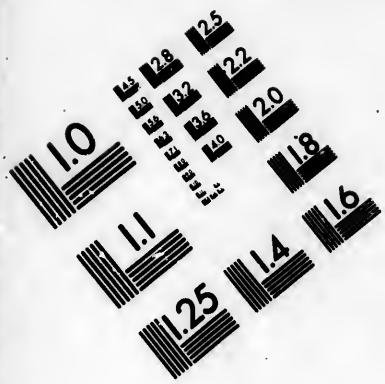

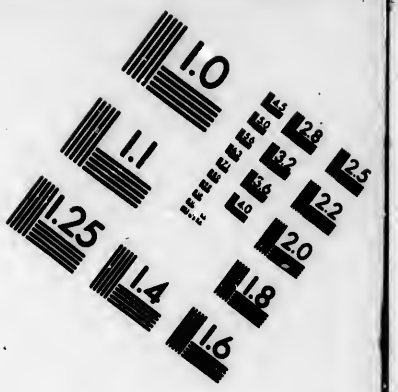

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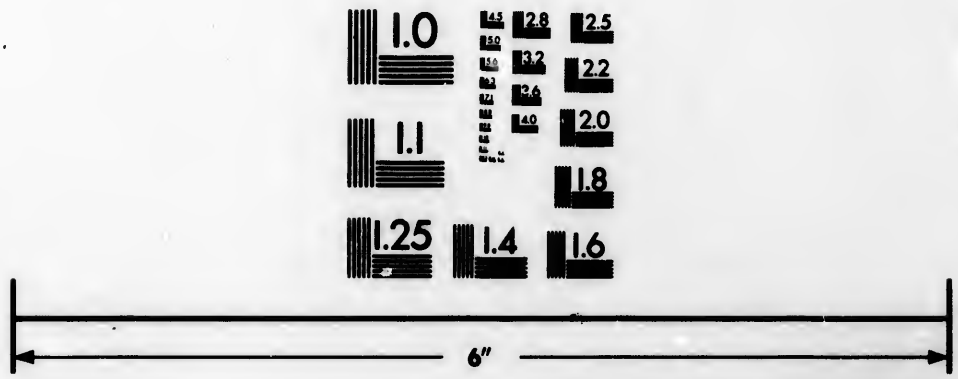

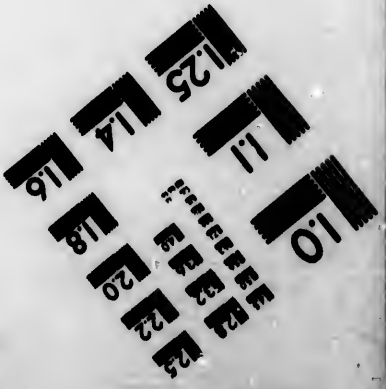

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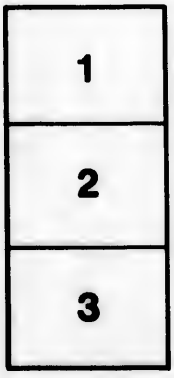

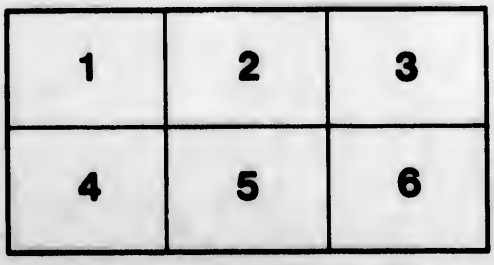

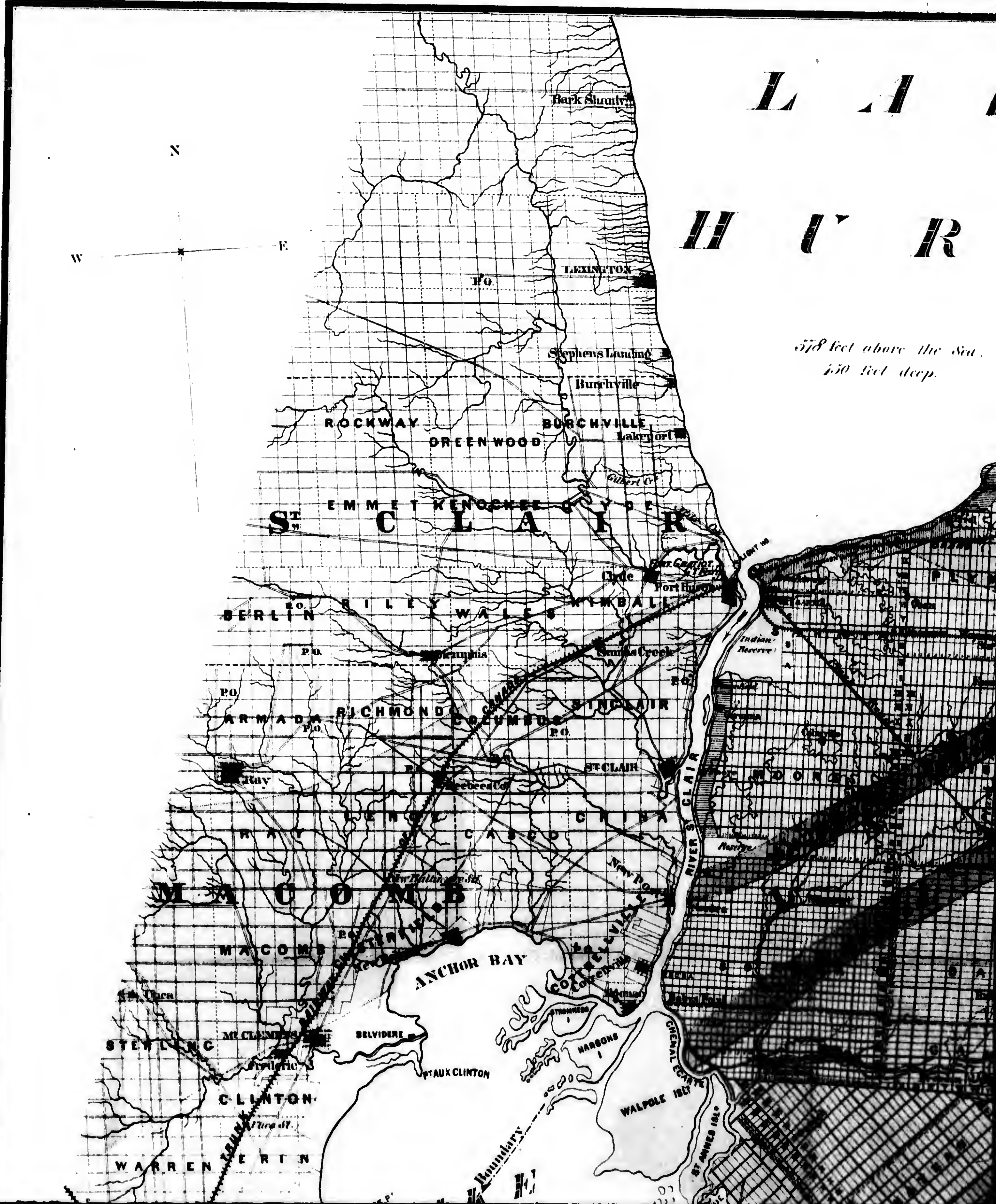
L A
H U R
578 feet above the Sea.
450 feet deep.
N
W
E
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P.O.
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Burchville
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GREENWOOD
BURCHVILLE
Lakeport
Gilbert Cr.
EMMET
KENOCKEE
CLYDE
ST. CLAIR
Clyde
Port Huron
BERLIN
RILEY
WALES
KIMBALL
Memphis
Smiths Creek
Indian Reserve
ARMADA
RICHMOND
COLUMBUS
St. CLAIR
Ray
LENOX
CHINA
RAY
CASCO
Reserve
RIVER St. CLAIR
M A C O M B
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STERLING
Mt. CLEMENS
BELVIDERE
Pt. AUX CLINTON
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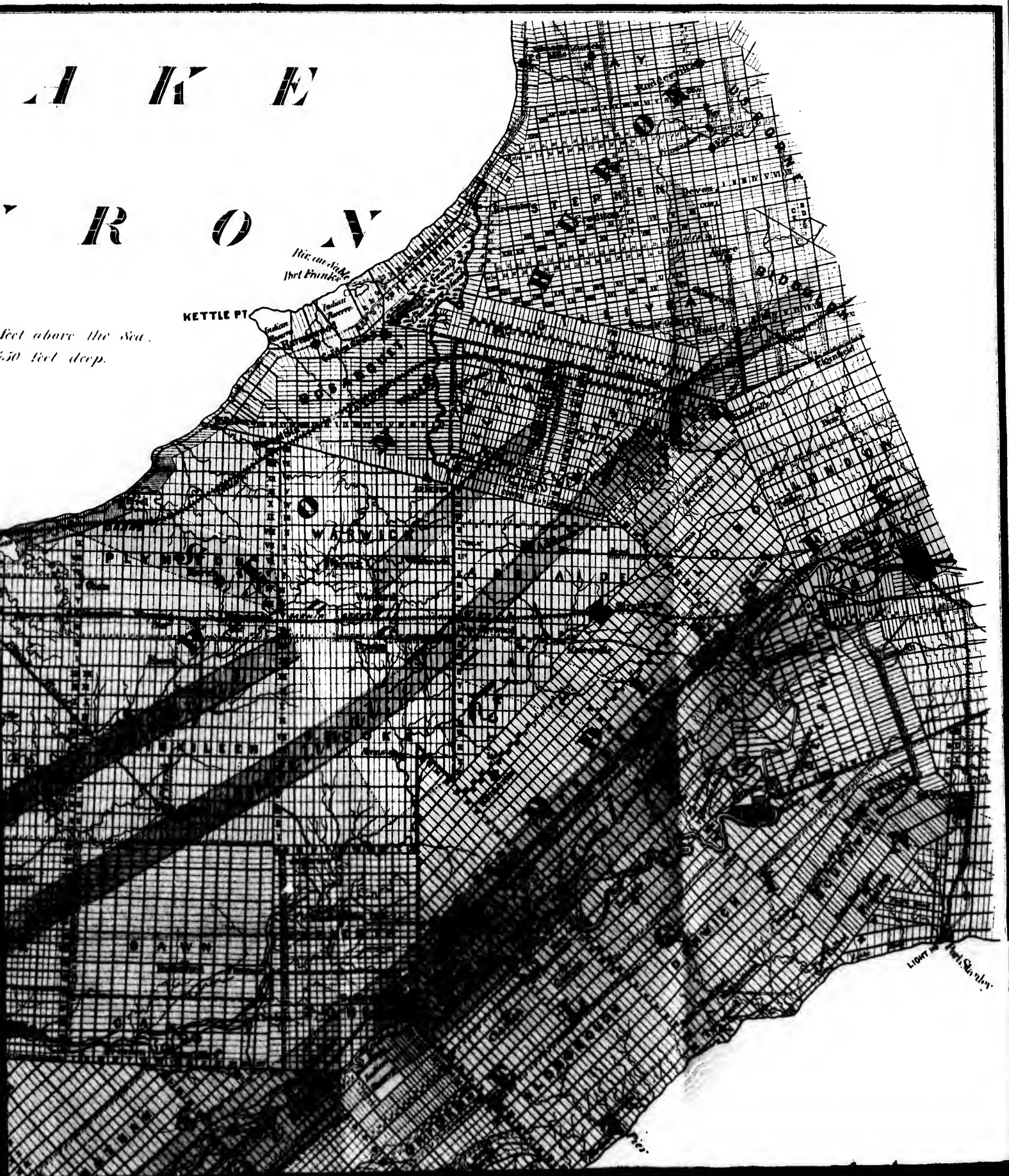
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CUL DU SUE
PATRICKS COVE
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GROSSE Pte
GREENFIELD
DETROIT
SPRINGWELLS
FORT WAYNE
STONY POINT
Light H.
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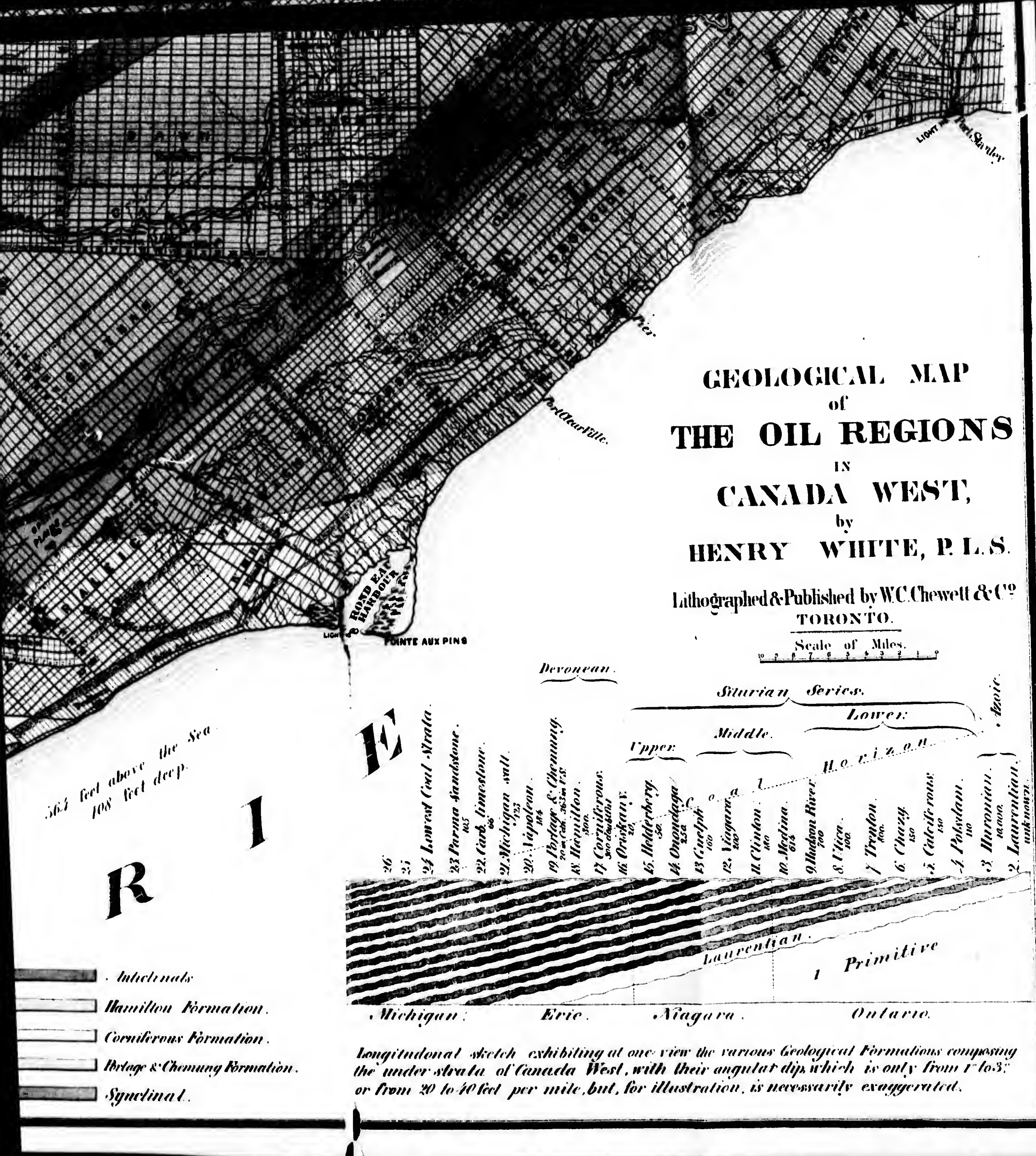
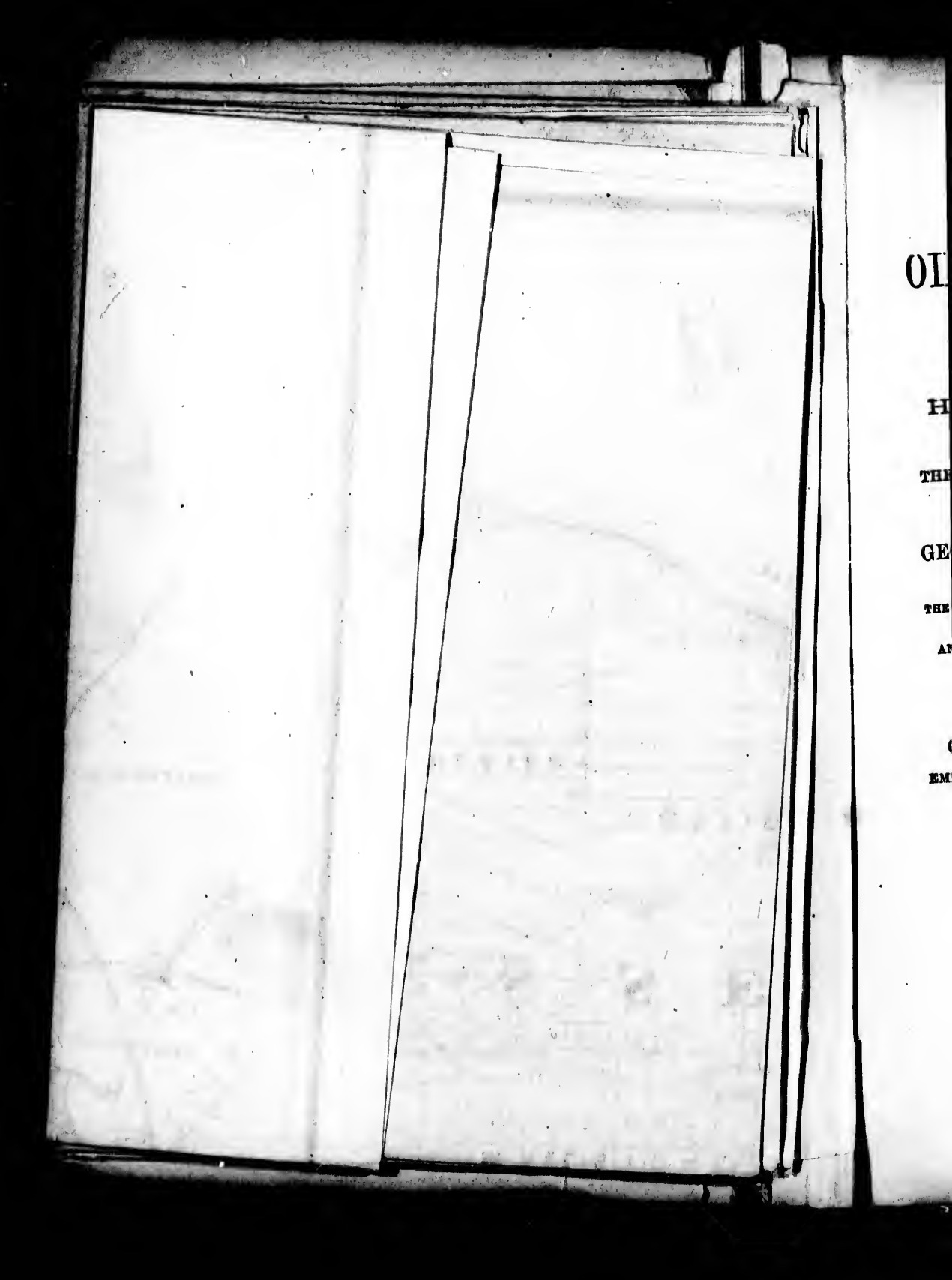


GEOLOGICAL MAP
of
THE OIL REGIONS
IN
CANADA WEST,
by
HENRY WHITE, P. L. S.
Lithographed & Published by W. C. Chewett & Co
TORONTO.
Scale of Miles.
Port Stanley
Port Clearville.
POINTE AUX PINS
RONDEAU HARBOUR
E
I
R
564 feet above the Sea
108 feet deep.
Anticlinals
Hamilton Formation.
Corniferous Formation.
Portage & Chemung Formation.
Synclinal.
Devonean.
Silurian Series.
Upper
Middle.
Lower.
Azoic
Coal Horizon
26
25
24 Lowest Coal Strata
23 Parma Sandstone
22 Carb. Limestone
21 Michigan salt
20 Napoleon
19 Portage & Chemung
18 Hamilton
17 Corniferous
16 Oriskany
15 Helderberg
14 Onondaga
13 Guelph
12 Niagara
11 Clinton
10 Medina
9 Hudson River
8 Utica
7 Trenton
6 Chazy
5 Calciferous
4 Potsdam
3 Huronian
2 Laurentian
unknown
Laurentian.
1 Primitive
Michigan.
Erie.
Niagara.
Ontario.
Longitudonal sketch exhibiting at one view the various Geological Formations composing the under strata of Canada West, with their angular dip, which is only from 1° to 3°, or from 20 to 40 feet per mile, but, for illustration, is necessarily exaggerated.



CSP

GEOLOGY,

OIL FIELDS, AND MINERALS,

OF

CANADA WEST:

HOW AND WHERE TO FIND THEM.

WITH A NEW THEORY FOR

THE PRODUCTION AND PROBABLE FUTURE SUPPLY OF PETROLEUM.

ACCOMPANIED BY ILLUSTRATED

GEOLOGICAL MAPS OF CANADA WEST AND OF THE OIL REGIONS;

THE FORMER GIVING THE FORMATIVE STRUCTURE OF THE PROVINCE, WITH TOWNSHIPS, COUNTIES, LAKES, RIVERS, CITIES, TOWNS, ROADS, RAILROADS, ETC.;
AND THE LATTER SHEWING EACH LOT, CONCESSION, AND OIL BEARING ANTICLINAL.

WITH A COPIOUS GLOSSARY, INDEX,

AND A

CATALOGUE OF 42 DIFFERENT MINERAL SPECIES;

EMBRACING 400 LOCALITIES WHERE THEY ARE TO BE FOUND, POINTED OUT BY TOWNSHIPS, LOTS, CONCESSIONS, ETC.

BY HENRY WHITE,

P. L. SURVEYOR, TORONTO.

TORONTO:
W. C. CHEWETT & Co., 17 & 19 KING STREET EAST.
1865.

PRINTED FOR THE AUTHOR

BY W. C. CHEWETT & CO., KING STREET EAST, TORONTO.

PREFACE.

The preface to a work is very often too much like the style of the pompous smiling clerk behind the counter, endeavoring with bland visage to dispose of his master's goods; or the liveried porter at the gentleman's door, all consequential smiles, salaams, scrapes and bows; in fact, too excessively polite, apologetical, and condescending; with the former of whom you are disgusted, and with the latter you do not desire to parry time, particularly if you are hungry and anxious to allay your thirst at the anticipated bounteous table of your kind host within; therefore you desire him not to delay, but to admit you at once, and conduct the way to the festive board, where you can revel in the good things set before you to your heart's content.

