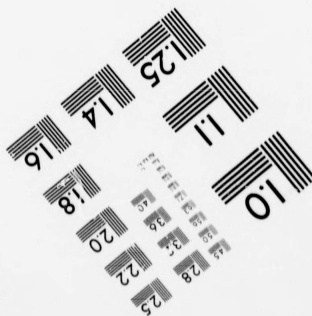
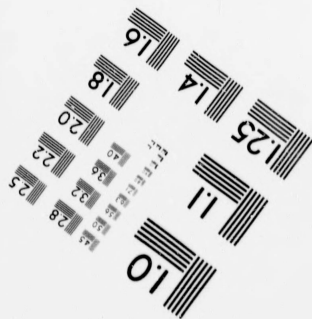
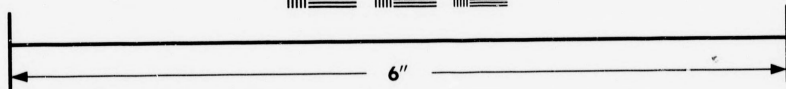
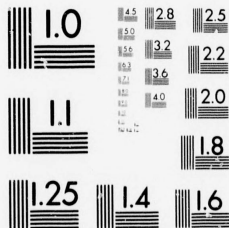


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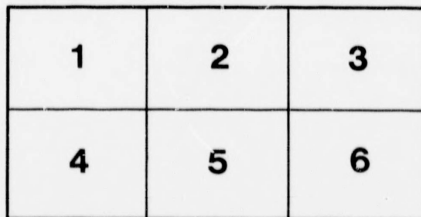
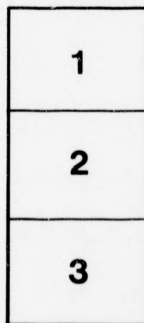
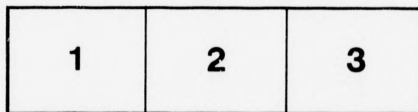
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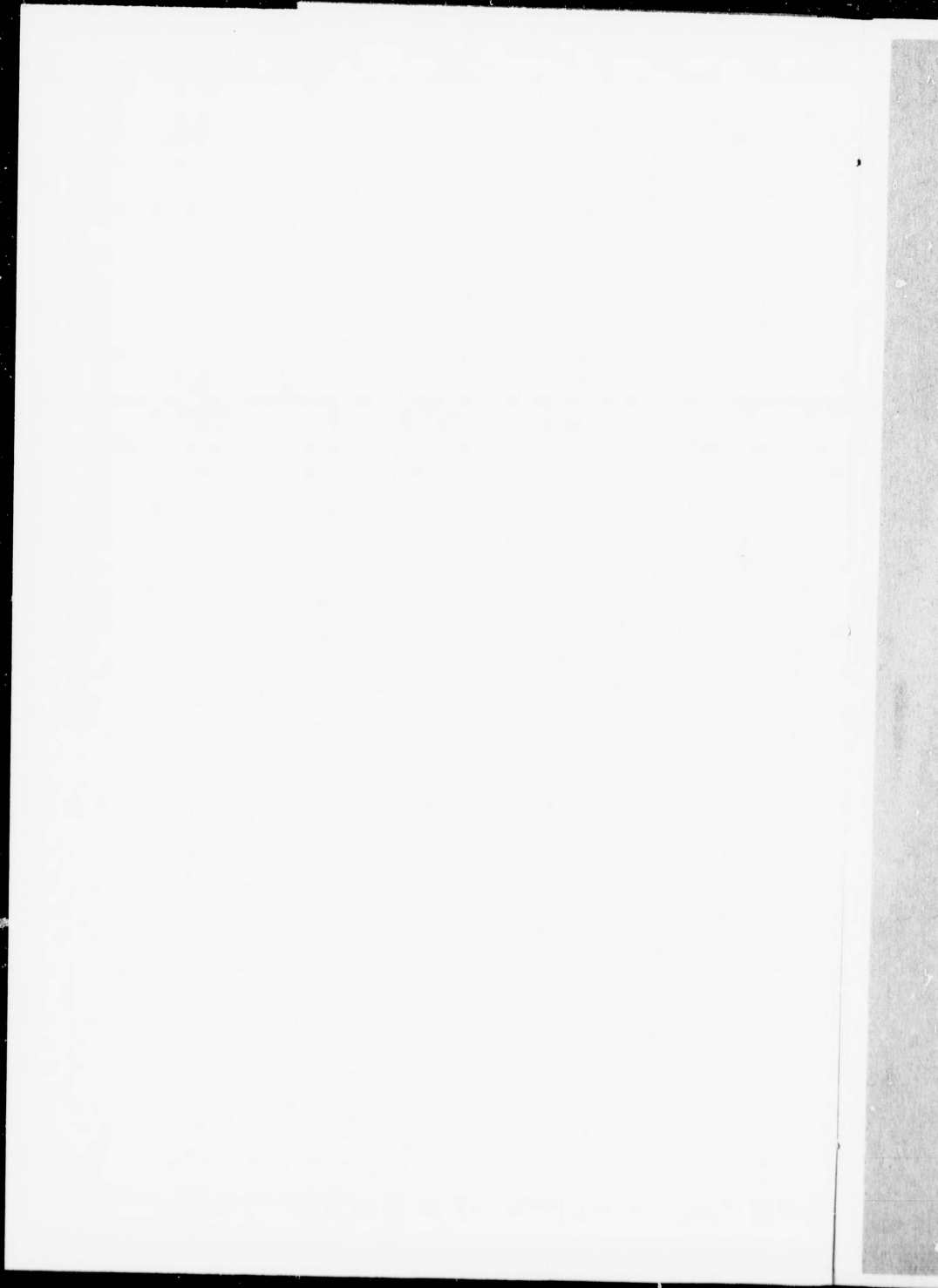
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A. M. CAMPBELL

