Beinn Na Leac, Isle of Raasay

[NG 592 389]–[NG 599 380]

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Introduction

The Bearreraig Sandstone Formation crops out extensively in the centre of the southern part of the Isle of Raasay, and forms the high cliffs on the eastern edge of the central part of the island. To the south-east of the main outcrop, a down-faulted outlier forms the upper part of the hill known as 'Beinn na Leac'. The fault that bounds Beinn na Leac is arcuate and can be seen in a small bay [NG 596 381], within the GCR site, from where it can be traced round the 'back' (west) of the hill (Figure 6.47) before reaching the coast again [NG 591 357] (though not exposed) at North Fearns. It appears to be a late listric fault related to glacial overdeepening of the sea east of Raasay, and there is clear evidence, from separated fault-scarp talus (e.g. at [NG 584 364]), of Holocene movement. Evidence of earlier, possibly synsedimentary, movement on a NNE–SSW fault, which could now be part of the Beinn na Leac Fault, is circumstantial.

The thick, often highly calcareous, sandstones of the Bearreraig Sandstone Formation, which form the upper part of Beinn na Leac, rest on thick Toarcian shales. As a result, landslips from the main scarp, and cambering of large blocks are common. The top of Beinn na Leac is also cut by large numbers of deep fissures caused by similar movements. The combination of acid peaty soil on the exposed top of the mountain with alkaline lime-rich soils in sheltered hollows and fissures has resulted in a great variety of micro-environments with varied floras.

The most important part of the Beinn na Leac site for Middle Jurassic stratigraphy is at Gualann na Leac [NG 599 379] on the north-eastern corner (Figure 6.48) and (Figure 6.49). Here, there is an excellent section through a major part of the Bearreraig Sandstone Formation, although it is discontinuous in the shales of the lower part. The base of the formation is seen at outcrop, but the top is missing because of erosion of younger sediments from the top of Beinn na Leac.

Description

The track along the east side of Beinn na Leac gradually ascends the succession from the Scalpa Sandstone Formation (Lower Jurassic, Pliensbachian) at North Fearns to the lower part of the Bearreraig Sandstone Formation at Gualann na Leac. The Scalpa Sandstone Formation forms the sea-cliffs below the track and the main part of the Bearreraig Sandstone Formation forms the rampart of high cliffs. The slopes between mark the position of the Toarcian shales and ironstone, including the Dun Caan Shale Member of the Bearreraig Sandstone Formation. However, there are few outcrops of this part of the succession, which is mostly covered by scree and landslipped material from the cliffs.

Below the bend in the track at Gualann na Leac, just south of the line of the Beinn na Leac Fault (Figure 6.47), the succession from the upper part of the Scalpa Sandstone Formation to the Bearreraig Sandstone Formation is exposed (Figure 6.48). The boundary between the Bearreraig Sandstone Formation and the Raasay Ironstone Formation (Toarcian) is abrupt and represents a hiatus with much of the Toarcian succession missing. The lowest 10 m of the Dun Caan Shale Member are well exposed and comprise very sparsely fossiliferous shales with a thin limestone near the base. Higher beds are rarely exposed until above the track where small discontinuous outcrops of micaceous shales with the ammonite *Pleydellia* occur. The shales pass up into a series of alternating silty shales and thinner calcareous siltstones or silty limestones. The first thin limestone bed is taken as the base of the Beinn na Leac Sandstone Member, of which this is the type section with a total thickness of 20.76 m. The basal limestone bed contains the ammonite *Leioceras.*

The lowest 9.17 m of the Beinn na Leac Sandstone Member consists of poorly fossiliferous alternating beds of soft silty sandstones and harder, more calcareous, silty sandstones. Rare *Leioceras* occur. The succession gradually becomes slightly coarser and more calcareous upwards, passing into alternating thinner beds of soft argillaceous sandstones and

thicker calcareous silty sandstones and sandy limestones 5.49 m thick. These form a series of ledges on a steep but accessible slope at the foot of the cliff. Fossils become more common but tend to be concentrated in patches; they include species of *Leioceras, Ludwigia* and *Graphoceras* in different layers ((Figure 6.48); Morton, 1965; Morton and Hudson, 1995), with belemnites and bivalves. The top 6.10 m of the Beinn na Leac Sandstone Member consist of thickly bedded, calcareous sandstones with thin silty partings, which form the lowest part of the vertical cliff. The outcrop is mostly inaccessible, but *Hyperlioceras* occurs in the lowest part of this unit.

