Coaley Wood, Gloucestershire

[ST 786 996]

N. Chidlaw

Introduction

The Coaley Wood GCR site is located on the crest and upper face of the Cotswold escarpment at about 200 m OD, about 1.5 km north of the village of Uley (Figure 4.20). It comprises a disused quarry on the escarpment crest and two sunken lanes, which extend down the scarp face and beyond the limits of the site. The site is critical in the interpretation of the late Toarcian history of the Severn Basin, and an almost continuous section is provided through the uppermost beds of the Lias Group, consisting of the Bridport Sand Formation and the Cotswold Cephalopod Bed Member, to within the highest formations of the Inferior Oolite Group.

The exposure of the Cotswold Cephalopod Bed Member is more condensed than the equivalent succession at the Wotton Hill GCR site. This is inferred to have occurred through the non-deposition or 'merging' of lithostratigraphical units rather than any erosion or loss of biostratigraphical units. Although a normal fault, with a strike of 120° and a downthrow to the south, passes through the quarry, the strata are otherwise undisturbed and have a regional dip of less than 1° to the south-east.

The upper part of the sunken lanes and the quarry expose the Inferior Oolite Group, and hence are not discussed here. The remainder of the sunken lanes within the lower part of the GCR site expose the highest parts of the Lias Group and the boundary beds of the Lower and Middle Jurassic succession, and form the subject of this account. These sections were described by Buckman (1887–1907, 1889), Richardson (1910b) and most recently by Cave (1977).

Description

Richardson's (1910b) section through the Cotswold Cephalopod Bed Member was said to be located 'at the top of the bank below [Coaley Wood] quarry'; the latter is the conspicuous quarry in the Inferior Oolite Group immediately west of Crawley Barns [ST 7867 9950]. Cave (1977) gave a grid reference of [ST 7863 9947] for an exposure of the Cotswold Cephalopod Bed Member, which was at the approximate location of Richardson's section, but commented that there were 'minor differences' between the two. Richardson's (1910b) section is the more stratigraphically continuous of the two, although Cave's (1977) description employed more accurate lithological descriptions and mentioned additional fauna. Nonetheless, clear differences exist in the lithological descriptions of some units as recorded by the two authors. The log reproduced in this account, and in (Figure 4.17), combines data from Richardson (1910b) and Cave (1977) to give as full an account as possible. However, where uncertainties occur, Richardson's descriptions have been adopted in preference to those of Cave. The Bridport Sand Formation was described most fully by Buckman (1889) and it is his recorded section that is reproduced here, with some additional stratigraphical and faunal information from Richardson (1910b).

	Thickness (m)
AALENIAN STAGE	
Birdlip Limestone Formation	
Leckhampton Member ('Scissum Beds')	
Scissum Zone	
19: Limestones, somewhat sandy.	*c.* 1.68
Opalinum Zone	

18: Opaliniforme Bed: Limestone, oolitic, very hard, ooliths commonly replaced by limonite are contained in a matrix of sparry calcite. Base irregular and welded to bed below. *Pseudolioceras beyrichi, Canavurina* sp., rhynchonellid brachiopods, *Myophorella* aff. *formosa, Parallelodon birsonensis, Tancredia? Leioceras* sp..	0.46
UPPER TOARCIAN SUBSTAGE	
Bridport Sand Formation	
Cotswold Cephalopod Bed Member	Total 0.79
Aalensis Zone	
17: **Aalensis Bed**: Limestone, rubbly, conspicuously ironshot. Full of belemnites.	0.15
Pseudoradiosa and *?Aalensis zones*	
16: **?Aalensis Bed** and **Moorei Bed**: Limestone, rubbly. *Pleydellia leura, Astarte lurida, Opis carinata, Cypricardia brevis,* 'and in this bed or that below' *Hinnites objectus, Pleuromya* and *Gervillia fornicata.*	0.20
Dispansum Zone and *Tbouarsense Zone, Fallaciosum Subzone* (part)	
15: **Dispansum and Struckmani beds**: Limestone, argillaceous, hard, with limonite pellets. Bivalves, belemnites, *Neocrassina, Pseudogrammoceras doerntense, P. placidum, P. bingmanni, P. quadratum, P. regale, P. struckmanni, P. compactile, Polyplectus discoides, Hammatoceras insigne* and *Pammoceras dispansum.*	0.18
Fallaciosum Subzone (part)	
14: Pedicum Bed ('Linseed Bed'): Marlstone, brown, rubbly. *Esericeras eseri, Haugia* aff *illustris, Pseudogrammoceras subfallaciosum, P. expeditum, P. thrasu, P. pedicum.*	0.18
Striatulum Subzone	
13: **Striatulum Bed**: Marl, filling irregularities in the bed below.	
Grammoceras toarciense, G. audax.	0.08
Bridport Sand Formation ('Cotteswold Sands')	
Variabilis Zone	
12: Very hard, bluish-grey sandy nodular bed.	0.08
11: Hard, blue-centred stone.	0.15
10: Sands, micaceous, fine grained, yellow.	*c.* 15.25
9: Brownish, concretionary rock, very slightly micaceous, containing dark oolitic grains and pieces of broken shells. Similar to Unit 15 of the Cotswold Cephalopod Bed Member, but harder. Some ammonites, but they are scarce.	0.84
8: Two bands of yellowish-blue, hard, somewhat sandy stone. *Phymatoceras pauper, Haugia* sp., large *Lima.*	0.61
7: Sands, yellow, becoming blue in the lower part.	3.05
6: Marl, concretionary, dark yellowish-brown, with ammonites.	0.08
5: Band of yellowish-blue, hard, sandy stone. Ammonites fairly abundant, especially on the top. *Haugia variabilis, H. grandis, Lytoceras sublineatum, Catacoeloceras ? dumortieri, Phymatoceras obtecta.*	0.23

