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Dinoflagellate cysts from the Bathonian — Tithonian (Jurassic) of North Bulgaria. I. Taxonomy of Bathonian and Callovian dinoflagellate cysts

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Л. Додекова — Динофлагеллатные цисты из бата — титона (юра) в Северной Болгарии. I. Таксономия батских и келловейских динофлагеллатных цист. В батских и келловейских отложениях в Северной Болгарии (в 70 разрезах скважин и 2 обнажениях) обнаружены богатые и часто хорошо сохранившиеся комплексы диноцист. В статье рассматривается таксономическое содержание установленных диноцист. Они распределены в 4 группы по типу археопиля: диноцисты с апикальным археопилем, диноцисты с интеркалярным археопилем, диноцисты с прецингулярным археопилем и диноцисты со смешанным типом археопиля. Описываются 86 видов, относящихся к 42 родам, многие из которых имеют исключительную биостратиграфическую ценность. Показано их географическое и стратиграфическое распространение в Болгарии. Роды следующие: *Adnatosphaeridium, Atopodinium, Belodinium, Chlamydophorella, Cleistosphaeridium, Compositosphaeridium, Dingodinium, Ellipsoidictyum, Escharisphaeridia, Kylindrocysta, Lagenadinium, Lithodinia, Parvulodinium, Rigaudella, Sentusidinium, Stephanelytron, Valensiella, Carpathodinium, Glomodinium, Kalyptea, Pareodinia, Tabulodinium* gen. n., *Aldorfia, Chytroeisphaeridia, Diacanthum, Gongylodinium, Gonyaulacysta, Heslertonia, Rhynchodiniposis, Scriniodinium, Tubotuberella, Ctenidodinium, Dodekovia, Eodinia, Korystocysta, Mendicodinium, Mosaicodinium* gen. n., *Nannoceratopsis, Polygonifera, Sirmiodiniopsis, Sirmiodinium, Wanaea.* Доминирующими в составе комплексов диноцист являются виды *Ctenidodinium, Lithodinia, Gonyaulacysta* и *Pareodinia.* Описываются следующие новые виды: *Tabulodinium senarium* sp. n. и *Polygonifera? aspera* sp. n., одна новая комбинация — *Mosaicodinium mosaicum* comb. n., а также *Lithodinia* sp. A и *Lithodinia* sp. B. Введен новый термин — „инклинация" — для определения характерного морфологического признака видов рода *Tubotuberella.*

Abstract. The Bathonian and Callovian sediments of North Bulgaria yielded rich and commoly well-preserved dinocyst assemblages. The assemblages studied are derived from 70 boreholes and 2 outcrops. In the present paper the taxonomy of the Bathonian and Callovian dinocysts established is considered. According to the archeopyle type they are divided into 4 groups: dinocysts with apical archeopyle, dinocysts with intercalary archeopyle, dinocysts with precingular archeopyle and dinocysts with combination archeopyle. 86 species belonging to 42 genera, a lot of them being of considerable biostratigraphic importance, are described. The geographic distribution and stratigrapic range in Bulgaria of these species are presented. The genera identified are: *Adnatosphaeridium, Atopodinium, Belodinium, Chlamydophorella, Cleistosphaeridium, Compositosphaeridium, Dingodinium, Ellipsoidictyum, Escharisphaeridia, Kylindrocysta, Lagenadinium, Lithodinia, Parvulodinium, Rigaudella, Sentusidinium, Stephanelytron, Valensiella, Carpathodinium, Glomodinium, Kalyptea, Pareodinia, Tabulodinium* gen. n., *Aldorfia, Chytroeisphaeridia, Diacanthum, Gongylodinium, Gonyaulacysta, Heslertonia, Rhynchodiniopsis, Scriniodinium, Tubotuberella, Ctenidodinium, Dodekovia, Eodinia, Korystocysta, Mendicodinium, Mosaicodinium* gen. n., *Nannoceratopsis, Polygonifera, Sirmiodiniopsis, Sirmiodinium, Wanaea.* Predominating in the composition of the dinocyst assemblages are the species of the genera *Ctenidodinium, Lithodinia, Gonyaulacysta* and *Pareodinia.* The following new species are described: *Tabulodinium senarium* sp n. and *Polygonifera? aspera* sp. n., a new combination — *Mosaicodinium mosaicum* comb. n., and *Lithodinia.* sp. A and *Lithodinia* sp. B. In order some characteristic morphological feature in the species of the genus *Tubotuberella* to be determined, a new term — inclination has been introduction.

Introduction

The Jurassic sediments of North Bulgaria are found in numerous boreholes referred to the searching of oil deposits. These sediments proved to contain differing in abundance and state of preservation dinoflagellate cyst assmeblages. Being a subject of continous and systematical research the dinocysts appeared to be one of the main fossil groups utilized in the development of the present views on the stratigraphy of the Jurassic System in North Bulgaria. Dinocysts have been found in 2 outcrops and 70 boreholes (fig. 1). The palynological-stratigraphic results of these investigations have been published in a series of articles by Dodekova in Сапунов et al. (1985), Сапунов et al. (1986a), Сапунов et al. (1986b), Сапунов, Чумаченко (1987). Sometimes, as is the case with the dolomites of the Drinovo Formation, the dinoflagellate cysts proved to be the only evidence for the dating the sediments (Dodekova in Николова, Сапунов, 1985).

The intensive palynological studies with stratigraphic purposes in view caused the delay in publishing the taxonomy of the Jurassic dinocysts. The present work, where the Bathonian and Callovian taxa are included, is the first of four articles dealing with the Bulgarian Bathonian — Tithonian dinoflagellate cysts. In the second and third articles the taxonomy respec-

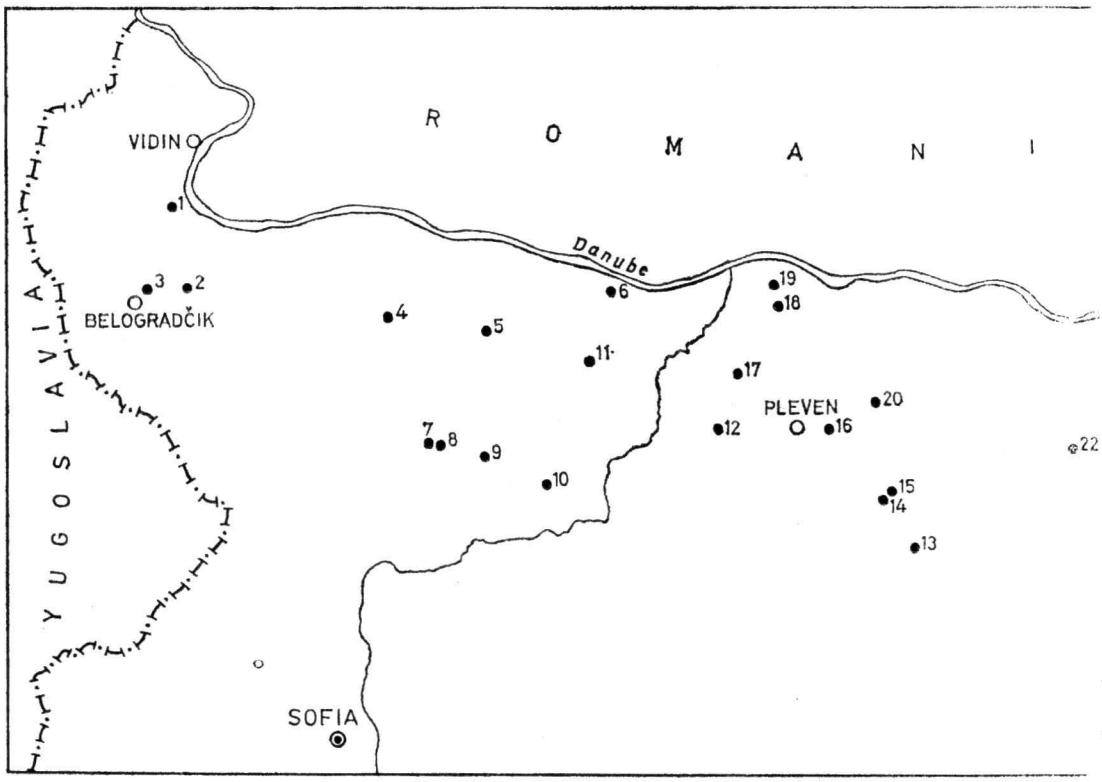
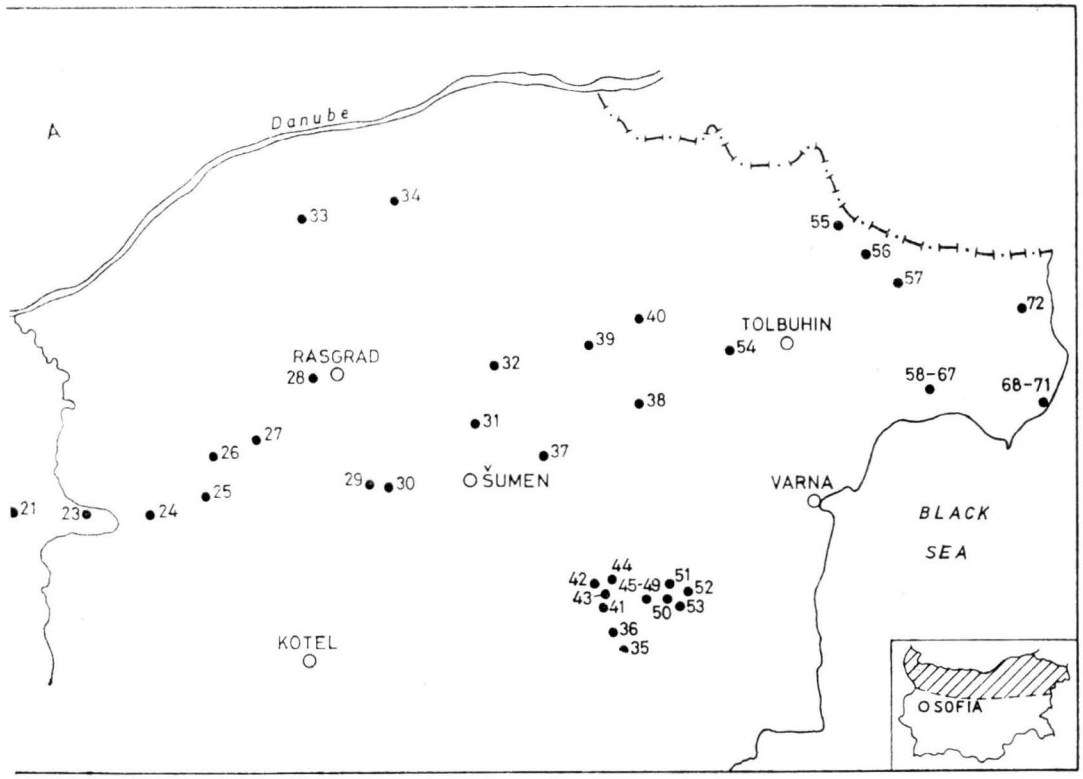


Fig. 1. Location of the studied boreholes and outcrops with Jurassic sediments
1 — R-1 Simeonovo, *2* — R-1 Bjalo pole; *3* — Town of Belogradčik, *4* — R-9 Septemvrijci, *5* — R-1 Hajredin, *6* — R-32 Selanovci, *7* — R-3 Čiren, 8—R-12 Čiren, *9*—R-10 Goljamo Peštene, *10* — R-7 Vârbica, *11* — R-1 Bârdarski geran, *12* — R-1 Dolni Dâbnik, *13* — R-2 Agatovo, *14* — R-4 Devetaki, *15* — R-5 Devetaki, *16* — R-2 Grivica, *17* — R-1 Trâstenik, *18* — R-3 Brest, *19* — R-2 Dâbovan, *20* — R-1 Slavjanovo, *21* — R-1 Resen, *22* — R-2hg Obedinenie, *23* — R-1 Jantra, *24* — R-1 Čapaevo, *25* — R-2 Vodica, *26* — R-2 Medovina, *27* — S-30 Kardam, 28 — S-1 Razgrad, *29* — R-3 Brjag, *30* — R-4 Vasil Levski, *31* — S-11 Hitrino, *32* — S-33 Esenica, *33* — R-1 Čerešovo, *34* — R-2 Preslavci, *35* — Eastern Stara Planina Mountain, Bala-

tively of the Oxfordian — Kimmeridgian and Tithonian dinocysts will be given. In the fourth article the biostratigraphic results in the chronostratigraphic interval under consideration will be summarized.

Taking into account the formal classification, which is being applied when describing fossil dinocysts, in the present work no supra-generic categories have been used. I agree with S t o v e r & E v i t t (1978, p. 8), that more of the supra-generic categories proposed are speculative and do not contribute for the formal classification to be brought closer to the biological classification of modern dinoflagellates. Accepted here is the suggested by them pragmatic ordering of taxa according to the archeopyle types — apical, intercalary, precingular and combination.

The terminology used by me when describing and figuring the species is partially complied with the one suggested by E v i t t et al. (1977). In accordance with N o r r i s (1978, p. 302, 303) and S a r j e a n t (1982b) I believe that some of the prefixes and sufixes introduced are unnecessarily making the text for hard reading and the words for hard pronouncing. The experience and knowledge accumulated in dealing with fossil finds are excluding the possibility that a palynologist would consider the fossil dinocysts to be living thecae. In parallel with the above I do use here the form and symbols of K o f o i d (1909), elaborated and made precise by E v i t t et al. (1977, p. 3), regarding the plate designation



ban Dere River, *36* — R-1 Komunari, *37* — S-21 Kalugerica, *38* — S-31 Esenica, *39* — S-24 Nikola Kozlevo, *40* — R-16h Orljak, *41* — R-9 Bozvelijsko, *42* — R-1 Hrabrovo, *43* — R-5 Tutrakanci, *44* — R-4 Mirovo, *45* — R-8 Sultanci, *46* — R-6 Sultanci, *47* — R-7 Sultanci, *48* — R-11 Žitnica, *49* — R-10 Padina, *50* — R-3 Junak, *51* — R-1 Junak, *52* — R-4 Junak, *53* — R-14 Grozdjovo, *54* — S-32 Dolina, *55* — S-12, Gornjak, *56* — S-9 Kardam, *57* — S-10 Černookovo, *58* — R-88 Caričino, *59* — R-87 Gurkovo, *60* — R-67 Makedonka, *61* — R-57 Makedonka, *62* — R-52 Vranino, *63* — R-55 Konare, *64* — R-53 Belgun, *65* — R-54 Gurkovo, *66* — R-109 Vranino, *67* — R-140A Makedonka, *68* — R-121 Gorun, *69* — R-3 Tjulenovo, *70* — R-1 Tjulenovo, *71* — R-7 Nonevo, *72* — R-1 Vaklino

of the tabulation and the tabulation formula, with which the palynological practice is connected for many years.

The taxa established, which I consider, are here not described in detail. In cases when my opinion differs from the one published by other palynologists, or there are debatable concepts concerning particular taxon in the literature, under the heading of "Comments" my own viewpoint is expressed.

When determining the stratigraphic range of the species I was sometimes lacking proper comparative biostratigraphic data, since finds of orthofossils in the boreholes are extremely scarce. All ammonite taxa (Сапунов et al., 1985; Сапунов et al., 1986a, 1986b; Сапунов, Чумаченко, 1987), found at the same or near the depth where dinocyst species were derived from, are noted under the heading of "Occurrence". The specified stratigraphic range of the lithostratigraphic unit including the dinoflagellate cysts is taken into account. The comprehensive European palynological literature, where the stratigraphic ranges of the dinocyst taxa are compared with the corresponding ammonite zones, has also been used.

Since the development of part of the taxa described has continued after the Callovian age, under a relevant heading all the available data for their occurrence are given. In the next publications such taxa are not going to be considered. Some of them are figured on the photoplates for being more suitable when illustrating the species in comparison with the Bathonian and Callovian specimens.

Refigured here are some of the type specimens of Bathonian dinocyst species published by Dodekova (1975).

All specimens illustrated are being kept in the collections of the Geological Institute, Bulgarian Academy of Sciences.

Taxonomy

Dinocysts with apical archeoplyle

Genus ***Adnatosphaeridium*** Williams & Downie, 1966

Type species (by original designation): *Adnatosphaeridium vittatum* Williams & Downie, 1966.

Adnatosphaeridum caulleryi (Deflandre, 1938b) Williams & Downie, 1969

Pl. I, fig. *1*

Type. Holotype illustrated by Deflandre (1938b, pl. 10, fig. 2, 3).

Comments. The type material of this species needs to be restudied, since it is bearring features characteristic for the genus *Systematophora* Klement, 1960 emend. Brenner, 1988. Similar observations are reported by Berger (1986, p. 336).

Occurrence. Boreholes: R-1 Žitnica (depth 1995.5—1998 m, Late Bathonian, Esenica Formation); R-9 Bozvelijsko (depth 2442.8 m, Late Bathonian, Polaten Formation); R-1 Junak (depth 1745.5 m, Early Callovian, Polaten Formation); R-3 Junak (depth 1792.1 m, Middle Callovian, Sultanci Formation; 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-7 Sultanci (depth 1924.5 m, Late Bathonian, Esenica Formation); R-1 Hrabrovo (depth 1974.5 m, Late Callovian, 1977.2 m, Middle Callovian, Sultanci Formation); S-11 Hitrino (depth 890 m, Early Callovian, Drinovo Formation); S-21 Kalugerica (depth 881 m, Early Oxfordian, Černookovo Formation); R-4 Mirovo (depth 1293 m, Kimmeridgian, Tiča Formation); R-1 Tjulenovo (depth 1010 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1265.7 m, Late Kimmeridgian — Early Tithonian, Černookovo Formation).

Genus ***Atopodinium*** Drugg, 1978

Type species (by original designation): *Atopodinium prostatum* Drugg, 1978.

Atopodinium prostatum Drugg, 1978

Pl. II, fig. *8*

Type. Holotype illustrated by Drugg (1978, pl. 1, fig. 1).

Comments. The Bulgarian specimens have 4 antapical lobes. The cingulum is divided into narrow rectangular plates though their exact number is not identified yet. The presence of posterior intercalary plate (lp), a triangular plate on the hypocyst (1'' or 2''), a posterior sulcal plate (lp), as well as some more complicated structure of the apex is admitted. The tabulation is very poorly marked and hardly identifiable.

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3185 m, Verenica Member of the Bov Formation); R-14 Grozdjovo (depth 2679 m, Late Bathonian — Early Callovian, Polaten Formation); S-1 Razgrad (depth 949.4 m, Esenica Formation, Early Callovian); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-9 Bozvelijsko (depth 2437 m, Middle Callovian, Sultanci Formation; depth 2444 m, Late Bathonian, Polaten Formation); S-11 Hitrino (depth 890 m, Early Callovian, Drinovo Formation); R-3 Brjag (depth 1280 m, Late Bathonian — Early Callovian, Polaten? Formation); R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1315.5 m, Late Bathonian, Dobrič Formation); R-67 Makedonka (depth 1375.7 m, Late Bathonian, Dobrič Formation); S-10 Černookovo (depth 944.6-949 m, Late Bathonian, Dobrič Formation).

Genus ***Belodinium*** Cookson & Eisenack, 1960b

Type species (by original designation): *Belodinium disculum* Cookson & Eisenack, 1960b.

Belodinium asaphum Drugg, 1978

Pl. I, fig. *7*

Type. Holotype illustrated by Drugg (1978, pl. 2, fig. 8).

Comments. The specimen figured has its operculum half-opened with short, inclined ventrally apical horn. The sutural ridge-like crests and the periphragm of the antapical pericoel have different in size perforations.

Occurrence. Boreholes: R-3 Čiren (depth 1292.5-1293.5 m, Late Callovian, Javorec Formation); R-3 Junak (depth 1785.3 m, Late Callovian — Early Oxfordian, Provadija Formation); R-7 Sultanci (depth 1895 m, Late Callovian, Sultanci Formation); R-8 Sultanci (depth 1964 m, Early Oxfordian, Provadija Formation); S-140A Makedonka (depth 1314.8 m, Late Callovian, Provadija Formation); R-9 Kardam (depth 877.5-878 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 752.8 m, Early Oxfordian; depth 756.6 m, Late Callovian, Černookovo Formation); S-32 Dolina (depth 743 m, Early Oxfordian, *Creniceras* cf. *renggeri* (Oppel, 1863), *C. renggeri* Zone, Černookovo Formation)

Belodinium obsoletum Dodekova, 1975

Pl. X, fig. *1*

Type. Holotype illustrated by Dodekova (1975, pl. 4, figs 1-4).

Comments. Stover & Helby (1987, p. 277) transferred *B. obsoletum* to the genus *Clathroctenocystis* Wiggins, 1972, which is here rejected. Genus *Clathroctenocystis* is a proximate cyst, in which the two wall layers are closely stuck to one another. There is small pericoel at the apical horn and the antapex. In fact, the epicyst pericoel of the Bulgarian species has its base larger versus the one of the type species *B. disculum*. It is also hard to be identified whether the granules on the endocyst, marked by Dodekova (1975, p. 24), are penitabular like those of the type species. All the Bulgarian specimens are quite vague and difficult to be studied. At the same time, the new Australian species *B. nereidis* Stevens & Helby, 1987 (p. 166) has, too, scarcely discernible penitabular ornamentation and varying relationships between its endocyst, cingulum and antapical pericoel. So far, I keep up *B. obsoletum* referred to the genus *Belodinium* until some additional morphological data are found.

Occurrence. Boreholes: R-9 Septemvrijci (depth 3686 m, Early Callovian, Verenica Member of the Bov Formation); R-14 Grozdjovo (depth 2679 m, Late Bathonian — Early Callovian, Polaten Formation); R-1 Junak (depth 1746.5 m, Late Bathonian, Polaten Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-1 Tjulenovo (depth 1010, Late Bathonian, Dobrič Formation); R-67 Makedonka (depth 1375.7 m, Late Bathonian, Dobrič Formation) and the boreholes studied by Dodekova (1975, p. 24).

Genus ***Chlamydophorella*** Cookson & Eisenack, 1958

Type species (by original designation): *Chlamydophorella nyei* Cookson & Eisenack, 1958.

Chlamydophorella raritubulae Dodekova, 1975

Pl. X, fig. *16*

Type. Holotype illustrated by Dodekova (1975, pl. 6, figs 13,14).

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-9 Septemvrijci (depth 3686 m, Early Callovian, Verenica Member of the Bov Formation); S-1 Razgrad (depth 949.4 m, Early Callovian, Esenica Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); S-31 Esenica (depth 756.5 m, Late Callovian, Černookovo Formation); S-10 Černookovo (depth 944.6-954 m, Late Bathonian, Dobrič Formation).

Chlamydophorella sp. SA Smelror, 1988a

Pl. I, figs *10, 11*

1988a. *Chlamydophorella* sp. SA Smelror, 1988a; p. 285. pl. 2. Fig. 12; pl. 4, fig. 6.
1988b. *Chlamydophorella ectotabulata* Smelror; Fig. 10B (nomen nudum).

Comments. Smelror (1988a) has figured *Chlamydophorella* sp. SA giving its dimensions and stratigraphic range. The same year Smelror (1988b) figures the same species as *Chlamydophorella ectotabulata* Smelror citing the previous publication. Type, diagnosis and description are not given so, according to CBN *C. ectotabulata* is nomen nudum. The Bulgarian Late Bathonian and Early Callovian dinocyst assemblages are abundant of specimens of this species.

Occurrence. Boreholes: R-1 Junak (depth 1746.5-1753 m, Late Bathonian, Polaten Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esencica — Polaten Formation); R-7 Sultanci (depth 1920-1924.5 m, Late Bathonian, Esenica Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation); R-109 Vranino (depth 1315.5-1319 m, Late Bathonian, Dobrič Formation; depth 1319-1323 m, Late Bathonian, Esenica Formation); R-67 Makedonka (depth 1375.7 m, Late Bathonian, Dobrič Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Dobrič Formation).

Genus ***Cleistosphaeridium*** Davey et al., 1966

Type species (by original designation): *Cleistosphaeridium diversispinosum* Davey et al., 1966.

Cleistosphaeridium polytrichum (Valensi, 1947) Davey et al., 1969

Pl. II, fig. *3*

Type. Holotype illustrated by Valensi (1947, p. 818, text-fig. 4).

Occurrence. Boreholes: R-1 Junak (depth 1744 m, Middle Callovian, Sultanci Formation); R-3 Junak (depth 1792.1 m, Middle Callovian, Sultanci Formation; depth 1792.2 m, Early Callovian, *Macrocephalites* sp.indet., Esenica—Polaten Formation); R-8 Sultanci (depth 1964 m, Early Oxfordian, Provadija Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation); R-9 Kardam (depth 877.5 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 756.5 m, Late Callovian, Černookovo Formation); S-33 Esenica (depth 756.5 m, Early Oxfordian, Černookovo Formation); R-5 Tutrakanci (depth 1765 m, Early Oxfordian, Provadija Formation); R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation) and the boreholes studied by Dodekova (1971; 1975).

Cleistosphaeridium tribuliferum (S a r j e a n t, 1962a) D a v e y et al., 1969

Pl. II, fig. *4*

T y p e. Holotype illustrated by S a r j e a n t (1962a, pl. 70, fig. 4).

O c c u r r e n c e. Boreholes: S-31 Esenica (depth 756.5 m, Late Callovian, Černookovo Formation); S-21 Kalugerica (depth 895.5 m, Callovian, Černookovo Formation); R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1291.6-1293.8 m, Late Oxfordian, Černookovo Formation).

Cleistosphaeridium varispinosum (S a r j e a n t, 1959) W o o l l a m & R i d i n g, 1983

Pl. II, fig. *6*

T y p e. Holotype illustrated by S a r j e a n t (1959, pl. 13, fig. 7).

O c c u r r e n c e. Abundant in borehole R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation).

Genus ***Compositosphaeridium*** D o d e k o v a, 1974

T y p e s p e c i e s (by original designation): *Hystrichosphaeridium costatum* D a v e y & W i l l i a m s, 1966. This species is a junior subjective synonym of *Hystrichosphaeridium polonicum* G ò r k a, 1965.

In accordance with Article 7.2 of CBN, which states: "A nomenclatural type (typus) is that element to which the name of a taxon is permanently attached, whether as a correct name or as a synonym. The nomenclatural type is not necessarily the most typical or representative element of a taxon", the name of the type species has to be preserved according to the original designation regardless of it being a subjective junior synonym of *H. polonicum*.

After Article 70 of ICBN, when a type species is junior subjective synonym it can be replaced by the senior subjective synonym, by following a decision of the International Commission on Zoological Nomenclature based on a proposal of some revising author.

The designation of *Compositosphaeridium bulgaricum* E r k m e n & S a r j e a n t, 1980 as a type species of the genus *Compositosphaeridium* is failing to meet the requirements of both the codes for the designation of type species is to be a single nomenclature act.

C o m m e n t s. Genus *Compositosphaeridium* was originally erected by D o d e k o v a (1974) on the basis of Bulgarian Late Bathonian — Early Callovian dinocysts, referred here to be conspecific with *Hystrichosphaeridium costatum* D a v e y & W i l l i a m s, 1966, the latter being designated by me as type species of the new genus. An year earlier G ò r k a (1965, p. 306, pl. 3, figs 5,6) has described a new species *Hystrichosphaeridium polonicum*, morphologically identical with *H. costatum*. When introducing the new genus I was aware of the great resemblance between the two species "*polonicum*" and "*costatum*", I knew about the emendation of B e j u (1971, p. 292) who has stated that *H. costatum* is a junior subjective synonym of *H. polonicum*, bu tI was misled by the determination of the species *C. costatum* made by G ò r k a (1970, p. 489), who without comparing the latter with the proposed by herself *H. polonicum*, has incorrectly assigned it to the genus *Cordosphaeridium*.

Later on E r k m e n & S a r j e a n t (1980, p. 67) referred *H. polonicum* to the genus *Compositosphaeridium*, considering it to be a senior synonym of *H. costatum*. As type species of the genus *Compositosphaeridium*, E r k m e n & S a r j e a n t (1980, p. 66) have set up new species *C. bulgaricum* based on the Bulgarian specimens and the description of *C. costatum* made by D o d e k o v a (1974, p. 26). S a r j e a n t (1978, p. 27) and E r k m e n & S a r j e a n t have pointed out some differences in the morphology of both species — "*bulgaricum*" and " *polonicum*", which do not sound conclusive.

Compositosphaeridium polonicum (G ò r k a, 1965) E r k m e n & S a r j e a n t, 1980

Pl. III, figs *6, 9, 11*

1980. *Compositospharidium polonicum*; E r k m e n & S a r j e a n t, p. 67, pl. 8, fig. 13, cum. syn.
1980. *Compositosphaeridium bulgaricum*; E r k m e n & S a r j e a n t, p. 66.

