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## 8 The Carboniferous (Namurian and Westphalian) of the Cliviger Valley, Todmorden

Paul Wignall University of Leeds and Paul Kabrna Craven and Pendle Geological Society

### Purpose

To examine Namurian and Westphalian deltaic cyclothems, their sedimentology and fossils.

### Logistics

A one-day excursion consisting of the short, but strenuous route of Ratten Clough (2 km), and a longer route taking in Coal and Paul Cloughs (8 km round trip). All routes involve walking over moorland and crossing streams so strong, waterproof footwear should be worn. Cars can be parked in a lay-by off the A646 (T) [SD 889 271]

Prior permission for access should be sought from Coal Clough Farm, Coal Clough Lane, off Pudsey Road, Cornholme, Todmorden, W. Yorks.

### Maps

O.S. 1:25 000 Sheet 690 Rawtenstall & Hebden Bridge; O.S. 1:50 000 Sheet 103 Blackburn & Burnley; BGS 1:50 000 Sheet 76, Rossendale (solid edition).

### Geological background

The Cliviger Valley straddles the Yorkshire/Lancashire border and at its head it marks the watershed of the drainage basins of these counties. It is also one of the most spectacular examples of a glacially over-deepened valley in the central Pennines. The incision of a glacial meltwater channel down the valley has caused the tributary streams to be left 'hanging' and these are currently actively cutting down into the bedrock, producing the numerous natural exposures of Carboniferous rocks that are the focus of this excursion.

The rocks belong to the Namurian Series (usually called the Millstone Grit) and the Westphalian Series (or Coal Measures). Both series are characterized by a repetitive association of rock types caused by the repeated advance of sandy deltas into a deep water basin that occupied this part of the world in the late Carboniferous. These cycles of sedimentation have been called cyclothems. They consist ideally of sediments that gradually coarsen upwards from shales through siltstones to sandstones. They are commonly capped by coals in the Coal Measures, though it should be noted that coals also occur in the Millstone Grit, and that their distinction from the Coal Measures is therefore somewhat arbitrary. As will be seen on the excursion, cyclothems are rarely ideally developed and the actual succession commonly consists of shale-siltstone sequences that are sharply overlain by sandstones which can vary greatly in thickness.

The shales at the bases of the cyclothems often contain a marine fauna which includes bivalves and goniatites. As the goniatites evolved very rapidly, each marine band usually contains a unique and diagnostic species that therefore facilitates their correlation.

There is a fascinating local history of mineral extraction along the line of the Cliviger Valley Fault. Evidence for lead mining dates back to the early 17th century when most of the activity was centred around Thieveley Farm. Though little evidence remains, there are clues to the mining such as old drifts and spoil heaps (e.g. in the vicinity of Dean Scout, [SD 870 278]), where galena and baryte can still be collected if you are lucky. Iron also used to be extracted by the early Sheffield ironmasters from the Coal Measures of Riddle Scout where the shales contain common siderite concretions.

## Excursion details

For those for whom such distinctions are important, the first half of this excursion occurs in Lancashire not Yorkshire.

### Locality 1 [SD 891 269]

The *Gastrioceras cancellatum* Marine Band is exposed in a small shale cliff and on the water-worn ledges at stream level at this location in the lower reaches of Ratten Clough. The shales of the marine band have been cemented to form a hard, resistant lithology.

A short distance upstream, the Lower Haslingden Flags form a small waterfall. Only 10 m thick here, this sandstone is considerably thicker further to the southwest around Rochdale and Bury where it is quarried for flagstone.

### Locality 2 [SD 890 267]

Ascend the increasingly steep and eventually precipitous Ratten Clough to the base of a superb cliff section of the Rough Rock — the quintessential example of a Millstone Grit, a coarse, feldspathic sandstone. In the lower, most accessible part of the cliff, the thin beds of fine sandstone belong to the Upper Haslingden Flags. This again is the rather feeble development of a sandstone which is thicker to the southwest. The Rough Rock, in contrast, occurs throughout the Pennines. At this locality it can be seen to erode down into the Upper Haslingden Flags for to cm, but on a larger scale the down-cutting is more spectacular. At Beater Clough, 600 m south of this locality, the erosion has cut down to a level nearly 15 m lower than that seen in Ratten Clough. The basal beds of the Rough Rock contain numerous stems of *Calamites* which probably occurred as log-jams in the fast-flowing rivers that deposited the Rough Rock. The abundant cross-beds seen in the cliff face represent cross-sections through sand bars within these river channels.

### Locality 3 [SD 888 267]

Those who have the stamina can make their way around the Rough Rock escarpment to the headwaters of Ratten Clough where the *Gastrioceras subcrenatum* Marine Band occurs. This contains goniatites and bivalves, and is taken as the boundary between the Namurian and the Westphalian.

It is instructive to view the hillside on the opposite side of the Cliviger Valley from this point. A series of ridges with steep southeasterly and gentle northwesterly slopes represents the expression of several Westphalian cyclothems dipping at around 20° to the west — sandstones form the ridge-tops. This is in contrast to the strata just examined on the southwest side of the valley which dip very gently to the southwest. The change in dip and strike occurs across the Cliviger Fault which runs along the line of the railway line in this part of the valley. This is a major fault with a downthrow of over 200 m to the north, along which patchy deposits of galena have been mined.

