
Chapter 19 Loch Maree to Kishorn, including Torridon, Gairloch, Applecross, Crowlin Isles, and Raasay

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The extensive district now to be described measures about thirty-six miles from north to south, with a maximum breadth of about nineteen miles. It embraces the largest continuous area of the Torridon. Sandstone, and displays that formation in its most typical forms. The denudation which further north has isolated the sandstones into numerous outliers has here also deeply trenched them and separated them into colossal groups of mountains, but without laying bare the underlying gneiss, save here and there where hills of that ancient rock have been buried under the vast mass of Torridonian sediment. It will be most convenient for purposes of description to divide the district into separate areas, and to trace the distribution and development of the rocks in each of them. These areas are (1) Loch Maree and Torridon, (2) Gairloch, (3) Applecross, (4) the adjacent Islands of Crowlin and Raasay.

(1) Loch Maree and Torridon

The Torridonian formation reaches very nearly its greatest elevation in the wild mountain district that stretches southward from Loch Maree, surrounds the head of Loch Torridon, and sweeps eastwards to Strath Carron. Within this area are included, with the exception of An Teallach, the loftiest of the Torridon mountains: Sail Mhor of Beinn Eighe (3217); Leagach (Liathach) (3456); Alligin (3232); Sgurr Ruadh (3141); Meall a' Chinn Deirg (3060); Beinn Damph (2958); and Fuar Tholl (2968); besides many other hills of lesser elevation. The topmost peaks of Sail Mhor, Leagach (Liathach), and Beinn Damph are thinly capped with Cambrian quartzite, but the great bulk of the mountain is in each case of Torridon Sandstone.

This portion of the ancient sandstone plateau affords an example of a stage of denudation intermediate between that found in the Applecross peninsula and that of the completely-isolated cones of Sutherland and north-western Ross. Though we have not in this region to replace in imagination such masses of vanished strata as those that once connected the Sutherland peaks, it is evident even to an untrained eye that the mountains here also have been carved out of a high table-land. Each of them has a complete individuality, and stands out distinctly from its fellows. The cols between the heads of the opposing glens and corries do not, as in Applecross, form part of the unbroken plateau, but have been cut down to a considerable level below that of the summits, and separate the mountains from one another by valleys often of great depth. Thus the watershed between the Torridon and Kinlochewe River, in the great valley which separates Beinn Eighe and Leagach from the hills of Coulin and Beinn Damph, is only 343 feet above sea level, the other cols ranging from 900 to 1400 feet in height. In the high ground that overlooks Strath Carron on the west, the separation into distinct peaks is much less complete. The dominant feature of this region is a more or less continuous ridge that extends southwest from Loch Clair to Glen Kishorn, and presents a steep, scarped face to the north-west; while on the further side lofty spurs, separated by deep glens, run out at right angles with a south-east trend. As this district, however, lies within the area of disturbance, in which successive thrust masses of Cambrian as well as Torridonian strata are involved, it cannot be regarded as part of the original Torridonian plateau.

The most important features in the geological structure of this area of undisturbed Torridonian strata are the powerful north and south dislocation known as the Fasagh fault, and the great anticlinal fold trending approximately in the same direction, the two features intersecting one another on the northern slopes of Leagach.

The Fasagh fault, so-called from the place of that name on the north side of Loch Maree, where it is particularly well seen, traverses the area from the mouth of the Grudie River to the head of Loch Kishorn. Its downthrow is to the east, and from the effect produced on the Cambrian strata further north the amount of its throw must be considerably more than 1000 feet. Its course at the surface is marked by a deeply-cut feature on the face of Leagach, above the head of Loch Torridon. It here brings down the upper and middle portions of the Applecross group against strata much lower in the series, for the hard quartzose sandstones with slimy partings and red clay seams, seen at the roadside immediately

west of Fasag, belong to the base of Group 2, while the red flaggy beds west of Torridon House may be regarded as the top of the Diabaig group. Another result of this fault may be seen in the absence of Cambrian strata in the west. The quartzites that cap Mullach an Rathain of Leagach and the eastern peak of Beinn Damph dip towards the sea, and but for the fault should have appeared on the higher hill-tops further west.

A line drawn southwards from Loch Bad na Sgalaig in Gairloch, across the summits of Beinn Dearg, Leagach, and Beinn Damph, and down Strath a' Bhathaich to the head of Loch Damph, marks the axis of a broad anticlinal fold in the Torridonian and Cambrian strata. West of this line the general dip is, with small local variations, steadily to the north and south of west. The anticline, well seen on the southern face of Leagach, where upwards of 3000 feet of thick-bedded purple gritty sandstones rise in an almost vertical wall above the road in Glen Torridon, crosses the crest of the mountain a little west of the quartzite-covered peak of Spidean a Choire Leith. The sandstones are here flat or nearly so, but dip away on either side to east and west at angles of 7°–10°. The small Cambrian outlier that caps the summit of Mullach an Rathain dips south-west, while the dip of the quartzites on the central and eastern peaks is to the east, showing that this fold is of post-Cambrian age. The quartzite on Mullach an Rathain rests upon several feet of green shale and red flaggy sandstone that may possibly belong to the base of the Altbea group.

(1) Diabaig Group

Nearly the whole of the Loch Maree and Torridon area is covered by the thick arkoses of the Applecross group. But the lowest or Diabaig group is here typically developed on Loch Torridon. In the township of Diabaig, on the north shore of the Outer Loch, this group consists of the following succession of strata:

Zone 3. Flaggy grits and sandstones becoming more massive at top, weathering bright red.

Zone 2 Dark shales and mudstones, with thin beds of grit and flagstone and calcareous bands.

Zone 3 Red flaggy grits and basal breccia.

The total thickness of the series at Lower Diabaig is about 700 feet. The breccia, composed of fragments derived from the underlying rocks, is a local base, and may occur at any horizon where higher beds overlap upon the gneiss. Both the highest and lowest zones are characterised by bright-red weathering, but are distinguished from each other by difference in grain. The grits of the upper zone pass into fine-grained sandstones, while the lower grits are invariably coarse, and often contain large scattered pebbles. The pebbles in this group, unlike those higher up in the series, seem to be largely of local derivation, and in the lowest zone are almost entirely composed of the subjacent gneiss.

