Dunaskin Glen

Highlights

Dunaskin Glen (Figure 12.11) is the best exposure of the lower Productive Coal Formation in the Scottish Basin.

Introduction

This stream section [NS 454 088] 3 km NW of Dalmellington, Cumnock and Doon Valley, Strathclyde, Scotland, shows the lower part of the Productive Coal Formation of the Ayr Coalfield. Details of the geology are provided by Simpson and Macgregor (1932) and Mykura (1967).

Description

Lithostratigraphy

The exposed sequence consists of 143 m of Productive Coal Formation, lying unconformably on deposits of the Upper Limestone Group (Figure 12.12). Elsewhere in the southern part of the Ayrshire Coalfield, the base of the formation is marked by a 30 m thick sandstone. Here, however, it is absent and the basal beds are mudstones, which form the start of a 41 m thick coarsening-upwards interval. The top of this unit is a 24 m thick sandstone, capped by a thick seat earth, known as the Dunaskin Fireclay, and which has been worked in the vicinity of Dunaskin Glen, for refractory bricks. The clay occurs over large areas of this southern part of the Ayrshire Coalfield, but Dunaskin Glen is the only good exposure. The coarsening-upwards unit as a whole probably represents a deltaic infill of a shallow, inter-distributary bay.

The succeeding 17 m represent transgressive conditions. At the base is a thin *Lingula* band, overlain by a 0.4 m lacustrine deposit known as the Dunaskin Clayband Ironstone. These then pass up through inter-distributary bay mudstones into a seat earth and 0.3 m thick coal. This brief period of emergence is then terminated by a return to brackish conditions, resulting in the deposition of a second *Lingula* band.

There then follows a 10 m thick sandstone, known as the Dunaskin Rock (Simpson and Macgregor, 1932). It has been identified over a large part of the southern Ayrshire Coalfield, but Dunaskin Glen is the type and best exposure. Here, it is a buff, medium to coarse-grained quartzitic sandstone, with an erosive base and marked cross-bedding. It was probably formed in large, fluvial complex, that prograded over the area from the south-east.

The next 67 m of the exposed succession here can be interpreted in terms of three coarsening-upwards cycles. The lower part of each cycle consists of mudstones. At other localities, the mudstones of the lower cycle include a marine band, but here they appear to be relatively featureless, inter-distributary bay deposits. Those of the second cycle are lacustrine mudstones, with an abundant non-marine bivalve fauna (see below), and for which Dunaskin Glen is one of the best localities (Mykura, 1967). The lowest beds of the third cycle are also lacustrine, but this time include two clay-band ironstones, known as the Dalmellington Blackband and Mussel Band ironstones. The former is over half a metre thick here, and has been extensively worked in the area.

The lower two cycles have a sandstone in the upper part, capped by a seat earth. It seems reasonable to assume therefore that they are deltaic infills of a slowly subsiding basin. The third cycle seems to have been terminated before fully emergent conditions could develop, by the deposition of lacustrine deposits immediately over the sandstone. These 12 m of lacustrine mudstones form the top of the Dunaskin Glen sequence.

Biostratigraphy

The only stratigraphically useful fossils reported from here are non-marine bivalves. However, there are diverse assemblages of these fossils available, which provide a good biostratigraphical control.

The lowest assemblage is associated with the Dunaskin Clayband Ironstone. It is not discussed in detail by Brand (1983), although it is probably from about the same level as the 'Pathhead 4 ft 6 in' assemblage in his tabulated species lists. Calver *in* Mykura (1967) identified from here *Carbonicola proxima* Eagar and *C.* aff. *extenuata* Eagar. Macgregor and Pringle (1934) argued that the assemblage belonged to the *C. communis* Zone, but Weir and Leitch (1936) correctly pointed out that it must belong to the *C. lenisulcata* Zone. It almost certainly belongs to the *C. proxima* Subzone, in the uppermost part of the zone, and indicates the lower Langsettian.

The next highest assemblage is from the lacustrine mudstone about 30 m below the Dalmellington Blackband Ironstone. The species list from the Dunaskin Glen exposure of this band given by Mykura (1967) includes *Carbonicola communis* Davies and Trueman, *C. pseudorobusta* Trueman, *C.* cf. *subconstricta* Wright *non* Sowerby (syn. *C.* cf. *oslancis* Wright — see Trueman and Weir, 1947), *Curvirimula subovata* (Dewar) (syn. *Curvirimula belgica* (Hind) — see Weir *in* Trueman and Weir, 1960) and *Naiadites flexuosus* Dix and Trueman. This clearly belongs to the *C. pseudorobusta* Subzone in the upper *C. communis* Zone, and indicates a level in the upper Langsettian.