1983. *Compositosphaeridium polonicum*; Woollam & Riding, pl. 5, fig. 2.
1984. *Compositosphearidium polonicum*; Riding, pl. 1, fig. 13.
1987. *Compositosphaeridium polonicum*; Riding, fig. 9/8.

Type. Holotype illustrated by Gorka (1965, pl 3, fig. 5)

Comments. Numerous specimens of *C. polonicum* have been recorded in the continuous succession of dinoflagellate assemblages from the Late Bathonian to the Early Kimmeridgian. Within this stratigraphic range all the forms have their morphology identical, but their view depends on the state of preservation of the fossil material. The septae and trabeculae described by me are inconstant, hard to be identified and can be observed in well-preserved specimens, and under high microscopic magnification. Generally, the longer spines in the distal end of the processes, that are being mentioned by all the authors, are in the majority of cases remnants from torn trabeculae. The pointed by me 12 compound tubes of the polytubular processes are observed in rare, extreme specimens. Normally, the components together with the mentioned monotubes and bitubes of the sulcus and the posterior intercalary processes are varying in number from 2 to 5-8. In the type material of *C. polonicum* Gòrka (1965, pl. 3, fig. 6), in the proximal end of the central process one can see 4-5 composite tubes positioned just on one side of the process. The orientation of the cysts has a strong bearing when the differences in the cross-sections of the processes are to be assessed. Depending on the plate dimensions in proximate cysts, narrower processes are predominating ventrally and larger ones — dorsally (Dodekova, 1974, p. 27). When describing the Oxfordian forms of *H. salpingophorum* Deflandre (1938, p. 34) has mentioned the variations in diameter of the processes in one and the same specimen, as well as between different specimens. The variations in the dimensions of the processes noted by Erkmen & Sarjeant are not real as can be seen from the following comparisons (in μm): diameter of the central body — Deflandre (1938) up to 50; Gòrka (1965) 20.88-34.18; Devey & Williams (1966) 47; Dodekova (1974) 42-55; Erkmen & Sarjeant (1980) 35-54; length of processes — Deflandre (1938) up to 25; Gòrka (1965) 13.92-19.24; Davey & Williams (1966) 19-28; Dodekova (1974) 17-23; Erkmen & Sarjeant (1980) 12-28; Gòrka (1970) respectively — 37.5-50 and 17.5-22.5. Sarjeant (1978, p. 27) has pointed the following features to be essential when distinguishing *C. polonicum* from *C. bulgaricum*: (a) polygonal cross-section of the polytubes in the latter. In most of the references, included by Erkmen & Sarjeant (1980, p. 67) in the synonymy of *C. polonicum*, the specimens illustrated have the same cross-section (Deflandre, 1938, pl. 10, figs 1-3; Klement, 1960, pl. 7, figs 3-5, text-fig. 31; Gòrka, 1965, pl. 3, figs 5, 6; 1970, pl. 5, fig. 1, pl. 6, fig. 7; Davey & Williams, 1966, pl. 10, fig. 4; Beju, 1971, pl. 5, fig. 3 and Erkmen & Sarjeant, 1980, pl. 8, fig. 13); (b) the cingular processes of *C. bulgaricum* are variable. The identification of variations in the cingular processes depends on the proper orientation of the specimen and the state of preservation of the fossil material. A deeply branched cingular process is mentioned by Davey & Williams (1966, p. 63). Similar processes can be seen on Deflandre's (1938, pl. 10, figs 2, 3) microphotographs and partly in Woollam & Riding (1983, pl. 5, fig. 2); Presence of septae, uniting adjacent processes in *C. bulgaricum*. Describing the septae Dodekova has noted: "Upon the ribs septae of different height develop. . . The septae are very fine and may remain unnoticed under the microscope by small augmentation. In some individuals well-developed septae are lacking, even the ribs upon the processes can be confined in their proximal end."

Finally, Erkmen & Sarjeant have noticed: "It should be noted that L. Dodekova herself recognized this difference, since she did not include the forms she described in 1967 into the synonymy of *Compositosphaeridium*". I admit that they had in mind the synonymy of *C. costatum*, which Dodekova (1974, p. 26) has accepted in full from Sarjeant (1972, p. 44, 45) "cum. syn." and where the latter has included the determined by Dodekova (1967, P; 22, 23, pl. 3, figs. 4, 5) *Hystrichosphaeridium salpingophorum* Deflandre, 1938.

Due to all stated above *C. bulgaricum* proved to be a junior subjective synonym of *C. polonicum*. If both species are to be preserved they will represent completely stratigraphic taxa.

Occurrence. Boreholes: R-5 Devetaki (depth 2951-2955.5 m, Middle Callovian, Verenica Member of the Bov Formation); R-9 Septemvrijci (depth 3686 m, Early Callovian, Verenica Member of the Bov Formation); R-32 Selanovci (depth 3026.9 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-14 Grozdjovo (depth 2659 m, Late Callovian, Provadija Formation); S-1 Razgrad (depth 919.4-943 m, Oxfordian — Kimmeridgian, Drinovo Formation); R-1 Junak (depth 1739 m, Late Callovian, Provadija Formation); Middle Callovian, Sultanci Formation; depth 1745.5-1746.5 m, Late Bathonian — Early Callovian, Polaten Formation; depth 1748-1750 m, Late Bathonian, Polaten Formation); R-3 Junak (depth 1785.3 m, Late Callovian — Early Oxfordian, Provadija Formation; depth 1791.2 m, Late Calovian — Oxfordian, *Lacunosella* cf. *aroloca* (Oppel, 1865), *L. aroloca* Zone, Sultanci Formation; depth 1792.1 m, Middle Callovian, Sultanci Formation: depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation; depth 1795.5-1801.5 m, Late Bathonian, Esenica — Polaten Formation); R-4 Junak (depth 1789 m, Callovian, at depth 1790.5 m, *Hecticoceras (Lunuloceras)* cf. *pseudopunctatum* (Lahusen, 1883), Sultanci Formation); R-7 Sultanci (depth 1896 m, Middle Callovian, Sultanci Formation); R-9 Bozvelijsko (depth 2437 m, Middle — Late Callovian, Sultanci Formation); R-11 Žitnica (depth 1998 m, Late Bathonian — Early Callovian, Esenica Formation); R-1 Hrabrovo (depth 1974.5 m, Late Callovian; depth 1977.2 m, Middle Callovian, Sultanci Formation); S-9 Kardam (depth 872.2-879 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 753.6 m, Early Oxfordian; depth 756.5 m, Late Callovian, Černookovo Formation); S-21 Kalugerica (depth 881-889 m, Early Oxfordian, Černookovo Formation); R-5 Tutrakanci (depth 1765 m, Early Oxfordian, Provadija Formation); R-3 Brjag (depth 1278 m, Middle Callovian, Černookovo Formation); S-24 Nikola Kozlevo (depth 659-670.8 m, Early Kimmeridgian, Černookovo Formation); S-30 Kardam (depth 1104 m, Early Kimmeridgian; depth 1115 m, Oxfordian, Drinovo Formation); R-3 Tjulenovo (depth 963.4 m, Late Callovian, Černookovo Formation); R-1 Tjulenovo (depth 1008-1010 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1298-1303 m, Early Oxfordian, *Neocampilites (Neocampilites)* cf. *helveticus* (Jeannet, 1951), Provadija Formation; depth 1311-1315 m, Late Bathonian — Early Callovian, Dobrič Formation); R-67 Makedonka (depth 1375 m, Late Bathonian, Dobrič Formation) and the boreholes published by Dodekova (1967; 1975).

Genus ***Dingodinium*** Cookson & Eisenack, 1958

Type species (by original designation): *Dingodinium jurassicum* Cookson & Eisenack, 1958.

Dingodinium minutum Dodekova, 1975

Pl. VII. figs *9—11*

Type. Holotype illustrated by Dodekova (1975, pl. 5, figs 13-15).

There is a misprint in the description of the species. The tabulation formula should be read: ?4′, ?a, 6″, 5‴, lp, 1⁗. Sarjeant (1978, p. 33) corrected the misprinted formula as follows: ?4′, ?2a, 6″, 5‴, 1p, 1⁗. Since it is noticed that all specimens of the type collection are with apical archeopyle, the inclusion of two superior intercalary plates appears to be inconsequent. The superior intercalary plates are pointed by Fensome (1979, p. 54) to be one of the differences distinguishing *D. minutum* from *Ambonosphaera callo-viana* Fensome, 1979. Both species bear strong resemblance in their general shape, ornamentation of the two layers, archeopyle type and dimensions. The former, however, is markedly asymmetrically cavate with higly developed ventro-antapical pericoel, with dorsally closely appressed endophragm and periphragm, and sometimes linearly ordered ornaments upon the two endophragm. The latter features are characteristic for the genus *Dingodinium*, as noted in the modern revisions of this genus made by Stover & Helby (1987, pp. 281, 282). They mention the genus to be laterally flattened, something which has hitherto not been observed in *D. minutum*.

Occurrence. Boreholes: R-14 Grozdjovo (depth 2659 m, Late Callovian, Provadija Formation); S-1 Razgrad (949.4 m, Early Callovian, Esenica Formation); R-1 Junak (depth 1739 m, Late Callovian, at depth 1739.8 m, *Hecticoceras (Jeanneticeras)* cf. *pleurospanium* (Parona & Bonarelli, 1985) is found, Provadija Formation; depth 1745.5 m, Late Bathonian — Early Callovian, Polaten Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-7 Sultanci (depth 1895 m, Late Callovian, Sultanci Formation); R-9 Bozvelijsko (depth 2437 m, Middle — Late Callovian, Sultanci Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation); S-9 Kardam (depth 877.5 m, Early Oxfordian, Černookovo Formation); S-33 Esenica (depth 744.3 m, Oxfordian — Kimmerid-

gian, Černookovo Formation); S-21 Kalugerica (depth 884.4 m, Early Oxfordian, Černookovo Formation; depth 891.5 m, Middle Callovian, Černookovo Formation); R-1 Tjulenovo (depth 1010-1017.4 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1311-1315.5 m, Late Bathonian — Early Callovian, Dobrič Formation) and the boreholes published by D o d e k o v a (1975).

Dingodinium harsveldtii H e r n g r e e n et al., 1984

Pl. I, figs *8, 9*

T y p e. Holotype illustrated by H e r n g r e e n et al. (1984, pl. 1, 1, figs. 4, 5).

C o m m e n t s. The Bulgarian specimens coincide with the type material in their dimensions, general shape, lack of distinct tabulation, except for the cingulum and the archeopyle, but differ in having better formed granulate ornaments on the endophragm.

O c c u r r e n c e. Boreholes: R-3 Čiren (depth 1292-1293.5 m, Middle — Late Callovian, Javorec Formation); R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-7 Sultanci (depth 1895 m, Late Callovian, Sultanci Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian Sultanci Formation).

Genus ***Ellipsodictyum*** K l e m e n t, 1960

Type species (by original desingation): *Ellipsoidictyum cinctum* K l e m e n t 1960

Ellipsoidictyum cinctum K l e m e n t, 1960

Pl. I, fig. *17*

T y p e. Holotype illustrated by K l e m e n t (1960, pl. 6, figs 15, 16).

O c c u r r e n c e. Boreholes: R-14 Grozdjovo (depth 2679 m, Late Bathonian — Early Callovian, Polaten Formation); S-1 Razgrad (depth 949.4 m, Early Callovian, Esenica Formation); R-1 Junak (depth 1745.5 m-Late Bathonian — Early Callovian; depth 1753 m, Late Bathonian, Polaten Formation); R-3 Junak (depth, 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-6 Sultanci (depth 1960 m, Late Bathonian, Esenica — Polaten Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation); R-9 Kardam (depth 8775 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 752.8 m, Early Oxfordian, Černookovo Formation); S-33 Esenica (depth 744.3-756 m, Early Oxfordian — Kimmeridgian, Černookovo Formation); S-11 Hitrino (depth 892.9 m, Callovian, Drinovo Formation); S-21 Kalugerica (depth 884.4-891 m, Middle Callovian — Early Oxfordian, Černookovo Formation); R-5 Tutrakanci (depth 1765 m, Early Oxfordian, Provadija Formation); R-3 Brjag (depth 1280 m, Late Bathonian — Early Callovian, ?Polaten Formation); S-30 Kardam (depth 1111.3-1114.9 m, Oxfordian, Drinovo Formation); R-1 Tjulenovo (depth 1117.4 m, Late Bathonian, Dobrič Formation).

Ellipsoidictyum cinctum "Form A" G o c h t, 1970

Pl. I, fig. *3*

O c c u r r e n c e. Borehole: R-6 Sultanci (depth 1960 m, Late Bathonian, Ecenica — Polaten Formation).

Ellipsoidictyum gochtii F e n s o m e, 1979

Pl. I, figs *14, 15*

T y p e. Holotype illustrated by F e n s o m e (1979, pl. 2, figs 8, 9, 11, 12; text-fig. 8).

O c c u r r e n c e. Boreholes: R-1 Junak (depth 1745.5 m, Late Bathonian — Early Callovian, Polaten Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation)

Ellipsoidictyum reticulatum (V a l e n s i, 1953) L e n t i n & W i l l i a m s, 1977b

Pl. I, figs *4, 5*

T y p e. Holotype illustrated by V a l e n s i (1953, pl. 2, figs 4, 5; pl. XIII, fig. 6).

O c c u r r e n c e. Boreholes: S-12 Gornjak (depth 852.2 m, ?Early Callovian, Dobrič Formation); S-10 Černookovo (depth 944.6-949 m, Late Bathonian, Dobrič Formation).

Genus ***Escharisphaeridia*** Erkmen&Sarjeant, 1980

Type species (by original designation): *Chytroeisphaeridia pococki* Sarjeant, 1968.

Escharisphaeridia pococki (Sarjeant, 1968) Erkmen&Sarjeant, 1980

Pl. II, fig. *9*

Type. Holotype illustrated by Sarjeant (1968, pl. 3, fig. 9).

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); S-1 Razgrad (depth 949.4 m, Early Callovian, Esenica Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-3 Tjulenovo (depth 953-954.4 m, Oxfordian, Černookovo Formation); S-32 Dolina (depth 743 m, Early Oxfordian, Černookovo Formation); S-12 Gornjak (depth 852.2 m, ?Early Callovian, Dobrič Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation).

Genus ***Kylindrocysta*** Fenton, Neves&Piel, 1980

Type species (by original designation): *Kylindrocysta spinosa* Fenton, Neves& Piel, 1980

Kylindrocysta spinosa Fenton, Neves&Piel, 1980

Pl. II, fig. *7*

Type. Holotype illustrated by Fenton, Neves&Piel (1980, pl. 14, fig. 13).

Occurrence. Boreholes: R-16h Orljak (depth 779-784 m, Middle Bathonian, Esenica Formation); R-12 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); R-1 Čerešovo (depth 1128.8-1130 m, Middle Bathonian, Esenica Formation).

Genus ***Lagenadinium*** Piel, 1985

Type species (by original designation): *Lagenadinium callovianum* Piel, 1985.

Lagenadinium callovianum Piel, 1985

Pl. I, fig. *6*

Type. Holotype illustrated by Piel (1985, pl. 1, figs 1-6).

Comments. Numerous specimens of *L. callovianum* are included in the Jurassic dinocyst assemblages in Bulgaria. A number of variations in the morphology, exclusively well described by Piel (1985), like shape and length of the apical horn, shape and dimensions of the coronas (one or two), as well as their proximity one beside the other are here confirmed. All that is represented in the framework of a quite noticeable intraspecific variation.

Occurrence. Boreholes: R-5 Devetaki (depth 2951-2955 m, Middle Callovian, Verenica Member of the Bov Formation); R-1 Junak (depth 1744 m, Middle Calovian, Sultanci Formation); R-3 Junak (depth 1785.3 m, Late Callovian — Early Oxfordian, Provadija Formation; depth 1792.1, Middle Callovian, Sultanci Formation; depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-1 Hrabrovo (depth 1974.5 m, Late Callovian, depth 1977.2 m, Middle Callovian, Sultanci Formation); R-7 Sultanci (depth 1920-1921 m, Late Bathonian, Esenica — Polaten Formation); R-9 Kardam (depth 878 m, Early Oxfordian, Černookovo Formation); R-3 Brjag (depth 1278.8 m, Middle Callovian, Černookovo Formation).

Genus ***Lithodinia*** Eisenack, 1935 emended Gocht, 1975b

1966. *Meiourogonyaulax* Sarjeant, p. 144

Type species (by original designation): *Lithodinia jurassica* Eisenack, 1935 emended Gocht, 1975b.

C o m m e n t s. The study of G o c h t ' s microphotographs of the type species and the abundant Bulgarian material suggest a correction in the tabulation formula to be made. One (?two) small preapical plate — 1pr — in the center of the apex is observed (G o c h t, 1975b abb. 11, 12, 23a; same work — pl. III, fig. 5). A small prolonged, nearly rectangular plate — 1''' from the postcingular series, ahead of the triangular plate — 2''' is available (G o c h t, 1975b, abb. 4, 5). It is located under the cingulum and is not one of the sulcal plates. Such interpretation of the hypocyst tabulation has also been made by I o a n n i d e s et al. (1976, p. 457, text-fig. 11). Regarding the foresaid corrections, the tabulation formula proves to be the following: 1—?2pr, 4', 6'', 6c, 6''', 1p, 1'''', 0-6s.

In the present taxonomic analysis I am taking the view of G o c h t (1975b, pp. 344, 345, 353, 354) F e n t o n, (1981, pp. 250, 251) and R i l e y & F e n t o n (1982, p. 200), that the genus *Meiourogonyaulax* S a r j e a n t, 1966 is a junior subjective synonym of the genus *Lithodinia*. Both genera have identical morphological features and stratigraphic range. The differences in their sutural elements, emphasized by S t o v e r & E v i t t (1978 p. 63), are on a species level. In S a r j e a n t ' s (1966, p. 144) original diagnosis of the' genus *Meiourogonyaulax* and in the one emended by G o c h t (1975, p. 353) for the genus *Lithodinia*, the sutural elements are synonymously defined. The state of the operculum has been discussed by F e n t o n (1981, pp. 250, 251) who stressed, that S a r j e a n t (1966, p. 144) admitted the operculum in the type species of the genus *Meiourogonyaulax* to be disintegrating and 1' — the first apical plate to be staying in place. In the Bulgarian dinocyst assemblages species with disintegrating operculum, as well as ones with monolitic operculum are recorded. I consider the archeopyle type to be the prime generic taxonomic criterion. In the argument around the genera discussed above, the archeopyle is defined as apical, type "A" with variable operculum, referred to as "interesting curiosities or variations" (S t o v e r & E v i t t, 1978, p. 9).

Lithodinia jurassica E i s e n a c k, 1935 emended G o c h t, 1975b

Pl. III, fig. *5*

T y p e. Holotype of the species refigured by E i s e n a c k (1936, pl. 4, fig. 4) and by G o c h t (1975b, fig. 22).

O c c u r r e n c e. Boreholes: R-12 Čiren (depth 1815-1817. 5m, Early Callovian, Verenica Member of the Bov Formation); R-1 Bărdarski geran (depth 3185-3188 m, Verenica Member of the Bov Formation); R-32 Selanovci (depth 3026.9 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); S-1 Razgrad (depth 949.4 m, Early Callovian, Esenica Formation); R-1 Junak (depth 1739 m, Late Callovian, Provadija Formation; depth 1746.5 m Late Bathonian, Polaten Formation); R-3 Junak (depth 1792,2 m, Early Callovian *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-6 Sultanci (depth 1960-1968 m, Late Bathonian, Esenica — Polaten Formation); R-7 Sultanci (depth 1896 m, Middle Callovian, Sultanci Formation; depth 1915.5-1924.5. m, Late Bathonian, Esenica — Polaten Formation); R-8 Sultanci (depth 1964 m, Early Oxfordian, Provadjia Formation; depth 1977.5 m, Late Bathonian, Esenica Formation); R-11 Žitnica (depth 1995.5 m, Late Bathonian — Early Callovian, Esenica Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); S-11 Hitrino (depth 891.3 m, Callovian, Drinovo Formation); R-3 Brjag (depth 1280 m, Late Bathonian — Early Callovian, ?Polaten Formation); S-24 Nikola Kozlevo (depth 718.9-724 m, Bathonian, Esenica Formation); R-1 Tjulenovo (depth 1008-1017. 4 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1315.5 m, Late Bathonian — Early Callovian, Dobrič Formation); R-67 Makedonka (depth 137.7-1381 m, Late Bathonian, Dobrič Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Esenica Formation).

Lithodinia borealis (S a r j e a n t, 1980b) R i l e y & F e n t o n, 1982

Pl. III, fig. *3*; pl. X, fig. *14*

T y p e. Holotype illustrated by S a r j e a n t (1972, pl. 5, fig. 3) as *Meiourogonyaulax decapitata* (W. W e t z e l, 1967).

C o m m e n t s. Operculum disintegrating in separate plates (F e n t o n, 1981, pl. 3, fig. 1; this paper, pl. 10, fig. 14).

Occurrence. Boreholes: R-3 Junak (depth 1797-1801 m, Late Bathonian, Esenica — Polaten Formation); R-7 Sultanci (depth 1924.5 m, Late Bathonian, Esenica — Polaten Formation); R-9 Bozvelijsko (depth 2442.8-2444.4 m, Late Bathonian, Polaten Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); S-21 Kalugerica (depth 904-908.5 m, Bathonian, Esenica Formation); R-1 Tjulenovo ; (depth 1010-1011.5 m, Late Bathonian, Dobrič Formation).

Lithodinia insulofigurata (Dodekova, 1975) Lentin & Williams, 1977b

Pl. X, fig. *10*

Type. Holotype illustrated by Dodekova (1975, pl. 2, figs 4, 5).

Occurrence. Boreholes: S-10 Černookovo (depth 946.0-948 m, Late Bathonian, Dobrič Formation); S-33 Esenica (depth 778.5 m, Bathonian, Esenica Formation); R-109 Vranino (depth 1315.5 m, Late Bathonian — Early Callovian, Dobrič Formation).

Lithodinia reticulata (Dodekova, 1975) Lentin & Williams, 1977b

Pl. X, fig. *5*

Type. Holotype illustrated by Dodekova (1975, pl. 2, figs 11, 12).

Occurrence. Boreholes: S-1 Esenica (depth 756.5 m, Late Callovian, Černookovo Formation); S-33 Esenica (depth 759.7 m, Late Callovian, Černookovo Formation); R-121 Gorun (depth 1420 m, Late Bathonian, Esenica Formation); S-21 Kalugerica (depth 904 m, Late Bathonian, Esenica Formation) and the boreholes published by Dodekova, (1975).

Lithodinia cf. ***superornata*** (W. Wetzel, 1967) Fenton, 1981

Pl. III, fig. *4*

Type. Holotype illusrated by Sarjeant (1980b, pl. 1, figs 1, 2, text-fig. 4) as *Meiourogonyaulax superornata.*

Comments. The Bulgarian species is bearing resemblance with *L. superornata* in its general habitus, high strongly perforated sutural septae and narrow antapex. The antapical plate is small, markedly inclined ventrally. *L. superornata* has shorter epicyst and entire distal ribs on the sutural septae. The designated by Sarjeant (1980b, p. 122, text-fig. 4) second posterior plate — 2p and transversely positioned sulcal plates are here not identified. The sulcus in the Bulgarian specimens is subdivided according to the standard "*gonyaulax*" type, but the exact number of sulcal plates could not be determined — 4-6s.

Occurrence. Boreholes: R-1 Junak (depth 1746.5 m, Late Bathonian — Early Callovian, Polaten Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-6 Sultanci (depth 1960 m, Late Bathonian, Esenica Formation); R-8 Sultanci (1977.5 m, Late Bathonian, Esenica Formation).

Lithodinia valensii (Sarjeant, 1966) Lentin & Williams, 1977

Pl. IX, fig. *13*

Type. Holotype illustrated by Sarjeant (1966, pl. 15, fig. 7).

Occurrence. Boreholes: R-1 Dolni Dăbnik (depth 2720 m, Early Bathonian, Polaten Formation); R-16h Orljak (depth 797 m, Middle Bathonian, Esenica Formation); S-31 Esenica (depth 779 m, Middle Bathonian, Esenica Formation); S-33 Esenica (depth 784.8-805 m, Early — Middle Bathonian, Esenica Formation); S-21 Kalugerica (depth 904 m, Middle Bathonian, Esenica Formation).

Lithodinia A sp.

Pl. II, figs *10-12*

Description. Cyst proximate, subspherical to polygonal in ambitus. Epicyst shorter than hypocyst. The wall is two-layered, both layers closely appressed with low fibrous filling in between. The periphragm is microperforated. Cingulum and sulcus large. Tabulation indicated by broad fibrous ribbon-shape septae, 3-4 μm high. Proximally they are

broader (4-6 m), distally becoming narrower. The largest septae are located around the antapical plate and dorsally upon the hypocyst. Narrowest are these around the cingulum. Tabulation formula: 1pr, 4′, 6″, 6c, 6‴, 1p, 1⁗, ?4-6 s. Archeopyle — apical, type A with monolithic operculum.

Dimensions (in μm). Length (apex lacking) — 56, breadth — 62μm.

Occurrence. Boreholes: R-67 Makedonka (depth 1370.8 m, Late Bathonian, Dobrič Formation); S-11 Hitrino (depth 890 m, Early Callovian, Drinovo Formation); S-12 Gornjak (depth 852.2 m, ?Early Callovian, Dobrič Formation).

Lithodinia sp. B

Pl. III, fig. *1, 2*

Description. Cyst proximate, subspherical to polyedrical. Cingulum proportionally narrow. Tabulation indicated by low (3μm) fibrous septae, which are larger in base, distally narrowing and ending with a microdenticulate rib. Proximally the septae are irregularly perforated. The cyst wall is microperforated. Tabulation formula (apex lacking): 6″, Xc, 6‴, 2p, 1pv, 1⁗. Archeopyle — apical, type A, with disintegrating operculum. In a single specimen 2 apical plates within the cyst are recorded.

Comments. *Lithodinia* sp. B resembles *Lithodinia* sp. A in its general shape, dimensions, wall structure and sutural septae, but *Lithodinia* sp. A differs in having broad cingulum and sulcus, and lacking second posterior intercalary plate — 2p.

Dimensions (in μm). Length (apex lacking) — 55, breadth — 57, length of septae — 3.

Occurrence. Boreholes: S-24 Nikola Kozlevo (depth 728 m, Middle Bathonian, Esenica Formation); S-1 Razgrad (derth 949.4 m, Early Callovian, Esenica Formation).

Genus ***Parvulodinium*** Dodekova, 1975

Type species (by original designation): *Parvulodinium clavatum* Dodekova, 1975

Parvulodinium clavatum Dodekova, 1975

Pl. X, fig. *7*

Type. Holotype illustrated by Dodekova (1975, pl. 6, figs 6-9).

Occurrence. Boreholes: S-1 Razgrad (depth 992 - 995 m, Middle Bathonian, Esenica Formation); R-7 Sultanci (depth 1921 m, Late Bathonian, Esenica — Polaten Formation); R-1 Junak (depth 1748 m, Late Bathonian, Polaten Formation); R-124 Gorun (depth 1420 m, Late Bathonian, Esenica Formation); S-21 Kalugerica (depth 908.5 m, Late Bathonian, Esenica Formation); R-1 Tjulenovo (depth 1010 m, Late Bathonian, Dobrič Formation); R-67 Makedonka (depth 1371.7 m, Late Bathonian, Dobrič Formation) and the boreholes designated by Dodekova (1975, p. 30).

Genus ***Rigaudella*** Below, 1982

Type species (by original designation): *Hystrichosphaeridium aemulum* Deflandre, 1938a

Rigaudella aemula (Deflandre, 1938a) Below, 1982

Pl. III, fig. *7*

Type. Holotype illustrated by Deflandre (1938b, pl. 11, fig. 1) and refigured by Below (1982, figs 16, 17).

Occurrence. Boreholes: S-11 Hitrino (depth 890 m, Middle Callovian, Drinovo Formation); S-32 Dolina (depth 743 m, Early Oxfordian, *Creniceras* cf. *renggeri* (Oppel, 1863), *C. renggeri* Zone, Černookovo Formation); S-140A Makedonka (depth 1314 m, Late Callovian, Provadija Formation).

Rigaudella filamentosa (Cooks&Eisenack, 1958) Below, 1982

Pl. III, fig. *8*

Type. Holotype illustrated by Cookson&Eisenack (1958, pl. 7, fig. 9).

Occurrence. Boreholes: R-1 Junak (depth 1739 m, Late Callovian, Provadija Formation, at depth 1739.8 m *Hecticoceras (Jeanneticeras)* cf. *pleurospanium* (Parona&Bonarelli, 1895) was found ; R-9 Kardam (depth 879 m, Early Oxfordian, Černookovo Formation); R-4 Mirovo (depth 1293 m, Tithonian, Tiča Formation); R-1 Tjulenovo (depth 1010-1017.4 m, Late Bathonian Dobrič Formation): R-109 Vranino (depth 1298 m, Early Oxfordian, Černookovo Formation).