An excellent section, in which the beds are well exposed throughout, is seen on the shore at Lower Diabaig, and may here be described. The gneiss rises from the shore to form the steep rocky eminence of An Torr, off the foot of which the basal conglomerate dips W.S.W. at a tolerably high angle, while small patches of conglomerate and breccia occur here and there on the steep slope above. Grey and red flagstones with scattered pebbles supervene, followed by about 400 feet of fissile grey shales and dark mudstones, alternating with thin bands of grit and compact fine-grained flagstone. Some of the fine-grained beds are highly calcareous and show the characteristic brown limestone-weathering. The dark shales are often ripple-marked and sun-cracked, and on some of the surfaces well-preserved impressions of rain drops can be seen. These facts point to shallow-water conditions, and the deposition of the sediment on a tidal shore, perhaps also to a warm and dry climate in which the shore silt dried and hardened between tides, so as to retain the markings impressed upon it. The shaly beds are succeeded by massive bright-red sandstones with shale partings, and these gradually pass up into the purple false-bedded grits of the Applecross group (II). A westerly dip prevails throughout, the angles varying from 8° to 10°, but at the western end of the section the inclination falls rapidly until the strata are nearly flat. Good sections of the group may be seen in the stream that flows out of Loch Roag, and in the two burns that flow into the northeast corner of Loch Diabaigs Airde. Further inland to the north other good exposures of the lower series appear between Loch Roag and Loch na h'Uamhaig, where a considerable extent of ground is occupied by bright-red flaggy grits with large scattered pebbles. In several places sandstone and breccia may be seen filling up hollows and cracks in the uneven surface of the gneiss, which here rises rapidly eastwards, until the purple grits of the Applecross group, brought on by a rapid overlap, are found resting on the gneiss on the western side of Ruadh-Mheallan at a height

of nearly 1700 feet.

Rocks of the Diabaig group are well displayed along the southern shore of Upper Loch Torridon, between Ob Gorm Mor and Shildaig. The eroded surface of the gneiss on the east side of the Aird Mhor is overlain by a thin cake of coarse angular breccia containing blocks of gneiss five and six feet long. Further west along the coast, flaggy red grits and ripple-marked flagstones with a south-westerly dip crop out along the shore east of Badan Vugie. At this spot a shallow syncline brings on purple and grey shales with pebbly bands dipping east, while dip slopes, of coarse conglomerate are seen resting on the gneiss at the mouth of the Balgy River. Breccia, with a westerly dip of 150–200, occurs again on the east side of Camas a' Chlàrsair (Bay of the Harper). The promontory between this inlet and Ob Mheallaidh (Deceitful Bay) is made up of red flaggy sandstones resting on grey flags and shales. The shores of the latter bay afford good exposures of purple fissile flagstones and greenish micaceous shales, the surfaces of the flaggy beds often showing sun-cracks and ripple-marks. The direction of the ripples, observed at Badan Vugie, runs east by north and west by south. As already referred to in Chapter 15, the base of the Torridonian series rises rapidly from the sea at Ob Mheallaidh, and passes round the northern end of Beinn Shildaig. The arkoses of the Applecross group overlap the Diabaig strata against the steep sides of the pre-Torridonian hill until they rest on the gneiss at an elevation of over 800 feet on the north-western shoulder of the mountain above Ceann-locha.

False-bedded grits and sandstones of the Diabaig group occupy the ground on the southern shore of Loch Shildaig and along the course of the Amhainn Dubh. They dip south-west at 10° , and rise steadily in the series, until they are cut off and brought down against the gneiss along the Inverbain River by the Applecross fault. This dislocation, which also bounds the Torridonian area for some distance north of Alligin Suas, on the opposite side of Loch Torridon, trends south-westwards across the peninsula, and throws down the Secondary rocks to the bottom of the Applecross valley. The relation of these younger strata to the Torridon grits, which rise in an escarpment nearly 1000 feet in height on the north-western side of the glen, shows that whether or not the dislocation was initiated in earlier times, it has been in operation since the Liassic period, seeing that it has displaced the Secondary strata for more than 1000 feet.

Further west, among the hollows of the old gneiss ridge which has been buried under the Torridonian formation, small areas of the Diabaig group have been laid bare, as at Artheslaig and on the shores of Loch Creagach. The gneiss cliffs along the eastern side of that loch are covered in places with thin cakes of flaggy red grit with pebbly bands and small patches of conglomerate and breccia, some of which is extremely coarse and calcareous, its large blocks of gneiss and hornblende-rock being cemented together by strings and masses of calcite. Ripple-marked flagstones and red flaggy grits, lying nearly flat, are seen along the shore at Kenmore, and also at Camas an Eilean, where they dip north-west at 10° – 15° .

On the south side of Loch Maree, where projecting portions of the ancient irregular land-surface of gneiss have been laid bare by the denudation of the overlying Torridonian sediments, the Diabaig group has been well exposed in a series of interesting sections. One of these has been cut by the River Lungard at Talladale, where, under a depth of 100 feet of hard compact brick-red grits with no pebbles, a series of black and grey shales, greywackes, reddish grits, and shales can be seen in the river-gorge to have a thickness of about 250 feet. Another fine section of black grits and dark and grey shales has been laid open in Gleann Airidh Chomhaich, one mile S.S.E. from Talladale.

The structure of the ground between Loch Maree and the hilly ground to the south-east of Strath Lungard is represented in (Figure 12). Between the lake and the strath one of the ridges of the old gneiss is unconformably flanked on either side by the lowest members of the Torridonian series. Strath Lungard is seen to be an ancient depression of the surface of gneiss, in which the Diabaig group, followed by the arkoses, has been deposited. To the south-east of the glen the gneiss once more rises to the surface in another ridge, beyond which the ground mounts up into the high hills of arkose in the Kinlochewe Forest.

In the section laid open by the River Lungard, the strata of the Diabaig group are seen to have a more or less persistent dip to the south or S.S.E. at an average angle of 10° , and to be traversed by small faults. They graduate upward through the fine-grained brick-red sandstones above mentioned, which in turn pass upward into massive pebbly grits of the arkose group. The uneven floor of Lewisian gneiss, with its dykes of epidiorite and hornblende-schist, rises on the east side of the valley to a height of about 1000 feet above sea-level. The Diabaig beds can be traced round the margin of this

ridge of gneiss, dipping off the old land-surface at angles from 5° to 10°.

