Dimmock's Cote Quarry

[TL 543 723]

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Introduction

This extensive quarry lying north of the A1123 near Dimmock's Cote, Wicken, and 2 km north of Upware (Figure 3.3) is of much more recent origin than Upware South Pit. It has been known for many years as 'Bridge Pit North', to distinguish it from a now-infilled quarry (Bridge Pit South) that lay south of the A1123. The first recorded visit by geologists was in 1950 (Worssam and Taylor, 1969). The Geologists' Association visited the pits in 1958 (Forbes, 1960), when Bridge Pit South was already becoming overgrown, but Bridge Pit North offered a good section. Kelly (1985) gave a comprehensive account of the fauna and sediments of the pit, and Wright *et al.* (2000) described the stratigraphy, sedimentology and palaeoecology of the section. Bridge Pit North, known presently as 'Dimmock's Cote Quarry', is now an extensive working quarry operated by the Wicken Lime and Stone Company, although operations here are being scaled down.

Description

The floor of this pit is approximately 200 m^2, and the principal area of interest is confined to the eastern half where the state of the faces is constantly changing. The following section was seen in 1996 by Wright *et al.* (2000):

	Thickness (m)
West Walton Formation	
Upware Limestone Member	
9. Cream-coloured, fossiliferous, soft, pisolitic oobiomicrite with regular alternations of micritic and shell fragment-rich bands. The fauna is prolific, including a variety of ammonites (*Perisphinctes* spp., *Cardioceras* spp., *Neoprionoceras* sp. and *Aspidoceras* sp.), an abundance of reef-phase gastropods and bivalves preserved as moulds of originally aragonitic shells, and a large variety of echinoids (passes up from Bed 7 in E of pit)	3.0–5.0
8. *The Coral Bed:* a bed of coarse, bioclastic, coral-rich limestone seen only on the west side of the pit, and yielding a wide variety of bivalves and gastropods, and a varied coral fauna: *Fungiastraea arachnoides* (Parkinson), *Isastraea explanata* (Goldfuss), *Microsolena* spp., *Montlivaltia dispar* (Phillips) and *Thamnasteria concinna* (Goldfuss)	0.6
7. Soft, grey, marly pisolite, poorly fossiliferous except in a band 3–4 m above the base, where echinoids (*Collyrites, Nucleolites,* etc.) are common	*c.* 4.0
6b. *The Crinoid Bed:* two beds of coarse biomicrite, the upper slightly paler and more sparry than the lower. Crinoid debris and pisoliths are abundant. The fauna is scattered in the main mass of the bed, and includes *Perisphinctes* (*Dichotomosphinctes*) aff. *antecedens* Salfeld, *Cardioceras* spp. and occasional bivalves and echinoids	0.6

6a. *The Sponge Bed:* shelly, fossiliferous, argillaceous limestone containing numerous species of *Cardioceras,* including *C.* (*Cardioceras*) *highmoori* Arkell, *C.* (*Scoticardioceras*) *excavatum* (J. Sowerby), *C.* (*Maltoniceras*) *maltonense* (Young and Bird), *C.* (*Cawtoniceras*) *cawtonense* (Blake and Hudleston), *C.* (*Subvertebriceras*) *densiplicatum* Boden and *C.* (*S.*) *zenaidae* Ilovaisky, *Perisphinctes* spp., and a variety of bivalve and echinoid species	0.1–0.2
Dimmock's Cote Marl Member	
5. Dark-grey mudrock containing *Cardioceras* (*Miticardioceras*) *tenuiserratum* (Oppel), *C.* (*Cawtoniceras*) *cawtonense* and *Chlamys* sp.	0.6
4. Grey argillaceous limestone containing *Cardioceras* (*Miticardioceras*) *sopotense* (Malinowska), *C.* (*Subvertebriceras*) *zenaidae, Perisphinctes* (*Arisphinctes*) aff. *pickeringius* (Young and Bird), *P* (A.) aff. *maximus* (Young and Bird) and a variety of bivalves	0.10–0.15
3. Dark-grey mudrock with scattered *Chlamys* sp. and *Gryphaea* sp. in a layer 0.2 m above the base	1.7
2. Grey, argillaceous, spicular, shelly limestone with *Perisphinctes* sp. and *Pleuromya* sp.	0.3–0.4
1. Dark-grey mudrock containing *Perisphinctes* (*Arisphinctes*) aff. *pickeringius* about the middle, with just above it a band containing common *Gryphaea* seen	to 1.5

