# Lye Hill Quarry

[SP 592 068]

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## Introduction

Lye Hill Quarry provides the thickest, best-exposed and most accessible succession in the Parandieri Subzone Wheatley Limestone. The quarry is situated immediately north of the A40 at its junction with the B4027. It provides an extensive exposure, with its four faces varying between 50 m and 150 m in length. It was first referred to by its present name early in the 20th century (Davies, 1909) although several previous descriptions of exposures in the Wheatley Limestone in the vicinity (Hull and Whittaker, 1861; Blake and Hudleston, 1877; Woodward, 1895; Blake, 1902a) may include this site.

The exposure was mentioned by Pringle (1926), but it was the researches of Arkell in the Oxford district (see below) that gave Lye Hill Quarry its full prominence. Subsequently, the site has received further attention through the work of McKerrow and Baden Powell (1953) and Callomon (1960), and it later figured prominently in the major work of Wilson (1968b) on carbonate facies variations within the Osmington Oolite and Coral Rag. The succession was studied in detail by Horton *et al.* (1995), who produced a radically revised interpretation of the section. Though well conserved, Lye Hill Quarry is at the time of writing being used as a car storage area, and as such is not suitable for visits by parties.

## Description

The quarry section lies entirely within the Wheatley Limestone Member of the Stanford Formation. The term 'Wheatley Limestone' was first employed by Blake and Hudleston (1877) to describe this detrital equivalent of the Coral Rag reef facies. In general terms, the Wheatley Limestone consists of massive-bedded, very rubbly weathering, medium- to coarse-grained biomicrites largely devoid of recognizable corals. Harder beds of densely bioclastic limestone with a partial sparry cement alternate with softer micritic beds.

The whole has a pronounced easterly dip, and this has given rise to a certain amount of controversy. Blake and Hudleston (1877), Arkell (1942, 1947b) and Wilson (1968b) were convinced that the true dip in this area was almost horizontal, and that the dip of 8° to the east seen in the quarry was depositional, the shelly limestones dipping off the Oxford coral reef situated to the west (see report for Cross Roads Quarry).

Pocock *et al.* (1908) felt that it was not clear to what extent the bedding in the quarry was cross-bedding rather than true bedding. Horton *et al.* (1995) established by mapping that the regional dip in the Wheatley area is 8° to 10° to the east, and that the bedding seen in the quarry is therefore true bedding, not cross-bedding. The presence of large-scale cross-bedding could not be substantiated. The total thickness measured bed by bed is 26 m. Elsewhere, a maximum of 10 m of Wheatley Limestone is seen. Horton *et al.* agreed with Arkell (1947b) that the anomalous thickness of 26 m was due to the situation of the Lye Hill area within the Wheatley Fault Zone, and that fault movement during the Oxfordian led to a substantially increased thickness of Wheatley Limestone.

The section below is taken from Horton *et al.* (1995).

| | Thickness (m) |
|---|---|
| ***Stanford Formation*** | |
| *Wheatley Limestone Member* | |
| 26. Hard, flaggy limestone | 0.4 |
| 25. Buff marl passing laterally into rubbly-weathering limestone | 0.85 |

| | |
|---|---|
| 24. Hard, compact, medium- to coarse-grained oobioclastic limestone | 0.57 |
| 23. Shelly, medium- to coarse-grained marl with abundant *Nanogyra nana* (J. Sowerby) | 0.75 |
| 22. Generally well-cemented, massive, very pale fawn limestone with abundant medium to coarse shell debris | 1.15 |
| 21. Shelly marl | 0.08 |
| 20. Hard, medium-grained, bioclastic limestone with abundant *N nana,* serpulids and rarer echinoids | 2.30 |
| 19. Shelly marl | 0.08 |
| 18. Massive bioclastic limestone | 1.18 |
| 17. Shelly marl | 0.08–0.12 |
| 16. Medium- to coarse-grained, rubbly limestone with differential cementation | 1.55 |
| 15. Rubbly bioclastic limestone with pockets and lenses of marl and micritic limestone | 0.75 |
| 14. Hard, massive, bioclastic limestone | 0.38 |
| 13. Bioclastic limestone, massive below, nodular at the top, with marl and micrite lenses | 0.53 |
| 12. Grey and brown banded marl passing laterally into limestone | 0.45 |
| 11. Medium-grained bioclastic limestone with well-rounded shell debris | 0.83 |
| 10. Shelly marl | 0.02 |
| 9. Medium-grained bioclastic limestone with low-angle cross-stratification | 0.72 |
| 8. Shelly marl | 0.05 |
| 7. Thinly bedded bioclastic limestone with scattered shelly bands, mostly oyster | 2.10 |
| 6. Shelly marl | 0.03–0.07 |
| 5. Medium-grained bioclastic limestone with many *N. nana* | 2.10 |
| 4. Shelly marl | 0–0.02 |
| 3. Medium- to coarse-grained, banded, oobioclastic limestone with scattered *N nana* | 1.20 |
| 2. Shelly marl | 0.04 |
| 1. Medium-grained bioclastic limestone with banding due to differential cementation | seen to 3.30 |
| (Shell-Pebble Bed seen in the floor of quarry in 1945 by H. J. Hambige; in the floor of the quarry in 1945 by H.J. Hambige; in Callomon, 1960, p. 197). | |

