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Two new Early Cretaceous dinocyst species from the Central North Sea Basin

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ABSTRACT – Two new species of dinocyst, *Cerbia monilis* and *Hapsocysta susanae* are described from the Lower Cretaceous of the Central North Sea Basin. The first ranges across the Aptian/Albian boundary and the latter is restricted to the Early to Middle Albian interval; both are valuable index taxa in this area. *Hapsocysta susanae* is remarkably similar to cysts 'without walls' described from the Late Oligocene and Early Miocene, and detailed comparisons are made. The ranges of the two species described here are illustrated against regional lithostratigraphic and biostratigraphic schemes. *J. Micropalaeontol.* **21**(1): 75–80, May 2002.

INTRODUCTION

The Lower Cretaceous sections of the United Kingdom Sector of the Central North Sea Basin are generally shaley, but with coeval turbidites that can be allocated to specific depositional sequences (Jeremiah, 2000); palynofloras are typically very rich and very diverse throughout. A recent, detailed palynological analysis of sections in many Central North Sea wells has allowed the development of a detailed and robust palynofloral subdivision of the entire Lower Cretaceous (Duxbury, 2001).

Analysis of Late Aptian and Albian sections in the Moray Firth area, quadrants 13, 14 and 20 (Fig. 1), has allowed the recognition of two further age-significant dinocyst species, in addition to those described in Duxbury (2001). These are *Cerbia monilis* Duxbury, n. sp. and *Hapsocysta susanae* Duxbury n. sp., and the present work is concerned with the morphological description and discussion of these taxa.

The upper part of the scheme defined in Duxbury (2001) is included in Figure 2, together with some lithostratigraphic and current new species data. Lithostratigraphy is essentially that defined by Johnson & Lott (1993), although the ages of some of the units have been modified (Fig. 2), based on these observations.

These modifications include the restriction of the Captain Sandstone Member to the latest Aptian and earliest Albian, younger than the LK30 (*nutfieldensis*) marine flooding event (Jeremiah, 2000; Duxbury, 2001) and the placing of the Rødby/Carrack formational boundary at a mid-Early Albian level. Johnson & Lott (1993) placed the base of the Captain Sandstone Member towards the base of the Early Aptian, and they had the Rødby/Carrack formational boundary at the top of the Early Albian.

Both new species are valuable stratigraphic indices, since they have very restricted ranges, and each can be common. The availability of core and sidewall core material in the study area has been valuable, particularly in resolving the range bases of these taxa.

Cerbia monilis is restricted to the Aptian/Albian boundary interval, zones LKP31 and LKP32 of Duxbury (2001), *jacobi* to *tardefurcata* ammonite zones. In the Moray Firth, its inception is within the Wick Sandstone Formation, Captain Sandstone Member and Upper Britannia Sandstone Formation, and its extinction is within the Carrack Formation (Johnson & Lott, 1993).

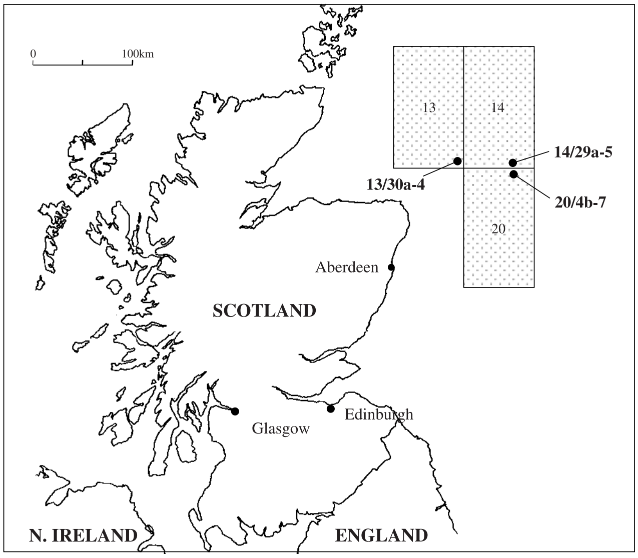


Fig. 1. Location map – main study area and relative positions of wells cited.

