Chapter 3 The Dalradian Formation

These rocks are the oldest in Arran, and as they appear to be the continuations of the Cowal schists, they are regarded as of Dalradian age. The great granite boss of North Arran has been intruded on the line of their outcrop, so that the structural characters and stratigraphical succession of the rocks have been much obscured. The outcrop is annular in shape, forming a ring round the granite, and is interrupted only for a distance of 3 miles on the eastern side between Glen Sannox and the White Water near Corrie. Even in this region the blank is not absolute, as a thin strip of baked schists is seen near the head of the Allt a' Chapuill. The outcrop varies much in width, reaching a maximum of 2 miles at Dougrie and to the east of Lochranza. On the west side of the granite the schist outcrop comes down to the coast; on the north-east and east, it is separated from the sea by a narrow, much-faulted strip of later sediments; on the south it is faulted against the Lower Old Red Sandstone. G.W.T.

All the rocks to be described in this chapter have undergone some amount of deformation. They have been folded and cleaved, and mica or chlorite has been developed along the cleavage planes to a greater or less extent. The original grains or pebbles in the rock, such as quartz and felspar, have also been more or less drawn out or elongated in certain directions along the planes of foliation, so as to produce a schistose structure. Sometimes these planes of schistosity coincide with the original bedding of the rock, but very often they do not, and over considerable areas the true bedding is obscured by the superinduced structures.

In texture these rocks vary from very coarse, gritty, and pebbly varieties to fine-grained slaty rocks or phyllites. Quartz veins, often coinciding with the foliation planes, are characteristic generally of these schists, but the amount of these varies much in different places; sometimes they are abundant, while in many districts in Arran few are to be observed. This paucity of quartz veins or the reverse, has, however, no relation to proximity to the granite, as the older writers supposed, for they were developed in the rock long prior to the intrusion of the granite. There is also great variation in the amount of mica developed in the schists. The term 'mica-schists', under which they have been referred to, is scarcely applicable to them as a whole, seeing that mica is sparingly developed in them except in the finer-grained varieties that appear along the coasts about Imachar, Pirnmill, and Thundergay, and the more gritty varieties in the neighbourhood of Lochranza. Along this north-western part of Arran, however, the rocks have been more than usually plicated, and contain numerous quartz veins. Along the eastern and south-eastern sides of the granite mass the schists contain little mica, and are little more than schistose grits. Generally the rock is a moderately fine grained schistose sandstone, including occasional bands of a fine blue slate, and also rocks of a decidedly gritty character, schistose greywacke, and conglomerate with deformed pebbles.

Stratigraphically, the Dalradian rocks in Arran are a continuation (of course with sea intervals) of the schists on the southern margin of the Highlands which have been described in the Memoir on the Cowal district of Argyllshire,<ref>Geology of Cowal, *Mem. Geol. Surv.,* 1897.</ref> and in the main they have the same north-east and south-west strike as in the Dunoon district, but with some variations due apparently to the intrusion of the granite mass. It is difficult to make out any definite order of succession over a large part of the area. The rocks are much folded on the south side of the lorsa valley and along the west coast. To the north-east of the granite mass there is a fairly uniform dip to the south-east and east, and there appears to be a regular upward succession from the ordinary gritty schists east of Lochranza through a thick series of slates (Dunoon ?) into a thick series of alternating coarse grits and fine beds, which apparently includes in its upper part a contemporaneous volcanic group, presumably of Arenig age (*see* next chapter). W. G.

According to observations by Prof. J. W. Gregory,<ref>J. W. Gregory and G. W. Tyrrell, Excursion to Arran, *Proc. Geol. Assoc.*, vol. xxxv., part iv., 1924, p. 404</ref> the coarse grits underlying the lavas and slates of North Glen Sannox (? Lower Ordovician) contain pebbles and grains of the schists to the west of them; and as these pre-lava cleaved grits and associated phyllites are identical with the grits and slates occurring in alternating bands on the north side of Glen Chalmadale, the schists lying unconformably beneath them must be still earlier in age, and almost certainly Dalradian. In proximity to the granite the general south-west strike of the Dalradian rocks is usually much changed. As Mr. E. B. Bailey<ref>Domes in Scotland and South Africa: Arran and Vredefort, *Geol. Mag.*, vol. lxiii., 1926, pp. 481–495.</ref> has

shown, the schists in most places have been bent up into parallelism with the granite margins, so that on the south-west and northeast sides of the granite strike lines of the schists take a right-angle twist as they approach the igneous contact (Plate 3). This abrupt change of strike can be easily followed on the slopes above Whitefarland. On the north-west side a beautiful synclinal structure has been developed, which is finely exposed on the shore north of Catacol Bay. Traces of the synclinal structure first appear near Rudha Bki north of Pirnmill. The syncline extends from Catacol, right through Lochranza, and reappears on the Newton side. On the south-east side of the granite the schists are already tilted to the south-east away from the granite margin, and no change in strike or dip has resulted from the intrusion.

