
Chapter 10 Mesozoic fragments in the Central Ring Complex

The Rhaetic, Jurassic, and Cretaceous formations are represented in Arran by fragmentary masses which have been involved in the Central Ring Complex. The Triassic marls are also found with the same mode of occurrence; and it was the association of these marls with Rhaetic beds which led to the definite ascertainment of the age of the New Red Sandstone beds in the southern part of the island. The igneous rocks, both massive and fragmental, with which these fragments are associated, are elsewhere described. As will appear from the detailed description of the fragments which contain fossils, they do not occur in close proximity, and sometimes as much as a mile intervenes between one fragment and another. In addition to the fossiliferous masses, there are others of limestone, of sandstone, and of shale, in which no organic remains have been found. It seems probable that these also are of Secondary or Mesozoic age, though it is not possible in each case to determine to which formation they belong.

In several instances the fragments have been much altered by intrusive igneous rock, and some of them have Cainozoic dykes or sills traversing them. Especially is this the case with the largest of the fragments, which contains not only beds of Rhaetic age but grey marls of the upper part of the Trias and a portion of the red marls which lie below, W.G.

Triassic fragments

At the west end of Muileann Gaoithe (Windmill Hill), on the north side of Glen Ormidale, and about 2 miles west-south-west of Brodick, there is a remarkable inclusion of Triassic marls, which is apparently caught between two masses of quartz-felsite, one of which forms Windmill Hill itself, and the other builds the smaller hill (1296 feet), to the west. The fragment is bright-red in colour, and forms a conspicuous feature in the almost vertical southern face of Muileann Gaoithe from any viewpoint in the Ormidale valley, or from the ridges to the south. The patch is wedge-shaped, both horizontally and vertically, and has a length of about 25 yards inward from the edge of the cliff, and extends perhaps 20 yards downward into the steep gully below. It consists of brick-red, tea-green, and ash-grey marls, with irregular curving fracture planes, vertical or dipping steeply to the north and north-north-west. It is bounded by a fault on the western side, and is traversed by several lines of fault, one of which is filled by a band of fault-breccia 12 inches wide. The faulting is displayed diagrammatically in great perfection on the bare horizontal floor. On the eastern side the felsite of Windmill Hill appears to have an intrusive contact with the sediments, as the former rock shows a beautiful flow structure, and other chilling effects, at the junction with the marls. The bounding fault-plane on the western side is occupied by a little dyke, 8 inches wide, of porphyritic basalt.

This patch may have been dropped down an explosion fissure in the older, western felsite mass, which appears to pass into a large granophyre mass farther west. The fissure may have been sealed up by the later felsite intrusion of Windmill Hill, which spread out from the same orifice.

Another smaller patch of red marl is to be found to the west of the main mass, a little way down a steep, grassy slope. Its relations cannot be determined, but felsite appears *in situ* between it and the larger mass.

These marl fragments are believed to be connected with a much more extensive area of presumably Mesozoic rocks, which run through the felsite masses of Windmill Hill in a north-east to south-west direction, from a point well down on the north side of Windmill Hill to the northern headwater of the Ormidale Burn. These rocks were formerly mapped as Carboniferous, and were described as such in the Memoir on Sheet 21. <ref>Geology of North Arran, etc., *Mem. Geol. Surv.*, 1903, p. 43.</ref> They consist of chocolate-coloured, sandy, micaceous shales, and whitish sandstone, with a dip of 70° to the west in the peaty gully on the north side of Muileann Gaoithe. In the northern headwater of the Ormidale Water, masses of hard quartzitic sandstone are found involved with felsite in a very complicated manner. A crag to the north of the burn consists of coarse, white, gritty sandstone dipping north-west at 20° to 30°. Traced to the east this sandstone appears to become baked, and is intersected by thin tongues of felsite. On the same line of strike other sandstone patches are found; and Mr. E. B. Bailey, when traversing these exposures with the writer in September 1925, found a patch of grey-blue sandy shale, only a few feet wide, which yielded indeterminable ammonites. Dr. G. W. Lee suggests that these fossils belong to the *Planorbis* Zone of the Lias. This patch can be easily found; it occurs on the west

side of the gully which lies to the west of the Triassic patch on Windmill Hill, about 120 yards south-south-west of the summit of that patch. G.W.T.