Hapsocysta susanae is restricted to the Early to Middle Albian, palyzones LKP33.1 to LKP34 of Duxbury (2001), *tardefurcata* to *loricatus* ammonite zones. Its inception is within the upper Carrack Formation, and its extinction is within the lower Rødby Formation (Johnson & Lott, 1993).

SYSTEMATIC DESCRIPTIONS

The following section includes brief descriptions of two new species, *Cerbia monilis* n. sp. and *Hapsocysta susanae* n. sp.; these taxa are treated alphabetically.

Figured specimens of these taxa, including holotypes and paratypes, are held at the Natural History Museum, Cromwell Road, London SW7 5BD. Natural History Museum reference numbers (F.D. numbers) are included for figured specimens in plate and figure captions.

England Finder (E.F.) references are included for holotypes and paratypes in Type Locality data, and for all figured specimens in plate and figure captions. Scale bars represent 10 μm in all photographic illustrations.

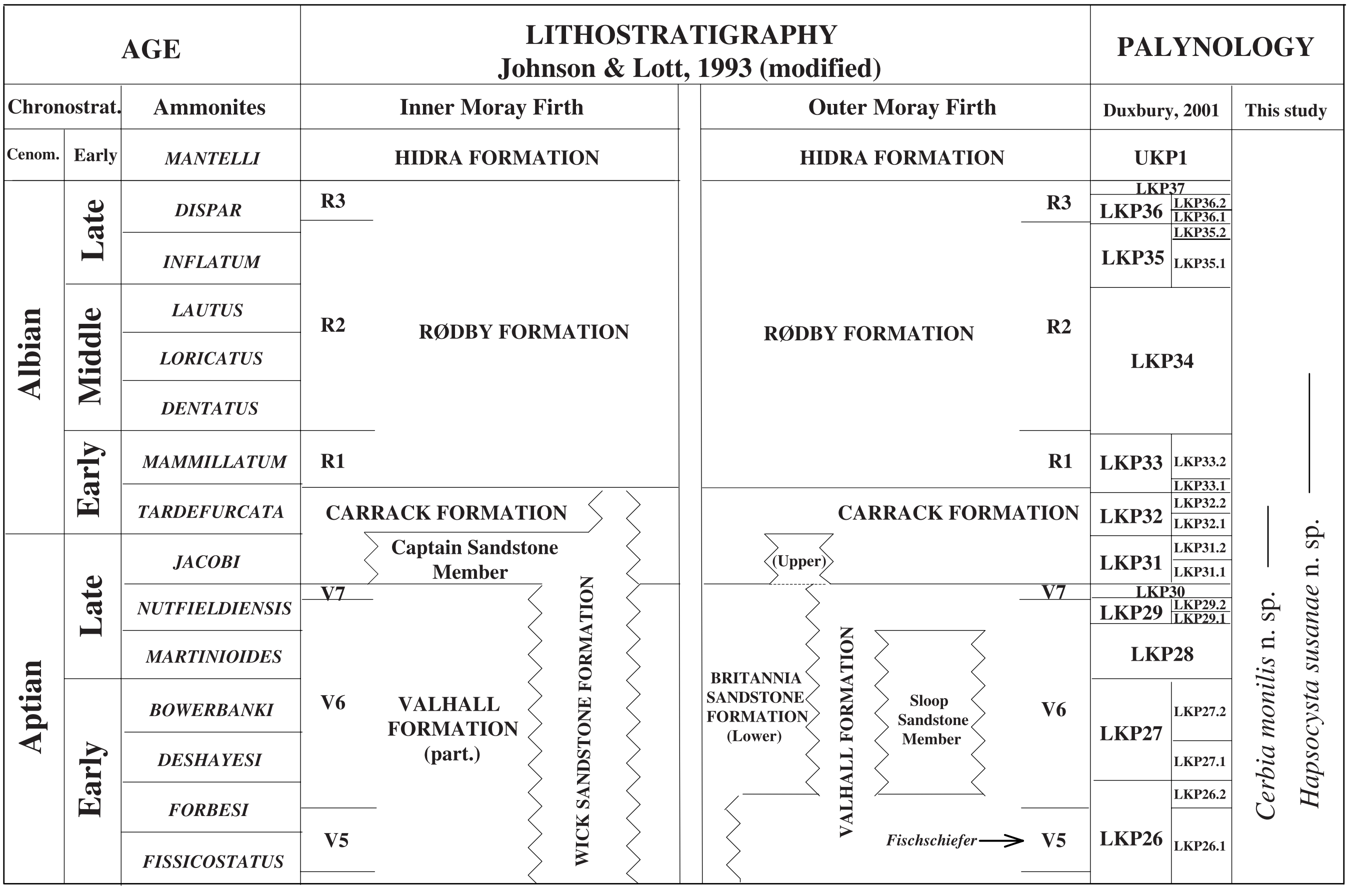


Fig. 2. The stratigraphic ranges of *Cerbia monilis* n. sp. and *Hapsocysta susanae* n. sp.

