Chapter 21 Isle of Skye

By C. T. Clough, with notes by A. Harker. The ground described in this chapter is comprised within Sheets 61, 70, and 71 of the Geological Survey Map of Scotland.

In Skye the south-eastern peninsula, including the parish of Sleat and the east end of Strath, is chiefly composed of Torridonian rocks. Two or three miles south of Kyleakin these rocks rise into the mountains of Sgurr na Coinnich (2401 feet) and Beinn na Caillich (2396 feet), but the hills become lower in a southwesterly direction, and beyond Loch na Dal nowhere exceed 1000 feet in height. In the northern part of the peninsula the elevation also decreases rapidly towards the north-west, and low dreary peat-covered tracts cover the area between Loch Eishort and Kyleakin. On the mainland of Inverness-shire, on the east side of the strait of Kyle Rhea, a narrow strip of Torridonian rocks may be conveniently described with those of Sleat.

On the flanks of Ben Suardal, in the parish of Strath, a small Torridonian area is separated from that to the east by a narrow band of Mesozoic rocks. North-west and west of that hill various small areas of Torridon Sandstone have been mapped. One of these lies to the north-east and east of Beinn na Caillich, west of Broadford, between Coire-chat-achan and the Kyle of Scalpay, and the rocks reappear in Scalpay Island. A little further to the north-west another strip of the formation, from half to a third of a mile wide, and more than two miles long, appears on the coast east of Loch Sligachan. A third narrow strip, never more than 200 yards wide, runs for three miles along the coast of Skye, from the middle of the Sound of Soay towards the head of Loch Scavaig.

It is certain that nearly all the Skye Torridonian rocks, and also those east of the Kyle Rhea, have been thrust forward from the south-east during the great post-Cambrian movements. This displacement is well seen near Ord, on Ben Suardal, and at Coire-chat-achan. But, as a rule, the rocks in this district have not suffered appreciable deformation or alteration, and they can be separated into various stratigraphical horizons, most of which, as stated in the last chapter, are more fully developed here than in any other part of the North-West Highlands.

Arranged in descending order, the Torridonian formation in Skye comprises the following sub-divisions of strata:

(2) Applecross Group. — Red and chocolate arkoses with pebbles of quartzite, felsite, jasper, pegmatite, and other rocks.

(1) Diabaig Group — (d) Kinloch Beds — A series of dark grey sandy shales and fine-grained grey and buff grits with thin calcareous lenticles.

(1) Diabaig Group — (c) Beinn na Seamraig Grits — Fine-grained buff or grey-green grits with some bands of grey sandy shale.

(1) Diabaig Group — (b) Loch na Dal Beds — Dark grey, gritty or sandy shales with fine-grained buff grits and small calcareous lenticles.

(1) Diabaig Group — (a) Epidotic Grits and Conglomerates — Beds with abundant pebbles of epidote and epidotized felspar. The finer bands show a greenish matrix. Occasional bands of purple and green shale.

The four lower sub-divisions represent in an enormously expanded form the Diabaig group of the region to the north. In Skye they occupy collectively an area about twice as large as that covered in this island y by the Applecross group. The boundaries between the different divisions, though not sharp, are yet generally sufficiently developed to allow of the detection and tracing of large faults. The three upper members of the Diabaig group have many characters in common. The grits are often excessively false-bedded, and, as in those of the Applecross group, the minor lamina) within certain beds are often arranged in sharp curves, though the tops and bottoms of these beds have a uniform slope. Many of the finer grits in each division are characterised by the presence of small spots, the size of a pea or less, which are usually paler than the rest of the rock. They seem to be due to a peculiar condition of the interstitial matter, and they were no doubt in existence prior to the post-Cambrian thrusts, for in several places they have been elongated in a parallel

direction along the cleavage planes. This feature may be seen two-thirds of a mile S.S.W. of Sgurr na Coinnich. A few of the coarser grits are red in consequence of the number of clastic grains of red felspar, but generally white felspar preponderates.

A traverse of the district in a south-easterly direction from Broadford Bay to the Sound of Sleat at Ardnameacan shows the several sub-divisions in their simplest relations. First comes the Applecross group, followed by the different members of the Diabaig group, in normal stratigraphical order. A considerable resemblance may be noted between the Kinloch and the Loch na Dal beds, but the other three divisions are so different from one another in lithological character that the Kinloch beds and the Loch na Dal beds cannot be regarded as repetitions of one series, with the Beinn na Seamraig grits lying in a fold between them. The great apparent thicknesses of the three upper sub-divisions d. o not seem due to repetition by thrusts and folds. There are no indications of thrusts or isoclinal folds, and very little cleavage can be detected along the parts of the traverse which these divisions occupy. The dip of the whole formation is continuously north-westwards — a direction opposite to that of the usual inclination of the thrusts and isoclinal folds of post-Cambrian age. It does not seem likely that the strata can once have had a general south-easterly dip, together with a set of obscure isoclinal folds and thrusts, and that these structures have been subsequently bent so as to be inclined towards north-west. Had this reversal taken place the cleavage-planes would also have dipped northwest, for it is a rule that when these planes are developed they lie parallel to the axial planes of the folds of the rocks in which they occur. But, as a fact, these planes, where seen along or near the line of traverse, always dip south-east. In some parts of the Applecross group the dip in a north-west direction has been increased in amount since Mesozoic times, but this increase has not made the cleavage dip north-west.

