Vallis Vale, Somerset

[ST 755 494]–[ST 757 492] and [ST 754 491]–[ST 757 486]

Introduction

The Vallis Vale GCR site comprises a series of disused quarries on the valley sides of the Mells and Egford stream systems [ST 757 492]–[ST 755 494] and [ST 757 486]–[ST 754 491], and is situated between the villages of Egford, Hapsford and Bedlam, 2 km north-west of Frome in Somerset. The locality is widely known for its spectacular and historically important exposure of the angular unconformity between the Carboniferous Limestone and the Middle Jurassic (Bajocian) Inferior Oolite (Conybeare and Phillips, 1822; De la Beche, 1846; Arkell, 1933). The site also includes a thick Lower Carboniferous succession of Courceyan–Arundian age encompassing much of the Black Rock Limestone and the type section of the Vallis Limestone. Whereas general descriptions of the Vallis Vale unconformity are presented by many authors (Macfadyen, 1970; Savage, 1977; Duff *et al.,* 1985; Prosser and King, 1999) and details relating to the Middle Jurassic section arc documented in a companion GCR volume (Cox and Sumbler, 2002), modern works on the Lower Carboniferous section at this site are generally lacking. The report that follows therefore relies heavily on the accounts of Bush (1925), Welch (1933), Kellaway and Welch (1955) and Butler (1973).

Description

The Lower Carboniferous succession at Vallis Vale lies on the northern limb of the Beacon Hill Pericline. Beds dip consistently to the NNW with dips progressively increasing from low to moderately steep angles as the sequence is traced from south to north across the site. The Black Rock Limestone is particularly well exposed in an old quarry on the eastern side of Egford Brook at the southern end of the site. Its outcrop continues northwards (albeit poorly), in a series of overgrown quarries mainly on the western side of Egford Brook. North-west of the Egford and Mells stream confluence and either side of the upstream section of the Mells River, the Vallis Limestone is exposed in partly overgrown quarries on the valley sides.

The most comprehensive (if dated) description of the lithological and palaeontological succession is by Bush (1925), who recorded an extensive section ranging from the Z_2 Subzone to the S_1 Subzone that was substantially thicker and more complete (see Butler, 1973) than the equivalent section described by Vaughan (1905) from the Avon Gorge (see GCR site report, this chapter). The lower part of this succession (Z_2–C_1 subzones) is represented by the Black Rock Limestone (Figure 9.42) while the upper part (C_2–S_1 subzones) is represented largely by the Vallis Limestone. Making allowance for the exaggerated outcrop widths due to thrusting (see Welch, 1933), the upper Black Rock Limestone here is approximately 200 m thick. It comprises dark crinoidal wackestones with a prominent chert development in its lower part (the 'Main Chert' of Butler, 1973, and others).

Towards the top of the unit, massive pale-coloured packstones and dolomitized beds become more common. Bush (1925) recognized three of Vaughan's (1905) faunal subdivisions in this part of the succession (Z_2, Horizon γ and C_1) and from each of them he recorded rich fossil assemblages dominated by solitary rugose corals, tabulate corals and brachiopods.

Notable records from the Z_2 Subzone include the brachiopods *Unispirifer tornacensis, Leptaena analoga* and the coral *Zaphrentites delanouei* with *siphonophyllia cylindrica* 'appearing low in the subzone' (Bush, 1925). In Horizon γ, other corals, including *Michelinia favosa, M. megastoma* and *Caninophyllum patulum,* enter the sequence (the latter reaching its acme at this level) accompanied by *S. cylindrica* and *Sychnoelasma konincki* in abundance. At the base of the overlying C_1 Subzone, large *S. cylindrica* are apparently particularly common (Bush, 1925). A somewhat similar faunal distribution was noted in the Black Rock Limestone at Burrington Combe (see GCR site report, this chapter) by Mitchell and Green (1965) who recognized three faunal subdivisions in the formation referred to as the 'Lower Fauna', the 'Middle Fauna' and the 'Upper Fauna' respectively. These three faunal subdivisions, later elevated by Ramsbottom and Mitchell (1980) to assemblage biozone status as the *Zaphrentites delanouei, Caninophyllum patulum* and *Siphonophyllia* *cylindrica* assemblage biozones respectively, broadly correspond to the faunal subdivisions Z_2, Horizon γ and C_1 recognized by Bush (1925) at Vallis Vale.

