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Type Specimens of Silicoflagellata and Archaeomonadaceae in the Collection of the Geological Survey of Austria: An inventory

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1 Text-Figure, 6 Plates

Dictyochales (Silicoflagellata/Silicoflagellida)
Archaeomonadaceae
Choanoflagellates
Taxonomy
Cretaceous
Cenozoic
Type Specimens
Palaeontological collection

Contents

Typusexemplare von Silicoflagellaten und Archaeomonadaceen in der Sammlung der Geologischen Bundesanstalt: Eine Bestandsaufnahme

Zusammenfassung

Der vorliegende Artikel enthält eine taxonomische und stratigrafische Übersicht der von Herbert STRADNER – allein oder mit Kollegen – beschriebenen Arten von Silicoflagellaten (Dictyochales) und Archaeomonadaceen, deren Typusexemplare sich in der Paläontologischen Sammlung der Geologischen Bundesanstalt in Wien (GBA, Österreich) befinden. Eine komplette Liste der einschlägigen Publikationen ist im Index aufgeführt und im Literaturverzeichnis enthalten.

Abstract

This publication presents a taxonomical and stratigraphical compilation of type specimens of Silicoflagellata (Dictyochales) and Archaeomonadacea designated by Herbert STRADNER, alone or with colleagues, and deposited in the Palaeontological Collection of the Geological Survey of Austria (GBA) in Vienna. A complete list of relevant publications is given in the index and fully included in the references.

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Introduction

For his doctoral thesis (STRADNER, 1956), Herbert STRADNER studied silicoflagellates from Cretaceous to late Neogene deposits. In his first paper (STRADNER, 1961) he demonstrated the variety of these microfossils in kieselgur (diatomite) deposits of Austria and other countries.

One of the best places to collect not only silicoflagellates, but also entire assemblages of siliceous microfossils (e.g. radiolarians, sponge spicules, ebridians, as well as the full wealth of marine diatoms) was the clay pit of the brickyard at Frättingsdorf in Lower Austria (BACHMANN et al., 1963). Under the guidance of Professor Dr. Adolf PAPP (1915–1983, University of Vienna) and Professor Dr. Georges DEFLANDRE (1897–1973, Muséum National d'Histoire Naturelle and Laboratoire de Micropaléontologie, École practique des hautes études, Paris), STRADNER compiled his thesis, a synopsis of which was published in STRADNER (1961).

The work at hand includes up-to-date taxonomy and stratigraphy (locality and formation names) and information on the deposition of type material. In general, stratigraphic terminology and chronostratigraphy follows the official stratigraphical chart of Austria (PILLER et al., 2004), if not indicated otherwise.

Taxonomy

The taxonomy above genus level follows "AlgaeBase" (GUIRY & GUIRY, 2013). Out-dated terms in the original descriptions or English translations of these are complemented with modern terms in square brackets [ ] according to MCCARTNEY (1988: Fig. 1). As to nomenclatural and taxonomic acts, the International Code of Nomenclature for algae, fungi, and plants (Melbourne Code) (MCNEILL et al., 2012) is followed.

Order: Dictyochales HAECKEL, 1894

Family: Dictyochaceae LEMMERMANN, 1901

Genus *Corbisema* HANNA, 1928 emend. FRENGUELLI, 1940

Corbisema triacantha (EHRENBERG, 1844) var. *flexuosa* STRADNER, 1961

Pl. 1, Figs. 1–10, Text-Fig. 1

*1961 *Corbisema triacantha* (EHRENBERG, 1844) var. *flexuosa* nov. var. – STRADNER, p. 89, Pl. 1, Figs. 1–8.
1966 *Dictyocha triacantha* var. *flexuosa* (STRADNER) GLESER – GLESER, p. 228, Taf. 5, Figs. 5, 6, 8, 10.
1968 *Corbisema triacantha flexuosa* STRADNER – BACHMANN & PAPP, Pl. 3, Fig. 7.
1970a *Corbisema triacantha* (EHRENBERG, 1844) var. *flexuosa* STRADNER – BACHMANN, p. 284, Pl. 1, Figs. 1–17.
1970b *Corbisema triacantha* (EHRENBERG, 1844) var. *flexuosa* STRADNER forma II – BACHMANN, p. 16.
1975 *Corbisema flexuosa* (STRADNER) – PERCH-NIELSEN, p. 685, Pl. 3, Fig. 10.
1989 *Corbisema flexuosa* (STRADNER) PERCH-NIELSEN – LOCKER & MARTINI, p. 566 [not illustrated].

Holotype: Since no types were indicated by STRADNER (1961), the holotype was subsequently designated by BACHMANN (1970b: 16) for *Corbisema triacantha* (EHRENBERG, 1844) var. *flexuosa* STRADNER forma II, STRADNER-Slide Breitenaich 14 (Coll. No. GBA 1961/005/0001), figured in STRADNER, 1961, on [Pl. 1] Fig. 1.

Derivation of name: Referring to the slightly rotated struts of the abapical ring.

Type locality: Outcrop at Wallern an der Trattnach, Breitenaich, northwest of Wels, east of Grieskirchen, Upper Austria.

Type stratum: "Oligozän-Schlier", "Älterer Schlier" now called Eferding Formation, Oligocene, Kiscellian to Egerian (local Paratethyan stages corresponding to Chattian in international stages (RUPP, 2011).

Original description (STRADNER, 1961: 89): "Dreistrahligsymmetrische, hohle Kieselgerüste, bestehend aus einem dreieckigen, mit Radialhörnern versehenen Basalring und einer von 3 kurzen Lateralbögen getragenen dreieckigen Apikalfläche. Stützstacheln und Scheidewände sind nicht ausgebildet. Bei größeren Exemplaren sind die Basalbögen wie die Flügel einer Schiffsschraube gedreht."

Translated description: Silicious microfossils composed of hollow tubes. The triangular basal [= abapical] ring consists of three lobes with long distal basal [= abapical] spines. No additional auxiliary spines [= pikes] developed. The central apical area is supported by three short lateral arcs [= lateral struts]. Separating membranes inside the tubes are missing. The three arcs [= struts] of the basal [= abapical] ring each are slightly rotated similar to the blades of a marine propelling screw.

