FIRST REPORT

ON THE

GEOLOGICAL SURVEY

OF THE PROVINCE OF NEW BRUNSWICK.

By Abraham Gesner, Provincial Geologist, &c.

[Continued.]

At the main fall the water descends by five successive steps, in the distance of five hundred yards, through a chasm averaging about thirty feet wide and a hundred feet deep.—Through this narrow gorge the whole contents of the river is poured out with a fury that defies description. The industry and ingenuity of man have considerably modified the appearance of this remarkable spot. It still however remains a most extraordinary hydraulic spectacle, and affords a power for turning machinery beyond computation. Having swept slowly along the valley above, the water is accumulated at the bridge over the top of the falls; it is then thrown by its own weight into the deep and narrow opening below, where spouting from cliff to cliff and twisting its foaming column to correspond with the rude windings of the passage, it falls in a torrent of froth into the tide below, or passing beneath the mills its fury seems abated as it mingles with the dense spray floating above.

There are six saw mills huddled together at this spot, and they appear like eagles nests clinging to the rocks on each side. A large sum of money has been expended in their erection, and they are now in full operation. The deep cavities in the rocks are overhung with the alder, and creeping evergreens, which seem to be placed here for the purpose of decorating one of nature's wild performances. The low roofs of the mills are strongly contrasted with the massive rocks they occupy, where they hold a precarious situation,—the shelving piles of deals seem to mock the violence of the pool beneath. Such is the power of habit the sawyer careless of danger, crosses the plank placed across the gorge, and ventures where his life depends upon an inch of space.

L'Etang.—L'Etang is an excellent harbour, formed by a neck of the main land, extending outwards towards Deer Island. On the east side of the harbour and on a narrow peninsula, there is an inexhaustible supply of limestone belonging to the formation, extentending towards St. John, and previously noticed. Its colours are black, blue, brown, and white, and wherever the strata are not too much fractured, a good marble might be procured. The course of the strata is north east and south west, the dip is north west at an angle of 80°—sometimes the layers are perpendicular. This limestone is under and overlaid by clay, and chlorite slates. It is penetrated by numerous dikes and veins of greenstone, from a few feet to four inches in thickness. These dikes do not cut across the strata, but rise between them, having produced considerable alteration in the appearance, and solidity of the rock; they have rendered the limestone crystalline, and sometimes filled it with cubic crystals of iron pyrites. Every facility is afforded at this place for burning the lime. It can be cheaply conveyed from the quarry to the kiln, and from the kiln on board of vessels. The property has been purchased by gentlemen from the United States, who are making preparations to calcinate the limestone upon a large and excellent plan. I followed this formation across the peninsula to a deep cove, and some distance in an easterly direction. There is an abundance of fuel on the tract, and suitable slates for erecting the kiln.

The new red sandstone and conglomerates, are the prevailing rocks at Dead Man's Head, and the Islands adjacent.

Beaver Harbour.—At Beaver Harbour there are considerable deposits of clay and *detritus*. In one instance, and near the house of Mr. Young, a bed of stiff blue clay was found belonging to the tertiary deposit, and containing the remains of shells like those in the marl of the Scoodiac. The clay is succeeded by a collection of sand and gravel, containing much oxide of iron, and sometimes the black oxide of manganese. It has arrested these mineral in their descent, and the pebbles are sealed together, forming a perfect conglomerate. The oxide of iron is finally converted into bog ore, shot ore, and the specular oxide. The oxides of iron produced by decomposition are frequently washed by rains into shallow basins on the surface, where they become consolidated into globular masses, especially when clay is present. These masses when broken often exhibit incurved lines having a metallic lustre. In this way may the clay iron stone of the coal fields have been produced. The above fact was observed by the celebrated Dr. Buckland; and at Beaver Harbour and other places, I have observed from pyrites gradually passing into a soluble state, thence collected by drainings from the soil, and finally through different stages of solidity, back to a hard compact ore. Such are the changes to which even solid and inorganic matter is liable.

The oxide of manganese is used in glass making, pottery, and chemistry, and may be useful when manufacturies are introduced into the country.

