Jurassic dinocysts from the Warboys Borehole, Cambridgeshire, England

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ABSTRACT—The stratigraphic distribution of dinocysts in sediments of Toarcian to early Oxfordian age from the Warboys Borehole, Cambridgeshire are described. Several forms have relatively restricted ranges and appear to be of stratigraphic value. Selected forms are illustrated.

INTRODUCTION

The IGS Warboys Borehole, Broughton, Cambridgeshire (TL 2903 7839) was drilled in early 1965 (Fig. 1) as part of an investigation into geophysical anomalies in the western Fens, and proved the following sequence:

| Thickness (metres) | Depth (metres) |
|--------------------|----------------|
| 1.295              | 1.295          |
| 63.272             | 64.567         |
| 5.511              | 70.078         |
| 1.220              | 71.298         |
| 3.886              | 75.184         |
| 1.436              | 76.620         |
| 10.527             | 87.147         |
| 8.967              | 96.114         |
| 74.345             | 170.459        |

Pleistocene:
Drift Deposits 1.295 1.295

Jurassic:
Oxford Clay 63.272 64.567
Kellaways Beds 5.511 70.078
Cornbrash 1.220 71.298
Blisworth Limestone 3.886 75.184
Upper Estuarine ‘Series’ 1.436 76.620
Grantham Formation 10.527 87.147
Upper Lias 8.967 96.114
Middle and Lower Lias 74.345 170.459

Pre Jurassic:
Diorite (age uncertain) 46.711 217.459

An excellent account of the sediments studied is given in Chapters 11 to 14 of Sylvester-Bradley & Ford (1968). The strata accumulated in the ‘Oxfordshire shallows’, (a swell region, close to the western edge of the London landmass), in a shallow water, mainly marine sedimentary régime.

The ammonite zonation used in this account is the work of Callomon (unpublished data, 1966) who proved a complete Callovian zonal sequence; those zones sampled for this study are shown in Fig. 2. The zonal sequence from the Toarcian to the Bathonian is incomplete and may be explained by both non-deposition and erosion.

This study is part of a project aiming at a refined zonation of the British Jurassic using dinocysts. The assemblage slides and figured material is housed in the MPA and MPK collections respectively, of the Institute of Geological Science, Leeds.

PALYNOLOGICAL ANALYSIS

Twenty-six samples were prepared for palynological study (Table 1). The residues were found to be dominated by microspores, plant cuticle and wood débris. This dominance of land plant derived material strongly suggests that the sediments accumulated in a relatively nearshore environment.

Rich, well-preserved dinocyst assemblages were encountered in all but two of the samples. Many of the taxa recognised have relatively long ranges although several with more restricted ranges appear to be stratigraphically useful.

STRATIGRAPHIC DISTRIBUTION OF DINOCYSTS

The distribution of the dinocyst taxa is outlined in Fig. 2.

TOARCIAN/AALENIAN (87.325–79.248 m.) – This interval is characterised by a low dinocyst diversity. *Nannoceratopsis gracilis* Alberti, 1961 is abundant at the Toarcian/Aalenian boundary, but has a total range of Pleinsbachian to Bathonian (Thusu, 1978). *Nannoceratopsis ambonis* Drugg, 1978 is very characteristic of the Aalenian in Britain; it has never been encountered in the Lias.

Two samples taken from the Grantham Formation (at 79.248 m. and 82.296 m.) proved to be barren of marine palynomorphs (dinocysts, acritarchs and tasmanitids). The palynomorphs are entirely terrestrially derived, indicating that the sediment accumulated in a non-marine environment.

BATHONIAN/EARLY CALLOVIAN (76.200–70.104 m.) – A number of taxa make their first appearance in the Upper Estuarine ‘Series’ (76.200 m.). Several of these taxa have been recorded from the late Bajocian, which is not represented in this section. These include, *Valensiella ovula* (Deflandre, 1947) Eisenack,
1963, *Tubotuberella eisenackii* (Deflandre, 1938) Stover & Evitt, 1978 and *Cianidodinium sellwoodii* (Sarjeant, 1975) Stover & Evitt, 1978.

Several taxa appear in the Cornbrash (70.104 m); many of these have been reported from the Bathonian (Thusu, 1978; Sarjeant, 1978). These include *Adnatosphaeridium aemulum* (Deflandre, 1938) Williams & Downie, 1969, *Adnatosphaeridium caulleryi* (Deflandre, 1938) Williams & Downie, 1969, *Hystrichogonyaulax pectinigera* (Gocht, 1970) Stover & Evitt, 1978, *Kalyptea stegasta* (Sarjeant, 1961) Wiggins, 1975, *Mendicodinium groenlandicum* (Pocock & Sarjeant, 1972) Davey, 1979b, *Nannoceratopsis pellucida* Deflandre, 1938 and *Sentusidinium rioultii* (Sarjeant, 1968) Sarjeant & Stover, 1978.

### Explanation of Plate 1

All specimens are x 700. “England Finder” co-ordinates follow the slide number for each specimen.

Fig. 1. *Scriniodinium crystallinum* (Deflandre, 1938) Klement, 1960: MPK 3557, MPA 12053/2, C54.

Fig. 2. *Endoscrinium* sp. Muir & Sarjeant, 1978: MPK 3558, MPA 12059/2, P32/2.

Fig. 3. *Chrytroesphaeridia cerastes* Davey, 1979a: MPK 3559, MPA 12063/2, Q57.

Fig. 4. *Belodinium asaphum* Drugg, 1978: MPK 3560, MPA 12054/2, J57/3.

