Kemble Cuttings, Gloucestershire

[ST 975 976], [ST 982 989], [ST 985 973]

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Introduction

The GCR site known as 'Kemble Cuttings' comprises three separate sections in railway and road cuttings near the village of Kemble, Gloucestershire. They include the type section of the so-called 'Kemble Beds' (Woodward, 1894), an ill-founded unit now absorbed into the Great Oolite and Forest Marble formations.

Description

Tetbury Branch Railway Cutting

The principal and best section of the Kemble GCR site lies within the cutting of the disused Kemble to Tetbury branch railway, about 1 km west of Kemble Station. The cutting is about 770 m in length [ST 9731 9741]–[ST 9791 9791] and up to *c.* 6 m deep (Figure 3.20). The beds are sub-horizontal so that essentially the same succession is present along the entire length of the cutting. The section was first described by Woodward (1894), on which the following description is based (with revised lithostratigraphical classification by the present author).

	Thickness (m)
Forest Marble Formation	
5: Pale false-bedded and fissile oolite with marly layers	1.82
4b: Brown and white marly clay, with occasional fissile beds of pale shelly oolite; abundant oysters	0.05–0.46
Great Oolite Formation	
'*Kemble Beds*'	
4a: Hard, irregular, marly limestone, weathering to a rubbly marl, impersistent; 'Fossil Bed' including *Epithyris oxonica* Arkell and *Plagiostoma cardiiformis* J. Sowerby	0.61–1.22
3c: Cross-bedded oolite, very shelly in places; including *Plagiostoma;* becoming more massive where capped by brown clay	1.68
3b: Irregular, impersistent, marly parting 3a: Cross-bedded oolite and thick beds of pale limestone including shell beds with *E. oxonica*, oysters and other fossils	2.43
Athelstan Oolite Formation	
2b: White marly oolite with scattered ooidal grains; 'perforated' (?bored) in places	0.91
2a: Even beds of white oolite, and marly beds	2.13
1b: *Dagham stone:* Bluish limestone; top part compact and bottom part ooidal, with irregular 'perforations' (?burrows)	0.23–1.06
1a: White, more-or-less ooidal limestone, with 'tubiform markings' (?burrows)	0.30

At the time of writing, the cutting was overgrown in parts, althought there were good exposures along much of its length particularly on the north-west side, between the two overbridges (Figure 3.21). A composite section recorded (by the present author) in 1996 showed:

	Thickness (m)
Forest Marble Formation	
Limestone, grey to buff, flaggy and very fissile, low-angle cross-bedding; coarse- to very coarse-grained, shell-fragmental and ooidal grainstone	up to *c.* 3.0
Marl, fawn to brown, poorly laminated, rich in shell debris	0.05–0.30
Great Oolite Formation	
'*Kemble Beds*'	
'*Reef Bed*'*:* Limestone, white to very pale-buff, rubbly to massive, very coarse-grained, shell-fragmental and peloidal packstone with abundant shells, mainly oysters (*Praeexogyra*), commonly in aggregates, with other bivalves, brachiopods and sporadic, small, recrystallized corals	0-c. 3.0
Limestone, pale-buff, massive to flaggy with marked cross-bedding in places, fine- to medium-grained, moderately well-sorted, uniform ooidal and shell-fragmental grainstone with pale ooids and coated shell fragments in a grey spar cement	up to *c.* 4.0

Tetbury Road Station Cuttings

The northernmost part of the GCR site lies near Thames Head, *c.* 1.5 km north of Kemble, and comprises some 550 m of railway cutting and adjoining quarry workings at the former Coates or Tetbury Road Station [ST 9804 9901]–[ST 9827 9852], together with *c.* 180 m of the cutting for the Foss Way road (A433), which passes beneath the railway. Woodward (1894) recorded a section in the road cutting, on which the following is based.

