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Eodinia poulseni sp. nov., a dinoflagellate cyst from Middle Jurassic of Central Poland

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ABSTRACT – A new species of dinoflagellate, *Eodinia poulseni*, is described from the Middle Jurassic of Central Poland. Light and scaning electron microscopy shows that this species has a complex cyst wall consisting of autophragm and ectophragm. *Eodinia poulseni* sp. nov. has similarities to some common Middle Jurassic species, especially when separate hypocysts are observed. Important differences between *Eodinia pachytheca*, *Mosaicodinium mosaicum*, *Wanaea acollaris*, *W. cornucavata* and *Hurlandsia rugarum* are discussed. Some phylogenetic and environmental relationships to the Early Cretaceous freshwater species *Hurlandsia rugarum* are suggested. *H. rugarum* shows similarity in archaeopyle, overall shape and tabulation formula but is acavate and also distinct from *E. poulseni* in time. *J. Micropalaeontol.* **21**(1): 43–49, May 2002.

INTRODUCTION

During a palynological study of core samples from five boreholes in the Kujawy region of Central Poland (Figs 1 and 2) a rich dinoflagellate cyst assemblage was recovered (Fig. 3) including a new species of *Eodinia* Eisenack, 1936. It is present in large numbers in all the boreholes analysed. The new species, named *Eodinia poulseni*, occurs within zone DSJ 15 (early–mid Bathonian) and DSJ 16 (mid–late Bathonian) of the dinoflagellate zonation for central Poland (Poulsen, 1998).

The study area is situated in the central part of the Mid-Polish Trough. This region was a part of the European Jurassic epicontinental basin close to the East-European Platform margin. The sedimentological setting and the palynofacies analysis also suggests a proximal position to the platform. The lithologies of the cores studied mostly consist of sandstones, clays and sandstones with clayey intercalations. The area was uplifted in Middle Jurassic times during a halokinetic phase. The uplift phase caused several synsedimentological erosional periods which created a number of facies differences.

Samples were prepared according to standard palynological techniques following Poulsen *et al*. (1990). Holotype, paratypes and type material are lodged in the Museum of the Geology Department of the University of Warsaw.

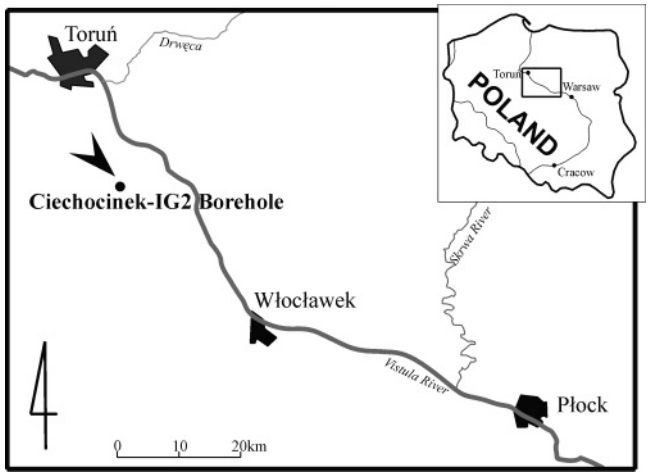


Fig. 1. Map showing holotype locality.

