

Observations on the Jurassic dinoflagellate cyst *Nannoceratopsis ambonis* Drugg, 1978

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ABSTRACT—The Lower to Middle Jurassic dinoflagellate cyst *Nannoceratopsis ambonis* Drugg, 1978 is here divided into two species, *Nannoceratopsis ambonis* Drugg, 1978 emend. nov. and *N. dictyambonis* sp. nov. on the basis of differing saggital band morphologies. The two species do not appear to intergrade morphologically and have differing stratigraphical ranges, *N. ambonis* emend. nov. being found from the Upper Pliensbachian (*spinatum* Zone) to the Upper Bajocian and *N. dictyambonis* sp. nov. being restricted to the uppermost Toarcian (*moorei* Subzone: *levesquei* Zone) – Lower Bajocian (*laeviuscula* Zone) interval.

INTRODUCTION

Drugg (1978) described three species of the Jurassic dinoflagellate cyst genus *Nannoceratopsis* Deflandre from material collected in Europe – *N. ambonis*, *N. plegas* and *N. tricerias*. *N. plegas* is similar in overall morphology to *N. gracilis* Alberti, 1961 but has a more elongate dorsal antapical horn which imparts a deep, sickle-shaped concavity to the antapex. It is a rare species which seems to be confined to the Aalenian of Europe (Drugg *op. cit.*, p. 71) and possibly is a variety of *N. gracilis*.

N. tricerias is a distinctive taxon because it is the only species of *Nannoceratopsis* known to possess three antapical horns. It is never found in large numbers, yet is persistent from the Lower Toarcian (*tenuicostatum* Zone) to the Lower Bajocian (*laeviuscula* Zone) in England (Riding, 1983; Woollam & Riding, 1983).

N. ambonis was erected by Drugg (*op. cit.*) to encompass forms similar in outline and overall morphology to *N. gracilis*, but differing in having smooth to very finely granulate autophragm and prominently thickened saggital bands, although the original description included forms with both solid and reticulate saggital areas (Drugg *op. cit.*, p. 70, pl. 6, figs. 3–7).

During investigations into the stratigraphical distributions of dinoflagellate cysts from the Jurassic of Britain, the author has observed many specimens of *N. ambonis* and it has become clear that the species, as described by Drugg, includes two distinct forms; those with thickened solid saggital bands, and forms with distinctly reticulate thickened saggital areas. In the populations of *N. ambonis* (*sensu lato*) studied, these two forms do not appear to intergrade morphologically with each other and, in Europe, have differing stratigraphical ranges. The morphotypes with solid unbroken saggital bands are found in strata of Upper Pliensbachian (*spinatum* Zone)

to Upper Bajocian age, whereas those with reticulate saggital bands have a more restricted range, occurring from the Upper Toarcian (*moorei* Subzone; *levesquei* Zone) to the Lower Bajocian (*laeviuscula* Zone). The latter morphotype is an especially good marker for the uppermost Toarcian, the Aalenian and the Lower Bajocian in England. When it is found near the Lower/Middle Jurassic boundary with other dinoflagellate cyst taxa of restricted occurrence such as *Scriniocassis weberi* Gocht, 1964 (which becomes extinct at the top of the Aalenian Stage) or species of *Parvocysta* Bjaerke, 1980 (which appear to die out at the top of the Aalenian *opalinum* Zone), reasonably fine biostratigraphical resolution may be achieved.

These two distinct forms of *N. ambonis* Drugg, 1978 are here given specific status in view of their consistently clear morphological differences, with apparent lack of intermediate forms, and their differing stratigraphical ranges.

SYSTEMATIC DESCRIPTIONS

Division Pyrrhophyta Pascher, 1914

Class Dinophyceae Fritsch, 1929

Order Nannoceratopsiales Piel & Evitt, 1980

Genus *Nannoceratopsis* Deflandre, 1938 emend.

Piel & Evitt, 1980

Type species. *N. pellucida* Deflandre, 1938, p. 183, pl. 8, figs. 8–12 emend. Evitt, 1961, p. 312.

Other species: see Lentin & Williams, 1981, p. 194.

Nannoceratopsis ambonis Drugg, 1978 emend. nov.
(Pl. 1, figs. 7–9, Fig. 1A)

1971 *Nannoceratopsis gracilis* Alberti, 1961 emend.
Evitt, 1962. Beju pl. 4, fig. 14.