On a New or Hitherto Unrecognized Geological Horizon in the Gas and Oil Region of Western Ontario.

By H. M. AMI.

Paper read March, 1899, before the Montreal Meetings of The Canadian Mining Institute.

Ex. Journ. Can. Min. Inst. Vol. II, pp. 186-191, Ottawa, 1899.



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On a New or Hitherto Unrecognised Geological Horizon in the Gas and Oil Region of Western Ontario, Canada.

By HENRY M. AMI, M.A., F.G.S.

The formation or geological horizon in question consists of a series of fine-grained calcareo-argillaceous pyritiferous shales associated with bands of marine fossiliferous limestone which overlie the Portage and Genesee shales of Western Ontario. The shales of Kettle Point on Lake Huron have, up to the present, been recognised as the highest strata in the geological scale of Palæozoic sediments occurring in Western Ontario.

These shales have been referred to the upper division of the Devonian system and are well developed at Kettle Point, where they crop, owing to a gentle arch or anticline occurring at that locality in the Palæozoic series. In Ohio and New York States they were recognised by Prof. Orton and Dr. J. M. Clarke, whilst Dr. Johnson has identified similar shales from the drift of the Chicago boulder clays.

The new geological horizon which overlies the Kettle Point shales as stated above is marine in origin. It contains a fossil fauna of not less than seven distinct species of organisms, with which I shall not deal at present as being outside the scope of this brief note.

These organisms mark a distinct period of encroachment of the old Palæozoic sea when marine sediments were laid down.

This formation which is probably part and parcel of the true marine Chemung formation so extensively developed across the lake in Michigan and again and better in New York State across Lake Erie, was reached by the drill at a depth of 600 feet below the surface. The superficial or Pleistocene deposits occupy but a fraction of the upper 600 feet and in them are found fragments of rock belonging to the Portage and Genesee shales underlying the hitherto unrecognised and unrecorded marine beds at this horizon in Ontario

The shales which underlie this new formation when subjected to a close examination have revealed many interesting features, foremost amongst which is the presence of numerous examples of the macrospores *Protosalvinia Huronensis* described by Sir William Dawson in his "Report on the Erian Flora of Canada" in 1871. These macrospores from the bore-hole and drillings when examined under a microscope show very marked characters. They are thus described by Sir William Dawson (loc. cit. supra): "Macrospores in the form of discs or globes, smooth and thick walled, the walls penetrated by minute radiating pores. Diameter about $\frac{1}{100}$ ths of an inch or a little more. When *in situ* several macrospores are contained in a thin cellular sporocarp, probably globular in form. From the upper Erian and perhaps lower carboniferous shales of Kettle Point."

The Niagara and Clinton formations of the Silurian system and the Corniferous formation of the Devonian system, are the formations from which most of the gas and petroleum of Canada have hitherto been obtained in the Province of Ontario.

