Chapter 7 English Midlands

This chapter covers sites in the southern-marginal parts of the Pennine Basin, as it laps up against the Wales–Brabant Barrier. There are five main areas of outcrop, which are known, from west to east, as the Shrewsbury, Coalbrookdale, Wyre Forest, South Staffordshire and Warwickshire coalfields; there are also small areas of outcrop in the Clee Hills of Shropshire (Figure 7.1). The coalfields of North Wales (Denbigh and Flint) and a small outcrop in Anglesey, are also in a marginal part of the Pennine Basin, but they contain no sites that merited inclusion in the GCR coverage, and so will only be touched on in passing in this chapter.

A little to the north of this belt of Midlands coalfields showing marginal sequences are two other areas of Coal Measures known as the Leicester–South Derbyshire and the North Staffordshire coalfields. They show sequences which are intermediate in character between those of Warwickshire and South Staffordshire, and the more fully developed, basinal sequences of Yorkshire and Lancashire (e.g. Earp, 1961; Spink and Ford, 1968; Worssam and Old, 1988). However, exposure here is very limited and only one site was selected during the GCR survey, in the North Staffordshire Coalfield (Metallic Tileries).

As they occupied a marginal position in the basin, the sequences here are relatively condensed and show frequent evidence of emergent conditions (e.g. red beds). Nevertheless, there are some grey measures of the Productive Coal Formation, with commercially exploitable coals, particularly in the Leicester–South Derbyshire and North Staffordshire coalfields. In the 1930s, the coalfields on the southern margins of the Pennine Basin had a combined annual output of up to about 12 million tons, while the intermediate Leicester–South Derbyshire and North Staffordshire coalfields produced up to about 10 million tons (Bone and Himus, 1936). This has remained more or less constant up to the present (Haim and Horton, 1969; British Coal Corporation Annual Report, 1990/91). The marginal position of these deposits also resulted in the development of other economically significant resources. Iron ore deposits, particularly in South Staffordshire, were extensively worked during the 19th and early 20th centuries, and mudstones suitable for brick and earthenware manufacture have been an important industrial resource in north Staffordshire, hence this area being referred to as 'the Potteries'.

History of research

The following will only deal with those areas in which sites have been selected. For historical details of work on the North Wales coalfields, the reader is directed to Calver and Smith (1974), while the Leicestershire Coalfield is discussed by Spink and Ford (1968) and Worssam and Old (1988).

Shrewsbury Coalfield

This area, which is also sometimes referred to as the Hanwood Coalfield, consists mainly of upper Westphalian red beds with only very limited coal development. The latter factor, together with the limited natural exposure, has meant that there has been relatively little interest in the geology of the area. The earliest study seems to have been by Murchison (1839), and a brief summary was provided some years later by Davies (1885). A memoir on the coalfield was published by the Geological Survey (Pocock *et al.,* 1938). Otherwise, however, the only geological work seems to have been part of studies on the Etruria Formation, by Robertson (1931) and Besly (1983, 1988).

Coalbrookdale Coalfield

The Productive Coal Formation is more extensively developed here than in the Shrewsbury Coalfield, and so the area received rather more attention from geologists. The earliest accounts were by Aiken (1811), Murchison (1839) and Prestwich (1840), who provide general descriptions of the stratigraphy. The so-called 'Symon Fault' (in fact, an unconformity below the Halesowen Formation) was described by Scott (1861) and Clarke (1901), whilst Woodward (1867) described a limulid arthropod from a lower Westphalian horizon. However, the economically viable seams had been worked out by the end of the 19th century and, as natural exposure is limited, interest from geologists waned. A

general description was provided by Watts (1925) as an introduction to a Geologists' Association excursion to the area, but otherwise investigations have been mainly restricted to the Etruria Formation, whcre workings for brick-clays provided some exposure (Robertson, 1931; Besly, 1983, 1988).

