

---

## Chapter 34 Geological structure of the ground between Loch More and Loch Glencoul

By C. T. Clough.

This tract of less elevated ground comprised in Sheets 107 and 108 of the map, affords many striking developments of the characteristic tectonic features of the North-West Highlands. These will be most conveniently illustrated by a series of transverse sections.

At the north end of the district a striking contrast is observable between the two sides of Loch More. On the south-west side the higher slopes of thrust Cambrian rock are composed to a large extent of fucoid-shale, serpulite-grit, and limestone, but those on the north-east side consist of quartzite, which there rises higher and covers a much larger surface. On the northeast side, also, the Cambrian rocks extend a mile further to the south-east than on the opposite side. The quartzite at the foot of Loch More is partly obscured, but does not seem appreciably displaced by a fault that runs up the loch. But a W.N.W. fault, hading and throwing down to south-west, is seen in Strath an Staca, and if continued in an E.S.E. direction it would trend along the loch. The contrast here referred to may perhaps be due to some obscure thrust hidden in the loch.

At the north-west end of the section shown in (Figure 26), the Lewisian gneiss (A) is covered unconformably by the quartzite (Ca, Cb), which has a gentle dip towards E.S.E. These rocks retain their original relations to each other. But immediately above them come masses of Cambrian rock which have been moved from the E.S.E., and disturbed by many thrusts and folds. It will be seen that in the south-eastern half of the section a small inlier of the gneiss emerges from beneath a mass of thrust and folded quartzite, and is itself folded, so that its north-western side is reversed, and the quartzite (Ca) appears to dip below the gneiss. The basal conglomerate of the quartzite, however, is exposed, showing that the junction of the two rocks is an unconformable one. This gneiss and the Cambrian rocks overlying it probably rest on the Glencoul thrust-plane, on which the thick masses of gneiss have been driven forward which appear above the unthrust quartzite at Loch Glendhu and Loch Glencoul. A little south of the line of section this thrust is distinguished from the others by these overlying masses of gneiss, but further north, at Loch na Creige Duibhe, the gneiss on the thrust is covered unconformably by the quartzite and other Cambrian rocks, and the beds on either side of it are of much the same character, so that it becomes uncertain which of the thrusts on the north side of the loch represents the Glencoul thrust.

Over the thrust Cambrian strata lie several other higher masses of rock, which have perhaps been carried from much greater distances. The lowest mass is chiefly of Lewisian granitic gneiss (A'), the next is a mylonised rock, and the third Moine-schist. The mylonised rock forms several very distinct outliers in, and near, the north-west half of the section, but the Moine-schist (M) only occurs near the south-east end. We shall speak further of these higher masses after completing the description of the lower.

At the north-west end of the section the boundary between the basal quartzite (Ca) and the pipe-rock (Cb) appears to be undisturbed, but before the serpulite-grit is reached a low-angled thrust or sole intervenes, on which are piled up stripes of quartzite and fucoid-shale. On the north-east side of the line of section some of the minor thrusts have been folded, and higher thrusts occasionally override lower ones. About a quarter of a mile south of the Lochmore shepherd's house the Cambrian rocks are found on the south side of some of the granitic gneiss and at a much higher level than to the west. Perhaps this is owing to a fold of slightly later date than the thrust on which these rocks were brought forward. The Cambrian rocks in the centre and near the south-east end of the section, which overlie the gneiss inlier, and which are supposed to be on the Glencoul thrust, appear to be disturbed by fewer thrusts than those on the "sole" near the north-west end.

The pipe-rock forms in one place a folded outlier on the basal quartzite, on the south-east side of which the dip is reversed, the pipe-rock appearing to dip under the basal quartzite. A little further to the south-east the base of the quartzite (Ca) is seen with its conglomerate, containing pebbles of quartz two or three inches long. These strata dip

under a thin banded hornblendic gneiss — part of the inlier of Lewisian gneiss already referred to. Beyond the inlier the basal quartzite and the pipe-rock appear in their natural position, but they are considerably folded.

The quartzite around the gneiss inlier forms a folded dome nearly a mile and a quarter long from north-west to south-east, and a mile broad. The general dip on all sides is directed away from the centre. On the north-east and south-west sides the strike runs nearly at right angles to the general strike of most of the thrusts and axes of fold belonging to the great post-Cambrian movements. A north-westerly strike also prevails in the Moine-schists on the north-east side of the dome, but does not appear in the unthrust quartzite. We conclude, therefore, that the north-west strike was probably developed while the thrust-movements were in progress.

In some of the bands of pipe-rock in the dome the pipes, which in the undeformed rock are perpendicular to the bedding, have been dragged into a diagonal position, the deformation being greatest in the zones in which there is some admixture of shaly material. About 1500 yards S.S.W. from the top of Beinn Lice the angle between the pipes and the bedding is in some bands not more than  $45^\circ$ , while in others it amounts to about  $70^\circ$ .

