
Chapter 36 The structure of the ground between Elphin and Strath na Sheallag

The first five paragraphs of this chapter, descriptive of the ground between Elphin and Strath Kanaird, have been supplied by L. W. Hinxman the rest is by the late W. Gunn. The district described is represented in Sheets 92 and 101 of the map of Scotland.

The ground to be described in this and the succeeding chapters differs in a marked degree from that which has been described in the foregoing pages. Owing to the extensive westward overlap of the Moine thrust-plane over all the lower dislocations, the belt of complicated structure has been reduced to a mere narrow stripe. No one, from the natural sections to be seen south of the county boundary between Sutherland and Ross, would suspect the existence of the extraordinary structure which is there concealed under the Eastern schists, but which, owing to extensive denudation, has been laid bare so instructively further north.

In the section shown in (Figure 40) the Lewisian gneiss appears at the western end rising from Loch Skinaskink and soon surmounted unconformably by the Torridon sandstones which form the mass of Cùl Mòr. The summit of that mountain is capped with an outlier of the basal quartzite, and the same member of the Cambrian series forms the eastern slopes. All these rocks retain their original relations to each other in the undisturbed ground. In the well-known Knockan cliff, which rises immediately above the road between the county boundary and Lochan Fasaìdh, the pipe-rock is succeeded by the fucoid-beds, serpulite-grit, and a small portion of the basal limestone, all resting in their natural sequence and dipping south-east at 9°–12°. But no higher strata have here survived in their proper places. The Grudaìdh limestone is abruptly cut off by the Elphin thrust-plane (Figure 39), which brings forward the heaped-up white dolomites of the Eilean Dubh group. These in turn are almost immediately truncated by the micaceous schists and flagstones that lie above the Moine thrust-plane. So great has here become the overlap of this great dislocation that only a few feet of crushed marble are visible between the two thrust-planes. Even this narrow stripe soon disappears, for at the southern end of the crag the Moine thrust-plane has overlapped the Elphin thrust, and the Eastern schists (M) are thus made to rest directly upon the basal limestone. (Plate 38) The angle of inclination of the Moine thrust is 8°–10° in the same direction and very nearly at the same angle as that of the dip of the undisturbed beds below. There seems at first sight to be a regular passage from the Cambrian rocks up into the schists above, and this section was formerly relied upon as furnishing one of the strongest pieces of evidence in favour of such a passage. The deceptive nature of this apparent conformity is, however, soon exposed when the outcrop of the schists is followed to the north and south.

At a point about half a mile east from the Knockan road at the county boundary the Moine thrust-plane is laid bare in the bed of a tributary of Amhainn a' Chnocain, its dip being to the south at angles varying from 10° to 15°. Following the outcrop of the bare plane for half a mile we find the heaped-up masses of Cambrian limestone dipping to the east, each successive bed having been truncated by the thrust. The quartzose flagstones (Moine schists, M) dip S.S.W., south, and S.S.E. away from the plane at low angles. No more striking instance of the complete discordance between the Cambrian strata and the Eastern schists and of the plane along which the displaced materials were driven is to be found in the North-West Highlands. (Sheet 101)

At the south end of Loch Fasaìdh a cross-fault throws the thrust-plane down into a peaty hollow below the road, and when the schists are next seen, in the burn flowing out of Lochan Fada, they are found to have overlapped on to the fucoid-beds, while a little further down the burn they have been brought against the pipe-rock by a normal fault. From this point southwards to Strath Kanaird the schists and flagstones rest on different horizons of the Cambrian series, passing transgressively from basal limestone to fucoid-beds, and from fucoid-beds to limestone.

At the Strath Kanaird fault, by which the Moine thrust, as well as the underlying Cambrian strata, has been shifted up the valley to Achnacairnen, the river has laid bare a small area of Lewisian gneiss in the bottom of the valley beneath the thin capping of mica-schist. The gneiss has no doubt been brought forward upon the same thrust-plane that has borne along the much larger mass of Lewisian rock exposed by denudation nearly a mile further east at Langwell. The Langwell inlier rests upon the piled-up Cambrian beds, but at Achnacairnen these have been overlapped, and the gneiss rests directly upon the undisturbed basal limestone. Additional proof of the further overlap of this thrust and of the thinness of the cake

of schistose rocks towards the outcrop of the thrust-plane, is found in the occurrence of a small lenticular area of gneiss exposed between the serpulite-grit and the thrust-plane at the roadside three-quarters of a mile north of Achendrean.

In the district between Strath Kanaird and Strath na Sheallag the belt of complication presents no marked physical features. In Strath Kanaird south of the river, where its area is increased by normal faults, it is as much as two miles broad, but for the most part less than 200 feet in height above the sea. Between this valley and that of the Ullapool River its width varies from a quarter to half a mile, and its surface rises to heights of 600 or 700 feet. In the valley below Loch Achall it widens out to as much as a mile, but in the intervening ground across to Loch Broom it never exceeds half a mile. On the west side of Loch Broom it stretches for a mile along the shore, and mounts up from sea-level to a height of about 1250 feet. To the east of Dundonnell Lodge it expands in an interesting anticline for more than a mile, but rapidly contracts to the southward until in places it is reduced to a mere narrow stripe, in which only the Moine thrust-plane can be seen. In the ground between the Strathbeg valley and Strath na Sheallag the belt reaches its highest point in this district, attaining there a height of 1500 feet.