Genus ***Sentusidinium*** Sarjeant&Stover, 1978

Type species (by original designation): *Tenua rioultii* Sarjeant, 1968.

Sentusidinium rioultii (Sarjeant, 1968) Sarjeant&Stover, 1978

Pl. II, fig. *5*

Type. Holotype illustrated by Sarjeant (1968, pl. 1, fig. 20).

Comments. The Bulgarian dinocyst assemblages are abundant of specimens of *S. rioultii*. Insignificant variations in the quantity and length of the processes, as well as their shape and branching are observed. The differences between *S. rioultii* and *S. villersense*, as pointed out in the description and microphotographs made by Sarjeant (1968, p. 231, 232 p. 1, figs 12, 16, 22; pl. 2, figs 1, 2, 4, 5, 10), are inconsiderable, ranging within the intraspecific variation. These two species are probably conspecific.

Occurrence. Boreholes: R-3 Čiren (depth 1292.5-1293.5 m, Middle — Late Callovian, Javorec Formation); R-1 Bjalo pole (depth 3387 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); S-1 Razgrad (depth 949.4 m, Early Callovian, Esenica Formation); R-1 Junak (depth 1744 m, Middle Callovian, Sultanci Formation; depth 1745.5 m, Late Bathonian — Early Callovian, Polaten Formation); R-3 Junak (depth 1792.1 m, Middle Callovian, Sultanci Formation; depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation; depth 1801.5 m, Late Bathonian, Esenica — Polaten Formation); R-6 Sultanci (depth 1968 m, Late Bathonian, Esenica — Polaten Formation); R-7 Sultanci (depth 1895 m, Late Callovian, Sultanci Formation; depth 1915.5-1924.5 m, Late Bathonian, Esenica — Polaten Formation); R-9 Bozvelijsko (depth 2437 m, Middle — Late Callovian, Sultanci Formation); R-11 Žitnica (depth 1995.5-1998 m, Late Bathonian — Early Callovian, Esenica Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation); S-140A Makedonka (depth 1314.8 m, Late Callovian, Provadija Formation); S-9 Kardam (depth 872.2 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 753.6 m, Early Oxfordian, Černookovo Formation); S-11 Hitrino (depth 891.3 m, Middle Callovian, Drinovo Formation); S-21 Kalugerica (depth 891 m, Middle Callovian, Černookovo Formation); R-3 Brjag (depth 1280 m, Early Callovian, ?Polaten Formation); R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1315.5 m, Late Bathonian — Early Callovian, Dobrič Formation); S-10 Černookovo (depth 944.6-949 m, Late Bathonian, Dobrič Formation).

Sentusidinium baculatum (Dodekova, 1975) Sarjeant&Stover, 1978

Pl. VII, fig. *13, 14*

Type. Holotype illustrated by Dodekova (1975, pl. 6, figs 1-3).

Occurrence. Boreholes: R-54 Gurkovo (depth 1341 m, Late Bathonian, Dobrič Formation); S-33 Esenica (depth 778.3 m, Late Bathonian, Esenica Formation).

Genus ***Stephanelytron*** Sarjeant, 1961a emended Stover et al., 1977

Type species (by original designation): *Stephanelytron redcliffense* Sarjeant, 1961a.

Stephanelytron redcliffense Sarjeant, 1961a emended Stover et al., 1977

Pl. II, fig. *2*

Type. Holotype illustrated by Sarjeant (1961a, pl. 15, fig. 11, text-fig. 10).

Occurrence. Boreholes: R-3 Smjadovo (depth 2175 m, Oxfordian, Tiča Formation); R-3 Junak (depth 1785.3 m, Late Callovian — Early Oxfordian, Provadija Formation; depth 1792.1 m, Middle Callovian, Sultanci Formation); R-9 Kardam (depth 870.5-878 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 752 m, Early Oxfordian, Černookovo Formation); S-33 Esenica (depth 759 m, Late Callovian, Černookovo Formation).

Stephanelytron scarburghense Sarjeant, 1961a emended Stover et al., 1977

Pl. II, fig. *1*

Type. Holotype illustrated by Sarjeant (1961a, pl. 15, figs 12—15).

Comments. The transferring of this species to the genus *Lagenadinium* made by Piel (1985, p. 112) is rejected by Riding (1987, p. 263) who points out the differences in the dimensions and structure of the coronas and the apex in both species. The same opinion is shared in this paper.

Occurrence. Boreholes: R-14 Grozdjovo (depth 2659 m, Late Callovian, Provadija Formation); R-5 Devetaki (depth 2951-2955 m, Verenica Member of the Bov Formation); R-1 Junak (depth 1739 m, Late Callovian, *Hecticoceras (Jeanneticeras)* cf. *pleurospanium* (Parona & Bonarelli, 1895), Provadija Formation; depth 1744 m, Middle Callovian, Sultanci Formation); R-3 Junak (depth 1785.3 m, Late Callovian — Early Oxfordian, Provadija Formation; depth 1791-1792.1 m, Middle Callovian, Sultanci Formation); R-1 Hrabrovo (depth 1974.5-1977.2 m, Middle — Late Callovian, Sultanci Formation); R-7 Sultanci (depth 1840 m, Late Oxfordian, *Microbiplices divergens* (Oppenheimer, 1907), *Epipeltoceras bimammatum* Zone, Provadija Formation); R-8 Sultanci (depth 1964-1968 m, Late Callovian — Early Oxfordian, Provadija Formation); R-9 Kardam (depth 872-877 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 753 m, Early Oxfordian; depth 756.5 m, Late Callovian, Černookovo Formation); S-33 Esenica (depth 753-756 m, Oxfordian, Černookovo Formation); S-21 Kalugerica (depth 875 m, Oxfordian; depth 891 m, Middle Callovian, Černookovo Formation); R-3 Brjag (depth 1278.8 m, Middle Callovian, Černookovo Formation); S-24 Nikola Kozlevo (depth 675 m, Late Oxfordian, Černookovo Formation); S-32 Dolina (depth 730 m, Oxfordian, Černookovo Formation); R-54 Gurkovo (depth 1320 m, Oxfordian, Černookovo Formation); S-30 Kardam (1111-1115 m, Oxfordian, Drinovo Formation); R-3 Tjulenovo (depth 953-954 m, Oxfordian, Černookovo Formation).

Genus ***Valensiella*** Eisenack, 1963a

Type species (by original designation): *Membranilarnax ovulum* Deflandre, 1947c.

Valensiella ovula (Deflandre, 1947c) Eisenack, 1963a

Pl. I, fig. *2*

Type. Holotype illustrated by Deflandre (1947c, fig. 22).

Occurrence. Boreholes: R-5 Devetaki (depth 2951-2955 m, Middle Callovian, Verenica Member of the Bov Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-7 Sultanci (depth 1915.5 m, Late Bathonian, Esenica — Polaten Formation); R-8 Sultanci (depth 1977.5 m, Late Bathonian, Esenica Formation); R-9 Bozvelijsko (depth 2437 m, Middle — Late Callovian, Sultanci Formation); R-1 Hrabrovo (depth 1977.2 m Middle Callovian, Sultanci Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); S-33 Esenica (depth 759.5 m, Late Callovian, Černookovo Formation); R-1 Čerešovo (depth 1128.8-1130 m, Middle Bathonian, Esenica Formation); R-109 Vranino (depth 1313 m, Late Bathonian — Early Callovian, Dobrič Formation); R-67 Makedonka (depth 1375.7 m, Late Bathonian, Dobrič Formation).

Valensiella ampula Gocht, 1970b

Pl. I, fig. *16*

Type. Holotype illustrated by Gocht (1970b, pl. 34, fig. 7).

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-9 Kardam (depth 877.5 m, Early Oxfordian, Černookovo Formation); R-1 Čerešovo (depth 1128.8-1130 m, Middle Bathonian, Esenica Formation); R-109 Vranino (depth 1315.5 m, Late Bathonian — Early Callovian, Dobrič Formation).

AGE / DINOFLAGELLATE CYSTS	MIDDLE JURASSIC					
	BATHONIAN			CALLOVIAN		
	early	middle	late	early	middle	late
1	2	3	4	5	6	7
1. *Nannoceratopsis gracilis*						
2. *Carpathodinium predae*						
3. *Lithodinia valensii*						
4. *Gongylodinium erymnoteichos*						
5. *Kylindrocysta spinosa*						
6. *Ctenidodinium combazii*						
7. *Nannoceratopsis spiculata*						
8. *Pareodinia ceratophora*						
9. *Ctenidodinium continuum*						
10. *Ctenidodinium cornigerum*						
11. *Lithodinia borealis*						
12. *Parvulodinium clavatum*						
13. *Lithodinia sp. B*						
14. *Scriniodinium asymmetricum*						
15. *Diacanthum ? filapicatum*						
16. *Rhynchodiniopsis? regalis*						
17. *Valensiella vermiculata*						
18. *Pareodinia groenlandica*						
19. *Ctenidodinium rotundum*						
20. *Dodekovia gochtii*						
21. *Wangea acollaris*						
22. *Gonyaulacysta pectinigera*						
23. *Aldorfia aldorfensis*						
24. *Ctenidodinium sellwoodii*						
25. *Valensiella ovula*						
26. *Sirmiodiniopsis orbis*						
27. *Pareodinia prolongata*						
28. *Korystocysta pachyderma*						
29. *Lithodinia jurassica*						
30. *Tubotuberella dangeardii*						
31. *Kalyptea stegasta*						
32. *Syrmiodinium grossi*						
33. *Pareodinia ceratophora scopaeus*						
34. *Gonyaulacysta eisenackii*						
35. *Chytroeisphaeridia scabrata*						
36. *Sentusidinium baculatum*						
37. *Tabulodinium senarium*						

1	2	3	4	5	6	7
38. *Cleistosphaeridium varispinosum*						
39. *Lithodinia insulofigurata*						
40. *Ellipsoidictyum reticulatum*						
41. *Belodinium obsoletum*						
42. *Tubotuberella cf. rhombiformis*						
43. *Lithodinia cf. superornata*						
44. *Lithodinia sp. A*						
45. *Korystocysta gochtii*						
46. *Ellipsoidictyum cinctum "Form A"*						
47. *Chlamydophorella raritubulae*						
48. *Heslertonia teichophera*						
49. *Ellipsoidictyum gochtii*						
50. *Chlamydophorella sp. SA*						
51. *Glomodinium reticulopilosum*						
52. *Atopodinium prostatum*						
53. *Mosaicodinium mosaicum*						
54. *Ellipsoidictyum cinctum*						
55. *Valensiella ampula*						
56. *Tubotuberella vozzhennikovae*						
57. *Lithodinia reticulata*						
58. *Compositosphaeridium polonicum*						
59. *Cleistosphaeridium tribuliferum*						
60. *Lagenadinium callovianum*						
61. *Dingodinium minutum*						
62. *Gonyaulacysta jurassica*						
63. *Adnatosphaeridium caulleryi*						
64. *Cleistosphaeridium polytrichum*						
65. *Sentusidinium rioultii*						
66. *Ctenidodinium ornatum*						
67. *Mendicodinium groenlandicum*						
68. *Rigaudella filamentosa*						
69. *Chytroeisphaeridia chytroeides*						
70. *Nannoceratopsis pellucida*						
71. *Scriniodinium cf. luridum*						
72. *Escharisphaeridia pocockii*						
73. *Rigaudella aemula*						
74. *Rhynchodiniopsis gochtii*						
75. *Pareodinia barentsensis*						
76. *Polygonifera? aspera*						
77. *Eodinia cf. pachytheca*						
78. *Gonyaulacysta centriconata*						
79. *Dingodinium harsveldtii*						

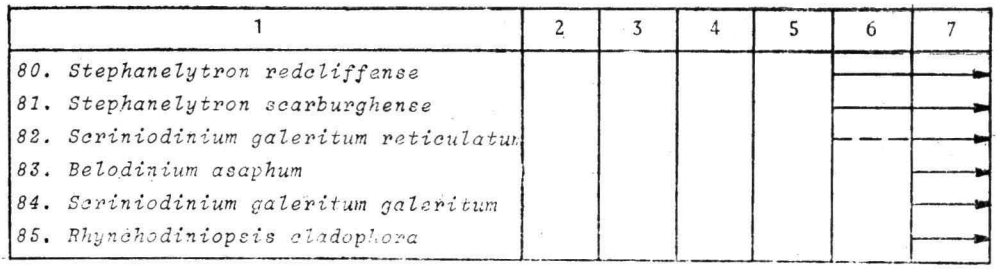


Fig. 2. Range-chart of the Bulgarian Bathonian-Callovian dinocyst species

Valensiella vermiculata G o c h t, 1970b

Pl. I, figs *12, 13*

T y p e. Holotype illustrated by G o c h t (1970b, pl. 34, fig. 10).

O c c u r r e n c e. Boreholes: R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-3 Brjag (depth 1280 m, Early Callovian, ?Polaten Formation); R-1 Čerešovo (depth 1128.8-1130 m, Middle Bathonian, Esenica Formation).

Dinocysts with intercalary archeopyle

Genus ***Carpathodinium*** D r u g g, 1978

T y p e s p e c i e s (by original designation): *Meiourogonyaulax? predaei* B e j u, 1971.

Carpathodinium predae (B e j u, 1971) D r u g g, 1978

Pl. V, figs *13 — 15*

T y p e. Holotype illustrated by B e j u (1971, pl. 4, fig. 4).

C o m m e n t s. Many specimens of this species are available in the Bulgarian dinocyst assemblages. They show variability in the shape and dimensions of the cysts. Through the latter, the intraspecific variation is being expressed. Narrow elongated specimens (pl. V, fig. *14*), as well as shorter and larger ones (pl. V, fig. *15*) are recorded. The perforations on the sutural septae are varying too. Sometimes, the septae are lacking perforations, looking in some specimens thoroughly fenestrate. Cysts bearing both kinds of septae, unperforated and perforated, as well as transitional, in terms of general habitus, forms are available. It could hardly be identified whether the archeopyle is intercalary (type 2I—2a+3a) or apical (type 2A—2′+3′).

O c c u r r e n c e. Outcrop: Town of Belogradčik, Early Bathonian, Polaten Formation; Boreholes: R-1 Dolni Dâbnik (depth 2720 m, Early Bathonian, Polaten Formation); R-7 Vârbica (depth 3604 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); R-9 Septemvrijci (depth 3711 m, Late Bajocian — Middle Bathonian, Etropole Formation); R-1 Simeonovo (depth 2144.5 m, Late Bajocian-Early Bathonian, Polaten Formation); R-2 Agatovo (depth 3276.6-3277.4 m, Middle Bathonian, Polaten Formation); R-2 Vodica (depth 1536 m, Late Bajocian — Middle Bathonian, Esenica Formation); R-16 Orljak (depth 857-970 m, Middle Bathonian, Esenica Formation); S-31 Esenica (depth 779-800 m, Middle Bathonian, Esenica Formation); S-33 Esenica (depth 783-801 m, Middle Bathonian, Esenica Formation); R-4 Vasil Levski (depth 1366 m, Middle Bathonian, Esenica Formation); R-1 Čerešovo (depth 1130 m, Middle Bathonian, Esenica Formation); S-24 Nikola Kozlevo (depth 765 m, Early Bathonian); S-32 Dolina (depth 756 m, Middle Bathonian, Esenica Formation).

Genus ***Glomodinium*** D o d e k o v a, 1975

T y p e s p e c i e s (by original designations): *Glomodinium reticulopilosum* D o d e k o v a, 1975.

Comments. The transferring of the genus *Glomodinium* to the genus *Pareodinia* Deflandre, 1947c, as made by Stover & Evitt (1978, p. 116) and Lentin & Williams (1981, p. 111) is here rejected. Put forward is the concept of Dodekova (1975, p. 26), Dörhöfer & Davies (1980, p. 12) and Davies (1983, p. 17) for this genus, having archeopyle type 3I, to be preserved.

Glomodinium reticulopilosum Dodekova, 1975

Pl. X, fig. *4*

Type. Holotype illustrated by Dodekova (1975, pl. 5, figs. 1-2).

Occurrence. Boreholes: R-3 Junak (depth 1792.1 m, Middle Callovian, Sultanci Formation; depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-11 Žitnica (depth 1995.5 m, Late Bathonian — Early Callovian, Esenica Formation); R-109 Vranino (depth 1315.5 m, Late Bathonian — Early Callovian, Dobrič Formation); R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation) and the boreholes published by Dodekova (1975, p. 26, 27).

Genus ***Kalyptea*** Cookson & Einsenack, 1960b emended Wiggins, 1975

Type species (by original designation): *Kalyptea diceras* Cookson & Eisenack, 1960b.

Kalyptea stegasta (Sarjeant, 1961a) Wiggins, 1975

Pl. IV, fig. *2*

Type. Holotype illustrated by Sarjeant (1961a, pl. 15, fig. 15, text-fig. 14).

Occurrence. Boreholes: R-5 Devetaki (depth 3038.7 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); S-1 Razgrad (depth 964.3 m, Bathonian, Esenica Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-121 Gorun (depth 1420 m, Late Bathonian, Esenica Formation); S-11 Hitrino (depth 885.5 m, Middle — Late Callovian, Drinovo Formation); R-1 Tjulenovo (depth 1010-1017.4 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1315.5 m, Late Bathonian — Early Callovian, Dobrič Formation); R-66 Makedonka (depth 1375.7-1381.7 m, Late Bathonian, Dobrič Formation); S-12 Gornjak (depth 855 m, Late Bathonian, Dobrič Formation); S-24 Nikola Kozlevo (depth 725 m, Bathonian, Esenica Formation); S-32 Dolina (depth 746 m, Late Bathonian, Dobrič Formation); S-54 Gurkovo (depth 1335 m, Late Bathonian, Dobrič Formation); S-10 Černookovo (depth 946.9 m, Late Bathonian, Dobrič Formation).

Genus ***Pareodinia*** Deflandre, 1947c

Type species (by original designation): *Pareodinia ceratophora* Deflandre, 1947c.

Pareodinia barentsensis Smelror, 1988a

Pl. X, fig. *15*

Type. Holotype illustrated by Smelror (1988a, pl. 3, fig. 5).

Comments. The Bulgarian specimens completely coincide with the description and figures made by Smelror, but their apical horn is longer (7 μm).

Occurrence. Borehole: R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation).

Pareodinia ceratophora Deflandre, 1947c

Pl. III, fig. *14*

Type. Holotype illustrated by Deflandre (1947c, fig. 1).

Comments. The greater part of the specimens determined have kalyptra.

Occurrence. Boreholes: R-3 Čiren (depth 1292.5-1293.5 m, Middle — Late Callovian); R-12 Čiren (depth 1815-1817.5 m, Early Callovian, Verenica Member of the Bov Formation); R-5 Devetaki (depth 3036.5-3038.7 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); R-9 Septemvrijci (depth 3711 m, Late Bajocian — Middle Bathonian, Etropole Formation); R-1 Jantra (depth 2079 m, Middle Bathonian, Esenica Formation); R-2 Agatovo (depth 3276.6 m, Middle Bathonian, Polaten Formation); S-1 Razgrad (depth 949.4 m, Early Callovian; depth 964.3 m, Late Bathonian, Esenica Formation); R-7 Sultanci (depth 1921 m, Late Bathonian, Esenica — Polaten Formation); R-8 Sultanci (depth 1977.5 m, Late Bathonian, Esenica Formation); R-1 Junak (depth 1745.5 m, Late Bathonian — Early Callovian; depth 1748-1753 m, Late Bathonian, Polaten Formation); R-16h Orljak (depth 779-858 m, Middle Bathionian, Esenica Formation); R-2 Preslavci (1032-1034 m, Middle Bathonian, Esenica Formation); R-9 Kardam (depth 879 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 775-807 m, Middle Bathonian, Esenica Formation); R-32 Esenica (depth 744.3 m, Oxfordian — Kimmeridgian, Černookovo Formation; depth 786 m, Middle Bathonian, Esenica Formation); S-11 Hitrino (depth 903 m, Late Bathonian, Esenica Formation); R-1 Čerešovo (depth 1070 m, Middle Bathonian, Esenica Formation); S-24 Nikola Kozlevo (depth 718.9-740 m, Middle Bathonian, Esenica Formation); R-1 Tjulenovo (depth 1010-1017.4 m, Late Bathonian, Dobrič Formation); R-67 Makedonka (1375-1381 m, Late Bathonian, Dobrič Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Dobrič Formation) and the boreholes published by Dodekova (1975).

Pareodinia ceratophora subsp. ***scopaseu*** (Sarjeant, 1972) Lentin&Williams, 1977

Pl. X, fig. *12*

Type. Holotype illustrated by Sarjeant (1972, pl. 2, fig. 4).

Occurrence. Boreholes: R-12 Čiren (depth 1815-1817.5 m, Early Callovian, Verenica Member of the Bov Formation); R-5 Devetaki (depth 2951-2955 m, Middle Callovian, Verenica Member of the Bov Formation; depth 3036.5-3038.7 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); S-1 Razgrad (depth 964.3 m, Late Bathonian, Esenica Formation); R-1 Hrabrovo (depth 1974.5 m, Late Callovian; depth 1977.2 m, Middle Callovian, Sultanci Formation); R-1 Junak (1753 m, Late Bathonian, Polaten Formation); R-16h Orljak (depth 779-800 m, Middle Bathonian, Esenica Formation); R-9 Kardam (depth 872 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 752.8 m, Early Oxfordian, Černookovo Formation); S-33 Esenica (depth 795.4 m, Middle Bathonian, Esenica Formation); S-11 Hitrino (depth 885 m, Middle — Late Callovian, Drinovo Formation); R-1 Čerešovo (depth 1128-1130 m, Middle Bathonian, Esenica Formation); R-1 Tjulenovo (depth 1010-1017.4 m, Late Bathonian, Dobrič Formation).

Pareodinia groenlandica Sarjeant, 1972

Pl. IV, fig. *1*

Type. Holotype illustrated by Sarjeant (1972, pl. 5, fig. 1).

Occurrence. Boreholes: R-5 Devetaki (depth 3038.7 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); S-1 Razgrad (depth 964.3 m, Late Bathonian, Esenica Formation); R-3 Junak (depth 1792.2. m, Early Callovian, *Macrocephalites* sp. indet.); S-31 Esenica (depth 776-809 m, Middle Bathonian, Esenica Formation); R-109 Vranino (depth 1315.5 m, Late Bathonian — Early Callovian, Dobrič Formation).

Pareodinia prolongata Sarjeant, 1959

Pl. X, fig. *17*

Type. Holotype illustrated by Sarjeant (1959, pl. 13, fig. 8).

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3185 m, Middle Callovian, Verenica Member of the Bov Formation); R-69 Bliznaci (depth 2558.8 m, Late Bathonian, Esenica Formation); R-16h Orljak (depth 779-857 m, Middle Bathonian, Esenica Formation); S-31 Esenica (depth 754.5 m, Early Oxfordian, Černookovo Formation).

Genus ***Tabulodinium*** gen. n.

Type species (by monotypy): *Tabulodinium senarium* sp. n.

Derivation of the name. Latin: tabula — plate, dinium — generic ending of dinoflagellate cysts.

Diagnosis. At the present stage of knowledge the generic diagnosis coincides with that of the type species. It can be elaborated and made more precise after new data or new

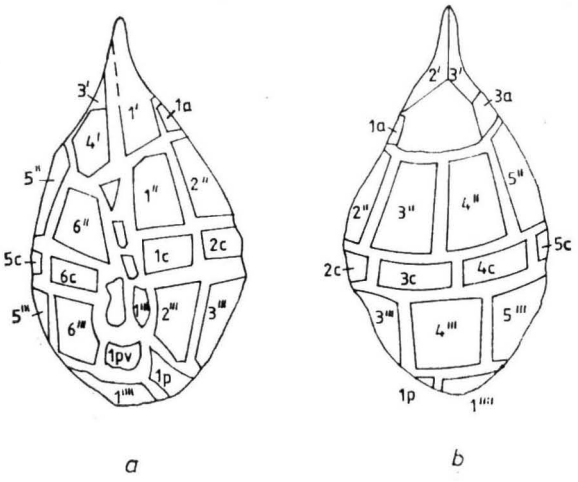


Fig. 3. Supposed tabulation sketch of *Tabulodinium senarium* gen. n. & sp. n. (a) in: ventral view; b) in dorsal view

species having similar morphology are found. The cyst is proximate, pareodinioid, ovoidal with intermediately long apical horn, with or without embrio of antapical projection. The tabulation is indicated by pandasutural bands and the plates are occupied by sculptural elements of low relief. Tabulation formula: ?pr, ?4′, 3-?a, 6″, 6c, 6‴, 1p, 1⁗, 0-6s. Archeopyle — intercalary, type I or 3I. Cyst's size — intermediate. "Kalyptra" is commonly present, but may be lacking some times. It is put in quotes here for it resembles ectophragm. Apicular structure on the apical horn is rarely observed, usually lacking.

C o m m e n t s. The genus *Tabulodinium* may be compared in its general shape, ornamentation, dimensions, presence of "kalyptra" and apicular structure on the apical horn only with the genus Paredodinia, but it differs from that genus in its distinctly formed pandasutural bands. The genus Pareodinia, though rarely, may be having sutural ribs, but is lacking zones devoid of ornamentation.

The tabulation formula of the genus *Tabulodinium* is not completely clarified yet. The pandasutural bands around the apex are not well marked. That makes the specification of the apical tabulation difficult.

Tabulodinium senarium sp. n.

Pl. IV, figs *4—10*; pl. IX, figs *3—5, 9, 10*

T y p e. Holotype is the specimen illustrated on pl. IV, figs *4, 5*, slide 910-5, borehole S-12 Gornjak, depth 852.2 m, ?Early Callovian, Dobrič Formation, North-Eastern Bulgaria.

D e r i v a t i o n of the n a m e. Latin: senarius — composed of six parts, in reference to the number of plates of the precingular, cingular, postcingular and probably sulcal series.

M a t e r i a l. 42 specimens.

D i m e n s i o n s (in μm). Holotype: length — 68, breadth — 38, length of apical horn — 13, breadth of cingulum — 5, thickness of the wall — 1.5. Range: length — 56-68, breadth — 33-41, length of apical horn — 11-13, width of cingulum — 4-5, thickness of the wall — 1.5 (measured 17 specimens).

D i a g n o s i s. Same as the generic diagnosis.

D e s c r i p t i o n. Cyst ovoidal to drop-like with strong and blunt moderate in length apical horn. The cyst is divided in two, nearly equal halves by broad helicoidal cingulum. The epicyst may be slightly longer than the hypocyst. The cingulum is marked on the lateral outline by a subconcavity. It is the broadest part of the cyst there. The epicyst is roundly conical, and the hypocyst — widely rounded, hemispheric. Tabulation indicated by pandasutural bands, which are clearly or poorly pronounced. The plates are occupied by thick, porous, spongy matter with perforations and areolae on their surface. Around the apex and apical horn this ornamentation is thinner and more poorly marked. Relatively thickest is the ornamentation on the hypocyst and the antapical plate, where in some specimens a protrusion resembling embrio of antapical horn is formed. The pandasutural bands are

lacking spongy matter, but have fine sculpture of a type, which is hard to be determine d— scabrate or punctate. The pandasutural bands around the apex are indistinct, whereupon the tabulation scheme in that part of the cyst remains unclear. The tabulation formula of the species with some uncertainty for the apex is the following: '?pr, ?4', 3-?a, 6'', 6c, 6''', 1p, 1'''', ?5-6s. A good deal of tabulation schemes for different specimens have been made in order a generalized tabulation scheme to be proposed (fig. 3). The holotype proved to be of utmost importance for the development of such scheme. In the holotype and some other specimens, two pinches in the upper part of the apical horn suggesting the presence of preapical plates are available. The presence of 4 apical plates is admitted. The number, size, shape and position of the plates of the precingular, cingular and postcingular series are shown on fig. 3. The first postcingular plate is very small, being considered by some authors to be a sulcal plate, reducing that way the number of postcingular plates to 5. Three intercalary plates, a big one — central — 2a and on both sides of it two symmetrical small ones — 1a and 3a, are identified. The vague ornamentation in the upper part of the epicyst makes the determination of the exact number of anterior intercalary plates difficult.

The posterior intercalary plate — 1p is large, lying under plate 2''' and partly under plate 3''', and sometimes may be fallaciously considered to be second antapical plate.

Archeopyle — intercalary, type I (2a) or 3I. In a greater number of specimens the archeopyle is type I with operculum free — plate 2a. In other specimens, having their archeopyle formed by plate 2a, the intercalary plates la and 3a are slightly opened, remaining attached to the cyst (pl. IV, figs *8-10*). In some specimens, though very rarely, all the three dorsal intercalary plates are lacking — archeopyle type 3I. So far, it remains unclear whether there is any gradation and gradualness in the development of the archeopyle from I to 3I, or the lateral plates (1a and 3a) are labile zones falling away under mechanical influence.