(2) Applecross Group

The great mass of arkose which forms the high mountainous country that stretches from Loch Marco to Loch Torridon, and thence southwards through the wilds of Applecross, varies but little in lithological character from one part of the area to another. The huge masses of Alligin, Beinn Dearg, and Leagach on the north, and of Beinn Damph, Beinn Shieldaig, and Beinn Bhan on the south side of Loch Torridon, are almost entirely built up of pebbly grits and coarse sandstones, often full of false bedding, and with occasional bands or seams of shale and flagstone. The general dip of these rocks is south-west or S.S.W., and the average angle of inclination 8°–12°, though in the neighbourhood of the more important faults it may rise to 25° or 30°. In the Glen Shieldaig and Applecross Forests the rocks are traversed by many narrow basalt dykes of Tertiary age, and the patches of vivid green herbage seen on the hill-side above the road in Glen Shieldaig are due to the decomposition of small sheets of augite-minette, intrusive in the sandstones. The architectural character produced by the regular parallelism and nearly horizontal stratification of the sandstones is exemplified in the mural precipices and castellated buttresses that sweep up almost from the sea-level on the north side of Upper Loch Torridon and Glen Torridon. But it is in Applecross that these noble features reach their highest development.

The Torridonian strata referred to in the foregoing pages lie entirely in the undisturbed region to the west of the line of complicated tectonic structure. But the area now under description includes also large tracts of the same rocks which have been displaced and modified by the post-Cambrian movements. The area of disturbance is bounded on the west by a line which runs S.S.W. from the head of Loch Maree, across Ben Eighe and the eastern shoulder of Leagach, and is continued along the southern slopes of Strath a' Bhathaich to the Kishorn River, where it is cut off by the Fasagh fault. Over the greater part of its course this line is of the nature of a thrust or reversed fault, but in the extreme north passes into a system of folds.

East of this line the relations of the Torridonian and Cambrian strata are no longer normal. A succession of thrust planes and folds, with a general N.N.E. trend, repeats the outcrops of the two formations and gives rise to a series of rapid alternations forming parallel bands, such as are seen on the map to occupy the ground between Coulin and Strath Carron.

The structure of this area is described in Chapter 37.

(2) Gairloch

The tract now to be described stretches from the promontory of Rudh' Re on the north to the Shieldaig Forest on the south. It is bounded on the east by the hollow of Loch Maree and the line of dislocation which runs thence north-westward to the coast about Camstrolvaig. By far the greatest portion of this large area is occupied by the Applecross arkoses. The Diabaig group, with its numerous inliers of gneiss, lies in a broad belt between the Shieldaig Forest and Loch Gairloch, and in a narrower strip along the western shore of the lower half of Loch Maree.

(1) Diabaig Group

Near the base of the group, in this area as elsewhere, coarse conglomerates or breccias containing pieces of hornblende-schist and Lewisian gneiss frequently occur. No sections have been noticed in which thick coarse conglomerates overlie shales, but occasional conglomerates may be observed which seem to be as high or higher in the series than some shales or fine grits elsewhere visible. As already shown, the conglomerates or breccias must be regarded as the local base of the group, but this base varies greatly in level in adjoining localities owing to the unevenness of the underlying surface of gneiss. The breccias and conglomerates have been derived from the waste of the Lewisian gneiss and its igneous rocks. Some of the blocks are occasionally four feet long, and one example of a mass of acid gneiss four or five yards long may be seen in the breccia on the roadside east of the Loch Garbhaig Burn. Occasionally a single deposit of breccia is found to be 70 or 80 feet thick, with thin intercalated partings of sandstone.

The best sections of the Diabaig shales and grits are found at the southern end of the area in the course of the Abhuinn Braigh Horrisdale, a mile and a half south-east of Loch Bad na Sgalaig, and in the burn which flows out of Loch Garbhaig into Loch Maree. The grits are distinguished from those of the Applecross group by their finer grain, greenish-grey fracture, and bright red or orange weathering. The larger fragments in them have been derived from the Lewisian gneiss, while pieces of quartzite and quartz-felsite, such as are abundant in the overlying group, are rare. The grits are intercalated with sandy shales, most of which are dark grey, but some purple, pale-green, or red in colour. Thin lenticular laminae of grit are abundant in the shales. Flakes of aliothigenic white mica, ripple-marks, and narrow veins filled with sand that probably represent sun-cracks, are also common in the shaly beds. Repeated search has been made in these sections for organic remains, but hitherto without success. The line of division between the Diabaig and Apple-cross groups is not well defined in this area. The passage beds, or alternations of rocks belonging to both groups, are in some places of considerable thickness.

It has been noticed that close to certain small patches of breccia near the Gairloch Established Church the approximately vertical foliation-planes of the underlying hornblende-schist become very nearly flat, being bent over in the direction of the fall of the ground. Instances of a somewhat similar change of dip of the Lewisian rocks close to steep pre-Torridonian surfaces are not uncommon in this area, but have not been noticed away from these surfaces. It looks as if the planes in question have been bent by some agent that acted superficially with a downward motion. The two agents which first suggest themselves are soil-cap and ice. No instance of recent bending by soil-cap motion has been observed among the Lewisian rocks, which are generally too firm and sound to be readily affected in this way. Bending of the gneiss planes, attributable to pleistocene or recent ice-action, occurs on the flat top of Beinn a Chaisgein Mòr, on the east side of the Fionn Loch.

The line separating the Diabaig from the Applecross group has been drawn at the top of the bright-red flaggy grits which overlie a series of grey and red gritty. shales and flagstones, and are succeeded by grits coarser in grain and not distinguishable from typical Applecross grits. Sections of the upper beds of the group are exposed in the burn ■-mile south-east of Badachro, on Loch Gairloch. In a burn nearly quarter of a mile west of this last-named place, the sequence of strata is as follows

	feet
Massive red grit, chiefly fine-grained	80
Massive fine red grit with thin dark-grey shaly partings	110
Massive fine-grained red grit, flaggy partings	32
Dark grey sandy shales	10
Fine-grained red grit	2
Dark greyish-green shales and bands of grey and red grit	12
Fine red grits with inclusions of purple shale, and purple shales	40

In the stream one mile north of the foot of Loch Gaineamhach the Diabaig group is well shown, and appears to exceed 500 feet in thickness.

To the north-east of Loch Gairloch, in the tract between that inlet and Loch Ewe, the Diabaig group is represented in broken tracts next to the surface of gneiss on which it rests. To the north of the road from Gairloch to Poolewe the basal conglomerates and sandstones abut nearly everywhere against the old surface of gneiss and hornblende-schist, and, as in other areas, often lie in hollows that had been eroded in these rocks before Torridonian time. A remarkable example of this kind may be seen around Loch an Eilein and Loch na Curaich, from two to three miles west of Poolewe. These lochs lie almost entirely in Torridon Sandstone, and are nearly everywhere surrounded by higher ground formed of gneiss. The hollows which they occupy must have existed before the sandstones were laid down (? rock-basins). The low dip of the beds here may be partly due to deposition on gentle slopes. East of Lochan nam Breac the conglomerate and sandstone rise into a fine escarpment, but do not form an outlier, since they are connected with the general mass.