Whereas the precise position of critical stratigraphical boundaries remains uncertain, the recognition of diagnostic conodont and coral taxa confirms a Courceyan–Chadian age for much of the Black Rock Limestone at this site. Typical Courceyan conodonts recorded by Butler (1973) from a low position in the sequence include *Polygnathus communis carina, Gnathodus delicatus* and *Pseudopolygnathus multistriatus,* whereas higher in the sequence the occurrence of *S. cylindrica* in abundance (Bush, 1925) and *S. garwoodi* (Sibly, 1906; see Ramsbottom and Mitchell, 1980, p. 62) confirms that the upper part of the Black Rock Limestone extends from the Chadian Stage into the Arundian Stage (see Riley, 1993) – a view also supported by evidence from Halecombe Quarry 6 km to the west where *Delepinea carinata* has been recorded at the base of the Vallis Limestone and *Siphonophylum garwoodi* has been recorded approximately 20 m lower in the sequence (Butler, 1973; George *et al.,* 1976; Kellaway and Welch, 1993).

Above the Black Rock Limestone, the Vallis Limestone comprises approximately 110 m of massive, pale-coloured crinoidal limestone. The term 'Vallis Limestone' was first introduced by Kellaway and Welch (1955) to describe a lateral facies equivalent of the lower part of the Burrington Oolite dominated by bioclastic and crinoidal limestones and seemingly devoid of ooids. The formation is widely regarded as Arundian in age (Wilson *et al.,* 1988; Green, 1992; Kellaway and Welch, 1993). At Vallis Vale it includes those beds originally referred to by Bush (1925) as belonging to the C_2 Subzone, towards the top of which bellerophontid gastropods, large corallites of *Amplexus* and *Sychnoelasma konincki* are common. The formation may also include some of those beds Bush (1925) ascribed to the S_1 Subzone, which include carbonate mudstones containing other Arundian corals (*Siphonodendron martini*)and oolitic beds, although the [British] Geological Survey (Institute of Geological Sciences, 1965) appear to regard a significant part of Bush's (1925) S Zone at Vallis Vale as belonging to a unit above the Vallis Limestone in the Clifton Down Group. The uncertainty regarding the extent of the Vallis Limestone arises because its boundaries appear to be poorly defined in many areas.

Interpretation

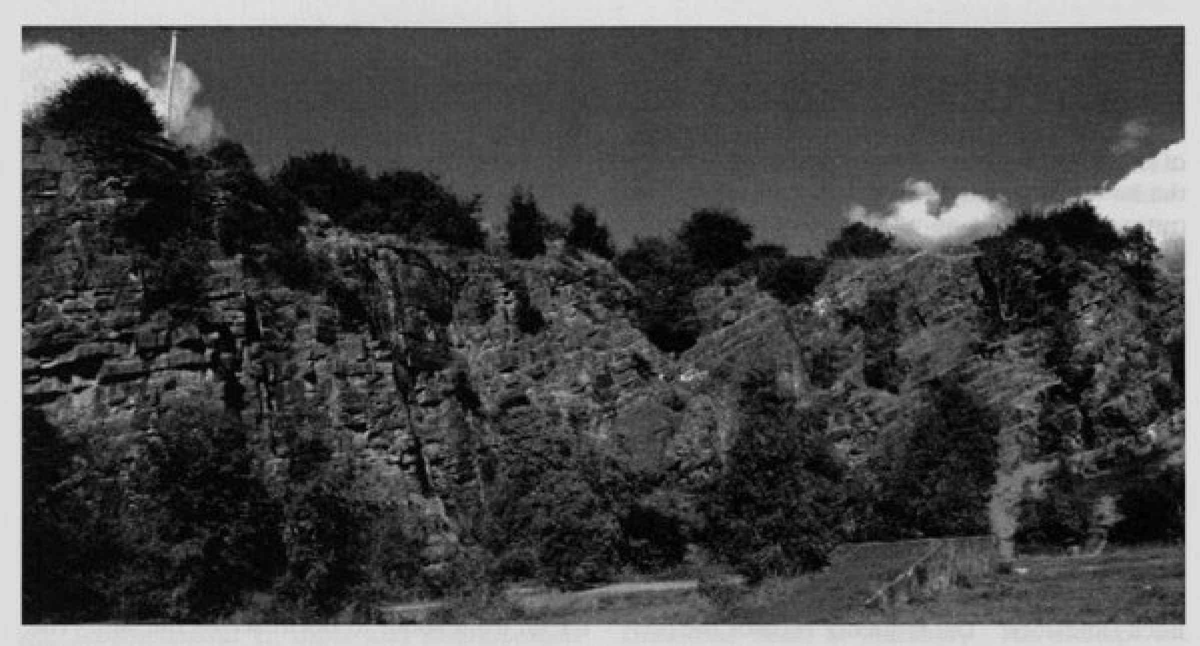
Regional mapping and biostratigraphical studies have indicated that the Lower Carboniferous successions of the eastern Mendips are thicker and stratigraphically more complete than they are farther north in the Bristol district where a number of non-sequences are recognized in the sequence (Bush, 1925; Welch, 1933; Kellaway and Welch, 1955; Butler, 1972, 1973; Mitchell, 1972; Ramsbottom, 1973; Green, 1992; Kellaway and Welch, 1993). Bush (1925) in particular noted that the Z_2–C_1 subzonal interval at Vallis Vale was substantially thicker than the equivalent section in the Avon Gorge where the *Siphonophyllia cylindrica* assemblage zone at the top of the Black Rock Limestone (the approximate correlative of the C_1 Subzone at Vallis Vale) is missing from the sequence (Ramsbottom and Mitchell, 1980; Mitchell, 1981). Variations in the character of the conodont assemblages from the Vallis Vale and Avon Gorge sections would appear to support this view (Butler, 1973).

