
Chapter 5 Forest of Dean and Severn coalfields

These two small areas of Upper Carboniferous lie between the much larger South Wales and Bristol–Somerset coalfields (Figure 5.1). A third area is poorly exposed and is not dealt with further here (the Newent Coalfield — see Cleal, 1987 and Worssam *et al.*, 1989, for brief accounts of this coalfield). The Severn Coalfield has never been worked commercially, but the Forest of Dean was, until about 20 years ago, still commercially active. According to Bone and Himus (1936), annual output in the 1920s and 1930s varied from 1 to 1.5 million tons. There is still some very small-scale extraction in parts of the forest, purely for local consumption, done by local residents known as Free Miners who, through historical precedence, are exempt from the government's monopoly on the exploitation of coal in Britain.

The Forest of Dean is scenically one of the most attractive British coalfields. It also has considerable scientific importance, in particular as one of the few sequences in Europe to straddle the Westphalian–Stephanian boundary and to yield diverse assemblages of pollen and spores. It is also important palaeogeographically, having been an area of uplift and erosion until near the end of the Westphalian, and only becoming an area of sediment accumulation following the Leonian Phase of tectonic activity.

History of research

Brief accounts of the geology of the Forest of Dean Coalfield were given by Buckland and Conybeare (1824) and Maclauchlan (1833, 1837), but the first attempt at a comprehensive description was by Insole and Bunning (1881). Stratigraphical analysis was further refined by Sibly (1912). The most significant account of the geology, however, is the Geological Survey memoir by Trotter (1942), which provides a full account of both the surface exposures and the underground workings. Subsequent brief reviews are provided by Moore *in* Trueman (1954), Welch and Trotter (1961), Gayer and Stead (1971) and L.P. Thomas (1974).

The finely preserved plant fossils found here have attracted numerous palaeobotanists to the area over the years, and there have been a number of biostratigraphical analyses (Arber, 1912; Crookall, 1930a; Wagner and Spinner, 1972; Cleal, 1992). There have also been several palynological investigations (Williams *in* Butterworth and Millott, 1960; Spinner, 1965; Wagner and Spinner, 1972; Butterworth and Smith, 1976).

The Severn Coalfield was first discovered in the 1870s, during the construction of the railway tunnel under the Severn Estuary (Jones, 1882). Other than the small outcrops near Portishead and Kingsweston, there are virtually no surface outcrops and so details of the geology remained almost completely unknown until the 1950s, when the then National Coal Board sponsored a programme of borehole exploration. Logs of some of these boreholes are given in Welch and Trotter (1961), and the plant biostratigraphy analysed by Cleal (1986a).

Lithostratigraphy

Both the Forest of Dean and Severn coalfields can be broadly divided into Pennant and Suprapennant formations. The junction between the formations is somewhat gradational, but is traditionally placed at the Brazilly Seam. In addition, a third unit (the Trenchard Formation) occurs at the base of the Upper Carboniferous in the northern part of the Forest of Dean. A generalized sequence of the Upper Carboniferous of the Forest of Dean is given in (Figure 5.2).

Trenchard Formation

Stratotype: Puddlebrook Quarry

Base defined: sub-Westphalian D unconformity in the northern part of the Forest of Dean.

Characteristic facies: conglomerates and coarse grits.

Chronostratigraphical range: upper Westphalian D.

Comments: Trotter (1942) assigned all strata below the Coleford High Dell Coal in the Forest of Dean to this formation. However, it is here restricted to those high-energy deposits occurring at the base of the Coal Measures in the northern part of the coalfield.

Forest of Dean Pennant Formation

Stratotype: Meezy Hurst

Base defined: base of lowest Pennant-type sandstone in the Forest of Dean.

Characteristic facies: mainly thick bedded, coarse-grained sandstones of the so-called 'Pennant-type', with some intervals of coals and mudstones.

Chronostratigraphical range: upper Westphalian D.

Suprapennant Formation

Stratotype: Oakenhill Railway Cutting

Base defined: Brazilly Coal.

