

II.—EVIDENCE OF THE POST-GLACIAL EXTENSION OF THE
SOUTHERN COAST OF NOVA SCOTIA.—BY W. H. PREST.

(Read Feb. 8th, 1892.)

At various points on our southern coast are deposits of peat and marsh mud below high water mark. These often contain roots and stumps of trees now existing in this Province, and, by their position and by other circumstances, point conclusively to a late subsidence of the land.

Similar deposits have been referred to by geologists as existing on the coast of Cumberland County, and the same conclusion has been drawn from their occurrence there. I will here give further evidence which may be of value in future investigations.

Below Black Point, at the mouth of the Liverpool River, Queens County, is a deposit of black mud containing roots of bushes. In some places the mud, nearly one foot thick, has been washed away by the force of the waves, disclosing the angular rocks beneath, which show no appearance of ever having been part of a sea beach. The marsh has now a covering of sea shells, and is daily washed by the tides.

On the coast at Black Rocks, south-east of Lunenburg, is another deposit of peat and mud containing tree stumps and roots. This peat bed is situated in a deep gulch or valley at the head of a cove, and is several feet deep. It is underlaid on each side of the gulch by what is probably a beach of sand and gravel, and overlaid by a slight deposit of sand and sea shells. Whether the underlying beach is of marine or fluvial origin I am not prepared to say, but the surface of the peat is washed daily by the tides. The following section will fairly illustrate the subject:

Section— $\left\{ \begin{array}{l} 1. \text{ Cambrian slates.} \\ 2. \text{ Sand and gravel.} \\ 3. \text{ Peat and mud, containing tree stumps.} \end{array} \right.$

That these stumps have grown where they are now embedded is indisputable, as they cannot possibly be accounted for by a land-slide. The contour of the neighbouring surface is totally opposed to it. The valley is surrounded by cliffs and rocky hill-sides, and contracts at its upper end into a narrow rocky gulch, so that the present position of the stumps is the only place where vegetation could have thriven and peat have been formed. The stumps are much decayed and worn level with the surface of the bog, but are still complete enough to show that they are indigenous to this spot.

At the mouth of Broad River, in Queens County, behind a sand bank, is a large depression which at low tide is a marsh containing a pond one quarter of a mile long. At high tide it is a lake. The oldest settlers say that sixty years ago, this place was a swamp covered with forest. The partly decayed stumps and roots now found at low tide attest to the truth of the story.

At Catherine River, east of Port Joli, in the same County, a large tract of salt marsh was dyked, and a new river channel cut. This channel, although cut through soil periodically covered by the tides, reveals several feet below the surface abundance of partly decayed roots, stumps and logs. The existence of a forest at this place seems to be beyond the memory of the oldest inhabitant and I have failed to secure any tradition relating to it.

At Port Mouton, also, as well as other places around our coasts, deposits of peat containing logs, roots and stumps are seen at low tide.

In Prince Edward Island, a short distance above the city of Charlottetown, there is to be seen at low tide a considerable deposit of peat and marsh mud containing the stumps and roots of immense trees larger than any I have ever seen on the Island. These stumps have been worn down and are gradually becoming covered with sand.

On the south shore of Cascumpec Bay is a vast bed of peat known as "Black Bank." It is the result of the growth of a species of peat moss denominated "Sphagnum." The contents of this bog have been estimated at 14,080,000 cubic yards. With

it is seen the usual accompaniment of tree roots, some of which are in a perfect state of preservation. One layer of roots is seen below low water mark. A section of this bog twelve feet high is exposed on a point, and, even at that height, the waves during storms reach its very top. The decrease in size of this bog must already have been considerable, as it is well known that the deposits are thin at the edges.

A like deposit, but of far less extent, is seen at Lennox or Indian Island in Richmond Bay. It is supposed to have an average depth of seven feet, and the tide reaches within three feet of the top. At low tide stumps and roots are seen here as elsewhere.

