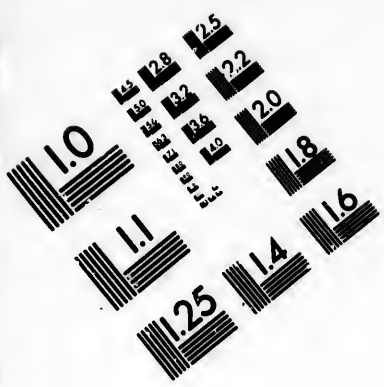

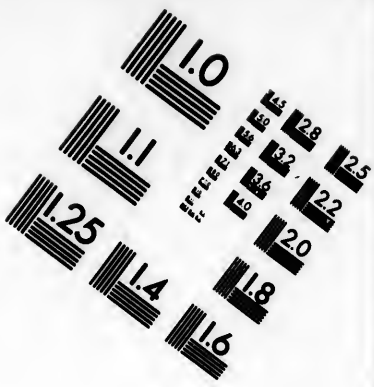

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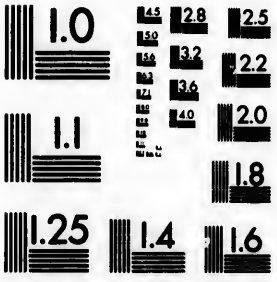

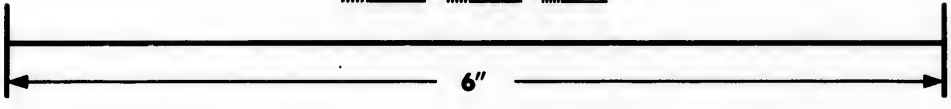

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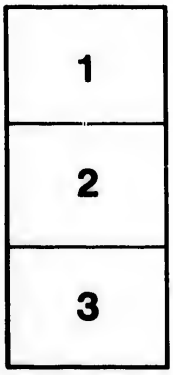

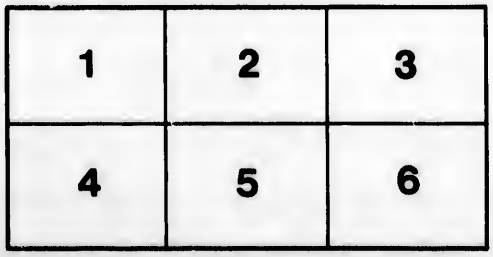

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ON THE SUPERFICIAL GEOLOGY OF THE GASPE PENINSULA.

by Robert Bell, C. E.; of the Geol. Survey of Canada.

(*Read before the Natural History Society.*)

The Gaspé peninsula embraces the region lying to the eastward of a line drawn across the country from the head of the Bay of Chaleur to about Matan on the St. Lawrence, and measures 140 miles in length by 70 in breadth.

The superficial accumulations of this district differ in their general character from those of the country to the west. One of the most remarkable points of difference is the absence of foreign boulders in Gaspé. On arriving in Gaspé Bay last spring, my attention was at once arrested by the contrast presented to many other parts of the country by the general scarcity of boulders of any kind in the fields, notwithstanding the hilly nature of the ground. On examination it was found that the loose masses were chiefly confined to the summits and more abrupt slopes of the hills, and farther, that they always belonged to rocks which existed *in situ* close by. During the whole summer, which was spent mostly in the interior of the County of Gaspé, my attention was directed to the inquiry; but I failed to discover a single stone which had not been derived from the rocks of the country, until I visited Cape Gaspé and Point Peter, where boulders of Laurentian gneiss were found in abundance on the sea beach. While the erratic masses of the interior are probably due to ancient glacial action, the presence of the Laurentian boulders on the beach, on the northern sides of Cape Gaspé and Point Peter, is no doubt owing to recent icebergs. The proof of this lies in the fact of their occurrence only on the beach, and that at points projecting into the open sea frequented by drifting ice, while they appear to be altogether absent from

the shores of the bay between these points. Gaspé Bay remains covered with fixed ice till late in the spring, and thus icebergs from the north are prevented from entering it. This want of far-transported boulders over such a large area, is a fact of great importance; for when we find loose fragments of useful minerals in this region we may be sure their source is not far off.

In the Gaspé country the geologist is not aided by artificial excavations; but the superficial strata may be studied in the natural sections afforded by land slides, and by the wearing away of the banks along the rivers and coast. Excepting the patches close to the shore, there is an entire absence of the flat-lying clay and regularly bedded sand so widely spread in the St. Lawrence valley to the westward. Along the river valleys, great accumulations of loose gravel are spread over the unmodified drift, or boulder formation, and on the lower levels the gravel is covered with loam or silt. In passing through the intervals, the streams in many places eat away their banks, first on one side and then at the next bend below, on the opposite side, depositing the material on the banks alternately opposite, and in this way the minor courses of a river are changed in a few years. At one time a small portion of the York River, at high water, flowed through a narrow channel, north of the main one, for a distance of about two miles, just before reaching the head of tide water. About twenty years ago, some obstructions were removed from this channel to allow timber to pass down it; and since that time it has become gradually enlarged, until now the whole river passes through it, except during freshets, when a part is forced through the old channel.