Characteristic facies: mainly mudstones, siltstones and coals; strata usually grey, but sometimes showing evidence of reddening.

Chronostratigraphical range: upper Westphalian D to lower Cantabrian.

Broadly following Trotter (1942) and Welch and Trotter (1961), it is possible to subdivide the Suprapennant Formation into three members. The lowest extends from the base of the Brazilly Seam to the base of the first sandstone above the Crow Seam, and is known as the Household Coal Member. It is mainly argillaceous deposits, and includes most of the economically exploited seams in the coalfield. This is overlain by the Serridge Sandstone Member, consisting of more arenaceous deposits. In the north of the coalfield it is almost exclusively sandstone, but to the south there is an interleaving of sandstones and shales. Coals are poorly developed in this part of the sequence. The upper part of the formation sees a return to predominantly argillaceous deposits with coals, and is referred to as the Woorgreen Member.

Chronostratigraphy

There are significant discrepancies as to the chronostratigraphical position of the Forest of Dean sequence and these are still being repeated in the literature. In view of its importance for understanding the significance of the sequence, the evidence will be reviewed briefly.

It is still stated that the base of the sequence is upper Bolsovian or Westphalian C (e.g. Ramsbottom *et al.*, 1978; Smith, 1987), this view can be traced back to Trotter (1942). The lowest biostratigraphical evidence of the Westphalian D is found at the Coleford High Delf, and it was considered that the underlying strata must be Bolsovian. There is no biostratigraphical evidence of any consequence from the underlying strata; the palynological data reviewed by Wagner and Spinner (1972) are equivocal. In fact, using the biostratigraphical data available to Trotter (i.e. non-marine bivalves), the Coleford High Delf could occupy *any* position within the Westphalian D, and it is therefore unlikely to represent the base of the stage. The point was confirmed by Wagner and Spinner (1972), who reported plant macrofossils of the *Lobatopteris vestita* Zone from the roof of the Coleford High Dell (incorrectly referred to as the Coalbrook High Dell in Cleal, 1992), which must therefore be upper Westphalian D (see also Cleal, 1986a, 1992). However, Wagner and Spinner's observations have been almost totally ignored in the literature.

Cleal *in* Ramsbottom *et al.* (1978) stated that the Westphalian–Cantabrian boundary in the Forest of Dean probably occurred in the upper Household Coal Member (Suprapennant Formation), probably at or about the Twenty Inch Rider Seam. This was based on Wagner and Spinner's (1972) record of *Odontopteris aequalis* Lesquereux (almost certainly *O.*

cantabrica Wagner) and *Alethopteris grandinioides* Kessler var. *subzeiller* Wagner from this level. Although this needs to be finally confirmed by additional data, it would seem to be compatible with similar results obtained from South Wales (Cleal, 1978, 1984b). It would make the Forest of Dean one of the few places in Europe to provide a good palynological record through the Westphalian–Stephanian boundary, and provide evidence to show if such fossils are of value for identifying this boundary.

Geological setting

During the Namurian and much of the Westphalian, this was a positive, erosional area providing sediment to the South Wales and Bristol–Somerset basins. It is widely referred to as the Usk Axis. It has been argued that the axis briefly ceased to be an area of uplift during the early Langsettian (Sullivan, 1964; Spinner, 1984). This is based on Langsettian palynomorphs reported from a thin mudstone overlying an outcrop of Viséan Drybrook Sandstone (the samples described by Sullivan and later by Spinner were collected at the same time — E.G. Spinner, pers. comm.). However, plant macrofossils collected from the same mudstone indicate a Visdan age, which is more compatible with the conformable field relationship of the mudstone with the Drybrook Sandstone (Cleal, 1986b). There is little other evidence, either from the Forest of Dean or neighbouring coalfields, that the Usk Axis was anything other than a positive area until the end of the Westphalian.

