Westphalian Coal Measures, Carboniferous, Northern England


Contents

- 1 Introduction
- 2 Northumberland and Durham
  - 2.1 Pennine Lower Coal Measures Formation
  - 2.2 Pennine Middle Coal Measures Formation
  - 2.3 Pennine Upper Coal Measures Formation
- 3 The Tyne valley outliers
- 4 Stainmore outlier
- 5 Cumbria
  - 5.1 Pennine Lower Coal Measures Formation
  - 5.2 Pennine Middle Coal Measures Formation
  - 5.3 Pennine Upper Coal Measures Formation
- 6 Canonbie
- 7 Bibliography

Introduction

Representative sections and correlations for the Pennine Coal Measures and Warwickshire groups. P916077.
Outcrop of Westphalian strata and the location of the principal coalfields in northern England, showing variation in rank across the Northumberland and Durham Coalfield. P916075.

Stratigraphical summaries for the main coalfields, and the correlations between them, are shown in (P916077).

**Northumberland and Durham**

The Westphalian Coal Measures succession of the Northumberland and Durham Coalfield accumulated along the northern margin of the Pennine Basin. It has more proximal characteristics, with a smaller marine influence, than are seen to the south in the classic coalfield successions of Lancashire and Yorkshire. Accordingly, fewer marine bands occur in Northumberland and Durham than in coalfields farther south, whilst those that are present are less well developed. In general terms, the Langsettian sequence of Northumberland and Durham has most in common with an upper delta-plain model, and the Duckmantian sequence with an alluvial-plain model.

The base of the Pennine Coal Measures Group in north-east England south of the River Tyne is placed at the Quarterburn Marine Band the inferred correlative of the Subcrenatum Marine Band the base of which defines the base of the Westphalian regionally (P916114). However, no definite occurrence of *Gastrioceras subcrenatum* has been found, nor has the Quarterburn Marine Band been proved north of the river Tyne. There, because the early Westphalian fauna is generally sparse, the base of the Pennine Coal Measures Group has to be taken immediately above the highest occurrence of marine, costate brachiopods. Similar problems exist with regard to the precise position of other boundaries — in Northumberland the Vanderbeckei Marine Band, the base of which marks the base of the Duckmantian (and also the base of the Pennine Middle Coal Measures Group),
is indicated only by the presence of a marginal marine *Lingula* fauna, whereas a wholly marine fauna (though still lacking the diagnostic Vanderbeekei fauna) occurs at the same level farther south in Durham.

**Pennine Lower Coal Measures Formation**

In the Northumberland and Durham Coalfield, the base of the Pennine Coal Measures was traditionally defined by the lowest workable coal, either the Ganister Clay Coal or locally in Northumberland the Brockwell Coal. These coals are now known to lie some distance above the Quarterburn Marine Band, with the intervening strata mainly consisting of sandstone with only thin and impersistent mudstone or coal interbeds. This is essentially a continuation of the lithofacies seen in the underlying Stainmore Formation of the Yoredale Group and it has, in the past, been referred to as ‘Millstone Grit’. Above the Ganister Clay Coal, the Pennine Lower Coal Measures contain a higher proportion of mudstone and coal, with the thicker, more productive seams in the higher part of the succession, commencing with the Brockwell Coal. Below this level the sandstones are coarse grained with some sufficiently siliceous to be termed ganisters. Above the Brockwell Coal the sandstone beds are thinner and finer grained but the increasingly argillaceous Pennine Lower Coal Measures sequence still comprises at least 50 per cent sandstone; five or six significant coal seams are also present. The Pennine Lower Coal Measures here comprise about 220 m of strata.

**Pennine Middle Coal Measures Formation**

The Duckmantian to Bolsovian, Pennine Middle Coal Measures comprise up to about 500 m of strata in the Northumberland and Durham Coalfield. The base is defined by the base of the Harvey Marine Band, the local correlative of the Vanderbeekei Marine Band. The Middle Coal Measures contain most of the workable coals, particularly in the lower section of about 180m up to the High Main Coal. This is the thickest and most widely worked seam over much of the coalfield; it contains excellent quality coal, is locally over 2.5 m in thickness, and formed the original basis for large scale exploitation of the Northumberland and Durham Coalfield. Several marine bands also occur, but like the Pennine Lower Coal Measures, more than 50 per cent of the succession is made up of sandstone. Above the High Main Coal some of these sandstones are coarse grained and massive: examples include the High Main Post (overlying the eponymous coal) and the Seventy Fathom Post, which was worked for grindstones.

**Pennine Upper Coal Measures Formation**

The base of the Pennine Upper Coal Measures is taken at the base of the Down Hill Marine Band, the local correlative of the more widely recognised Cambriense Marine Band. It is preserved in the Sunderland area, where it is overlain by about 150 m of poorly exposed strata in the much-faulted Boldon Syncline. The main features of this sequence are the predominance of grey argillaceous strata, the presence of only a few thin coals and the general sparseness of the nonmarine bivalve faunas. Nearby, the presence of Pennine Upper Coal Measures strata concealed beneath Permian to the east and north of Sunderland has been inferred on structural grounds, but no stratigraphical information is available. North of the River Tyne, near Killingworth, on the northern (downthrow) side of the Ninety Fathom Fault, the presence of some 155 m of Upper Coal Measures is again inferred entirely on structural grounds by analogy with the Sunderland district.

