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## Chapter 24 The Cambrian strata from Durness and Eireboll to Loch More

By B. N. Peach and J. Horne. The district described in this chapter is comprised in Sheets 107, 108, 113, and 114 Geological Survey Map of Scotland, on the scale of 1 inch to a mile (1:63360).

### 1 Durness Outlier

The Cambrian strata of Durness cover a triangular area about fourteen square miles in extent, of which about nine square miles are occupied by the dolomites and limestones of the Calcareous Series. The apex of this tract lies in Strath Dionard, about nine miles south-west of Durness village, and its base stretches along the north coast from the Kyle to Sangobeag. As shown on Sheet 114, this arrangement is due to powerful faults. Along their eastern margin the beds are completely separated from the members of the Cambrian system at Eireboll, with which they were at one time united, by a north-east and south-west dislocation that brings them in contact with the Lewisian gneiss. On part of their western boundary also they are truncated by a fault that lets down the Basal Quartzites and Pipe-rock zones against the Lewisian gneiss and Torridon Sandstone, while on the north the area is defined by a north-west and south-east dislocation. Thus a double system of normal faults — one set trending northeast, the other north-west — forms a characteristic feature in the structure of the Durness basin.

#### Arenaceous Series

On the west side of the Kyle of Durness, both at Dail and south-west of Keoldale Pier, the double unconformability of the Basal Quartzites on the Gneiss and Torridon Sandstone is clearly displayed. For example, on Meall Sgribhinn, about six miles north-west of Durness village, where there is an important outlier of the lower Quartzite with the basal bands of the Pipe-rock, the Torridon Sandstones dip at gentle angles to the north-west and the overlying Cambrian beds to the E.S.E. Eastwards, near the mouth of the Kyle, at Dail, the red sandstones are overlapped by the quartzites till the latter rest directly on the ancient floor of gneiss. Confirmatory evidence of the transgression of the quartzites is obtained on the hill-slopes between Beinn a' Bhacaidh and Beinn an Amair, south-west of Keoldale Pier (Sheet 114), where a sequence can be traced from the basal breccia of the arenaceous series to Sub-zone 3 of the Pipe-rock, which is visible on the west shore of the Kyle. The higher bands of the latter sub-division occur in the southern part of the basin at Sithean Mòr (four and a half miles south-west of Durness), but they are there much obscured by peat and drift.

In the north-east corner of the area, between Smoo House and Sangobeag, both sub-divisions of the quartzite reappear, bounded by faults on either side.

#### The Middle Series

The Fucoid-beds and *Salterella*-grit are not well exposed in the Durness area, owing partly to the covering of superficial deposits and partly to the interruption of the sections by the waters of the Kyle. Between Sithean Mòr and Drochaidh Mhor, at the mouth of the River Dionard, isolated outcrops of these zones fix their position relatively to the quartzites and overlying limestones. Further north, about half a mile east of Keoldale House, the same zones are again met with in their proper stratigraphical position, but they are abruptly truncated by faults, and the exposures are incomplete.

#### Calcareous Series

The dark leaden-coloured dolomites that overlie in normal order the *Salterella*-grit are well displayed at Rudha' a' Ghrudaidh — a promontory at the head of the Kyle of Durness — from which the lowest group of this series has been named, where they dip to the E.S.E. at 12°. But even here the sequence is not so perfect as that on the east shore of Loch Eireboll, to which attention will be directed in this Chapter. Proceeding from this promontory in a south-east direction to the great fault that bounds the Cambrian basin along its eastern margin, the observer crosses in order the overlying divisions of the Calcareous Series to the Croisaphuill beds (Group vi), which are the highest that come in contact with that dislocation.

