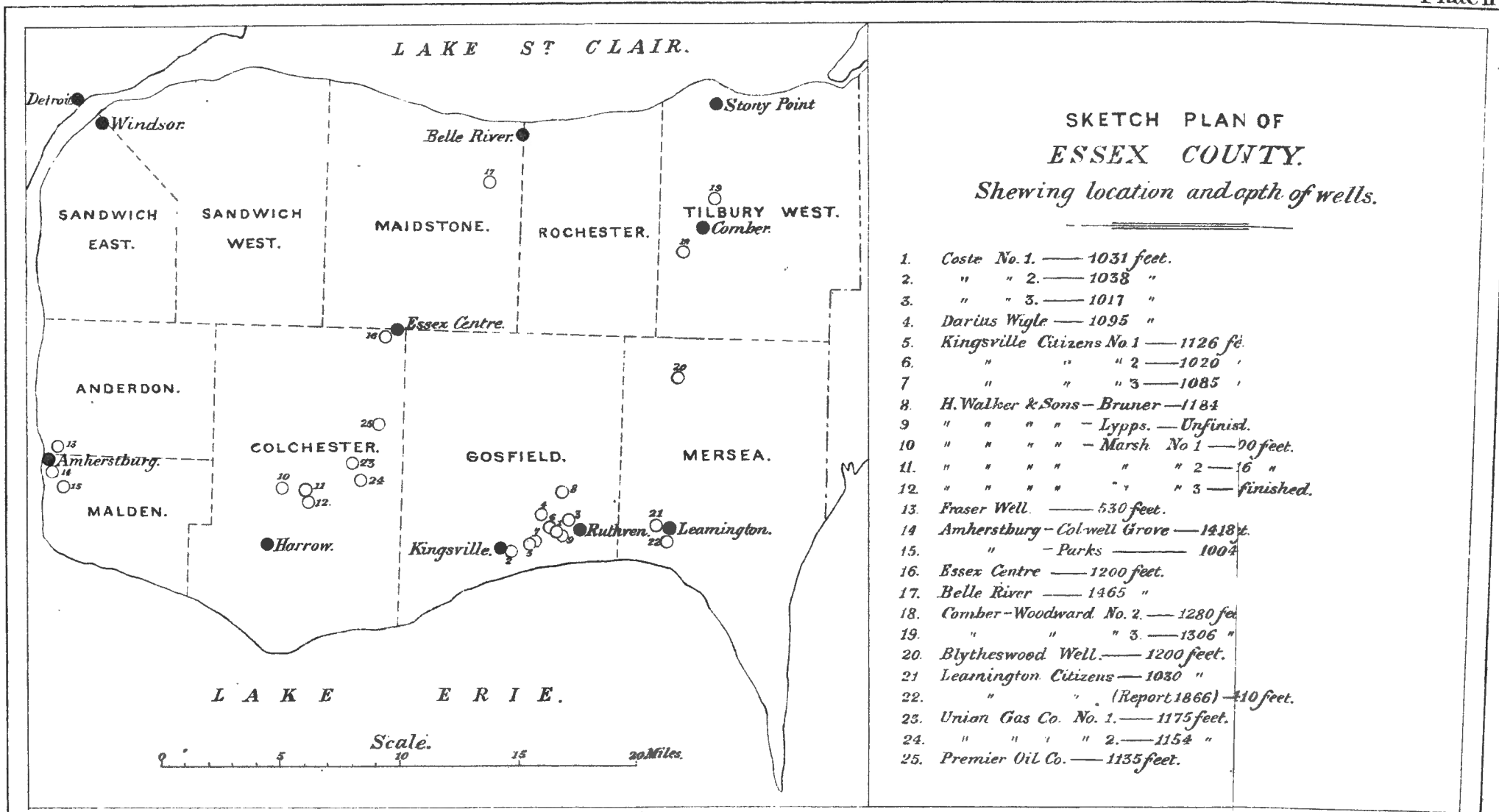
While drilling for gas on what is known as Walker's Marsh, oil, in what was at first thought to be paying quantities, was found, and



# Geological Survey Department. Canada.

ALFRED R.C. SELWYN, C.M.G., LL.D. F.R.S. &c. DIRECTOR.

Plate II.



Drawn for photo-lithography by L.N. Richard B.A.Sc.

To illustrate report on Gas and Oil options in Ontario by H.P. Brumell.

