
Dirlot Castle

[ND 123 484]–[ND 130 488]

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Introduction

Dirlot Castle in Caithness lies close to the western margin of the former Orcadian Basin, represented by a major sequence of Middle Devonian lacustrine and fluvial sedimentary rocks up to 6 km in thickness. At the GCR site small inliers of metamorphic basement rocks attributed to the Moine succession, cut by granitic veins, protrude through the Devonian Old Red Sandstone strata. This allows a glimpse of the rocks underlying the Orcadian Basin, and illustrates the nature of the unconformable contact at the base of the dominantly lacustrine sequence. The significance of the locality is long established. It was visited by Sir Roderick Murchison following the suggestion of the Caithness geologist Robert Dick (Murchison, 1859), and was subsequently described in detail by Crampton and Carruthers (1914), who interpreted it as representing an island within the Orcadian lake. More recently, the Dirlot Castle locality has been interpreted as representative of the marginal facies of a lacustrine system. Donovan (1973) and Parnell (1983) have described algal stromatolites and duricrusts from the site.

Description

At Dirlot, about 20 km WSW of Thurso, two inliers of basement rocks are exposed in the gorge and banks of the River Thurso (Trewin and Hurst, 1994). The main outcrop is at Dirlot Castle, with a further smaller exposure a few hundred metres to the north-east (Figure 6.33). Murchison (1859) described these rocks as a 'boss of flag-like gneiss', and Crampton and Carruthers (1914) described grey-coloured gneisses aligned at high angles, intruded by numerous granitic veins. These early workers correlated the basement rocks at Dirlot with the metamorphic Moine rocks of the North-west Highlands.

The metamorphic rocks are best exposed in the river cutting immediately below the castle and churchyard (Figure 6.33). Here, interlayered gneissose semipelite, micaceous (biotite-rich) psammite and subsidiary feldspathic quartzite are steeply dipping and deformed by open folds with subhorizontal NW–SE-trending axes. Quartz segregations parallel to the gneissosity are common. The rocks are intruded by numerous, unfoliated, medium- to coarse-grained granite and aplitic microgranite veins. The granite is highly reddened, the colouration increasing with weathering towards the contact with the overlying sedimentary rocks. In thin section, the feldspars are largely altered to fine-grained white mica (sericite), and the biotite is highly chloritized.

The basement rocks are overlain by a breccia conglomerate up to 60 cm thick, composed of pebble- to cobble-size clasts of the underlying Moine and granitic lithologies. The unconformity surface is irregular, with a shallow easterly dip that steepens to the east. The clast lithologies and their angular and unsorted nature suggest a locally derived scree-like deposit (Donovan, 1973). Occasional rounded pebbles indicate an additional source of more actively worked sedimentary material.

The breccia is cemented by carbonate, which in places takes the form of algal stromatolites. The stromatolites occur as clast coatings of concentrically layered rusty-brown ferroan dolomicrite, with minor calcite spar infilling irregular cavities. Individual stromatolite colonies are hemispheroids 5–15 mm across that are typically linked to form an irregular mat. Stromatolite coatings are perhaps best developed on the largest clasts, where they reach up to 8 cm in thickness. Fissures up to 2 m deep are seen in the basement rocks that contain stromatolitic encrustations. Sparse flakes of stromatolite are present in the breccia.

The breccia passes rapidly upwards into purplish and grey siliceous and micaceous thin-bedded alluvial sandstones in which stromatolites are absent. The sandstones are overlain by typical dark-grey 'flaggy' siltstones of the Orcadian

Middle Devonian lacustrine succession, which are well exposed in the upper parts of the river gorge at the Dirlot Castle site.