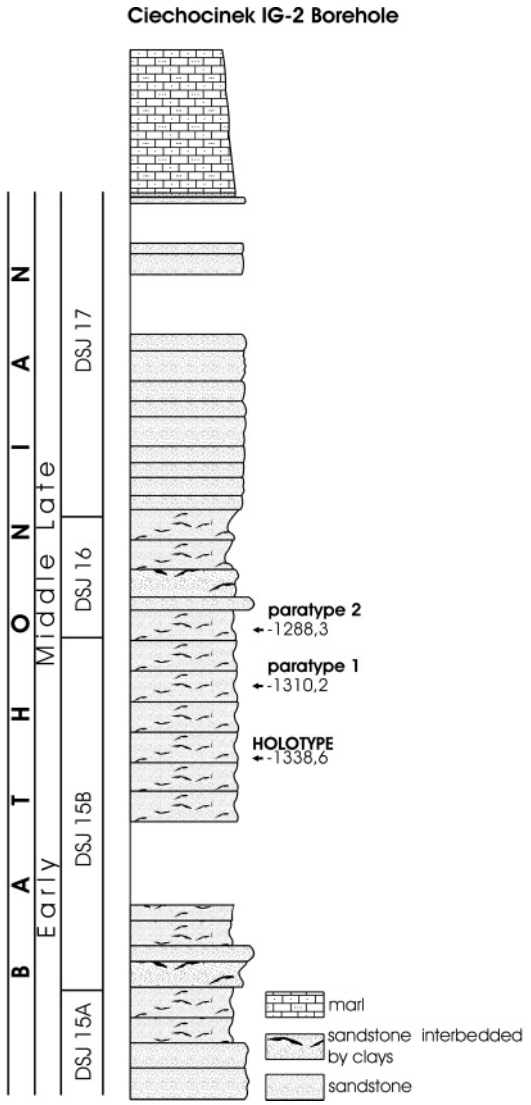


Fig. 2. Section of the Ciechocinek IG-2 borehole and its stratigraphic position, with reference to the dinoflagellate cyst zonation of Poulsen (1998).

