
Chapter 8 Descriptions of the several districts of the Lewisian Gneiss

Cape Wrath to Loch Laxford

This district is contained in Sheets 107, 108, 113, and 114 of the Survey Map of Scotland on the scale of one-inch to a mile (1:63360). The present chapter has been written by B. N. Peach, J. Horne, C. T. Clough, and L. W. Hinxman.

Character of surface

This district extends eastwards from Cape Wrath to the mouth of Loch Erribol, and is bounded on the landward side by a line drawn from the head of that sea-loch south-west to Loch-na-Tuaidh, and thence nearly due west to the river Laxford at a point about two miles above its mouth. The Lewisian Gneiss occupies slightly more than half of this area, the rest being mainly covered by the Torridon Sandstone. In the south the gneiss forms the promontory between Lochs Inchard and Laxford, and extends eastwards for a distance of 8 to 10 miles to the western slopes of Arkle and Fionne-Bheinn. North of Loch Inchard the gneiss appears in approximately parallel belts of irregular outline, which stretch from south-west to north-east, and are separated from one another by outcrops of Cambrian and Torridonian strata of varying breadth. The boundaries of these belts are to a large extent determined by a system of parallel faults which are described in the section dealing with the Torridonian rocks of this area. In the dreary region known as the Parph, between Cape Wrath and the Kyle of Durness, the tracts of gneiss are comparatively featureless, seeing that they are covered with extensive flat peat-mosses. It is only along the magnificent cliff sections on either side of the Cape, and on the western shore of the Kyle, that the relations of the rocks in this district can be satisfactorily observed.

West of the Durness limestone basin, and especially in the intensely glaciated region around Rispond, the gneiss presents a series of smooth, bare, mammillated surfaces that rise gradually from the shore of Loch Erribol to the summit of the rocky hill of Ceannabeinn, a height of 1157 feet above sea-level. From this point the elevation of the gneiss increases gradually to the south-west, the older rocks rising to heights of 2000 to 2300 feet on the slopes of Spionnaidh and Crann Stacach, and passing beneath the Cambrian quartzite that caps the extreme summits of the hills that rise above the wild valley of the Dionard river. On the west side of this deep and rugged glen the gneiss forms the flanks and northern spurs of Fionne-bheinn; and on Ceann Garbh, the most northerly peak of that mountain, reaches a height of 2952 feet. This is the greatest elevation attained by unmoved Lewisian gneiss in Britain.

The country immediately south and south-east of Loch Inchard is known as the Ceathramh Garbh (pron. Kerroo Garrav), or "rough quarter", from its peculiarly rugged configuration. The observer who views this district from a distant elevation sees spread beneath him a billowy expanse of bare grey rock (see (Plate 1). for comparison), the crests of the ridges approaching more or less to a common level which is found to range from 400 to 600 feet in the south-east portion of the area, and from 300 to 450 feet in that to the north-west. The general impression thus conveyed is that of a plain of marine denudation, sloping gently towards the west. The whole district is cut up by innumerable valleys and craggy features running in divers directions, and not infrequently crossing the present watersheds. Many of the valleys and rocky features are almost straight, and mark lines of fault or crush. The majority of them run north-east and south-west; but a good many have a north-west and south-east direction, while a few run nearly due north and south.

As examples of the north-east-south-west series, reference may be made to those which pass through Loch Sgeir a' Chadha and Loch na Claise Inchairich, several of which are exposed on the north-west coast of Loch Laxford, and are there accompanied with thin dykes of diabase; also to those which pass through or near the eastern part of Loch Crocach, two miles west of Rhiconich, one of which, on the coast rather more than $\frac{1}{4}$ mile east of Ardmore, is as much as 5 yards wide.

The most prominent of the north-west-south-east features is the valley which runs so straight between Loch Inchard and the north side of Loch Stack, and which is occupied for a great part of its length by a series of long, narrow lakes. A line of crush probably runs near the valley bottom for most of its course, and passes in a north-westerly direction along the straight southwestern side of the upper part of Loch Inchard. This southern area is remarkable for the multitude of small

lochs of the most diverse shapes that are dotted over the surface. Besides those shown on the one-inch map several others are so hidden away among the rock-knolls as to have escaped the notice of the Ordnance Surveyors. Many of these lochs are undoubtedly rock-basins, and the gneiss can be traced uninterruptedly round them. They have, however, no general direction, and often wind about in a most complicated manner. Their long axes seem to be independent of the direction of the ice movement, and in a good many cases, as, for instance, Loch na Claise Inchairich, Loch na Fiacail, and Loch Crocach, lie along lines of crush or fault. The few larger lochs that occur in the gneiss areas of the north appear either to occupy hollows in the drift, or to be partially enclosed by accumulations of superficial deposits. The south-western coastline is also deeply indented by branching sea-lochs, whose shores and islets afford excellent sections of the Lewisian rocks.

Along the western coast the Lewisian rocks have been laid bare in a series of lofty precipices, of which those at Cape Wrath are particularly striking (Plate 5).

Much of the gneiss in the northern district is covered with peat and drift, but in the region south of Loch Inchar a great part of the ground is bare of drift and even of vegetation, though many of the stream-courses are choked with drift boulders. A striking feature of the country between Rhiconich and Laxford Bridge is the number of perched blocks which crown the smooth crests of the bare gneiss ridges and stand out in relief on the sky-line.

General characters of the rocks

The whole of the Lewisian rocks in the district under consideration belong to the unmoved area. They have not been affected by the great post-Cambrian thrusts, and their structures are to-day essentially the same as in pre-Torridonian times.

The gneiss of this northern district can in places be easily seen to consist of a fundamental complex invaded by granites and pegmatites, but this complex may not quite represent the early complex of the central district. In fact, as will be shown in the sequel, there is good reason for the belief that traces of both basic and ultrabasic dykes, in all probability referable to the period of intrusion of those of Scourie and Loch Inver, are to be found on Beinn an Amair, three miles south-west of Durness, and near Cape Wrath. As explained by Mr. Teall in a former chapter, great difficulty is sometimes experienced in this area in distinguishing between the biotite gneisses of the fundamental complex and some of the intrusive foliated granites. On Ben Amair, where the invading granite takes the form of dykes and sills which traverse the complex of basic and acid gneiss and modified dykes, all alike in the granulitic stage, there is no difficulty in separating the granite from the granulitic biotite-gneiss of the real original complex. In other parts of the district, however, where both groups of acid material have passed into the granular condition, it is almost impossible to distinguish between them. The granite presents no chilled margin, and seems to merge into the surrounding rock.

The gneiss of the original complex in this district includes three of the groups or sub-groups into which Mr. Teall has divided the Lewisian rocks:

1. Grey gneiss, in which biotite is the predominant or only ferro-magnesian mineral (IV. 1).
2. Hornblende-biotite-gneiss, containing a considerable proportion of hornblende in addition to the biotite (III. B 1).
3. Dark gneiss, in which hornblende is the predominant mineral (III. A).

These three varieties alternate in bands or areas of varying breadth having, as a rule, no sharply defined boundaries, but graduating from the more acid into the more basic type as the proportion of hornblende present increases. In structure these gneisses are granular; but in places, as on the north slopes of Beinn Amair, they are in the granulitic stage. The hornblende-gneiss (c) which appears to preponderate in the area between Cape Wrath and Laxford Bridge is mainly composed of hornblende and plagioclase felspar, but generally contains a little pyroxene. The hornblende does not occur in bladed or acicular forms, but in stout crystals, almost as broad as long ("short crystallisation").