The general strike of all the Torridonian rocks in Skye is northeast and south-west. Those which lie furthest south-east show stronger indications of dynamo-metamorphism — more cleavage or foliation, more elongation of particles, more tendency to granulitisation in the matrix — than the rocks which lie to the north-west. Further, as they are followed south-westwards from Kyle Akin towards Loch an Eilean, in Strath, or Isle Ornsay, the metamorphism gradually decreases in strength.

The Torridonian rocks in the parts of Skye north-west or west of Strath Suardal, and in the Island of Scalpay, are much mixed with igneous rock, and it is not certain to what horizon some of them belong, or to what extent they have been affected by thrusting. These rocks will, therefore, not be dealt with in the descriptions of the several Torridonian divisions which are to follow in this chapter. A few facts relating to them may, however, be stated here.

The different patches of Torridonian rock which occur in the part of Skye between Coire-chat-achan and the Kyle of Scalpay are outliers above the Ben Suardal thrust, and they overlie Cambrian limestones. In all these outliers the rock is less felspathic and more siliceous than the usual type of Applecross grit. It is a close-grained quartzose grit, passing locally into a quartzite with cementation by silica. In the Torridonian strip east of Loch Sligachan, the lowest rocks, which are at the west end, resemble the common Applecross type. They consist of red and grey sandstones and grits, containing a considerable amount of felspar, and having pebbly bands on some horizons. Over these, in the eastern part of the area, come less felspathic and more quartzose fine-grained grey rocks, which often weather with a pink colour.

The general dip of the Torridonian rocks on the Skye shore near the Island of Soay is north-west at low angles. The lower part consists of fine-grained sandstones with some flaggy and shaly beds weathering red, pink, or grey. These are overlain by less fine-grained and pinker sandstones, with some conglomeratic bands, and then by pebbly grits, weathering pale-grey or white.

The Torridonian beds in the Island of Scalpay admit of division into two members. The highest and principal member composes most of the north-eastern and central part of the island, and also extends nearly to Rudha Aosail Sligeach. It consists chiefly of coarse felspathic sandstones, weathering reddish, often false-bedded, and with pebbly seams and beds throughout. Its thickness may be as much as 4750 feet. Below this comes finer sandstone, also felspathic, never pebbly, and this passes down through intermediate beds, which are often laminated and flaggy, into close-grained quartzose grits with little or no felspar, and of a grey, greenish-grey, or white colour. The thickness of the lower member appears to be about 1300 feet.

(1) Diabaig Group

This lowest member of the Torridonian formation, which, in the Loch Carron and Loch Alsh district, assumes a different character from that of the same group further to the north, crosses into Skye and attains there its greatest development. As shown in the foregoing table, four distinct assemblages of strata can be recognised in it.

a. Epidotic Grits and Conglomerates

This sub-division between Kyle Rhea and Loch na Dal occurs in four detached areas, none of which is as much as half a mile broad from north-west to south-east. Three of them lie near together, and form an almost continuous exposure from Port Aslaig to within half a mile of Ardnameacan. The most north-westerly area touches the coast on both sides of Dun Ruaige. In the southern part of Sleat other four or five small detached areas have been noticed. Even the largest of these, which has its approximate centre about half a mile south-west of the outlet of Loch a' Ghlinne (four miles and a half N.N.E. of Point of Sleat), does not much exceed 20 acres. The rocks in the areas adjoining the Sound of Skye are well exposed in coast-sections, and those in the southern part of Sleat are also for the most part bare and crag.

In no unthrust area of the Torridon Sandstone do we know of rocks quite like what those under description may be supposed to have been in their original condition. None of them have escaped alteration in the course of the great post-Cambrian movements, and, speaking generally, the alteration is greater in this than in the other Torridonian sub-divisions. In the district between Loch na Dal and Kyle Rhea the epidotic grits lie to the east of most of the other rocks which can with confidence be claimed as Torridonian, and they, therefore, approach nearer to the region in which the thrusts and accompanying movements had their source. The areas in the southern part of Sleat lie in a network of thrusts, and have been considerably mylonised and crushed. Nevertheless, excepting in certain bands, the alteration has not gone far enough to produce a distinctly granulitic matrix, or to obscure the outlines of the larger constituents of the rock, which is crowded with determinable pebbles and clastic grains.