Fig. 5. *Mendicodinium groenlandicum* (Pocock & Sarjeant, 1972) Davey, 1979b: MPK 3561, MPA 12064/2, J59.

Fig. 6. *Hapsidaulax margarethae* Sarjeant, 1975: MPK 3562, MPA 12071/1, T59/4.

Fig. 7. *Reutlingia gochtii* Drugg, 1978: MPK 3563, MPA 12059/2, H39/3.

Fig. 8. *Stephanelytron scarburghense* Sarjeant, 1961 emend. Stover *et al.*, 1977: MPK 3564, MPA 12056/2, Q28/2.

Fig. 9. *Stephanelytron redcliffense* Sarjeant, 1961 emend. Stover *et al.*, 1977: MPK 3565, MPA 12059/1, B31/1.

Fig. 10. *Dinopterygium absidatum* Drugg, 1978: MPK 3566, MPA 12056/2, K37/3.

Fig. 11. *Adnatosphaeridium aemulum* (Deflandre, 1938) Williams & Downie, 1969: MPK 3567, MPA 12058/2, S29/3.
Warboys Jurassic dinocysts
**Fig. 2 Dinocyst range chart.**

*A complete Callovian zonal sequence was proved, however, only those zones sampled are shown.

_Hapsidaulax margarethae_ Sarjeant, 1975 was found in the Upper Estuarine 'Series'. This is the first record of this form, other than the type material from the Bathonian of the Isle of Skye.

**MIDDLE/LATE CALLOVIAN** (62.484–24.384 m.) – This interval is characterised by a great diversity of dinocysts and the appearance of significant taxa. _Ctenidodinium continuum_ Gocht, 1970 is not found above the late Callovian, which accords with the findings of Woollam (1980), but not with Thusu (1978), who records this form from the Oxfordian as well as the Callovian. _Energlynia acollaris_ (Dodekova, 1974) Sarjeant, 1978 appears to die out in the _athleta_ Zone, _proniae_ Subzone. This agrees with the work of both Thusu (1978) and Woollam (1980).

The presence of _Reutlingia gochtii_ Drugg, 1978 in the _athleta_ Zone, _spinossum_ Subzone, (33.528–35.052 m.) constitutes its first published record other than the type material (it was originally described from the _athleta_ zone in Germany and appears to be an excellent marker).

**CALLOVIAN/OXFORDIAN BOUNDARY** (23.799 m.) – _Atopodinium prostatum_ Drugg, 1978 and _Dinopterygium absidatum_ Drugg, 1978 span this boundary and have relatively short ranges, hence they are useful stratigraphically. _Belodinium asaphum_ Drugg, 1978 and _Polystephanhorus paracalathus_ (Sarjeant, 1960) Downie & Sarjeant, 1965 appear to be restricted to the Callovian/Oxfordian boundary according to Fig. 2, although these forms are known to have longer ranges (unpublished data).

The aforementioned taxa, together with _Stephanelytron_ spp., _Endoscrinium_ sp. of Muir & Sarjeant, 1978 and _Wanaea digitata_ Cookson & Eisenack, 1958 are highly characteristic of this interval. Their distribution in the Warboys section is generally consistent with Raynaud (1978), Thusu (1978) and Woollam (1980).
Table 1. Details of Samples

| Slide Number | Depth (metres) | Lithostratigraphic Unit          |
|--------------|---------------|---------------------------------|
| MPA 12050    | 5.181 – 6.096 | Upper Oxford Clay               |
| 12051        | 9.144 – 10.668|                                |
| 12052        | 12.192 – 13.716|                               |
| 12053        | 15.240 – 16.764|                              |
| 12054        | 18.288 – 18.313|                              |
| 12055        | 21.336 – 22.860|                              |
| 12056        | 24.384 – 24.409| Middle Oxford Clay             |
| 12057        | 27.432 – 28.956|                              |
| 12058        | 30.480 – 30.505|                              |
| 12059        | 33.528 – 35.052|                              |
| 12060        | 36.576 – 38.100|                              |
| 12061        | 39.624 – 41.148|                              |
| 12062        | 42.672 – 44.196|                              |
| 12063        | 45.720 – 47.244|                              |
| 12064        | 48.768 – 50.292| Middle Oxford Clay – to 49.225 m|
|              |               | Lower Oxford Clay – to 50.292 m|
| 12065        | 51.816 – 53.340| Lower Oxford Clay             |
| 12066        | 54.864 – 56.388|                              |
| 12067        | 57.912 – 59.436|                              |
| 12068        | 60.960 – 62.484|                              |
| 12069        | 70.104         | Cornbrash                      |
| 12070        | 73.152         | Blisworth Limestone            |
| 12071        | 76.200         | Upper Estuarine 'Series'       |
| 12072        | 79.248         | Grantham Formation             |
| 12073        | 82.296         | "                              |
| 12074        | 85.344         | "                              |
| 12075        | 87.325         | Upper Lias                     |

EARLY OXFORDIAN (22.860–5.181 m.) – Two taxa are confined to the early Oxfordian; Acanthaulax senta Drugg, 1978 and Wanaea fimbriata Sarjeant, 1961. A. senta is known to occur in the lamberti Zone, uppermost Callovian in Britain (unpublished data), whereas W. fimbriata is confined to the early Oxfordian mariae and cordatum zones in N.W. Europe, (Sarjeant, 1961; Raynaud, 1978; Thusu, 1978; Woollam, 1980).

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