

Canadiana - Palaeontology (1486)

"On a Modern Submerged
Forest at Fort Lawrence,
Nova Scotia"

by
J. W. Lawson

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in a
book of
the
series

The position of the gravels of the coast of France shows how very great has been the change of level around the English Channel area* since the period of their dispersion.

The formation of valleys, such as those of the French chalk-area, may seem to some to require an agency more powerful than that now suggested; but, taking as our guide the quantity of lime taken up by every gallon of rain-water which flows from our own chalk-district, the question becomes one of time, in the course of which every line of inequality along which water may flow must ultimately be deepened and widened out. This is not the place for details of such a calculation; which, with other effects of subaërial agency, I propose to submit collectively. If the cause be the true one, we have the data for the determining the lapse of time from the elevation of the Drift-beds down to the times in which we live; and, however vast that period may seem, which is but the newest date in our geological reckoning, we must not on that account merely reject the result.

The extent of the hydrographical area of the southern counties of England and of the opposite side of the Channel during the period of the distribution of the Drift-gravel can now be determined with tolerable accuracy, by combining the results of several observers (more particularly those of Mr. Prestwich and Mr. Morris) who have noticed and described them. Over the whole area I have never seen, or even heard of, the presence of a single form which would indicate marine origin. In spite of the great extent of the area, I believe the body of water to have been fresh; and, as a whole, it may be geologically the equivalent of some of the northern gravel-drifts, which were undoubtedly marine.

The climatal conditions are, I think, indicated by the manner in which large blocks of siliceous sandstone have been lifted and let fall amidst accumulations indicating no great moving power. Such appearances are well seen in the drift-area to the north of the chalk-range of Surrey, particularly about Ash. The distance from which these blocks have been moved cannot have been very great; and the only condition which seems to meet the requirements is one—where coast-ice was periodically formed and dispersed, carrying with it such materials as might be included in or attached to it.

JANUARY 3, 1855.

Dr. A. Halley was elected a Fellow.

The following communications were read:—

1. *On a MODERN SUBMERGED FOREST at FORT LAWRENCE, NOVA SCOTIA.* By J. W. DAWSON, Esq., F.G.S.

THE extraordinary tides of the Bay of Fundy, and its wide marshes and mud-flats, are well known to geologists as affording some of the best modern instances of rapid tidal deposition, and of the preserva-

* See Quart. Journ. Geol. Soc. vol. vi. p. 69, and vol. vii. p. 118.

tion of impressions of footsteps, rain-drops, and sun-cracks. Attention has not, however, been called to the fact which I propose to notice in this paper, that much, if not the whole, of the marine alluvium of the Bay of Fundy rests on a submerged terrestrial surface, distinct indications of which may be observed in the mud-flats laid bare at low tide, and in the deep ditches dug for drainage.

In their natural state, the alluvial soils of the Bay of Fundy are mud-flats overflowed by the high tide, and either quite bare or covered in part with salt-grass. Large tracts have, however, been reclaimed from the sea, and are distinguished by the name of "dyked marsh," or more shortly "dyke." There are in Nova Scotia 40,000 acres of dyked marsh, and in New Brunswick perhaps 10,000 acres. The soil of the marshes is everywhere a fine marine mud, deposited in thin layers by the tides, and of a brownish-red colour; except in the subsoil and in the lower parts of the surface where the colour has been changed to grey by the action of sulphuretted hydrogen on the ferruginous colouring matter. Though remarkably productive of grasses and cereals, no part of the marsh-land supports forest trees. Dyked and salt marshes occur in nearly every creek and inlet of the upper part of the Bay of Fundy, more especially in Minas Basin, Cobequid Bay, and Cumberland Basin; and it is in this latter that the submarine forest to which this paper refers is found to underlie the marine alluvium.

Fort Lawrence is a low point of upland, resting on Lower Carboniferous rocks, and separating the estuaries of two small streams, the La Planche and Missequash; the latter forming at this place the boundary between Nova Scotia and New Brunswick. Both of these rivers, as well as the other streams emptying themselves into Cumberland Basin, have at their mouths extensive tracts of marsh, and in this instance the marsh-land extends beyond and overlaps the upland point separating the rivers. At the extremity of the point the upland slopes gently down to the dyked marsh, beyond which there is a narrow margin of salt-marsh, scantily clothed with coarse grasses and *Salicornia*. This margin of marsh without the dyke is overflowed by the highest tides, and may therefore be taken as the high-water level. Owing to the toughness of the upper layer matted with roots, and the action of the neap tides, it presents at the outer edge a perpendicular front about five feet in height. Below this there is a sloping expanse of red mud, cut into many inequalities by the tidal currents, which appear here to be removing the old deposit rather than adding new material. On the surface of this mud I saw impressions of rain-drops and sun-cracks, tracks of sandpipers and crows, and abundance of the shells of *Sanguinolaria fusca**. There were also a few long straight furrows, which I was told had been produced by the ice in spring. Owing to the firmness of the mud, they remained (in August) quite sharply marked, though in places filled up with new mud.