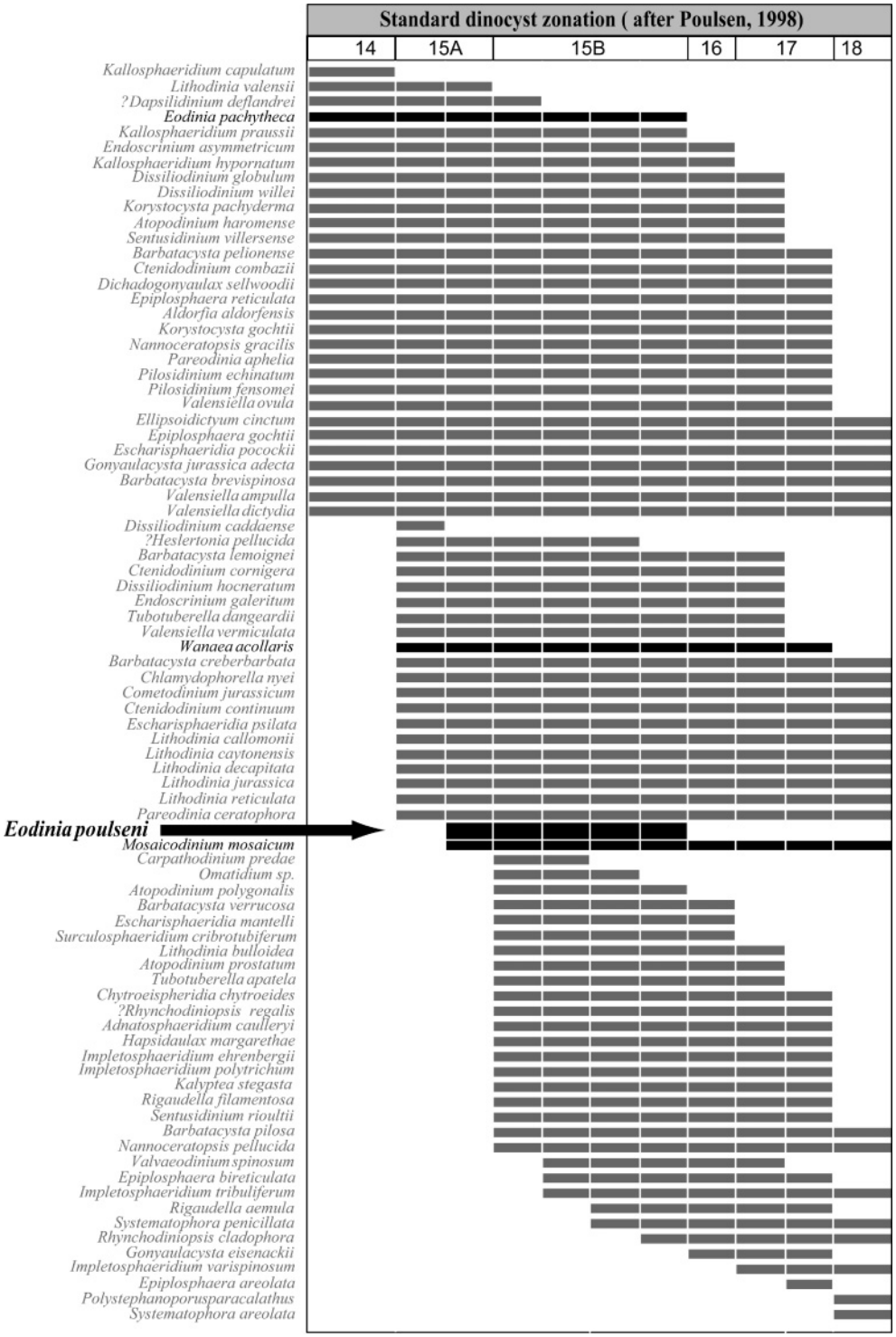


Fig. 3. Stratigraphic range of *Eodinia poulseni* sp. nov. compared to other dinoflagellates.

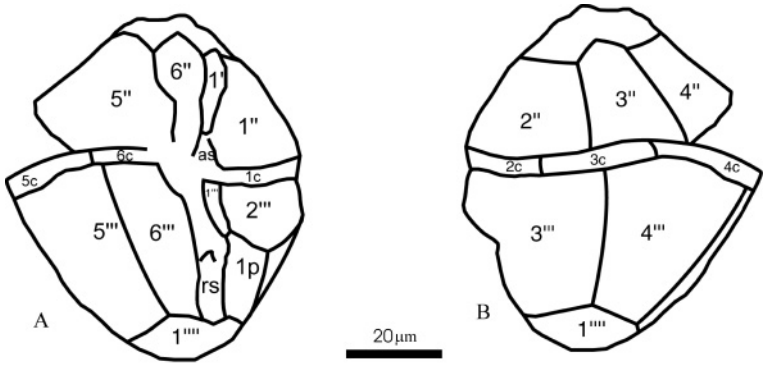


Fig. 4. The reconstructed tabulation formula of *Eodinia poulseni* on (**a**) ventral and (**b**) dorsal sides of the cyst.

SYSTEMATIC DESCRIPTION

Division **Dinoflagellata** (Butschli 1885) Fensome *et al.*, 1993
Subdivision **Dinokaryota** Fensome *et al.*, 1993
Class **Dinophycae** Pascher, 1914
Order **Gonyaulacales** Taylor, 1980
Suborder **Gonyaulacineae** Norris, 1978 (autonym)
Family **Gonyaulacaceae** Lindemann, 1928
Subfamily Leptodinioideae Fensome *et al.*, 1993

Genus *Eodinia* Eisenack, 1936 emend. Gocht, 1975 emend. Berger, 1986

Remarks. Emendations of the genus *Eodinia* Eisenack, 1936 by Gocht (1975) and Berger (1986) described the wall structure and provided details of the endophragm and periphragm. However, Stover & Evitt (1978), in a modified generic description, correctly described both the auto-and ectophragm. *Mosaicodinium* Dodekova, 1990, seems to be closely related but differs from *Eodinia* Eisenack, 1936 by the presence of an antapical paraplate which is inclined and elongate (Dodekova, 1975). In contrast, the genus *Eodinia* is characterized by a symmetrical, antapical paraplate (Gocht, 1975).

Eodinia poulseni sp. nov.
(Pl. 1, figs 1–6)

Derivation of name. *Eodinia poulseni* is named after Dr Niels Erik Poulsen (Geological Survey of Denmark and Greenland), the author's first teacher in Jurassic dinoflagellate cysts.

Shape. Polygonal with a conical hypocyst and flat epicyst where a small apical protrusion is formed by the ectophragm.

Wall relationship. Cyst holocavate. Autophragm and ectophragm are developed uniformly around the whole cyst.

Wall features. Autophragm smooth to scabrate. Ectophragm continuous, smooth and transparent. The two layers are connected by solid pillars.

Paratabulation. The complete tabulation pattern is difficult to recognise in light microscopy. In SEM a gonyaulacacean sexiform type tabulation is reflected with tabulation formula: ?′, 6′′, 6c, 6′′′, 1p, 1′′′′ (Fig. 4). The antapical paraplate is symmetrical.

Archaeopyle. Epicystal. Operculum attached ventrally.

