Harford Cutting, Gloucestershire

[SP 1356 2184]–[SP 1410 2159]

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Introduction

Harford Cutting (Figure 3.52) is situated on the disused Andoversford to Bourton-on-the-Water railway in Gloucestershire, about 3 km northwest of Bourton. It exhibits fine sections through the middle and upper parts of the Inferior Oolite Group of the Cotswolds, and is the type section of both the Hayford Member of the Birdlip Limestone Formation (Lower Inferior Oolite), and the Aston Limestone Formation (Middle Inferior Oolite) (Barron *et al.,* 1997).

Description

This long cutting, up to about 15 in deep, still exposes an excellent section showing the succession from the upper part of the Birdlip Limestone Formation (Lower Inferior Oolite), to the middle part of the Salperton Limestone Formation (Upper Inferior Oolite). It was first described by Buckman (1890), who termed it the 'Third cutting west of Bourton'. Some additional information was given by Richardson (1929b), who also revised the stratigraphical classification of the beds, and the succession was summarized by Arkell (1947b). Woodward (1894) mentioned it only briefly, but provided an instructive sketch-section along the cutting (fig. 43, cutting Q) indicating a considerable amount of faulting ((Figure 3.53); see also Barron, 1999b). The exposures were re-examined and described by Parsons (1976b), and the following section is based on his account.

	Thickness (m)
Salperton Limestone Formation	
Clypeus Grit Member	
12: Limestone, very fossiliferous, pisolitic, bioclastic, with layers rich in poorly preserved bivalves alternating with horizons rich in brachiopods; harder and more massive towards base, where also less pisolitic; *Parkinsonia* (*P.*) cf. *eimensis* (S.S. Buckman *non* Wetzel), *P.* (*P.*) sp., *P.* (*Okribites?*) cf. *parkinsoni* (S.S. Buckman *non* Sowerby), *Stiphrothyris tumida* (Davidson), *Pleuromya uniformis* (J. Sowerby)	3.0
Upper Trigonia Grit Member	
11: Limestone, sandy, limonite-rich, slightly 'iron-shot', bioclastic; highly fossiliferous with numerous brachiopods; softer towards base; in three courses, lowest slightly conglomeratic; *Strenoceras* (*Garantiana*) *garantiana* (d'Orbigny), *S.* (*G.*) sp., *S.* (*Pseudogarantiana?*) cf. *quenstedti* (Wetzel), *Rhactorhynchia hampenensis* (*S.S.* Buckman)	1.0
Aston Limestone Formation	
Notgrove Member	
10b: Limestone, hard, white, ooidal, well bedded and forming prominent ledge; bored and oyster-encrusted top surface, with vertical borings passing through full thickness of bed	0.40
10a: Limestone, hard, white, ooidal, broken up and tufa-coated; thinning towards east	0–2.30

Gryphite Grit Member	
9: Limestone, grey-brown, sandy, bioclastic, in four or five courses separated by sandy partings; very shelly, especially towards base; top surface flat and bored; lowest course highly burrowed; *Gryphaea bilobata* J. de C. Sowerby)	1.40
8: Limestone, brown, sandy, bioclastic, softer than Bed 9; very fossiliferous, with shells of infaunal bivalves replaced by yellow-orange clay; highly burrowed and upper part bored; *Sonninia* aff. *ovalis* (S.S. Buckman ex Quenstedt), *Gryphaea bilobata, Pleuromya* sp.	0.40
7: Marl, brown, sandy; common serpulid-encrusted *Gryphaea*	0.28
6b: Limestone, brown, sandy, bioclastic, very shelly, in two or three irregular courses; sandy marl parting at base	0.40
6a: Limestone, hard, grey, sandy, bioclastic, very fossiliferous, with many shells replaced by limonite; *Sonninia* cf. *patella* (Waagen)	0.40
5b: Marl, very sandy	0.08
5a: Limestone, brown, very sandy, in one to two courses; sandy marl parting at base	0.28–0.14
4: Limestone, hard, grey, sandy, bioclastic limestone, sparsely flecked with limonite and with soft, red sandy material infilling burrows; in two courses; *Cenoceras sp., Darellia* aff. *toxeres* S.S. Buckman, *Euhoploceras* aff. *alternata* (S.S. Buckman), *Hyperlioceras subsectum* (S.S. Buckman), *H. rudidiscites* S.S. Buckman, *Reynesella* sp., *Discocyathus* sp., *Pinna cuneata* Phillips, *Pseudomelania* sp., *Trigonia costata* Parkinson	0.60
Lower Trigonia Grit Member	
3: Limestone, soft, rubbly, Iron-shot', weathering to marl; harder, conglomeratic for 0.06 m at base; highly fossiliferous with many bivalves, notably *Pleuromya*	0.25
Birdlip Limestone Formation	
Harford Member	
'*Tilestone*'	
2b: Limestone, pale-cream; numerous soft, pale-brown ooids; very fossiliferous, with many poorly preserved shells; top surface bored, basal part more coarsely ooidal, and conglomeratic with limonite-coated pebbles 0.60	
2a: Limestone, sandy, blue-hearted, weathering brown; bored at top; fossiliferous with numerous small fish teeth and crinoid ossicles (latter replaced by limonitic clay); *Graphoceras* cf. *apertum* (S.S. Buckman) probably from this bed	seen to 0.38
Obscured	
'*Watford Sand*'	
1: Sand, yellowish-brown, with sandstone doggers, poorly exposed	*c.* 0.60

