Art. II.—Geological Gleanings in Nova Scotia and Cape Breton*. By the late Rev. D. Honeyman, D.C.L.

We propose to give some account of an examination of a portion of Cape Breton, which is of unusual interest, scientifically and economically. Our observations may be regarded as gleanings. The region is somewhat familiar to us as it is a field in which we did considerable pioneer work in 1851, and subsequently in 1861, when we were collecting material for the Nova Scotian Department of the London International and Great Exhibition of 1862. On the present occasion our headquarters is Strathlorne, an extension of the Mabou district, which lies on the east side of Cape Mabou. This side is chiefly known to us through the reports and sheet maps of Mr. Fletcher of the Geological and Natural History Survey of Canada.

On our way from Halifax to our destination we selected a route, a great part of which was new. Our first observations were made between Tracadie, Antigonish County, and Port Mulgrave, in the County of Guysboro'. The geology of this region was not altogether new to us, as we had often travelled between Nova Scotia and Cape Breton, and had a practical acquaintance with the rocks that lay in our way and rendered travelling somewhat rough and uncomfortable. In 1861 we had crossed from Plaster Cove, Port Hastings, to the foot of Cape Porcupine, and examined the beautiful section on the shore. Of this the Archæan crystalline rocks were found to be the centre. These were then regarded as igneous, intrusive rocks of Devonian age. On either side were stratified rocks, which we regarded as of Lower Carboniferous age. Mr. Fletcher now very properly assigns the crystalline rocks of Cape Porcupine to the Pre-Cambrian or Archæan, while he regards the stratified rocks as

* This paper, as well as that which precedes it, was found among Dr. Honeyman's MSS. after his death. It describes observations made a few months before his death, and covers very much the same ground as the preceding paper. It had clearly not been revised for publication.

of Devonian age. We have now these rocks beautifully exposed in the rear by the construction of the railway. On leaving Tracadie we took our stand on the platform of the car that we might make a kind of reconnoissance of the railway sections. We observed interesting sections of rocks, and especially the Porcupine's back, extending onward to the Strait of Canso, ruddy with the outcrops of its Syenitic masses. We hope to be able to make a more satisfactory examination of this section at some future time. Our route now was from Port Mulgrave to Baddeck by the steamer "Marion." We observed with interest the exposure of rocks, especially on the Nova Scotian side of the Strait of Canso, and compared them with those of the Cape Breton side. Our next point of chief interest was St. Peter's Canal, and the approach to it. The aspect of the Canal was in striking contrast with that in 1861. Then it was only an unsightly work. Now it is finished and of great utility. Its walls of igneous Diorite are of great geological interest. To me they were specially interesting, although the sight was very transitory. I had previously made a very close acquaintance with these rocks, through a fine collection of specimens presented to our Provincial Museum. Of one of these I had a microscopic section prepared by A. A. Julien of New York. This was subjected to a Polariscopic examination, and the results communicated to the Institute of Natural Science.

After clearing the Canal we turned our eyes in the direction of "Marble Mountain," of the East Bay Archæan range. We discovered, *in a manner*, this mountain in 1861, and collected specimens of its marble for the London Exhibition. Some years after it was *re*-discovered by Mr. Brown of P. E. I. Mr. Fletcher, in his report, gives Mr. Brown the credit of the original discovery. On all sides of the Bras d'Or to Baddeck and onward to Whycocomagh, all was familiar. We thought of the Mastodon tooth of Baddeck, and also of the noble spire of Gyracanthus magnificus, as well as the *Femur* of the Mastodon of Middle River.

At Whycocomagh, our next station, we were reminded of the Archæan Crystalline limestone which we examined in 1861, and represented by a specimen in our collection of marbles at the

London Exhibition. From Mr. Fletcher's Report and Map, this appears to be an extremity of the Pre-Cambrian Rocks of the Craigneish Mountains. We also collected a specimen of marble subsequently at the other extremity of Craigneish. Our route now is from Whycocomagh to Strathlorne, along the west side of Lake Ainslie. Cream-brown sandstones of Lower Carboniferous age are exposed in all directions. We reach the South-East end of Lake Ainslie. The beautiful sheet of water extends all the way to Strathlorne, a distance of twelve miles. Its greatest width is about four miles.

