

TRANSACTIONS

OF THE

Nova Scotian Institute of Natural Science.

ART. I.—NOVA SCOTIA GEOLOGY (SUPERFICIAL.) *Continued from Transactions 1875-6.* BY REV. D. HONEYMAN, D. C. L., F. S. A., F. R. S. C., *Curator of the Provincial Museum.*

(Read Nov. 1881.)

PART I.—HALIFAX COUNTY.

IN H. M. Dockyard, opposite the North street Station of the Intercolonial Railway, is an elevation known as "Observatory Hill." The removal of a considerable part of this during the past summer in filling up an extensive and deep pond, afforded an admirable opportunity of examining its interior. Its proximity to my residence enabled me to note the progress of operations. The superintendent, Mr. Nolan, kindly took note of every massive boulder exposed, observing its position and size. "*Rudis indigestaque*" is its general description; structure, it had none. It was just an unloaded heap of rubbish. Its chief materials were coarse sand and clay. Through this masses of quartzite were scattered from top to bottom. The weight of one was estimated by Mr. Nolan at 13 tons. I was present at one fall in which there were three enormous boulders. One of them fell upon the car-track; nine men were required to remove it. Among the other boulders were syenites, gneisses, granites, diorites, jaspers, porphyries and diorite-amygdaloids from the Cobequid Mountains, and dolerite-amygdaloids from Blomidon. The form of this accumulation was oblong; its base occupied an area of 18 acres; its height was about 50 feet, more than the half of it still remains.

Glaciation was observed on the side of Water street, near the Dockyard, before the I. C. R. was extended to North street. Opposite the Sugar Refinery and on the same street, striation was observed last summer. The course of this was, N. 30 W., S. 30 E., mag.; N. 48 W., S. 48 E., true. This is in the direction of Blomidon and Observatory Hill. In my first paper I pointed out another course of glaciation at Wellington Station, on the I. C. R., made by the transportation of the Cobequid Mountain contingent on its way to unite with that of Blomidon for the formation of Observatory Hill and corresponding accumulations. The direction of Wellington Station glaciation is nearly N. and S. true. The Cobequid Mountain boulders have travelled overland from 65 to 70 miles; the Blomidon 60 miles. The massive quartzite boulders have travelled between $\frac{1}{2}$ a mile and 8 miles.

FORT NEEDHAM.

The elevation so-called has a constitution similar to that of Observatory Hill. This, too, has Archæan syenite boulders, as well as Triassic amygdaloid. I collected specimens of these in exposures not far from the glaciation opposite the Sugar Refinery. In passing to the west side I ascended the hill. On the top I observed quartzite boulders of dimensions not inferior to those of Observatory Hill. In the western exposures on Gottingen street I collected Archæan syenites and diorites, and Triassic amygdaloids.

On the same street, opposite the Wellington Barracks, exposed glaciation is extensive. The general direction corresponds with that of Water street, S. 48 E., N. 48 W.

CITADEL HILL

furnished Archæan and Triassic boulders. On the east side there is glaciation having the same direction as the preceding. The glaciation of Point Pleasant Park is generally S. 38 E., N. 38 W.

EASTERN EXTENSION.

Accompanied by Mr. Bell, High Sheriff of Halifax, I proceeded last summer to extend my acquaintance with the geology of the eastern part of Halifax County. I now give the results of my examination of the Superficial Geology.

PART II.

WAVERLEY GOLD MINES.