A log of the section is given in (Figure 3.4), and the quarry is illustrated in (Figure 3.5). The Dimmock's Cote Marls are only exposed in drainage ditches in the floor of the quarry. In thin section, the marls are seen to be composed of bioclastic mudstone. The calcareous layers consist of variably calcified, shelly spiculite containing spicules of the sponge *Rhaxella perforata* (Hinde). The Sponge Bed (Bed 6a) is heavily bioturbated into the Dimmock's Cote Marls, with infilled burrows. It is a markedly argillaceous, bioclastic limestone with bivalves and ammonites preserved as mud-filled moulds. There is then a sudden change to the coarse-grained limestone of the Crinoid Beds (Bed 6b), in which macrofossils are scarce. In thin section, profuse crinoid ossicles are seen, with many bivalve fragments.

The lower part of Bed 7, seen at the east end of the pit (Figure 3.5), is a grey manly, pisoidal limestone that is so poorly cemented it can be dug by excavators. The clasts are pisoids rather than oncoids, as they are rounded and no algal structure's are visible in them. Bed 9, as seen in this exposure, consists of tougher, cream-coloured, fossiliferous limestone. The rock has an abundance of ooids, seen in thin section set with pisoids similar to those occurring below in a fine, micritic matrix.

Much of the Coral Bed, which occurs between beds 7 and 9, and which was formerly visible in the quarry, has been quarried away. Worssam and Taylor (1969) noted 1.2 m of hard 'Coral Rag' containing *Montlivaltia dispar, Thamnasteria concinna* and *Thecosmilia* sp..

Interpretation

Upware lies on the north-western margin of the London Platform, and Palaeozoic rocks are present only a comparatively short distance below the base of the West Walton Formation. The BGS borehole at Soham 5 km to the east [TL 593 745] proved Silurian–Devonian rocks to be 128 m below its base. Situated on the edge of the massif; the Upware sequence marks the outbuilding into deeper water to the north-west of a ramp of shallow-water carbonate sediments formed originally on the shallows of the London Platform as suggested by Gallois and Cox (1977). Within the Upware inlier there is a marked thickening northwards from Upware South Pit to Dimmock's Cote Quarry.

During deposition of the Dimmock's Cote Marls, shallow-water sedimentation took place to the south, near Upware. One and a half metres of 'coral rock and marl' was described at Upware South Pit by Wedd (1898). Similar soft marls with lenses of *Thecosmilia* limestone were described by Wedd at Upware Village. Dimmock's Cote Quarry was some distance from the shallows, and clays and silts were laid down, with the development of *Rhaxella* sponge thickets during periods of clearer water. The fauna covered a variety of ecological niches, including the burrowing *Pinna* and *Pholadomya,* surface-dwelling *Oxytoma, Gryphaea* and *Serpula,* and free-swimming *Chlamys* and *Camptonectes.* However, the fauna is nowhere near as prolific as in parts of the Upware Limestone, suggesting that conditions were not particularly tolerant to life, possibly with a restricted circulation and unstable bottom conditions.

The Sponge Bed (Bed 6a) and Crinoid Beds (Bed 6b) together bear the hallmarks of a tempestite. The constituents of these beds appear to have formed originally in a wide variety of shallow-water carbonate environments. Thickets of '*Pentacrinus*'grew in large lagoonal areas. In the shallows around the lagoons, micritic envelopes were deposited on shell fragments in large areas of bioclastic sand. Echinoids browsed in the muds, small coral patch reefs developed, and there were numerous bivalve colonies. When this area was swept by a severe storm, a ramp of bioclastic sediment was built out into deeper water to the north-west. Echinoids, ammonites and bivalves were caught up and trapped in the sediment, the bivalves being deposited whole but not in life position. Those organisms that survived the storm, or recolonized, quickly bioturbated the sediment, burrowing into the underlying marls. Voids are filled with lime mud, and the spaces beneath broken shells filled with sparry calcite. Such infiltration fabrics are classic indicators of a tempestite (Kreisa and Bambach, 1982). A similar bed is seen in the Passage Beds sequence at Spikers Hill Quarry (see site report for Spikers Hill, this volume).