A vast amount of material must be transported every year from the land into the sea by the action of these streams. The greater portion of it is carried out from the shore by the currents and deposited on the bottom of the sea. Alluvial islands and mud flats are formed at the mouths of some of the rivers which enter the sea in sheltered situations. The most conspicuous of these are found in Gaspé Bay, at the mouths of the Dartmouth and York Rivers, where the meadow islands, comprising hundreds of acres, furnish pasture and hay for the horses and cattle of the settlers in the neighbourhood. Natural dykes are thrown up along the borders of these islands, and upon them long rows of trees and bushes venture out beyond the outline of the woods upon the upper islands.

Along the rivers, the silt is from one to six feet and even more

in thickness, and is frequently found to consist of very thin layers, separated by films of vegetable matter, probably marking the annual increase. Near the sea level, the silt is generally more than six feet in depth, and is much mixed with prostrate timber, often in such quantities as to suggest the idea that they are jammed accumulations of drift-wood which have been gradually buried beneath the soil.

Besides underlying the river intervals, the unmodified drift frequently occupies the smaller valleys and ravines, to a considerable depth. It consists generally of a stiff and sticky mixture of coarse sandy clay with gravel and boulders. The majority of the boulders are small, and many of them are longitudinally grooved and striated. It is impossible to say what thickness this boulder formation may attain, but it was seen exposed in many places to a depth of at least 100 feet. So far as the evidence afforded by the materials themselves is concerned, it would thus appear to be of local glacial origin. Some of the banks occur in such situations as to suggest the idea of their having been terminal moraines of the glaciers which once ran down the valleys. No ice grooves have hitherto been observed upon the solid rocks, probably because these are seldom or never uncovered in situations where their occurence might be looked for. Grooves were found on the rocks at the head of the fall on the Dartmouth, and a fall at the mouth of its first large tributary from the north. These were no doubt produced by stones borne by the ice and drift timber which are swept rapidly down with the freshets in spring. These current scratches are quite short, and made upon an uneven surface; while true glacial furrows are continuous, and always occur on a smoothed or planed base. Some years ago, the tributary just referred to, cut off a narrow neck of land which separated it from the river for several hundred yards, so that it now enters it in a direct course, at right angles to that of the river. At every spring freshet, since this change took place, it has precipitated a large quantity of shingle over the ledge at its mouth, into the bed of the river, and in this way a bank has been formed opposite to the fall which is already as wide as the former channel of the river, and is every year increasing in extent, and turning the main stream farther out of its original course.

The small amount of debris usually found about the cliffs would seem to indicate that the country had existed in its present condition for a comparatively short period; but on the other

hand, there are facts which shew that the present state of things has continued for a very great length of time. The principal of these are the accumulation of sand bars and points along the coast, and the wearing of the solid rocks in the channels of the rivers. About ten miles from its mouth, the Darmouth river crosses the Gaspé limestone in a gorge varying from 100 to 200 feet deep, cut through the whole formation, which is more than 2,000 feet thick, and tilted up at an angle of 45 degrees. At the Mountain Portage, on the Magdalen, the river flows in a deep and narrow ravine cut in the shale for a distance of a mile below the high fall. It is not asserted that these ravines have been excavated altogether by the rivers themselves, but they appear to have deepened them considerably. The second stretch of the York River cuts the Gaspé limestones and sandstones almost at right angles to their strike, and often flows for a considerable distance between perpendicular walls of sandstone, from twenty to eighty feet in height. The river itself appeared to have been the principal agent in wearing these channels. In some places large masses of the sandstone, which are known to have fallen from the cliffs within a recent period, are diminishing rapidly every year by the action of the ice and water, while the accumulations of the fragments, which are seen at every bend, when the water is low, afford striking evidence of the great wearing and transporting power of this rapid stream. Where the sandstone beds lie almost horizontally the river has in some cases cut for itself a very deep and narrow channel in the bottom of the main gorge. Two of these narrows, as they are termed, are only about one foot wide, and yet the whole volume of the river, at its ordinary height, passes through these confined spaces. It was necessary of course, to carry our canoes at these places, and although the extremely narrow portions were only a few yards in length, the channels leading into them were in both cases so crooked as scarcely to allow the canoes to turn between the walls. The sandstone beds in this part of the river are almost everywhere riddled with pot-holes. Many of them are very deep, and by their constant enlargement they sometimes meet and merge into one another. In this way one of the narrow places just described has been partly formed. One of the pot-holes measured thirteen feet in depth and eleven feet in diameter, and many others close by were nearly as large. The surface of the rock at the top of one of the cliffs, about twenty feet above the present

river bed, was observed to be worn smooth by the action of water, and covered by several feet of gravel.