So far as I am aware, none of the oil or gas producing wells of Western Ontario derive their oil or gas from the Trenton formation of the Ordovician (Lower Silurian) system. (See discussion.)

That the Trenton formation of the States of Ohio and Pennsylvania is well known as a gas and oil-producing series of strata need scarcely be mentioned before this Mining Institute, and whilst in only one or two isolated instances the Trenton formation has been reached by the drill, nevertheless we venture to hope that before long wells sunk sufficiently deep to reach the Trenton formation, which underlies the Devonian and Silurian strata of the Huron-Erie peninsula of Ontario at a depth of some 3,000 feet, (more or less, depending upon the points of departure,) will reward the enterprising company which will make the venture.

It will be clearly seen that every few hundred feet of strata which overlie the gas- or oil-producing strata which are eagerly sought by the drillers makes considerable difference in the calculations as to the relative position and exact geological horizon indicated. From a very complete series of drillings recently received at the Geological Survey

SECTION OF WELL AT WALLACEBURG ONT.

CHARACTER OF STRATA TRaversED BY DRILL	THICKNESS OF STRATA	GEOLOGICAL FORMATIONS
1. Sands and Clays.	35 Feet	1. Recent Champlain Period
2. Boulder clays.	120 " 140 "	2. Glacial (Erie) clay.
3. Chemung limestone and shales.	300 "	3. Chemung.
4. Portage and Genesee shales.	600 " 625 " 650 " 665 "	4. Portage and Genesee.
5. Limestone, shales & clays	750 "	5. Hamilton.
Light coloured limestone.	850 " 950 " 1000 "	6. Corniferous.
7. Sandstone?	1100 "	7. Oriskany?
8. Fine grained Dolomites.	1200 " 1300 "	8. Lower Eelderberg WaterLine
9. Gypsiferous Dolomites	1380 " 1400 " (Gypsiferous)	9. Onondaga & Salina
10. Dolomites.	1500 " 1600 " 1700 "	10. Guelph.
11. Limestone.	1820 " 1865 " (Disturbed) 1900 " 1925 "	11. Niagara.
12. Calcareous and arenaceous shales, Gray sandstone, Red shales and marls.	2000 " 2020 "	12. Clinton.
13. Red shales. Red marls.	2085 "	13. Medina.
14. Light & dark shales.		14. Lorraine.
15. Black bituminous shales and limestones.		15. Utica.
16. Limestones.		16. Trenton.

Department from the County of Bothwell and placed in my hands by the Director for examination with a view to ascertain what geological formations had been traversed by the drill, I was able to ascertain very definitely just *where we were* owing to the presence of a large number of fossil organic remains detected in the drillings or small pieces and fragments not crushed to powder by the jumping drill.

And here let me make a suggestion which I hope will some day be carried out. In Western Ontario we need three or four typical log-sections from a diamond drill. The amount of money invested in our oil, gas, salt, gypsum, and associated industries and resources of the western peninsula fully justify such an expenditure. In examining drillings obtained from the jumping drill it is oftentimes a matter of considerable difficulty in eliminating the ever constant and recurring factors of error due to falling chips and broken fragments, reputed to come from certain definite depth, (but which from careful examination can be detected and to some extent checked,) especially when drillings are examined from the top downwards and not in the natural order of deposition of these formations, from the bottom upwards.

In the Bothwell drillings mentioned above, the new geological horizon was found to a depth of 600 feet, and below that and down to 670 feet the drill had struck and traversed the Kettle Point shales, charged with remains of *Protosalvinia (Sporangites) Huronensis* Dawson, which connects these Devonian formations of the Chemung, Portage and Genesee. The Hamilton shales and clays and limestones were then traversed and taking the drill down to a depth of nearly 800 feet, which amount, had the fossils not been obtained, would not have been reckoned from the *section* in that part of Canada and led to a grievous error in our calculations.