With these preliminary observations I might reasonably introduce my reader to a perusal of the succeeding pages, without further circumlocution; but such a flagrant departure from the customary *code diplomatique* would be unpardonable in the extreme, and not at all in accordance with the *flank* movements of good generalship; which, while making a *feint*, lets the enemy enter the gates of the fortress to feast upon what is within. In order, therefore, to obviate the necessity of the guest being obliged in his hurry to kick the bland clerk, knock down the smiling porter, or batter the bulwarks of the fortress, I shall deliver him the key; briefly saying that the impetus which the last few years has given to speculative

mining enterprise in Canada and the United States, more particularly in that of oil, and the absence of any unincumbered brief compendium of the geology of the Western Province, whereby a knowledge of its geology and mineral producing formations could be acquired, without a life of labour and voluminous reading, as at present; and the total absence of any practical advice or instruction to explorers as to how or where the prevailing minerals in any formation may be found; has induced the production of the following pages; collated and compiled at considerable labour, not only from personal observation, extending over a period of many years; but also from the most authentic available sources and records, amongst which I must prominently acknowledge my indebtedness, more particularly to the various reports of the Geological Survey of Canada, by Sir William Logan, and his able staff of assistants, extending as they do, over a period of more than twenty years; and his condensed report of the same survey in 1863; and also that very excellent little work of 1864, on the Mineralogy of Canada, by Prof. Chapman, of the University College, Toronto, &c. From the information contained in these, and other sources, I have, with a liberal and unsparing hand, availed myself, in the compilation of a considerable part of what follows; which is not designed as an elementary or text book for the use of colleges and schools, but just what it purposes to be—a brief and comprehensive synopsis of the geology of Western Canada, in which all the various formations composing that part of the Province are classified in the order of their respective positions and relative ages; and their leading and distinguishing characteristics (other than fossils) given, so that they may be easily recognized by the explorer; from the Laurentian formation, in the north-east, up to the Portage and Chemuing Group, in the south western part of Canada: with a notice of the economic minerals (and how to find them) which pervade each respective formation, and a catalogue of

forty-two of the known mineral species, and over 400 localities in which they occur pointed out, as well as a new theory for the origin of petroleum, and its probable future supply, and how and where to find it, with a brief notice of what might be the origin of coal.

The map of the oil regions of Western Canada, which accompanies this work, is prepared on a scale of five miles to the inch, and was got up with great care and accuracy, and exhibits on a sufficiently large scale each distinct lot and concession; with all the cities, towns, villages, roads, railroads, lakes, rivers, &c., from and including London, Canada, on the east, to the extreme west of the Province; and Detroit, and as large a portion of the adjoining State of Michigan as the oil territory probably extends.

The different formations within that area are distinguished upon it by colours; and the main anticlinal axis in which (and its subordinates) petroleum may be expected to be found, are also marked as bands, from the east, to where they make their exit in the western extremity of the Province, at the upper end of Lake Erie, &c.

And on the Geological Map of the Western Province, which also accompanies this work, is laid down, not only the different localities where the various rocky formations occur, but also all the townships, counties, roads, railroads, lakes, rivers, cities, towns, villages, &c., up to the present date, with a tabular view of all the railroad stations and their respective distances in Western Canada.

The longitudinal sketch will at once convey a better idea of the geographical and geological position of the various stratas and formations that compose the superstructure of the western part of the Province than any written description.

In conclusion, both sections of our Province abound in minerals of the greatest importance in a commercial or speculative point of view, which only requires combined capital, scientific investigation, skilled labour, and *American enterprise*, to develope their unbounded resources, with unquestionably good prospects of handsome realizations on any judiciously expended capital for that purpose, *and thereby make Canada one of the richest mineral producing countries in the world.*

TORONTO, 1st May, 1865.

INTRODUCTION.

THE Earth's history, back to an indefinite period, is inscribed in the rocky layers and masses of material matter of which the globe is composed, and from that period the successive changes to which it has been subjected are susceptible of intelligible investigation.

The study of geology is the first step to obtain this knowledge. By studying the forces now in action, the manner in which they act, and the effects which they are daily producing and the application of the knowledge which these phenomena teach, to the explanation of similar effects from the same producing cause in past formations of the Earth's crust, we shall be able to understand the changes of which these effects are nothing more than faithfully recorded memorials; and if we can ascertain the relative order of time in which these events have occurred we shall have a connected, though undated, chronological history of all the great changes that have heretofore transpired or taken place in the world's varied and progressive stages.

The basis upon which this reasoning is founded is the analogy between the past and present laws of nature, for, however circumstances may vary, the elementary forces are ever the same. With what perfect and unerring confidence in their invariable uniformity can the astronomer predict the future eclipse or the returning comet after his long travel of a

thousand years; and the geologist, with equal certainty, describe the extinct animals entombed in the rocky structure of past geological epochs.

It can thus be shewn that there has been a different distribution of land and water from that which exists at the present time, and that mountains have arisen and again been made low in the successive alternate periods of duration that have elapsed since the chaotic world assumed its rotundity, so as to obliterate all resemblance between the truly ancient and modern geography of the surface of our globe. We can also look back through the gulf of elapsed time and see the successive races of animal and vegetable inhabitants of the world, each different from the other and from those which now exist, rising in their generation in uninterrupted series—the beginning and the end of which are only known to the Creator—to fall again, become extinct, and be succeeded by others, to run their appointed race and perish in like manner.

Again, there is the relation of geology to other sciences, such as *chemistry*, *mechanics*, *botany*, *zoology*, *comparative anatomy* and *mineralogy*. These relations are those of mutual dependence. For while *chemistry* assists us to investigate and determine the effects of heat, acids, electricity, &c., on mineral subjects, and the action of these substances on each other; and the principles of *mechanics* enables us to investigate the manner in which the great agents *water* and *heat* effect the removal of materials and elevate and maintain masses. *Botany* and *zoology* unfolds the wonderful records preserved in the form of fossil remains, by the study of which we are enabled to perceive, that most of the fossils belong to extinct species, and to arrange them in the order of their respective groups and relative epochs; while *comparative anatomy* aids in shewing how, from a bone or fragment, to reconstruct the whole animal. And on the knowledge of *mineralogy*, geology

is dependent for a visible recognition of the composition of the various rocky masses. A knowledge of their mineral constituents often enables the geologist to understand their origin and derivative history.

By being reasonably *posted* in these matters, geology at once directs to localities of useful and economic minerals, and throws much light upon their origin. It restores many species of shapeless organic bodies which have been buried in the earth, and enables the naturalist to fill up many wide gaps in the plan of existing creation, and carries back the history of the animal and vegetable kingdoms to incredibly remote periods of antiquity, and exhibits the plan of creation as it extended up through the stream of time.

According, therefore, to the intimacy of our acquaintance with these kindred sciences, so also shall we be the more successful and accurate in our researches and investigations of the mineral resources of the Earth. But it is not essential, nor do I wish it implied as being necessary, that an elaborate study or knowledge of these sciences should be entered into or acquired for the purposes just stated, but what I do say is, that at least a partial knowledge of the majority of them are both necessary and essential to inevitable and satistactory success in mineralogical pursuits. To the miner this knowledge is of the most essential service, as it often decides on a moment's inspection whether certain minerals may or can not occur in a given region; for many valuable minerals are found only in a very limited part of the geological series of rocks. It also enables the miner to understand the mode of mineral occurrence, which may be in layers more or less parallel with the rocky strata, or in veins cutting across them, or they may be in regular or irregular masses or mere disseminated constituents of the compassing rock.

The chemical constitution of the Earth comprises sixty-two simple substances which are known to chemists, and of these only sixteen constitute the greater part of the Earth's crust. The other forty-six consist for the most part of rare minerals, or are disseminated in very minute proportions through the more common and more abundant substances.

1st. *Oxygen* is the most abundant of all the elementary substances. It constitutes $\frac{1}{5}$th of the atmosphere. In combination it forms $\frac{8}{9}$ths of water, and $\frac{2}{3}$ths to half of all the solid materials of the globe. It enters into the composition of all earthy, mineral and metallic bodies.

2.—*Silicon*, called silicic acid and silica. This mineral permanently exists in nature only in combination with oxygen, in nearly equal parts, forming silica. Thus compounded it constitutes $\frac{45}{100}$ths to $\frac{50}{100}$ths of the Earth's crust. One quarter of the Earth is therefore silicon or quartz.

3.—*Calcium* exists principally in combination with oxygen forming lime, of which it forms about $\frac{2}{3}$rds. Lime exists mostly in combination with *carbonic acid*, forming carbonate of lime. About 7 per cent. of the Earth is calcium.

4.—*Aluminum*, in combination with oxygen in equal parts, forms alumina. It exists in most minerals and rocks, and constitutes $\frac{1}{3}$th of feldspar, and about 5 per cent. of the Earth's crust.

5.—*Magnesium*, in combination with oxygen, it forms magnesia, of which it constitutes about $\frac{2}{3}$ths, and this compound forms about $\frac{4}{10}$ths of serpentine, and 10 to 20 per cent. of dolomite, and about 8 per cent. of the whole crust of the Earth is composed of magnesium.

6.—*Iron*. Is never found native except in metioric stones. It combines with oxygen, sulphur and carbon, and forms about 2 per cent. of the crust of the globe.

7.—*Carbon.* Six parts of carbon and 16 of oxygen form carbonic acid, which forms $\frac{1}{3000}$ths of the atmosphere, but it is chiefly locked up in a solid state in combination with lime, magnesia, &c. It exists in a free state in coal, and it is possible it may also exist in a free state in the oil producing formations. If not, it is being disengaged and set free by chemical action. About two per cent. of the earthy matter is carbon.

8.—*Potassium* exists in nature in combination with oxygen forming potassa, of which it constitutes about $\frac{1}{6}$ths. Potassa is contained in the clay, soil, feldspar, &c., forming about five per cent. of the unstratified rocks, being about $\frac{1}{10}$th of the feldspar in them, and about one per cent. of the Earth's volume.

9.—*Hydrogen* forms $\frac{1}{9}$th part of water, and resides principally in that element. Water exists, not only in the oceans, lakes, rivers, and the atmosphere, but is widely disseminated in a *sold, dry state* in many rocks and minerals. Hydrogen constitutes about $\frac{1}{2}$ per cent. of the earthy mass.

10.—*Sodium* is chiefly found in common salt, albite and basalt, and is the next in abundance.

11.—*Sulphur* is found in a free state in volcanic countries, but exists in greatest abundance in combination with many metals, as lead, iron, copper, &c., as well as gypsum. In minute quantities it enters into all soils, and vegetable as well as animal bodies.

12.—*Manganese* is universally disseminated through all rocks and soils, but its volume is not more than $\frac{3}{1000}$ths of the whole.

13.—*Chlorine* is also universally disseminated, but exists in greatest abundance in salt, and in the chlorides of magnesium and calcium of the ocean.

14.—*Phosphorus* is formed in small quantities in the bones of all vertibrated animals, in mineral phosphate of lime, and in all soils.

15.—*Fluorine* exists chiefly in fluor spar, combined with calcium, hornblende, mica, and most of the unstratified rocks.

16.—*Nitrogen* is generally diffused through the vegetable kingdom in small proportion, but its principal abode is in the atmosphere, and animal bodies. With the exception of nitrogen, all these sixteen simple substances exist chiefly or solely in combination; and the other forty-six exist for the most part in rare minerals, or are disseminated in very minute proportion through the more common substances. Many of these binary compounds unite together again, and form salts or ternary compounds, such as the carbonate of magnesia, sulphate of lime, the silicates of potash, of soda, of lime, and other bases.

The mineral constitution of the Earth is therefore like a book, composed of the different letters of the alphabet, formed into words, sentences and chapters. So is the crust of the Earth composed of many distinct kinds of minerals, which, like the letters of the alphabet, being mixed together, constitute rocks; and many of these rocks occurring in groups of strata, with certain distinctive marks, constitute sentences, pages and distinct chapters, as it were, in the history of the respective formations constituting the Earth's crust.

Minerals, then, are the alphabet of Geology. There are more than five hundred different kinds of minerals in the crust of the globe; and if a knowledge of all were an indispensable preparation for the study of Geology, then might the reader well despair, and become discouraged in the accomplishment of such an arduous task. But *five only* of all these constitute about *nine-tenths* of the crust of the Earth; and by mastering these, with the addition of two or three more in number, will

embrace $\frac{1}{2}\frac{9}{8}$ths of the whole structure of the Earth's surface, and be amply sufficient for all ordinary and practical purposes.

Rocks are of two kinds, differing both in structure and origin—the *stratified* and the *unstratified*. The stratified rocks were deposited from water, and occur in *layers* overlying the *unstratified*, and are therefore of more recent origin. Hence those which lie beneath, or farthest down, are the most ancient; and where two dissimilar stratified rock formations occur in junction, the one overlying the other, their relative age is obvious; and by this simple principle of position, the relative age of most of the rocks have been determined. The *unstratified* rocks usually occur in irregular masses, sometimes overlying other rocks, or in veins running across the layers of stratified rocks, or forming beds interposed between those strata. Ancient granite and modern lavas are alike unstratified, and of igneous origin—the various unstratified rocks having been erupted in a melted condition, at different periods of the history of the Earth. The unstratified rocks which are now being erupted and thrown up from volcanoes have their source beneath all other known rocks; and it is inferred from various data, that those of ancient date were in like manner thrown up from beneath the then existing rocks. Going far back in the geological history of the globe, we reach a period when the oldest stratified rocks rested alone upon the granite, the oldest of the unstratified. Nay, we can run the mind's eye still further back through the misty gulf of time, to a period so remote that the primitive rocks lay naked, and uncovered by any secondary strata, and when all beneath was doubtless immense irregular beds, now forever hidden, but which, being subsequently covered over, have become the reservoirs or great fountains, from whence eruptions of igneous rocks took place in after epochs, through the previously accumulated secondary strata, whose contents reveal to us the

physical structure and history of the Earth, from the earliest period of their deposition to the present time.

It appears to me that it would be more natural in a historic science, to commence at the beginning, in the remotest region of the past that we can fix upon, and follow down the stream of time, recording the successive events in chronological order, as they transpire and come under review, than to adopt the more customary system of beginning at the *end* and running *back* against the current into the past, to the beginning.

In accordance, therefore, with the former plan, I shall ask the reader to accompany me, at a *very remote* period of the world, and place himself, in imagination, on one of the Laurentide Mountains, in the north-east part of Western Canada, with his face to the south-west. From this point of view, and at the *time* we speak of, you will see a vast inland freshwater ocean, bounded on the north and north-east by the Laurentian water-shed, and covering the whole of south-western Canada, and a large portion of the adjoining States, with all our present inland lakes. Let him now run his mind's eye still further back into the vista of the past, and see, as it were, the former oceanic waters, that covered this portion of the globe, gradually subsiding, and the whole continent slowly rising from out the mighty deep, where it had been entombed for countless ages. Then let him, through the same medium, in after epochs, see the subsequent subsidence or lowering down of the bed of this great inland ocean, just referred to, and the noisy rushing of the waters to its animal and, perchance, vegetable clothed bosom, and he will see the probable beginning of the vast amount of sedementary strata that has been deposited through succeeding and successive countless generations, in its bed. Ancient man! look again, after the lapse of a mighty interval in the stream of time; and what do you see? All disappeared! sunk, and gone again to the bottom of the great

ocean, save a few high mountain peaks in the distance, far apart, and now no longer mountain tops, but islands, surrounded by water, and clasped in the close embrace of the ocean's mighty bosom. What now? Do you see those thousands of moving islands floating southward over the bosom of this great sea? Whence come they, and what is their mission? O, they are nothing but Leviathan icebergs, from some northern continent and frozen sea, sailing southward, and denuding the ocean's bed in their grinding course, in search of a more genial clime to deposit their rocky merchandize from the polar ocean, and become once more a liquid element themselves. Now, my very ancient friend and fellow-traveller through the regions of remote antiquity, just take one more look before we part company, it may be forever, and see our continent slowly emerging again from under the ocean and these monsters of the deep, with the evident marks of their destructive action on its surface, to be subsequently clothed in rich and luxuriant verdure, and become, in the fullness of time, the abode of santient and intelligent man, *and behold it as it is.*

GEOLOGY, OIL FIELDS, AND MINERALS

OF CANADA WEST;

HOW AND WHERE TO FIND THEM.

The distribution and succession of the rocky and organic structure and covering of the earth's surface is generally known and divided into three groups—Eruptive, Metamorphic, and Sedimentary; but is also sometimes known as Igneous, Acqueous, and Organic—in conformity with the general modes of derivative or formative process. But they admit of another and far more interesting classification as well as subdivision, based on the long periods or relative ages of their respective formations.

These formations, groups, and their subdivisions, will be briefly treated of in their respective *ascending* order, so far as relates to Canada West; and it may as well be remarked here, that many of the consecutive formations which might lithologically be expected to succeed each other in the ascending order of their relative ages, as demonstrated by existing fossil remains, are wanting. But notwithstanding this, similar geological groups of contemporaneous ages may in the accruing and accumulating materials of which they are composed, be represented in different places by dissimilar component parts, such as limestone, silicious and argillaceous, and so on. It will be easy to understand this, if we reflect that, at the present time, different rocks are being formed at different places in as many different localities from as many dissimilar

materials; therefore the compositions of those rocks must be also dissimilar, though formed during contemporaneous epochs. Beginning with the gneiss which overlies the primative, or what is known as the Igneous Formation, and which has recently received from Sir W. Logan, the name of the

LAURENTIAN FORMATION.

This is the lowest as well as the oldest recognized formation on the Continent of America, and notwithstanding the many conflicting theories as to its structure, is of sedimentary and metamorphic origin. Its components are, feldspar, quartz, and mica, which is generally known by the name of gneiss, and is in fact essentially the same in composition as the igneous or primary crust of the earth; but owing to metamorphic action its particles are in a different state of aggregation. It is in many places interstratified with extensive beds of crystaline limestone, which is, in some places, beautifully variegated and sufficiently compact for marble.

This formation extends from the coast of Labrador in the east, to beyond the mouth of the McKenzie River in the N. W. Arctic Ocean; and is bounded on the south (generally speaking) by the Gulf and River St. Lawrence; the north shore of the Georgian Bay to about ten miles west of the western outlet of the French River. At this point it trends away, crossing Lake Temmiskimang in the N.E. for an unknown distance, and is overlaid on the north by one or two ancient formation, of which little at present is known. Its outcrop to the north from this general easterly line, though being at a short distance, is undefined; but it stretches many miles in broken succession along the north shores of Lakes Huron and Superior, where it reappears from under the superincumbent and more recent formations, and bears away in a general westerly direction to the east side of Lake Winnipeg, from

whence it bears away to the N.W. through a *terra incognito* to the mouth of the McKenzie River at the Arctic Ocean There is another extensive outcrop of this formation connecting with it at the Thousand Islands on the River St. Lawrence, which covers an area of some 45,000 square miles on the south side of the St. Lawrence, and in the State of New York. It extends from the general southern boundary above laid down to an unknown distance in the north, embracing an area in Canada of over 200,000 square miles.

It abounds with many minerals of great economic importance and commercial value, particularly lead, copper, plumbago, mica, marble, baryta, molybdenum, titanic, chromic, specular, magnetic, and black oxide of iron, making Canada one of the richest iron producing countries in the world.

The geological student will at once understand that the formation above partially delineated, overlies the Granitoid, or what is generally known as the primary crust of the earth; the particles of which, at or near its surface, during vast succeeding epochs, becoming disentegrated by the combined agency of chemical action, water, and the atmosphere, denudation and wearing away took place, and the particles of which combining with the elements of inorganic nature, being washed down by drifts, currents and glacial action to the beds o ancient seas were, by subsequent metamorphic action, and the upheaval of ancient continents, converted into dry land of a sedimentary crystaline and compact stratified structure. In all parts of the world striking illustrations and examples may be found of the same slow destructive and washing down denuding process; but however striking and evident the present results of denudation are, they were evidently greatly surpassed by those of ancient geological epochs; but confining our observation to recent effects only, it must be apparent to the most superficial observer, that a vast amount of sedimentary matter is annually and even daily being washed down, and under

process of accumulation in the bottom of our seas, lakes, and valleys, from the higher lands, by the abrading action of the waves against the lake coasts, and the denuding action of streams and rivers in their courses from the higher lands. The detrital matter thus obtained and accumulated, is deposited, or sown as it were, annually and even daily over sea, lake, and valley beds, during long and succeeding lapses of duration, contributing day by day material for the formation of new sedimentary rocks. In fact the present rocky structure, and high lands, worn down by atmospheric agency, by streams and rivers, and the abrading action of the lakes and seas, furnish the material for new and other deposits, which are again under pressure, chemical agency, heat, and electro-magnetism, converted into the various formations of rocky structure and sedimentary deposits that encrust our globe. For it is now universally admitted on the most reliable and incontrovertable evidence, that the various sedimentary and other rocks which make up the solid portion of our globe. were not formed during one short or unbroken period, (as many over zealous orthodox advocates, who rejecting the evidence of those faculties with which their Creator endowed them, affect to believe) but were slowly elaborated and gradually built up, and pulled down and re-erected by the same gradual process, during long and mighty lapses of duration. Did they only reflect that the telescope has revealed to us stars or worlds, at such a remote and immeasurable distance from us, that light, though travelling at the rate of 12,000,000 of miles per minute, will take 500,000 years to reach this earth! they might arrive at a different and more demonstrable conclusion respecting the age of the earth. Let the curious in figures calculate this little problem and reflect upon the result. Is there any reason why a more recent birth should be given our planet than the world from whence that ray of light emanated? "In the beginning God created the heavens and the

earth." Is He constantly creating new worlds? or was the work finished in the *beginning*, as recorded by the sacred historian, and borne out to a demonstration by geological facts? To the reflective consideration that these queries may give rise to, I beg to leave them; and proceed to pick up a piece of pebble derived from one of these secondary formations, and picture to ourselves the successive stages of its many changes and transmutations since its ultimate particles were ushered into being, (at a period so remote, that the human mind in its present state, can no more comprehend the mighty void in duration that has since elapsed, than it can grasp infinity, or the whale drink up the mighty sea in which he swims) we can then, in the language of the poet, hear

> "The moaning of the homeless sea,
> The sound of stream, that swift or slow,
> Draws down Æolian hills, and sow
> The seeds of continents yet to be."

These atoms in a great measure comprise within themselves the elements of their own consolidation, in the form of calcareous or ferruginous matter, which act upon the other substances in the manner of a cement, which with the combined agency of chemical action, is of itself in many instances sufficient to cause consolidation, independent of the consolidating work of transmitted heat in earlier periods, from subterranean depths, or generated amongst deep sediments by natural causes, in causing the cohesion of the originally loose materials of stratified rocks. These sedimentary deposits and accumulations, in the beds of ancient seas, have again been subjected to many varying and successive alternative changes, such as elevation above the sea level, with alternations of up-heaval and depression, denudation, tilting up, and fracturing eruptions, metamorphism and cleavage, to enter into a discussion of which would occupy too much space, and be out of place in this very limited, and short sketch, which is only

designed as a synopsis of the Geology of Western Canada, illustrative of the accompanying map of the oil regions, and longitudinal section of overlying stratifications; but the proper understanding of the foregoing principles of sedimentary deposit and subsequent consolidation is deemed necessary to a full understanding of their origin, composition, and mode of structure.