Paracingulum. Indicated by transverse parallel ridges.

Parasulcus. Indicated by a depression on the hypocyst.

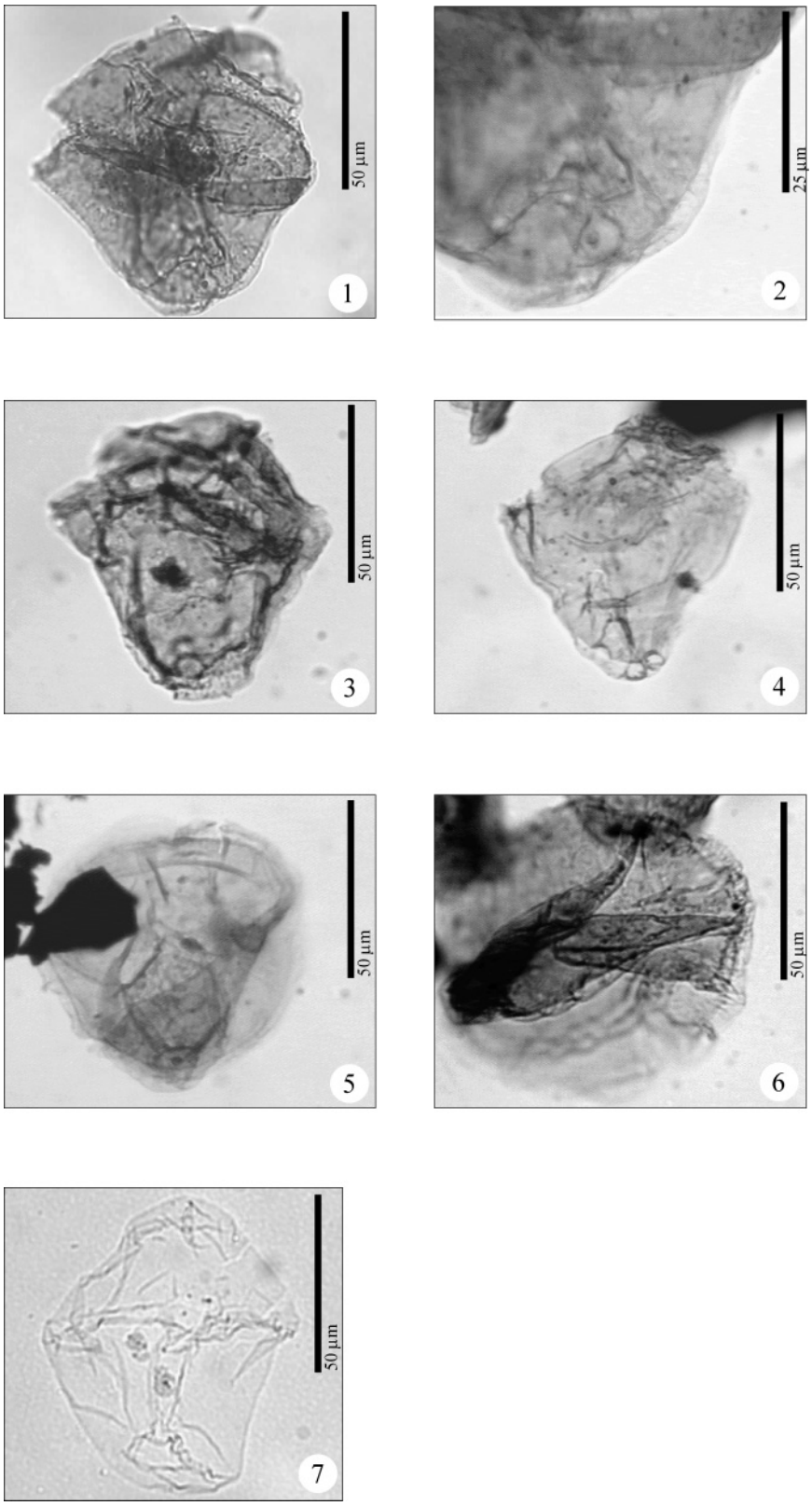
Size. Intermediate, see 'Dimensions'.