Coming to Dartmouth we proceeded on the road to Waverley. A short distance from the road to Preston drift was observed having a few Archæan Syenites without Triassic amygdaloids. In my former paper I noticed the occurrence of the latter on the Preston road. No more drift was seen until we reached the Waverley Mines. In an exposure of drift at the back of the stables I had collected Triassic amygdaloids on a former examination. Here they were collected a second time—two specimens. We proceeded farther and reached what is called the Old Guysboro' Road. This road runs easterly and crosses the direction of transportation. I consequently expected interesting revelations in this route. Drift was first observed near Rutherford's Mill, about four miles along the road. In it were syenite boulders. At Sullivan's (see Map of Halifax County) glaciation was seen and examined. The rock is argillite; the course of the striation is N. S. mag. (N. 18 W., S. 18 E. true). At Goff's archæan boulders, syenite and diorites are numerous. The sinking of a well showed considerable thickness of red clay. A beautiful specimen of Triassic amygdaloid with amygdals of radiating stilbite was found about a mile beyond this, which was evidently a rare one thus far east. Cuttings and other exposures of drift continued as far as Meagher's Grant. In these I found syenitic and dioritic boulders, with other amygdaloids (dioritic, with calcite amygdals) similar to those found in Observatory Hill. In Meagher's Grant, on the road to Musquodoboit Harbour, at an outcrop of lower carboniferous limestone, I observed drift with boulders of syenite and diorite. We then lost sight of the drift, our course being over solid granite. About a mile before we reached the harbour, we left the granite and entered upon argillites. These are largely obscured by the granite transportation, which has evidently taken the place of the syenite, which seems to have been intercepted by the granite belt over which we have passed. At the Harbour, on its west side, I found a few small boulders of syenite and diorite. It required close observation to find these among

the abounding granite boulders. I suppose they may have reached this point by travelling along the course of the Musquodoboit River.

JEDDORE.

We observed only granite transportation until we came to Jeddore. Then road cuttings gave promise of something different; but as we intended to go as far as Clam Harbour, we left the examination of this drift until our return. Approaching our destination we observed on the road a considerable outcrop of quartzite with glaciation. At the entrance of the Clam Harbour road, a large outcrop of argillite, which is beautifully glaciated, was passed, and we came soon to our terminus.

CLAM HARBOUR.

Looking around this locality, I observed some exposures of the familiar drift of the usual reddish colour, and found syenitic and dioritic boulders. This led me to expect other exposures on the shore. We made for Clam Bay. The impression made by the first view of this Bay will not readily be effaced. It has a sweep of about 11 miles, as far as Jeddore Head, and is washed by the broad Atlantic. It was ebb-tide, showing the greatest extent of its wide beach and white sands. On the bank was observed an exposure of red drift. In this I collected syenites, diorites, &c. From this point, the similarity of the several drift banks extending to Jeddore Head was readily recognizable. Not having an opportunity to examine these, I resolved upon doing what was next best,—upon examining carefully the exposures already referred to as occurring upon the road, regarding these, as corresponding with the lofty banks on the side of the bay. Connected with our drift bank, and partially overlying it, a marine formation is in progress, washed and heaped up by the Atlantic waves and storms. This sand is beautifully white, being chiefly formed of the siliceous and micaceous *detritus* of the transported granite.

In this formation we have—

- 1 Ripple marking.
- 2 Rill marking.
- 3 Worm tracks.

- 4 Worm burrows.
- 5 Bird tracks. *Tringa minuta*.
- 6 Imbedded egg cases of Raia. (*Pisces.*)
- 7 *Mollusca. Natica heros.*
- 8 *Moactra solidissima.*
- 9 *Mya arenaria.*
- 10 *Saxicava (?)*
Crustacea.
- 11 Crabs.
- 12 Shrimps.
- 13 *Echinoidea. Echinus. Echinarachnius, &c.*

We have thus the "Recent" (Cené) lying directly on Post-pliocene drift. The succession is seemingly irregular. The arrangement corresponds, however, with that occurring at the other parts of the bay, and other drift accumulations on the shore, on to Thrum Cap, at the mouth of Halifax harbour. The clays and sands of the Champlain period appear to be wanting. That either these or their equivalents are absent, we have no reason to suppose. That the Red Heads and other drift banks of the shore are the extremities of the drift transportation, I do not believe. I rather believe that it may have extended to a considerable distance, and that it has been denuded to a great extent since the Glacial period, by the ceaseless action of the Atlantic. On this supposition the Pleistocene drift *may* now underlie the Banks, and be overlaid by Champlain clays and sands, with overlying clays and sands of the present period. Returning I examined the two glacial exposures already referred to. The courses of the two are parallel, being S. 10 W., N. 10 E. mag., or N. 8 W., S. 8 E., true.