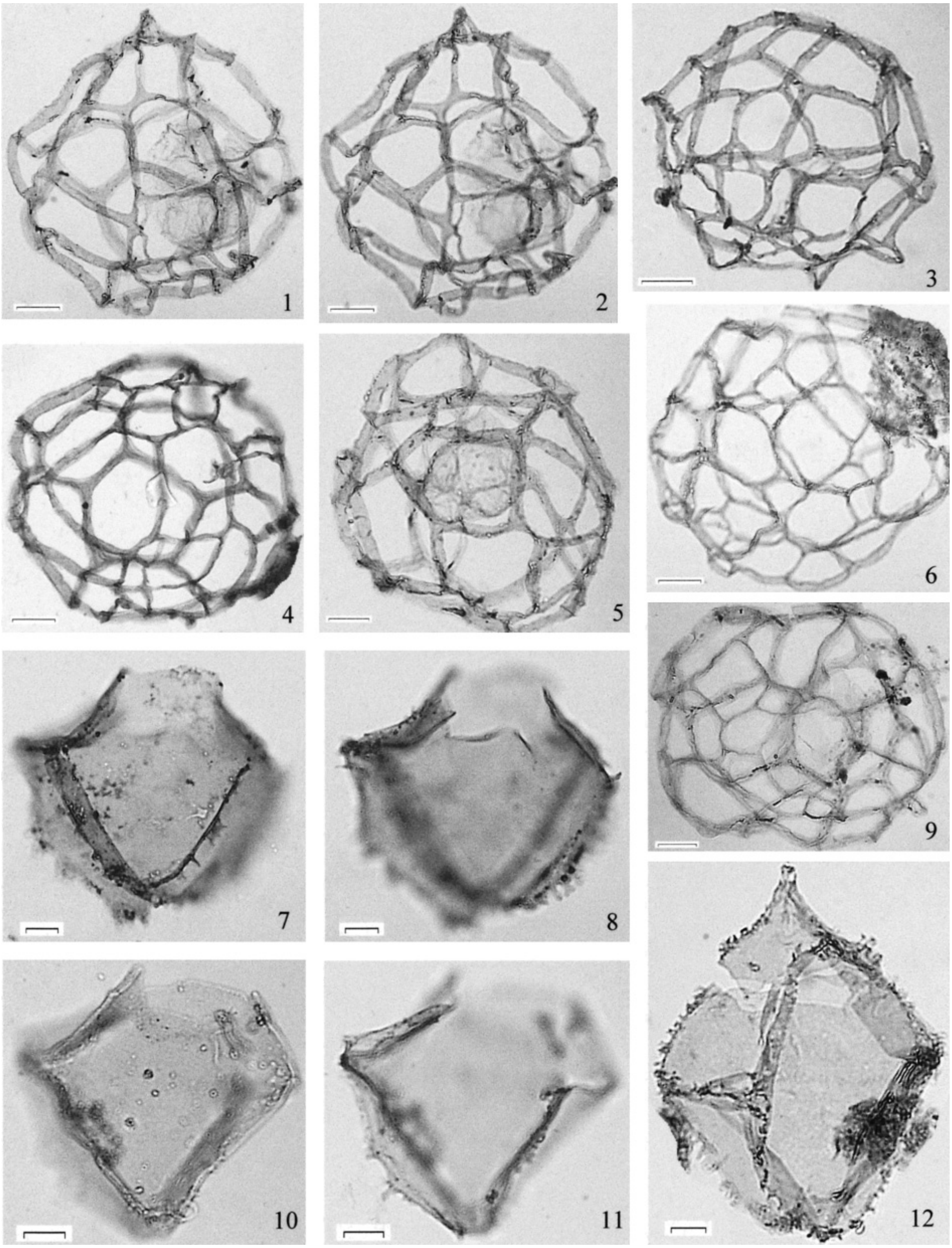
Division **Dinoflagellata** (Bütschli, 1885) Fensome *et al.*, 1993
Subdivision **Dinokaryota** Fensome *et al.*, 1993
Class **Dinophyceae** Pascher, 1914
Subclass **Peridiniphycidae** Fensome *et al.*, 1993
Order **Gonyaulacales** Taylor, 1980
Genus *Cerbia* Below, 1981