Both sides of Beaver Harbour are composed of clay, and chlorite slates, sometimes there are narrow deposits of hornblende slate; all of them contain nodules of green chlorite, which is used by the Indians for making pipes. On the east side of the harbour, the chlorite rock contains a vein of pure white carbonate of lime, about two feet wide, and embraces a small quantity of lead and copper ores. At the eastern head of the harbour the rocks are singularly striped from the tops of the high cliffs, down to the sea. Some of these nearly perpendicular stripes are composed of hornblende almost pure, and of a deep green colour. Sometimes the rock resembles hornblende slate, but it separates into rhomboids when broken, and the planes of cleavage differ from what might be called the lines of stratification. The hornblende divisions are alternated with the reddish trap, which passes into a hard and compact jasper, also rhombodial in its structure. In one instance a vein of this kind of jasper appears forty feet wide, and extends to the top of the precipice, which is upwards of one hundred feet high, and almost perpendicular. It appears that the hornblende and feldspar refused to unite during the time of their fusion. Similar facts appear along the coast towards the Poclogan. The changes effected by the heat, which must have accompanied the eruption of trappean matter from the lower parts of the earth, are so numerous and varied that it is difficult to place under proper classes, the rocks thus produced and acted upon. The clay slate is seen passing into hornblende, and the greywacke becomes solid quartz; sandstone is converted into jaspar, and limestone imperfectly indurated, is changed into crystalline marble.* The rocks from Beaver Harbour for a number of miles eastward along the coast, exhibit similar characters. Trap, hornblende slate, feldspar rock, and red jasper, are sometimes mingled with each other; again they are separated, and mark the shore with a variety of colours, and lance shapped figures, represented on the front of lofty and perpendicular cliffs. Sometimes talcose slate may be seen, and when placed in contact with a dyke, is changed into a hard clinkstone. That rock forms a considerable hill half a mile northward of Seely's Cove. The trap contains large veins of quartz and calcareous spar. A number of small veins of magnetic iron ore were also observed, but none of them are sufficiently wide to afford a proper quantity for working. The sulphuret of iron in cubic crysals, and irregular pieces, is common: but none of the zeoliteswere observed.

This part of the coast has a very gloomy and forbidding appearance; lofty precipices—shelving and overhanging cliffs rise abruptly from the sea, and being inaccessible at almost every point, offer no way of escape for the unfortunate traveller who might be landed beneath them. There are also deep caves, and wide chasms, where but a few rays of light ever enter, and no sound can be heard but the murmurings of the sea, ever washing their deepest vaults. That these frightful openings were formed by earthquakes, there can be no doubt, as the walls on either side clearly show that they were once united. The examination of such places is not free from danger, on account of the violence of the waves, and the detached pieces of rocks constantly falling from the cliffs above.

Red Head is a lofty cliff rising perpendicular from the side of the Bay. It is composed of the red feldspar trap, which gradually passes into a compact red jasper, capable of receiving a fine polish. The jasper may not only be procured in sufficient quantities to meet its use for ornamental purpose, but also supply an abundance of material to erect whole buildings. Had the ancient Greeks and Romans possessed a much less quantity of this mineral than is found at Red Head, they doubtless would have employed it in their magnificent works of art.—The great limestone formation, previously mentioned, was seen north of Seely's Cove, and it continues beneath the forest, following its course in a north easterly direction.

Poclogan and Le Proe.—The shore from the Poclogan to New River, is composed of argillaceons slate, talcose, and hornblende slates, frequently interrupted by numerous dikes, and changed in their composition and position by causes already referred to. The talcose slate is most abundant, and embraces large veins of quartz, and occasionally narrow seams of the micaceous oxide of iron. Its dip is towards the south east, angle 40°. At the entrance of the Le Proe, the conglomerate and new red sandstone appear again, and compose two small and beautiful islands, situated about a mile from the shore. The river is navigable for small craft only three miles from its mouth, where there is a beautiful waterfall, employed in driving saw mills. The sandstone at this place is intermediate between the new red, and that forming the upper series of coal measures. Its general dip is north west 45°. Following the river some distance northward of the bridge, the new red sandstone becomes decided in its characters, and occupies a tract of low level country, well distinguished in its appearance and agricultural character, from the naked crests of hills whose origin is to be ascribed only to operations in which heat was the principal agent. Excellent freestones may be quarried in this neighbourhood: they will not be found too hard, and will resist the weather.

