Chapter 6 Bristol–Somerset Basin

This basin has been estimated to be about 600 km in area (Figure 6.1), and thus one of the most important developments of Upper Carboniferous strata in southern Britain (Moore and Trueman, 1942). However, four-fifths of it is covered by Mesozoic strata, often at some depth. This has limited the degree to which the coal has been exploited; its annual productivity reached a maximum of only about 1.5 million tons between the world wars (Bone and Himus, 1936), and the last pit closed over 20 years ago.

Even where the Upper Carboniferous does crop out at surface, it is mostly covered by superficial deposits. Consequently, there is very little natural exposure except along the steep sides of the Avon Valley, and so direct observations of the surface geology can only be made at man-made exposures such as railway cuttings and claypits. This has made it difficult to develop a coherent network of GCR sites to demonstrate the Upper Carboniferous geology of the area.

History of research

The earliest attempt to summarize the geology of the Bristol–Somerset Coalfield was by Buckland and Conybeare (1824), who brought together the main pieces of stratigraphical and structural evidence then available. The principal problem at this time was the tectonic complexity of the area, which made it difficult to establish a uniform stratigraphical scheme throughout the coalfield. This problem was further investigated by officers of the Geological Survey (Woodward, 1876). In addition, local geologists affiliated with the coal companies were providing much useful data, the names of McMurtrie and Cossham standing out as being particularly important (McMurtrie, 1867, 1869, 1890, 1901; Greenwell and McMurtrie, 1864; Cossham, 1879, 1885).

The second phase of research on the coalfield was undertaken in the 1930s and 1940s at the University of Bristol, co-ordinated largely by A.E. Trueman. Although he was only professor at Bristol for four years, Trueman, together with his then research student L.R. Moore, instigated a fundamental revision of the geology of the coalfield. They brought together a wealth of new information derived from the collieries, and integrated it with the then new biostratigraphical techniques involving plant and non-marine bivalve fossils. The resulting papers still provide some of the most detailed published descriptions of the stratigraphy and structure of this coalfield (Moore, 1938, 1941; Moore and Trueman, 1937, 1939, 1942).

Most recently, the area has been investigated by Kellaway, on behalf of the British Geological Survey. Until recently, his most important publication was a paper dealing with the upper Westphalian part of the sequence here and its relationship to other, nearby coalfields, such as South Wales and Warwickshire (Kellaway, 1970). He also published a number of summaries of the geology of the coalfield (Kellaway and Welch, 1948, and in Curtis *et al.,* 1955). The strength of his work lay in the detailed mapping for which he was responsible, and the lithostratigraphical correlations that he established. Recently, the British Geological Survey Memoir for the coalfield has been published (Kellaway and Welch, 1993), which is in many ways the culmination of Kellaway's works.

In addition to the stratigraphical work that has been undertaken in the coalfield, it is perhaps worth mentioning briefly its palaeontology. The area has long been renowned for yielding finely preserved plant adpressions, some of which were featured in the pioneering palaeobotanical studies by Sternberg (1820–1838) and Brongniart (182 81838), apparently supplied by Buckland. Papers dealing with aspects of the palaeobotany have been written by Kidston (1887), Lillie (1910), Crookall (1925, 1929) and Thomas and Cleal (1994), and many specimens were figured in Kidston's (192 31925) memoir on the British Coal Measures plant fossils. Recent discoveries have also demonstrated the importance of this area for animal fossils, particularly insects and other arthropods (Jarzembowski, 1989).

Lithostratigraphy

The lithostratigraphical classification of these strata broadly follows that of Kellaway (1967, 1970). The Namurian part of the sequence, which is mainly known from boreholes, is referred to as the Quartzitic Sandstone Formation or 'Group'.

This is overlain by a thick sequence of Coal Measures, which includes a lower, coal-bearing interval (the Productive Coal Formation), a thick, mainly arenaceous interval (Downend and Mangotsfield formations), and an upper, coal-bearing interval (Farrington, Barren Red, Radstock and Publow formations). A generalized sequence of the Bristol–Somerset Coal Measures is shown in (Figure 6.2).

Quartzitic Sandstone Formation

Stratotype: Ashton Park Borehole (Kellaway, 1967) — no suitable surface exposure currently available.

Base defined: base of lowest Namurian sandstone.

Characteristic facies: massive sandstones. Chronostratigraphical range: Pendleian to Yeadonian.

Productive Coal Formation

Defined in South Wales (see Chapter 4) Chronostratigraphical range: Langsettian to Bolsovian.

Comments: In the southern part of the basin, the upper part of the Productive Coal Formation is significantly more arenaceous, and has resulted in the recognition of two discrete members, the Vobster and New Rock 'groups' (Moore and Trueman, 1937, 1942). However, this subdivision cannot be recognized elsewhere in the coalfield.

Downend Formation

Stratotype: Bickley Wood

Base defined: the base of the first massive sandstone or conglomerate above the Cambriense Marine Band.

Characteristic facies: lenticular quartz-conglomerates and red-measures. Chronostratigraphical range: upper Bolsovian to lower Westphalian D.