Remarks. Sarjeant (1985) considered the genus *Cerbia* Below, 1981 to be a 'junior subjective synonym' of *Tenua* Eisenack, 1958, and that the former genus should be abandoned. He emended *Tenua* to include the paratabulation formula 4′, 0a, 6′′, X-6c, 5-?6′′′, 1p, 1′′′′, Xs, which is very similar to that already defined for *Cerbia* by Below (1981) as 4′, 6′′, Xc, 6′′′, pc, 1′′′′, Xs, although he did not state whether such a formula was also directly observed in Eisenack's material. In addition, Sarjeant (1985) included *Tenua hystricella* Eisenack, 1958 as a junior synonym of *Tenua hystrix*, the type species of the genus.

In his emended diagnosis of *Tenua* Eisenack, 1958, Sarjeant (1985, p. 93), stated, 'Peniplates outlined by continuous or discontinuous lines of tubercles or short, solid processes; intratabular processes lacking'. However, his photographs of Eisenack's (1958) holotypes of *Tenua hystrix* and *Tenua hystricella* (Sarjeant, 1985, pl. X, figs 5 and 6 respectively) show dense 'intratabular processes', contrary to Sarjeant's emendation, with apparently only minor evidence of 'lines of tubercles'. The latter appear to be entirely missing from the holotype of *T. hystricella*. Also, Alberti's (1961) illustrations of *Circulodinium* Alberti, 1961 from the Hauterivian and Barremian of

Explanation of Plate 1

Scale bars in all photographs represent 10 µm. **Figs 1–6, 9**. *Hapsocysta susanae* n. sp.: **1**, **2**, holotype (**1**) focused on the upper, ventral surface and (**2**) focused on the dorsal surface. The endocyst and apical projection are clearly illustrated in this specimen. Well 14/29a-5 at 8399.0 ft (sidewall core) (E.F. K43.0, F.D. 631), Middle Albian; **3**, a specimen in oblique polar orientation, well 14/29a-5 at 8399.0 ft (sidewall core) (E.F. U31.0., F.D. 633), Middle Albian; **4**, paratype, in oblique lateral orientation. The apical projection is observed towards the top of the photograph, well 14/29a-5 at 8420.0 ft (sidewall core) (E.F. S42.4., F.D. 632), Middle Albian; **5**, a specimen in oblique polar orientation with the endocyst in place, well 14/29a-5 at 8399.0 ft (sidewall core) (E.F. P41.2., F.D. 634), Middle Albian; **6**, **9**, specimens with unusually delicate parasutures, possibly a function of sample processing, well 20/4b-7 at 8600 ft (ditch cuttings), Middle Albian (E.F. H34.1 and K26.0 respectively, F.D. 635 and F.D. 636 respectively). **Figs 7, 8, 10–12**. *Cerbia monilis* n. sp.: **7**, **8**, holotype (**7**) focused on the upper, dorsal surface and (**8**) focused on the ventral surface. The angularity of the cyst and characteristic parasutural ornament are clearly illustrated. Well 13/30a-4 at 6387.00 ft (conventional core) (E.F. W37.0, F.D. 637), Early Albian; **10**, **11**, a specimen showing the typical triangular hypocystal outline, caused by folding along the parasutures, well 13/30a-4 at 6364.33 ft (conventional core) (E.F. Q27.2, F.D. 638), Early Albian; **12**, paratype, a complete specimen, with the operculum detached. The characteristic folds and parasutural ornament are well-demonstrated. Well 20/4b-7 at 8660.20 ft (conventional core) (E.F. N40.0, F.D. 639), Late Aptian.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Germany (Alberti, 1961, pl. 4, figs 7–13 and 20) are remarkably similar to Sarjeant's illustrations of the holotypes of *T. hystrix* and *T. hystricella* (also German material). The genus *Circulodinium* may, therefore, be a junior synonym of *Tenua*, although it was not mentioned at all in Sarjeant (1985).