These rocks are least altered near Ardnameacan. In the coast-sections from half a mile to a mile north-east from this point the included pebbles have not been elongated nor is cleavage prevalent. North-eastwards indications of greater change appear: glistening foliation-planes often cross the bedding, the pebbles have been drawn out in a parallel direction, often across the bedding, and thin quartz-veins with some red felspar are occasionally seen.

The sub-division consists for the most part of grits and conglomerates, in which the fresh matrix shows prevailing tints of green or lemon yellow. The green tints are chiefly due to flakes of chlorite, the yellow to small grains of epidote or pieces of felspar which have been partially converted into epidote. The bands in which a yellow tint predominates are generally only from two to four inches thick. They are harder than the others, contain a greater proportion of quartz-grains, often of an opalescent character, and weather with a pale-buff or dirty-white colour. The greener parts, besides the chlorite, contain many grains and streaks of epidote, of red felspar, and of quartz, the latter often stained with hematite on their surfaces and along cracks. These colours form vivid contrasts in the shore-pebbles freshly washed by the tide. Some bands contain so many pebbles of red felspar that the green and yellow tints are hardly noticed. In many of the sections false-bedding is conspicuous — for instance, on the coast a quarter of a mile north-east from Rudha Guail.

The larger grains vary considerably in size in adjoining bands, but on the average they are bigger than those in any other of the Skye Torridonian rocks. In the beds half a mile south-west of the outlet of Loch a' Ghlinne, and half a mile north-east of that of Loch Lamarscaig (three miles N.N.E. of Point of Sleat), some pebbles or boulders exceed a foot in length, and are of such stout form that they cannot have been much elongated by shearing. These coarse beds probably lie near the base of the series. In the coarsest beds between. Kyle Rhea and Loch na Dal it is rare to find pebbles exceeding the size of a pigeon's egg: towards the top of the sub-division the grains become smaller, and the grits are mixed with sandy shales, some of which have a green tint and are so mixed with thin laminae of fine grit that the rock presents a ribboned appearance. Most of the high beds are greener than the lower, and are sometimes inter-stratified with grey beds like those in the Loch na Dal subdivision. It is noteworthy that the green colour is usually changed into black or grey in the neighbourhood of igneous intrusions.

Interstratified with the Epidotic Grits occasional bands may be seen of sandy purple, or variegated purple and green shale, which are unlike any other shales in the Diabaig group of Skye. Examples of them can be examined about 70 yards north-east from the foot of Allt Thuill.

In the areas half a mile south-west of the outlet of Loch a' Ghlinne, and half a mile north-east of that of Loch Lamarscaig, numerous large pebbles of opaque white quartz — apparently vein-quartz — may be observed, sometimes seven or eight inches long, and with their outsides stained with haematite. Other pebbles consist of opalescent quartz, which, though it never by itself forms pebbles as large as some of those of the other variety of quartz, not uncommonly occurs with felspar, either red or white, in pebbles which are of considerable size, and which have the aspect of many Lewisian gneisses. Most of the larger pebbles, too, which occur in a coarse band a little south of Port Aslaig, closely resemble some of these gneisses. That coarse band contains also pebbles of pink quartz-felsite, purple felstone, and quartzite. Such pebbles are generally common in the Applecross division, but rare in the Diabaig beds.

About 300 yards south-west of the foot of Allt Caillte some of the epidote grains are as large as hazel-nuts. In a slice (S5413) [NG 786 195] prepared from a grit that occurs a quarter of a mile north-east of Dun Ruaige, many epidote grains are included within felspar pebbles. In the Loch a' Ghlinne and Loch Lamarscaig areas above referred to, some of the pebbles are composed of opaque white quartz and epidote, or of these substances and red felspar. Some of the pebbles, four or five inches long, show the epidote disposed in subparallel streaks.

It seems probable that the majority of these epidote or epidosite grains and pebbles consisted of their present substance at the time the beds containing them were formed. If they had been formed from felspar after the deposition of the strata, it is not likely that some felspar pebbles would have been left quite unaffected, nor would there probably have been such an intermixture of grits rich in epidote with others in which this mineral is scarce. Small grains of epidote are abundantly mixed with grains of other heavy minerals — magnetite, sphene, zircon, &c. — in thin parallel streaks, which represent the bedding of the rock, in various almost unaltered beds in other Torridonian subdivisions in Skye, and it is clear that these are clastic grains.

As has already been remarked, in various parts of the North-West Highlands the pre-Torridon surfaces of the Lewisian gneiss are abundantly traversed by strings of epidote, and the felspar folia have been more or less converted into epidosite. There is thus no difficulty in explaining how clastic grains of epidote should form part of the detritus that *was* first derived from such surfaces by denuding agents.

In some slides made from the rocks half a mile S.S.W. of the Loch a' Ghlinne outlet, broken bits of green hornblende occur in considerable abundance. One of the slides contains a number of grains of black iron ore.