Near the south-east end of the section drift comes on again, but between the quartzite and the Moine-schist cream-coloured compact limestone, probably part of the Eilean Dubh division, makes its appearance. The limestone is divided into thin laminae dipping  $23^\circ$ , in a direction  $22^\circ$  north of east, which display minute flakes of white mica on their surfaces, and stretching lines which run nearly east and west. The extent to which the limestone has been altered suggests either that it lies on some higher thrust than the quartzite, or that it has been altered by some agent besides dynamo-metamorphism. A small exposure of dioritic rock ([S2735](#)) [NC 31 29], seen a little north-west of the limestone, may belong to a thin intrusive sheet within the limestone. This sheet possibly crosses the line of section, and may have caused part of the alteration. It is the most northerly of the thrust post-Cambrian intrusive rocks, and lies seven or eight miles further north than any similar unthrust intrusion.

The thrust gneiss overlying the Cambrian masses in the northwestern half of the section (A■) mainly consists of a red granitic gneiss like those near Laxford, but closely intermixed with many pegmatites and some dark-grey crushed bands of uncertain nature. Owing to the brecciation which this gneiss has undergone, its pre-Torridonian foliation is rarely distinct for more than a few yards. To find in the unthrust area similar granitic gneisses we must go, not to the nearest unthrust gneiss in a W.N.W. direction, but to the sides of Loch Stack, some two or three miles to the north — chiefly on account of the difference between the strike of the large masses of unthrust gneiss and the direction, of movement of the thrusts, seeing that the general trend of these movements lay  $15^\circ$  or  $16^\circ$  nearer east and west than the strike of the gneiss. It is quite possible that the granitic gneiss in the section may have been thrust forward from a distance of nine or ten miles.

The thrust which brings on the granitic gneiss has in most places a gentle E.S.E. inclination, but about 700 yards south of Lochmore Lodge it becomes vertical with an east and west strike. About 1000 yards south-east from the Lodge it inclines steeply to south-west. The change of direction, and the rise in level of the boundary of the gneiss observable about a quarter of a mile south of Lochmore shepherd's house, may possibly indicate a folding of the thrust-plane. On the south side of the gneiss we have suggested in the section that the thrusts may also be reversed by folding along axial planes inclining south-east, for in some exposures the dip is southerly, as if the limestone were lying over the mylonised rock.

Nearly three-quarters of a mile E.N.E. from the head of Loch na Creige Duibhe, and only a little distance north-east of the line of section, considerable areas of limestone dipping southeast are exposed. The limestone seems at first to lie within the mylonised rock, but it is so little altered that we at once recognise that the western part belongs to the Ghrudaidh and the eastern part to the Eilean Dubh sub-divisions. It is difficult to explain how the limestone can have escaped with so little alteration if it really lay in the mylonised rock; possibly it may be intercalated between this rock and the granitic gneiss. The mylonised rock, of a dark-grey colour, and finely laminated, forms a striking contrast with the granitic gneiss. Eight or nine outliers of it rest on, or partly on, the granitic gneiss, two of the most conspicuous of which are crossed by the line of section. The rock shows a sericitic lustre on the parallel shear-planes, and contains many small eye-shaped bits of red felspar, together with some larger red masses, some as much as several yards long and several feet broad. Some of the masses seem to be composed of mylonised pegmatite, but others may have been derived from a granitic gneiss like that below. The shear-planes of the grey rock are much puckered, but their general dip is E.S.E. or

south-east, and frequently at rather high angles. About 350 yards north-east of the mouth of the burn at the head of Loch na Creige Duibhe the thrust-plane between the grey rock and the granite gneiss is distinct, and it is here observable that the laminae in the grey rock sometimes dip more steeply than the plane. The stretching lines in the mylonised rock run slightly north of west, a direction about  $20^\circ$  nearer east and west than that of the dip of the planes which they traverse. On the hill three-quarters of a mile southwest from Lochmore shepherd's house they are indicated by trains of small granules of epidote.

It is uncertain what the rock was from which the grey mylonised rock has been chiefly formed, but it seems to contain, as already indicated, some pieces which may be mylonised granitic gneiss. On the north-east side of the line of section it is difficult to draw a line between this mylonised rock and the holo-crystalline Moine-schists of Beinn Lice.

The section (Figure 27), in a general N.E. direction, crosses a tract where many of the rocks and thrusts have a north-westerly strike, and have been folded along axes which are nearly at right angles to the general direction of movement of the post — Cambrian thrusts. This north-westerly strike is found not only in many of the Cambrian masses, but also in the Moine-schists. All the Cambrian and Lewisian rocks have no doubt been covered by an arch of Moine-schist (indicated by the dotted line in (Figure 27)), but the upper and central parts of the arch have been denuded so as to expose the rocks below the schist for a mile or more further east than they can be seen on either side of the arch.

Below the Moine-schist (M) and a band of mylonised rock which often underlies it, a large mass of Cambrian and Lewisian rocks, confused with thrusts, reposes on the Glencoul thrust-plane. The north-eastern part of this mass forms the great dome above referred to in the description of (Figure 26). The south-western part is so much disturbed by thrusts that its structure is difficult to make out, but probably the greater part, if not all, of it lies on thrusts which override the dome. None of these thrusts, however, are seen between the dome and the Moine-schists at the north-eastern end of the section, nor are they so numerous at the south-western end as they are a little further towards the north-east, as shown in the figure. But for the folding along north-west axes, and the denudation of the Moine arch, the higher masses now laid bare might never have been exposed. The north-eastern end of the section, and more than half of the Cambrian dome, are so covered by drift that many of the rocks which we suppose to occur in this area are not seen for considerable distances from the line of section. We shall describe first the Cambrian and Lewisian rocks to the south-west of the dome, and then the mylonised rocks and Moine schist.