About a mile from the head of the lake we come to Archæan rocks. (See Fletcher's Map.) We collect specimens of these, granites. They extend to the lake. Where we cross them they are a mile in width. The area is sub-(isosceles) triangular, the base being on the lake. The height of the triangle is about 2½ miles and the base 2 miles. Two miles farther we come to the reputed oil region of Lake Ainslie.

About 8 miles farther we reach the manse of Strathlorne. Our position is somewhat elevated and commands an extensive view. In front is an intervale through which winds a stream. This is beautiful with luxuriant herbage, as the season has been remarkably early and favourable for vegetation. Beyond lie the Mabou Highlands with Cape Mabou, having an elevation of 1000 feet. These extend to the sea forming headlands, distinguished as Cape Mabou and Sight Point. The range of mountains has a N. E. and S. West trend. They extend from Broad Cove on the East to Mabou Harbour on the West. Like the Highlands of Scotland they have their glens and waterfalls. In anticipation, we would observe that they have also had their glaciers in the past. We observe the map of the Geological Survey of Canada represents this area as Pre-Cambrian, *i. e.*, Archaean, according to our terminology. Hills rise all around. The Geological Map of the Survey represents the Formation of the extensive area occupied by these as Lower Carboniferous Metamorphic. North of our position and at distances from two to three and a half miles are three areas, colored red, and distinguished by lettering as Dolerite and Diorite igneous rocks. The region has been very

appropriately named "Strathlorne." To the north of this lies Broad Cove, with its coal mines. Loch Ban, a continuation of Lake Ainslie, is another grand physical feature.

We now proceed to examine the region in detail. There have been heavy rains which have almost caused a flood. These have been favourable for our work. Since our arrival we have had showers which have cleared and brightened surface material lying on the roads and fields. Our attention has been directed to the Superficial Geology. Boulders abound. These are largely 'Archæan,' of very familiar aspect. Of these we proceed to make a representative collection for our Provincial Museum. Thus we have a fine collection of Syenites and Syenitic Gneisses and Porphyrites, &c. Hornblendic Diorites, igneous rocks, are also represented. These boulders were collected on the way to the areas of those rocks already noticed. There can be no doubt that the Archæan Boulders came from the 'Highlands,' having been transported in a southerly direction. In addition to these we find boulders of other material and formation, chiefly Carboniferous. The bulk of the superficial material is sand. The hills show nothing but sand. The rocks are so completely covered that up to the present we have not been able to find one outcrop (Tuesday). We presume, however, that the underlying rocks are 'Lower Carboniferous,' and the surface Post-Pliocene drift of "Glacial and Champlain" Period. We observe that Mr. Fletcher found glaciation on the shore at Green Point, Mabou Harbour, and inland, at the region of Oil operations on the west side of Lake Ainslie. We shall give these due attention. It would not have been surprising if Glaciation had been altogether absent on account of the general character of the Formation and the deep covering of drift. We intend to direct our chief attention to the surface geology. In so doing we will necessarily give some attention to the other.

We will pursue the mode of investigation followed in Nova Scotia. Taking for granted that Mr. Fletcher's observations on Glaciation are accurate, we extend his lines southerly and draw two series of parallels. A line of one series passes onward to the east of Whycocomagh, and ends in St. Patrick's Channel. This

traverses the centre of the Highlands, and then Carboniferous all the way to Whycocomagh, where it goes between the two great areas of Archæan rocks, *Cragneish* and *Mulloch*. Another commencing at McIsaac's Pond passes through Loch Ban, and along the major axis of Lake Ainslie, and proceeds onwards to St. Patrick's Channel, above the narrows; extended farther it enters the Great Bras d'Or at 60° 55′ long., N. W. of Marble Mountain. It thus avoids the Archaean areas on either side of Lake Ainslie, and just touches the area at St. Patrick's Channel.

We also extend the glacial course on the west side of Lake Ainslie in the petroleum region. This in its extension to the Mabou Highlands passes into the Gulf of St. Lawrence, about half a mile north east of Sight Point. In the opposite direction it passes through the Archæan area on the west side of Lake Ainslie, and south of the petroleum region, and enters into Lake Ainslie.

