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## ADVANCE.

God bade the sun with golden step sublime
Advance!
He whispered in the listening ear of time,
Advance!
He bade the guiding spirit of the stars,
With lightning speed, in silver shining cars,
Along the bright floor of his azure hall,
Advance!
Sun, Stars, and Time, obey the voice, and all
Advance!

The river, at it its bubbling fountain, cries
Advance!
The clouds proclaim, like heralds, through the skies,
Advance!
Through the world the mighty Master's laws
Allow not one brief moment's idle pause
The earth is full of life, the swelling seeds
Advance!
And summer hours like flow'ry harnessed steeds
Advance!

To man's most wondrous hand the same voice cried
Advance!
Go clear the woods, and o'er the bounding tide
Advance!
Go draw the marble from the secret bed,
And make the cedar bend its giant head;
Let domes and columns through the wondering air,
Advance!
The world, O man, is thine; but would'st thou share,
Advance!

Unto the soul of man the same voice spoke,
Advance!
From out the chaos, thunder-like, it broke,
Advance!
Go track the comet in its wheeling race,
And drag the lightning from its hiding-place;
From out the night of ignorance and fears,
Advance!
For love and hope, borne by the coming years,
Advance!

## ON THE PHYSICAL STRUCTURE OF THE WESTERN DISTRICT OF UPPER CANADA.

BY W. E. LOGAN, F. R. S., F. G. S., AND DIRECTOR OF THE GEOLOGICAL SURVEY OF CANADA.

The Western District of Upper Canada has, at a short distance on the north-west side of it, the coal-field of Michigan, and at a somewhat greater on the south-east, what has been called the coal-field of Appalachia. The former, as has been ascertained by the investigations of the geologists of the United States, occupies the chief part of the interior of the southren peninsula of Michigan, and has a superficies of about 12,000 square miles, while the latter, extending in length from the north-eastern corner of Pennsylvania to Tennessee, and in breadth from the vicinity of Lake Erie to the sources of the Potomac, presents the greatest known carboniferous area on the face of the globe, its suface being equal to about 60,000 square miles. The rocks of the Michigan coal-field, where they approach nearest to Lake Saint Clair, and those of the Appalachian, where they do the same in regard to Lake Erie, exhibit an attitude so near to horizontality, that, without accurate admeasurements, it would not be easy to detect their dip. Those between the coal-fields and the two Lakes equally do so, and those again between the Lakes themselves are, as a whole, flatter still. The Western District, thus flanked on both sides by coal measures, and showing no easily observed reason in the dip why they should no. be carried across it, might induce those who had made no careful examination of the matter to entertain a hope that some outlying patch of such measures might yet be found in that part of Canada. The ascertained structure of the District, however, shows that such a hope would be ill founded; and I propose to place before the Institute an explanation of what that structure is, illustrated by a map and section, that part of the map representing a portion of the United States being copied from the works of American geologists.

The rocks comprehended in the section in descending order are—

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| 1. Gneissoid, or Metamorphic series. | | |
| 2. Huronian or copper-bearing rocks, perhaps equivalent to the Cambrian of England. | | |
| 3. Potsdam Sandstone. | | |
| 4. Calciferous Sand-rock, Chazy, Birdseye, Black River, and Trenton Limestones. | } | Lower Silurian |
| 5. Utica Slates. | } | |
| 6. Hudson River group. | } | |
| 7. Medina Sandstone. | } | |
| 8. Clinton and Niagara groups. | } | Upper Silurian. |
| 9. Gypsiferous Rocks, Onondaga Salt group. | } | |
| 10. Corniferous limestone* | } | |
| 11. Hamilton group. | } | Devonian. |
| 12. Chemung and Portage groups. | } | |
| 13. Mountain or Carboniferous Limestone. | } | Carboniferous. |
| 14. Coal measures. | } | |

It is not my intention to give any detailed description of these rocks, but for their mineral and fossil contents, as well as their respective thicknesses, refer to the various official reports presented to the government on the progress of the geological survey of the Province, and of those of the geologists of the United States; nor shall I allude to their geographical distribution in datail farther than as occasion may require, the map being sufficient to explain it.

Taking these rocks in their general groupings, it will be perceived by the map that the Lower Silurian series, by a change in the strike from west to north-west, sweeps round from Lake Ontario to Georgian Bay, and proceeds thence by the north side of the Manitoulin Islands, and the north shore of Lake Huron, to the northern peninsula of Michigan The Upper Silurian follows them. The Niagara Limestone at the base, aids in forming the neck of land separating and holding up Lake Erie from Lake Ontario, and continues in a ridge along the Blue Mountains, and the promontory terminating at Cabot's head and the Manitoulin Islands are only an interrupted prolongation. The Gypsiferous rocks succeed conformably, running from Grand Island, by the Welland and Grand Rivers, to the River Sauguine, while the superimposed Corniferous Limestone, from Lake Erie on the one side and Lake Huron on the other, is projected forward into the Western District as far as the Township of Zone. The same formation, with a projected form in an opposite direction, comes up from Ohio by the upper end of Lake Erie, and is carried north-easterly as far as the eastern side of Chatham.—Between Zone and Chatham, the Hamilton group composed of black bituminous shales, constitutes a narrow band, which runs north-westward toward Lakes Huron and St. Clair, and southwestward to Lake Erie, gradually widening in both directions in the surface it occupies, and finally merging into two rings, or irregular circular belts, one of which is rudely concentric with the coal measures of Michigan, and the other with those of the Appalachian field—of which last, however, the map shows but a small portion. Within these two rings, thus united by the band across the Western District, and between them and the carboniferous centres the Chemung the Portage groups occupy their place, in two broad and entirely separate zones, one of them showing itself north-west of Lake St. Clair, and the other south-east of Lake Erie.