It therefore appears that the genus *Tenua* Eisenack, 1958 is essentially as defined by that author, as 'Thin-walled, oval shells without fields or tabulation, which are comparatively thickly set with short, solid, rod-like spines' (translation by Norris & Sarjeant, 1965), although this was felt actively misleading by Sarjeant (1985). It may be added that there is only rarely some penitabular alignment of spines, and that the mid-dorsal and mid-ventral areas are essentially devoid of ornament. Otherwise, *Tenua* is dissimilar to the clearly paratabulate genus *Cerbia*.

The genus *Cerbia* Below, 1981 has therefore been retained here, as in Duxbury (2001).

Cerbia monilis n. sp.
(Pl. 1, figs 7, 8, 10–12)

Derivation. From the Latin *monile*, necklace – in reference to the parasutural ornament of this species.

Diagnosis. A thin-walled, proximate dinoflagellate cyst with an angular outline. A pronounced, rounded apical horn and low lateral and antapical projections are present. Short spines are aligned very largely along epicystal and hypocystal parasutures, although occasionally these also may occur along paracingular margins. These spines are variable in their morphology, often distally bifurcate and sometimes laterally joined at their distal extremes. Spines at the apex anastomose into a fibrous network. Paratabulation appears to be typical for the genus. The archaeopyle is apical, with a zig-zag margin; the operculum is almost always detached.

Holotype. Plate 1, figs 7, 8.

Paratype. Plate 1, fig. 12.

Locality & horizon. Holotype: well 13/30a-4 at 6387.00 ft (conventional core), Early Albian (E.F. W37.0). Paratype: well 20/4b-7 at 8660.20 ft (conventional core), Late Aptian (E.F. N40.0).

Dimensions. Holotype (operculum detached): length 83 μm, width 85 μm. Overall (operculum detached): length 95 (80) 67.5 μm; width 90 (77.5) 67.5 μm; 30 specimens measured. Paratype (operculum attached): length 105 μm, width 80 μm.

Remarks. *Cerbia monilis* n. sp. differs from all other species of this genus in its very distinct cyst morphology, particularly an angularity of outline caused by the presence of apical, lateral and antapical projections, and the characteristic cyst folding. The latter feature is almost exclusively restricted to parasutural areas, so that parasutural spines typically run along the folds.

Folding imparts an essentially triangular shape to the hypocyst, causes some constriction of the archaeopyle and emphasizes the height of the dorsal epicyst. In addition, although some dorso-ventral flattening is observed, it appears to be significantly less pronounced than in other species of this genus.

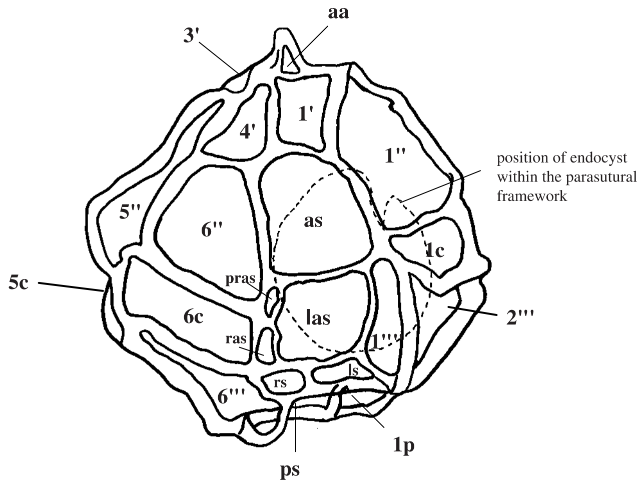

Fig. 3. *Hapsocysta susanae* n.sp. The holotype, ventral surface, well 14/29a-5 at 8399.0 ft (sidewall core), Middle Albian (E.F. K43.0, F.D. 631). This specimen is also figured in Plate 1, figs 1, 2.

The operculum is almost always detached, and only one specimen with an attached (but displaced) operculum was observed in the study wells (paratype, Pl.1, fig. 12).