By far the best sections for studying the sequence, lithological characters, and palaeontological sub-zones of this series occur in the north part of the basin, by the shore of Balnakiel Bay, and on the low ground southwards to Loch Borrallaidh and east to the village of Durness, where a complete succession of the several members is exposed from the Eilean Dubh beds (Group ii) to the fine-grained dolomites and limestones at the top (Group vii). The general dip of the strata is here towards E.S.E., at angles varying from 15 to 30°, and their outcrops are shifted to some extent by normal faults. Indications of cleavage may be observed at certain localities — as, for instance, on the shore near Balnakiel Bay and north-west of Durness village. At the former place the dip of the bedding is 10°, that of the cleavage 45°; while the strike of the strata is N. 35° E., and that of the cleavage planes north and south.

Of special interest in this part of the Durness basin is the development of the two highly fossiliferous sub-divisions (Groups v. and vi), which, in the field, are readily distinguishable by their lithological characters. The Balnakiel beds (Group v), consisting of alternations of dark and light grey dolomite with some bands of limestone, are visible on the shore for a distance of 400 yards west of Balnakiel Farmhouse, and stretch south by the west side of Loch Croisaphuill, where their outcrops are shifted by a normal fault; but they are continued in the island in Loch Borrallaidh and southwards to the Kyle west of Keoldale. Both on the shore and in various inland exposures the bands are charged with *Maclurea*, *Murchisonia*, *Ophileta*, *Pleurotomaria*, and other fossils. The members of the overlying Croisaphuill group are conspicuously developed on the ridges east of Loch Croisaphuill and of Loch Borrallaidh, where the bands of massive dark-grey dolomites and limestones consist largely of worm-casts that project on the surface. The organic remains most commonly met with in these beds are those of *Maclurea*, especially opercula, *Piloceras*, and *Trocholites*.

Reference ought to be made to the fossiliferous localities in the southern part of the basin where these two groups (v. and vi) are exposed, about four miles S.S.W. of Durness village. A suite of organic remains similar to those found between Loch Borrallaidh and Balnakiel has been collected near an old Pictish tower by Bealach Mor, not far from the great fault that defines the eastern limit of the basin. Though isolated by faulting and denudation, the exposures of these two groups in different parts of the Durness area can be correlated by palaeontological evidence.

The members of the highest sub-division (Group vii), consisting of light-grey dolomites and limestones, with an occasional dark band charged with *Murchisonia*, are overlain in Sangomore Bay, near the village of Durness, by shattery quartzite, striped fissile schist, contorted schists, and gneiss. Though unquestionably resting on the limestone and sharing in the normal faulting of the district, these crystalline strata do not prove a conformable upward succession, as formerly supposed. The key to the reading of this and the corresponding section at Fair-aird Head is to be found in the Eireboll district, and will be described in detail in Part 4., Chapter 33.

East of the great fault in Sango Bay that truncates the Durness basin, the representatives of the Sailmhor and Sangomore groups are again brought to the surface, where their characters may be studied in clear coast sections. The well-known Smoo Cave described by Professor Heddle *Mineralog. Mag.*, vol. iv., pp. 171, 248–251. has been eroded out of the granular dolomites and white limestones of the Sangomore group.

As already stated, the dolomites and limestones of the Durness area are characterised by cherts, which are specially developed on certain horizons. The large spheroidal masses near the base of the Sailmhor group are well displayed on the shore a quarter of a mile east of Eilean Dubh in Balnakiel Bay; the bands at the base of the Sangomore sub-division may be studied in the cliffs of the inlet leading to Smoo Cave. Professor Heddle gives an analysis of the bands of chert in the Sangomore Group from this locality — *Mineralog. Mag.*, vol. iv., p. 250. and the lines of small chert nodules in the Croisaphuill group are exposed on the rocky knolls east of the loch of that name and east of Loch Borrallaidh. Far to the west of the Durness basin, on An Garbh-eilean, Eilean nan Cas-leac, and at Port Odhar, representatives of the Balnakiel and Croisaphuill groups, with their characteristic fossils, are met with, bounded on the south by a powerful north-west and south-east fault. Their probable relation to the crystalline schists of Fair-aird Head will be described in Part 4. Again, on Eilean Hoan, east of Durness village, and about a mile E.N.E. of Smoo, dolomites and limestones, much disturbed by faults, have been correlated with Groups ii., iii., and v. of the Durness sequence.