Wyre Forest

The earliest account of the Upper Carboniferous geology of this area is by England (1834), but this was soon over-shadowed by Murchison's (1839) now classic account of the Palaeozoic of the English Midlands. There followed numerous papers dealing with this area, but those of two people, both amateurs for at least part of the time, are worth special mention (a full list is provided by Arber (1914) and Kidston *et al.* (1917)). G.E. Roberts, perhaps better known for his work on the Old Red Sandstone of this area, published a number of short contributions on fossils from the Wyre Forest Coalfield (Roberts, 1858, 1860, 1861a, 1861b), whilst Thomas Cantrill worked on the stratigraphy of the coalfield (Cantrill, 1895). Also of considerable significance was a borehole drilled near Claverley by the Geological Survey, which provided an almost complete sequence through the Upper Carboniferous of this area (Gibson, 1913).

This work culminated in the second decade of the 20th century. At this time, two projects analysing the plant fossils from here were instigated by Arber and Kidston. The problem they encountered was the absence of a Geological Survey memoir on the area to provide a stratigraphical background to their work, and so they themselves provided detailed accounts of the geology (Arber, 1914; Kidston *et al.,* 1917).

Thereafter, interest in the geology of the area declined. The long-awaited Survey Memoir was published (Whitehead and Pocock, 1947), and it is mentioned in some more general accounts, such as Robertson's (1931) study of the Etruria Formation. Otherwise, however, little of note has been published. The reason for this is far from clear; coal was still being extracted from at least one colliery up until the 1960s, and there is a certain amount of natural outcrop, although no GCR site has been selected. There is certainly considerable potential for further work here.

Clee Hills

Although only of small extent, and never providing coal in any quantity, the Upper Carboniferous outcrops of Titterstone Clee and Brown Clee have been the subject of a number of geological studies. They are referred to briefly by Murchison (1839), and described in more detail in his classic 1839 book *The Silurian System.* Other brief accounts are provided by Jones (1871, 1873) and Piper (1884). The most detailed account is probably that of Dixon *in* Kidston *et al* (1917), whilst some of the outcrops are admirably described in a Geological Survey memoir (Greig *et al.,* 1968).

Jones and Owen (1961) provide a detailed discussion on the lower beds and their relationship to the underlying strata. The palynology of some of the deposits has been discussed by Turner and Spinner (1990) and Turner and Owens (1993).

South Staffordshire Coalfield

This has yielded considerable quantities of iron-ore and coal, and resulted in the development of the Birmingham–Wolverhampton area as a major industrial centre. However, there was relatively little interest in the coalfield among early geologists, the only published accounts of interest being of *in situ* tree stumps (Beckett, 1845; Dawes, 1845; Ick, 1845). The first coherent account did not appear until the publication of the Geological Survey memoir (Jukes, 1859). Later memoirs (Whitehead and Eastwood, 1927; Mitchell *et al.,* 1945; Whitehead and Pocock, 1947) provide a comprehensive guide to the geology of the coalfield and its outcrops. Otherwise, the only studies of note were by Kidston (1888b, 1914) and Arber (1916) on the plant fossils and their biostratigraphical significance.

Warwickshire Coalfield

A number of early works deal with the red beds in the upper part of the coalfield (e.g. Conybeare and Phillips, 1822). These strata were assigned to the New Red Sandstone and thought to be Triassic in age, but they were subsequently assigned to the Permian (Ramsay, 1855; Howell, 1859). The age of these beds remains problematic. Some authors

suggest they are mid-Stephanian to Autunian (e.g. Haubold and Sarjeant, 1973). However, Crookall *in* Mitchell *et al.* (1942) argued that there was no unequivocal evidence that they are younger than Westphalian D, and this is the position still generally held today.

The geology of the productive part of this coalfield attracted relatively little attention, beyond the publication of survey memoirs (Howell, 1859; Mitchell *et al.,* 1942), together with an important paper by Vernon (1912). Most recent data are reviewed by Fulton and Williams (1988), Old *et al.* (1987, 1991) and Worssman and Old (1988).

