Shipton-On-Cherwell Cement Works and Whitehill Farm Quarry, Gibraltar, Oxfordshire

[SP 473 177], [SP 478 186]

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Introduction

Shipton-on-Cherwell Quarry Cement Works at Shipton-on-Cherwell, Oxfordshire, exposes a section from close to the base of the White Limestone Formation up to the Cornbrash Formation ((Figure 3.70) and (Figure 3.71)). The nearby Whitehill Farm Quarry exhibits a less extensive stratigraphical succession, but includes an unusual facies of the White Limestone Formation. The two localities together characterize well the local Middle to Upper Bathonian stratigraphy of the district, in which considerable facies variations occur at several levels. Shipton-on-Cherwell Cement Works is the type locality of the Shipton Member of the White Limestone Formation, and is also of historical importance as the site from which many fossil reptile remains were collected, including crocodiles and dinosaurs.

The earliest reference to the quarries is by Phillips (1871) who described the fossil reptile finds. Later, Odling (1913) and Arkell (1931) provided descriptions of the lithological succession. Allen and Kaye (1973) examined the sedimentary facies of the upper part of the White Limestone and Forest Marble formations, Palmer (1979) considered the palaeoecology and sedimentology of the White Limestone Formation, whilst Sumbler (1984) clarified the stratigraphical classification. Richardson *et al.* (1946) largely reiterated Arkell's (1931) account, and Page (1989) provided a detailed log of the Cornbrash Formation.

Description

The following section at Shipton-on-Cherwell Cement Works is based on Arkell (1931), Richardson *et al.* (1946), Allen and Kaye (1973), Palmer (1979), Sumbler (1984) and Page (1989).

	Thickness (m)
Cornbrash Formation	
Upper Cornbrash	
Limestone, brown, shell-detrital, sandy, with rare *Macrocephalites;* marl seam at base yielding *Microthyridina* cf. *lagenalis* (Schlotheim), *Rhynchonelloidea cerealis* S.S. Buckman and *Lopha* cf. *marshii* Arkell; thin seam of pebbly, dark-flecked limestone at base, cemented to and infilling borings in underlying bed	0.25
Lower Cornbrash	
Limestone, grey, shelly, micritic, capped by a bored hardground; *Neocrassina hilpertonensis* (Lycett), *Trigonia, Meleagrinella echinata* (Wm Smith); also *Clydoniceras discus* (J. Sowerby) (Astarte–Trigonia Bed of Page (1989))	0.70–1.05
Limestone, marly, rubbly, with marl seams; common bivalves including *Gresslya, M. echinata* and *Pleuromya*	0.95–1.05
Limestone, buff, shell-detrital, shelly; passing up into Jaggy, marly limestone; *Liostrea, M. echinata, Obovothyris obovata* (J. Sowerby) and serpulids; 0.05 m shelly marl at base with *Cererithyris intermedia* (J. Sowerby)	0.40–0.50