At Gallas Point and other places in Orwell Bay, tree stumps apparently rooted in the marshes in which they grew, are seen five feet below high water mark. Those accumulations, once, undoubtedly, on a much higher level have been recently submerged, so that the sea is continually working upon them.

The above details are, I believe, entered in a published report on the Geology of Prince Edward Island. I mention this to show that in the neighbouring Provinces also a gradual subsidence is now going on. There are, undoubtedly, numerous other places along our coasts where it is apparent that peat bogs and forests are being slowly engulfed by the ever-advancing sea. A summary of this class of evidence seems to show that there has been a very recent (geologically speaking) subsidence of the Maritime Provinces. This subsidence must have been at least eight or ten feet, for in order to protect and promote the growth of vegetation, the surface must not only be above the highest tides, but must be beyond the reach of the sand and stones thrown up by storms, especially in an exposed situation like Black Point. Unfortunately we have no means of determining the time in the case of subsidence as we have in the case of elevation, all evidence being swallowed by the ever-restless sea.

At Musquodoboit Harbor, Halifax Co. when the tide is low and the water placid, is seen a deep and narrow channel extending through the surrounding flats to the sea. This channel is walled with cliffs of solid rock in some places almost perpen-

dicular, and may be seen at various places throughout the Harbour. At the head of the Harbour where the Musquodoboit River enters, the channel is extended by a like depression and steeply escarped rocks. This last is seemingly a simple continuation of the defile below, and a glance at the steep parapets a short distance above tells the story of its formation. Like Niagara, it has been apparently for many thousands of years subject to the undermining and eroding influences of the swiftly flowing river. Ages ago after the last recession of the continental ice fields it probably began its work, which resulted in the present almost perpendicular cliffs, and ages hence should the same influences be still at work, time, if not man, will witness the retreat of the steep rapids and their present position occupied by a deep defile resembling the one below.

The formation of this river gorge, I have ascribed to what seems to me the most efficient and probable cause, supported by similar evidence on the LaHave, East, Sutherland and numerous other rivers. That it was formed since the glacial age, the cliff tops glaciated to the edges which are yet angular and unworn, seem to prove. That it was not formed by the sea is evinced by its tortuous course through the surrounding hills, preventing the possibility of powerful action at the foot of the cliffs. That it is not an enlarged fissure is demonstrated by the undisturbed state of the slate and quartzite strata through which it is cut. Thus we are left to accept the formative influences first detailed as the most reasonable and effective cause of its conformation.

Now to apply this argument where it rightfully belongs I may say that the Harbour channel is an exact counterpart in almost every particular of the river channel. Its surroundings, tortuous course, conformation and geological structure are the same, but while the harbour channel is fringed with water-covered mud and sand flats, the river flows through dry land. However, the inference forced upon us seems to be the same, viz., that the harbour channel was excavated by the river at a time when the land was at least thirty feet higher, and the mouth of the river seven miles farther south than it is at present. To pursue the subject still further some credence may perhaps

be given to the theory that the granite boulder dredged by the Challenger one hundred miles off the coast denotes the extension of glaciers and consequent existence of land that much farther south.

Speculations regarding the time when this doubtful southern extension of glaciers took place might not be altogether futile if we only knew the rate of deposition on that part of the sea bottom. No doubt the above mentioned boulder was on the surface or within a few inches of the surface of the mud or clay composing the bottom, and the inference drawn from these facts will be, that either the annual deposition is inconceivably small or that the boulder was dropped from a passing iceberg long subsequent to the great ice age.

As to the time when the Musquodoboit River began to excavate its channel, an approximate estimate might be made, provided the rate of erosion were known. The rock is a hard quartzite and slate, and with only the now existing denuding agencies its excavation would be a work of many thousand years. To take Sir Charles Lyell's calculations for the much softer rocks of the Niagara, which is I think 33,000 years, we may arrive at a very rough approximation. But as his figures have been often disputed, we must rest content in the belief that many thousand years ago our sea coast extended much further south, and that had it remained so, Halifax would never have been the chief Naval Port of the British North American squadron.