Magdalen Quarry

[SP 552 072]

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Introduction

Magdalen Quarry (or 'Workhouse Quarry') has its earliest known reference in 1610 (Arkell, 1947c, p. 49). The quarry was worked for building stone until just before World War I (Pringle, 1926). Since then it had deteriorated, but has recently been cleaned up and fenced off, and is now managed as a nature reserve by Oxford City Council, who have renamed it 'Headington Quarry'. The quarry is tucked away amidst houses south of the A420 (Figure 2.47). It is not easy to find; the access road leads south from the southern part of Wm Kimber Crescent to a parking area in front of the quarry. The quarry displays fine E–W- and N–S-trending faces some 50 m in length where lateral facies changes in Parandieri Subzone carbonate rocks (Wheatley Limestone) can be followed closely. The section was described by Buckman (1923–1925, p. 50) and figured prominently in the accounts of Arkell (1927, 1933, 1935, 1933–1948, 1936b, 1947b, c).

Description

When first described by Buckman (1923–1925), the quarry showed a 6 m sequence of Corallian rocks. A drawing of the quarry face as seen in the 1920s was figured by Arkell (1927, 1933). However, exposure at the time of writing does not permit all the observations of the early workers to be verified as the lowest 1–2 m are shallowly buried beneath a cover of loose talus. The following section was measured by the author in 1998 (entries in brackets from Buckman (1923–1925) and Arkell (1933)), and the quarry face is illustrated in (Figure 2.50).

	Thickness (m)
Stanford Formation	
Wheatley Limestone Member	
7. Massive, very tough, rubbly bioclastic limestone with cross-bedding dipping to the south-east	seen to 2.0
6. Very rubbly, thin-bedded, micritic or clayey, shelly limestone	0.50
5. Medium-grained, bioclastic limestone (the 'First Headington Hard')	0.35
4. Rubbly, poorly bedded, bioclastic limestone	0.45
3. Tough, medium-grained bioclastic limestone containing numerous spines of *Hemicidaris intermedia* (Fleming) — the 'Hedgehog Course'	seen to 0.45
(probable gap — 0.75 m — not exposed)	
Kingston Formation	
Beckley Sand Member	
(2. *Headington Shell Bed:* bluish-grey, tough, ooidal limestone, largely made up of fossils, with *Lima, Chlamys, Myophorella, Gervillella, Perisphinctes, Aspidoceras* and *Cardioceras,* etc.. Numerous 'lydite' and grey limestone pebbles present, with pyrite and carbonaceous matter	0.3)
(1. Soft sand	seen to 0.9)

The Beckley Sands (Bed 1) were described by Buckman (1923–1925) as soft sands without hard bands or doggers.

Bed 2, the Headington Shell Bed, contains a remarkably prolific fauna of bivalves and ammonites exceptionally well preserved in its fine micritic matrix.

Beds 3–7 (Wheatley Limestone) contain numerous well-rounded coral clasts mostly 2–2.5 mm in diameter. Most bivalves are comminuted, with occasional *Nanogyra nana* (J. Sowerby). The rock weathers very readily, but the two beds of bioclastic limestone, beds 3 and 5, stand out. As was noted by Arkell (1933), there is substantial facies variation within Bed 7 in the quarry. The specific layers of hard limestone (the Second and Third Headington Hards) are difficult to make out now, but the general pattern is still recognizable. In the north-west end of the quarry the rock is tougher and coarser (Arkell's 'Nodular Rubble'), with abundant coral clasts between 5 and 10 mm in diameter. *Fungiastraea arachnoides* (Parkinson), *Thamnasteria concinna* (Goldfuss), *Thecosmilia annularis* (Fleming) and *Rhabdophyllia phillipsi* Edwards and Haime are all represented. Passing eastwards, the coral clasts become smaller, between 2 and 5 mm in diameter, and beds of fine- and medium-grained coral-shell sand alternate. At the south-east end of the quarry little bedding is seen, and Bed 7 has become a fine-grained, white, porous, massive, bioclastic limestone, the 'Pendle' of the quarrymen.

The following is a complete list of ammonites recorded from this quarry and from the nearby Vicarage Quarry, which abuts onto Magdalen Quarry:

Wheatley Limestone

Perisphinctes (*Dichotomosphinctes*) *antecedens* Salfeld, 0.45 m above the First Headington Hard.

