
Excursion 1: Glen Rosa and Glen Shurig

((Figure 6), localities 1 to 23)

The main purpose of this excursion is to provide the visitor with an introduction to the geology of North Arran. It covers a wide range of formations and the localities selected for examination include sections of Dalradian, Lower Old Red Sandstone, Upper Old Red Sandstone, Carboniferous and Permian rocks, as well as sections in the Northern Granite and representative examples of some of the minor intrusions (pitchstones, felsites and dolerites) of Tertiary age. The excursion also furnishes numerous illustrations of glacial phenomena and striking views of the scenery of the North Arran mountains.

In following out this excursion from locality 1 to locality 14 the visitor is descending in the geological succession from Permian through Carboniferous and Old Red Sandstone to Dalradian, whereas in the latter part of the itinerary the sequence is an upward one from Dalradian to Permian.

1. [NS 0190 3600] The beds exposed between Brodick Pier and the mouth of the Cloy Water (Invercloy) belong to the lower part of the Brodick Beds (see p. 37). They consist of a series of breccias made up of more or less angular fragments of rock embedded in a red gritty matrix formed mainly of rounded grains of quartz. The fragments are almost entirely quartzite, vein-quartz or quartz-mica-schist, types of rock common among the Dalradians of the southern Grampians, and vary in size from pieces 15 to 18 cm in diameter down to pebbles less than 1 cm across. The often rounded nature of the smaller pebbles should be noted, as well as the wind-rounded quartz grains present both in the matrix and in the intercalated beds of sandstone. Occasionally pebbles whose surfaces suggest that they have been polished and faceted by wind action occur. The assemblage as a whole points to accumulation during occasional rain storms or cloudbursts in a desert climate.

The general inclination of these beds is to the south at angles of about 15°. At two localities on the shore there are oval-shaped areas, 15.5 and 46m in diameter respectively, within which the conglomerates are much broken up and shattered so as to simulate the appearance of a volcanic agglomerate. There is no evidence, however, of the presence of any igneous material. Tyrrell (1928, p. 81) suggested that the phenomena may be due to the explosive effects of gases emitted from small, underlying intrusions of Tertiary age, but a more recent explanation (Astin and Macdonald 1983, pp. 47–58) attributes the breccias to a sedimentary origin associated with local faulting.

2. [NS 0097 3642] Examine the intrusion of pitchstone well exposed at the back of the schoolhouse yard and in the Stronach Wood behind (please do not hammer in the schoolyard). It can be traced for some 320m more or less parallel to the strike of the red Permian sandstone into which it has been intruded, and the mode of occurrence suggests that it is a sill. It is a hard splintery rock, with a dark-green, almost black, colour in hand specimen and a characteristic resinous lustre. The porphyritic crystals embedded in the glassy groundmass are feldspar and olivine but some bands are almost free of phenocrysts. Specimens frequently show a striped appearance produced by differential movement of the rock (fracture flow) while still in a molten condition. A drawing of part of a thin section of the pitchstone is reproduced in (Plate 2), (Figure 7).

The schoolhouse pitchstone belongs to the same group of porphyritic Arran pitchstones which includes the Glen Shurig dyke of locality 23 and the Tormore dykes of Excursion 13.

3. [NS 0083 3627] Visit the old quarries in the brick-red sandstones belonging to the dune-bedded rocks at the base of the Permian succession, the Corrie Sandstone. These sandstones dip to the south-southwest at angles of between 30° and 40°. The dune-bedding and rounded quartz grains ("millet seed" grains) characteristic of the division should be carefully examined. It is often difficult to determine the true angle of dip in these rocks owing to the prevalence of the dune-bedding. Note the wide, flat tract of low ground stretching up Glen Cloy, composed in part of recent river alluvium but mainly of deposits belonging to the old raised sea-beaches. In High Late-glacial Raised Beach times (p. 63) the Stronach ridge must have been a promontory separating the lower portions of Glen Cloy and Glen Rosa.

The standing stone at the roadside at Stronach (almost opposite the school) is a slab of red Permian sandstone measuring about 3 m in height, 1.5m in breadth and about 0.6m in thickness. There are a number of such solitary monoliths in Arran, the most notable being at Auchencar farm on the west-central side of the island, which rises above ground to a height of 4.8m and may have a total length of 6.4m. Some of the standing stones, like that at Auchencar, may have originally formed part of a stone circle similar to the well-known circles on Machrie Moor and Tormore.