The sulcal plates, when well-marked, are ?5-6s. Commonly they are hardly identifiable. The specification of the tabulation is made difficult because of the presence of "kalyptra". The majority of specimens studied have "kalyptra" (all microphotographs illustrated except the holotype). By analogy with the kalyptra in the genus *Pareodinia* (sensu G o c h t, 1970b, pp. 154, 155 and W i g g i n s, 1975, pp. 98, 99) I do consider its presence to be a primary one, and its absence in some specimens, including the holotype, as due to mechanical dismemberment. The "kalyptra" of the new taxon looks much more like a thin ectophragm than a concentration of organic matter. It is variously shaped due to the different state of preservation. It has coarse superficial reticulation and, in some specimens, likeness of sutural ribs. In some parts of the cyst this "outer layer" looks intimately connected with the ornamentation of the autophragm. The specimen shown on pl. IV, figs *8-10* is having its archeopyle with completely preserved "kalyptra". The availability of specimens lacking "kalyptra" is hitherto preventing the new taxon to be considered as a cavate cyst.

O c c u r r e n c e. Boreholes: S-12 Gornjak (depth 852.2 m, ?Early Callovian, Dobrič Formation); R-87 Gurkovo (depth 1371.3 m, Late Bathonian, Dobrič Formation); R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation).

Dinocysts with precingular archeopyle

Genus ***Aldorfia*** S t o v e r & E v i t t, 1978

T y p e s p e c i e s (by original designation): *Gonyaulacysta aldorfensis* G o c h t, 1970b.

Aldorfia aldorfensis (G o c h t, 1970b) S t o v e r & E v i t t, 1978

Pl. VI, fig. *1*

T y p e. Holotype illustrated by G o c h t (1970b, pl. 31, fig. 10).

C o m m e n t s. *A. aldorfensis* is morphologically close to *Scriniodinium dictyophorum* (D e f l a n d r e, 1938b) B r e n n e r, 1988, *S. galeritum* subsp. *reticulatum* K l e m e n t, 1960 and *S. dictyotum* C o o k s o n & E i s e n a c k, 1960b. As B e r g e r (1986, p. 339) notes, these species might readily be mixed up. The differences in the wall structure pointed out by B r e n n e r (1988) are difficult to be identified under light microscope.

Occurrence. Boreholes: R-5 Devetaki (depth 2951-2955 m, Middle Callovian, Verenica Member of the Bov Formation); R-1 Bârdarski geran (depth 3185-3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-1 Bjalo pole (depth 3387 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-1 Junak depth 1744 m, Middle Callovian, Sultanci Formation; depth 1745.5- 1746.5 m, Late Bathonian — Early Callovian; depth 1748-1753 m, Late Bathonian, Polaten Formation); R-3 Junak (depth 1792 m, Middle Callovian, Sultanci Formation; depth 1797 m, Late Bathonian, Esenica — Polaten Formation); R-6 Sultanci (depth 1968 m, Late Bathonian, Esenica — Polaten Formation); R-7 Sultanci (depth 1895 m, Late Callovian, Sultanci Formation; depth 1918-1924.5 m, Late Bathonian, Esenica — Polaten Formation); R-9 Bozvelijsko (depth 2442.8 m, Late Bathonian, Polaten Formation); R-69 Bliznak (depth 2558.8 m, Bathonian, Esenica Formation); R-16h Orljak (depth 857.5 m, Middle Bathonian, Esenica Formation); S-33 Esenica (depth 788.8-800 m, Middle Bathonian, Esenica Formation); R-121 Gorun (depth 1420 m, Late Bathonian, Esenica Formation); R-1 Čerešovo (depth 1128 m, Middle Bathonian, Esenica Formation); R-7 Nonevo (depth 1032 m, Middle Bathonian, Esenica Formation); R-1 Tjulenovo (depth 1010-1017.4 m, Late Bathonian, Dobrič Formation); R-67 Makedonka (depth1 377.7 m, Late Bathonian, Dobrič Formation); R-88 Caričino (depth 1274-1276 m, Late Bathonian, Dobrič Formation); R-1 Razgrad (depth 949.4 m, Early Callovian, Esenica Formation).

Genus ***Chytroeisphaeridia*** (Sarjeant, 1962a) Downie & Sarjeant, 1965

Type species (by original designation): *Leiosphaeridia (Chytroeisphaeridia) chytrocides* Sarjeant, 1962a.

Chytroeisphaeridia chytroeides (Sarjeant, 1962a) Downie & Sarjeant, 1965 ded Davey, 1979d

Pl. VII, fig. *12*

Type. Holotype illustrated by Sarjeant (1962a, pl. 70, fig. 13).

Occurrence. Boreholes: R-5 Devetaki (depth 2951-2955 m, Middle Callovian, Verenica Member of the Bov Formation); R-1 Bârdarski geren (depth 3185-3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-9 Septemvrijci (depth 3686 m, Early Callovian, Verenica Member of the Bov Formation); R-3 Čiren (depth 1292.5-1293.5 m, Middle — Late Callovian, Javorec Formation); R-1 Junak (depth 1750 m, Late Bathonian, Polaten Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-7 Sultanci (depth 1896 m, Middle Callovian, Sultanci Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation); S-9 Kardam (depth 876.9 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 756 m, Late Callovian, Černookovo Formation); S-24 Nikola Kozlevo (depth 696 m, Callovian, Černookovo Formation; R-1 Tjulenovo (depth 1010 m, Late Bathonian, Dobrič Formation); R-3 Tjulenovo (depth 954 m, Oxfordian, Černookovo Formation).

Chytroeisphaeridia scabrata Pocock, 1972

Pl. X, figs *9, 11*

Type. Holotype illustrated by Pocock (1972, pl. 27, figs 24, 25).

Occurrence. Borehole: S-12 Gornjak (depth 852.2 m, ? Early Callovian, Dobrič Formation).

Genus ***Diacanthum*** Habib, 1972 emended Habib & Drugg, 1987

Type species (by original designation): *Diacanthum hollisteri* Habib, 1972.

Diacanthum? filapicatum (Gocht, 1970b) Stover & Evitt, 1978

Pl. V, fig. *5*

Type. Holotype illustrated by Gocht (1970b, pl. 31, fig. 1).

Comments. Stover & Evitt (1978, p. 152) referred the species *G. filapicata* to the genus *Diacanthum* Habib, 1972 on account of the likeness of the archeopyle, but the genus has its apex round and is lacking apical horn. Supported in this paper is the view of Berger (1986, p. 340) that the genus *Diacanthum* is not suitable for the species *D.? filapicatum* to be included in it. The latter is morphological most closely fitting to the genus *Lies-*

bergia Berger, 1986 (p. 341). The assignment of the species *D.? filapicatum* to the genus *Dichadogonyaulax* Sarjeant, 1966 made by Jan Du Chêne et al. (1986, p. 11) is unacceptable, since both taxa have distinct archeopyle types. The Bulgarian assemblages include specimens of *D.? filapicatum* with precingular archeopyle split in the zone of the cingulum. This splitting is not considered to be an epicyst archeopyle, but is due to a mechanical impact. Apparently, the cingulum is a labile zone not only for taxa having epicyst archeopyle. Split like that has also been observed by me in specimens of *G. jurassica* (Deflandre, 1983). However, single epi-, or hypocysts of *D.? filapicatum* or *G. jurassica* are never being observed in large numbers in the dinocyst assemblages, as is usually the case with species having epicyst archeopyle.

Occurrence. Boreholes: R-32 Selanovci (depth 3026.9 m, Early Callovian, *Macrocephalites* sp. indet. Verenica Member of the Bov Formation); R-2 Agatovo (depth 3276.6 m, Middle Bathonian, Polaten Formation); R-1 Junak (depth 1745.5 m, Early Callovian — Late Bathonian; depth 1750 m, Late Bathonian, Polaten Formation); R-3 Junak (depth1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-7 Sultanci (depth 1915.5 m, Late Bathonian, Esenica — Polaten Formation); R-8 Sultanci (depth 1982 m, Late Bathonian, Esenica Formation); R-16h Orljak (depth 779-800 m, Middle Bathonian, Esenica Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); S-33 Esenica (depth 805 m, Middle Bathonian, Esenica Formation); S-11 Hitrino (depth 899 m, Bathonian, Esenica Formation); R-3 Brjag (depth 1280 m, Early Callovian, ?Polaten Formation); R-1 Čerešovo (depth 1128.8-1130 m, Middle Bathonian, Esenica Formation); R-7 Nonevo (depth 1032-1033.8 m, Middle Bathonian, Esenica Formation); R-1 Tjulenovo (depth 1010-1017.4 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1315.5 m, Late Bathonian — Early Callovian, Dobrič Formation); R-67 Makedonka (depth 1371.7-1381.7 m, Late Bathonian, Dobrič Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Dobrič Formation) and the boreholes published by Dodekova (1975).

Genus ***Gongylodinium*** Fenton, Neves & Piel, 1980

Type species (by original designation): *Gongylodinium erymnoteichos* Fenton et al., 1980.

Gongylodinium erymnoteichos Fenton et al., 1980

Pl. III, fig. *10*

Type. Holotype illustrated by Fenton et al. (1980, pl. 14, figs 8, 9).

Occurrence. Recorded in an outcrop of Lower Bathonian sediments from the Polaten Formation around the town of Belogradčik. Boreholes: R-1 Čerešovo (depth 1128.5-1130 m, Middle Bathonian, Esenica Formation); R-7 Vârbica (depth 3604 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); S-24 Nikola Kozlevo (depth 718.9 m, Bathonian, Esenica Formation).

Genus ***Gonyaulacysta*** Deflandre, 1964 emended Stover & Evitt, 1978 emended Sarjeant, 1982a

Type species (by original designation): *Gonyaulax jurassica* Deflandre, 1938b.

Gonyaulacysta jurassica (Deflandre, 1938b) Norris & Sarjeant, 1965, emended Sarjeant, 1982a

Pl. V, fig. *4*

Type. Holotype illustrated by Deflandre (1938b, pl. 1, figs 2, 3, text-figs 1, 2), Sarjeant (1982, pl. 6, figs 1, 2) and Jan Du Chêne et al. (1986c, pl. 37, figs 1-3).

Comments. The species is published by Dodekova (1967, pl. 2, fig. 1). It is an abundant component of the Jurassic dinocyst assemblages from the Upper Bathonian to the Oxfordian. Scarce, single finds are available in the Kimmeridgian, too. The following subspecies have been identified: *G. jurassica* (Deflandre, 1938b) subsp. *jurassica* Deflandre, 1938b emended Sarjeant, 1982a; *G. jurassica* (Deflandre, 1938b)

subsp. *adjecta* Sarjeant, 1982 a, as well as *G. jurassica* (Deflandre, 1938) subsp. *adjecta* var. *longicornis* Deflandre, 1938b emended Sarjeant, 1982a, — pl. V, fig. 10.

Gonyaulacysta jurassica (Deflandre, 1938b) subsp. *jurassica* Deflandre, 1938b emended Sarjeant, 1982a shows cavation on the epicyst as well as on the hypocyst, with developed opistopyle on the antapical plate.

Gonyaulacysta jurassica (Deflandre, 1938b) subsp. *adjecta* Sarjeant, 1982a, is found to be a predominating form in the Jurassic dinocyst assemblages. It differs from the nominate species in the lack of hypocyst cavation and opistopyle.

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-32 Selanovci (depth 3026.9 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-1 Junak (depth 1739 m, Late Callovian, Provadija Formation; depth 1744 m, Middle Callovian, Sultanci Formation; depth 1745.6-1746.5 m, Late Bathonian — Early Callovian; depth 1748-1753 m, Late Bathonian, Polaten Formation); R-1 Junak (depth 1792 m, Middle Callovian, Sultanci Formation; depth 1795 m, Late Bathonian, Esenica — Polaten Formation); R-6 Sultanci (depth 1958-1968 m, Late Bathonian, Esenica — Polaten Formation); R-7 Sultanci (depth 1840 m, Late Oxfordian, Provadija Formation; depth 1895 m, Late Callovian, Sultanci Formation; depth 1915.5-1924.4 m, Late Bathonian, Esenica — Polaten Formation); R-8 Sultanci (depth 1977 m, Late Bathonian, Esenica Formation); R-11 Žitnica (depth 1995.5 m, Late Bathonian — Early Callovian, Esenica Formation); R-1 Hrabrovo (depth 1974 m, Late Callovian, Sultanci Formation); S-31 Esenica (depth 756.5 m, Late Callovian, Černookovo Formation); S-11 Hitrino (depth 891.3 m, Middle Callovian, Drinovo Formation); R-4 Mirovo (depth 1400.5 m, Middle Callovian, Sultanci Formation); R-1 Tjulenovo (depth 1008-1017 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1303 m, Early Oxfordian, Provadija Formation; depth 1311-1315 m, Late Bathonian — Early Callovian, Dobrič Formation); R-67 Makedonka (depth 1371-1375 m, Late Bathonian, Dobrič Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Dobrič Formation).

Gonyaulacysta centriconata Riding, 1983

Pl. V, fig. *8*

Type. Holotype illustrated by Riding (1983, pl. 1, figs *1 - 3*).

Comments. This species, under the name of *Endoscrinium* sp. Muir&Sarjeant, 1978, has been utilized by Додекова in Сапунов et al. (1986a) when developing the stratigraphy of series of boreholes in North Bulgaria. Later on Riding (1983) introduced the new species *G. centriconata*, including in its synonymy *Endoscrinium* sp. Muir&Sarjeant, 1978.

Occurrence. Boreholes: R-5 Devetaki (depth 2951-2955 m, Middle Callovian, Verenica Member of the Bov Formation); R-3 Čiren (depth 1292.5-1293.5 m, Middle — Late Callovian, Javorec Formation); R-1 Junak (1739 m, Late Callovian, *Hecticoceras (Jeanneticeras)* cf. *pleurospanium* (Parona&Bonarelli, 1895), Provadia Formation; depth 1740.5 m, *Lacunosella* aff. *arolica* (Oppel, 1865); depth 1744 m, Middle Callovian, Sultanci Formation); R-3 Junak (depth 1785.3 m, Late Callovian — Early Oxfordian, Provadija Formation); R-7 Sultanci (depth 1895 m, Late Callovian, Sultanci Formation); R-1 Hrabrovo (depth 1974.5m, Late Callovian; depth 1977.2 m, Middle Callovian, Sultanci Formation); S-30 Kardam (depth 1115.4 m, Early Oxfordian, Drianovo Formation); S-32 Dolina (depth 743 m, Early Oxfordian, *Crenicaras* cf. *renggeri* (Oppel, 1863), *C. renggeri* Zone, Černookovo Formation).

Gonyaulacysta eisenackii (Deflandre, 1938b) Gòrka, 1965, emended Sarjeant, 1982a

Pl. V, fig. *9*

Type. Holotype illustrated by Deflandre (1938b, pl. 6, figs 7-8, text-figs 3,4) and by Sarjeant (1982a, pl. 7, figs 5,6).

Comments. *G. eisenackii* is published by Dodekova (1967, pp. 18, 19, pl. 2, figs 9-11).

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-9 Septemvrijci (depth 3686 m, Early Callovian, Verenica Member of the Bov Formation); R-2 Agatovo (depth 3276-3277 m, Middle Bathonian, Polaten Formation); S-1 Razgrad (depth 933.5 m, Early Oxfordian, Drinovo Formation; depth 949.4 m, Early Callovian, Esenica Formation); R-1 Junak (depth 1770.3 m, Oxfordian, Tiča Formation; depth 1792.1 m, Middle Callovian, Sultanci Formation); R-7 Sultanci (depth 1840 m, Late Oxfordian, Provadija Formation); R-1 Hrabrovo (depth 1974.5 m, Late Callovian; depth 1977 m, Middle Callovian, Sultanci Formation); S-9 Kardam (depth 870-877 m, Early Oxfordian, Černookovo

Formation); S-140A Makedonka (depth 1285 m, Early Kimneridjan, Černookovo Formation); S-31 Esenica (depth 752.8-754 m, Early Oxfordian, Černookovo Formation); S-33 Esenica (depth 744.3 - 756.4 m, Oxfordian — Kimmeridgian, Černookovo Formation); S-21 Kalugerica (depth 881 m, Early Oxfordian, Černookovo Formation); R-5 Tutrakanci (depth 1765 m, Early Oxfordian, Provadija Formation); S-24 Nikola Kozlevo (depth 659-670 m, Early Kimmeridgian, Černookovo Formation); S-30 Kardam (depth 1105 m, Early Kimmeridgian, Drinovo Formation); R-3 Tjulenovo (depth 956-962 m, Late Callovian — Oxfordian, Černookovo Formation); R-109 Vranino (depth 1315 m, Late Bathonian — Early Callovian, Dobrič Formation); S-32 Dolina (depth 730 m, Oxfordian, Černookovo Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Dobrič Formation); S-10 Černookovo (depth 944.6 m, Late Bathonian, Dobrič Formation).

Gonyaulacysta pectinigera (G o c h t, 1970b) F e n s o m, 1979

Pl. V, figs *6, 7*

T y p e. Holotype illustrated by G o c h t (1970b, pl. 33, fig. 1).

C o m m e n t s. In some of the Bulgarian specimens suturocavations around the antapex are observed. I admit that similar suturocavation is supposed to exist in the holotype of the species, on the plate boundary between plates 1p, 3''' and 1'''' (G o c h t, 1970b, pl. 33, fig. 1b). The same is noticed by R i d i n g (1983, p. 199), too.

O c c u r r e n c e. Boreholes: R-7 Vârbica (depth 3604 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Sultanci Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation); S-33 Esenica (depth 795.4 m, Middle Bathonian, Esenica Formation); S-21 Kalugerica (depth 904 m, Bathonian, Esenica Formation); R-2 Medovina (depth 1269-1271 m, Middle Bathonian, Esenica Formation); R-1 Čerešovo (depth 1128-1130 m, Middle Bathonian, Esenica Formation); R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation); R-67 Makedonka (depth 1375.7 m, Late Bathonian, Dobrič Formation).

Genus ***Heslertonia*** S a r j e a n t, 1966 emended D u x b u r y, 1980

T y p e s p e c i e s (by original designation): *Gonyaulax heslertonense* N e a l e & S a r j e a n t, 1962.

Heslertonia teichophera (S a r j e a n t, 1961a) S a r j e a n t, 1976c

Pl. X, fig. *18*; pl. III, fig. *13*

T y p e. Holotype illustrated by S a r j e a n t (1961a, pl. 15, fig. 9).

O c c u r r e n c e. Boreholes: R-1 Bjalo pole (depth 3385 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-3 Junak (depth 1792.1 m, Middle Callovian, Sultanci Formation; 'depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation).

Genus ***Rhynchodiniopsis*** D e f l a n d r e, 1935 emended B e l o w, 1981 emended S a r j e a n t, 1982a emended J a n D u C h ê n e et al., 1985

T y p e s p e c i e s (by orignal desigination): *Rhynchodiniopsis aptiana* D e f l a n d r e, 1935

Rhynchodiniopsis cladophora (D e f l a n d r e, 1938b) B e l o w, 1981

Pl. VI, fig. *4*

T y p e. Holotype illustrated by D e f l a n d r e (1938b, pl. 7, fig. 1).

C o m m e n t s. This species published by D o d e k o v a (1967, pl. 17, pl. 2, figs 2-8) has been recorded from the Oxfordian sediments in S-10 Černookovo. In the present study the earliest certain finds of *R. cladophora* occurred in the latest Late Callovian.

O c c u r r e n c e. Boreholes: R-2hg Ovča mogila (depth 1549 m, Early Kimmeridgian, Pleven Formation); S-1 Razgrad (depth 919.4-943 m, Oxfordian, Drinovo Formation); R-1 Junak (depth 1739 m, Late Callovian — Early Oxfordian, Provadija Formation); R-3 Junak (depth 1770.3 m, Late Oxfordian, Tiča Formation); R-7

Sultanci (depth 1840 m, Late Oxfordian, at depth 1840.4 m *Microbiplices divergens* (Oppenheimer, 1907) was found, *Epipeltoceras bimammatum* Zone, Provadija Formation; depth 1895 m, Late Callovian, Sultanci Formation); S-9 Kardam (depth 870-880 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 750.5 m, Early Oxfordian, Černookovo Formation); S-33 Esenica (depth 744.3 m, Oxfordian — Kimmeridgian, Černookovo Formation); S-21 Kalugerica (depth 790 m, Kimmeridgian, Drinovo Formation; depth 884 m, Early Oxfordian, Černookovo Formation); R-5 Tutrakanci (depth 1740-1765 m, Early — Middle Oxfordian, Provadija Formation); R-3 Brjag (depth 1244 m, Oxfordian, Černookovo Formation); S-24 Nikola Kozlevo (depth 657-670 m, Early Kimmeridgian, Černookovo Formation; depth 680-690 m, Oxfordian, Černookovo Formation); S-30 Kardam (depth 1104 m, Early Kimmeridgian; depth 1115 m, Oxfordian, Drinovo Formation); R-3 Tjulenovo (depth 953-962 m, Late Callovian Oxfordian, Černookovo Formation); R-109 Vranino (depth 1295 m, Late Oxfordian, *Idoceras* sp., Černookovo Formation; depth 1303 m, Early Oxfordian, *Neocampilites (Neocampiltes)* cf. *helveticus* (Jeannet, 1951), Provadija Formation); S-10 Černookovo (depth 920-937 m, Oxfordian, Černookovo Formation).

Rhynchodiniopsis gochtii (Pocock, 1972) Jansonius, 1986

Pl. IX, figs *6, 8*

Type. Holotype illustrated by Pocock (1972, pl. 22, fig. 12, text-fig. 6) and refigured by Jansonius (1986, pl. 1, figs 1-3, text-fig. 14).

Comments. I have at my disposal several specimens of *R. gochtii*, all of them in apical or antapical position. Compoundly branching and distally linked cingular processes are seen. Admitted here is that the specimen designated by Pocock (1972, p. 102, pl. 23, fig. 11) as Dinoflagellate sp. B and determined by Jansonius (1986, p. 220, pl. 3, fig. 18, text-fig. 17) as *Wanaea clathrata* Cookson & Eisenack, 1953 is in fact *R. gochtii* in an antapical position. Along the sutures on the epicyst of the Bulgarian specimens some scarce, branching processes, distally free are available. That has been noted by Jansonius (1986, p. 218). In my belief, this ornamentation is to be a primary one and not a result of mechanical dismemberment. The species is hardly distinguished to be cornucavate.

Occurrence. Boreholes: R-1 Junak (depth 1739 m, Late Callovian, *Hecticoceras (Jeanneticeras)* cf. *pleurospanium* (Parona & Bonarelli, 1895), Provadija Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation).

Rhynchodiniopsis regalis (Gocht, 1970b) Jan Du Chêne et al., 1985

Pl. V, fig. *3*

Type. Holotype illustrated by Gocht (1970b, pl. 33, fig. 6, text-fig. 10).

Comments. Jan Du Chêne et al. (1985, p. 120) referred this species to the genus *Rhynchodiniopsis* provisionally, because of the presence of intratabular spines like those in the holotype on the species illustrated by Gocht (1970b).

Occurrence. Boreholes: R-32 Selanovci (depth 3026.9 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-14 Grozdjovo (depth 2683 m, Middle Bathonian, Polaten Formation); R-6 Sultanci (depth 1968 m, Late Bathonian, Esenica — Polaten Formation); R-7 Sultanci (depth 1915.5-1924.5 m, Late Bathonian, Esenica — Polaten Formation); R-11 Žitnica (depth 1995.5-1998 m, Late Bathonian — Early Callovian, Esenica Formation); R-1 Junak (depth 1748-1750 m, Late Bathonian, Polaten Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); R-1 Čerešovo (depth 1128.8-1130 m, Middle Bathonian, Esenica Formation); R-67 Makedonka (depth 1375.7 m, Late Bathonian, Dobrič Formation).

Genus ***Scriniodinium*** Klement, 1957

Type species (by original designation): *Gymnodinium crystallinum* Deflandre, 1938b, p. 165, pl. 5, figs 1-3.

Scriniodinium asymmetricum (Riding, 1987) comb. n.

Pl. V, fig. *1*

Type. Holotype illustrated bu Riding (1987, fig. 7/1).

Comments. In accordance with Stover & Evitt (1978, p. 187) Jan Du

Chêne et al. (1986c, p. 315) and Brenner (1988, p. 72) the genus *Endoscrinium* (Klo-ment, 1960) Vozzhennikova, 1967 is considered by me as a junior synonym he the genus *Scriniodinium*. That made it necessary a new combination to be developed and tf-species *E. asymmetricum* to be transferred to the genus *Scriniodinium*.

Occurrence. Boreholes: R-1 Bjalo pole (depth 3385-3387 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-7 Vârbica (depth 3604 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); R-1 Junak (depth 1753 m, Late Bathonian, Polaten Formation); R-1 Čerešovo (depth 1128.8-1130 m, Middle Bathonian, Esenica Formation).

Scriniodinium galeritum (Deflandre, 1938b) subsp. *galeritium* Klement, 1960

Pl. VI, fig. *2*

Type. Holotype illustrated by Deflandre (1938b, pl. 5, fig. 7) and refigured by Jan Du Chêne et al., 1986c (pl. 104, figs 10, 11).

Comments. The nominate species is published by Dodekova (1967, p. 13, pl. 1, figs 4, 5).

Occurrence: Boreholes: R-2hg Ovča mogila (depth 1549 m, Early Kimmeridgian, Pleven Formation); S-1 Razgrad (depth 933-943 m, Oxfordian, Drinovo Formation); R-1 Hrabrovo (depth 1974.5 m, Late Callovian, Sultanci Formation); S-9 Kardam (depth 870-880 m, Early Oxfordian, Černookovo Formation); S-31 Esenica (depth 750-755 m, Early Oxfordian, Černookovo Formation); S-33 Esenica (depth 753 m, Oxfordian, Černookovo Formation); S-32 Dolina (depth 715 m, Early Kimmeridgian, Černookovo Formation; depth 728 m, Oxfordian, Černookovo Formation); S-21 Kalugerica (depth 872-884 m, Early Oxfordian, Černookovo Formation); R-5 Tutrakanci (depth 1725-1740 m, Oxfordian, Provadija Formation); R-3 Brjag (depth 1238-1224 m, Oxfordian, Černookovo Formation); S-24 Nikola Kozlevo (depth 668-670 m, Early Kimmeridgian; depth 678-690 m, Oxfordian, Černookovo Formation); S-30 Kardam (depth 1104-1115.4 m, Oxfordian — Early Kimmeridgian, Drinovo Formation); R-3 Tjulenovo (depth 953-954.4 m, Oxfordian, Černookovo Formation); R-109 Vranino (depth 1289-1291 m, Early Kimmeridgian; depth 1293.8 m, Late Oxfordian, *Idoceras* sp., Černookovo Formation; depth 1298-1301 m, Early Oxfordian, *Neocampylites (Neocampylites) delmontanus* (Oppel, 1863); *Neocampylites (Neocampylites)* cf. *helveticus* (Jeannet, 1951); Provadija Formation).

Scriniodinium galeritum (Deflandre, 1938b) subsp. ***reticulatum*** Klement, 1960

Pl. VI, fig. *5*

Type. Holotype illustrated by Klement (1960, pl. 2, fig. 1) and refigured by Jan Du Chêne et al. (1986c, pl. 108, figs 9, 10).

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3185-3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-14 Grozdjovo (depth 2659 m, Late Callovian, Provadija Formation); S-1 Razgrad (depth 939 m, Oxfordian, Drinovo Formation); R-1 Junak (depth 1739 m, Late Callovian, *Calliphylo-ceras* cf. *disputabile* (Zittel, 1869), *Lacunosella* aff. *aroloca* (Oppel, 1865), *L. arolica* Zone, Provadija Formation); R-1 Hrabrovo (depth 1974.5 m, Late Callovian, Sultanci Formation); S-9 Kardam (depth 887 m, Early Oxfordian, Černookovo Formation); S-21 Kalugerica (depth 888 m, Early Oxfordian, Černookovo Formation); R-5 Tutrakanci (depth 1765 m, Early Oxfordian, Provadija Formation); S-24 Nikola Kozlevo (depth 669-671 m, Early Kimmeridgian, Černookovo Formation); R-109 Vranino (depth 1276 m, ?Early Kimmeridgian, Černookovo Formation; depth 1298-1303 m, Early Oxfordian, Provadija Formation).

Scrinidinium cf. ***luridum*** (Deflandre, 1983b) Klement, 1960 sensu Riding et al., 1985

Pl. V, fig. *2*
1985. *Scriniodinium* cf. *luridum*; sensu Riding et al., pl. 4, fig.5·

Comments. The species is distinguished for its well-shaped narrow apical horn, which is not observed in *S. luridum* (Deflandre, 1938b) Klement, 1960.