	Thickness (m)
Forest Marble Formation	
Rubble and tumbled masses of fissile, shelly oolite with lignite Grey clay with thin rubbly beds of ooidal marly limestone; fossils fairly abundant ('Bradford Clay')	1.07
Great Oolite Formation	
'*Kemble Beds*'	
Pale shelly oolite	0.76
Brown marly oolite and hard, compact limestone with scattered ooidal grains	0.91
White and brown, false-bedded, shelly oolite	1.52

Present exposure is limited, but there are ample indications of flaggy Forest Marble Formation limestone in the railway cutting and a small exposure of ooidal limestone of the 'Kemble Beds' can be seen in the road cutting [ST 9816 9870]. In 1966, a section showed white flaggy oolite of the Forest Marble Formation with 0.6 m of marl at the base, resting on a bored surface of 'Kemble Beds' limestone (P. Toghill, 1966, BGS Geological Sheet ST 99 NE).

At the base of the Forest Marble Formation here, J. Buckman (1858) recorded 2.13 m of fossiliferous clay that yielded, among other fauna, the type specimen of the ammonite *Clydoniceras hollandi* (S.S. Buckman) (Buckman, 1925; Arkell, 1933) (Figure 3.22).

Kemble Station Cutting

The southernmost section comprises *c.* 260 m of cutting on the Gloucester to Swindon railway, between the road overbridge [ST 9854 9741] immediately south of Kemble Station, and the northern portal of Kemble Tunnel [ST 9858 9715]. There, Woodward (1894) recorded *c.* 10 m of strata with *c.* 0.8 m of marl and clay near the base, yielding fossils such as '*Terebratula maxillata*' (= *Epithyris oxonica*) and '*Lima*' (=*Plagiostoma*) *cardiiformis.*

BGS mapping (Sheet ST 99 NE) by P. Toghill in 1966 indicated that the cutting is excavated mainly in beds of the Forest Marble Formation. The succeeding Cornbrash Formation occurs adjacent to a fault that crosses the cutting approximately midway between the bridge and the tunnel. In 1966, some 6 m of greyish-fawn, cross-bedded, fine- to coarse-grained, shell-fragmental oolite with marl seams belonging to the Forest Marble Formation were exposed just north of the tunnel; the underlying more massive oolite may represent the 'Kemble Beds'. The sides of the cutting are now overgrown with vegetation, and at the time of writing exposure (1996) was very poor.

Interpretation

Kemble Cuttings form the type locality for the 'Kemble Beds', a term introduced by Woodward (1894) for a 'considerable development of false-bedded oolites' that occurs in the upper part of the Great Oolite Group north-eastwards from the Minchinhampton area (see GCR site report, this volume). The top of the 'Kemble Beds' was defined by the base of the Forest Marble Formation, which, in the Tetbury Road Station Cuttings, was drawn at the base of the fossiliferous clay. This clay was thought to be a reliable, if impersistent, marker bed equating with the Bradford Clay. The latter was originally described from Bradford-on-Avon in Wiltshire (see Woodward, 1894; and Gripwood Quarry GCR site report, this volume), where it yielded a distinctive and well-preserved fauna including the crinoid *Apiocrinus* and brachiopods such as *Digonella digonoides* S.S. Buckman.

