

ART. VII.—THE SOUTHERN SYNCLINAL OF THE PICTOU COAL FIELD. BY EDWIN GILPIN, M. A., F. G. S., &c., &c.

I PURPOSE this evening to draw your attention to a hitherto neglected part of this Coal field, and to add to the arguments already advanced, in favour of the extension of the Albion group across the eastern part of the district, in my papers on the Pictou Coal Field, and the grouping of its seams, read before the Newcastle (England) Institute of Mining Engineers, and before you. The investigations of the structure of the Pictou Coal field during the last few years have not been of importance; but I hope to show from the various available sources of information, that there is a strong probability that the portion now to be described, contains valuable deposits of coal.

It is to be greatly regretted that much of the prospecting done during the early history of this Coal field was entrusted to men little qualified for the task. Borings and trial pits were put down without the slightest regard to the general structure of the field, and in one or two instances based on wonderful ideas of the uselessness of searching for coal seams under conglomerates. These trial openings were seldom connected by surveys, and when records were kept, they generally gave merely so many feet of sandstones and shales as having been penetrated. The consequence of this is, that in spite of the large sums of money spent in explorations, there are many gaps left, of which little is positively known, and the information gathered was in some cases erroneously considered as indicating the absence of coal.

The researches of Sir W. Logan, while Director of the Canadian Geological Survey, have led to the generally received conclusion that the productive strata of the Pictou Coal field are bounded by four great faults, bringing up lower measures on all sides. This eminent field geologist has also determined the positions of various smaller dislocations affecting the different undulations, and repeating the crops of the lower seams.

NOTE.—Reference to Sir W. Logan's map of the Pictou Coal Field will show the position of the seams and faults referred to in this paper.

One of these boundary faults runs from a point above McNaughton's mills on McCullock's Brook, to Parks' mills on Sutherland's River, and has Coal measures to the north, Millstone grit and older rocks to the south—thereby limiting the extension of coal crops in the latter direction. Another fault, or rather succession of faults, forms the western boundary of the Coal field, and produces a similar effect on the coal strata in that locality.

A short distance to the south of the Stellarton Station, Sir W Logan has laid down what he calls the McLeod fault, and describes as an upthrow to the south pursuing a course roughly parallel to that already mentioned and known as the south fault. The evidence of the presence of this fault on the west side of the East River is not clear; and those best qualified to speak with authority on the subject, tell me that careful search on the line marked by Sir W. Logan has failed to show trace of its passage. On the east side of the River the effects it is said to produce, are not such as to show with certainty that its influence on the configuration of the Coal field is at all equal to that claimed in the report of the Geological Survey. In this paper the fault is retained in all its supposed intensity to show that even under unfavourable circumstances the district to be considered is of great value; the conclusions to be drawn when it is, in my opinion, more justly considered as not present in serious moment, will be given further on. Between these faults no measures of an age older than the productive are known to exist, and the coal strata are with every appearance of reason considered to run across this interval without undergoing disturbance.

The western boundary fault has cut off the southern extension of the Westville seams, broken from their continuity with the Albion seams by the fault at McCullock's Brook, which produces a down-throw to the west. This fault has course N. 22° W., and intercepts the Main seam a short distance to the west of McCullock's Brook. On the down-throw side of the fault going south, the northerly dip at first is not changed, but on the south line of the Acadia area the measures become flat, then dip south, then flatten again, and finally assume a northerly dip as the workings of the

Intercolonial Coal Company are approached. This undulation of the measures, aided by the fault, obscured the crop of the Main seam most thoroughly; and it was long believed that it was thrown out of reach.

