Watton Cliff, Dorset

[SY 454 907]

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Introduction

The GCR site at Watton (or West) Cliff covers about 750 m of cliff and foreshore between Eype Mouth and the River Brit. It represents the best single exposure of Bathonian sediments in Dorset (Figure 2.15) although the state of the exposure depends on the extent of landslips. The Bathonian section, comprising Forest Marble Formation overlying Frome Clay Formation, is faulted against older Jurassic (Lias Group) beds at both its eastern and western ends. A tiny patch of Cornbrash Formation was formerly present on the summit of Watton Cliff, but has since been eroded away, suggesting that the Forest Marble Formation is largely complete (Arkell, 1933). The section is famous for two brachiopod marker horizons: the Wattonensis Beds (named after the two most common species, *Rhynchonelloidella wattonensis* Muir-Wood and *Wattonithyris wattonensis* Muir-Wood; Kellaway and Wilson, 1941) at the base of the Frome Clay Formation; and the Boueti Bed (named after *Goniorhynchia boueti* (Davidson)) at the base of the Forest Marble Formation. Although, as their name implies, the section is the type locality for the Wattonensis Beds, they are visible only in three places: indifferent exposure above the landslip beside the Eype Mouth Fault in Fault Corner; intermittent exposure beneath the beach shingle on the foreshore at the seaward end of the Eype Mouth Fault; and in a disturbed state in the *c.* 9 m-wide shatter-belt of the so-called 'West Cliff Fault' (Figure 2.16). The rest of the succession is well exposed in the cliff, though not easily accessible, and is becoming degraded. The section was cited by Buckland and De la Beche (1836) and later described by Woodward (1894), Buckman (1922a), Arkell (1933), Wilson *et al.* (1958), Torrens (1969b), Hallam (1970), Macfadyen (1970), Holloway (1981, 1983) and Callomon and Cope (1995).

Description

The following description is modified from Cal-lomon and Cope (1995), whose description was itself based on Wilson *et al.* (1958) and Torrens (1969b). Additional data has been inserted from Hallam (1970) and Holloway (1981, 1983). Bed numbers follow Torrens (1969b).

	Thickness (m)
Forest Marble Formation	
7: Clay with laminated lenses of sandstone forming 'tiles' with spectacular trace fossils including *Gyrochorte comosa* Heer (common), *Imbrichnus wattonensis* Hallam, *Monocraterion, Neonereites, Pelecypodichnus, Planolites, Rhizocorallium, Teichichnus, Thalassinoides* and *Tibikoia*	2.5
6: Clay and shale with lenses of shelly limestone and laminated, ripple-marked sandstone	6.0
5: Limestone, calcirudite, massive, ooidal, flat- and cross-bedded; bored pebbles (up to 0.15 m diameter) of grey micrite and sparsely ooidal micrite; shelly with abundant broken or complete but disarticulated pectinid bivalves and oysters, common crinoid columnals, shark teeth, fossil wood (logs up to 1 m long) and occasional disarticulated brachiopods	2.0
4: Clay, blue, with silt streaks	0.5
3: Limestone, argillaceous, fine grained, weathering cream-coloured, hard, forming prominent bed 0.3 2: Shale, calcarenitic, laminated and with silt streaks	1.8

1: Shale, blue-grey; lenses of brownish-grey, fissile calcirudite and calcarenite including, 6.6 m above the base, a 200 m-long, wedge-shaped unit thinning and fining from a coarse 0.35 m-thick calcirudite to a 0.10 m-thick calcarenite *Boueti Bed* (unnumbered)	12.0
Marl, calcareous (argillaceous micrite), whitish, very shelly; fossils include bivalves (*Arcomytilus asper* (J. Sowerby), *Camptonectes laminatus* (J. Sowerby), *Catinula anclfffensis* (Cox and Arkell), *Chlamys* (*Radulopecten*) *vagans* (J. de C. Sowerby), *Gervillella acuta* (J. de C. Sowerby), *Nicaniella* (*Trautscholdia*) *cordata* (Trautschold), *Pholadomya* sp., *Placunopsis socialis* Morris and Lycett, *Praeexogyra hebridica* (Forbes), *Trigonia costata* J. Sowerby and *Vaugonia impressa* (Broderip)); gastropods (*Pleurotomaria burtonensis* Lycett and *Turbo burtonensis* Lycett); brachiopods (*Goniorhynchia boueti* and terebratulids); echinoderms (*Apiocrinus elegans* (Defrance) and '*Cidaris*'sp.); serpulids; bryozoans; occasional corals (*Montlivaltia*)*;* large *Thalassinoides* burrow-networks at base	0.35
Frome Clay Formation	
8: Marl, shaly, blue	1.5
7: Limestone, argillaceous, fine grained, laminated, white	1.5
6: Marl, blue-grey	16.4
5: Alternating pale, argillaceous, fine-grained limestone and marl	0.45
4: Clay, marly to beach level	6.0
3: Gap	
2: Oyster bed; clay with abundant small or broken *Praeexogyra hebridica*	0.75
1: *Wattonensis Beds:* Alternating clays and thin limestones; richly fossiliferous with varied fauna dominated by brachiopods including *Acanthothiris powerstockensis, Rhynchonelloidella* spp., *Rugitela* spp., *Tubithyris* spp. and *Wattonithyris* spp.; bivalves including *Catinula knorri* (*Voltz*)*, Modiolus anatinus* Wm Smith, *Parallelodon* sp. and *Trigonia elongata* J. de C. Sowerby; occasional ammonites including holotype of *Procerites wattonensis* Arkell	seen to *c.* 8