The Waford Sand' is now only poorly and sporadically exposed, but indications of its presence can be found, particularly near the remains of the overbridge towards the eastern end of the cutting. There, Buckman (1890, beds 15 to 17) recorded 1.9 m of yellow sand with a 0.6 m-thick bed of brown sandstone. The succeeding 'Tilestone', up to 1.5 m thick

(Buckman, 1890) is moderately well exposed.

The succeeding beds are well exposed throughout much of the cutting, particularly on its northern side. The Notgrove Member (formerly the Notgrove Freestone), is the most prominent and distinctive bed in the section, and can be readily traced along almost the full length of the cutting. It is readily identified by its heavily bored upper part, and the well-developed hardground top surface. It shows a marked thinning along the section, from *c.* 2.4 m in the west to only *c.* 0.3 m in the east.

Interpretation

Harford Cutting still exposes almost all of the succession described by Buckman (1890), and the units identified by Parsons (1976b) in the section above can be identified with relative ease. There are a number of minor faults in the section, as illustrated by Woodward (1894, fig. 43; (Figure 3.53)). A recent geological survey of the area (Barron, 1999b) revealed that most of these are of non-diastrophic origin, being connected with camber and gull structures, which are spectacularly developed in the fields immediately to the south and south-east of the cutting. A gull that crosses the cutting *c.* 150 m from its western end is revealed as a graben some 35 m wide, with step-faulted margins, in which the strata are down-faulted by *c.* 5 m.

The 'Harford Sand' (Bed 1), the lowest horizon recorded in the section, was first described and named by Buckman (1890) at this locality. Parsons (1976b) deduced, on the basis of its matrix, that a specimen of *Graphoceras* cf. *apertum* (*S.S.* Buckman) in the Oxford University Museum came from the overlying 'Tilestone' (Bed 2a), though the species is not of precise zonal significance. As recognized by Parsons (1976b) and Mudge (1978a,b), the stratigraphy at the level of the 'Harford Sand' and 'Tilestone' is complex and laterally variable and, for this reason, these two units, together with the associated Snowshill and Naunton clays (Buckman, 1897; Richardson, 1929b) have been combined into one unit, the Harford Member (Mudge, 1978a,b; Barron *et al.,* 1997). Harford Cutting is the designated type section, although the member is better developed and exposed at Jackdaw Quarry (see GCR site report, this volume). The Harford Member belongs to the late Aalenian Concavum Zone (Parsons, 1980a), and constitutes the topmost unit of the Birdlip Limestone Formation, which corresponds with the Lower Inferior Oolite in the Cotswolds region (Barron *et al.,* 1997).