Rhaetic rocks

A short distance north of the farmhouse of Derenenach, two small streams which have cut gorges in the low-lying mass of granophyre cross the road. The longer and more northerly of these two burns is called Allt nan Dris, and is the only one of the two which is marked on the One-inch Map. In the middle part of its course this stream traverses the largest of the identifiable fragments in the volcanic vent, which is of an irregular shape and extends over several acres. It is probably quite a quarter of a mile in length from north to south, and its width is at greatest about 150 yards. This patch contains the black shales and thin limestones of Rhaetic age, which are exposed for a length of nearly 90 yards in Allt nan Dris about a quarter of a mile north-east of Derenenach. The greater portion of this fragment, however, consists of grey and red Triassic marls, the red marls forming the bulk of it. One cannot be quite certain about the actual order of succession in this mass, as the rocks are broken, or faulted and disturbed, and we do not see the different subdivisions actually in contact, but the following is the probable arrangement in descending order:

Black shales and thin grey limestones of Rhaetic age
Greenish-grey or pale-coloured compact marls — Upper Keuper
Red Marls — Keuper

These beds are bounded on the west by the Derenenach granophyre, which occupies a strip of ground nearly a quarter of a mile in width between them and the road. They are best reached by following the burn upwards. On coming to the old sheepfold some of the red marls or mudstones may be noticed in the slope opposite with a high dip to the west, and they are also exposed in a small branch stream which we pass on the left. Soon the stream inclines more to the eastward, and we find in it a considerable section in the red marls, which appear to be nearly flat or have a gentle inclination eastward. The section is somewhat obscured, however, by several sills and dykes of felsite. Above this steep part the stream takes a sharp turn to the left and we lose sight of the rocks. A little higher up on the south side we observe the grey marls in the bank, lying nearly horizontal or with a gentle dip to the south-west, and a few yards farther we come upon the Rhaetic black shales on the same side. They do not occur here, however, on the north-east side, but are opposed to the grey marls which on the north-east side are at a higher level than the Rhaetic shales of the south-west side, so that there is manifestly a fault or break of some kind along the burn. Nearer to the sharp bend there occurs in one place a mass of the Rhaetic shale containing thin limestone bands on the north-east side, and it was from this locality that all the best specimens were obtained. We do not, however, see the relation of this mass to the grey marls, and the junction is probably not natural.

The black shales on the south-west side of the stream here have yielded organic remains, but they are in a crushed and fragmentary condition. Altogether these Rhaetic shales seem to be more disturbed than either the red or grey marls, and it is impossible to make out any order of succession in them. Often they appear to be nearly vertical, as in the fragment from which the fossils were obtained. The whole length of the exposure is in a small rocky gorge, and about 40 yards of it is below the sharp bend where the stream turns from a south-east to a due east direction. Above this bend the black shales may be traced for about 50 yards on the south side of the burn, but they do not extend so far on the north side. It seems probable, however, that they may occupy a considerable area to the south-west of the bend in the stream, where there is a smooth grassy slope, and excavations here might reveal other fossiliferous bands. The exposures above the bend in the stream have yielded no fossils.

The grey marls, as we have stated, appear on both sides of the stream, but the outcrops are not exactly opposite, as they are higher up on the north side, and opposed to the Rhaetic beds on the south side.

These rocks were surveyed in the year 1899, and their peculiar characters, as being unlike anything occurring elsewhere in Arran, were remarked on. Specimens of the dark ferruginous shales were obtained, and were supposed to resemble certain rocks occurring in the Old Red Sandstone near Strathpeffer and elsewhere in the north of Scotland. In May 1900, however, A. Macconochie, the fossil-collector of the Survey, was successful in obtaining undoubted organic remains from the beds, and the collections made by him on being examined by E. T. Newton were referred to the Rhaetic beds.

The following is Newton's determination of the specimens:

Fossils from the Rhaetic of Shiskine, Arran

Pteria contorta (Portl.)

Pecten valoniensis DeFr.

Schizodus [*Axinus*] *cloacinus* Quenst.

Protocardium philipianum ? Dunk. (= *C. rhaeticum* Merian.)

Modiola minima ? J. Sow.

Estheria minuta ? Goldf.

Gyrolepis alberti ? Ag.

Nearly three-quarters of a mile distant from the Rhaetic beds in Allt nan Dris in a north-east direction, and about the same distance south of Glenloig, is a mass of unfossiliferous shale which may belong to this formation. It is about 35 yards in length from N.N.E. to S.S.W., and is nearly vertical or dipping steeply to E.S.E. The rock, much altered and hardened to a kind of blue porcellanite, is bounded on the east by volcanic agglomerate and on the west by an intrusive mass of quartz-felsite. The volcanic agglomerate has undergone much alteration as well as the shale, and there is not much hope of obtaining fossils from this locality.