Holotype. Plate 1 (fig. 1). Slide C2/103. Co-ordinates: X=300,Y=1118 (upper right corner X=001, Y=0007). Holotype is lodged at the University of Warsaw in the Museum of the Geology Department under catalogue number IGPUW/Df/01/001a. Locality: Ciechocinek IG-2 Borehole, depth −1338.6 m (Fig. 2), Central Poland, Kujawy region.

Paratype 1. Plate 1 (fig. 3). Slide C2/103. Co-ordinates: X=322,Y=1416 (upper right corner X=001, Y=0007). Ciechocinek IG-2 Borehole, depth −1338.6 m (Fig. 2). Cat. No. IGPUW/Df/01/001b.

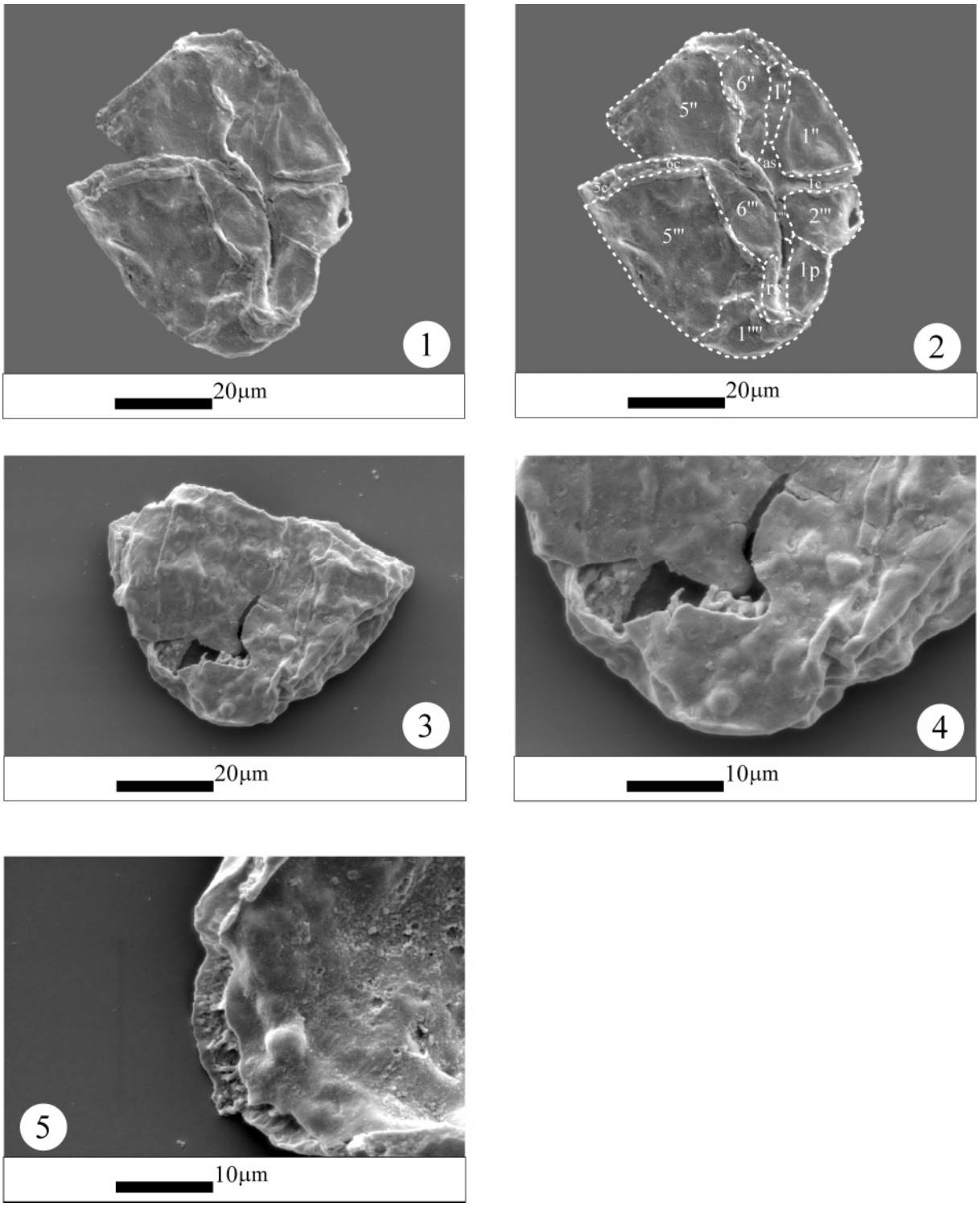
Paratype 2. Plate 1 (fig. 4). Slide C2/74. Co-ordinates: X=280,Y=1215 (upper right corner X=001, Y=0007). Ciechocinek IG-2 Borehole, depth −1310.2 m (Fig. 2). Cat. No. IGPUW/Df/01/002.

