

BLOCKLEY STATION QUARRY

OS Grid Reference: SP181370

Highlights

Blockley Station Quarry in Gloucestershire is the only extant inland British Lower Lias exposure which has yielded fish material. It displays an unique section of the Upper Clays of the Lower Lias that are not exposed elsewhere in the British Isles.

Introduction

Blockley Station Quarry, a large brickpit in the northern Cotswolds (Figure 12.7), is well known to British Jurassic stratigraphers in displaying an unrivalled section through much of the Upper Clays of the Lower Lias (Pliensbachian). In recent years the workings have been extended both upwards and downwards and fish remains have been collected from a crinoidal horizon near the base of the quarry (Figure 12.8A, 12.8B). The fish-bearing unit, the Crinoid–Belemnite Bed, is composed of soft clay with abundant macroinvertebrate material, making bulk processing by wet sieving an excellent means of sampling large amounts of sediment for microvertebrate remains. Much of the material collected from Blockley comprises tiny shark teeth and denticles, fossils that would be missed by other means of field collecting.

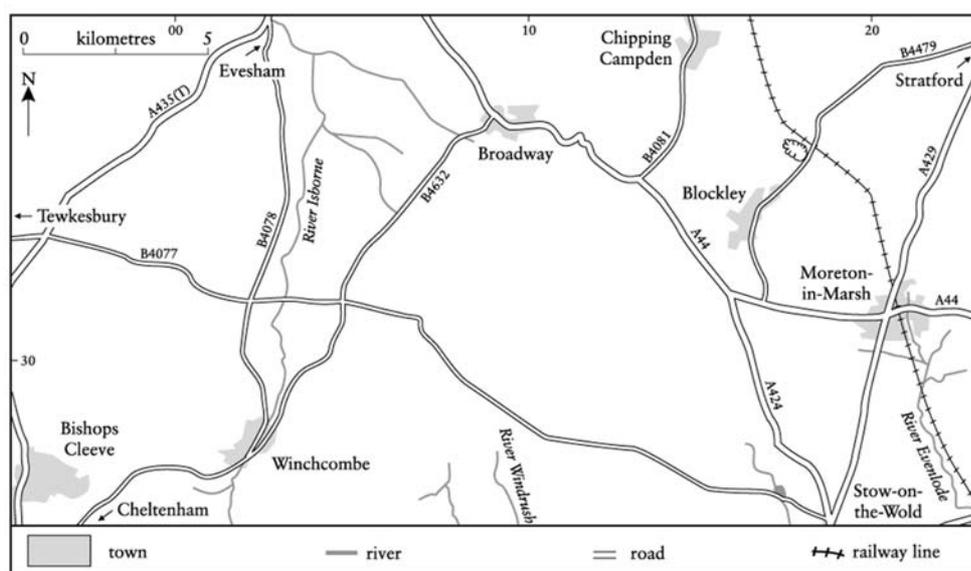


Figure 12.7: Sketch map of the area around the Blockley Old Station Quarry GCR site, which is to the north-east of Blockley.