At the distance of 326 paces from the abrupt edge of the marsh, and about twenty-five feet below the level of the highest tides, which

* Probably identical with *Tellina Balthica*, Linn.

here rise in all about forty feet, the mud becomes mixed with sand and gravel, with occasional large stones, probably dropped by the ice. At this level appear erect stumps and many prostrate trunks of trees. The stumps are scattered as in an open forest, and occupy a belt of 135 paces in breadth and extending on either side for a much greater distance. I saw more than thirty stumps in the limited portion of the belt which I examined. Between the lowest erect stumps and the water-level at low tide is a space of 170 paces, in which I observed only fragments of roots and prostrate trunks, which may, however, be the remains of trees swept away by the ice from the portion of the shore on which these fragments now lie.

On digging around some of the stumps, they were found to be rooted in ground having all the characters of ordinary upland forest-soil. In one place the soil was a reddish sandy loam with small stones, like the neighbouring upland of Fort Lawrence. In another place it was a black vegetable mould, resting on a whitish sandy subsoil. The smallest roots of all the stumps were quite entire and covered with their bark, and the appearances were perfectly conclusive as to their being in the place of their growth. I have no doubt that the whole of these stumps have been deeply covered with the marsh-deposit, and have been laid bare by the encroachments of the tides on this somewhat exposed point. In a few places the lowest layer of the mud originally deposited over the forest soil could be observed. It is a very tough unctuous blue clay, with a few vegetable remains resembling roots of grasses. This may have been the first deposit from sea-water, while the forest was still sufficiently dense to prevent the access of coarser sediment.

All the stumps and trunks observed were pine and beech (*Pinus strobus* and *Fagus ferruginea*), and it is worthy of notice that these are trees indicative rather of dry upland than of swampy ground. The pine-wood is quite sound within, though softened and discoloured at the surface. The beech is carbonized at the surface, and so brittle and soft that trunks of large size can be cut with a spade, or broken across by a very slight blow. Owing to this softened condition of the beech-stumps, they are rounded at top, and scarcely rise above the surface of the mud; while some of the pines project more than a foot. Even these last, however, are much worn and crushed by the pressure of the ice. The largest stump observed was a pine, two feet six inches in diameter, and exhibiting about 200 lines of growth.

These appearances cannot be explained by driftage, for the trees are rooted in a perfect woodland-soil; nor can they be accounted for by landslips, for the stumps are separated from the nearest upland by marshes nearly a quarter of a mile in width, and the upland is low and gentle in its slope. The popular explanation is that the tides have at some former period been dammed out, or their entrance obstructed by a narrowing of the mouth of the Bay. This theory is countenanced by the present state of the tideway of the St. John River, in which a ledge of rock so obstructs the narrow entrance, that, while at low tide there is a considerable fall outward, at half

tide the water becomes level, and at high tide there is a fall inward; the level within not rising to that of high water without, except in times of flood, when the excess of fresh water in the river supplies the deficiency of tide-water. It is evident that the complete removal of this obstruction would enable every tide to overflow ground now covered only by the annual river-floods; and, on the other hand, the river would be daily drained out to the level of the low tide. Such an obstruction would without doubt produce a change in the water-level of Cumberland Basin, and might even enable trees to flourish a few feet below the present high-water mark; but it could not under any circumstances enable upland-woods to grow nearly at the level of low tide in a country so well supplied with streams.

The only remaining mode of accounting for the phenomena is the supposition that a subsidence to the amount of about forty feet has occurred in the district. Such a subsidence is not likely to have been limited to Fort Lawrence Point; and accordingly I have been informed by intelligent persons, long resident in the neighbourhood, that submerged stumps have been observed at a number of other places, in circumstances which showed that they were *in situ*; and that trees and vegetable soil have been uncovered in digging ditches in the marsh. Nor are these appearances limited to Cumberland Basin. At the mouth of Folly River, on the southern arm of the Bay, a submerged forest on an extensive scale is said to occur; and in the marshes of Cornwallis and Granville vegetable soils are found under the marsh. These facts render it probable that the subsidence in question has extended over the whole shores of the Bay, and that the marshes have been deposited and the present lines of coast-cliff cut since its occurrence.

The marshes of the Bay of Fundy are known to have existed at or about their present level for 250 years. It is true that an opinion prevails in some of the marsh-districts, that the tides now rise higher than formerly, and in proof it is alleged that the dykes are now maintained with greater difficulty, and that tracts of marsh once dyked have been abandoned. The settling of the mud and the narrowing of the tidal channels by new embankments may, however, have produced these effects. For the antiquity of these submerged forests, we must therefore add to the two centuries and a half which have elapsed since the European occupation of the country a sufficient time for the deposition of the alluvium of the marshes. On the other hand, the state of preservation of the wood, after making every allowance for the preservative effects of the salt-mud, shows that its growth and submergence must belong to the later part of the modern period.

It is a singular coincidence that this comparatively modern instance of the submergence and burial of a forest should occur in the vicinity of the Joggins cliffs, which so well exhibit the far more wonderful events of a like character which occurred in the Carboniferous Period.