Northward from the Gairloch Hotel, above the fine exposure of basal conglomerate there to be seen, thick red sandstones supervene, having coarse bands in places, and dipping to the west at about 10°. In Strath Bay a coarse

sandstone is visible, followed to the west of the main stream by a band a few feet thick of dark-grey argillaceous sandstone, which is the only band exposed along this shore that at all resembles the typical Diabaig group. All the strata of the continuous section towards the west belong presumably to the arkose or Applecross group. In the course of the River Sand, east of the large mass of diorite that forms the hill Meall Glac na Daraich, and apparently a long way up in the arkose group, certain strata have been met with which present many of the characters of the Diabaig group. They be, however, near the local base. Their lowest visible beds consist of alternations of massive and flaggy sandstones, dipping northwards, succeeded upwards by grey tiles and shales, massive red sandstone, and about 150 feet of grey shales passing under massive red sandstone.

In the centre of the peninsula west of Inverasdale the basal beds are well exposed about Bac and Leth-Choin. A great depth of gneiss-conglomerate with bands of red sandstone is there succeeded by coarse red sandstone with bands of conglomerate. As for more than half a mile the dip is north-westwards at 15°–20°, rising among the higher beds to 30° or more, the thickness of strata there exposed must be about 1000 feet.

The red rocks visible at the Rudh Re probably belong to the basal group, though the gneiss is nowhere visible. At the northern extremity of the peninsula the sandstone is fine-grained, well bedded, and much of it almost flaggy. The same kind of sandstone, undulating eastwards to Camas Mor, is covered unconformably by several Triassic outliers. Its successive synclines and anticlines can be followed for a long distance south of the fault which bounds the largest Secondary outlier.

(2) Applecross Group

As already stated, this sub-division of the Torridonian formation covers the larger part of the district. On the north side of Loch Gairloch to the west of Strath Bay a fairly continuous section of the arkoses, with a steady dip between W.N.W. and north-west, can be followed as far as Altgreshan, a distance of six miles across the strike in a straight line. The angle of inclination varies from about 10° in the lowest beds to 15° or 20° higher up in the series. Probably this coast-line exposes not less than some 6000 or 7000 feet of the arkose group. It is true that a gap in the continuity of the shore-section occurs at Big Sand, where the Torridonian rocks are concealed under unconformable Secondary rocks, but other exposures inland along the strike and also in Longa Island opposite serve to supply the missing portions of the series. Throughout this thick succession of strata the arkose displays its usual characters. Its normal coarse pebbly texture is varied north of Port Erradale by the intercalation of bands and partings of red shale.

Further north in the peninsula the same type of strata spreads over the ground, which is for the most part covered with peat. The characteristic arkoses appear in the low-lying tract to the north-west of Inverasdale and east of Loch an Drainc. They are a continuation of the strata seen on the other side of Loch Ewe, about Mellon Charles, and at the north end of Isle of Ewe. As there is a steady easterly dip averaging about 20° across a breadth of about three miles, the thickness of rock here must amount to 5000 feet without a visible base or top.

South of Loch Gairloch, where the Applecross group is again well displayed, the best sections are to be seen on the southern coast-line of the loch between Badachro and Openham, and inland in the cliffs of Bus-bheinn and Beinn an Eoin, which rise between Loch a' Ghobhainn and Loch Maree. The grits exposed in these sections are composed of fragments of quartz — often opalescent — or of pink felspar, varying in size from a mustard-seed to a small pea. With them are large pebbles of quartzite, jasper, quartz-felsite, and other unfoliated igneous rocks.

The minor laminae in the false-bedded bands are often curved into a vertical or reversed position, their upper edges being cut off abruptly by the overlying grit, and sometimes they assume other more complicated forms. They do not represent mere lines of staining, but differ in grain as well as in colour. A good example of this peculiar structure may be seen on the coast about a mile and a half east of the Red Point. The pebbles in the curved laminae often lie with their long axes parallel to the sides of the laminae, even where these are vertical. This curved lamination in the Torridonian Sandstone was noticed by Sir Archibald Geikie, who gave a sketch of an example of it from Gairloch in his *Textbook of Geology* (1882), P. 479.

The original inclination of the false-bedding, observed in various places in this area, seems to be generally in an easterly or south-easterly direction, as can be seen at such widely-separated localities as Sron a' Mhuilt (south side of Loch Gairloch), An Tarbh (on the coast three and a half miles south of Loch Gairloch), and the foot of the burn flowing out of Loch a' Bhaid Fhearna (three miles S.S.E. of Gairloch).

The grits of this group, here as in some other districts, are occasionally so much disintegrated as to give rise to accumulations of blown sand. This feature can be seen on the northeastern side of Beinn Bhreac, where a considerable deposit of blown sand has been derived from the waste of the grits on the south-west side of the hill.

On the west side of Badachro Bay a series of purple grits has been laid bare, which enclose lenticles of purplish shale ranging up to three feet in length, and stripes of shale, succeeded below by fine grits, the bedding-planes of which show parallel rod-like marks, five inches long, stained with haematite. These strata probably lie near the base of the Applecross group. Similar grits with shale-lenticles are seen on the west side of Eilean Horrisdale, and on the coast one-third of a mile southwest of Fraoch-Eilean (south side of Loch Gairloch). On the first-named islet violent false-bedding and irregular junctions of fine and coarse-grained grits are exposed. The surfaces of the finer grits sometimes weather in irregular hollows, and show rhomboidal or polygonal forms, probably due to contraction in drying. Examples of these features are to be seen near Sron nan Gabhar and Badantional on the coast between Eilean Horrisdale and Sron a' Mhuilt (on the south side of Loch Gairloch), a mile east of Sgeir Ghlas, half a mile south-west of the top of Meall na h'iTamha (between five and six miles south of Loch Gairloch), and at various other places. Bands of clayey shale of various colours, varying from mere partings to beds one foot in thickness, are intercalated with the grits at Badantional, and at a point a mile and a half N.N.W. of the foot of Loch na h-Oidhche (about three miles south of Slattadale), near the base of the Applecross group. A bed of brick-red micaceous sandstone three feet thick occurs in the coarse grits a mile and a quarter S.S.E. of the foot of Loch a' Bhealaich (about five miles S.S.W. of Slattadale), and gives rise to a green ledge. Similar ledge-forming bands of red and yellow sandstone and shaly grit are seen on the slopes of Beinn Bhreac and Bus-bheinn.

