

SOME NOTES ON THE GEOLOGY OF THE CUMBRAES.

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It has been said that "the geology of Arran is an epitome of that of Scotland." We may not claim that for the Greater and Lesser Cumbrae, but there is much more to interest a geologist in the Greater Cumbrae than what appears at first sight.

In the first place it is quite a museum of trap-dykes; about two hundred of these may be counted as specifically outlined on the Ordnance Map, and described in the "Memoir" published with it. Then it has a notable "fault" running north and south which has left a distinct impression on the scenery. It has also two distinct sedimentary rocks, viz., the Upper Old Red Sandstone and the Calciferous Sandstones; these with conglomerates, cornstones and dolomitic limestones give diversity both to the colour and the aspect of the island.

Then we have abundant evidence of glacial action. The rocks are in many cases smoothed into rounded forms, and stones and boulders may be met with which are of a schistose character and must have come from the north side of the Firth. Large deposits of shells, many of them whole, and some broken and mixed with fragments of a calcareous seaweed and earth, form a marl covering the surface of parts of the old sea-beach.

On the shores and built into the dykes of the fields we find a great variety of minerals exposed in the stones scattered about or piled in heaps to clear the fields. This is very noticeable round the south-west end of the island where granite and schistose boulders, as well as those from trap-dykes, lie about and invite study.

With regard to the kinds of rock of the Greater Cumbrae, a great similarity exists with those of the southern part of Bute. Here, as in South Bute, we have Upper Old Red Sandstone to the north and the Calciferous Sandstones to the south. The latter are well exposed all round Millport Bay and are generally of a white colour. There are also numerous beds of a reddish clay or shale between these sandstone beds.

The higher parts of the island and onwards to the north end are of the old red sandstone. Through these numerous dykes find their way.

In all this we have very similar conditions to those in the south part of Bute, as at Kilchattan where we have the Upper Old Red Sandstone and the Calciferous Sandstones with trap-dykes.

At Kilchattan we have besides, as a special feature, the Columnar Sandstones. This structure is not developed in Cumbrae, but the white Calciferous Sandstones are often cracked into short pillar-like forms. We have also about Kilchattan much evidence of glacial action from the presence of schistose rocks as boulders on the shore.

In the "New Statistical Account of Scotland" published in 1840, we find that:—"The freestone, which is in great plenty, is of various kinds; the common white sandstone is of the best quality for building, and a reddish-brown sandstone of fair grain." Speaking of the dykes the Account says:—"The most remarkable of these are two on the east side of the island, running nearly parallel and from five to six hundred yards distant from each other. Their direction is from northwest, where they spring from the hill to the south-east where they disappear in the sea. The one to the north-east measures upwards of 40 feet in height, nearly 100 feet in length, and in mean thickness from 10 to 12 feet. The one to the south-west is upwards of 200 feet in length, from 12 to 15 feet in thickness, and from 70 to 80 feet in height, where it joins the hill, but drops considerably towards the sea, and when viewed in a certain direction exhibits the distant resemblance to a lion crouching—hence it is sometimes called the Lion. These dykes are composed of blue whin, with

joints and seams like basalt, but not in columns, and must have been originally produced by some dreadful concussion of nature." The Account adds, "There is also plenty of limestone found in the island which might be wrought to great advantage, were it not for the expense of coal, which must all be brought at great expense either from Glasgow, Ardrossan, or Ayr."

It is also stated that there were five quarries and upwards of eighty men employed cutting out blocks for the different railroads in the Shires of Ayr and Renfrew.

The calciferous sandstones are the lowest members of the great carboniferous formation, and appear on the eastern side of the Firth of Clyde upwards to Gourrock. They consist of cement stones and red and white sandstones, and can be well studied in Auchentreoch Glen near Dumbarton, where Bell in his "Among the Rocks around Glasgow" says, "their chemical composition shows them to be a magnesian limestone or dolomite. In the glen we observed one or two old kilns, showing that attempts had been made to utilise them, but they have nowhere been turned to much account owing to their thin bedded character and their poorer quality compared with the neighbouring carboniferous limestones together with the want of coal to assist in calcining the stone."

The Little Cumbrae differs much from its greater neighbour, and bears some similarity to the south end of Bute directly opposite.

The "Memoir of the Geological Survey" says: "The lower carboniferous volcanic rocks occupy considerable areas in Ayrshire, Little Cumbrae, and South Bute. In the latter locality the lavas form a striking set of ridges which dip steeply to the south-west; in the Little Cumbrae they are disposed in a shallow synclinal and the beds form a series of gently sloping terraces" "on the eastern side of the island sandstones which appear to be inter-bedded into the lower part of the volcanic series crop out."