Vol. V, Part Q.

several wells were drilled both by Messrs. Walker and Sons, of Walker-ville, and the Union Gas Company. It was found, however, that the quantity of oil available in any one well nowhere exceeded three barrels per day, and was accompanied by so much salt water that operations were discontinued.

I am unable to give the records of most of the wells in this county, for although specimens are at hand from several, they have not yet been closely examined; suffice it to say that the oil and gas horizon is near the summit of the Clinton or base of the Niagara formation.

*Wells in Tilbury Township.*

Three wells have been sunk in this township, near Comber, and are Tilbury. known as numbers 1, 2 and 3 respectively. Of No. 1 no data are available, and it is understood that through some defect it was not accepted from the contracting driller.

No. 2.—Is on lot 7, concession 5, Tilbury West. It was Comber, No. 2 drilled for Mr. M. J. Woodward, of Petrolea, to a depth of 1,280 feet. At 1,213 feet a small quantity of oil was found, several barrels of which were shipped to the proprietors' refinery at Petrolea.

The record of drilling as supplied by the driller is as follows:—

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 "
Limestone, blue . . . . .	10 "
"    hard, with shale . . . . .	55 "
"Very hard rock," with pyrites . . . . .	20 "
Limestone, hard . . . . .	156 "
" . . . . .	10 "

Casing was carried to a depth of 683 feet effectually shutting off all water. Elevation above tide 604 feet.

Comber, No. 3 No. 3.—This well is about half-a-mile west and one mile south of the Michigan Central Railway Station at Comber, and is 1,306 feet deep. It was drilled, for the same gentleman as the preceding, by Mr. J. R. Minhinnick, of London, Ont., to whom I am indebted for the following :—

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 "

Unlike the last, no oil was found, and gas in small quantities was found at 260 and 1,078 feet.

Fresh water was found at 150 feet or twenty-six feet in the first limestone, sulphurous water at 260 feet, and a strong flow of saline water at 1,127. Casing was carried to a depth of 700 feet.

Elevation above tide 600 feet.

#### *Wells in Maidstone Township.*

Maidstone,  
Belle River.

*Belle River.*—Two wells were sunk near this village, both of which are on lot 12, concession 6, township of Maidstone, at an elevation of about eighteen feet above Lake St. Clair, or about 600 feet above tide. The deepest was 1,465 feet, of which the following record is available :—

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

Water was first found at 275 feet or at the base of the dark shales ; and again, at 1,300 feet, a strong flow of salt water was

found, though no salt beds were pierced. Gas in small quantities was noted, though at what depth was not stated.

Though no name is given to the strata penetrated below the twenty-five feet of sandstone, there is every reason to believe that they consisted of shale, etc., of Medina age, and that the boring ceased in that formation.

The other well was drilled close to the foregoing and reached a depth of 1,010 feet, the record of rocks pierced being practically the same. Water was found under similar conditions and at the same depths; gas was not noted.

*Well in Anderdon Township.*

Only one well was sunk in this township, viz., "The Fraser Well," Anderdon,  
Fraser well. drilled about one-half mile east of the Detroit river and near the town line. The well is only 530 feet deep, seventy feet of which consisted of surface deposits. Fresh water was found at 130 feet, but neither gas nor oil was noted.

*Wells in Malden Township.*

During 1889 a company was formed in Amherstburg under the title Malden. of the "Great South-western Gas and Oil Company, of Amherstburg." This company drilled two wells near the town, viz., "The Colwell Grove Well," on lot 2, concession 1, and the "Parks Well," on lot 4, concession 2, of Malden township, in neither of which was any economic result attained.

I am indebted to Major John Savage, of Petrolea, for records of these two wells, as follows:—

*Colwell Grove Well*—Depth, 1,418 feet.

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

Colwell Grove  
well.

Casing was carried to a depth of 508 feet, or eight feet into the first shale, effectually shutting off all water down to that depth. A heavy flow of salt water was found at 1,115 feet, to shut off which no effort was made. Neither gas nor oil was noted.

Parks well.

*Parks Well.*—Depth, 1,004 feet.

Surface (sand and gravel).....	30 feet.
Limestone.....	228 "
Sandstone (?).....	84 "
Limestone... ..	182 "
Gypsum... ..	12 "
Limestone.....	468 "

The well was cased to a depth of 820 feet ; at 987 feet, a heavy flow of salt water was found accompanied by small quantities of gas.

*Wells in Colchester Township.*

Colchester.

In and about "Walker's Marsh," in this township, several wells were sunk from which small flows of oil were obtained, the greater quantity being found in Messrs. Walker and Son's wells, Nos. 1 and 2. The supply proving to be small, the field has been abandoned.