Size: Abapical ring diameter (measured from the middle of the abapical corner to the middle of the opposite side) about 30–35 µm, total diameter with abapical spines (measured from tip of spine to tip of another spine) 50–60 µm.

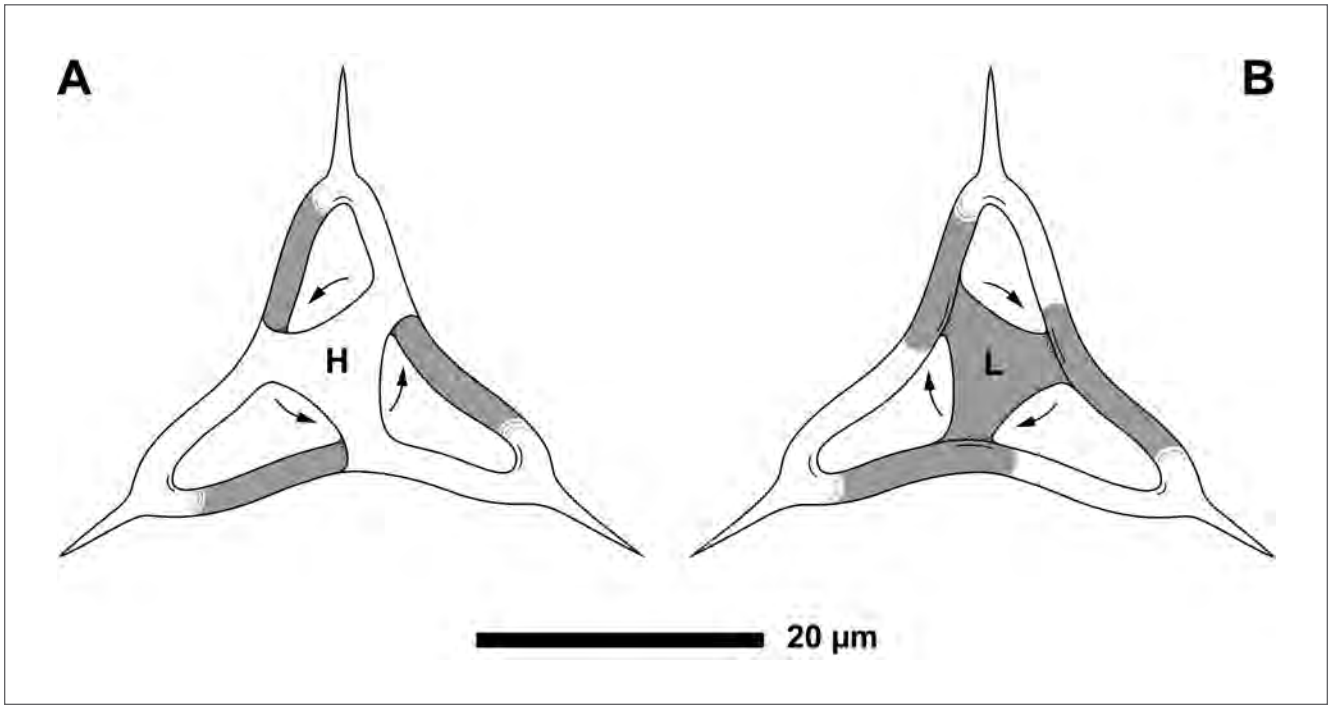
Relations: These forms derive from Mesozoic taxa of *Corbisema* which, originally, possessed separating membranes.

Occurrence: Upper Oligocene (Chattian).

Comments: The apical structure is sinistrally rotated, i.e. counterclockwise when seen in apical view (see Text-Fig. 1, A). The living flagellate produces a second siliceous skeleton inside the cell body before cell division. These two skeletons exhibit identical three-dimensional features. As yet, we did not observe any specimen of *Corbisema triacantha* var. *flexuosa* with dextral or clockwise rotation, respectively. In rare cases such double skeletons are preserved as fossils. BACHMANN (1970a: Pl. 1, Fig. 17) has illustrated such a double skeleton of *Corbisema triacantha* var. *flexuosa*.

The rotation of the arcs of the basal ring is best studied in the light microscope at magnifications lower than 1,000 x, while shifting the focus levels.

Separating membranes, such as observed and figured independently by STRADNER in his thesis (STRADNER, 1956) and in STRADNER (1961: Fig. 1, E–F, Pl. 1, Figs. 15–33), as well as in Japan by TSUMURA (1959: Pl. 1, Fig. 9) and TSUMURA (1963: Pl. 1, Fig. 6, Pl. 5, Figs. 1–2, Pl. 7, Fig. 2), were not found in *Corbisema triacantha* (EHRENBERG, 1844) var. *flexuosa* STRADNER, 1961. This feature, to be observed in the genera *Corbisema* and *Mesocena*, deserves further studies regarding its potential biostratigraphic value and evolutionary meaning.



Text-Fig. 1.
Plan views of *Corbisema triacantha* var. *flexuosa*, after STRADNER (1961: Pl. 1, Figs. 1, 2). The apical area is rotated counterclockwise [sinistral] against the basal ring. A) Apical view of specimen (lectotype as designated by BACHMANN, 1970b, for specimen figured in STRADNER, 1961: Pl. 1, Fig. 1) with apical area and the three short lateral arcs [lateral struts] rotated counterclockwise as indicated by black arrows, with resulting inclination/tilt of the three arcs [struts] of the basal ring. H = high; areas in grey are lower (farther away from the observer), white areas higher (closer to the observer).
B) Abapical view of specimen with rotated apical area as indicated by black arrows, L = low. Since the apical area is the reference plane for the definition of the rotation, the arrows indicate a "clockwise/dextral" direction in this view. The basal ring with tilted arcs [struts] is resembling a marine propelling screw.