Occurrence. Borehole: R-1 Bjalo pole (depth 3387 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation).

Genus ***Tubotuberella*** Vozzhennikova, 1967 emended Sarjeant, 1982a emend. n.

1967. *Tubotuberella* Vozzhennikova, p. 179.
1977. *Tubotuberella*; emend. *B*rideaux, p. 36.
1977. *Glabridinium* Brideaux, p. 35.
1977. *Dimidiadinium* Brideaux, p. 37.
1978. *Tubotuberella*; emend. Stover & Evitt, p. 196.
1982. *Tubotuberella*; emend. Sarjeant, p. 41.

Type species (by original designation): *Tubotuberella rhombiformis* Vozzhennikova, 1967.

Diagnosis. The same as Sarjeant's (1982a, p. 41) with the following addition: a characteristic morphological feature in the species of the genus *Tubotuberella* is the ever strongly inclined, ventrally lying antapical plate — 1'''', wich is at 30° angle with the dorsal postcingular plate — 4'''. Introduced here is the term "inclination", from the Latin word -inclino — to incline, for expressing the inclination of the antapical plate. The opistopyle is positioned on the lower end of the antapical plate — 1'''', on the boundary with the postcingular plate — 4''' and is never occupying the whole antapical plate. Tabulation formula: 0-2?pr, 4', a?, 6'', 6c, 6''', 1p, 1pv, 1'''', s?.

Comments. The generic diagnosis is here made more precise by the tabulation formula for the more distinctly tabulated species, the tabulation of the hypocyst (fig. 4) and the structure of the hypopericoel. The latter was firstly illustrated by Gocht (1970b, p. 143, figs 12, 15). The development of opistopyles is due to the availability of hypopericoel and ventrally inclined antapical plate. The latter is poorly pronounced in *G. jurassica* where the antapical plate is sometimes slightly inclined. In *G. eisenackii* the inclination of 1'''' is greater and the opistopyles respectively are of larger size. The inclination angle in *G. eisenackii* is bigger than that in the species of the genus *Tubotuberella*. On the grounds of the above, bearing in mind the untypical inclination and other features of *G. eisenackii* designated by Sarjeant (1982a, pp. 19-25), I preserve the species to be referred to the genus *Gonyaulacysta*.

In the case of large opistopyles, a secondary increase of the inclination angle may sometimes occur. In such case much more measurements of different specimens should be made.

For the greater part of the species belonging to the genus *Tubotuberrella* the inclination is about 20° *(T. rhombiformis, T. sphaerocephalus, T. dangeardii, T. egementii, T. whatleyi)* and about 25° *(T. uncinata)*. The measurements have been made using the microphotographs of the holotypes published. In my believe the illustrated tabulation schemes of *T. dangeardii* subsp. *dangeardii* Sarjeant (1968, p. 226, fig. 3 and 1982a, p. 22, fig. 5c, d) and *T. egementii* Gitmez (1970, p. 273, fig. 18) do not reflect the real tabulation. The opistopyle is considered to be antapical plate, and the markedly inclined plate 1'''' may be seen on the photographs of Sarjeant (1968, pl. 1, fig. 21; pl. 3, figs 8, 15; 1982a, pl. 5, fig. 7; pl. 8, figs 4, 6) and Gitmez (1970, pl. 10, fig. 5). The correct tabulation scheme is shown on fig. 4 where the inclination is very typical. The strongly inclined antapical plate is causing deformation on the postcingular plates 3''' and 5'''. The latter ones have short ventral and highly elongated lateral-dorsal sides. The dorsal part of the hypocyst is occupied by an extendedly-trapezoid plate 4'''.

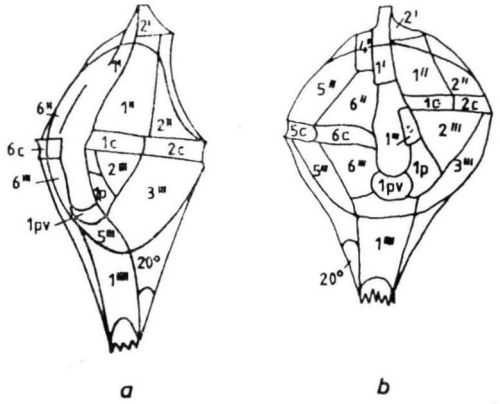


Fig. 4. Revisedtabulation sketch of *Tubotuberella dangeardii* (Sarjeant, 1968) with inclination 20°:(a) in ventro-lateral view; (b) in ventral view

PLATEI

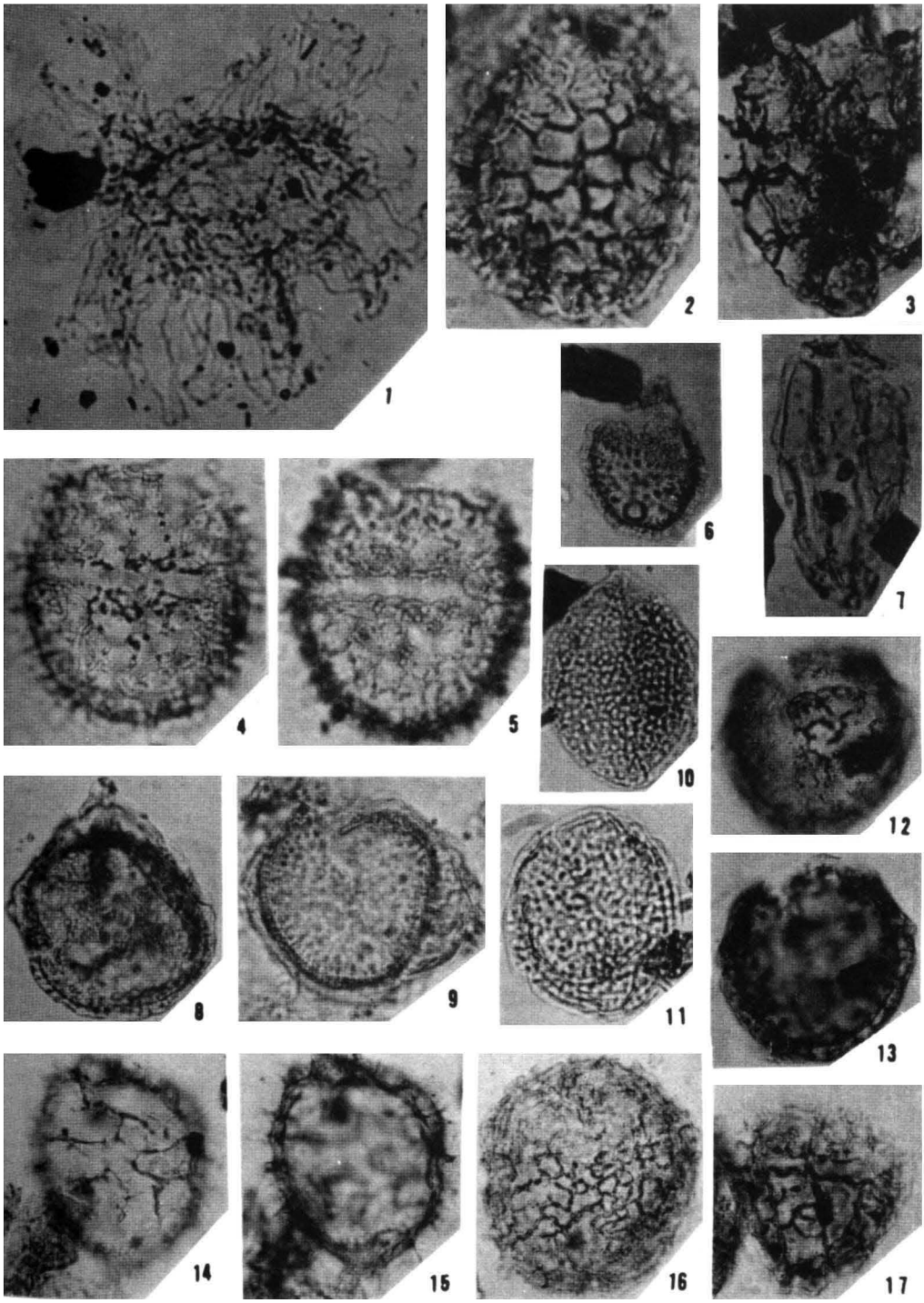


PLATE I

1. *Adnatosphaeridium caulleryi* (D e f l a n d r e, 1938b). Slide 1710-2, Borehole R-4 Mirovo, depth 1293 m, Tiča Formation, Tithonian, ×600
2. *Valensiella ovula* (D e f l a n d r e, 1947c). Slide 1375-1, borehole S-33 Esenica, depth 795.7 m, Černookovo Formation, Late Callovian, ×600
3. *Ellipsoidictyum cinctum* "Form A" G o c h t, 1970b. Slide 3421-1, borehole R-6 Sultanci, depth 1960 m, Esenica — Polaten Formation, Late Bathonian, ×600
4. *Ellipsoidictyum reticulatum* (V a l e n s i, 1953). Slide 910-9, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, ×700
5. The same specimen viewed by transparency, ×700
6. *Lagenadinium callovianum* P i e l, 1985. Slide 3639-1, Borehole R-1 Hrabrovo, depth 1977.2 m, Sultanci Formation, Middle Callovian, ×500
7. *Belodinium asaphum* D r u g g, 1978. Slide 1322-2, borehole S-31 Esenica, depth 756.5 m, Černookovo Formation, Late Callovian, ×500
8. *Dingodinium harsveldtii* H e r n g r e e n et al., 1984. Slide 3133-2, borehole R-1 Bârdarski Geran, depth 3188 m, Verenica Member of Bov Formation, Middle Callovian, ×600
9. *Dingodinium harsveldtii* H e r n g r e e n et al., 1984. Slide 3499-1, borehole R-7 Sultanci, depth 1895 m, Sultanci Formation, Late Callovian, ×600
10. *Chlamydophorella* sp. SA S m e l r o r, 1988a. Slide 870-6, borehole S-32 Dolina, depth 745.5 m, Černookovo Formation, Callovian, ×600
11. *Chlamydophorella* sp. SA S m e l r o r, 1988a. Slide 910-22, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, ×600
12. *Valensiella vermiculata* G o c h t, 1970b. Slide 3941-12, borehole R-3 Junak, depth 1792.2 m, Esenica — Polaten Formation, Early Callovian, ×570
13. The same specimen in median view, ×570
14. *Ellipsoidictyum gochtii* F e n s o m e, 1979. In high focus. Slide 3639-5, borehole R-1 Hrabrovo, depth 1977.2 m, Sultanci Formation, Middle Callovian, ×550
15. The same specimen, in median focus, ×550
16. *Valensiella ampula* G o c h t, 1970b. Slide 3133-3, borehole R-1 Bârdarski geran, depth 3188 m, Verenica Member of Bov Formation, Middle Callovian, ×600
17. *Ellipsoidictyum cinctum* K l e m e n t, 1960. Slide 3941-2, borehole R-3 Junak, depth 1792.2 m, Esenica — Polaten Formation, Early Callovian, ×550

PLATE II

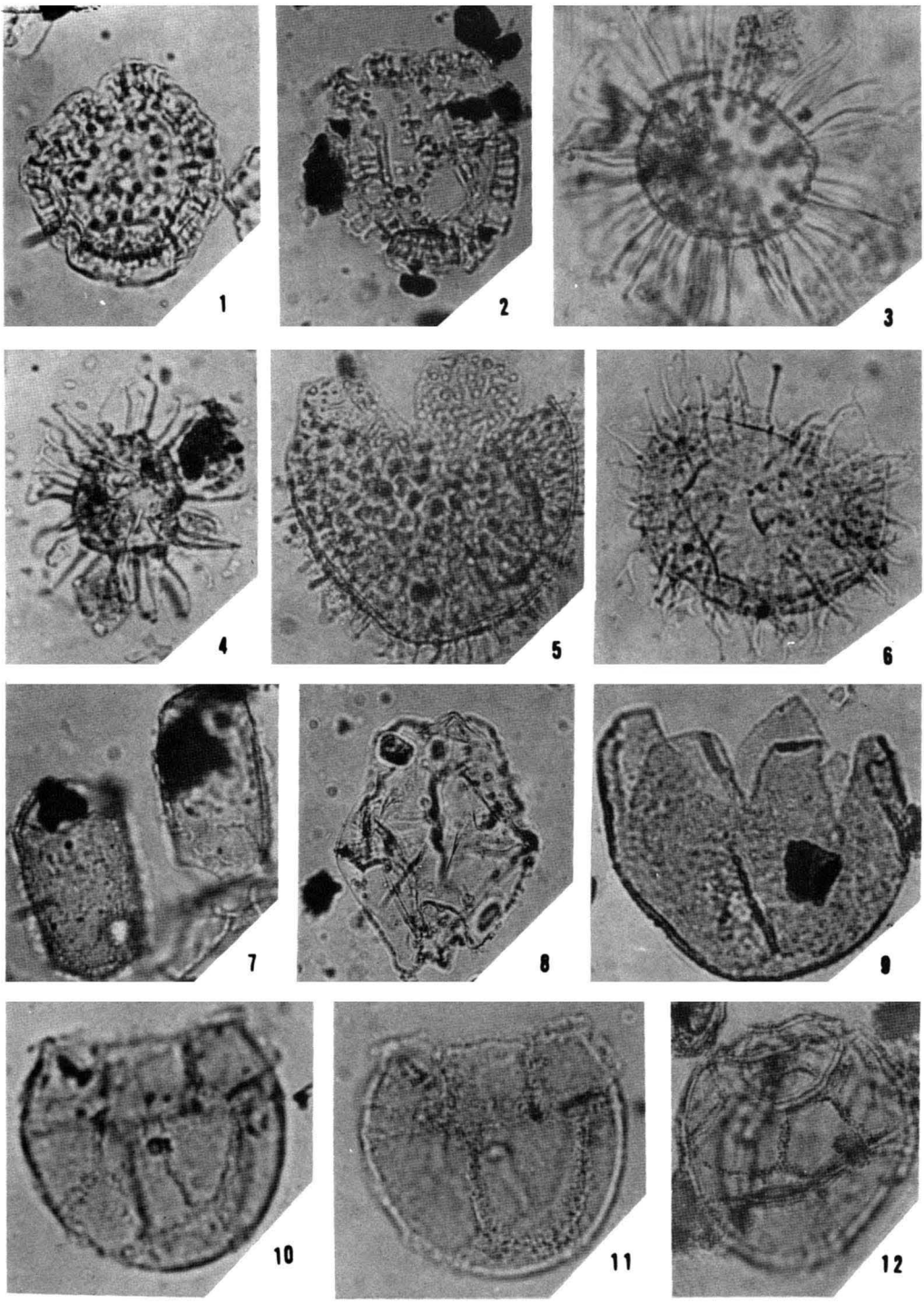


PLATE II

1. *Stephanelytron scarburghense* S a r j e a n t, 1961a. Slide 1298-1, borehole S-9 Kardam, depth 877.5 m, Černookovo Formation, Early Oxfordian, × 600
2. *Stephanelytron redcliffense* S a r j e a n t, 1961a. Slide 1310-2, borehole S-9 Kardam, depth 870.5 m, Oxfordian, Černookovo Formation, × 600
3. *Cleistosphaeridium polytrichum* (V a l e n s i, 1947). Slide 1130-21, borehole S-10 Černookovo, depth 944.6-949 m, Dobrič Formation, Late Bathonian, × 800
4. *Cleistosphaeridium tribuliferum* (S a r j e a n t, 1962a). Slide 1938-2, borehole S-30 Kardam, depth 1115.4 m, Drinovo Formation, Early Oxfordian, × 600
5. *Sentusidinium rioultii* (S a r j e a n t, 1968). Slide 910-1, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, × 700
6. *Cleistosphaeridium varispinosum* (S a r j e a n t, 1959). Slide 1969-1, borehole R-1 Tjulenovo, depth 1017.4 m, Dobrič Formation, Late Bathonian, × 550
7. *Kylindrocysta spinosa* F e n t o n et al., 1880. Slide 1270-5, borehole P-2 Preslavci, depth 1033 m, Esenica Formation, Middle Bathonian, × 600
8. *Atopodinium prostatum* D r u g g, 1978. Slide 1130-3, borehole S-10 Černookovo, depth 944.6-949 m, Dobrič Formation, Late Bathonian, × 500
9. *Escharisphaeridia pocockii* (S a r j e a n t, 1968). Slide 3558-1, borehole R-1 Junak, depth 1739 m, Provadija Formation, Late Callovian, × 600
10. *Lithodinia* sp. A. In ventral view by transparency. Slide 910-1, Borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, × 600
11. The same specimen, in dorsal view, × 600
12. *Lithodinia* sp. A Note the monolithic operculum in place. Slide 910-1, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, × 500

PLATE III

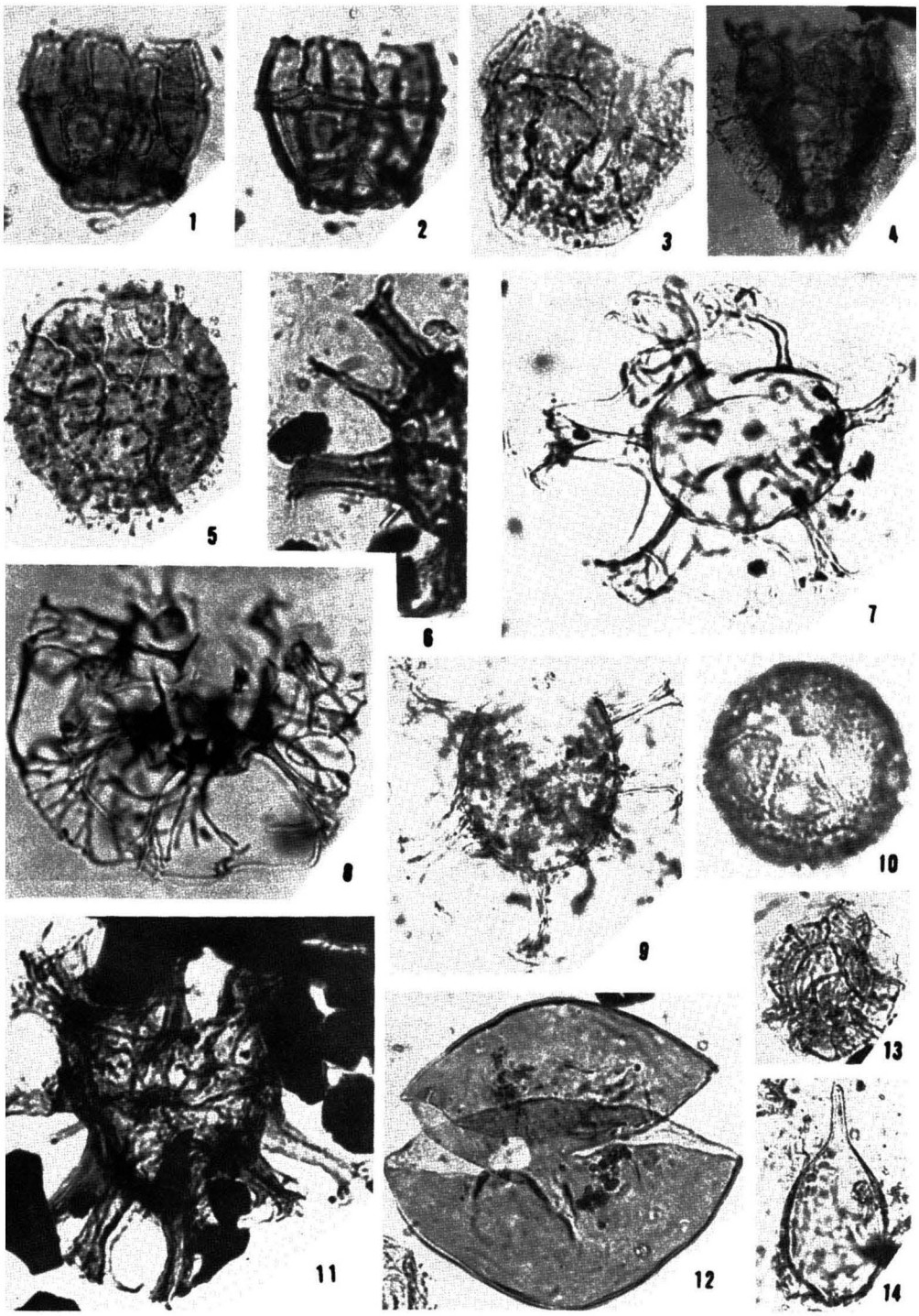


PLATE III

1. *Lithodinia* sp. B. In ventral view, note the posterior intercalar plate-2 p. Slide 996-1, borehole S-24 Nikola Kozlevo, depth 728 m, Esenica Formation, Middle Bathonian, ×500
2. The same specimen; dorsal side viewed by transparency, ×500
3. *Lithodinia borealis* (Sarjeant, 1980b). Slide 1961-1, borehole R-1 Tjulenovo, depth 1017.4 m, Dobrič Formation, Late Bathonian, ×600
4. *Lithodinia* cf. *superornata* (W. Wetzel), 1966), Slide 3562-1, borehole R-1 Junak, depth 1746.5 m, Polaten formation, Early Callovian — Late Bathonian, ×600
5. *Lithodinia jurassica* Eisenack, 1935. In vetral view: opercular pieces in place. Slide 3133.2, borehole R-1 Bârdarski geran, depth 3188 m, Verenica Member of Bov Formation, Middle Callovian, ×600
6. *Compositosphaeridium polonicum* (Górka, 1965). Note the clear septum uniting the proximal ends of the upper left processes. Slide 4073-1, borehole R-14 Grozdjovo, depth 2659 m, Provadija Formation, Late Callovian, ×600
7. *Rigaudella aemula* (Deflandre, 1938b). Slide 903-9, borehole S-32 Dolina, depth 743 m, Černookovo Formation, Early Oxfordian, ×500
8. *Rigaudella filamentosa* (Cookson & Eisenack, 1958). Slide 903-9, borehole S-32 Dolina, depth 743 m, Černookovo Formation, Early Oxfordian, ×500
9. *Compositosphaeridium polonicum* (Górka, 1965). Slide 1130-21, borehole S-10 Černookovo, depth 944.6-949 m, Dobrič Formation, Late Bathonian, ×500
10. *Gongylodinium erymnoteichos* Fenton et al., 1980. Slide 387-3, Town of Belogradčik, Polaten Formation, early Bathonian, ×600
11. *Compositosphaeridium polonicum* (Górka, 1965). Slide 1676-2, borehole R-5 Tutrakanci, depth 1765 m, Provadija Formation, Middle Oxfordian, ×600
12. *Mendicodinium groenlandicum* (Pocock & Serjeant, 1972). In ventral view with sulcal concavity. Slide 3133-4, borehole R-1 Bârdarski Geran, depth 3188 m, Verenica Member of Bov Formation, Middle Callovian, ×550
13. *Heslertonia teichophera* (Sarjeant, 1961a). Slide 3941-1, borehole R-3, Junak, depth 1792.2 m, Esenica — Polaten Formation, Early Callovian, ×550
14. *Pareodinia ceratophora* Deflandre, 1947c. Slide 1016-2, borehole S-10 Černookovo, depth 946.9 m, Dobrič Formation, Late Bathonian, ×450

PLATE IV

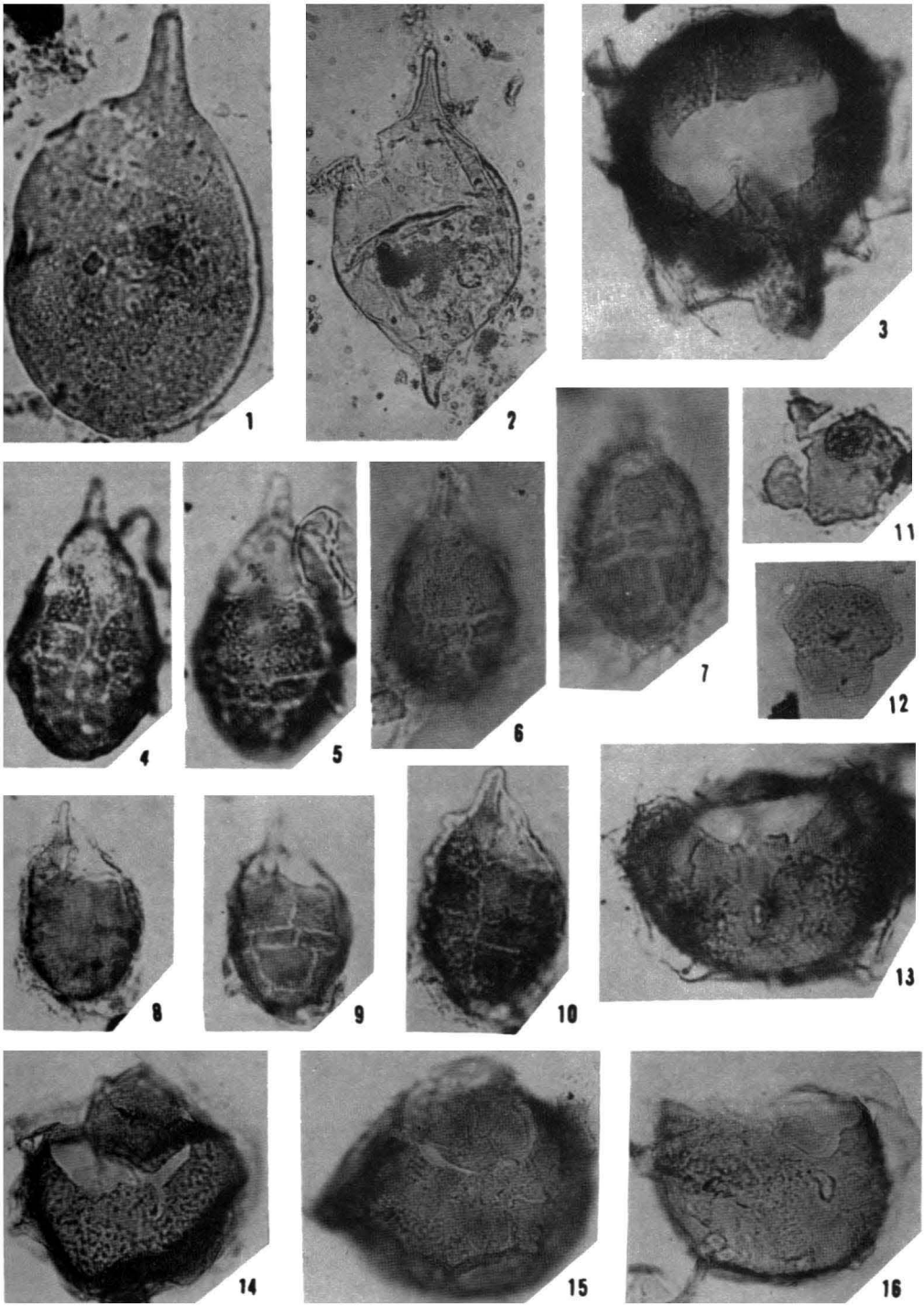


PLATE IV

1. Pareodinia groenlandica S a r j e a n t, 1972. Slide 1360-1, borehole S-31 Esenica, depth 809 m, Esenica Formation, Middle Bathonian, ×600

2. Kalyptea stegasta (S a r j e a n t, 1961a). Slide 1016-4, borehole S-10 Černookovo, depth 946.9 m, Dobrič Formation, Late Bathonian, ×500

3. Polygonifera? aspera sp. n. In apical view, operculum displaced in lower part of the photo; combination archeopyle with apical and tree intercalar plates symmertrically lacking. Slide 3639-8, borehole R-1 Hrabrovo, depth 1977.2 m, Sultanci Formation, Middle Callovian, ×600

4-10. Tabulodinium senarium sp. n. Dobrič Formation: *4* — holotype, in ventral view by transparency, without "kalyptra", slide 910-5, borehole S-12 Gornjak, depth 852.2 m, ?Early Callovian, ×600; *5* — the same specimen, in dorsal view, ×600; *6* — in epi-ventral view, slide 1969-3, borehole R-1 Tjulenovo, depth 1017.4 m, Late Bathonian, ×500; *7* — the same specimen, in hipo-dorsal view with "kalyptra", by transparency, ×500; *8* — in median view with "kalyptra" as outer wall layer, slide 2058-11, borehole R-87 Gurkovo, depth 1371.5 m, Late Bathonian, ×450; *9* — the same specimen, in lateral view by tansparency, ×450; *10* — the same specimen, in lateral view with archeopyle and "kalyptra" as outer wall layer not broken, ×530