Description. Isolated, conical hypocysts are typical. The autophragm/ectophragm relationship is clearly seen on the edges of the hypocyst. In the epicyst a small apical protrusion is occasionally discernible. In the hypocysts, the pillar connections are evident in apical view (Pl. 1, fig. 6). Dark-coloured cysts usually show a scabrate autophragm. Common folds on cyst surface blur the tabulation pattern. Under SEM a gonyaulacacean type tabulation is reflected by low, narrow ridges (Pl. 2, figs 1, 2). The antapical paraplate was only seen in a few specimens. It is symmetrical, gonyaulacacean–sexiform type (Pl. 1, fig. 5). In the SEM micrographs of the hypocsts, some trichocyst pores (Pl. 2, fig. 4) are weakly expressed (Gocht, 1975).



Explanation of Plate 1

Figs 1–6. *Eodinia poulseni* sp. nov.: **1**, holotype; **2**, holotype at higher magnification, showing the endophragm/periphragm wall relationship; **3**, paratype 1; **4**, paratype 2; **5**, antapical view, showing normal, symmetrical antapical (1′′′′) paraplate; **6**, antapical view, illustrating the similarity to *Wanaea acollaris* in this position. **Fig. 7**. *Hurlandsia rugarum* (Piasecki, 1984) Lister & Batten, 1988; holotype.



Explanation of Plate 2

Figs 1–5. *Eodinia poulseni* sp. nov.: **1**, **2**, complete specimen in SEM and partial tabulation formula interpretation; **3–5**, SEM photomicrographs showing the internal pillar structures between wall layers.

	Eodinia poulseni sp.nov.	*Eodinia pachytheca*	*Mosaicodinium mosaicodinium*	*Wanea acollaris*	*Wanea cornucavata*	*Hurlandsia rugarum*
Shape	ellipsoidal	ellipsoidal	spheroidal to subspheroidal	subspherical to broadly biconical	subspherical to broadly biconical	angular to rounded-hexagonal
Epicyst	conical*	conical*	symmetrical*	conical*	conical*	symmetrical*
Hypocyst	conical* (higher than epicyst)	conical* (higher than epicyst)	symmetrical*	conical* (higher than epicyst)	conical* (higher than epicyst)	symmetrical*
Horns	short apical formed by ectophragm	short apical	apical prominence formed by ectophragme	antapical horn present	cavate antapical horn	blunt, low apical horn present
Caviation of the wall	holocavate	holocavate	holocavate	acavate	hypocavate	acavate
Wall relationship	autophragm + ectophragm	autophragm + ectophragm	autophragm + ectophragm	autophragm	autophragm + ectophragm	autophragm
Wall features	parasutural bands with low medial crests, ectophragm, psilate, continuous supported by pillar structures and bearing trichocyst pores	parasutural bands with low medial crests, ectophragm with system of reticulate ridges surrounding lumina or perforation	mosaic structure on the wall, sutures marked by membranous septa with distal margin denticulated or passing into fringes; intratabular crests	parasutural bands smooth to fimbriate commonly with perforate bases; low relief between crest and autophragm	perforated ectophragm suported by irregular processes	autophragm smooth, usually folded
Paratabulation	gonyaulacoid discernible only in SEM, in light micr. vague; paraplate 1′′′′ symmetrical	gonyaulacoid discernible only in SEM, in light micr. vague; paraplate 1′′′′ symmetrical	Reflected, gonyaulacoid, paraplate 1′′′′ asymmetrical	reflected only in hypocyst gonyaulacoid	gonyaulacoid discernible only in SEM, in light micr. vague expressed by crests on ectophragm supported on parasutural lines by higher processes	incomplete gonyaulacoid reflected by thin ridges
Archaeopyle	tAtPa, operculum normally attached ventrally	tAtPa, operculum normally attached ventrally	epicystal tAtPa	tAtPa, operculum normally attached ventrally	epicystal type tAtPa, operculum normally adnate in parasulcal area	epicystal tAtPa
Paracingulum	indicated by transverse parallel ridges	indicated by transverse parallel ridges	narrow, asymmetrical	indicated by transverse parallel ridges or septa (higher than other)	indicated by archaeopyle margin and trabeculate paracingular flange	usually distinct
Parasulcus	shallow depression	shallow depression	narrow	shallow depression, outlined by parasutural ridges and interruption of paracingulum	shallow depression	present as shallow depression*
Approx. size (μm)	80/100	80/100	100/129	84/100	78/83 (hypocyst)	71/66