The strata comprising the Lower Bajocian beds previously referred to as the 'Middle Inferior Oolite' (i.e. beds 3 to 10 of the section above, together up to about 6.2 m thick) have recently been combined into a properly defined lithostratigraphical unit, the Aston Limestone Formation, of which this cutting is the type locality (Barron *et al.,* 1997). Parsons (1976b) collected a considerable and important ammonite fauna from the Gryphite Grit Member, indicating that whilst the greater part of the member probably belongs to the Laeviuscula Zone (Ovalis Subzone), the basal part at this locality (Bed 4) extends down into the underlying Discites Zone, which also encompasses the Lower Trigonia Grit. The Gryphite Grit Member (Barron *et al.,* 1997) was formerly divided into two units, the lower part (the Buckmani Grit of Buckman, 1895) being characterized by the brachiopod *Lobothyris buckmani* (Davidson), and the upper (the Gryphite Grit of Buckman, 1895) by *Gryphaea bilobata,* but the distinction is insufficient to justify this separation (Parsons, 1976b; Barron *et al.,* 1997). *G. bilobata* is quite common throughout the upper half of the member, and Richardson (1929b) recorded *L. buckmani* from a level possibly corresponding with Bed 8.

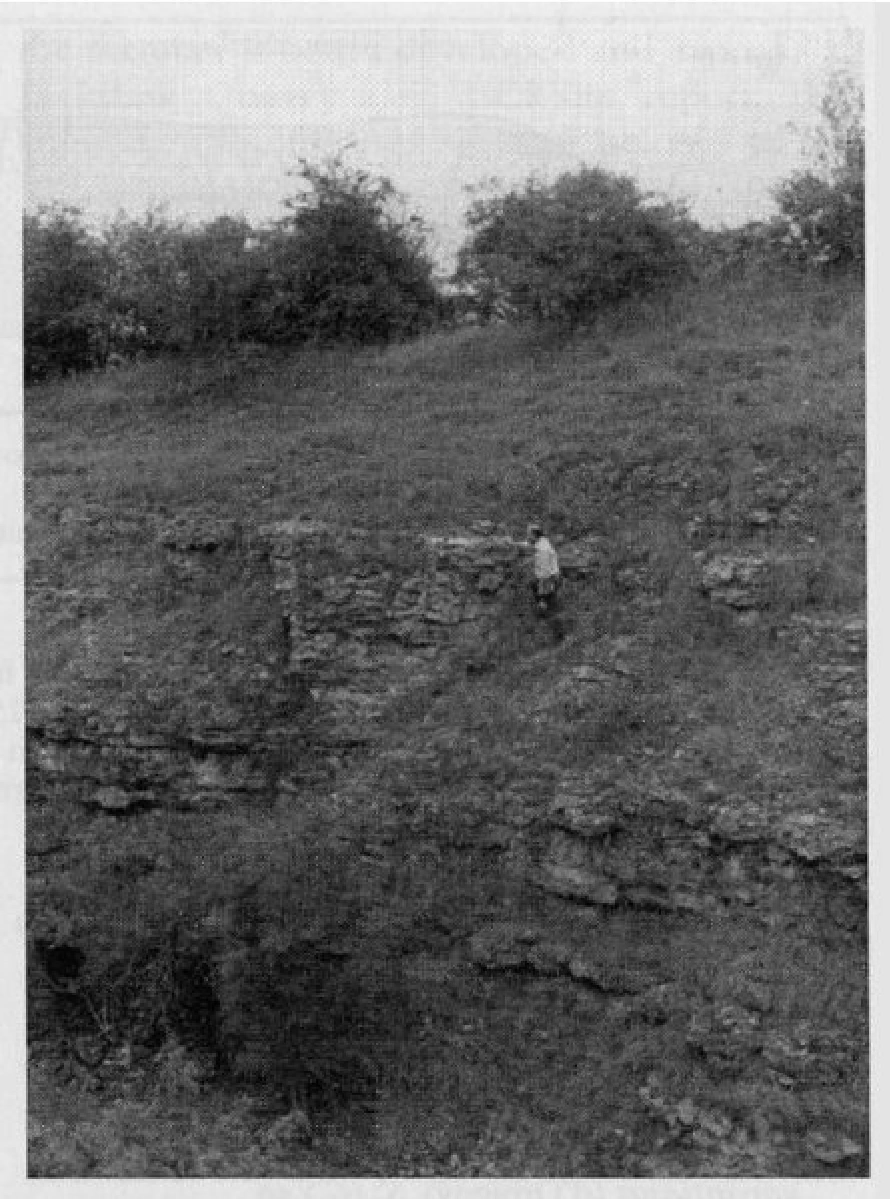
The marked thinning of the Notgrove Member is due to the erosional non-sequence at its top, the so-called 'Bajocian denudation' of Buckman (1895). The thinning is particularly marked in this area because of its proximity to the Vale of Moreton Axis (Arkell, 1933; Sumbler *et al.,* 2000). The Notgrove Member is cut out entirely a short distance beyond the eastern end of the cutting, and is absent from the Aston Farm Cutting (the 'second cutting west of Bourton-on-the-Water') 500 m to the south-east, where the hardground and bored bed is developed on an attenuated Gryphite Grit Member (mistakenly identified as Notgrove Freestone by previous authors, e.g. Richardson, 1929b; Arkell, 1947b). Immediately beyond that cutting, mapping shows that the whole of the Aston Limestone Formation is cut out (Barron, 1999b).