Walker's  
No. 1.

*Walker's No. 1.*—This well on lot 8, concession 6, Colchester township, is 1,300 feet deep, terminating in a fine grained brown sandy shale. A small show of oil was noted at 1,000 feet accompanied by a very small quantity of gas. Water was found at 180 feet and again at 1,100 feet ; the latter not being cased off as the casing was only carried to a depth of 600 feet. .

The following record has kindly been furnished by the 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	"

*Walker's No. 2.*—This well is on lot 11, concession 6, Colchester; Walker's No. 2. and reached a depth of 1,016 feet; the record to this depth is very similar to that obtained of the foregoing. Casing was carried to a depth of 600 feet and sulphurous water accompanied by oil was found at 1,000 feet; this well is said to have pumped five barrels of oil per diem.

*Walker's No. 3.*—This well, on lot 11, concession 5, Colchester, was Walker's No. 3. not, at the time of my visit, completed, though it has been since reported that small quantities of oil and gas were obtained.

### *Union Gas Co.*

*Well No. 1.*—A syndicate composed of Messrs. P. McLaren, of Union Gas Co. Perth; N. A. Coste, of Amherstburg; E. Coste, of Buffalo; D. McGillivray, of Port Colborne, and others, under the provisional title of the Union Gas Co., sank two wells between the Walker's marsh series of wells and Essex Centre, unfortunately, however, without success. The first, or No. 1, was drilled on lot 17, concession 7, Colchester, to a depth of 1,175 feet, near the base of the Niagara formation, according to the following record, kindly furnished by Mr. E. Coste:—

Surface.....	66 feet.	
Limestone, white and grey...	169 "	Corniferous.
Dolomite and gypsum, with blue black shales towards bottom.....	740 "	Onondaga.
Dolomites.....	200 "	Guelph and Niagara.

Sulphurous water was found at 582 and 613 feet, which was shut off by casing to a depth of 630 feet. A strong flow of salt water was, however, found at 1,175 feet, on finding which the casing was drawn and the well abandoned.

*Well No. 2.*—This well on lot 16, concession 6, Colchester, No. 2. reached a depth of 1,154 feet, and though twenty-one feet less than the foregoing, was nineteen feet lower in the geological scale, terminating two feet below the summit of the Clinton.

The record furnished by Mr. E. Coste shows:—

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.



Casing was carried to a depth of 680 feet which was, however, withdrawn on the subsequent abandonment of the well.

**Essex Centre.** *Wells at Essex Centre.*—A well was drilled during 1889 on lot 283, South Talbot Road, Essex Centre, Colchester, by the Central Gas and Oil Company, of Essex county, of which Mr. John Milne, of Essex, Centre, is president. It reached a depth of 1,200 feet without either gas or oil being noted. Specimens of the drilling were obtained and are now in the Geological Survey office. Considerable flows of water interfered greatly with the operations and necessitated a string of casing 950 feet in length. The first flow of water was found at 130 feet or nineteen feet below the surface of the rock; this was followed by fresh water seams at 155 and 190 feet, by sulphur water at 310 and 565 feet and salt water at 800 and 1,130 feet.

A well was drilled at Decew's mill for water which was found at 180 feet, or fifty feet below the base of the surface deposits. The depth reached was 209 feet, neither gas nor oil being noted.

**Sweetman's Mills.**

*Premier Oil Company's Well.*—This well was drilled by Mr. R. E. Menzies for the above company on lot 19, concession 9, Colchester North, at Sweetman's mills to the depth of 1,135 feet where salt water was struck; neither gas nor oil was found.

*Wells of the Ontario Natural Gas Co. in Gosfield Township.*

**Ont. Nat. Gas Co., Coste No. 1.**

*Coste No. 1.*—This, the first well drilled for gas in the county, afforded about 10,000,000 cubic feet a day. It is on the north-west corner of lot 7, concession 1, and about midway between the villages of Kingsville and Ruthven. Gas was struck at 1,017 feet in a vesicular dolomite, probably of Clinton age. The boring was then continued to 1,021 feet, when the great pressure made it no longer possible to operate the tools. The supply has, unfortunately, never been drawn upon owing to dissensions among the shareholders of the company. Frequent borings have since been made in the vicinity, but nothing of any value has been found, except in the well bored by the Citizens Company of Kingsville, described below as Citizens' No. 2.