North Staffordshire Coalfield

Geological interest in this coalfield has a venerable history, going back to Plott (1686), who first delineated the main divisions of the Carboniferous of the area, including the 'Coal-measures' and the 'Gritstone' (i.e. Millstone Grit). More detailed and 'modern' accounts followed some time later by Conybeare and Phillips (1822). The Geological Survey took an early interest in the coalfield, producing a number of maps, and eventually memoirs (Gibson, 1905, 1925), which provided a firm lithostratigraphical framework for subsequent work. Recently, the Survey have produced an additional memoir relevant to the area (Evans *et al.,* 1968), and also a report on borehole investigations (Earp, 1961).

Based on observations in North Staffordshire, Stobbs (1905a) provided one of the first detailed analyses of marine band biostratigraphy in this country. On the whole, however, the marine bands are not as well developed here as in the more basinal sequences further north (see Chapter 10). This necessitated the development of alternative biostratigraphical tools in the Potteries, and seems to have generally encouraged work on other groups of fossils. The early work, particularly on fossil fish, is summarized by Ward (1890). Subsequently, interest concentrated mainly on non-marine bivalves (e.g. Hind, 1893; Hind and Stobbs, 1903; Stobbs, 1906; Melville, 1945), plants (Kidston, 1891, 1897, 1905; Dix, 1931b) and palynology (Millott, 1939, 1946; see Smith and Butterworth (1967) for a review of the subsequent palynological studies in this coalfield). Of particular interest is the role that North Staffordshire played in the development of Kidston's (1923) stratigraphical classification, with many of the units (essentially equivalent to stages) being named after formations here (e.g. Blackband 'Group', Newcastle-under-Lyme 'Group', Keele 'Group'). Although Kidston's scheme has now fallen into disuse, being replaced by the Heerlen Classification, for many years it was the standard classification for British Coal Measures strata.

Lithostratigraphy

The marginal sequences dealt with in this chapter differ from those of the central parts of the Pennine Basin in two main ways. Firstly, for the most part the Millstone Grit Group is poorly developed. In most areas immediately adjacent to the Wales–Brabant Barrier (e.g. the southern parts of the South Staffordshire Coalfield — see Brewin's Canal Cutting), Westphalian strata lie unconformably on Lower Carboniferous or older beds. About 10 km further north, condensed Millstone Grit sequences have been proved in boreholes (Mitchell, 1954; Taylor and Rushton, 1971), and only when north Staffordshire and south Nottinghamshire are reached can fully basinal sequences be seen (Falcon and Kent, 1960; Trewin and Holdsworth, 1973).

Secondly, red beds occur more commonly and the Productive Coal Formation is correspondingly restricted. Such beds are often barren of fossils, which has caused problems of correlation, and thus of establishing a coherent stratigraphical classification. Recent work (Besly, 1988; Besly and Turner, 1983) is starting to unravel the problems, but much of the results are as yet unpublished. Consequently, the following classification is only provisional, and will need to be revised in the light of new work.

Millstone Grit Group (not subdivided into formations)

Cornbrook Sandstone Formation

Stratotype: Cornbrook Dingle

Base defined: base of Upper Carboniferous in Clee Hills.

Characteristic facies: massive, pebbly sandstone, sometimes stained red.

Chronostratigraphical range: Duckmantian.

Productive Coal Formation

Defined in South Wales (see Chapter 4)

Blackband Formation

Stratotype: North Staffordshire Coalfield Base defined: the coal seam known as the Bassey Mine.

Characteristic facies: grey or very rarely red mudstones, with coals, carbonaceous clay-ironstones, and non-marine limestones.

Chronostratigraphical range: upper Bolsovian.

Etruria Formation

Stratotype: North Staffordshire Coalfield Synonyms: Hadley Formation (Shrewsbury Coalfield), Old Hill Marls (South Staffordshire Coalfield).

Base defined: the lowest primary red beds in the Langsettian to Bolsovian interval; the formation is often transitional with the Productive Coal Formation.