The drift cuttings on the road side at Jeddore yielded, as was expected, boulders of syenite and diorite, also a beautiful diorite amygdaloid boulder, having sub-spherical amygdals of reddish quartz (chalcedonic). Between Jeddore and Musquodoboit Harbour no drift cuttings of this kind were observed. At the latter place syenite and diorite boulders were again collected.

About a mile farther, at Petpiswick, extensive outcrops of

strata were observed. These are much glaciated. The very ferruginous character of the argillites affected the compass so much that I was unable to take the course of the striation. The accompanying drift cuttings on the road side showed the usual syenite and diorite boulders. In a cutting of drift at the Chezzetcook road, I found similar boulders and a large agate.

PORTER'S LAKE.

Between this and Chezzetcook I expected most certainly to find drift corresponding with that of Three Fathom Harbour point and Half-Island, where I found Triassic amygdaloids on my first examination. (Paper 1875-6.) I found neither amygdaloid drift nor glaciation. About a mile beyond Porter's Lake we found very distinct glaciation, and of considerable width, without any appearance of drift. The course of the former is N. E. magnetic; S. 18 E., N. 18 W., true. The transportation is granite. One immense boulder near a glaciated surface, attracted particular attention. It had interfered with the growth of a tree of considerable size. By it the trunk of the tree was indented half way. Proceeding, we arrived at Big Salmon River. At the beginning of Preston, drift was well exposed in the bed of a brook on the right side of the road. I here found a Triassic amygdaloid boulder of considerable size. The granite transportation ended before we reached Salmon River. I had thus certain evidence that this belt of granite which had not heretofore had a place in our geological maps, extended in width from Meagher's Grant to Musquodoboit Harbour, less one mile,—i.e., about 6 miles in length, from Ship Harbour, next Clam Harbour, to Lake Major, near the Waverley Gold Mines, 28 miles. We have now reached ground described in the previous Paper.

PART III.

Resuming our investigations, Mr. Bell and I proceeded directly to Meagher's Grant. From this we took the road to Little River Settlement; course N. E. Syenite boulders were observed along the road and in the settlement. From this we proceeded to Middle Musquodoboit; course N. E. Syenite boulders were observed all the way. They abound at the bridge

which crosses the Musquodoboit River. From Middle Musquodoboit we proceeded to Upper Musquodoboit; course, E. Deep cuttings of drift and vast numbers of syenite boulders, large and small, were observed. Reaching the road leading to the Cariboo Gold Mine, we turned in the direction of the mine; S. On the South side of the Musquodoboit River we returned to Middle Musquodoboit, observing syenite boulders all the way through, but not in so great a number as we observed on the north side, by which we went.

From Middle Musquodoboit we went to Gay's River; course, N. W. On this road we found the drift banks very numerous, and very deep cuttings, showing abundance of syenite boulders; great and small boulders of dioritic amygdaloids were also found with amygdals of calcite. At Gay's River we advanced into Colchester County as far as the "Gay's River Gold Field." On this road syenitic boulders were also observed. Returning by the same road to Halifax County, we proceeded to Elmsdale by the old road; S. W. Drift, with syenitic boulders, was observed all the way. A short distance beyond the road to Milford, syenitic boulders were particularly noticed beside a "roche moutonnee" very singularly ruttled. Here the Cobequid Mountains, the source of the syenitic boulders, were seen in the distance, without any intervening elevations.