Mangotsfield Formation

Stratotype: Winterbourne Railway Cutting Base defined: Mangotsfield group of coals. Characteristic facies: cross-bedded, Pennant-type sandstones.

Chronostratigraphical range: Westphalian D.

Farrington Formation

Stratotype: undefined (no surface outcrops available).

Base defined: base of No.9 Coal of Radstock. Characteristic facies: grey, coal-bearing measures.

Chronostratigraphical range: upper Westphalian D.

Barren Red Formation

Stratotype: undefined (no surface outcrops available).

Base defined: base of Rock Coal of Radstock.

Characteristic facies: red mudstones and s stones.

Chronostratigraphical range: upper Westphalian D.

Radstock Formation

Stratotype: undefined (no surface outcrop available).

Base defined: Nine Inch Coal of Radstock.

Characteristic facies: grey, coal-bearing measures.

Chronostratigraphical range: upper Westphalian D.

Publow Formation

Stratotype: Hursley Hill Borehole (no surface exposures available).

Base defined: Forty Yard Coal of Pensford.

Characteristic facies: grey mudstones and sandstones, sometimes developing a reddish coloration, and with some thin coals.

Chronostratigraphical range: upper Westphalian D to lower Cantabrian.

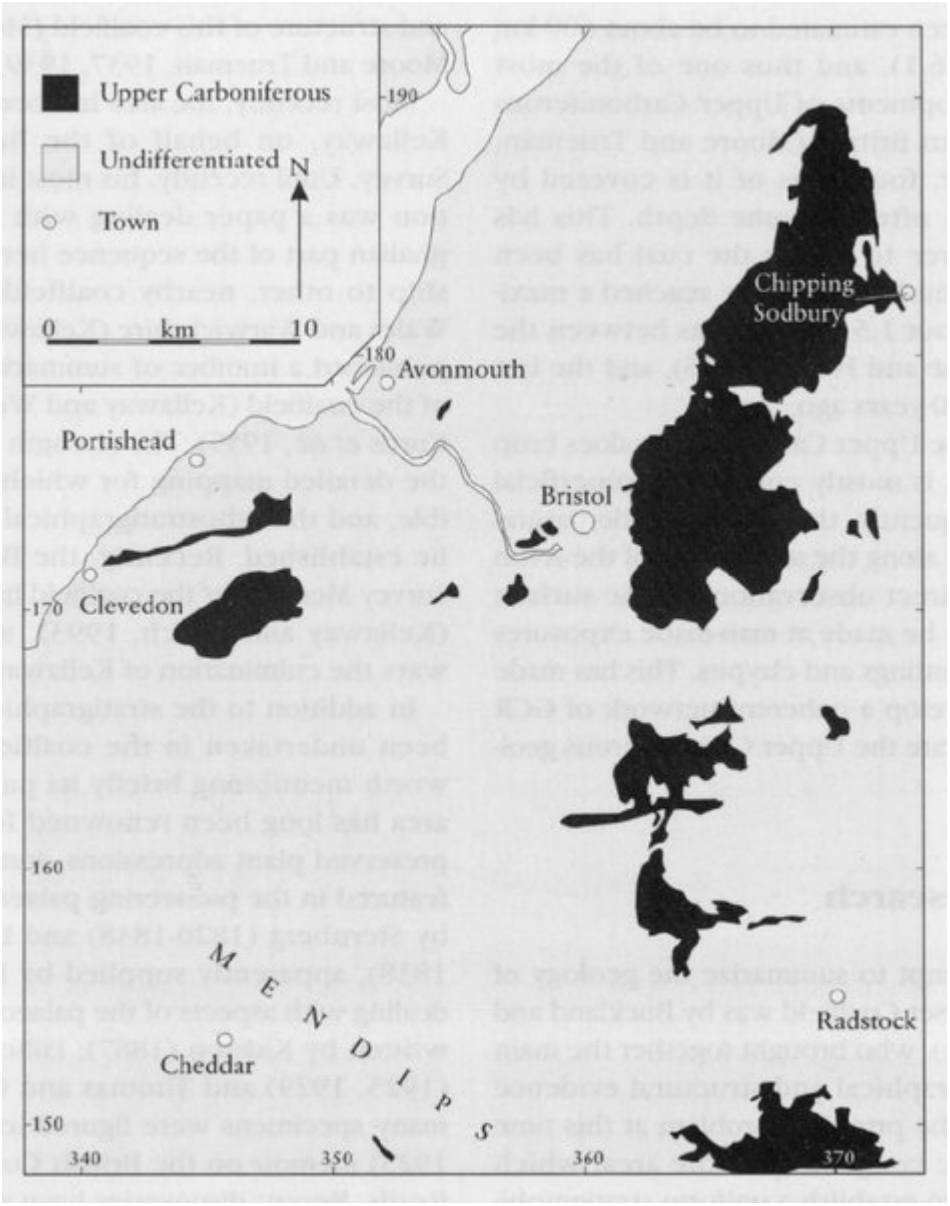
Geological setting

From the lithostratigraphical pattern outlined above, the Bristol–Somerset Coalfield is clearly closely related to the South Wales Coalfield; the Downend and Mangotsfield formations are probably equivalent to the South Wales Pennant Formation, and the Farrington, Barren Red, Radstock and Publow formations to the Grovesend Formation. They were clearly not part of the same depositional basin, since they were separated from each other by the narrow southwards extension of the Wales–Brabant Barrier, known as the Usk Axis. Nevertheless, the processes that generated the formation of these two basins, and which caused the uplift of the sediment-producing hinterlands would seem to have been the same, i.e. nappeloading along the northwards migrating Variscan Front (see the Introduction to Chapter 4 for a further discussion of this model).