The gap in the section of the Frome Clay Formation, recorded above as Bed 3, was estimated by Buckman (1922a) to represent 12 m of strata but Torrens (1969b) and Callomon and Cope (1995) considered this was probably an underestimate.

Callomon and Cope (1995) replaced the descriptors 'sandy calcareous', 'sandy' and 'calcareous sandstone' of Wilson *et al.* (1958) and Torrens (1969b) with the terms 'calcarenite' and 'calcarenitic' implying that there was no silt-or sand-grade quartz material present in the Forest Marble Formation. However, the detailed investigation of these beds by Holloway (1981, 1983) indicates that such material is indeed present as streaks and lenses, particularly in the upper beds.

The brachiopod fauna of the Wattonensis Beds (Buckman's 'Brachiopod Beds') was described by Buckman (1922a) and Muir-Wood (1936). Other faunal records from the locality include foraminifera (Cifelli, 1959), holothurians (Hampton, 1957), mammalian teeth (Freeman, 1976) and other vertebrate (including fish and reptile) remains (Dineley and Metcalf, 1999).

Interpretation

Up until the 1980s, the beds now classified as Frome Clay Formation were referred to as 'Upper Fuller's Earth Clay' (e.g. Torrens, 1980b; Holloway, 1981, 1983). _ Since then, however, Penn and Wyatt's (1979) claim that the latter member lay below the Wattonensis Beds rather than above has been more widely accepted, and their term 'Frome Clay Formation' is therefore now used for the higher beds (e.g. Callomon and Cope, 1995). The revised classification is based on Penn and Wyatt's (1979) correlation of the Wattonensis Beds with the Lower Smithi Limestone of the Bath-Frome area rather than the Rugitela Beds at the top of the Fuller's Earth Rock Member (see (Figure 2.4)). The latter marks the base of the Upper Fuller's Earth Clay in the type area of the Fuller's Earth Formation at Bath.

According to Callomon (in Callomon and Cope, 1995), the holotype of Arkell's (1958b) ammonite *Procerites wattonensis* from the Wattonensis Beds on the foreshore at the Eype Mouth Fault can be re-identified as *P.* cf. or all *quercinus* (Terquem and Jourdy). This taxon is indicative of the Quercinus Subzone to which Callomon therefore assigned the whole of the Frome Clay Formation at Watton Cliff. Recognition of this subzone is particularly significant because it allows the Wessex Middle–Upper Bathonian succession to be integrated with that of other European areas by the application at this level of their better substantiated ammonite-based Bremeri and Retrocostatum zones. The base of the Retrocostatum Zone is marked by the base of the Quercinus Subzone. Recognition of subzones in common with continental Europe means that the previously used Hodsoni and Orbis zones can be superseded (Page, 1996a).

At the base of the Forest Marble Formation, the Boueti Bed is easily recognizable although it is less accessible and its fauna is rather less diverse here than farther east at Herbury (see Shipmoor Point–Butterstreet Cove and Tidmoor Point–East Fleet Coast GCR site report, this volume). The bed forms a remarkably constant and persistent marker nearly as far north as the southern edge of the Mendips but the only ammonites known from it are small microconch *Clydoniceras* (known as *Delecticeras*) that are diagnostic only of the Upper Bathonian Substage in general. Elsewhere, the overlying lower part of the Forest Marble Formation has yielded *Clydoniceras hollandi* (S.S. Buckman), which is indicative of the Hollandi Subzone of the Discus Zone. Deposition of the Boueti Bed is considered to have been slow because many of its shells are encrusted with bryozoans and serpulids (e.g. Arkell, 1933; Wilson *et al.,* 1958). The Digona Bed, which forms another brachiopod marker bed higher up in the Forest Marble Formation at Herbury (see Shipmoor Point–Butterstreet Cove and Tidmoor Point–East Fleet Coast GCR site report, this volume), cannot be recognized at Watton Cliff. The impersis-tent occurrence of this bed led Holloway (1981, 1983) to doubt its correlative value.