## 2 Loch Eireboll to Loch More

The Cambrian strata of the Durness basin are separated from those at Loch Eireboll by a prominent ridge of Lewisian gneiss, which, beginning on the shore at Ceannabeinne, extends south by Beinn Spionnaidh, Foinne-Bheinn, and Beinn Arcuil to Loch More.

## The Quartzites

The crest and eastern slope of this ridge are covered by the members of the arenaceous series, which, to the west of the post-Cambrian displacements, have a gentle dip to the E.S.E. Throughout the whole of this tract the basal quartzites rest directly on the Lewisian gneiss, and the peculiar decomposition of the felspar in the rocks of the underlying platform may be studied close to the unconformable junction on the slopes of Beinn Spionnaidh, of Crann Stacach, and by the road between Rispond and Port nan Con.

The best development of the pebbly grit or fine conglomerate at the base of the quartzites in this northern region occurs on a col at a height of about 900 feet, and about one mile south of Meall Meadhonach, west of Loch Eireboll, where bands of coarse pebbly grit and fine conglomerate alternate with gritty quartzite for about ten feet. In the coarser bands the pebbles vary from a quarter of an inch to an inch across, and consist of pink and white quartz, felspar, jasper, altered quartzite, and felsite, among which one small fragment of grey gneiss has been observed. Such a development is, however, quite exceptional, for, as a rule, the conglomeratic or pebbly bed is only about a foot thick.

Outliers of quartzite appear to the west of the main belt, of which, perhaps, the most interesting is to be seen about half a mile W.S.W. of Meall Meadhonach, where a patch of the lower zone with some basal bands of pipe-rock is truncated by a northeast fault — the higher of the two parallel dislocations that throw down the Durness basin. Small detached masses of the basal quartzites, isolated by denudation, appear on the gneiss platform, as, for instance, on Ceann Garbh — one of the peaks of Foinne-Bheinn — at a height of 2952 feet. Again, within the belt of quartzite west of Loch Eireboll, outliers of the lower zones of the pipe-rock rest on the basal quartzites, showing the unequal erosion of the members of the arenaceous series. All the sub-zones of this division have been identified, though not mapped, in the Eireboll region, partly in the undisturbed and partly in the thrust masses. The total thickness of this series in this northern area is between 500 and 600 feet.

Between the head of Loch Eireboll and Loch More a striking feature presented by the quartzites on the eastern slope of the lofty ridge of gneiss is the reduplication of the various zones by the post-Cambrian movements, to which attention will be directed in Part 4. Among these displaced materials, serpulites (*Salterella*) were found in a massive band of quartzite at the top of Sub-zone 3 of the pipe-rock (the sub-division with the trumpet-shaped worm burrows) at Lochan na Faoilege, on the east slope of Beinn Arcuil (Sheet 108, one-inch).

On the east side of Loch Eireboll the quartzites appear among the thrust masses, and have been traced in more or less continuous belts from the northern headland of Mol Mhor, southwest by Ben Heilem and Camas an Duin, to the head of that sea-loch. At various localities in this tract the basal breccia has been found in contact with the upturned floor of Lewisian gneiss, and the sub-zones of the pipe-rock are characteristically developed.