Genus: *Dictyocha* EHRENBERG, 1837

Dictyocha aegea STRADNER & BACHMANN, 1978

Pl. 2, Figs. 1–4

*1978 *Dictyocha aegea* n. sp. – STRADNER & BACHMANN, p. 805, Fig. 1, Pl. 1, Figs. 12–16.
1986 *Dictyocha aegea* – LOCKER & MARTINI, p. 903, Pl. 2, Figs. 10–12, Pl. 11, Fig. 3.

Holotype: Coll. No. GBA 1978/015/0001, STRADNER-Slide no. F, England Finder K57/O. Figured on Pl. 2, Fig. 1 herein.

Derivation of name: From the Aegean Sea.

Type locality: Aegean Sea north of Crete, DSDP Site 378.

Type stratum: DSDP Leg 42, Sample 378, Core 8, Site 1, 114–115 cm depth, Upper Pliocene, NN 16.

Original description (STRADNER & BACHMANN, 1978: 805–806): A silicoflagellate species with the general features of *Dictyocha fibula*, from which it differs by the four-lobed, angular outline of the basal [= abapical] ring and its compressed flanks. The basal [abapical] spines in direction of the major axis are short, less than $^1/_3$ of the greater diameter of the [abapical] ring and have additional pikes near them, which emphasize the angular outline of the basal [abapical] ring. The spines in direction of the minor axis are reduced to the size of longer distal [abapical] pikes, to about $^1/_8$ of the shorter diameter of the basal [abapical] ring. At the place where these shorter spines insert, the basal [abapical] ring appears compressed and in some specimens, even caved in. At this straight or concave part of the basal [abapical] ring there can be centripetal knobs or pikes, which are not basal [abapical] sustaining pikes in a strict sense. The holotype and also most of the paratypes have four basal [abapical] pikes, which point in abapical direction and are inserted near the lateral struts. The apical bar is fibuloid; that is, in the direction of the major axis. Asperoid specimens are extremely rare and thus fall within the normal ratio of variation.

Size: Overall length more than 50 µm, overall width 30 µm; basal ring length approximately 40 µm, width approximately 25 µm.

Relations: Similar skeletons have been described by LOCKER (1975) as *Dictyocha varia* f. *extensa*. *Dictyocha varia* LOCKER has the apical bar transverse, that is, asperoid or parallel to the direction of the minor axis, and is smaller and less elongate than *Dictyocha aegea*.

Occurrence: Upper Pliocene, Aegean Sea north of Crete, DSDP Site 378, and Upper Miocene, southwest Pacific, Leg 90 (LOCKER & MARTINI, 1986).

Dictyocha schauinslandii (LEMMERMANN, 1901) FRENGUELLI var. *rotundata* STRADNER, 1961

Pl. 3, Figs. 1–5

*1961 *Dictyocha schauinslandii* LEMMERMANN forma *rotundata* nov. – STRADNER, p. 92, Pl. 3, Figs. 62, 65, 66.
1968 *Dictyocha schauinslandii* (LEMMERMANN) FRENGUELLI var. *rotundata* STRADNER – LOEBLICH et al., p. 112, Pl. 21, Figs. 13–15.
1970b *Distephanus schauinslandi* LEMMERMANN var. *rotundata* STRADNER – BACHMANN, p. 11.

Holotype: Since no types were indicated by STRADNER (1961), the holotype was subsequently designated by BACHMANN (1970b: 11), however, under the name *Distephanus schauinslandi* [one "-i" only] LEMMERMANN var. *rotundata* STRADNER as figured in STRADNER (1961), on [Pl. 1], Fig. 8. Coll. No. GBA 1961/005/0006, STRADNER-Slide Li/6/A.

Derivation of name: From Latin *rotundatus*, meaning roundish or rounded, according to the overall shape of this variation of *D. schauinslandii*.

Type locality: Kieselgur Quarry at Limberg, Lower Austria.

Type stratum: Limberg Subformation of the Zellerndorf Formation, upper Lower Miocene. In terms of Central Paratethys stages this formation corresponds to Ottnangium to lowermost? Karpatian or in terms of international stratigraphy to Burdigalian, respectively (cf. ROETZEL et al., 1999).

Original description (STRADNER, 1961: 92): "Hohle, oft ovale Kieselgerüste mit stark reduzierten Radialhörnern, die auch gänzlich fehlen können, und blasig aufgetriebenem oder flächig erweitertem Basalring. Apikalfenster sehr klein oder durch Apikalfläche ersetzt."

Translated description: Oval silicious structures of hollow tubes without basal corner spikes. The inflated junctions of the apical structure combine in the centre which is either perforated by a very small round or oval apical window, or showing a flat apical membrane.

Size: 45–65 µm in length, 30–45 µm in width.

Occurrence: Upper Lower Miocene, Ottnangium–?lowermost Karpatian (regional Central Paratethys stages) as corresponding to Burdigalian.

Comments: Specimens of this variation are rare and in our present view represent teratological (malformed) forms of the typical *D. schauinslandii*. Whether or not it is justified to keep up the variety *rotundata* remains subject to discussion.

Genus: *Cannopilus* HAECKEL, 1887 emend. DEFLANDRE, 1952 emend. BACHMANN, 1967

Cannopilus picassoi STRADNER, 1961

Pl. 4, Figs. 1–8

*1961 *Cannopilus picassoi* n. sp. – STRADNER, p. 92, Pl. 3, Figs. 101–104.
1963 *Cannopilus picassoi* STRADNER – BACHMANN et al., p. 153, Pl. 20, Figs. 74–81, Pl. 22, Figs. 17–19.
?1962 *Cannopilus sphaericus* GEMEINHARDT – BACHMANN & ICHIKAWA, p. 171, Pl. 9, Figs. 9–10, Pl. 10, Figs. 1–3.
1968 *Cannopilus picassoi* STRADNER – BACHMANN & PAPP, Pl. 3, Fig. 16.
?1968 *Cannopilus sphaericus* GEMEINHARDT – BACHMANN & PAPP, Pl. 3. Fig. 15.
1968 *Cannopilus picassoi* STRADNER – LOEBLICH et al., p. 67, Pl. 1, Figs. 11–13.
non 1968 *Cannopilus tetraceros* DEFLANDRE in BACHMANN & ICHIKAWA, 1962 – LOEBLICH et al., p. 69, Pl. 3, Figs. 1–5.
1970b *Cannopilus picassoi* STRADNER – BACHMANN, p. 14.
1986 *Cannopilus picassoi* STRADNER – LOCKER & MARTINI, p. 902, Pl. 1, Fig. 4.