The rock on the south-west side of the serpulite-grit (Cd) in the south-west limb of the dome is gneiss, beyond which lies a band of basal quartzite (Ca), probably separated from the gneiss by a thrust of no great magnitude. In an adjacent exposure the basal quartzite can be seen lying unconformably on the gneiss, which contains patches of sheared agalmatolite. On the south-western side of the basal quartzite, however, a thrust must intervene, for there the serpulite-grit (Cd) and fucoid-shale (Cc) appear, the latter converted in places into a lustrous schist. Beyond these Cambrian formations the Lewisian gneiss comes on again (A). Its boundary, which can be easily traced, is found to be twisted into a syncline with north-west axis. On the north-east side of Loch Strath nan Asinnteach, the same gneiss is overlain unconformably by the basal quartzite, and a mass of gneiss and quartzite seems to rest on a still higher thrust-plane. A junction of the quartzite and the gneiss mass which joins the gneiss at the top of the section is well seen about 300 yards east of the outlet of Loch Strath nan Asinnteach, but the two rocks have been so much sheared that the unconformability between them is to a large extent masked.

On the south-west side of the highest gneiss in the syncline more masses of gneiss and Cambrian strata appear to crop out than on the opposite side. Perhaps several of them lie on one thrust, like the piled-up stripes on the low-angled thrust or sole near the north-west end of the section in (Figure 26). The thrusts have sometimes brought rocks high in the original undisturbed sequence over others which are lower — for instance, the pipe-rock sometimes lies directly on the gneiss without the intervention of any basal quartzite. Some of the thrust masses of basal quartzite and pipe-rock include sheared intrusive sills, which cannot all be shown in the section. One sill generally appears a little above the base of the quartzite, and another a little above the base of the pipe-rock. Some of the rocks in these thrust masses have been greatly deformed. Thus, in a burn nearly a quarter of a mile south-west from the foot of Loch Strath nan Asinnteach, an exposure may be seen of basal quartzite in which some of the pebbles are two inches long though only  $1/6$  inch broad, and the long axes of all those on the same slab are parallel, generally trending about west  $3^\circ$  north, but sometimes west

24° south. Some of the felspar pebbles have been repeatedly cracked almost at right angles to the long axes, and the cracks are filled with quartz. Further up the same burn the conglomerate at the base of the quartzite is represented by a thin streak of pale yellow sheared rock, perhaps formed chiefly from agalmatolite, which contains pebbles of quartz. The total thickness of the basal quartzite and of four thin sheared intrusive sheets which occur in it is here only about 30 or 40 feet.

In Gleann Dubh burn, about 700 yards below the outlet of Loch Strath nan Asinnteach, for a few feet above and below an exposure of a thin stripe of basal quartzite, the gneiss has been greatly sheared, especially the south-western portion of the mass, its chief planes being parallel to those in the quartzite. The exposure of gneiss shown at the south-west end of the section in (Figure 27), just under the Moine-schist, is part of this sheared mass. It is mixed with many thin stripes, from a few feet to some yards in length, of basal quartzite, at least nine of which can be seen in a space less than 170 yards long. The gneiss and quartzite are here so mixed, and have their chief planes so parallel, that they may be considered to form a new complex.

The Moine-schists (M) at the north-east end of the section are chiefly siliceous granulitic flagstones, folded into isoclines with both limbs dipping at gentle angles slightly to the north of east. The mylonised rock represented below the schist is not actually seen in the line of section, but it may be there concealed under drift.

The section (Figure 28) is drawn through a tract in which the Glencoul thrust is very clear, and from which it can be traced for many miles to the south. It has been figured and described by Dr. Callaway. The Age of the Newer Gneissic Rocks of the Northern Highlands. *Quart. Journ. Geol. Soc.*, vol. XXXIX., p. 373. It is by this dislocation that the great masses of gneiss which form Beinn a' Bhutha, Beinn Aird da Loch, and Cnoc na Creige have been driven over the quartzite. Some of these masses are more than 1700 feet thick and at least several miles broad. This important displacement, known as the Glencoul thrust, is not that which has brought forward the granitic gneiss in the section shown in (Figure 26). At the head of Loch na Creige Duibhe the granitic gneiss has been thrust over Cambrian limestones, which rest, without much disturbance, upon the serpulite-grit, fucoid-shale, and quartzite on the north-eastern side of Beinn a' Bhutha. These Cambrian rocks below the thrust extend E.S.E. for more than a mile, and as they dip N.N.E. more steeply than the slope of the ground the mass of gneiss which lies unconformably below the quartzite soon appears towards W. S. W. This gneiss must, therefore, lie below the granitic gneiss, and the Glencoul thrust which has carried it forward must lie below the thrust which brought up the granitic gneiss.

The Glencoul thrust may possibly lie directly in certain places on unthrust Cambrian rocks, but in other places a thrust mass of considerable thickness is interposed between it and the undisturbed quartzite. The intervening material, which consists mainly of thin stripes of Cambrian strata, often dipping steeply and separated from one another by steep minor thrusts, sometimes rests on a low-angled thrust or sole which has nearly the same inclination as the Glencoul thrust. (Figure 28)

The mass of gneiss brought forward by the Glencoul thrust is covered at various places, besides the north-east side of Beinn a' Bhutha, by Cambrian strata which rest on it unconformably, and are frequently crossed by steep lines of rupture, probably formed while the mass was being thrust forward. But no displacements comparable in magnitude to the Glencoul thrust are met with until near the south-east end of the section, where, overlying the Cambrian rocks, sheared Lewisian gneiss and schist of the Moine series have been brought forward by different, thrusts with gentle inclinations in an E.S.E. direction.