**The Tyne valley outliers**

A series of small faulted outliers of Westphalian strata occur along the Tyne valley, forming the Midgeholme, Plenmeller and Stublick coalfields. The outliers are mostly elongated east–west and
consist of southward-dipping Coal Measures; they are terminated abruptly to the south against the Stublick–Ninety Fathom fault system. Opencast coal investigations since the 1980s have improved the stratigraphical correlations with nearby areas of the Northumberland and Durham Coalfield, based largely on lithology, augmented by sparse palaeontological data (P916077).

A cumulative thickness of about 200 m is represented through the three outliers, mostly from the Pennine Lower Coal Measures, but extending upwards into the lowermost Middle Coal Measures. Most of the stratigraphically useful horizons lie within the Lower Coal Measures (P916077). The Low Main Sandstone and its equivalents can be traced throughout the outliers, and provides a useful lithostratigraphical marker. The presence of the Victoria Shell Bed above the Slag Coal helps to fix the position of the coal and the underlying sandstone-dominated interval. A marine fauna from the Plenmeller West opencast site is believed to be from the equivalent of the Gubeon (Listeri) Marine Band, which places the horizon some 100 m below the Harvey (Vanderbeckei) Marine Band, the boundary between the Pennine Lower and Middle Coal Measures.

**Stainmore outlier**

Over 300 m of Westphalian Coal Measures strata are preserved in two small areas in the Stainmore outlier, a narrow fault-block located at the intersection of the Dent and Pennine faults, south-east of Brough. They conformably succeed Namurian strata, and dip steeply eastward to be terminated against faults. The succession spans the Pennine Lower and Middle Coal Measures and is closely comparable, both in thickness and lithology, with the equivalent strata seen in the Durham Coalfield, 25 km to the north-east (P916077). A correlative of the Subcrenatum Marine Band marks the base of the Pennine Lower Coal Measures sequence, whereas the Vanderbeckei Marine Band is replaced by a nonmarine shell bed. Towards the top of the succession there is a well-constrained correlation with the Bensham coal seam of the Pennine Middle Coal Measures in Durham.

**Cumbria**

The Cumbrian Coalfield (P916075), with its numerous productive coal seams, crops out in a broad arc around the west and north of the Lake District from Egremont in the southwest to Caldbeck in the east. Concealed deposits occur below a cover of Permian and Triassic rocks in the Vale of Eden and north of the Maryport Fault, but have not proved to be economically exploitable. Farther north, the Canonbie Coalfield is situated at the northern margin of the north-north-east trending Solway Syncline and seismic reflection data confirm that the Pennine Coal Measures of Cumbria and Canonbie meet beneath this major structure. Westphalian strata also extend offshore under the Irish Sea and have been encountered in boreholes north of the Isle of Man. Some of the most productive seams were worked from sub-sea collieries with pit-head installations located on the coast at Whitehaven and Harrington.

Working of the Pennine Coal Measures in the Cumbrian Coalfield has always been hampered by a closely spaced set of north-west-trending post-Carboniferous faults. These faults are usually steeply inclined and rapidly switch throw along strike. Also present are a set of north-east-trending, large-throw, low-angled faults which are more widely spaced (5–10 km); they may represent a postdepositional reactivation of an original set of basin-margin growth faults. The Pennine Lower Coal Measures have a relatively uniform thickness across the coalfield, but in west Cumbria, the Pennine Middle Coal Measures show an overall thickening from south-east to north-west, suggesting that by then the Lake District Block was a positive, though not necessarily emergent, area.

Unlike the situation in Northumberland, the position of the Subcrenatum Marine Band, and hence the base of the Westphalian, is well established from boreholes throughout the Cumbrian Coalfield.
In contrast, the Vanderbeckei Marine Band is poorly developed in the Cumbrian Coalfield and its position can only be inferred from the presence of shells or fish remains. The Aegiranum Marine Band and the slightly lower Haughton Marine Band are recorded from the Whitehaven coastal collieries and to the north of Distington. However, over most of the coalfield the Aegiranum and higher marine bands appear to be cut out below the unconformable base of the Whitehaven Sandstone, which itself is no older than the Cambriense Marine Band.

**Pennine Lower Coal Measures Formation**

In the Cumbrian Coalfield, the Pennine Lower Coal Measures comprise three to four coarsening-upward cycles, each culminating in a thick bed of fluvial sandstone. Coals, though few in number, are laterally persistent. They may occur singly or in groups of two or three clustered immediately below the base of a major sandstone unit.