To any one accustomed to consider the forms derived from the intersection of surfaces, who will carry in his mind that the various formations which have been given are nothing more than a set of thick, close-fitting, comformable sheets which are intersected by the general surface of the country, it will be at once apparent that the ascertained geographical distribution of the formation results from the fact that between the Michigan and Appalachian coal-fields there is a flat anticlinal arch, the axis of which runs, with a gentle curve, from the upper extremity of Lake Ontario, by London, Zone, and Malden, to the Maume River, at the upper end of Lake Erie, and that between Chatham and Zone, there is in it a slight transverse depression.

This anticlinal arch is represented in the section, the line of which runs in a north-west and south-east direction from the one coal-field to the other, a little south-west of the Hamilton shales in Chatham. The section is given on a scale at one mile to an inch, both horizontally and vertically; for it is only by using the same scale for both measurements that a true idea can be at once conceived of the very small slope in a set of strata that is required to produce important effects in geographical distribution.

It will be seen by the section that between the highest formation in the Western District (the Hamilton group) and the Carboniferous series, the rocks that are wanting (the Chemung and Portage groups) have a thickness of about 2500 feet, and without a very extensive area of these, there can be no reasonable expectation of coal.

The position of the great Lakes of the St. Lawrence, and the distribution of the rocks in connection with them, is one of the grandest and most beautiful instances to be met with, of the dependence of the geographical features of a country upon geological structure. Lake Ontario, Georgian Bay with its continuance behind the Manitoulin Islands and Green Bay, with in Wisconsin, are excavations in the same formation of the Lower Silurian series—Lake Erie, Lake St, Clair, Lake Huron and Lake Michigan, are excavations in equivalent constituents of the Upper Silurian, while there runs a ridge separating these two sets of excavations from one another, which derives its main characteristic from the Niagara Limestone. The Chemung and Portage groups, which are composed chiefly of sandstone, have been strong enough to resist the denuding forces which have produced the excavations and we find them forming equivalent limits to the Upper Silurian, or perhaps more correctly Devonian Lakes. It is thus the distribution of these various rocks, which is again dependent in a great measure upon the anticlinal arch running between the two great coal fields, that gives to a very large part of Upper Canada its present geographical form.

Let us suppose that there was the smallest possible patch of the Carboniferous series in the Western District. What would be the result? It would be surrounded, of course, by the Chemung and Portage groups. These would give around the Carboniferous centre, a broad ring of sandstone, which would reach as far as Malden to the south-westward and London to the north-eastward, and the Western and London Districts, instead of being underlaid chiefly by calcareous, would be so by siliceous rocks The structure in connection with the coal-patch being sinclinal instead of anticlinal, the projected forms of the Corniferous Limestone would be turned in the opposite directions to those they now have, and in Canada, all the formations below would in succession be carried farther to the eastward. With the distributions of the rocks, the forms of the Lakes dependent on this distribution, would be altered The sandstones surrounding the coal-patch would extend, with the exception of the coal patch, across from the Michigan to the Appalachian coal-field, and if like causes are to be supposed productive of like effects, one-half of Lake Erie and a part of Lake Huron would be obliterated, and the remaining portions modified in form. In short, the supposition of an acre of the true Carboniferous rocks existing in the Western District, requires as a consequence, the supposition of a very extensive change in Upper Canadian geography.

If it be supposed that the coal-patch might be present through the influence of a dislocation one of the conditions of such a dislocation must necessarily be that it must produce a downthrow on one side or the other, of at least 2500 feet, and it would still be required that on the downthrow side the wide zone of sandstone, and all the circumstances consequent on it, should follow the coal until interrupted by the fault. But if disturbances had occurred in this part of America of sufficient force to produce a dislocation of this order, it is probable that it would not be a solitary one. The strata of the District would have been tilted up to various high angles, and instead of its flat surface, dependent on the flatness of its rocks, the country would have presented a mountainous one.

Unless, therefore, workable coal seams are to be found in older rocks than those of the true carboniferous age, which no ascertained facts either in the United States or in Canada, or any other part of America, authorize us to expect, it appears to be a necessary consequence of the structure of the Western District that none will be met with there. But though there are no true coal measures in the District, there are rocks which may readily be mistaken for such by observers, who unaware, when actual workable coal seams are not before the eye, how extensive an examination it may be expedient to make and how many circumstances connected with geological structure it may be necessary to bring into harmony, before it is definitely pronounced whether a particular set of strata are likely to be associated with coal seams, are disposed to come to a hasty conclusion, founded upon mere resemblances. These rocks are the black bituminous shales of the Hamilton group. They are no doubt nearly identical in mineral character with similar shales frequently found interstratified with true coal measures. Like them they in several places hold so much bituminous matter as to give a partially inflammable character to the rock, and to yield petroleum or mineral oil. Not only do they resemble them in mineral character, but also in some degree in respect to a portion of their fossil contents. Coal measures are strongly marked by their fossil plants, and in