The numerous dark bands, masses, and lenticles of basic and ultra-basic material that occur with these gneisses cannot with any certainty be separated from them in point of origin, and must be regarded for the most part, at least, as portions of the original complex. This is particularly the case with the lenticular masses which are so abundant in certain areas,

and often appear to be completely surrounded by the more acid rocks. These lenticles vary in size from small knots or "eyes" an inch or two across to masses many yards in diameter, and are wholly or in great measure composed of dark hornblende, are often fringed or sheathed with a matted mass of crystals of a very black mica, probably haughtonite. The bands of basic material vary from a few inches to several yards in breadth. Their continuity in tracts where the later acid intrusions are prevalent is often interrupted by the injection of granite and pegmatitic material, with the result that portions of the basic rock are isolated in the form of lenticular masses, in whose linear arrangement the course of the band can still be traced. The lenticles thus produced differ, of course, in their origin from, and must not be confounded with, the original knots above described.

The fine coast sections in the Kyle of Durness and at Cape Wrath afford no satisfactory evidence as to whether or not these basic bands should be regarded as later intrusions in the original complex. They are foliated throughout in agreement with the common foliation of the gneiss amidst which they occur, and no unmistakable instance has been detected of the transgression of the foliation planes of the gneiss by the basic material. In the cliffs east and south of Cape Wrath, where the rocks are sharply folded, the dark bands follow the plications, which they make visible in a very conspicuous manner.

A short distance west from the Ferry House, in the Kyle of Durness, a good example may be seen of one of these bands of dark basic rock. It has somewhat the appearance of an intrusive dyke, though its relations to the gneiss are nowhere distinctly visible. It has been traced in a W.N.W. direction for a distance of nearly $\frac{1}{4}$ mile, and can be examined at several places along the side of the road to Cape Wrath. The rock of this band is thoroughly foliated, its nearly vertical planes dip south-west, while the mineral particles are arranged in lines indicating movement in one particular direction. The chief constituents of this rock are felspar and hornblende, with a little mica along the divisional planes. The relative amount of the first two minerals continually varies; some bands being highly feldspathic, others more hornblendic, while there are also thin bands and lenticles of pure hornblende. Segregation of the various minerals is thus suggested. The whole mass is so singularly free from acid material, either original or introduced, as to suggest that it may be a later basic intrusion in the original complex, comparable to a "Scourie dyke". If such be the origin of the band its injection may have been posterior to the movements which produced the early folding and puckering, but anterior to those which gave rise to the cleavage foliation of the gneiss.

The later intrusive origin of certain narrow bands of basic rock with more or less parallel sides, that can be traced for several hundred yards on the summit and northern slopes of Beinn Amair, can be assumed with more certainty. They appear to transgress the different bands of the original complex both vertically and horizontally, and not to share in the folding of these bands but to follow an independent course that is more or less parallel to the direction of the planes of the longer axes of the folds both in their dip and strike. The rock near the sides of these bands is different in texture, and the ingredients are more intimately mixed than in the centre, which often has a mottled appearance from the arrangement of the quartz and felspar in small aggregates.

The behaviour of these basic masses, cutting as they do the banding of the gneisses of the original complex, while they not only share in a common foliation with them, but are now in identically the same state of crystallisation, points to the inference that they were injected into these gneisses when the latter had already acquired their banding, but prior to the time when they were subjected to the forces which produced their present foliation and puckering. As these bands have the same trend as the longer axes of the folds, they would also lie more or less at right angles to the direction in which these forces were applied. Hence they would not share in the puckering of the surrounding gneiss, though they would be compressed and foliated in a direction more or less parallel with the foliation planes of the gneiss, and differing from it only so far as the coefficient of friction of their material differed from that of the materials of the gneiss.

It is possible that other bands of this nature may occur in the northern area, with a trend different from that of the axes of the folds, and inclined at a less angle to the horizon. In such cases they would partly share in the folding of the gneiss, and hence would more easily escape detection. In those areas where the later granitic intrusions play a subordinate part, the banded gneisses are generally found to be thrown into a system of folds, whose long axes have a general north-west and south-east trend.<ref>It was, doubtless, this structure which led Murchison to insist on the north-west strike of the fundamental gneiss in contradistinction to the north-north-east strike of the eastern schists and flags.</ref> The axial planes of these folds may be vertical. in which case normal folds are produced, and the rocks either undulate at gentle

angles or are sharply compressed, giving the appearance of verticality. More often they are oblique to the horizon, and the folding is consequently isoclinal. In this case the overfolding may become so extreme as to produce the effect of horizontality in the flattened limbs of the folds.

The first type of folding occurs — in both varieties — at Cape Wrath; the second may be observed at several places along the west side of the Kyle of Durness, as, for example, at the mouth of the Kyle immediately south of Port Odhar.

In addition to this system of plication the banded gneisses further show a persistent foliation which traverses the different materials included, in the folds in a direction more or less parallel to their longer axes. The mineral particles are arranged along planes which follow the same direction, but the banding is not destroyed. Hence we may infer that the whole of the material has been rearranged by the movements which resulted in the folding and foliation now apparent in these rocks.

The acid materials which have been intruded into the original complex of the gneiss are well displayed along the west side of the Kyle of Durness. They take there the form of massive pegmatites often many yards in breadth, and of thinner bands of fine or medium-grained granite. In parts of the section the rocks of the original complex bear a comparatively small proportion to the quantity of introduced material. The granite is not foliated, though a tendency to a linear arrangement or orientation of the minerals, especially of the biotite, can generally be detected. This lineation is often more or less parallel to the foliation of the gneiss, but sometimes lies at an angle with it of not less than 20°. The edges of the granite intrusions distinctly transgress the foliation planes of the peiss, sometimes cutting them at a considerable angle, while the apophyses from the granite often penetrate the gneiss for several yards in a most irregular manner. Many inclusions of gneiss, of all sizes, likewise appear in the granite.

The pegmatite veins, which are evidently a phase of the same acid intrusion and derived from the same magma, cut the gneiss, the granite, and one another, and are often developed along the junction of the two rocks. The granite is decidedly acid in composition, the feldspars being oligoclase and microcline, with biotite as the principal ferro-magnesian constituent: though in some cases, as, for example, in one or two bands north from Durness Ferry, a considerable amount of hornblende is also present. The pegmatites are extremely coarse, with large crystals of microcline. They contain biotite in large but scanty crystals, though these sometimes become more abundant along the edges of the vein.

In the neighbourhood of Cape Wrath, where these acid intrusions are largely developed, the rocks immediately below the lighthouse, and for some distance on either side of it, seem to be chiefly composed of granitic material which has invaded the original complex, the whole now forming a second granitoid complex, in which such portions of the early acid gneiss as remain cannot always be distinguished from the later acid intrusions. The basic portions of the original complex, which have to a greater degree resisted the invasion of the granite, retain their distinctive character and appear as knots and bands in the newer complex. The banded appearance of the rocks forming this complex, which is particularly marked in the ground immediately south of the Cape, does not appear to be due to the arrangement of the mineral constituents of the whole system in different layers, but rather to a rapid alternation of bands of unfoliated granite with other thinner bands and seams of foliated material belonging probably to the original complex. The whole assemblage of rocks in this part of the district may now be regarded as a series of composite or synthetic gneisses. A large portion of these may undoubtedly be referred to the later intrusion of granite, but this is combined with the acid gneiss of the original complex in such a manner that the rocks of the earlier and later origin cannot be distinguished from one another with any certainty. Both granite and original complex are cut by veins of pegmatite. They are, however, thin and very small in bulk compared with the granite. In this respect the Cape Wrath rocks are the reverse of those of the Kyle of Durness, where the pegmatites are largely in excess, and where we appear to be dealing with the edge of this area of intrusion.