**Coste No. 2.**

*Coste No. 2.*—This boring, made by the same company as the preceding, is on the south-west corner of the south half of lot 1, concession 1, township of Gosfield, close to the Lake Erie, Essex and Detroit River Railway Company's station at Kingsville. Beyond the fact that the depth reached was 1,038 feet, no information is at hand, though it is presumed that the rocks pierced are very similar to those in Coste No. 1.

**Coste No. 3.**

*Coste No. 3.*—Was also bored by the same company and is on lot 8, concession 2, Gosfield. No particulars are at hand regarding it except

that the depth reached was 1,017 feet, and that up to that point the well was barren of gas or oil, and that salt water was struck in heavy flows near the bottom of the well.

*Isaac Wigle Well.*—This was drilled by a syndicate composed of some of the shareholders of the above-mentioned company, and is on lot 5, concession 2, Gosfield. It proved, however, to be practically barren of gas, only small quantities being noted at 1,090 feet, at which depth the drill was about fifteen feet above the beds in which Coste No. 1 finished. The total depth was 1,095 feet, where a heavy flow of salt water was struck. The surface deposits showed a total thickness of 117 feet and the casing was carried 468 feet deeper.

*Wells of the Citizens' Gas, Oil and Piping Co. of Kingsville.*

Three wells in all were drilled by this company, which was incorporated in 1889, with S. A. King as president and J. H. Smart as secretary.

*Citizens' No. 1.*—This, the first well drilled by the above company, is on lot 3, con. 1, East Division Gosfield South, and is 1,126 feet deep. The boring was begun on the 18th May, 1889, and was not finished, owing to several unavoidable delays, till the 19th of August of the same year. The first water was struck at sixty-eight feet, and was shut off by casing to a depth of 604 feet. Gas in small quantities was obtained at 750 feet, which was, however, interrupted by a heavy flow of salt water between 1,100 and 1,121 feet.

*Citizens' No. 2.*—This well was drilled on the road allowance of the second concession about 55 yards west of Coste No. 1, and reached a depth of 1,020 feet. No particulars of the boring are at hand beyond the fact that in the vesicular dolomite at that depth a daily flow of gas equal to 7,014,000 cubic feet was obtained. The gas has been piped to Kingsville, a distance of about three miles, where it is being utilized in a small measure by the people of that place. The drilling of this well was the cause of considerable litigation between its owners and those of Coste No. 1, who were, however, finally unable to restrict operations.

That the precedent so established, of allowing mining of any kind to be carried on upon the road allowances of a municipality is bad, cannot be denied. More especially is this so in regard to operations in search of gas or oil, as these minerals are peculiar in their mode of occurrence, and, have not like solids, a fixed position.

**Citizens' No. 3**     *Citizens' No. 3.*—This, the last well sunk by the above company, is on lot 4, con. 1, Gosfield South, it reached a depth of 1,085 feet without affording gas in quantity, a small flow only being noted at 980 feet. Salt water was struck at 1,085 feet, and the well was abandoned.

**Bruner Well.**     *Bruner Well.*—This well was drilled by Messrs. Walker and Sons, of Walkerville, on lot 18, con. 3, to 1,184 feet, a greater depth than was reached in any other boring made in the township. A small show of gas was noted at 1,020 feet, which was, however, cut off by a heavy flow of salt water, struck at a lower point. Casing was carried to a depth of 580 feet.

*Wells in Mersea Township.*

**Leamington.**     *Well one Mile South of Leamington.*—Regarding a well sunk some years ago near the village of Leamington, Dr. T. S. Hunt writes as follows :— \*

“On the seventh lot of the first range of Mersea and a mile south of the village of Leamington, a well was sunk through clay 100, limestone 310 = 410 feet without finding either oil or saline water. The rock at 380 feet from the surface was a somewhat magnesian limestone. Indications of oil in the shape of gum-beds or superficial layers of thickened petroleum are said to have been found in this vicinity.”

**Leamington Citizens Well.**     *Well at Leamington.*—During 1889 a syndicate of citizens of this place under the title of the Leamington Citizens Natural Gas Company, undertook to bore for natural gas in the vicinity of the village and commenced operations on the 10th of May of the same year. The well known as “The Leamington Citizens Well” is on the south half of lot 5 concession 2, Mersea, a short distance west of the village and alongside the L. E. E. & D. R. Ry. Co.’s tracks. Operations were suspended at 1,030 feet owing to heavy flows of salt water which were never cased off. The surface deposits measured 128 feet in thickness, beyond which the casing was carried only twelve feet or 140 feet from the surface. Water was struck at 135, 410, 425 and 500 feet, and gas in small quantity at 965 feet. At the time of my visit the well was full of water and although there was a strong odor of gas at the casing the quantity was not sufficient to indicate any pressure on a Pitot’s tube over an aperture bushed to one inch.