The schists are baked hard and hornfelsed for a distance of from 100 to 300 yards from the granite margins, and near the actual contacts the foliation becomes very obscure or is completely obliterated. As the rock is more resistant than the granite itself it occasionally forms a ridge at a higher elevation than the granite immediately adjoining. This is finely shown in Glen Catacol and Glen Easan Biorach, where the streams have cut narrow gorges through the altered schist. A short account of the contact metamorphism effected by the granite is included on a later page (p. 156). G.W.T.

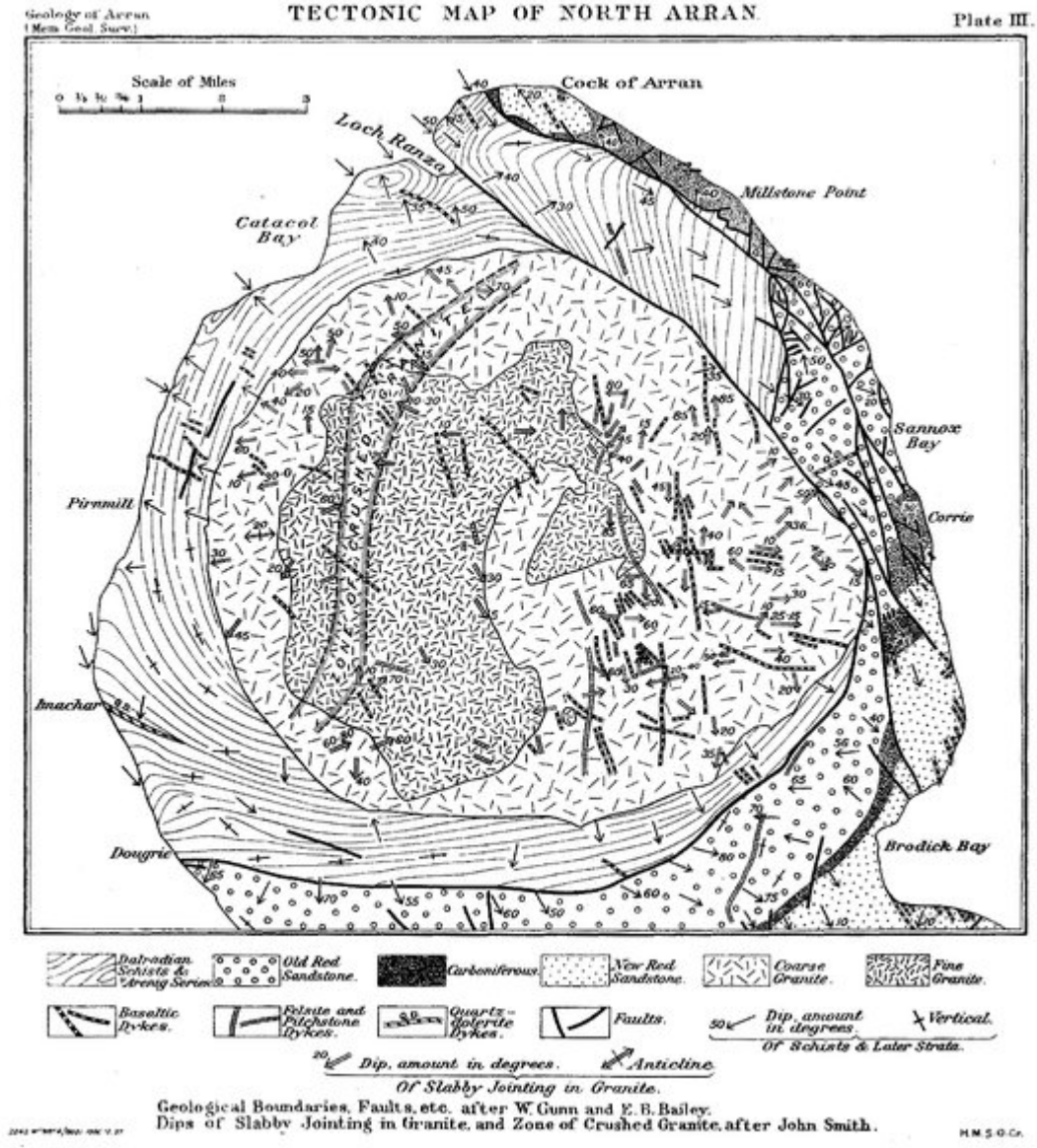
Detailed description

To the east of Glen Rosa there is a good exposure of schists all over Glenshant Hill. In the Cnocan Burn, below the mill dam, the true dip of the schists is to the south-east or south-south-east at a high angle, and the foliation dip is there coincident with that of the bedding. The rocks are mostly gritty and some are pebbly, and this type of schist prevails nearly all over Glenshant Hill. In Creag Rosa some alternations of thin, gritty, and slaty bands show that the beds are vertical with a north-east strike. To the north-west of this the foliation strikes in one place to the north-north-east, while the bedding strikes east-north-east, so that the true dip is at a high angle to the south-south-east. Near the granite these rocks are considerably altered, and appear to be more contorted than usual. Much of the same type of schist prevails on the opposite side of Glen Rosa, about the hill called Cul nan Creagan, where thin quartz veins occur occasionally in the rock. In Gleann Easbuig, east side, and 950 yards north from the top of An Tunna, is a very coarse pebbly band of a slightly greenish tinge, which is about 30 feet in thickness. The deformed pebbles are of quartz and felspar, set in a slightly chloritic matrix, and the rock which contains them maybe traced in a direction slightly north of west for about 200 yards, cutting across the foliation of the ordinary schist nearby. There is much gritty schist on the north-west side of Gleann Easbuig, but no rock so coarse as that described above was noticed there. On the hills called Beinn Chaorach and Beinn Lochain to the south of the Iorsa valley the schists are generally so plicated that it is difficult to make out any prevailing strike. Much of it is fine grained, with quartz veins. On the