The complexity of structure and the number of the thrusts vary considerably in different parts of this district. While, as a rule, the wider the belt the greater is its complication, occasionally, as, for example, due east of Ullapool, more thrust-planes may be observed in a width of about 300 yards than in some of the widest parts. At that place six or seven important thrusts may be counted, although generally there are not more than three. The uppermost of these is the great Moine thrust, which brings on the Eastern schists, and runs continuously through the district. Its plane dips at a less angle than those of the others, which consequently it occasionally overlaps, so as to give rise to the deceptive appearance of a regular transition from the Cambrian strata up into the Moine-schists. The other thrusts cannot be certainly identified from one part of the district to another, seeing that they cannot be traced continuously and that the material brought forward by Any one thrust is not always the same.

The comparatively simple structure which prevails for nearly six miles south from Knockan ceases at Strath Kanaird, where, mainly by the more extensive denudation of the rocks above the Moine thrust-plane, but partly also by several large faults, the belt of complication has been exposed over a width of two miles. Near the hamlet of Achindrean the Torridon Sandstone is overlain in the usual unconformable relation by the lower members of the Cambrian series, which dip to the E.S.E. at an angle of about 15°, and succeed each other in their proper order up to the lowest parts of the calcareous groups. At that part of the succession the Moine thrust-plane abruptly enters and brings in the Eastern schists. Some 350 yards eastwards from the outcrop of the thrust-plane a large fault, ranging N.N.E. and with a westward downthrow of about 400 feet, brings the pipe-rock again to the surface, as may be seen here and there in a few knolls which rise out of the alluvium of the river. The quartzite is succeeded by a portion of the fucoid-beds, which are soon truncated by another north-east fault, also throwing down to the west, so as once more to expose the pipe-rock, fucoid-beds, and serpulite-grit, as well as a much thicker slice of the lower part of the limestone, which may possibly be brought on by a small thrust. Beyond these strata, one of the larger thrusts brings a slice of Lewisian gneiss above the limestone, and a little further east comes the Moine thrust. So little inclined is the plane of this dislocation here that it forms a gentle syncline filled with its characteristic schists, and emerges again at the surface not far to the east. This flat basin has been cut across by a normal N.N.E. fault, which has a displacement of about 150 feet, and shifts the outcrop of the thrust-plane. Owing to the removal of the overlying schists by denudation the same mass of Lewisian gneiss now reappears with three patches of the basal quartzite resting unconformably on its green epidositic surface. It is evident that these rocks were brought forward from a region lying to the east where no Torridon sandstone existed in Cambrian time, having either never been deposited there or having been denuded before the deposition of the quartzite. The Moine thrust-plane above this mass of gneiss was bent into an anticline, probably not a simple one, but with several minor folds, which seem to have also affected the underlying mass.

At the main bend of the stream, nearly a quarter of a mile east of Langwell, an interesting section affords a clear view of the thrust-plane. On the east side of the stream near the waterfall from beneath the flaggy Moine-schists the thrust-plane emerges, dipping eastward at an angle of 4°–5°. Immediately below the "sole" a felted breccia made up of crystalline limestone and a decomposed basic dyke lies immediately on the gneiss. In some parts of the district the number of minor thrusts is considerable, but as they often merge into one another or are overlapped by more important thrusts, sections drawn across adjacent ground but not far apart seldom resemble each other in their details.

While the ground between the Kanaird River and Loch na Maoile presents an almost bewildering succession of thrusts by which every portion of the Cambrian series has been broken up and piled together, the confusion has been increased by the constant repetition of the dislocated masses by normal faults in a north-east and an east and west direction. Some of these dislocations have a vertical throw of 500 or 600 feet. To the north of Loch na Maoile a large triangular patch of limestone, mainly belonging to the Eilean Dubh group, appears at first sight to be comparatively undisturbed, but when closely examined it is found to be one mass of thrusts, for it is studded in places with lenticular bits of various other kinds of rock, serpulite-grit, fucoid-beds, quartzite, and even a fragment of a basic dyke. The heaping-up of material by minor thrusts is well seen on either side of the outlet of Loch na Maoile. For some distance further southwards the complication becomes less, and the belt of complication narrows so much as to be in one place not more than a hundred yards in width. It broadens again to the south of the large west bay of Loch na Maoile, the greater part of its width consisting of thrust and disturbed limestone which has been pushed over the basal quartzite. The sloping surface of this limestone is known as Bad na h-Achlaise. Nearly all these limestone exposures form tracts of green turf, grateful to sheep and pleasing to the eye in a wilderness of rock and heather. The main thrust by which all these Cambrian rocks have been driven forward coincides, for some two or three miles south of the large Strath Kanaird fault, with the upper surface of the serpulite-grit. This position may be seen on the south end of Loch Dubh, the strata not having been moved, and retaining their usual dip of 15° to the E.S.E. Immediately to the east of these rocks thrust pipe-rock may be seen inclined in the same direction at 65°, and, still further east, at 40°. To the west of Loch Ob an Lochain the highly-inclined and thrust pipe-rock is overlain by thrust serpulite-grit and fucoid-beds variously disposed, while above all comes a thrust mass of the limestone sloping down to the loch.

From Loch Dubh Beag southwards for about a mile the ground is covered with drift, so as to conceal the geology, but it is presumed that the main thrust which brings on the quartzite keeps close to the serpulite-grit, as it does in the ground to the north. The position of the Moine thrust is a little more certain, since the schists crop out in a few places. In Strath Mor, near the sources of the Allatyrne Burn, two large normal north-east faults crossing nearly at right angles repeat certain of the strata, which are thus repeated no less than four times. The structure of this interesting ground is represented in the section given in (Figure 41).