The results of the Geological Survey, however, afford ground for the opinion that the crop of the seam known as the Culton, is the continuation of the Main seam—its strike to the westward being intercepted obliquely by the great West fault which it finally leaves for a distance, and is worked under the name of the Acadia seam by the Drummond, Acadia, and Nova Scotia Collieries. This view is supported more by the relative positions of the seam and associated strata, than by any similarity in the coals themselves. The Acadia, Culton, and Main seams have no coal beds immediately overlying them, while coal seams are found beneath them all at equivalent depths. The importance of this conclusion is evident, as the greatly increased extent of the Main or Acadia seams, as well as of the underlying seams, is at once shown.

At present mining operations are confined to the Main or Acadia and the Deep seams, but from practical trials it is known that many of the lower beds are workable, and the amount of coal thus available may be gathered from the fact that there are over 100 feet of coal in the seams of the Albion group, the lowest as yet known in the Pictou Coal field.

The dip of the Culton seam on McCulloch's Brook, and the anticlinal structure of the measures of the south-east part of the Acadia area above described, form what is known as the Bear Creek synclinal of the report of the Geological Survey of the Pictou Coal field. This synclinal is continued up to the west side of McCulloch's Brook, at which point we leave it at present.

Following the crop of the Main seam, which as it is the highest, may be taken as the exponent of the Albion group, from the Foster pit to the eastward we find it crossing the East River and gradually turning to the east and south, until cut by the McLeod fault. The course of the Main and Deep seams as far as this point, is well ascertained by underground workings, and the pits and boreholes on the Pictou Company's area. The McLeod fault being

an upthrow to the south, the continuation of the line of crop beyond the fault must be searched for to the eastward at a distance determined by the amount of dislocation, and the angle of dip of the strata.

We have now briefly sketched the line of this important seam from Westville to the McCulloch fault, and thence to the McLeod fault on the east side of the East River. Explorations to settle its position have not yet been pushed beyond this point, but enough has been done to afford a reasonable basis for calculations as to its continuation beneath what are known as the Upper seams, viz: the McBean and Marsh groups as shown in my paper on the Pictou Coal Field.

Underlying the Main seam on Coal Brook are 1286 feet of sandstones and shales, containing no less than 12 seams of coal, varying in thickness from two to twenty feet. The effect of the McLeod fault would naturally be to thrust some of these coals nearly on the line of the Main seam; and we find this to be the case. A short distance to the east of the point where the outcrop of the Main seam is intercepted by the McLeod fault, the crop of an 8 foot seam, known as the McLeod, has been opened and traced, its strike being found to be S. 15° E., at an angle of 15°. Underlying this at a short distance, is reported the crop of a second seam. The strike of the coal and associated strata gradually turns to the south-west, and then bending to the east of south, is abruptly cut off by the great South fault.

The limited explorations that have been made in the vicinity of the McLeod fault are not decisive enough to show which of the Albion group it is identical with, there having been no attempt made to ascertain its relation to over or underlying seams. The crop of a coal seam is known on the bank of a small brook near the house of W. Miller, about one-half mile to the south of the crop of the main seam. It is on the south side of the McLeod fault, and where exposed dips to the east at a moderate angle. The interval between this bed and the McLeod seam shows a considerable extent of ground underlaid by coal.

Between the latter seam and the Culton adit on McCulloch's

Brook there has been hardly anything done to show the economic value of the coal measures. It is known that at one or two points reverse or southerly dips are met in the strata exposed, and that indications of coal have been observed—enough to show that the synclinal form is preserved from the Bear Creek area to the McLeod seam. This undulation is a minor one, being nowhere as deep as that to the north, known as the Albion or Middle synclinal, “The deepest point in this trough showing only about 800 or 900 feet from the surface to the Acadia (main) seam.” *Geological Survey*.

We have now traced our synclinal as far eastward as the Fulling Mill on McLellan’s Brook. A short distance to the westward of this Sir W. Logan has marked on his map of the Pictou Coal Field a fault running N. 25° W., which he calls the Mill Road dislocation, and considers that it produces an upthrow to the westward. The evidence on which it is laid down does not appear quite conclusive, and I have been informed that in consequence of explorations made last summer there is reason to consider it not of so large an extent as anticipated.