Description of the different areas in the district

Cape Wrath

The amount of peat and drift which covers the country immediately south and south-east of the Cape conceals the landward limits of the granite intrusions, and only in the sections afforded by the range of magnificent sea-cliffs can the extent and relation of the granite to the surrounding rocks be determined. The coast-line westwards from Geodha-na-Seamraig runs parallel to the general W.N.W. strike of the old granitoid gneiss, which, varied with a few dark

basic bands, extends in an almost unbroken rampart to Clais Charnach. The western side of this inlet is formed by a great mass of red granite weathering grey, which on the landward side is intrusive in an extremely basic portion of the original complex.

The cliffs between this point and the Cape are also largely formed of the rocks of the granitoid complex, but contain numerous dark bands of basic material which, by their strongly contrasted tint, mark out the intense folding to which the rocks have been subjected (Plate 5). The vast sea-walls along this part of the coast are for the most part inaccessible either by land or sea, but in the inlet immediately west of the lighthouse — used as a boat harbour in calm weather — the rocks can be more closely studied. The original complex of the gneiss is there seen to bear but a small proportion to the amount of introduced material, which consists for the most part of a fine-grained grey or reddish granite, like that of the Kyle of Durness, and showing the same tendency to a linear arrangement of the biotite crystals. This rock occurs in bands of varying breadth, of which one that crosses the steep cliff immediately under the lighthouse must be at least 60 feet thick. The edges of the granite intrusions usually cross the foliation planes of the gneiss at gentle angles, but are often seen to cut off and isolate portions of the original complex. The pegmatite is small in amount compared with the granite. The larger veins traverse both the granite and the original complex, and run vertically up the face of the cliff.<ref>The geological world was first made acquainted with the complicated grouping of the rocks of this coast by the somewhat exaggerated drawing of "Gneiss and Granite Veins at Cape Wrath " given by Macculloch in (Plate 31). of his " Description of the Western Islands of Scotland" (1819). Some of the details of the cliffs, such as the feeble foliation of the granite veins in the same direction as that of the gneiss, the puckering of the bands of granite and pegmatite, and the way in which some of the lighter acid-veins wriggle upward through the gneiss, were illustrated by Sir Archibald Geikie in his Textbook of Geology.</ref>

The folding in the gneiss is not so intense about Cape Wrath as it is in the cliffs further east. The nearly horizontal bands are thrown into gentle undulations, but are at times suddenly compressed into sharply puckered folds. The dark bands which share in this folding are often interrupted and isolated by the pegmatite veins forming lines of eye-shaped masses of basic material.

The rocks for some distance south from the lighthouse have already been described in the foregoing pages which discuss the general character of the granitoid complex. The edge of this area of acid intrusion seems to be reached about 200 yards north of A'Chailleach. In the neighbourhood of the fault which here brings in a small patch of Torridon conglomerate, rocks of the original complex again prevail, consisting of nearly vertical flaggy biotite-hornblende gneiss with a north-west strike. The sharp folds into which they have been thrown are well brought into view by the numerous conspicuous bands of black hornblende rock. A good deal of granitic material is still present here in the form of thin bands of medium-grained granite and veins of coarse pegmatite. The general character of the rocks resembles that of those on the Kyle of Durness, but the original complex is here of a considerably more basic type.

A peculiar and composite rock, which may have formed an ultra-basic dyke, occurs on the face of the cliff about 80 yards south from the fault, and immediately below the base of the Torridon conglomerate. It forms a lenticular vein or mass nearly 100 yards in length, running north-westward in a direction parallel to the strike of the gneiss. The northern end is chiefly composed of chert and massive blue haematite, the central portion of chert, and the southern part of serpentine, talc, and actinolite. The whole vein is characterised by stellate bundles of hydrous anthophyllite, with some asbestos. The chert and haematite are probably due to subsequent infiltration; the serpentine to decomposition of original minerals forming the vein.

Between the next inlet south from this point, where a small stream falls into the sea, and the fault, which again brings the Torridonian strata down to sea level, the amount of introduced granitic material once more increases, with a corresponding diminution in the bulk of the original complex, until the rocks resemble in general character those at the Cape.

Kyle of Durness

That part of the western shore of the Kyle of Durness which lies between the Ferry House and Port Odhar at the mouth of Balnakeil Bay, displays the Lewisian gneiss in an excellent section which is continuous, save for the small area of

Cambrian quartzite on either side of the Daill burn. Here the original complex consists of a series of well-banded gneisses in which the basic element perhaps predominates, the hornblende variety being for the most part in excess of the more acid types. Here are also many bands and lenticles of basic and ultra-basic material, most of which must be regarded as forming part of the fundamental complex.

The later intrusions of acid material, which form so large a portion of the rocks in this section, have been already referred to in the general account of the rocks of this area (p 105). A typical example of the fine-grained biotite-granite intrusions of Loch Laxford type, which can be seen immediately south from the Ferry slip, forms a belt several feet in breadth, including bands of basic material and seams of dark mica that may have been portions of the original complex invaded by the granite. Pegmatite intrusions are also fairly numerous in this part of the section, though not so abundant as further north. The knots and thin veins of this rock are often sheathed with black mica, sometimes accompanied by dark hornblende in large crystals. Knots of these two minerals also occur within the pegmatite veins. The stream that falls into the Kyle $\frac{3}{4}$ mile north-west of the Ferry House has cut a deep ravine between the road and the sea. On the north bank of this gully, a short distance below the bridge, a lenticular mass of ultra-basic rock surrounded by granite material is well exposed.

The centre of this mass is composed of very dark hornblende, with bands of coarsely crystalline hornblende and mica; the edges consist of soft, decomposing, green hornblende and actinolite, with black mica and a talcose mineral. The rocks in the deep cove at the mouth of this stream, and for some little distance northwards of it, are much disturbed, reddened, and decomposed, being probably affected by the proximity of the Keoldale fault, which, immediately to the north, throws down the Cambrian quartzite.

On the further side of the Cambrian outlier the rocks are to a very large extent made up of later intrusive material, mostly in the form of pegmatite, which reaches its maximum development immediately south of Port Odhar. Many of the thin bands of fine-grained granite here show a linear structure parallel to the sides of the bands, due to the presence of thin parallel veins of pegmatite. About halfway between Dail and Port Odhar one or two thin granite dykes appear which differ somewhat in composition from the ordinary biotite granites of the area. A specimen [\(S8507\)](#) ^{<ref>Numbers within brackets in the description of rocks refer to the collection of microscopic slides made by the Geological Survey.</ref>} from one of them is described by Mr. Teall as closely allied to one type of the Laxford granites, and is found under the microscope to be composed of microcline, biotite, hornblende, and quartz, with sphene and apatite as important accessories. The rock is remarkable for the large amount of microcline and sphene present in it. The rocks of the original complex in this part of the coast-section are similar in general character to those at the Ferry. Bands and knots of basic and ultra-basic material are largely developed to the south of the old landing slip $1\frac{1}{2}$ mile north of Dail. Compressed vertical folding of the Cape type is characteristic of this part of the section, but at Port Odhar the rocks are thrown into flattened isoclinal folds.