In the line of section followed in (Figure 28), the Glencoul thrust-plane is not actually exposed at the surface, but on the north side of Loch Glencoul it overlies fucoid-shale, and this horizon has perhaps often formed a plane of weakness along which the rupture has proceeded. Between Aird da Loch and the head of Loch Glencoul, a distance of about a mile and a half, the outcrop of the thrust-plane descends from about 700 feet to the sea-level, with a general inclination of about 7° in an E.S.E. direction. This slope is less than the average dip of the quartzite below, and, as for some distance on the north side of Loch Glencoul the thrust-plane is nearly flat or even inclines towards north-west, the mass of strata between the quartzite and the overlying gneiss increases in thickness towards the upper end of the inlet.

The gneiss (A) just above the Glencoul thrust-plane has been sheared and is crossed by bands of crushed gneiss parallel to the plane of movement. A little above that plane, however, the pre-Torridonian banding in the gneiss becomes quite distinct, and in many places can be seen to strike nearly at right angles to the thrust-plane. The Lewisian rocks here exposed differ litho-logically from those in the unthrust area lying to the west of them. They contain many thick red pegmatites, which in the unthrust gneiss are rare. On the other hand, while basic dykes of pre-Torridonian age are numerous in the unthrust gneiss, they appear to be absent from the thrust gneiss beyond half a mile north from Glen Coul. In the unthrust gneiss the belt which in respect of pre-Torridonian features most resembles the thrust gneiss of this locality lies some miles further to the north. <sup><ref></sup>The N.E. belt described in Ch. IX. <sup></ref></sup> The thrust gneiss and pegmatites of Beinn a' Bhutha and Beinn Aird da Loch are crossed and slightly faulted by many thin epidotic strings, having no general direction, and probably produced during the thrust-movements.

About a mile from the south-east end of the section in (Figure 28) the basal quartzite can be seen to rest on the thrust gneiss and to dip to the east. The boundary between the two rocks probably keeps along the original unconformable junction, for some of the pegmatites under the quartzite contain sheared agalmatolite — a material rarely found except near the old pre-Cambrian floor. Yet there has been enough of movement along the junction to produce parallel shear planes in the gneiss. On either side of the line of section a thin, somewhat sheared intrusion of porphyrite appears at, or near, the base of the quartzite. The pipe-rock succeeds the basal quartzite, but before we reach the top a line of compact crush (t), hading towards west in some places, brings on the gneiss, again, covered unconformably by the basal quartzite dipping E.S.E. Another crush line (t) is soon crossed, and we then enter an area of gneiss rather more than 300 yards broad, at the further side of which a thin band of hornblende-porphyrite [\(S2736\)](#) [NC 294 325] occupies a narrow depression, and clings to the base of the quartzite for a great distance (F). Higher up in the succession comes the pipe-rock in its natural position, followed by an obscure area which is probably underlain by thin stripes of fucoid-shale, serpulite-grit, and limestone, disturbed by occasional faults. Though not seen along the line of section, at least six of these faults break through the base of the basal quartzite, the porphyrite, or the pipe-rock, a little further to the north. They strike nearly north and south, and have a hade and downthrow towards the west. They closely resemble the lines of compact crush just referred to, and, like them, hade in the direction of downthrow — differing in this respect from the common thrusts — but, on the other hand, they twist more frequently and suddenly than most normal faults. They end in a northerly direction at a line of thrust which strikes W.N.W., and which emerges from below the great thrust that brings on the gneiss at the south-east end of the section. They not improbably form part of the series of dislocations produced during the thrust-movements.

The highest member of the Cambrian series here exposed is the Ghrudaidh limestone, which is seen under the gneiss and crumpled schist at the south-east end of the section. The gneiss overlying the limestone, which is a much-sheared part of the band shown at the south end of the section in (Figure 27), encloses many thin streaks of highly-sheared basal quartzite, as well as other siliceous streaks of more uncertain character. Near Locham Feith an Leothaid some red mylonised stripes, which may have been formed from pegmatites, are nearly parallel to one another and to the chief shear-planes, so as to give the rock a flaggy appearance. The shear-planes are contorted and crossed by many almost horizontal fault-planes, which also cross the red stripes, and must have been formed after the rock was in a mylonised condition. Both the shear-planes and the limbs of fold are generally inclined to east or south-east — in the same direction as the chief planes in the quartzite a little further to the west. The schist above the mylonised gneiss contains many thin much-puckered siliceous stripes, and is part of the "Stack schist". A little further to the south-east a gradual change occurs in the lithological character of the rocks, which pass into less-crumpled granulitic schists like those on Beinn Lice.

