

Selected *Cribroperidinium* species (Dinophyceae) from the Kimmeridgian and Volgian of northwest Europe

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ABSTRACT

Two new dinoflagellate species, *Cribroperidinium complexum* and *C. erymnoseptum* are described from the Kimmeridgian of the Norwegian Continental Shelf and Spitzbergen. The morphotypes described as *Cribroperidinium* sp. A by Davey (1982) from the Portlandian of Denmark, are thought to be conspecific with *Cribroperidinium gigas* Raynaud 1978. The holotype of *Cribroperidinium longicorne* (Downie) Lentin & Williams 1985 has been examined and is discussed. *J. Micropalaeontol.*, 12 (2): 219-7. December 1993.

INTRODUCTION

During palynological analysis of Late Jurassic (Kimmeridgian - Volgian) sediments from the Norwegian continental shelf and Spitzbergen, significant numbers of the genus *Cribroperidinium* were observed. Two species; *C. erymnoseptum* sp. nov. and *C. complexum* sp. nov. are introduced here. Other species, including *C. longicorne* (Downie) Lentin & Williams 1985 and *C. gigas* (Raynaud) Helenes 1984, were also recorded and are discussed in the following systematic palynology section. Type and illustrated material is from three localities (Figure 1); well 7120/12-2 in the Barents Sea, well 2/1-8 in the Gyda Field and outcrop material from the Janusfjellet Formation at Myklegardfjellet, Svalbard. Type material is stored in the slide collection of BP Norway, Forusbeen 35, 4033 Forus, Stavanger.

The species "*Gonyaulacysta*" *gigas* was introduced by Raynaud (1978) from the Kimmeridgian and Volgian of the North Sea and adjacent areas. Subsequently, Davey (1982) described a similar form as *Cribroperidinium* sp. A from the Volgian to Ryazanian of the Haldager No. 1 borehole in Denmark. Whilst Davey compared this morphotype to *Cribroperidinium longicorne* (Downie) Lentin & Williams 1985, which is also similar, he did not refer to *C. gigas*. Lentin & Williams (1981), transferred the species *C. gigas* to *Millioudodinium*, and it was most recently transferred to *Cribroperidinium* by Helenes (1984), who considered it to be a "provisionally assigned species". It is proposed that *C. gigas* and *Cribroperidinium* sp. A are conspecific, although published and unpublished literature has tended to ignore *C. gigas* in favour of *Cribroperidinium* sp. A Davey. (eg. Riley *et al.* 1989, Riding & Thomas 1988). The synonymy is formally discussed in the following systematic palynology section.

SYSTEMATIC PALYNOLOGY

Division **Pyrrophyta** Pascher 1914
Class **Dinophyceae** Fritsch 1929
Order **Peridiniales** Haeckel 1894
Family **Gonyaulacaceae** Lindemann 1928
Genus ***Cribroperidinium*** Neale & Sarjeant 1962,
emend Helenes 1984