Characteristic facies: red mudstones, with fluvial-channel sandstones and alluvial-fan conglomerates; the mudstones frequently show evidence of palaeosols.

Chronostratigraphical range: Langsettian to Duckmantian in the south of the area, changing gradationally to Bolsovian and Westphalian D in the north.

The overlying strata have been traditionally assigned to five formations (Halesowen, Newcastle, Keele, and Enville Beds, and the Clent Conglomerates), but this scheme is currently being reviewed by B. Besly.

Geological setting

The Late Carboniferous geological evolution of this area is summarized by Besly (1988) and Fulton and Williams (1988). Being near the margins of the Pennine Basin, the Wales–Brabant Barrier caused a significant reduction in subsidence rates. At times between the late Namurian and Bolsovian, subsidence was enough to allow a condensed sequence of Productive Coal Formation to develop. More often, however, the reduced subsidence caused emergent conditions with a lower water-table. This resulted in the development of red mudstones with frequent palaeosols but few coals, known as the Etruria Formation. In areas adjacent to uplifting parts of the Wales–Brabant Barrier, (e.g. Northeast Shropshire and West Warwickshire blocks) proximal alluvial fan deposits occur. In all cases, the sediment seems to have been derived from the south.

In the middle Westphalian D, there appears to have been some tectonic activity and, as a consequence, the Etruria Formation is overlain unconformably by upper Westphalian D and possibly lower Stephanian strata. This unconformity is referred to locally in the Coalbrookdale Coalfield as the Symon 'Fault'. The beds above the unconformity have been assigned to a variety of lithostratigraphical units (e.g. Halesowen Beds, Keele Beds). As pointed out in the previous section, however, their inter-relationships are far from clear and it is impossible at present to establish a detailed geological history. The only point which now seems evident is that the beds immediately overlying the unconformity were derived from two discrete sources: from the south, which produced the 'Pennant-like' sandstones known as the Halesowen Beds; and from the north, which produced the red sandstones known as the Keele Beds. The timing of this tectonic activity, and the petrography and provenance of the Halesowen Beds, suggests strongly a link with

developments in southern Britain that resulted in the development of the Forest of Dean Coalfield and the unconformity in the eastern part of the South Wales Coalfield. These developments in southern Britain have in turn been correlated with the Leonian phase of tectonic activity, which has been identified over large areas of Europe (see Chapters 4 and 5).

GCR site coverage

This has attempted to show the main facies of the Westphalian formations in this part of the Pennine Basin; unfortunately, no suitable sites showing the condensed Namurian sequences were identified. The GCR site coverage may be summarized as follows:

1. Cornbrook Sandstone Formation

(a) Cornbrook Dingle (type section)

(b) Benson's Brook (basal unconformity and relationship with Productive Coal Formation)

2. Productive Coal Formation

(a) Benson's Brook (development of formation in Clee Hills, and its relationship with the Cornbrook Sandstone Formation)

(b) Brewin's Canal Cutting (basal part of formation in South Staffordshire Coalfield)

(c) Doulton's Claypit (middle part of formation in South Staffordshire Coalfield)

(d) Eyemore Railway Cutting (Aegiranum Marine Band in Wyre Forest)

3. Etruria Formation

(a) Ketley Claypit (alluvial plain facies)

(b) New Hadley Brickworks (alluvial fan facies)

4. 'Halesowen and Newcastle Beds'

(a) Halesowen Road Cutting (best exposure of Halesowen Beds in type area)

(b) Kingsbury Brickworks (best exposure of unconformity between Halesowen and Etruria formations)

(c) Metallic Tileries (best exposure of unconformity between Newcastle and Etruria formations)

5. 'Keele Beds'

(a) Cheswardine Canal Cutting (the formation near its type area)

(b) Alveley Grindstone Quarry (Alveley Grindstone facies)

