Rubha Dunan

[NC 018 069]–[NC 030 069]

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Introduction

The headland of Rubha Dunan, near Achiltibuie (Figure 4.1) and (Figure 4.21), is essentially a palaeohill formed of Lewisian gneisses and Stoer Group sandstones that have resisted recent erosion more effectively than the overlying gently dipping sedimentary rocks of the younger Torridon Group. The Stoer Group beds belong to the Clachtoll Formation and dip between 5° and 20° to the WNW The steeply dipping unconformity between the Stoer and Torridon groups, which represents a Precambrian hill-slope, is beautifully exposed in low cliffs on the south side of the headland (Figure 4.22). The overlying Torridon Group beds belong to the Diabaig Formation and consist of red sandstones containing breccia units, succeeded by grey siltstones. The beds dip 20°–25° to the south-east initially but dips decrease away from the unconformity to between 5° and 10°.

The sedimentary rocks above the unconformity were thought to be Triassic when they were first mapped by the Geological Survey in 1888, but Lawson (1965) pointed out that several supposed Triassic conglomerates in north-west Scotland were, in fact, intra-Torridonian.

Palaeomagnetic measurements by Irving and Runcorn (1957) showed a major shift in direction of magnetization between the red sandstones (Stoer Group) forming the headland of Rubha Dunan and the Torridon Group rocks about 200 m to the south-east. This led to the suggestion that the intra-Torridonian conglomerates detected by Lawson overlay a major angular unconformity, corresponding to the magnetic break at Rubha Dunan (Stewart, 1966b). Later palaeomagnetic and stratigraphical studies have confirmed this hypothesis.

Description

Rubha Dunan is a 10–30 m-high grassy and rocky promontory that lies some 1.5 km southwest of Achiltibuie, and the GCR site principally encompasses the 15–20 m-high cliff-section along its southern edge. The lowest Torridonian beds are massive conglomerates of the Stoer Group, composed exclusively of local gneiss debris, which fringe the gneiss palaeohill to the south of Achlochan House at [NC 024 069]. The overlying 70 m are tabular red sandstones exposed along the southern shore of the peninsula (Figure 4.21). These sandstones contain centimetre-sized angular gneiss fragments, and channels up to about 40 cm deep, filled by lateral accretion deposits. In the highest beds exposed, west of the fault at [NC 0225 0674], grain size decreases and bedding surfaces commonly show symmetrical ripples and desiccation cracks. About 300 m ESE from the headland of Rubha Dunan, at [NC 0210 0677], the sequence contains a bed of red siltstone 0.9 m thick, above which the sandstones are finely laminated with an average grain-size of about 0.2 mm and a maximum of 0.5 mm. The millimetre-scale laminations commonly form low-angle cross-beds. Within the laminated sequence are poorly laminated to massive beds, which, however, are of similar grain-size and virtually indistinguishable in thin section. These thicker-bedded units have erosional bases and contain gneiss pebbles up to 3 cm in size. Rarely, small blocks of the laminated facies can be found incorporated in the more-massive beds. A contact between the two sub-facies is particularly well seen in the low cliffs 200 m south-east of the headland at [NC 0199 0678], where the pebbly sandstone is trough cross-bedded. The stratigraphical level here is estimated to be about 50 m beneath the Stac Fada Member of the Bay of Stoer Formation, which crops out on the coast about 1 km to the north. The summit of a gneiss hill forms a small inlier at the headland Rubha Dunan [NC 018 068] where the stratigraphical level is roughly 100 m above the local base of the sequence seen near Achlochan. Hence, palaeo-relief at the time of Stoer Group deposition must have been at least 100 m.

The most spectacular exposures of the breccias at the base of the Torridon Group are found in the eastern part of the Rubha Dunan section. At [NC 0242 0678] the low sea cliff exposes a palaeohill slope dipping at 15°–25° to the west,

formed in sandstone of the Clachtoll Formation (Stoer Group) (Figure 4.22). Tabular- bedded, red sandstones belonging to the Diabaig Formation (Torridon Group), onlap the hill and partially bury it. These overlying sandstones dip 20°–25° to the south and enclose red sandstone blocks up to 4 m across that can be matched petrographically with the nearby Clachtoll Formation sandstones (Figure 4.23). The resultant boulder bed is about 6 m thick and forms a fringe no more than 25 m wide marginal to the basement hill. It is overlain by sandstones and fissile red siltstones that are locally rippled and desiccated. About 20 m stratigraphically above the base of the Torridon Group sequence the red sandstones are succeeded by poorly exposed grey fissile siltstones (Diabaig Formation) with similar dip. The grey siltstones can be matched with those of the same formation exposed farther south along the coast, and elsewhere (see Diabaig GCR site report, this chapter). Thus, the boulder bed described above is Precambrian and not Triassic in age. The steeply dipping unconformity between the Stoer Group and Torridon Group rocks can be traced westwards along the present coastline for about 150 m.