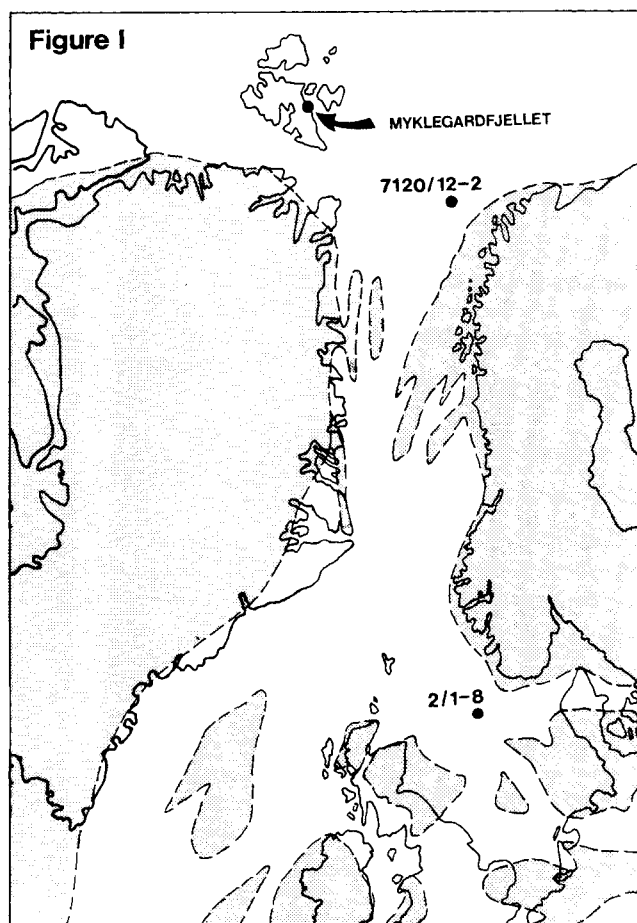


Fig. 1. Sample localities for studied material. Late Jurassic palaeogeography (shaded) modified from Larsen (1987).

Cribroperidinium complexum sp. nov.
(Pl. 1, Figs 1-9)

Diagnosis. A large species of *Cribroperidinium*, hypocyst broadly rounded, epicyst merging into a pronounced apical horn which is terminated by a complex apicular structure, composed of interlinking trabeculate elements. Sexiform gonyaulacoid

paratabulation expressed by parasutural crests or ridges, which often develop proximate vacuoles and/or distal trabeculae. Parasutural features are more strongly expressed antapically and along the paracingulum. Surface of autophragm scabrate to granulate. Precingular archaeopyle, type P (3'').

Size range. 80µ-130µ overall length (holotype 122µ x 98µ).

Holotype. Slide NBS 1838, England Finder Q33/4.

Type locality. Norsk Hydro Norwegian Well 7120/12-2, at 1838m (Hekkingen Formation).

Derivation of name. After the complexly structured apical horn.

Remarks. The apical horn is variably developed (compare Pl. 1, Figs 2 and 6). It is always surmounted by a complex apical structure composed of trabeculate elements. No intratabular ridges or crests have been observed and there are no small dorsal intercalary plates (Pl. 1, Fig 9).

Comparison. *Cribroperidinium complexum* sp. nov. is easily identified by its characteristic apical horn, style of parasutural ornament and large size. *Cribroperidinium gigas* (Raynaud) Helenes 1984 is often of similar overall shape, but the horn, although long and terminated by a solid extension, is not ornamented by trabeculate elements. In addition, *C. gigas* has a thicker wall, ornamented by spines. *Cribroperidinium longicorne* (Downie) Lentin & Williams 1985 is usually smaller, with a thin wall and poorly defined paratabulation.

Occurrence. The author has observed this species in sediments of Kimmeridgian age from Spitzbergen (Janusfjellet Formation) and from the Kimmeridgian of well 7120/12-2 in the Barents Sea, where it occurs commonly at some levels. It has also been observed in Kimmeridgian sediments from the Halten Terrace, though it has not been recorded in the North Sea or further south.

The early Kimmeridgian age interpretation for these sediments is based on the co-occurrence of other stratigraphically diagnostic dinoflagellate cysts. In the Barents Sea material, *C. complexum* was observed in conjunction with *Gonyaulacysta jurassica*, *Endoscrinium luridum*, *Rhynchodiniopsis cladophora*, *Geiselodinium* sp., *Perisseiasphaeridium pannosum*, *Ambonosphaera staffinensis* and *Atopodinium haromense*. In Spitzbergen, *C. complexum* was recorded in a number of outcrop samples of the Janusfjellet Formation. The assemblages here were quite poor, with *Horologinella spinosigibberosa*, *Paragonyaulacysta borealis*, *Pareodinia ceratophora*, *Aldorfia dictyota*, *Atopodinium haromense* and *Cribroperidinium ehrenbergi* group *sensu* Helenes (1984). In the Haltenbanken area of the Norwegian Sea, *C. complexum* has been observed in core material with *Gonyaulacysta jurassica*, *Perisseiasphaeridium pannosum*, *Oligosphaeridium patulum*, *Cribroperidinium longicorne*, *Paragonyaulacysta capillosa*, *Rhynchodiniopsis cladophora* and *Geiselodinium paeminosum*.