From Elmsdale we returned to Dartmouth and Halifax city. Between Elmsdale and Waverley we missed the familiar drift, with syenitic boulders. Instead of these we had another granite transportation from the belt of granite which is seen from the Intercolonial Railway, on the east side of Fletcher's Lake, as we pass by Railway from "Windsor Junction" to the "Wellington Station." We now come to the end of the old Guysboro' road, which we have already travelled twice.

PART IV.—COLCHESTER COUNTY.

I resumed my investigation in this County, accompanied by the Hon. Samuel Creelman, Chief Commissioner of Mines of Nova Scotia. We proceeded by railway to the Brookfield Station. This station is distant from Three Fathom Harbour 43 miles; from

the Cobequid mountains, 17 miles. Here syenitic boulders are found in abundance. From this we went to the Brookfield iron (hematite) deposit; thence to the lead mines of Smithfield and Pembroke, and then to the "Cross Roads" of Upper Stewiacke and "Round Bank," Mr. C.'s residence, our course being generally easterly. In all this tortuous route syenitic boulders were seen in abundance. Like Mr. Bell, Mr. Creelman had become greatly interested in my investigations, and he now regards the boulders of life-long acquaintance in a new and interesting light. The "Cross Roads" just referred to are noted on our maps. The striation of Clam Harbour extending northerly passes through this point, and cuts the Cobequid mountains in the vicinity of "Mount Thom," Pictou County, where the Archæan belt seems to terminate. I consequently expected the syenite and associate boulders to diminish in number and gradually disappear to the east of the "Cross Roads." Standing in front of Mr. C.'s residence we see Berry-hill on the south side of the Stewiacke River. On either side of it there is a depression. The Clam Bay line of transit would seem to run along the left depression, while the Jeddore would traverse the other. We went to the top of this hill (S.). On the table land are several extensive farms. The Archæan boulders which abound below seem to have almost disappeared. After a diligent search among stone cairns collected out of the cultivated fields, I found only half-a-dozen diorites. We traversed a summit road to some distance westward, toward the Jeddore line, without observing the looked for boulders. Descending northwest on the side of this depression, we came to the line of boulder passage (Jeddore line), and reached the region of abounding boulders. Afterwards I investigated the region to the N. E. of the "Cross Roads." Contrary to expectation, I found Archæan boulders in abundance, as I went along the course of the Stewiacke River, toward the Pictou and Colchester County line. In the river the abundance of boulders, both large and small, was particularly observed as well as their variety and beauty. I advanced to within two miles of the County line, and found large boulders still occurring. I left off the search for their termination at this time.

We afterward proceeded to "Riversdale station," of the Pictou railway, i. e., in a northerly direction, toward "Mount Thom." Archæan boulders were seen in abundance occurring along the road, except where the mud and mire were too deep for any stone to raise its head. They were seen at the station, and on the north of Salmon River, in sufficient abundance and magnitude, and at no great distance from the mountain. We were now 47 miles N. of Clam Bay, and 3 miles S. of Mount Thom. From Riversdale we returned by railway to Halifax.

PART V.—PICTOU COUNTY.

I returned to Riversdale station and thence proceeded onward. On both sides of the line of railway, Archæan boulders were observed. I stopped at West River station for the purpose of examination. Here boulders abound. Those in front of the station are occasionally of large size, most of them are syenite, one is granite, being composed of quartz, muscovite and orthoclase and resembling the granites of Halifax. It is much different from the other granites which I have found in the Cobequids, although it is unquestionably derived from rocks of the same series. I then walked along the road which leads to settlement S. E. of the station. The usual boulders were observed all the way,— $1\frac{1}{2}$ miles. I collected at the end of the road, syenites, diorites and dioritic amygdaloid. Further examination in this direction is deferred to another season. Returning to Halifax I stopped at Milford station for the purpose of examining the *roche moutonnee*, referred to in Part III. Starting from Milford in search of this rock, I had some difficulty in finding it, so that I travelled about thirty miles before I succeeded in my search. These wanderings, however, were of service, as they showed me Archæan boulders in all directions, and the want of triassic boulders where I expected to find them. On the *roche* in question I observed five well-defined parallel lines having a course S. to E. N. 10 W. Besides these are parallel *ruts*, having a course S. 40 E., N. 40 W. Two of these were bent and turned in a direction S. 30 E. The character of this rock, quartzite, its position 13 miles east of the Halifax meridian, north side of the band of