On the south side of the entrance of the Le Proe, the sandstones of the coal measures appear; their dip is northward 75°. This sandstone extends along the shore of Mace's Bay to the entrance of the Basin, a distance of two miles, where it is covered by a coarse conglomerate, and finally by the red sandstone. Near the entrance of the Basin, the conglomerate presents a bold cliff: the same rock continues southward where it is again overlaid by the new red sandstone at Point Le Proe.

The discovery of this coal formation was unexpected, as the general features of the country near it are unfavourable to its existence. A complete section has been made on its western side by the encouragements of the sea, and by a difficult exploration made of the creeks and ravines in its neighbourhood, it was found not to exceed three miles in its longest diameter. Some hope might have been entertained that coal could be found, but upon examination the strata were ascertained to dip north west at an angle of 75°, and therefore it is most probable that if they contain that mineral, it would have been exposed among the layers now placed almost upon their edges. It is true that the outcropping of the coal might be covered with other rocks, beds of sand, clay, &c., but the section above mentioned, made across one of the diameters of the coal basin, and the strata, would have exposed the coal if it existed in any considerable quantity.

The sandstone composing the rocks of this coal basin, contain numerous remains of plants, now unknown in this climate, or at any higher latitude: but although a long period of time has evidently elapsed since they were buried in the earth, they still exhibit much of their original beauty, and even the vegetable fibre of their woody trunks. The most abundant of these plants now converted into fossils (or petrifactions as they were formerly called) approach nearest in their characters, to the fir tribe. Some of this class were observed, having parts of their trunks extending outwards from the solid sandstone, and measuring twenty inches in diameter. The ferns which often appear in coal fields are more rare, and but few fossil specimens of that plant, were procured at this place. Several branches of the stigmaria, like that described in Dr. Buckland's Geology, were discovered, and are beautifully marked on their surfaces with curious figures, that distingnish their class from every other either of the former or present growth. Many of these once living vegetables have their bark converted into coal or lignite. Some whole trees have been thus changed, and as those substances are more readily removed, than the solid rock where they have been buried, their situations are represented bydeep holes in the side of the cliffs. It would be irrelevant to the object of this report to enter deeply into a description of these singular relics; but none who behold them can refrain from reflecting upon the remarkable revolutions this planet has suffered. The effects so often mentioned, as having produced great alterations upon other rocks, and referred to the application of volcanic agency, are also very manifest in the strata of this coal formation, and are equally interresting. Doubtless by that agency the whole series of layers belonging to this group, has been thrown from its former almost level situation, and while one side of the coal basin has been elevated, the other has been depressed to a great depth from the surface. Its rocks have been hardened, and crystals of feldspar are formed among the consolidated particles of sand. The small quantity of coal and lignite still remaining, have been changed into a kind of anthracite, and the once flourishing fir is transmuted into a stone that rings under the blow of the hammer.

The strata of conglomerate extending from Mace's Bay to Point Le Proe, are thick and composed of pebbles of trap, porphyry, and occasionally serpentine, united by a calcareous cement. They contain numerous veins of calcareous spar and quartz, and also afford evidence of the disturbing force communicated to all the formations along the coast.—The extreme point where the lighthouse stands is new red sandstone, in which several narrow veins of asbestus have appeared from time to time, as the sea gradually removes the yielding rock. The same formations compose the shores of Dipper Harbour. It is somewhat singular that when the conglomerate rises to the surface, the soil is immediately improved and covered with a large growth of hardwood, while other rocks are accompanied with the spruce and cedar. About a mile northward of the Harbour, the great limestone formation was again observed, with enormous masses of serpentine that occasionally reach the coast. Leaving this place and proceeding towards Saint John, the attention will be arrested by a number of deep chasms and hollows often separated from each other by large grotesque columns, formed by the hand of nature, in the solid materials of the earth. The rocks being of unequal hardness, yield to the sea at one point, and resist it at others; hence the rudest figures, and most unsightly pinnacles are placed according to the taste of the most disordered imagination. Still farther eastward the trap appears again, having forced its way through talcose slate, and the dangerous reef and frowning precipice have resulted from causes now inactive.