This very distinctive species is very short-ranging, restricted to the Aptian/Albian boundary interval, zones LKP31 and LKP32 of Duxbury (2001) (*jacobi* to *tardefurcata* ammonite zones), where it can be common. In the study area, its inception is within the Wick Sandstone Formation, Captain Sandstone Member and Upper Britannia Sandstone Formation, and its extinction is within the Carrack Formation.

Genus *Hapsocysta* Davey, 1979
Hapsocysta susanae n. sp.
(Pl. 1, figs 1–6, 9; figs 3–5)

Derivation. After my wife, Susan, in recognition of her continuing and necessary patience with the author.

Diagnosis. A spheroidal dinocyst species which consists mainly of an open parasutural network. Individual parasutures are V-shaped in cross-section, composed of a thickened, linear base and two smooth, ribbon-like flanges. A gonyaulacacean paratabulation of the form acl., aa, 4′, 6′′, as, 6c, pras, ras, las, 6′′′, rs, ls, ps, 1p, 1′′′′ is outlined by trifurcation of the parasutures. The width of individual parasutures varies between 0.8 μm and 2.8 μm, with the more slender ones bordering the smaller paraplates. A short apical projection, composed entirely of parasutural material, is observed in lateral orientation, and a small, very thin-walled, wrinkled endocyst is observed in the minority of specimens.

Holotype. Plate 1, figs 1, 2; fig. 3.

Paratype. Plate 1, fig. 4; fig. 4.

Locality & horizon. Holotype: well 14/29a-5 at 8399.0 ft (sidewall core), Middle Albian (E.F. K43.0). Paratype: well 14/29a-5 at 8420.0 ft (sidewall core), Middle Albian (E.F. S42.4).

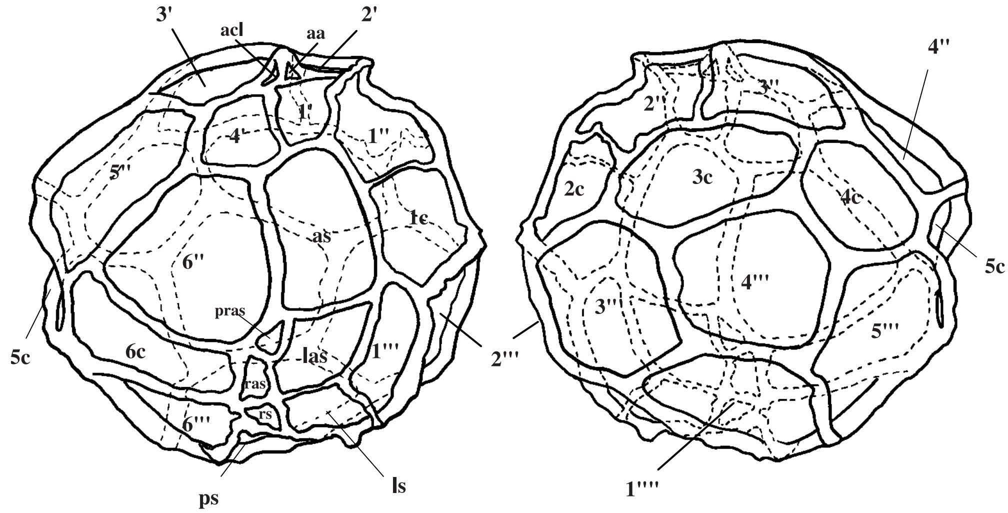

Fig. 4. *Hapsocysta susanae* n.sp. Paratype, showing oblique ventral and oblique dorsal surfaces, well 14/29a-5 at 8420.0 ft (sidewall core), Middle Albian (E.F. S42.4., F.D. 632). This specimen is also figured in Plate 1, fig. 4.