In the mid-Westphalian D, the axis appears to have been subject to enhanced uplift, causing a stratigraphical non-sequence in the eastern part of the South Wales Coalfield (see Introduction to previous chapter). Subsequently, however, uplift ceased and, for the first time since the Viséan, the area became one of significant sediment accumulation. The timing of these events is of interest as it not only coincides with tectonic activity recognizable elsewhere in Britain (Cleal, 1987), but also with events over large areas of Europe (see Introduction to previous chapter for relevant references). This widespread event is known as the Leonian tectonic phase.

Initially, sedimentation reflects relatively high energy conditions and probably represents a proximal position within a fluvial delta. Palaeocurrents tend on average to be to the west. However, the overall distribution of arenaceous and conglomeratic deposits indicates that the northern part of the Forest of Dean occupied the most proximal position within the delta. It is likely that the top Pennant Formation in the eastern part of the South Wales Basin (i.e. that above the infra-Pennant Formation unconformity and starting at about the No. 3 Llantwit Seam) is a lateral extension of the Forest of Dean Pennant Formation (Cleal, 1992).

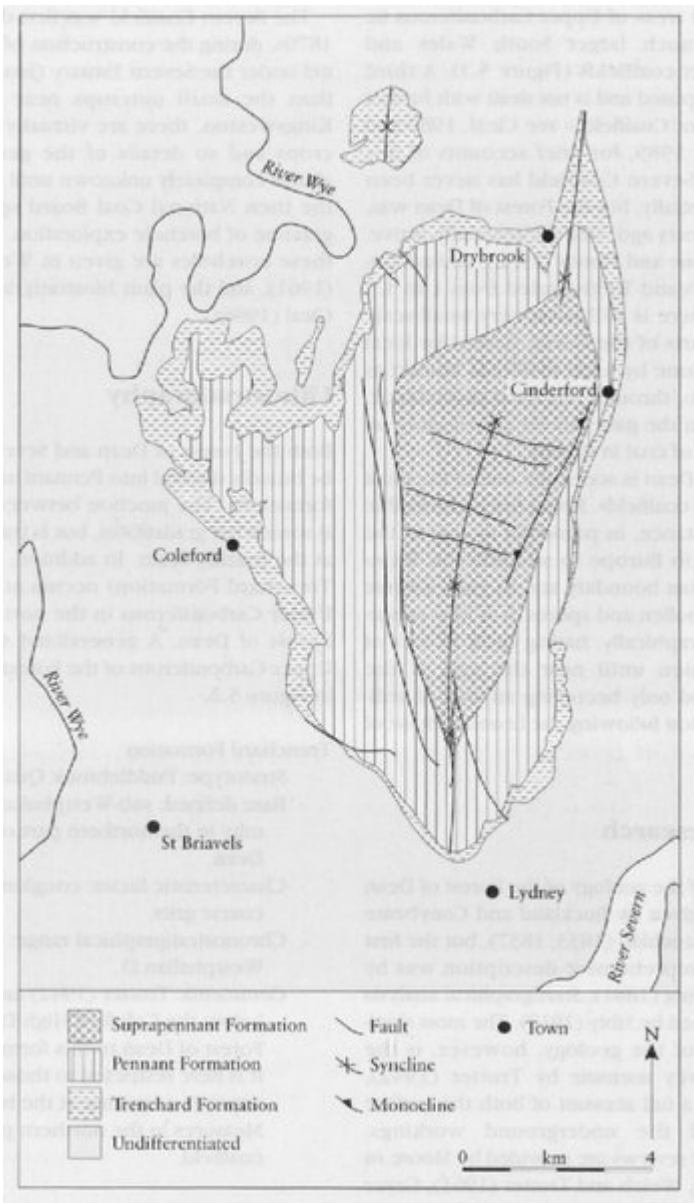
Shortly before the end of the Westphalian, the style of sedimentation became quieter and reflects flood-plain conditions. The result was the formation of the Suprapennant Formation. These strata are of similar facies to the Grovesend Formation in South Wales, but detailed correlations suggest that they represent quite distinct formational units (Figure 5.3). A brief return of fluvial arenaceous deposits (the Serridge Sandstone) occurs in the middle of the formation but, on the whole, the rest of the Forest of Dean Upper Carboniferous represents relatively quiet conditions.