Holotype: Since no types were indicated by STRADNER (1961), the holotype was subsequently designated by BACHMANN (1970b: 14) for STRADNER'S (1961) Fig. 101 (on Pl. 3 therein). Coll. No. GBA 1961/005/003, STRADNER-Slide "Frättingsdorf Nr. 5", England Finder N35/2, figured on Pl. 4, Fig. 2 herein.

Derivation of name: Dedicated to Pablo PICASSO (1881–1973), the great master of modern art, with gratitude. (Many people are not aware of the fact that Picasso had a clear line of drawing, especially in his early years. In a recorded interview he said to a visitor: "Of course, you could draw like that, but would you?").

Type locality: Former brickyard at Frättingsdorf, Lower Austria.

Type stratum: "Badener Tegel", Lanzhot Formation of the Waschberg Zone, Lower Austria, Middle Miocene. The Lower Lagenid Zone of the lower Badenian in Central Paratethys stages corresponds to Langhian in terms of international stratigraphy.

Original description (STRADNER, 1961: 92): "Kugelige, hohle Kieselgerüste, bestehend aus sehr zarten englumigen Apikalbögen, welche etwa fünf Dutzend kleine runde Apikalfenster umschließen. Basalring wesentlich kleiner als der Durchmesser des Apikalapparates. Die fünf Radialhörner und die Zusatzstacheln sind lang und geschwungen."

Translated description: Spherical, hollow silicious structures composed of very delicate apical hollow arcs [= struts], which enclose about five dozen of small round apical windows. The basal [abapical] ring is smaller than the diameter of the apical structure. The five radial spines as well as the apical spines are long, slightly curved and point in opposite directions.

Size: 25–30 µm in diameter, total height including spines about 60 µm.

Relations: *Cannopilus picassoi* shows closer similarities or even smooth transitions to *C. sphaericus* GEMEINHARDT in its general shape, i.e. that the apical apparatus is globular and the diameter of the abapical ring distinctly smaller than that of the apparatus. However, *C. picassoi* STRADNER predominantly has five radial spines and about five dozen (60) apical windows of about equal size, and the radial spines stick out in abapical direction while *C. sphaericus* has 30–40 apical windows of different size (those framed by the lateral arches are bigger than the apical ones), and the abapical ring is six- to nine-rayed with spines sticking out in lateral directions, though more or less inclined in abapical direction. BACHMANN & ICHIKAWA (1962: 173) observed that there is a progressive trend in these forms towards more complexity, i.e. a higher number of apical windows in stratigraphically younger forms.

Occurrence: Langhian, Middle Miocene.

Comments: BUKRY & MONECHI (1985: 378) have combined globular forms, including *Cannopilus picassoi* STRADNER, 1961, in their new genus *Caryocha*. For the moment, we keep *C. picassoi* in its original genus assignment. The type material of other globular *Cannopilus*-species such as described by the late Alfred BACHMANN, remains to be restudied using SEM techniques.

Family Archaeomonadaceae Deflandre, 1932a

Preliminary remark: Cretaceous marine sediments containing well-preserved siliceous microfossils are extremely rare and therefore Marta Hajós and Herbert Stradner appreciated the unique chance to document the contents of siliceous microfossils of DSDP site 275 in light-microscope, transmission electron microscope as well as scanning electron microscope. The holotypes described by both authors together are documented on electron microscopy plates (glass plates) and films, which were deposited in the micropalaeontological archive of the Geological Survey of Austria (GBA) in Vienna. Glass slides for light microscopy (new species found by M. Hajós) are deposited at the Geological and Geophysical Institute of Hungary in Budapest.

Genus *Artisphaeridium* Stradner, 1975

Type species: *Artisphaeridium fragile* Stradner, 1975 (in: Hajós, 1975, p. 938, Pl. 39, Figs. 4–6).

Derivation of name: From Latin *artes* = the fine arts.

Generic diagnosis: Spherical cysts with surface ornamentation consisting of mushroom-shaped protrusions and large spines.

Artisphaeridium fragile Stradner, 1975 (in Hajós, 1975)

Pl. 5, Figs. 1–3

1975 *Artisphaeridium fragile* n. gen. n. sp. Stradner – Hajós, p. 938, Pl. 39, Figs. 4–6.

Holotype: Coll. No. GBA 1975/016/0001 (TEM Plates No. 5136 and 5137, stereo pair, Elmilab GBA). Figured herein on Pl. 5, Fig. 1.

Derivation of name: From Latin *fragilis* = fragile.

Type locality: DSDP Leg 29, Site 275, Lithologic Unit 1, sample 2-1, interval 130–132 cm.

Type stratum: DSDP Leg 29, Site 275, Lithologic Unit 1.

Original diagnosis (Stradner in Hajós, 1975, with additional contribution from Herbert Stradner: 938): "Spherical cyst covered with hundreds of small mushroom-shaped protrusions with an irregular outline. Some standing free, others grown together. Length of 12 or more larger spines unknown, as all are missing in type specimen."

Size: 6 µm in diameter.

Occurrence: Upper Cretaceous, Campanian–Maastrichtian.

Comments: The question arises whether the formation of the mushroom-like surface protrusions are an intermediate step to form a second layer outside the original one. Since we do not know the life-cycle of the Cretaceous Archaeomonadaceae we can only speculate about the purpose of these protrusions. The electron micrograph of the holotype shows areas where the "umbrellas" of the mushroom-shaped protrusions are joined to form a continuous layer. The single larger spines are part of the inner layer and effect a reduction of the sinking speed of the cyst in ocean water.

