

XIV.—*Notes on the Geology of Deeside, near Ballater.* By WM. HAMILTON BELL.

(Read 20th April 1882.)

In August 1880, having been led to choose Ballater as summer quarters, I found that the surrounding district was one possessing very interesting geological features. On studying my geological map, I found that it contained the serpentine formation, and not having met with it before elsewhere, I took it up as one of my studies, not from its being of very great interest in itself from the authorities I had then read on the subject, but from its novelty, which has its pleasure and profit when no other special formation is to be found on the spot.

In Juke's and Geikie's Manual, serpentine is described as "a rock intimately associated with altered limestone, and is itself, probably, in many cases a further stage of metamorphism of magnesian limestone." "But it may be the result of metamorphism of augitic, hornblende, or olivine bearing rocks. It is compact, dull, usually of some shade of dirty green, with a splintery fracture and easily scratched. It occurs sometimes in small veins, layers associated with limestones, and sometimes in large masses, and forms ranges of hills." The formula according to the same authority appears to be 44·14 of silica, 42·97 of magnesia, and 12·89 of water. In the section attached to Knipe's map of the general formation of the earth's crust, I see that the serpentine is placed next to the gneiss and mica.

I have found no special work on serpentine, but have consulted De la Beche, Bonney, and others who have treated of it; and I have derived the most useful information on the subject from the papers of Professor Heddle in the "Royal Society's Transactions," where he deals with the mineralogy of Scotland. It has been more prominently dealt with in foreign journals, where I suppose the formation is more fully met with than in this country, but I do not enter into any dissertation here, as my object is more to note what I found in the locality than what it may be elsewhere.

The serpentine is found *en masse* on the Coyle, which is a hill divided into three summits. It is on the property of the Prince of Wales at Birkhall, about 4 miles from Ballater. Between the Coyle and Abergeldie, the residence of the Prince, the march line crosses the north-west peak. It rises on the north side of the River Muick; and on the opposite side the rock is gneiss, which formation continues up to Loch Muick, (out of which this stream

flows), and extends down towards Ballater, to the Braichley Burn, which sharply divides it from the granite. On the west side of the Coyle, towards Lochnagar, granite is the formation; but the Coyle is almost entirely serpentine. I paid numerous visits to the hill, and at first was disappointed at not finding more of what I then could distinguish as serpentine, and had to content myself with small success. I found, however, some fine specimens of the best kind, and on my return to town I entered more fully into the study of the subject. I also procured some large specimens from Unst in Shetland, and I then remembered the peculiar weathering of the rocks, without at the time knowing that it was serpentine, so it was with increased zest that on my return to Ballater in 1881 I resumed my researches there.

In then prosecuting my inquiries I found that in Scotland the serpentine is mostly met with in Shetland; At Portsoy in Banffshire, The Coyle; In Ayrshire, and at Colmonell, Girvan, and elsewhere in that neighbourhood. I had gained much information on the geology of the district during the previous year, from Alexander Shivas, the police constable at Ballater, who I found to be a man, that seems to combine with his duties of looking after the waifs and strays of the population, the happy knack of keeping his eyes open to the stray geological formation of the neighbourhood as he passes along. In my talks with him in 1881 I found that Professor Heddle had gone over the whole district, and the Rev. Mr Mickie, the Established Church minister of Dinnet, was well acquainted with the Coyle. I wrote to Professor Heddle, and he most kindly sent me the third chapter of his report to the Royal Society on the mineralogy of Scotland. In this he deals fully with the serpentine beds I was in pursuit of, and in following his remarks upon my geological map, I found they both agreed; that from Portsoy the serpentine bed can be traced to the Bück of Cabrach in Banff, from whence they trifurcate. One bed passing to the south-west loses itself in the serpentine marble of Glentilt; another striking due south is seen on the Kindy, Morven, Culbleen, passes on to the Coyle, is again seen in the cliffs of the Canlochan of Glen Isla, and is last seen at Kingoldrum and Lintrathen near Catlaw Hill in Forfarshire; while the third, running east by Chapel-town, Insch, Oyne near Benochie, Prenmay, Barrahill, Beaully, and Belhelvie, passes into the German Ocean 5 miles north of Aberdeen, as the Schiller Spar of the Black Dog Rock. It is instructive to note how it thus breaks out suddenly at different places, and then disappears. I passed through the Royal Deer Forest of Balmoral, from Inchbobart on Loch Muick, to Abergeldie, at the very foot of the Coyle, and not a vestige of the appearance of the rock was to be seen except on the hill itself.