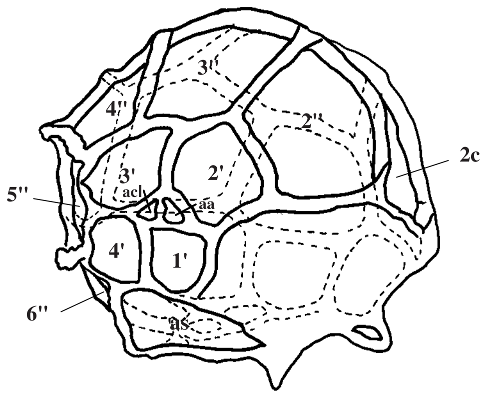

Fig. 5. *Hapsocysta susanae* n.sp. A specimen showing the relationship between the apical, precingular and as paraplates, well 14/29a-5 at 8399.0 ft (sidewall core), Middle Albian (E.F. U31.0., F.D. 633). This specimen is also figured in Plate 1, fig. 3.

Dimensions. Holotype: 70 × 70 μm. Paratype: 71 × 68 μm. Overall: 78 (70) 60 × 73 (65) 50 μm, 15 specimens measured. Endocyst: 34 (33) 30 × 28 (27) 26 μm, 3 specimens measured.

Remarks. This species has been placed in *Hapsocysta* Davey, 1979 because it is essentially an open meshwork, composed of narrow strands, outlining the paratabulation and surrounding an endocyst. Unfortunately, the paratabulation of the genus *Hapsocysta* has not been formally reported, and no direct comparisons may be made. However, Davey (1979) described, 'large, basically pentagonal, pre- and postcingular, and antapical areas, elongate paracingular areas and small, subcircular parasulcal areas'.

An endocyst is observed only in the minority of specimens of *Hapsocysta susanae*, and no clear attachment to the parasutural framework has been discerned. The absence of an endocyst from the majority of specimens may be due to its easy detachment and small size; it is presumably easily detached and typically lost through the wide mesh of the encircling framework.

Close comparisons may be made between *H. susanae* and the type species, *Hapsocysta peridictya* (Eisenack & Cookson, 1960) Davey, 1979, which occurs at the same stratigraphic level in the study area (although the last species has a significantly longer range). Specimens of *H. peridictya* (Eisenack & Cookson, 1960) Davey, 1979 illustrated and described by Morgan (1980) are particularly reminiscent of *H. susanae*, including specimens which, 'lack an endophragm'.

H. susanae differs from *H. peridictya* (Eisenack & Cookson, 1960) Davey, 1979 in having a more rigid parasutural framework with broader individual elements, in its significantly smaller overall size and in the smaller size of the endocyst relative to the parasutural network. The last feature may account for the characteristic loss of the endocyst in *H. susanae*.

In addition, *H. susanae* has an apical projection, a feature absent from *H. peridictya* (Eisenack & Cookson, 1960) Davey, 1979, and no specimens of *H. susanae* have yet displayed, 'a continuous ectophragm joining the trabeculae', as described for some specimens of *H. peridictya* by Morgan (1980).

The structure of *H. susanae* is very reminiscent of the genera *Evittosphaerula* Manum, 1979 and *Chaenosphaerula* Damassa, 1997. These are monotypic, morphologically very similar, and the type species, *Evittosphaerula paratabulata* Manum, 1979 and *Chaenosphaerula magnifica* Damassa, 1997 were described from the Lower Miocene and Upper Oligocene respectively. However, *H. susanae* differs from both of these in possessing an apical projection and an endocyst (although this is usually lost).

Detailed comparison may be made of the paratabulation of *H. susanae* (figured here) with illustrations in Damassa (1997, figs 2, 3 and 6) of apical–ventral paratabulation patterns for *E. paratabulata* Manum, 1979 and *C. magnifica* Damassa, 1997. In particular, the configuration of paraplate quartet {5′′, 4′, as, 6′′} is most similar to that in *C. magnifica* and to most species of *Impagidinium* Stover & Evitt, 1978. However, the multi-paraplate sulcal arrangement in *H. susanae* is very similar to that of *E. paratabulata*.

The structure of *H. susanae* also bears some resemblance to the genus *Cannosphaeropsis* Wetzel, 1933, although the trabecular network of the latter genus bears short, distally bi- or trifurcate spines (see Duxbury, 1980; Marheinecke, 1992), a feature absent from *H. susanae*.

The stratigraphic range of *H. susanae* is short, restricted to the Early to Middle Albian, palyzones LKP33.1 to LKP34 of Duxbury (2001), where it can be common. In the study area, its inception is within the upper Carrack Formation, and its extinction is within the lower Rødby Formation.

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