**Blytheswood.**     *Well at Blytheswood.*—A well was during 1889 drilled near this place on the north-west corner of lot 7, concession 9, Mersea, presumably by

\* Geol. Surv. of Can. Rept. of Progr., 1866, p. 249.

the Standard Oil Company to the depth of about 1,200 feet. From facts gleaned from operators in the district, I understand that a small flow of gas was obtained at 1,050 feet, followed at 1,150 feet by a heavy flow of salt water which was not cased off, the casing being carried to a depth of but 800 feet. Oil was not found.



## APPENDIX A.

TABLE of Beaumé's Hydrometer with Corresponding Specific Gravities. Table of Gravities.

Temp. 60° Fahr.

[illegible]



## APPENDIX B.

COST OF "DRILLING RIG" COMPLETE AT PETROLEA, ONT. F. O. B. Cost of  
drilling rig.

One 20 h. p. boiler and 20 h. p. engine (10 ins. diameter and 14 ins. stroke).....	\$ 800
One 3½-in. steel counter shaft, 5 ft. long, 4 flanges, crank waist pin, nodale pin, saddle, 2 pair brasses and pitman straps, 2 stirrup and plates, 2 14-in. sheaves for derrick.....	90
Wooden wheels and rig spring pole and wrench block .....	97
One 12-in. leather belt, 28 ft. long.....	25
One 12-in. 5-ply rubber belt, 40 ft. long.....	25
1,000 ft. ash poles.....	23
One horn socket with clevis.....	7
One 2-legged socket with dog.....	14
One 3½-in. drill sinker, 30 feet long.....	55
One 3-in. do do .....	42
One 2½ in. do do .....	35
One pair 1½-in. jars.....	26
One pair 1½-in. jars.....	23
One pair 1-in. jars, for fishing.....	15
Two Dutchman's subs.....	18
Three 6-in. drill bits.....	54
Three 4¾ in. do .....	42
One 12-in. mud bit.....	15
One 8-in. reamer.....	16
One 6-in. do .....	14
One 5-in. do .....	13
Two tool wrenches.....	10
Two pole wrenches.....	4
Twenty pairs pole joints and centre straps.....	70
One drill swivel and drill chain.....	14
One draw swivel.....	8
One cast-iron spring pole jacket.....	6
One slipper-out with cast wheel.....	15
One pole holder.....	2
One weight and two clevises for rope.....	4
One 4-in. sand pump, 36 feet long.....	27



One sand pump hanger and chain.....	\$ 4
Two chain rings and hooks for tools.....	3
One lever and two chains for wrenches.....	3
One $\frac{5}{8}$ -in. chain ring and hook for casing.....	8
One stirrup bolt, king bolt and plate.....	4
Two $1\frac{1}{4}$ -in. clamp bolts.....	4
One chain and swivel for spool.....	3
One 12-inch auger .....	18
One 8-in. mud pump .....	14
100 feet boring stems and connections.....	45
<hr/>	
Total.....	<u><u>\$ 1,715</u></u>

## APPENDIX C.

### BIBLIOGRAPHY.

The following list of works referring to the hydrocarbons in Canada Bibliography. is taken from the Report on Petroleum by S. F. Peckham, vol. X., 10th Census, U. S. For those interested in the study of hydrocarbons there is no better list. Some additions have been made to the list by the writer, of works referring to boring operations, or otherwise intimately connected with the subject.

