A GUIDE TO THE GEOLOGY OF COLONSAY.

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INTRODUCTION

Colonsay is largely made up of sedimentary rocks. In far distant geological time these were sediments such as muds and sands, which were deposited in layers on the sea bottom. With burial under the accumulating sediment, and the passing of time, the material became hardened and turned into rocks such as mudstones and sandstones. The appearance of the rock in each layer or bed depends upon the grain size, colour, and mineral composition of the original sediment, which can be very variable, as a look at a modern area of sediment deposition such as a beach or estuary will show.

The beds of sedimentary rock were slowly buried to a depth of several kilometres where they became subject to earth stresses which deformed or folded the previously planar beds and in places caused fracture or faulting. The results of these processes can be seen in many parts of Colonsay. Some rocks underwent some slight internal change or metamorphism, with some taking on a preferred direction of splitting, or cleavage, that is, becoming slates.

Some of the faults became filled, while still deeply buried, by molten rock material which cooled and solidified to form planar bodies called dykes. Larger masses of igneous rocks were formed in what are now the Scalasaig and Kiloran Bay - Balnahard areas by gas-rich molten rock forcefully intruding the buried sedimentary rocks.

The stresses at depth eventually caused the uplift of all these rocks, and with removal of the overlying material by erosion they appeared at the land surface. The erosion, by water and wind continues at the present day, with softer rocks such as some of the slates and zones of faulting being more vulnerable and giving lower land, and harder rocks such as some of the slightly metamorphosed sandstones being more resistant and forming the craggy; higher ground. Erosion by ice was significant during the period of the glaciation of the British Isles, and the fluctuating sea-levels of this period produced several raised beaches, cliff lines and caves which are preserved above the present day sea level.

THE GEOLOGY TO BE SEEN

Rocks and minerals

The accompanying geological sketch map shows the overall distribution of the main rocks of the island. The curving pattern of the sedimentary rocks is a reflection of large-scale folding of the beds while they were at depth. Of course, in many places the rocks are not actually visible at the surface

but are covered by modern deposits such as soil, peat, concrete etc. The map indicates several areas where the sediments are especially significant, such as the raised beaches around Garvard and Machrins, and the extensive deposits of wind-blown sand west of Machrins and at Ardskenish.

Within each zone of rocks depicted on the map, the types are quite variable, for example in colour and grain-size, and hence their bedded nature is usually easy to see. For instance, the zone of 'mudstone and sandstone' in the S.W. of the island contains several thick beds of a very white sandstone which can be seen curving westwards from the Strand road and northwards from around Machrins. Almost everywhere the beds of rock are distinctly inclined, because of the folding. Narrow beds of limestone occur around Loch Staosnaig and Kiloran Bay.

At one place on Colonsay, namely the north side of Balnahard Bay in the far north of the island, the very ancient 'base' on which the sedimentary rocks were originally deposited has been exposed. At a time long before it formed that substrate, it had been burried to such depths - perhaps 20 km. or more - that its starting material was entirely reconstituted to form the metamorphic rock known as gneiss (pronounced 'nice'). After it eventually found itself at the earth's surface the first sediment to be deposited on this gneiss 'bedrock' was a sand full of pebbles. This material, now a rock known as a conglomerate, and its constituent pebbles, can be seen on the slope of Leac Bhuidhe, next to the gneiss.

Two kinds of igneous rock account for most of the dykes. In the southern half of Colonsay and on Oransay they are mainly a very fine-grained, black, tough igneous rock known as basalt. In the northern half of Colonsay they tend to be a dark-green, somewhat crumbly rock called lamprophyre. Examples of the former can be seen by the Strand, just to the E. of the road, and of the latter towards the north of the beach at Kiloran Bay. Dykes especially rich in the flaky mineral biotite, occur on the coast to the N.E. of Riasg Buidhe and S. of Kilchattan.

The igneous intrusion at Scalasaig is of diorite, but is variable in detail. Much of it is a tough featureless rock, made dark in colour by the presence of dark-green augite crystals. The syenite N. of Kiloran Bay is dark coloured in parts because of its dark-green hornblende, but in some parts is full of salmon-pink feldspar.

Veins of white quartz are common in many of the sedimentary rocks of Colonsay, perhaps most commonly in the slaty rocks. In places, such as the area S. of Milbuie, the veins also contain pink feldspar.

Numerous other rock-types and mineral varieties can be seen on Colonsay, but are of restricted occurrence. Fragments of additional varieties can be found on the present day beaches, where they have been brought from nearby islands and the mainland.