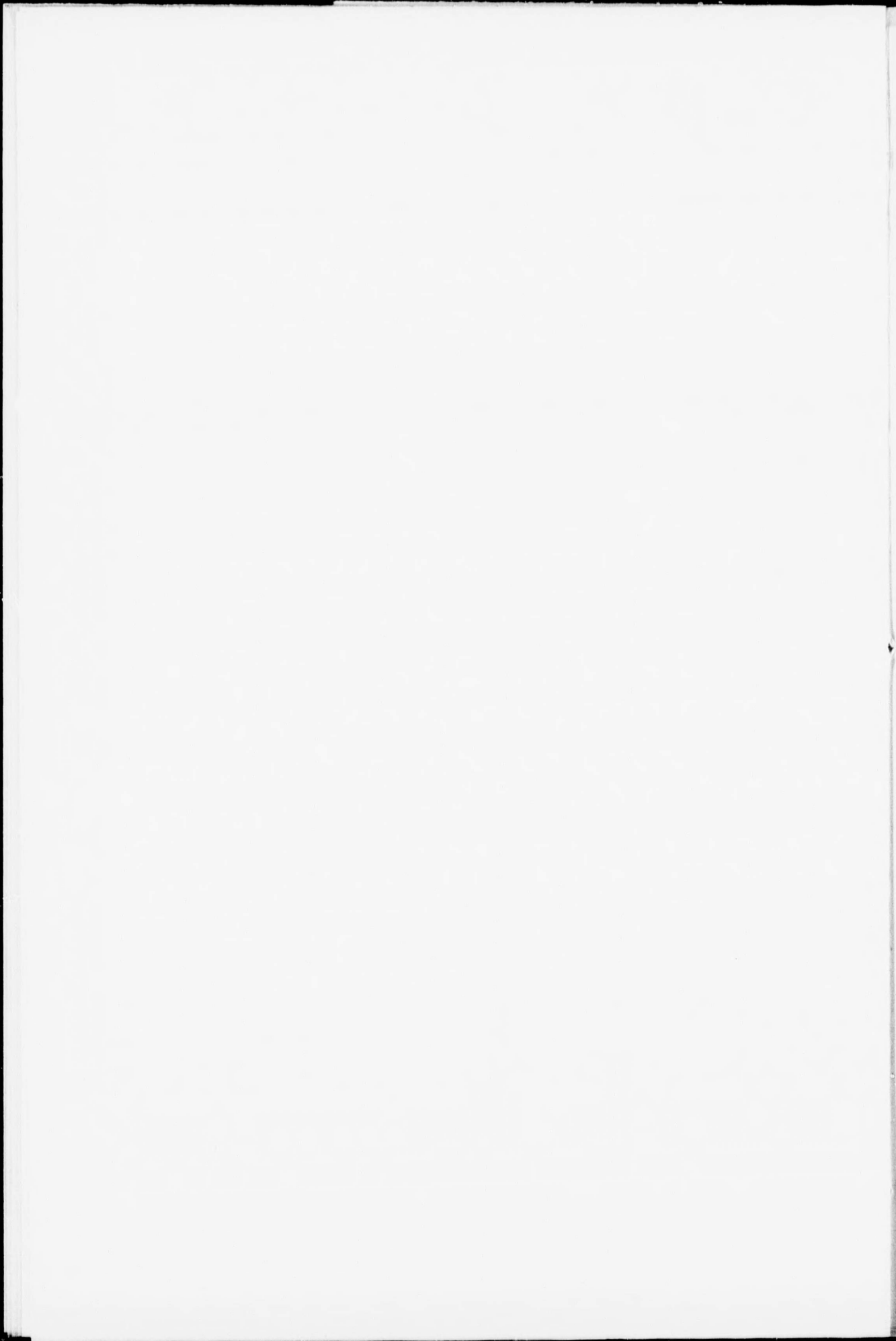
As it was, the drill traversed the above formations, then the Corniferous and the Oriskany (if present at all) through the lower Helderberg and Water Lime group consisting for the most part of fine-grained compact dolomites succeeded downward by the gypsum and salt-bearing dolomites of the Onondaga and Salina formations. The Guelph and Niagara dolomites and limestones were then traversed in the same succession or order as mentioned and the underlying Clinton shales like-