Beinn an Amair

Gneisses referable to the fundamental complex, and all in the granular or coarsely granulitic stage, make up the greater proportion of the rocks on this mountain. The basic portions which form the smaller part of this mass consist of hornblende-gneiss and hornblendite. An ultra-basic rock, of which a talcose mineral forms the chief constituent, may also be seen about 200 yards south of the summit-cairn. The acid rocks are chiefly biotite-gneisses, but often contain more or less hornblende and pass into hornblende gneisses, especially near their junction with more basic bands. The folding, for the most part of the isoclinal type about axial planes inclined at a high angle to the horizon, is often very sharp, though the folds are of no great depth.

In addition to the hornblende gneisses of the original complex, certain narrow belts of similar rock may be, like others described in previous pages, later intrusions. Three of these dyke-like bands, having an E.S.E.–W.N.W. trend, occur within a distance of 400 yards from the top of the hill in a N.N.E. direction. Another band, probably a continuation of one of them, can be seen about 500 yards N.N.W. from the same point.

Granite and pegmatite veins are not so numerous on Beinn an Amair as along the shore of the Kyle of Durness. The granite occurs for the most part in distinct dykes from 2 feet to 20 yards in breadth, trending more or less in the direction

of the foliation, but cutting obliquely across the banding and foliation-planes of the gneiss, and also transgressing the dyke-like basic masses. Good examples of this transgression may be seen in many places on the hill, the best being exposed on a bare ridge above half a mile to the N.N.W. of the top.

At the eastern end of this mountain mass, where the waters of the Kyle of Durness have laid bare a fine continuous section along the shore, the veins of granite and pegmatite are so numerous as almost to exclude the rocks of the original complex. What is seen of the older gneisses appears to be coarser in grain than where the granites are not so prevalent; while there is a greater preponderance of hornblendic gneiss than on the summit or higher slopes of Beinn an Amair.

Beinn a' Bhacaidh

The eastern half of Beinn a' Bhacaidh, the hill immediately south-west of Beinn an Amair, is occupied by Cambrian and Torridonian strata; but rocks of Lewisian age rise in a more or less continuous bare ridge along its western face. The veins of granite and pegmatite, which here make up the greater proportion of the rock, strike across this ridge in sharp contrast with the darker gneiss into which they are intruded, giving to the whole hill-face a peculiarly striped or brindled appearance when viewed from a distance. The gneisses of the original complex, though perhaps a little coarser in grain, are in much the same condition as those of Beinn an Amair.

North of the small lochan that lies high up on the mountainside, the biotite-gneiss is in excess over the more basic type; but to the south of it large masses of hornblendic gneiss appear, in some places, almost to the exclusion of the acid gneiss. These basic masses seem to be the eastern extension of similar rocks which rise on the ridge south of Fasbheinn, on the further side of a peaty and drift-filled hollow, through which they cannot be traced. The dip of the foliation planes is more irregular than on Beinn Amair, and alternates between north-east and south-west. About 600 yards N.N.E. of the above-mentioned lochan a dyke-like mass of hornblende gneiss shows a finer grain near its edges than at the centre.

The most conspicuous feature on the ridge south of Fasbheinn just referred to, is the great preponderance of basic hornblendic gneiss over the acid portion of the original complex. Masses of hornblendic gneiss with bands of purer hornblende-rock form the greater part of the ridge, almost to the exclusion of the more acid gneiss. Where the acid and basic bands alternate, as they do near the south-east corner of Loch na Gainmhich, rapid overfolding, similar to that observed elsewhere in the region, is well displayed.

The gneisses are cut by massive bands of granite and innumerable veins of pegmatite, but not to such an extent as on Beinn a' Bhacaidh.

To the south of Loch na Gainmhich the basic and acid materials of the original complex are more evenly distributed, and the gneiss is consequently banded or flaggy. Hence from the comparative scarcity of granite and pegmatite veins, the folding is remarkably well seen in this region. As the result of the constant repetition of the bands by folding upon vertical or highly-inclined axes a vertical or highly-inclined foliation has been produced, while the individual bands of the gneiss can be traced as horizontal or gently-inclined layers. As the granites and pegmatites often follow certain of these layers in preference to others, their outcrops are apt to resemble those of sills intruded among gently-inclined strata. This effect is more particularly seen in the manner in which they cap the summits, and partially or wholly encircle the slopes of the low hills south-west of Loch Gainmhich. A similar disposition of the pegmatite veins, accompanying rapid folding, is to be observed in the area immediately north of the mouth of Loch Sandwood and in the small Lewisian inlier on Cnoc Poll Mhurain. about a mile north of Sheigra.

Much of the central region south of Fasbheinn is obscured by peat and drift, the rocks being laid bare only on the hill-tops, and here and there along the streams. On the north side of Mael Meallach Mòr coarse hornblendic gneisses enter largely into the original complex as on the hills to the north. Veins of granite and pegmatite abound, and sometimes show conspicuous graphic arrangement of the quartz and felspar.

The Amhainn na Buaigheal Duibhe, 4½ miles south-west of Durness, affords a good section for two miles above its mouth, showing highly corrugated hornblende and biotite-gneisses cut by innumerable granite and pegmatite-veins. Just above high-water mark a fine example of the intrusion of pegmatite along the weak limb of a fold can be observed.

A' Ghlasbheinn

The rocks on this mountain are much decomposed and pervaded with lines of crush and fault, along which they are stained with Immatite. A little to the north of the lochan on the summit a green hornblendic gneiss contains knots of radiating actinolite surrounded by mica. At a point about 200 yards north of this lochan the felspar of the pegmatites has been altered into agalmatolite. As this form of decomposition, as already stated, prevails characteristically round the margin of the Cambrian quartzite in the Loch Eireboll region, the inference seems probable that the top of A' Ghlasbheinn has but recently been denuded of its Cambrian covering. In fact, owing probably to the recent removal of the Torridonian and Cambrian strata, and the rotten state of the surface of older rocks over which they were deposited, it is not now possible to obtain an accurate knowledge of the unweathered condition of the Lewisian rocks over much of the area under consideration. Such is the case over most of the narrow belt of gneiss which extends north-eastwards from An Socach, 3½ miles north of Rhiconich. On the northern slopes of that hill large masses of hornblende-gneiss appear to form part of the original complex, since they are associated with veins of quartzo-felspathic material distinct from the later granite and pegmatite intrusions.

The ground along the north side of Loch Inchard, and between Rhiconich and the slopes of Foinnebheinn, has not been revisited since it was examined in the early days of the Survey of the North-West Highlands, when but little was known as to the nature of the Lewisian gneiss. It has therefore been thought better not to attempt here any detailed description of the rocks in those areas.

Rispond to Strath Dionard

From the shore between Rispond and Ceannabeinne west of Loch Eireboll, a belt of Lewisian gneiss about two miles in breadth extends southwards for a distance of ten miles to Strath Dionard. On the west it is bounded by the normal fault which throws down the Cambrian basin of Durness, and on the east it is overlain unconformably by the Cambrian quartzite of Loch Eireboll.