GCR site coverage

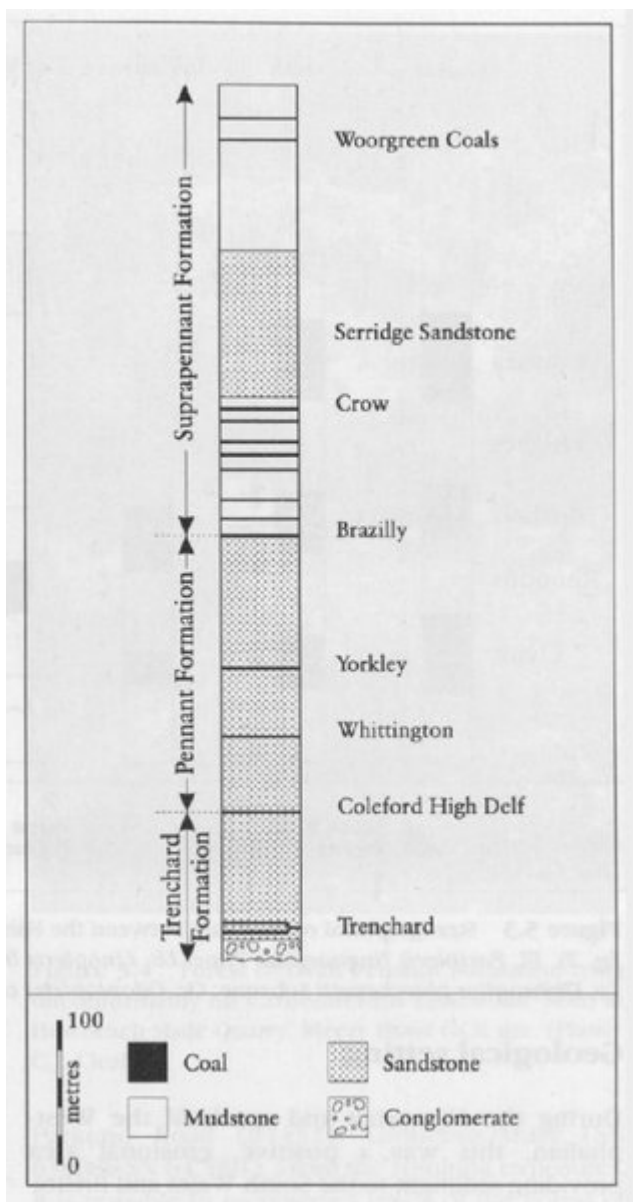
Very little of the Severn Coalfield is exposed, since it mostly lies under Mesozoic cover. The only GCR site representing this area is at Portishead, and is one of only two known exposures of the Pennant Formation in the coalfield (the other is a small quarry at Kingsweston, Bristol — Matthews *et al.*, 1969).

In contrast, Upper Carboniferous exposures in the Forest of Dean are numerous, both as natural outcrop and quarries. They are mainly in the Pennant Formation, for which one is 'spoilt for choice' in selecting representative sites. In this survey, the key GCR site was Meezy Hurst, providing a more or less complete and typical sequence through the Pennant Formation of the Forest of Dean. This is supplemented by Puddlebrook Quarry, selected to show the conglomeratic base of the Trenchard Formation, that occurs in the north of the coalfield. The situation was far more difficult in the Suprapennant Formation; only one site was selected (Oakenhill Railway Cutting) and this is very overgrown.