In the ground traversed by the section in (Figure 29) the Glencoul Thrust is likewise strongly marked, but it is here overlain by another great thrust which, often with a hade to north-west, has carried forward a mass of gneiss, together with some quartzite lying unconformably upon it, as well as other Cambrian rocks, often separated from one another by minor thrusts. At the south-eastern end of the section two still higher thrusts are shown — perhaps continuations of the two at the south-east end of the section in (Figure 28). The lowest of these has carried forward a thin band of greatly-sheared rock — apparently Lewisian gneiss — while the highest, or Moine Thrust (T■), has brought on a fine-grained puckered schist which contains many thin siliceous streaks, and which seems part of the boud represented in (Figure 28).

Near the shore, and on the islands near the head of Loch Glencoul, the stripes of fucoid-shale and serpulite-grit become mixed in a south-easterly direction with Ghrudaidh. limestone. This constant repetition of strata is due to steep thrusts rather than to folds, and from the sections on the sides of the loch it would seem that these steep stripes and thrusts have all been carried forward on a low-angled thrust or sole (T) of much the same character as that represented near the north-west end of the section in (Figure 26).

The Glencoul thrust-plane, on which the thick mass of gneiss exposed in the north-western half of the section has been driven forward, is seen on two islands and near the south side of the loch. For a few feet above it the rocks are often finely sheared along planes striking parallel to the thrust-plane, so that the old banding of the gneiss cannot be recognised. Higher up, the gneiss contains many basic pre-Torrionian dykes, now generally in the condition of hornblende-schist, though dykes of the same chemical composition and age in the unthrust gneiss to the west are seldom foliated except near the edges, or along lines of special shearing. Many thick pegmatites appear in this displaced mass of gneiss and in the basic dykes, though such pegmatites are rare in the unthrust gneiss to the west. The unmoved gneiss that best corresponds with the thrust gneiss of Glencoul lies about six miles to the north. In most of the thrust gneiss the basic dykes trend towards W.N.W. as in the unthrust area; but to the west of Glencoul House, and to a less extent to the N.N.E. of Loch Coir' a' Bhaic, when the dykes come within a little distance of the Glencoul thrust they are twisted nearly into parallelism with it. Near Glencoul two dykes show this change, one for a distance of about 170 yards, and the other for nearly half a mile, and for a third of a mile west of the last-mentioned dyke the gneiss above the thrust continues to strike parallel to the thrust, and is folded along axial planes that incline in the same direction as the line of disruption. Some of the gneiss near the higher thrusts and near the Moine-schist has been intensely crushed along parallel planes, which are coated with small scales of sericitic mica.

A little to the south-east of the middle of the section a narrow depression occupied by a siliceous crush-rock indicates the position of the great thrust (T), which in this district comes next above the Glencoul thrust. Gneiss appears on either side of the depression, but to the north-east the quartzite comes on with its basal conglomerate lying unconformably on the gneiss. A little above the conglomerate an intrusive sheet (F) makes its appearance. At a distance of more than a quarter of a mile from the base of the quartzite, and beyond four or five outcrops of sills, the pipe-rock (Ch) is reached. Its outcrop measures only 40 yards in width, and is overlain, not by the fucoid-shale, but by a band of serpulite-grit (Cd), which is in turn overlain by a thin stripe of limestone (Ce I.). In some places, however, the limestone is cut out entirely by another thrust, which brings up the basal quartzite once more. Besides this thrust there must also be another at the top of the pipe-rock, and perhaps a third within, or at the side of, the serpulite-grit. The thrust-plane which overlies the limestone is admirably seen in the roof of a cave hollowed out of the limestone. The plane inclines east at 22°, and the limestone below, for a depth of fifteen inches, has been broken up into lens-shaped pieces, often from three to six inches long, which are inclined to south-east, and are swathed round by thin calcareous laminae.

A thin band of pipe-rock — the sub-division IV. in part — lies immediately under the sheared gneiss, and seems to have undergone a larger amount of shearing. It contains various thin bands which look like the sheared gneiss above, but which may represent sills. The general direction of the lines of movement on the shear-planes is about 34° north of west. The alteration of the pipe-rock in this locality was fully described by Dr. Callaway in his Notes on Progressive Metamorphism. *Geol. Mag.*, 1884, p. 218.

Most of the Cambrian rocks in the south-east part of the section have been pushed forward on a thrust-plane which has a general north-westerly inclination, but perhaps the greatly-sheared pipe-rock just under the sheared gneiss lies on some still higher thrust-plane. These Cambrian rocks do not usually extend more than 100 or 200 yards from the section-line. On either side they are flanked either by the Lewisian gneiss, or, close to the south-east end of the section, by the basal quartzite which lies unconformably on this gneiss. They only form a thin veneer over the gneiss, as represented in (Figure 29). The thrust-plane has in some places been sharply folded, and bits of basal quartzite have been carried on it, and may be seen nipped into a steep cliff of gneiss.

At the base of the band of sheared gneiss which comes above the pipe-rock at the south-east end of the section a finely-sheared rock, about a foot thick, with laminae hardly thicker than paper, looks as if it might possibly be a mixture of sheared gneiss and quartzite. Its laminae are sometimes steeper than those of the quartzite below. The "Stack-schist" — as we have termed the band of schist above the sheared gneiss at the Stack of Glencoul — is part of the same band as

the puckered schist with thin siliceous streaks which occurs at the south-west end of the section in (Figure 27) and at the southeast end of that in (Figure 28). The siliceous streaks at the Stack of Glencoul, and also many of those in other localities, differ from the sheared Cambrian quartzite in having a greenish-grey colour. The line between the mylonised rock and the overlying schist is tolerably well defined.

