Ravenhead Brickworks

Highlights

Ravenhead Brickworks shows the best exposed sequence between the Honley and Parkhouse marine bands in the Pennine Basin, yielding both marine and non-marine faunas. It is also the best site for demonstrating the sedimentology of the lower delta-plain deposits of the lower Langsettian of this basin.

Introduction

This quarry [SD 515 040] on the south-west side of Up Holland, 3 km ESE of Skelmersdale, Lancashire, used to be worked for shales and mudstones in the lower Langsettian of the Lancashire Coalfield (Figure 10.17). Although the site was abandoned some years ago and has been partly infilled, a considerable part of the original sequence can still be seen. The stratigraphy of the site has been described by Eagar (1951) and aspects of the sedimentology by Broadhurst *et* al. (1980) and Broadhurst (1988). A detailed account of the field geology is given by Eagar *in* Broadhurst *et al* (1970).

Description

Lithostratigraphy

The complete sequence exposed here is 90 m thick. The lowest 7 m are a coarsening-upwards sequence of mudstones and shales, and correspond to the third of the cycles overlying the Soft Bed at Honley. These are overlain conformably by a sandstone, which is 4.5 m thick in the northern part of the site, but thins southwards to less than 1 m.

The sandstone was reported to be immediately overlain in the northern part of the quarry by a thin seat earth, thought to mark the position of the Lower Foot Mine coal. However, this is no longer visible, and the sandstone is now seen to be succeeded by a 4 m coarsening-upwards cycle of mudstones and shales, which are brackish at the base and non-marine towards the top. A second cycle, this time 16 m thick, then follows, with marine shales at the base passing up into non-marine mudstones, and then 3 m of ganister. The cycle is completed by a complex of seat earths and coals, the latter including the Rambler Mine and Lower Mountain Mine.

Above the Lower Mountain Mine, there follows 21 m of alternating laminated sandstones and mudstones (Figure 10.18). The sedimentology of this part of the succession was examined in detail by Broadhurst *et al.* (1980), who argued that it represents floodbasin lake deposits, with the sandstones being crevasse splays. Within the sandstones, bivalve moulds and burrows were identified. From the distribution of these bivalve traces, it was concluded that each sandstone–mudstone couplet was one year's sedimentation, and thus that the sediment supply was controlled by a seasonal (monsoonal) cyclicity (see also Broadhurst, 1988). If this model is correct, it suggests an extremely high rate of sedimentation, in the realm of 30 cm/year, and contrasts with the much slower rate of peat accumulation represented by the coals (Broadhurst and France, 1986).

This lacustrine interval is then succeeded by a thin, dirty coal known as the Bullion Mine. The roof of this coal is 0.6 m of marine shales with bullions, the Listeri Marine Band known locally as the Bullion Mine Marine Band, which marks the base of another coarsening-upwards cycle. The cycle, which is some 27 m thick, consists of dark shales immediately overlying the marine band, passing up into flaggy shales, and then a flaggy sandstone known as the Inch Mine Rock. This is capped by 1.2 m of ganister, which has yielded some excellently preserved lycophyte rooting structures, and a streak of coal which is thought to be the Inch Mine Coal elsewhere in the coalfield.

The top part of the succession consists of 1.5 m of dark marine shales, passing up into 6 m of grey non-marine siltstones, with two well marked carbonate bands.

Biostratigraphy

Marine bands

Four marine or brackish bands have been identified in this sequence. The lowest immediately overlies the Lower Foot Mine coal. It has only yielded inarticulate brachiopods and cannot be correlated with any of the standard marine bands mentioned by Ramsbottom *et al.* (1978).

The marine shales 4 m above the Lower Foot Mine, and locally known as the Lower Foot Mine Marine Band, have yielded a more diverse assemblage belonging to the Gastrioceras/Pectinoid Fades of Calver (1968). There is no published species list for this site in particular, but Eagar *in* Broadhurst *et al.* (1970) mentions from the nearby Pimbo Lane Quarry *Gastrioceras* aff. *subcrenatum* (Frech), *Anthracoceras* sp., *Lingula* sp. and bivalves. The bed is thought to be the Honley Marine Band in the standard classification by Ramsbottom *et al.* (1978).

The carbonate concretions in the Bullion Mine Marine Band have yielded well preserved, three-dimensional ammonoids, including *Gastrioceras listeri* (Sowerby) and *G. circumnodosum* Foord (syns. *G. retrorsum* Chalmers and *G. normalis* Chalmers — see Ramsbottom and Calver, 1962) as well as the bivalves *Dunbarella papyracea, Posidonia insignis* and *Caneyella multirugata.* This is the widely distributed Listeri Marine Band, which is one of the most important stratigraphical marker-horizons in the Langsettian of the Pennine Basin.

The marine shales at the base of the topmost cycle preserved in this sequence has yielded no more than fish-scales and indeterminable organic debris. However, its position immediately overlying the Inch Mine indicates that it is what is locally known as the Inch Marine Band, and which is the Parkhouse Marine Band in the Ramsbottom *et al.* classification.

Non-marine bivalves

Well preserved bivalves occur at two principal levels. In the lower 7 m of the succession, a sequence of assemblages has been mentioned by Eagar *in* Broadhurst *et al.* (1970). In the lower part, there are elongate anthraconaioid shells, together with *Carbonicola declinata* Eagar and *C. limax* Wright. This is then replaced by assemblages containing *C.* aff. *fallax* Wright, *C.* aff. *pilleolum* Eagar and *C.* aff. *protea* Wright. There is a clear comparison here with the bivalves found in the third (i.e. uppermost) of the cycles recorded from Honley Station Cutting.