1973 *Nannoceratopsis gracilis* Alberti, 1961. Johnson & Hills, pl. 3, figs. 13, 15, 17 and 18.

1978 *Nannoceratopsis ambonis* Drugg, 1978. Drugg, pl. 6, figs. 3, 5, 7.

Emended diagnosis. Species of *Nannoceratopsis* which is subtriangular in outline. Two antapical horns are present separated by a concave antapical margin; usually the dorsal horn is longest, the ventral horn normally being markedly reduced. The autophragm is smooth to finely granulate. At the saggital band the autophragm is prominently thickened, producing a distinctive continuous solid rim around the hypocyst when seen in lateral view. When observed in lateral view the width of a single saggital band comprises 4–9% of the maximum cyst breadth. Archaeopyle cingular (Piel & Evitt, 1980).

Holotype. Drugg (1978), pl. 6, fig. 3.

Locality and horizon. Eschach, Swabia, Germany; *concauum* Zone, Aalenian.

| Dimensions. | Minimum | Mean | Maximum |
|--------------------|-------------------|-------------------|-------------------|
| | (μm) | (μm) | (μm) |
| Length | 60 | 66 | 82 |
| Width | 36 | 41 | 51 |

(20 specimens measured).

Remarks. *N. ambonis* emend. nov. is similar in shape and overall morphology to *N. gracilis* Alberti, 1961, but differs by having a prominently thickened solid saggital band. The above emendation restricts *N. ambonis* to forms with solid, unbroken, thickened saggital bands, thereby excluding morphotypes with reticulate thickened saggital areas (see below).

Stratigraphical range. Upper Pliensbachian (*spinatum* Zone) to late Bajocian.

Explanation of Plate 1

All figures are $\times 630$.

Figs. 1–6. *Nannoceratopsis dictyambonis* sp. nov.

Fig. 1. Holotype, MPK 3832, left lat. view; note the relatively thin, unornamented autophragm of the lateral portion of the hypocyst compared with the thickened, reticulate saggital band. Lincolnshire Limestone, Bajocian (*discites/laeviuscula* Zones), Cockle Pits Borehole, Humberside (NGR SE 9323 2865), depth 7.5 m.

Fig. 2. Specimen MPK 4069. Left lat. view showing prominently thickened reticulate saggital band. Stratigraphical details and location as fig. 1, depth 9.39 m.

Fig. 3. Specimen MPK 4070. Right lat. view. Snowhill Clay, Aalenian, Unit 8 of Parsons, 1976 (?*concauum* Zone). Jackdaw Quarry, Gloucestershire (Grid Ref.: SP 078 310).

Fig. 4. Specimen MPK 4071. Right lat. view of a specimen in which the reticulate ornament on the saggital band is best developed in the antapical region. Stratigraphical details, location and depth as fig. 2.

Fig. 5. Specimen MPK 4072. Slightly oblique right lat. view; note the two rows of lacunae (cf. Fig. 1C). Stratigraphical details, location and depth as fig. 2.