At the west end the pipe-rock (Cb) with its usual dip is succeeded in regular order by the fucoid-beds (Cc) and the serpulite-grit. The further continuous sequence of the series is interrupted here by the thrust, which brings on the quartzite (Ca). A north-east fault (f) soon brings on the fucoid-beds and serpulite-grit again, now surmounted by a considerable thickness of limestone (Ce), above which lies the thrust quartzite (Ca). The thrust-plane on which this quartzite reposes dips at so low an angle that it soon overlaps the limestone, as shown by the dotted lines in (Figure 41). Where this thrust next comes to the surface it is overlain by Torridon Sandstone. In the intervening area the quartzite must rest unconformably on the sandstone, as indicated in the section. Above these rocks comes the Moine thrust (T■) with its accompanying schists, which are soon truncated by a fault that trends to the south-east, and has a down-throw to the north-east of about 300 feet. This dislocation has given rise to a striking topographical feature, the elevated limestone and Torridon Sandstone forming a low crag on the south side of the dale, while the Moine-schists on the north lie on a lower plane. On the south side of the fault thrust Torridon Sandstone appears at the surface, but is quickly cut off by another large north-east fault with a downthrow to the north-west of about 400 feet. On the other side of this dislocation the upper part of the pipe-rock (Cb) is seen at the surface. Continuing on our line of section, the fucoid-beds (Cc), serpulite-grit (Cd), and limestone (Ce), with their usual E.S.E. dip, successively appear until cut off by the thrust, which here, as between the two faults, has carried forward the Torridon Sandstone (B). Not far to the south-east comes the Moine thrust (T■), together with the crystalline flaggy micaceous Eastern schists (M).

The area of thrust Torridon Sandstone here referred to broadens out eastward, so as to cover a considerable area. The inclination of its strata is eastward, generally at high angles. The southern edge of this sandstone mass is very complicated, the thrust-plane having been bent, folded, and faulted in a variety of ways, while the rocks revealed beneath it, which have been brought forward on a great sole, consist of a mixed assemblage of Cambrian strata of all kinds in which it is not easy to make out any definite arrangement. To the west in the unmoved ground the succession is perfectly normal up to the serpulite-grit, but above that horizon all is confusion. First comes a narrow-strip of limestone some 150 yards in length, with a strip of fucoid-beds. which has been driven over it. Further east for more than a hundred yards the rock appears to be chiefly thrust limestone, but with slices of fucoid-beds, serpulite-grit, and quartzite. To the north of this

disturbed ground the thrust Torridon Sandstone forms a feature which is conspicuous from the south side of the river. An exceptionally clear section of the thrust-plane may be seen nearly 200 yards north of the prominent crag called Creag nam Broc, and almost due west of Glastullich. It dips N.N.E. at an angle of 45° over the limestone. A little further east the thrust-plane again appears, dipping 35° east of north at angles of 40° – 45° . The area of Torridon Sandstone accompanied by Lewisian gneiss bounds this complicated tract on the east and south, the plane of thrust here dipping S.S.E. at 50° – 60° . In one place it overlaps all the minor thrusts, so that for some 30 yards or so the gneiss comes in contact with the serpulite-grit. The thrust again trends eastwards, and in tracing its course we soon arrive at the finest section of all, where, in the Creag nam Broc, the Torridon Sandstone lies immediately over the limestone. The plane of thrust here dips northward at an angle of 12° over the limestone, while the thrust sandstone rises above it in an overhanging cliff, so that it can be examined under the most favourable circumstances. To the east of this section the rocks above the thrust-plane have been removed by denudation, so as to lay bare the underlying limestone over a considerable area. The structure of this portion of the district is illustrated by (Figure 42).

This section, beginning on the west near the small burn called Allt Glac an't Seilich, runs in a direction east by south towards the outlet of Loch Achall. The pipe-rock (Cb) is here succeeded in regular order and with the usual dip to E.S.E. by the fucoid beds and serpulite-grit (Cc and Cd). These strata are overlain by the thrust-plane, on which in the triangular area, above referred to, the limestone and other rocks have been thrust together in great confusion. Next comes a smaller thrust bringing in a slice of the pipe-rock, and then one of the larger thrusts, which has carried forward a portion of the Lewisian gneiss (A). A small fault (f) here throws down all these rocks to the east. On its further side the thrust-plane, as well as the rocks resting on it, has been bent into a synclinal fold, in which the Torridon Sandstone (B) lies unconformably on the gneiss (A). This thrust, whereby the gneiss has been driven forward, must overlap the lower thrust, which has pushed the quartzite over the limestone. The latter member of the Cambrian series is here apparently of great thickness, with a south-easterly dip of 40° to 50° . Though the strata have probably been repeated by minor thrusts, they show no trace of the folding that has affected the overlying thrust-planes. These planes before their denudation must have arched over the limestone somewhat in the manner represented by the dotted lines in the section. On the east side of the anticline the quartzite lying on its thrust-plane is overlain in turn by the higher dislocation, which once more brings in view the gneiss with its covering of unconformable Torridon Sandstone. Owing to a small normal north-easterly fault the gneiss again appears at the surface until further east it passes finally under the Torridon Sandstone (Bb). Some patches of the basal quartzite (Ca) which have survived on the surface of the sandstone not only illustrate the double unconformability of the Torridon series on the Lewisian gneiss and of the Cambrian quartzite on the Torridonian Sandstone, but indicate that the latter rock has been driven forward from some now concealed eastern area where its thickness is not great. The thrust rocks of Strath Kanaird prove that no Torridon Sandstone existed at that place in Cambrian time, for the quartzite rests there immediately on the Lewisian gneiss. Beyond some obscure ground the section reaches the Moine thrust and enters the region of the Eastern schists (M).