Subsequently, there was renewed argillaceous sedimentation, albeit with a much higher bioclastic input (Bed 7). As the ramp stabilized, oolite shoals built up the surface of the ramp to sea level. At the north-western margin of the ramp, a coral reef became established, as noted by such authors as Brighton (1938), Forbes (1960), Ali (1983) and Kelly (1985). Only parts of this reef have ever been seen. At present, coral reef limestone occurs in the western face, though as quarrying began here in the 1960s, coralliferous limestone was exposed in the centre of the pit (Worssam and Taylor, 1969). The turbulent environment in the shallow reef area continually ground up bioclastic debris that accumulated around the more robust coral skeletons. On the eastern side of the pit, comminuted reef debris occurs along with a rich bivalve–gastropod–echinoid fauna (Bed 9). The fauna shows an excellent variety of deep burrowers (*Pleuromya, Goniomya*) and shallow burrowers (*Modiolus, Gervillella, Trigonia, Sowerbya*) . Epifaunal forms (*Gryphaea, Opis*), and byssate forms (*Mytilus, Pteroperna,* young pectens), along with small branching corals, colonized the surface, along with a prolific gastropod and echinoid fauna on and just beneath the surface. Small ammonites (*Miticardioceras*) swam freely. This environment represents well-oxygenated, protected shelf conditions, possibly back reef. Southwards (Upware South Pit), conditions became deeper, with folicaeous colonies of *Thamnasteria* and *Microsolena* growing in water depths of 15–20 m only affected by wave action during storms.