In the areas half a mile south-west of Loch a' Dhlinne outlet, and half a mile north-east of Loch Lamarscaig outlet, the pebbles of quartz and of rocks resembling massive Lewisian gneisses are not generally much flattened nor elongated in a parallel direction, though they are crossed with small crush-lines and sometimes bent. Intimately mixed with these stout pebbles, however, are others composed of highly-sheared material, which are flatter and longer, some being a foot long though only one or two inches thick, in a direction across their foliation. It seems probable to the writer that the flat pebbles referred to had nearly the same form as now at the time of their incorporation in the bed, and that the parent rocks from which they were derived were finely sheared in pre-Torridon times. If these parent rocks were finely sheared we should expect the pebbles from them to be of a flattish form, much as we find in pebbles made from shale. The long axes of these flattish pebbles lie in parallel planes, but they have no general direction, and in one pebble (Slice (S7843) [NG 598 055]) of mylonised substance the shear-planes continue distinctly up to the edge and there end, without entering the enclosing matrix, and the long axes of the quartz grains in. the matrix are not parallel to the shear-planes in the pebble. We may, therefore, conclude that somewhere near the area of deposition of the conglomerate there was an exposure of pre-Torridon mylonite, probably of the same age as those near Loch Maree. The mylonised pebble represented in Slice (S7843) [NG 598 055] is composed of alternating water-clear and opaque white granulitic layers with small augen of red felspar — plagioclase in part — and macroscopically it resembles two rocks which occur *in situ* in the neighbourhood, one a Lewisian gneiss and the other a granulitised band of the Moine series.

It is not certain that in Skye the base of the Epidotic Grits is anywhere seen. The conglomerate half a mile south-west of the Loch a' Ghlinne outlet is folded as well as crushed, and perhaps the original thickness need not exceed 80 or 100 feet. The Epidotic beds between Allt Thuill and Allt Caillte are perhaps 200 or 300 feet thick.

b. Loch na Dal Beds

The chief outcrop of the Loch na Dal sub-division extends from Kyle. Rhea to Loch na Dal. Near Meall Port Mealary and Rudha Guail the beds are folded to a considerable extent, and the outcrop is of irregular form. The greatest width (which is near Loch na Dal) is two-thirds of a mile. Outcrops, which are no doubt continuous under the Sound of Skye with this band, are exposed in good coast-sections on the east side of Kyle Rhea, and on the south-west side of Loch na Dal. The first-mentioned outcrop, which may be seen on the north side of Glenelg Bay, is not in most places more than from 20 to 40 yards wide. The outcrop on the south-western side of Loch na Dal is covered by rocks brought forward on the Moine thrust.

The sandy or gritty shales, which form a large proportion of .the sub-division, are usually of a dark-grey colour, but weather laminae are a brown crust. The purer shale lamin are mixed in extremely thin alternations with sandy or gritty material. Very often ten or twelve such layers may be counted in the thickness of an inch, and it is rare to find more than an inch of pure shale. Some of the clastic grains in the gritty layers are as large as peas, and isolated grains of this size may lie in rows in the shale.

This close intermixture of fine and coarse material is a marked feature in the sub-division, though not confined to it, for a similar rapid alternation, though perhaps not in quite so striking a form, is to be found in the Kinloch sub-division. The surfaces of the laminm often display abundant flakes of white sedimentary mica and ripple marks.

The sandy shales are intermingled with thin bands of sandstone or grit, of a greenish-grey colour, which split along the bedding into rather thin slabs, and generally contain grains of quartz and felspar which are large enough to be discerned by the unaided eye. The quartz-grains are often slightly opalescent, or of a pale blue colour. The felspar grains are either red or white, and not granulitised. In Specimen (S7704) [NG 721 151], a slightly altered gritty shale from the shore a little more than a third of a mile north-east from Ardnameacan, the dark bands are too fine-grained to be capable of satisfactory determination even under the microscope, but are probably in the main composed of granules of quartz and flakes of micaceous minerals.

The sub-division includes some massive grits which, when fresh, have a buff or greenish-grey hue, but which weather with a buff crust, suggestive of the presence of some finely-diffused ferriferous carbonate. These grits are most abundant near the top of the sub-division, and they so closely resemble most of the Beinn na Seamraig grits that in places no satisfactory boundary can be drawn between them.

Thin calcareous streaks and lenticles, rarely more than six inches thick, and weathering with a brown colour, are common in the gritty shales and-grits. Most of them are full of clastic grains of quartz and felspar, which project on the weathered faces.

At Port Aslaig, and between that little bay and Allt Thuill, the shore exposes bands of purer and blacker shale than commonly occur, one of them being somewhat calcareous. In the little burn north-east from Allt an Doire-daraich this bed of shale is perhaps 18 or 19 feet thick, but only a small proportion of it has a calcareous composition.