#### *Abbreviations.*

- A.J.S.—American Journal of Science and Arts (Silliman's Journal).      Abbreviations  
A.J.G.L.—American Journal of Gas-lighting.  
An. M.—Annales des Mines.  
A.S.J.—Art Society Journal.  
B.B.S.N.S.—Bulletin of the Buffalo Society of Natural Sciences.  
B.S.G.F.—Bulletin de la Société Géologique de France.  
C.J.—Canadian Journal.  
C.R.—Comptes-Rendus des séances de l'Académie Française.  
C.N.—London Chemical News.  
C. Nat.—Canadian Naturalist.  
G.S. Report.—Report of the Geological Survey of Canada.  
J.F.I.—Journal of the Franklyn Institute.  
J.S.A.—Journal of the Society of Arts.  
J.R.G.S.—Journal of the Royal Geographical Society.  
J.S.C.I.—Journal of the Society of Chemical Industry.  
P.A.A.A.S.—Proceedings of the American Association for the Advancement of Science.  
P.A.P.S.—Proceedings of the American Philosophical Society, Philadelphia.  
P.B.S.N.H.—Proceedings of the Boston Society of Natural History.  
P.C.I.—Proceedings of the Canadian Institute.  
Ph. J.—Pharmaceutical Journal, London.  
T.A.I.M.E.—Transactions American Institute of Mining Engineers.  
T.R.S.—Transactions of the Royal Society.  
T.R.S.C.—Transactions of the Royal Society of Canada.

## BIBLIOGRAPHY.

Date.	Author.	Subject or Title.	Reference.
1820	Harman, D. W.....	Journal of voyages and travels in the interior of North America (notes on Athabasca bitumen).....	Andover, Flagg & Gould, 1820.
1833	Back, Capt. R. W....	Account of route to be pursued by the Arctic land expedition in search of Capt. Ross (notes on Athabasca bitumen).....	J. R. G. S., iii, 65.
1850	Hunt, T. Sterry.....	On soils, peat, asphaltum, mineral springs, etc. ....	G. S. Report, 1849-50.
1850	Jackson, C. T.....	On the asphaltic coal of New Brunswick. ....	P.B.S.N.H., 1850, p. 279;
1851	do J. G.	Reports on the Albert coal mine.....	A. J. S. (2) xi, 292.
1851	Percival and others	Narrative of an expedition in search of Sir John Franklin (notes on Athabasca bitumen).....	New York, 1851. A. J. S. (2) xiii, 276.
1852	Richardson, Sir J....	On a vein of asphaltum at Hillsboro', Albert Co., N.B.	P. A. P. S., v, 241.
1852	Taylor, R. C.....	Various articles in Dictionary of Arts, etc. ....	8th edition, 1854-60.
1853	Ure, A.....	do under the different headings.....	Philadelphia, J. W. Moore, 1855.
1854	Encyclopædia Britannica .....	Statistics of coal.....	A. J. S. (2) xxxii, 85.
1855	Taylor, R. C.....	Rock oil, its geological relations and distribution....	Ph. J. (2) iv, 73.
1861	Andrews, E. B. . . .	On the history of petroleum or rock oil. ....	C. Nat. (1) vi, 245.
1861	Hunt, T. Sterry.....	Oil springs of America and Canada.....	J. S. A., x, 89.
1861	Macrae, Alexander..	Descriptive catalogue of a collection of economic minerals of Canada.....	Montreal, 1862.
1862	Geological Survey Corps. ....	On the petroleum springs of western Canada.....	Ph. J. (2) iv, 67.
1862	Robb, Chas. . . . .	Petroleum gas .....	Jour. of the Board of Arts and Mfrs. for Upper Canada.
1863	Boileau, Gauldrée...	Exploitation de l'huile minérale dans l'Amérique du Nord.....	Paris, 1863.
1863	Fleming, Sandford..	The oil wells of Canada. ....	J. S. A., xi, 652.
1863	do .....	Notes on the present condition of the oil wells of Enniskillen.....	C. J., viii.
1863	Geological Survey Corps .....	Various articles on bitumens, etc. ....	G. S. report, 1863.
1863	Hunt, T. Sterry.....	Contributions to the chemical and geological history of bitumens and pyroschists or bituminous shales. .	A. J. S. (2) xxxv, 157, reprinted in Chemical and Geological essays, Boston, 1875. J. R. Os- goode & Co.
1863	Pelouzé, J., et Aug. Cahours.....	Recherches sur les pétroles d'Amerique.....	Articles in comptes rendus etc.
1864	Archer, Prof .....	Oil wells of Pennsylvania and Canada. ....	A. S. J., August, 1864.
1864	Bailey, L. W.....	Report on the mines and minerals of New Brunswick	Fredericton, 1864.
1864	Marcet, William....	On petroleum, its economic value, and a visit to the petroleum wells of Canada.....	J. S. A., xi, 230.
1865	Bailey, L. W., and others.....	Observations on the geology of southern New Brunswick .....	Fredericton, 1865.
1865	Hind, H. Y. ....	Preliminary report on the geology of New Brunswick.	do 1865.
1865	Hitchcock, C. H....	Albertite of New Brunswick.....	A. J. S. (2) xxxix, 267.]
1865	Hunt, T. Sterry.....	Petroleum, its geological relations considered with special reference to its occurrence in Gaspé. ....	Quebec, G. E. Desbarats, 1865.
1865	Rand, Theo. D.....	On the occurrence of petroleum in Canada.....	J. F. I., lxxx, 220.
1865	Schorlemmer, C....	Presence of benzole series in Canadian petroleum....	T. R. S., xiv, 168; C. N. xi, 255.
1865	.....	The oil district of Canada.....	New York, Am. News Co., 1865.
1866	Andrews, E. B.....	Petroleum in its geological relations.....	A. J. S. (2) xlii, 33.
1866	Hunt, T. Sterry.....	On petroleum.....	C. Nat. xi, 121. P. A. A. A. S., 1866.
1866	do .....	do and its geology. ....	G. S. report, 1863-66.

