AN EXPOSURE OF GLAUCONITIC BEDS AND AYLESBURY LIMESTONE (PORTLANDIAN, UPPER JURASSIC) IN BUCKINGHAM STREET, AYLESBURY

JONATHAN D. RADLEY

A section of Glauconitic Beds and Aylesbury Limestone is presented from a temporary exposure in Buckingham Street, Aylesbury – An abundant molluscan fauna is recorded, together with details of palaeoecology.

The Portlandian (Upper Jurassic) strata of Buckinghamshire are currently poorly exposed, since the closure of numerous stone and sand pits which were once a conspicuous feature of the Vale of Aylesbury (see for instance Fitton 1836, Blake 1880).

The overall lithostratigraphic framework and stratigraphic palaeontology of these strata is nevertheless tolerably well known, thanks to the efforts of various earlier workers (notably Fitton 1836; Blake 1880 and Davies 1899), A summary of stratigraphy is provided in Fig. 1. Details of sedimentology and palaeoecology are still relatively poorly known, owing in part to the current paucity of surface sections.

In combination, two local Sites of Special Scientific Interest (Bugle Pit SSSI at Hartwell, see Radley 1991; Warren Farm SSSI near Stewkley, see Barker 1966 for instance) show degraded sections of the Crendon Sand, Creamy Limestones and Purbeck Formation (Fig. l).

Permanent exposures in lower units (Upper Lydite Bed up to Aylesbury Limestone, Fig. 1.) are currently confined to shallow surface scrapes and ditch sections. In such exposures, these soft and locally decalcified strata weather back rapidly. Consequently, clear details of lithological variation and enclosed faunas are soon lost. Temporary exposures are consequently an important source of geological data.

During a geological site survey throughout the county in 1988 (Rowland 1989), the author located a richly fossiliferous temporary section in Buckingham Street, Aylesbury (SP819139). Here, excavations for the Kingsbury Court shopping centre exposed over 3 metres of unweathered Portlandian strata, comprising the top of the Glauconitic Beds and the lower part of the Aylesbury Limestone (Fig. 1). The section was capped by limestone-rich soil and made ground. During several visits to the site, the section was logged and a representative fauna was collected.

THE SECTION

The exposures consisted of vertical faces a few metres long and horizontal ledges in the base of the excavation. The following section describes beds from the top downwards.

Aylesbury Limestone

6. Rubbly biomicrite, with poorly-preserved moulds of *Protocardia dissimilis* (J. de C. Sowerby) as well as calcitic *Plicatula* sp. Grades up into Recent deposits. – (70cm seen)

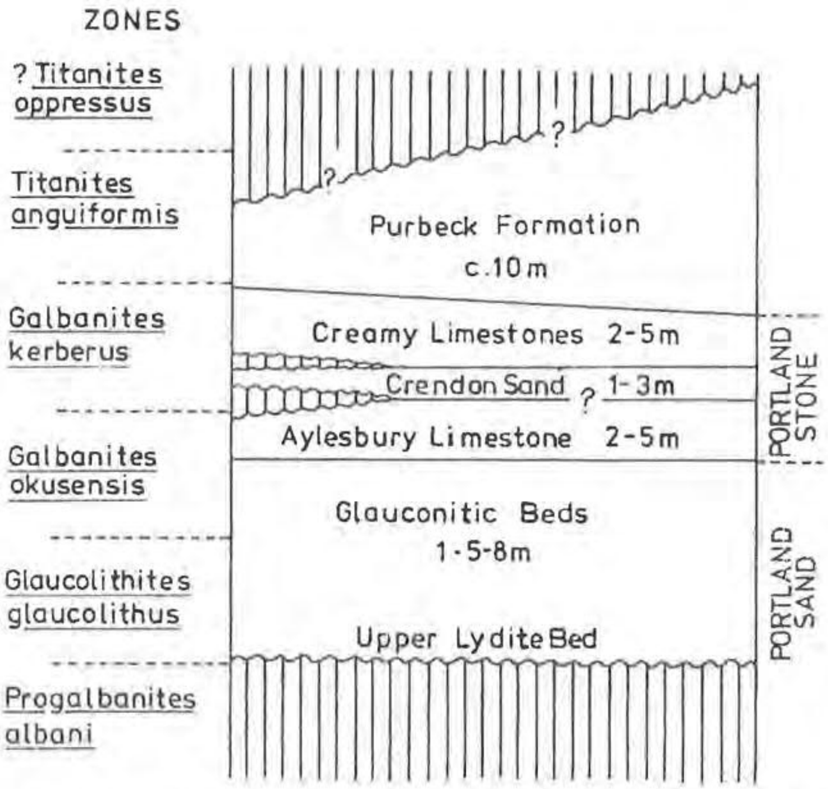

Fig. 1. Portlandian stratigraphy in the Aylesbury area (adapted from Wimbledon 1980 and Radley 1991)

5. Orange to brown-coloured hard ferruginous clay, containing shaley partings and much fossiliferous shelly micrite. – (25cm)

Bivalvia:	*Camptonectes lamellosus* (J. Sowerby)
	Ostrea expansa J. Sowerby
	Pleuromya uniformis (J. Sowerby)
	Protocardia dissimilis

4. Cream to grey-coloured chalky micrite, rich in moulds of bivalves with rarer gastropods and ammonites, The bed grades up into bed 5. – (45cm)

Bivalvia:	*Canptonectes lamellosus*
	Laevitrigonia gibbosa (J. Sowerby)
	Protocardia dissimillis
Gastropoda:	*Natica elegans* J. de C. Sowerby
Ammonitida:	*Titanites* sp.