In our walks we have advanced as far north on the Broad Cove and Margaree roads as the Diorites, noticed in our introductory description, and cross limestone strata on the Margaree road. Archæan boulders have for some time disappeared, as we have been receding from the bounds of the Highlands. Our last specimens were collected some time before we reached the forks of the (Broad Cove and Margaree) roads. We had also crossed our sand hills twice, in the direction of Loch Ban, and made a collection of Archaean boulders on our way, in the deep ruts. In our second walk we advance along the top of the Loch to the right. A boulder was observed lying in our way, only here and there. At length we come within their range of transport, and found them sufficiently abundant and varied. We again commenced collecting. Coming abreast of a mountain on the left, we observed an outcrop of rocks high on its sides. We ascended. On our way Archæan boulders appeared in great numbers, continuing up to the outcrop of rocks. These belong to Mr. Fletcher's Lower Carboniferous Metaphoric, and incline at a high angle. When examining them, and looking for an appropriate specimen, we observe, right at the top, Archæan boulders. Of these we

also take specimens. Advancing to the summit we find similar boulders as far up as the top. We have reached an elevation which commands an extensive view. We see the Highlands over the Strathlorne sand hills, which we now regard as a glacial Moraine. We take levels and find that we are on a height corresponding with Fletcher's Archæan border and junction of the Lower Carboniferous Metamorphic. We descend the mountain in the homeward direction and find a considerable outcrop of a coarse conglomerate. Reaching our headquarters we examined Fletcher's map to locate our outcrops and found an observation 75° dip. We are not aware that he noted the occurrence of the Archæan boulders as we have not with us any of his Reports. We consider their occurrence at this elevation very important in its bearing on the height of our glacier, and its relation to the 1000 feet summit of Cape Mabou and associate elevations.

Proceeding on the road toward Mabou and in a course subparallel with the Highlands, with the strath and river on our right and the sandy Moraine on our left, we observe Archæan boulders in great abundance. The sand hills are succeeded by a mountain, on whose sides the rocks outcrop so as to be distinctly seen from the road. We cross the bridge over the river which here proceeds direct from the mountain gorge under the name of McAuley's Brook. Tracing its course on the map we find it coming from the one side of Cape Mabou, while other brooks proceed from the Cape in an opposite direction, toward the Gulf. We continue our progress along the road, still observing abundance of Archæan boulders. Coming to a road ascending the hill on the left, we turn in this direction. Archæan boulders are observed up to the top. Continuing we descend on the opposite side, still observing Archæan boulders on our way, some of them of large size. We collect specimens. Advancing we come in sight of Loch Ban and Lake Ainslie. We have now on our right a deep hollow with a brook (?). We follow this until we reach the low ground and swamp, which reach to Loch Ban. We have now the mountain with the outcropping Carboniferous rock very loftily in the rear. Away on the right Black River with its dense woods is seen, also proceeding toward Lake Ainslie. Our

present position is 4 miles distant from the mountain at the side of Loch Ban on which we made our observations on the previous day. Our glacier has thus acquired a breadth of four miles and has got a fair start toward Lake Ainslie. We have planned farther examinations in the centre and extremities of the Highlands and on both sides of Loch Ban and Lake Ainslie.

Our next course was on towards the shore. We went by the road to the coal mines. Here we found Archæan boulders on our way up to a certain point, where they seemed to disappear. Coming to the shore, we examined the banks as far as the outlet of McIsaac's Pond. We did not reach the section of rocks on the shore towards Cape Mabou. Sands and clays with imbedded boulders are exposed on the shore. We collected water-worn Archæan boulders on the shore. These may have been transported along the shore from Cape Mabou. We were now at the extremity of our Lake Ainslie hypothetical line which passes through McIsaac's Pond. It has been proposed to convert this into a harbour for the coal mines. On our way we had observed the low hills having the grey Diorites which are defined on Fletcher's map. On our return we collected specimens of these, and proposed to make a more particular examination of them and the Diorites on the Margaree Road opposite, afterwards.