The Mussel Band Ironstone yields an almost identical *C. pseudorobusta* Subzone assemblage. The Dalmellington Blackband Ironstone here only yielded a few species, such as *Curvirimula belgica* (Hind), which are not particularly diagnostic biostratigraphically. Elsewhere, however, this ironstone has yielded some of the classic assemblages of the *C. pseudorobusta* Subzone (Hind, 1894; Weir and Leitch, 1936; Trueman and Weir, 1947)

The stratigraphically highest fossils here occur in the topmost lacustrine mudstone exposed. The horizon is shown in the stratigraphical section by Mykura (1967), but no species list is provided.

There is little published palaeobotanical evidence from this coalfield, and nothing from this particular site. However, Absalom *in* Walton *et al.* (1938) claims that that the junction between Dix's floras C and D occurs at the Dalmellington Blackband Ironstone. This equates essentially with the junction between the *Neuralethopteris jongmansii* and *Laveineopteris loshii* subzones in the classification given in Cleal (1991).

Interpretation

This is the best exposure through part of the lower Productive Coal Formation in the Ayrshire Coalfield. The coalfield has one of the thickest developments of Coal Measures in the Scottish Basin. The only significant exception is the small Douglas Coalfield (Lumsden and Calver, 1958), but exposure here is much poorer. In contrast, the Ayrshire Coalfield, especially the southern part, provides some excellent natural exposures, of which Dunaskin Glen provides the longest and most complete succession. It thus plays an important role in understanding the Upper Carboniferous stratigraphy of the Scottish Basin.

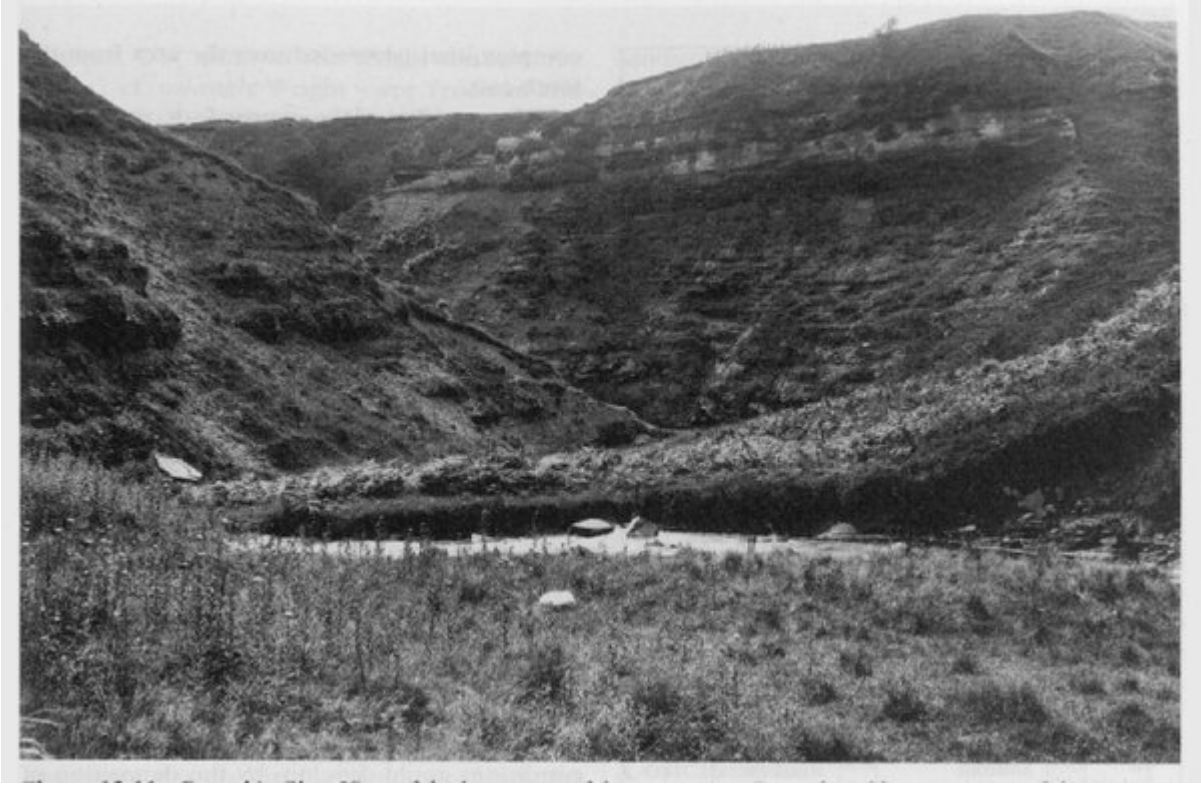
The general sedimentology observable at Dunaskin Glen reflects a lower delta-plain setting, with small-scale deltas infilling a slowly subsiding basin. This can be seen in the predominance of brackish and marine deposits, alternating with sandstones, and the limited development of coals. A clear comparison can be drawn with the coeval deposits in South Wales (e.g. Cwm Gwrelych–Nant Llyn Fach — see Chapter 4) and the Pennines (e.g. Ravenhead Brickworks — see Chapter 10). There are nevertheless differences from these areas, such as the development of at least one thick seat earth (the Dunaskin Fireclay), and the fact that the 'marine' bands never develop further than brackish conditions.