Structures

Many examples of folds of bedded rocks occur throughout the island. Examples on the scale of a few metres occur on the shore below the western-most part of the main road, and on the E. coast on the beach S.E. of Baleruminmore. In the dark slaty rocks, for example around Port Mor and the coast E. of Balerumindubh, the beds are so intricately contorted and riddled with quartz veins, that it is difficult to envisage them having once been sea-bottom muds.

The paths of some of the faults are shown on the map, but rarely can the actual fault be seen in the rocks. They are best detected by their effect on topography. Because they tend to be eroded preferentially they typically form strips of low-lying ground. Two good examples of this are the valley followed by the road W. of Scalasaig, in the central part of Colonsay, and the marked strip of flat land around Kilchattan. In this latter case, a fault-zone runs N.E. from Port Mor, where it is responsible for the bay, through Kilchattan and along Loch Fada, where it causes the extremely narrow and elongate shape of the loch.

Topography

In addition to the influence of the differing hardnesses of the rocks and the presence of fault-zones on the topographic pattern, it is worth noting the effects of two erosional agents. During the glaciation, the main ice flowed from E. to W. across Colonsay, scouring the eastern flanks of the island barrier, to produce a lower sea-bed to the E. and the smooth, low rocky shore which typifies much of the E. coast. Many of these ice-smoothed surfaces, for example N. of Port Olmsa and the S. shores of Loch Staosnaig still bear the ice-scratches or striations.

The effect of marine erosion in the past is recorded by old rock shelfs, beaches, and cliff-lines now elevated as a result of relative falls in sea-level. An old rock shelf and cliff line forms the land at Uragaig, and the road S. of Port Mor runs along a raised beach, with the old cliffs to the E. Caves were worn in parts of the cliffs while they were still subject to marine erosion, particularly in the N.W. of Colonsay, and as the sea left they became sites now of archaeological interest.

A NOTE ON THE GEOLOGICAL TIMING

Geological dates have been avoided in the foregoing account; for readers with some knowledge of the geological time scale a short summary follows.

The basal gneiss at Balnahard beach is of Lewisian age and underwent metamorphism at about 1800 million years ago (ma) and possibly at earlier times also. It was being uplifted at about 1500 ma, eventually to form the submarine substrate for deposition of the sedimentary rocks of Colonsay. These are collectively known as the 'Colonsay Group', and also form Oransay and the northern half of the Rhinns of Islay. The geological age of these rocks is unclear. They are commonly thought to be Torridonian, implying an age of

deposition of about 900 ma, but could equally well be Moinian or Dalradian, with an age anywhere down to about 600ma. Among the obstacles to learning their age is their complete lack of fossils and the impracticability of radiometric methods.

The deformation of these rocks took place over a protracted period but an important phase was at about 480 ma, part of the Caledonian Orogeny of northern Britain. Some of the first lamprophyre dykes were being emplaced about then. Most were intruded along with the Kiloran Bay and Scalasaig masses about 400 ma (Devonian), although the mica-rich dykes at Riasg Buidhe and Kilchattan are of 270 ma (Carboniferous) age. The basalt dykes are of 70 ma (Tertiary) age.

The area was glaciated several times between 2 ma and 10,000 years ago, and although sea-level fluctuations continue, by approximately 5,000 years ago the island had taken on its present form.

EXCURSIONS

An infinite number of excursions are possible on an island with so much geology and such scope for walking, but a good feel for the geology can be obtained on the main roads. The following itineraries therefore follow the roads, with the addition of places of special interest.

Scalasaig - Kilchattan - Kiloran circuit

Leaving Scalasaig pier, the road runs westwards over the Scalasaig igneous intrusion. The low, wooded ridge immediately to the N. and the rocky ground around the hotel are of diorite, with the enclosing sedimentary rocks making the higher ground to the N. and S. These enclosing rocks reach the road just past the last buildings, and consist of a series of sandstones. Their appearance varies but the beds show a fairly consistent, moderate inclination to the E.

Immediately past the junction with the Strand road, the fine-grained, easily split, black sandstones to the S. are heavily sheared, partly by the large fault which underlies the low ground between here and Machrins. There are many veins of quartz. Around Machrins the sandstones are more grey-green, with some thick beds to the N. distinctly white.

Looking S.W. across the golf course, the old wave-cut rock shelf is largely hidden by the expanses of wind-blown shell sand, but it surfaces here and there, especially out on the Ardskenish peninsula. It is low, flat land, contrasting with the higher patches of relatively durable coarse sandstones, such as those forming the ice-rounded hill of Dun Gallain and the area around Turnigil. Some of the coarser beds at Turnigil contain small pebbles of pink feldspar, burgundy-coloured quartz, and a lime-green mineral called epidote. The old cliffs lie immediately to the E. of the road.