Bifrons Zone, Crassum Subzone

4: Sands, line grained, yellow.	c. 7.6
3: Sandstone band, yellowish-blue, hard. *Hildoceras bifrons* abundant, *H. semipolitum, Pseudolioceras lythense, Plagiostoma* sp., *Hinnites objectus.*	0.30
2: Sands, yellow, visible for some metres, and conjectured to extend down to the spring.	12.2

Serpentinum and *Bifrons zones*

Whitby Mudstone Formation

1: Clay, blue. Exposures mostly obscured by vegetation.

Buckman (1889) divided the Bridport Sand Formation into two main units. The 'Lilli Bed' corresponds to beds 2 to 4 of the above section, and the Tariabilis Bed' encompasses beds 5 to 12 of the section. Only this latter part of the formation, from Bed 5 upwards, is included within the GCR site boundary. Buckman's estimated thickness for the Bridport Sand Formation here, as at Nibley Knoll, probably was under-estimated. Cave (1977) considered that the Bridport Sand Formation thickens northwards and reached a thickness of perhaps as much 76 m at Cooley Peak (1.8 km north of Coaley Wood). A further 30 m of the formation may, therefore, be present in the vicinity of this site.

Wright (1878–1886) figured, as *Harpoceras discoides,* a specimen of *Polyplectus* aff. *discoides* from the Dispansum and Struckmani beds (Donovan, 1954). Howarth (1992) described the type assemblage of *Hildoceras semipolitum,* originally described by Buckman, from a 0.3 m-thick hard sandstone band 12 m above the base of the Bridport Sand Formation; this is Bed 17 of Buckman (1887–1907, 1889) and Bed 3 of this section. It was said to be still exposed in the 1960s, in the bed of the track leading down the scarp through Coaley Wood.

Interpretation

Although the Cotswold Cephalopod Bed Member at Cooley Wood attains less than a fifth of the thickness seen at the Wotton Hill GCR site it appears to have an almost equally complete ammonite sequence, lacking only the Levesquei Subzone 'Dumortieria Bed'. The succession here is condensed to such an extent that only six distinct lithostratigraphical units can be recognized, as against ten at Wotton Hill, but the ammonite evidence shows that this has occurred through the apparent 'merging' of successive units towards the top of the sequence. However, some uncertainty surrounds the precise details of the ammonite sequence since several species listed in beds 14 and 15 by Richardson (1910b) and Cave (1977) are characteristic of horizons lower in the Toarcian Stage. Only re-determination of this material can resolve this issue (K.N. Page, pers. comm.).