During our discussions of the problem, whether the ultrastructural differences in the surface ornamentation justify to keep up a separate genus for these forms, we have tried to find comparable microphotographs and/or electron micrographs of Cretaceous archeomonadine cysts. Both authors (K. Perch-Nielsen and H. Stradner) had received and had been working independently on almost identical samples without being informed by DSDP. A direct correlation with Perch-Nielsen's lightmicroscopic photographs in the same DSDP volume (Perch-Nielsen, 1975) is difficult. However, the specimen of *Archaeomonas paucispina* Deflandre as figured in Perch-Nielsen (1975: Pl. 12, Fig. 5, SEM) seems to show a similar but complete cyst with larger spines and the outer layer completely closed. Perch-Nielsen (1978: DSDP Leg 38) shows very elucidating REM micrographs of *Litheusphaerella spectabilis* Deflandre (Perch-Nielsen, 1978: Pl. 2, Figs. 11–12) in different states of preservation, and *Litheusphaerella* sp. (Perch-Nielsen, 1978: Pl. 4, Figs. 6–8, light micrographs). The "T-shaped spines" mentioned in the description of the latter (Perch-Nielsen, 1978: 151) are understood as optical cross-sections of the mushroom-like surface protrusions.

In a study about recent archaeomonadines off East Antarctica (e.g. Riaux-Gobin & Stumm, 2006), different stages of wall development of cysts are shown. The forms described as *Litheusphaerella spectabilis* Deflandre forma 1 and 2, therein (Riaux-Gobin & Stumm, 2006: Fig. 4, *L.* cf. *spectabilis*, Fig. 5, G–H) show different stages in the development of the mushroom-like protrusions towards the develoment of the second layer.

The very exact drawings of *Litheusphaerella spectabilis* in Deflandre (1932b: 354, Figs. 34–37) show distinct "bâtonnets" [= little rods] which are described as characteristic feature of the genus *Litheusphaerella*. The overall morphology shows a trend to form an outer layer.

We leave it up to further investigations and discoveries to find out, whether such morphotypes only occur in the Cretaceous, whether they are of biostratigraphic value or not, and whether they ought to be included in the genus *Litheusphaerella* Deflandre.

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Taxonomic index of taxa of siliceous nannofossils originally described by Herbert STRADNER, alone or with colleagues:

Relevant references on siliceous nannofossils originally described by Herbert STRADNER, alone or with colleagues:

BACHMANN (1970b), BACHMANN et al. (1963), HAJÓS (1975, with additional contribution from Herbert STRADNER), STRADNER (1956, 1961, 1971, 2002), STRADNER & BACHMANN (1978), STRADNER & ALLRAM (1981).

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Plate 1

Scale bar of Fig. 3 also valid for Figs. 4, 5 and 7–10.

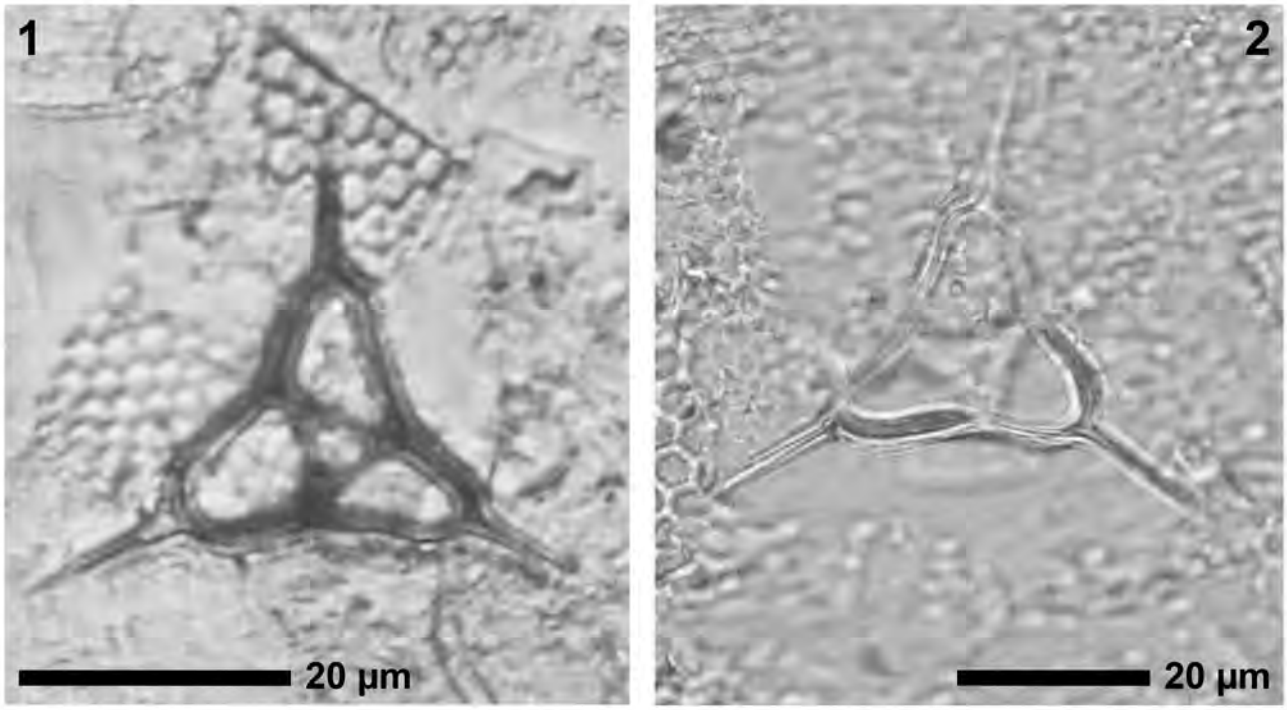
Fig. 1: *Corbisema triacantha* (EHRENBERG), apical view of specimen, Coll. No. GBA 1961/005/0001, STRADNER-Slide No. "Breitenaich 49", England Finder T45/3 (with hollow abapical tubes filled with air). Locality: Wallern an der Trattnach, Breitenaich, Upper Austria.