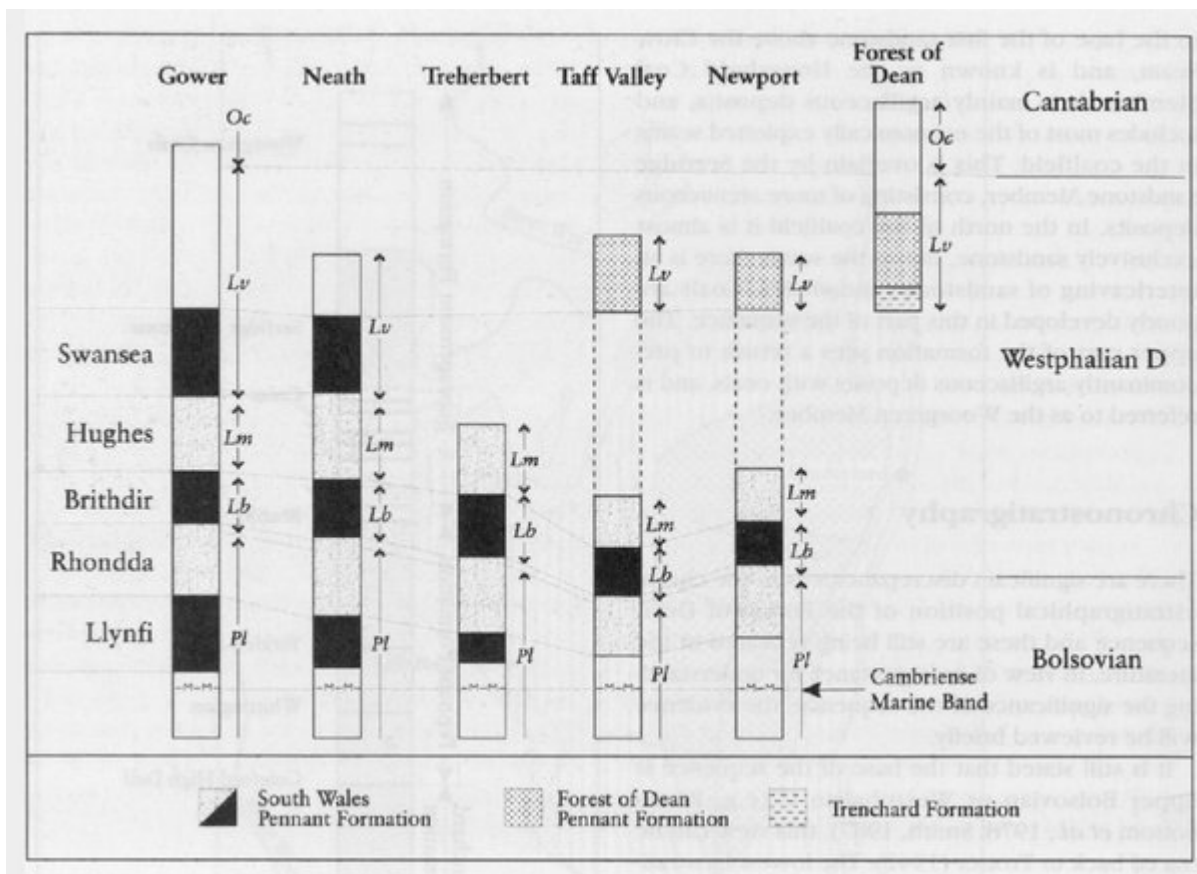
[References](#)



(Figure 5.1) Map of the Forest of Dean and Severn coalfields. Based on Gayer and Stead (1971, fig. 1) and Cleal (1986a, fig. 1).



(Figure 5.2) Generalized sequence of the Upper Carboniferous of the Forest of Dean. Based on Gayer and Stead (1971, fig. 3).



(Figure 5.3) Stratigraphical relationship between the Forest of Dean and South Wales coalfields. After Cleal (1991, fig. 2).
 Pl, *Paripteris linguaeifolia* Zone; Lb, *Linopteris banburti* Zone; Lm, *Lobopteris micromiltoni* Subzone; Lv, *Dicksonites plueckenetii* Subzone; Oc, *Odontopteris cantabrica* Zone.