11-16. Polygonifera? aspera sp. n. Borehole R-1 Hrabrovo, depth 1977.2 m, Sultanci Formation, Middle Callovian: *11* — free operculum with apical and intercalar plates, slide 3639-1, ×600; *12* — free apical operculum, slide 3639-2, ×500; *13* — holotype, in ventral view with two slightly marked hypocystal lobes, flagellar mark and a large archeopyle, slide 3639-4, ×600; *14* — specimen in apical-ventral view, operculum slightly displaced, slide 3639-5, ×550; *15* — specimen with two wall layers wholly appressed; operculum slightly displaced consisting of four apical and two intercalar plates, slide 3639-5, ×500; *16* — specimen in ventral view with flagellar mark and a large archeopyle, slide 3639-1, ×500

PLATE V

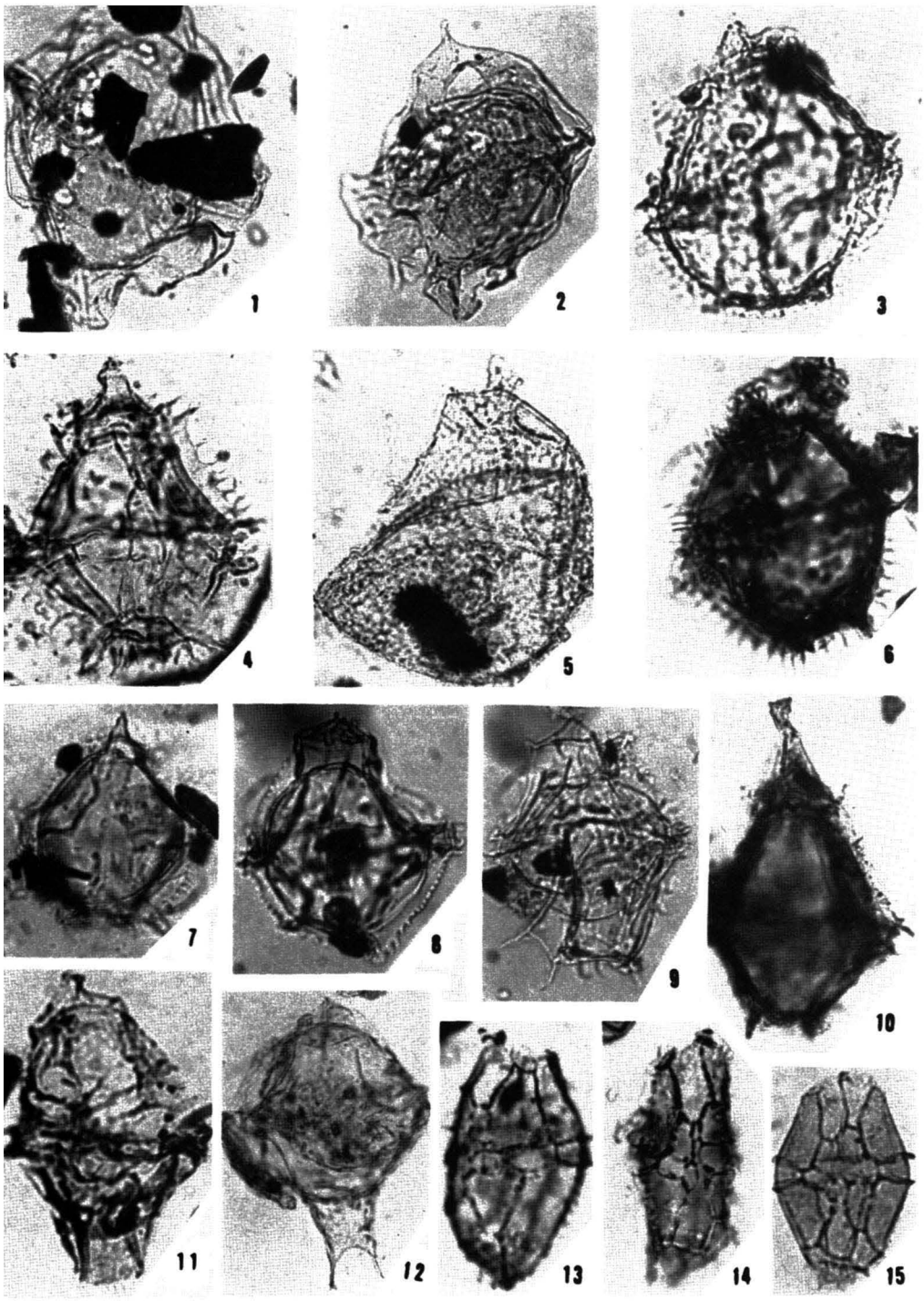


PLATE V

1. *Scriniodinium asymmetricum* (R i d i n g, 1987) comb. n. Slide 4019-3, borehole R-1 Bjalo pole, depth 3387 m, Verenica Member of Bov Formation, Early Callovian, ×500
2. *Scriniodinium* cf. *luridum* (D e f l a n d r e, 1938b) sensu R i d i n g et al., 1985 comb. n. Slide 4019-1, borehole R-1 Bjalo pole, depth 3387 m, Verenica Member of Bov Formation, Early Callovian, ×500
3. *Rhynchodiniopsis? regalis* (G o c h t, 1970b). Slide 1270-5, borehole R-2 Preslavci, Esenica Formation, Middle Bathonian, ×600
4. *Gonyaulacysta jurassica* (D e f l a n d r e, 1938b). Slide 3133-3, borehole R-1 Bârdarski Geran, depth 3188 m, Verenica Member of Bov Formation, Middle Callovian, ×550
5. *Diacanthum? filapicatum* (G o c h t, 1970b). In lateral view. Slide 1016-1, borehole S-10 Černookovo, depth 946.9 m, Dobrič Formation, Late Bathonian, ×500
6. *Gonyaulacysta pectinigera* (G o c h t, 1970b). In dorso-median view, 3941-9, borehole R-3 Junak, depth 1792-2 m, Esenica — Polaten Formation, Early Callovian, ×600
7. *Gonyaulacysta pectinigera* (G o c h t, 1970b). In ventral view. Slide 910-8, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, ×450
8. *Gonyaulacysta centriconata* R i d i n g, 1983. In ventral view. Slide 1133, borehole R-67 Makedonka, depth 1370 m, Dobrič Formation, Middle Callovian, ×500
9. *Gonyaulacysta eisenackii* (D e f l a n d r e, 1938b). In lateral view. Slide 1298-1, borehole S-9 Kardam, depth 877.5 m, Černookovo Formation, Early Oxfordian, ×500
10. *Gonyaulacysta jurassica* subsp. *adjecta* var. *longicornis* (D e f l a n d r e, 1938b). In dorso-median view. Slide 3941-13, borehole R-3 Junak, depth 1792.2 m, Esenica —Polaten Formation, Early Callovian, ×600
11. *Tubotuberella dangeardii* (S a r j e a n t, 1968). Slide 2101.2, borehole R-2 Agatovo, depth 3276 m, Polaten Formation, Middle Bathonian, ×600
12. *Tubotuberella dangeardii* (S a r j e a n t, 1968). Slide 3941-2, Borehole R-3 Junak, depth 1792.2 m, Esenica — Polaten Formation, Early Callovian, ×550

13-15. *Carpathodinium predae* (B e j u, 1971). Town of Belogradčik, Polaten Formation, Early Bathonian, ×450; *13* — slide 417-1, in lateral view; *14* — slide 417-2, in ventral view, long and narrow specimen; *15* — slide 417, in ventral view

PLATE VI

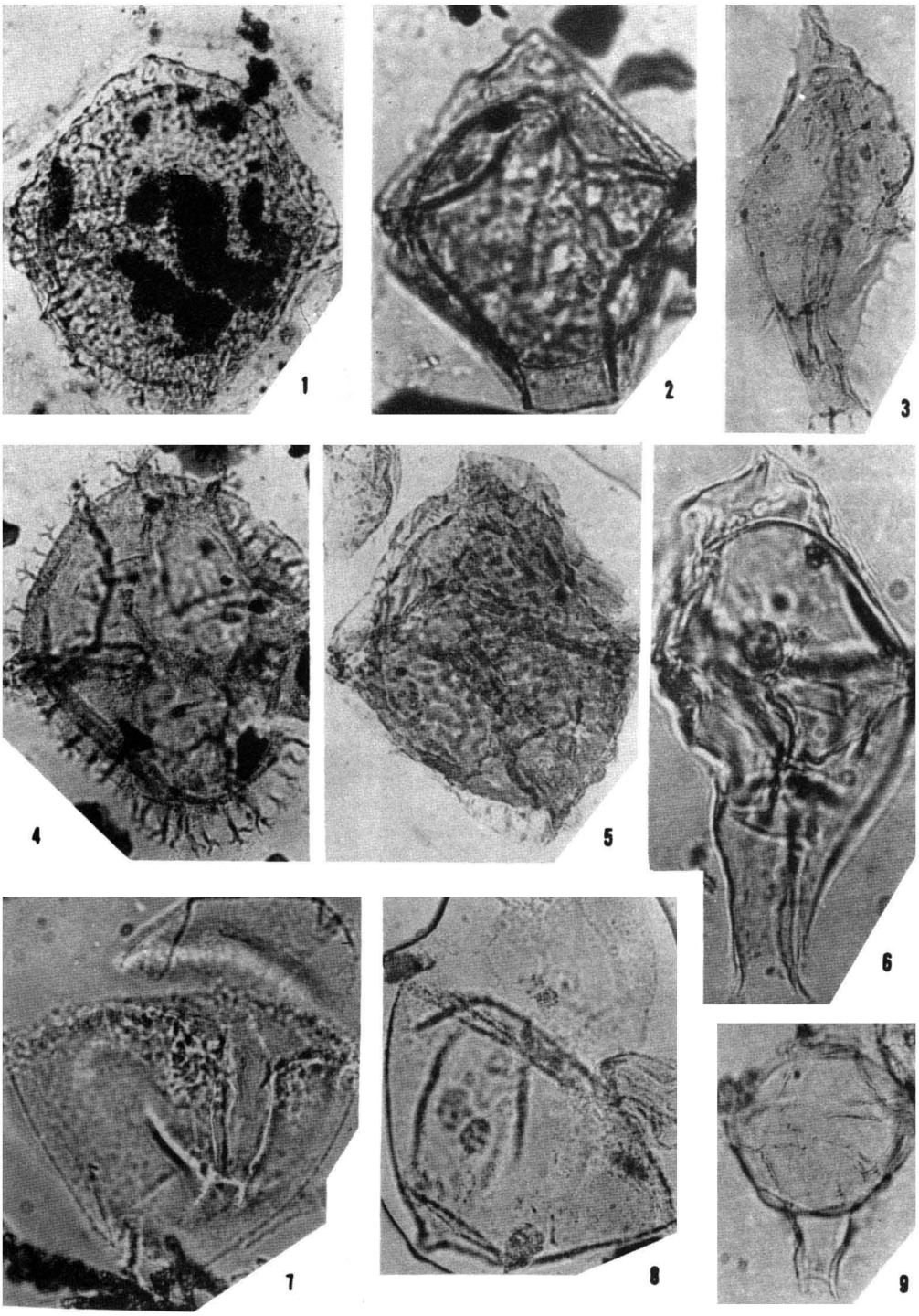


PLATE VI

1. *Aldorfia aldorfensis* (G o c h t, 1970b). Slide 1016-2, borehole S-10 Černookovo, depth 946.9 m, Dob: Formation, Late Bathonian, ×500
2. *Scriniodinium galeritum* subsp. *galeritum* (D e f l a n d r e, 1938b). Slide 1987-1, borehole R-109 Vranino, depth 1303 m, Provadija Formation, Early Oxfordian, ×580
3. *Tubotuberella vozzhennikovae* (S a r j e a n t, 1982b). In ventro-lateral view. Slide 3941-9, borehole R-3 Junak, depth 1792.2 m, Esenica — Polaten Formation, Early Callovian, ×500
4. *Rhynchodiniopsis cladophora* (D e f l a n d r e, 1938b). Slide 1940-1, borehole R-3 Tjulenovo, depth 954 m, Černookovo Formation, Oxfordian, ×500
5. *Scriniodinium galeritum* subsp. *reticulatum* K l e m e n t, 1960. Slide 3132-3, borehole R-1 Bårdarski Geran, depth 3185 m, Verenica Member of Bov Formation, Middle Callovian, ×500
6. *Tubotuberella* cf. *rhombiformis* V o z z h e n n i k o v a, 1967. In ventro-lateral view, note a big opistopyle and inclination. Slide 1044-2, borehole R-54 Gurkovo, depth 1332 m, Dobrič Formation, Late Bathonian, ×1000
7. *Wanaea acollaris* D o d e k o v a, 1975. Note the sulcus on the hypocyst, seen in distorted with air bubbles slide 910-9, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, ×600
8. *Wanaea acollaris* D o d e k o v a, 1975. Note the tabulation on the epicyst. Slide 910-20, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian ×570
9. *Tubotuberella dangeardii* (S a r j e a n t, 1968). In ventral view. Slide 910-1, borehole S-12 Gornjak, dept 852.2 m, Dobrič Formation, Early Callovian, ×600

PLATE VII

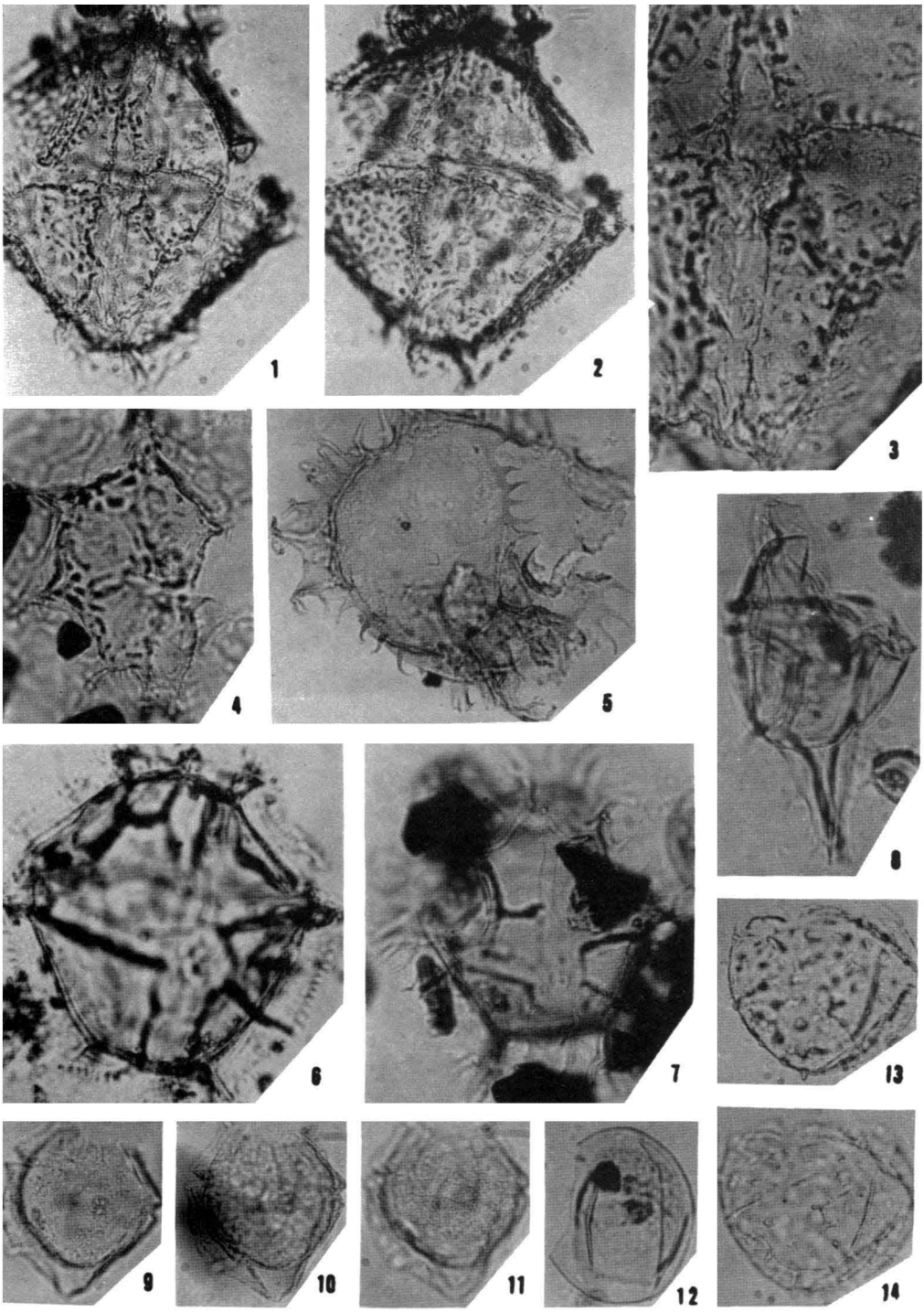


PLATE VII

1-4. Mosaicodinium mosaicum (D o d e k o v a, 1975) comb. n. Borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian: *1* — slide 910-2, holotype, in ventral view, ×599; *2* — the same specimen, in dorsal view by transparency, ×500; *3* — the same specimen, construction of the sulcus, ×1000; *4* — slide 910-3, epicyst in apical view, construction of the apex, ×550

5. Ctenidodinium combazii D u p i n, 1968. Slide 2101-2, borehole R-2 Agatovo, depth 3276 m, Polaten Formation, Middle Bathonian, ×500

6. Ctenidodium continuum G o c h t, 1970b. Slide 1130-28, borehole S-10 Černookovo, depth 944.6-949 m Dobrič Formation, Late Bathonian, ×600

7. Ctenidodinium ornatum (E i s e n a c k, 1935). Slide 910-5, borehole S-12 Gornjak, depth 852.2 m, Dobri Formation. ?Early Callovian, ×550

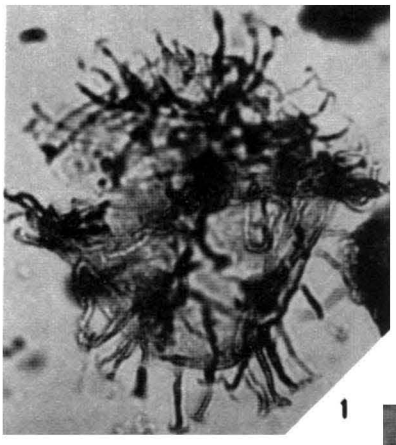
8. Tubotuberella dangeardii (S a r j e a n t, 1968). In lateral view, note the inclination between the plates 1'''' and 4''' Slide 910-1, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, ×650

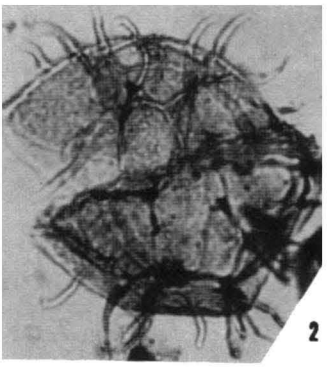
9-11. Dingodinium minutum D o d e k o v a, 1975. Holotype, slide 910-10, borehole S-12 Gornjak, depth 852.2 m,, Dobrič Formation, ?Early Callovian, ×500; *9* — In ventral view by transparency; *10* — In median view; *11* — In dorsal view

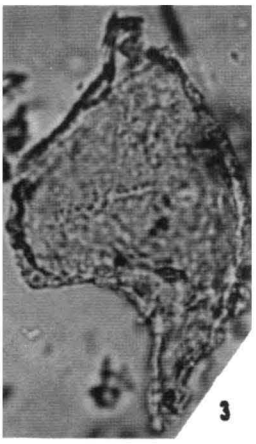
12. Chytroeisphaeridia chytroeides (S a r j e a n t, 1962a). In lateral view. Slide 1940-1, borehole R-3 Tjulenovoč, depth 954 m, Černookovo Formation, Oxfordian, ×500

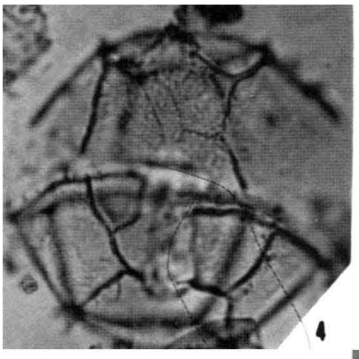
13, 14. Sentusidinium baculatum (D o d e k o v a, 1975). Holotype, slide 1053-2, borehole R-54 Gurkovo, depth 1341 m, Dobrič Formation, Late Bathonian, ×450

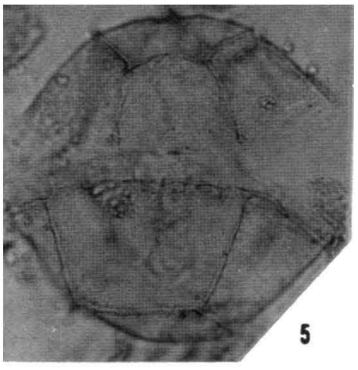
PLATE VIII

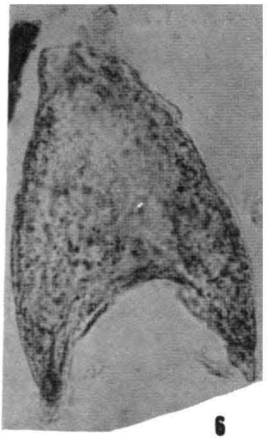

1

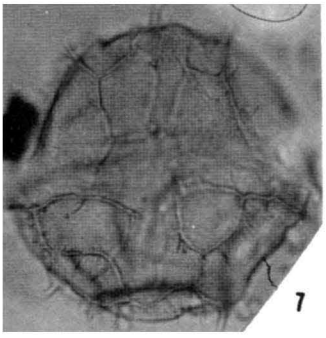

2

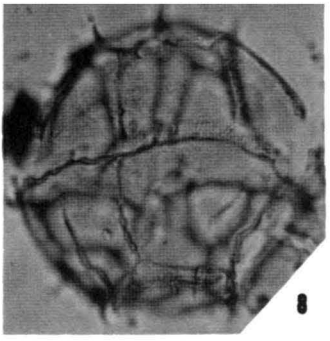

3

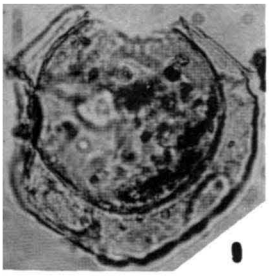

4

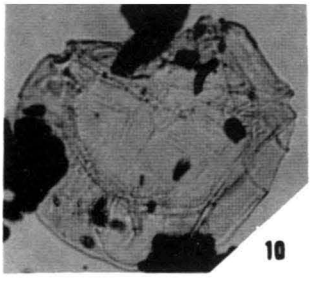

5


6


7


8


9


10


11

PLATE VIII

1, 2. Ctenidodinium cornigerum (V a l e n s i, 1953). Slide 2101-2, borehole R-2 Agatovo, depth 3276.6 m, Polaten Formation, Middle Bathonian, × 600

1 — specimen with long processes bi-trifurcated at distal ends; *2* — specimen with acuminate ending processes, rarement bifurcate

3. Nannoceratopsis gracilis A l b e r t i, 1961. Slide 417.2, Town of Belogradčik, Polaten Formation, Early Bathonian, 600

4. Ctenidodinium sellwoodii (S e r j e a n t, 1975a). In ventral view by transparency. Slide 3133-1, borehole R-1 Bârdarski geran, depth 3188 m, Verenica Member of Bov Formation, Middle Callovian, ×550

5. The same specimen in dorsal view, × 550

6. Nannoceratopsis pelluciáa R e f l a n d r e, 1938b. Slide 3941-1, borehole R-3 Junak, depth 1792.2 m, Esenica — Polaten Formation, Early Callovian, × 500

7, 8. Ctenidodinium aff. *sellwoodii* (S e r j e a n t, 1975a). Slide3 133-1, borehole R-1 Bârdarski Geran, depth 3188 m, Verenica Member of Bov Formation, Middle Callovian, × 500

7 — in ventral view, note the plate 2p on the left lower part of the photo; *8* — in dorsal view, by transparency

9. Sirmiodiniopsis orbis D r u g g, 1978. Slide 1130-27, borehole S-10 Černookovo, depth 944.6-949 m, Dobrič Formation, 600

10. Sirmiodinium grossi A l b e r t i, 1961. Slide 903-1, borehole S-32 Dolina, depth 743 m, Černookovo Formation, Early Oxfordian, 500

11. Nannoceratopsis spiculata S t o v e r, 1966. Slide 1799 m, borehole R-1 Čerešovo, depth 1128.8 m, Esenica Formation, Middle Bathonian, 600

PLATE IX

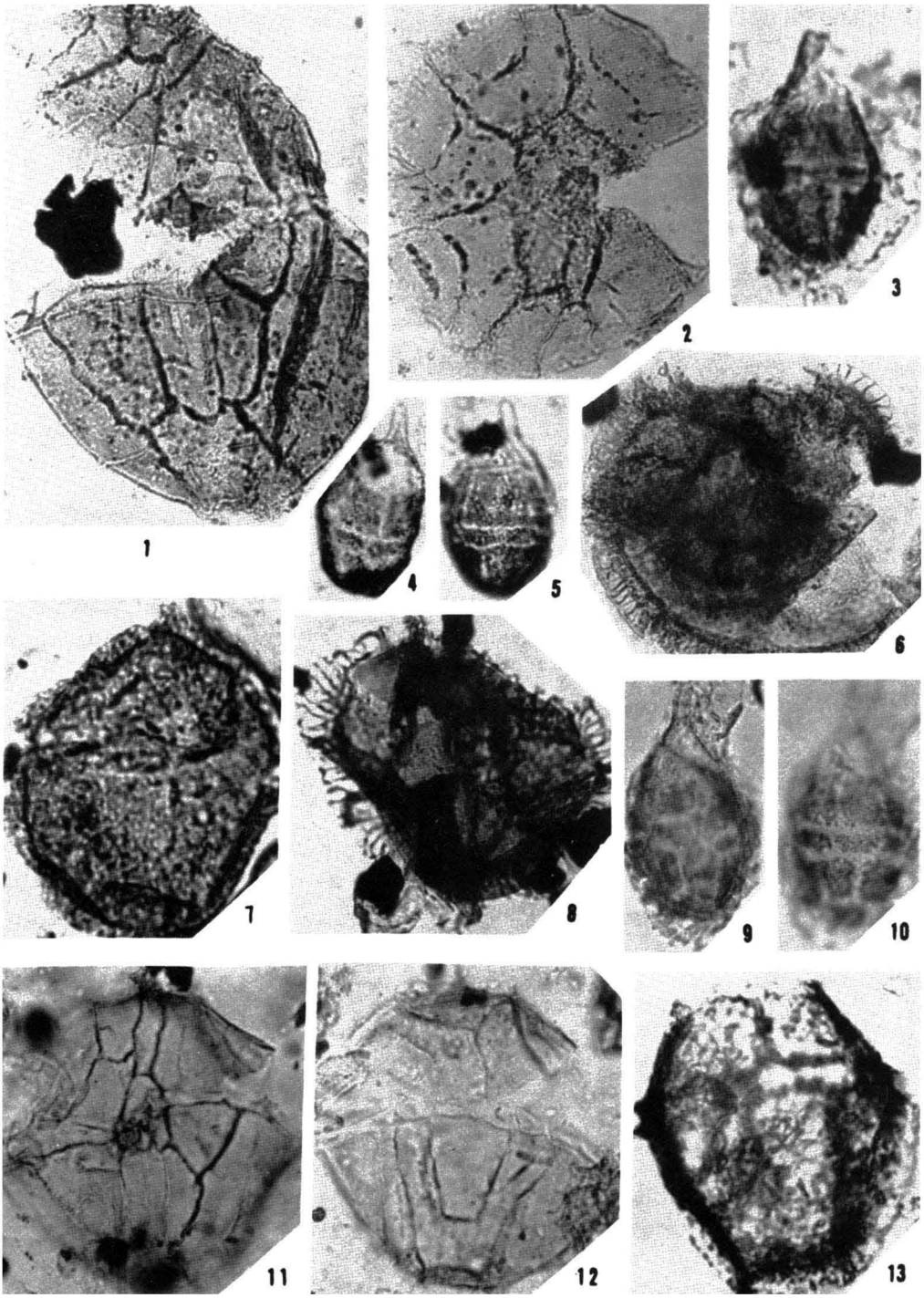


PLATE IX

1, 2. Korystocysta gochtii (S a r j e a n t, 1976). Slide 3133-3, borehole R-1 Bârdarski Geran, depth 3188 m, Verenica Member of Bov Formation, Middle Callovian, ×600: *1* — whole specimen, with epicystal archeopyle; *2* — epicyst, in apical view

3-5, 9, 10, Tabulodinium senarium sp. n., Dobrič Formation: *3* — slide 1969-4, borehole R-1 Tjulenovo, depth 1017.4 m, Late Bathonian, × 550; *4* — slide 910-6? borehole S-12 Gornjak, depth 852.2 m, ?Early Callovian, × 470; *5* — slide 910-5, borehole S-12 Gornjak, depth 852.2 m, ?Early Callovian, ×470; *9* — in ventral view, by transparency, slide 1969-4, Borehole R-1 Tjulenovo, depth 1017.4 m, Late Bathonian, ×550; *10* — same specimen, in dorsal view, × 550