And I might also observe in this place that so far as regards the Upper Province, and particularly certain portions of it along and to the south-west of the Laurentian formation, there are wanting in the geological horizon in many places, that more or less uniform succession of recognized sedimentary accumulations and marked secondary deposits and series, which might from analogy be expected to be found there, and to succeed each other with the usual degree of uniformity, and which have hitherto, in the old world as well as in other countries and places, been one of the finger posts and guides to the geological student in the building up and erection of the great bulwark of geological science, since the earliest infancy of its study to the present time. But uniform succession in accordance to relative age never exhibits a complete series in ascending order in any one locality. They are only known in the following regular ascending order by a comparison of their relative positions at different places. 1st. The Primitive or Granitic Formation; 2nd, The Laurentian Series; 3rd. The Huronian series (the last two being known as the azoic rocks); 4th. The Silurian Series, and its subdivisions (some of which are wanting in many places in Canada); 5th. The Devonean Series, and its subdivisions; 6th. The Carboniferous Series and its subdivisions (wholly wanting in Canada West, but partially developed in the Gaspé district in Canada East); 7th. The Permean Series, wholly wanting in Canada. These are known as the palæozoic rocks—"palæozoic" is a compound Greek word signifying ancient life. 8th. The Triassic Series; 9th. The Jurassic

Series; 10th. The Cretaceous Series, known as mesazoic or secondary rocks; and 11th. The Cainozoic or Tertiary rocks, wholly wanting in Canada; and 12th and 13th. The drift deposits and modern formations, both developed in Canada. Thus Nos. 2, 3, 4, the lower part of 5, and 12 and 13 alone occur in Canada West, all the others being wanting, thereby leaving a great gap or void (which has probably been caused by denudation) between our geological horizon in Western Canada, and the lowest American series, or coal-bearing formation—see longitudinal sketch.

The distinguishing peculiarities of the Laurentian formation is its general dark grey colour; its stratification; and in many places its high angular dip; corrugations and contortions; interspersed with large beds of crystalline limestone; and containing within its area innumerable small lakes and rivers, which abound with immense quantities of various kinds of fish of the finest quality.

THE TEMMISKIMANG FORMATION.

At Lake Temmiskimang and westward lying on the Gneiss, and apparently dipping under the Huronian formation, is another series of a compact silicious and argillaceous, fine grained, cleavable rocky structure, weathering from dark grey and dingy olive green, to bottle and sea green. In some places the cleavage is very perfect, and the material well adapted for the manufacture of roofing slate. It is probable that its thickness exceeds 1000 feet. It is apparently succeeded by a quartzite of pretty uniform character throughout the whole mass, which weathers from greenish white to a light yellowish brown. It appears to be composed of quartz and feldspar with occasional scales of silvery mica. It is in general moderately fine grained, but in some places it is coarse and approaches the character of a fine conglomerate with pebbles of white trans-

parent quartz. In some places it is well adapted for honestones. Its total thickness as determined by the hills of which it is composed, and in which it forms horizontal layers, is between 400 and 500 feet. This greenstone extends westward, crossing the Sturgeon, Maskinongi, Wahnahpitae, and White-fish Rivers, and becomes more coarse grained as you proceed westward, and whether it is an overflow, constituting the base of the upper Huronian, or an eruptive mass in the form of a dyke, at a later period, has not been ascertained, in fact very little is known of it. That part which came under the writer's notice, some 60 or 80 miles north of Lake Nipissing, in 1863 appeared in many places to assume the character of intrusive dykes. It is intersected in some places by large quartz-veins, holding sulphuret of copper, and specular iron. The copper prevails in small yellow specs more or less throughout the formation. The recognized succeeding

HURONIAN FORMATION

Overlies the greenstone, and is frequently interstratified with igneous rocks of a similar character, which are sometimes seen to cap the hills where the strata below is nearly horizontal; but whether these distinct stratas belong to the same formation or to two distinct gelogical periods matters little to our present purpose, as they are supposed and recognized as belonging to the Huronian formation.

It more or less overlies in broken succession the Laurentian series from, about ten miles west of the western outlet of the French River, where it enters the lake, to, and for some distance westward of, Lake Superior; but is at intermediate intervals and in many places wanting, and intersected by intrusive rocks; and in other places is overlaid by more recent deposits, supposed to be altered Silurian strata, belonging in part to the Potsdam Group, and partly to the Calciferous

series of Quebec, to be hereafter described. Its thickness is propably about 10,000 feet, but its Northern limit as well as its area is unknown.

The economic minerals found in this formation and the overlying metamorphic lower Silurian are, copper, lead, zinc, silver, quartzose-sandstone suitable for making glass of good quality, nickel, cobalt, arsenic, molybdenum, roofing slates, uranium, honestones, jasper conglomerate, and *gold* sparingly.

The Palæozoic formation, as known in Canada West, comprise in asending order, a complete series belonging to the Silurian, and part of the earlier succeeding Devonean epoch.

The Silurian strata will be divided into the lower, middle and upper series; Chazy; Trenton; Utica; and Hudson River, Formations and groups.

THE POTSDAM FORMATION.

A series of slate rocks and slate conglomerates, resembling those of the Huronian, associated with beds of Chert, sometimes coloured black from the presence of anthracitic matter, grey and red dolomites, interstratified trap beds, and some argillaceous sandstones, all more or less altered by metamorphic action, and containing copper, iron, &c. &c., are found at Thunder Bay, and especially near the grand falls of the Kaministiqua River; are supposed to belong to the Potsdam period. They overlie the Huronian rocks in unconformable stratification with these, and hence belong to a succeeding geological epoch. If they are of this age, the question arises, do they represent a distinct series older than the sandstone beds of the East? Or are they to be considered of the same period of deposition?

The rocks of this formation which have their development or outcrop at Grenville, Lanark, Renfrew, Leeds, and Carlton counties; and in the townships of Pittsburg; Storrington; and

Loughborough; and west of Knowlton Lake; consist essentially of beds of sandstone of various colours, but principally yellow, brown, green, red, and white. Some of the sandstones are fine grained, and of a purely silicious character, and some exhibit bands, or stripes, of variegated colours, and are occasionally interstratified with a few layers of dolomite, or more or less impure limestone.

The economic minerals of this group comprise good building stone, now used in the erection of the Ottawa Parliament Buildings; quartzose sandstone, almost free from the oxyd of iron, and suitable for the manufacture of glass, and refractory sands, and sandstones, for lining sides and floors of furnaces; and, if it has its representatives at Lake Superior, which is not improbable, as before surmised, then native copper, native silver, silver glance, amethyst quartz, sulphate of baryta, &c., may be added. In fact recent discoveries seem to confirm this view. It is about 110 feet thick.

The name of this group was given by the American Geologists before the geological survey of Canada commenced, and is derived from *Potsdam* near Ogdensburg in the state of New York.

THE CALCIFEROUS GROUP

Consists, in western Canada, chiefly of dolomite, or magnesian limestone, more or less, in many places, impregnated with silicious matter, varying from over 40 per cent. downward; sometimes interstratified by beds of grey, brown, and white, silicious sandstone, alternating in some places with calcareous beds in the same district, which yield a very poor lime. East of the Gneissoid belt, at the Thousand Islands, on the St. Lawrence, in the counties of Leeds, Greenville, Lanark, and Renfrew, there are extensive outcrops of this formation, containing in many places important deposits of Galena; and it is probable that they may occur west of the Gneissoid belt, which

crosses the St. Lawrence at the Thousand Islands, in a thin band, at the top of the outcrop of the Potsdam series, in the Townships of Pittsburg and Loughborough, although no positive indication of its presence there have been found or identified.

Although displaced in many localities, in Lower Canada, from the top of the middle Silurian downward; and where they consist, in their southern extension in the Eastern Townships, and in Gaspé; of grey, black, red, and green, shales; and are known as the Quebec Group, over a thousand feet in thickness, and interstratified with beds of dark and other coloured dolomites, limestones, and sandstones, weathering to chloritic, talcose, and schistose shales; yet its fossiliferous evidence places it in its true geological position. It also contains epidote, slates, serpentines, marble, and other analogous rocks, in many places holding large deposits of copper ore, chromic and magnetic iron ores, galena, &c. &c.; the sandy desintegrations of which, forming the alluvial sediments, holding a large amount of the black oxyd of iron in fine particles, contains, as well as the quartz veins, a considerable quantity of native gold. The strata of the upper copper bearing series of Lake Superior belong to this group—the lower being generally refered to the Potsdam formation.

They consist of red and green sandstone conglomerates, quartzose sandstone, limestone, and shales, and interstratified masses of compact amygdaloidal trap, and greenstone dykes; and the entire formation is generally capped by trap of a basaltic character. Its thickness is estimated by Sir William Logan at 150 feet in the east to 10,000 feet in the west.

These amygdaloidal traps contain agates, amethyst quartz, calcspar, zeolites, green earth, epidote, specular iron, native copper &c.; but the entire formation is also traversed by a considerable number of mineral veins belonging to two distinct systems, some being parallel with the range of the strata,

whilst others run in a converse direction. They consist of calc and heavy spar, and quartz, sometimes mixed with zeolites, fluorspar, copper, iron pyrites, native silver, silver glance, sulphate of baryta, galena, amethyst quartz, agates; and Baron de Rottenburg asserts the existence of gold in the alluvial deposits, and more particularly in the sands of a stream on Michipicoton Island, and holds that the country there is auriferous. And why not? It is in its equivalent that gold is found in the Eastern Townships!

The more important exposures of these upper copper bearing rocks, at Lake Superior, occur principally on the south side of Thunder Bay, where they form an escarpment of white sandstone, about 200 feet thick, belonging to the bottom of the higher group; also between Thunder and Black Bay, Point Porphery, Granite Islet, Edward Island, the mouth of the Neepigon River, the Battle Islands, St. Ignace, Michipicoton, Cape Gargantua, Batchiwanung Bay, and Mamainse.

THE CHAZY FORMATION

Occupies a transition position between the underlying Calciferous and the overlying Trenton groups, and consists principally of grey, brown, and black dolomites, and bituminous shales, and quartzo-calcareous sandstones, exhibiting a highly fossiliferous and concretionary structure. It derives its name from the town of that name in Clinton County, N.Y. It occurs somewhat extensively in the Townships of Nepean, March, Ramsey, Huntly, Hawksbury, &c., east of Kingston; and may appear between the Potsdam and Black river formations in Storrington and Loughborough. It is also largely developed at L'Orignal, on the Ottawa; Pembroke, in Renfrew County; and stretches away in broken succession to the Mingan Islands, in the east, and the Sault St. Marie, in the west: but with the exception of an exposure observed by Mr. Murray of the geo-

logical survey west of Little Mud Turtle Lake in the N.E. part of Bexley, in the County of Victoria; and the sandstones of Sault St. Marie, and surrounding locality; their occurrence west of Kingston, though it is possible they may be developed in many other places, have not as yet been definitely recognized.

Its economic materials consist of dolomitic limestone, in the Township of Nepean, well adapted for, and yielding the celebrated "Hull cement;" fine grained, grey, and red limestones, suitable for the manufacture of marble; a thin bedded limestone at L'Original, on the Ottawa River, extensively worked for tombstones and other purposes; an excellent sandstone for building purposes, near Pembroke; and good limestone for the same purpose from many other localities in Canada West, as well as in Canada East. It is about 150 feet thick.

THE TRENTON FORMATION,

Otherwise known as the Bird's Eye and Black River Groups, occupy a large space in the field of the Geological horizon of Western Canada. From certain fossils being restricted locally to the bottom beds of the group, a devisable distinction has sometimes been drawn as above, and employed in reference thereto, thus in a great measure recognizing two subformations. The strata comprising both divisions of the entire group, is 600 or 700 feet in thickness, and consist almost entirely of highly fossiliferous limestone, well adapted for building purposes, and usually of a dark grey colour, and occasionally bituminous, sometimes interstratified with thin calcareous clay, and sandstone; but its prevailing characteristic is essentially thick bedded limestone, passing into thin shaly limestone, some of which are sufficiently fine grained and free from foreign matter, to receive a good polish and be employed as marble and lithographic stone. These suitable for marble occur more particularly in the Townships of Pakenham; Gloucester;

Cornwall; Kingsbury; Oxpoint, near Belleville; Cobourg; Coboconk Village, in Summerville; Bexley; and Rama, north of Lake Simcoe. The Rama stone is however highly silicious, and difficult to dress, but very durable. A thin light coloured band belonging to the base of the series, and which may be found in many localities, from Marmora through Cobokonk, and Rama, to Cold Water River, on the Georgian Bay, yields a good lithographic stone; aud in some places, as at Cold Water, where it is of a green colour, it has long been used by Indians in the manufacture of ornaments and pipe bowls.

This formation is extensively developed in the Counties of Prescott; Russel; Carlton; Renfrew; and Lanark, between the St. Lawrence and the Ottawa Rivers, and particularly at the City of Ottawa; but they occupy a still greater area on the west and north-west of the gneissoid belt before referred to, as crossing the St. Lawrence at the Thousand Islands. It skirts the shore of Lake Ontario as far westward as the neighbourhood of Cobourg; thence it stretches northward as far as the Townships of Marmora, and Dummer; thence northwesterly, along the southern outcrop of the Laurentian Formation, to the outlet of the Severn River, on the Georgian Bay. Its general western limit extends from a little west of Cobourg to a short distance west of Collingwood, on the Georgian Bay; so that Lake Simcoe; Balsam; Rice; Sturgeon; Camerons; and some other small lakes are embraced within its area, but it is much covered by drift deposits containing gneissoid, and crystaline limestone boulders from the Northern Laurentian formation. Its exposures, in proportion to its area, are not very numerous, except at its base, contiguous to the Laurentian, where the lower series are extensively exposed; at Beaverton, and the Lake Simcoe Islands, Thorah, Eldon, Mara, &c., where the lower sections of the upper divisions are partially exposed; and at Lake Ontario, where the upper characteristics are partially exposed, and appear underlying the Utica Shale.

Proceeding westward, further exposures are to be met with in many of the islands along the north shore of the Georgian Bay and Lake Huron, crossing to the northern side of the Manitoulin Islands, and finally, after touching several other points, disappears on the north part of St. Joseph's Island, at the mouth of St. Mary's River.

THE UTICA FORMATION

Appears in broken and detached sections in several places in Western Canada, particularly in the immediate vicinity of Ottawa City; and in the townships of Cumberland; Clarence; and Plantagenet, in the counties of Prescott, and Russel; but is far more extensively developed on the north shore of Lake Ontario, from near Cobourg to the township of Pickering. From these latter points it sweeps to the north-west under the superincumbent drift, reappearing on the Georgian Bay, a little west of Collingwood; and thence, extending north-westward, it appears in a narrow strip on the Manitoulin Islands, where it is very bituminous, discharging mineral oil; and finally disappears on St. Joseph's Island.

Its best exposures are at Ottawa; Whitby; under the Blue Mountains at Nottawasaga Bay; at Cape Smyth; and some of the neighbouring islands of the Manitoulin group. It does not in any place exceed one hundred feet in thickness in Western Canada; but in Eastern Canada, where it is largely developed, it is much thicker.

Its peculiar and distinguishing characteristics are its highly fosiliferous and dark brown bituminous shales, sometimes holding anthracitic matter, and occasionally interstratified by dark coloured limestones. In Collingwood, Whitby, and elsewhere, these shales are sufficiently rich in bituminous matter to yield profitable returns of mineral oil and gas for illuminating purposes, when that material commands the ordinary

price; and experiments have been made at Collingwood which afforded by distillation about twenty gallons to the ton of shales; but the discovery and development of the oil springs of Enniskillen in the west, and the cheapness of the natural material, with which the demand is supplied, has caused those distilleries to cease working; but the time may come, however, when these hidden treasures can be profitably extracted and made a source of commercial enterprise, at many points of its outcrop.

Its name is derived from the city of Utica in the state of New York.

THE HUDSON RIVER FORMATION

Is essentially composed of sandstone flags, of a blue and green gray colour, weathering brown; and in Canada West is about 700 feet thick. Associated with the bituminuous shales of the Utica series, this formation occurs as an outlier in the vicinity of the Ottawa City. Its principal development however in this section of the Province is along the western extremity of Lake Ontario, from the Rouge River in the township of Pickering, in the county of Ontario, to the River Credit in the township of Toronto, in the county of Peel, underlying the city of Toronto; and on the western shores of the Georgian Bay, from near Collingwood to Albemarle, in the Indian Peninsula. In the intervening space between these points, crossing the Western Peninsula, there are many exposures; particularly at the Don, Humber, Mimico, and Credit; Point Montresor, Point Rich, Point Bouchier, in Nottawasaga Bay, Point William, Cape Croker, &c., and in many of the small islands including the great Manitoulin and Cockburn, in Lake Huron; but it is in the main very generally concealed by overlying drifts. It yields good flagging and building stone; and whetstones of fair quality are obtained at the Blue Mountains, near Collingwood; and yellow Ochre in Nottawasaga, and

Sydenham; with clay suitable for the manufacture of red and white bricks in several localities.

This formation takes its name from the Hudson River, in the state of New York.

THE MEDINA FORMATION,

Begins the middle Silurian series, and, skirting the south shore of Lake Ontario, crosses from the United States into Canada, at the mouth of the Niagra River, and sweeps around the head of the lake, under the city of Hamilton, as far eastward as Port Credit, in Toronto Township, forming a narrow belt, consisting of red and green arenaceous, or sand shales, succeeded by a coarse and somewhat loosely consolidated sandstone of a red colour, overlaid by marls and shale beds, striped and spotted with green, which is again capped by a grey band, some ten or twelve feet thick; the whole being about 600 feet in thickness. From Port Credit it bears away to the north-east for about twenty miles, then diverges to the north-west through east and west Flamboro, Nelson, Caledon, &c., following and overlying the western margin of the underlying Hudson River Formation, through the Indian Peninsula to Cabots head in the Georgian Bay, and westward to the Manitoulin Islands. Building and grinding stones of good quality are its principal economic materials, and are obtained in this formation at Hamilton, Dundas, Waterdown, Georgetown, &c. The succeeding and scarcely separable

CLINTON FORMATION,

Consists of a series of beds of green, grey, and red shales, with occasional interstratified limestones, and dolomites. Where it overlies the Medina, at the mouth of the Niagara River, it is only a few feet thick, but increases as it ascends, and sweeps

round following the Medina to the north, till reaching Cabots Head, at the Georgian Bay, it attains a thickness of 180 feet. Further to the west it may be seen at the Manitoulin Islands. Exposures of this and the preceding formation are seen along the coast, at Cabots Head, Cape Commodore, Owen Sound, Nottawasaga, Caledon, Esquesing, Georgetown, Flamboro, Dundas, Wellington Square, Hamilton, Saltfleet, Louth, St. Catharines, Thorold, Queenstown, and in the gorge of the Niagara River.

From the Clinton outcrops, at Thorold and St. Catharines, more particularly, a strong water-lime, or cement is largely manufactured and of a very good quality.

THE NIAGARA FORMATION

Consists, at its base or lower parts, of about twenty feet of of dark grey limestone, succeeded by a considerable thickness of dark bituminous thin bedded limestone, or calcareous shales, which are again overlaid by thick bedded limestones, also of a bituminous character. At the Falls, the calcareous shales are about 80 feet thick, succeeded by the thick bedded strata, which is about the same thickness, and over which the cataract breaks, making it 160 feet at this locality, though at others it is found to be greater.

This formation is well displayed at the Falls, and along the gorge of the Niagara River to Queenstown, where it forms an abrupt cliff or escarpment easily recognized, and thence extends westerly, from that locality, to the west of Hamilton, where it turns, forming an acute angle or elbow on its eastern side, and nearly a right angle on its west side; and widening out as it extends to the north-east, turns again, and bears away to the north-west, gradually decreasing in breadth, till with slight interruption in its progress or elevation, it enters Lake Huron, in the Indian Peninsula, west of Cabots Head; thus traversing

and underlying parts of the counties of Lincoln, Wentworth, Halton, Peel, Simcoe, and Grey. It also constitutes Fitzroy Island, the Flower Pots, &c.; and the southren portion of the Manitoulin Islands, where it turns to the south-west and extends along the western shore of Lake Michigan.

Both the shales and limestones contain thin bands of gypsum, and the cavities and fissures of the limestone, in many places, contain crystals of calcspar, pearl-spar, gypsum, blende, galena, &c., but I am not aware that either of the latter have been found in sufficient quantity in any place in this formation to be of commercial importance—though it may yet be discovered.

In connection with this formation, it may be mentioned, that strata of apparently the same age as that of the Niagara group, and having the same characteristics, have been discovered resting on the so-called, Lower Huronian Formation, at Lake Temmiskimang, on the north side of the great Laurentian water-shed, near the head waters of the Ottawa River. But as the geological structure of that part of Canada is comparatively little known, I shall confine myself to a mere mention of the fact, with the hope that, when the more important and pressing demand of the settled and known economic portions of our country is attended to by our excellent geological staff, it will receive due attention.

In western Canada however, its outcrops and exposures are well developed in the following places—Niagara, Queenston, Thorold, Hamilton, Ancaster, Dundas, Rockwook, Belfontaine, Caledon, Mono, Mulmer, Nottawasaga, Artemesia, and Euphrasia, where there are many high cliffs, particularly at Nottawasaga and Beaver River; Owen Sound; Cape Paulet, on the Georgian Bay, to Cape Chien at Cabots Head, where it overlies 180 feet of the Clinton formation.

It is about 200 feet thick and yields excellent building stones,

THE GUELPH FORMATION

Succeeds the Niagara formation, and its rocks are largely developed in the neighbourhood of Guelph and Galt. They have not been traced beyond the limits of the Province—hence the local name.—They consist of dark brown very bituminous dolomites, succeeded by a mass of whitish coraline dolomites, which in some places are not crystalline, as at the quarry near the right bank of the River Speed, about half a mile above Guelph. They follow the more western outcrop of the Niagara formation, and are supposed to be lenticular shaped, thining out to the west in Lake Huron, before reaching Michigan in the west, and in the neighborhood of Ancaster in the east, with a central thickness of about 160 feet.

Its principle exposures are near Guelph; at Elora, on the Grand and Irvine Rivers, where its vertical cliffs are over 80 feet high; at Hespeler, on the branch of the Great Western Rail Road; at Preston; Galt; Dumfries, and several other places.

It supplies excellent stone for building purposes; and completes the middle Silurian series.

THE ONONDAGA FORMATION

Forms the lower subdivision of the upper Silurian series, which however only contains the Onondaga and Lower Helderberg formations. It crosses the Niagara River at the village of Waterloo, and can be traced westward from Lot No. 8 in the 7th, to Lot No. 23 in the 2nd Concession of the Township of Bertie; thence, sweeping round toward the shore of Lake Erie behind Cape Albino, is again traceable from Lot No. 15 in the 3rd Concession of Humberstone, to the Welland Canal, on Lot No. 26 in the 2nd Concession of the same Township; thence stretching away to the North West, it follows the general out-

crop of the Niagara and Guelph Formations, to the neighborhood of the mouth of the Saugeen River, at Lake Huron, crossing portions of the Counties of Welland, Haldimand, Brant Oxford, Waterloo, Perth, and Bruce; but along its whole course is, in many places, much covered over by drift deposits. It is next seen at the Island of Mackinaw, and on the adjoining coast of Michigan.

This formation so largely developed in the State of New York, and containing the salt wells of that state, is considered to be of chemical origin, and consists essentially of thin bedded dolomites, usually of a yellowish colour, which are sometimes blue, and green argillaceous, with associated lenticular and dome-like masses of gypsum. Many of the strata, both above and below the gypsum contain such a proportion of clay as to make it suitable for a hydraulic cement.

The exposures of this formation in Canada, so far as examined, appear to belong principally to its upper portions, from the summit to a little below the gypsum bearing beds. These gypsum beds sometimes extend for a quarter of a mile, but have always been found on working to be lenticular in form, and to generally dwindle away, till the upper and underlying strata come in contact; and this peculiarity often gives rise to mounds on the surface which indicates the probable presence of gypsum beneath.