The single sheets of calcirudite/calcarenite that occur within the Forest Marble Formation, for example in Bed 1, were probably derived from an accumulation of allochthonous shell-debris that was re-distributed into a thin layer (Holloway, 1983). These lithologies also occur as compound sequences of sheet and lensoid shell-bodies such as in Bed 5. The tops of the shell bodies are usually cross-bedded, suggesting that they were reworked by currents. This facies may represent shallow-marine shoals built by episodic high-energy events, such as storms, of sufficient strength to rework the tops of the shoals and erode small channels within them (Holloway, 1983). Bed 5 may represent a laterally extensive, correlatable horizon in the Wessex region. Elsewhere in Dorset, the massive limestones of this unit were formerly worked for local building stone and for road-metalling. Mammalian teeth from Watton Cliff recorded by Freeman (1976) probably came from this bed.

The trace fossils notable in Bed 7 of the Forest Marble Formation have been described by Hallam (1970) and Holloway (1981). The most common form is *Gyrochorte.* At the time of Hallam's work, the interpretation of this ichno-genus, which appears as low, winding ridges with a plaited structure on bedding surfaces, was the subject of debate and no definite conclusion could be drawn regarding the nature of the *Gyrochorte* organism or the precise mechanism of formation of the structures. Heinberg (1973) thought they were produced by a polychaete-like worm moving obliquely through the sediment, and Hantzschel (1975) concluded that they were doubtless made by an organism (possibly a worm or a crustacean) tunnelling through the sediment. However, Holloway (1981) thought they might be formed by the movement of infaunal bivalves through soft sediment because they are intimately associated with the bivalve resting-trace *Pelecypodichnus;* this seems dubious as abundant *Pelecypodichnus* are known in beds with no *Gyrochorte* at all O.D. Hudson, pers. comm.). Hallam (1970) did, however, interpret the depositional environment of the deposits containing

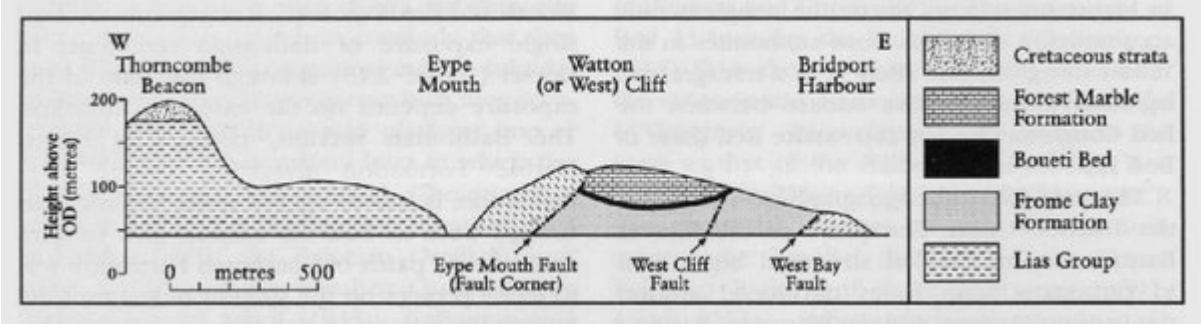
Gyrochorte, which he envisaged as shallow marginal marine, probably a coastal lagoon with slightly lowered salinity owing to the influx of freshwater from a nearby river or system of rivers. He considered the other trace fossils to be consistent with this interpretation. These include *Imbrichnus wattonensis,* the type specimen of which, as its name implies, comes from this locality.