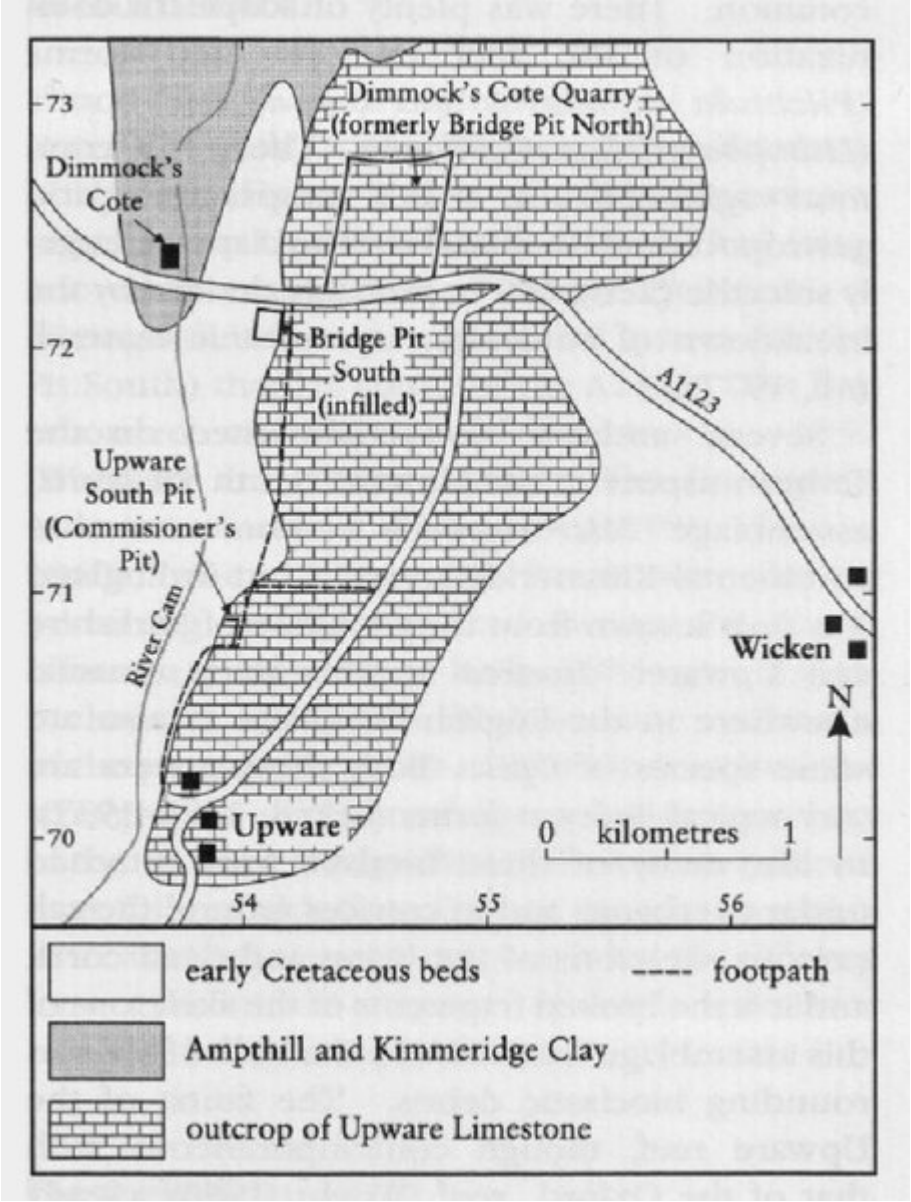
The cardioceratid ammonites found at Dimmock's Cote Quarry are mostly long-ranging forms, but the presence of such subgenera as *Cawtoniceras* in the Dimmock's Cote Marl and *Maltoniceras* in the Crinoid Bed establishes that both units probably belong to the upper Maltonense Subzone of the Densiplicatum Zone. However, the presence of two species of *Miticardioceras* in Bed 5 of the Dimmock's Cote Marl, including rare *C.* (*M.*) *tenuiserratum,* suggests that this part of the sequence may represent the very lowest Tenuiserratum Zone.

The occurrence in the same beds, along with these Boreal cardioceratids, of Tethyan perisphinctids, means that the section is of considerable use in correlating the Boreal and Sub-Boreal zonal schemes of Sykes and Callomon (1979). Bed-by-bed collecting has shown that the perisphinctid faunas of the Dimmock's Cote Marls, with their predominance of *Arisphinctes,* contrast with those of the Upware Limestone, with their predominance of *Perisphinctes* (*sensu stricto*) . Dimmock's Cote Quarry encompasses the change within the perisphinctid succession from *Arisphinctes*-dominantfaunas to *Perisphinctes* (*sensu* stricto)-dominant faunas. This is a very important change that can be recognized over much of Europe (G■owniak, 1997), and at this locality the change can be tied down closely within the Boreal cardioceratid zonal scheme.

