Lagrae Burn

Highlights

Lagrae Burn is the best site demonstrating the upper part of the Sanquhar Coalfield, and the best site in Scotland for the Skipsey's Marine Band.

Introduction

This is a tributary [NS 705 153]–[NS 706 135] of the River Nith, 3 km WNW of Kirkconnel, Nithsdale, Dumfries and Galloway, Scotland. The exposed strata in effect provide a continuation of the succession seen at Polhote and Polneul Burns, showing the middle and upper parts of the Sanquhar Coalfield. A general description of the geology of this area is provided by Simpson and Richey (1936), and details of the field geology of the site can be found in Davies (1970). Details of the Skipsey's Marine Band here are given by Currie *et al.* (1937).

Description

Lithostratigraphy

The sequence represented here is about 125 m thick, although it is not continuously exposed. However, the isolated outcrops can been interpreted in the context of a number of boreholes drilled in the immediate vicinity and described by Davies (1970). The lowest strata represented here are the Calmstone and Creepie coals, neither of which are now exposed but their positions can be identified by old surface workings. The stratigraphically lowest beds to actually outcrop are a lacustrine mudstone, overlain by a siltstone and seat earth. The latter underlies a coal known as the Target Seam, although it cannot be seen here.

The next highest exposed strata are about 6 m of fine sandstone separating two beds of marine mudstones. The latter are known locally, in ascending order, as the Bankhead and Eastside marine bands. In the nearby Sanquhar No. 243 Borehole, the Bankhead Marine Band is about 10 m above the Target Seam.

There then follows about 15 m of poorly exposed, mainly arenaceous deposits, overlain by a thin coal (0.2 m thick) and a marine carbonaceous siltstone — the Skipsey's Marine Band. This band is well known throughout the coalfield, and in fact in most of the coalfields of the rest of the Scottish Basin (Currie *et al.,* 1937), but Lagrae Burn provides one of the best and most fossiliferous exposures.

Above the Skipsey's Marine Band are 13 m of mainly mudstones with thin beds of sandstone. About 1.5 m above the Skipsey's band, the mudstones represent brackish conditions, but the rest appear to be non-marine, probably inter-distributary bay deposits. This part of the succession is eventually capped by a 1 m thick seat earth and then a thin lacustrine mudstone.

The rest of the sequence is poorly exposed, although certain features can be seen. About 39 m above the Skipsey's Marine Band are 2.7 m of mudstones and thin coals. Of greater interest is a 1 m thick coal overlain by dark grey, marine mudstones. This is the Lagrae Marine Band, which has only been identified at this locality. Some distance above this marine band then comes poorly exposed, red mudstones of the Barren Red Formation, which are the highest strata exposed here.

Biostratigraphy

Marine bands

Both the Bankhead and Eastside marine bands only yield inarticulate brachiopods and 'non-marine' bivalves *Anthracosia* and *Naiadites.* They thus represent brackish rather than fully marine conditions. According to Davies (1970), these probably represent what have become known as the Clowne and Haughton marine bands in the standard classification of Ramsbottom *et al.* (1978).

The fauna of the Skipsey's Marine Band here is described in detail by Currie *et al.* (1937). They identify the following species: brachiopods — *Lingula pringlei* Currie; bivalves — *Posidonia sulcata* (Hind) and *Dubarella macgregori* (Currie); cephalopods — *Orthoceras* cf. *asciculare* (Brown) and *Homoceratoides jacksoni* Bisat. In addition, Davies (1970) lists from here *Coleolus?* sp., *Aviculopecten delepinei* Demanet, *Limatulina* cf. *alternans* (McCoy), *Donetzoceras aegiranum* (N.J. Riley, pers. comm.), *Metacoceras costatum* (Hind), *Cypridina, Hindeodella* sp. and *Lonchodina* sp. Currie *et al.* (1937) argued that such an assemblage is diagnostic of what is now referred to as the Aegiranum Marine Band, and this view is still generally accepted (e.g. Ramsbottom *et al.,* 1978). It thus marks the junction between the Duckmantian and Bolsovian stages in this sequence.

A mudstone 1.5 m above the Skipsey's band has yielded *Planolites.* According to Calver *in* Davies (1970), this marks 'the final retreat stage of the incursion' (i.e. the Aegiranum transgression) rather than a separate marine band in its own right.

The Lagrae Marine Band has only yielded a restricted assemblage of *Lingula, Curvirimula, Planolites, Glomospira* and fish remains. Such an assemblage is not diagnostic of any of the marine bands in the standard set outlined by Ramsbottom *et al.* (1978), but Calver *in* Davies (1970) argued that its position relative to the Skipsey's Marine Band and the inferred position of the Top Marine Band suggested that it may be equivalent to the Edmondia Marine Band.

Non-marine band

Non-marine bivalve assemblages are known from just three horizons in this section. The lowest comes from a mudstone between the Creepie and Target coals. Davies (1970) does not list what occurs here, beyond '*Estheria*' sp. and mussels. Elsewhere in the coalfield, however, this band has yielded an assemblage of the *Anthracosia atra* Subzone, indicating the upper Duckmantian. *A. atra* (Trueman) was also found in the Bankhead Marine Band.

The third horizon is a thin mudstone 14 m above the Skipsey's Marine Band, from where Davies (1970) mentions *Naiadites* cf. *daviesi* Dix and Trueman. According to Trueman and Weir (1955), this species ranges from the upper part of the 'Lower *similis-pulchra*' Zone to the basal *A. phillipsi* Zone.

Interpretation

This is the best exposed sequence through the upper part of the Sanquhar Coalfield, ranging from upper Duckmantian to probably middle Bolsovian (biostratigraphical control in the upper part of the sequence is poor). It represents a time of maximum basinal subsidence in this area, allowing the development of numerous coals and marine bands. It seems that this was caused by the effective absence of movement along the Southern Uplands Fault during the Westphalian, which allowed deltaic sedimentation to spread into this area from the Scottish Basin to the north. There was certainly some post-Carboniferous movement of the fault (Lumsden and Davies, 1965), and the absence of Permian strata in the area suggests that it may have been re-activated by end-Variscan tectonics.

The exposure of the upper part of the sequence is incomplete, although there is potential for excavation work, which may reveal the transition zone between the Productive Coal and Barren Red formations. Davies (1970) implied that the coloration is the result of staining from overlying Permian red beds. If, as suggested above, the Permian was never deposited here due to uplift along a rejuvenated Southern Uplands Fault, however, then the reddening of the Barren Red Formation may be primary or sub-primary, similar to that seen in the Etruria Formation of the English Midlands.

The site is also of considerable interest because of the exposure of the Skipsey's Marine Band, the presumed equivalent in the Scottish Basin of the Aegiranum Marine Band. Currie *et al.* (1937) provide a detailed palaeontological analysis of the most important outcrops of the band in the Scottish Basin, from which it becomes clear the Lagrae Burn contains one of the most diverse faunas. Furthermore, it is the only one of the sites with a diverse assemblage where the band can be

seen in a reasonably continuous stratigraphical succession. Lagrae Burn is also the only known site for the Lagrae Marine Band, and the only place where the Bankhead and Eastside marine bands can be seen in the Sanquhar Coalfield in a continuous stratigraphical succession.

Conclusions

Lagrae Burn is the best exposure of the upper part of the coal-bearing sequence in the Sanquhar Coalfield, which is about 305 million years old.

References