The main part of the cliff at Gualann na Leac consists of cross-bedded sandstones and sandy limestones of the Raasay Sandstone Member, varying in colour from white or pale-grey to yellow and occasionally red. This unit forms the top of Beinn na Leac and the rampart of cliffs southwards, with an incomplete thickness of at least 140 m. The Raasay Sandstone Member consists of mixtures, in variable quantities, of shell-sand (derived mainly from bivalves, crinoids and bryozoans) and medium to coarse quartz-sand. Shell material is mostly comminuted and no longer identifiable, but one ammonite (*Witchellia* aff *sutneri* (Branco)) was found at Gualann na Leac, 43 m above the base of the Raasay Sandstone Member. The sediments are thinly to very thinly bedded with cross-bedded units mostly 0.15–1 m thick, which are planar or subplanar. Some larger scale units occur higher in the Raasay Sandstone Member, and locally some trough cross-bedding is developed. The cross-bedding, corrected for regional tilt, dips consistently towards NNE to north-east (Morton, 1983a).

Interpretation

The Dun Caan Shale Member at Gualann na Leac probably belongs entirely to the Aalensis Subzone of the Upper Toarcian Levesquei Zone. Evidence for this in the lower beds is limited at Gualann na Leac, but is supported at other localities on the Isle of Raasay (Lee, 1920; Morton, 1965). The top of the Dun Caan Shale Member is defined at the change to the slightly coarser and more calcareous lithologies of the Beinn na Leac Sandstone Member. This is older at this locality (base of Opalinum Zone) than at Bearreraig Bay (see GCR site report, this volume), where the similar upward change to the Ollach Sandstone Member is placed at the base of the Murchisonae Zone. The Dun Caan Shale Member is exceptionally thick (38 m) on Beinn na Leac compared with only 9 m at the opencast ironstone mine [NG 569 365], 3 km to the west, and at the Inverarish Burn [NG 570 371] sections (Morton, 1965; Morton and Hudson, 1995), and *c.* 10 m in a section south-east of Loch na Mna [NG 584 382], 1.4 km to the west. These sections lie on the other side of the Beinn na Leac Fault, and it is possible that this fault may have been active during sedimentation.

The upwards coarsening from the Dun Caan Shale Member into the Beinn na Leac Sandstone Member on Beinn na Leac differs from that seen between the Dun Caan Shale Member and the Ollach Sandstone Member at Bearreraig Bay (see GCR site report, this volume) in three ways: firstly, the coarsening begins earlier (Opalinum Zone compared with Murchisonae Zone); secondly, the coarsening is less marked, with silty, fine-grained, calcareous sandstones or sandy limestones, but no massive sandstone; and thirdly, there is only one coarsening-up cycle through the Aalenian and into the Lower Bajocian succession, both of which are much thinner than at Bearreraig Bay. The sediments were deposited in a marine shelf below wave base, with extensive bioturbation but no evidence of current activity, on a sea floor that appears to have been firmer than at Bearreraig Bay. These differences between Beinn na Leac and Bearreraig Bay are symptomatic of the great lateral variation in thickness and facies of the Bearreraig Sandstone Formation.

The Raasay Sandstone Member, which forms the main part of the Aalenian–Bajocian succession on the Isle of Raasay, is typical of the cross-bedded facies of the Bearreraig Sandstone Formation. This facies, interpreted as the result of deposition in tidal sand waves (Morton, 1983a), spread diachronously northwards from southern Strathaird to south-eastern Raasay, then to western Raasay and southern Trotternish. At Gualann na Leac, the change from the normally bedded facies of the Beinn na Leac Sandstone Member to the cross-bedded facies of the Raasay Sandstone Member can be assigned, by means of ammonites, to between the Discites and Ovalis zones.