4. [NS 0094 3675] Examine the sill exposed in the Rosa Water at the footbridge near the museum (formerly Rosaburn Smithy). It is an example of a composite intrusion, that is, an intrusion formed by successive injections of molten material of different composition. The sill, in part basalt, in part felsite, is intruded into Permian sandstones here dipping in a south-easterly direction at about 32° and the section from above downwards shows:

1. Red sandstone.
2. Basalt—about 1.2 m.
3. Felsite, spherulitic and banded, with a sharp junction against (2), about 2.1 m.
4. Felsite with fragments of basalt, about 1.2m.

The basalt fragments in the lower part of the felsite have probably been derived from a second intrusion complementary to the first but not exposed (Tyrrell 1928, pp. 137–138 and fig. 19).

Continue along the footpath to the junction with the Brodick—Corrie road and note on the way the old channel of the Rosa Water to the west of Strabane. The mouth of the Rosa has shifted its position several times and its present course out to sea (like that of the lower part of the Cnocan Burn) is in part at least artificial.

5. [NS 0058 3686] The section in the Rosa Water at Rosa Bridge on the Brodick—Corrie road shows a metre or so of sandstone and shales that can be definitely assigned to the Upper Carboniferous. Their age is proved by the occurrence of thin ribs of ironstone containing fresh-water lamellibranchs (mussels) and fragments of plant (lepidodendroid) stems. One of these ironstones, 23 cm thick, outcrops a few metres above the bridge.

Red sandstones belonging to the Permian are exposed 110 m or so downstream from the bridge, so that the junction between the Carboniferous and Permian rocks must be drawn in the gap between the two exposures.

6. [NS 0036 3677] From locality 5 follow the String Road for a short distance until it is joined by the branch road to Glen Rosa. Examine the exposure on both sides of the Glen Rosa road. The rocks here are sandstones belonging to the Carboniferous Limestone Series and are nearly vertical. Note the hollow feature adjacent to the northern edge of the String Road, against the old churchyard, where the Corrie Limestone (Excursion 4, locality 8) was at one time worked on a small scale at the surface. The sandstones are composed almost wholly of angular quartz grains and some of the beds are white in colour. They closely overlie the limestone and their compact siliceous character makes them a useful index horizon in mapping the various exposures of the Lower Carboniferous succession between Corrie and Glen Shurig. These white sandstones with their angular grains should be compared with the red, round-grained sandstones of the Permian (Plate II).

Note that the outcrops are cut off to the west by a fault which shifts the Carboniferous rocks southwards to the hillside south of the String Road.

Continue along the String Road to Glen Rosa Cottages at the entrance to Glen Rosa and note how the solid rocks are nearly everywhere concealed by alluvial and glacial deposits. The pebbly red sandstones, cut by a few thin dykes, which are seen in the Shurig Water about 230m slightly north of west of the old churchyard, belong to the Upper Red Sandstone and a small outcrop of rocks referred to the same series occurs at the roadside 310 m south of the cottages. The boundaries between the Carboniferous and the Upper Old Red Sandstone and between the latter and the Lower Old Red Sandstone can only be approximately indicated on the map.

7. [NS 0010 3755] Strata of Lower Old Red Sandstone age are exposed by the roadside near the Cottages and are well seen on the wooded ridge (Am Binnein) to the west. They consist of massive dull-red sandstones together with bands of

purplish sandy shales dipping to the northwest or west-northwest at angles of between 50° and 60°. The sandstones, which sometimes show sun-cracked surfaces, were at one time worked for local building purposes in small quarries at the east end of the wood.

On passing into Glen Rosa note the wide U-shaped valley with the steep sides and hanging valleys characteristic of glaciated regions. The floor has been levelled by the deposition of alluvial sediments through which the Rosa follows a winding course. Good sections showing river gravels and sands can be examined at a number of places where the stream has cut into former flood-plains.

Note the roughly defined higher terrace which can be traced up the glen as far as the bend in the stream just above locality 8, a distance of about 2.4 km from the mouth of the Rosa Water. This most likely was formed as outwash deposits laid down at a time when the ice stood at the moraines near locality 10.