Fig. 2: *Corbisema triacantha* (EHRENBERG) var. *flexuosa* STRADNER, abapical view of specimen, Coll. No. GBA 1961/005/0001, STRADNER-Slide No. "Breitenaich 49", England Finder T45/3 showing the typical rotated arcs of the abapical ring. Locality: Wallern an der Trattnach, Breitenaich, Upper Austria.

Figs. 3–10: *Corbisema triacantha* (EHRENBERG), line drawings from STRADNER (1961: Pl 1, Figs. 1–8) showing different abapical and apical views; Fig. 4 illustrates the rotation of the arcs (see also Fig. 2 of this plate and Text-Fig. 1).

Fig. 6: Surface ornamentation sometimes observable under the light microscope.

Figs. 7–8: Small specimen in plan and side view.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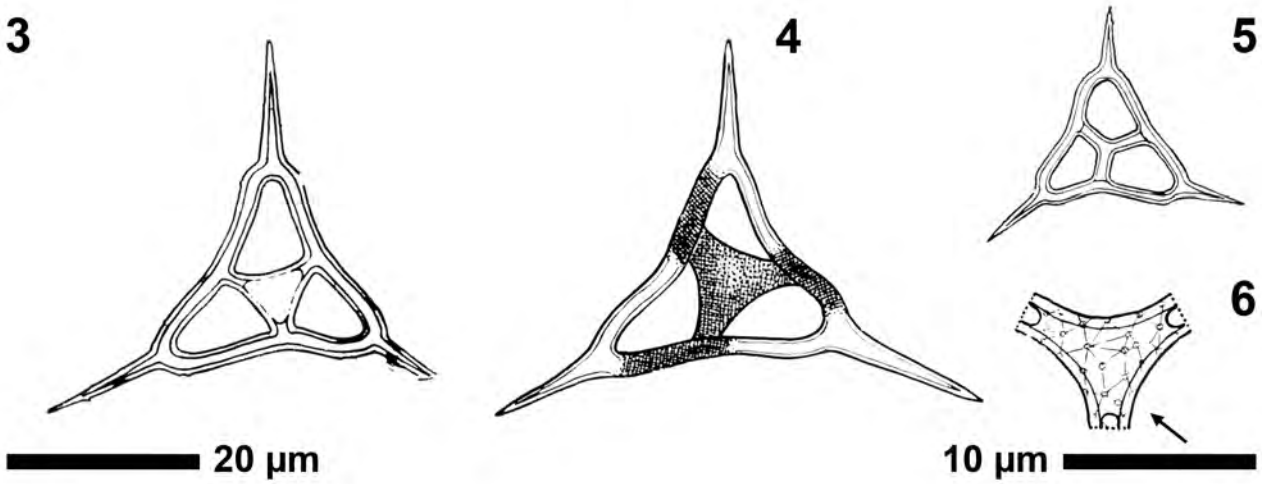
2
20 µm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4
5
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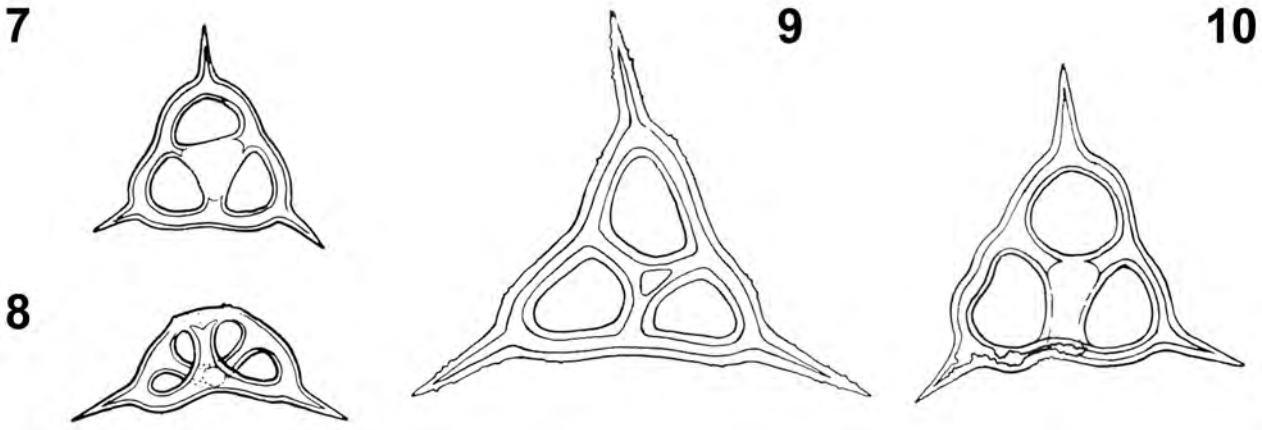

7
8
9
10

Plate 2

Fig. 1: *Dictyocha aegea* STRADNER & BACHMANN, 1978. Abapical view of holotype, Coll. No. GBA 1978/015/0001, STRADNER-Slide no. F, England Finder K57/O. Refigured (edited) from STRADNER & BACHMANN (1978: Pl. 1, Fig. 16).

Fig. 2: *Dictyocha aegea* STRADNER & BACHMANN, 1978. Apical view of paratype, Coll. No. GBA 1978/015/0003, STRADNER-Slide No. E/B, refigured (edited) from STRADNER & BACHMANN (1978: Pl. 1, Fig. 15).

Figs. 3–4: Scanning electron micrographs of a paratype in plan (Fig. 3) and side view (Fig. 4). Reproduced (edited), from STRADNER & BACHMANN (1978: Fig. 1).

Locality: Aegean Sea north of Crete, DSDP Site 378, DSDP Leg 42, Sample 378, Core 8, Site 1, 114–115 cm depth, Upper Pliocene, NN 16.