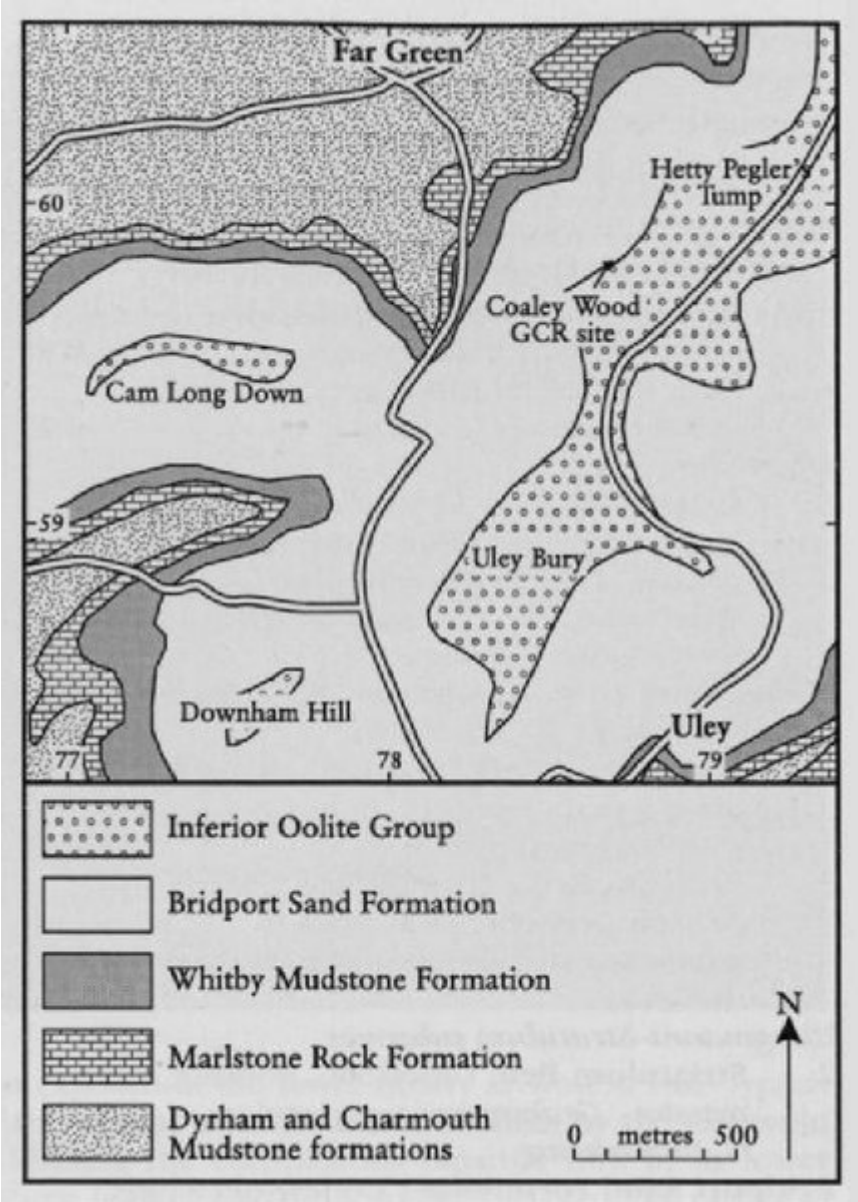
The reduction in thickness from Wotton Hill to the Coaley Wood GCR site (Figure 4.17) can be ascribed to their relative positions within a half-graben. The stratigraphical condensation at Cooley Wood accords well with its inferred position towards a 'hingeline' structural high and contrasts with the succession at Wotton Hill, inferred to lie closer to the hanging-wall of the half-graben fault. The thickening of the main part of the Bridport Sand Formation towards Stroud, noted by Cave (1977), would appear to conflict with this, but the available evidence is insufficient to establish whether this thickening is at the expense of the 'Whitby Mudstone Formation or reflects local or temporary variations in basin subsidence. The more highly condensed nature of some of the lithostratigraphical units, and the absence of the Levesquei Subzone, suggests that the rate of subsidence slowed down dramatically towards the close of the Toarcian Stage. However, this contrasts with the situation at the third GCR site, Haresfield Hill. Here the Aalensis, Moorei and Dumortieria beds are well represented but the remainder of the Cotswold Cephalopod Bed Member seen at the other two sites is absent. These differences between Coaley Wood and Haresfield Hill indicate significant differences in the timing and rates of subsidence in different parts of the Severn Basin during the Toarcian Stage and perhaps account for the apparently anomalous thickening of the Bridport Sand Formation between Wotton Hill and this site.