Arkell (1931) correctly equated the type 'Kemble Beds' with the upper part of the White Limestone Formation farther north-east but, like many other workers (e.g. Richardson, 1933), he placed great reliance on the correlative value of the 'Bradford Clay fauna'. Because he recognized this fauna within, and not at the base of, beds of typical Forest Marble Formation type in Oxfordshire, he concluded that 'Kemble Beds' of White Limestone Formation type passed laterally into Forest Marble Formation facies. For this reason, Arkell (1931, 1933) recommended the abandonment of the formational term 'Forest Marble', but later he used it to include the 'Kemble Beds' (Arkell, 1947b). The 'Kemble Beds' thus came to be regarded as the lower part of the Forest Marble Formation, and the term Wychwood Beds' (Arkell, 1931) was used for the upper part, above the supposed Bradford Clay. In fact, as is now recognized (Torrens, 1980b; Sumbler, 1984, 1991), the so-called 'Bradford Clay fauna' is essentially facies controlled and is of little value for correlation. For example, *D. digonoides,* a key element of the fauna, occurs at various horizons within the White Limestone and Forest Marble formations (see, for example, Stony Furlong Cutting GCR site report, this volume). Arkell's classification, based on invalid stratigraphical criteria, greatly confused attempts at correlation in the upper part of the Great Oolite Group, and the definition of the base of the Forest Marble Formation was a subject of debate for many years, as reviewed by Sumbler (1984). The varied and inconsistent usage of the term 'Kemble Beds' by different authors, variously encompassing a range of strata within the White Limestone and Forest Marble formations, has led to the term being abandoned. However, as originally conceived by Woodward (1894), it was a potentially valid unit, equating with the Signet Member (Cirencester district) or Bladon Member (Oxfordshire) at the top of the White Limestone Formation (Sumbler, 1984, 1991), or, to the south-west, the Upper Rags Member, the latter treated as part of the Forest Marble Formation by Cave (1977) and Wyatt (1996a) (as in the Bath type area; see Brown's Folly GCR site report, this volume; and (Figure 3.4)), but at Kemble, perhaps better considered as part of the Great Oolite Formation because the base of the Forest Marble Formation is now recognized as a regional erosive disconformity (Sumbler, 1984, 1991, 1999; Sumbler *et al.,* 2000) which locally cuts out the 'Kemble Beds' or their equivalents. It is readily traced once this important fact is recognized.

Woodward (1894) himself found great difficulty in separating his 'Kemble Beds' from the Forest Marble Formation without the presence of a well-developed 'Bradford Clay' as in the Tetbury Road Station Cuttings. Thus, at Kemble Station and the Tetbury Branch Railway Cuttings, he included all of the beds now recognized as Forest Marble Formation in the 'Kemble Beds'. Conversely, Cave (1977) included much of the succession at these sites in the Forest Marble Formation, drawing the base of that unit at the bottom of the 'Reef Bed' facies (Figure 3.20), because of the occurrence of *D. digonoides* within it.

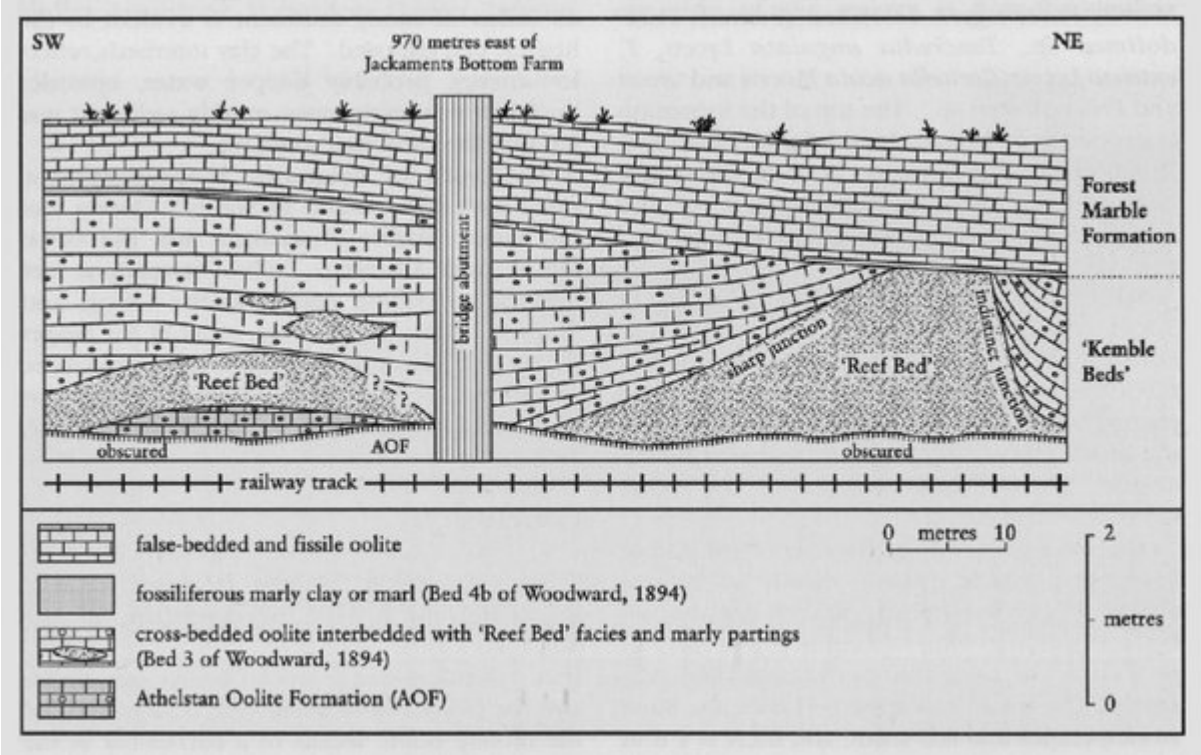
The exposures at Kemble Cuttings, most notably in the Tetbury Branch Railway Cutting may be interpreted with little difficulty in the light of knowledge of the succession in the Cirencester district (Sumbler *et al.,* 2000). The base of the Forest Marble Formation is marked by a thin but fairly persistent marl (= Woodward's Bed 4b; see above), which broadly equates with the supposed 'Bradford Clay' of the Tetbury Road Station Cuttings. The limestones of the Forest Marble