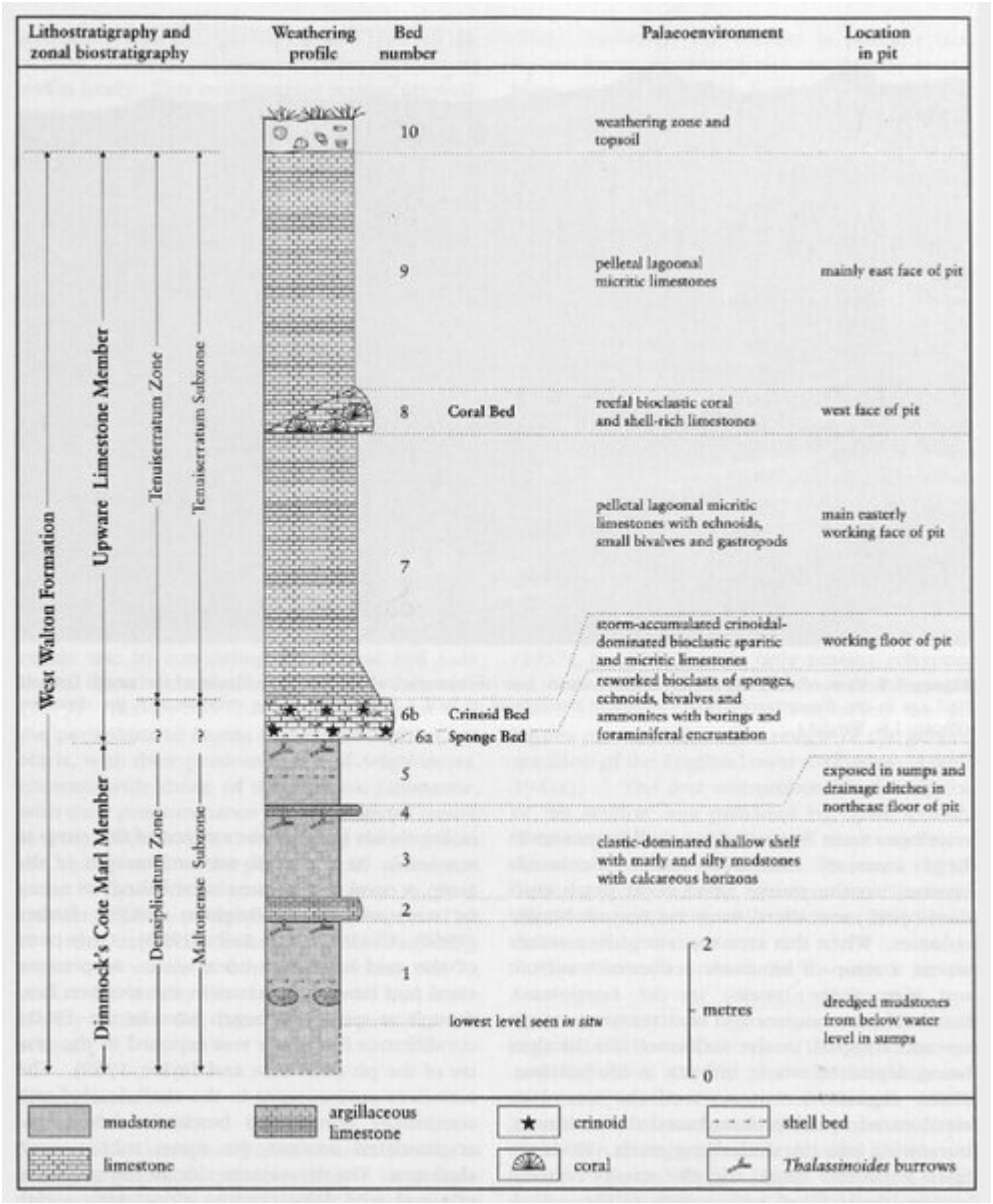
Conclusions

Dimmock's Cote Quarry is an essential locality in any stratigraphical, palaeontological or palaeo-geographical study of the British Oxfordian. The unique abundance of contemporaneous Tenuiserratum zone cardioceratids and Plicatilis Zone and Pumilus Zone perisphinctids confers exceptional value on the ammonite faunas of this site for the purposes of international correlation. Other fossil groups are equally well represented. Nine coral species occur in the Upware Limestone in association with 12 species of echinoid. However, the locality is perhaps best known for its abnormally rich and diverse assemblage of reef-dwelling bivalves, of which 67 species have been recorded.

References



(Figure 3.3) Locality map of quarries in the Upware inlier. Outcrop of the Upware Limestone (mapped as 'West Walton Beds'), Ampthill and Kimmeridge clays from BGS Sheet 188 (Cambridge) (1981) and Wright et al. (2000).



(Figure 3.4) Log of the 'Corallian' succession in Dimmock's Cote Quarry (after Wright et al., 2000, fig. 4).

(Figure 3.5) View of the central part of the eastern face of Dimmock's Cote Quarry. Blocks of the tough Crinoid Bed are in the foreground, with the manly limestones of Bed 7 and Bed 9 being excavated in the distance. (Photo: J.K. Wright.)