Except for climbing over some tougher sandstones the road continues northwards along the raised beach, passing immediately to the E. of a mature cobble beach, towards Port Mor. Looking westwards out to sea, the sea-floor

olive-green rock is weathered a dark red-brown colour. The road here is occupying an old beach surface, now raised fractionally above the present level of the Strand.

Kiloran Bay

This is perhaps the single most interesting area, geologically, on Colonsay. The arrangement of the beds of sedimentary rock is like a basin, with the beds to N. of the bay dipping to the S. and curving round to the S. of the bay where they dip to the N. The sequence of sedimentary rocks is therefore repeated roughly symmetrically away from the bay both northwards and southwards. For example, a ginger-brown weathering thin limestone appears below the gate to the beach, in the small ravine about half-way to the wooden hut to the N.W. (Note the dyke about 30m. further on from the hut). The same limestone bed curves round the bay, hidden below the wind-blown sand, but appears again high on the hillside opposite, the S. slopes of Carnan Eoinn. Its brown appearance makes it discernible at a distance from the dull grey rocks above and below.

Towards the north side of the beach, the low reefs in the sand are of very dark slates, sharply folded and transected by a dyke of lamprophyre. Past there, towards the fence, is a very striking rock. It consists of angular blocks of a variety of sedimentary rocks, all jostled together. Such a rock is called a breccia, but this one is volcanic in origin, the fragmentation having been produced when the gas-rich igneous material just to the N. of here blasted its way in. The sand-blasted surfaces, facing S.W. are excellent examples of a volcanic breccia. In places it is cut by lamprophyre dykes.

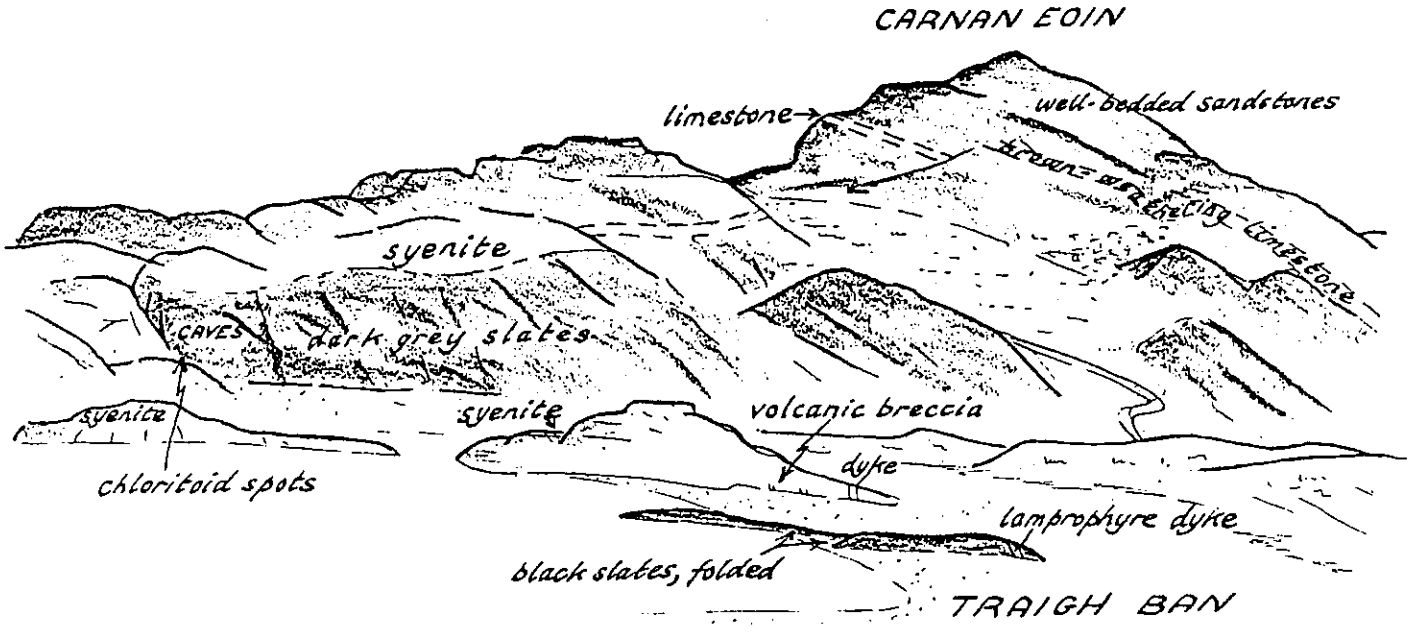
Climbing northwards over the rocks, the proportion of fragments of white quartz increases and the igneous mass is reached. The outermost parts are a very coarse hornblende-pink feldspar rock, with the sizes and proportions varying from place to place. Some parts are almost wholly hornblende, which is up to 2 cm. in length. Other parts are a rich pink, because of the abundance of feldspar. The rock as a whole is a syenite, and it, too, is cut by dykes of lamprophyre.