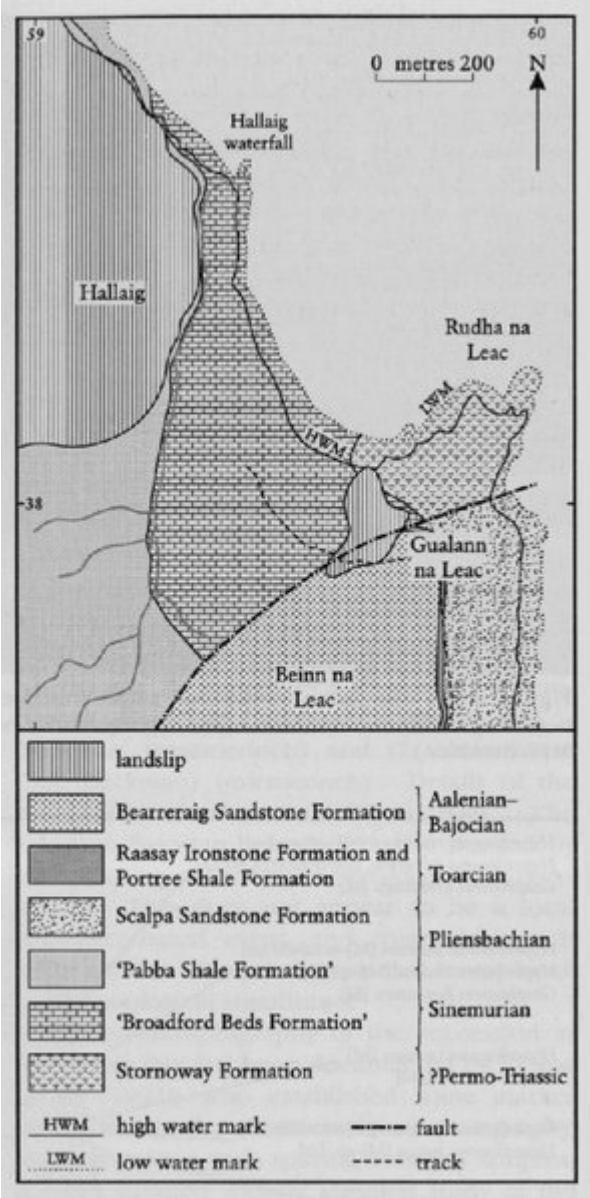
The cross-bedded facies of the Bearreraig Sandstone Formation consists of medium- to coarse-grained, quartz-rich, terrigenous sand that has been redistributed by strong tidal currents and mixed with autochthonous shell material. The tidal current directions are along the length of the Hebrides Basin, and the consistent NNE to north-east directions seen on Beinn na Leac are parallel to the Screapadal and Applecross Faults. These are interpreted (Morton, 1983a) as having

been sufficiently active during deposition to influence sea-floor topography and control tidal current directions. The Beinn na Leac Fault has, for part of its length, a similar trend and, as during deposition of the Dun Caan Shale Member, may have been active during sedimentation.