metamorphic rocks, in sight of the Cobequid mountains, and its very distinct glaciation, led me to regard it as a very interesting object. In my paper of 1875-6, I quoted an observation from a table in "Acadian Geology," a position at the Gore having striation with a course S. 20 E. I had resolved to search for this striation. This *roche* saves me the trouble, and seems to furnish a sufficient reason, in connection with other observations, to which I shall yet refer in a future paper, for the distribution of boulders to the east of Clam Harbour line. It also gives occasion to modify certain conclusions at which I had arrived in my first *Paper*. Coming from the N. E., I searched as far as Elmsdale for boulders and minerals from the Triassic eruptive rocks, which extend as far east as Five Islands, without finding any. In my *Paper of 1875-6*, I stated that I had found specimens in the clays of Enfield. Last summer I found a specimen as I was approaching the top of Grand Lake from the Enfield station. Enfield, therefore, seems to be the limit of their distribution in this direction. The other extreme points seem to be half-a-mile beyond Gore. On the old Guysboro' road, the east end of Preston and the west point of Five Fathom Harbor. These two seem to be a sort of outliers, while extreme points of the main triassic amygdaloid transportations are Fletcher's station on the Intercolonial, Navy Island, on the east side of Bedford Basin, Dartmouth Cove and Laurencetown, at Half-Island.

GRAND LAKE.—(CENE FORMATION.)

While investigating the Pleistocene Geology around Grand Lake, I directed attention to the Lacustrine forms which I believed, in common with others, to be "Prehistoric Pottery." (Proceedings 1879-80.) I examined these *in situ*, and secured several specimens. I was therefore led to entertain some doubts in regard to their artificial formation. A chemical examination showed me that the supposed plastic portion of the article was *Hydrous iron sesquioxide*, and that the supposed pottery was "Lacustrine hematite concretions." We have therefore in Grand Lake a new formation in progress of a singular construction.

ROCKING STONE.

Roche Perché.

The Rocking Stone of Spryfield has long been regarded as an object of interest; it is situate about 11 miles north of Pennant Head, and 5 miles west of Sandwich Point, which lies between York Redoubt and Herring Cove. I had long heard of it, but had not seen it until the last Saturday of last October. I was astonished at its imposing appearance. Having reached its top by a ladder, which is placed against it for the convenience of visitors, I enjoyed a strange rock in this wonderful cradle. My conductor and companion, Simon D. Macdonald, F. G. S., seeing me seated on the top, went to the end of a lever, also placed in position, and commenced operations. The mass began to move, the motion increased and the rocking commenced, and was continued until I was satisfied. Mr. Murphy, C. E., Provincial Engineer, informed me that he had measured the boulder and calculated its weight, which is about 200 tons. It must be wonderfully set and balanced. It is placed in the forest, a beautiful little lake is on its west side. The sun setting in the west, the scene was beautiful and romantic. The boulder has a venerable look. It is coated with lichens, so that its lithological character is not at all apparent. This has led to the belief that it is not like the rocks around. My hammer soon satisfied me regarding its true character. It is a mass of coarse, porphyritic granite. Its constituent minerals are glassy-brown quartz, black mica and beautiful white orthoclase. The rock upon which it is poised is of the same character, and so are the other granite boulders in the locality. It may have travelled 9 or 10 miles, or it may not be far removed from its original position. As we walked to and from, I made observations on our way which I shall briefly describe:

HALIFAX TO DUTCH VILLAGE.