These lava flows which give the island a terraced appearance belong to lower carboniferous times, they are basalts and show a columnar structure about the south end of the island.

The nearest old active centres or volcanic vents occur not far off, viz.—on the shore in Bute about a mile south-east from Kilchattan Pier where, according to the "Memoir," "there is a crag formed of volcanic agglomerate which contains fragments of trap; also limestone and baked sandstone or quartzite. An intrusive basic sheet appears to occupy part of the site of this vent" and further "the large oval mass of altered olivine-basalt which forms Suidhe Hill was probably intruded into an old volcanic vent." Several other centres of old volcanic action are situated on the mainland between Largs and Ardrossan.

The large mass of volcanic agglomerate to south-east of Kilchattan is very impressive as the black crags rise high above the shore and give the spectator the feeling that he is looking into an extinct crater.

The igneous rocks of the Cumbraes are of carboniferous age, and the sedimentary rocks are also of this age or older.

The Cumbraes and South Bute are thus very similar and differ much from Arran, where, according to the "Memoir" the "intrusive rocks are of tertiary age forming all the marked features," and adding, "our admiration of this grand hill and valley system in Arran is by no means diminished on realising that it is all of recent geological date, and that none of it was in existence before the Tertiary Period."

Arran, however, has a deposit of the calciferous sandstones on the north shore at Millstone Point and opposite Bute. A straight line drawn from this point in an east-north-east direction passes through the same calciferous formation near Kilchattan in Bute, Millport in Cumbrae, and to the heights above Fairlie in Ayrshire. A small patch of this rock lies on the east side of Little Cumbrae. The dip of the red sandstone beds in the Greater Cumbrae is mostly south-easterly on the west coast. On the east side it varies from a westerly direction to a more or

less easterly one. At the highest part of the island the dip is south.

The rock there varies from a brownish-red to a lighter red with white patches. Some surfaces show fine ripple marks, and on the moor around the exposed surfaces are smoothed by ice action.

The trap-dykes vary much in character and direction. If we take the Ordnance Map we find that from 75, which may be counted on the east side of the fault, there are 70 running in a south-westerly direction, whilst only 5 show as running in a south-east or south south-easterly direction.

Through the middle and west side of the island we find about 60 running more or less south-westerly, whilst running in a south-easterly direction there are about 12. There are only about 10 which show a fairly north and south direction.

The most interesting feature in these dykes is the number of a trachyte character, showing on fracture a rough surface and reddish colour. Some of these can be well seen at Farland Point.

These trachytes are understood to be the oldest form of the Cumbrae dykes, and run in a south-west direction, and are confined to the red sandstone beds. The other dykes are mostly composed of basalt, of the usual black or brownish colour, and vary a good deal in their character. Olivinic-Basalts are numerous, and porphyritic in structure.

Dolerite dykes also occur, some of them of great length and breadth; they run in an east and west direction, and are later in formation than the others.

The two great dykes referred to in the Statistical Account, and which stand out like walls near the Keppel Pier, are interesting, not only for their striking appearance, but also for their mineral characters.

Thus the Diel's Dyke, the larger one of the two is, according to the Memoir of the O.S. Survey an "Augite Andisite," "these rocks are nearly black and of fine texture with small scattered felspar crystals," and are of late tertiary igneous times.

The Lion Rock appears to be of much the same character, it is in parts very black with yellowish crystals, and in other parts, lighter to a brownish colour; just before it dips into the sea it cuts a trachyte dyke running east and west. The red sandstone in contact with the dykes is greyish in colour. These two large dykes run nearly north and south or just about magnetic bearing.

The Lion dyke can be traced north to the line of fault where it stops as do the other dykes on this part of the east side of the island, showing that the fault must have occurred after the dykes had been formed.

Some of the exposed dykes, like those two large ones, are very much cracked with joints, but the columnar structure is not very noticeable.

It is understood that cracks and joints in masses of rock faces are due to contraction from the molten condition to the solid in the igneous rocks, and in sedimentary rocks shrinkage causes similar results. This may be noticed sometimes where a pool of muddy water has dried up, as the surface then presents a series of cracks, arranged not unlike the upper surface of the columnar sandstones.

The glacial features show mostly in numerous large boulders readily seen resting on the shore or raised beach terrace so well marked all round the island.

The islands in Millport Bay show smooth and rounded form, as also do the rocks about the Harbour below the lighthouse on the Little Cumbrae. Below the sands in Millport Bay there are numerous stones, some of metamorphic rocks all well smoothed and in some cases striated.

A large grey granite boulder, fine grained, lies on the calciferous sandstones of the west side of Kames Bay, and another at Portachur Point is of a light pink colour with coarse grain.

