

of water. Many of these are of a red colour, and of a much larger size than their in-shore brethren.

I have enumerated perch among the edible fishes, because though used only as food for swine at St. Margaret's Bay, they are eaten in many other places, and are said to be very palatable when skinned and properly fried.

Some years ago in Portland, U. S., I saw a large picnic party leaving the wharf in a small steamer with music and flying colours, for an excursion down the Bay. The party, I found by an account of their excursion, afterwards published, was no other than the "Ancient and Honourable Fraternity of Cunnors," and one source of amusement for the day was angling for and eating their finny namesakes. Happy days were these, before the terrible scourge of civil war fell upon that wonderfully prosperous country. Well would it have been for that people if innocent amusements had served as a sufficient outlet for their excitable temperament, and brotherly love had proved too strong for ambition and political animosity. Well will it be for us if we be warned by their example, and the sight of the wreck prove stronger than the voice of the syren. "*Nam tuarum res agitur paries cum proximus ardet.*"

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ART. XI. ON SUBMERGED FOREST TREES IN CUMBERLAND BASIN. BY P. S. HAMILTON.

NEAR the margins of the head waters of the Bay of Fundy are found, in several places, certain accumulations which geologists have distinguished by the name of "submerged forests." One of the most extensive and most plainly visible of these is to be found near the head of Cumberland Basin, and has been carefully examined and geographically described by Prof. Dawson in his "Acadian Geology," page 32; but similar appearances may be seen elsewhere on the shores of Chiegnecto Bay, and also of Cobequid Bay and of some estuaries of streams emptying into Minas Basin. At the several places referred to, on the extensive slope of the flats between high water and low water

mark, there are found imbedded in the marine alluvium portions of trunks and also stumps of trees, the latter often remaining in their original position and resting upon the remains of upland soil, upon which they are supposed to have originally grown.

Great importance has been attached to these remains as evidences of a subsidence of the land generally in that section of the country where they are found. Dr. Dawson, with apparently no hesitation, utters the opinion that there has been a change of sea level here, the cause of which he says must be assigned to "either the rupture of a barrier previously excluding the sea water, or an actual sinking or subsidence of the whole western part of the Province." He believes that "a subsidence has taken place over a considerable area, and to a depth of about forty feet;" and this subsidence he supposes to have been gradual. Entertaining, as I most certainly do, a profound respect for so eminent an authority, I must nevertheless take the liberty of at least questioning this conclusion, and of expressing the opinion that too much importance has been attached to the appearance of these submerged tree stumps. I shall briefly give my reasons for doing so in this paper.

I am not aware that any evidences of a subsidence of the land in the Western, or Northern part of Nova Scotia, have been discovered, except these appearances at Cumberland Basin, and a few other similar localities. If these appearances can be sufficiently accounted for through other causes of a distinctly local character—causes which we may now see in daily operation, we may reasonably conclude that the subsidence is *not proven*. The action of the tides about the heads of the Bay of Fundy may easily be imagined even by those who have never witnessed them. Wherever a vertical surface, whether of rock or earth, is presented to the tidal current, the bank so exposed is rapidly worn away by the great force of the current. The matter thus swallowed up by the water and held in suspension by it for a time, is eventually deposited upon the flats, or gentle slopes, over which the tides flow. It sometimes happens that the alluvial deposits thus made again undergo the same process. If we examine any of the channels intersecting the marshes formed by the Bay of Fundy tides, we shall find that,

throughout a large proportion of their length, there is a gradual change going on in the *locus* of the channel itself. On one side of it we shall usually find an abrupt bank of alluvial soil; on the other, a broad expanse of recently deposited mud, sloping gradually from high-water down to low-water mark. This bank is being constantly sapped, and its component materials carried away by the tide which, on the other hand, is as constantly depositing a corresponding quantity on the opposite slope. Thus, where artificial means are not taken to prevent it, the older marsh land is being daily engulfed whilst new marsh is being made; but, as of course, the upland banks and sandstone cliffs bordering the Bay and its estuaries are constantly being subjected to this same sapping process, the whole area of marine alluvial deposits is steadily and rapidly enlarging. As might be supposed from the great abrading force of the tides of the Bay of Fundy, combined with the effect of winter frosts in this climate, the work of disintegration and removal goes on rapidly among even the firmest materials which go to form the shores of the head waters of the Bay: these are the new red sandstone of Colchester, Hants, and Kings, and the soft carboniferous sandstones and shales of Cumberland Counties. Still more rapidly does this process go on where the shore happens to consist of a deep gravelly upland soil. To the existence of such soils at several localities on the margin of the channels of the Bay and to their rapid washing away by the tides may, I think, be attributed the appearances at Cumberland Basin and elsewhere, which are supposed to be the remains of extensive submerged forests.