8. [NR 9892 3785] A broad, sill-like mass of igneous rock is here intruded into the Lower Old Red Sandstone sediments. It is a fine-grained grey, sometimes pinkish, rock which can be traced in a south-southwesterly direction, by Torr Breac and Torr Dubh, for about 1.6m. Under the microscope it is seen to consist mainly of stout, lath-shaped crystals of feldspar together with pale-coloured augite in single grains or aggregates; a good deal of chlorite is also present, with scattered grains of epidote and a little quartz. Epidote also occurs here and there in veins or streaks. The rock represents a dolerite intrusion in which the feldspars have been altered and chlorite and epidote developed as new minerals.

9. [NR 9878 3781] Examine here the sections in hard sandstones and sandy mudstones of the Lower Old Red Sandstone, dipping steeply to the west-northwest.

10. [NR 9877 3813] Good sections in coarse sandstones and hardened, almost slaty mudstones, are seen in the Rosa Water close to the line along which the Lower Old Red Sandstone comes into contact with the Dalradian schists. The position and direction of this boundary can be closely fixed and followed for some distance and its nature should be carefully studied. Anderson has recorded (1945, p. 278) that at one point, 302m southwest of the Rosa Water, Dalradian schistose grits are in sharp contact with pebbly sandstones of the Lower Old Red Sandstone, the latter actually passing under the older rock for a metre or so. Some time should be spent in tracing and examining the line of contact here and in the little tributary where it is crossed by the Glen Rosa track and a search should be made for evidence of disruption along the junction. The variation in strike and dip of the Lower Old Red Sandstone and Dalradian should also be noted.

The Lower Old Red Sandstone sediments here have been considerably altered and are grey or greenish-grey in colour in contrast to the usual dark-red or purple hues of the series (see for example locality 7). Epidote has developed in the gritty sandstones and imparts a greenish tinge to them, while some secondary silica seems to have formed. The purple mudstones and shales have been altered to hard, blue-grey massive rocks in which the bedding is obscured. These changes are due to contact alteration in the vicinity of the great mass of the Northern Granite. The induration and alteration of Lower Old Red Sandstone and Dalradian rocks alike have served to obscure the nature of the junction line. This was taken by Anderson (*loc. cit.*) to represent a continuation of the Highland Boundary Fault. Tomkeieff (1961, p. 16) referring to the discordant boundary on the hillside above Glen Rosa says that "this discordance may be due either to an unconformity or a fault". Certainly the former cannot on the local evidence be ruled out (see also p. 27).

A fine series of moraines crosses Glen Rosa except where breached and cut through by the stream. They represent stages in the retreat of the glacier which occupied the glen in Lateglacial times. Good sections of the materials composing the moraines (earthy sands and gravels with boulders and stones of all sizes) can be seen in the banks of the Rosa Water a little above locality 10.

11. [NR 9839 3858] Here hard, bluish-coloured Dalradian schists, baked and indurated through proximity to the granite, can be examined. They show the development of contact minerals such as andalusite and cordierite, giving the rocks a spotted or speckled appearance. They are mostly altered schistose grits but some of the finer-grained bands have taken on the character of a splintery contact-hornfels. These rocks should be compared with the more typical Dalradian schists to be examined on Cul nan Creagan (locality 14).

A short distance upstream and a few metres below the junction of the Garbh Allt with the Rosa Water is the schist—granite boundary. The actual contact can be closely located. The coarse granite near the contact is cut by veins of finer-grained granite and shows in places irregularly shaped drusy cavities in which good crystals of amethyst and smoky quartz (cairn gorm) have been obtained. Stop at the footbridge over the Garbh Allt for a view looking northwards up the U-shaped valley of upper Glen Rosa with Beinn a'Chliabhain rising on the left and on the right the steep western face of Glenshant Hill, and the Goatfell massif beyond. Cir Mhòr (798m) dominates the head of the glen and is connected to the Goatfell ridge by the low col of The Saddle (431m) which separates Glen Rosa from Glen Sannox. Behind Cir Mhòr can be seen Ceum na Caillich, the Carlin's or Witch's Step: this deep-cut rift in the jagged outline is due to a dyke, 7.3m wide, which has weathered away more rapidly than the granite it cuts.

Ascend the Garbh Allt, keeping to its northern bank, and note the coarse granite with its characteristic jointing, well seen where the burn rushes over the falls to join the Rosa Water.