3. Buff to orange-coloured crumbly clayey limestone with nodules of hard grey biomicrite. Some sand is present in lower parts of the bed, but diminishes towards the top. This bed is highly fossiliferous, and is particularly rich in small *Nanogyra nana* (J. Sowerby). Those larger bivalves which originally possessed aragonitic shells are preserved partly or wholly as moulds; Oysters are preserved in original calcite; infaunal bivalves tend to be articulated. – (45–75cm)

Bivalvia:	*Camptonectes lamellosus*
	Isognomon bouchardi (Oppel)
	Lima rustica (J. Sowerby)
	Lithophaga sp.
	Modiolus sp.
	Myoconcha portlandica Blake
	Nanogyra nana

	Ostrea expansa
	Parallelodon cf. *nobilis* (Contejean)
	Pleuromya uniformis
	Plicatula sp.
	Protocardia dissimilis
Gastropoda:	*Natica elegans*
Ammonitida:	*Glaucolithites* sp.
Annelida:	*Glomerula* sp.
	?Propomatoceros sp.
Bryozoa:	*Hyporosopora portlandica* (Gregory)

Echinodermata: spine of a regular echinoid

2. Gradationally-based hard biomicrite, with an upwards-decreasing sand content, Moulds of bivalves abound throughout. – (35cm)

Bivalvia:	*Pleuromya uniformis*
	Protocardia dissimilis

Glauconitic Beds

1. Fine-grained mustard-coloured sands with a low glauconite content and occasional grains of black chert. The sands are locally cemented and contain numerous subvertical seams of black clay. Shell pavements occur at the top and are dominated by *Isognomon* and *Ostrea*. Badly-preserved bivalve moulds are moderately abundant throughout. – (90cm seen)

Bivalvia:	*Camptonectes lamellosus*
	Isognomon bouchardi
	Myoconcha portlandica
	Ostrea expansa
	Pleuromya uniformis
	Plicatula sp.
Aamonitida:	*?Glaucolithites* sp.
Crustacea:	Indeterminate decapod fragment
Annelida:	*Glomerula* sp.

DISCUSSION

The Portland Sand and Stone of Buckinghamshire (referred to here as the Portland Beds) are dominated by fine-grained sands (sometimes glauconitic) and shelly biomicrites containing a rich fauna dominated by large marine molluscs. Details are provided for instance by Blake (1880), Bristow (1968) and Townson (1971). These sediments were deposited in shallow marine environments close to the western margin of the Anglo-Brabant Landmass (Cope, Ingham & Rawson 1992). Palaeoecology and sedimentology of the Portland Beds of south-west England have been discussed by Townson (1975) and Oschmann (1988), for instance. Detailed palaeoecological and environmental analysis of the Buckinghamshire succession is still confined to the unpublished work of Townson (1971) and Radley (1990).

Bed 1 (Glauconitic Beds) is probably of low-energy shallow offshore origin, as indicated by the abundance of unabraded and articulated marine bivalves. *Pleuromya uniformis* is often found in what is inferred to have been a burrowing position in life with long axis vertical or subvertical. The structureless nature of the sands may be due to pervasive bioturbation. This could have been due to burrowing crustaceans: indeterminate decapod remains were found in the bed.

The *Isognomon-Ostrea* shell pavements in the upper part of the bed probably reflect reduced influx of clastic material, culminating in the dominantly carbonate lithologies of the overlying Aylesbury Limestone (see below). Presumably, firmer stable substrates initially facilitated colonisation by epifaunal byssally-attached *Isognomon* and *Myoconcha* (Palmer 1979). Cementing forms (*Ostrea* and *Plicatula*) subsequently colonised the newly available hard substrates.

Stable substrates persisted throughout deposition of beds 2–6 (Aylesbury limestone). Beds 2,4,5 and 6 contain mixtures of infaunal and epifaunal bivalves, which are often articulated and sometimes in inferred life positions (Palmer 1979 and Oschmann 1988 provided details). At the time of deposition, the texture of these sediments was probably that of firm mud. The abundant epifauna of bed 3 (Palmer 1979 and Oschmann 1988) reflects a temporary reduction in sedimentation, resulting in harder substrates. The sediment was never hard enough to allow colonisation by a cemented epifauna, although profuse *Nanogyra nana* and serpulids occur in this bed, encrusting larger shells, and found loose in interstitial sediment. Like bed 1, beds 2–6 are also relatively massive and probably extensively bioturbated. Articulated *Pleuromya uniformis* is sometimes found in bed 4, with valves at varying angles to the inferred vertical or near-vertical life position (also see Townson 1971). This disturbance is attributed to post-mortem bioturbation. Similarly, the genesis of well-developed nodular limestones in bed 5 may be linked to former burrow systems in the sediment.