On renewing my researches last summer (1881), and being



now somewhat acquainted with the peculiar weathering of the rock, I had no difficulty in recognising at once the full extent of the formation. The hills rise to 1900 feet above the level of the sea, and about 1200 feet above the Muick.

On ascending the north-east shoulder, I found some beds of red porphyry and granite *in situ*, with many boulders of granite, but no serpentine, until about 200 feet from the summit. I found there, that the hill was one amorphous mass of serpentine. I now recognised the peculiar weathering of the Shetland rock, and wondered I had not been struck with it the previous year, for having once ascertained it was serpentine, I had no more difficulty in recognising it wherever I met it. The serpentine on this shoulder is of a coarse greenish-grey colour outside, but where broken up is of a dark greenish hue, very tough, but splintery, with continual veins of steatite running through it. The south-west, and highest summit, is also one mass of serpentine of the same amorphous nature, but I found some very fine veins of what is noble serpentine, much harder, and which takes a fairish polish. Indeed I have had some shirt ornaments, &c., and plaid brooches made from it, and although the polish is not so fine as agate and other minerals, yet they keep me in memory of the pleasure I had in their capture.

The south-west summit is so peculiar that I think it right to take a little more note of it. It rises into a very abrupt cone of about 200 feet above the body of the hill, and is so exceedingly like a volcanic cone of pure serpentine, that I at first thought it had been the crater of a volcano. Almost all the authorities hold that in most instances serpentine is an igneous eruptive rock, but generally so in intrusive veins, but here it seems to have been forced out from this cone, and spread over the whole hill, as is seen in so many cases where basalt, greenstone, &c., have been ejected in lava-like streams. This is especially the case on the north-west and south-west summits, but on the centre or lowest summit the same appearance is not so visible. I also found on the south-west hill some good specimens of asbestos. I find in Rutley's Mineralogy a remark "that serpentine is found in a fibrous state resembling asbestos, and then is known as chrysolite," but I produce a large specimen found here, which is pure asbestos. Actynolite in talc, as well as chrysolite and malacolite, is also to be found here.

The only other matter I would refer to in connection with the serpentine on these hills is, that having heard it stated that the soil of that formation is generally barren, I found here, that over the whole hill the grass was fine and very green, and almost no heather where the serpentine was *in situ*; almost no grouse found; in fact, the pasture, to the extent of 1000 acres I should say, is let for sheep grazing, while the hills in the imme-

diatle neighbourhood are granite, and the soil cold and sour. Mr Mickie also noticed the same peculiarity in the Hill of Morven 8 miles away, where serpentine is also found, and states that there the very same characteristic obtains as I have here noted, and that at 2 miles distance you can tell where you will find serpentine and where granite, and be guided to the junction of the two rocks within a few yards.

Leaving the serpentine, I would now turn eastward and take notice of a district mentioned by Mr Michie in a geological, archæological, and historical work on the district of Loch Kinnord. He states that during the tertiary period, the Muir of Dinnet (4 miles east of Ballater) and district of Kinnord formed the largest of the whole series of lakes that occupied the valley of the Dee from the Linn of Dee to Aboyne. "It was produced by a rocky barrier, stretched across the valley of the Dee above Aboyne, and the lake, thus formed, terminated in a fine bay, the shores of which swept round behind the farm of Ballaterich, and away northward with many a headland and creek into the district of Cromar." The whole of this district has evidently been a lake, at one time occupying an area of at least 7 miles from north to south, and 5 from west to east. It is bounded by Morven (2800 feet high) on the west, the Hill of Sockhaugh, near Logie Colston, on the north, Mortlich on the east, and the Dee on the south. There are remains of this lake still visible in the lochs of Kinnord and Davan, of which Mr Michie has given a most interesting account.

These lochs are very beautiful, although surrounded by peat mosses, and I may mention that I found large quantities of a very old decayed white peat, which I was led to look for there, from two articles published in the *Aberdeen Free Press* in August 1880. It was there spoken of as a substance which might take the place of the German kiesselghur so much used in the manufacture of dynamite, and for this purpose parties were in treaty with the proprietor.\*

Leaving Loch Kinnord and proceeding west from Bogangore, by what was the old road to Ballater, at the foot of Culbleen Hill, at about 200 feet above the bed of the Dee, I came upon a series of heather-covered moraine-like mounds, continuing through the moor for fully 2 miles. The road cuts through these mounds in many places, so that the interiors are quite exposed. These present the appearance of masses of water-worn gravel, mixed in the most pell mell confusion, the boulders being often of very large size; but I observed no striæ, nor any of the blue tenacious clay of the Till, which it so much resembled. These moraine-like mounds are innumerable, and are scattered all over the moor to the

