

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, 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 sandstones, 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 underlain chiefly by calcareous, would be so by silicious rocks. The structure in connection with the coal-patch being sinclinal instead of anticlinal, the projected forms of the Carboniferous 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 distribution 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 portion 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 mineral 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 the Hamilton shales are found *Calamites*, a genus abundant in the Carboniferous rocks, though the species may perhaps be different. These *Calamites* in the Hamilton shales, having lost their interior by decay, are found compressed into flat stripes and converted into crystalline coal, as they generally are under similar conditions in true coal measures. The circumstances of the case, therefore, might occasionally deceive even practical observers, had they not other guides in the Crustacea and Mollusca of the formation, and a traced out and ascertained place for it in the order of superposition, in which by prior extended examinations its constituent strata had become known. It has been well ascertained by the geologists of the United States, that the place of these shales in Northern New York and Pennsylvania is about 2500 feet beneath the Carboniferous rocks; and before the institution of the State geological surveys, the formation had been very extensively and very expensively examined by boring, excavation, and surface explorations in search of coal seams, but of course without success; and it is with a view to aid in preventing a repetition of such useless expenditure in Canada that the present paper and its illustrations are submitted to the Canadian Institute.

On a method for preserving the sensitiveness of Collodion Plates for a considerable time.

By JOHN SPILLER AND WILLIAM CROOKES.*

The extreme sensitiveness of Collodion as compared with paper and other photographic surfaces, renders this material invaluable in all cases where rapidity of action is desirable, but

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