In the account given in Chapter 16 of the petrography of the Torridonian formation, reference was made to the scarcity or absence of pebbles of the Lewisian gneiss from all parts of the formation save the lower members, and, on the other hand, to the presence of fragments of rock for which no known source has yet been found. Percentages of the varying rocks represented among the pebbles in the Applecross group in the southern half of the 'Gairloch district were taken, and these are illustrated in the following table. The pebbles, one inch and upwards in length, were collected from certain spots, *a*, *b*, *c*, *d*, *e*, each about a square yard in extent, in an exposure of coarse purplish grit:

Table of percentage of different rocks in the coarse grit 150 yards N.N.W. from the top of Meall na h' Uamha, 5½ miles south from Loch Gairloch.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	Total	Percentage of whole collection
Vein quartz, often reddened	14	15	18	14	9	70	40.2
Unsheared igneous rocks, chiefly quartz felsite and red felspar porphyry	11	8	9	10	9	47	27
Quartzose Lewisian gneiss, and quartzose schist with some felspar and mica	5	6	5	2	6	24	13.8

Jasper-like rocks, red, yellow, and black	4	2	4	3	5	18	10.3
Quartzite, generally of a pale red or yellow colour	4	4	4	1	2	15	8.6

Reference has already been made to the occurrence of veins of Torridonian sediment that have filled up cracks and crevices in the underlying gneiss. But in the Gairloch district the Torridonian strata themselves have been found to be traversed by veins of sandstone. Near Gairloch several "sand dykes" cut nearly vertically through Torridon grits. The trend of these dykes varies between N.N.E. and E.N.E., a direction which is also shared by some of those in the Lewisian gneiss, nearly on the strike of the most conspicuous of which these Torridonian dykes are found. Sand-dykes are seen in the coarse grit at the base of the Diabaig series in or near the burn three-quarters of a mile and again five-eighths of a mile north-west of the mouth of Lochan Druim-na-Fearna. At the first-named place only one dyke, about eight inches thick, was observed. At the second several dykes can be seen, some of them a foot broad, and they project beyond the surface of the grit, which they cut. They contain some large pieces, which may have been derived from Torridon grit, but in most parts they are finer in grain and redder than the Torridon grit at their sides.

By far the best examples, however, are two which appear 350 yards apart, rather more than two miles south-east of the Red Point. Standing out on the coast like igneous dykes, they traverse grits which probably lie at least 3000 feet above the base of the Applecross group. One of them, about six yards wide, has distinct and straight sides from the top to the bottom of the rock-section, which is about 50 feet high, and they incline towards the south-east at about 75°. No distinct bedding can be detected in the dyke, though at one place there seems an obscure stratification which dips steeply to north-east. The grits which the dyke cuts are inclined towards north-west at about 15°, are rather coarser grained than the dyke-rock, and in some bands contain many pebbles about half an inch long. In the dyke, on the other hand, the larger pieces do not usually exceed 1–12th of an inch in length. The middle of the dyke is irregularly jointed, but the marginal portions are crossed by some rather close joints which are parallel to the sides. The other dyke, which lies further to the north-west, is also about six yards wide, and is seen from top to bottom of a cliff about 70 feet high. It is finer grained than the grits which it cuts, and it presents joints which are parallel to the side both in the marginal portions of the dyke and in the grit near it.

(3) Applecross

In no part of its course along the coast of the North-West Highlands is the central division of the Torridon Sandstone more impressively developed than in the parish of Applecross. The area forms a peninsula extending from Loch Torridon to the mouth of Loch Carron, and bounded on the east by the hollow in which the road runs from Shildaig to Loch Kishorn. It is divided into two unequal portions by the valley of the Applecross River, which coincides with one of the leading dislocations of the district. This fault is prolonged in a northeasterly direction across the water-shed, and has given rise to the valley of the Allt an t' Strathain, which descends into Loch Shildaig. Each of these tracts has its own peculiarities of topography. That to the north stretches as a rocky expanse of Torridon Sandstone, which, rising steeply from the Applecross valley to a height of more than 2000 feet, falls gradually towards the north and west.

The southern tract presents one of the most striking scenes to be found in any portion of the region. From the alluvial flats of the Kishorn River and the northern shore of Loch Kishorn the ground rises steeply into a high plateau, of which the chief heights are Beinn Bhan (2936 feet), Sgorr-na-Caorach (2539 feet), and Meall Gorm (2325 feet). Though there is evidence to prove that even the highest summits were overtopped by the ice during the great glaciation, still the plateau is singularly bare of drift. Hence it presents in a striking form those physical features which are so characteristic of this formation. Where the streams have cut backwards into the mountainous tableland — as, for instance, Allt Coire Attadale, Allt na Fhraoich, and Allt na Chumhaing — the valleys are bounded by mural escarpments several hundred feet high. Where side streams have trenched these walls of sandstone, giant buttresses have been formed, as on the eastern sides

of Sgorr na Caorach and Beinn Bhan. As already mentioned, these lateral spurs, intersected by deep clefts, due to lines of joint, to faults, or to the decomposition of intrusive dykes, and weathering into lofty pinnacles, represent early stages of erosion in the development of such isolated ridges of Torridon Sandstone as Stack Polly, north of Loch Broom. On the east side of Beinn Bhan, one of these ridges (An Poite) has been partially severed from the lofty plateau, with which it is now connected only by a high col. Still another familiar feature of the topography of the Torridon Sandstone, which has been alluded to in the foregoing chapters, is admirably displayed by the mountains of Applecross. Owing to the gentle inclination of the strata the hill-slopes have a terraced aspect, determined by the outcrops of harder ribs of sandstone. These regular terraced features are equally conspicuous when seen from a distance, as from the hills east of Loch Kishorn, or from the crest of the plateau looking eastwards from Creag Gorm. to Carn Dearg and Sgorr na Caorach. (See (Plate 3) and (Plate 32)) Where, however, the dip of the strata is greater than the slope of the ground, as along the western portion of the Applecross peninsula between Loch Toscaig and Allt Mor, and to the north of the Applecross River, the contour is irregular. The successive outcrops of sandstone then form parallel ridges of rock with intervening hollows, which have been largely modified by glacial action.

