Bridge of Weir, Renfrewshire

[NS 395 656]–[NS 411 658]

Introduction

The Bridge of Weir GCR site [NS 395 656]–[NS 411 658] lies 20 km west of Glasgow, and here crops out in the River Gryfe (or Gryffe or Gryfe Water) extending 1.5 km downstream from the town provide the best natural sections of the upper parts of the Lawmuir Formation and much of the Lower Limestone Formation in the west of the Central Coalfield Basin, south of the Clyde. Moreover, these exposures lie at the western extremity of the outcrops of these formations within the Central Coalfield Basin and are the closest remaining outcrops to the Paisley and Hurlet districts, which have in the past provided the standard reference sections for these Brigantian intervals (Figure 2.4). Details of the locality have been provided by Macnair and Conacher (1914), Carruthers and Richey (1915), Macnair (1915), Hinxman *et al.* (1920), Macgregor *et al.* (1925), Forsyth and Wilson (1965), Wilson (1966) and Paterson *et al.* (1990).

Description

The general dip of the succession is to the east, and the Lawmuir Formation is partially exposed in outcrops at the upstream end of the section. These outcrops are complicated by a fault that runs along the bed of the stream and are probably also faulted against lavas of the Clyde Plateau Volcanic Formation (Strathclyde Group). The lowest beds exposed are calcareous shales and limestone bands (2.3 m) of the Hollybush Limestone, which are seen on the north bank of the river. Within the limestone there is a band of *Siphonodendron* and solitary corals, and the gigantoproductid *Latiproductus* cf. *latissimus* is abundant in a fauna that includes other brachiopods (*Gigantoproductus giganteus, Eomarginifera, Pleuropugnoides* cf. *pleurodon*), sparse molluscs and the echinoid *Archaeocidaris.* Beds immediately above the Hollybush Limestone are not exposed in the River Gryfe. However, about 10–12 m of strata (Macnair and Conacher, 1914), including the positions of the Hollybush Sandstone and the Lady Anne Coal, appear to lie between the Hollybush Limestone and the next exposed horizons, which are associated with the Blackbyre Limestone.

The lowest of these exposures occurs where a small drain enters the river on the southern bank, and shows fireclay and a thin coal (13 cm) separated from the Blackbyre Limestone by 0.3 m of dark shales. The fauna of these shales includes *Actinopteria, Posidonia becheri* (*indicating an* age no younger than P_{1d}) and other bivalves, goniatite fragments, rhynchonellids, productoids, *Lingula* and fish remains. The preservation of some of the fossils is very fine and traces of the original colour banding have been observed in *Lingula* and some of the bivalves (Hinxman *et al.,* 1920). The base of the Blackbyre limestone here is a dark, calcareous shale (1.2 in) with an abundance of crushed productoids and other brachiopods, crinoid debris and fragments of *Siphonodendron.* The top of the limestone is not seen particularly well, but small outcrops in the river and loose material in the river and in adjacent fields support the view that the top is bleached and nodular, and that it passes up into a greenish nodular fireclay, which may be as much as 5 m thick (Macnair and Conacher, 1914; Forsyth and Wilson, 1965).

A break in the exposures above the Blackbyre Limestone is the result of old workings, and the Hurlet Coal (0.7 m), the Alum Shale (0.3 m) and the bottom bed of the Hurlet Limestone (1.4 m) are not exposed. However, exposures of the interbedded calcareous shales and limestones with crinoid and brachiopod debris (9 m), which make up the upper parts of the Hurlet Limestone are found in the river. The Hurlet Limestone is the lowest horizon within the Lower Limestone Formation, thus these beds and the remaining outcrops in the section belong to this formation.