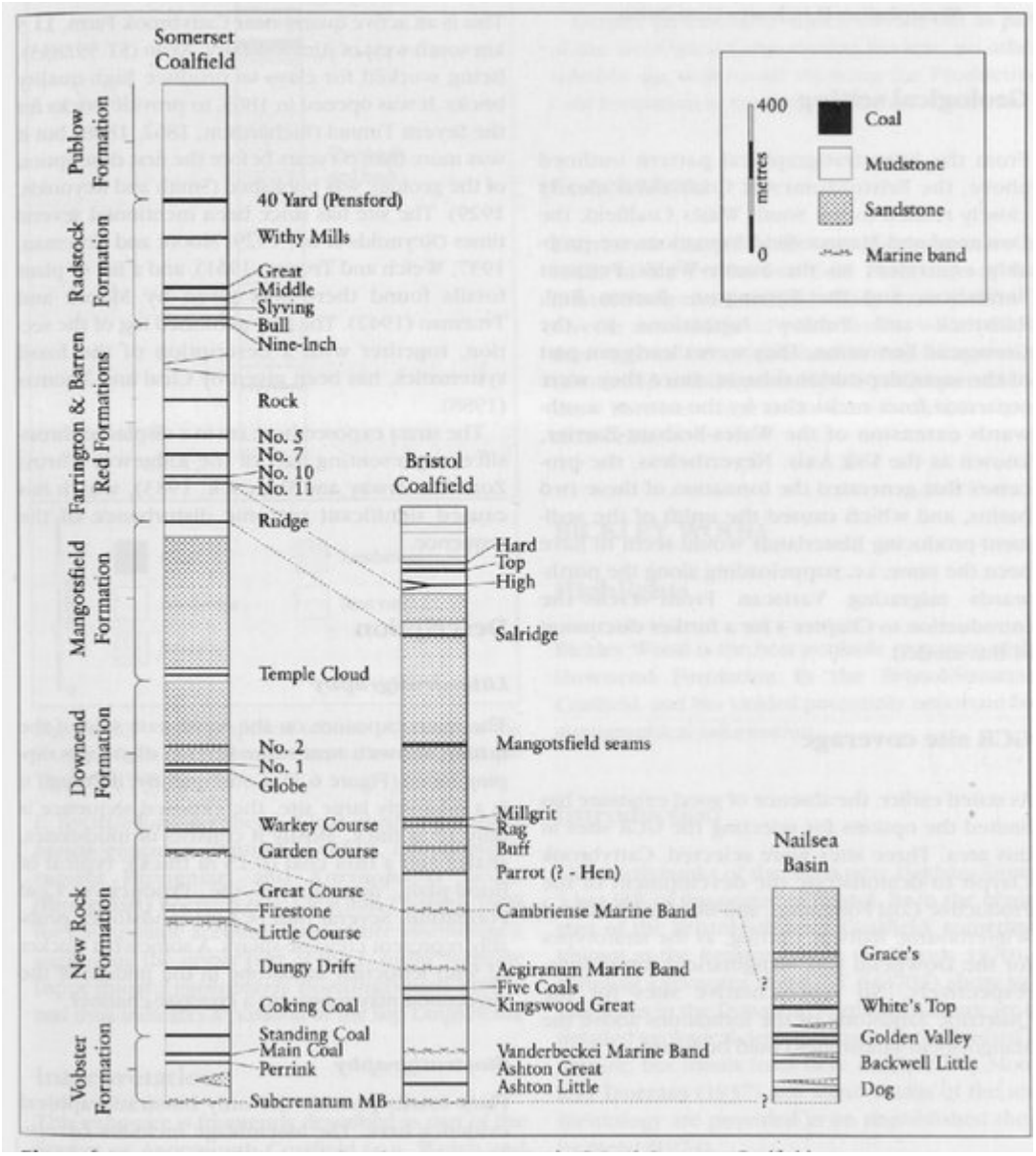
GCR site coverage

As stated earlier, the absence of good exposure has limited the options for selecting the GCR sites in this area. Three sites were selected, Cattybrook Claypit to demonstrate the development of the Productive Coal Formation, and Bickley Wood and Winterbourne Railway Cutting, as the stratotypes for the Downend and Mangotsfield formations, respectively. No representative sites for the Quartzitic Sandstone or the formations above the Mangotsfield sandstones could be found.

References



(Figure 6.1) Map of the Bristol-Somerset Coalfield. After Kellaway and Welch (1993).



(Figure 6.2) Generalized Upper Carboniferous sequence in the Bristol-Somerset Coalfield.