Formation and the 'Kemble Beds' are superficially rather similar, although the limestones of the latter are generally of a finer grain-size, and of a whiter, more chalky appearance. The top surface of the 'Kemble Beds' is hard and well cemented, and locally bored. Where the 'Reef Bed' facies is absent, the upper part is a grey to buff pervasively burrowed, wackestone with abundant floating shell fragments and ooids, and is closely similar to the typical lithologies of the Signet Member, with which it equates (Sumbler, 1991). The 'Reef Bed' (Woodward's 'Fossil Bed', 4a) is lenticular and impersistent, passing laterally into, and apparently including bodies of, unfossiliferous limestone like that beneath. A sketch section illustrating these relationships is reproduced in (Figure 3.20). In places, the contact between the 'Reef Bed' and surrounding limestones is sharp, and sporadically bored, but elsewhere it is gradational, and evidently the two types of limestone accumulated contemporaneously. The 'Reef Bed' yields large *Epithyris oxonica, Praeexogyra, Plagiostoma* and corals such as *Isastrea, Thamnasteria* and *Chomatoseris,* and in facies and fauna is much like the equivalent Fairford Coral Bed, which occurs at the top of the Signet Member 10–15 km to the northeast of Kemble (Sumbler, 1991). The contact with the limestones beneath the 'Reef Bed' is generally gradational in this cutting. Woodward's (1894) description of his Bed 2b (see above), the topmost unit of his 'White Limestone' (no longer exposed), is suggestive of the bored Bladonensis Bed, corresponding with the top of the Ardley Member of the White Limestone Formation or, as it has been termed in the Kemble area, the Athelstan Oolite Formation' (Cave, 1977; Wyatt, 1996a).