Feeble saline and sulphurous springs are occasionally met with in this formation in Canada west, as at Tuscarora, and Chippawa; and in a limestone strata in the bed of the York River, at York, small quantities of galena may be found, as well as in the limestones which overlie the black shales, from the upper part of the ridge which extends between the falls of Niagara and Ancaster village. They are highly bituminous and for the most part magnesian for the whole distance; and they abound in the finest cabinet specimens of selenite, celestine, pearl-spar, blende, and galena. Crystals of the latter

mineral exists in greater or less quantity in nearly all the limestones from the Pentamerous band to the summit of the upper beds; but they are in the greatest abundance in the latter, especially in the Township of Clinton, near the village of Beamsville, where an unsuccessful attempt was made to work it, on a Lot in the 8th Concession. The ore is seen on each side of the main fissure, and disseminated throughout the limestone.

Its principle exposures are at Waterloo Village, in Bertie; along the Grand River between Cayuga, Paris, and the Don Mills; at Ayton, and Newstadt, in the Township of Normandy, on the upper Saugeen; Walkerton, in the Township of Brant; and at several other places along the river, particularly at the elbow, in the south west corner of the Township of Elderslie; and below Paisley, on the bank of the river, and in many other localities.

Its principal economic minerals, so far as yet discovered, or made known, consist of its gypsum beds and material for hydraulic cement; but it is not beyond the range of possibility that brine may be obtained from its lower strata, and workable qualities of galena from the range of strata already mentioned.

The principal places where gypsum is mined are at and about Paris, in the Towships of Brantford; in Oneida; Mount Healy; Cayuga; Indiana; and York, in the Township of Seneca. The amount obtained at these places annually is about fourteen or fifteen thousand tons, worth in its unground state on the spot $2 per ton; and when ground for manure it is worth about $3.50 per ton.

The name of this formation is derived from "Onondaga," a small manufacturing village, near Syracuse, in the State of New York, and is in Canada West, from 200 to 300 feet thick, and overlaid by what is known as

THE LOWER HELDERBERG GROUP.

Resting directly upon the western flank of the Onondaga formation, constitute the summit of the Silurian Series. It has been divided by the United States geologists into the following divisions in ascending order. 1st. The Water lime group, or Tentaculite limestone. 2nd. The Pentamerous limestone, 3rd. The Delthyris shaly limestone. 4th. The Encrinal limestone, and 5th. The upper Pentamerous; but none of these subdivisions enter Canada except the first, or Water line Group. This section of it crosses and enters Canada opposite Buffalo, and can be traced, pretty successively and continuously, in a band, varying from twenty to forty-five feet thick, from this point, in the Township of Bertie, to Cayuga, beyond which no further extension has been found or recognized; though it may extend along the western outcrop of the Onondaga zone, up to, or even into, and beyond Lake Huron.

They consist at their base of thin bedded grey porous dolomite, interlaminated with and holding bluish leaves; in other places grey conglomerate or breccia, grey and brownish slaty dolomites, lavender grey, and light bluish grey compact dolomites.

Outcrops of this formation occur on Lot No. 5 in the 10th Concession of the Township of Bertie, where it is about 20 feet thick; at what is known as Jones' tract, where it is about 45 feet thick; and at Rattlesnake Falls, on a tributary of the Grand River, on No. 35 and 36 in the 1st Concession of the Township of Cayuga, where it is about 25 feet thick. Its strata in their subdivisions closely resemble, in lithological character the upper portion of the preceding gypsiferous formation.

Besides good building stone, they yield, as the name of the subdivision which enters Canada implies, hydraulic cement, celestine, gypsum, and fluor spar.

Its name is derived from the Helderberg Mountains in the eastern part of the state of New York, and it is succeeded by the Devonean Strata, in which the first traces of vertibrated life and land vegetation are found; and which, in Canada, is subdivided in ascending order into four formations, known as the Oriskany, Corniferous, and Portage, and Chemung Formations; the first and last of which are however but slightly developed in Canada.

THE ORISKANY FORMATION

Is divided by the United States Geological Survey into three divisions on very slight characteristic distinctions, which may be considered as more local than general in their application. In Canada many of the fossil characteristics by which they make this subdivision, pass successively from the lowest division and ascend into the Corniferous formation which overlies them all. It can therefore only be looked upon as a sandstone formation which is regarded as the base of the Devonean Series.

The lowest of these bands only, enter Canada at Waterloo, on the Niagara River, and which does not in its lithological and other characteristics, seem very materially to differ from the same strata in New York. The lower beds in many places seem to be composed of chert and hornstone, often containing considerable quantities of iron pyrites, and beautiful specimens of purple fluor spar. These beds are succeeded again by a sandstone, which does not retain a characteristic uniformity, but differs in many places.

On Lots No. 46, 47, 48, and 49 in the 1st Concession, north of the Talbot Road, in the Township of Cayuga, and on the corresponding lots in the Townships of Oneida, there are large exposures of this formation. In this locality it is composed of fine grains of white quartz, in some parts, so closely cemented as to assume the character of a white compact quartzite, and

in other parts, the quartz grains are coarser, and mixed with occasional grains of feldspar, while in the Township of Dunn, near Haldimand, it is mostly made up of large angular pieces of hornstone, which, with a great number of large corallines and other fossils present render it almost useless as a building stone; but at other places along its outcrop, good material for building purposes may be found, and some of them have been used in the manufacture of millstones, for grinding oats. The sandstone of this formation somewhat resembles the white beds of the Potsdam, and is of a white light grey, to yellowish, and brown colour. It is probable that portions of it would be found sufficiently free from the presence of iron to make it suitable for the manufacture of silicious ware. It extends as a thin band along the southern edge of the Onondaga formation, from where it enters Canada, in the Township of Bertie, opposite Buffalo, to the County of Norfolk.

It is exposed in Bertie, Dunn, North Cayuga, Oneida, and Windham, and is from a few inches, at its thinest, to about twenty feet at its thickest exposure, but is frequently wanting between the water lime series of the underlying Oriskany and overlying

CORNIFEROUS FORMATION,

Which follows in ascending order, and is composed of highly fossiliferous and bituminous limestone, containing a large amount of chert, or hornstone, from which it has derived its name. It is divided by the United States geologists into two successive masses, which are said to be distinguished by characteristic fossils, and lithological peculiarities. The lowest part consists of strata of light grey limestone, sometimes almost wholly made up of encrinal columns and corals, resembling in a great measure the beds at the base of the Niagara limestone. It yields near its base a handsome variegated marble, and generally good compact limestones for building and lime-burning

purposes, which varies near the top from drab, and light grey, to blue, green, and black, having in the latter case black shales associated with it.

The hornstone which forms the lower division is largely developed in many places all through, and in some places constitute nearly the whole of the strata, and is highly fossiliferous, but not to so great an extent as the one below, and the corals are much smaller in proportion. The lower division attains in New York, a thickness of twenty feet, and is there called the Onondaga limestone, which must not be confounded with the underlying Onondaga formation, or salt group, and where the upper division attains a thickness of 70 feet, and is there called the Corniferous limestone. These two, with an additional schoharie grit constitute what is described and known there, as the upper Helderberg group.

It has been found that in Western Canada, many of the fossils of the Oriskany sandstone pass up into the Corniferous limestone, and that the American limestone cannot in consequence be recognized here as a distinct formation. Therefore the two American groups of limestone are, with us, united under the name of the Corniferous formation.

This being the oil-bearing formation, and consequently one of the most important economical groups in a speculative and commercial point of view, I have deemed it advisable to give the foregoing details and distinctions, in order that the uninitiated or unprofessional reader may be better prepared to follow me through a discussion, of the *past, present and future formative process of that recently introduced great luminous staple of commerce—mineral oil.*

In the first place, however, I shall endeavour to follow out the programme laid down, and complete as far as possible, its geological and lithological description. But as the locality underlaid by this formation, in Canada West, has acquired so much notoriety, and such a degree of importance in a specu-

lative and mercantile point of view, in consequence of the enormous production of the so-called "Rock oil," from the many wells recently sunk within its geological area, it is desirable for the general information that a more detailed geological description respecting that important group, should be given, and which I make no doubt will be acceptable if not appreciated by the reader.

This formation enters Canada directly west of the underlying formation already described, opposite Buffalo, and follows its partially undefined outcrop to the west, along the shore of Lake Erie, resting sometimes on the Oriskany sandstone, and where this is wanting, on the water limestone series below. It can be traced by outcrops from Horne's Quarry in Bertie, near the Ridgeway Station of the Buffalo and Lake Huron Railway, at various places on the lake shore, as well as inland, as far west as Woodhouse and Miudleton in the extreme west of the County of Norfolk. Its eastern outcrop, however, turns off to the northward through north Cayuga, to within seven miles west of the mouth of the Saugeen River on Lake Huron. From this general eastern boundary where it forms parts of the Counties of Welland, Haldimand, Norfolk, Brant, Oxford, Perth, Huron, and Bruce, on the east, it dips to the west at a slight angle of some 20 to 30 feet to the mile for some distance—if not continuous—in conformity with the underlie of the preceding underlying formations; but *apparently* rises again and crops out in the west, in the Counties of Kent, Essex, and Lambton. This undulation—if it really exist—may have been caused either by upthrows in the west, *intermediate denudation*, which is the most probable, or otherwise; but it is more than probable the dip of the formation is nearly uniform and continuous from its eastern boundary, as before delineated, to the extreme western part of the Province, and underlies the whole of that area; but that a greater degree of denudation and wearing away, took place

across its central part, than at its eastern and western extremes; thereby forming, as it were, a depression, which was subsequently filled up by the succeeding or Hamilton formation, and its overlying drift. Should this view hold good, and its dip be taken at 30 feet to the mile, it would attain a thickness, after deducting the natural fall in the surface westward, of some 2,000 to 3,000 feet at Lake St. Clair; but this, however, may be very much modified by slight undulating causes, and appears hardly probable, as the estimate thickness of its equivalent in Michigan, according to Professor Winchall, is only about 350 feet. It is, however, much more largely developed in Western Canada than in the State of N. Y., and may possibly attain that thickness at the place indicated. It thus embraces an area, including its underlie and exposures, of some 6,000 or 7,000 square miles. But a large part of that area—though the Corniferous or oil bearing formation, underlies at no great depth beneath the surface—is overlaid by drift and a north and south cross belt, known as the Hamilton formation, (but might be more appropriately designated the Lambton formation) which centrally intersects it, and rests on a central saddle shaped, low *anticlinal axis*, running east and west, through the Western Peninsula of Canada West, from Hamilton, at the head of Lake Ontario, to and beyond Cincinnati in the United States.

Having now given the outlines of its general geographical position, so far as relates to Canada West, I shall proceed to a consideration of its lithological and other characteristics, other than is fossiliferous remains, and notice some further localities of its more extensive outcrops as well as its economic minerals.

This formation is essentially composed, or made up of highly fossiliferous limestone, generally free from magnesia, and highly bituminous, combined with layers of chert, calcareous sandstone, highly bituminous shale, and hornstone

from which latter, as before remarked, it derives its name. The limestones abound in fossil remains, which, at or near the base of the formation, contain vast quantities of fragmentary crinoids, and other traces of organic life; and which, having their organic remains—if I may say so—destroyed through the lapse of ages, left cavities, or vacuums, in the enclosing rock; which, being subsequently refilled by silicious matter, retains perfect traces of the original organic structure of their former occupants. This generally holds good throughout the whole formation; and many of the beds are nothing more than aggregates of silicified organic remains, with so little calcareous matter, that the whole mass coheres after the carbonate of lime has been dissolved out, and they have no doubt, formed the original neuclii, to and around which, during the consolidation of the composing and containing strata, much of the cherty matter has been attracted; and in some of which a kind of oily substance, supposed to be rock oil or petroleum, has been found. It is upon this unimportant, though quite natural fact, that the prevailing theory of defunct carbonaceous organism, being the origin of petroleum, is endeavoured to be established.

These limestones, unlike the great masses of the middle and upper Silurian formations of Canada West, effervesce freely with acids, and are not dolomitic. It is found that on the lake shore, near Port Dover, where there are some of the silicious organic beds already referred to, that they are marked with epsomites, the impressions of which generally occur between the underlying chert and the overlying limestone, and are often highly bituminous, with a liquid carbonaceous matter often filling the pores of the coral remains. Instances of this kind are met with at Horn's Quarry, at Bertie; Gravelly Bay, in Wainfleet; and at the Village of Jarvis; but as a general rule, the coral cells are completely empty. In some places bituminous shales in thin layers are found along the

north shore of Lake Erie, as far west as the formation extends. In the same section of the country but higher up in the series, blue limestone twenty feet thick, alternating with grey beds of the same material, are associated with cherty layers, and interstratified with thin bands of dark coloured limestone. These strata are, in some places, quartzose, and in general, yield good stone for building purposes. At Woodstock, nearly in a direct line on the anticlinal axis before referred to, as running longitudinally through the Western Peninsula, is an outcrop of the Corniferous formation; in Wallace and Elma, its characteristic fossils indicate its presence; and further west in Garrick and Howick the same characteristics indicate its near presence; while to the northward its outcrop crosses the S.W. corner of Brant, and is seen upon the Teeswater River, near the eastern boundary of Greenock. On the south shore of Lake Huron, west of the Saugeen River, it is seen to crop out in many places, within a distance of four or five miles along the coast, and lying in nearly horizontal buff coloured beds near the surface of the water, exhibiting evidences of having once contained vast quantities of organic remains, which are however now replaced by chert. Again at Point Douglass, in the Township of Bruce, it appears as a calcareous sandstone, skirting the coast line, associated with calcareous beds, holding numerous nodules of chert, with black bituminous shales, and blue and drab coloured dolomites, some of which might be advantageously manufactured and used as a hydraulic cement. Although the strata there apparently holds no fossils, yet its fissures contain celestine, quartz, and calcite; and a coarse grained black band composed of an aggregate of imperfect crystals of calcite, highly bituminous, overlies the sandstone; and this is again succeeded, in ascending order, by thin alternate beds of black bituminous shales, and dark coloured calcareous strata, capped by thin blue layers and pale yellowish beds of brownish calcite, marked by lenticular

shaped crystals and epsomites. About twenty feet of dark gray granular bituminous limestone, interstratified with layers of brown inflammable limestone, and belonging to this formation, crops out near the Village of Kincardine, in the township of the same name, on the lands of Mr. Barker, which is extensively used and quarried, and yields a good stone for building and lime-burning purposes. Where the boundary line between Ashfield and Colborne strikes the lake, near Port Albert, on the Nine Mile River, there is a cliffy outcrop facing the water, of a few feet in thickness, which is seen at intervals along the shore of the lake for about a mile. They are destitute of fossils, and consist, in ascending order, of calcareous beds striped with thin bituminous shales, and pale yellowish dolomitic layers, sometimes three feet thick, marked by lenticular crystals of calcite, or by cavities from which such crystals have disappeared.

Further exposures of this formation may be seen near Port Colborne, Dunn, Rainham, Walpole, Woodhouse, N. and S. Cayuga, near Woodstock village, St. Mary's, Carrack (on the branch of the Maitland River), Brant, Port Douglass, and elsewhere along the coast of Lake Huron; Bruce, Kincardine, Port Albert, and in Blanchard, on the Maitland River, near Goderich, and at Malden, near Amherstburg, which is over one hundred miles to the westward of St. Mary's, and where good buff coloured and whitish grey limestones, suitable for building and lime, and it is said lithographic purposes, occur near the surface.

The limestones contained in this formation are all more or less bituminous, which is in some places in a liquid form, filling the cavities in its corals and other fossils; but they have only been noticed in this latter state in isolated patches, or widely separated thin beds, which are in some instances saturated sparingly with oil, while others, having the same characteristics immediately above and below, are completely

destitute of that mineral. These oil bearing bands, varying from three to six inches in thickness, so far as known, seldom occur, and scarcely warrant the assumption that the liquid hydrocarbonaceous matter contained in their minute cavities is the great fountain from whence the almost illimitable supply of petroleum oil is obtained, though they may, and no doubt do, form a very important auxiliary in its generative process. The intermediate stratifications, composing the great body of this formation, are also made up of broken masses of encrenites and other organic remains, which might on the same principle be expected to contain liquid carbon or petroleum, but it does not contain any, and its principal components, (organic remains,) are only seen as a dry paste, by which the interstices of the coral bearing beds are filled up, thereby forming a cohesive mass.

Oil is found flowing naturally from three distinct geological horizons, or formations, in Canada—1st. In the limestone of the comparatively low Trenton Formation, in which no traces of either vegetable or vertibrated animal life exist, or are found; 2nd. In limestones of the upper Silurian Formation, as at Gaspé; and 3rd. In the Corniferous Formation, as at many places in Western Canada. To this may be added, that small quantities of an allied hydrocarbonaceous matter issues naturally from other intermediate formations, as at Bertie; and at the Manitoulin Island, from the Utica Formation; and a similar material has been obtained by distillation from the shales of the latter formation at Collingwood. At Kettle Point, on Lake Huron, in a formation overlying all of these, and at other places in the same horizon, and even above it, the black bituminous shales of which they are composed are known to be inflammable, and are said, by the Indians, to have continued burning for a long time, where they are exposed along the shore.

It is, however, from the central region occupied by the Cor-

niferous formation of Western Canada that the supply of our rock oil has been hitherto mostly obtained.

The other formations and localities indicating the presence of this mineral have been, as yet, only partially examined by the Geological Survey of this Province, and remains wholly unexplored by private enterprise. Their resources, therefore, in that mineral, in a speculative or commercial point of view, remains comparatively unknown.

This is not a little surprising when we consider the vast amount of capital and speculative enterprise employed in its development, where its existence has become an established fact; but on the other hand, when we contemplate the history of its first production, from the native soil of Canada, a few years ago, and the maddened folly and wild epithets that were so gratuitously and liberally bestowed upon the enterprising few who were the original means of bringing this hidden treasure forth from the bowels of the earth; I cannot but believe that, were they (who are so ready to condemn and howl down legitimate speculative enterprise, through some peculiar dormancy, or obscuration of their perceptive faculties, but who are ever ready to made a grab, or follow in the wake of the pioneer,) to follow the enterprising example set them, and cause scientific explorations and experiments to be made, at a moderate outlay, with a view to its further development in other localities, but that success would crown their efforts. But in the attempt to carry out successfully any such experimental explorations for a further discovery of that mineral, or any other, it is necessary that scientific knowledge and skilled labour should be procured and brought to bear; and that no such enterprise should be entrusted to the *tailor, tinker, or shoemaker*, as is too often the case, on the sole merits that he or they had previously visited *a grog shop or gambling booth in California, or elsewhere, in search of minerals*, and must therefore be, in the estimation of the unthinking, "*experienced*

and well posted. Did such people only reflect that, as a general rule, the results attending such unskilled explorations, and which too often fill the sad records of the uneducated miner's life, generally end in as sad disappointment to the misguided employer, as it was disastrous to the inexperienced employee, in his random researches for the precious metal in the land from whence, by an ignorantly conceded assumption of arrogance, *his distinctive experienced mineralogical prestige* is derived, they would not only exercise a greater degree of intelligent judgment in their selections for such an important purpose, requiring the highest professional knowledge, but be rewarded by an hundredfold degree of comparative probable success. I have known, and do know men and tradesmen, of the very lowest mediocrity of education, or wholly destitute of that acquirement, or any part thereof, in this city and elsewhere; men that actually cannot even name or distinguish one rock or formation from another, much less its components or peculiar mode of combination, or from analogy form an opinion as to where similar rocks may be found, who are presumptive enough to put themselves forward as *experienced California or Australia gold miners*, on the simple recommendation that *they have been there*, mole-like, grovelling unsuccessfully amongst the rocks, that knew just as much about them as they did about the rocks; and whose *experience* terminated as might have been expected, in blind disaster, a collapsed purse, recourse to the highway or gambling table, a retrograde or *flank* movement, and ultimate ignominious *retreat* back, *when possible* under the circumstances, with their "*mineral rod*," to become once more the knight of the *goose*, the *lapstone*, or the *soldering iron* (whence they had better never departed), to be on hand for an engagement by the simple, during these speculative mining times, as *experienced exploring mineralogists.* I am however aware that there are a *few chance* exceptions to this, but like "angel's

visits," they are few and far between — it is the general rule.

That portion of Western Canada, as before remarked, which lies within the Corniferous formation, may therefore be described *as all that part of the Province lying to the south and west of a curved line running from the foot of Lake Erie, through Stratford, to an undefined point on Lake Huron, west of the mouth of the Saugeen River.* A considerable part of this area is, however, overlaid by the shales of the Hamilton formation, and the overlying Portage and Chemung groups; but by far the greater part is overlaid by drift deposits of clays, sands, and gravels, and it is in, or through, these overlying clays, sands, and gravels; and their underlying Hamilton formation, near the centre of the area, that mineral petroleum springs are found in the greatest abundance, and wells are sunk, sometimes through, to, and into the underlying Corniferous formation. Where the wells are only sunk some 40 to 60 feet through the drift accumulations to the Hamilton shales, they are called *surface* wells; but where boring has taken place into, and through the underlying Hamilton formation, they sometimes flow and are called *flowing* wells. The oil wells of Pennsylvania, and many of those in Ohio, are sunk deep into the sandstone of Devonean age, which there overlies the Hamilton formation; but which is wanting in Canada, and is supposed to have been removed from off the Hamilton formation in Canada West by denudation; and it is theoretically surmised that these sandstones, like the overlying shales, gravels, and drifts, which in some places cover our oil-bearing rocks, as at Enniskillen, and elsewhere, *act as reservoirs*, and retain the oil as it rises upwards from the underlying, and in some places deeper seated Corniferous formation, and prevents it reaching the surface, and being vapourized, floated or washed away. But the rocky structure of a great portion of the oil-bearing formation in Western Canada is destitute of any

covering, except the superficial sands and clays, and in some places is quite naked; and whatever may have been, *or now is* the producing cause of liquid hydrocarbonaceous matter in the earth, its process of action seems in a great measure to be either partially suspended, or to have ceased altogether, in the higher and more exposed strata; and that all the oil that has been generated in such cases was, through long lapses of duration, lost, instead of having been retained in the superincumbent strata, as under the Hamilton formation; or that during a period subsequent to its denudation, but previous to the deposition of the drift deposit over its exposed surface, the generative process of oil formation was, through atmospheric and other agencies, accelerated, and the mineral escaping at the exposed surface was lost, instead of having been retained, as in the case where it was then overlaid by higher formations, whether of a loose gravelly nature in the form of drift, or a more compact rocky structure.

In Dereham, Oxford, Mossa, and other places, where sand and clay overlie the Corniferous formation, natural springs are found, yielding small quantities of oil; but so far as I can learn, neither the surface wells or those sunk in the rock beneath have as yet furnished any great quantity of oil; but this may be owing to not striking the crown of the *anticlinals*, where the oil is certain to collect when set free.

