

ART. VIII.—SURFACE GEOLOGY OF THE PICTOU COAL FIELD.
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BOULDER clay covers large portions of this field; it often contains pebbles of the rocks immediately underlying, mixed with fragments of those passed over by the ice flow from the higher ground lying to the south and southwest, and with occasional boulders well rounded and travel-worn of still older rocks from more distant localities.

One of the largest of these known in the neighborhood lies on the edge of the Pictou Town Branch Railway, near Stellarton, and must weigh not less than forty tons. Some of the smaller are striated, but much of the rock of which the pebbles and boulders in the clay are composed is of too perishable a nature to retain surface markings after exposure to the elements, and striæ are rare.

In the clay there are frequently found grains and small pebbles of coal, which there is every reason to believe are from the outcrops of beds proved to be close at hand, and these, it is noticeable, have their edges rubbed off as from exposure to much abrasion, although removed but a comparatively short distance from their parent source.

In places the clay has been cut through, and the outcrop of soft measures in a friable condition exposed. The dark shales, coal and fireclays appearing in the clay as darker streaks, which gradually take on the character of individual beds decomposed in lessening degree until a compact form is acquired, and although the direction of the outcropping may be contrary to that assumed for the flow of the drift, no folding back of the streaks has been noticed in the sections.

Thin beds, or partings of sand, are occasionally seen in the clay, and streaks of various tints of red may be detected.

One interesting drifted fragment was observed on the side of the abandoned Drummond railway, passing through the lands of James Cameron.

In making a drain outside a cutting at this point, broken coal and black shale were turned up, so trial-pits looking for a possible seam of coal were, in consequence, put down. But instead of the expected coal measures the excavations only showed a mass, a couple of feet thick, thirty feet or so wide, of coal and shale partly imbedded in the clay, which in turn rested on undisturbed mottled, reddish beds of the millstone grit series. The probability being that this particular mass of broken measures had drifted from a point southwestward, half-a-mile or more from where it was found stranded.

The drift in some parts lies in well-defined ridges, gently rounded and coursing in the western portion of the coal basin about N. 40 E. The parallelism of the ridges west of Stellarton is well marked, and their course seems entirely unaffected by the elevation and direction of the subjacent surfaces.

It was at first supposed that the ridges near the river may have been old banks of the stream when it flowed at higher levels, closer inspection made it clear that there had been no such erosion as a river bears on the face of its banks, the sides of the ridges being equally rounded and uniformly graded.

These ridges may be seen on both sides of the river, where it enters the coal basin, and on the flank of McGregor's hill, in a series of elevations, some seven in all, having very much the appearance of river terraces.

It is also evident that the depressions between adjoining ridges are not due to subærial denudation, the area drained in many cases not being sufficient to supply the necessary flow of water to mould the surface into its present form, and this opinion is strengthened by the knowledge that it is not a characteristic of mining water to traverse a country in straight lines. Some of the depressions are at times water-runs which do not confine themselves to one course but in places break through to an adjoining depression, the deviated course apparently following the strike of some underlying stratum of soft or friable material.

And at such places the extent of the denudation, where not only has the boulder clay been washed away, but the older formations have been further eroded, may be taken as some gauge of the time since the present condition of things began.

One of the more convincing evidences of the glacial character of these ridges is a depression perfectly straight from the slightly raised centre of which water flows, when there is any to flow in diametrically opposite directions.

To the mineral explorer a knowledge of the nature of these deposits leads him to sink his trial pits in the lower ground where he may expect to find the surface offer less depth than on the crest of the ridges, and this knowledge is of no small value in the field under review since the excessive thickness of the diluvium is in many parts a great bar to the study of the structure of the older rocks beneath.

Twenty and thirty feet is a common depth, while sinkings sixty and even eighty-six feet have failed to pierce these deposits. The deepest spots are where it is supposed the river and larger brooks at one time ran previous to the deposition of the drift.

The position of these beds of drift is also a matter of no small worth to the Railway contractor, for there have been several instances where men accustomed to the soil of other sections of country have been disagreeably surprised to find the cost of earthwork in Nova Scotia far exceeded their estimates and experience elsewhere.

After the agreement in 1858 between the Local Government and the General Mining Association threw open the unreserved mineral lands to other lessees, an endeavor was made to trace the coal beds outside the Association's areas, but beyond a few chains distant this endeavor to the westward was for many years a failure. West of a certain line, the depth of the surface material was found to suddenly increase, and several trial pits and boreholes were abandoned when they failed to reach the rock at forty feet and more. This western limit of shallow drift probably indicates the eastern bank of McCulloch's brook in pre-glacial times, and studied in the light of our present knowledge of the underlying strata, it marks also the eastern side of the McCulloch's

Brook fault,—that great dislocation* of some 2600 feet which separates the Westville from the Albion field, and down tilts the former in the direction of the latter.