Limestone, buff, shell-detrital, micritic; with many 'nests' of *C. intermedia;* also *Chlamys* (*Radulopecten*)*, M. echinata* and *Pleuromya; Thalassinoides* burrow-system locally at base (Intermedia Bed)	0.15–0.20
Forest Marble Formation	
Limestone, shell-detrital, ooidal, cross-bedded, locally with clay drapes on foresets and current-rippled surfaces; uneven, channelling base; passing laterally, in the form of wedges and fingers, into Mudstone, pale greenish-grey, massive, uniform, slightly silty; channel-fills locally at top, including earlier channels with limestone-fill and later channel with calcareous sandstone-fill	5.0–8.0
White Limestone Formation	
Bladon Member	
Upper Epithyris Bed	
Comprising three facies: (i) *Modiolus* facies (up to 0.45 m) consisting of pale-green, bioturbated, marly, micritic, shell-detrital, pelletal limestone, with plant debris, some terrigenous sand and abundant disarticulated *Modiolus;* present only locally at base and passing laterally and vertically into (ii) coral–brachiopod facies ('Cream Cheese Bed' of Arkell, 1931) consisting of pale-grey to white micritic limestone, containing dominantly *Epithyris oxonica* Arkell and branching corals, the latter commonly in growth position; (iii) calcarenite facies consisting of shell-detrital, locally cross-bedded limestones, which rest erosively on the other facies and locally on the underlying Fimbriphenotoni Bed	0–2.0
Fimbriata–Waltoni Bed	
Clay, pale- to dark-green, with sporadic shelly partings containing *Bakevellia waltoni* (Lycett) and *Eomiodon fimbriata* (Lycett); also abundant lignitic plant-debris, including large logs; large burrow-fills penetrating up to 0.35 m from top surface; chalky concretions near top; inter-fingering beds of shelly, bioturbated, marly, shell-detrital limestone, mainly in lower part, with many oysters	*c.* 2.0
Limestone, pale-grey, shell-detrital, pelletal, micritic, marly, with abundant *Epithyris oxonica,* as well as *Modiolus,* oysters and sporadic stands of branching corals (Middle Epithyris Bed of Arkell, 1931)	*c.* 1.0
Ardley Member	
Limestone, white or pale-buff, micritic and sparry, pelletal, bioturbated, commonly shell-detrital, with sporadic marly limestone beds; locally, a hardground at top; thin marl *c.* 2 m below top with locally abundant *Epithyris* above it ('Lower Epithyris Bed' of Arkell, 1931); burrowed bed *c.* 2 m below top; massive, well-cemented, sandy limestone bed at base	6.5
Clay, grey, sandy, shell-detrital; passing down into marl	0.5
Shipton Member	

Limestone, whitish-grey or brownish, micritic and sparry, bioturbated, with marly limestone beds and thin clay-seams; hardground at top with the gastropod *Aphanoptyxis excavata* Barker (Excavata Bed); burrowed beds 0.8 m and 2.3 m below top 4.0

The quarry is at present (1997) being restored. The deepest part is now infilled and the Shipton Member is no longer exposed. The Bladon Member is concealed beneath fallen debris of the overlying Forest Marble and Cornbrash formations but excellent exposures of those two formations and the Ardley Member of the White Limestone Formation are still visible.

The Ardleyensis Bed, within the Ardley Member, is not readily apparent at Shipton-on-Cherwell Cement Works; however, comparison with the nearby Kirtlington Quarry [SP 494 199] suggests that it probably lies immediately beneath the thin marl bed *c.* 2 m from the top of the member. In the neighbouring Whitehill Farm Quarry, all but the top 1 m or so of the Ardley Member and the basal sandy clay bed, are replaced by shell-fragmental oolites with large-scale cross-bedding. The member here is capped by a bored, locally oyster-encrusted hardground.

Shipton-on-Cherwell Cement Works has yielded a variety of fossil reptile remains, including those of turtles, dinosaurs and crocodiles. However, because of the confusing nomenclature of the several quarries in the area, many of the fossils are difficult to localize. Benton and Spencer (1995) believed that reptiles were found at four horizons in the quarry as follows: *Dacentrurus retustus* (Huene), a stegosaur, in the Lower Cornbrash; *Cetiosaurus* in the Forest Marble Formation; *Teleosaurus* and other crocodiles, plus *Cetiosaurus,* in the Fimbriphenotoni Bed; crocodile remains in the Ardley Member. A comprehensive list is given by Benton and Spencer (1995).

Interpretation

The micritic limestones of the White Limestone Formation (Shipton and Ardley members) were probably deposited in the shallow but low-energy waters of an extensive, protected, carbonate lagoon, located between the London Landmass and a carbonate sand-barrier shoal-belt to the west. Common bioturbation in the limestones suggests a stable substrate in which burrowing organisms, particularly bivalves, proliferated. The large-scale cross-bedding, seen in the Ardley Member of Whitehill Farm Quarry only, is believed to have been formed by storm-moved shelly oolite shoals within the lagoon. The hardgrounds that cap both the Shipton and Ardley members, the latter locally bored and oyster-encrusted, indicate pauses in sedimentation during which the sea-floor sediment was cemented. Other breaks in sedimentation are suggested by discrete burrowed horizons.