From a biostratigraphical standpoint, the site is significant for yielding one of the best examples of the *Carbonicola pseudorobusta* Subzone non-marine bivalve assemblages, from the Mussel Band Ironstone. The three-dimensionally preserved shells from here allow the full range of morphological variation to be observed. It is an almost identical assemblage to that found elsewhere in the Dalmellington Blackband Ironstone, and which has been discussed in detail by Trueman and Weir (1947).

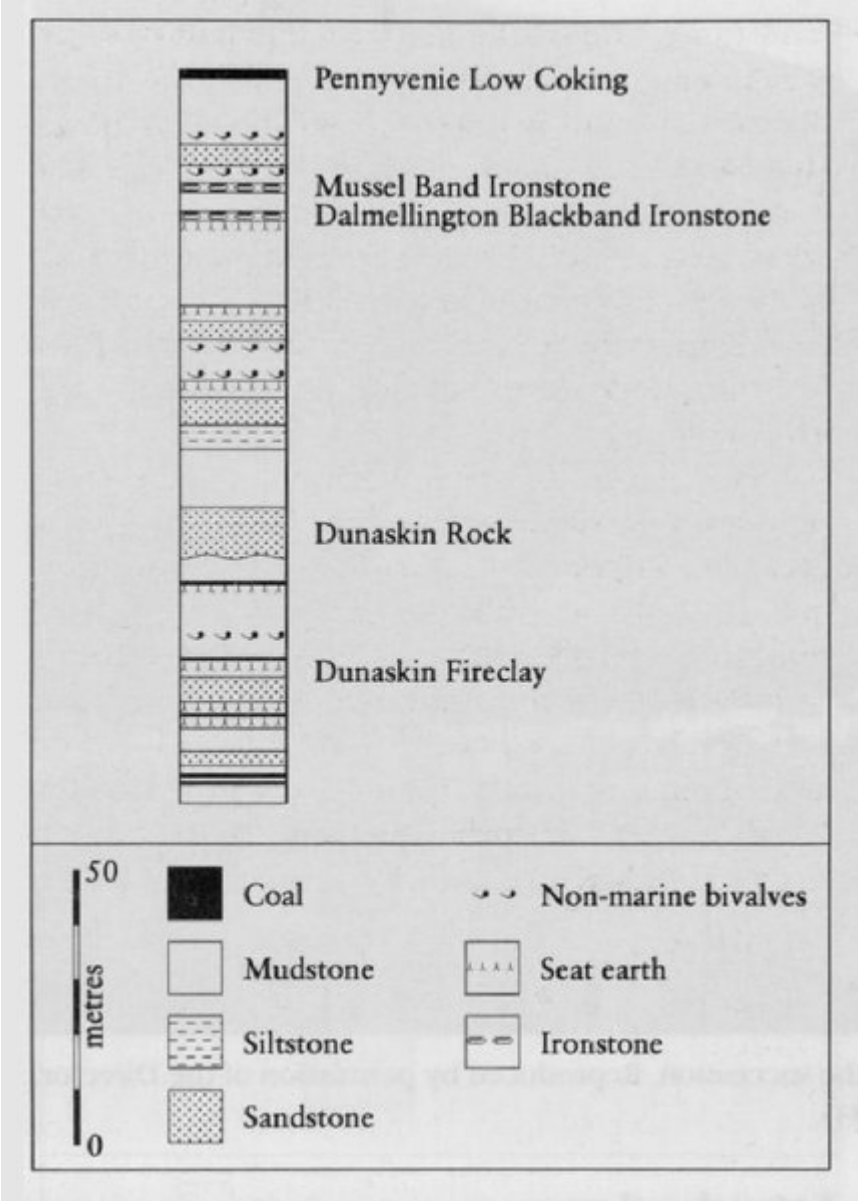
Conclusions

Dunaskin Glen is the best exposure of coal-bearing, early Westphalian rocks (about 313 million years old) in Scotland.

References



(Figure 12.11) Dunaskin Glen. View of the lower part of the succession. Reproduced by permission of the Director, British Geological Survey: NERC copyright reserved (C3083).



(Figure 12.12) Coal Measures exposed at Dunaskin Glen. Based on Mykura (1967, pl. 1).