The section represented in (Figure 30) runs in a generally northeasterly direction, while the Cambrian rocks, the Moine-schists, and the thrust-planes have locally a N.N.W. strike. The folds to which this strike are due have not affected the unthrust quartzite or the Glencoul thrust-plane. They were probably developed while the masses which they affect were being thrust forward. The section only illustrates the north-eastern end of the large district affected by these cross folds. The higher thrusts and the Moine-schists are confined to the north-eastern half of the section.

The gneiss (A) at the south-western end is bounded on the north-east by a nearly vertical thrust, which has brought in the basal quartzite lying unconformably on gneiss which forms the centre of an anticline with N.N.W. axis and with the quartzite in both limbs. The conglomerate at the base of the quartzite is repeated by at least one small thrust. A thin sill (F), about two feet thick, appears below the conglomerate, and another one near the top of the basal quartzite. The quartzite is considerably sheared, and near the base contains some thin veins of quartz and felspar. In the eastern limb of the anticline the pipe-rock which there comes on is sharply folded along axes striking slightly west of north, but has an outcrop hardly 50 yards wide, for it is cut off on the east side by a north-west thrust, the plane of which sometimes dips steeply towards the west. This appears to be the Ben More thrust — one of the best-marked displacements in the district — but in the present line of section it has no special characters to distinguish it.

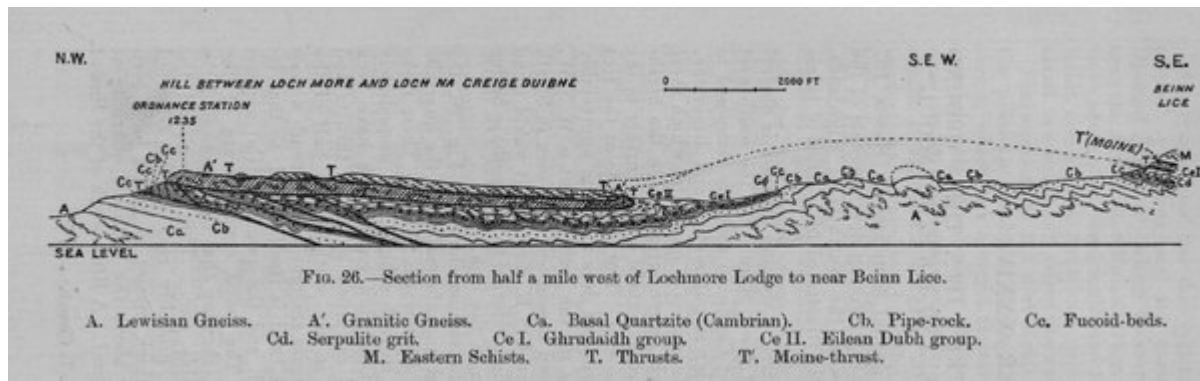
On the north-east side of what is believed to be the Ben More thrust, there comes first a patch of basal quartzite, then a steep thrust, beyond which lies a mass of gneiss crossed by several other steep thrusts, two of which unite with the Ben More thrust in a north-west direction. The gneiss is bounded on the north-east by another thrust mass, composed chiefly of quartzite, and lying between two thrusts striking slightly west of north. The quartzite mass is crossed by many lines of crush (tt), most of which have a steep dip towards the west and a downthrow in the same direction. In some parts of the mass a thin sill lies at the base of the quartzite, two others appear in the upper half of the basal quartzite, and one or two more near the top of the pipe-rock. The quartzite mass is succeeded by an area of furoid-shale (Cc) and serpulite-grit (Cd) with a thin sill, but to the northwest of the line of section the Ghrudaigh limestone (Ce I.) also comes on in natural sequence above the grit, and on the southeast side a large mass of pipe-rock, which rises up from below the shale, is repeatedly folded along axes striking slightly north of west. The different zones are crossed by crush-lines which strike in the same direction. The throws along the lines are not large nor constant in direction, but the downthrow seems always in the direction of hade. The top zone is somewhat shaly and more cleaved than the massive rocks below, and contains a number of thin veins of quartz and felspar.

Further north-east the section shows a narrow area chiefly composed of thin stripes of Ghrudaigh limestone (Ce I.), serpulite-grit (Cd), and sheared sills. These strike against the exposures of furoid-shale, serpulite-grit, and limestone referred to in the last paragraph, and are separated from them by a thrust-plane which strikes N.N.W. They are disturbed by minor thrusts (t) as well as folds, and the thrust (T) below may be regarded as a sole. Above the stripes of serpulite-grit and limestone, pipe-rock (Cb) comes in, frequently folded into isoclines with both limbs dipping gently to north-east. The pipes often make angles of about 45° with the bedding, and the rock cleaves readily along them.