The youngest beds seen in the section belong to the Salperton Limestone Formation (corresponding to the Upper Inferior Oolite) but this formation is better exposed at its type locality, the First Cutting West of Notgrove (see GCR site report, this volume). At its base, the Upper Trigonia Grit Member has yielded specimens of *Strenoceras,* indicating the Upper Bajocian Garantiana Zone. Parsons (1976b) recorded 3.0 m of the succeeding Clypeus Grit Member, but up to *c.* 7 m are represented in the graben described above. Parsons (1976b) collected *Parkinsonia* spp. from the basal part, which he assigned to the Bomfordi Subzone of the Upper Bajocian Parkinsoni Zone. In this area, the Clypeus Grit Member is known to extend into the Lower Bathonian Zigzag Zone (Sumbler *et al.,* 2000).

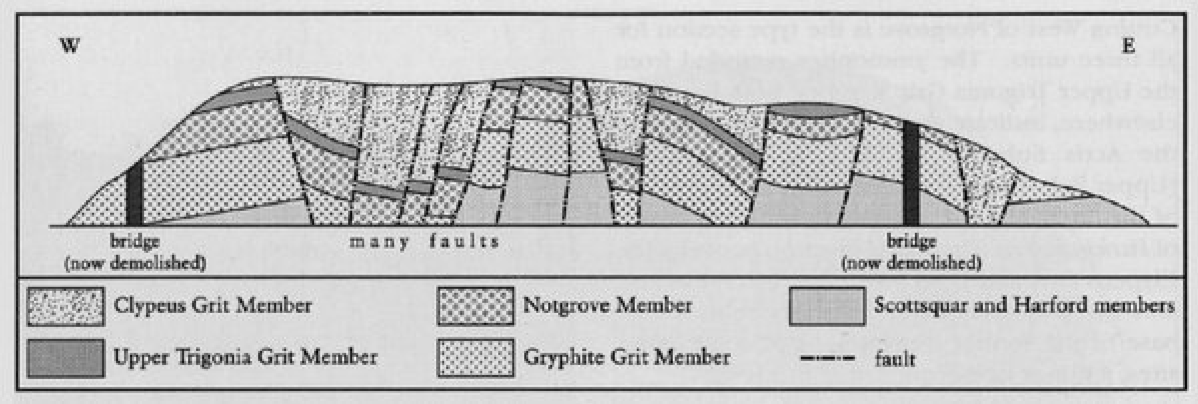
Conclusions

Harford Cutting is an important section in the Inferior Oolite Group of the Cotswolds, showing the succession from the Harford Member in the Birdlip Limestone Formation up to the Clypeus Grit Member of the Salperton Limestone Formation. It shows an excellent section through the Aston Limestone Formation (Middle Inferior Oolite), of which it is the type section, and is one of the few places where thinning of the latter towards the Vale of Moreton Axis can be seen in one exposure. The strata have yielded an important collection of ammonites that confirm the zonation of the succession, which ranges from late Aalenian to latest Bajocian in age.

References



(Figure 3.52) Exposure of the Aston Limestone Formation in Harford Cutting. The geologist's hand rests on the planar top surface of the Notgrove Member. (Photo: M.G. Sumbler.))



(Figure 3.53) Sketch section illustrating the northern face of Harford Cutting. (After Woodward, 1894, fig. 43.) Total length of section c. 550 m; maximum depth c. 15 m. Vertical bars are bridges, now demolished. Recent examination of the cutting indicates that this diagram is not accurately drawn to scale; for example, the width of the graben near the western end of the section is greatly exaggerated. However, it gives a reasonable impression of the section's complexity.)