Conclusions

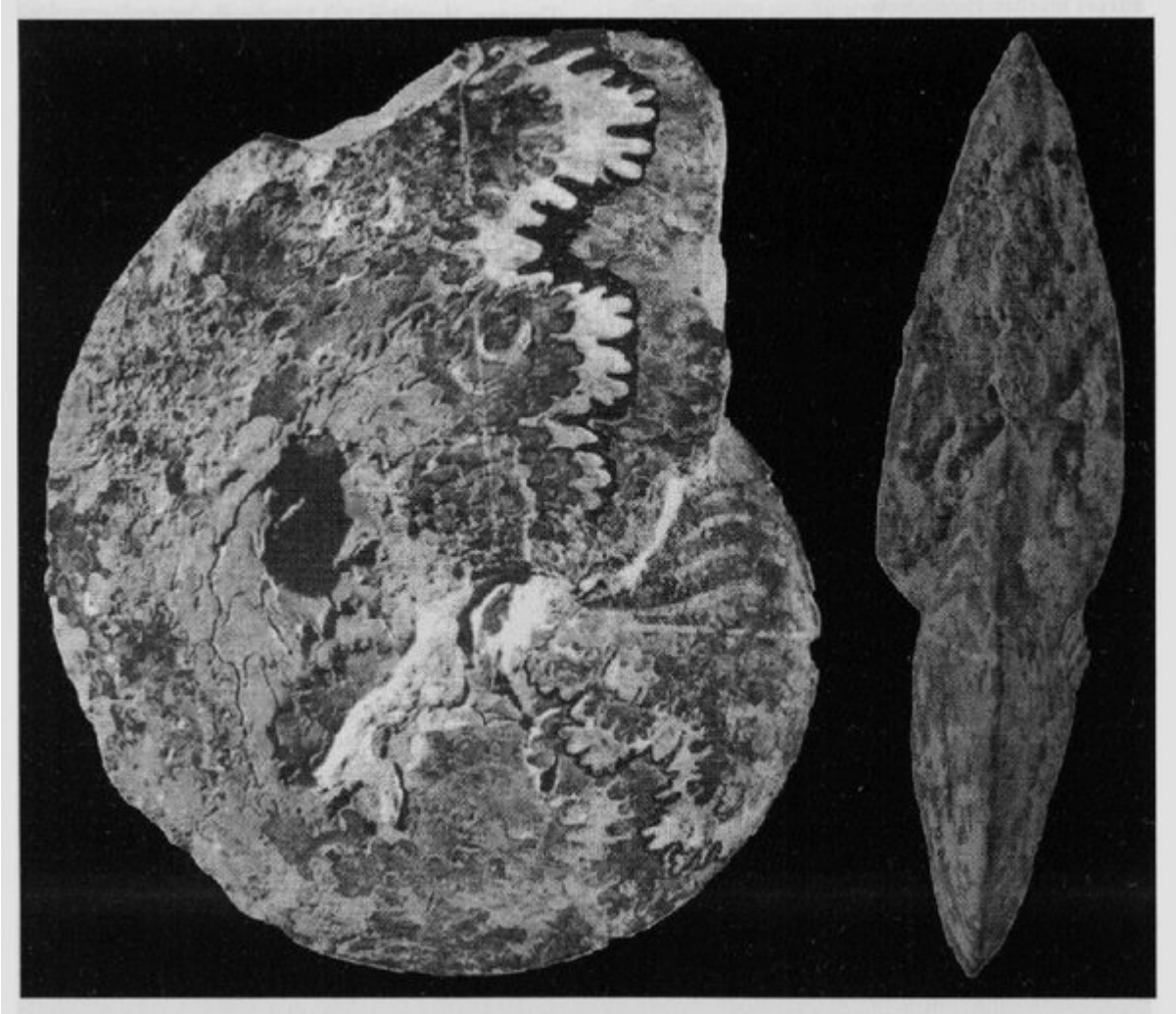
Kemble Cuttings form the type locality of the 'Kemble Beds'. This term has been compromised by misuse, and is widely misunderstood, and for this reason is now obsolete. The unit is now recognized as being equivalent to the better-defined Signet Member of the White Limestone Formation, which, in the Kemble Cuttings area, may be termed the 'Upper Rags Member', herein regarded as the sole local representative of the Great Oolite Formation at Kemble, but to the south-west as the basal member of the Forest Marble Formation. The Tetbury Branch Railway Cuttings shows a fine development of the 'Reef Bed', variously included in the 'Kemble Beds' or Forest Marble Formation, but now recognized as part of the Upper Rags Member, and equating with the Fairford Coral Bed to the north-east. At the Tetbury Road Station Cuttings, a clay at the base of the Forest Marble Formation, which has been equated with the Bradford Clay of Wiltshire, has yielded an ammonite indicating the Upper Bathonian Discus Zone, one of the few stratigraphically significant ammonites known from the formation.