Above the Hurlet Limestone are dark shales with siderite nodules (4.3 m), fireclay (0.3 m) and a thin coal (15 cm). More dark shales (4.3 m), with *Lingula* at the base and siderite nodules towards the top, occur above the coal and pass up into beds of black and greenish-coloured fireday. There are polygonal shrinkage cracks in the fireclays, and well-preserved stigmarian roots, which have a complex infill derived from the overlying deposits, extend down into the fireclays. The overlying beds belong to the Blackhall Limestone, which is in two parts separated by shales and other clastics. The lower part (0.3 m) consists of two units of finely bedded ostracode limestone (Figure 2.30) with a thin shale parting. These

limestones also contain fish remains, coprolites and spirorbid worm tubes. Between this and the upper part of the Blackhall Limestone are dark shales and greenish mudrocks. The shales contain abundant ostracode and fish debris and one of the mudrocks contains irregular carbonate concretions. The upper part (0.45 m) of the Blackhall Limestone consists of three beds of hard, crinoidal limestone with small solitary corals. On the upper surface of the limestone, at the junction with the overlying shales, irregular oncoidal bodies, developed around orthoconic cephalopods and other shells, are common. The bottom metre of the shale also contains an abundant marine fauna, which has been listed by Forsyth and Wilson (1965) and Wilson (1966). Notable elements include the brachiopods *Crurithyris urii* and *Tornquistia youngi,* the bivalves *Nuculopsis gibbosa, Phestia attenuata* and *Pernopecten fragilis,* cephalopods and gastropods.

The remainder of the succession is dominated by mudrocks and is about 35 m thick. About 15 m above the Blackhall Limestone a group of fireclays and ostracode-bearing ironstone bands has been recorded (Hinxman *et al.,* 1920), and towards the top, above siltstones, there are two marine limestones, which are the Main Hosie Limestone and the Mid Hosie Limestone. These limestones and associated mudrocks were included by Snook (1999) in an analysis of facies and faunal associations in the Hosie Limestones. The Main Hosie Limestone (0.25 m) is a crinoidal limestone with abundant small gastropods at the top. The Mid Hosie Limestone is an argillaceous limestone (0.45 m) with crinoid debris at the base. The shales between the two limestones are not completely exposed but contain trace fossils and, especially below the Mid Hosie Limestone, shelly fossils. The shales (6 m) seen above the Mid Hosie Limestone also contain marine fossils.

Interpretation

The full thickness of the Lawmuir Formation in the Bridge of Weir area is uncertain as the succession below the Hollybush Limestone has never been proved. It is unlikely to be as thick as that near Howwood, 6 km to the south, where nearly 100 m of strata have been recorded below the Hollybush Limestone and include the remarkable Quarrelton Coals and one marine horizon, the Dykebar Limestone (Hinxman *et al.,* 1920; Paterson *et al.,* 1990). The Hollybush Limestone is, however, the first horizon with a rich marine fauna, and the presence of corals and gigantoproductids at Bridge of Weir is typical of its development in the south-west of the Central Coalfield Basin. The lower parts of the Blackbyre Limestone at Bridge of Weir are also comparable in development to other localities although the presence of corals is unusual. The presence of *P. becheri* in the basal shales is indicative of the P_1 Zone. The leached and nodular top of the Blackbyre Limestone has caused some problems in interpretation and in comparison with the Paisley district, where an ostracode limestone, the White Limestone, occurs below the Hurlet Limestone and 12 m above the top of the Blackbyre Limestone. It appears that both the White Limestone and the roof beds of the Rlackbyre Limestone are absent at Bridge of Weir (Macnair and Conacher, 1914; Forsyth and Wilson, 1965;) and that the leaching and nodular character is due to soil development and plant growth on a disconformity surface.

Although the Alum Shale at the base of the Hurlet Limestone is not exposed, Macnair (1915) recorded, in loose material, elements of the Abden (or Macnair) Fauna, which is widely developed at this horizon (Wilson, 1989). The Hurlet Limestone in the River Gryfe is very thick compared to Its occurrences in the Paisley and Hurlet areas where it is usually less than 2 m thick and overlain by unfossiliferous shales (Hinxman *et al.,* 1920; Macgregor *et al.,* 1925; Forsyth and Wilson, 1965). Its increased thickness at Bridge of Weir appears to be largely due to the incorporation in the limestone of calcareous shales and limestone bands, which are the lateral equivalent of the unfossiliferous shales, and which include the position of the Inchinnan Limestone (Whyte, 1981). Similar thickening of the Hurlet Limestone towards the margin of the Central Coalfield Basin occurs at Howwood, Campsie and Corrieburn (Forsyth, 1978; Whyte, 1981).