The rocks along this belt are the south-eastern prolongations of those already described that lie to the west of the Kyle of Durness. Apart from the later intrusions of granite and pegmatite of pre-Torridonian age, the members of the complex, which are well exposed in the above sections between Rispond and Ceannabeinne, comprise early basic knots and lenticles consisting of hornblende-gneiss or hornblende-biotite-gneiss, enclosed within more acid material which, containing abundant quartz and felspar, may be described as biotite-gneiss. Sometimes there appears to be a gradation from the one type to the other. The rocks are granular, and are characterised by short crystallisation. The members of the complex are arranged in well-defined parallel bands that have been folded on vertical or highly-inclined axial planes, which strike north-west and south-east. Striping is well seen on many of the nearly vertical faces, and particularly on the sea-cliff northeast of Ceannabeinne House, where the hornblende and biotite-gneisses in thin bands are rapidly plicated in moderately deep folds. There they dip to the north-east at 84°, and on one of these surfaces this lineation is inclined to the north-west at high angles.

These rocks are traversed by numerous veins, sills, and dykes of pink granite and pegmatite, the former containing oligoclase, microcline, quartz, biotite, and rarely muscovite. These later acid intrusions are more or less parallel with the strike of the granular gneisses and seem to be introduced in many places along the weak limbs of folds. Many of the granite sills and dykes show an orientation of the micas parallel to their margins; indeed, in some localities along the belt to Strath Dionard, the foliation is so marked that they resemble the older biotite gneisses of the complex. At Rispond, however, their intrusive character is apparent. The pegmatites traverse the granite-sills and do not show a similar orientation of the micas, but frequently an appearance of coarse mineral-banding. Dr. Heddle described a vein of graphic granite belonging to this series that occurs on the north shore of Rispond harbour, and displays a fine development of microcline and oligoclase, and contains also Haughtonite and magnetite.<ref>*Mineralog. Mag.*, vol. IV., p. 224. </ref> The same mineralogist called attention to the fact that in the Lewisian gneiss between Rispond and Beinn Ceannabeinne,

agalmatolite surrounds the crystalline portions of the felspar, which he attributed to a change of the oligoclase.<ref>Ibid., p. 215</ref> This type of decomposition, as above referred to, has been found by the Geological Survey to be characteristic of the surface of the old gneiss platform where it has been covered by the Cambrian quartzite.

At the head of Loch Eireboll and at the base of the eastern slopes of Beinn Spionnaidh and Crann Stacach the Lewisian gneiss has been laid bare near Polla by the denudation of the overlying thin cake of Cambrian quartzite. There the members of the complex have the same north-west strike. An exceptional type of rock is found in this inlier, essentially composed of microcline, green pyroxene, hornblende, quartz, and other constituents. (See the section on Petrography, Chapter 4. II. A 3)

Within the belt affected by the post-Cambrian movements on the east side of Loch Eireboll various detached masses of Lewisian gneiss occur, most of which lie to the west of the outcrop of the Moine thrust-plane. Their relations to the Cambrian strata will be described in Part 4, only a brief reference being here made to their petrographical characters. The proofs that these detached masses really belong to the Lewisian gneiss have been already summarily stated in this volume in the section on Previous Literature.

In the small areas stretching south from Whitten Head (Ceann Geal Mòr) towards Freasgeal, the rocks consist of dark hornblendic gneiss, traversed by innumerable veins of granite and pegmatite, which are well seen on the northern sea-cliffs. Though the rocks are crushed in places they show their old structures, but their general strike, with some exceptions, is approximately north and south. The masses that run south from Inverhope by Hope Ferry to Ben Poll Ath-roinn (locally known as Ben Arnaboll) are composed of hornblendic and micaceous gneisses of the Cape Wrath types, intersected by veins and irregular masses of pink granite and pegmatite, the prevailing strike being in a north-east direction. Similar rocks appear on Creag na Faoilinn and Creag Earail beyond the head of Loch Eireboll. In these various areas the gneiss is traversed by numerous shear-planes, whereby the acid and basic materials have been sheared and mylonised.

Above the Moine thrust-plane an important band of reconstructed gneiss has been traced from the west slope of Beinn Thutaig south-west to Loch Hope and onwards to Meall a' Bhaid Tharsuinn. The rocks in this band dip to the south-east and have common foliation planes with the overlying Moine-schists. This zone and the faulted portions of the same mass in Sango Bay and at Fair-aird Head contain the type which has been described by Dr. Teall as zoisite gneiss.

District between Loch Inchard and Loch Laxford

By C. T. Clough

The rocks in this peninsula resemble generally those above described in the ground to the north-east. The biotite and hornblende-gneisses which are regarded as part of the fundamental complex possess a granular rather than a granulitic structure. It is doubtful whether they include any pyroxene gneisses. They are associated with bands of hornblende-schist or dark hornblende-gneiss, which, in some places, behave like dykes, and in others, like parts of the early complex; hence it is uncertain whether they represent dykes of the "Scourie type". Granitic gneisses of intrusive origin, and pegmatites in which microcline is the predominant felspar, are very abundant. In the pale gneisses of the fundamental complex there is frequently a second foliation parallel to that of the later granite gneisses, from which it may be inferred that the characters of many of the early gneisses have been modified since the intrusion of the granitic bands.

In the tract now to be described the arrangement of the rocks differs considerably from that in the area further south — the northeastern portion of the district extending from Laxford to Kylesku. In this portion the gneisses have a W.N.W. strike, with the limbs of fold and second foliation-planes dipping steeply S.S.W., while in the Laxford and Loch Inchard area it is only in the south-west half that a W.N.W. strike and S.S.W. dip prevail, and in the north-east part both strike and dip are variable, and the first foliation planes are sometimes flat.

Ultra-basic and basic rocks of the Fundamental Complex

Examples of this group are to be found at the following localities: About ■ mile slightly west of south of Cnoc na h-Ula, between Rhiconich and Loch Laxford, a rock consisting chiefly of crystals of black hornblende and biotite extends about a hundred yards parallel to the strike of the neighbouring gneisses, the greatest breadth being about twenty yards. A smaller exposure of a similar type is seen nearly ■ mile south of that hill. Another variety, consisting chiefly of large flakes of black biotite, traceable for at least a hundred yards, occurs rather more than ■ mile slightly north of west of the south end of Loch-na-Claise Iuchairich.

Thin bands consisting chiefly of biotite, or biotite and hornblende, with small lumps and streaks of quartz and felspar resembling pegmatites, are common, which give rise to depressions and, in many cases, have formed lines of weakness, along which movement has taken place. The displacement has contorted the biotite-flakes along axial planes, which, in any one locality, all hade in one direction. Quartz veins and thin seams of gneiss sometimes occur in the bands, and are sharply contorted, though the gneisses above and below the bands are not affected. From the trend of the axial planes exposed about ¼ mile north of the north-west end of Caol Loch a' Mhin Ath — a point two miles south-east of Laxford Bridge — it may be inferred that the gneiss on the south-west side has been moved in a north-west direction. The proportion of biotite is sometimes greater near the margins of the bands than in the middle, and it seems possible that this mineral has been produced during the movements. In some places biotite is also common in thin streaks which traverse the more hornblendic parts, and which perhaps represent lines of movement.

Those basic rocks which can be referred with confidence to the early complex form irregular outcrops or eye-shaped lumps varying in diameter from an inch to more than a hundred yards. They occupy a large part of the ground at the following" localities: between Loch Cròcach and Loch Ceum na Staidhreath, between Loch Inchard and Loch Mor Ceann na Salle, near the head of Loch a' Chathaidh, near Lochain na Creige Gile, one mile north of Loch Stack Lodge, and between the head of Loch a' Gharbh Bhaid Mhòir and Ben Arkle. In the coast section and inland cliffs, basic lenticles, several yards broad, are frequently enclosed by bands of paler gneiss, which become thinner just above or below the eye-shaped masses, so that the usual strike and dip are soon regained. Strings and irregular bands of pale gneiss traverse the early basic rocks, as for instance about 1■ miles slightly north of west of the head of Loch a' Gharbh Bhaid Mhòir, and 250 yards north of Loch Eileanach (two miles north of Loch Stack). In the former locality there are many dark inclusions in the pale gneiss, which were probably derived from a contiguous basic patch.