To a large extent the differences noted above are a reflection of the palaeogeography of southern England during early Carboniferous times and of the deposition of sediments on a southward-dipping carbonate ramp (Wright, 1987a; Leeder, 1992) that was subsiding at a greater rate and more continuously in the south than it was to the north ((Figure 9.3)b). In this context, the Black Rock Limestone, with its open marine faunas, is interpreted as an early Carboniferous offshore and relatively deep-water mid- to outer-ramp facies, while the Vallis Limestone probably formed as part of an E–W-trending and southward-prograding carbonate sand shoal, the Burrington Oolite–High Tor Limestone barrier complex ((Figure 9.4)b), which extended across parts of southern England and South Wales during Arundian times (Wright, 1987a; Wilson *et al.,* 1988).

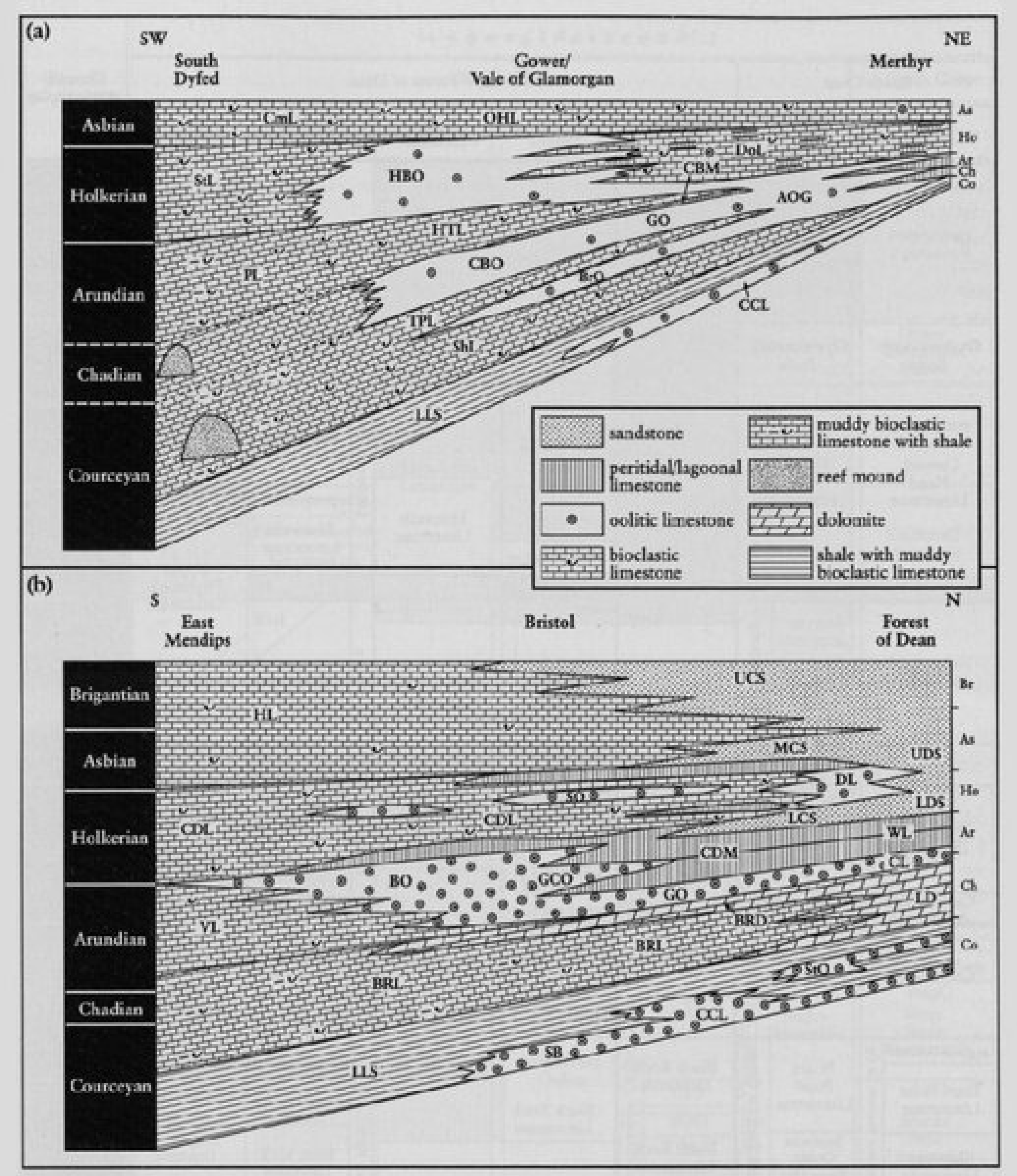
Conclusions

This site offers a particularly well-developed and stratigraphically complete Courceyan–Arundian section that includes the middle and upper parts of the Black Rock Limestone and the type section of the overlying Vallis Limestone. Its rich macrofossil and microfossil assemblages make it an important reference section for stratigraphical correlations across the South Wales–Mendip Shelf in early Dinantian times. The locality also includes a historically significant angular unconformity which is widely regarded as the one of the most spectacular examples of its type in southern England.