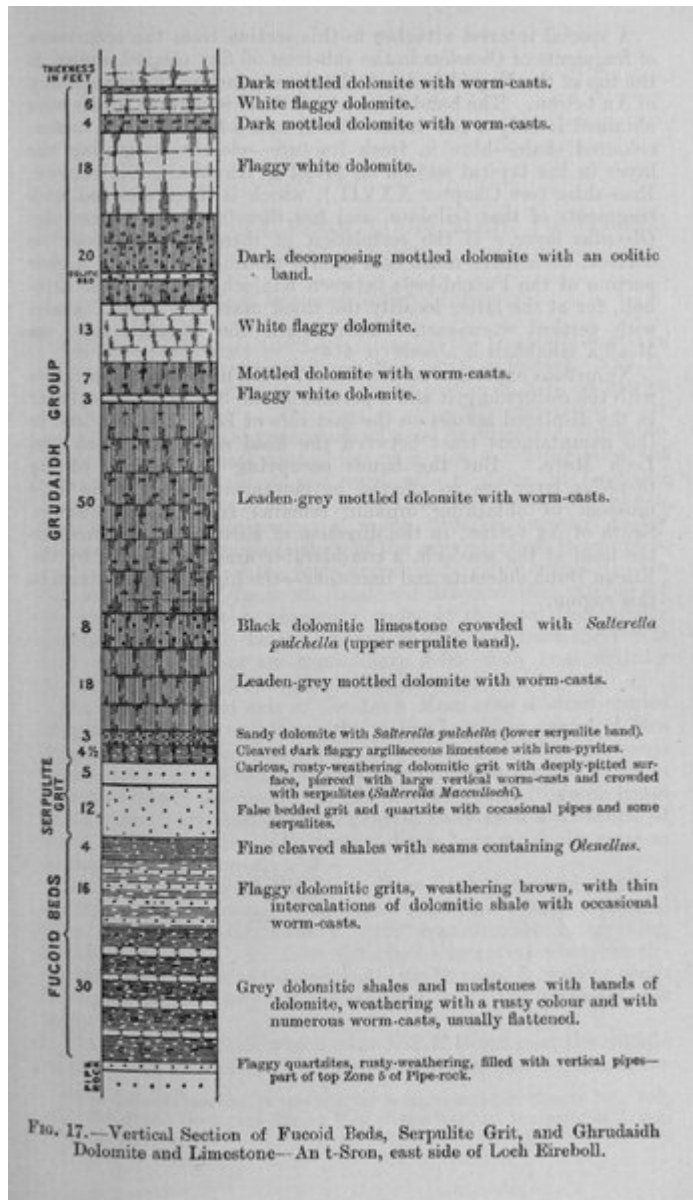
## Fucoid Beds, Salterella Grit, and Limestone

One of the best sections showing the lithological characters and palaeontological sub-zones from the base of the Fucoid-beds to the top of the dolomites and limestones of the Ghrudaidh group occurs on the promontory of An t-Sron, on the east side of Loch Eireboll, about a mile south of Heilem. The structural relations of the strata will be described in the sequel (Part 4., Chapter 33), but the order of succession and thickness of the bands are given in the following vertical section: (Figure 17)

A special interest attaches to this section from the occurrence of fragments of *Olenellus* in the sub-zone of fine cleaved shales at the top of the Fucoid-beds, so clearly exposed on the promontory of An t-Sron. The band from which these important fossils were obtained is only a few inches thick, and consists of soft cream-coloured shale — blue in fresh fracture — closely resembling the layer in the typical section on Meall a' Ghubhais, Kinlochewe, Ross-shire (see Chapter 27), which is there crowded with fragments of that trilobite, and has therefore been termed the *Olenellus* layer. If the

correlation of these two sub-zones be correct, then there must be a lateral modification of the higher portion of the Fucoïd-beds between Kinlochewe and Loch Eireboll, for at the latter locality the thick mass of "piped" shales with vertical worm-casts which overlie the *Olenellus* layer on Meall a' Ghubhais is absent (p. 414).

Numerous exposures of the Fucoïd-beds, usually in association with the *Salterella* grit and a portion of the basal limestone, occur in the displaced masses on the east side of Loch Eireboll and in the mountainous tract between the head of that sea-loch and Loch More. But the bands occupying the horizon of the *Olenellus* layer are so affected by movement that there is little prospect of obtaining organic remains from these outcrops. South of An t-Sron, in the direction of Eireboll House, towards the head of the sea-loch, a considerable area is occupied by the Eilean Dubh dolomite and limestone — the highest sub-division in this region.



(Figure 17) Vertical Section of Fucoïd Beds, Serpulite Grit, and Ghrudaïdh Dolomite and Limestone — An t-Sron, east side of Loch Eireboll.