We next proceeded on the road to Cape Mabou, which branches off the Broad Cove and Margaree Roads. As we proceeded, we observed Archæan boulders in abundance, increasing in numbers and dimensions as we proceeded onward and upward. Coming to the branching of the Port Ban Road, we proceeded to a short distance along this road, observing the Archæan boulders. We returned, and proceeded along the road to the Cape. Crossing the bridge over a brook we ascended, observing the very deep ruts in the boulder clay excavated by the heavy rain-floods. Archæan boulders, large and small, were abundant enough. We were now near Fletcher's junction line of the Lower Carboniferous and Archæan. We had not seen any outcrop of the strata of the former on our way. All were obscured by the overlying drift. Heavy rain prevented us from proceeding further in this direction. We will return on another day.

Mabou.

We would now extend our investigation in the course sub-parallel to the Highlands and towards Mabou. We begin at the Black River Road where our course was previously diverted towards Lake Ainslie. All the way we found Archæan boulders: numerous when we approached the Archæan mountains, less so when we were at a distance and had Lower Carboniferous hills intervening. Reaching Mabou River Bridge, we found them sufficiently abundant. We next proceeded on the road to the Harbour Mouth, and towards the S. West extremity of the Mabou Highlands—Archæan mountains. We found our boulders occurring all the way, and collected specimens. We next searched beginning at the bridge and proceeding up the river or away from the mountains. We walked as far as practicable along the E. side of the ——— and found Archæan boulders all the way. We have thus advanced in opposite directions in the hypothetical parallel line on the south-west of the Mabou Highlands. This conforms with glaciation observed by Mr. Fletcher at Green Point.

Our next station is at the residence of Donald Macdonald, Esq., the extreme S. E. point of the Mabou Highlands—Archæan. We have found Archæan boulders abundant enough up to this point. We now look around us. Archæan and Lower Carboniferous boulders are seen everywhere. We go to the shore of the harbour and find them equally abundant. Subsequently we ascended the only brook which proceeds from the mountain, and where a road to the pasture crosses the brook we found a good outcrop of rocks. We examine them and collect specimens. They are Archæan, but so friable as to make it difficult to secure good solid specimens having characters which are exhibited by the transported boulders. This is the only outcrop which we can find in this quarter. We ascended the mountains. All is obscured by soil and luxuriant vegetation.

Green Point.

We proceed to this Point. As we advance the mountains

retreat. We are now in a region which we examined in 1851, and subsequently when collecting specimens in 1861 for the great London Exhibition of 1862. We now traverse the enormous beds of Gypsum, with their heights and hollows characteristic of such deposits. We still observe plenty of our Archæan boulders. This perplexes us somewhat, as we expected that they would now disappear. We reach Green Point, our present *terminus ad quem.* We come to the great Carboniferous conglomerate, which we had observed on our way to the coal mines in 1851. I would remark that I then explored this region, which had not been visited by the author of Acadian Geology, and collected specimens which are now in our Provincial Museum. I have also given a record of the observations made, in my First Paper on the Geology of Antigonish County. (Transactions of this Institute.) Looking at these conglomerates, I thought that Mr Fletcher must surely have made a mistake, as it was hardly possible that these rocks could be glacially grooved and retain the marking in a position so exposed, and on the verge of the Gulf. However, there they were. We observed parallel grooving on the edges of a stratum which was comparatively plain, and also on its face. The course of all of these is S. 20 E. magnet. Our perplexity caused by the frequent occurrence of Archæan boulders on our way to the west of the Archæan rocks of the mountains was also dispelled, thus: The great conglomerate is largely composed of boulders of Archæan rocks, as we found them on the north side of the Cobequid mountains, as well as the south side. (*Vide* Paper on the Geology of I. C. R.) These are easily detached from the rock by the action of the sea and of the atmosphere, as well as glacial action. This conglomerate may therefore be regarded as a secondary source, and a transportation northward, caused by the sea and other agencies of the Lower Carboniferous period. Superficial observers may thus have been led into error, and persuaded that both southern and northern transportation may have been effected by similar agency, viz., Post-Pliocene glacial, in opposition to pre- and post- glacial.

Following the direction of the glacial grooves and at the same time traversing the Lower Carboniferous Conglomerate, we

actually passed along the hypothetical line of Mr. Fletcher's observation and reached Mabou Harbour accordingly. We then walked along the east side of the harbour at the foot of the Conglomerates and drift observing our boulders as we proceeded embedded in the drift and lying on the shore, and reached the other boulders of preceding days, which had come directly from the Archæan rocks. We have thus found transportation from the mouth of the harbour to a distance below Mabou bridge—5 miles direct.