The clays of the Fimbriata–Waltoni Bed (the lower part of the Bladon Member), which yield bivalves tolerant of brackish-water conditions and which feature an abundance of lignitic plant-debris, have been interpreted as the deposits of a seashore saltmarsh, through which waters, charged with land-derived debris, drained seaward via a system of creeks (Palmer, 1979). The intercalated marly limestones probably formed carbonate sand-banks during more open marine episodes; their flourishing epifauna indicates a stable substrate and only moderately turbulent waters. The large burrow-fills and the 'caliche'-like concretions at the top bear witness to a depositional break and almost emergent conditions. Subsequently, corals and brachiopods colonized the surface whilst, concurrently, *Modiolus* thrived in scattered patches of muddy, sandy limestone that accumulated where higher-energy conditions prevailed. The micritic limestones that characterize the coral-brachiopod facies of the Upper Epithyris Bed (the remainder of the Bladon Member) were then deposited in lower-energy conditions where currents were restricted by the growth of corals. Finally, the calcarenite facies is envisaged as the product of carbonate sand-shoals formed in shallow, turbulent waters, which scoured the sea floor to produce the erosive channelling base. It should he noted that beds of the Bladon Member were included within the Forest Marble Formation ('Kemble and Wychwood Beds') by Allen and Kaye (1973).

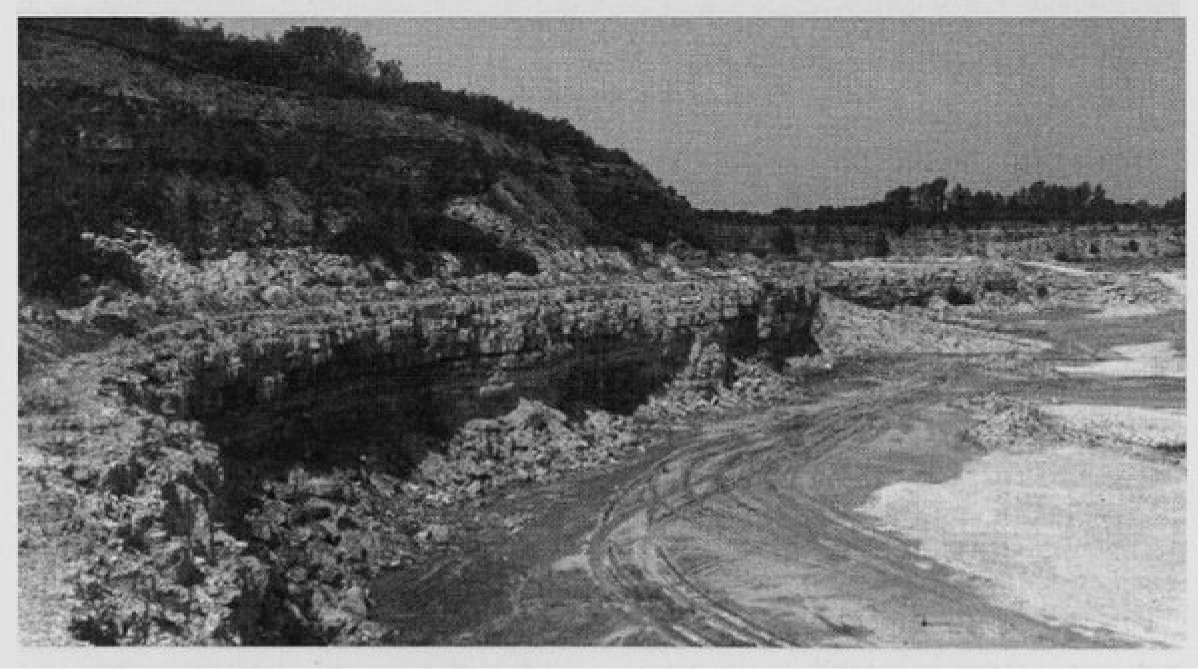
The cross-bedded, ooidal limestones of the Forest Marble Formation are interpreted as a large, elongate sand-shoal formed in a high-energy environment, which was flanked by quieter and deeper waters where mud accumulated (Allen and Kaye, 1973) (Figure 3.72). Polygonal desiccation cracks have been noted in the muddy bottomset beds and mud drapes of the limestones, suggesting that the top of the shoal was exposed at low tides. After a pause in sedimentation, the regionally uniform, shell-detrital, bioturbated, micritic limestones of the Cornbrash Formation were formed in an extensive, shallow shelf-sea, the moderate-energy conditions of which permitted deposition of calcareous mud containing fine, abraded, shell detritus, the latter probably winnowed by gentle currents. The bored top of the Lower Cornbrash, and the overlying pebbly bed, indicate a significant break in deposition; the Upper Cornbrash forms the basal unit of the overlying Callovian succession.