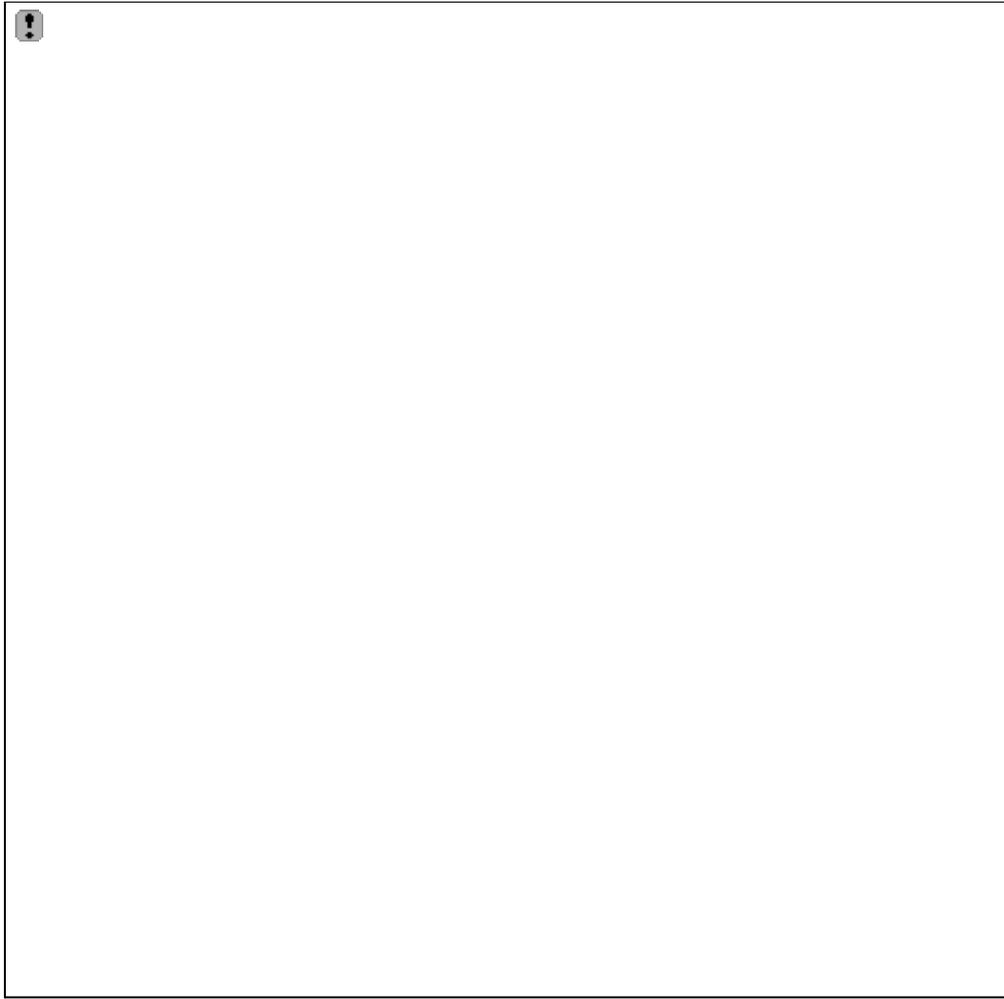




Figure 12.8: (A) Blockley Station Quarry, close-up of north-west faces of the Upper Clays in the Lower Lias, with basal limestones (photo: K. Page). (B) Blockley Station Quarry, north-west faces of the Upper Clays in the Lower Lias, with basal limestones (photo: S. Metcalf).

The pit continues to be worked and there is much potential for future finds as the workings expand. The succession of the Upper Clays at Blockley is the most complete and fossiliferous (in terms of macro-invertebrates and, in particular, zonal ammonites) in the British Isles and provides missing information on a number of key Lower Lias stratigraphical issues, as beds of equivalent age elsewhere are unfossiliferous (e.g. the Midlands) or absent (e.g. Dorset; Callomon, 1963, 1968; Callomon *et al.*, 1993). Hence the new fish material can be precisely dated within the Pliensbachian zonation scheme, providing much-needed stratigraphical evidence for studies in macro-evolution of Lower Jurassic selachian groups.

Description

Although brickmaking began at Blockley in the early part of the 20th century, it appears that the section was fairly small and by all contemporary accounts unfossiliferous (e.g. Richardson, 1929). The first serious attempts to log the section came in the early 1950s when brickmaking resumed after a lull during the war years (e.g. Cox, 1950, p. 263; Channon, 1950, p. 260). The section recorded here is based upon the classic stratigraphical logs made during the latter part of the 1960s by J. Callomon (1968) and subsequently improved by him (*in* Callomon *et al.*, 1993), following extension of the workings in the 1980s:

		Thickness (m)
Lower Lias: Pliensbachian		
<i>?davoei</i> Zone, <i>maculatum</i> Subzone		
8	Clay, weathered	seen 1.0–2.0
7	Siltstone, buff, lenticular, bioturbated, sparsely fossiliferous, ammonites	0.0–0.2
<i>ibex</i> Zone, <i>luridum</i> Subzone		
6	Clays, grey and brown, limonitic nodules abundant; sparsely fossiliferous	6.0
5	Clays, as above, with scattered small concretions and crushed fossils	4.0
4	Mudstone, impersistent, light brown or layer of calcareous concretions; Fauna IV	0.0–0.15
3	Clay, grey, fairly common ammonites	0.3
2	Pecten Bed. Mudstone, grey to light brown, fossils, many well preserved; highly diverse bivalve fauna, belemnites; Fauna III	0.15–0.45
1	Clay, grey very fossiliferous throughout, ammonite fauna; Fauna II	8.5
Z	Crinoid–Belemnite Bed coarse calcite shell and ossicles of <i>Belanocrinus</i> forming hard quarry floor; Fauna I	seen 0.15

Fish remains have so far only been recovered from Bed Z, which forms a hard base to the quarry. This bed is only exposed during most prolific quarrying activity, and was not recorded on the earlier logs of the section. The section has a rich invertebrate fauna, dominated by ammonites, belemnites and bivalves, with rarer brachiopods, gastropods and echinoderm material (Channon, 1950, p. 260). The ammonite succession at Blockley has provided a base for extensive studies into the phylogeny and evolution of liparoceratids (e.g. Callomon, 1968). This has meant that the units can be precisely correlated to the *ibex* and *davoi* Zones of the Lower Pliensbachian. The excellent biostratigraphical information for the Blockley section has meant that the fish-bearing unit and the overlying beds can be correlated with the Lower Lias of Dorset. The beds exposed at Blockley have provided much missing stratigraphical information on part of the Lower Lias, which is frequently unfossiliferous or not exposed elsewhere, as in Dorset (Callomon *et al.*, 1993).