Cribroperidinium erymnoseptum sp. nov.
(Pl. 2, Figs 1-9)

Diagnosis. A species of *Cribroperidinium* with a subspherical to ovoidal body, surmounted by a small apical horn. Sexiform Gonyaulacoid paratabulation is expressed by variably developed parasutural features of generally low relief. These comprise an assortment of irregular arched/trabeculate crests, spines, and columns, which may be capitate, echinate and bifurcate distally. Similar features are developed as growth lines on intratabular areas. Archaeopyle precingular, type P (3'').

Size range. 50µ-80µ overall length (holotype 78µ x 57µ).

Holotype. Slide 41818.3, England Finder R53

Type locality. BP Norwegian Well 2/1-8 at 3937.40m (core, Farsund Formation).

Derivation of name. Greek *erymnos*, fenced, fortified, strong. With reference to the robust, fence-like parasutural features.

Remarks. The hypocyst and epicyst are of more or less equal proportions, separated by a slightly laevorotary paracingulum. The short apical horn is solid and may be simple, spinose or capitate. The parasutural ornament is variably developed, from rows of spines or columns, aligned along paraplate boundaries to complex fence-like crests, comprising arched and trabeculate elements. The crests are generally 2-4µ in height, but can be over 5µ on the hypocysts of some strongly ornamented specimens.

Comparison. *Cribroperidinium erymnoseptum* sp. nov. differs from other species of the genus by the characteristic parasutural features and smooth autophragm. Some of the more ornamented forms are similar to *Exiguisphaera phragma* Duxbury 1980, but do not have 2P archaeopyles and have coarser, more robust parasutural ornament.

Occurrence. The author has recorded *C. erymnoseptum* from the Kimmeridgian of the North Sea. In the type material, numerous specimens were observed, associated with a rich and diverse marine microflora, including; *Endoscrinium luridum*, *Gonyaulacysta jurassica*, *Geiselodinium* sp., *Oligosphaeridium patulum*, *Perisseiasphaeridium pannosum*, *Scriniodinium invitibulum*, *Glossodinium dimorphum*, *Pareodinia ceratophora*, *Prolixosphaeridium granulosum*, abundant *Circulodinium distinctum* group *sensu lato*, and common *Cribroperidinium ehrenbergi* group *sensu* Helenes (1984).

Cribroperidinium gigas (Raynaud 1978) Helenes 1984.
(Fig. 2, Figs 1-4)

1978 *Gonyaulacysta gigas* Raynaud, p.392-393, pl. 2, fig. 16, text-fig. 5.

1982 *Cribroperidinium* sp. A Davey, p. 27, pl. 10, figs. 5, 6.