The thickness of the Loch na Dal beds seems to increase southwestwards from Kyle Rhea to Loch na Dal. Although the outcrop on the coast north of Dun Ruaige is not sharply defined either from the Beinn na Seamraig grits above or from the Epidotic Grits below, the thickness of the sub-division there is estimated at about 600 feet. On the north-east side of Loch na Dal the width of outcrop is partly increased by folding, but, after making allowance for this reduplication, there still seems to be more than twice the depth of strata visible near Kyle Rhea, which is only about six miles away. There may possibly, however, be some deceptive structure in the Loch na Dal section which has escaped notice.

c. Beinn na Seamraig Grits

This sub-division is named after a hill two miles north-east of Loch na Dal, whence it can be traced in a north-easterly direction over Ben Bheag, Ben Aslak, and Beinn Bhuidhe, to the Kyle Rhea, of which it forms the western, and a narrow strip on the eastern, shore. Towards the south-west it passes by the head of Loch na Dal and over A' Mhaoile. A little south-west of this hill the lower beds begin to be covered by rocks brought forward on the Moine thrust, and about half a mile south-east of Cnoc Bealach na Coise the whole outcrop is hidden.

The base of these grits forms a somewhat even line, excepting about a mile south-west of Port Aslaig, where it is folded along axes striking north-east. Their top is a little uncertain between Beinn Bheag and Allt Bas a' Mhuic, north of the village of Kylerhea. Near the head of Glen Arroch it strikes nearly east and west for a mile and a half. The width of the outcrop varies considerably. On Ben Aslak, where greater than anywhere else, it is about two miles and a half.

To the south-west of Cnoc Bealach na Coise (about two miles W.S.W. of Isle Ornsay) it is not certain that any of the Beinn na Seamraig grits emerge from beneath the Moine thrust until the head of Allt a' Mhuilinn, west of Ostaig. Some massive grits, however, near Loon Mhic Charmichael may possibly belong to this sub-division.

The only coast-sections in which this sub-division is exposed are those in Kyle Rhea, and in these the rocks are much more altered than further south-west.

Most of the grits near the top of Beinn na Seamraig are massive, fine-grained, and of a greenish-grey colour, but they weather with a pale-buff crust. The clastic grains do not often exceed the size of peas. Many of the quartz-grains are opalescent and of a pale-blue colour. On the coast 300 yards south of the foot of Allt a' Choire Bhuidhe (one mile north of Kylerhea), we noticed some pebbles containing both quartz and felspar, and others that resembled jasper. Some of the finer grits — for instance, those on the north-east side of the burn about 1000 yards east of Beinn Bheag — show thin dark-grey streaks containing clastic grains of some black iron ore. Occasionally the grits are so fine-grained and compact as to resemble quartzite, as may be seen on the south side of Beinn Bhuidhe and on the coast 50 yards south of the foot of Allt a' Choire Bhuidhe: the colour of these bands is a greenish-grey, not white.

Specimen (S7679) [NG 796 210], of a considerably altered grit from the shore a little more than three-quarters of a mile W.N.W. of the south end of Bernera, has been analysed by Mr Teall with the following result:

SiO_2	73.56
Al_2O_3	13.62
Fe_2O_3	2.3
CaO	1.04
MgO	Trace
K_2O	4.24
Na_2O	3.98
Loss on Ignition	1.08
	99.82

Intercalated shale-bands are seen near the top of Ben Aslak, a third of a mile north-east of the top of Beinn na Seamraig, and at many other places near the top and bottom of the sub-division. They are always closely mixed with lamina; of sandy or gritty material, and generally weather with a somewhat deeper brown tint than the grits with which they are intermixed. Near the top of the sub-division the proportion of shale usually increases upward in the series, and in most places, particularly near the head of Glen Arroch and Allt Eas a' Mhuic, the top itself is consequently ill-defined.

At the head of Loch Eishort the dip is constantly north-west, though the amount varies. There is no reason to suspect here a repetition by folding. The width of the Beinn na Seamraig outcrop being not less than a mile, the estimated thickness of the sub-division is 2600 feet. In areas further to the north-east it is also necessary to admit a great thickness of these strata.

d. Kinloch Beds

The strata between the Beinn na Seamraig grits and the Applecross group are well seen near Kinloch, at the head of Loch na Dal; hence the name of that place has been taken to designate them. The proportion of shale in this sub-division is probably less than that of grit, but considerably greater than that in the sub-divisions above and below. The Kinloch Beds cover more ground in Skye than any other member of the Diabaig group, and about the same as the Apple-cross rocks. Their chief outcrop extends from Loch Alsh to the northern tributaries of Abhuinn Glinne Mheadhonach — a distance of 16 or 17 miles in a south-westerly direction. It then bends to the north, but at Tokavaig twists back into its previous course, and runs out to sea between Ob Gauscavaig and Tarskavaig Bay. All the islands in this bay, except Sgeir Fhada and Sgeir Biodaig, are composed of beds belonging to this sub-division, likewise a narrow interrupted strip extending along the coast for about a mile south of the bay. Between the Loch an Eilean north-west fault and Tokavaig, the boundary between this subdivision and the higher rocks is a thrust, along which the lower rocks have been pushed over the higher, and near Loch Meodal and Loch nan Uamh the base of the sub-division is covered by gneiss brought forward by the Moine thrust. Among several small detached areas, one is found in .the, upper part of Allt a' Mhuilinn and four in the complicated region near Ord.