The shelly micrites which constitute much of the Aylesbury Limestone at this and other localities must have formed as lime mud. In recent seas, such sediments form in shallow tropical and subtropical environments (Wilson 1975). The breakdown of calcareous algae (such as the green alga *Penicillus*) is thought to be a primary contributor to lime mud in these modern warm-water environments, together with degraded skeletal debris, planktonic biota and a probable chemically-precipitated fraction (Wilson 1975). Because of the algal contribution, such sediments necessarily form at shallow photic depths.

The reduction in clastic input in late Glauconitic Beds times was a widespread event, as indicated by the recognition of this boundary throughout the Buckinghamshire Portlandian outcrops (eg. Wimbledon 1980). The inferred reduction in sedimentation during deposition of bed 4 (Aylesbury Limestone, see above) may similarly represent a relatively widespread but hitherto unrecognised event. Despite variations in thickness (see above), bed 3 retained its faunal and lithological character throughout the excavation (an area of over 600 square meters). This high fossiliferous *Nanogyra*-rich bed may possibly be of use in local correlation.

The following conclusions can be drawn concerning the Aylesbury Limestone environment.

(1) The sea floor comprised firm but unconsolidated stable well-oxygenated substrates, allowing colonisation by varying ratios of infaunal and epifaunal bivalves and other taxa.

(2) Extensive bioturbation by unknown agents probably caused destruction of most primary sedimentary structures, and may also be responsible for disturbance of deep burrowing bivalves, and the partial or occasionally total disarticulation of some shallow burrowers.

(3) The abundant micrite of the Aylesbury Limestone is at least partly the product of algal breakdown. This indicates shallow photic conditions.

(4) Details from unweathered sections may facilitate establishment of internal lithostratigraphic subdivisions within the Aylesbury Limestone.

The Portlandian strata of the Aylesbury area are crucial to our understanding of southern England in Upper Jurassic times. It is therefore essential that staff of the Buckinghamshire County Museum be notified of any temporary exposures.

REFERENCES

Barker, D. 1966, 'Ostracods from the Portland and Purbeck Beds of the Aylesbury District', *Bull. Br. Mus. Apt. Hist.* (Geol.), **11**, 459–487.

Blake, J. F. 1880, 'On the Portland rocks of England', *Q. Jl. geol., Soc. Lond.*, **36**, 189–236.

Bristow, C. R. 1968, 'Portland and Purbeck Beds', in Sylvester-Bradley, P. C. and Ford, T. D. (eds). *The Geology of the East Midlands*, 300–311, Leicester University Press, Leicester.

Cope, J. C. W., Ingham, J. K. & Rawson, P. F. (eds) 1992, *Atlas of Palaeogeography and Lithofacies*. Geological Society, London, Memoir, **13**.

Davies, A. M. 1899, 'Contributions to the geology of the Thame Valley', *Proc. Geol. Ass.*, **16**, 15–58.

Fitton, W. H. 1836, 'Observations on some of the strata between the Chalk and the Oxford Oolite, in the South-east of England'. *Trans. Geol. Soc. Lond*, Ser. 2, **4**, 103–388.

Oschmann, W. 1988, 'Upper Kimmeridgian and Portlandian Marine Macrobenthic Associations from Southern England and Northern France', *Facies*, **18**, 49–82,

Palmer, T. J. 1979, 'The Hampen Marly and White Limestone Formations: Florida-type carbonate lagoons in the Jurassic of central England', *Palaeontology*, **22**, 189–228.

Radley, J. D. 1990, *Palaeontological investigations or some late Jurassic and early Cretaceous gastropods from southern England*. M.Sc. thesis, University of Keele.

Radley, J. D. 1991, 'Palaeoecology and deposition of Portlandian (Upper Jurassic) strata at the Bugle Pit, Hartwell, Buckinghamshire', *Proc. Geol. Ass.*, **102**, 241–249.

Rowland, K. 1989, 'News from Aylesbury', *Geol. Curator*, **5 (4)**, 165.

Townson, W. G. 1971. *Facies analysis of the Portland Beds*. D. Phil. thesis, University of Oxford.

Townson, W. G. 1975, 'Lithostratigraphy and deposition of the type Portlandian', *Q. Jl. Geol. Soc. Lond.*, **131**, 619–638.
Wilson, J. L. 1975, *Carbonate facies in geologic history*, xiii + 471 pp. Springer-Verlag, Berlin, Heidelberg, New York.
Wimbledon, W. A. 1980, 'Portlandian correlation chart', in Cope, J. C. W. (ed.). 'A correlation of Upper Jurassic rocks in the British Isles Part Two: Middle and Upper Jurassic', *Spec. Rep. Geol. Soc. Lond.*, **15**, 85–93.

Fieldwork during 1988 was funded by the Ernest Cook Trust, the Geologists' Association's Curry Fund and GFX Hartigan Ltd. In addition, the author is grateful to Buckinghamshire County Council for use of museum facilities at that time.