north side of the Iorsa the rock is altered by the granite, and the foliation rendered obscure in many places, the most prominent planes being joints, which seem the result of the granite intrusion. The rocks are well exposed in the lower part of Glen Scaftigill, and in the adjacent burn of Allt na h-Airidhe. In Glen Scaftigill the schist is moderately fine grained, and bluish or grey in colour; the foliation is generally even and regular with little contortion and few quartz veins. The foliation dip is to the south or south-south-east at a high angle; sometimes it is vertical, while the bedding as seen distinctly in one place strikes north-east, and dips steeply south-east. The foliation at this place dips south-south-east. To the westward, about Cnoc Donn and between this hill and Dougrie. Point, there is a strong band of gritty rock which is very slightly schistose, and is apparently overlying a thick band of black, bluish, and grey phyllitic schist, which is much contorted. Some very coarse and pebbly bands of the gritty rock are exposed in the old sea-cliffs three-quarters of a mile north of Iorsa Foot, and the contorted slaty rock is exhibited in many places to the south-east of Balliekine. Alternations of gritty and slaty schists, very much plicated, appear along the shore between Balliekine and Imachar, and opposite the latter place the schists are more than usually contorted, with abundant veins of quartz. On the hills nearly a mile east-north-east of Imachar alternations of pebbly bands with rocks of a finer grain show that the strike of the foliation is from 10° to 15° farther west of north than that of the bedding. Both are practically vertical. North of Allt Gobhlach, along the shores of Penrioch (Penrioc) and Auchmore, the schists are not so much plicated, but numerous faults crossing the alternations of fine and coarse rock are exposed on the shore. At North Thundergay, again, the rocks are as plicated as at Imachar. There are some very coarse bands about Penrioch, but they are usually thin and cannot be traced far. One of them contains pebbles from 2 to 4 inches long. There is also, east of North Penrioch, a band of light-coloured, schistose, micaceous limestone 4 or 5 feet thick, which was formerly quarried and burnt for lime. It can be traced for a considerable distance to the northward. Some other very thin calcareous bands are intercalated in a dark-coloured schist.