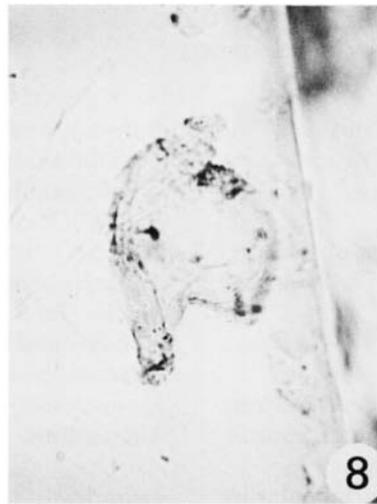
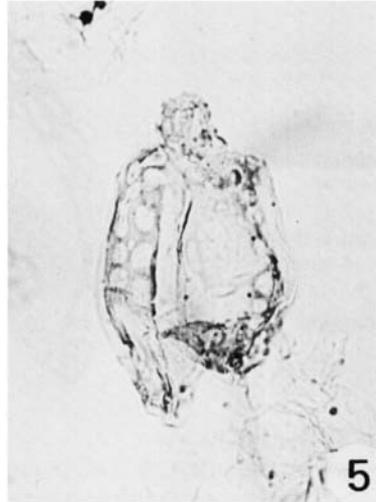
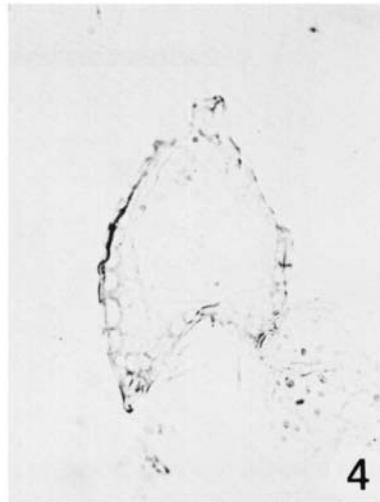
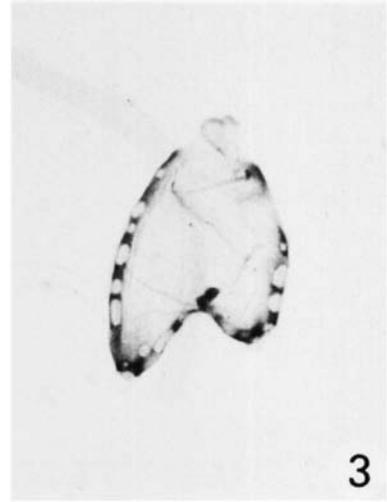
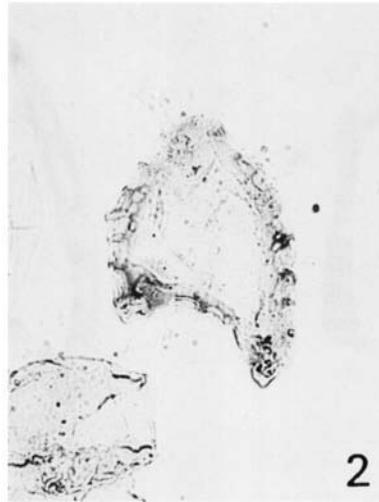
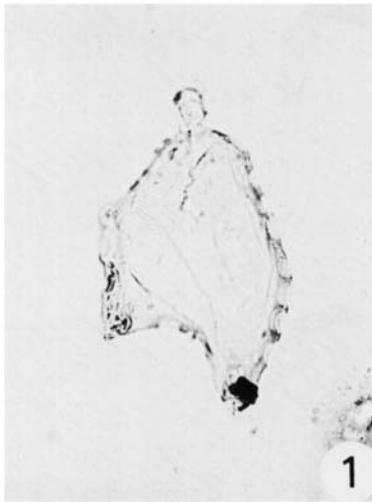
Fig. 6. Specimen MPK 4073. Oblique right lat. view; note the relatively narrow thickened saggital band with a single row of lacunae (cf. Fig. 1B). Stratigraphical details, location and depth as fig. 1.

Figs. 7–9. *Nannoceratopsis ambonis* Drugg, 1978 emend. nov.

Fig. 7. Specimen MPK 4074. Right lat. view; note the prominent solid, thickened saggital band. Snowhill Clay, Aalenian, Unit 11 of Parsons, 1976 (?*concauum* Zone). Location as fig. 3.

Fig. 8. Specimen MPK 4075. Right lat. view; note the poorly developed ventral antapical horn. Northampton Sand Formation, Aalenian. Nettleton Bottom Borehole, Lincolnshire (NGR TF 1252 9820), depth 388.68 m.

Fig. 9. Specimen MPK 4076. Right lat. view; note the paracingulum separating the very small epicyst from the hypocyst. Stratigraphical details, location and depth as fig. 2.