BIBLIOGRAPHY—*Continued.*

Date.	Author.	Subject or Title.	Reference.
1866	Winchell, A. . . . .	Geology of petroleum in Canada West. . . . .	A. J. S., xli, 176-178.
1867	Fouqué, M. . . . .	Etude chimique des cinq gaz des sources de pétrole de l'Amérique du Nord. . . . .	C. R., lxvii, 1045.
1867	Hunt, T. Sterry. . . . .	Pétroles de l'Amérique du Nord. . . . .	B.S.G.F., xxiv, 570-573.
1867	do . . . . .	Un catalogue descriptif de la collection des minéraux économiques du Canada. . . . .	Paris, 1867.
1868	Boileau, Gaudrée. . . . .	Mémoire sur les pétroles du Canada. . . . .	An. M. (6) iv, 105.
1868	Dawson, Sir J. W. . . . .	Bituminous shales, stellarite and petroleum . . . . .	Acadian Geol., 2nd ed., 1868.
1868	Hunt, T. Sterry. . . . .	Notes on geology of south-western Ontario. . . . .	A. J. S. (2) xlvii, 355.
1869	Hartley, E. . . . .	Report on part of the Pictou coal field. . . . .	G. S. Report, 1869.
1869	Hunt, T. Sterry. . . . .	On the Goderich salt region. . . . .	do 1869.
1869	Peckham, S. F. . . . .	On the probable origin of albertite and allied minerals . . . . .	A. J. S., xlviii, 362; A. J. G. L., xi, 164.
1870	Winchell, A. . . . .	Sketches of creation. . . . .	New York, Harper Bros., 1870.
1871	Hunt, T. Sterry. . . . .	Laurentian limestones of North America (Anthracite?) . . . . .	Albany, 1871.
1871	Honeyman, D. . . . .	Notes on limestone containing petroleum in Nova Scotia. . . . .	A. J. S. (3) i, 386.
1872	Bailey, L. W., and G. F. Matthew . . . . .	Preliminary report on geology of southern New Brunswick. . . . .	G. S. Report, 1870-71.
1872	McLeod, M. (editor) . . . . .	Canoe voyage from Hudson Bay to Pacific by the late Sir George Simpson in 1828. . . . .	Ottawa, J. Durie & Son, 1872.
1873	Henry, J. G. . . . .	The early and later history of petroleum. . . . .	Philadelphia, Jas. B. Rodgers & Co., 1873.
1875	Hunt, T. Sterry. . . . .	Chemical and geological essays . . . . .	Boston, J. R. Osgood & Co., 1875.
1875	Poole, H. S. . . . .	Report, Dept. of Mines of Nova Scotia for the year 1874. . . . .	Halifax, 1875.
1876	Bailey, L. W. . . . .	Woods and minerals of New Brunswick. . . . .	Fredericton, 1876.
1876	Geological Survey Corps. . . . .	Descriptive catalogue of a collection of economic minerals of Canada. . . . .	Montreal, 1876.
1876	Smith, J. Lionel. . . . .	Observations on the history and statistics of the trade and manufacture of Canadian salt (borings). . . . .	G. S. Report, 1874-75.
1878	Bailey, L. W., and R. W. Ells . . . . .	Albert shales and albertite. . . . .	do 1876-77.
1878	Harrington, B. J. . . . .	Notes on mineral resins. . . . .	do 1876-77.
1878	do . . . . .	Catalogue des minéraux économiques du Canada. . . . .	London, 1878.
1878	Hunt, T. Sterry. . . . .	On the Goderich salt region and Mr. Attrill's explorations (borings). . . . .	G. S. Report, 1876-77.
1878	Poole, H. S. . . . .	Report, Dept. of Mines of Nova Scotia for the year 1877. . . . .	Halifax, 1878.
1880	Bailey, L. W., R. W. Ells and G. F. Matthew. . . . .	Notes on albertite. . . . .	G. S. Report, 1878-79.
1881	Gilpin, E., jr. . . . .	Report, Dept. of Mines of Nova Scotia, 1880. . . . .	Halifax, 1881.
1882	Macoun, John . . . . .	Manitoba and the Great North-west (Athabasca bitumen) . . . . .	Guelph, "World" Pub. Co., 1882.
1883	Ells, R. W. . . . .	Report on geology of Gaspé peninsula. . . . .	G.S. Report, 1880-82.
1883	Hoffmann, G. C. . . . .	Notes on bituminous sand-rock and mineral tar or maltha. . . . .	do 1880-82.
1885	Bell, Robt . . . . .	Athabasca bitumen. . . . .	do 1882-84.
1885	Fletcher, Hugh. . . . .	Geology of northern Cape Breton (petroleum of Lake Ainslie). . . . .	do 1882-84.
1885	Peckham, S. F. . . . .	Report on petroleum, Vol. X., Tenth Census, U.S. . . . .	Washington, 1885.
1886	Ells, R. W. . . . .	Geology of Albert and Westmoreland counties, New Brunswick. . . . .	G. S. Report, 1885.
1886	Geological Survey Corps . . . . .	Descriptive catalogue of a collection of economic minerals of Canada. . . . .	London, 1886.