No ammonites have been collected from beds below the Cornbrash Formation in either quarry; thus, their chronostratigraphy relies on regional correlation using rhythmic, deposition units, and the recognition of persistent marker beds (Wyatt, 1996a). On this basis, the Shipton Member of the White Limestone Formation, which is capped by the Excavata Bed, is assigned to the Middle Bathonian Subcontractus and Morrisi zones. The overlying Ardley Member, capped by the Bladonensis Bed, and Bladon Member are inferred to belong to the Bremeri Zone and the lower part of the Upper Bathonian Retrocostatum Zone. In turn, the Forest Marble Formation, which overlies an erosion surface on the White Limestone Formation, is considered to belong to the Discus Zone, Hollandi Subzone; the upper part of the Retrocostatum Zone is not represented. The occurrence of *Clydoniceras discus* (J. Sowerby) in the Lower Cornbrash indicates the Discus Subzone, and *Macrocephalites herveyi* (J. Sowerby), collected from the Upper Cornbrash, confirms the Lower Callovian Herveyi Zone.

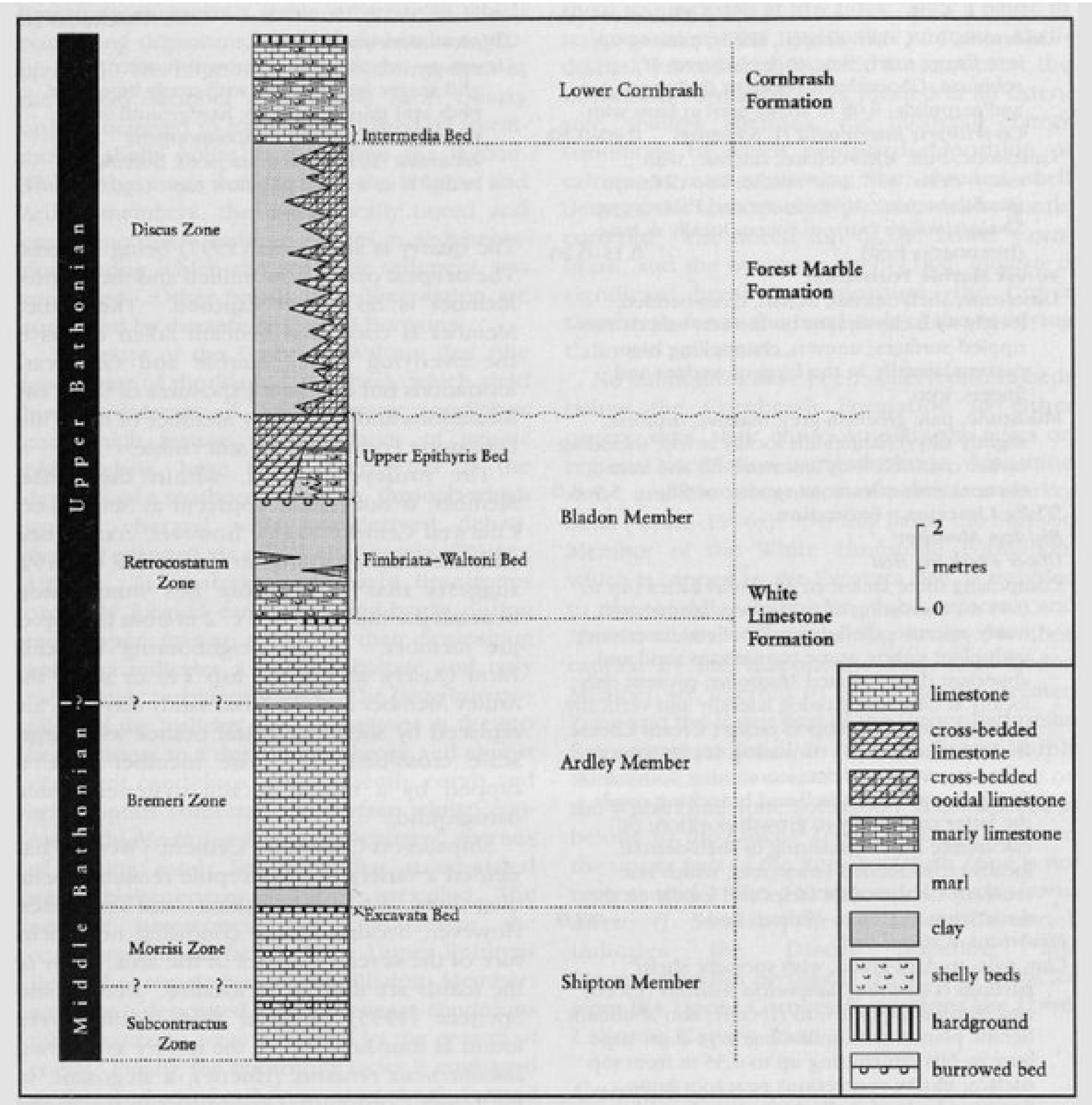
Conclusions

Shipton-on-Cherwell Cement Works and Whitehill Farm Quarry together display a typical Middle to Upper Bathonian succession, ranging from the base of the White Limestone Formation to the top of the Lower Cornbrash; it includes the type section of the Shipton Member of the White Limestone Formation. Hardground beds in the White Limestone Formation provide evidence of depositional breaks associated with cementation of sea-floor sediment. Very shelly beds in the formation yield well-preserved fossils, especially brachiopods and bivalves. Large-scale, cross-bedded limestones in the Ardley Member, seen in this district only in Whitehill Farm Quarry, demonstrate the locally rapid fades changes that may occur in the White Limestone Formation. The section of the Forest Marble Formation is remarkable for the pronounced lateral facies changes that are displayed. In the greater part of the section at the GCR site, the formation is composed of limestone but in the eastern part of the quarry, beyond the GCR site, the upper and greater part of the formation has passed into mudstone. Both the White Limestone and Forest Marble formations have been the subject of exhaustive palaeoecological, sedimentological and general facies studies, and still afford opportunities for further research. The Cornbrash Formation in the quarries has yielded ammonites diagnostic of the Upper Bathonian Discus Zone and Lower Callovian Herveyi Zone. Shipton-on-Cherwell Cement Works has proved to be the best source of Middle Jurassic crocodiles in Britain, and has also yielded the bones of turtles and dinosaurs.