Some basic masses show no clear foliation or banding, and the white constituents are aggregated in small round spots, often about ¼ inch long; where apparent, it is usually but not always parallel to the margin. Occasionally garnets are abundant, and are generally of a port wine colour and without distinct idiomorphism. This mineral often occurs in small spherical aggregates mixed with granules of felspar and surrounded by a thin rim of similar granules. The aggregates are not usually more than ¼ inch long, but are sometimes so abundant as to form half the rock-mass.

Hornblende-gneiss

The varieties of this rock, near and south of Loch Inchard, which have been examined under the microscope, are all referable to Group III., B. 1 (hornblende-gneiss proper), in which the hornblende is of a compact type and the structure granular. Most of the pale bands certainly belong to the early complex. These, together with thin alternating zones of biotite-gneiss, form a large part of the coast between Eilean na Saille and Rudh' a Cheathraimh Ghairbh north of Loch Laxford, and on the south-west side of Loch Inchard. Nearly the whole of the dark folia in the rock are formed of hornblende prisms, which are sometimes more than half an inch long and nearly as broad. The quartz is colourless and translucent, the felspar pale grey or pink. Some bands on the north-east side of the river Laxford, 300 yards below the bridge, and in other places, contain many grains and small crystals of yellow epidote. The hornblende and other minerals are fresh, and the epidote appears to be original. In an exposure of gneiss 200 yards north-east of Cnoc Glac na Stairne, about 300 yards east of Lochan na Cloiche, three miles west of Rhiconich, enclosed lumps about a yard long consist chiefly of epidote. On the top of Cnoc na h-Ula somewhat similar small knots, embedded in a grey gneiss, are composed of epidote and scapolite.

Biotite-gneiss

Only three of the gneisses with biotite in excess of hornblende, in the area south of Loch Inchard, have been examined under the microscope. Two of these, one [\(S2987\)](#) [NC 23 48] from the roadside north of Laxford, the other [\(S3238\)](#) [NC 255 480] from a mile and 300 yards E.N.E. of Laxford Bridge, possess a granular structure, and in the third [\(S3478\)](#) [NC 229 480] from the roadside a mile north-west of Laxford Bridge, the structure is partially granulitic. The gneisses of this group frequently contain small knots and lenticles, composed chiefly of hornblende. Their colour is generally pale, and the biotite is less in proportion than the hornblende in the hornblende-gneiss. Biotite rarely forms broad streaks.

A broad zone containing a large proportion of massive biotite-gneiss appears a little south of Loch Poll na Bà Baine, 1 mile west of Rhiconich, and can be followed over Cnoc an Daimh to the coast south of Bagh Loch an Ròin. Some parts are so massive that perhaps in hand-specimens they might be taken for unfoliated granite. But a foliation with a prevalent S.S.W. dip at high angles is generally clear, and certain bands in the zone are folded into isoclinal folds with limbs dipping S.S.W.

Large areas consisting chiefly of biotite-gneiss occur between Loch Sgeir a' Chadha and Loch na Caillich, south and south-east of Loch na h-Ula, south-west of Rhiconich, and on the east and south sides of the head of Loch a' Gharbh Bhaid Mhòir, 2½ miles E.N.E. of Laxford Bridge, where the first foliation or broad banding is sometimes poorly developed, and the rock has a granitic aspect. Lenticles, consisting chiefly of hornblende and biotite, and swathed round by the first foliation planes of the gneiss, are abundant in places. In other localities there is an appearance resembling false-bedding, the minor laminae in certain bands being disposed in waves, while those above and below are even and parallel to one another.

Basic dykes

Bands of hornblende-schist which may possibly represent dykes are often difficult to trace, being frequently traversed by pegmatites and granite gneisses. They have no general north-west direction like the well-marked dykes near Scourie. Where the gneiss strikes north-west their trend is almost the same, but elsewhere it is different. A little west of Loch a' Gharbh Bhaid Mhòir several bands strike northeast, and between Cnoc Gorm Mor and Loch Crocach a band runs nearly north and south for half a mile. It is probable, therefore, that if these hornblende-schists represent basic dykes, they have been twisted since their intrusion. Some of them cut the adjacent gneiss in places, while not far off there are no indications of intrusion. These schists are often interrupted so as to form lenticular strips which seem surrounded by the gneiss, thus recalling the broken parts of certain "Scourie dykes", which are crossed by thrusts; but in most cases no such displacements can be observed. If the strips represent portions of dykes, the conditions prevailing in this area at, or subsequently to, the time of intrusion must have differed widely from those further south, for the thrusts truncating the intrusions have produced no recognisable change in the surrounding rocks.

As certain dykes of granite-gneiss have been continuously traced for several miles across the area in nearly straight paths, it follows that, if the strips of hornblende-schist represent portions of dykes broken by thrusts, these displacements must be earlier than the granite gneiss. Yet in the district south of Laxford several granite gneiss intrusions pierce the Scourie dykes, and both possess a common foliation.

Lithologically these schists differ somewhat from those usually composing the basic dykes in the Laxford and Loch a' Chairn Bhain area. They are less fissile and schistose, and contain hornblendes of stouter form. They are more fine-grained than many of the hornblende schists of the early complex, and their composition is more uniform. The foliation frequently crosses the margins of the bands, and is parallel to that in the gneiss — a phenomenon common both in the early basic rocks and in the "Scourie dykes". In some places a linear foliation or rod-structure replaces the plane-parallel foliation. Garnets are usually common, and frequently occur in small aggregates surrounded by a thin white rim of felspar granules. One of the doubtful bands half a mile slightly north of east of Badcall Quay, Loch Laxford, contains hypersthene and augite as well as quartz [\(S4478\)](#) [NC 233 480], and is classed as a pyroxene gneiss, but the quartz is not opalescent like that in the pyroxene gneiss near Scourie.

The cliffs by the road east and north-east of Badcall Quay show several dyke-like bands, most of which are only a few feet thick. One, about 200 yards east of the store-house, cuts the foliation of a pale hornblende gneiss almost at right angles. The foliation in the gneiss dips S.S.W. at a low angle, while the sides of the dyke-like band usually dip steeply

N.N.E., but become irregular near the top of the section.

Later Granite-gneiss

Over the area between Loch Inchard and Loch Laxford the granite gneisses are less abundant than southwest of the latter loch. They increase, however, from north-east to south-west, and from north-west to south-east, until between Loch Stack and Ben Arkle they are specially abundant over an area of about two square miles. These rocks appear both as dykes and sills, and are not all of the same age, some of the former being later than some of the latter. Indeed, it is probable that all the granite dykes were not intruded at the same time.

Most of these gneisses or foliated granites are of a pale pink colour, and contain small flakes of black biotite parallel to one another and to the thin quartz streaks which help to define the foliation. In some thick bands between Loch Stack and Loch an Fhionn Leathaid there is some hornblende as well as biotite. Small grains of magnetite or ilmenite are also occasionally observed. The predominant feldspars in these rocks are oligoclase and microcline.