1981 *Millioudodinium gigas* (Raynaud) Lentin & Williams

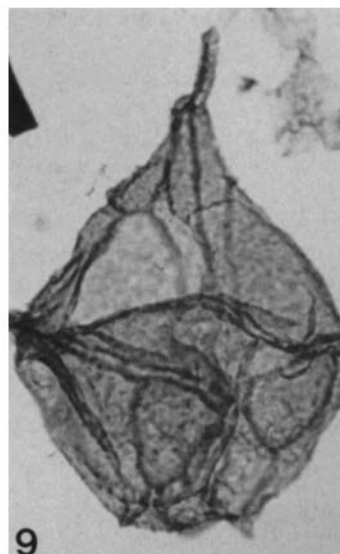
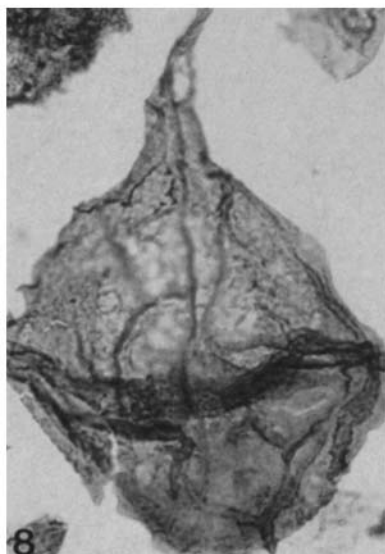
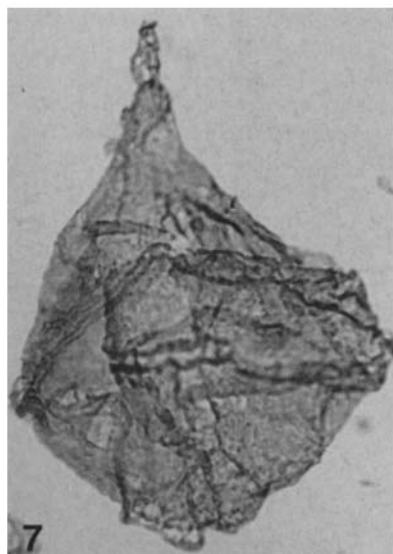
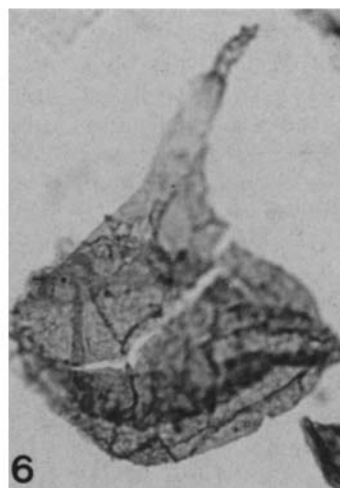
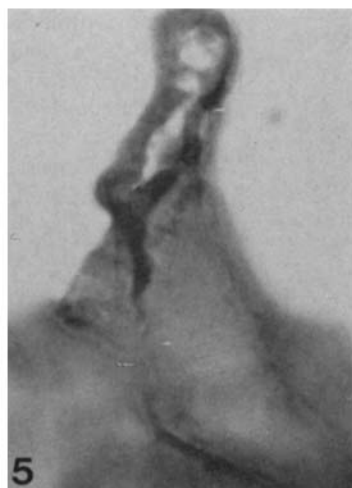
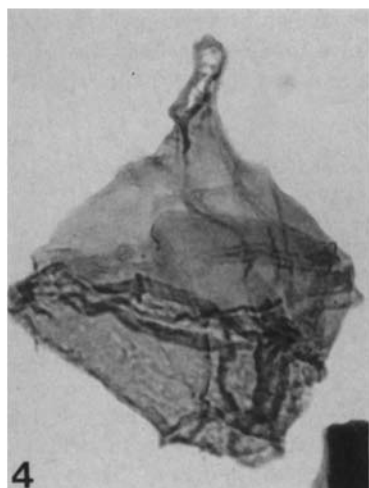
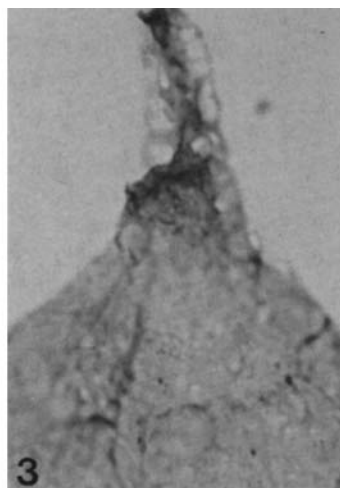
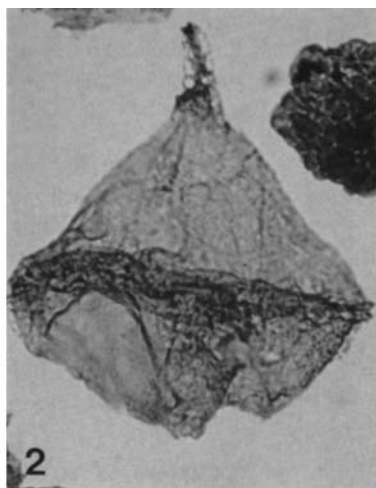
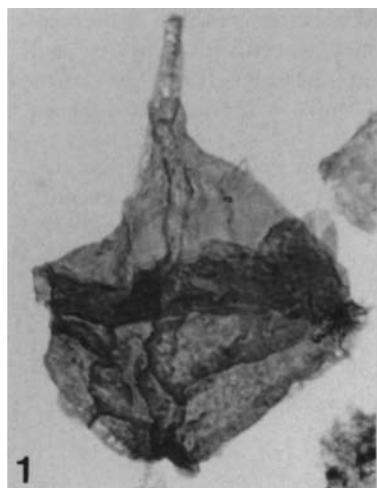
1984 *Cribroperidinium?* *gigas* (Raynaud) Helenes, p. 128.