Our starting point is North Street, opposite Railway Station and H. M. Dockyard. Along North Street we proceeded westward. Beyond Agricola Street crossing is an outcrop of argillites, beautifully glaciated. The course of this striation is S. 20

E., N. 20 W., mag.; or S. 38 E., N. 38 W., true. This is 10° different from the course already observed at the Sugar Refinery opposite Wellington Barracks, and at Brunswick street, Citadel Hill. *Part I.* This striation corresponds with that of Pleasant Park, which is generally S. 20 E., mag. *Paper of 1875-6.* Coming to Leahy Villa, we find another glaciated exposure. It is 30 years since I first discovered this. The appearance is not now so striking as it was then. I had heard of Agassiz's glacial theory and glaciation before leaving Scotland. This was the first glaciation that I had seen. Since then it is very much defaced; the glaciation has largely shelled off. I would remark that the position of the argillites is vertical. It would be impossible for me to cut off either with hammer or chisel, a piece of unstriated surface, as the weather has done, or as I could do this if striated. This would seem to indicate that a thin *stratum* had been formed on the ends of the tilted argillites by the pressure of the striating agency. Here the prevailing course is S. 10 E., mag. Feeble and small *striae* diverge from this course; grooves occasionally run to 30° and return to 20° . Faults are very numerous here and elsewhere, varying from 2 to 9 inches. The course is not interrupted by these. The north side ascends and then at a considerable angle, and then it becomes level. Two granite boulders lie on this exposure; of these, the largest is $3\frac{1}{2} \times 3 \times 2$ feet. The extent of exposure is 300 x 150 feet. Farther on in the drain on the north side of the road, is another exposure, having a width of 30 feet, and striation course S. 20 E. There are still two others before reaching the Bridge. The striation of one has been shelled off, the other has a steep northern inclination on the surface. Coming to the North West Arm, our course was changed from W. to S. W. Here we observed great sections of drift. The boulders were granite, gneissoid and argillites, syenites and diorites and amygdaloids, dioritic and doleritic were absent. We entered on a road which I had not previously travelled. We were now among granites. Coming into line with Williams's Lake, we suddenly passed into gneissoid rock, and then into granite. I recognized an old acquaintance, and was on familiar grounds, having followed the gneissoid rocks on

this side of the harbour, in all their windings and dovetailings, into the granite, and defined them on the Admiralty Charts of Halifax harbour, years ago. Here the granites are strikingly porphyritic; these are *roches moutonnées*. The ruts in these indicate transportation and its direction. The deep ruts only survive; air, ice and water have so affected the material of the rock as to efface fine striation. Coming to a cross road, we turned to the right and at length reached the "Rocking Stone." Not being altogether satisfied, I returned to the N. W. Arm the succeeding Saturday and continued the westerly course beyond the bridge, going along the St. Margaret's Bay road. Rocks outcropping on the right side are gnessoid. I found one beautiful syenitic gneiss boulder on the road. This is the only one that I have seen west of H. M. Dockyard. Drift cuttings are observed without noteworthy boulders. Approaching the Halifax water works the granites which extend south to the Atlantic coast came forward to the road. They are seen in conjunction with the gnessoid rocks. At a distance of four telegraph poles beyond the four mile post, a gnessoid rock is seen on the left side of the road, scooped out, with striation on the side of the scooping. The position of the striation and the ferruginous character of the rock, made it impossible to observe the course accurately with the compass. It seemed to be about S. 20 E., N. 20 W., mag. A large granite boulder rested above. The granite here is not porphyritic as that in the vicinity of the Rocking Stone; the constituent minerals are the same. This is granite transportation No. 3. The amygdaloidal and syenitic transportation, which Mr Hare reports on the north, seems to have been intercepted. —*Paper by Mr. Hare, Transactions, 1879-80.*

CENE.

In the lake at the Halifax water works, Mr. Keating, the City Engineer, reports the existence of an argillaceous deposit, which is largely composed of diatoms. Its thickness is about 6 feet.

(To be continued.)