Lias

The locality in which the Lias fossils are found is about 1 mile south-east from that of the Rhaetic patch in Allt nan Dris, and nearly half-a-mile due south from the top of Ard Bheinn. It is 300 yards north of a fork in the Ballymichael Burn, and near the head of the glen in a dry gully on the north-west side of the stream. The patch consists of brownish, crumbling, calcareous shale and impure decomposed limestone, in some parts of which fossils are abundant, but mostly in the form of casts. The exact area occupied by this shale cannot be ascertained, but it is probably 100 yards in length and nearly 50 yards in breadth. Between it and the stream is found a yellowish granophyre, and on the north-east side occurs a fine, dark, basic rock. On the south-west side of the shale occurs the volcanic agglomerate with an apparently vertical boundary, and in one place the two rocks seem somewhat mixed.

The late Dr. B. N. Peach, to whom this singular fragment of a formation was shown, was the first to obtain fossils from it and to recognize their Liassic facies; and the collection then made (June, 1900) was despatched to E. T. Newton, who fully confirmed Peach's observations. In October of the same year a further search at this locality was made by Macconochie, which resulted in considerable additions to the original list. The fossils all belong to the Lower Lias (Angulatus Zone), and no traces of any beds that will fill up the gap between these rocks and the Cretaceous formation have been found, so that it is very probable they were related to one another in Arran as they are in Ireland, where the Cretaceous rocks repose unconformably on those of the Lower Lias. Newton examined the whole set of fossils from this locality, and furnished the following list of them:

Fossils from the Lower Lias (Angulatus Beds), Arran

Cf. *Schlotheimia angulata* (Schloth.)

Amberleya acuminata Chap. and Dew.

Cerithium semele ? Martin

Cerithium sp. (cf. *falsani* Dumortier.)

Pleurotomaria tectaria Tate

Arca ?

Astarte sp.

Pteria lanceolata Sow.

Cardinia listen J. Sow.

Cardita heberti Terq.

Goniomya sp. (cf. *rhomboifera* Goldf.; and *sinemuriensis* Oppel)

Gryphaea arcuata Lamarck

Inoceramus [*Crenatula*]

Myoconcha psilonoti ? Quenst.

Nucula sp. (2 forms.)

Nuculana [*Leda*] *tatei* Newton (= *L. renevieri* Tate)

Nuculana sp. (cf. *quenstedti* Tate)

Ostrea irregularis ? Quenst.

Pecten subulatus ? Goldf.

Pholadomya ?

Protocardium truncatum ? J. de C. Sow.

Tancredia ? *peachi* E. T. Newton

Unicardium cardioides Phillips

Ditrupa globiceps Quenst.

Ditrupa sp.

Serpula sp.

Lima pectinoides ? J. Sowerby
Lima succincta Schloth.
Modiola sp.
Myoconcha psilonoti ? Quenst

Pentacrinus basaltiformis Miller
Wood

Cretaceous

Rather more than a mile to the east of the road Ballymichael Glen branches into two. A small stream comes in from the east, but the main valley continues in a north-east direction. A few yards above this fork there are lying at intervals in the bed of the main stream some blocks of a light-coloured limestone containing irregular lumps of chert or flint. They are not numerous, and have been apparently derived from the coarse volcanic agglomerate which forms here the western bank of the stream for about 60 yards from the branch stream a small trail of these limestone blocks was observed on the slope. There is, however, no mass of the rock anywhere, and no fragment large enough to be indicated on a map of any scale. The limestone of these blocks is in character remarkably like that of the chalk of Ireland, which is not a soft friable rock like that of England, but a hard and compact limestone, especially where it has come in contact with igneous rock. The siliceous concretions in the limestone are irregular in shape, and occur just like flints in chalk or like chert in cherty limestone. They are almost pure white, certainly lighter in colour than the limestone itself, and they project on a weathered surface. The limestone itself is compact, fine grained, and of a grey colour.

This locality is only about 200 yards south of the patch or fragment of Lias already described, and the volcanic agglomerate occupies the intervening ground.