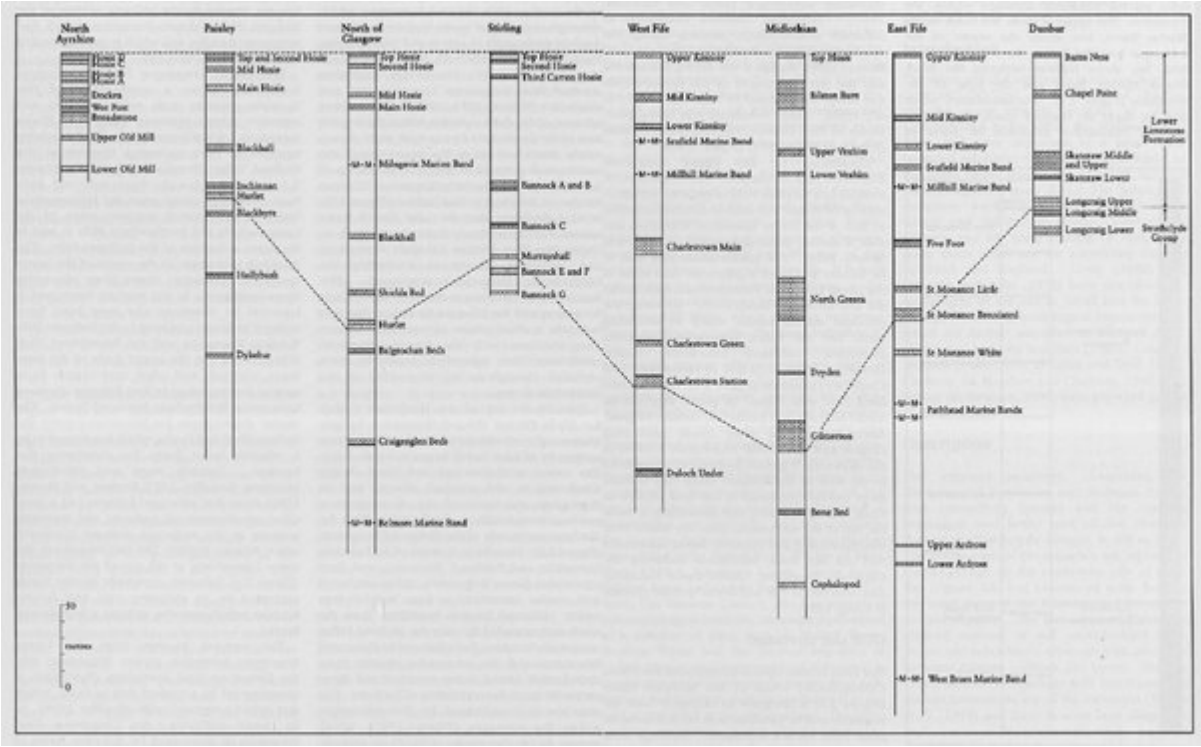
The non-marine beds above the Hurlet Limestone include two intervals with siderite nodules, which correlate with the Upper Househill Clayband Ironstone and Lower Househill Clayband Ironstone of the Hurlet district (Hinxman *et al.,* 1920; Paterson *et al.,* 1990), and a coal seam, which may lie at about the same level as the Wilsontown Smithy Coal of Lanarkshire (Hinxman *et al.,* 1920). The outcrop of the Blackhall Limestone at Bridge of Weir has been described as 'incomparably the best exposure in Renfrewshire of a horizon of great interest to the stratigrapher and palaeontologist' (Hinxman *et al.,* 1920). It shows extremely well the salient characters of the horizon, with a lower lagoonal or freshwater limestone and an upper marine limestone overlain by shales with a distinctive marine fauna. This marine fauna is the Neilson Shell Bed Fauna, which forms an excellent guide to this horizon (Wilson, 1966, 1989).

In the strata above the Blackhall Limestone the beds of ostracode-bearing ironstones are a persistent feature of sections throughout the Glasgow region (Hinxman *et al.,* 1920; Forsyth and Wilson, 1965). North of the Clyde they underlie the position of the Milngavie Marine Band but this dies out southwards and is not found at Bridge of Weir. The Mid Hosie Limestone and Main Hosie Limestone and associated strata are thus the only marine horizons in the upper part of the Bridge of Weir section. The bioturbated siltstone beds below the Main Hosie Limestone may represent the lateral equivalent of the Hosie Sandstone (Paterson *et al.,* 1990).