Palaeomagnetic studies by Stewart and Irving (1974) and Torsvik and Sturt (1987) have shown that the unconformity at Rubha Dunan corresponds to a major shift in palaeomagnetic direction, implying that the area drifted from a palaeolatitude of about 10° N in Stoer Group time to 30° or 40° S when the Torridon Group was deposited. Stewart (2002) provides a wider summary and discussion of the existing palaeomagnetic data.

Interpretation

The Rubha Dunan GCR site contains excellent exposures of the unconformity between the Stoer Group and the Lewisian basement, and the younger unconformity between the Stoer Group and the overlying Torridon Group. The south side of the headland of Rubha Dunan offers a splendid section through the Clachtoll Formation, which constitutes the lower part of the Stoer Group. The lowest beds are breccias with clasts derived from local Lewisian gneiss basement, which are interpreted as laid down by alluvial fans in a rift-valley around 1100–1200 Ma. Above the breccias are sandstones and siltstones, representing an alternation of finely laminated wind-blown sands and texturally massive flood deposits.

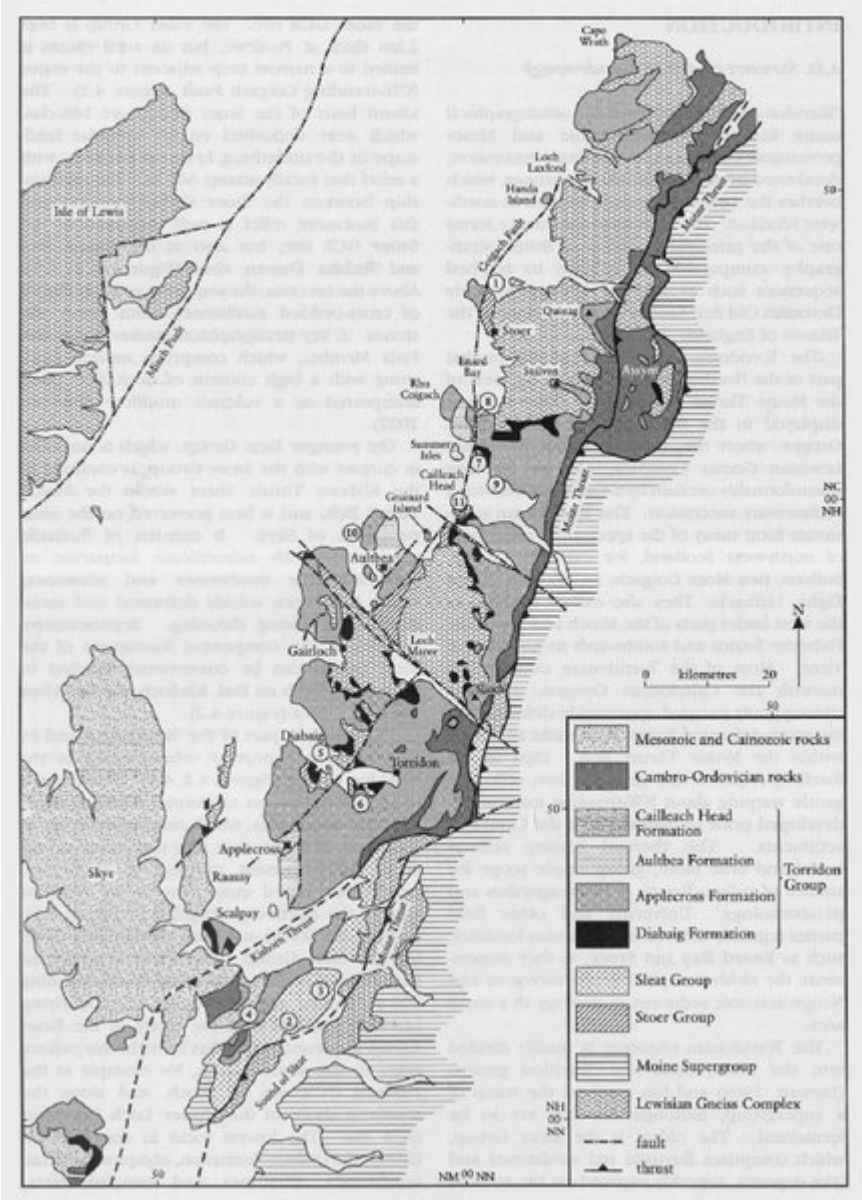
The Stoer Group sediments were lithified, tilted westwards and eroded between *c.* 1150 Ma and 1000 Ma to form the hill-slopes that are exposed around Rubha Dunan. This uplift and erosion may well relate to the Grenville Orogeny whose main effects were focused in eastern Canada (Gower and Krogh, 2002; Stewart, 2002). During the evolution of the rift environment in which the later Torridon Group sediments were initially laid down, sandstone boulders up to 4 m across (Figure 4.22) tumbled down the steep hillside and plunged into shallow lakes where they were gradually covered by wave-rippled sands belonging to the basal Diabaig Formation.