At Farland Point and resting on the red sandstone there, is a gneissoze boulder, of a greyish-green colour, with twisted parts and veins of quartz; the surfaces were much smoothed: it would weigh about two tons. Other large Schistose boulders are found along the shores or raised beach terraces.

There are also glacial clays with shells, and beds of these found on the high terrace where Cumbrae College stands, were described by Messrs Crosskey and Robertson in the Geological Society of Glasgow Transactions for 1868.

Later deposits of shells are found largely about Portachur Point in the raised beach which extends in a wide and long flat stretch round that part of the coast.

The soil here is largely a shell marl and specimens can readily be got where rabbit burrows exist. At Doughend Hole the upper part of the shore contains these shells in much abundance. A great part of this shelly marl is due to a calcareous seaweed, the stems of which are now broken up into small pieces; it is the *Melobesia Calcareo*. Mr Elmhirst, the Curator of the Marine Station at Keppel Pier, tells me that he has dredged it from the sea on that coast.

I am indebted to Mr Elmhirst for facilities in the study of these shells in the fine collection in the Museum, as also for much help otherwise.

This shell marl though abundant on the Millport side of the island, seems to be wanting on the north end. Possibly the calcareous nature of the rocks on which it rests accounts for its growth, as the other parts of the raised beach terraces are cut out of the old red sandstone.

Great attention is now paid by geologists to "Petrography," slices of the rocks being made and examined under the microscope. This will be seen by the following extract from the "Memoir" referred to at p. 119 where reference is made to the De'il Dyke:—"These slices show that these rocks are *Augite-Andesites with a glassy base*. The porphyritic crystals are labradorite. The little felspars of the grained mass, presenting striated "lath-shaped" sections usually about 0.01 inch long, are acid labradorite or andesine-labradorite. Augite of light brown colour, occurs in little granules, and there may be a few crystals of an earlier generation with perfect outlines and a length of 0.02 or 0.03 inch. Little granules of magnetite are found, but not abundantly. Occurring interstitially among these elements is a considerable amount of glassy base of a brown colour."

Treating the subject broadly the trap rock may be divided into two great classes, acid and basic, depending upon the proportion of silica in their composition. Thus in the acid class we may have from 70 to 75 per cent. of silica, whilst in the basic class the silica falls to about 50 per cent. Both classes are mainly composed of felspar (a mineral composed of silica and alumina with soda or potash).

In the acid division we have the trachytes and in the basic the basalts and dolerites. Further, the felspar in the acid division is a soda or potash felspar (albite or orthoclase) and in the basic it is mostly a lime felspar (labradorite).

In the field we may distinguish these divisions by the weathering of their surfaces, thus, the acid rocks tend to show a whitish colour, whilst the basic rocks show a reddish brown.

The acid rocks are generally considered to be the older.

The name trap is from the Swedish *trappa*, a stair, and its original application in geology was to the great masses of basaltic material which often occur in stepped or terraced masses (well shown in the Little Cumbrae). Trap has been defined as a lime and soda felspar (labradorite), and augite with grains of magnetite, and basalt as a fine grained trap.

Basalt is black in colour due partly to the proportion of augite in its composition, whilst trachyte is light and reddish in colour due to its large proportion of felspar. Andesite (so named as having been found extensively in the Andes) comes in between these two extremes.

Dolerite is composed of felspar and augite; diorite of felspar and hornbende.

NOTES ON EARLY BUTE VOLUNTEERING.

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When the Seven Years' War began in 1756, Britain was totally unprepared for the great struggle. Only three regiments were fit for service in England, while the Militia had on former occasions proved its inefficiency. The threat of an invasion in 1756 led to the re-organisation of the Militia, and in 1758 the Militia Bill was altered to permit the enrolment of volunteers in the ranks of the militia. Twenty years later volunteers, as substitutes for militiamen, were formed into separate companies. Then in 1794, after the outbreak of the war with France, volunteers were again enrolled. Three years later the volunteer movement reached Bute. Blain records that in the beginning of 1797 the noblemen, freeholders, and other heritors of the County of Bute having met, resolved to form such number of volunteer companies as might be found necessary in the then critical state of affairs. It was reported to the meeting that a considerable enrolment of volunteers had already taken place on the estates of the Marquis of Bute and of the Duke of Hamilton, and that a company of volunteers had already been raised in the Burgh of Rothesay. The meeting thereupon resolved to offer to Government the formation of two other volunteer companies to consist of 70 men each—thus making three companies for the County—one in Rothesay, one in the landward part of Bute and in Cumbræ, and one in Arran. The meeting further resolved that in the event of such companies being called into active service the County would make reasonable provision for the families of such persons enrolled in them to whom assistance might be necessary. The Government intimated