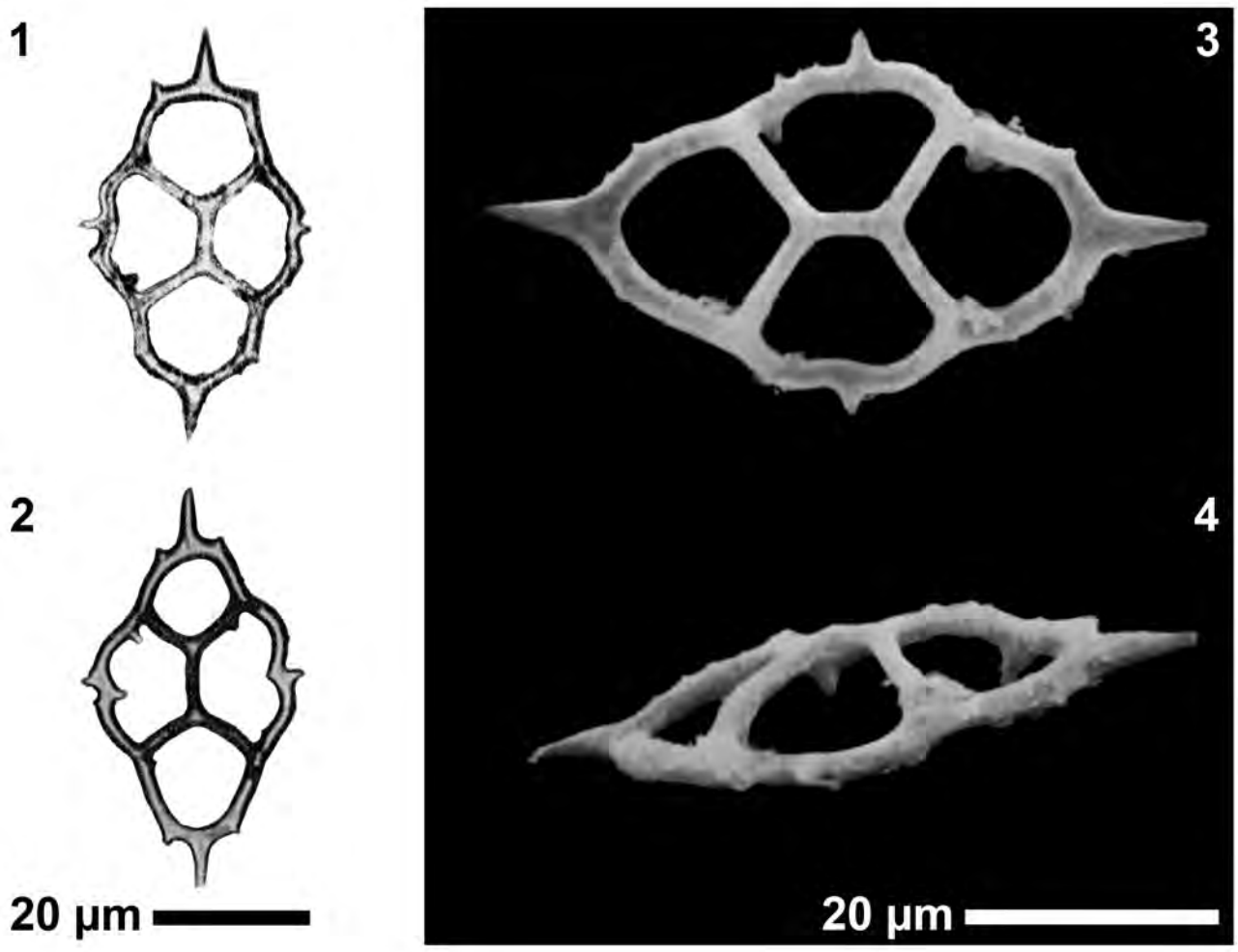

1
2
20 µm
3
4
20 µm

Plate 3

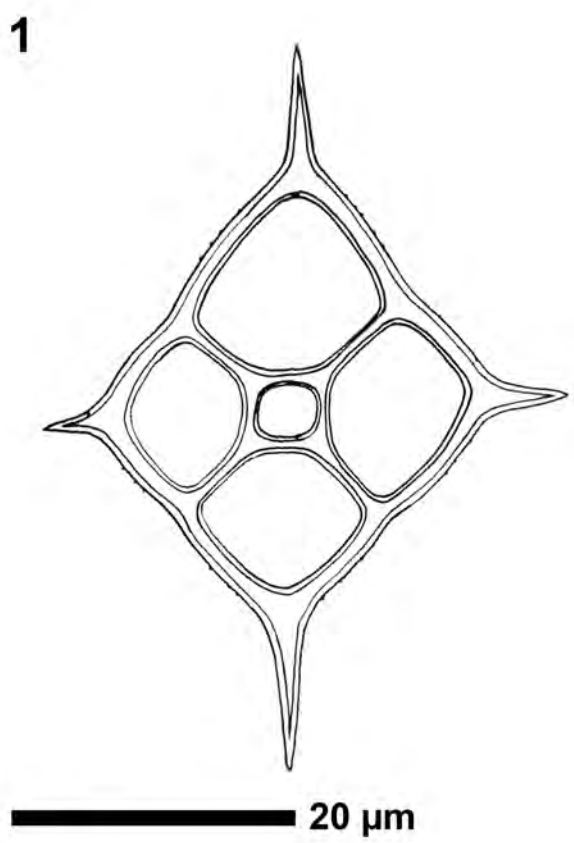
Fig. 1: *Dictyocha schauinslandii* LEMMERMANN. Line drawing of representative specimen in apical view (reproduced from STRADNER, 1961: Pl. 2, Fig. 60).

Figs. 2–5: Teratological (abnormal) forms.

Fig. 2: *Dictyocha schauinslandii* var. *rotundata* STRADNER, apical view, teratological form of *Dictyocha schauinslandii* in light microscope, Coll. No. GBA 1961/005/0006, STRADNER-Slide No. Li/6/A.

Figs. 3–5: Line drawings of teratological forms reproduced from STRADNER (1961: Pl. 2, Figs. 62, 65, 66). 3) abapical view; 4, 5) apical view.