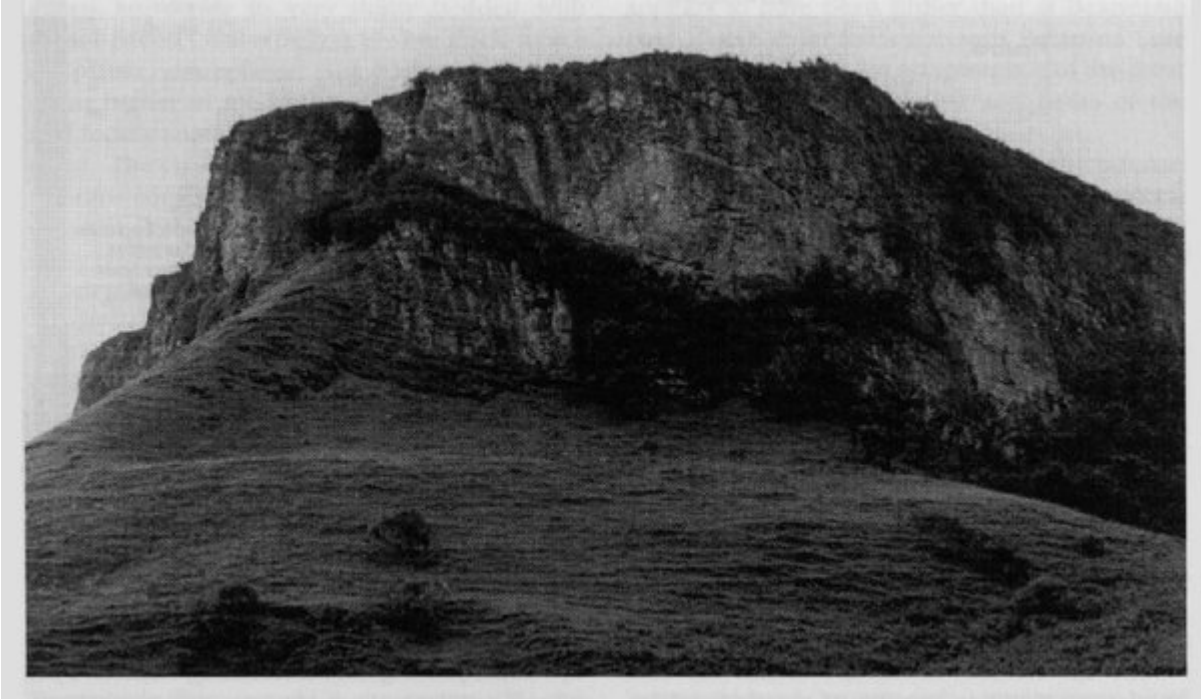
Conclusions

The importance of the Beinn na Leac GCR site lies in the fact that it enables clear documentation of some of the lateral changes in the stratigraphy of the Bearreraig Sandstone Formation in this part of the Hebrides Basin. The succession of ammonite faunas does not provide a refer ence section for Aalenian–Bajocian biostratigraphy, but it enables most parts of the succession and, in particular, important facies changes to be dated and correlated with other localities. The most important features of the succession on Beinn na Leac are the thickening of the Dun Caan Shale Member in comparison with other localities on the Isle of Raasay; a single coarsening-up sequence in the Aalenian-Lower Bajocian succession and different facies development compared with Bearreraig Bay (see GCR site report, this volume); and ammonites that show that the change to cross-bedded facies occurs within the Discites and Ovalis zones, thereby calibrating one point in the diachronous spread of the cross-bedded facies of the Bearreraig Sandstone Formation. The section also shows the Toarcian–Aalenian and Aalenian–Bajocian stage boundaries.