6. Rhynchodiniopsis gochtii (P o c o c k, 1972). In apical view. Note the cingular ornamentation. Slide 3941-7, borehole R-3 Junak, depth 1792.2 m, Esenica — Polaten Formation, Early Callovian, ×540

7. Eodinia cf. *pachytheca* E i s e n a c k, 1936. Slide 3639-2, Borehole R-1 Hrabrovo, depth 1977.2 m, Sultanci Formation, Middle Callovian, × 730

8. Rhynchodiniopsis gochtii (P o c o c k, 1972). In apical view, note the cingular processes with connected distal ends. Slide 3558-1, borehole R-1 Junak, depth 1739 m, Provadija Formation, Early Oxfordian—Late Callovian, × 530

11, 12. Korystocysta pachyderma (D e f l a n d r e, 1938b). Slide 2028-1, borehole R-88 Čaričino, depth 1276 m, Dobrič Formation, Late Bathonian, × 500: *11* — specimen in ventral view; *12* — specimen in dorsal view, with growth bands

13. Lithodinia valensii (S a r j e a n t, 1966b). In median focus. Slide 541-5, borehole R-1 Dolni Dăbnik, depth 2729 m, Polaten Formation, Early Bathonian, 700

PLATE X

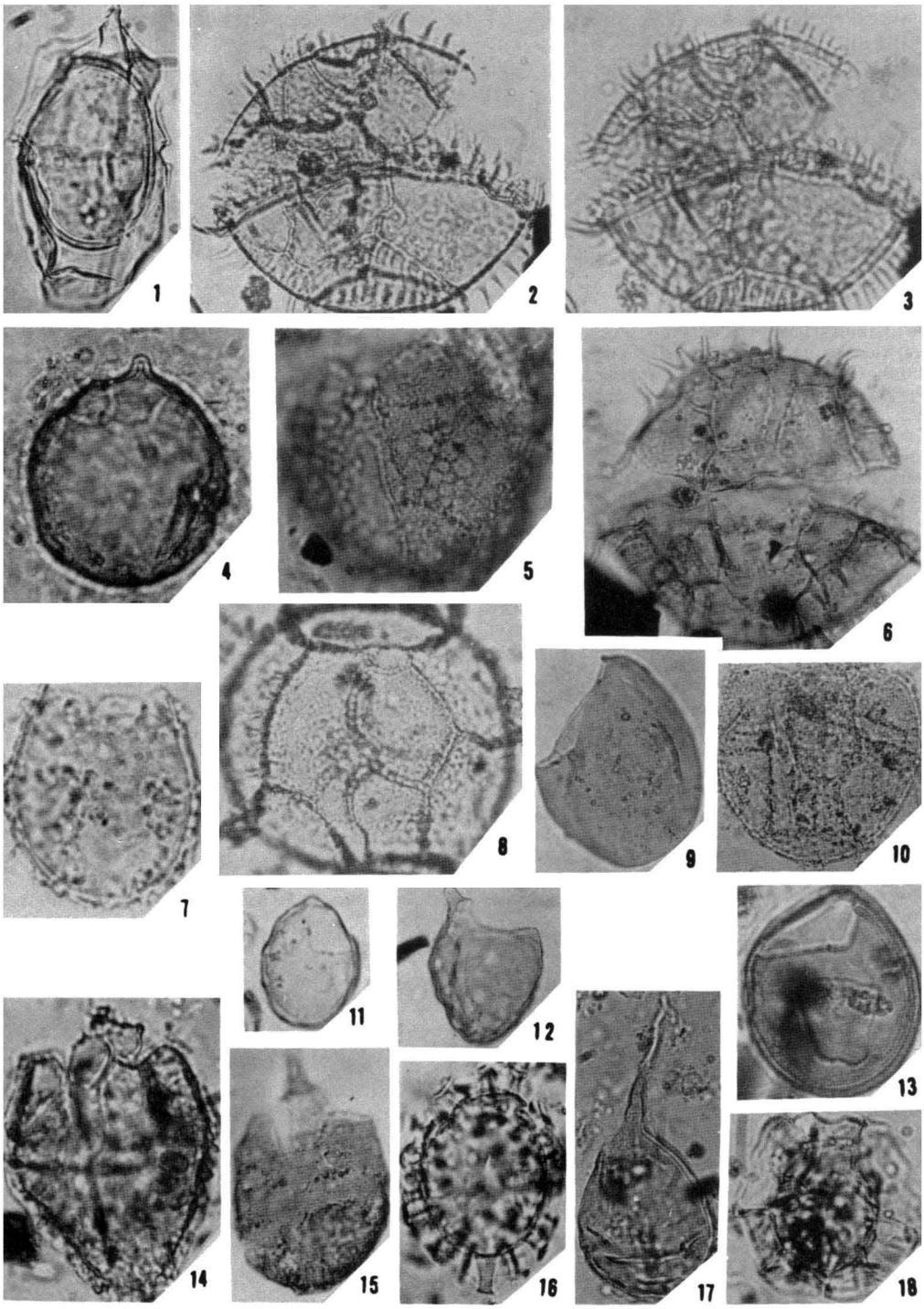


PLATE X

1. *Belodinium obsoletum* D o d e k o v a, 1975. Holotype, in median focus, slide 1130-19, borehole S-10 Černookovo, depth 944.6-949 m, Dobrič Formation, Late Bathonian, ×650
2, 3, 6, 8. *Ctenidodinium rotundum* D o d e k o v a, 1975:
2 — holotype, in ventral view by transparency, slide 910-1, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, ×500; *3* — the same specimen in dorsal view, ×500; *6* — specimen in ventral view. Note the asymmetrical cingulum and more rare sutural spines, slide 3133-1, borehole R-1 Bărdarski Geran, depth 3188 m, Verenica Member of Bov Formation, Middle Callovian, ×500; *8* — epicyst in apical view by transparency, slide 1130-4, borehole S-10 Černookovo, depth 944.6-949 m, Dobrič Formation, Late Bathonian, ×500
4. *Glomodinium reticulopilosum* D o d e k o v a, 1975. Holotype, in dorsal view, with 31 archeopyle, opercular pies in place, slide 1130-30, borehole S-10 Černookovo, depth 944.6-949 m, Dobrič Formation, Late Bathonian, ×800
5. *Lithodinia reticulata* (D o d e k o v a, 1975). Holotype, in ventro-lateral view, slide 1130-2, borehole S-10 Černookovo, depth 944.6-949 m, Dobrič Formation, Late Bathonian, ×700
7. *Parvulodinium clavatum* D o d e k o v a, 1975. Holotype in ventral view, slide 911-4, borehole S-12 Gornjak, depth 854 m, Dobrič Formation, Late Bathonian, ×1000
9, 11. *Chytroeisphaeridia scabrata* P o c o c k, 1972: *9* — slide 3941-9, borehole R-3 Junak, depth 1792.2 m, Esenica — Polaten Formation, Early Callovian, ×600; *11* — slide 910-5, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, ×420
10. *Lithodinia insulofigurata* (D o d e k o v a, 1975). Slide 1016.4, borehole S-10 Černookovo, depth 946.9 m, Dobrič Formation, Late Bathonian, ×500
12. *Pareodinia ceratophora* subsp. *scopaeus* (S a r j e a n t, 1972). Slide 3639-2, borehole R-1 Hrabrovo, depth 1977.2 m, Sultanci Formation, Middle Callovian, ×550
13. *Dodekovia gochtii* (D o d e k o v a, 1975). Holotype, slide 910-1, borehole S-12 Gornjak, depth 852.2 m, Dobrič Formation, ?Early Callovian, ×720
14. *Lithodinia borealis* (S a r j e a n t, 1980). Two plates and 1pr of apical operculum in place. Slide 1534-2, borehole S-21 Kalugerica, depth 904 m, Esenica Formation, Late Bathonian, ×600
15. *Pareodinia barentsensis* S m e l r o r, 1988a. Slide 3639-1, borehole R-1 Hrabrovo, depth 1977.2 m, Sultanci Formation, Middle Callovian, ×500
16. *Chlamydophorella raritubulae* D o d e k o v a, 1975. Paratype, slide 1130-15, Borehole S-10 Černookovo, depth 944.6-949 m, Dobrič Formation, Late Bathonian, ×750
17. *Pareodinia prolongata* S a r j e a n t, 1959. Slide 1045-2, borehole S-54 Gurkovo, depth 1333 m, Dobrič Formation, Late Bathonian, ×465
18. *Heslertonia teichophora* (S a r j e a n t, 1961a). Slide 1130-24, borehole S-10 Černookovo, depth 944.6-949 m, Dobrič Formation, Late Bathonian, ×630

The inclination in *T. dentata* R a y n a u d, 1978 was not measured because on all microphotographs (R a y n a u d, 1978, pl. 2, fig. 13 and J a n D u C h ê n e et al., 1986ɔ pl. 126, figs 1-3) the sutures are blurred by broad sutural crests and the tabulation, anp the position of plate 1'''' is dubious. I suppose that the inclination is over 30° and taking into account also the presence of caudiculae, and the general view of the cyst, I am coming to the conclusion that *T. dentata* R a y n a u d, 1978, p. 395, pl. 2, fig. 13 is to be referred to the genus *Gonyaulacysta-Gonyaulacusta dentata* (R a y n a u d, 1978), analogically to *G. eisenackii*.

Another species having inclination analogical to the one characteristic for the genus *Tubotuberella* is *Scriniodinium asymmetricum* (R i d i n g, 1987), though a number of other morphological features keep it to be belonging to the genus *Scriniodinium*.

Tubotuberella dangeardii (S a r j e a n t, 1968) S t o v e r & E v i t t, 1978

Pl. V, fig. *11*, *12*; Pl. VI, fig. *9*; Pl. VII, fig. *8*

T y p e. Holotype illustrated by S a r j e a n t (1968, pl. 3, fig. 8, text-fig. 3).

C o m m e n t s. As a typical representative of the tabulated forms of the genus *Tubotuberella*, this species has poorly marked tabulation. The latter is indicated by low ridges with scarce short spines. The availability of some well-preserved specimens made it possible a tabulation scheme specifying the plate pattern of the hypocyst to be developed (fig. 4). Plate 1''' is a small, narrow rectangle positioned between the sulcus and the larger triangular plate 2'''. 1''' is in contact with the cingulum (B r e n n e r, 1988, p. 29). Plates 3''' and 5''' are irregularly shaped, with their side short toward the ventral end and 2.5 to 3 times longer toward the dorsal end (fig. 4a). Plate 4''' is highly elongated, trapezoid. Plates 1p and 1pv are avai-, lable too. The epicyst has its apical structure indistinct, but a specimen in a proper for these studies position has not been found yet. Tabulation formula: ?pr, 4', a?, 6', 6c, 6''', 1p 1pv, 1'''', s?.

Subspecies of *T. dangeardii* are not being distinguished in the Bulgarian dinocyst assemblages.

O c c u r r e n c e. Boreholes: R-3 Čiren (depth 1292.5-1293.5 m, Middle — Late Callovian, Javorec Formation); R-12 Čiren (depth 1815-1817.5 m, Early Callovian, Verenica Member of the Bov Formation); R-2 Agatovo (depth 3276.6-3277.4 m, Middle Bathonian, Polaten Formation); R-14 Grozdjovo (depth 2659 m, Late Callovian, Provadija Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet.,; depth 1795.5-1801.5 m, Late Bathonian, Esenica — Polaten Formation); R-7 Sultanci (depth 1915-5-1920 m, Late Bathonian, Esenica — Polaten Formation); R-11 Žitnica (depth 1995.5 m, Late Bathonian, Esenica Formation); R-1 Junak (depth 1753 m, Late Bathonian, Polaten Formation); R-3 Brjag (depth 1280 m, Early Callovian, ?Polaten Formation) and an outcrop of the Kotel Formation, Balaban Dere River, Eastern Stara Planina Mountain.

Tubotuberella cf. ***rhombiformis*** V o z z h e n n i k o v a, 1967 ex S t o v e r & E v i t t, 1978

Pl. VI, fig. *6*

T y p e. Two different specimens are illustrated by V o z z h e n n i k o v a to be a holotype of species (pl. 101, fig. 2 and pl. 104, fig. 2). S t o v e r & E v i t t (1978, p. 197) determined one of the specimens illustrated on pl. 102, fig. 3a and pl. 104, fig. 2 to be a lectotype.

C o m m e n t s. The Bulgarian specimens are rhomboid in shape, with long hypopericoel, relatively big epipericoel with small, sharp apical horn and in their general shape they look like *T. rhombiformis*. However, in some specimens scarce fine spines on the sutures are available. They are abundant component of the Late Bathonian and Early Callovian assemblages, while the type material has been recorded in Upper Jurassic sediments.

O c c u r r e n c e. Boreholes: S-12 Gornjak (depth 852.2 m, ?Early Callovian, Dobrič Formation); S-54 Gurkovo (depth 1332 m, Late Bathonian, Dobrič Formation); R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation).

Tubotuberella vozzhennikovae (S a r j e a n t, 1982a) J a n D u C h ê n e et al., 1986c.

Pl. VI, fig. *3*

T y p e. Holotype illustrated by S a r j e a n t (1982, pl. 8, fig. 9).

C o m m e n t s. The Bulgarian specimens have the characteristic indented or spine-like distally sutural ridges. Sometimes, the scarce spines are bifurcate at their distal end. Some specimens have "accessory" shorter apical "horn", which might be due to the the preisence of higher sutural septae on the plate boundary betwe en the apical precingular series.

O c c u r r e n c e. Boreholes: R-3 Čiren (depth 1292.5 — 1293.5 m, Middle-Late Callovian, Javorec Formation); R-1 Bârdarski Geran (depth 3063 — 3066 m, Late Oxfordian-Early Kimmeridgian, Pleven Formation); R-1 Junak (depth 1739 m, Late Callovian, Provadja Formation; depth 1744 m, Middle Callovian, Sultanci Formation; depth 1745.5 m, Late Bathonian — Early Callovian, Polaten Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica-Polaten Formation); R-7 Sultanci (depth 1895 m, Late Callovian, Sultanci Formation); R-1 Tjulenovo (depth 1008 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1315.5 m, Late Bathonian — Early Callovian, Dobrič Formation); S-12 Gornjak (depth 852.2 m, ? Early Callovian, Dobrič Formation); S-10 Černookovo (depth 944.6-949 m, Late Bathonian, Dobrič Formation); an outcrop of the Kotel Formation, Balaban Dere River, Eastern Stara Planina Mountain.

Dinocysts with combination archeopyle

Genus ***Ctenidodinium*** D e f l a n d r e, 1938b emended W o o l l a m, 1983 emended B e n s o n, Jr., 1985

T y p e s p e c i e s (by original designation): *Lithodinia jurassica* var. *ornata* E i s e n a c k, 1935.

Ctenidodinium combazii D u p i n, 1968

Pl. VII, fig. *5*

T y p e. Holotype illustrated by D u p i n (1968, pl. 1, figs 4, 5, text-figs 3, 4).

O c c u r r e n c e. Boreholes: R-5 Devetaki (depth 3036.5-3038.5 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); R-1 Simeonovo (depth 2144.5 m, Late Bajocian — Middle Bathonian, Polaten Formation); R-1 Jantra (depth 2084 m, Middle Bathonian, Esenica Formation); S-1 Razgrad (depth 992.2 m, Middle Bathonian, Esenica Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); R-16h Orljak (depth 779-859.6 m, Middle Bathonian, Esenica Formation); S-33 Esenica (depth 795.4 m, Middle Bathonian, Esenica Formation); R-2 Medovina (depth 1343.5 m, Early Bathonian, Esenica Formation); R-1 Čerešovo (depth 1070 m, Middle Bathonian, Esenica Formation); R-7 Nonevo (depth 1032-1033.8 m, Middle Bathonian, Esenica Formation); R-1 Resen (depth 2417 m, Middle Bathonian, Esenica Formation); R-1 Čapaevo (depth 2189 m, Early Bathonian, *Oppelia (Oxycerites) yeovillensis* (R o l l i e r, 1911), Esenica Formation); the outcrops of Middle Jurassic rocks, Kotel Formation in the Eastern Stara Planina Mountain (D o d e k o v a, T c h o u m a t c h e n c o, 1989). The chronostratigraphic range of this species in Bulgaria is Upper Bajocian — Middle Bathonian. Very scarce, uncertainly identified specimens have been found in the Upper Bathonian and Lower Callovian.

Ctenidodinium continuum G o c h t, 1970b

Pl. VII, fig. *6*

T y p e. Holotype illustrated by G o c h t (1970, pl. 52, fig. 15).

O c c u r r e n c e. Boreholes: R-2 Agatovo (depth 3276-3277 m, Middle Bathonian, Polaten Formation); R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-10 Goljamo Peštene (depth 2753-2754 m, Early — Middle Bathonian, Gorno Belotinci Member of the Bov Formation); R-1 Hajredin (depth 3558 m, Bathonian, Bov Formation); R-9 Septemvrijci (depth 3711 m, Late Bajocian — Middle Bathonian, Etropole Formation); R-1 Jantra (depth 2079-2084 m, Middle Bathonian, Esenica Formation); R-1 Junak (depth 1744 m, Middle Callovian, Sultanci Formation; depth 1745.5-1750 m, Late Bathonian — Early Callovian, Polaten Formation); R-3 Junak (depth 1759-1801 m, Late Bathonian, Esenica — Polaten Formation); R-7 Sultanci (depth 1918 m, Late Bathonian, Esenica — Polaten Formation); R-9 Bozvelijsko (depth 2437 m, Late Bathonian — Middle Callovian, Sultanci Formation); R-16h Orljak (depth 779-857 m, Middle Bathonian,

Esenica Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); S-10 Černookovo (depth 944.6-949 m, Late Bathonian, Dobrič Formation); S-31 Esenica (depth 770 m, Bathonian, Esenica Formation); S-33 Esenica (depth 770-787 m, Late Bathonian, Esenica Formation); R-4 Mirovo (depth 1399 m, Middle Callovian, Sultanci Formation); R-4 Vasil Levski (depth 1368 m, Middle Bathonian, Esenica Formation); R-1 Čerešovo (depth 1128 m, Middle Bathonian, Esenica Formation); R-1 Tjulenovo (depth 1010-1017.4 m, Late Bathonian, Dobrič Formation); R-109 Vranino 1311 m, Late Bathonian — Early Callovian, Dobrič Formation); R-67 Makedonka (depth 1380 m, Late Bathonian, Dobrič Formation); S-12 Gornjak (depth 853.5-855 m, Late Bathonian, Dobrič Formation); S-53 Belgun (depth 1180 m, Late Bathonian, Dobrič Formation); S-24 Nikola Kozlevo (depth 728-735 m, Middle Bathonian, Esenica Formation); S-32 Dolina (depth 748-760 m, Middle — Late Bathonian, Dobrič Formation); R-54 Gurkovo (depth 1340-1350 m, Bathonian, Esenica Formation); R-55 Konare (depth 1090 m, Bathonian, Esenica Formation); R-1 Čapaevo (depth 2279-2280 m, Early Bathonian, *Procerites* sp. indet., Esenica Formation).

Ctenidodinium cornigerum (Valensi, 1953) Jan Du Chêne et al., 1985

Pl. VIII, figs *1, 2*

Type. Holotype illustrated by Valensi (1953, pl. 1, fig. 8) and refigured by Jan Du Chêne et al. (1985, pl. 1, figs 6, 7; text-fig. 1).

Comments. This species has been determined by Valensi (1953, p. 27) as *Gonyaulax cornigera*. Subsequently it has been designated by Sarjeant in Davey et al. (1969, p. 14) to be a type species of the new genus *Hystrichogonyaulax*. Under the name of *Hystrichogonyaulax cornigera* it has been published by Додекова in Сапунов et al. (1985, p. 148) and in Сапунов et al. (1986a, p. 108). Finally, after the epicyst archeopyle in the type material of the species *H. cornigera* was demonstrated the latter was definitely referred to the genus *Ctenidodinium* (Jan Du Chêne et al., 1985).

Occurrence. Boreholes: R-2 Agatovo (depth 3276.6-3277.4 m, Middle Bathonian, the species makes up over 80% of the dinocyst assemblage, Polaten Formation); R-7 Sultanci (depth 1915-1924.5 m, Late Bathonian, Esenica — Polaten Formation); S-32 Dolina (depth 758 m, Middle Bathonian, Dobrič Formation); S-24 Nikola Kozlevo (depth 728 m, Middle Bathonian. Esenica Formation); R-54 Gurkovo (depth 1340 m, Late Bathonian, Dobrič Formation); R-55 Konare (depth 1090 m, Bathonian, Esenica Formation).

Ctenidodinium ornatum (Eisenack, 1935) Deflandre, 1938b sensu Deflandre, 1938b

Pl. VII, fig. *7*

Type. Holotype published by Eisenack (1935, pl. 4, fig. 9) by Eisenack & Klement (1964, p. 389) and Eisenack (1963, pl. 4, fig. 6).

Comments. Brenner (1988, p. 46) is drawing attention on the fact that the type specimen of Eisenack is incomplete, being therefore unable to comprehensively characterize the species. Because of that in the description of *C. ornatum* the "plesiotype" of Deflandre (1938b, pl. 9, figs 1, 2) is used.

Occurrence. Boreholes: R-3 Čiren (depth 1292.5-1293.5 m, Middle — Late Callovian, Javorec Formation); R-12 Čiren (depth 1815-1817.5 m, Early Callovian, Verenica Member of the Bov Formation); R-5 Devetaki (depth 2951-2955 m, Middle Callovian, Verenica Member of the Bov Formation); R-2hg Ovča mogila (depth 1549 m, Early Kimmeridgian, Pleven Formation); R-1 Bârdarski geran (depth 3063-3066.5 m, Early Kimmeridgian, Pleven Formation); R-14 Grozdjovo (depth 2659 m, Late Callovian, Provadija Formation); R-1 Hrabrovo (depth 1974 m, Late Callovian; depth 1977.2 m, Middle Callovian, Sultanci Formation); R-7 Sultanci (depth 1896 m, Middle Callovian, Sultanci Formation); R-1 Junak (depth 1744 m, Middle Callovian, Sultanci Formation); R-3 Junak (depth 1785 m, Late Callovian — Early Oxfordian, Provadija Formation); R-9 Kardam (depth 874-879 m, Early Oxfordian, Černookovo Formation); S-33 Esenica (depth 753-756 m, Early Oxfordian, Černookovo Formation); R-11 Hitrino (depth 894 m, Early Callovian, Drinovo Formation); S-21 Kalugerica (depth 876 m, Oxfordian, Černookovo Formation); R-4 Mirovo (depth 1399 m, Middle Callovian, Sultanci Formation); R-3 Tjulenovo (depth 955 m, Oxfordian, Černookovo Formation); R-109 Vranino (depth 1298-1300 m, Early Oxfordian, *Neocampylites (Neocampylites) delmontanus* (Oppel, 1863), Provadija Formation); R-67 Makedonka (depth 1371.7 m, Late Bathonian, Dobrič Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Dobrič Formation).

Ctenidodinium rotundum D o d e k o v a, 1975

Pl. X, figs *2, 3, 6, 8*

T y p e. Holotype illustrated by D o d e k o v a (1975, pl. 4, figs 13, 14).

C o m m e n t s. W o o l l a m (1983, p. 193) transferred *C. rotundum* to the genus *Dichadogonyaulax* S a r j e a n t, 1966, pointing out the symmetry of the cingulum ornamentation. That made it necessary *C. rotundum* to be refigured and the asymmetry of its cingulum to be emphasized (pl. X, fig. 6) as well as the typical structure of the apex (pl. X, fig. 8) of the genus *Ctenidodinium* (B e n s o n, J r., 1985). *C. rotundum* shows variations in the density and length of the spines on the sutural septae, as well as on their distal end — acuminates to bifids.

I admit that *Dichadogonyaulax stauromatos* S a r j e a n t, 1976a (p. 9, pl. 2, fig. 4; pl. 3, figs 5, 6; text-fig. 1A-C) is probably conspecific to *C. rotundum* and that the complex structure of the apex pointed out is due to a combined optical laying on of the apical plates upon the antapical one (S a r j e a n t, 1976a, pl. 3, fig. 6).

O c c u r r e n c e. Boreholes: R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-9 Septemvrijci (depth 3686 m, Early Callovian, Verenica Member of the Bov Formation); R-1 Bjalo pole (depth 3385 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-32 Selanovci (depth 3026.9 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-1 Junak (depth 1750 m, Late Bathonian, Polaten Formation); R-3 Junak (depth 1797-1801 m, Late Bathonian, Esenica — Polaten Formation); R-6 Sultanci (depth 1958 m, Late Bathonian, Esenica — Polaten Formation); R-7 Sultanci (depth 1958 m, Late Bathonian, Esenica — Polaten Formation); R-11 Žitnica (depth 1995-1998 m, Late Bathonian — Early Callovian, Esenica Formation); R-16h Orljak (depth 779-859 m, Middle Bathonian, Esenica Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); R-2 Medovina (depth 1300 m, Bathonian, Esenica Formation); R-109 Vranino (depth 1315-1323 m, Late Bathonian — Early Callovian, Dobrič Formation); R-67 Makedonka (depth 1369-1381 m, Late Bathonian, Dobrič Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Dobrič Formation) and the boreholes published by D o d e k o v a (1975).

Ctenidodinium sellwoodii (S a r j e a n t, 1974) S t o v e r & E v i t t, 1978

Pl. VIII, figs *4, 5*

T y p e. Holotype illustrated by S a r j e a n t (1974, pl. 1, figs A, B; pl. 2, figs I, J).

C o m m e n t s. The tabulation formula is here interpretated as: 2pr, 4′, 1—2?a, 6″, 6c, 6‴, 1p, 1p, 1⁗, s?. S a r j e a n t' s (1974, pl. 1, figs A, C, E) apical plate 1′ is here interpretated to be larger preapical plate. The cingulum is asymmetrical and the apical pattern of tabulation after B e n s o n, J r. (1985) is characteristic for the genus *Ctenidodinium*.

O c c u r r e n c e. Boreholes: R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-32 Selanovci (depth 3026.9 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation).

Ctenidodinium aff. ***sellwoodii*** (S a r j e a n t, 1974) S t o v e r & E v i t t, 1978

Pl. VIII, figs *7, 8*

C o m m e n t s. This species resembles *C. sellwoodii* (S a r j e a n t, 1974), but differs from the latter in having one big posterior intercalary plate — 2p, lying under a small rectangular postcingular plate — 6‴ (pl. VIII. fig. *7*).

O c c u r r e n c e. Borehole: R-1 Bârdarski geran (depth 3188 m, Middle Calliovian, Verenica Member of the Bov Formation).

Genus ***Dodekovia*** D ö r h ö f e r & D a v i e s, 1980

T y p e s p e c i e s (by original designation): *Dodekovia syzygia* D ö r h ö f e r & D a v i e s, 1980.

Dodekovia gochtii (D o d e k o v a, 1975) D ö r h ö f e r & D a v i e s, 1980

Pl. X, fig. *13*

T y p e. Holotype illustrated by D o d e k o v a (1975, pl. 3, fig. 10).

O c c u r r e n c e. Boreholes: R-2 Agatovo (depth 3277.4 m, Middle Bathonian, Polaten Formation); S-1 Razgrad (depth 949.4 m, Early Callovian, Esenica Formation); R-1 Junak (depth 1745. 5 m; Late Bathonian — Early Callovian, Polaten Formation; depth 1746.5-1750 m, Polaten Formation); R-3 Junak (depth 1801.5-1804.5 m, Late Bathonian, Esenica — Polaten Formation); R-7 Sultanci (depth 1918-1924.5 m, Late Bathonian, Esenica — Polaten Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); R-3 Brjag (depth 1280 m, Early Callovian, ?Polaten Formation); R-1 Tjulenovo (depth 1010-1070.4 m, Late Bathonian, Dobrič Formation); R-67 Makedonka (depth 1371.7-1381.7 m, Late Bathonian, Dobrič Formation) and the boreholes published by D o d e k o v a (1975, p. 31)

Genus ***Eodinia*** E i s e n a c k, 1936 emended G o c h t, 1975a

T y p e s p e c i e s (by original designation): *Eodinia pachytheca* E i s e n a c k, 1936.

Eodinia cf. ***pachytheca*** E i s e n a c k, 1936 emended G o c h t, 1975a

Pl. IX, fig. *7*

T y p e. Holotype illustrated by E i s e n a c k (1936, fig. 1) and refigured by G o c h t (1975a, figs 21 a, b).