References

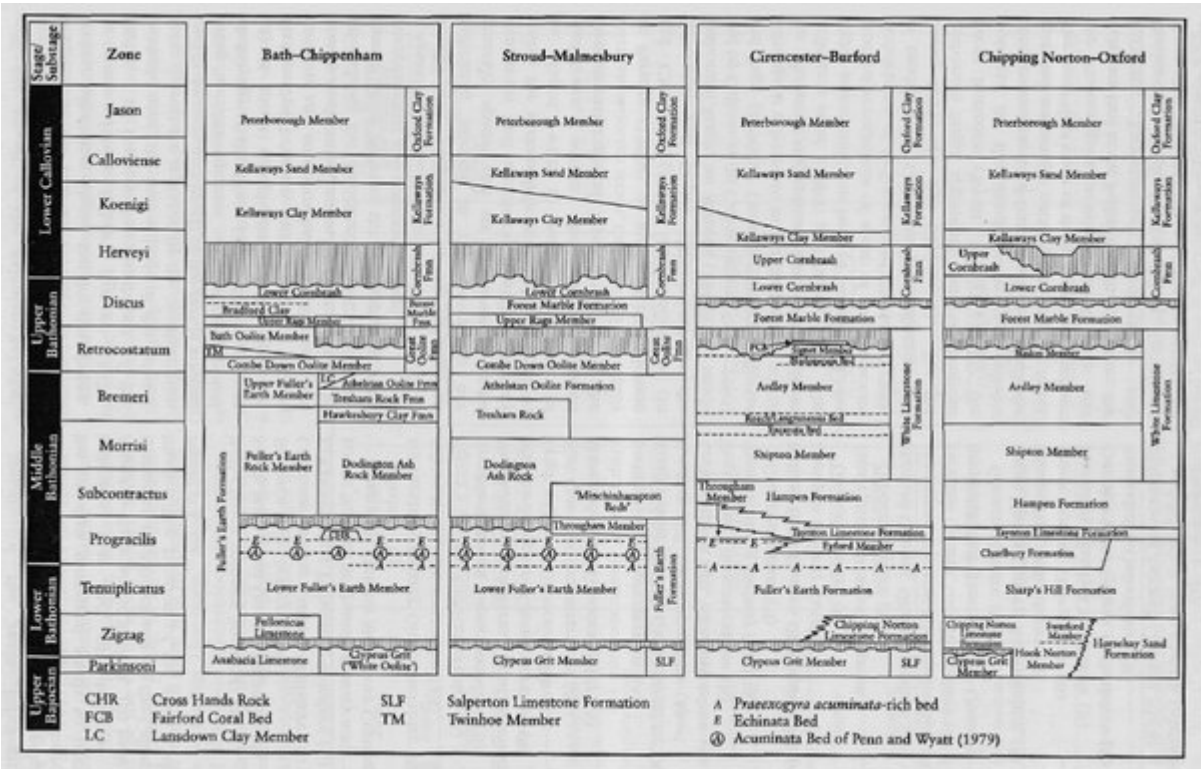


(Figure 3.20) Diagrammatic section showing the lateral relationships in the 'Kemble Beds' (Great Oolite Formation) at Tetbury Branch Railway Cutting, Kemble Cuttings. (After Cave, 1977, fig. 18.) In other parts of the cutting (see description of Tetbury Branch Railway Cutting), the 'Reef Bed' facies is developed at the top of the 'Kemble Beds'.)

(Figure 3.21) Exposure of Forest Marble Formation in the Tetbury Branch Railway Cutting, Kemble Cuttings. (Photo: M.G. Sumbler.))



(Figure 3.22) Holotype of Clydoniceras hollandi (S.S. Buckman) from the basal clay of the Forest Marble Formation of Tetbury Road Station Cuttings, Kemble Cuttings. (Reproduced from Arkell, 1951, pl. 1, figs 6a,b.) The specimens are reproduced at c. 97% natural size, courtesy of the Palaeontographical Society.)



(Figure 3.4) Lithostratigraphical classification of the Great Oolite Group and overlying beds in the Cotswold area. Columns are deliberately separated one from the other because the nomenclature as used in different areas is in need of rationalization. Vertical ruling indicates non-sequence. (Based on data in Cave, 1977; Horton et al., 1987; Page, 1989, 1996a; Sumbler et al., 2000; Wyatt in Sumbler, 1996; and herein.))