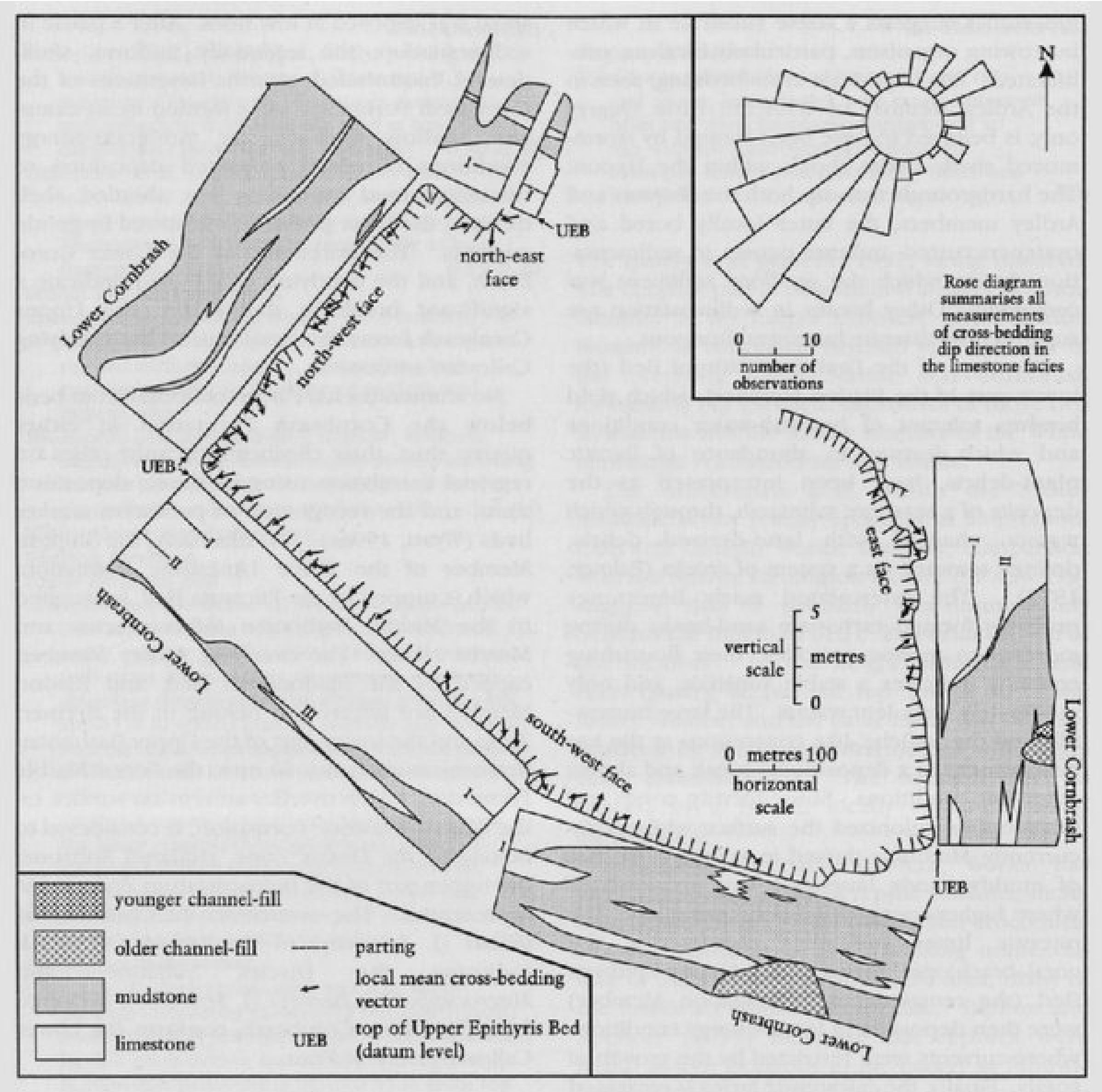
References



(Figure 3.70) Shipton-on-Cherwell Cement Works. The lower face is the Ardley Member (White Limestone Formation), overlain by the Bladon Member (covered by scree), Forest Marble Formation and then remanie Cornbrash Formation. (Photo: M.G. Sumbler.))



(Figure 3.71) Graphic section of the Bathonian succession at Shipton-on-Cherwell Cement Works.)



(Figure 3.72) Facies variation in the Forest Marble Formation of Shipton-on-Cherwell Cement Works. (Based on Allen and Kaye, 1973, fig. 3.))