The section represented in (Figure 43) runs parallel to that in (Figure 42) at a distance to the south of rather more than a quarter of a mile. It starts in the basal quartzite at the level of Loch Broom, about 100 yards south of the marked bend in the road that occurs half a mile south-east of the Royal Hotel. The basal quartzite, pipe-rock, fucoid-beds, and serpulite-grit lie here on the Torridon Sandstone quite undisturbed, and allowing the usual dip to the E.S.E. of about 15° . Immediately above them, however, a thrust has driven forward a strip of Torridon Sandstone, followed by the quartzite (Ca, Cb) and succeeding members of the Cambrian series, dipping to the east at 30° – 40° . Above the top of the fucoid-beds, however, comes the Lewisian gneiss, though the serpulite-grit (Cd) and limestone (Ce) probably supervene in their proper order underneath the thrust-plane, as represented in the section. The exact place of the Moine thrust cannot here be fixed, as the ground is obscured with drift, but in the higher ground the Eastern schists (M) come on with their usual flaggy character and low easterly dip of 10° – 45° .

A section drawn about a mile further south than the last shows the structure represented in (Figure 44). The Torridon Sandstone, basal quartzite, pipe-rock, and fucoid-beds are here concealed under the waters of the loch. The serpulite-grit, however, is seen, followed by some 15 to 20 feet of a whitish limestone, above which a thick mass of Torridon Sandstone (Bb) has been driven by a thrust, of which the plane dips to the south-east at 25° – 30° . The lower part of the sandstone, which is coarse, has been drawn in out, and is crushed or mylonised, its usual pinkish or brown colour being changed to green. Further east the sandstone is overlain with quartzite (Ca), the line of junction being

possibly a slight thrust. The whole of these thrust rocks have been so disturbed and contorted that it is not easy to estimate their thickness. As in the previous sections, a mass of Lewisian gneiss (A) with patches of Torridon Sandstone resting on it has been driven over the quartzite. In places the plane of the thrust by which this displacement has been produced dips at a gentle angle, while in others it has been thrown into a series of rather sharp folds, so that its outcrop at the surface is very irregular. In several places near the edge of the thrust-plane the normal positions of the Torridon Sandstone and the gneiss are reversed, and the former appears to dip under the latter at a high angle, as on the eastern side of an anticline which bounds the quartzite, where the younger formation dips under the older at angles of 30°–45°. A little to the west of the road the Moine thrust is met with, followed as usual by the schists (M), which it introduces. These schists, dipping eastwards at a gentle angle but occasionally crumpled, are well exposed at the head of the bay of Loch Broom, called Camas an Daimh. They are underlain immediately to the west by a crushed rock, not improbably Torridon Sandstone, and then by the granitoid gneiss, which now comes on in force for a distance of 500 yards along the shore as a massive acid rock that offers a marked contrast in character to the flaggy Moine-schists.

The belt of complication in its southward course now passes under the waters of Loch Broom. On the south-western side of this inlet of the sea it is found considerably to the south, the Moine thrust, for example, being about a mile to the south of its position where last seen on the opposite side. The plane of this thrust crops out opposite to Leckmelm House, and dips to the E.S.E. at 10° over much-altered Torridon Sandstone. It is immediately surmounted by the usual flaggy, grey quartzo- micaceous schists. The outcrop of the thrust-plane trends at first westwards, and then north of west for nearly a mile and a half altogether, rising gradually to over a thousand feet above the sea, and in the western part of its course forms a fine topographical feature. The gentle south-easterly dip of this plane or "sole" exactly coincides in some places with the slope of the ground. Only one other thrust makes its appearance here; it is probably the continuation of that which brings on the Lewisian gneiss and patches of Torridon Sandstone to the east of Corry Point on the opposite side of the loch. On the shore its position is at first hidden by the raised beach of Newton Loggie, but it comes into sight west of the rocky knoll on which stand the ruins of the old Pictish tower called Dun Lagaidh. The plane of this thrust seems for a long distance to keep an even surface at the top of the serpulite-grit, over which comes a mass of Lewisian gneiss, covered with many unconformable patches of Torridon Sandstone. The gneiss continues to be the rock immediately resting on the sole of the thrust as far south as a little beyond Loch Lagaidh. The overlying Torridon Sandstone, much altered and with its bedding generally confused, now comes to lie on the thrust-plane for a quarter of a mile as a band not more than 70 or 80 yards broad. The gneiss soon reappears, however, for a short distance next to the thrust-plane until the sandstone resumes its place between that plane and the much-disturbed Cambrian strata.

The most remarkable feature along this part of the belt of complication is to be observed on the slopes of the great ridge that rises to the east of Dundonnell Lodge, where, as shown on Sheet 92, an anticlinal loop of the thrust rocks strikes eastwards for about a mile, while the main mass of the Torridon Sandstone and of the Cambrian rocks that lie immediately to the westward have been unaffected by this complication. The outcrop of the Moine thrust-plane bends eastward on the north of this fold to return again on the south side, and resume thereafter its usual southerly direction. But this singular disturbance is not confined to the rocks that underlie the thrust-plane. It continues in the crystalline schists, which are found to be vertical or nearly so, right across the whole ridge eastward through Cnoc an Droighinn to the edge of Loch Broom. Not only so, but on the opposite side of the loch high dips also prevail among the Eastern schists on this line of complication for a long way to the east. Although much of the ground is obscured by peat and drift, enough of rock is exposed at the surface to afford a probable clue to the general structure of this portion of the complicated belt. The section in (Figure 45) explains what is believed to be the arrangement of the rocks here. It is drawn from a point on the Ullapool road in a south-easterly direction up the steep slope and across a portion of the plateau above.