Sir W. Logan states that he can find no evidence of any disturbance on the line of the production of the Mill Road fault to the north of McLellan’s Brook. Should this be the case, it forms a decided exception to the general rule, affecting the north and south faults of the Pictou Coal field, as proved by underground workings, they increase rapidly as they go to the north, frequently at the rate of one in five.

The large body of shales overlying the Main seam does not appear as persistent as the coal itself. The Foord Pit was sunk 900 feet to the Main seam, through dark shales and ironstone bands only, while the Foster Pit sunk in equivalent measures less than one mile to the westward, passed through large beds of sandstone before reaching 280 feet of shale immediately overlying the same seam. In the pit sunk on the Pictou Company’s area, on the east side of the river, sandstones were penetrated, replacing the enormous beds of shale overlying the same seam a short distance to the westward. As these changes in the nature of the strata enclosing

the coal seams, occur in so short a distance, I would venture to suggest that they render the theory of the alleged unconformity of the measures lying to the east of the old Mill Road fault of less weight, especially when as in the Geological Survey report, the bend of the measures to the east, and the quick change from shales to sandstones are brought forward in the absence of more definite knowledge, as the signs of an important fault.

At present we are best acquainted with the western side of the black shales, and the experience of the miners shows that the change from the soft carbonaceous black shales to the post and sandstone rocks is very sudden, and may be marked by a line drawn from the mouth of Coal Brook to the old Colin Pits. On the east side of the East River, the thickness and uniformity of the black shales exposed, almost continuously, from the mouth of McLellan's Brook to the Grant farm, coupled with the large beds of sandstone, sunk through one-third of a mile eastward, would allow on the east side an equal sudden change from carbonaceous to arenaceous measures.

Still following the line of synclinal we have next to notice the oil shales opened on McLellan's Brook, one quarter of a mile north of the Fulling Mill. These oil shales are found to occupy the apex of a synclinal with a north-east course, and are considered with every appearance of reason the equivalents of the oil shale opened on the Marsh Brook and also on the property of the Merrigomish Coal Company, three-fourths of a mile to the north-east of the Marsh pit; their dip and strike at these points being conformable to the seams of the Marsh group.

A short distance to the south of the Fulling Mill are a series of faults bringing up lower measures which come abruptly against the seams of the Marsh and McBean's groups. The effect therefore of these faults has been to throw the crops of the oil shales considerably to the north of the position they would naturally occupy at the south-west apex of the McBean synclinal, and to bring into the position formerly occupied by them the series of coal seams known as the McLean and Mountain groups. We are thus enabled to trace this comparatively shallow synclinal from end to end of the coal field, and to show that its presence has a great effect on the probability of the extent of the Albion or Main seams across the whole district.

It is estimated by Sir W. Logan that the McBean 8 foot seam underlies the Marsh group at a vertical depth of 700 to 800 feet. The thickness of the measures between the oil shales and the Fulling Mill being only 437 feet by actual measurement, it would not appear possible to find the outcrop of this seam south of the oil shales on McLellan's Brook, as it probably abuts against the Fulling Mill fault at a considerable depth from the surface.

Were the Mill road fault absent, or of comparatively small extent, the task of comparing the various horizons would be a slight one, as but one set of faults would require to be accounted for. A comparison might then be confidently made between the 3 feet seam and black shales found above the Fulling Mill, and the $3\frac{1}{2}$ feet seam on McLellan's Brook near the Halifax Company's east line, which is also found near the mouth of Coal Brook on the Intercolonial Railway and further to the westward. *The underlying seams of the Albion group would then reach the South fault with a strike to the east of south, and leave the fault again as the measures lying to the south of the McBean seam assume their north-east line.*

This form would show that the eastern half of the district possesses an almost similar structure to that found at Westville, where the interception of an undulation by a fault has hidden the crop of the Main or Acadia seam for a short distance in the vicinity of the Grog Brook.