Differing views have been expressed regarding the origin of the "hanging" junction of the Garbh Allt with the Rosa. The former flows at first southwards from Coire a'Bhradain across the 300m ("Thousand Foot") Platform, but at about the 245m level, where it is joined by the burn from Coire na Cuiseig, it turns east-northeastwards and cascades steeply down to the Rosa, a fall of at least 150 metres. One interpretation attributes the discordance to widening of Glen Rosa by glacial erosion. Another explanation suggests modification of the drainage pattern. On the latter interpretation the Garbh Allt was at one time the headwaters of Gleann Easbuig which joins the Machrie Water near Glenloig, but was later captured and diverted eastwards by a small tributary flowing down the west slopes of Glen Rosa. This diversion is of recent origin and has not yet been able to cut a deep channel or gorge (for references see p. 58).

12. [NR 9780 3845] Near here note the presence of occasional thin dykes and crush-lines in the granite.

13. [NR 9756 3833] At this locality there is an excellent section in the burn showing the granite-schist contact. The granite is here fine-textured for the metre or so nearest the contact. Cordierite has been recorded from the adjoining schists. The next part of the route takes the visitor southwards to Cul nan Creagan, but before leaving the Garbh Allt he should note that it rises in Coire a'Bhradain between Ben Nuis and Beinn a'Chliabhain. This corrie contains a magnificent set of moraines which are well worth a visit.

14. [NR 9765 3749] Good hill-top sections of gritty, sometimes pebbly schists, locally carrying quartz veins and steeply inclined to the southeast, can be examined on Cul nan Creagan (350m). From this point onwards the succession of stratified rocks encountered is an upward one, from Dalradian to Permian. From Cul nan Creagan the route lies in a direction a little south of east towards the headwaters of the Allt a'Bhrighide, a tributary of the Shurig. This burn provides splendid sections in the Lower Old Red Sandstone.

15. [NR 9852 3722] Note here the occurrence of fine-grained red sandstones, among which are intercalated thin beds of mudstone or shale. Some of the bedding planes show sun-cracks.

16. [NR 9867 3715] Examine at this locality the two dykes, 0.46 and 0.2m thick respectively, of tachylite, a black compact glassy rock of basaltic composition. Under the microscope the thinner dyke shows small crystals and needles of labradorite in an almost opaque glassy matrix.

A little farther downstream are good exposures of conglomerate composed mainly of pebbles of quartzite and quartz, with intercalated bands of fine-grained, deep-red sandstone and some purplish shales. These give way downstream to breccias in which large pebbles and fragments of andesitic lavas are numerous. This occurrence may be compared with that noted on Excursion 6 (locality 3). No extrusive igneous rocks are known in the Lower Old Red Sandstone succession on the east side of the island. On the west side, however, an interbedded volcanic series (hornblende- and olivine-andesites) is present in a belt stretching from near Auchencar to near Garbh Thorr. The occurrence of the breccias with igneous rock fragments in the east suggests that there, too, there was a volcanic series the denudation of which provided materials to the conglomerates.

17. [NR 9898 3697] There is an excellent section here in a massive intrusion of felsite to which the name the Glen Shurig dyke has been given. It is about 30m wide where seen in the Allt a'Bhrighide and can be followed in a direction a little

west of south across Glen Shurig and the String Road. A second 9m felsite dyke crosses the Allt a'Bhrighide just below the first. These felsites are compact, finely crystalline or cryptocrystalline rocks.

18. [NR 9889 3645] Follow the line of the thick felsite dyke down to its outcrop in the Shurig Water. A little downstream from this there is a good section showing sandstones with shale bands dipping southeast at angles ranging from 48° to 65°. The sandstones are highly feldspathic, purplish in colour and weather to a yellowish hue.

The dip arrows at locality 18 (fig. 6) indicate sections where fragments of fossil plants were obtained in 1897. There are two horizons at which these occur:

1. in a 0.75 m band of shale best exposed in the right bank of the stream, about 180m from its junction with the Allt Mòr;
2. about halfway between (a) and the mouth of the Allt Mòr.