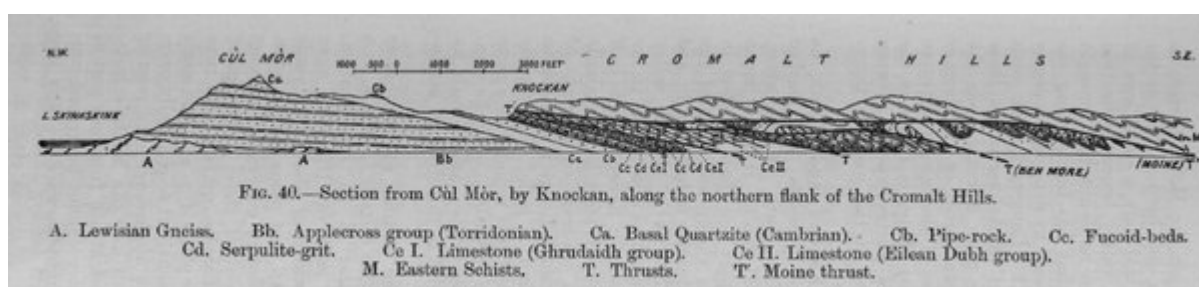
The Torridon Sandstone and the overlying unconformable Cambrian strata are here lying undisturbed in their normal position. Some slight displacements begin to be observable in the fucoid-beds, and the dip of these strata rises to 20° or 30°. Eventually, however, after several minor thrusts and repetitions, the lower part of the limestone (Ce) makes its appearance, only to be immediately truncated by the thrust which brings up the Torridon Sandstone, much crushed and otherwise altered, and to be observable in the fucoid-beds, and the dip of these strata rises to 20° or 30°. Eventually, however, after several minor thrusts and repetitions, the lower part of the limestone (Ce) makes its appearance, only to be immediately truncated by the thrust which brings up the Torridon Sandstone, much crushed and otherwise altered,

and veined with strings of quartz with a core of Lewisian gneiss in its midst. Then follows the great Moine thrust (T1) with its accompanying flaggy schists. Up to this point the section merely repeats the sequence of rocks seen further north. But on the plateau a little further to the south-east the anticlinal fold abruptly makes its appearance. Along the western part of the axis of this fold an almost continuous outcrop of the fucoid-beds can be followed for a distance of about 650 yards. These strata are everywhere vertical, and probably their whole thickness may be represented here on each side of the axis, as the breadth of their double outcrop is in some places nearly 150 feet. About 150 yards to the north-east of the Ordnance station (A 1193) on Creag Chorcurach (Sheet 92) a small exposure of serpulite-grit on the south side of the axis leads to the presumption that this rock overlies the fucoid-beds. A strip of thrust quartzite (Ca) probably runs along both sides of the anticline, flanked by Torridon Sandstone (Rh) as a continuous band connected with the tract to the north and running all round the flanks of the anticline. As the sandstone from its position on the north side of the fold must obviously overlie the quartzite there, it has evidently been brought into that position by a thrust. The quartzite in like manner must have been driven over the serpulite-grit. The "soles" of these several thrusts have been ridged up together with the strata between them, and now appear folded in anticlinal form as if they had been original stratification-planes. Moreover, it is evident that all these rocks have been brought forward on a thrust-plane which has not been affected by the anticlinal folding, seeing that the quartzite and Torridon Sandstone lying to the west have remained undisturbed.

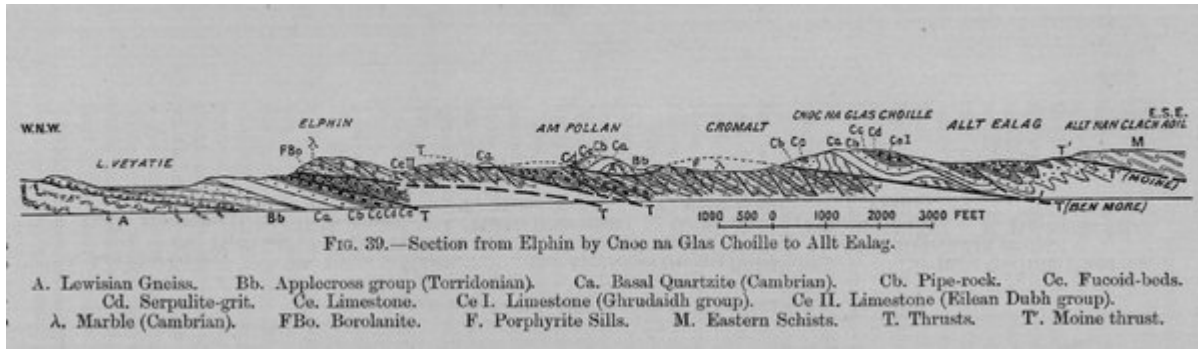
The actual outcrop of the Moine thrust-plane is obscured on both sides of the anticline. On the south side the Torridon Sandstone, here a light-coloured siliceous grit, sometimes a conglomerate, has been rendered so schistose as at first sight to be barely recognisable. Traced further to the south-east it assumes a more and more altered condition until it becomes so like the flaggy Eastern schists near the Moine thrust that the two groups of rock can hardly be distinguished from each other. To the east of the Ordnance station on Creag Chorcurach occasional bands of a coarse gritty schist or crushed gneiss alternate with bands of finer grain like the Moine-schists. Whether or not the whole of this material should be regarded as altered Torridon Sandstone and Lewisian gneiss remains undecided.