"Our Glacial Problem."

The glaciation of Green Point suggests *influences* from beyond like the transportation on the Gulf shore in Antigonish County, and the glaciation on the verge of Cleveland Iron Mountain, Nictaux, and on the Canaan Road, Aylesford. The hypothetical parallels in Cape Breton and the natural sub-parallels of Lake Ainslie and Mabou Harbour conform with that of the Strait of Canso. We have already seen that the transportation and Harborus—Fjords—of Nova Scotia also conform with the Strait of Canso. The two thus conform with one another. *Vide* Nova Scotia on the Admiralty Chart and Fletcher's admirable and thoroughly reliable map of Cape Breton. We have the latter mounted and on the wall before us which makes all this very clear.

Loch Ban.

We advanced still farther on Loch Ban than on a preceding occasion. As we proceeded on the east side towards Lake Ainslie, we observed Archæan boulders of the usual kind and variety on the road and on both sides of it. Special attention was given as we came near to Lake Ainslie. Here the Loch becomes a narrow neck. We now turn from the main road to the right and cross what seems to be a glacial moraine of considerable magnitude. A deep hollow, a longitudinal excavation, causes a corresponding descent. Massive boulders are seen and examined. They are Syenites, Quartz-Syenites, and Diorites. Of these we collect specimens. We reach our terminus when we come to the lake.

Here it is of the greatest breadth. Its oblique axis is about 6 miles in length, the outlet being the extremity on our left. Our glacial track is now the major axis of this lake. Its length is now 6 miles from the shore and 8½ from the summit of Cape Mabou.

Cape Mabou

is readily accessible by the road that branches off the road to the Broad Cove Mines and McIsaac's Pond and Margaree. Following this road, we come to a branching road which leads to Port Ban. We proceed along this a short distance, observing an outcrop of Archæan boulders. We return. Crossing a bridge over a brook, as on a former occasion, we ascend, crossing the hilly ridge in front of the mountains. In the ruts we observe clays and boulders plentiful enough. The first outcrop of chocolate-colored sandstones is observed. This reveals the constitution of the hills. We then come to the valley between these and the mountains. We are surprised at seeing farms, the existence of which we did not expect. Proceeding along this valley, we at length ascend into the mountains. A second outcrop and the last of the Lower Carboniferous is observed. Onwards we see on the side of the road the first outcrop of the rocks of the mountain. They are diorites. Proceeding, we observe on the road, all the way, Archæan boulders of the same character as those already described in our wanderings, and outcrops of the rocks that produce them. We reach the summit and find an extensive table-land, with farms that astonish on account of their extent and excellence. Boulders are sufficiently plentiful, but the rocks are completely obscured by soil of excellent quality and dense vegetation. We are approaching Cape Mabou summit. Our guide directs attention to the watershed and White Brook. A beautiful outcrop of red syenitic gneiss is seen on the road. We have observed numerous outcrops of shaley rocks. In White Brook we collect (subsequently) Gneisses and Hornblendic Schists. We reach the summit, a height of 1,000 feet. Here we add to our collection a piece of a boulder of syenite; on our return we give farther attention to the outcrop.

Diorite Mountain.

This is the last of a short range of mountains that extend from Loch Ban in a northerly direction. We have already directed attention to the southern extremity of this Lower Carboniferous range, on which we found Archæan boulders. We now enter on the middle of the range from the Broad Cove road and at the northern end of the Sandy Hills (moraine). We find Archæan boulders on our way. We cross the moraine and ascend the mountains. We find a boulder or two, and then they disappear. We proceed along the mountains, northward, observing outcrops of chocolate sandstones, and come to Diorite Mountain. This is a very interesting mountain. The exposures on its sides and the outcrops on its summit reveal the character of the rocks. They are of the same constitution as those of Arisaig and East River, associated with the Lower Carboniferous formation. Like the Arisaig igneous diorite they are compact, amygdaloidal, porphyritic and vesicular. We collected specimens of compact rock and porphyrites on the highest outcrop.*

* This paper is obviously unfinished.