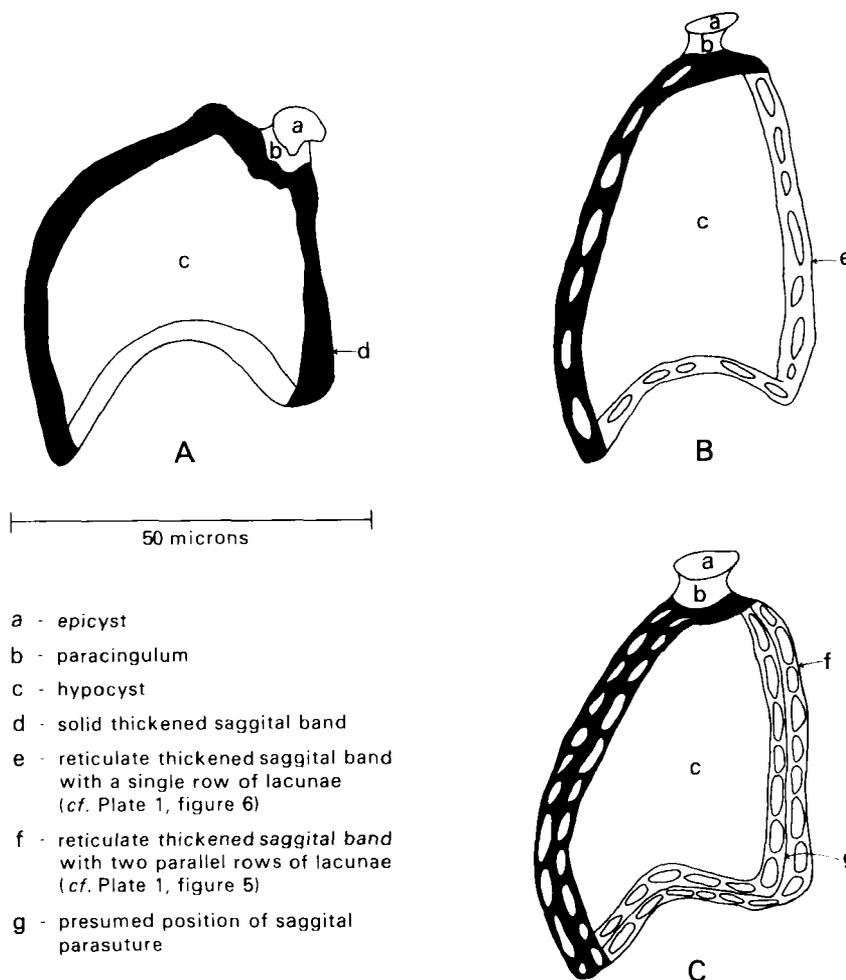


Fig. 1. A. Line drawing of *N. ambonis* Drugg, 1978 emend. nov.

B, C. Line drawings of *N. dictyambonis* sp. nov. B depicts a typical specimen with a single row of lacunae on the saggital band. C is a drawing of the rare variety of this species with two parallel rows of lacunae in the saggital area, presumably separated by the saggital parasuture.

The unshaded saggital areas are viewed by transparency.

Nannoceratopsis dictyambonis sp. nov.

(Pl. 1, figs. 1-6, Figs. 1B & C)

1978 *Nannoceratopsis ambonis* Drugg. Drugg, p. 70, 71, pl. 6, figs. 4, 6.

1978 *Nannoceratopsis* sp. 1. Fenton & Fisher, pl. 1. fig. 3.

1983 *Nannoceratopsis ambonis* Drugg, 1978. Woollam & Riding, 1983, pl. 2, fig. 3.

1983 *Nannoceratopsis ambonis* Drugg, 1978. Riding, 1983, pl. 2, figs. 4 and 5.

Derivation of name. The specific epithet is derived from the Greek, *diktyotus* meaning reticulate and *ambon* meaning ridge or rim.

Diagnosis. Species of *Nannoceratopsis*, subtriangular in outline, possessing two antapical horns which are separated by a concave antapical margin. The dorsal

horn is normally the longest. The autophragm is smooth with the exception of the saggital area. The saggital band is prominently thickened and is reticulate, usually possessing a single row (rarely two) of lacunae of variable length. Archaeopyle circular (Piel & Evitt, 1980).

Holotype. Specimen MPK 3832 (Slide No. MPA 13792/1, "England Finder" co-ordinate 024/4); Pl. 1, fig. 1.

Locality and horizon. Lincolnshire Limestone, Bajocian (*discites/laeviuscula* Zones), Cockle Pits Borehole, Humberside (NGR SE 9323 2865), depth 7.5 m.

| Dimensions. | Minimum (μm) | Mean (μm) | Maximum (μm) |
|-------------|------------------------------|---------------------------|------------------------------|
| Length | 58 | 68 | 76 |
| Width | 34 | 40 | 46 |

(24 specimens measured).