C o m m e n t s. The Bulgarian specimens are morphologically coinciding with the diagnosis of the species. Cyst ellipsoidal with short obtuse apical horn. The wall is two-layered with fibrous sheaves between the two layers. Under light microscope vague indications of cingulum, sulcus and tabulation are seen. Under strong augmentation the noticed by G o c h t (1975a) ring-like structures on the periphragm are observed. Archeopyle — epicystal.

The Bulgarian specimens are distinguished from the type material in having smaller dimensions (in μm): overall length — 68, overall breadth — 57, length of apical horn — 8, wall thickness — 3-5.

O c c u r r e n c e. Bo.eholes: R-1 Bârdarski geran (depth 3185-3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-1 BHrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation)

Genus ***Korystocysta*** W o o l l a m, 1983

T y p e s p e c i e s (by original designation): *Dichadogonyaulax kettonensis* S a r j e a n t, 1976a.

Korystocysta gochtii (S a r j e a n t, 1976a) W o o l l a m, 1983

Pl. IX, figs *1, 2*

T y p e. Holotype illustrated by S a r j e a n t (1976a, pl. 2, fig. 1, text-fig. 2 A-C).

C o m m e n t s. Supported in this paper is the view of R i l e y & F e n t o n (1982, p. 199), that the morphological variations between *K. gochtii* and *K. kettonensis* are insignificant, ranging within the intraspecific variation and that both species are conspecific. These two species are not distinguished amongst the abundant Bulgarian dinocyst assemblages.

O c c u r r e n c e. Boreholes: R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-32 Selanovci (depth 3026.9 m, Early Callovian, *Macrocephalites* sp. indet., Veronica Member of the Bov Formation); R-1 Junak (depth 1746.5 m, Late Bathonian — Early Callovian, Polaten Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Dobrič Formation); R-1 Čerešovo (depth 1033 m, Late Bathonian, Esenica Formation).

Korystocysta pachyderma (Deflandre, 1938b) Woollam, 1983

Pl. IX, figs *11, 12*

Type. Holotype illustrated by Deflandre (1938b, pl. 7, figs 6, 7).

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3063-3066.5 m, Late Oxfordian — Early Kimmeridgian, Pleven Formation); R-1 Junak (depth 1746.5 m, Late Bathonian — Early Callovian, Polaten Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonion, Esenica Formation); S-33 Esenica (depth 778.3 m, Late Bathonian, Esenica Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Dobrič Formation); S-24 Nikola Kozlevo (depth 685 m, Oxfordian, Černookovo Formation).

Genus ***Mendicodinium*** Morgenroth, 1970

Type species (by original designation): *Mendicodinium reticulatum* Morgenroth, 1970

Mendicodinium groenlandicum (Pocock & Sarjeant, 1972) Davey, 1979

Pl. III, fig. *12*

Type. Holotype illustrated by Poc o'ck & Sarjeant (1972, pl. 2, fig. 1).

Comments. In some of the Bulgarian specimens a faint concavity on the ventral side of the hypocyst, supposedly indicating the position of the sulcus, is observed. The equatorial split is helicoid, laevorotatory, analogical with the tabulated forms.

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3185-3188 m, Middle Callovian, Verenica Member of the Bov Formation, where it constitues 60% of the dinocyst assemblage); R-32 Selanovci (depth 3026.9 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-14 Grozdjovo (depth 2659 m, Late Callovian, Provadija Formation; depth 2679 m, Late Bathonian — Early Callovian, Polaten Formation); R-1 Junak (depth 1746.5 m, Late Bathonian — Early Callovian; depth 1748 m, Late Bathonian, Polaten Formation); R-3 Junak (depth 1785.3 m, Late Callovian — Early Oxfordian, Provadija Formation; depth 1801.5 m, Late Bathonian, Esenica — Polaten Formation); R-6 Sultanci (depth 1968 m, Late Bathonian — Early Callovian, Esenica — Polaten Formation); R-7 Sultanci (depth 1920-1924 m, Late Bathonian, Esenica — Polaten Formation); R-9 Bozvelijsko (depth 2445 m, Late Bathonian, Polaten Formation).

Genus ***Mosaicodinium*** gen. n.

Type species (by monotypy): *Ctenidodinium mosaicum* Dodekova (1975, p. 18, 19, pl. 1, figs 1-6; pl. 2, figs 1, 3, 6).

Derivation of name. Latin: mosaicus — mosaic, with reference to the mosaic view of the cyst and -dinium — the generic ending of dinoflagellate cysts.

Diagnosis. Proximo-chorate cyst, spherical to subspherical. Wall two-layered with thick autophragm and thin ectophragm. Ectocoel occupied by fibrous, irregular in shape and dimensions sheaves. Cyst's apical horn short, built by the ectophragm only. Narrow asymmetrical cingulum is dividing the cyst into nearly equal halves. Sulcus narrow, extending from mid-epicyst to the antapical plate. Tabulation marked by distinct sutural crests with indented, varying in length distal edges. Tabulation formula: 0-3pr, 4′, 0-2a, 6″, 6?c, 6‴, 1p, 1⁗, 6s. Plate 1p is elongated, plate 1⁗ — asymmetrical, ventrally inclined. Intratabular crests are irregularly found in the plates of the precingular and postcingular series. Archeopyle — epicystal, combination, type E. Specimens with operculum ventrally attached, as well as single epi- and hypocysts are encountered too.

Comments. Dodekova (1975) incorrectly referred the species mosaicum to the genus *Ctenidodinium*. By the ensuing investigations of taxa with epicystal archeopyle (Gocht, 1975a; Stover & Evitt, 1978; Woollam, 1983; Benson, Jr., 1985), morphofeatures serving to distinguish a number of controversial in the literature taxa have been pointed out. The presence of two-layered wall with complex structure and apical horn are contrary to the diagnosis of the genus *Ctenidodinium*. Berger (1986, p. 344) just on the basis of wall structure transferred the species *C. mosaicum* to the genus *Eodinia*, extending its generic diagnosis in order that species with sutural crests and distinct tabulation to be included as well. This emendation is considered here to be groundless. Thus, the introduc-

tion of the new genus *Mosaicodinium* as transitional in morphofeatures between the genera *Ctenidodinium*, *Korystocysta* and *Eodinia* became necessary. Genus *Ctenidodinium* is composed of autophragm only, lacks apical horn and "growth hands" in its species are quite rarely observed (G o c h t, 1984). Genus *Korystocysta* has its apical horn built by the autophragm and sutural elements, as well as its wall one-layered, lacking mosaic view. W o o l l a m (1983, p. 194) and B e r g e r (1986, p. 344) admit the presence of two-layered wall for the genus *Korystocysta* and B e n s o n, J r., (1985, p. 154) notes the presence of autophragm only. Genus *Eodinia* has two-layered wall with complex structure, but the massive or fibrous sheaves in the ectocoel are narrow, equal in length and the cyst's surface looks dotted or finely perforated. In optical section it is nearly holocavate in ambitus. Genus *Mosaicodinium* has its fibrous sheaves thick, gathered in varinyg in breadth groups. Under light microscope the cyst's surface looks like a "Roman mosaic". Some larger "mosaic stains" reach up to 7/11 μm in size. Besides, the sheaves are varying in length and the ectocoel is variously manifested. The latter can be clearly seen in the area around the apical horn (formed by the sheaves, ectophragm and sutural elements only), around the cingulum, the antapical plate and the points of intersection of the sutural elements. Genus *Eodinia* has its apical horn composed of both the wall layers. Its tabulation can be observed only under SEM and is marked by indistinct sutural ribs and growth bands. Genus *Mosaicodinium* has distinct tabulation indicated by varying in length sutural crests with indented edges. Its cingulum is asymmetrical with sometimes long, complexly interlacing and branching processes in its lower end, analogical to the flange in some species of the genus *Wanaea*. The presence of asymmetrical antapical plate serves to distinguish the genus *Mosaicodinium* from the genus *Eodinia*.

The new genus resembles the genus *Ctenidodinium* and *Korystocysta*, in particular, in its structure of the apex with preapical and anterior intercalary plates (sensu B e n s o n, J r., 1985). Analogically to the genus *Korystocysta*, *Mosaicodinium* has intratabular septae — "growth bands" upon the pre- and postcingular plates, developed to different extent.

Mosaicodinium mosaicum (D o d e k o v a, 1975) comb. n.

Pl. VII, figs *1—4*
1975. *Ctenidodinium mosaicum* D o d e k o v a, p. 18, 19, pl. 1, figs 1-6; pl. 2, figs 1-3, 6.
1986. *Eodinia mosaicum*; B e r g e r, p. 344, fig. 7/7.

T y p e. Holotype illustrated by D o d e k o v a (1975, pl. 1, figs 1-3).

A d d i t i o n a l d e s c r i p t i o n. Tabulation formula: 2pr, 4', 2a, 6'', 6?c, 6''', 1p, 1'''', 6s. Archeopyle — epicystal, type E. Characteristic features — apical horn built by the ectophragm, fibrous fascicles in the ectocoel and sutural elements; distinct mosaic structure of the wall; asymmetrical cingulum and antapical plate; ectocoel, in optical section, visible in the area around the apical horn and the points of intersection of the sutural elements; posterior intercalary plate — 1p — elongated; intratabular crests; cingulum and sulcus relatively narrow. Variations reflecting the intraspecific variation are expressed as varying in length sutural septae with different in length spines on their distal end and irregularly developed intratabular crests — "growth bands".

O c c u r r e n c e. Boreholes: R-3 Čiren (depth 1292.5-1293.5 m, Middle — Late Callovian, Javorec Formation); R-12 Čiren (depth 1815-1817.5 m, Early Callovian, Verenica Member of the Bov Formation); R-32 Selanovci (depth 3026.9 m, Early Callovian, *Macrocephalites* sp. indet., Verenica Member of the Bov Formation); R-1 Bârdarski geran (depth 3188 m, Middle Callovian, Verenica Member of the Bov Formation); R-1 Junak (depth 1745.5 m, Late Bathonian — Early Callovian, Polaten Formation); R-3 Junak (depth 1792.2-1795.5 m, Late Bathonian — Early Callovian, Esenica — Polaten Formation); R-7 Sultanci (depth 1918-1924.5 m, Late Bathonian, Esenica — Polaten Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation); S-10 Černookovo (depth 944.6-949 m, Late Bathonian, Dobrič Formation); S-12 Gornjak (depth 852-855 m, Late Bathonian — Early Callovian, Dobrič Formation); R-54 Gurkovo (depth 1332-1337 m, Late Bathonian, Dobrič Formation); S-11 Hitrino (depth 890-892.9 m, Callovian, Drinovo Formation); S-1 Razgrad (depth 949.4 m, Early Callovian, Esenica Formation); R-1 Tjulenovo (depth 1010 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1315.5 m, Early Callovian, Dobrič Formation); R-67 Makedonka (depth 1371.7 m, Late Bathonian, Dobrič Formation).

Genus ***Nannoceratopsis*** D e f l a n d r e, 1938b emended P i e l & E v i t t, 1980

T y p e s p e c i e s (by original designation): *Nannoceratopsis pellucida* D e f l a n d r e, 1938b.

Nannoceratopsis gracilis A l b e r t i, 1961 emended v a n H e l d e n, 1977

Pl. VIII, fig. 3

T y p é. Holotype illustrated by A l b e r t i (1961, pl. 7, fig. 17).

O c c u r r e n c e. Boreholes: R-7 Vârbica (depth 3604 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); R-16 Orljak (depth 858-859.6 m, Middle Bathonian, Esenica Formation); S-33 Esenica (depth 790-800 m, Middle Bathonian, Esenica Formation); S-11 Hitrino (depth 903.4 m, Bathonian, Esenica Formation); R-5 Tutrakanci (depth 1841 m, Bathonian, Esenica Formation); R-2 Medovina (depth 1341 m, Early-Middle Bathonian, Esenica Formation); R-4 Vasil Levski (depth 1365 m, Early — Middle Bathonian, Esenica Formation).

Nannoceratopsis pelliucida D e f l a n d r e, 1938b emended E v i t t, 1961b

Pl. VIII, fig. 6

O c c u r r e n c e. Boreholes: R-3 Čiren (depth 1292.5-1293.4 m, Middle — Late Callovian, Javorec Formation); R-12 Čiren (depth 1815-1817.5 m, Early Callovian, Verenica Member of the Bov Formation); R-1 Bârdarski geran (depth 3063-3066 m, Late Oxfordian — Early Kimmeridgian, Pleven Formation); S-1 Razgrad (depth 949.4 m, Early Callovian, Esenica Formation); R-3 Brjag (depth 1278 m, Middle Callovian, Černookovo Formation).

Nannoceratopsis spiculata S t o v e r, 1966

Pl. VIII, fig. *11*

T y p e. Holotype illustrated by S t o v e r (1966, pl. 8, fig. 1).

O c c u r r e n c e. Boreholes: R-2 Agatovo (depth 3276.6-3277.4 m, Middle Bathonian, Polaten Formation); S-1 Razgrad (depth 949.4 m, Early Callovian, Essenica Formation); R-1 Junak (depth 1746.5 m, Late Bathonian — Early Callovian, Polaten Formation); R-16h Orljak (depth 800-857 m, Middle Bathonian, Esenica Formation); R-2 Preslavci (depth 1032-1034 m, Middle Bathonian, Esenica Formation); S-31 Esenica (depth 785 m, Middle Bathonian, Esenica Formation); S-33 Esenica (depth 795 m, Middle Bathonion, Esenica Formation); S-32 Dolina (depth 771-774 m, Middle Bathonian, Dobrič Formation); S-11 Hitrino (depth 898 m, Callovian, Drinovo Formation); R-4 Mirovo (depth 1403 m, Bathonian, Esenica Formation); R-2 Medovina (depth 1341.5 m, Early — Middle Bathonian, Esenica Formation); R-3 Brjag (depth 1281 m, Early Callovian, ?Polaten Formation); R-1 Čerešovo (depth 1128.8-1130 m, Middle Bathonian, Esenica Formation); R-1 Tjulenovo (depth 1011.5 m, Late Bathonian, Dobrič Formation); R-67 Makedonka (depth 1375.7 m, Late Bathonian, Dobrič Formation); R-88 Caričino (depth 1276 m, Late Bathonian, Dobrič Formation), around the town of Belogradčik, Early Bathonian, Polaten Formation and the boreholes published by Dodekova (1975).

Genus ***Polygonifera*** H a b i b, 1972

T y p e s p e c i e s (by original designation): *Polygonifera evittii* H a b i b (1972, p. 376, pl. 5, figs 1, 2).

Polygonifera? aspera sp. n.

Pl. IV, figs *3, 11-16*

T y p e. Holotype is the specimen illustrated on pl. IV, fig. *13*, slide 3639-4, borehole R-1 Hrabrovo, depth 1977.2 m, Middle Callovian, Sultanci Formation, East Bulgaria.

D e r i v a t i o n o f n a m e. Latin: asper — rough, uneven, hard with reference to the wall layers relief and the difficulties met when determining the tabulation scheme.

M a t e r i a l. 57 specimens and over 25 free operculums.

D i m e n s i o n s (in μm). Holotype: diameter of endocyst — 64, diameter of pericyst — 79. Range: diameter of endocyst — 52-64, diameter of pericyst — 64-86 (22 specimens measured).

D i a g n o s i s. Cyst camocavate with spherical to subspherical endocyst and polyedrical pericyst, lacking apical and antapical horn. Endophragm thick, scabrate to irregularly reticulate in one and the same specimen, with single rare tuberculae. Periphragm very thin, readily being deformed. Its surface is scabrate to granulate or with very fine indistinct reticulation. There are traces of tabulation on it marked by vague low ribs. Tabulation formula: 1-2?pr, 4′, X?a, 6″, X?c, 6‴, 1p, 1pv+Xs, 1⁗. Archeopyle combination, apical-intercalary, type 4AtI/4AtI. Operculum free, composed of 4 apical plates. The intercalary plates are falling apart together with the operculum, or later one by one (pl. IV, figs *11*, *12*).

D e s c r i p t i o n a n d r e m a r k s. The new species here introduced is highly vulnerable to secondary deformations. Hence, the great variability in its shape. Similar variation in the shape and cavation of *P. eisenackii* M e r h o t r a & S a r j e a n t, 1984a is mentioned by M e r h o t r a & S a r j e a n t (1984a, p. 46). In *P.? aspera* the two wall layers may be closely stuck together or widely separated, no matter which part of the cyst is considered. The two layers are always appressed on the apex forming thus a faint broadly-conical swelling. Antapical pericoel may be present, but is commonly lacking. When present it lacks the shape typical for the genus *Polygonifera* (H a b i b, 1972, pl. 5, figs 1, 2; B r e n n e r, 1988, pl. 12, figs 3-6), but is largely rounded. The typical for the genus ventral, antapical and lateral pericoels are, in the new species, rarely, as if occasionally manifested. Same is the case with the dorso-ventral flattening pronounced in the genus *Polygonifera*. The well-preserved specimens of *P.?aspera* have shperical or subspherical endocyst. Regardless of the thick endophragm the epiendocyst is being oftenly deformed, disintegrating at? plates or dismembering. Endosyst's ornamentation is irregulaly distributed. Usually the endosulcus is poorly ornamented, slightly concave, always having flagellar mark (pl. IV, figs *13*, *16*). Tabulation indicated on the periphragm by low ribs, hardly distinguishable for the numerous secondary folds. Distinct cingulum and two ventral hypocyst lobes, characteristic for the genus, are sometimes observed. They are far poorly expressed in comparision with those of the type species.

The archeopyle is apical-intercalary concerning both the endo- and periphragm, which are in this part of the cyst closely appressed. Type — 4At I/4AtI. Initially 4 apical plates fall away. Specimens with their peri-endoapical operculum half open or slightly displaced are found (pl. IV, fig. *14*). A vast amont of such free operculums are available in the slides (pl. IV, fig. *12*). Subsequently or simultaneously the Xa intercalary plates drop off. Specimens with 3a symmetrically positioned, detached intercalary plates around the apical archeopyle are observed (pl. IV, fig. *3*). In some free apical operculums half-detached intercalry plates are available (pl. IV, fig. *11*). Finally, some specimens have widely opened archeopyle (pl. IV, fig. *16*). All the aforementioned suggests the presence of series of intercalary plates around the plates of the apical series. Anterior intercalary plates in genus *Polygonifera* have hitherto not been reported. The latter and the mentioned earlier morphological differences, as well as certain features of the new species *P.? aspera* similar to those of the type species *P. evittii* gave us the ground to be referring with great reservations the species *P.? aspera* to the genus *Polygonifera*.

O c c u r r e n c e. Boreholes: R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation, where it constitutes about 50% of the dinocyst assemblage); R-7 Sultanci (depth 1896 m, Middle Callovian, Sultanci Formation).

Genus ***Sirmiodiniopsis*** D r u g g, 1978

T y p e s p e c i e s (by original designation): *Sirmiodiniopsis orbis* D r u g g, 1978.

Sirmiodiniopsis orbis D r u g g, 1978

Pl. VIII, fig *9*

T y p e. Holotype illustrated by D r u g g (1978, pl. 7, fig. 11).

Occurrence. Boreholes: R-7 Vârbica (depth 3604 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); R-1 Bârdarski geran (depth 3188 m, Middle Calovian, Verenica Member of the Bov Formation); R-9 Septemvrijci (depth 3686 m, Early Callovian, Verenica Member of the Bov Formation); S-1 Razgrad (depth 949.4 m, Early Callovian, Esenica Formation); R-1 Junak (depth 1745.5-1746.5 m, Late Bathonian — Early Callovian; depth 1748-1753 m, Late Bathonian, Polaten Formation); R-3 Junak (depth 1785.3 m, Late Callovian — Early Oxfordian, Provadjia Formation; depth 1792.1 m, Middle Callovian, Sultanci Formation; depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet., Esenica — Polaten Formation); R-7 Sultanci (depth 1924.5 m, Late Bathonian, Esenica — Polaten Formation); R-11 Žitnica (depth 1995.5 m, Late Bathonian — Early Callovian, Esenica Formation); R-1 Hrabrovo (depth 1977.2 m, Middle Callovian, Sultanci Formation); R-16h Orljak (depth 779-784 m, Middle Bathonian, Esenica Formation); S-21 Kalugerica (depth 895 m, Callovian, Černookovo Formation); R-4 Mirovo (depth 1399 m, Middle Callovian, Sultanci Formation); R-1 Tjulenovo (depth 1010 m, Late Bathonian, Dobrič Formation).

Genus ***Sirmiodinium*** Alberti, 1961 emended Warren, 1973

Type species (by original designation): *Sirmiodinium grossi* Alberti, 1961.

Sirmiodinium grossi Alberti, 1961 emended Warren, 1973

Pl. VIII, fig. *10*

Type. Holotype illustrated by Alberti (1961, pl. 7, fig. 6).

Comments. All Bulgarian specimens are roundly-pentagonal in ambitus.

Occurrence. Boreholes: R-3 Čiren (depth 1292.5-1293.5 m, Middle — Late Callovian, Javorec Formation); R-7 Vârbica (depth 3604 m, Middle Bathonian, Gorno Belotinci Member of the Bov Formation); R-2 Agatovo (depth 3276-3277.4 m, Middle Bathonian, Polaten Formation); R-4 Devetaki (depth 2869-2871 m, Tithonian, Pleven Formation); R-5 Devetaki (depth 2951-2955 m, Middle Callovian, Verenica Member of the Bov Formation); R-1 Slavjanovo (depth 1815 m, Early Tithonian, Kaspičan Formation); R-3 Brest (depth 1818.5 m Early Tithonian, Kaspičan Formation); R-2 Dâbovan (depth 1634.5 m, Early Tithonian, Kaspičan Formation); R-1 Trâstenik (depth 2192 m, Early Tithonian, Pleven Formation); R-2 Grivica (depth 2385 m, Early Tithonian, Pleven Formation); S-1 Razgrad (depth 913.5 m, Oxfordian — Kimmeridgian; depth 933.5 m, Oxfordian, Drinovo Formation); R-3 Smjadovo (depth 2175 m, Oxfordian, *Monticlarella* cf. *czenstochowiensis* (Römer, 1870), Tiča Formation); R-1 Junak (depth 1550 m, Late Tithonian; depth 1605 m, Middle Tithonian, Tiča Formation); R-3 Junak (depth 1695.5 m, Late Tithonian, Tiča Formation); R-7 Sultanci (depth 1895 m, Late Callovian, Sultanci Formation); S-9 Kardam (depth 880-977.5 m, Early Oxfordian, Černookovo Formation; S-31 Esenica (depth 750-756 m, Late Callovian — Early Oxfordian, Černookovo Formation); S-33 Esenica (depth 744.2-753 m, Oxfordian — Kimmerdgian, Černookovo Formation); S-24 Nikola Kozlevo (depth 660-670 m, Early Kimmeridgian, Černookovo Formation); S-32 Dolina (depth 743 m, Early Oxfordian, *Creniceras* cf. *renggeri* (Oppel, 1863), *C. renggeri* Zone, Černookovo Formation); S-11 Hitrino (depth 891.3 m, Middle Callovian, Drinovo Formation); S-21 Kalugerica (depth 884.4-895 m, Callovian — Early Oxfordian, Černookovo Formation); R-3 Brjag (depth 1278.8 — 1280 m, Early — Middle Callovian, ?Polaten Formation); S-30 Kardam (depth 1114.5 m, Oxfordian, Drinovo Formation); R-3 Tjulenovo (depth 953-954.5 m, Oxfordian, Černookovo Formation); outcrop: Eastern Stara Planina Mountain, Middle Bathonian — ?Early Callovian, Kotel Formation, Balaban Dere Rirer.

Genus ***Wanaea*** Cookson & Eisenack, 1958 emended Fensome, 1981

1976b. *Energlynia* Sarjeant, p. 164.

Type species (by original designation): *Epicephalopyxis spectabilis* Deflandre & Cookson, 1955.

Comments. There are a lot of disputable problems regarding the genera *Wanaea* and *Energynia* Sarjeant, 1976b. In the original diagnosis of the genus *Wanaea*, Cookson & Eisenac (1958, p. 57) do not mention any vestiges of tabulation. Later on Evittin in Sarjeant (1966, p. 154) suggesterrd a gonyaulax type tabulation for the genus *Wanaea* and corrected the cyst orientation (Evitt, 1967, p. 80). Sarjeant (1967b), Fensome (1981) and Woollam (1982) in their publications concerning the morphology and taxonomy of the genera *Wanaaea* and *Energlynia* do not consider the poorly marked tabulation to be an explicit morphological feature distinguishing the two genera. Woollam (1982, p. 47, pl. 2 figs 3, 5) has even noted feeble "sutural lines" upon the epicyst o. *W. fimbriata*, which are much better distinguished on the sank in the hypocyst operculum (fig. 4, the same plate). All the three authors emphasize that the most essen-

tial feature disinguishing the two genera is the presence of crests, ribs, lace-like edging and fringes on the lower sutural line of the cingulum. In the original diagnosis of genus *Wanaea* Cookson&Eisenack (1958, p. 57) remark the diffirent width of the "edging" and report the edging in the paratype of *W. spectabilis* to be 5 μn in width. Fensome (1981, p. 51) in his emended diagnosis of the genus *Wanaea* included proximate and proximo-chorate cysts having "a more or less broad crest or flange".

The name of the new species *Wanaea acularis* introduced by Dodekova (1975, p. 20, 21) suggests by itself the lack of well-shaped collar. On the basis of the latter Sarjeant (1978, p. 14) transferred the species *W. acollaris* to the genus *Energlynia*, which he erected himself. Subsequently, Fensome (1981, p. 50) synonymised *E. kyrbasia*, type species of the genus *Energlynia*, with *W. acollaris* and determined the latter to be a type for the genus *Energlynia*.

In the description of *W. acollaris* Dodekova remarks the presence of ornaments, which width in the area of the cingulum reaches up to 4.65 μm, i. e. just 0.35 μm less than the width of the edging in the paratype of the genus *Wanaea*. These ornaments (spines and granulae) having their distal and sometimes proximate ends linked (Dodekova, 1975, p. 21) are very well illustrated on the SEM microphotograph of Drugg (1978, pl. 8, fig. 1). The differences in the ornamentation on the lower end of the cingulum between *W. acollaris* and the type material are less pronounced than those between the type species and the species with wide edging.

On account of the above, supporting the view of Drugg (1978, p. 74) and Riley & Fenton (1982, p. 200) I do consider the genus *Energlynia* Sarjeant, 1976b to be superfluous.

Wanaea acollaris Dodekova, 1975

Pl. VI, fig. *7, 8*
1976b. *Energlynia kyrbasia* Sarjaent; p. 166, figs 1-16.

Type. Holotype illustrated by Dodekova (1975, pl. 3, figs. 1-4).

Comments. A specimen from the type locality has its epicyst properly positioned for the purpose of the study and its tabulation is relatively more distinct. Hence, the establishment of the following apical tabulation formula became possible:2pr, 4′, 2a (pl. VI, fig. *8*),as the configuration and dimensions of the apical and precingular plates are identical with the pattern of epicystal tabulation in the genera *Ctenidodinium* and *Korystocysta* (Woollam, 1983, text-fig. 1/2 and Benson, Jr., 1985, p. 150). The pointed by Sarjeant (1976b, fig. 1) superior ventral intercalary plate (2a) here is not confirmed. The reported spines on the antapical horn (Sarjeant, 1976b, p. 164, 168) or "antiapicular" structures (Fensome, 1981, p. 50) are, in fact, sutural ribs, which could be seen in certain position of the cyst. By means of the latter the antapical pattern of tabulation proposed by Sarjeant (1976b) is confirmed. In the Bulgarian dinocyst assemblages some additional specimens of this species show that the number of antapical plates is exceeding one. Their exact number remains unclear because of the poorly marked tabulation and improperly positioned fossils, though it may prove to be 2′′′′, 3′′′′ or 4′′′′. The archeopyle is epicystal, type E (sensu Benson, Jr., 1985, p. 150).

Occurrence. Boreholes: R-1 Bârdarski geran (depth 3185 m, Middle Callovian, Verenica Member of the Bov Formation); R-3 Junak (depth 1792.2 m, Early Callovian, *Macrocephalites* sp. indet. Esenica — Polaten Formation); S-11 Hitrino (depth 892.9 m, Early — Middle Callovian, Drinovo Formation); R-1 Čerešovo (depth 1128.8-1130 m, Middle Bathonian, Esenica Formation); R-7 Nonevo (depth 1032-1033.8 m, Early — Middle Bathonian, Esenica Formation); R-1 Tjulenovo (depth 1017.4 m, Late Bathonian, Dobrič Formation); R-109 Vranino (depth 1315.5-1318 m, Late Bathonian — Early Callovian, Dobrič Formation) and the boreholes published by Dodekova (1975, p. 18).

Postscript

When this paper was already in press, I received the article of Smelror* which had valided *Chlamydophorella ectotabulata* in accordance with CBN. Therefore the specimens described here as *Chlamydophorella* sp. SA Smelror, 1988a, should be referred to *C. ectotabulata* Smelror, 1989.

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