Along the course of the belt of complicated structure for a long distance southwards the pipe-rock is not followed by any of the later members of the Cambrian series, but by a thrust-plane on which rests a thick mass of siliceous mylonite, forming the under part of the crop east of Dundonnell House and the ground further south. The next rock visible is the flaggy Moine-schist, but the boundary between it and the underlying mylonite is ill-defined. The two rocks seem to graduate into each other as in other places in the districts to the north. The mylonite may not improbably be composed not only of the crushed and rolled-out members of the Cambrian series and the Torridon Sandstone, but also of crushed crystalline-schist.

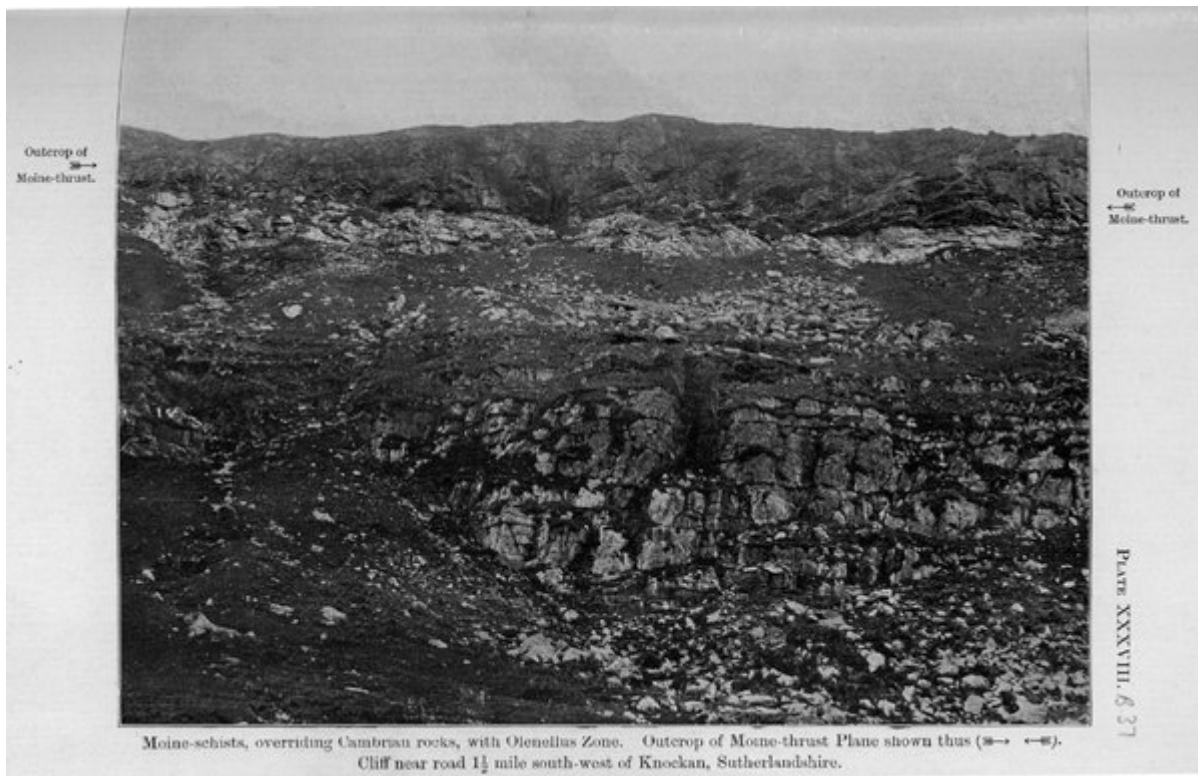
So greatly does the belt of complication contract in width as it goes southward that for some distance there may possibly be no recognisable thrust rock at all at the surface. From an examination of the rocks in Strath Beg alone one could hardly come to any other conclusion than that the Moine-schists overlie the Cambrian rocks conformably as was formerly believed. Rather more than a mile further south the serpulite-grit once more shows itself, with a strip of deformed quartzite thrust between it and the Eastern schists. The tumid-beds likewise make their appearance, but much dislocated and displaced. The whole of the rocks here have been greatly disturbed. They pass under a mass of thrust Torridon Sandstone, which, as usual in this district, has been much deformed by pressure and is full of quartz-veins. This mass is truncated by the Moine thrust-plane, which lies nearly flat or gently undulating, and supports the Eastern schists. As the foliation-planes of these schists are inclined at a considerable angle, they must abut against the sole of the thrust. The foliation-planes certainly coincide here with those of stratification, for they separate bands that distinctly differ from each other in lithological composition.



(Figure 40) Section from Cùl Mòr, by Knockan, along the northern flank of the Cromalt Hills. A. Lewisian Gneiss. Bb. Applecross group (Torridonian). Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce I. Limestone (Ghrudaidh group). Ce II. Limestone (Eilean Dubh group). M. Eastern Schists. T. Thrusts. T'. Moine thrust.



(Figure 39) Section from Elphin by Cnoc na Glas Choille to Allt Ealag. A. Lewisian Gneiss. Bb. Applecross group (Torridonian). Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce. Limestone. Ce I. Limestone (Ghrudaidh group). Ce II. Limestone (Eilean Dubh group). λ. Marble (Cambrian). FBo. Borolanite. F. Porphyrite Sills. M. Eastern Schists. T. Thrusts. T'. Moine thrust.