Coast-sections in which the Kinloch Beds may be examined occur in Loch Alsh, at either side of Loch Eishort near the head. and between Ob Gauscavaig and Tarskavaig Bay. The sections near Kinloch lie in deep burns, which keep along the strike of the more shaly beds for considerable distances. Grits in the division make the rocky slopes of Carn an t' Seachrain, Beinn na Caillich, and Sgurr na Coinnich (west of Kyle Rhea). Like the other Diabaig grits, these rocks are harder than the Applecross grits, and have resisted denudation better.

The shales of the division bear a close resemblance to the Loch na Dal shales. The sandy laminae intermixed with the shales are not, however, so coarse grained, as a rule, as those in the Loch na Dal division, and the calcareous lenticles are less numerous.

The sedimentary layers of magnetite and other heavy minerals are, on the other hand, thicker than in the Loch na Dal division, and there are more bands of massive fine-grained grit.

In Glen Arroch the width of outcrop is about a mile and 300 yards, and the calculated thickness is 3500 feet. Between the head of Loch Eishort and Loch na Dal the thickness is probably still greater.

Different horizons in the division vary considerably in character, and in some places there are very thick grits. In the neighbourhood of Kinloch there are thick grits near the top of the division, and the boundary between the Kinloch and the Applecross rocks represents a boundary between different types of grit rather than between grit and shale.

On the south side of Tokavaig, after passing through the passage beds between the Applecross and the Kinloch beds, we reach a set of shales of considerable thickness. Below these, but in their present position over them, as all the beds in this locality are inverted, there is a series of grits, fine-grained, spotted, and red or reddish-brown in colour; bands of shale occur between the grits, but the proportion of grit throughout a horizon 800 or 900 feet thick is evidently large.

In specimen (S5068) [NG 745 220], from a grit a mile W.S.W. of Sgurr na Coinnich, grains of oligoclase are more abundant than in the Applecross beds, but they are accompanied with grains of microcline and microperthite. In specimen (S5069) [NG 742 225], from a fine grey grit near the head of Allt na Pairc-fraoich (two and a half miles south of Kyle Akin), the same three felspars occur.

The beds near the top and bottom of the sub-division usually contain the greatest proportion of shale. The best sections of the shaly beds near the top are to be seen on Rudha Ard Treshnish (Kyle Akin), at the head of Loch Eishort, near Mulled]. an Achaidh Mhoir, and near the centre of Ob Gauscavaig. At the first two places impure calcareous lenticles, resembling those in the Loch na Dal division, are common. The shaly beds near the base appear near Rudha na Caillich, three-quarters of a mile south of Sgurr na Coinnich, and in burns near Kinloch. It is doubtful whether calcareous lenticles occur in these beds. The grits interbedded with the shales near the base contain dark layers of heavy clastic grains, which sometimes include so many of magnetite as to disturb the compass at a distance of a few feet. One layer of this kind, detected in a grit about 100 yards slightly north of east from Sgurr na Coinnieh, is from an inch to an inch and a half thick, but cannot be traced more than a few yards. A specimen (S5071) [NG 764 222] from this layer is divisible into two

halves, one of which attracts the north pole and repels the south pole of the compass, while the other does the opposite: the dividing plane is oblique to the bedding. Mr. Allan Dick, who has been so good as to examine the rock for the Survey, reports that the rock contains 27.5 per cent. of metallic iron, equivalent to 37.97 per cent. of magnetite. The microscopic slide shows magnetite in crystals and crystal groups, zircon, a brown substance apparently in part micaceous, and a little quartz and felspar. This layer dips south-east at about 34°. A second layer, noticed in a grit on An Sgulan, is in one place six inches thick, but the lower part is not so rich in magnetite as the rest. This layer occurs about 200 or 300 feet above the base of the subdivision, and is probably on about the same horizon as that on Sgurr na Coinnich. Thinner layers, rich in magnetite and other heavy minerals, are not uncommon at higher horizons.

In spite of the false-bedding, the sub-division generally contains such distinct alternations of material along bedding planes that there is seldom any doubt about the true dip, and in this respect it offers a striking contrast to the Applecross group. Ripple-marks are common on the surfaces of the finely-laminated sandstones and sandy shales. They have been unusually well exposed on the coast south-west of Ob Gauscavaig. Clastic scales of white mica are abundant on many of the same surfaces. Rain-pitted shales may be seen in the burn north-east of Kinloch.