Interpretation

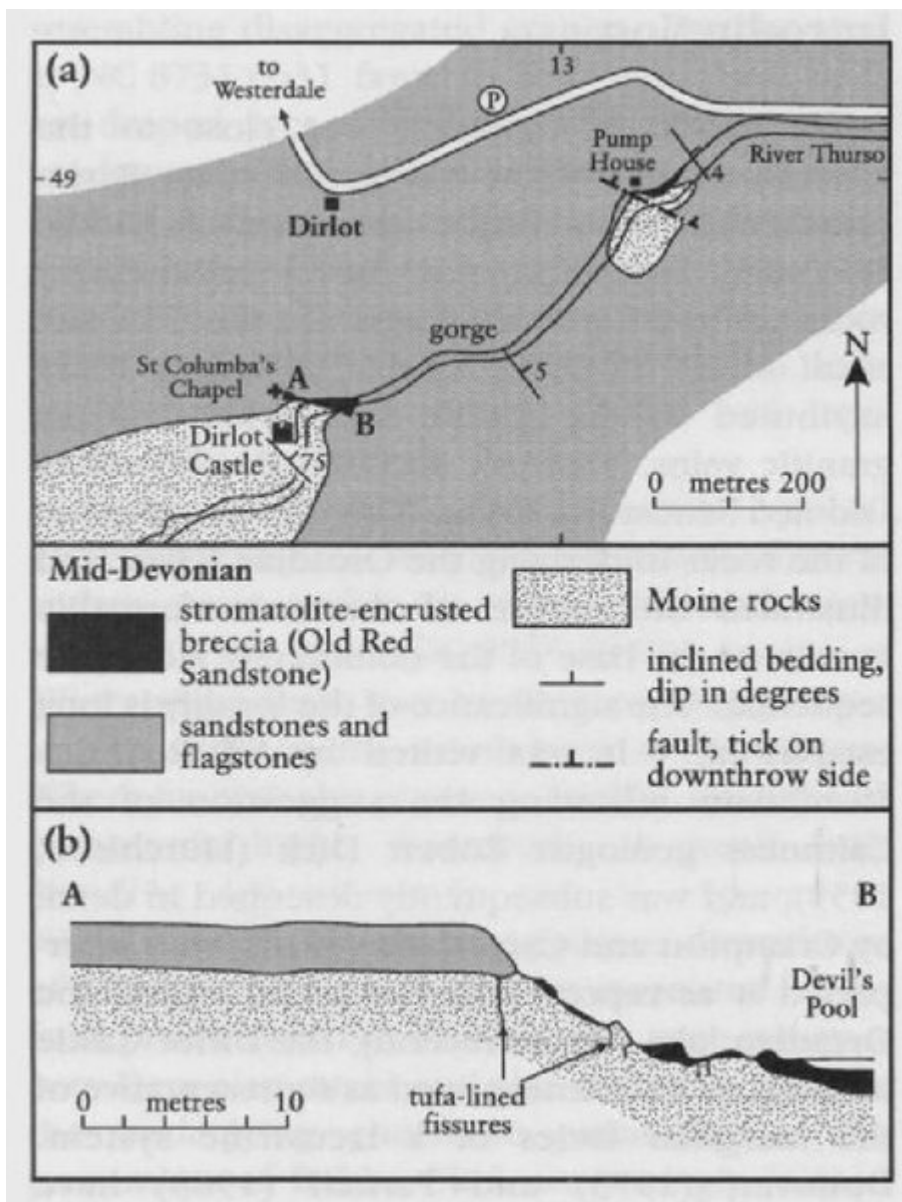
The rocks at Dirlot Castle represent a local basement high within the Mid-Devonian Orcadian lacustrine basin. These would probably have been small islands within the Orcadian lake, developed close to its margins. Mid-Devonian lacustrine breccias and sandstones unconformably overlie metamorphic and igneous basement lithologies typical of the Moine assemblage of east Sutherland. The basement rocks are similar to the rocks exposed in Strath Halladale some 20 km to the west. The outcrop of basement rocks implies that Moine lithologies extend from the western edge of the Orcadian Basin continuously eastwards under the Lower and Middle Old Red Sandstone sequences at least as far as Dirlot Castle, a distance of some 10 km.

The relationship between the crystalline basement rocks and the overlying sediments provides an insight into the sedimentary processes that occurred at the lake margins. The sharp relief, angularity and local derivation of clasts, and preservation of detrital stromatolite flakes in the breccia deposits all indicate a relatively low-energy environment. The presence of stromatolites suggests warm shallow-water conditions, with the minor fragmentation caused by relatively low-energy wave action or periodic dessication. The thicker coatings on the larger clasts indicate their stability. The fluvial sandstones that overlie the sequence further indicate the marginal nature of the environment.

Conclusions

The exposures at Dirlot Castle are an example of a Devonian lake-margin setting where both the sedimentary processes and the nature of the crystalline basement underlying the basin can be discerned. The basement rocks are gneissose Moine semipelites and psammites, which are folded and cut by numerous granitic veins and pods. Mid-Devonian breccias and sandstones unconformably overlie the Moine rocks and granitic intrusions, which show limited reddening and alteration. The thin lenticular breccias are interpreted as scree deposits whereas the sandstones are probably fluvial. The breccia is cemented by carbonate (normally dolomite) that locally forms concentric layers that coat individual breccia clasts. The carbonate was deposited by algal colonies, termed stromatolites, that lived in shallow water in the brackish Orcadian lake. Similar marginal facies are exposed in several other localities in the Orcadian Basin (e.g. see the Red Point and Yesnaby GCR site reports in *The Old Red Sandstone of Great Britain* GCR Volume; Barclay *et al.*, 2005), but at Dirlot Castle the nature of the Moine basement and its role as an upstanding island in the Orcadian lake are very clearly seen.

[References](#)



(Figure 6.33) Geological map of Dirlot Castle with sketch section through gorge. Based on Donovan (1973) and Trewin and Hurst (1994). common. The rocks are intruded by numerous, unfoliated, medium- to coarse-grained granite and aplitic microgranite veins. The granite is highly reddened, the colouration increasing with weathering towards the contact with the overlying sedimentary rocks. In thin section, the feldspars are largely altered to fine-grained white mica (sericite), and the biotite is highly chloritized.