Headington Shell Bed

P. (*D.*) *antecedens*

P. (*D.*) *. buckmani* Arkell (holotype)

P. (*Perisphinctes*) *chloroolithicus* (Giimbel)

Aspidoceras (*Euaspidoceras*) cf. *vettersianum* Neumann

Cardioceras (*Scoticardioceras*) *excavatum* (J. Sowerby)

C. (*Subvertebriceras*) *costulosum* (Buckman) (holotype)

C. (*Sagitticeras*) *moderatum* (Buckman) (holotype)

C. (*S.*) *cariniferum* (Buckman) (holotype)

Goliathiceras (*Goliathiceras*) *ammonoides* (Young and Bird)

G. microtrypa (Buckman) (holotype)

G. elegans Arkell

G. chamoussetiforme Arkell

Interpretation

In their respective monographs, both Buckman (1923–1925) and Arkell (1935–1948) emphasize the importance of the ammonite assemblages occurring here. The bulk of the specimens came from the Headington Shell Bed. The occurrence of so many species of *Goliathiceras* and *Sagitticeras* is a firm indication of the presence of the Vertebrale Subzone — yet the occurrence of the *Dichotomosphinctes* and *Perisphinctes* (*sensu stricto*) *is* an equally firm indicator of the presence of the Antecedens Subzone (approximately equivalent to the Maltonense Subzone). Because of this, Callomon (1960) was driven to the conclusion that both subzones are present in the 0.3 m thickness of the shell bed, the Vertebrale and

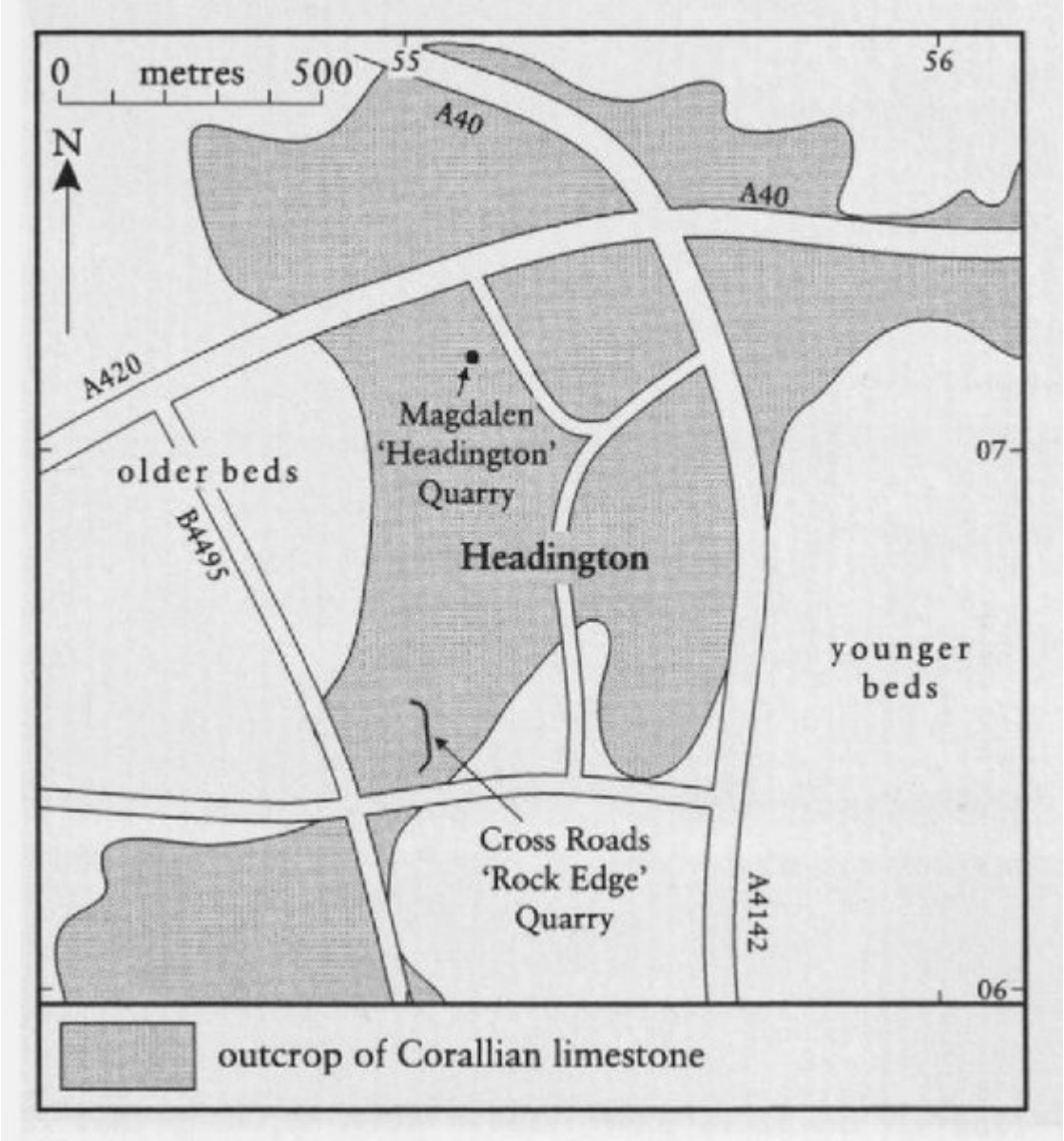
Maltonense Subzones having joined together into a single homogeneous bed. The Headington Shell Bed thus represents a remanie deposit laid down during a period of intense sediment starvation over a considerable period of time. The shells are perfectly preserved, with little abrasion or fracturing during transport. The bivalves represent shallow-burrowing, surface-dwelling and free-swimming forms. Here and elsewhere around Oxford, the Wheatley Limestone yields a Sub-Boreal Parandieri Subzone fauna, almost certainly equivalent in this case to the Boreal Tenuiserratum Subzone.