The nature of the sub-Torridon Group unconformity at Rubha Dunan, together with the large shift in palaeomagnetic direction described above, indicates the presence of a significant time-gap between the deposition of the Stoer and Torridon groups. This has been confirmed by recent radiometric dating (Turnbull *et al.,* 1996), which shows that at least 100 million years elapsed between the two periods of deposition. These data suggest that the Stoer Group rocks were deposited around 1150 Ma and Torridon Group rocks around 1000 Ma (see Stewart, 2002).

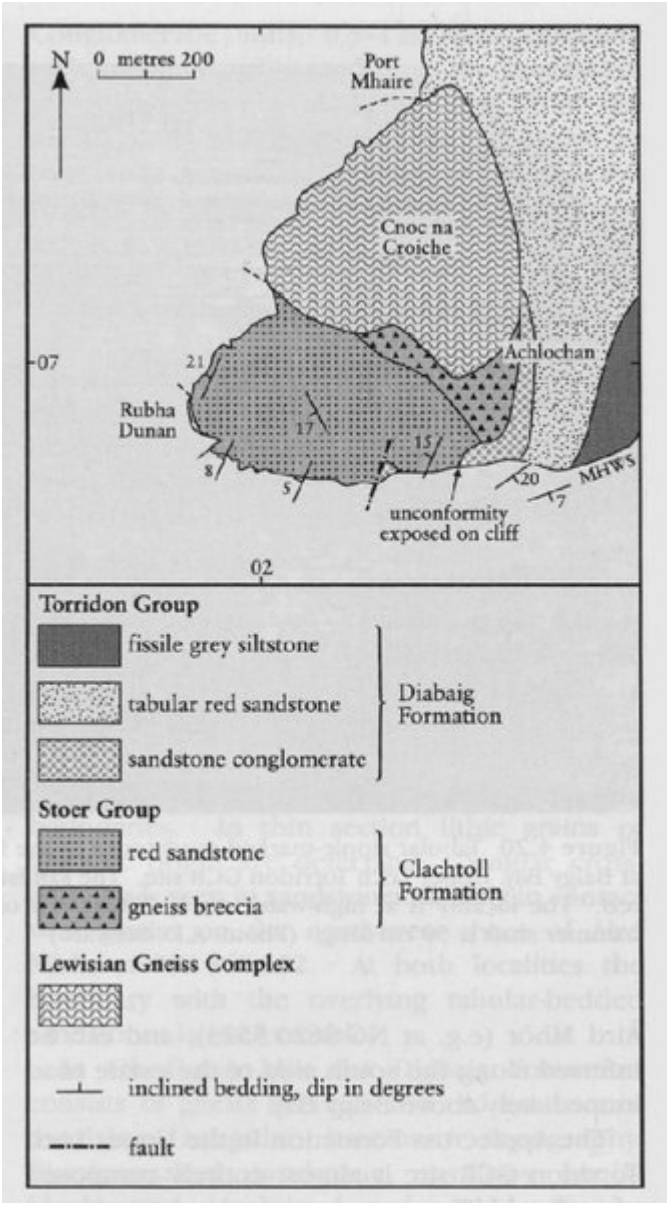
Conclusions

The Rubha Dunan GCR site provides excellent exposures of both sub-Torridonian and intra-Torridonian unconformities. Breccias and overlying sandstones of the Stoer Group, deposited against an ancient hill formed of Lewisian gneisses, are exposed on the south coast of the Rubha Dunan peninsula. The Lewisian gneisses and the gently WNW-dipping Stoer Group rocks are unconformably overlain by later breccias, sandstones and siltstones of the younger Torridon Group that dip gently south-east. The Stoer Group–Torridon Group unconformity is superbly exposed in the south-east part of the site. This site is also of historical interest, for it was here that Irving and Runcorn (1957) first detected a major change in the relict palaeomagnetic direction within the Torridonian succession, later correlated with a major unconformity and time-gap. The Rubha Dunan site is ideal for teaching and further research work and is of national importance.