As before remarked, a low main anticlinal axis runs longitudinally through the western section of the Province, from the west end of Lake Ontario. The crown of the arch passing thence through Woodstock (in the neighbourhood of which the Corniferous formation folds over it), describes a gentle curve, by the Thames, and along the general course of the Great Western Railroad, to Chatham, and Pigeon Bay, on Lake Erie. But it appears more than probable that there are subordinate anticlinals, parallel to this, on both sides of the main axis, besides others that are again divergent. Enniskillen is on

the north side of this anticlinal axis, but its oil springs may be, and very probably are, on a subordinate one, parallel, divergent, or connected with it; and which may possibly branch off by Port Sarnia into the Michigan oil fields, or it may in some way be connected with the apparent upheaval of the Guelph Formation at Rockwood. Undulations are observable in the Corniferous Formation near Point Albino, and crossing the Welland Canal at the 2nd concession of Humberstone. The courses of these are about south-west; while that of another, on lot No. 13, in the 1st concession of Rainham, is about north-west, which would indicate other undulations; and another in the Oriskany Formation, in North Cayuga, shews an axis running about south-west. There is therefore little doubt but that small subordinates, and parallel, or nearly parallel, anticlinals, traverse that whole region, having others in some instances divergent, and running in an oblique north-west and south-east direction, from the axis of the main anticlinal.

The central portion of this great anticlinal, with its subordinates, are again much depressed towards their central parts, by a *synclinal*, which, crossing from Plympton, at Lake Huron, to Oxford, at Lake Erie, gives them a somewhat *saddle-shaped depression*, which is filled up by the Hamilton and overlying formations; the former of which attains a width of only 25 miles on the great anticlinal belt between the Thames and Sydenham River, but on either side spreads out to the north-east and south-west along the shores of the two lakes. It is possible however that some of these subordinate undulations may bring to or near the surface, domes, or ridges of the underlying formations, as it is probable may now exist at Goderich, and Point Douglass, on Lake Huron. Scientific reasoning and inferences, which subsequent practical experiments have so far fully confirmed, has demonstrated that *it is at, along, or near the crown of these anticlinals*, in hydrocarbonaceous bearing formations that liquid *petroleum may be expected to be found.*

Some of the springs in Western Canada appear to be on the line of the great anticlinal as before indicated, and others are, no doubt, either on, or connected with subordinate undulations; for, the oil being lighter than water, and permeating with it the strata, naturally rises to the highest part, or crown of the different anticlinals, where it is confined, and from whence it escapes into the overlying deposits, or to the surface by natural rents, cracks, fissures, or borings.

By the sinking of wells, and the aid of artificial borings, into the underlying oil bearing rocks below, and the recently discovered improved modes of refining it, as well as the various purposes of life to which its uses have been, and can be applied, has been the means of greatly increasing its supply and augmenting its demand.

Rock oil has therefore created quite a mercantile revolution in the article of light alone; and caused an almost unparalleled new branch of manual, mechanical, and speculative industry to spring up within a very short period.

It therefore becomes a matter of the greatest importance to enquire, and if possible, determine where these anticlinals and their subordinates are located in oil bearing formations; as well as the secret opperations of nature, that has been, and *now* are employed, in its formative process; and also, whether its supply is likely to continue, or *become exhausted.*

I am aware that the task, as to the formative process of Rock oil, is somewhat complicated, but the difficulty does not, however, arise so much from not being able to furnish a scientific solution of the proposition as in combating the prevailing views, which appear to have received (for want of due consideration) a kind of quasi authoritative sanction from many writers. I shall not, however, stop to argue against the popular but unthinking, current, or *usufrux*, of public opinion, though high its basis, or unfounded its data; but proceed to launch before the *reflective* and *thinking* public my own views as to

the *producing cause* of mineral oil, and its probable *future supply* from the *same source.*

Hydrocarbonaceous matter is found, from the base upward, in the Palæozic rocks of Canada, but its presence is still more strongly marked in the limestones of the Trenton Formation, and in most of the limestones of the succeeding formations, which, in many cases, assume the form of bitumen, and in others, that of petroleum, or mineral oil, as in Pakenham, and Lancaster, in the Trenton Formation; at Riviere a la Rose, and and Montmorenci, in the Birds Eye Formation, it exudes from fossil corals; at the Manitoulin Island, a petroleum spring rises from the Utica Formation; and in the Hudson River Formation, in the Township of Gildersland, near Albany, in the State of New York, petroleum is found. But it is principally in the higher formations, or strata of the Devonean age, that petroleum is found in Canada.

The dolomites, or magnesian limestone of the Niagara Formation, are generally more or less bituminous, and which, in some places are said to contain so much solid bitumen, that it exudes from the rock when it is heated.

But, ascending still higher in the geological area, we find that certain portions of the limestones of the Corniferous formation are still more bituminous, as at Bertie, where two oil-bearing beds are visible, the one three and the other eight inches thick, while others are said to be there; one of which being concealed by water in a quarry pond, and the other flowing out on the water where the rocks are exposed by quarrying; at the village of Jarvis; at Gravelly Bay, in Wainfleet; and in Rainham; while Kincardine, and the Manitoulin Islands afford bituminous shales containing 12·8 to 8·8 per cent. respectively of bitumen, soluble in benzole.

The overlying sandstones of the Portage and Chemung Group, are often highly impregnated with petroleum, and have long been known to yield oil springs; and it is in these, and

still higher strata, that the oil wells of Ohio and Pennsylvania are sunk; though it is possible that these, like the wells of Western Canada, have their source in the Corniferous formation below; but this is only conjectural, as there appears to me to be no reasonable objection *why any carboniferous limestone, containing the necessary chemical re-agents—or chemically circumstanced*—if I may be allowed the expression—may not be made to surrender its carbonaceous matter; and it is well known that all limestones contain a very high per centage of carbon, a great portion of which has been, as before remarked, abstracted from terrestrial circulation, as well as from organic remains.

The oil-bearing districts of Western Canada have been long known to the Indians, and were made known by natural flows, at which places the oil was found floating on the water, and was gathered by spreading and saturating their blankets with the surface liquid, and then squeezing out the retained oil. This was used by their medicine men as a specific for rheumatism, and was probably equal to, if not more efficacious than, many of the patent nostrums of the present day. In many places, as at Enniskillen, the overflow of oil becoming dried, partly by volatilization, and partly by oxidation, left solid beds of tarry bitumen, which are found, from the surface to ten feet beneath it, varying in thickness from a few inches to a couple of feet, some of the deeper of which, are separable into thin layers or laminie, and retain the impressions of vegetable and animal life, which had been embedded in it, while in a liquid state, thus *representing the characteristics of coal.*

The localities within which natural oil springs have been hitherto observed, in the western part of Western Canada, so far as known to the writer, are at the north and south sides of the Townships of Enniskillen, in Mossa, Bothwell and Oxford, on the Thames; Big Otter Creek, in Dereham, near Tilsonburg, Bertie, Jarvis, Wainfleet, Manitoulin Islands, and other localities. (*See Catalogue.*)

The oil springs of Enniskillen, which are supposed to take their rise, through the superincumbent strata of the Hamilton formation, from the underlying Corniferous limestone, have been sunk by borings to various depths, which, striking upon cavities connected with anticlinals, as before remarked, bring to the surface large quantities of petroleum, often accompanied by saline waters and inflammable gas.

These wells are now so numerous, and have been sunk to so many varying depths, with so many varying remunerative commercial results, in a mercantile or speculative point of view, that, to enter into a detailed enumeration of them, would carry me beyond the design and contemplated limits prescribed for this synopsis, without any corresponding advantage to the reader. Suffice it to say that, as a general rule, the surface wells are sunk, from 40 to 60 feet through drift deposits, before reaching the underlying rock, or shale; and that the borings extend from 150 feet and over, into the underlying rocks, before reaching the Corniferous limestone, or supposed oil-bearing formation.

Though circumstances lend a certain degree of doubtful probability in support of two of the many theories heretofore advanced respecting the supposed source from whence mineral oil is obtained,—coal and organic remains—yet it appears to me, its origin, though it may be susceptible of being chemically solved, is at present (more particularly by this mistification in which these many conflicting theories have shrouded it) involved in a considerable degree of obscurity; and that, although one of these theories may be, to a certain extent, an auxiliary to its primary production, they are all wide of the mark.

A few of the theories which I shall notice, pre-supposes, as well as others, far fetched and unwarrantable conclusions. One of these connects the natural flow of petroleum in Western Canada, by fissures or subterraneous rents, in underlying formations, with the coal-bearing strata of districts occupying

much higher geological positions, in Michigan, Ohio, or Pennsylvania. To this view it may on good grounds be objected that the coal bearing strata of Ohio and Pennsylvania occupy a geological position of 860 and over 10,000 feet respectively above the Corniferous, or petroleum-bearing formation of Western Canada; and that a long lapse of duration must necessarily have intervened between the deposition of the two series of strata; and that they are geographically separated by the respective distances of about 80 and 200 miles; as well as the opposite angular dip of the intervening strata, between the Western Canadian Rocks of Devonean age, and those of Ohio and Pennsylvania. See sketch map. The unquestionable certainty of the general uniformity of these angular inclinations, in the intervening spaces, coupled with the fact that the coal formation is far above that particular strata which would bring the oil along its natural stratification up into Western Canada, leads to the inevitable conclusion that, if this coal is the origin of our petroleum, it must have first penetrated through all the intervening strata to the respective depths of the Canadian formation below these coal deposits, to be thence conveyed along the natural strata in an upward direction, till it emerges, after its long travel of a thousand years through the bowels of the earth, in Western Canada. Though circumstances may lend a certain degree of plausibility to this theory, yet it is unsupported by demonstrable facts, and is in the highest degree improbable. Still it may be said that the oil was generated in some of these coal-bearing beds, at some subsequent epoch of unknown geological history, and from thence conveyed by fissures to our Western Devonean strata. Many facts are however opposed to this view. No evidence of the occurence of *oil in these, or in any other coal beds* of other localities have hitherto been obtained; neither are any reservoirs of petroleum known to exist in the coal rocks of England, or any other coal producing country. But small quantities of the same sub-

stance, have been found in strata far below, and topographically, far removed from the geological horizon of these coal-bearing deposits of a succeeding era in the world's history; so that its conveyance there by connecting fissures becomes an almost absolute physical impossibility.

I might appropriately, in this place, and in connection with this subject, notice a few of the many wild and extravagant theories advanced by unthinking writers to account for the origin of petroleum. One writer states, that at a period when the earth was in a highly heated condition, asphaltum was volatilized and suspended over the earth in the form of a vast cloud:—must have smelled greasy, I should think—and that when the earth began to cool, the lighter portion of the asphaltum began to condense in the colder latitudes, and descended upon the disturbed strata of the Alleghany coal fields and the oil producing states; and that the hard asphaltum of Trinidad is nothing more than the residuum which might be expected after distillation on so grand a scale. Another states that the great reservoirs of petroleum are the works of the coral insect, and that liquid petroleum occurs in rocks far below the coal formation. Another believes the petroleum to be the bitumen of Anthracite coal which has been extracted from it by heat on the east side of the Alleghanies, and ejected on the west side of those hills. Others suppose that petroleum is merely the gasses from deep seated coal-beds, which may be subjected to a low heat, and condensed upon coming in contact with water which fills the fissures of the strata in the coal-fields; and that the gas which escapes so violently when the reservoirs are tapped, is merely the free gas which occurs when coal is distilled in retorts, and which is only condensed by artificial means. There is a very strong resemblance between petroleum and the crude oil distilled from coal; but similarity of origin ought to have produced oils precisely similar; they are not. Again it is said that the vast amount of

carbonaceous animal life—*human* as well as otherwise—that inhabited the world prior to, and which were destroyed at, the time of the universal flood, were drifted by the waters and currents of the, then, seas, and rivers, and settling into great deposits at their bottom and estuaries, were, in the course of time, covered over by sedimentary matter; which subsequently becoming consolidated, retained the carbon of these animals, as an indestructible element, and which is now, through the subsidence of the ancient waters, or upheaval of the land, being surrendered in the form of that prime and indispensable necessity of civilized life—*a cheap, safe and economical light.* Again, and lastly, it is said that, the ancient maps and assumed delineations of the locality of what was once the land of the Pharaohs, are all wrong; and some of our more enthusiastic American cousins, placing it amongst the oil regions of the western hemisphere, attribute the great flow of that material, to the immense destruction of locusts, *bull frogs* and other animals, which perished during the time of the plagues of Egypt. These suppositions are crude, incongruous, and irreconcilable with any known data or facts, and shall be passed over without further remark.

The other theory which I intend making some remarks upon, brings down the supposition of the pre-existence of a former great living and vegetable occupation of the earth's surface, at interrupted intervals, during the time of the formation of the various oil-bearing stratas that are found to encompass its surface. On this supposition we must conclude that, the earth's surface was at various times procreative, and capable of sustaining enormous multitudes of animal as well as vegetable life, that at subsequent periods were destroyed; and becoming physically extinct, left their relative proportions, as well as their carbonaceous matter, in the enclosing sedimentary rocks; and that this carbonaceous matter was taken up, and retained by such enclosing sedementary strata; which subse-

quently becoming solidified by metamorphic and other agencies, in after periods discharged its carbon as liquid petroleum.

It must also be borne in mind in connection with these views, that petroleum is found issuing from strata of a far earlier period in subordinate structures of the earth, where vertibrated animal or vegetable life is seldom, if ever found. But the fossiliferous and other remains contained in the oil-bearing strata, are not more numerous than they are in that of other Silurian and succeeding formations, in which not a particle of oil or bituminous matter is known to exist; but, on the contrary, it is found in strata apparently wholly devoid of organic remains, as in the greenstone dykes at Gaspé.

Dispensing therefore with all these conflicting discrepancies and views (some of which border close upon absurdity) as to the origin of that very important material—the discussion of the merits of each could not be entered into here without dragging the great majority of my readers through an unprofitable and extensive quantum of philosophic mire, as well as overstepping the prescribed bounds of our space, without any corresponding beneficial results to the general reader, we may ask—how then can we account for the prevalence of this mineral in one locality, and its total absence in another formation, while both apparently contain the same vegetable, animal, and mineral constituents, and physical properties? Or how shall we attempt to account for its existence where there are *no organic* remains, if it is of *organic* origin? Or how shall we account for its origin at all? The answer is obvious—

CHEMICAL AGENCY!!

It was observed by Black as far back as 1757 and described by him in his inaugural dissertation, that carbonic acid gas was abundant in common limestone and magnesia—such as our dolomites—and that it could be expelled from these substances

by the action of heat or acids. It can be easily extracted from these common materlals by the action of dilute hydrochloric acid, which takes up the lime, and carbonic acid gas escapes with effervescence.

If this operation were conducted under a pressure of about 36 atmospheres, such as might reasonably be assumed at a distance far above the supposed deep seated sources of rock oil, and at a temperature of 32° F., it would become a condensed liquid of a hydrocarbonaceous nature; which, in either case, acting as a re-agent on the carbonate of lime contained in the oil-bearing formations, would cause it to become soluble, thereby liquifying and setting free its carbon, in excess of this carbonic acid; which being acted upon again by *hippuric* acid—a constituent found in the urine of man and other semi-herbiferous animals, more especially if they were, as we may reasonably assume fed upon tropical fruit, such as almonds, or other Benzoic acidulous food—or some other unknown chemical agency, separates in the form or consistency of liquid carbon. Benzoic acid—the *chemist's* only *known* resort as a dissolvent for solid bituminous matter—such as might reasonably be expected to be found in the constituents of mamilliary and other remains of sedimentary organism, is a most powerful re-agent, and will, under favourable circumstances, set free the carbon in a liquid carbonaceous state from its containing mass. Again, it is known that water containing free carbonic acid, either derived from decaying vegetable matter, or otherwise, is a powerful dissolvent of the carbonate of lime, and the bicarbonate then formed is easily decomposed and precipitated by various natural agencies, and such I presume has been the mode of formation of much of our limestone strata. Why should this not be re-acted on again by some other decomposing agent, and made to surrender its carbon?

This, or some other unknown chemical process, may be still, and very probably is, going on, generating oil; or rather acting

on the highly carbonaceous limestones, of some chemically favoured localities, causing them to set free their carbon; while in others, which do not contain, in connection with their limestone, the necessary chemical re-agents, the carbon is retained in a crystalline or other state, in the containing rock, which otherwise refuses to give it up.

While chemistry has shed lustre upon many important facts, and rendered great aid in the solution of many doubtful geological problems; and its study, like that of the microscope, opened up to us, as it were, another new world of important enquiry and investigation, and drew aside the mantle of mystery in which multitudes of simple natural phenomena were previously shrouded, it may be said to be, as yet, in a comparative state of infancy; and that many unquestionable facts and operations of nature, wholly incapable of demonstration by any *known* chemical laws, are patent to our senses; amongst which the existence of chlorine, oxygen, &c., &c., in a solid state, in a great many of their components; the peculiar condition of water in a hydrated substance; and *the existence of carbon* in *meteoric stones*, which would tend to establish *its existence* among the *primary* elements and original components of the earth. Besides this latter, we have the further fact also, that, in many parts of the world during volcanic outbreaks, *petroleum* has frequently made its appearance in considerable quantities, from what we may presume to be the primitive formation, particularly at Mount Vesuvius in 1861, through fissures in the sea-bed, or around the volcanic vent. It is also known that small quantities of bitumen and petroleum are found in formations geologically far removed and far older than any coal-bearing strata. What is graphite, that abounds so extensively in the lowest as well as in the oldest formations in Canada, but mineralized carbon? Again, what is that precious gem, the diamond, which is also found in the oldest sedimentary drift deposits, but carbon in a peculiar,

but unknown chemical crystallized state? Why, therefore, may we not be allowed to class carbon as being amongst the primary elementary materials of which the earth is composed, instead of attributing its production to a subsequent and organic origin, that could not exist without its generation or absorption, in their system?—a very gratuitous but unwarrantable assumption.

But I am aware that in the face of universally admitted and established facts, such as the unknown operations of chemical agency in the conversion of carbon into mineralized graphite, or the crystallized diamond, &c., that there are certain chemico-geologists, who refuse to admit the explanation of any self-evident natural phenomena, not susceptible of being demonstrated by laboratory investigations. They hold that all the various forms of carbon, as well as the various compounds into which it enters, are necessarily of organic derivation. In view of the many recognized facts incapable of solution by our present comparatively limited chemical knowledge—some of which have been already noted—I cannot but think this view is too arbitrary and unfounded, and assumes too much.

It has been inferred by some that, because a few of the deep oil wells of Enniskillen became intermittent, and that others partially ceased flowing altogether, that the supply in such had, or soon would, become exhausted; and that it was only a question of a little time, with additional tapping and drainage, and the reservoirs—in which the animal and vegetable theories have placed it—would soon become emptied, and no future supply obtained. This supposition might hold good were that theory an established fact, or even admissible; but with all due respect for the learned promulgators of that view, I must, in the absence of further convincing evidence, dissent from it, and advance a more reasonable opinion—*That it is being constantly generated and produced by some peculiar but unknown chemical action, in self-forming fissures and ca-*

verns, amongst the fossiliferous and other carbonaceous rocks of the formations in which it is found, in quantities proportioned to the relative chemico-carbon-producing materials contained in the strata thus being acted upon; and that its existence in the older strata is attributable to the fact, that carbon is one of the primary elements of which the earth is composed, and is contained in, and chemically acted on, and discharged from these primative rocks in the form of liquid petroleum, by some unknown chemical agency; and that this chemical or formative process is constantly going on, supplying these cavities from whence it is obtained, just as the infiltration of water supplies the exhausted or over-pumped wells, the supply in which may, like many of the oil caverns, become temporarily exhausted, but never finally suspended or extinct till the materials from which their supplies are derived, become exhausted, or otherwise escape; or (in the case of the oil wells) the producing chemical cause ceases or becomes suspended.

In support of this view, I cannot, within my prescribed limits, be expected to give a detailed or any elaborate scientific dissertation, and shall therefore confine myself to the following brief facts.

The oil springs that supplied the petroleum used as cement in the erection of the Tower of Babel are still flowing in the vicinity of the remains of that ancient structure of folly; and oil producing wells have been in existence in eastern countries from a very early age, as at Burmah, Persia, and Zante, —the latter of which is mentioned by Herodotus—which have never ceased flowing and producing in those countries vast quantities of burning fluid or petroleum.

Again, compare the oil from the sand-well before and some time after it ceases flowing, and as you can readily perceive the difference in aspect between a new and old guinea, so will you also as easily recognize the contrast between the old and the new oil; for the latter bears striking evidence of its comparative newness of *manufacture*, while the former looks old,

If we accept the view that it is of organic origin, we must assume that the subterraneous caverns or reservoirs, in which it is contained, are of enormous dimensions; that the former accumulation of carbon-producing organic remains, of an unknown nature, in their immediate vicinity to such a vast amount as to produce the great quantities of mineral oil, that have been known to escape from their sources, must have been very great indeed—the assumptions are too great. But the production of such immense quantities as are now available for commercial purposes from these sources (were enterprising capital employed in their developement), and others in the United States, Canada, and elsewhere, render it in the highest degree very improbable, if not absolutely impossible, that this mineral has its origin *exclusively* in the perishable sea-weeds and defunct animal remains of former Devonean seas.

The limestones of oil-bearing formations are generally of marine origin and impregnated with saline water, holding in solution common salt, with lime and magnesia, as chlorites and sulphates. Similar salts will at first impregnate the overlying and accompanying argillaceous feldspathic sediments; and the slow decomposition of the feldspathic matter which they contain, yields out a portion of soda, as a soluble silicate, which will decompose the soluble salts of lime and magnesia present; which reacting on the carbonate of these bases, by a similar decomposition, gives rise to carbonate of soda. Hence mineral waters, which have their origin in argillaceous rocks, are found to be alkaline, from the presence of carbonate of soda.

These alkaline waters permeating the adjoining calcareous and feldspathic strata, displaces the earthy salts, and the marine limestone becomes impregnated with a solution of the carbonate of soda; which in turn is decomposed by the carbonate of lime, magnesia, &c., with the formation of the silicates of these bases. The regenerated carbonate of soda, being now set free,

again attacks and dissolves more silica; and thus continues the process of converting carbonates into silicates, with the disengagement of carbonic acid, which in turn acts violently on magnesian and other limestones with which it comes in contact, ending in the disengagement of their carbonaceous matter. This may be again acted upon by benzoic, hippuric, or sulphurous acid gasses, the latter of which is known to escape through natural and other cavities in oil-bearing regions,—or by some other means; amongst which we must not overlook the powerful reducing and dissolving agency of organic matter, in its containing rocks, as a very probable auxiliary, as before remarked respecting hippuric acid, in this chemical work of decomposition, and oil-producing process; by which is being rendered back to nature those primal elements of which the earth is composed, and from which their components were—more particularly carbon—in early epochs of the world's history, extracted in greater abundance than in after periods. For it appears evident that the proportion of the element (carbon) existing in a diffused state is much less now than it was at former sedimentary periods. This may be accounted for by the fact that, its previous absorption, from the terrestrial circulation, was more extensive and rapid in former geological epochs, as evidenced by its great abundance in all sedimentary strata, and coal deposits (which is just so much carbon withdrawn from atmospheric circulation) than in after periods. So that much of the rocky structure of the earth, when in a sedimentary condition, contained, not only the elements of its own consolidation, but those also of its subsequent decomposition and dissolution; and that this slow but certain process of building up, and pulling down, absorption, and subsequent decomposition, and dissolution, has been, and is imperceptibly, though certainly and surely going on, from the remotest period of formative antiquity to the present time—rendering back to nature the elements of their composition and organization,

which were originally abstracted from it, to undergo in perpetual mutation the same process, "till time itself shall be no more." And such is the case with all flesh when life's transient day is past. Its components—carbon, iron, lime, phosphorus, sulphur, &c.—are being constantly dissolved and rendered back to the dust from whence they sprung, to be absorbed and commingled with their kindred elements in nature's great digestive maw, and doomed to undergo the same mutative process through vast periods of time, till

> "The last loud trumpet's dreadful piercing sound,
> Shall through the rending vaults and tombs resound,
> And with voice of thunder, and terrific roar,
> Call forth from man's abode, and death's dark shore,
> All living nations, and departed dead,
> To meet the Judge, with trembling conscious dread."