BIBLIOGRAPHY—*Concluded.*

Date.	Author.	Subject or Title.	Reference.
1886	Pohlmann, Julius...	Thickness of the Onondaga salt group at Buffalo, N.Y.	B. B. S. N. S., 1886.
1887	Coste, E. ....	Petroleum production for the year 1886 and previous years.....	G. S. Report, 1886, Part S.
1887	Dawson, G. M. ....	On certain borings in Manitoba and North-west Territories.....	T. R. S. C., iv, sec. iv.
1887	do .....	Notes on northern geology.....	G. S. Report, 1886.
1887	Obalski, J. ....	Report on natural combustible gas. ....	Report Crown Lands Dept., Quebec, 1886-87.
1887	Redwood, Boverton.	Notes of a recent visit to some of the petroleum-producing territories of the United States and Canada	Jourl. of the Soc. of Chemical Industry, June, 1887.
1887	do .....	Petroleum, its production and use. ....	New York, D. Van Nostrand, 1887.
1888	Ashburner, C. A. ....	Geology of Buffalo as related to natural gas explorations along Niagara River.....	T. A. I. M. E., xvii.
1888	Beil, Robt. ....	The petroleum field of Ontario.....	T. R. S. C., v, sec. iv.
1888	Coste, E. ....	Petroleum production for the year 1887.....	G. S. Report, 1887-88, Part S.
1888	Kerr, James. ....	The oil belt.....	Toronto "Mail," Dec. 1, 1888.
1888	Lafamme, L'abbé...	Le gaz naturel dans la province de Québec.....	T. R. S. C., vi, sec. iv.
1889	Ashburner, C. A. ....	Natural gas explorations in the eastern Ontario peninsula.....	T. A. I. M. E., xviii.
1889	Brumell, H. P. ....	Petroleum production for the year 1888.....	G. S. Report, 1889, Part S.
1889	Ingall, E. D. ....	Mines and mining on Lake Superior (Gas at Silver Islet).....	do 1887-88. Pt. H.
1889	McRae, John C. ....	Geological formation at Port Colborne, as shown by drilling for natural gas.....	P. C. I., 1889.
1889	Marvin, Chas. ....	Coming oil age. ....	London, R. Anderson & Co., 1889.
1890	Blake, Wm. P. ....	Uintahite, albertite, grahamite and asphaltum described and compared, with observations on bitumen and its compounds.....	T. A. I. M. E., xviii.
1890	Brumell, H. P. ....	Natural gas.....	G. S. Report, 1888-89, Part S.
1890	do .....	Petroleum.....	do 1888-89 do
1890	Obalski, J. ....	Report on mining service for 1889 and for 1890.....	Reps., Comm'r Crown Lands, Quebec.
1890	do .....	Mines et minéraux de la province de Québec.....	Quebec, 1890.
1890	.....	Report of the Royal Commission on the mineral resources of Ontario.....	Toronto, Warwick & Sons, 1890.