We find all the broader expanses of marine alluvium, or marsh land, about both arms of the Bay of Fundy, dotted with isolated patches of upland. These are called islands, even where they are not bathed by the water on any side; because of their island-like appearance as they uprear themselves above the sea-like level of the marsh. Some of these on the shores of Cobequid Bay and Minas Basin show, where sections of them have been made by the action of the tides, beds of new red sandstone covered with a deep layer of soil; but, for the most part, both there and elsewhere, after going beneath the surface soil, we

find them to consist merely of beds of gravel. Where not denuded of their growing timber, its prevalent varieties, especially where the gravelly sub-soil is found, are usually pine, oak, and birch, and often differ from those of the neighbouring main upland. These so-called islands vary in area from a few roods up to several hundreds of acres; and in elevation from 10 or 15, up to 60 feet above the level of the surrounding alluvium. They abound in the marshes of Truro and Onslow. Long Island and Boot Island, on the seaward margin of the Grand Pre are notable examples of them; and others are to be seen of smaller dimensions in the marshes skirting the rivers of King's County. We find numbers of them again in the broad alluvial plains of Cumberland and Westmoreland. In the midst of the great Tintamarr there is one which comprises several farm steadings; and there is another of comparatively large area near the mouth of the Missiquash, and but a short distance from the site of the submerged stumps described by Dr. Dawson. It is no part of my present purpose to discuss the question of how these islands were formed. I think, however, that the supposed subsidence of the western coast of Nova Scotia may be accounted for by the disappearance of one of them in the vicinity of Fort Lawrence ridge in Cumberland County.

I have already referred to the abrading force of the tides upon the banks of their containing channels. The rapidity with which the tidal current saps and removes the material forming those banks is very remarkable. Cobequid Bay forms in part the boundary between the townships of Truro and Onslow. Farmers now mow grass and make hay in Onslow on the identical spot where, within the memory of many persons still living, the same processes were carried on in Truro, the Bay having changed its bed to the extent of its whole width within so brief a period. This is unmistakably proved at one particular spot by the fact that the remains of a breakwater formerly built in Truro have gradually become "annexed" to Onslow. It is possible that in other localities the tides have made equally great encroachments on the Onslow shore. Such being the case, where the shore of the Bay consists of a compact, clayey alluvium, it may easily be conceived that the abrading effect of the tide cer-

tainly could not be much less where the enclosing banks consist of a loose upland soil resting upon beds of gravel. If a proof of this were required, it might be found at Savage's Island, in Truro. This is one of those many isolated patches of upland already referred to, which lies upon the immediate southern margin of Cobequid Bay. In the old times of the French dominion in Acadia, the north-eastern and most elevated part of this island was consecrated and used as a burial-ground; and it is still so used by the Micmac Indians in that part of the Province. We may reasonably suppose that the old Acadian French would not bury their dead very near the brow of what must have been, even then, a steep, but no doubt wooded bank, exposed to the destructive action of the tides. At all events, that destructive action has been so great that so long ago as five-and-twenty years since, or more, many of the graves on Savage's Island had been opened at the bottom, and human bones were occasionally to be seen strewn down the steep bank where the undermining tide had produced land-slides.

Now, let us suppose that, some centuries since, there existed one of these gravelly and then wooded mounds, similar to others now to be seen in that vicinity, on the margin of the Cumberland Basin, at the most western extremity of the marsh which extends from the mouth of the Missiquash to the mouth of the La Planche. A glance at the map will show that on no other part of the shores of Chiegnecto Bay is the tidal current likely to strike with greater force than on this very spot. What would take place? The tide would gradually undermine the upland bank opposed to it. All the finer particles of earth would be carried away by the water. The coarser and more ponderous pebbles and boulders, if any, would sink to a lower level. Meanwhile the surface soil, being above the immediate action of the water, would still remain like a closely woven mat, held together by the intertwined roots of growing trees and the rootlets of grasses and other vegetable productions. Eventually this undermined and mat-like surface would slide, or drop, into the water in large flakes. The submerged turf would almost immediately collect a coating of mud from the overflowing tide; whilst the trunks of the still standing trees would be broken or ground

off, by the action of floating ice, the stumps and roots remaining embedded in the bottom of the Bason. This process, which may be witnessed on a small scale on the banks of any stream, would be continued until the whole hillock or island disappeared.

I believe that, in fact, this is what has taken place at the spot, off Fort Lawrence ridge, so particularly described by Dr. Dawson. This is only a conjecture, it is true: but it is one which seems to be favored by more facts than that other conjecture that there has been a recent subsidence of the whole western or northern coast of Nova Scotia. There are no evidences in confirmation of the latter view—at least none that I am aware of—except the appearance of these submerged tree-stumps and turf in Cumberland Bason, and in some other spots about the Bay of Fundy, where their presence can be still more easily accounted for upon the former hypothesis. These vegetable remains cannot be of very great age. We have continuous records of the history of Nova Scotia for over two hundred years. We may fairly assume that these forest fragments became submerged within that period. Had there been, within that period, any sudden subsidence of a large tract of country to the depth of forty feet, it would almost unquestionably have been attended with some very striking phenomena, which the inhabitants of the country could not have failed to observe, and of which they would have handed down to us some written testimony. Had there been, within that period, any subsidence, either sudden or gradual, to such an extent, we should surely find upon the coasts of the country numerous evidences of it which could not be explained away upon any other hypothesis than that of there having been such a subsidence. We have no such additional evidences. I therefore think that, for the present, we are justified in concluding that there has been no such subsidence, and that the instances of the submergence of forest trees, herein referred to, are local and exceptional, and are attributable simply to the action of the tidal currents in the Bay of Fundy.