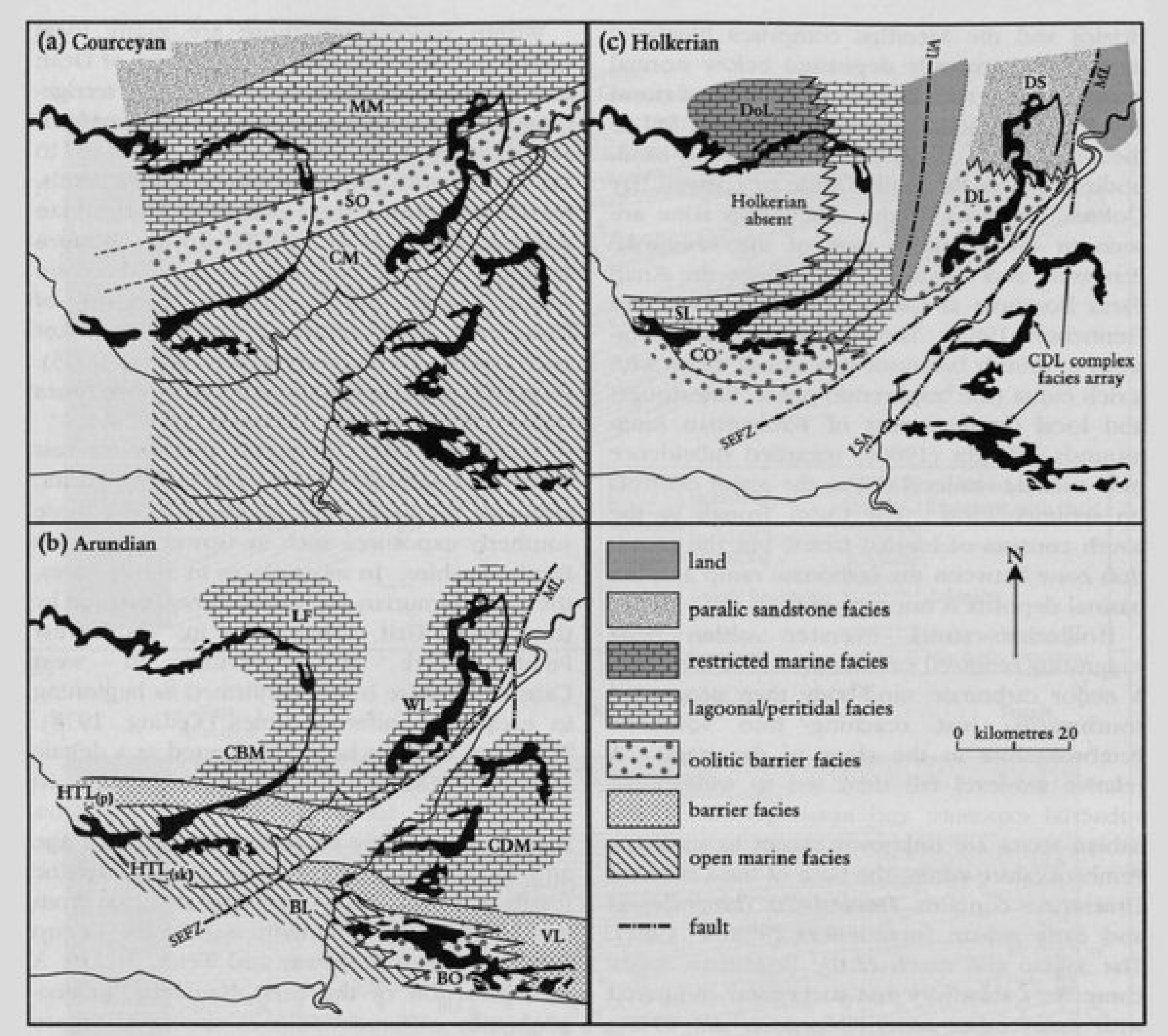
References



(Figure 9.42) Quarry section in the Black Rock Limestone (Courceyan) at the southern end of the Vallis Vale GCR site. (Photo: P.J. Cossey.)



(Figure 9.3) Simplified stratigraphical sections of Dinantian strata in south-west Britain illustrating the distribution of Dinantian lithofacies. Section (a) based on Wright (1986a) and Burchette et al. (1990); approximate length of section, 100 km. Section (b) based on information from Kellaway and Welch (1955, 1993), Burchette et al. (1990) and Green (1992); approximate length of section, 80 km. (LLS — Lower Limestone Shale; CCL — Castell Coch Limestone; ShL — Shipway Limestone; BrO — Brofiscin Oolite; TPL — Tears Point Limestone; CBO Caswell Bay Oolite; GO — Gully Oolite; AOG — Abercriban Oolite Group; CBM — Caswell Bay Mudstone; PL — Pen-y-Holt Limestone; HTL — High Tor Limestone; StL — Stackpole Limestone; HBO — Hunts Bay Oolite; DoL — Dowlais Limestone; CmL — Crickmail Limestone; OHL — Oxwich Head Limestone; SB — Shirehampton Beds; StO — Stowe Oolite; BRL — Black Rock Limestone; BRD — Black Rock Dolomite; LD — Lower Dolomite; CL — Crease Limestone; VL — Vallis