(2) Applecross Group

The arkoses or grits of this subdivision form a band which, stretching south-westward across the island from Kyle Akin to Loch an Eilean, in Loch Eishort, is covered unconformably on the north-western side by the Mesozoic rocks, and on its south-eastern margin is succeeded by the Kin-loch Beds, which lie conformably below. In a south-westerly direction from the road between Broadford and Isle Ornsay the breadth of the band decreases, until on the north-eastern side of Loch an Eilean it hardly amounts to three-quarters of a mile. A large fault, which, with downthrow to the north-east, crosses Loch Eishort, through Loch an Eilean, and runs up the burn between Ben Vokie and Monadh Morsaig, has had the effect of lifting up on its south-western side a thrust-plane, together with a group of rocks that lie below this plane, while on its northeastern side these underlying rocks are hidden under the Torridonian strata which overlie the plane. This set of lower rocks, much disturbed by thrusts and folds, includes several isolated exposures of the Applecross group. The thrust-plane has been folded into an anticline along an axis striking north-eastwards. On the west side of the western limb of this folded thrust another detached band of Applecross beds forms Sron Daraich and Druim Dubh, on the south side of Loch Eishort, and runs out to sea at Ob Gauscavaig. It lies above the thrust-plane, and may have been continuous with the Kyle Akin and Loch an Eilean band before the formation of the fault which crosses the loch. The Torridonian rocks near Ben Suardal belong exclusively to the Applecross group. They have been thrust over Cambrian limestone, and the thrust-plane below them has been folded into an anticline with an axial plane striking N.N.E.

The best sections of the Applecross group in Skye are to be seen on the coast between Ob Lusa and Kyle Akin and on the north-east side of Loch an Eilean. The most common rock is a chocolate or purple-red arkose or grit, in which the larger grains, chiefly consisting of red felspar and quartz, do not exceed the size of a small mustard seed. Occasionally — as, for instance, on the coast a quarter of a mile north-west of Sgeir Gormul — coarser bands may be noticed, in which the grains are as large as peas. but for the most part the rocks, here as in the Loch Carron district, are finer in grain than those of the same group in Applecross and in the country further to the north. The quartz-grains are often somewhat opalescent. Grains and pebbles of composite rocks are common. Though generally smaller than in more northerly districts, they yet frequently exceed in size any of the quartz and felspar grains which occur in company with them, some of them being an inch in length. Among the materials of these composite pebbles, pegmatite, red felstone, red porphyrite, arkose, vein-quartz, jasper, and pink and purple quartzite have been observed.

False-bedding is so prevalent and marked that the true dip can often only with difficulty be determined. Here, as in the other districts already described, the minor laminae within the thicker beds are sometimes arranged in irregular curves, while the surfaces of these beds retain a uniform slope. See (Figure 13) Good examples of this structure may be seen on the coast near Kyle House; likewise on the east side of Loch Lonachan (three miles south of Broadford), near the upper end, where the curved lamination is shown by thin streaks with many black clastic grains. Similar streaks are common throughout the group. Characteristic instances of these can be observed in the southeastern part of Eilean Heast (Loch Eishort). In a specimen from the northern coast, a quarter of a mile south-west of Ob Allt an Daraich (two and a half miles W.S.W. of Kyle Akin), some layers are composed mainly of quartz and felspar with epidote and a little chlorite, while the

dark layers contain a great number of grains of ilmenite and epidote. Other forms of iron-ore have also been observed to be disseminated in the Applecross group of Skye. Thin streaks and lenticles, often about an inch thick, of a deep purple tint, can frequently be seen to keep parallel with the bedding, as in Eilean Heast, on Loch Eishort, and on the northern coast 350 yards E.S.E. of Bogha an t-Sasunnaich (two miles west of Kyle Akin). Nearly half a mile E.N.E. of the market stance, Skulamus (two miles E.S.E. of Broadford), thin laminae of haematite, hardly 1/20 inch thick, have been noticed, also running parallel to the bedding. Scars formed of rocks of this group often weather with more rounded outlines than do those formed of the Diabaig grits. Some exposures show spots, about the size of a pea, and of a brighter red tint than the matrix, which are probably of the same nature as those already referred to in the Diabaig grits. Thin calcareous lenticles have been observed in the grits on the coast 360 yards S.S.E. of Bogha an t-Sasunnaich and a few neighbouring localities.

Besides the predominant sandstones and grits or arkoses, subordinate thin bands of shale may be observed on various horizons in the group. These are red, purple, or green in colour, but towards the base of the group are of a dark-grey tint, and they then resemble those of the underlying Kinloch Beds.

The breadth of the Applecross group between Skulamus and the outcrop of the Kinloch sub-division near Allt Cul Airidh Lagain is about two and a quarter miles, and the calculated thickness of strata amounts to 5000 feet; but as the top of the group has not been detected anywhere in Skye, it is impossible to say how much of the original depth of the group here is no longer to be seen.