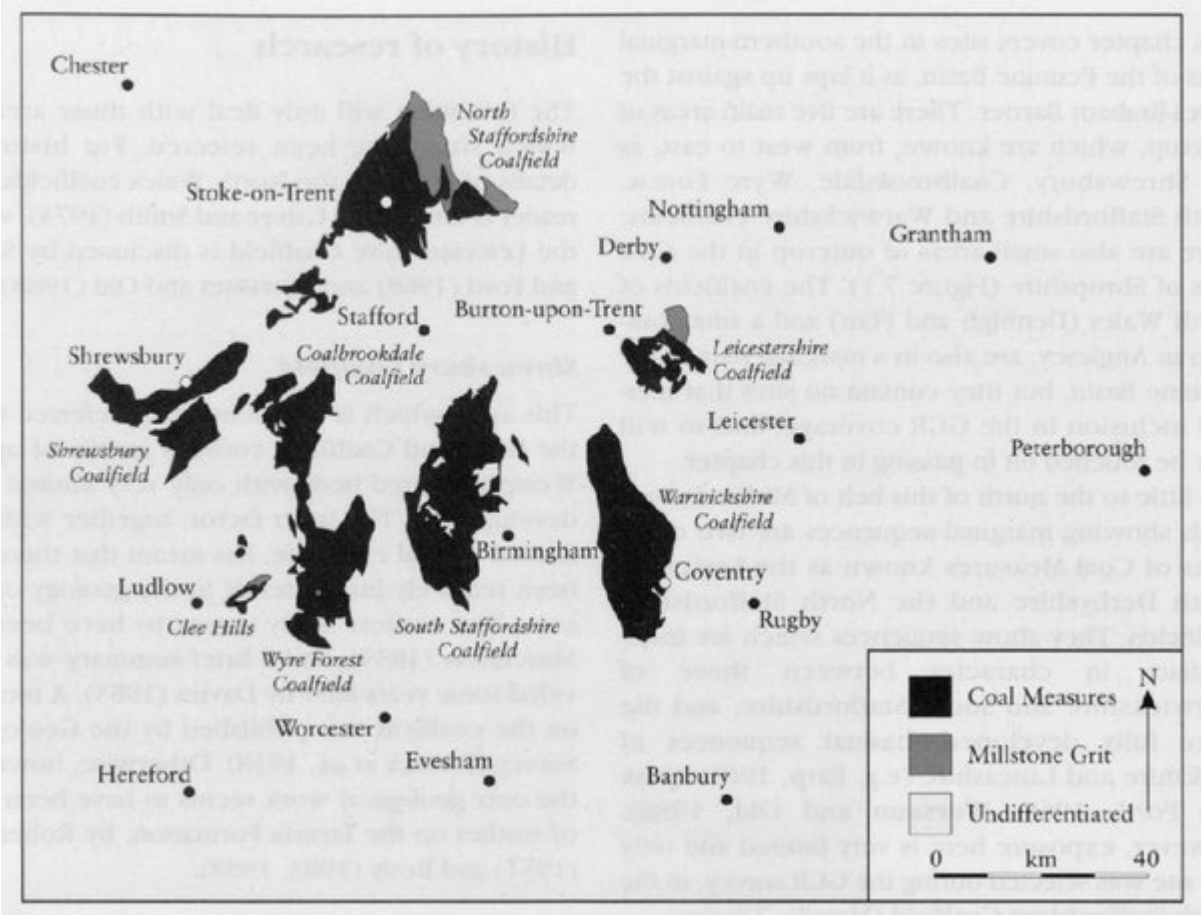
6. 'Enville Beds'

(a) Gospel End Cutting (alluvial fan association)

(b) Webster's Claypit (ephemeral fluvial association)

In view of the work currently being done by B. Besly on the Upper Carboniferous beds of the English Midlands, this coverage will undoubtedly require significant revision in the near future, especially that covering the upper part of the sequence.

References



(Figure 7.1) Upper Carboniferous outcrops in the English Midlands and northern Welsh Borders. Based on Hains and Horton (1969, pl. II), and Earp and Hains (1971, fig. 2).