*Author's interpretation.

Table 1. Comparison of the important morphological features of the species that may be confused with *Eodinia poulseni* sp. nov.

Dimensions. Whole cyst: holotype height: 82 μm, width 91 μm. Hypocysts (based on 23 specimens; maximum/mean/minimum): height: 74/60/49 μm, width: 93/77/55 μm.

Recorded occurrence. Zones DSJ 15 (early–mid Bathonian) and DSJ 16 (mid–late Bathonian).

Comparison and remarks. Within holocavate cysts, *Eodinia poulseni* differs from *Mosaicodinium mosaicum* Dodekova, 1975 and *Eodinia pachytheca* Eisenack, 1936 by having a psilate to shagreenate, continuous ectophragm. The two latter species are characterized by a mosaic and reticulate outer layer ornamentation, respectively. In apical view, *Eodinia poulseni*

resembles *Wanaea acollaris*. The pillars between the wall layers in *Eodinia poulseni* in this position are very similar in appearance to fringe-like structures surrounding the cingulum in *Wanaea acollaris* (Pl. 1, fig. 6). However, *Wanaea acollaris* can be distinguished by an antapical horn and is also acavate. In contrast, in *Wanaea cornucavata* Feist-Burkhard & Pross, 1998 the cavate antapical horn is fully developed.

The Early Cretaceous species *Hurlandsia rugarum* Lister & Batten, 1988 (Pl. 1, fig. 7), shows clear similarities in overall shape, archaeopyle and tabulation type to *Eodinia poulseni*. They can be differentiated only by their wall structure. *Hurlandsia rugarum* is acavate, whereas *Eodinia poulseni* is holocavate.

Lister & Batten (1988) suggested that *Hurlandsia rugarum* is probably the product of a freshwater dinoflagellate. The reduction in wall number may be due either to environmental factors or phylogenetic reasons. This point should be considered in the future study of both Jurassic and Cretaceous material.

The most important morphological features of the species discussed above are compared in Table 1.

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REFERENCES

Berger, J.P. 1986. Dinoflagellates of the Callovian–Oxfordian boundary of the 'Liesber- Dorf' quarry (Berner Jura, Switzerland). *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, **172**: 331–355.

Dodekova, L. 1975. New Upper Bathonian dinoflagellate cysts from north-eastern Bulgaria. *Bulgarian Academy of Sciences, Palaentology, Stratigraphy and Lithology*, **2**: 17–34.

Gocht, H. 1975. Neuuntersuchung von Eodinia pachytheca Eisenack, 1936 (Dinoflagellata, Oberjura). *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, **148**: 12–32.

Lister, J.K. & Batten, D.J. 1988. Hurlandsia, a new non-marine Early Cretaceous dinocyst genus. *Neues Jahrbuch für Geologie und Paläontologie, Monatshefte*, **8**: 505–516.

Poulsen, N.E., Gudmundsson, L., Hansen, J.M. & Husfeld, Y. 1990. Palynological preparation techniques, a new Maceration tank-method and other modification. *Geological Survey of Denmark series C.*, **10**.

Poulsen, N.E. 1998. Bajocian to Callovian (Jurassic) dinoflagellate cysts from central Poland. *Acta Geologica Polonica*, **48**: 237–245.

Stover, L. & Evitt, W.R. 1978. Analyses of pre-Pleistocene organic-walled dinoflagellates. *Stanford University Publications, Geological Sciences*, **15**: 1–300.