The only part of the group which seems appreciably altered by dynamo-metamorphism lies near Kyle Akin and between Kyle Akin and Ob Allt an Daraich. The alteration is there shown by the occasional presence of cleavage, and of thin veins of quartz with specks of felspar. Traced diagonally across the strike from Kyle Akin towards Ob Allt an Daraich, the strata show a diminution both of the cleavage and of the veins, as if the metamorphic change were dying out in a north-westerly direction. Towards the south-west, along the strike of the strata from Kyle Akin, the cleavage and the quartz-veins in like manner become less prominent; they were not noticed either in Allt Mor or at the head of Loch Eishort, nor anywhere else in the Apple-moss group of Skye. Many of the veins of quartz and felspar contain a little chlorite also. While most of them are less than an inch wide, some reach a width of six inches. They are well seen a little west of Caisteal Maol (Kyleakin), and near Kyle House, where they generally incline to the north-west, and, though of short extent individually, are closely crowded together in certain bands of rock.

Near the base of the Mesozoic rocks, the Applecross arkoses appear to have been deeply weathered and jointed prior to the deposition of these overlying sediments, and they have also been partially stained with a deep Indian red colour. In the area between Glac an Skulamus (two miles south-east of Broadford) and the head of Allt Garbh, and at the sides of Allt Lochan Dubh na Brie, the chief joints and splitting planes are of a deep Indian red tint, while the heart of the rock is paler and presumably free from staining. In some places, for example near the bridge over Abhuinn Ashik (three miles east of Broadford), and, again, nearly a third of a mile north-east of the outlet of Loch Buidhe (two miles and a half south of Broadford), the arkoses are crossed by so many irregular calcareous streaks and veins of limestone, the substance of which has no doubt been derived by percolation downwards from the overlying Mesozoic beds, that the plane of junction between the arkoses and these overlying beds is not readily ascertained.

At the sides of many of the Tertiary dykes, the Applecross beds assume a somewhat conchoidal fracture and a dirty buff or straw colour like that already noticed as conspicuous in the Crowlin Isles and elsewhere. Much the same colour is also found near certain lines of crush and the Ben Suardal thrust-plane. In certain places near Broadford, as, for instance, in Allt a' Mhuilinn and on the hillside half a mile S.S.W. of the Established Church, they have assumed the above colour in their general mass and have also been veined and spotted with green epidote, presumably in consequence of the influence of some underlying mass of Tertiary igneous rock which is not exposed.

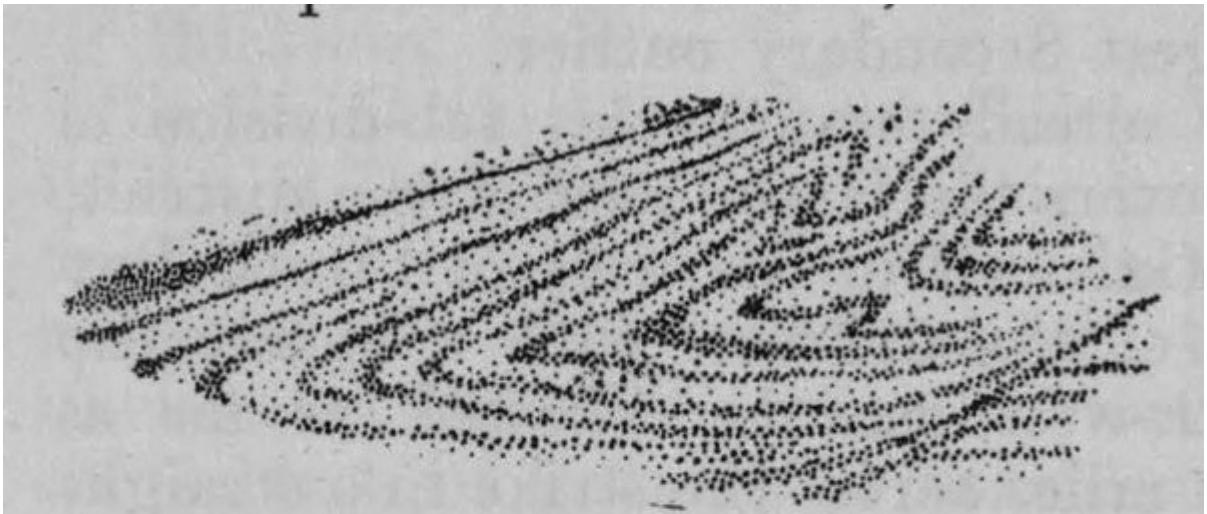

FIG. 13.—Portion of vertical face of Torridon Sandstone (Applecross Group) with laminæ in curves. Coast about a mile and a half east of the Red Point, five miles south of Loch Gairloch.

(Figure 13) Portion of vertical face of Torridon Sandstone (Applecross Group) with laminas in curves. Coast about a mile and a half east of the Red Point, five miles south of Loch Gairloch.