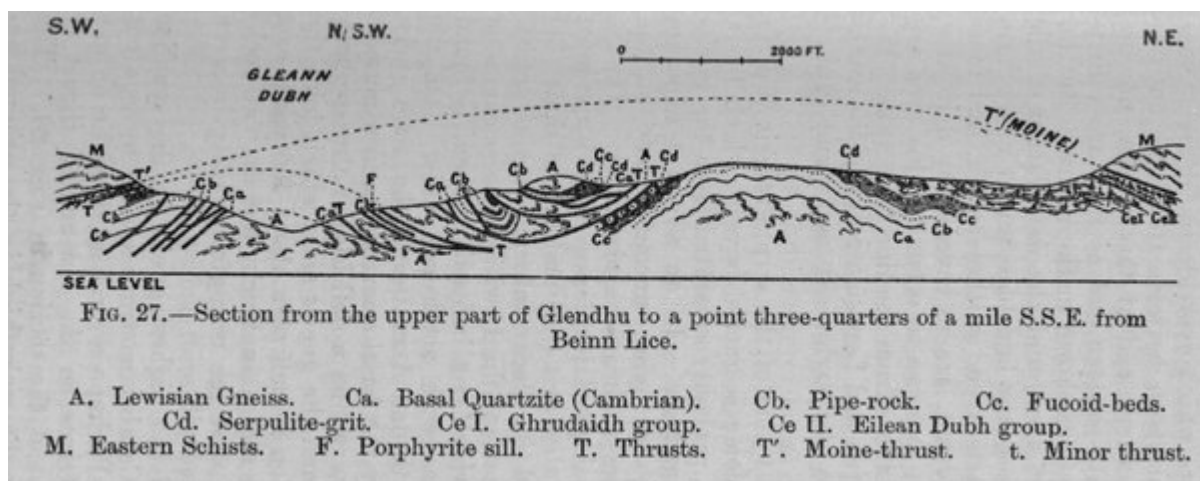
Still further to the north-east, on the slopes above Loch an Urchoil, a small exposure of basal quartzite (Ca) rises up from below a denuded anticline of the thrust-plane on which the overlying schist rests. This quartzite, which has been sheared into thin laminae that show close parallel lines of movement running about west 20° north, appears to lie on a still higher thrust-plane than the pipe-rock mentioned in the last paragraph.

Above the sheared pipe-rock, a zone, rarely more than ten feet thick, is composed of thin bands of quartzite and some mylonised rock. The quartzite bands have been folded into isoclines with both limbs inclining to north-east. They sometimes contain thin quartz-felspar veins which have not been sheared. The mylonised rock, with its small eyes of felspar and streaks which look like sheared pegmatite, has probably been derived in the main from Lewisian gneiss. It is surmounted by a schist (M) like that in the Stack of Glencoul. This rock has been folded along axes striking north-west, first, into a syncline, and then, further north-east, into an anticline. Beyond the anticline the general dip is to north-east at

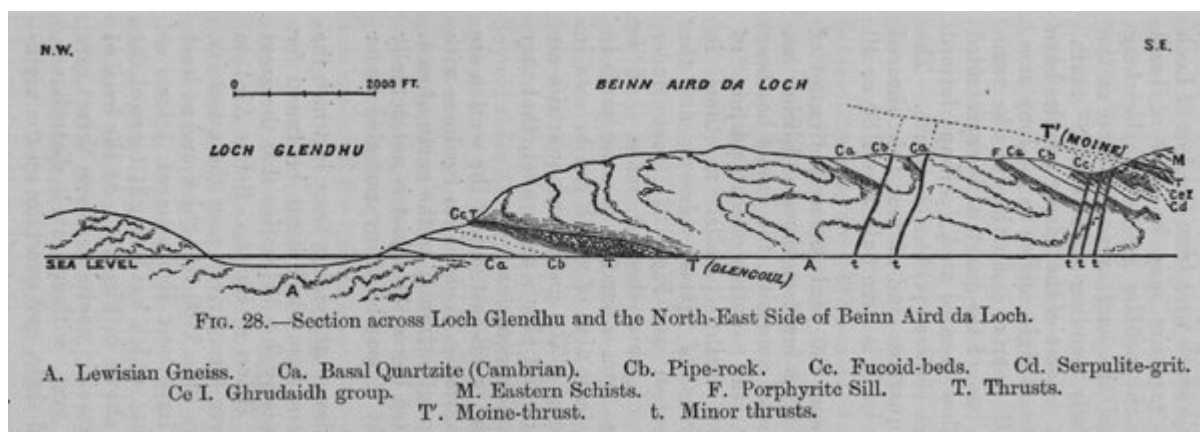
angles varying between 15° and 30°, and on the north-east side of Loch an Urchoil comes the mass of granulitic Moine-schists like those on Beinn Lice.



(Figure 26) Section from half a mile west of Lochmore Lodge to near Beinn Lice. A. Lewisian Gneiss. A' Granitic Gneiss. Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite grit. Ce I. Ghrudaïdh group. Ce II. Eilean Dubh group. M. Eastern Schists. T. Thrusts. T'. Moine-thrust.



(Figure 27) Section from the upper part of Glendhu to a point three-quarters of a mile S.S.E. from Beinn Lice. A. Lewisian Gneiss. Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce I. Ghrudaïdh group. Ce U. Eilean Dubh group. M. Eastern Schists. F. Porphyrite sill. T. Thrusts. T'. Moine-thrust. t. Minor thrust.



(Figure 28) Section across Loch Glendhu and the North-East Side of Beinn Aird da Loch. A. Lewisian Gneiss. Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce I. Ghrudaïdh group. M. Eastern Schists. F. Porphyritic Sill. T. Thrusts. T'. Moine-thrust. t. Minor thrusts.