Reference has already been made (p. 326) to the hills of gneiss which rise through the Torridon Sandstone on the south side of Loch Torridon, and on the flanks and hollows of which the lowest members of the formation are here and there exposed. These basal strata can be seen at many places along the gneiss margin between Croic Bheinn on the south and Arrin-achruinach on the north, and between Croic Bheinn and Inbhirban on the north-east. This area affords another striking instance of the extreme irregularity of the surface of the Lewisian gneiss upon which the Torridon sediments were deposited. Along more than two miles of the junction line northwards from Loch Gaineamhach (Sandy Loch) strata more than 1000 feet up in the Applecross group are in contact with the gneiss. Although, as already mentioned (p. 326), the Diabaig group appears near Ardheslaig and round the shores of Loch Creagach (Craggy Loch), on the Loch Torridon side of the ridge, nevertheless further inland bed after bed of the Applecross arkoses is seen to strike at and to abut against the gneiss of the old mountain-system, the dip of these strata being persistently towards the west. This structure is illustrated in (Figure 14), from which it will be seen that the arkoses overlap the Diabaig group and resting immediately on the gneiss, attain a great development towards the west. This section and the map (Sheet 81) likewise furnish further proof that some of the present hollows on the gneiss surface are older than the time of the Torridonian sediments which were deposited in them, and have not yet been everywhere removed from them by denudation. Thus, on the eastern side of the gneiss ridge which extends from Arrin-a-chruinach southwards to Croic Bheinn, many of these ancient valleys may be still seen choked up with the angular debris of Torridonian time. Examples of them are well displayed round the shores of Coire Buidhe, in the hollows of Beinn Tire, at Ardheslaig, and in the lower course of the Inbhirban River. It is worthy of note that the higher up the slopes of these old mountains the strata are followed the less breccia appears in them at their junction with the gneiss; indeed, it is often quite absent, the red sandstones being then found immediately resting on the older rocks. This feature is specially noticeable along the western line of contact, as may be seen between the northern bays of Lochs Gaineamhach and Ceópach, also to the north of Loch a Bhealach (Loch of the Pass).

With the exception of these eastern tracts, where the old gneiss ridge has been once more exposed by denudation, together with its partial relics of the Diabaig group, the whole of the northern portion of Applecross is covered by the central group of the Torridon formation. This group consists here as elsewhere chiefly of reddish or purplish coarse arkose, with a few intercalations of red or green mudstone and shale. The arkoses include scattered well-rounded pebbles, which are sometimes aggregated into thin beds of conglomerate. As a rule, these pebbles rarely reach a diameter of two inches. They consist of quartzite, quartz-schist, felsitic rocks sometimes showing fluxion banding, and spherulitic structures, jasper, green slaty rock, vein-quartz, and, more rarely, fragments like the Lewisian rocks of the mainland. (See Chapter 16 for an account of the petrography of these fragments).

The structure of the northern part of Applecross is of the simplest kind. (See (Figure 14)) As the strata dip on the whole steadily towards the west at angles varying from 15°–25°, the thickness of the arkoses must here amount to not less than 6000 feet. The only marked feature that sometimes relieves the monotonous simplicity of the area is to be found in the occurrence, both in the gneiss and among the Torridonian rocks, of two systems of igneous dykes — an older set of mica-traps and lamprophyres with an east and west trend, and a newer series of Tertiary basalt, which runs north and south. Both systems of intrusions bleach and alter the rocks along their margins, but no other special modification was observed in this area. Besides the great fault already mentioned as traversing Applecross from north-east to south-west,

and throwing down the Secondary rocks to the south with a displacement of more than 1000 feet, a number of minor faults exist, of which a considerable proportion have given rise to distinctive surface features. The rocks along their course and that of the dykes have weathered more rapidly than those at a distance from them. The chief topographical details of the ground, however, are produced by the massive beds of the arkose, which, dipping towards the coast-line, give rise to sharp escarpments facing eastwards and to long dip-slopes that sink towards the west. The coast-line, unlike much of that in the Torridon ground to the north, is comparatively low and tame. It shows two rock-shelves (*seter*) marking the 100 feet and 50 feet beaches of the west coast. All the rock features have been more or less modified by glaciation.

Though the southern division of Applecross presents a bolder and loftier series of landscapes, its geological features are on the whole a repetition of those in the northern area just described, with the omission of the gneiss protuberances and the scanty patches of the Diabaig group. The Torridon Sandstone is admirably developed, but it is represented mainly by the central group of the formation. The arkoses stretch from the Kishorn valley across the lofty plateau to the Toscaig River and Allt Mor, east of Applecross village, where finer sediments supervene, which probably belong to the highest division of the formation. The general dip of the strata is westerly or a few degrees to the north or south of that point, and the average angle varies from 10° to 12°. The sequence between Kishorn and the western shore south of Applecross village is interrupted by a few minor faults, which, however, increase in number to the south-east of Loch Toscaig, in the direction of Uags and Airidh-drishaig, where the angles vary from 15° to 20°.

The arkoses present in this area their usual aspect of massive false-bedded grits with scattered pebbles, which, in places, alternate with fine-grained false-bedded sandstones and bands of shale. The scattered pebbles in the arkoses may be seen in abundance on the hill-slope north-east of Uags — the extreme southern point of Applecross — where they consist of felsite, jasper, quartz, fine-grained purple quartzite, and other materials. The thin bands of shale occasionally associated with the group may be illustrated by an example exposed on the crest of the plateau at Creag Ghorm by the side of the road leaning to Applecross, where about six feet of green shaly mudstones and dark micaceous shales are associated with false-bedded grits. Another band, about two feet thick, has been traced along the edge of the eastern escarpment of Carn Dearg and round the head of the corrie of Allt na Fhraoich that drains the col between Cara Dearg and Sgorr na Caorach.

The fine-grained sediments, which probably belong to the highest or Altbea group of the Torridon Sandstone, are well exposed on the shores of Loch Toscaig, and in the Toscaig River for about a mile to the east of the hamlet of that name; thence they extend northwards by Carn nan Uaighean (1190 feet) and An Glastulach (886 feet) towards the village of Applecross, where they are covered unconformably by Triassic and Jurassic strata. The dominant members of this series of strata are fine-grained, brick-red, false-bedded sandstones, sandy flags, and micaceous shales, which are occasionally associated with coarse grits, the whole dipping westwards at angles varying from 10° to 20°. But even to the west of these fine-grained sediments, coarse pebbly grits supervene on the shore about half a mile to the south of Milton of Applecross (where the pebbles measure about an inch across), and on Airdhubh, a promontory east of Eilean-nan-Naomh.