The section was sketched by Phelps (1985) in a review of the ammonite bio- and chronostratigraphy of the Lower Pliensbachian. He subdivided many of the beds on Callomon's log and provided a tripartite division of the *luridum* Subzone, based upon liparoceratid ammonite zonule biostratigraphy. The section contains four distinct and clearly distinguishable ammonite faunas, which are labelled I–IV on Callomon's log. These can be correlated with equivalent faunas of the Dorset coast to illustrate the considerable non-sequence in the southern region (Callomon *et al.*, 1993). Bed Z (Crinoid–Belemnite Bed of Callomon *et al.*, 1993) correlates with one of the components, the Crumbly Bed, at the top of Lang's bed 120, the Belemnite Marls in Dorset (Lang *et al.*, 1928) and bed 2, the Pecten Bed, is equivalent to the Belemnite Stone, or Lang's bed 121 of that region. All of the succeeding strata in the Blockley section (beds 3–8) are missing from the Dorset coast succession (Callomon *et al.*, 1993).

Fauna

Fish remains have been recovered from the lower shelly units (bed Z on Callomon's log) in the section at Blockley Station Quarry by bulk sampling (Ward, pers. comm., 1994). The fauna consists mostly of abundant microshark teeth, denticles, and semionotid scales and teeth (Ward, pers. comm.; Figure 12.9):

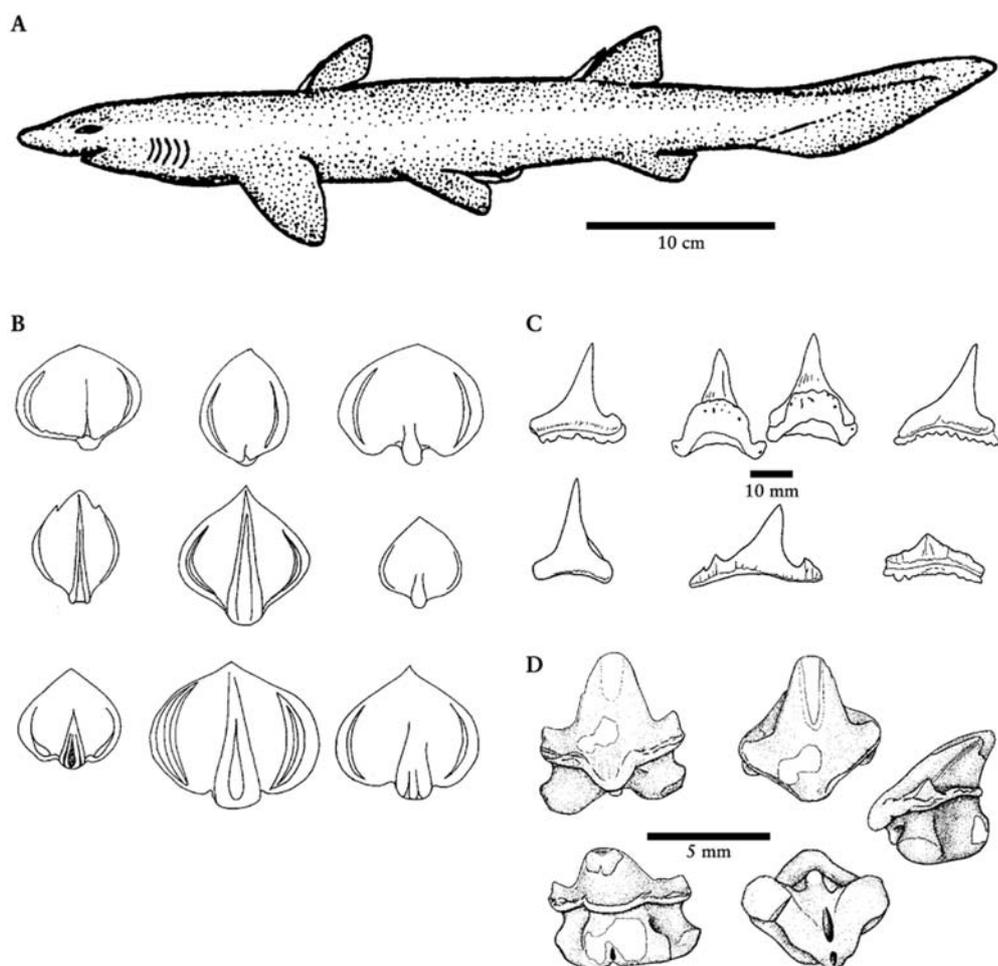


Figure 12.9: The elasmobranch fishes from Blockley Old Station Quarry: (A) restoration of *Synechodus* by Duffin and Ward (1983b); (B) denticles ($\times 30$) and (C) teeth of *Synechodus* from Duffin and Ward (1983b); (D) views of tooth (holotype NHM P 60788) of *Agaleus dorsetensis* Duffin and Ward (1983b).