When it is possible that some of our disintegrated atoms, when called forth in that dreadful day, may be found supplying the material for the lamp, the smith's forge, the plasterer's trowel, the apothecary's laboratory; or happily the *bung hole* of the wine merchant's cask of some future unborn generations yet to be (for nothing shall be lost)—sad reflection on the pompous arrogance and haughty pride of poor perishable man.

This subject, though now extended beyond the limit of my original design, might be instructively prolonged to a much greater extent, and might also appropriately be made to embrace a brief notice of the origin of the great coal deposits of the world, which, after the abstraction of the vast amount of carbon from atmospheric circulation, as before remarked, and its subsequent absorption by secondary formations, *are just as likely to have had their origin in the consolidation of liquid petroleum in low vallies, clothed with luxuriant verdure (the traces of which they yet retain) in recent ages of the world, as to attribute it to a purely vegetable origin.* But

however anxious, or instructive the enquiry may be to the earnest enquirer, the great length to which its discussion would lead, in order to give it any degree of justice, necessarily precludes the possibility of a further notice of the subject in this place.

I shall therefore conclude this part of my subject with the advice that, having pointed out the formations and localities in which natural oil is known to exist, and may be expected to be found; and seeing also that reason and experience have confirmed the fact, *that, it is at or along the crown of these anticlinals that petroleum centres or collects; we must, in order to be successful, look for these anticlinals in oil-bearing formations. They are sometimes (where not covered over by too much drift) marked by slight elevations on the surface; but it is only from a minute examination and measurement of the angular inclinations of the sub-strata that the precise locality of these anticlinals can be definitely determined. This is an easy process when exposures occur, or facts noted, in deep borings. For if, from the same surface level, several borings are made in an oil-bearing neighborhood in various given directions, and the several depths of the same strata noted, it would be easy to determine the inclination of the underlying strata, and where the crowns of the anticlinals are located, and may be found, and where borings may reasonably be expected to be successful in the production of liquid petroleum.*

To those who go exploring for other minerals, I would merely say: First acquire a sufficient knowledge of the rocky geological structure of the country, to enable you to readily distinguish the rock-masses of the various formations. Then, from comparison of circumstances, *search only in the matrix or vein-stone of these formations, in which, from analogy, the mineral searched for may be expected to be found*, and do not go blindly and indiscriminately to work, as is too often the case, in a general search through all the rocky formations, and all parts of them, for what may be a physical impossibility for the rocky structure of that formation to contain.

THE HAMILTON FORMATION

Consists, in Canada West, of all the strata between the Corniferous limestone and the Genesee shale, and occupies the lowest portion of the saddle-shaped depression, or synclinal crossing the anticlinal, noticed while treating of the Corniferous formation, as crossing the peninsula from Lake Huron to Lake Erie, and which separates the Corniferous into two areas. In consequence of superincumbent drift deposits, it is not easy to determine the precise boundaries of this formation. It, however, crosses the counties of Norfolk, Elgin, Kent, Middlesex, Lambton, and the southern part of Huron. Exposures occur in several places at Bosanquet, and on the G. T. Railroad, near the Widder station. Where exposed it consists of marls and clay, with occasional beds of intercallated limestone, the whole abounding in fossils. Its thickness is about 300 feet. It derives its name from "Hamilton," a village in Madison county, N. Y., and must not be confounded with "Hamilton city," in Canada West, which is situated on the Medina formation, and, geologically, much below the horizon of the Hamilton formation. American geologists usually divide it into three groups, the lowest consisting of dark bituminous schists, and known as Marcellus shales; the second is made up of argillaceous and other shales, flags, and limestones, which are sometimes overlaid by a bed called the Tully limestone. The third or uppermost group consists of dark shales, known as Genesee shales, which are sometimes, as with us, separated and classed with the succeeding Portage and Chemung group.

The first division is not known to enter Canada, but the second and third do; and the third is classed with the succeeding formation, leaving the second only to be classed as a distinct formation here. It is through this formation that the oil springs of Enniskillen, which are supposed to have their source in the underlying Corniferous strata, take their rise;

and in which numerous borings and surface wells have been sunk to variable depths, which in their descent, meeting with cavities connected probably with inticlinals, bring to the surface large quantities of crude oil, often accompanied by inflammable gas and saline water. It would appear from the strata passed through in sinking these wells and borings, that the formation is overlaid by a great drift deposit varying from 60 feet downward in thickness, and that it is underlaid by much soft shale, which at one place was penetrated to the depth of 224 feet below 60 feet of drift, without meeting with the limestone beneath.

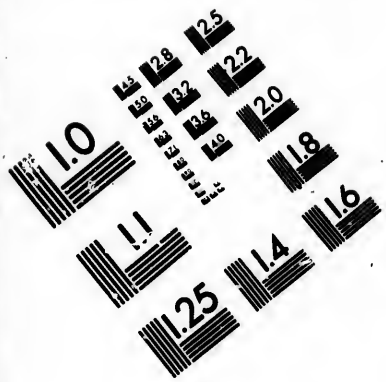
THE PORTAGE AND CHEMUNG GROUP

Consist, in Western Canada, of a few isolated patches of highly bituminous black shales, which are probably the equivalent of the Genesee slates so largely developed in Michigan and other districts of the U. S. These black shales are met with at Cape Ipperwash, or Kettle Point, in Bosanquet, on the shore of Lake Huron; at Kingston's Mills, Bear Creek, in Warwick; and at Brenan's Mills, in Brooke. It is not improbable, however, that further exposures may yet be found on the south side of the anticlinal near Lake Erie, underlying the drift. At Kettle Point, where a vertical section of some twelve or fourteen feet, of very fissile, black, bituminous shale, weathering to a leaden grey, and stained by brown oxyd of iron, are exposed, spheriodal concretions are found, whose fancied resemblance to inverted kettles, may have given rise to the name which the place bears. These shales abound in fossils and contain so much inflammable matter that they take fire and burn with a flame, after which they become brick-red.

The black colour and inflammable characteristic of these shales, like those of the Utica Formation, have led many to suppose that coal-beds might be found in their vicinity. Be-

tween these shales, however, and the nearest approach to the coal horizon in the southern peninsula of Michigan, there is wanting, in Western Canada, the remaining portion of this group, which in Michigan is 363 feet thick. Following this in ascending order, we have what has been named the Napoleon Group of sandstone, 123 feet thick; then the Michigan salt group, 184 feet thick, which consists of marls, dolomites, and beds of gypsum, yielding brine springs of great strength and purity. To this again succeeds 66 feet of carboniferous limestone, and 105 feet of sandstone, making 840 feet, before reaching the coal measures of Michigan, on the west side of Lake Huron. And, on the south side of Lake Erie, we have above the Hamilton formation, and its overlying black shales, a thickness of more than 10,000 feet, of silicious and argillaceous rocks, before reaching the coal measures of the Appalachian field. So that the probability of finding mineral coal in Western Canada is reduced to an almost physical impossibility, though greater quantities of an allied substance may be eventually found in greater abundance, in the drift and other deposits overlying the Corniferous formation, as that region becomes more developed, and being the immediate production of the oil contained in that strata.

CATALOGUE OF MINERALS.



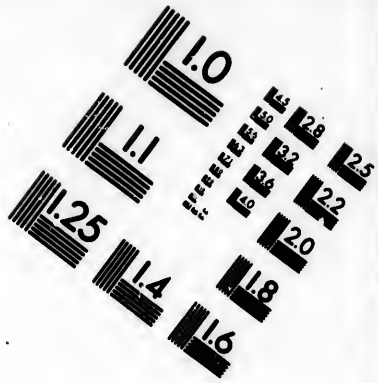
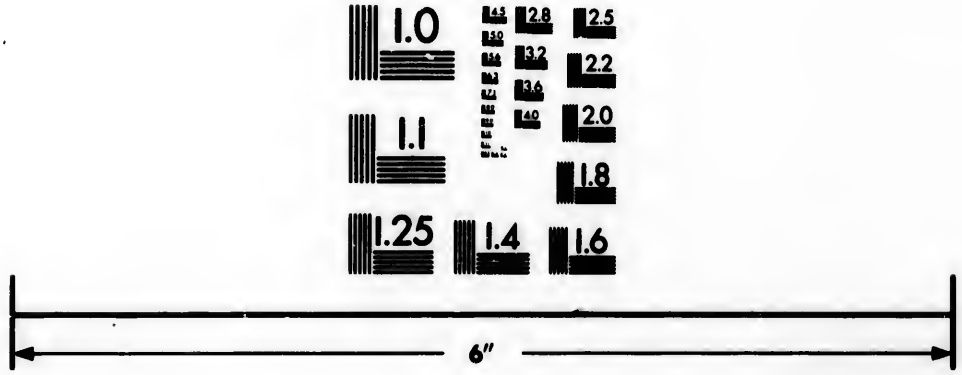


IMAGE EVALUATION
TEST TARGET (MT-3)



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A CATALOGUE OF 42 OF THE MOST VALUABLE ECONOMIC MINERALS,

WITH THEIR LOCALITIES DESIGNATED BY LOT, CONCESSION, OR OTHERWISE, THAT OCCUR IN WESTERN CANADA, EMBRACING OVER THREE HUNDRED LOCALITIES WHERE THEY MAY BE FOUND.

Township, &c.	Lot.	Con.	Remarks.
			AGATES.
Michipicoton Island	.....	.....	Agates are found along the shores and in many other places in the Huronian formation, and particularly at these places.
St. Ignace Island	.....	.....	
Thunder Bay	.....	.....	
			AMETHYST.
Bruce Mines	.....	.....	Large transparent prismatic crystals in quartz veins.
Lake Superior	.....	.....	In Trappean rocks along the north shore, in abundance.
			ARSENIC.
Michipicoton Island	.....	.....	Lake Superior—found in Copper and Nickel ore.
Bruce Mines	.....	.....	Lake Superior—found in Iron, Nickel and Sulphur ore.
Wallace Mines	.....	.....	Lake Huron—found in Iron, Nickel, and Copper ore.
			BITUMINOUS SHALE.
Bertie	.....	18	2	Oil oozes out in three places, from the shales.
Bosanquet	.....	.....	Cape Ipperwash, or Kettle Point, Lake Huron.
Brooke	.....	20	7	East branch of Bear Creek, at Branon's Mills.
Cape Smyth	.....	.....	Manitoulin Island—oil oozes out of the Utica shale.
Collingwood	.....	.....	Near the town, and formerly worked for oil.
Kincardine	.....	.....	6, 7	On the south line.

Warwick	7	8	On a branch of Bear Creek, near Kingston's Mills.
Whitby	.....	.....	Near the lake shore, at the town of Whitby.
Windsor	.....	.....	Near the town.
			BARYTA, SULPHATE OF.
Bathurst	4	6	A vein of white heavy Spar 1 foot wide, in Gneiss.
Bruce Mines	.....	.....	Found in small quantities at this place.
Burgess North	.....	.....	Occurs in Gneiss, about 1 foot wide.
Dummer	.....	.....	Said to be found in this township.
Fort William	.....	.....	Beds of Baryta are found here.
Lake Superior	.....	.....	68 miles east of Fort William and 8 miles east of Gravelly Point, on a lofty island; it is found in Porphyry fissures, and generally on the north shore of Lake Superior, in vein stones of copper lodes.
Lansdowne	.....	.....	Bed 28 feet long and 2½ feet wide.
McNab	.....	.....	At the mouth of the Dochart river.
Nipissing Lake	.....	.....	Iron Island—a vein 4 to 6 inches wide.
Niagara Falls	.....	.....	Small veins occur here.
Pigeon River	.....	.....	Lake Superior—found in considerable quantities.
Port Daniel	.....	.....	A vein occurs here, 1 foot wide.
Thunder Bay	.....	.....	Lake Superior—found in considerable quantities here.
			BERYL.
Rainy Lake	.....	.....	230 miles north west of Lake Superior—this mineral is found on the east side of the lake, in Porphyritic Granite.
			COBALT.
Elizabethtown	.....	.....	Extensive deposit of Iron Pyrites, holding Cobalt.

Township, &c.	Lot.	Con.	Remarks.
			COPPER ORE.
Bastard	24	10	A bed occurs on this lot, 2 to 5 inches thick.
Batchawanung Bay	.....	.....	North shore of Lake Superior.
Black River	.....	.....	Lake Superior—bed 25 to 30 feet wide, containing Copper, Pyrites, Molybdenum, Blende and Galena.
Bruce Mines	.....	.....	Bed 2 to 4 feet wide, worked by the Bruce Mining Company.
Burgess North	1, 2, 5	8, 9	Bed 6 to 8 inches thick and 300 feet long—Copper Pyrites.
Cape Gargantua	.....	.....	There is a rock here containing Native Copper.
Caribou River	.....	.....	On the east branch there is a vein from 2 to 5 inches thick.
Dorie River	.....	.....	Michipicoton Bay—Copper occurs in Greenstones and Slate.
Echo Lake	.....	.....	On the north side there is a deposit about 4 feet wide.
Edward's Island	.....	.....	Native Copper is found on the north side.
Fluor Island	.....	.....	South extremity is traversed by numerous veins holding Copper.
Hudson's Bay Post	.....	.....	Small portions of Copper Pyrites half a mile above the Post.
Kaministiqua River	.....	.....	Numerous veins holding Blende, Galena, Copper and Iron Pyrites.
Lake Nabiquekobing	.....	.....	At the east end of this lake there is a bed 2 feet wide.
Maskinonge Lakes	.....	.....	Numerous Copper veins and specks found at and about this locality; also at Lakes Matagamashing and Wahnapitiping and tributaries, Iron and Copper is found.
Meredith Locati	.....	.....	Copper and Galena—Montreal Mining Company.
Mica Bay	.....	.....	A deposit of Green Copper ore, 7 or 8 inches thick.
Mississague River	.....	.....	At the Grand Portage, several veins 2 to 4 feet wide containing Copper Pyrites, as well as others in the same locality.
Michipicoton Bay	.....	.....	Numerous Quartz veins holding Copper ore.

Michipicoton Island ..	.....	.....	On the north side, a soft Amygdaloidal bed holds Native Copper.
Otter Head	.....	.....	10 miles north of Michipicoton Island, Copper is found in abundance.
Pigeon River	.....	.....	Numerous veins at the mouth holding Copper ore.
Point Porphery	.....	.....	Several metal bearing veins occur in this locality.
Point Aux Mines	.....	.. ...	8 miles north of Mamainse Island, Copper is met with.
Root River	.....	.....	Lake Superior—this deposit is worked by Mr. A. Rankin.
Sand Bay to Mica Bay	.....	.....	20 miles, many deposits of ore are found between these places.
Simpson's Island.....	.....	.....	Copper ore is found on this island.
Spanish River	.....	.....	10 miles north of its mouth, there is a bed about 2½ feet wide.
St. Ignace Island	.....	.....	At the N. extremity, there is a bed 4 to 6 inches wide, 1 mile long.
Thunder Cape.....	.....	.....	Copper found in this locality.
Wallace Mines.....	.....	.....	Contains several deposits of valuable ore.
Wellington Mines	.....	.....	Lake Huron—1 mile north of the Whitefish river.
			FLUOR SPAR.
Gargantua Point	.....	.....	Lake Superior—found 3 miles east of this point.
Gravelly Point.....	.....	.....	Lake Superior—in Porphyry on an island opposite.
Niagara	.....	.....	Found crystalized with other Spars in this formation.
Nipissing Lake.....	.....	.....	In fissures in the Limestone on Iron Island.
Pic Island	.....	.....	Lake Superior—Purple Spar opposite this island, in Syenite.
Prince's Mines.....	.....	.....	Lake Superior—is found here in Quartz and Calcite.
Ross	.....	.....	In two places in crystalline limestone, associated with green Apatite.
			GOLD.
Michipicoton Island ..	.....	.....	Lake Superior—Gold has been found in a stream on this island.
Prince's Mine	.. ..	.....	Lake Superior—Gold and Silver has been found in calcareous spar.

Township, &c.	Lot.	Con.	Remarks.
			GRAPHITE.
Lutterworth	.....	.....	Extensive deposits occur in this and other townships in the northern part of Victoria county, of a very superior quality.
			GYPSUM.
Brantford	.....	.....	All these places produce large quantities of Gypsum, and it is extensively quarried and manufactured, and is to be found in many other places along the outcrop of the Guelph formation.
Cayuga	.....	.....	
Mount Healy	.....	.....	
Paris	.....	.....	
Seneca	.....	.....	
York	.....	.....	
			HYDRAULIC CEMENTS.
Alumette Island	.....	.....	All these localities, and many others where Magnesian Limestones are found, yield Hydralic Cement; and in some of these localities, particularly between Cayuga and Paris, it is mined to a considerable extent. This material will probably be found in other places, from Paris to Lake Huron, in the same formation.
Brantford	.....	.....	
Esquesing	.....	.....	
Hawkesbury	.....	.....	
Kingston	.....	.....	
Loughborough	.....	.....	
Nepean	.....	.....	
Point Douglas	.....	.....	
Rockwood	.....	.....	
Thorald, &c.	.....	.....	
			IRON—ANHYDROUS PEROXYD OF.
Bristol	2	1	Occurs at two places near Hudson's Wharf, in small quantities.

McNab	6	C&D	Important deposit on these lots, near the Fall of the Dochart, one-fourth of a mile from Lac des Chats.
			IRON—BLACK OXYD OF.
Hollow Lake	.....	.....	Magnetic Oxyd in fine grains, in large quantity.
Sarnia	.....	.....	A bed in fine sand-like grain, near the town.
			IRON—BOG.
Bastard	21	7	The extent of this deposit is not known—2 feet thick.
Camden	13	B	Occurs in quantity 1 mile above Monk's Mills.
Charlotteville	4	3	Occurs in these lots as well as in other places in the neighbourhood of the lake shore.
" "	6,13,14	6	
Eardly	21	8	Found at Upper Rocky Point, 6 inches broad.
Fitzroy	.....	.....	Found near the Chats.
Hull	14	17	Found on this lot.
March	.....	.....	On the shore of Lake Constance.
Middleton	17	31	North of the Talbot road.
" "	.....	8	On Venison Creek.
Templeton	.....	.....	On the Riviere Blanche, above McArthur's Mill.
Windham	12	14	Found on this lot.
			IRON—CARBONATE OF.
Echo Lake	.....	.....	Occurs with Copper Pyrites in a Quartz vein.
			IRON—MAGNETIC.
Bedford	21	9	Bed 364 ft. thick; and also found on 6 in the 3rd, 8 in the 4th, and 25 in the 5th concessions.
Belmont	8	1	A succession of beds 500 feet wide—may connect with Marmora.

Township, &c.	Lot.	Con.	Remarks.
			IRON—MAGNETIC (*continued*).
Escott	7	2	Bed 6 to 7 inches wide, 50 yards long, contains Copper Pyrites in considerable quantity.
Grandison	.....	.....	Bed 20 feet thick.
Grenville	S ½ 3	5	Bed 7 or 8 yards wide and 350 feet long; also on No. 3, 4, 5, in the 4th, 7th, 8th concessions.
Hull	S ½ 11, 12	7	A large deposit 90 feet thick.
Madoc	11	5	Bed 20 to 30 feet wide, 2 miles long. The cross bands possess magnetic polarity.
Marmora	9	8	The ore is found disseminated through the rock.
" "	12	8	This deposit is 20 to 30 feet wide and 300 yards long.
Seymour	25	12	This bed is 30 yards wide.
South Crosby	26, 27	6	Bed 200 feet thick and 6 or 7 miles long.
South Sherbrooke	14	1	Bed 12 feet thick.
" "	17, 18, 19	8	A bed 60 feet thick crosses these lots.
Wentworth	26	6	Two beds 100 yards apart and half a mile long.
			IRON—OCHRE.
Nassagaweya	....	.....	In abundance at McKann's Mills and other places in the Clinton formation.
Nottawasaga	2	11	South side, river bed, 2 to 3 feet thick—Chalybeate Springs.
Owen Sound	.....	.....	A bed over 4 ft. thick, at the foot of a hill in the Clinton formation.

			IRON—PYRITES.
Elizabethtown	19	2	Near Brockville, a large mass holding Oxyd of Cobalt.
Mud Turtle Lake	.....	.....	Summerville—Found in small quantities around this lake.
			IRON—SPECULAR.
Ancaster	.....	.....	
Bastard	.....	.....	A thin bed is exposed, with many indications.
Iron Island	25	10	Bed 50 feet wide and 3 feet thick.
Lansdowne	.....	.....	Lake Nipissing—bed 40 yards wide half a mile long.
Ramsay	9	12	Indications of ore are found on this lot.
Wallace Copper Mines	.....	.....	Indications are met with in many places in this township.
	.....	.....	Lake Huron—a small deposit occurs here.
			JASPER.
Bruce Mines	.....	.....	L. H.—imbedded in white or greenish Quartzite of a brilliant color.
Lake Huron	.....	.....	Is found in abundance on the north shore and Bruce Mines.
			LABRADORITE.
Georgian Bay	.....	.....	This beautiful brilliant ornamental stone forms a breadth of 5 miles on the Georgian Bay, 90 miles east of French River, 60 miles west of Penetanguishene; and along the valley of the Ottawa it may be found in many places.
Ottawa	.....	.....	
			LEAD—GALENA.
Bedford	18, 19, 21	8	A bed 4 feet wide and 1 to 2 inches thick.
" "	19	7	5 parrallel lodes within ¼ mile; 1 mile east there are others.
" "	18	5	Bed 16 feet deep and 6 inches wide.
Black River	.....	.....	L. S.—a vein at the mouth 1½ to 5 feet broad, holding Iron Pyrites.

Township, &c.	Lot.	Con.	Remarks.
			LEAD—GALENA (*continued*).
Fitzroy	20	8	Lode about 6 inches wide.
Granite Island	.....	.....	Lake Superior—vein about 12 inches broad.
Lansdowne	2, 3	8	Lode about 2 feet wide and a quarter mile long.
" "	3	8	Lode 6 to 12 inches broad and 50 feet deep.
Meredith's Location	.....	.....	Lake Superior—Mamainse—found in small quantities.
Ramsay	3	6	Lode 1 mile long and 2½ feet broad, contains Iron Pyrites, Copper Pyrites, and Blende.
			LIMESTONES.
Amherstburg	.....	.....	Limestone found here, suitable for building and other purposes.
Balsam Lake	.....	.....	Excellent Limestones found at and around this lake.
Bowmanville	.....	.....	Good Limestone quarries found here.
Cornwall	5, 6	2	Two beds of Black Limestone, each 3 to 5 feet thick.
Charlottenburg	.....	.....	Good beds of Black Limestone found here.
Dummer	.....	.....	Good Limestones found here.
Elizabethtown	.....	.....	Crystalline Limestone is found here.
Eramosa	.....	.....	Furnishes excellent Limestone for building and other purposes.
Finch	.....	.....	Good beds of Black Limestone found here.
Galt	.....	.....	Good Limestone for architectural purposes.
Goderich	.....	.....	And other places in the Corniferous formation furnish good stone.
Guelph	.....	.....	And other places in the Niagara formation furnish good stone.
Hespeler	.....	.....	Excellent Limestone found here.
Hawkesbury, E. & W.	.....	.....	Beds of fine Limestone occur here.
Kenyon	.....	.....	Affords a good Grey Limestone.