The lowest 30 m of the Pennine Middle Coal Measures succession are fine grained, with a number of locally prominent Lingula bands. The lowest coal seam, the Harrington Four Foot, is recognised across the whole area. It is located a few metres above the Subcrenatum Marine Band, and immediately below the Harrington Four Foot Rock. This is a major sandstone unit, often the only stratigraphical marker for the base of the Coal Measures in old borehole records. To the north, the Harrington Four Foot Rock grades to siltstone and a set of thin coals known collectively as the Albrighton coals appear. More generally, the succession above the Harrington Rock includes coal seams of variable thickness and quality: the Upper and Lower Threequarters seams, the Wythemoor ‘Parrot’ Seam, and the Micklam Fireclay Seam.

Higher in the succession, the next cycle contains the Sixquarters Seam and, immediately overlying it, the Sixquarters Rock sandstone. This seam is one of the prime economic coals of west Cumbria, both onshore and offshore, whilst the sandstone is a regionally prominent channel sand body that has been worked as a building stone. Above the sandstone a mainly argillaceous succession contains, in upward sequence, the Lickbank, the Eighteen Inch and the Little Main seams. The Little Main has been a popular target for mining; the lower two coals are of lesser interest but increase in thickness and quality offshore.

**Pennine Middle Coal Measures Formation**

The Vanderbeckei Marine Band, usually represented by a Lingula shell band in west Cumbria, appears 15 metres above the Little Main seam, but does not mark a change in general lithofacies. In the lower part of the formation, mussel bands are developed locally and a number of coals are present. The coals are mainly of indifferent quality, except for the Yard Seam (locally known as the Metal Band), which was worked throughout the coalfield. Above the Yard Seam, the Pennine Middle Coal Measures display a more pronounced cyclicity, with quite thin units of mudstone with coal separating thicker (25–35 m) sandstone-prone intervals. This section contains the two thickest and most widely exploited coal seams of the area: the Main (Cumbria) Band and the Bannock Band. The two associated sandstone units, the Main Band Rock and the Bannock Band Rock, are relatively thick and have erosive bases so that, in places, the underlying coal seam is cut out.

Continuing upwards through the Pennine Middle Coal Measures, the next 50–70 m are mainly argillaceous but contain three major coal seams: the Tenquarters, Slaty and White Metal. In the north-west of the coalfield the lowest seam has an overlying sandstone unit, the Tenquarters Rock, that forms a prominent cliff along the coast, north of Parton. Above the White Metal seam a major sandstone unit is present called the Countess Sandstone from the disused pit of that name. This sandstone forms a 20-m cliff on the coast from Parton south to Whitehaven and is encountered in boreholes throughout the region.
The Countess Sandstone marks the upper limit of major workable seams in the Whitehaven area. Between the top of this sandstone and the base of the Whitehaven Sandstone Formation (discussed below) is an interval subject to marked lateral variation. A number of thin coal seams are present, and the Black Metal and Brassy seams, are identified. Several, however, have no local name, or obvious regional correlative. In the Whitehaven collieries and from Workington northwards, this interval contains a series of mudstone/sandstone cycles, with thin coals, and the presence of the Aegiranum Marine Band indicates the upward passage from Duckmantian into Bolsovian strata.

**Pennine Upper Coal Measures Formation**

The St Helens Marine Band, recorded from the northern part of the coalfield, is correlated with the Cambriense Marine Band and so some 70 m of overlying strata are classed as Pennine Upper Coal Measures. The rocks are largely sandstone and mudstone, mostly reddened to some degree, with a few thin coals and claystone seatraths.

**Canonbie**

The Canonbie Coalfield is situated at the northern margin of the north-north-east-trending Solway Syncline, beneath which it links with the Cumbrian Coalfield. It is likely that the individual coal seams of Cumbria and Canonbie persist across this structure and although correlation has not been proved by deep boreholes, it is supported by seismic reflection results. The limited area of exposed Coal Measures strata around Canonbie lies mainly to the north of the border in Scotland (P916075). Interpretation based on boreholes and seismic surveys carried out in the 1980s indicated that the concealed coalfield to the south was larger and had more potential than was previously envisaged. In common with the other coalfields of the region, the Subcrenatum Marine Band has not been found in the Canonbie Coalfield. However, the tentative correlation of a marine band near the base of the Becklees Borehole (NY 3517 7158) with the Templeman’s (Langley) Marine Band of the Cumbrian Coalfield has enabled a generalised stratigraphical succession to be established. The Pennine Lower Coal Measures succession is about 120 m in thickness, the Middle Coal Measures is about 230 m and Upper Coal Measures is about 170 m thick. Coals are present in the Lower Coal Measures but are commonly unnamed and are difficult to correlate. Borehole information indicates that they are generally less than 0.8 m in thickness. The main seams are from the Pennine Middle Coal Measures, principally seven of Duckmantian age (P916077). There are only a few thin coals present in the Upper Coal Measures, most of them being located close to the base. The exception is the aptly named High Coal, which occurs about 170 m above the base of the Pennine Upper Coal Measures and has been proposed as a convenient marker for the base of the overlying Warwickshire Group.

**Bibliography**


Burgess, I C. 1986. Lower Carboniferous sections in the Sedbergh district, Cumbria. *Transactions of*


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- Request account