Remarks. Members of the *N. gracilis* Alberti, 1961/*N. senex* van Helden, 1977 complex often have a reticulate autophragm, but this reticulation is present over the entire cyst surface, not confined to the saggital area as in *N. dictyambonis* sp. nov. The lacunae present on the autophragm of *N. gracilis/senex* are also much smaller in diameter than those in the thickened saggital area of *N. dictyambonis* sp. nov. This species differs from *N. ambonis* emend. nov. by having a reticulate saggital band. The overwhelming majority of specimens referable to *N. dictyambonis* sp. nov. have a single row of lacunae on the saggital band, specimens with two parallel rows (e.g. Pl. 1, fig. 5) represent an extremely rare variety of this species. The saggital parasuture is presumed to be coincident with the thin tract between the two rows of lacunae in these forms (see Fig. 1C). Conversely the position of the saggital parasuture in forms of *N. dictyambonis* sp. nov. with a single row of lacunae is not clear. **Stratigraphical range.** Upper Toarcian (*moorei* Subzone; *levesquei* Zone) to Lower Bajocian (*laeviuscula* Zone).

DISCUSSION

Piel & Evitt, 1980, in a superbly illustrated account, figure SEM photomicrographs of *N. gracilis* and *N. senex* which clearly show, for the first time, the complete paratabulation pattern of this genus. They also illustrate transversely striate saggital bands with a centrally positioned saggital parasuture. Piel & Evitt (*op. cit.*) interpreted the transverse striations on the saggital band as cyst-equivalents of megacytic zones (areas of thecal growth) in living dinoflagellates. The functional significance of the thickened saggital bands (= megacytic zones) of *Nannoceratopsis ambonis* emend. nov. and *N. dictyambonis* sp. nov. is not clear; possibly they imparted added mechanical strength to the theca, and thus to the cyst.

Nannoceratopsis ambonis emend. nov. and *N. dictyambonis* sp. nov. are distinguished by differing saggital band morphologies. The two species do not appear to intergrade morphologically and have different stratigraphical ranges in Europe.

The distinctive morphology and restricted stratigraphical range of *N. dictyambonis* sp. nov. makes it an excellent marker within the uppermost Toarcian to Lower Bajocian interval in Europe.

ACKNOWLEDGEMENTS

The author wishes to thank Dr. R. Harland (B. G. S. Keyworth) for his comments on the original draft. This contribution is published with the permission of the Director, British Geological Survey (N.E.R.C.)

REFERENCES

- Beju, D. 1971. Jurassic microplankton from the Carpathian Foreland of Roumania. *Annales Institutii Geologici Publici Hungarici*, **54**(2), 275–317.
- Drugg, W. S. 1978. Some Jurassic dinoflagellate cysts from England, France and Germany. *Palaeontographica* Abt. B, **168**, 61–79.
- Fenton, J. P. G. & Fisher, M. J. 1978. Regional distribution of marine microplankton in the Bajocian and Bathonian of northwest Europe. *Palinologia*, Número extraordinario 1, 233–243.
- Johnson, C. D. & Hills, L. V. 1973. Microplankton zones of the Savik Formation (Jurassic), Axel Heiberg and Ellesmere Islands, District of Franklin. *Bull. Can. Petrol. Geol.*, Calgary, **21**(2), 178–218.
- Lentin, J. K. & Williams, G. L. 1981. Fossil dinoflagellates; index to genera and species, 1981 edition. *Bedford Institute of Oceanography*, Report Series, BI-R-81–12, 345 pp.
- Parsons, C. F. 1976. Ammonite evidence for dating some Inferior Oolite sections in the north Cotswolds. *Proc. Geol. Ass.*, London, **87**(1), 45–63.
- Piel, K. M. & Evitt, W. R. 1980. Paratabulation in the Jurassic dinoflagellate genus *Nannoceratopsis* and a comparison with modern taxa. *Palynology*, Dallas, **4**, 79–104.
- Riding, J. B. 1983. The palynology of the Aalenian (Middle Jurassic) sediments of Jacdaw Quarry, Gloucestershire, England. *The Mercian Geologist*, **9**(2), 111–120.
- Woollam, R. & Riding, J. B. 1983. Dinoflagellate cyst zonation of the English Jurassic. *Rep. Inst. Geol. Sci.*, No. 83/2, 42 pp.