The Wheatley Limestone as developed at this site represents an opportunity to examine a facies intermediate between the wholly detrital carbonate accumulations of the Wheatley district and the true coral bioherms formerly visible only 1.2 km south at Windmill Quarry (Figure 2.49). The size of the coral clasts at the north-west end of Magdalen Quarry shows that the sediment was accumulating very close to a coral reef, as at the Cross Roads site, but no sign of in-situ corals is seen. The Wheatley Limestones of Magdalen Quarry may be regarded as forming a reef-flank facies, dipping off the eastern side of the Oxford reef development (Figure 2.49). In only a short distance the transition from coarse reef rubble to finer grainstones may be observed. Arkell's drawing of the quarry face (1927, 1933), made when the face was better exposed than it is at the time of writing, shows all horizons within the quarry section thinning to the east, particularly the Nodular Rubble and the 'Hard Bands' and 'Hedgehog Course' (whose 'hedgehog' spines were, of course, echinoid spines). These thin, tough limestones were the beds sought by the quarrymen for building stone, but, being porous, they are not particularly resistant to weathering, and are now regarded as an unfortunate choice for that purpose. The 'Pendle' is thickest in the eastern side of the quarry. It is a whiter and more comminuted detrital facies than occurs at Wheatley, 4 km to the east.

Conclusions

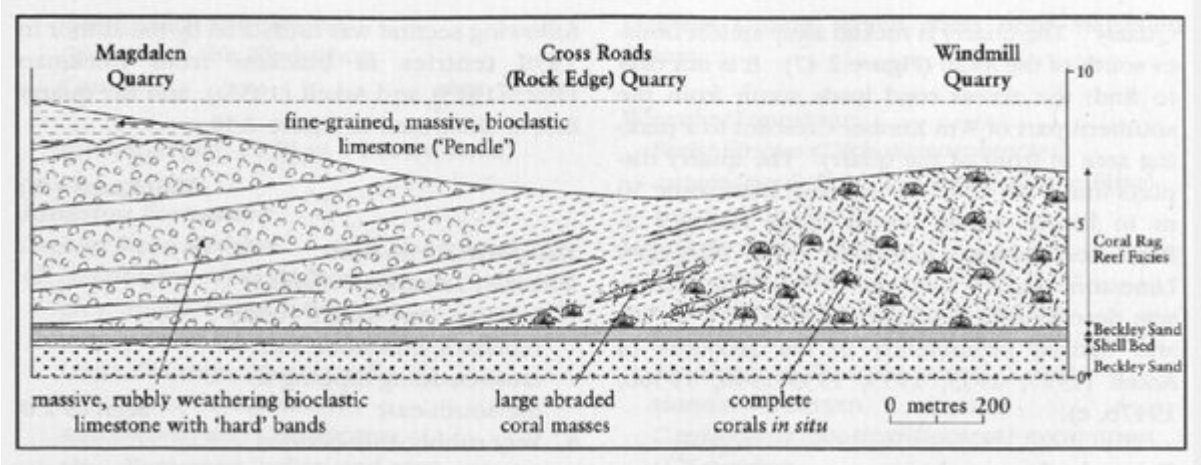
This site is essential to the palaeogeographical reconstruction of coral reef development in the vicinity of Oxford in late Jurassic (Mid Oxfordian) times. Rapid lateral lithological and thickness changes are well displayed within the Wheatley Limestone of the quarry section, and in a short distance a complete transition from coarse reef rubble to finer grainstones may be observed. The Headington Shell Bed has been an important source of ammonites, with the very close juxtaposition of Vertebrale Subzone cardioceratids and the immediately overlying Maltonense Subzone perisphinctids, all within one 0.3 m bed. The ammonites are beautifully preserved, and the holotypes of five ammonite species have been collected from the Shell Bed at this quarry or at the adjacent Vicarage Quarry.

References



(Figure 2.47) Locality map for Cross Roads Quarry and Magdalen Quarry. Outcrop of the Corallian limestones from BGS Sheet 237 (Thame) (1994).

(Figure 2.50) View of the main east–west face at Magdalen Quarry showing the irregularly bedded Wheatley Limestone. The 'First Headington Hard' (Bed 5, 0.35 m) is just below the level of the mapcase (36 cm long). (Photo: J.K. Wright.)



(Figure 2.49) Correlation of sections in Magdalen Quarry, Cross Roads Quarry and Windmill Quarry (after Arkell, 1927, fig. 11), showing the transition from Coral Rag reef facies on the right into Wheatley Limestone facies on the left.