The overlying Leckhampton Member is significantly thicker, at 2.14 m, than the Cotswold Cephalopod Bed Member but comparable with the other two sites. However, initially subsidence appears to have been rather greater than at the other two GCR sites, with the Opaliniforme Bed here being more than 50% thicker. Although the base of the Leckhampton Member is not conglomeratic here, an erosional hiatus may be indicated by its irregular base.

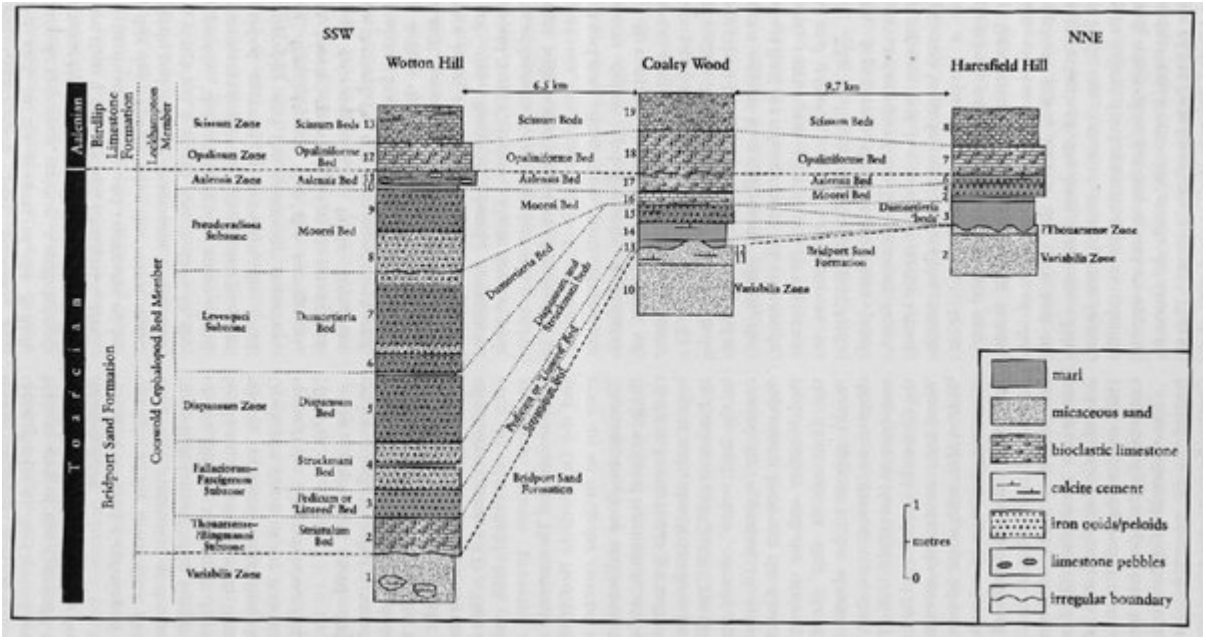
Conclusions

The sunken lane exposure of Upper Toarcian strata at the Coaley Wood GCR site provides an opportunity to examine the local lithostratigraphical units at the boundary of the Lower Jurassic Lias Group and the Middle Jurassic Inferior Oolite Group. All the ammonite zones are present, from the Variabilis Zone through to the Opalinum Zone, in a highly condensed succession. The site is well documented and provides a complete section through the Cotswold Cephalopod Bed Member, valuable for comparison with other exposures of the same beds in this area, and particularly the other GCR sites at Wotton Hill and Haresfield Hill. Together they demonstrate differences in rate and timing of subsidence across part of the Severn Basin during late Toarcian times. The upper part of the underlying Bridport Sand Formation ('Cotteswold Sands') is also exposed, containing bands of calcite-cemented sandstone with rare *Haugia* ammonites from the Variabilis Zone. The succession is capped by the Leckhampton Member (Scissum Beds) of the Birdlip Limestone Formation.

References



(Figure 4.20) Geology and location map for the Coaley Wood GCR site.



(Figure 4.17) Lithostratigraphical and biostratigraphical correlation of named units within the Cotswold Cephalopod Bed Member (Bridport Sand Formation) at the GCR sites of Wotton Hill (from new observations by Chidlaw), Coaley Wood (after Richardson, 1910b) and Haresfield Hill (after Buckman, 1887–1907; and Richardson, 1904). Ammonite zonal stratigraphy revised by K.N. Page.