Limestone; BO — Burrington Oolite; GCO — Goblin Combe Oolite; CDM — Clifton Down Mudstone; WL — Whitehead Limestone; CDL — Clifton Down Limestone; SO — Seminula Oolite; DL — Drybrook Limestone; LDS — Lower Drybook Sandstone; UDS — Upper Drybook Sandstone; LCS — Lower Cromhall Sandstone; MCS Middle Cromhall Sandstone; UCS — Upper Cromhall Sandstone; HL — Hotwells Limestone.)



(Figure 9.4) The Lower Carboniferous palaeogeography of south-east Wales and part of southern England illustrating the distribution of facies for the (a) Courceyan, (b) Arundian, and (c) and Holkerian stages. (MM — Mitcheldean Member; SO — Stowe Oolite; CM — Cwmyniscoy Mudstone; LF — Llanelly Formation; CBM — Caswell Bay Mudstone; HTL — High Tor Limestone (p — peloidal; sk — skeletal); BL — Birnbeck Limestone; BO — Burrington Oolite; VL — Vallis Limestone; CDM — Clifton Down Mudstone; WL — Whitehead Limestone; DL — Drybrook Limestone; DoL — Dowlais Limestone; SL — Stormy Limestone; DS — Drybrook Sandstone; CO — Cornelly Oolite; CDL — Clifton Down Limestone; UA — Usk Axis; ML — Malvern Line; SEFZ — Severn Estuary Fault Zone; LSA — Lower Severn Axis.) Based on Burchette (1987) and Wilson et al. (1988).