Behind St. John's Bay on the west coast of Newfoundland Mr. James Richardson observed a set of ancient sea margins, seven in number, rising above one another at intervals varying from 50 to 150 feet. The lowest is 500, and the highest 1225 feet, above the sea, and each is marked by a horizontal belt of boulders and pebbles of Potsdam sandstone, arranged by the waves of the sea when it stood at these levels. At Blanc-Sablon Bay, on the Labrador side of the Straits of Belleisle, as many as fourteen distinct terraces with beach gravel on each, occur between 47 and 357 feet above high-water mark. There is thus sufficient evidence of a great depression and subsequent elevation of the land in this region, while in Gaspé a bank of stratified sand and gravel, eighty feet high, which occurs on the Magdalen River at an elevation estimated at 1600 feet above the sea, and similar deposits at many intermediate levels, indicate that a gradual rise of equal amount has taken place in the peninsula, but possibly at a different period. I am not aware that far transported boulders have been noticed anywhere on the high lands between Gaspé and the meridian of Quebec, but must leave this uncertainty, and also the reason of their apparent absence in Gaspé, to be solved by future research, and proceed to describe the modified drift of the district.

The narrow border of clay land extending almost continuously from Quebec along the south side of the St. Lawrence, terminates a few miles below Matan; and to the east of this locality only a few small patches of clay occur on the north coast. The largest of these is at the mouth of the Magdalen River, and comprises about 1000 acres on the west side of Magdalen Bay. It is probably fit for the manufacture of bricks, and holds marine shells. No stratified clay whatever appears to exist on the eastern coast, but in the southern part, it occurs along the Bay of Chaleur for some distance on each side of the mouth of the Great Cascapedia River. In this clay, Sir William Logan found shells of *Mya* and *Saxicava* in a great number of beds lying above one another, to the height of seventeen feet over high-water mark, in the position which they occupied when in life. Each bed is separated from the one below it by a thin layer of sand, which also fills the tubular openings through which the inhabitants of the shells once communicated with the surface. At L'Anse au Gascon, near Port Daniel, *Mya arenaria*, *M. truncata*, *Cardium Grœnlandicum*, and

Tellina proxima were found in sand at about fifteen feet above high-water mark. The gravel beds which have been already mentioned as existing along the river valleys, are sometimes arranged in terraces. One of the most striking examples of this, is met with six miles up the York River. Here a regular terrace about thirty-five feet high comes to the north side, and runs almost straight for about three miles, cutting off the bends of the river. About twenty-five miles up the same stream, and more than 400 feet above the sea, the gravel is almost destitute of vegetation, and is worn into a number of terraces and mounds. Terraces were observed not far from the shore at Grand Pabos and on the west side of Mal Bay. Three of the most conspicuous at the last mentioned locality were estimated at eight, fifteen and fifty feet above the sea. On the south side, of the northwest arm of Gaspé Bay, an ancient beach, 154 feet above the water, is marked by a sudden step along a hill-side, and traces of other beaches are found at lower levels. On the north side of the peninsula a terrace is met with in many localities at an average height of fifty feet. At the mouth of the Matan River, the upper six feet of this terrace is of fine sand resting upon bluish clay; at their junction are found *Natica clausa*, *Mya arenaria*, *Tellina Grœnlandica*, *Mytilus edulis*, and *Mesodesma Jauresii*, together with *Balanus crenatus*. West of Matan a well marked terrace of the same height occurs one mile below the Metis River. Eight miles up this river, *Balanus Hameri*, *Natica clausa* and *Saxicava rugosa* are found at the height of 245 feet above the sea; and two miles west of the mouth of the same river, *Saxicava rugosa* and *Mya arenaria* occur in sand at the height of 130 feet.