These blocks were noticed by [Dr.] B. N. Peach in June, 1900, who remarked at the time on their resemblance in character to the Antrim chalk. They were afterwards, in October of the same year, searched by A. Macconochie, and the organic remains were examined by E. T. Newton, who furnished the following list:

Fossils from the limestone and chert of Ballymichael Glen, Shiskine, Arran

Inoceramus (piece of shell showing prisms)

Polyzoa (*Entalophora* ? and *Escharina* ?)

Echinoderm fragments

Porosphra globularis

Hexatinellid sponge fragment (*Plocoscyphia* ?)

Tetractinellid and other spicules

Globigerina cretacea d' Orb. (and other species)

Textularia, etc., etc.

Rather more than a mile N.N.W. of this locality, and 1100 yards north-east from Derenenach, a mass of cherty limestone of the same character occurs in a cave on Ard Bheinn, and some specimens of the limestone taken from this cave contain Cretaceous foraminifera. This 'Pigeon Cave', as it has been called, can be traversed for many yards sloping downward in a west-south-west direction. The arched roof of the cave, which slopes downward like the floor, appears to be composed entirely of basic igneous rock — one of the numerous intrusive masses of the vent. On the north side, near the entrance, occurs 2 to 3 feet of dark-coloured hardened shale, which dips westward at 20° to 25°. Below this the section is somewhat obscure, but appears to be first basic igneous rock, then a light-coloured crystalline limestone — the Cretaceous rock — and afterwards a white baked sandstone or quartzite. These rocks on the north side are cut out on the south side by the arching over of the trap roof. Some of the limestone of this locality is converted to crystalline marble by igneous action, and all traces of organic remains have been destroyed.

Probably other patches of the limestone occur in the agglomerate of this neighbourhood, as there is a line of swallow-holes about 200 yards south-west of the cave, and there is one about the same distance due south from the cave.

Three-quarters of a mile north-east from the 'Pigeon Cave' of Derenenach is another cave in which limestone occurs, about 500 yards south of Glenloig. The locality where this occurs is called Creag an Fheidh, and there is a

steeply-sloping hollow about 20 yards wide running in a north-north-east direction and bounded by crags on either side. On the western side of the hollow, and running in the same direction as it, occurs a basalt dyke 4 feet in width, and there appears to be on the east side another dyke the width of which is not clear. The cave is on the western side of the hollow, and has a slanting opening some 12 to 15 feet high. It runs back at right angles to the hollow about 15 yards at the north end. It is at this part of the cave that the limestone is visible, but it is very irregular in thickness, and only some 2 to 3 feet at the most, though, as the rock was once quarried, it may have been much thicker. It occurs in association with sandstone and some shale, and dips to the N.N.W. apparently from 30° to 40°. A patch of limestone may also be seen at the foot of the crag on the eastern side of the hollow. The limestone at this locality is much altered by contact with intrusive igneous rock which overlies it, and which has converted it into crystalline marble. There is no trace of chert in it and no organic remains, so that it is doubtful to what geological period it belongs. The cave has no doubt been enlarged by artificial means, but it is certainly to a great extent natural, and water sinks at the western end at a place now covered by loose stones. Probably this, was at one time open. An old road leads up to the cave.

Headrick<ref>Headrick, J., View of the Mineralogy, etc., of the Island of Arran, 1807.</ref> noticed the occurrence of limestone at this place, but was mistaken as to its mode of occurrence, and in another part of his work he gives the following analysis of the limestone (p. 345):

Glenloig Chalky Limestone

| | |
|-------------------|-----|
| Carbonate of lime | 98 |
| Clay | 2 |
| Total | 100 |

Other masses

In addition to the above, there occur in the volcanic vent several large masses of a whitish, fine-grained sandstone, which probably are fragments of some Secondary formation. The largest of these is found in a line between the top of Ard Bheinn and the summit of Beinn Bhreac, and about 700 yards distant from the latter. It is some 250 yards in length and 15 to 20 yards in breadth, and forms a rather marked feature running in an east-north-east direction. It is bounded on one side by agglomerate and on the other by granite, and it appears to dip nearly south-east at an angle of 50°.

The next largest mass of the same kind is found about 200 yards south of the 'pigeon cave' and is oval in form, and apparently about 70 yards in length. Smaller patches of the same kind may be seen about 100 yards south-west of the same cave.

Other masses of sandstone occur about 150 yards north-east of the Rhaetic patch in Allt nan Dris, and 200 yards north of the old sheepfold on the same stream. W.G.