The influence of this fault on the surface configuration still remains, on the one hand a uniform slope towards it, on the other ranges of low hills abruptly terminating against it.

In the pre-glacial stage of its existence, the brook doubtless flowed at a lower level than at present over part of its course, and as erosion proceeded, and influenced by the inclined strata on the one side, it pressed eastward against the broken measures of the fault, or crossed over and skirted the Albion section.

After the deposition of the glacial drift ceased, and the brook renewed its existence, and in part guided by the form of the ridges already referred to, and partly by the general trend of the old contour not entirely obliterated by the new coating it had received, it began again its work of erosion at a higher level than at which it left off, and it traversed almost, if not altogether, on the eastern side of the fault in question. To what extent the fault and the old bed of the brook coincide can only for the present be conjectured, but as the working of the Westville collieries proceeds into the improved ground, it cannot be long before the actual position of the great break will be determined at one or more points along its course.

If the theory be tenable that it was the ancient brook that made the valley, now filled so deeply with drift, it is equally probable that the depth of clay, 35 to 70 feet thick, near the railway station at Stellarton, indicates that the river channel in pre-glacial times ran under what is now its left bank, and flowed in a course to which its deviations to and fro across the broad interval have not since restored it.

In Acadian geology, page 61, it is stated:—"A very large proportion of the present feature of the surface is due to the denudation in the production of the boulder deposits. The ridges of Cumberland, the deep valley of Cornwallis and Annapolis, the great gorges crossing the Cobequid Mountains and the

* Mr Hartley, in the Survey Report for 1869, gives it as 1600 feet only.

western end of the North Mountains in Annapolis and Digby Counties : such eminences as the Greenhill in Pictou County and Onslow Mountain in Colchester are due in great part to the removal of soft rocks by denuding agencies of this period, while the harder rocks remained in projecting ridges. On the other hand it might be shewn that many masses of rock which once projected above the surface have been greatly diminished or entirely removed."

This supposition, that the glacial was a period chiefly of denudation, the deposits being little more than sufficient to leave a record of its existence is somewhat at variance with that already implied in this paper. But while there can be no doubt that denudation in part was a result of the glacial period, and the rounding of the Atlantic Coast hills certainly effected by ice in that and probably similar periods of previous ages, observations in the small section of country now under consideration seem to point to other conclusions, at least with regard to part of its configuration.

Some influence other than relative hardness of the strata to resist the abrading influence of ice would seem to have been at work in determining the positions of the hills and hollows. Take the case already referred to, the conjectural ancient valley of McCulloch's brook, it is not easy to suppose that ice in any form could have plowed it out, and worked in a deposit 60 and 80 feet thick, and at the same time left at levels two and three hundred feet higher measures of much softer texture. The conditions observed would be more readily accounted for by imagining that the face of the country previous to the drift period had very much the same general contour that it has to-day though somewhat less reduced in height no doubt, and that that contour was acquired by subærial denudation subsequent to the period of stratigraphical disturbance.

It would seem to be something more than a coincidence, the association of lines of lesser elevation and well marked dislocations. The bed of the east river follows through a very broken section of ground, the entrances into, and the exits from, the basin of other water courses are invariably associated with dis-

turbed strata, and if it be rightly inferred that in the shattered rocks of dislocations subærial agencies would exert most influence, the association of the two is readily explained.

On the other hand, if it is assumed that the inequalities of the surface have been formed by the action of ice and marine currents, the reasoning applied to the clay ridges should be applicable to the hills and hollows, and approximate form and direction in rocks of uniform texture might fairly be expected.

This is not seen in the pre-glacial surfaces, which have been protected from subsequent erosion by the covering of drift.

But the faults that have circumscribed the basin and severed it into sections would rather appear to have been the primary cause for the hills and hollows assuming their present form under the hand of agents conveniently classed as subærial, acting through the ages that have been since the time when elevating and lateral pressures broke the uniformity of the carboniferous strata.

To clearly show this would require the field to be carefully mapped and contoured, which, unfortunately, has not yet been done. Such a map would further shew that the highest beds in the Marsh pit series, in fact the highest in the coal measure, is at the lowest elevation above the sea in the eastern section of the basin, and is overlaid by a small pond in shape of an arrow-head, whose edges are parallel to the strike of the strata on two sides of a subordinate fold.