Kingston	.....	.....	Good Limestones found in this neighbourhood.
Lake Simcoe	.....	.....	Abundance of Limetone flags all around this lake.
Lancaster	.....	.....	Beds of Black Limestones found here.
Lochiel	.....	.....	Grey Limestone is found here.
McNab	.....	.....	Crystalline Limestones are found here.
Niagara	.....	.....	Beds of fine Limestone occur at and about.
Oshawa	.....	.....	Some good Limestones found here.
Owen Sound	.....	.....	And many other places in the Niagara formation.
Prescott	.....	.....	Good quarries are found both above and below Prescott.
Puslinch	.....	.....	Affords a good Limestone.
St. Mary's	.....	.....	Good Limestones for building purposes are found here.
Thorald	.....	.....	Limestones suitable for building and burning purposes.
Winchester	.....	.....	Beds of Black Limestone found here.
			LITHOGRAPHIC STONE.
Brant	8	7	Oxbow, on the Saugeen river, a very good Stone is found half a mile south of Walkerton, in the bed of a small stream.
Hungerford	12	10	At the edge of the river, below the mills, the bed is 8 to 9 inches thick, and may be found at the base of the Trenton formation in many places from there to Rama.
Malden	.....	.....	Near Amherstburg. Buff coloured and whitish grey.
Marmora	.....	.....	Iron works on the Crow river, several good beds occur.
Rama	.....	.....	In several places at the base of the Trenton formation.
Summerville	.....	.....	Near Cobokonk village.
			MANGANESE.
Batchawanung Bay	.....	.....	Lake Superior—bed 50 to 60 feet wide holds Manganese.

Township, &c.	Lot.	Con.	Remarks.
			MARBLE AND SERPENTINE.
Arnprior		.....	At Arnprior Mills, where it is manufactured.
Barrie	27, 28	9, 10	A fine white variegated Marble is obtained here.
Bastard		.....	Near Beverly; quarried for tombstones.
Burgess		.....	Olive, green and red coloured Serpentine.
Cornwall		.....	Point Clare—two beds of black Marble.
Dudswell	22	7	Affords great varieties of different coloured Marble.
Elziver	.....	.....	A good white Marble is obtained here.
Madoc	18	7, 8	White Magnesian Limestone suitable for Marble.
Marmora	.....	.....	Near the Marmora Iron Works.
McNab		.. ...	At the mouth of the Madawaska river—marble.
Packenham	.....	.....	Chocolate coloured fine grained Marble.
Seymour	.....	.....	4 miles below Allan's Mills—red, orange, blue and green Marble.
Wentworth	18	1	Serpentine and Limestone; would make fine Marble.
			MOLYBDENUM.
Black River	.....	.....	Lake Superior—small quantities found here.
Mud Turtle Lake	.....	.....	Small quantities found at this and other places and lakes in North Victoria.
Terrace Cove	.....	.....	Small quantities found in Quartz veins.
			NICKEL.
Elizabethtown	.....	.....	Is found in a bed of Iron Pyrites, near Brockville.
Michipicoton Island	.....	.....	Silver associated with Copper in Amygdaloid.
Wallace Mines	.....	.....	Silver associated with Sulphuret of Iron and Arsenic.

PEAT.

Beckwith	.....	3, 8	Found in considerable quantities in those concessions.
Caledonia	.....	.....	Bed about 3 or 4 feet thick.
Clarence	.....	.....	Is found in this township in considerable quantity.
Cumberland	.....	.....	Found here in considerable quantity.
Finch	.....	.....	Occurs on the Rain river.
Gloucester	.....	3,4,5	About 5,000 acres; 8, 15 to 21 feet deep.
Grenville	1, 4, 5	.....	Bed about 36 acres; 10 feet deep.
Harrington	4, 5	1	Bed 40 acres; depth various, from 10 to 25 feet.
" "	12	5	Bed 60 acres; depth about 25 feet.
Huntly	.....	9, 10	2,500 acres; 8, 12, to over 20 feet deep.
Nepean	.....	.....	Three areas of about 1,000 to 3,000 acres each occur here.
Osnabruck	.....	.....	Peat is found on the Rain river.
Roseburgh	.....	.....	Peat is found on the Rain river.
Sheffield	12	4, 5	300 to 400 acres; about 4 feet thick.
Westmeath	.....	1, 5	And in the rear of front A; about 3,000 acres.
Ottawa & St. Lawrence	.....	.....	In the level section of country lying between the Ottawa and St. Lawrence rivers large Peat bogs occur.

PETROLEUM, BITUMEN AND ASPHALTUM.

Bertie	13	2	In three places, both solid and liquid.
Cornwall	.....	.....	A black carbonaceous matter, similar to that at Bertie, is found in coral cells in the Trenton formation here.
Dereham	.....	.....	Near Tilsonburg, &c., are oil springs and wells.
Enniskillen	.....	.....	There are numerous springs and wells here affording large quantities of oil, as well as many layers of solid bituminous matter, in different parts of the township.
Jarvis	.....	.....	One mile west of the village, Petroleum is found.

Township, &c.	Lot.	Con.	Remarks.
			PETROLEUM, BITUMEN AND ASPHALTUM (*continued*).
Kincardine	6, 7	.....	Asphaltum and Shales are found in S. line, yielding 18 per cent. of Petroleum.
Lancaster	.....	.....	Found in cavities in Limestone in the Trenton formation.
Manitoulin Island	.....	.....	Petroleum runs from a spring at Cape Smyth.
Mosa	.....	.....	Wells and springs; probably on the Main Anticlinal.
Niagara Formation	.....	.....	The Dolomites of this formation are very bituminous.
Orford	.....	.....	Affords Oil from wells and springs, and is on the Main Anticlinal.
Packenham	.....	.....	Mineral Oil is found in this township in large orthocerate cavities.
Rainham	.....	.....	Fossil cavities are found filled with Oil here.
Thames River	.....	.....	Several springs are known along the valley of this stream, as well as that of Oil Creek.
Wainfleet	.....	.....	Gravelly Bay—Oil is found similar to that of Bertie.
			ROOFING SLATE.
Lake Superior	.....	.....	Kaministiqua River } May also be found in many other places at
" "	.....	.....	On Slate Island ..... } Lakes Huron and Superior, in the Huronian
" "	.....	.....	Ance a la Bouteille } formation.
Papoonge, Kaministiqua R., L. S.	1, 2 12 1–8	1 2 3	Good slates on these lots near the head of navigation. Belongs to Mr. Alderman Vickers, Toronto.
Temmiskimang Lake	.....	.....	Up the Montreal River, three miles from the lake.

			SANDSTONE.
Bedford	.....	.....	From Bedford in the W. via Perth, to Brockville in the E., a multitude of exposures of very fine Sandstones occur. In some places the beds are massive and of fine quality.
Brockville	.....	.....	
Cayuga North	46, 47, 48, 49	1	N. Talbot road—large exposures worked for millstones.
Dundas	.....	.....	The band of Sandrock is 12 feet thick in this township.
Esquesing	.....	.....	Near Georgetown, on the Grand Trunk Railway, exposures occur.
Hamilton	.....	.....	In its neighbourhood and vicinity exposures occur.
Hawkesbury	.....	.....	Grenville canal locks are made of stone from here.
Alumette Island	44, 45, 46, 47, 48	5	Beds 3 or 4 feet thick occur here.
Matchedash Bay	.....	.....	A fine grey Sandstone is found at the mouth of Coldwater river.
Nepean	26, 27, 28	5 6	Extensive exposures occur here.
Nottawasaga	.....	.....	It is here employed for the manufacture of grindstones.
Oneida	46, 47, 48, 49	...	Large exposures occur here, some suitable for millstones.
Pembroke	.....	.....	About 4 miles below the village, good Sandstones are found.
Perth	.....	.....	Sandstones of good quality are found here.
Ramsay	.....	.....	A good Stone is obtained here.
Waterdown	.....	.....	The band of Sandrock is 12 feet thick here.
			SELENITE.
Manitoulin	.....	.....	Found on this island.
Niagara Falls	.....	.....	At and about the Falls.
Simcoe Lake	.....	.....	Near the mouth of the Severn river.

Township, &c.	Lot.	Con.	Remarks.
			SILVER.
Black River.....	.....	.....	Lake Superior—the Galena from these two places gives 30 oz. to the ton of Lead.
Mamainse...	.....	.....	
Michipicoton Island...	.....	.....	L. S.—small quantities of silver is associated with Calcareous Spar.
Prince's Mine	.....	.....	L. S.—Silver and Gold has been found in Calcareous Spar.
St. Ignace.....	.....	.....	Silver is associated here with Sulphuret of Iron and Arsenic.
			STEATITE—SOAPSTONE.
Elziver.....	.....	.....	The only known deposit of this useful mineral that we are aware of in Canada West (unless it is found in the Western oil regions) occurs in Gneiss rock in the township of Elziver.
			SULPHUR.
Charlotteville	.....	.....	The deposits of Sulphur at these places are no doubt occasioned by the numerous springs which are impregnated with sulphuretted hydrogen in these and other places in Canada West.
Clinton.....	.....	.....	
Lutterworth.....	.....	.....	
Niagara, &c.	.....	.....	
			URANIUM.
Mamainse.....	.....	.....	L. S.—In a vein 2 in. wide at the junction of the Trap and Syenite.
			WHETSTONES AND GRINDSTONES.
Allumette Falls	.....	.....	Good Stones found here in the Chazy formation, and at the Chats and Whetstone Point on Chaudiere Lake, and several other places.
Chats.....	.....	.....	
Chaudiere Lake	.....	.....	

Collingwood, &c.	.....	.....	Good Stones are prepared here from fine grained Sandstone of the Hudson River formation.
Madoc	4, 5	6	A good material for common Whetstones occurs here.
Maskinongi River and Lakes	.....	.....	Abundance of good material here of a very fine silicious quality, suitable for the manufacture of whet and honestones.
Nottawasaga.....	.....	.....	Grindstones and coarse Whetstones are made here.
Ottertail Lake.....	....	.....	On the Thessalon River, a fine grained stone suitable for the manufacture of Honestones is abundant, as well as in other parts of the Huronian formation.

ZINC.

Prince's Mine	.....	.....	L. S.—Abundance in veins of Copper Glance and Native Silver here, and is found at other places on N. shore.

ZIRCON.

Grenville	.....	.....	Found in some abundance in Calc, Sphene, and Plumbago.
Pic Island	.....	.....	L. S.—In small crystals in Feldspar and Hornblende.

GLOSSARY.

INDEX.

ERRATA.

Page 9, in the last line, for "compassing" read "composing."

" 10, in the 8th line from the bottom, omit the word "it."

" 18, in the 12th line from the bottom, after "St. Lawrence," supply the word "and."

" 23, top line, for "mesazoic" read "mesozoic."

" 25, in the 13th line from the top, and after the word "series" supply the following omission: "and the lower of these series will be sub-divided into the Potsdam, Calciferous, Chazy, Trenton, Utica, and Hudson River; the Middle, into the Medina, Clinton, Niagara, and Guelph; and the Upper Series, into the Onondaga and Lower Helderberg formations and groups."

" 26, in the 4th line from the bottom, for "Greenville" read "Grenville."

" 38, in the 10th line, for "Normandy" read "Normanby."

" 52 & 53, 56, for "Oxford" read "Orford."

ERRATA.

Page 3, in the last line, for "compressing" read "compressing."

" 10, in the 8th line from the bottom, omit the word "it."

" 18, in the 17th line from the bottom, after "to Lawrence,"
add "of the old."

" 23, top line, for "immediate" read "intermediate."

" 29, in the 3rd line from the top, and after the word "prefer"
supply the following sentence:—"and the Lower and Upper
portion will be equally well for the Gardens, Orchards,
Parks, Pastures, and Hay Fields, and Shelter, the Middle,
being the Best Land, Steepest, and Sharpest, and
the Upper Strata, for the Quarries and Lower and
Shelving Banks and Copses."

" 30, in the 4th line from the bottom, for "Hemsville" read
"Gloucester."

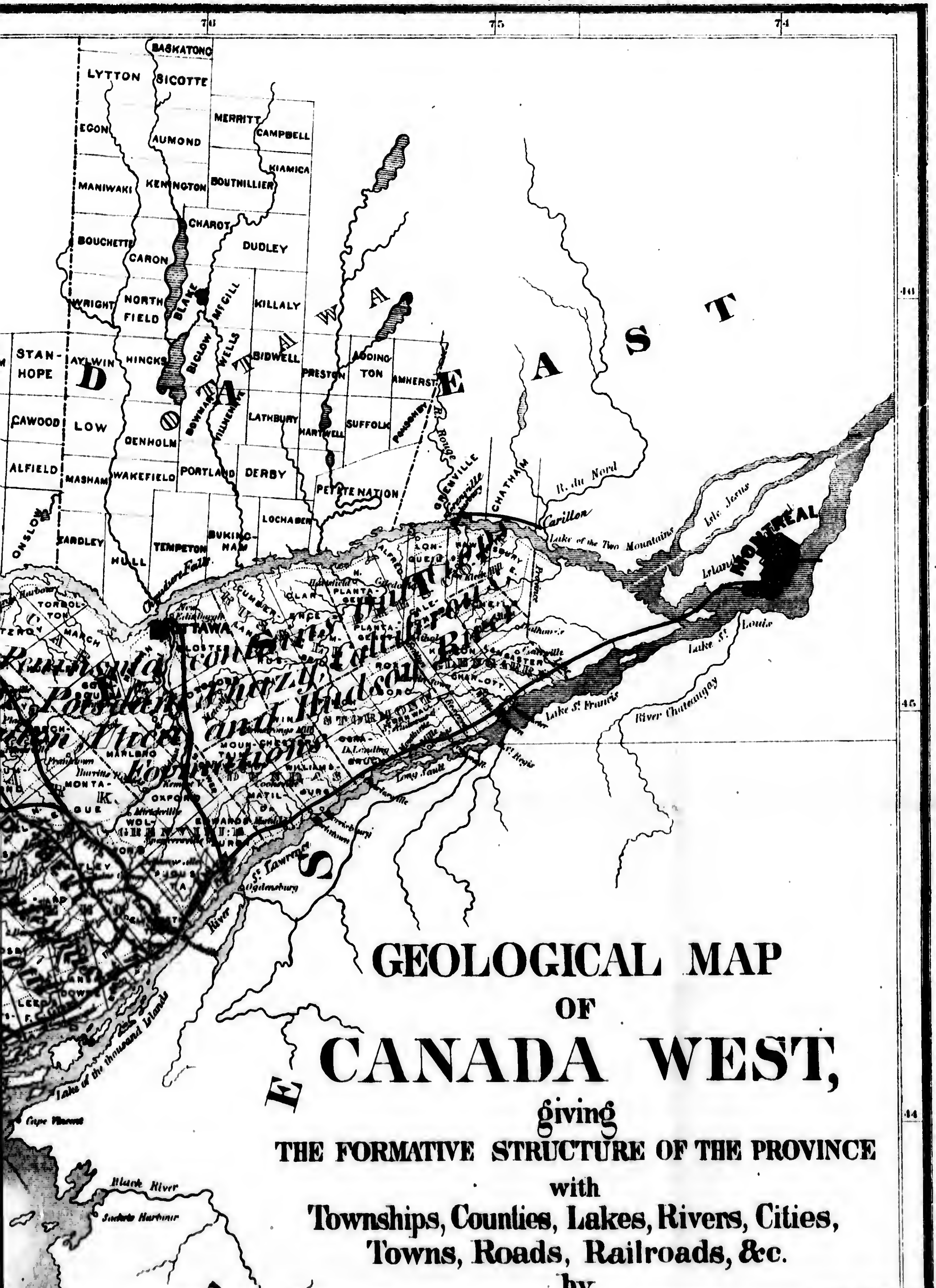
" 85, in the 3rd line from the bottom, for "Newmarket," read "Newmarket."

" 42 & 86, for "Carlow" read "Orford."

84
83
82
81
46
45
44
HURONIAN, F.
GLADSTONE
BRIGHT
THOMSON
COBDEN
ESTEN
SPRAGGE
LEWIS
TENNYSON
SHAKESPEARE
BALDWIN
VICTORIA
SALTER
HALLAM
MERRITT
The Mountains above the Sea
North Channel
Drummond Id
Cockburn Id
Barrie Id
GREAT
ISLAND
Western Id
BIDWELL
SHEGUIANDAH
SANDFIELD
ASSIGNACK
TEHKUMMAH
These Islands with part of the Coast are composed principally of the Trenton, Hudson River, Utica, Clinton and Medina Formations
to Collingwood
French River
Byng Inlet
Squaw Id
Lonely Id
Fitzwilliam Id
Bears Rump
Flower Pot Id
Isle of Caves
Cape Hurd
Wingfield Pt
Cabots Head
Dyer Bay
ST EDMUND
LINDSAY
EASTNOR
ALBEMARLE
AMABEL
GEORGIAN BAY
LAKE HURON
595 feet above the Sea
75 fathoms deep.
Thunder Bay
SAGANAW BAY
Lyell Id
Christian Id
Hope Id
Franklin Id
Parry Sound
MOWAT
WALLBRIDGE
Nottawasaga Bay
Owen Sound
Chantry Id
Douglas Pt
Pentangore
Clark Pt
Port Albert
Goderich
BRUCE
HURON
ARRAN
DERBY
SULLIVAN
EUPHRASIA
COLLINGWOOD
CULROSS
CARRICK
ROSS
PROTON
EGREMONT
LUTHER
HOWICK
MINTO
MORRIS
WALLACE
GREY
ELMA

DIEU ET MON DROIT
LAKE NIPISSING
French River
Byng Inlet
Franklin In.
Parry Sound
Gibson's Mill
Hope I.
Christian I.
Nottawasaga Bay
COLLINGWOOD
LAURENTIAN
TRENTON
BOUNDARY BETWEEN THE GNEISS & TRENTON
GENERAL EASTERN BOUNDARY
OPEONGO L.
Ottawa or Grand River
PEMBROKE AND MATTAWAN ROAD
Ottawa and Opeongo Road
Petewawa River
Allumette Island
Pembroke
Madawaska River
LAKE SIMCOE
DURHAM
PRINCE EDWARD
C
A
F.
GRAHAM
GLADSTONE
LABOUCHERE
KIRKBY
ABERFORD
HASTINGS
ABERDEEN
ESHER
SHEEN
CHICHESTER
PONTEFRACT
WHATHAM
MANSFIELD
NIPISSING
CHEWETT
LAMONTAIN
BALDWIN
COLLINS
PAPINEAU
MATTAWIN
CLARA
MARIA
HEAD
WESTMEATH
ROSS
FRASER
WILBERFORCE
ALGONA
BRUDENELL
GRATTAN
BURNS
RICHARDS
MURCHISON
JONES
SHERWOOD
HAGARTY
NIGHTINGALE
AIRY
LYELL
LAWRENCE
LIVINGSTONE
MC CLINTOCK
FRANKLIN
BRUNEL
STEPHENSON
MOWAT
BLAIR
WALLBRIDGE
BROWN
MC KENZIE
HAVELOCK
EYRE
CLYDE
SABINE
SHERBORNE
GUILFORD
HARBURN
BRUTON
MCCLURE
WICKLOW
CARLOW
RAGLAN
LYNDOCH
GRIFFITH
BROUGHAM
BLITHFIELD
MACAULAY
MCLEAN
RIDOUT
STANHOPE
HARCOURT
DUDLEY
CARDIFF
MONCK
DRAPER
OAKLEY
MINDEN
DYSART
MONMOUTH
FARADAY
DUNGANNON
MAYO
EFFINGHAM
ABINGER
MILLER
CANONTO
LONGFORD
SNOWDON
GLAMORGAN
CHANDOS
WOLLASTON
LIMERICK
CASHEL
ANGLESEA
BARRIE
CLARENDON
DALTON
DIGBY
CAVENDISH
ANSTRUTHER
BURLEIGH
TUDOR
GRIMSTHORPE
ELZEVIR
KENNEBEC
OLDEN
HINCHINBROOKE
MARA
ELDON
FENELON
VERULAM
SMITH
DOURO
DUMMER
BELMONT
HUNTINGDON
HUNGERFORD
ORO
GEORGINA
MARIPOSA
MANVERS
CAVAN
CLARKE
HOPE
HALDIMAND
HAMILTON
SOPHIASBURGH
MARYSBURGH
HALLOWELL
AMELIASBURGH
HILLIER
ATHOL
TAY
MEDONTE
MATCHEDASH
PROTON
LUTHER
100 Miles
Hamilton to Cape Vincent 190 Miles

C A N A D A
GRAHAM
GLADSTONE
LABOUCHERE
KIRKIBY
ABERFORD
HASTINGS
ABERDEEN
ESHER
SHEEN
CHICHESTER
PONTERFRACT
WALTHAM
MANSFIELD
HOODERSFIELD
CLAPHAM
STAN-HOPE
AYLWIN
HINCKS
LYTTON
EGAN
MANIWAKI
BOUCHETTE
CARON
WRIGHT
NORTH FIELD
LESLIE
CAWOOD
LOW
DENHOLM
THORNE
LITCHFIELD
ALFIELD
MASHAM
WAKEFIELD
CLARENDON
BRISTOL
ONSLOW
EARDLEY
HULL
PEMBROKE AND MATTAWAN ROAD
CLARA
MARIA
HEAD
WESTMEATH
ROSS
HORTON
MACNAB
FITZROY
TORBOLTON
MARCH
GENERAL EASTERN BOUNDARY OF THE ...
OPEONGO L.
Ottawa
RICHARDS
BURNS
FRASER
WILBERFORCE
ALGONA
GRATTAN
MURCHISON
AIRY
NIGHTINGALE
LIVINGSTONE
LAWRENCE
SABINE
LYELL
JONES
SHERWOOD
HAGARTY
BRUDENELL
SABASTOPOL
RADCLIFFE
LYNDOCH
GRIFFITH
BROUGHAM
BLITHFIELD
CLYDE
EYRE
HAVELOCK
SHERBORNE
STANHOPE
GUILFORD
HARBURN
BRUTON
MCCLURE
WICKLOW
CARLOW
RAGLAN
BAGOT
MAYO
ASHBY
DUNGANNON
CASHEL
EFFINGHAM
ABINGER
MILLER
CANONTO
DALHOUSIE
DYSART
DUDLEY
HARCOURT
CARDIFF
FARADAY
MINDEN
MONMOUTH
GLAMORGAN
SNOWDON
CHANDOS
ANSTRUTHER
CAVENDISH
WOLLASTON
LIMERICK
ANGLESEA
BARRIE
GRIMSTHORPE
TUDOR
ELZEVIR
HUNGERFORD
HUNTINGDON
MADOC
KENNEBEC
OLDEN
HINCHINBROOK
STORRINGTON
KINGSTON
SMITH
DOURO
DUMMER
BELMONT
SEYMOUR
CAMDEN
MARLBOROUGH
MONTAGUE
OXFORD
MANVERS
CAVAN
HAMILTON
HALDIMAND
CRAMAHE
AMELIASBURG
SOPHIASBURGH
HILLIER
HALLOWELL
MARYSBURGH
ATHOL
PRINCE EDWARD
GRAND TRUNK RAILWAY
CNEISS & TRENTON
POTSDAM
Lake of the thousand Islands
Wolf Island
Cape Vincent
Black River
Sackets Harbour
100 Miles
Hamilton to Cape Vincent 190 Miles
O