An upheaval of the land appears to be going on, along the south side of the lower St. Lawrence. At Rivière du Loup, *Tellina Grœnlandica*, and a large variety of *Mya arenaria* are imbedded in great numbers, in the sand and disintegrated shale of raised beaches along both sides of a rocky ridge running eastward from the Government Quay, and varying from about five to about fifteen feet above the highest tides. To the east of Rivière du Loup, narrow terraces or raised beaches are met with in many localities, favorable to their preservation, along the coast as far as Cape Gaspé. They are found at numerous heights from the present sea level to fifteen feet above it. A terrace about five feet above the high-tide mark, and averaging 100 yards in breadth, extends from Rimouski to Whale Cape, with the

exception of some interruptions caused by steep and rocky portions of the coast. It is composed of fragments of shells, and the ruins of the rocks which rise in the banks behind it, and forms an excellent road-bed, as well as a productive soil. The shells of these terraces belong to the same species as those now living on the shore, and among them the *Mesodesma*, which is not found in the post-pliocene deposits about Quebec or Montreal, is particularly abundant, immense numbers of these shells sometimes occurring in groups without any intermixture of sand or gravel. Large bones of whales were observed in several places between Metis and Matan, partially imbedded in the five-feet terrace. At Ste. Anne des Monts five or six distinct terraces of sand and gravel rise one above another to a height of about twenty-five feet over the sea. They all abound in shells, generally much broken and worn, belonging to the common littoral species. The formation of sand points, and of long sand beaches, closing up bays, and forming lagoons in numerous places on the east and south coasts, would also indicate that a gradual elevation of the land is now going on. The principal of these are, Peninsula Point and Sandy Beach, which, stretching from the opposite sides of Gaspé Bay, leave but a narrow channel between their extremities; the beach running across from Cape Haldimand to Douglastown, forming Douglastown Lagoon; the narrow beach nearly five miles long separating Mal Bay from the Barachois; the beaches of Grand Pabos and Port Daniel Lagoons; Pespebiac Point; and the beach forming the lagoon at the mouth of the Wagamet, or Bonaventure River. These beaches are above the influence of the tides, and, in places, support a growth of spruce trees. Peninsula Point is nearly covered by a spruce grove. In the northwest arm of Gaspé Bay several small partially wooded sand points have been formed at the foot of the high rocky banks; and these, like the two large points, are found by the settlers who live on the top of the cliffs to be very convenient for landing places, and by the whalers for their sheds. Some of the points were observed to be thrown up into a series of small parallel ridges. Barriers of sand and gravel are thrown across several small coves or recesses between rocky points near Grand Pabos; and in this way a number of ponds are produced which being above the influence of the tide, are quite fresh, and to them, the sea-birds resort every day to drink. These facts appear to prove that the elevation of the country along the south side of the lower St. Lawrence, is still

in progress. I might however add that I was informed by an old resident, that on some of the flats between Rivière du Loup and Rivière Ouelle large drifted logs lie rotting in places now rarely reached by the highest tides, and even then they are covered by only a few inches of water—quite insufficient to float such large timber. On the north coast of Gaspé I observed the remains of a very old wreck lying among spruce bushes above high-water mark, and at the time supposed it to be an evidence of elevation. I am inclined to regard it as doubtful, however, since reading the accounts in the newspapers of the effects of the great gale and unprecedentedly high tide which recently visited these shores, sweeping away storehouses and boats supposed to be altogether beyond the influence of the sea.

The gradual subsidence of the Atlantic coast of the United States, appears to be proved beyond a doubt. In the Geological Journal for 1861, Dr. Gesner states that between New England and Newfoundland, the coast of the British provinces is rising in some places, while it is being submerged in others. Perhaps the most remarkable proof of subsidence is the sunken forests in Minas Bay, fully described by Dr. Dawson in his *Acadian Geology*. The elevation of Gaspé, now going on, is probably a continuation of the same movement which caused the whole peninsula to rise above the sea, and which appears to be connected with the other undulatory movements extending along the coast of the whole continent. It is worthy of remark, in connection with this subject that in Ohio and Upper Canada, a very gentle inclination appears to have been detected in some of the ancient water margins. On the Labrador coast, besides the evidence of recent upheaval afforded by the raised sand and limestone-gravel plains, and the worn pillars of Mingan, Sir Charles Lyell states that some of the rocks above the sea level at this locality are perforated by the burrows of the *Saxicava* in such a good state of preservation as to show that they have not been exposed to the weather for a very great length of time. In addition to these facts, the occurrence of whales' bones, covered by moss and lying among the bushes above the influence of the tide, in both Labrador and Newfoundland, affords geological evidence of elevation, while a gradual rise of that island above the sea appears to have been observed by the inhabitants, as is shewn by the following extract from the *Newfoundland Times* of October, 1847 :—

"It is a fact worthy of notice that the whole of the land in

and about the neighbourhood of Conception Bay—very probably the whole island—is rising out of the ocean, at a rate which promises at no very distant day, materially to affect, if not to render useless, many of the best harbors we have on the coast. At Port de Grave a series of observations have been made, which undeniably prove the rapid displacement of the sea level in the vicinity. Several large flat rocks, over which schooners might pass some thirty or forty years ago with the greatest facility, are now approaching the surface, the water being scarcely navigable for a skiff."

Montreal, February 2nd, 1863.