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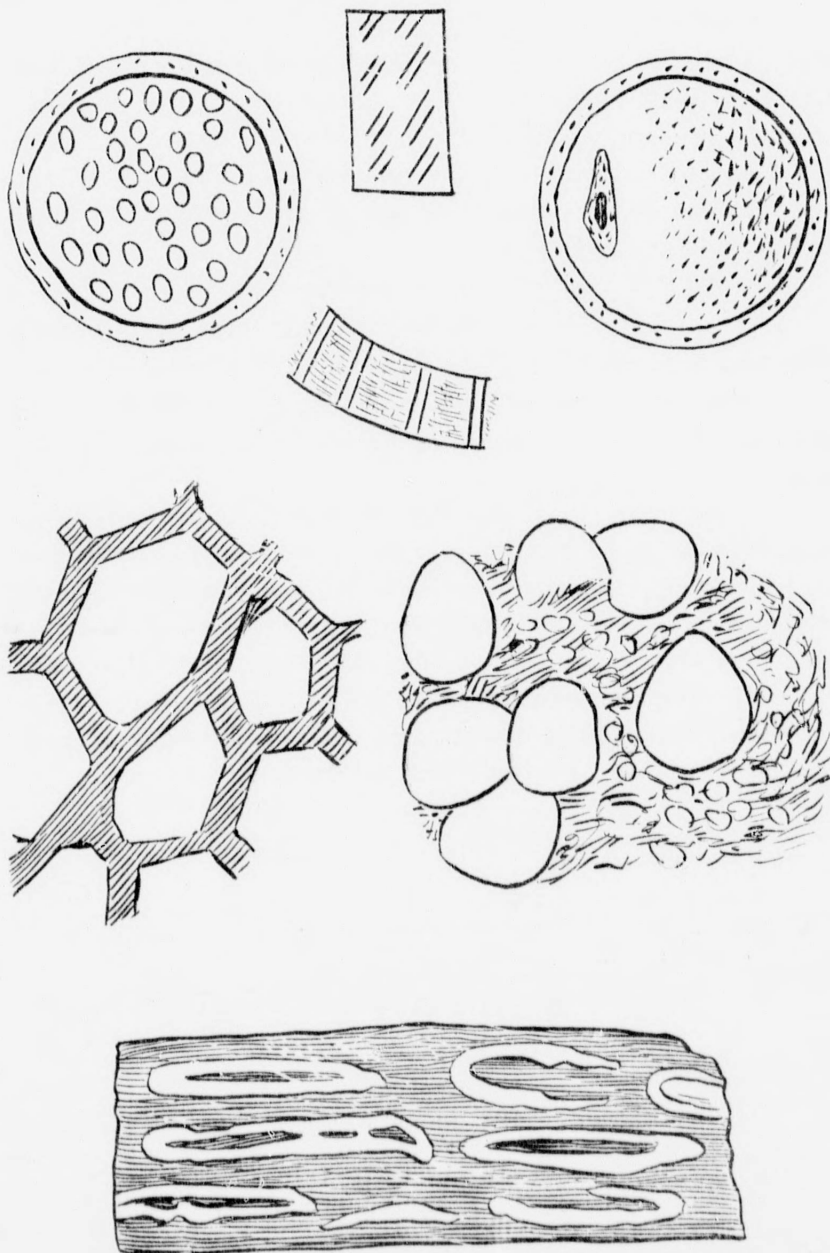


wise. At the last hearing and from samples received at the Department the "gray band" of the *Medina*—consisting of hard, dry, light gray sandrock—was actually struck at a depth of 2,035 feet, and lower down to a depth of 2,100 feet the typical red muds and shales of the *Medina* formation were being traversed, leaving no doubt whatever as to the geological horizon reached.

It would then follow from the above that—

1. The Hamilton formation of Western Ontario extends over a wider area than was at one time suspected.
2. That the Portage and Genesee or Kettle Point shales also extend south from Kettle Point to a point in Bothwell County beyond Wallaceburg.
3. That above the Kettle Point or *Protosalvinia* (*Sporangites*) shales there occurs a distinct series of marine beds containing numerous fossil organisms, including crinoidea, crustacea, brachiopoda, not previously recognised, and forming an important cover over the underlying Hamilton, Corniferous and older formations in the Huron-Erie peninsula. These marine beds with overlying and interstratified shales as ascertained from drillings, constitute the Chemung formation or uppermost member of the Devonian system in Ontario.

Characteristic Fossils from Devonian Strata in Gas and Oil
Region of Ontario.



PROTOSALVINIA (SPORANGITES) HURONEUSIS, DAWSON.

Magnified views of macrospores, showing pores, portions of the wall greatly magnified, the hilum and internal granular matter, group with remains of sporocarp, cellular tissue of sporocarp highly magnified, also cross section of Upper Devonian shale showing flattened macrospores.—(After Sir William Dawson.