In a paper read before you about two years ago, I gave what I considered grounds for the equivalence of the Widow McLean and the Albion groups.

The identity of these groups was supported, in addition to other arguments, by the fact, almost too strong to be a coincidence, that both these series of seams are overlaid at a height varying from 1300-1600 feet by a set of comparatively small coal seams, and that as yet no coal has been found in the intervening strata.

During the summer of 1874 another seam has been found in this series overlying the Main seam. Its thickness is about 4 ft. 6 in. which you will observe closely, agrees with that of the Mountain or Haliburton seam. There have not been any attempts yet made to

prove its extension east and west, but the fact of its presence in this part of the coal field, helps to support the views previously advanced.

Until the extent to which the crop of the Main seam is thrown to the eastward by the McLeod fault is ascertained, there are not sufficient grounds to determine if it reaches the South fault before being met by the Mill road fault. Should investigations prove this to be the case, the force of the argument is not lost, as the 1200 feet of measures underlying the Main seam are not all intersected by this fault, as its course cuts the measures at a slight angle.

If we consider the McLeod fault as one not of importance, we would find the Main seam crossing to the South fault nearly on the line of the McLeod seam; and then the 3 feet seam above the Fulling Mill would naturally fall into its relation to the Mountain group on one hand, and the seams found overlying the Main seam on the other side.

The extension of the Widow McLean or Main seams behind or underlying the McBean seam, is the only thing needed to demonstrate the fact that from one end to the other of the Coal field along its southern border, is an almost continuous outcrop of a group of large seams. The inferences to be drawn from this need not be extended beyond a thought of the amount of ground that must be underlaid by the seams of the Lower or Albion group.

A careful study of the various faults and dislocations of the southern part of this Coal field reveals in a most striking manner the care and wisdom of the Great Architect of the Universe. Did the strata follow the laws regulating their position in Cape Breton and other Coal fields, we would have had the Albion group, containing two of the largest and finest coal seams in the world, buried hundreds of feet below the surface, and accessible only over a limited area. On the contrary, an examination of the map accompanying my paper, shews the crops of this lower group extending in an irregular form from end to end of the Coal field, affording not only unusual facilities for opening, but also a satisfactory proof of its presence immediately south of the conglomerates.

Returning to the interval between the southern and McLeod faults on the west side of the river, we find a district one and a half

miles wide, yet unexplored. The comparison made in the report of the Geological Survey of Canada, of some of the strata in this section, with sandstones immediately overlying the conglomerate below New Glasgow, is not borne out by Prof. Dawson's researches, he being inclined from fossil evidence, as shown by his paper on the transition of the Carboniferous into Permian, read last year before the Geological Society of London, to consider the latter an extension of the upper part of the Middle or Productive coal measures. From the facts gathered relative to the structure of the Pictou Coal field, these measures as suggested by the Geological Survey report, are probably lower than those containing the Albion Main and Deep seams. The fact however of the extension of the Bear Creek synclinal across this district, and that the amount of dislocation caused by the McLeod fault is not of serious moment, are important considerations. The reverse or southerly dips and the presence of coal, point out the existence of seams of the Albion or Lower group at this point, and the width between the two faults would allow of a development, little if at all, inferior to that attained by the seams of the middle or Albion synclinal.

The question then arises why explorations have not been made commensurate with the size of this district, and the importance of ascertaining the presence of workable coal seams. A considerable part of this space between the southern and McLeod fault is owned by a company which naturally is not at present solicitous about its contents, as their valuable working areas in other parts of the field afford it full occupation. The dull state of our Coal trade is also an evident reason why the attempt proposed a short time ago to employ the diamond drill in that part of the district held by other parties was not carried out.

There is, however, as far as our present knowledge extends, no reason to doubt that this will eventually prove a very valuable addition to the present working limits of the Pictou Coal Field, and that its extent is ample enough to afford room for the investment of capital in several large Collieries.