For the second half of the excursion, cars are best parked in Cornholme for there is little parking space in the Pudsey Clough valley. Make your way up this valley, noting the impressive crags of the Reddish Shore Rocks at the head of the Clough. This is the Rough Rock again which is here curiously weathered into very large rounded blocks.

### Locality 4 [SD 906 269]

An excellent series of trackside exposures shows the lowest beds of the Coal Measures. The shales above the Rough Rock form a steep bank, although the previously seen *Gastrioceras subcrenatum* Marine Band is obscured by debris at the base of the slope. The trees on this slope show the characteristic curving trunks produced by gradual downslope movement during their growth — a phenomenon typical of many trees on the steep hillsides of the central Pennines. The Woodhead Hill Rock rests with a sharp contact on the shales and displays well-developed trough cross beds. The shale immediately below the sandstone has been contorted, possibly because of a wholesale downslope movement of the sandstone.

From here proceed northwest up Coal Clough.

## Locality 5 [SD 905 271]

Coal Clough shows a sharp deviation in its course as it cuts down through a thin sandstone, the Ganister Rock. Several interesting features can be demonstrated at this outcrop which help us to understand Coal Measure deposition. The basal contact of the sandstone is erosive, cutting down into the shale (which here contains siderite nodules) for up to 40 cm. Clearly, sand deposition was preceded by an interval of erosion. Within the lower beds of sandstone there are large 'rafts' of coal, a few centimetres thick and up to 3 m wide. The coal does not represent *in situ* growth of plants as there are no roots developed beneath it. However the rafts are too large to have been carried far from their original site of formation. This sandstone probably accumulated in a river channel which was undercutting its peaty banks, causing large pieces to fall into the channel.

## Locality 6 [SD 904 273]

If permission has been obtained at Coal Clough Farm, ascend the upper reaches of Coal Clough to where an impressive 100 m long cliff section displays a variety of Coal Measure shales. At the base of the cliff, the Lower Mountain Mine coal seam is developed with a sandstone rib at its centre. This is directly overlain by the *Gastrioceras listeri* Marine Band, which contains goniatites and several species of bivalve including the spectacular, radially ribbed *Dunbarella papyracea*. The marine band contains large bullions (carbonate concretions) which formed early in the burial history of the shale, thereby preserving the goniatites in an uncompacted state. Occasionally the chambers of the goniatites contain a viscous, green oil rather like *Swarfega*, presumably the decomposed remains of the goniatite animal itself.

The following sections in Paul Clough can either be examined by returning to Locality 4 or, as described here, by crossing the moorland from Locality 6 to Stiperden House and walking downstream. The dip of the rocks in Paul Clough is rather steep which means that an exceptionally large amount of Namurian stratigraphy can be seen over a relatively short distance.

## Locality 7 [SD 910 279]

In a small shale bank, the goniatite *Reticuloceras bilingue* occurs in rather flaky, grey shales. This is a notably different goniatite-bearing lithology to the fissile black shales of the *Gastrioceras listeri* Marine Band of the previous locality.

Walking downstream from this locality, two thin sandstones can be seen to cross the valley but the intervening shales are not exposed.

## Locality 8 [SD 907 276]

The third sandstone, the Holcombe Brook Grit, and its overlying shales, is rather better exposed. In many parts of this region this Grit is capped by a good-quality coal, one of the oldest hereabouts. However at this locality a cannel coal is developed, a much poorer quality shaly coal that is formed by the transport and deposition of vegetation in pools and ponds. The cannel coal sits on a seatearth containing curious lumpy concretions.

Around 30 m downstream from the top bedding plane of the Holcombe Brook Grit, the *Gastrioceras cancellatum* Marine Band occurs at stream level. The fossils are rather poorly preserved at this locality.

## Locality 9 [SD 907 273]

Further downstream, the Lower Haslingden Flags intersect the stream. Around 2 m above the top of the sandstone a hard-weathering, fissile, black shale sits on a horizon of contorted shale. The appearance of this shale and its geochemical attributes are identical to that of marine band black shales; this is the newly discovered Owd Bett's Marine Band. It is named after a type locality north of Bury. The only marine fauna consists of rare conodont microfossils. More of these marine bands without goniatites probably await discovery in the Pennines. The *Gastrioceras cumbriense* Marine Band occurs a further 2 m above the Owd Bett's Marine Band at the top of the section (Figure 8.3).

## Locality 10 [SD 907 272]

This splendid gorge in the Rough Rock allows nearly the entire 34 m thickness of the sandstone to be examined. In the upper part of the section, cross sets up to 8 m in height can be discerned — testimony to the presence of large dunes or bars that must have formed in a channel of appreciable depth.

## [Bibliography](#)



*(Figure 8.3) Locality 9: Lower Haslingden Flags at left of outcrop overlain by softer weathering siltstones. The hammer denotes the position of Owd Bett's Marine Band; the *Gastrioceras cumbriense* Marine Band occurs in soft weathering shales behind the rucksack. Photo : P. Kabrna.*