1987 *Cribroperidinium* sp. A Davey 1982, Heilmann-Clausen, pl. 10, fig.6

Explanation of Plate 1

Cribroperidinium complexum sp. nov.

Fig 1, ventral focus, note trabeculate parasutural features at lower left, x600, **Figs 2, 3**, holotype, 2, x600, 3, x1000, **Figs 4, 5**, lateral view, 4, x600, 5, x1000, **Fig 6**, lateral view of specimen with a long apical horn, x600, **Figs 7, 8**, large specimen with trabeculate parasutural ornament on the antapical pole, 7, dorsal focus, x600, 8, ventral focus, x600, **Fig 9**, dorsal view, note precingular archaeopyle, x600. All specimens from the Hekkingen Formation (Kimmeridgian) in Well N7120/12-2.



1987 *Cribroperidinium gigas* (Raynaud), Heilmann-Clausen, pl. 10, fig. 13

1989 *Cribroperidinium* sp. A Davey 1982, Barron, pl. 1, figs. 2, 3

Diagnosis. (Translation from Raynaud 1978, p. 392-393) "A species of large proportions. Body spherical to ovoidal, with a thick and granulose wall, sometimes bearing short spines. Very long, almost smooth apical horn, with dimensions equal to approximately two-fifths of the total length. Cingulum and tabulation marked by thick crests."

Remarks. Davey (1982) gives a very similar description for *Cribroperidinium* sp. A, and it is proposed that this form is conspecific with *C. gigas*. Helenes (1984) considered this to be a "provisionally assigned species". The morphology of this species is very variable, both in overall shape, length of apical horn and development of spines/ornament.

Occurrence. Previous published records of this taxon include late Volgian/early Ryazanian to earliest middle Volgian (Riley *et al.*, 1989), late Ryazanian to early Portlandian of the Haldager No. 1 borehole and earliest Portlandian (*albani* Zone) of southern England (Davey 1982) and Portlandian to Kimmeridgian of the North Sea (Raynaud 1978). The present author has observed *C. gigas* from the Kimmeridgian to latest Volgian of the North Sea. The species may be abundant in the lower part of the Late Volgian and upper part of the Middle Volgian. Raynaud (1978) did not record *C. gigas* from any of his outcrop material in the UK, but saw frequent specimens from the North Sea. Davey (1982) however, observed large numbers of "*Cribroperidinium* sp. A" from the *anguiformis-okusensis* (*giganteus*), *oppressus* and *primitivus* Zones of eastern England, and from the early Portlandian of the Haldager No. 1 borehole, Denmark.

Cribroperidinium longicorne (Downie 1957)

Lentin & Williams 1985

(Pl. 3, Figs 1-6)

1957 *Gonyaulacysta longicornis* Downie, p. 420, pl. 20, fig. 8, text-fig. 2a,b.

1982 *Millioudodinium longicornis* (Downie) Sarjeant, p. 39.

1985 *Cribroperidinium?* *longicorne* Lentin & Williams, p. 79.

Remarks. Lentin & Williams (1985, p.79) state "Because of the uncertainty as to the tabulation mode, we consider the present generic assignment provisional". The present author has examined the holotype of *C. longicorne*, which has a thin, pale wall and the paratabulation is only partially discernible. The apical horn is hollow for approximately half its length, terminating in a solid, flexuose extension. Short spinules are developed at gonial points, only rarely along parasutures. Intratabular areas are finely granular. Because of the very faint paratabulation, precise details of paratabulation, such as the presence or absence of dorsal intercalary paraplates on the epicyst, or

of L-type ventral organisation were not discernible. The author has observed many specimens comparable with the holotype, and also transient morphotypes between *C. longicorne* and members of the *C. ehrenbergi* group Helenes (1984). Specimens intermediate between *C. gigas* and *C. longicorne* have also been observed.