A loose block, probably from Bed 15, contained *Nanogyra nana, Pseudomelania heddingtonensis* (J. Sowerby), echinoid fragments and fish teeth. These occurred along with pisoids, 1.5–2 mm diameter coral fragments and shell fragments in a grey, argillaceous, micritic matrix. Callomon (1960) lists the following from the Wheatley Limestone of this area: *Perisphinctes* (*Perisphinctes*) *parandieri* de Loriol, *P.* (*P.*) *chloroolithicus* (Gümbel), *P.* (*Dichotomosphinctes*) *buckmani* Arkell and *P.* (*D.*) *auriculatus* Arkell.

## Interpretation

Horton *et al.* (1995, fig. 14) plotted the distribution of Wheatley Limestone, Coral Rag and Littlemore Clay facies in the area to the east of Oxford. They noted that an area of patch reef with coral masses and interdigitating debris-filled channels similar to that occurring at Cumnor (see site report for Cumnor, this volume) extends to just east of the A4142 on the eastern side of Oxford (Figure 2.47), and then NNE towards Beckley. East of this line, there are no coral masses, just detrital Wheatley Limestone. Lye Hill Quarry is thus situated some 4 km east of the nearest patch reef.

The Lye Hill site provides an ideal opportunity to examine in detail the composition of the Wheatley Limestone. The allochems are derived largely by micritization of well-packed, skeletal shell debris swept from the reef facies of the Oxford area. Frequently present are amorphous lumps (pisoids), the centres of which are often composed of a mosaic of calcite (Wilson, 1968b) suggesting their formation by algal degradation. The grain size of these sediments decreases from Beckley, 5 km to the north-west, to Wheatley, and this is accompanied by a change in particle type from mainly coralline debris to intrasparites (Folk, 1959).