76
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46
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BASKATONG
LYTTON
SICOTTE
MERRITT
CAMPBELL
ECON
AUMOND
KIAMICA
MANIWAKI
KENSINGTON
BOUTHILLIER
CHAROT
BOUCHETTE
CARON
DUDLEY
WRIGHT
NORTH FIELD
BLAKE
McGILL
KILLALY
STAN-HOPE
AYLWIN
HINCKS
BIGLOW
WELLS
BIDWELL
PRESTON
ADDING-TON
AMHERST
CAWOOD
LOW
LATHBURY
HARTWELL
SUFFOLK
DENHOLM
ALFIELD
MASHAM
WAKEFIELD
PORTLAND
DERBY
PETITE NATION
GRENVILLE
CHATHAM
R. du Nord
Carillon
LOCHABER
EARDLEY
HULL
TEMPETON
BUKING-HAM
Lake of the Two Mountains
Isle Jesus
MONTREAL
Lake St. Louis
Lake St. Francis
River Chateaugay
St. Regis
Long Sault
MARCH
MARLBRO
OXFORD
St. Lawrence
Ogdensburg
Lake of the thousand Islands
Cape Vincent
Black River
O T T A W A
E A S T

GEOLOGICAL MAP
OF
CANADA WEST,

giving

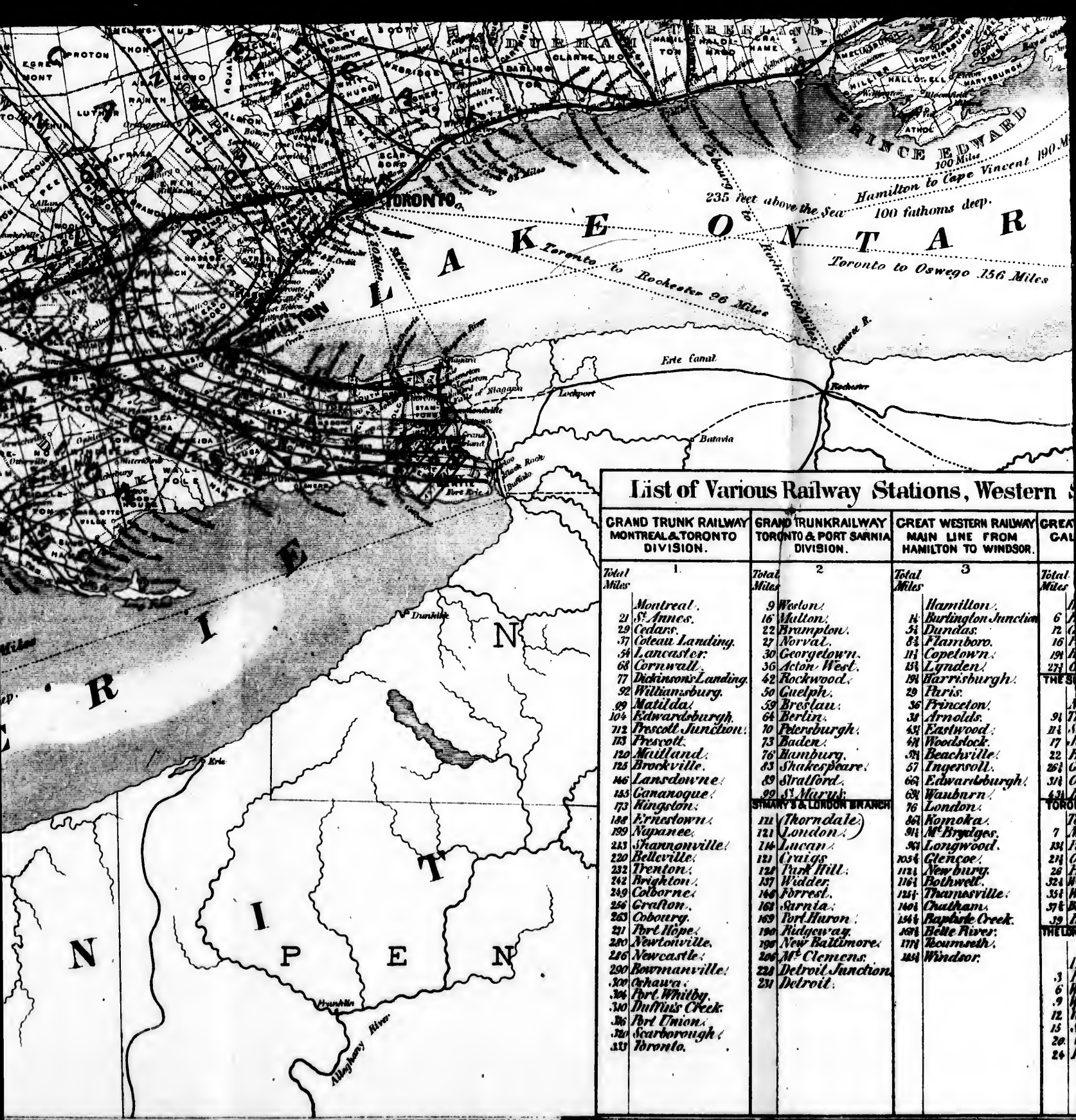
THE FORMATIVE STRUCTURE OF THE PROVINCE

with

Townships, Counties, Lakes, Rivers, Cities, Towns, Roads, Railroads, &c.

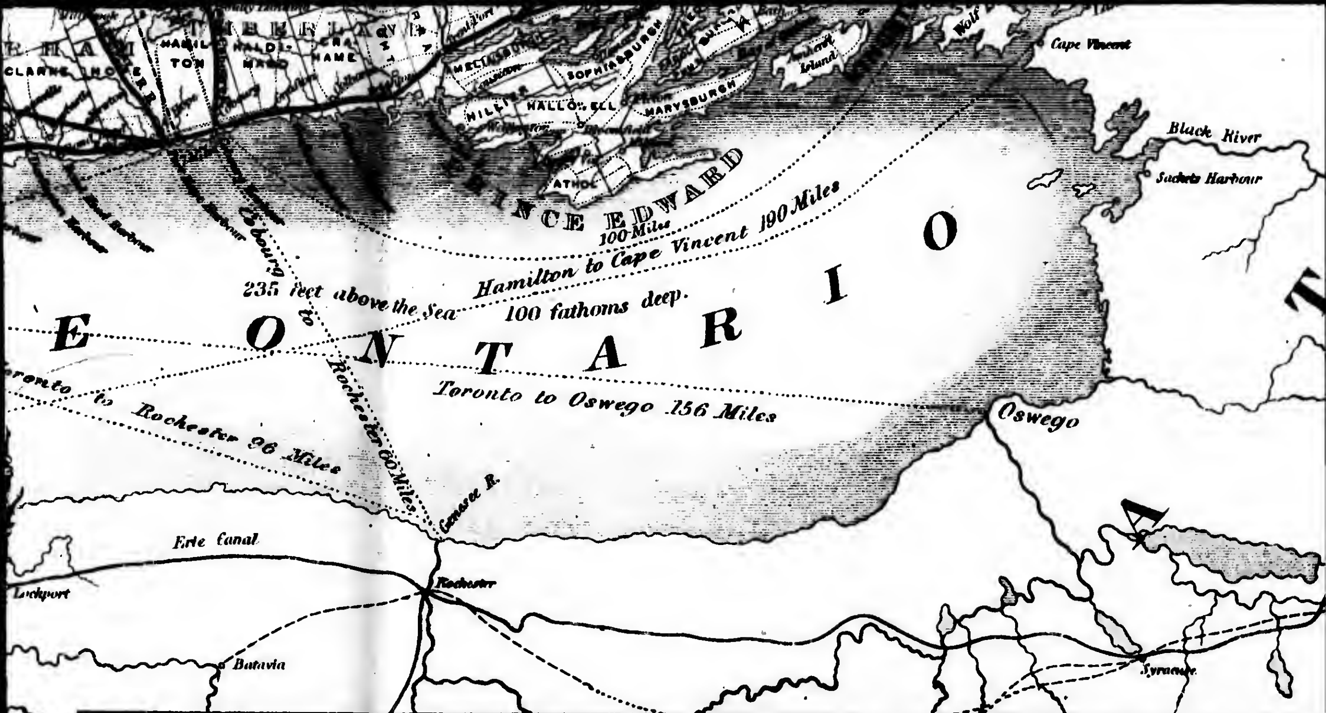
by

PORTAGE AND CHEMUNG FORMATION
HAMILTON FORMATION
CORNIFEROUS FORMATION
Detroit & Goderich 125 Miles
Detroit to Buffalo 240 Miles
18 fathoms deep.
564 feet above the Sea
LAKE ST CLAIR
LAKE ERIE
Port Albert
Goderich
Bayfield
Port Huron
Detroit
Newport
Cleveland
Fairport
Pt. Pele
Pele I.
CHATHAM
Louisville
O H I O



List of Various Railway Stations, Western

GRAND TRUNK RAILWAY MONTREAL & TORONTO DIVISION.		GRAND TRUNK RAILWAY TORONTO & PORT SARNIA DIVISION.		GREAT WESTERN RAILWAY MAIN LINE FROM HAMILTON TO WINDSOR.		GREAT WESTERN RAILWAY GALT
Total Miles	1.	Total Miles	2	Total Miles	3	Total Miles
	Montreal.	9	Weston.		Hamilton.	
21	St. Annes.	16	Malton.	4½	Burlington Junction	6
29	Cedars.	22	Brampton.	5¾	Dundas.	12
37	Coteau Landing.	27	Norval.	8¾	Flamboro.	16
54	Lancaster.	30	Georgetown.	11¾	Copetown.	19¼
68	Cornwall.	36	Acton West.	15¾	Lynden.	27¾
77	Dickinson's Landing.	42	Rockwood.	19¼	Harrisburgh.	THE S
92	Williamsburg.	50	Guelph.	29	Paris.	
99	Matilda.	59	Breslau.	36	Princeton.	
104	Edwardsburgh.	64	Berlin.	38	Arnolds.	9¼
112	Prescott Junction.	70	Petersburgh.	43¾	Eastwood.	11¾
113	Prescott.	73	Baden.	47¾	Woodstock.	17
120	Maitland.	76	Hamburg.	52¾	Beachville.	22
128	Brockville.	83	Shakespeare.	57	Ingersoll.	26¾
146	Lansdowne.	89	Stratford.	66¾	Edwardsburgh.	31¾
155	Gananoque.	99	St. Marys.	69¾	Waubnrn.	43¾
173	Kingston.	ST MARY'S & LONDON BRANCH		76	London.	TORO
188	Ernestown.	111	(Thorndale.)	86¾	Komoka.	
199	Napanee.	121	(London.)	91¾	Mt Brydges.	7
213	Shannonville.	114	Lucan.	96¾	Longwood.	13¾
220	Belleville.	121	Craigs.	103¾	Glencoe.	21¾
232	Trenton.	128	Park Hill.	112¾	Newbury.	26
242	Brighton.	137	Widder.	116¾	Bothwell.	32¾
249	Colborne.	146	Forrest.	125¾	Thamesville.	35¾
256	Grafton.	163	Sarnia.	140¾	Chatham.	37¾
263	Cobourg.	169	Port Huron.	154¾	Raptistic Creek.	39
271	Port Hope.	190	Ridgeway.	168¾	Belle River.	THE LO
280	Newtonville.	196	New Baltimore.	177¾	Tecumseth.	
286	Newcastle.	206	Mt Clemens.	184¾	Windsor.	
290	Bowmanville.	228	Detroit Junction.			.3
300	Oshawa.	231	Detroit.			6
306	Port Whitby.					9
310	Duffin's Creek.					12
316	Port Union.					15
320	Scarborough.					20
333	Toronto.					24



List of Various Railway Stations, Western Section of the Province & their Re…

GRAND TRUNK RAILWAY MONTREAL & TORONTO DIVISION. 1.

Total Miles	Station
	Montreal.
21	St Annes.
29	Cedars.
37	Coteau Landing.
54	Lancaster.
68	Cornwall.
77	Dickinson's Landing.
92	Williamsburg.
99	Matilda.
104	Edwardsburgh.
112	Prescott Junction.
113	Prescott.
120	Maitland.
125	Brockville.
146	Lansdowne.
155	Gananoque.
173	Kingston.
188	Ernestown.
199	Napanee.
213	Shannonville.
220	Belleville.
232	Trenton.
242	Brighton.
249	Colborne.
256	Grafton.
263	Cobourg.
271	Port Hope.
280	Newtonville.
286	Newcastle.
290	Bowmanville.
300	Oshawa.
304	Port Whitby.
310	Duffin's Creek.
316	Port Union.
320	Scarborough.
333	Toronto.

GRAND TRUNK RAILWAY TORONTO & PORT SARNIA DIVISION. 2

Total Miles	Station
9	Weston.
16	Malton.
22	Brampton.
27	Norval.
30	Georgetown.
36	Acton West.
42	Rockwood.
50	Guelph.
59	Breslau.
64	Berlin.
70	Petersburgh.
73	Baden.
76	Hamburg.
83	Shakespeare.
89	Stratford.
99	St Marys.
ST MARY'S & LONDON BRANCH	
111	(Thorndale.)
121	(London.)
114	Lucan.
121	Craigs.
128	Park Hill.
137	Widder.
146	Forrest.
168	Sarnia.
169	Port Huron.
190	Ridgeway.
196	New Baltimore.
[illegible]	Mt Clemens.
228	Detroit Junction.
231	Detroit.

GREAT WESTERN RAILWAY MAIN LINE FROM HAMILTON TO WINDSOR. 3

Total Miles	Station
	Hamilton.
1½	Burlington Junction
5½	Dundas.
8½	Flamboro.
11½	Copetown.
15½	Lynden.
19½	Harrisburgh.
29	Paris.
36	Princeton.
38	Arnolds.
43½	Eastwood.
47½	Woodstock.
52½	Beachville.
57	Ingersoll.
66½	Edwardsburgh.
69½	Wauburn.
76	London.
86½	Komoka.
91½	Mc Brydges.
96½	Longwood.
105½	Glencoe.
112½	Newbury.
116½	Bothwell.
125½	Thamesville.
140½	Chatham.
154½	Baptiste Creek.
167½	Belle River.
177½	Tecumseth.
188½	Windsor.

GREAT WESTERN RAILWAY GALT AND GUELPH BRANCH. 4.

Total Miles	Station
	Harrisburg.
6	Branchton.
12	Galt.
16	Preston.
19½	Hespeler.
27½	Guelph.
THE SUSP. BRIDGE & HAMILTON BRANCH.	
	Niagara Falls.
9½	Thorold.
11½	St Catherines.
17	Jordan.
22	Beamsville.
26½	Grimsby.
31½	Ontario.
43½	Hamilton.
TORONTO TO HAMILTON 6.	
	Toronto.
7	Mimico.
13½	Port Credit.
21½	Oakville.
28	Bronte.
32½	Wellington Square.
35½	Waterdown.
37½	Burlington Junction.
39	Hamilton.
THE LONDON & PORT STANLEY RAILWAY. 7.	
	London.
3	Point Mills.
6	Westminster N.
9	Westminster S.
12	Yarmouth.
15	St Thomas.
20	Whites.
24	Port Stanley.

THE BUFFALO & LAKE HURON RAILWAY. FROM FORT ERIE TO GODERICH. 8.

Total Miles	Station
	Fort Erie.
8½	Ridgway.
12½	Sharkes' Crossing.
17½	Port Colborne.
23	Wainfleet.
31½	Feeder.
37	Dunnville.
45½	Canfield.
50½	Cook's Station.
57½	Caledonia.
64	Middleport.
66½	Onondago.
77½	Cainsville.
74½	Brantford.
82½	Paris.
88½	Richwood.
91	Drumbo.
96½	Plattsville.
106½	Tavistock.
114½	Stratford.
127	Mitchell.
132	Carronbrook.
138½	Seaforth.
139½	Harpurhey.
146½	Clinton.
158½	Goderich.
THE ERIE & ONTARIO RAILWAY. 9.	
	Niagara.
8	Queenston.
10	Stamford.
11½	Suspension Bridge.
14	Clifton House.
17½	Chippewa.

THE NORTHE… OF CA… FROM TORONTO T…

Total Miles	Station
	Toront…
5	Daven…
8	Weston.
11½	York.
14½	Thornh…
18½	Richmo…
23	King.
30½	Auror…
34½	New M…
38	Hollan…
41½	Bradfo…
44½	Scanla…
49½	Guilfor…
52	Lefroy
	Bell Ew…
52	Lefroy
57½	Craigv…
63½	Barrie
68½	Harris…
71½	Essa
73½	Angus
80	Sunni…
86	Nottaw…
94½	Collin…
PORT HOPE, LINDSAY … AND ITS BRANCHES	
	Port Hop…
6	Quays.
8	Perryt…
10	Campb…
15	Summ…
18	Millbr…
24	Manv…
26	Bruns…
28	Lyttles…
33	Oman…
38	Kelly's
43	Linds…

The Branch to P… main line at Mill… Port Hope Ry … Station at …

78 77 76

giving

THE FORMATIVE STRUCTURE OF THE PROVINCE

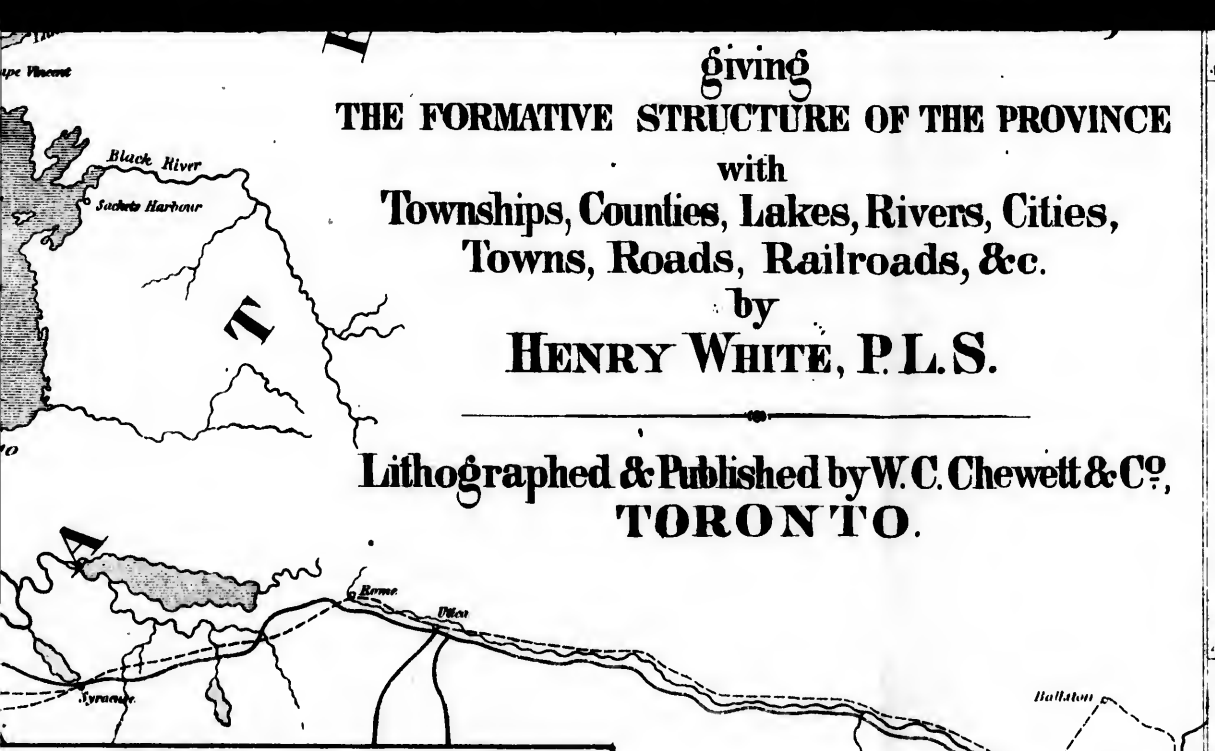
with

Townships, Counties, Lakes, Rivers, Cities, Towns, Roads, Railroads, &c.

by

HENRY WHITE, P.L.S.

Lithographed & Published by W.C. Chewett & Co.,
TORONTO.



rovince & their Respective Distances.

ALD & LAKE HURON RAILWAY. T ERIE TO GODERICH.

6.

t Erie.
gway.
rkes Crossing.
t Colborne.
infleet.
der.
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sfield.
k's Station.
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ddleport.
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rpurhey.
nton.
derich.

IE & ONTARIO RAILWAY.

9.

iagara.
eenston.
mford.
pension Bridge
Non House.
ippewa.

THE NORTHERN RAILWAY OF CANADA. FROM TORONTO TO COLLINGWOOD

Total Miles.	10.
	Toronto.
5	Davenport Road.
8	Weston.
11¼	York.
14½	Thornhill.
18¼	Richmond Hill.
23	King.
30¼	Aurora.
34½	New Market.
38	Holland Landing.
41¼	Bradford.
44½	Scanlans.
49½	Guilford.
52	Lefroy.
	Bell Ewart (Brh).
52	Lefroy.
57¼	Craigville.
63½	Barrie.
68¾	Harrisons.
71¾	Essa.
73½	Angus.
80	Sunnidale.
86	Nottawasaga.
94	Collingwood.

PORT HOPE, LINDSAY & BOBCAYGEON RAILWAY AND ITS BRANCHES TO PETERBORO.

11.

	Port Hope.
6	Quays.
8	Perrytown.
10	Campbells.
15	Summit.
19	Millbrook.
24	Manvers.
26	Brunswick.
29	Lyttles.
33	Omamee.
38	Kellys.
43	Lindsay.

The Branch to Peterboro leaves the main line at Millbrook 19 miles from Port Hope. It is 9 miles long with a Station at Peterboro.

THE COBOURG AND PETERBORO RAILWAY. EXCLUSIVE OF THE EXTENSION TO LAKE CHEMUNG

Total Miles.	12.
	Cobourg.
5	Baillemore.
10	Bradins.
14	Harwood.
17	Indian Village.
21	Keene.
24	Morgans.
28	Peterboro.

This road is being extended to Lake Chemung and 4 miles of the extension is now opened.

BROCKVILLE & OTTAWA RAILWAY & PERTH BRANCH TO SMITH'S FALLS.

13.

	Brockville.
10	Bellany.
21	Irish Creek.
28	Smiths Falls.
37	Franktown.
46¼	Carleton Place.
53	Almonte.

The portion of this Road opened is from Brockville to Almonte. The Branch from Smith's Falls to Perth is 12 miles long with a Station at Perth.

PRESCOTT & OTTAWA RAILWAY

14.

	Prescott.
1¼	Prescott Junction.
9	Spencerville.
12¼	Doyles.
16¾	Oxford.
22¾	Kemptville.
31¼	Osgoode.
34¼	Kellys.
36	Middleton.
38	North Osgoode.
43¾	Gloucester.
46¾	Billings.
53¼	Ottawa.

Boundaries of Counties
Do. of Townships
Railroads
Canals
Plank and Gravelled Roads
Other Roads
Proposed Railroads

Scale of Miles
10 20 30 40 50