Occurrence. There have been many published records of this useful stratigraphic marker species, including more recently; Kimmeridgian (*huddlestoni* to *cymodoce* Zones) of southern and eastern England (Riding and Thomas 1988, Riding 1987), middle Kimmeridgian to early Volgian of the North Sea (Riley *et al.* 1989), middle to early Kimmeridgian of the southwestern North Atlantic (Zotto *et al.* 1987), Kimmeridgian (*mutabilis* Zone) of southern Germany (Dürr 1987), Kimmeridgian (*mutabilis* Zone) of southern England (Nøhr-Hansen 1986).

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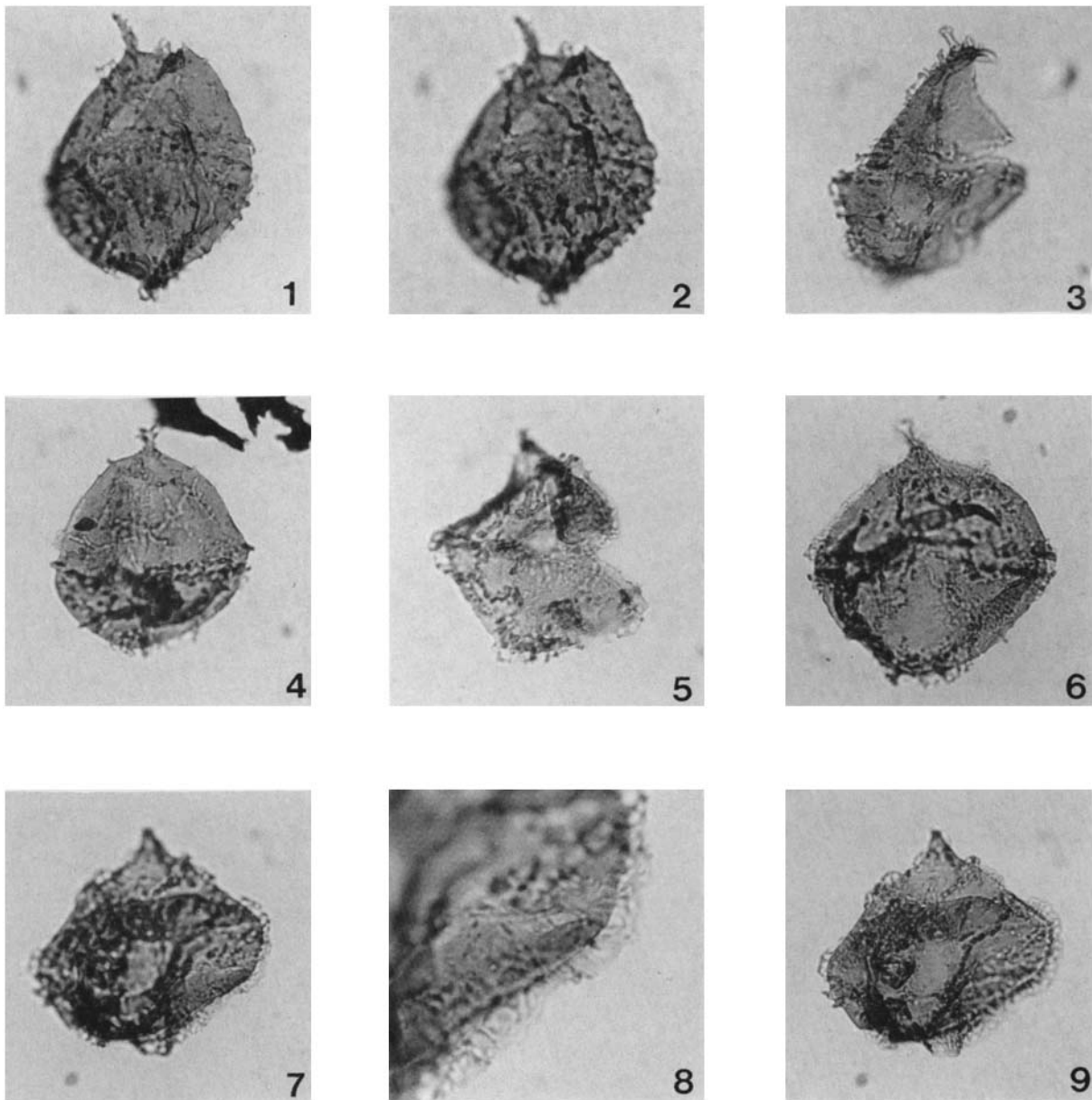
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Explanation of Plate 2

Cribroperidinium erymnoseptum sp. nov.