The northern margins of the syenite body are also a volcanic breccia, but here the fragments are mainly quartz and are very rounded. The dark, slaty rocks which form the ground rising steeply from the bay show, in places, many small (about 5 mm.) spots. They are actually a mineral called chloritoid, and can be seen, for example, in the low parts of the W.wall of the gully in which the Kiloran caves have been eroded.

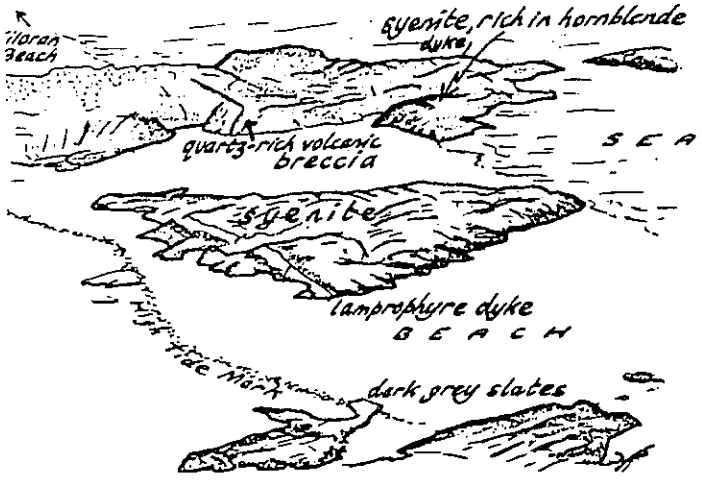
Scalasaig

The geology around Scalasaig is analogous to that described above at Kiloran Bay, but is less easy to see. Beds of sedimentary rock form the higher hills. They, too, are part of a 'basinal' structure as at Kiloran Bay, but because the centre of the 'basin' is away to the S.E. (E. of Balerumindubh), around Scalasaig itself the beds are all inclined to the S.E. The diorite igneous intrusion occupies the lower ground of Scalasaig. It can be seen, for example, in the low, wooded ridge that runs westwards from the pier, parallel to the road. Again as at Kiloran Bay, much of the boundary of the igneous intrusion is occupied

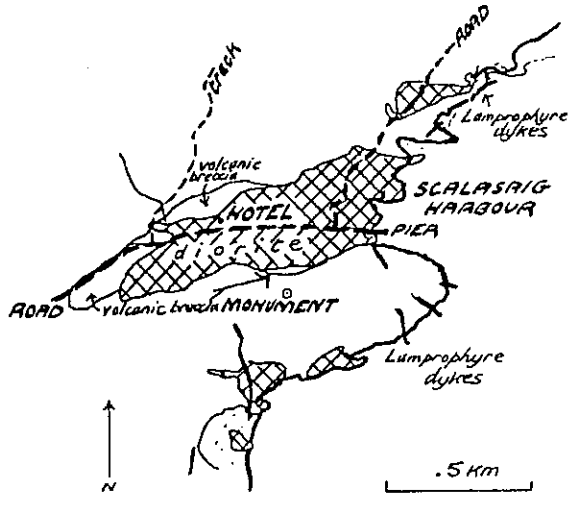
by volcanic breccia although there are no water-worn, clean surfaces here. The breccia at the S.boundary can be seen just S. of the track that runs S. of the church, parallel to the road, and there are small dykes of lamprophyre and basalt. Further small satellite igneous masses occur along the coast S. of Scalasaig, for example around the submarine Cable Terminal, about 5 km. S.W. of the lighthouse. Along the N.boundary of the Scalasaig intrusion, the breccia forms the low rubbly ground to the N.E. of the hotel.



View N.E. across Kiloran Bay.



View S.W., at N. end of Kiloran Bay looking S.W.



Geological sketch map of the Scalasaig district.

Geological sketch map of Colonsay

(showing major rock-types and place-names mentioned in the guide)