Most of the bands are distinctly foliated throughout. In some places the foliation crosses the margins and is continuous with the second foliation in the earlier gneisses; but usually, both in dykes and sills, it is parallel to the sides.

The sills are specially abundant W.N.W. of Loch Stack, where the largest examples occur, one on the north side of that loch being at least 160 yards wide. The thick sills are generally coarsest in grain, and usually contain many thin pegmatites, about half an inch thick, and parallel to the foliation. Besides the nearly vertical sills and dykes there are gently inclined sheets, an example of which occurs about ■ mile W.S.W. of the head of Loch an Tigh Sheilg, four miles E.N.E. of Laxford Bridge, where an intrusion of granite gneiss, with an almost horizontal base, cuts the vertical bands of an earlier gneiss. The foliation in this intrusive gneiss fades south-west, striking against the base, and there is a parallel second foliation in the earlier gneiss.

The general direction of the dykes is somewhat north of west, slightly nearer west than the strike of the earlier gneiss nearer Laxford, and of the basic dykes on the south side of this loch. Some, however, strike east and west, and a few run north-east. One of the W.N.W. dykes has been traced from the west slope of Ben Arkle to the coast south-east of Eilean Meall a' Chaoruinn, a distance of nearly five miles. Near its south-east end the width varies from 60 to 40 yards, diminishing in a north-west direction. It splits in two branches N.N.E. of Badcall Quay, and is joined by others of varying width at different points. It cuts the first foliation planes of the adjacent gneiss along the whole of its course. About half a mile E.N.E. of Loch Airidh a' Bhaire, two miles north-east of Loch Stack Lodge, the foliation in the dyke is parallel to its margins, but the bands in the earlier gneiss on the south side are nearly flat: no second foliation in the earlier gneiss parallel to the foliation in the dyke has here been detected. In another locality, however, rather more than half a mile slightly east of south of the head of Loch a' Gharbh Bhaid Mhàir, where the broad bands of the older gneiss are nearly flat, a second foliation has been developed parallel to the side of the dyke and its planes of foliation.

In a dyke ■-mile E.N.E. of the south-east end of Caol Loch a' Mhàir, 2¼ miles E.S.E. of Laxford Bridge, the foliation is not parallel to the side, but almost in the same direction as the bands of the earlier gneiss which it traverses. In this case the latter are supposed to represent both the first and second foliation planes. About a third of a mile south-east of the head of Loch a' Gharbh Bhaid Mhàir a thin dyke of granite gneiss cuts a broader sill of the same material, and is accompanied with a displacement of two feet. The foliation in the dyke is parallel to that in the sill and also to the sides of the dyke, but at a considerable angle to the sides of the sill.

In a section ■ mile E.S.E. of the head of Loch a' Gharbh Bhaid Mhàir the early gneiss and some thin foliated granite sills are folded, both limbs inclining south-east at gentle angles. Alike in these sills and the early gneiss there is a foliation, almost parallel to the axial planes of fold, which crosses the margins of the sills. Hence it may be inferred that the development of these common planes of schistosity was subsequent to the folding. It is uncertain whether the granite dykes have been folded in like manner.

The rarity of thick pegmatites in the granite dykes and the fact that the latter, in some cases, cut the pegmatites, suggest that many of the dykes are later than some of the sills. For example, by the road 200 yards south-east of Badcall Quay a

granite-gneiss dyke, about a foot thick, cuts three pegmatites; and about 1,000 yards S.S.W. of the head of Loch a' Gharbh Bhaid Mhòir, a thin dyke foliated parallel to the side intersects several pegmatites.

About 200 yards S.S.E. of the outlet of Loch a' Bhlar Locha, and rather more than ■-mile north-east of the head of Loch a' Gharbh Bhaid Mhòir some thin dykes of granite-gneiss are accompanied with displacements which affect the pegmatites, the dykes being foliated parallel to their sides, but not crushed.

Pegmatites are common everywhere in the Laxford district, and specially abundant near the north end of Ben Arkle. The thickest bands occur near that mountain, also in the peninsula south of Loch Dhugaill (where some of them are 60 yards wide), and about ■-mile S.S.W. of Cnoc na h-Ula. Most pegmatites are parallel to the first foliation planes of the gneiss, and when the latter are folded they follow the fold. Hence, in the peninsula south of Loch Dhugaill, and elsewhere near Loch Laxford, the strike is W.N.W., while near Loch na h-Ula, and on the east side of the road a mile S.S.E. of Rhiconich some outcrops are nearly circular. (See (Plate 15). and (Plate 16))

A number of pegmatites behave like dykes and cut the banded gneisses and hornblende schists. When the pegmatites are thin, so that both sides can be seen at once, they sometimes appear as lines of fault though uncrushed, as for instance on the roadside a little north-east of Badcall Quay. Again, about a mile slightly west of south of the head of Loch an Tigh Sheilg, N.N.W. of Ben Arkle, a thin pegmatite sill is crossed in a distance of a few feet by three small pegmatites, each having south-east at 45°, and behaving as a reversed fault or thrust. These must have been formed after the sill. That the pegmatites are not all of the same age is also shown by the fact that some are earlier than certain intrusions of granite gneiss, while others are later. Some pegmatites have a tendency to expand suddenly here and there into a series of lenticles or knots connected by narrow veins, and surrounded by attenuated bands of gneiss. In some places small lenticles of pegmatite seem isolated in the gneiss — a feature common in rocks that are unusually rich in black mica, the contrast in colour enabling them to be readily perceived. Examples occur 140 yards west of the mouth of the burn that drains Loch Sgeir a' Chadha, 1½ miles south-west of Rhiconich, and near the south end of Loch Ceum na Staidhreach, 2½ miles W.N.W. of Rhiconich.

The chief felspar in the pegmatites is microcline of a pale red colour. In the crags nearly a mile E.S.E. of the head of Loch a' Gharbh Bhaid Mhòir it shows conspicuous chatoyant lustre, and some of the cleavage faces exceed a square foot in area. Quartz is usually in much smaller proportion than felspar, but in a few thin bands, as for instance on the east side of Cnoc an Rudha, Loch Inchard, it is in excess. In a pegmatite, three inches thick, near the coast 170 yards north of the mouth of Loch an Roin, the exterior is composed almost wholly of felspar and the interior of quartz. Black mica is more common than white. In a pegmatite on the coast 350 yards south of Eilean Dubh, near the entrance to Loch Inchard, it forms large flakes two inches broad, which coalesce into irregular lumps and short strings.

Specks and streaks of black iron ore, apparently ilmenite, occur in the pegmatites between half a mile and a mile and a quarter S.S.E. of Cnoc na h-Ula, east of Loch Laxford; also in the pegmatite with strings of black mica near Eilean Dubh, and in other localities.