These plant remains are referred to *Psilophyton*, an early type of vascular plant characteristic of the Lower Old Red Sandstone of Angus, etc. It belongs to the Psilophytales, a subdivision of the Pteridophyta, one of the three non-seed-bearing divisions of the Plant Kingdom which includes the ferns, horsetails and clubmosses of the present day as well as many of the old Carboniferous swamp plants and trees. *Psilophyton* itself was a small plant possessing upright, branching, cylindrical stems some of which carried spines; the diameter of the stems varies from 1 to 7 mm. Of the Arran specimens only one could be determined specifically as *Psilophyton princeps*. This fossil plant was first discovered in Arran in the Allt Mòr, the tributary of the Shurig already referred to, some distance up from its mouth, by Sir A. Geikie and his students in 1882.

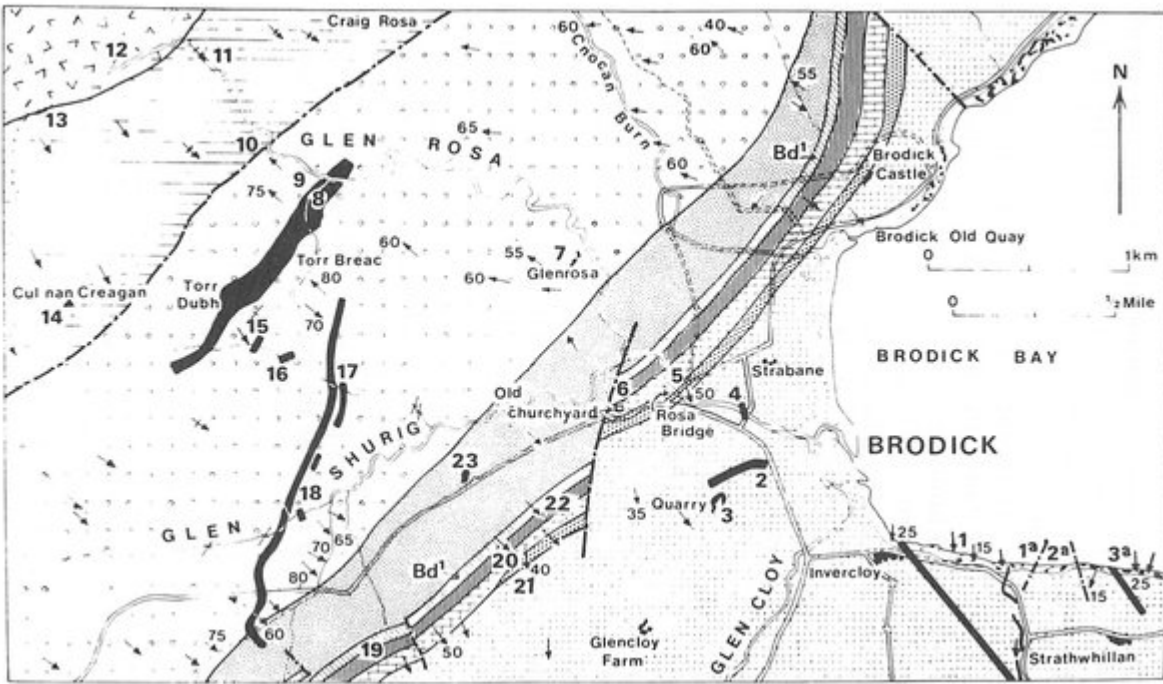
Follow the Allt Mòr upwards to the String Road, noting the stream exposures of hard, micaceous, reddish-purple and sometimes pebbly sandstones cut by thin basalt dykes. The dip steepens to about 80° near the road at the line where the upper limit of the Lower Old Red Sandstone has been drawn. Cross the road and ascend the hillside to locality 19; in doing so the outcrop of the Upper Old Red Sandstone, here concealed by drift, has been traversed.

19–22. At locality 19 [NR 9902 3559] and again at localities 20 [NR 9976 3612] and 21 [NR 9988 3601] to the northeast there are rocks belonging to the Carboniferous. Exposures are poor, however, and it would be advisable if the visitor were familiar with the Carboniferous succession displayed along the Corrie shore before examining the Glen Shurig sections. If so there will be little difficulty in recognising representatives of the Calciferous Sandstone lavas at localities 19 and 22 [NR 9902 3559], and between 20 and 22 some of the white quartzose sandstone overlying the Corrie Limestone (see Plate II, fig. 2). This limestone is not now seen here but its position is marked by a hollow along which it was quarried. All the beds have a steep dip to the southeast.