A section drawn from the Kishorn valley westwards by Beinn Bhan, Sgorr na Caorach, and Creag Ghorm to the margin of the Triassic rocks at Applecross, gives a thickness of about 7000 feet for the Torridon Sandstone in the southern part of the peninsula, of which the fine-grained sediments north of Loch Toscaig amount probably to about 1000 feet.

Igneous intrusions similar to those in the northern part of the area appear also in the southern portion. Thus, several basalt dykes trending N.N.E. and north-west traverse the highest part of the plateau between Meal Gorm and Beinn Bhan and the western area between Airidh-drishaig and Camasterach. A few thin sills of the same material are associated with the sandstones on the shore, about a mile and a half south of the village of Applecross. Several dykes of mica-trap and quartz-felsite also occur, as shown upon the map. The only exceptional feature among the igneous rocks of Southern Applecross is the occurrence of two small necks, probably of Tertiary age, which pierce the sandstone plateau, about the level of 1000 feet, in the valley of the River Toscaig, four miles S.S.E. of Applecross village.

Southern Applecross lies between two powerful lines of dislocation. Its north-western margin is defined by the great fault already mentioned as continuous across the peninsula to Loch Shiel-daig. On its south-eastern side also it is bounded by

another important line of fracture, which runs along the northwestern side of Loch Kishorn and inland up the Kishorn valley. Besides these dominant dislocations various faults are traceable through the area, but owing to the uniform character of the strata it is difficult to estimate the amount of their displacement. Along the south shore, near Airidh-drishaig, branches of the great Kishorn fault, with a downthrow to the south-east, have been traced for some distance; one strikes the shore about a mile east of Airidh-drishaig, and can be followed westwards by Loch Airidh Alasdair to the coast-line north of Uags, while another occurs between Airidh-drishaig and Uags.

(4) The Crowlin Isles

This little group of three islands lies a mile and a half off the south-west point of Applecross. Their combined area amounts to a little more than a square mile. They are formed of a series of hard sandstones and shales belonging to the uppermost or Altbea group of the Torridon formation, traversed by a network of later igneous intrusions chiefly in the form of basalt dykes of Tertiary age. The sandstones are reddish and grey in colour, fine-grained, compact, and hard in texture. In composition they are fine-grained arkoses, in which the felspar grains are remarkably fresh. They are divided into massive beds from two or three feet up even to twenty feet in thickness. Their finer lamination, indicating false-bedding, affords a good instance of the complicated structure already referred to, as it is singularly convoluted. These massive beds may succeed each other without any parting of other material, but a thin layer of green, red, or grey micaceous flagstone or shale not infrequently intervenes between them. Such layers of shale occasionally reach a thickness of from 14–20 feet, and they here and there show evidence of having been locally eroded before the deposition of the overlying sandstone. It is not uncommon, therefore, to find more or less rounded galls of shale in the sandstones. As the dip of the strata through the islands is towards the N.N.W. at an average angle of about 15°, the thickness of the strata here exposed must amount to above 2000 feet.

The sandstones are much affected by two systems of joints which run, approximately, the one set N.N.W. and S.S.E. and the other east and west. Some of these joints are accompanied by faults, none of which, however, appear to be of much importance, except one, which, running near to and parallel with the southern shore of Eilean DM-, is in all probability the extension of a fault on the opposite mainland, already alluded to as a branch of the great Kishorn fault. The fault on Eilean Mòr is accompanied by several minor dislocations, which have given rise to much brecciation of the strata along their course. The rocks are here traversed by a network of joints and smaller faults, many of which have served as fissures for the uprise of igneous material now found in the form of dykes. Two sets of such intrusions can be distinguished. On the east shore of Eilean Mòr, immediately to the east of the only dwelling-house on the island, an east and west dyke of pink quartz-felsite is seen to be cut by a north and south dyke of basalt. The former probably belongs to the older series found in Applecross, of which the age is doubtful; but the basalt dyke is no doubt one of the abundant Tertiary series. The Torridonian rocks are much bleached, hardened, and even vitrified in places where in contact with these basalt dykes. The joints, faults, and dykes give rise to narrow gullies around the coast and to trench-like hollows across the interior of the islands. The contours of all the islands have been smoothed and rounded by glaciation, and raised beaches are found at the heads of all the little creeks and inlets.

(5) Raasay

The Torridonian strata in this island occupy a small area south of Manish Point, about six square miles in extent, lying between the Lewisian gneiss of the extreme northern part of the island and the Jurassic tract of the south. They likewise form the Eilean Fladday and the islet of Griana-sgeir. In general character they agree with their equivalents on the mainland. They include portions of the two lowest groups of the formation.

The Diabaig group is well developed along the eastern margin of the area, especially as regards the bright-red grits which form its upper portion. The dark flags and shales are well exposed on the shore at Brochel Castle and along the east side of Eilean Fladday. At the last-named locality they contain a few thin bands of calcareous sandstone, like that seen at Lower Diabaig on Loch Torridon.

The sequence of the strata at Brochel is as follows:

Jointed grey micaceous shales, with thin bands of grey sandstone and coarse pebbly grit	150
Massive false-bedded bright red sandstone, with shale bands	
Alternations of bright red sandstones and ripple-marked grey and red flaggy shales	about 200
Fine-grained red and grey sandstones, sometimes with scattered pebbles, and intercalations of grey shales	
Bright red flaggy sandstone and more massive sandstone, with occasional thin bands of shale	about 700