(Plate 38) Moine-schists overriding Cambrian rocks, with Olenellus zone — outcrop of Moine-thrust shown thus (→ ←); cliff near road 1½ mile south-west of Knockan, Sutherland-shire. B37

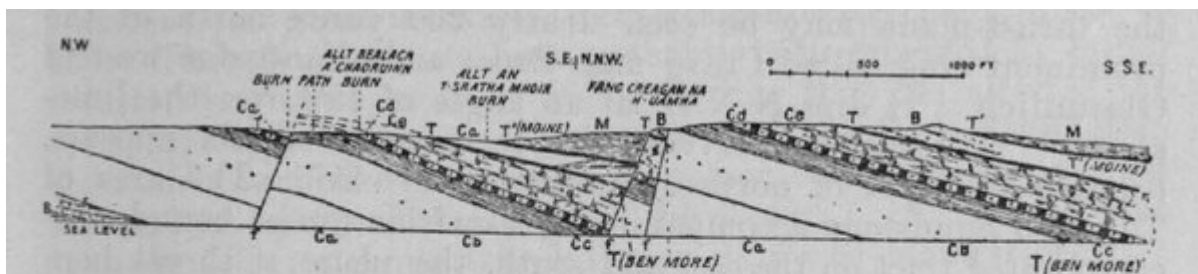


FIG. 41.—Section across upper limit of Allatyrne Burn, two miles north of Ullapool.

B. Torridon Sandstone. Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce. Limestone. M. Eastern Schists. T. Ben More thrust. T'. Moine thrust. f. Faults.

(Figure 41) Section across upper limit of Allatyrne Burn, two miles north of Ullapool. B. Torridon Sandstone. Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce. Limestone. M. Eastern Schists. T. Ben More thrust. T'. Moine thrust. f. Faults.

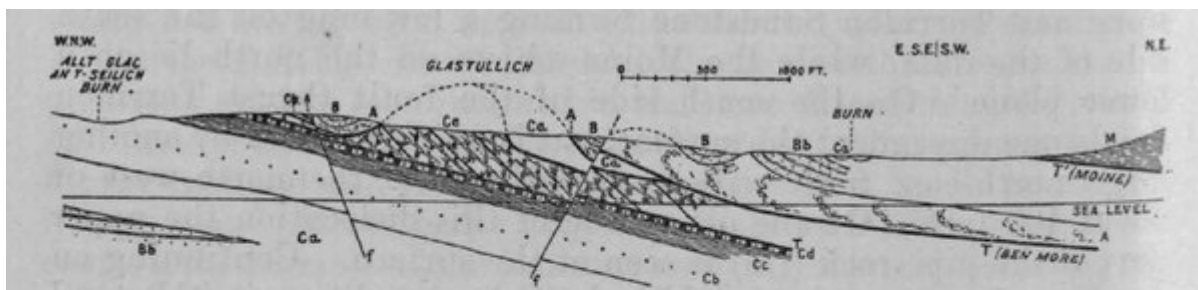


FIG. 42.—Section in Achall Valley, 1½ miles N.N.E of Ullapool.

A. Lewisian Gneiss. B. Torridon Sandstone. Bb. Applecross group (Torrídonian). Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce. Limestone. M. Eastern Schists. T. Thrusts. T'. Moine thrust. f. Faults.

(Figure 42) Section in Achall Valley, 1½ miles N.N.E of Ullapool. A. Lewisian Gneiss. B. Torridon Sandstone. Bb. Applecross group (Torrídonian). Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce. Limestone. M. Eastern Schists. T. Thrusts. T'. Moine thrust. f. Faults.