Conclusions

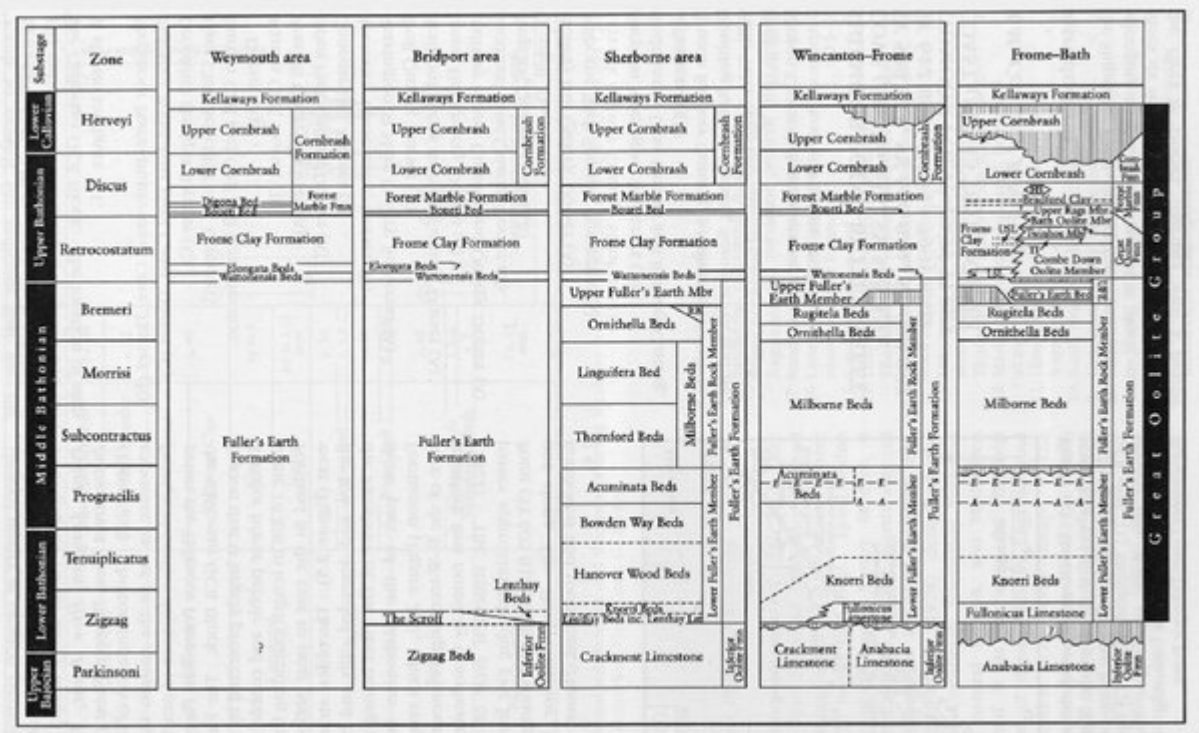
Watton Cliff although unscalable from above and below without specialist equipment, is the single most important exposure of Bathonian rocks in Dorset. The succession here, comprising the Frome Clay Formation overlain by the Forest Marble Formation, is predominantly of clay and shale, with some limestone beds. The exposure of the Frome Clay Formation, which occurs only in the Wessex region, is particularly important because, in its type area, it is known mainly from cored boreholes. There are two important faunal marker horizons: the Boueti Bed at the base of the Forest Marble Formation, and the Wattonensis Beds at the base of the Frome Clay Formation. Named after particular species of brachiopods, these marker horizons are widespread and persistent and important for regional correlation. The Wattonensis Beds have also yielded sparse ammonites that enable recognition of the Upper Bathonian Quercinus Subzone and partial chronostratigraphical classification of the section. The upper part of the Forest Marble Formation here shows a varied suite of trace fossils.

References

(Figure 2.15) Watton Cliff. The Boueti Bed at the base of the Forest Marble Formation cuts the cliff near the sharp bend in the cliff profile on the left (arrowed). Below lies the Frome Clay Formation. (Photo: A5838, British Geological Survey, 1932.))



(Figure 2.16) Diagrammatic cross-section of the cliffs between Eype Mouth and the River Brit (Bridport Harbour), including the Watton Cliff GCR site. (After Macfadyen, 1970, fig. 18.))



(Figure 2.4) Lithostratigraphical classification of the Great Oolite Group in the Wessex region. Vertical ruled lines indicate non-sequence. (Based on data in Penn and Wyatt, 1979; Torrens, 1980b; Page, 1989, 1996a; Bristow et al., 1995, 1999; and Wyatt, 1998.) (-E-E-E-E- = Echinata Bed; -A-A-A-A- = Acuminata Bed of Penn and Wyatt (1979); HS = Hinton Sand Member; LSL = Lower Smithi Limestone; RB = Rugitela Beds; TI = Twinhoe lronshot; UFE = Upper Fuller's Earth Member; USL = Upper Smithi Limestone.))