Little Dipper Harbour is a small cove, affording shelter only to vessels of moderate size. On its west side several veins of sulphate of barytes were discovered in a compact greenstone. The barytes is associated with crystals of quartz, and in a few instances with a beautiful amethyst of a deep violet colour. The above rock is continuous to Chance Harbour, where it forms lofty and leaning cliffs of much grandeur and beauty. On the east side of the harbour, trap, argillaceous, and talcose slates, form a cliff two hundred feet above the level of the sea. The slates are much fractured, and embrace numerous veins of quartz. Sometimes the quartz is connected with crystalized carbonate of lime, of a deep red colour, and a beautiful green chlorite which appears to have been rendered fluid, and disseminated throughout every crevice in the strata. The soil in this neighbourhood is extremely scanty, and the summits of the hills are unoccupied by a shrub of any kind. It is only in the valleys where collections of sand, gravel, and clay sometimes appear, that any encouragement is offered for the honest employment of the farmer. But what nature has denied on one hand she has supplied on the other and the coast abounds in excellent fish of several varieties.

Musquash.—From the above place to Musquash Harbour, the red and jaspery trap is most abundant, there are, however, numerous intrusions of the hornblende variety, and the shore appears to be interstratified with several kinds of sedimentary and volcanic matter. The sea washes against the mural cliffs, and sharp fragments of rock stand up like needles to pierce the rushing waves. The clefts and fissures, before noticed are common here, and more than once was my boat nearly filled with water, by being urged by the waves into their narrow openings. The Gooseberry Islands at the entrance of the harbour, do not require particular mention, as they were found not to possess any minerals of importance.

Musquash Harbour is a mile and a half wide and two miles long, it can be approached safely, and affords a shelter from all winds. Its eastern side at the entrance is composed of alum and copperas slates, with strata containing plumbago and the sulphuret of iron. The decomposition of the iron pyrites often covers the rocks with a thick coating of the brown and red oxides. At one situation the front of the cliff is covered with small crystals of the sulphate of iron grouped together, and sometimes covering the rock to the thickness of an inch. Thus an abundance of copperas is produced by natural operations, for the decomposable variety of the sulphuret of iron from being exposed to the atmosphere and moisture, undergoes a chemical change, and is converted into copperas. The same rock also contains the sulphate of alumine by which the addition of a small quantity of the sulphate of potash will yield alum. The above minerals are so abundant that any quantity of alum and copperas might be manufactured at a small expense, while they are now imported from England and the United States, where few such opportunities are afforded for their manufacture as can be seen at Musquash. These slates are met by the limestone formation. which near their junction is very impure and often ferruginous; a short distance north of Mrs. Shannon's house it is penetrated by a dike of deep green serpentine. The serpentine having been mixed with the limestone has formed a beautiful marble of the "verde antico" variety, but it is to be feared that the rock has been too much fractured to supply any large slabs. Beautiful pieces of green marble were also procured here, and as it sometimes contains crystals of iron pyrites, it affords a rich variety for ornamental purposes. Fine specimens of satin spar were discovered at this spot, and a singular variety of brecciated marble has been produced by the intrusion of the dikes.

The limestone was examined some distance from the shore, where it appears to be cavernous. On the side of a hill there is a narrow opening, that probaly communicates with a cave, but the passage is narrow and crossed by a small brook which descends among the rocks and finally re-appears breaking out at the beach some distance below. I made an attempt to descend into this dark chasm, but as it appeared to open directly downwards, and the men I had employed were unwilling to volunteer their aid, its exploration was deferred. The same formation also appears at French Creek, so named from a French armed brig having escaped from an English man of war, by entering the inlet concealed from the harbour. It also appears at a number of places on both sides of the river. On the west side of the harbour it forms a ridge of considerable extent. This is not only an excellent situation for making lime, but a good marble quarry might be opened and its productions shipped with little previous labour and expense. The marble is white with blue veins. It bears a fine polish, and if opened to a proper depth will afford blocks of a large size. Crystals of limped quartz are common in the altered slates. They are called diamonds by the inhabitants, from possessing the property of cutting class. The alum and copperas slates were also found on the west side of the harbour.