Figs 1, 2, holotype, dorsal view, x600, **Fig 3**, lateral view of broken specimen, x600, **Fig 4**, dorsal view of specimen with reduced ornament, x600, **Fig 5**, specimen with complex parasutural ornament, x600, **Fig 6**, dorsal focus, x600, **Figs 7-9**, views of specimen with very ornate and complex parasutural crests, note the smooth autophragm, 7, 9, x600, 8, x1000 All specimens from the Farsund Formation in well N2/1-8.



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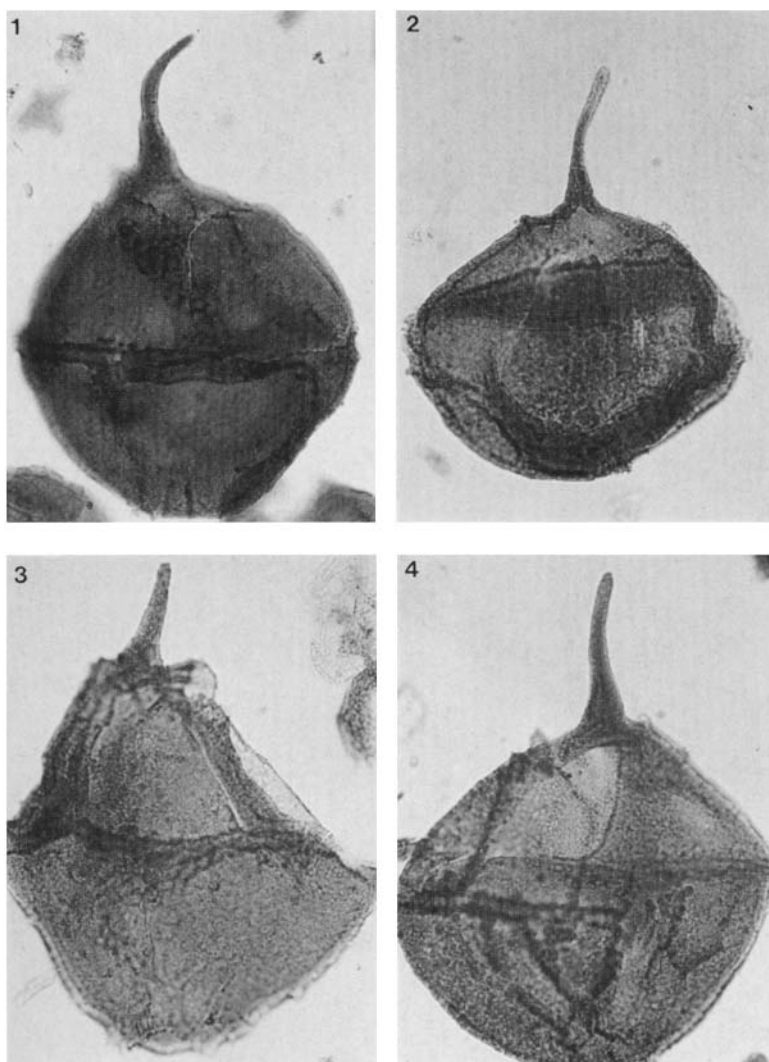


Fig. 2 *Cribroperidinium gigas* (Raynaud) Lentin & Williams 1985. **Fig 1**, left dorsal view of specimen with operculum in place and thick, densely ornamented wall, x600 (approx.). **Fig 2**, dorsal view, x600 (approx.). **Fig 3**, left lateral view, x600 (approx.). **Fig 4**, dorsal view x600 (approx.). All specimens from the latest Middle Volgian of the Central North Sea.

Explanation of Plate 3

Cribroperidinium longicorne (Downie) Lentin and Williams 1985. **Figs 1-3**, holotype, slide KL 11.15, Kimmeridge Clay at Setchey, Norfolk, England. **Fig 2**, enlargement of apical horn showing the hollow proximal and solid distal portions, x1000. **Figs 4-6**, Kimmeridge Clay of the Central North Sea, x600.