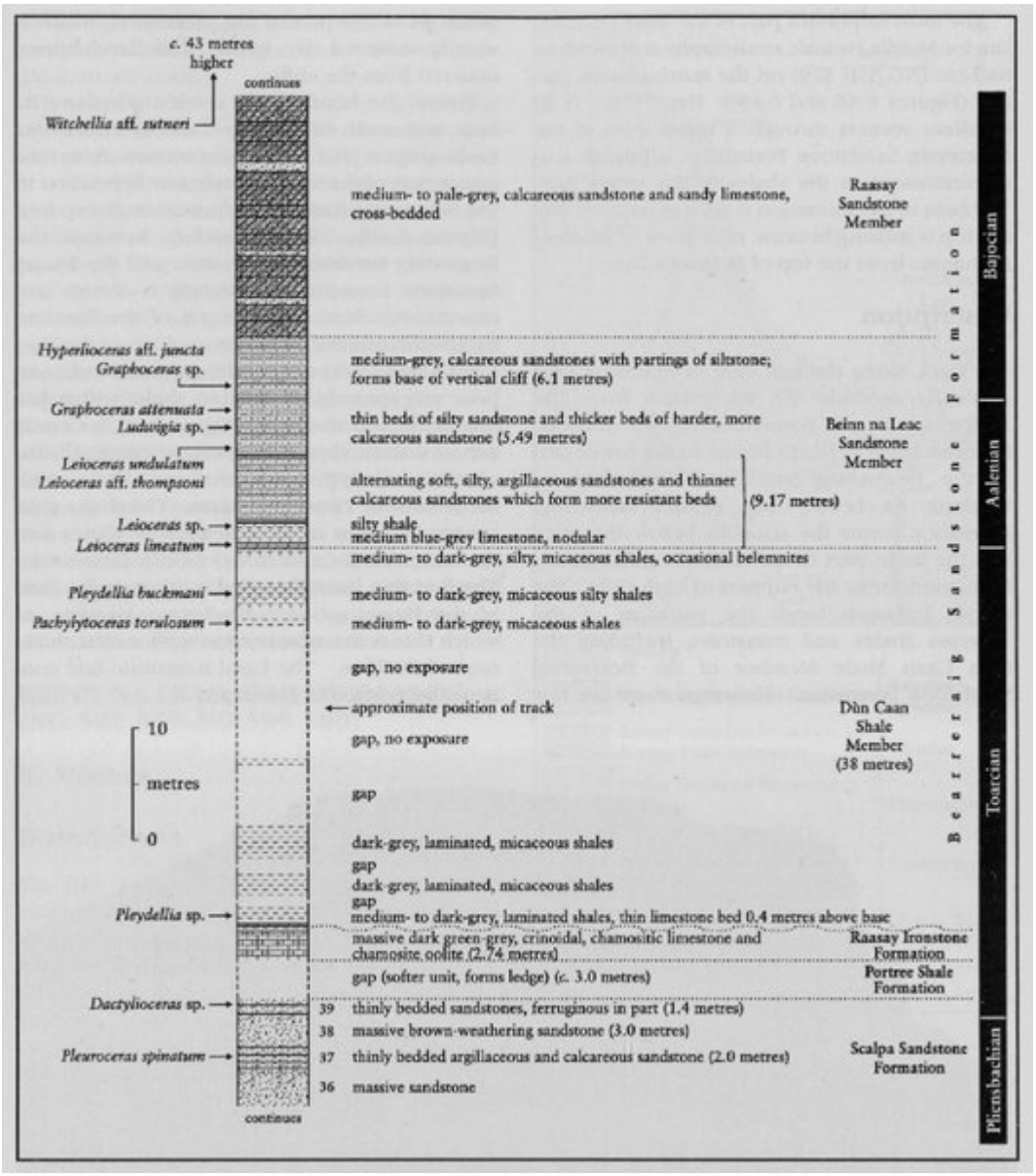
References



(Figure 6.47) Geological map of the northern part of Beinn na Leac, Rudha na Leac and Hallaig, Isle of Raasay (Quaternary sediments and minor intrusions omitted). (After Morton and Hudson, 1995, fig. 9.))



(Figure 6.48) Gualann an Leac (northern face of Beinn na Leac). The grassy slopes in the lower left are the Dun Caan Shale Member above which, left of centre, are the steeper slopes, with ledges sloping down to right, formed by the Beinn na Leac Sandstone Member. The upper part of this member forms the lower third of the lower cliff, while the upper part of the lower cliff and the high cliffs behind are composed of the Raasay Sandstone Member. (Photo: N. Morton.))



(Figure 6.49) Succession from the top of the Scalpa Sandstone Formation (Lower Jurassic, Upper Pliensbachian) to the lower part of the Bearreraig Sandstone Formation (uppermost Toarcian, Aalenian and Lower Bajocian) at Gualann na Leac. (After Morton and Hudson, 1995, fig. 14.))