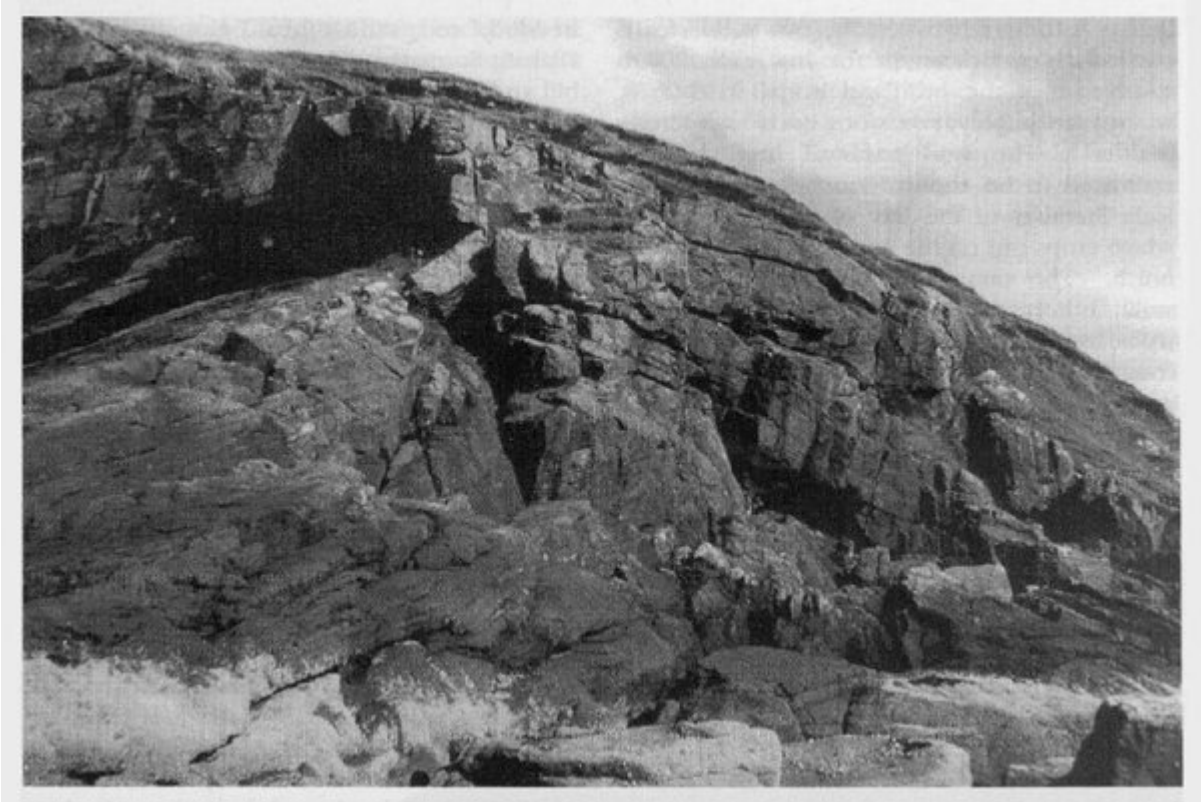
References



(Figure 4.1) Geological map showing the distribution of the main stratigraphical divisions of the Torridonian in north-west Scotland and the location of GCR sites: 1— Stoer; 2 — Loch na Dal; 3 — Kylerhea Glen; 4 — Loch Eishort; 5 — Diabaig; 6 — Upper Loch Torridon; 7 — Rubha Dunan; 8 — Enard Bay; 9 — Achduart; 10 — Aultbea; 11 — Cailleach Head.



(Figure 4.21) Geological map of the Rubha Dunan headland, near Achiltibuie.



(Figure 4.22) The unconformity between the Stoer Group (dipping to the left) and the Torridon Group (dipping right) just above high-water mark on the south side of Rubha Dunan. The cliff section is 15 m high. (Photo: A.D. Stewart.)

(Figure 4.23) Red sandstone block in the Diabaig Formation (basal Torridon Group), derived from the Stoer Group, which forms the hill-slope behind. High-water mark on the south side of Rubha Dunan [NC 0244 0678]. The hammer shaft is 50 cm long. (Photo: A.D. Stewart.)