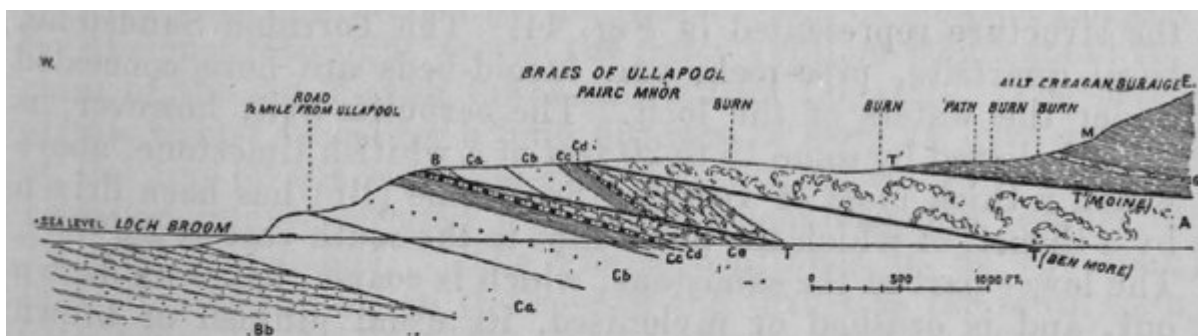
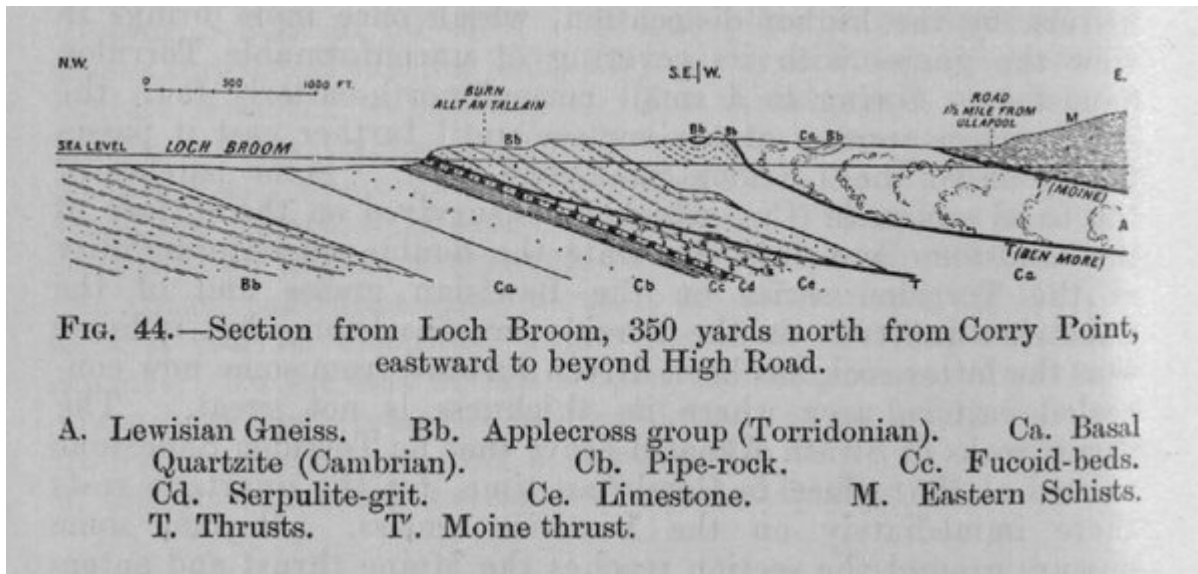


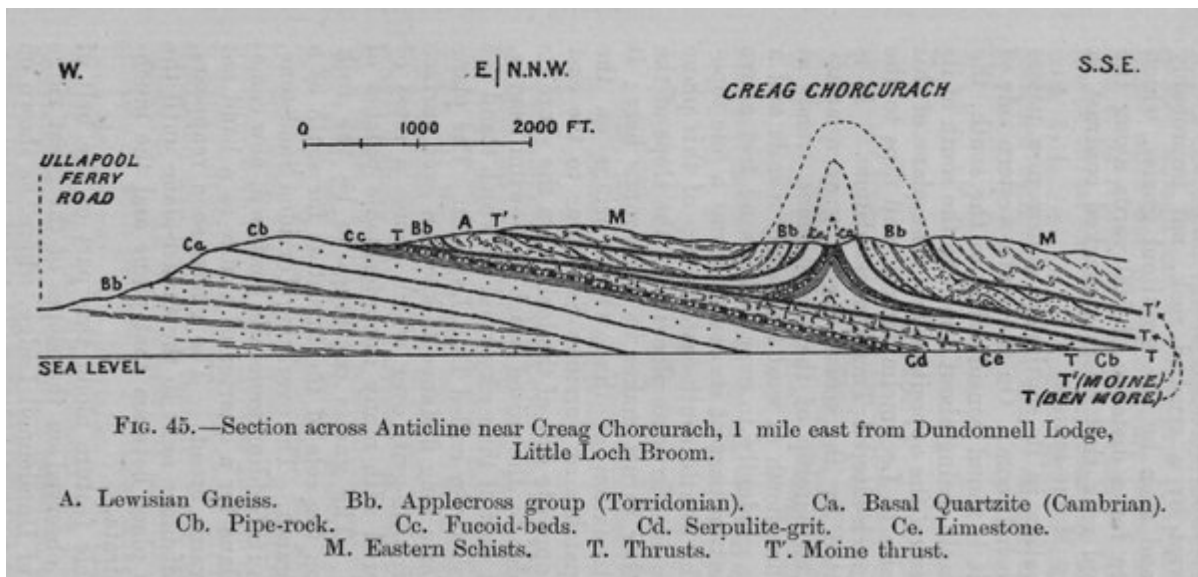
FIG. 43.—Section from Loch Broom across the Braes of Ullapool to Allt Creagan Buraige.

A. Lewisian Gneiss. B. Torridon Sandstone. Bb. Applecross group (Torrídonian). Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce. Limestone. M. Eastern Schists. G. Intrusive Igneous Rock in Moine-schist. T. Thrusts. T'. Moine thrust.

(Figure 43) Section from Loch Broom across the Braes of Unapool to Allt Creagan Buraige. A. Lewisian Gneiss. B. Torridon Sandstone. Bb. Applecross group (Torridonian). Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce. Limestone. M. Eastern Schists. G. Intrusive Igneous Rock in Moine-schist. T. Thrusts. T'. Moine thrust.



(Figure 44) Section from Loch Broom, 350 yards north from Corry Point, eastward to beyond High Road. A. Lewisian Gneiss. Bb. Applecross group (Torridonian). Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce. Limestone. M. Eastern Schists. T. Thrusts. T'. Moine thrust.



(Figure 45) Section across Anticline near Creag Chorcurach, 1 mile east from Dundonnell Lodge, Little Loch Broom. A. Lewisian Gneiss. Bb. Applecross group (Torridonian). Ca. Basal Quartzite (Cambrian). Cb. Pipe-rock. Cc. Fucoïd-beds. Cd. Serpulite-grit. Ce. Limestone. M. Eastern Schist & T. Thrusts. T'. Moine thrust.