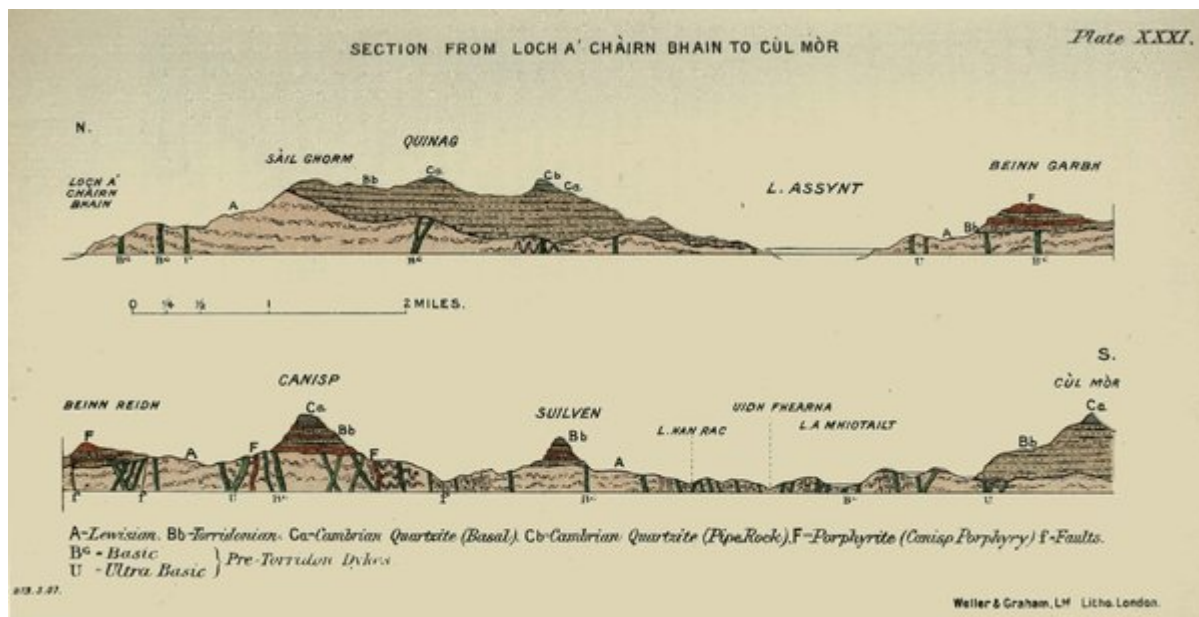
Two pegmatites displaying an arrangement of their constituents parallel to the sides have been already mentioned.. In others the grain varies in different bands, the marginal ones being in some cases coarser, and in others finer, than the middle layer. More rarely, as in an instance on the coast a little north-east of the mouth of Loch an Roin, Loch Inchard, five bands may be distinguished, each nearly parallel to the side.

Thin pegmatites with a foliation crossing from side to side have been noted at the top of Cnoc na Suil Chruthaiche, north side of Loch Laxford, and nearly ■ mile slightly south of west of that eminence, ■-mile slightly east of north of the head of Loch an Tigh Sheilg, one mile north of Arkle, and elsewhere. In the first locality the quartz is arranged in thin parallel streaks crossing the pegmatite; in the second the pegmatite, about two inches thick, is in a dyke of granite gneiss and is disposed in sharp folds striking north-west, the foliation both in the gneiss and the . pegmatite being parallel to the axial planes of the folds. Distinct foliation is rare in the coarse, thick pegmatites, in spite of the fact that the dykes of granite-gneiss, which are probably later than many of the pegmatites, are always foliated. During movements the thick pegmatites appear to have behaved as massive grits which, as is well known, have often remained uncleaved, even when the shales intercalated among them have been altered into slates.

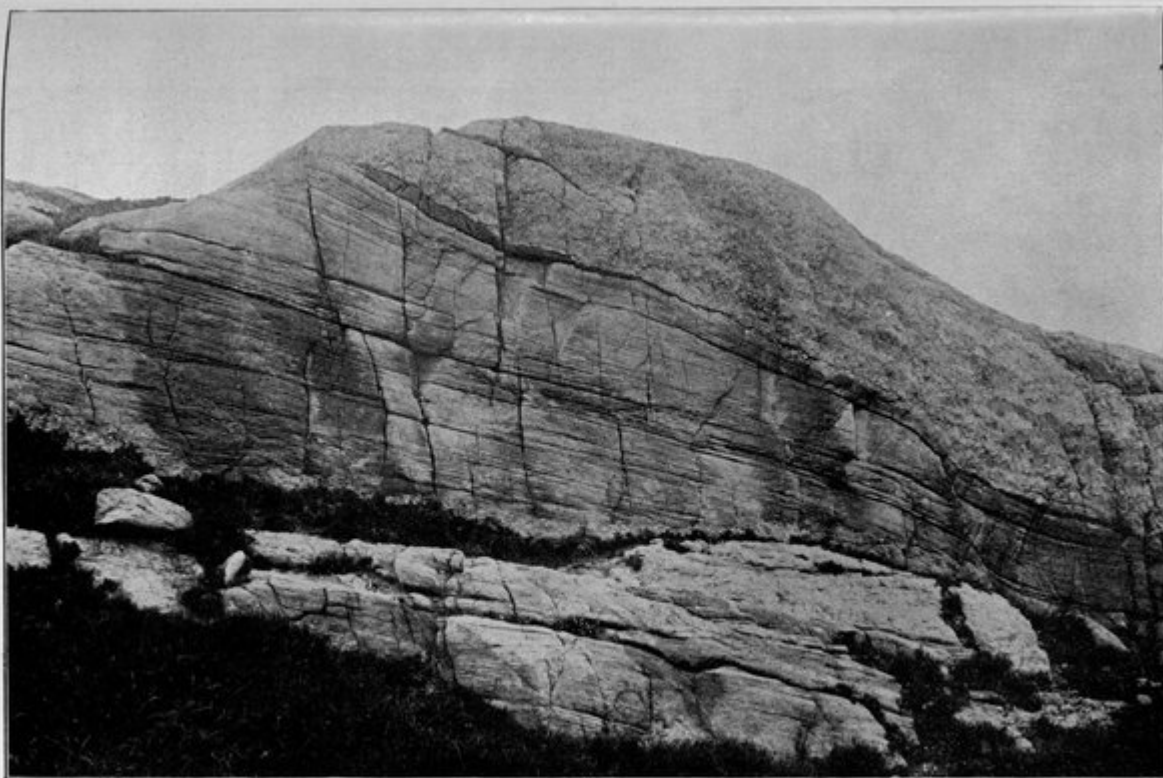
Effects of Pre-Torridonian movements on the gneiss

Thin streaks of red, purple or black, compact rock, like halleflinta, often crowded with pieces of hornblende-schist and gneiss, have been observed in many places near Loch Inchard. A quarter of a mile north and half a mile slightly west of north of the west end of Eilean an Eireannaich, Loch Laxford, the streaks extend over a considerable area, but they do not appear to have a general direction, and they are not indicated by any superficial feature of the ground. Some of the streaks behave as faults. The black varieties have a close resemblance to the flinty crush rocks in the Gairloch district. and, like them, are probably of pre-Torridonian age.

A specimen of a streak within a pegmatite a quarter of a mile slightly south of west of the north end of Loch Eileanach, two miles north of Loch Stack, has been examined under the microscope. The matrix has a felsitic aspect, and shows a remarkably perfect fluxion-structure. The pieces of quartz embedded in the matrix show undulose extinction, and portions of many of them have been ground into powder.



(Plate 31) Coloured section from Loch a' Chairn Bhain to Cùl Mòr, showing denudation of the Torridon sandstone on the plateau of Lewisian gneiss.



Rock face—upper part consists of coarse pegmatite, lower part of Hornblende-Gneiss with parallel structure.
About one mile south of Rhiconich, Sutherlandshire.

(Plate 15) Rock face — upper part consists of coarse pegmatite, lower part of hornblende-gneiss with parallel structure; about one mile south of Rhiconich, Sutherlandshire. B18



A portion of the rock shown in Plate XV., exhibiting the intrusive character of the pegmatite.
One mile south of Rhiconich, Sutherlandshire.

(Plate 16) A portion of the rock shown in