Chondrichthyes: Elasmobranchii: Neoselachii: Squalomorphii *Synechodus occultidens* Duffin and Ward, 1993 *S. enniskilleni* Duffin and Ward, 1993.

Chondrichthyes: Elasmobranchii: Neoselachii: Galeomorphii

Agaleus dorsetensis Duffin and Ward, 1983 Osteichthyes: Actinopterygii: Neopterygii: Halecostomi '*Lepidotes*' sp.

Interpretation

During the early Lias Epoch, central England formed part of a large depositional basin, which was gradually deepening towards the end of Upper Clay sedimentation. The clays of the Lower Lias represent deposition in normal offshore marine facies, although the basin tended to become periodically stagnant. Late Lower Lias subsidence probably was at its azimuth in Gloucestershire, although the Upper Clays thin toward the London–Ardennes island in eastern Oxfordshire and Northamptonshire (Hallam, 1968).

Scattered microvertebrate remains are recovered from the basal Crinoid–Belemnite Bed (bed Z) by bulk sampling and acid preparation of the calcareous cemented shelly clays. The residues are rich in an impoverished microshark fauna, which includes teeth and dermal denticles of the neoselachians, *Agaleus dorsetensis* Duffin and Ward, 1983, *Synechodus occultidens* Duffin and Ward, 1993 and *S. enniskilleni* Duffin and Ward, 1993, also known from the Lower Lias of Lyme Regis (Figure 12.9). The assemblage has poor diversity and little else except the ganoid scales and button-like teeth of semionotids (*?Lepidotes*' sp.), which have been recovered from the washings. The prevalence of the small benthonic palaeo-spinacid and orectolobid sharks with

unspecialized diets, and the bony fish with teeth, which suggest a durophagous habit, supports sedimentological evidence that the biodebris of the Crinoid–Belemnite Bed represents a locally stable shelly substrate or shell bank within the basin.

Comparison with other localities

The fish fauna recovered from the Upper Clays of the Lower Lias at Blockley complements the rather sporadic, but much better preserved, finds made at Lyme Regis during the 19th and 20th centuries. However, the fossiliferous sediments at Blockley Station can be bulk-processed for microscopic remains.

Conclusions

Blockley Station Quarry is important and has a conservation value as the only extant fish-bearing section of the Upper Clays (Pliensbachian) of the Lower Lias in the British Isles. The fish-bearing units yield a typical Liassic neoselachian fauna and are readily accessible for further bulk sampling which will undoubtedly continue to produce more specimens.

Reference list

- Callomon, J.H. (1963) Sexual dimorphism in Jurassic Ammonites. *Transactions of the Leicester Literary Philosophical Society*, **57**, 21–56.
- Callomon, J.H. (1968) The Kellaways Beds and Oxford Clay. In *The Geology of the East Midlands* (eds P.C. Sylvester-Bradley and T.D. Ford), University of Leicester Press.
- Callomon, J.H., Oates, M.J., Coe, A.L. and Metcalf, S.J. (1993) Day excursion B: Jurassic of Oxfordshire and Cotswolds. *Arkel International Symposium on International Jurassic Geology. Geological Society Guide*, 47 pp.
- Channon, P.J. (1950) New and enlarged Jurassic sections in the Cotswolds. *Proceedings of the Geologists' Association*, **61**, 242–60.
- Cox, L.R. (1950) Field meeting in the Cotswolds. *Proceedings of the Geologists' Association*, **61**, 261–7.
- Duffin, C.J. and Ward, D.J. (1993) The early Jurassic Palaeospinacid sharks of Lyme Regis, southern England. *Belgian Geological Survey, Professional Paper*, **264**, Elasmobranches et Stratigraphie, 53–102.
- Hallam, A. (1968) The Lias. In *The Geology of the East Midlands* (eds P.C. Sylvester-Bradley and T.D. Ford), Leicester University Press, pp. 188–210.
- Phelps, M.C. (1985) A refined ammonite biostratigraphy from the Middle and Upper Carixian (Ibex and Davoei zones, Lower Jurassic) in north-west Europe and stratigraphic details of the Carixian–Domerian boundary. *Geobios*, **18**, 321–62.
- Richardson, L. (1929) Rhaetic. In *Handbook of the geology of Great Britain* (eds J.W. Evans and C.J. Stubblefield), Thomas Murby and Co., London, pp. 341–49.