Few places can afford a better situation for calcining lime, quarrying marble, and manufacturing alum and copperas, and it is to be hoped that some enterprising individual will soon bring those materials into use, and render them of public utility.

In many instances it is remarkable how these slates have been twisted in their structure. They often appear like sheets of paper crumpled up, or doubled into folds. The lines of these folds are distinct from those of the strata, although there are instances where the strata themselves have apparently been wrapped together. It is most probable that this disturbance was effected when the mass was in a soft state, and is not the result of its original mechanical situation. Here again each formation is accompanied by frequent volcanic intrusion, and the same changes of level, and in the chemical characters of the rocks are exhibited, which have been already so often referred to.

Eastward of Musquash, the rocks are of the trap kind, interwoven with the altered slates. At a number of places, the former contains narrow veins of the micaceous oxides of iron, quartz, chlorite, and carbonate of lime. Sometimes beautiful crystals of quartz are found lining cavities or geodes. The cliffs will average from one to two hundred and fifty feet in height, and frequently rise so perpendicuarly from the sea, that a landing cannot be effected among them,—Large tabular masses of the slates are yearly falling, and the shore is covered with the ruins of the broken strata. I made attempts to land at a number of places, but could not proceed any distance on foot. Even in calm weather, the undulations of the sea are constantly rolling into deep gorges, and cavernous openings, where the rocks are rendered slippery by a luxuriant growth of marine plants.

At Negro Head the trap becomes more amorphous, and presents lofty cliffs of much grandeur. There are great quantities of coarse red jasper, coated with red oxide of iron. The talcose slate has become flinty, and resembles chert or hornstone.

At Manawagonis there are deep beds of gravel, sand, and clay, which, being exposed to the sea, are constantly washed away, and the Bay is rendered wider and more shallow, yearly. The islands in Manawagonis Bay, and Partridge island at the entrance of Saint John Harbour, are composed of rocks similar to those just described. The trap forms the eminence where the tower and block house are built at Carleton, while the slates will be found to occupy the lower grounds.

It is an extremely difficult task to arrange in separate classes the different kinds of igneous rocks, or such as have had their origin in heat: for, besides being mixed with each other, almost indefinitely, they frequently partake of the characters of the strata they have penetrated and disturbed; and although many of their varieties have been distinguished by mineralogists under different names, they frequently pass into each other by different gradations, so that it is impossible to draw a line of distinction between them.

These remarks also apply to the trap rocks so often mentioned, and the granite and syenite, evidently of much greater antiquity. Again, the changes produced by the eruption of the trap dikes, and other collections of volcanic matter, on the slates, limestones, conglomerates and sandstones already mentioned, are not only numerous, but appear to have been governed by circumstances which were not uniform, and therefore a particular description of them might render this report more voluminous than useful.*

*"Hornblende Schist," says Dr. M'Culloch, "may at first have been mere clay; for clay or shale is found altered by trap into Lydian stone, a substance differing from hornblende schist almost solely in compactness and uniformity of texture. In Shetland argillaceous schist, (or clay slate) when in contact with granite, is sometimes converted into hornblende schist, becoming first silicious, and ultimately at the contact hornblende schist."—*Syst. of Geol. vol.* 1. *p.* 211.

*The secondary and tertiary rocks also, when they are intersected by balsatic dikes, have frequently undergone some change,—beds of shale and sandstone are indurated, and reduced to jasper; compact limestone and chalk are converted into crystalline marble, and chalk flints altered to a slate like that resulting from heat in an artificial furnace.—*Buckland's Geology and Mineralogy, vol.* 2, *page* 9.

(To be continued.)

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