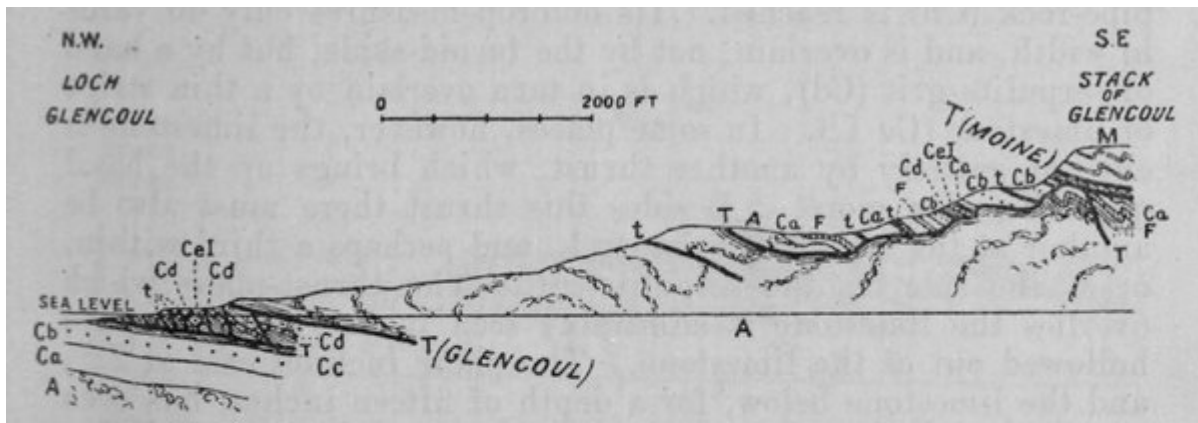


FIG. 29.—Section from Loch Glencoul to the Stack of Glencoul.\*

- |                     |                                 |                        |
|---------------------|---------------------------------|------------------------|
| A. Lewisian Gneiss. | Ca. Basal Quartzite (Cambrian). | Cb. Pipe-rock.         |
| Cc. Furoid-beds.    | Cd. Serpulite-grit.             | Ce I. Ghrudaidh group. |
| M. Eastern Schists. | F. Intrusive Igneous Rocks.     | T. Thrusts.            |
| T'. Moine-thrust.   | t. Minor thrusts.               |                        |

(Figure 29) Section from Loch Glencoul to the Stack of Glencoul. The Stack of Glencoul is not named on the one-inch map, but it lies nearly two miles south-east from Glencoul cottage. A. Lewisian Gneiss. Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Furoid-beds. Cd. Serpulite-grit. Ce I. Ghrudaidh group. M. Eastern Schists. F. Intrusive Igneous Rocks. T. Thrusts. T'. Moine-thrust. t. Minor thrusts.

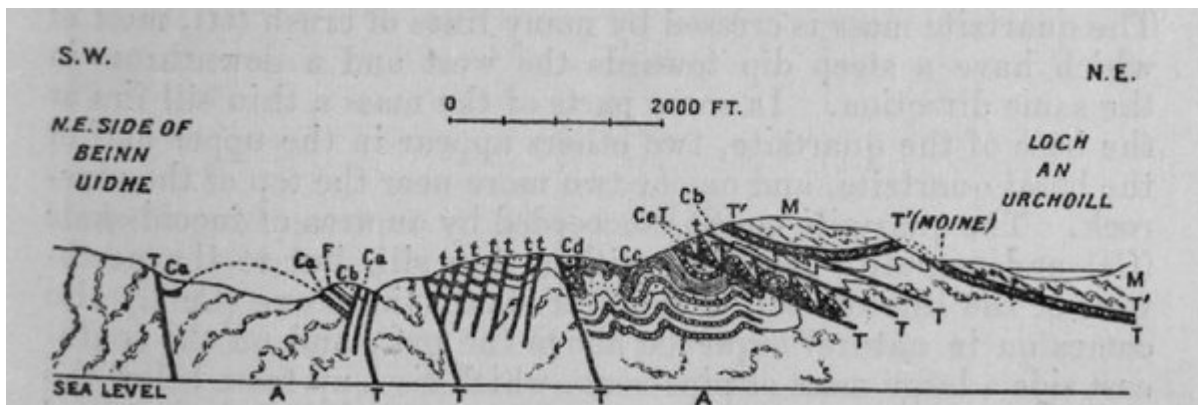


FIG. 30.—Section from the North-East Side of Beinn Uidhe to Loch an Urchoill.

- |                     |                                 |                        |
|---------------------|---------------------------------|------------------------|
| A. Lewisian Gneiss. | Ca. Basal Quartzite (Cambrian). | Cb. Pipe-rock.         |
| Cc. Furoid-beds.    | Cd. Serpulite-grit.             | Ce I. Ghrudaidh group. |
| M. Eastern Schists. | F. Intrusive Igneous Rocks.     | T. Thrusts.            |
| T'. Moine-thrust.   | t. Minor thrusts.               |                        |

(Figure 30) Section from the North-East Side of Beinn Uidhe to Loch an Urchoill. A. Lewisian Gneiss. Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Furoid-beds. Cd. Serpulite-grit. Ce I. Ghrudaidh group. M. Eastern Schists. F. Intrusive Igneous Rocks. T. Thrusts. T'. Moine-thrust. t. Minor thrusts.