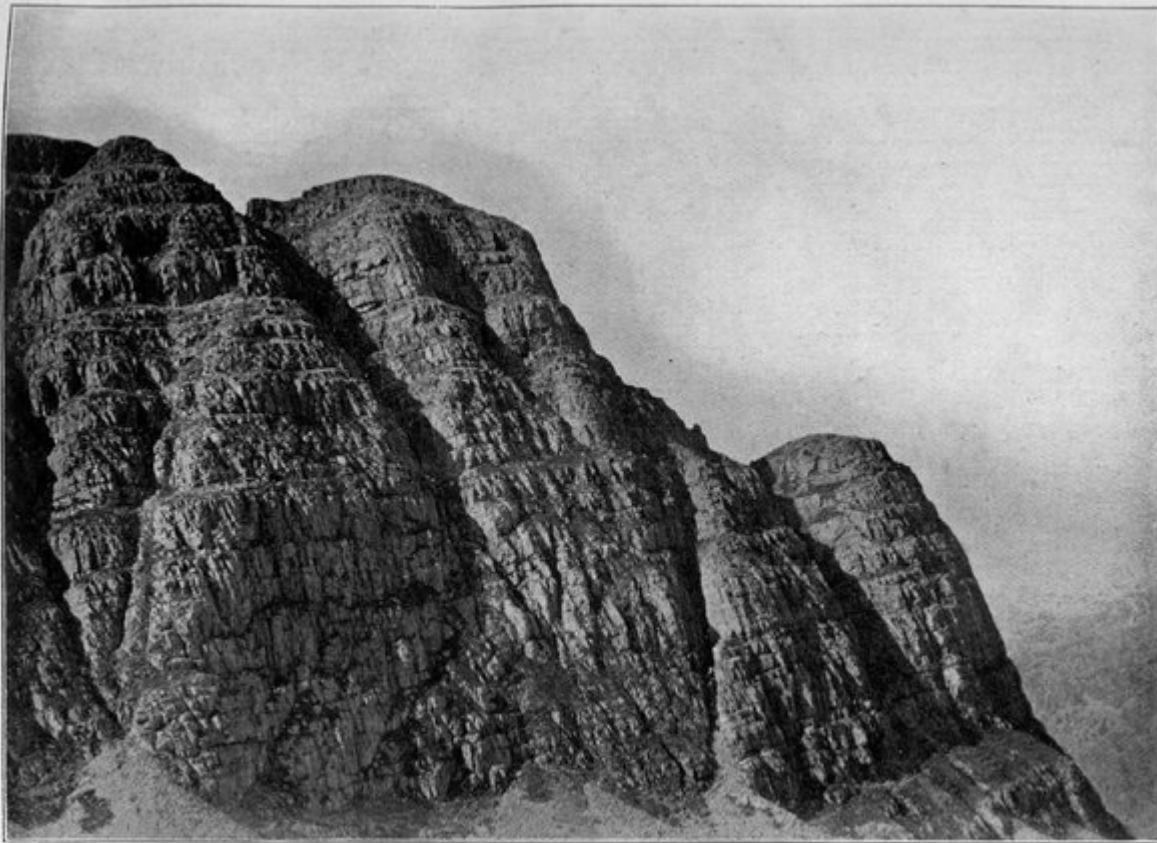
The total thickness of the series here is not less than 1000 feet. It will be noticed that the rocks in this section differ from those described at Diabaig in the greater proportion of micaceous sediments, and the absence of calcareous beds. The strata are inclined to W.S.W. at an average angle of 15°. The red grits are also well seen along the cliffs on the south side of Loch Arnish, where they dip west and W.N.W. at 15°–20°.

The basement breccia is not present in the Brochel section, but is seen clinging to the surface of the gneiss near Lockan Uachdair, along the shore of Loch Arnish, and on the east side of Caol Fladda, opposite Eilean Fladday. The dark-blue and grey flagstones of Fladday, though not cleaved, but much jointed, were formerly worked as an inferior kind of roofing slate.

The rest of the Torridonian area of the island is occupied by the false-bedded red and purple grits and sandstones of the Applecross group. They are sometimes pebbly, and contain occasional thin bands of red shale and flagstone, but as a whole vary but little in character. They dip steadily in a general westerly direction at an average angle considerably higher than that generally observed on the mainland, and ranging from 18° to 23°. They are traversed by numerous N.N.W. basalt dykes, probably of Tertiary age, which, as in Applecross, have altered and bleached the sandstone, in several instances, to a distance of more than 20 feet from the edge of the dyke. Where the igneous material, as often happens, has weathered out, it has left a narrow gully between two vertical walls of hardened whitish-grey sandstone. Reference may also be made to two neck-like masses of breccia, composed of fragments of unaltered grit and sandstone, cemented together in one case with calcite. The largest of these forms the picturesque crag on which the ruined castle of Brochel stands; the other lies a mile inland, near the west aide of Lochan Uachdair. Both are probably of volcanic origin, and, like the two necks in Southern Applecross, may be part of the great volcanic series so largely developed in the neighbouring Island of Skye.



(Figure 12) Section across Srath Lungard, showing the Torridonian Series lying upon an eroded platform of Lewisian Gneiss, A. Lewisian Gneiss. Ba. Diabaig Group. Bb. Applecross Group.



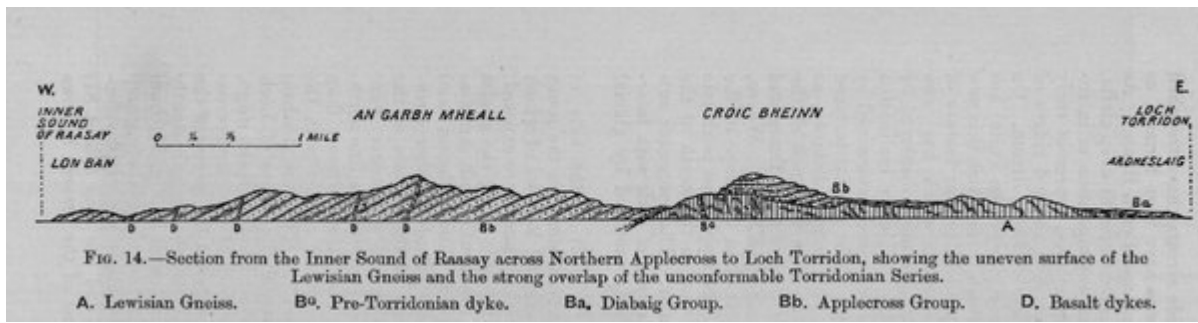
Torridonian Precipices : Sgurr na Caorach, Applecross, Ross-shire.

(Plate 3) Torridonian precipices, Sgurr na Caorach, Applecross, Ross-shire. C49–50.



Precipices of Torridon Sandstone. Beinn Bhan, Applecross, Ross-shire.

(Plate 32) Precipices of Torridon sandstone; Beinn Bhan, Applecross, Ross-shire. C61–C62



(Figure 14) Section from the Inner Sound of Raasay across Northern Applecross to Loch Torridon, showing the uneven surface of the Lewisian Gneiss and the strong overlap of the unconformable Torridonian Series. A. Lewisian Gneiss. B^G. Pre-Torridonian dyke. Ba. Diabaig Group. Bb. Applecross Group. D. Basalt dykes.