Before leaving the hillside a traverse should be made to locality 21 to see the red, cross-bedded Permian sandstones which form the crest of the ridge between Glen Shurig and Glen Cloy. The sandstones are inclined at high angles in a more southerly direction than the underlying Carboniferous. The junction between the two cannot be closely fixed.

23. [NR 9957 3655] At this locality, on the branch road leading to West Shurig farm, a search may be made for an interesting pitchstone dyke. This is a dark-green rock carrying phenocrysts of quartz, pyroxene, iron-rich olivine and feldspar. These minerals occur as clusters or aggregates set in a glassy matrix or groundmass containing numerous crystallites. For a full description of this pitchstone see Scott (1915, pp. 147–150).

[References](#)



(Figure 6) Geological sketch-map of the Brodick area to illustrate Excursion 1 and part of Excursion 2.

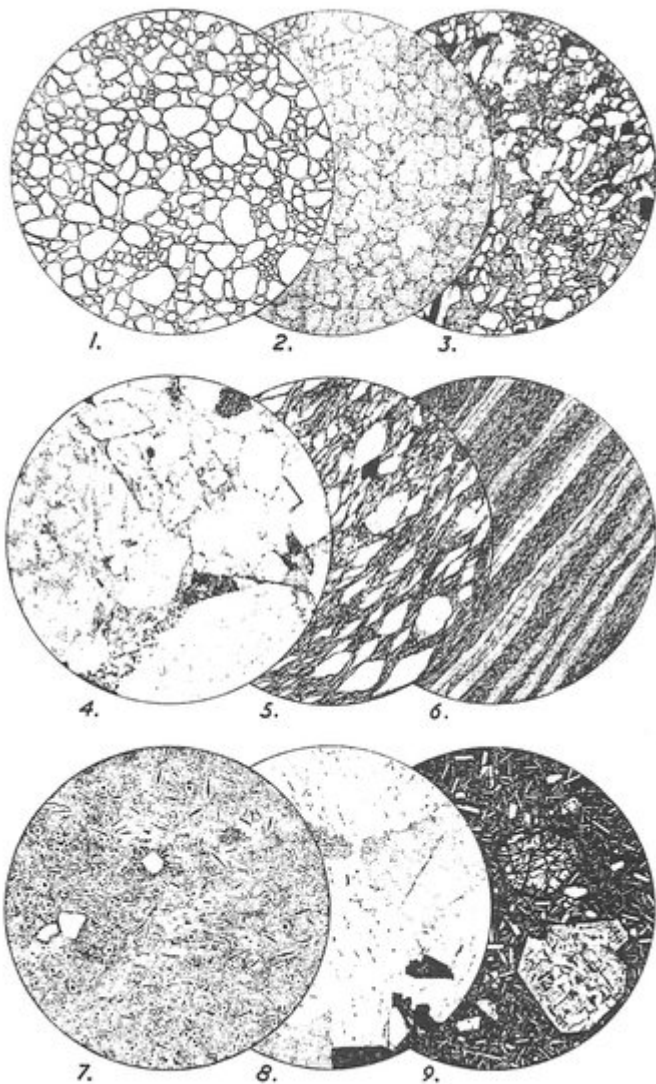
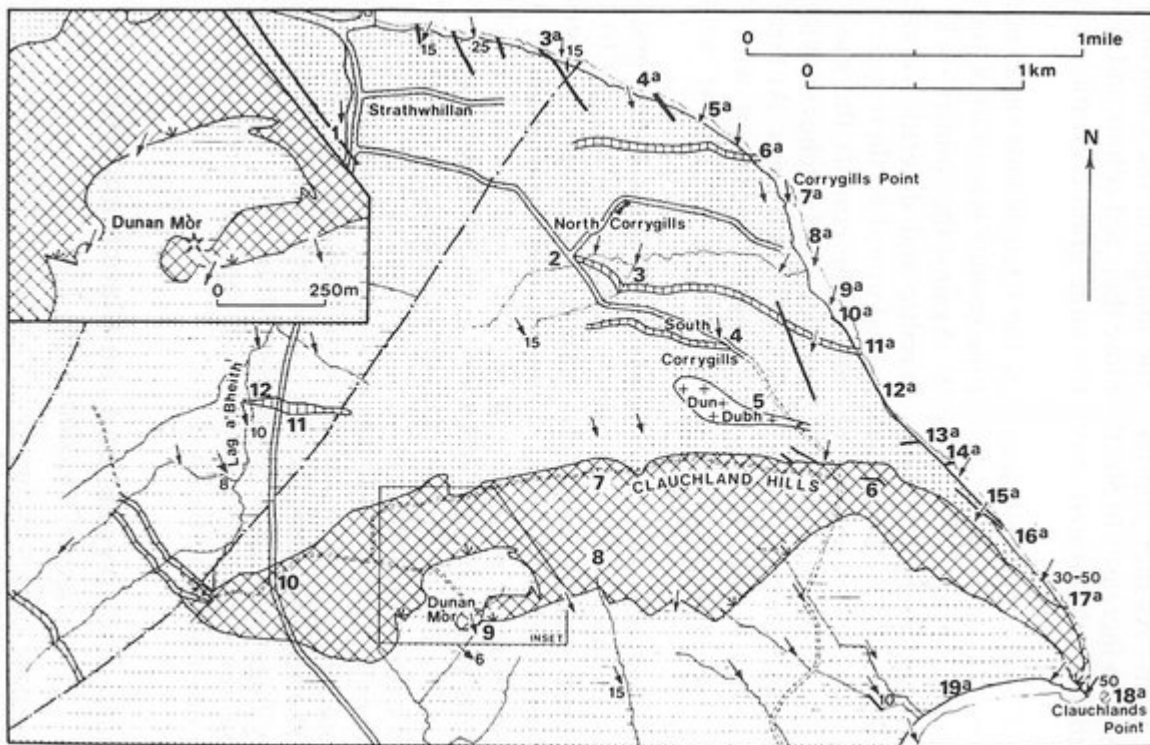