\* See Paper by W. Ivison Macadam, page 207.



extent of 300 or 400 yards on each side of the road and up to the foot of the hills. They are more numerous and larger at the outlets of two streams which flow from Morven, 2 miles back to the north, viz., the Glen Colston and Tullich Burns, the height of the mounds often reaching 30 or 40 feet. I may here mention in reference to these mounds that I have met with the same in two other localities—one at the foot of the Hill Benchonzie (3000 feet high), 7 miles north of Crieff. At the foot of the last summit of that hill, these mounds are scattered about in all directions as far as Loch Turrit, and continue, after leaving that loch, to the steep descent of the River Turrit. They are even seen occasionally until that river reaches the level ground before it enters the Earn at Crieff. The other locality is on the road that passes the foot of Ben Cruachan on the road between Dalmally and Inveraray. They are quite similar in appearance to those above mentioned; but my attention was not turned to them at the time, and it was only on meeting them here that they recurred to my recollection.

On approaching Ballater from the east after leaving these moraines we come to the Pass of Ballater, which lies between the Hill Craigandaroch and another hill which seems to have once formed part of it. Craigandaroch is about 500 feet high above the plain, in which Ballater is seen lying at its foot. It is of red granite, and of very much the same formation as the hill on the other side of the pass. On the side of Craigandaroch the slope is very steep, but on the other side it is more so, and the granite is tossed about in the utmost confusion, the masses often consisting of blocks of hundreds of tons. It looks as if the two hills had been once united, but torn asunder by some mighty convulsion. I notice this, because while Craigandaroch, which presents the appearance of a huge grave mound, is thus torn asunder, there are two similar hills about 3 or 4 miles further up the Dee, on its opposite side. The one is called Craig Yourie, and is fully 600 feet high—it is of granite also, and entirely separate from the adjoining ground like Craigandaroch; while the other, at the foot of which Abergeldie lies, is of the same appearance to the north, but continues its junction with the hills behind it, and resembles what I think Craigandaroch might have been before its disjunction with the adjoining hill at the pass. I mention this as these hills have often puzzled me as to their formation.

At the west end of the Pass of Ballater, at Abergairn, and immediately behind the Free Church manse of Ballater, the Hill of Pronich rises to the north to a height of 1500 feet. In this immediate neighbourhood, there is a fine lode of lead or galena. The rock in which the lead is found is a dark brown ferruginous gneiss, like charred wood. A great deal of pure

white quartz, in large boulders, and *in situ*, is close to the lead, but it is in the gneiss and the fluor spar, purple and green, that the mine has been sunk. The lead and fluor spar are associated with a very fine zinc blende in large quantities also.

The proprietor, the Marquis of Huntly, for some years conducted a series of explorations here, with the view of developing these minerals. They were first directed by Mr Bett, an eminent English mining engineer and geologist, and afterwards by Mr Michie of Dinnet, and I believe, a company is being treated with, with the object of taking a lease of the mines. In the meantime, however, operations are suspended. An exposure of this lode of lead was made on the banks of the Dee 2 miles further west, at the breaking up of the ice in 1881, but not to any extent; and there is a story current that Mr Farquharson of Monaltrie many years ago got enough silver out of lead found a mile east of this to make buttons for his chieftain jacket and a snuff-box. The zinc found is said to be the purest of any found in the country.

I come now to the last of my researches in this neighbourhood. Proceeding up the River Gairn, which rises at the foot of Ben Avon, and enters the Dee about  $1\frac{1}{2}$  mile from Ballater, the hills on the east side are granite, but on the west gneiss. I was struck with the numerous old limekilns I met with, and about 5 miles up I came upon a large limestone quarry, called Dalnabo, at the back of the Hill "Gailleigh." I found idocrase in large abundance in the quarry, and cinammon stone; and Professor Heddle, in his before-mentioned report, gives the names of twenty-three minerals found on the Gairn, some of them very rare; in fact, more minerals are found here than in any other locality in his Report.

From what I had heard from my friend the policeman, I proceeded up the Gairn to Gairn Shiels shooting-lodge, and about a quarter of a mile from Rinloan Inn, and where the river comes sharply in from the north, I found a vein of red trachyte. I understand that this trachyte runs through the Gaelligh Hill in a south-east direction, and appears again in the south at about the same distance from Kylochreich Inn on the road from Ballater to Balmoral, but I did not follow it over the hill. It crops out, however, in several places on the above trend, and is sometimes seen with other veins of trachyte, blue and white in colour.