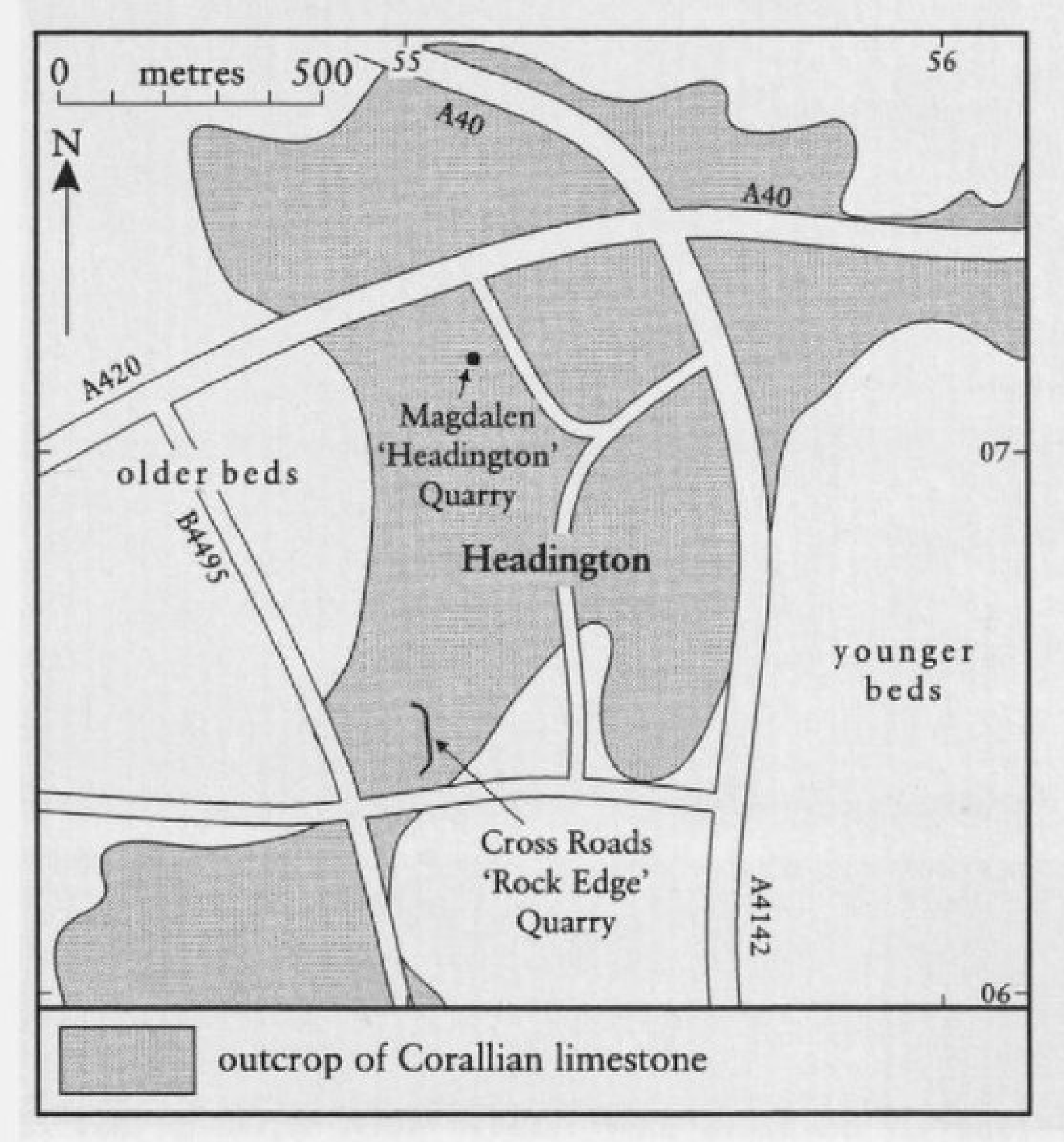
The lack of coral debris only 4 km from the reef is remarkable, particularly when it is considered that coral debris was traced 20 km east of the Hackness coral–sponge reef in Yorkshire by Wright (1992; see report for Hackness Head). It is likely that current action at Oxford was stronger, and coral fragments were completely abraded before the shell debris reached the Lye Hill area. These detrital carbonates forming the Wheatley Limestone were thus deposited on the margins of the deeper water east of the Oxford reef. Clay-rich limestones laid down under gentle offshore marine conditions alternate with highly comminuted, cross-bedded shell debris laid down during storms. The frequent occurrence of nests of *Nanogyra* cemented together suggests in-situ growth of small oyster patch reefs. These represent the only faunal elements able to tolerate the unstable substrate, the bivalves cementing to each other in the rapidly shifting depositional environment. Rapid subsidence within the Wheatley Fault Zone allowed the accumulation of reef detritus beds four times thicker than the reef itself (Arkell, 1927).

The extensive perisphinctid fauna of the Wheatley Limestone is the type fauna of the Parandieri Subzone of Callomon (1960). Correlation of this Sub-Boreal subzone with the standard Boreal zonal scheme is not certain, but the Parandieri Subzone is probably equivalent to the upper part of the Tenuiserratum Subzone and the Blakei Subzone (Wright, 1996a).

## Conclusions

This is a key Corallian locality in any facies analysis of the Oxford coral-reef area. The site displays extensive sections in the Wheatley Limestone, of Mid-Oxfordian age, only a kilometre from its type locality. This site marks a strategic position in Middle Oxfordian palaeogeography, as increasingly argillaceous facies replace carbonates north-eastwards along the Corallian outcrop (Horton *et al.,* 1995). The facies characteristics of the Lye Hill sequence reflect this change in the nature of the depositional environment as the Wheatley Limestone grades laterally into the 5 m thick deposits of marl and clay termed the Oakley Beds in north Oxfordshire, Buckinghamshire and Bedfordshire.

**References**




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