PLATE II. Micro-sections of some typical Arran rocks.

(Plate 2) Micro-sections of some typical Arran rocks. Fig. 1. Permian sandstone, old quarries at Corrie. x12. Grains of quartz, feldspar and quartzite, the surfaces of which have been rounded by wind abrasion ("millet seed" grains), are coated and cemented loosely by limonite. Fig. 2. Lower Carboniferous Sandstone, south side of String Road, 915m SW of Brodick Church. x13. Angular grains of quartz (dusty with fluid inclusions) and of decomposed feldspar and siliceous rock are loosely cemented by clay. Fig. 3. Lower Old Red Sandstone, shore cliff, 800m S of Dougrie. x 11.5. Angular and unsorted grains of quartz (clear), decomposed feldspar (grey) fragments of mudstone, igneous rocks and oxidized iron ore are compactly cemented by the fine-grained waste of similar material. Fig. 4. Pebbly grit, Dalradian, near SE end of Creag Ghlas Laggen, North Arran. x 10.5. Fig. 5. Cleaved grit, Dalradian, shore 69m ESE of Loch Ranza pier. x9-5. The rock has been sheared. Quartz and quartzite pebbles have been deformed and ground away until their long axes lie parallel to the schistosity which is strongly developed by parallel orientation of the chlorite and muscovite flakes of the matrix. Fig. 6. Slate, Dalradian, old quarries on hillside 2.4km E of head of Loch Ranza. x 13. The paler and darker bands represent more silty and more clayey alternations of the original strata. Within the paler bands the effect of shearing can be seen in the development of a lenticular schistosity on a microscopic scale. Fig. 7. Pitchstone dyke, Schoolhouse, Brodick. x12. Small euhedral crystals of quartz lie in a matrix of rock-glass from which numerous crystallites of pyroxene have grown. In other parts the rock contains euhedral prisms of zoned plagioclase and pyroxene which are not shown in this figure. Fig. 8. Granite, Glen Rosa. x12. The rock is composed of oligoclase (showing straight cleavage lines), orthoclase (turbid), quartz (clear, with tiny inclusions and cracks), and biotite (dark, with straight close cleavage). A small prism of zircon lies on the left side of the topmost biotite). Fig. 9. Olivine basalt lava, Lower Carboniferous, Corrie shore opposite schoolhouse. x10.5. Euhedral phenocrysts of purplish augite (bottom right) and olivine serpentinized along cracks (centre) lie in a matrix composed mainly of plagioclase laths, augite grains, and iron ore granules.



(Figure 7) Geological sketch-map of the Brodick-Lamlash area to illustrate Excursions 2 and 3. For key see Figure 5.