Eagar *in* Broadhurst *et al.* (1970) also mentions well preserved shells from immediately below the Honley Marine Band. A list of species is not mentioned from here, but from the nearby Pimbo Lane Quarry, Eagar records *Carbonicola obliqua* Wright, *C. limax* Wright, *C. artifex* Eagar, *C.* aff. *declinata* Eagar and *Curvirimula* sp. This is the characteristic assemblage of bivalves that has been found widely in the Pennine Basin from just below the Honley Marine Band (Eagar, 1956).

Traces of bivalves occur extensively in the alternating sequence of sandstones and mudstones between the Lower Mountain Mine and Bullion Mine coals (Broadhurst *et al.,* 1980). Shells are very rare, but Eagar *in* Broadhurst *et al.* (1970) reports *Carbonicola* aff. *extenuata* Eagar and *Anthraconaia* sp. from a siltstone immediately above the Lower Mountain Mine. This is an extremely low occurrence of the *extenuata*-type of *Carbonicola,* which rarely ranges below the Listed Marine Band (Ramsbottom *et al.,* 1978).

Interpretation

This is the best exposure in the Pennine Basin of that part of the lower Langsettian between the Honley and Parkhouse marine bands. It includes a particularly good outcrop of the Listed Marine Band, which is one of the most widely distributed of the Langsettian Marine Bands, second only to the Subcrenatum Marine Band. There are also diverse assemblages of non-marine bivalves of the *C. fallax–C. protea* Subzone, and what might be the lowest known occurrence of the *C. extenuata* Subzone.

This is also the best known site for showing the characteristic sedimentology of the lower Productive Coal Formation of the Pennine Basin. Much of the succession consists of a series of coarsening-upwards cycles, with marine or brackish strata at the base and often capped by a coal and/or seat-earth. They represent classic examples of the cyclothem,

which for many decades was the main sedimentological model used to explain Westphalian deposition patterns in Europe. Although the cyclothem model has not proved satisfactory for explaining the middle and upper delta-plain deposits found higher in the Westphalian, it still generally holds good for the lower delta-plain deposits of the lower Langsettian.

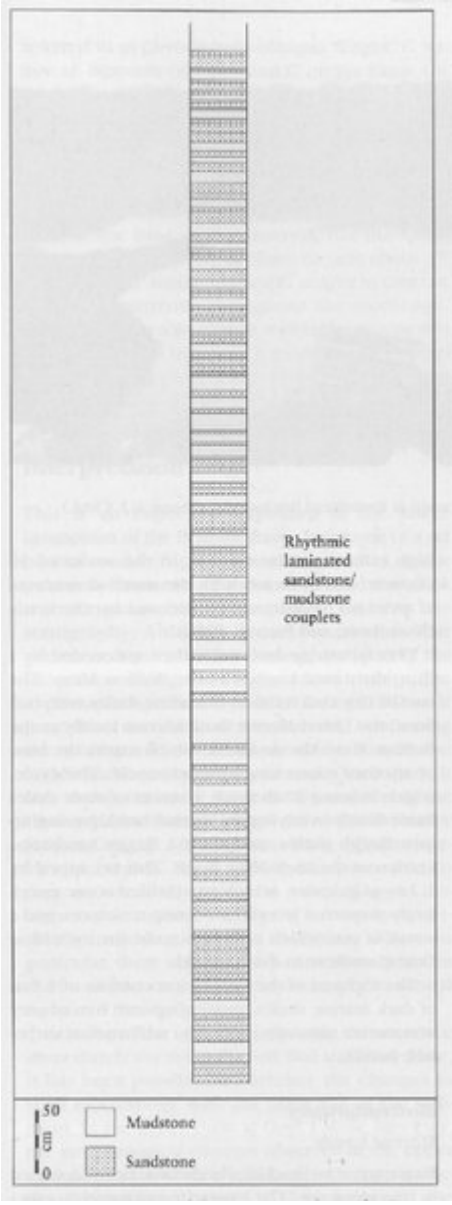
Also present here are strata that were deposited by smaller-scale cycles in a lacustrine setting, producing varve-like couplets of sandstone and mudstone. Broadhurst *et al.* (1980) have argued that these beds demonstrate that a monsoonal cyclicity was controlling the flow of sediment into the delta, although the deltas themselves were probably subject to a more uniform climate. They also showed that the deposition of the elastics in this part of the sequence was extremely rapid (*c.* 30 cm/year). From this it would seem that, despite their relative thicknesses, the vast majority of time is represented by the coals rather than the elastic deposits. These observations made at Ravenhead Brickworks are clearly of vital importance for understanding the environment and deposition of the Productive Coal Formation, not only of the Pennine Basin, but throughout the belt of paralic basins of northern Europe.

Conclusions

Ravenhead Brickworks is the best exposure of rocks between the Honley and Parkhouse marine bands in the Lower Coal Measures of the Pennine Basin. The sequence includes both marine and non-marine strata, and is important for showing the patterns of deposition in a lower delta-plain setting during the early Langsettian, about 315 million years ago.

References

(Figure 10.17) Lower Langsettian lacustrine deposits exposed at Ravenhead Brickworks. (Photo: C.J. Cleal.)



(Figure 10.18) Part of the sequence above the Lower Mountain Mine visible at Ravenhead Brickworks, showing sandstone–mudstone couplets thought to represent seasonal deposits in a lacustrine environment. Based on Broadhurst (1988, fig. 19.3).