In the lower part of the Pirnmill district the schist forms a remarkable series of ridges and hollows nearly coincident with the strike; higher up the hillsides other marked features are apparently due to joints or faults, as their direction makes an angle with the strike. Near the granite the schist is much hardened, and the finer varieties assume a bluish colour. A marked set of joints appears also to have been developed in this altered rock by the action of the granite. These joints are in places much more prominent than the foliation planes, which are nearly obliterated.

On the north side of the stream Allt nan Eireannach, nearly half a mile south-south-west of Catacol Bridge, there occurs a beautifully glossy, gritty mica-schist with abundant sericite mica on the foliation planes. Along a great part of this burn runs a thick band of dark slaty schist, which is probably identical with that which appears near the foot of Abhainn Bheag on the east side of Glen Catacol. And there is strong probability that the same band continues southward from Glen Catacol nearly parallel to the boundary of the granite, but at no great distance, as far as the Allt Gobhlach opposite Pirnmill.

North-westerly dips prevail in the schists in the district between Catacol and Pirnmill, though, of course, there are many minor folds parallel to the general strike. On the eastern side of Catacol Bay there is a marked synclinal fold, which runs nearly parallel to and not far from the coast. The line of it crosses the loch a little north of Lochranza Castle, and it can be observed for some distance east of the loch but gradually disappears, so that from North Newton there seems to be a regular and apparently ascending series in the schists all along the edge of the high ground to the south-eastward as far as to Corloch, where we come upon the supposed Arenig lavas. On the shore at North Newton, where the rocks have a high dip to the south-south-east, the schists are gritty, somewhat greenish and chloritic, with alternating bands of finer slaty schist, more micaceous or chloritic, and with more abundant quartz veins. Some bands outcropping to the east of the hamlet are very strong and coarse. Variable rocks of more or less gritty character prevail over Cnoc nan Sgrath and Ton Meadhonach till, near the road leading to the Cock, we come upon the edge of a thick slaty series, in which there are two old slate quarries about a quarter of a mile south of the road. In the larger and more easterly quarry there are rather coarse and thickly laminated bluish slates with some pale coloured or greenish, probably chloritic, bands. The slates are not glossy, and there is not much mica on the foliation planes. Dark bluish, fine slaty schist with quartz veins appears in Creag Ghlas Cuithe at the edge of the high ground, where the dip is almost due south. In Glen Chalmadale the dip is eastward, and between these two localities the strike describes a curve of a quarter of a circle. This slate band is most probably the Dunoon series described in the Memoir on the Cowal district. To the eastwards succeeds a strong, coarse, and thick gritty mass, which is probably the Kilcreggan series. It is a very massive grey and greenish greywacke, only slightly schistose, the bedding of which is as even and as regular as a sandstone. In one place there is interbedded a few feet of greenish slaty rock, which much resembles the Green Beds in character. Pebbly bands are common in this rock and show the bedding clearly, which dips from 30° to 50° east-south-east. This rock forms a very the set of crags, some of which are bounded by straight faces running nearly across the strike. They appear to be due to joints, along which the rock has parted, and masses have fallen away. In the upper part of this series are alternations of slaty and gritty beds which give rise to strike features crossing the line of crags. These pass up into a greenish slaty series which forms the highest ground at the Ordnance Station 1453, and this is the highest point attained by the schists in the island. About half a mile south of this the gritty series below forms crags at Creagan a' Choilich, where a very coarse, pebbly, quartzo-felspathic band may be seen. Eastwards from the Ordnance Station another thick gritty series comes on above the finer band, the upper part of it being marked by a very coarse, quartzose pebbly band 100 yards in breadth. In various places along the course of this band it may be observed that the true dip as shown by the quartz pebbles is high, sometimes nearly vertical, while the planes of schistosity or foliation dip about 30° or 40°. At the southern exposure of this band there is a cross fault which shifts it westward no feet or more. The crag here is visible at long distances. The pebbly quartzose rock is white in colour, and is penetrated by conspicuous white quartz veins. A portion of the rock might be described as a conglomerate. Another band of dark and bluish slaty schist succeeds to the eastwards, and is some 200 yards across, but is little exposed except on the crags; and then comes a gritty series, variable in character and half a mile wide, which continues till we arrive at the so-called Arenig traps. W.G.



(Plate 3) Tectonic map of North Arran.