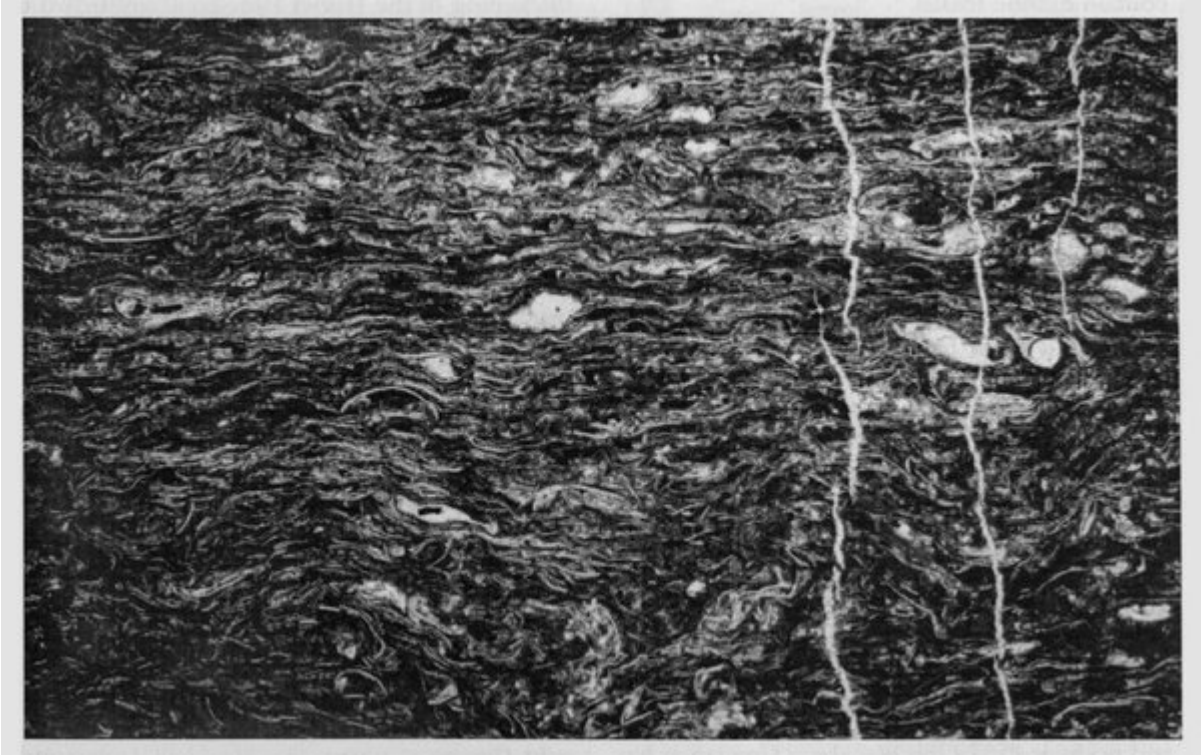
Conclusions

The Bridge of Weir GCR site is undoubtedly the finest section of the Lawmuir Formation and Lower Limestone Formation (Brigantian) in the west of the Central Coalfield Basin and is the closest available section to the standard reference area from which the stratigraphy of these units was first determined. It includes vital sections of a number of important marine and non-marine marker bands from the Hollybush Limestone (Lawmuir Formation, Strathclyde Group) up to the Mid Hosie Limestone (Lower Limestone Formation, Clackmannan Group).

References



(Figure 2.4) Correlation of the principal marine horizons in the Brigantian Lower Limestone Formation and uppermost part of the Strathclyde Group in the Midland Valley from North Ayrshire to Dunbar. Note that most of the named units figured here are, unless otherwise stated, limestones (names abbreviated). Based on various sources and including information from George et al. (1976), Cameron and Stephenson (1985), Wilson (1989) and Francis (1991).



(Figure 2.30) Photomicrograph of ostracode valves, shell debris and fish remains in the lower part of the Blackhall Limestone (Lower Limestone Formation, Clackmannan Group, Brigantian). The horizontal field of view is approximately 0.4 mm. (Photo: M.A. Whyte.)