Locality: Kieselgur Quarry at Limberg, Lower Austria. Limberg Subformation of the Zellerndorf Formation, upper Lower Miocene.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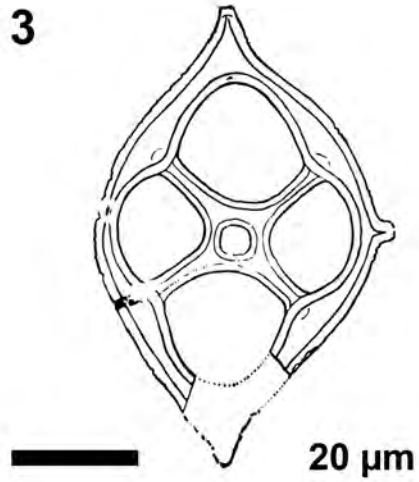
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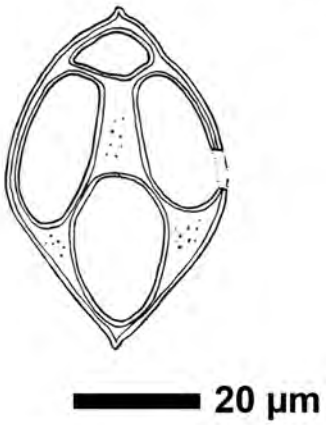

5
20 µm

Plate 4

Fig. 1: *Cannopilus picassoi* STRADNER, lateral view of specimen with short spines.

Fig. 2: *Cannopilus picassoi* STRADNER, lateral view of holotype, Coll. No. GBA 1961/005/003, STRADNER-Slide "Frättingsdorf Nr. 5", England Finder N35/2, with long and apical spines.

Fig. 3: *Cannopilus picassoi* STRADNER, detail view of spherical structure consisting of a grid of arcs surrounding hexagonal and rare pentagonal windows. Whether the white dots at the junctions of the arcs are knobs or just an optical phenomenon will have to be clarified.

Fig. 4: *Cannopilus picassoi* STRADNER, abapical view showing the pentagonal abapical ring with abapical spines.

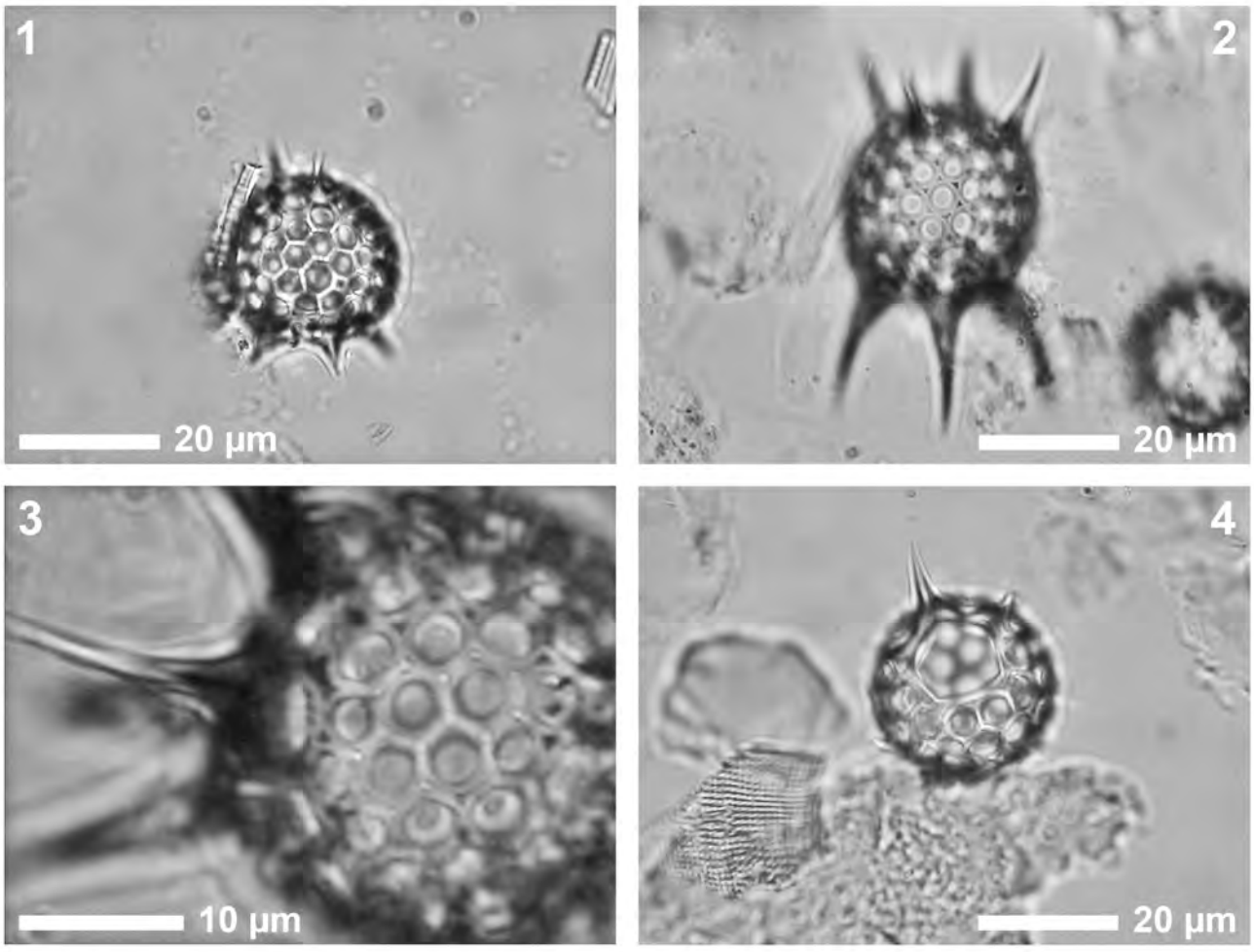
Figs. 5–8: *Cannopilus picassoi* STRADNER, original line drawings reproduced from STRADNER (1961: Pl. 3, Figs. 101–104).

Figs. 5–6: Side views.

Fig. 7: Apical view.

Fig. 8: Abapical view.

Type locality: Former brickyard at Frättingsdorf, Lower Austria. "Badener Tegel", Lanzhot Formation of the Waschberg Zone, Middle Miocene.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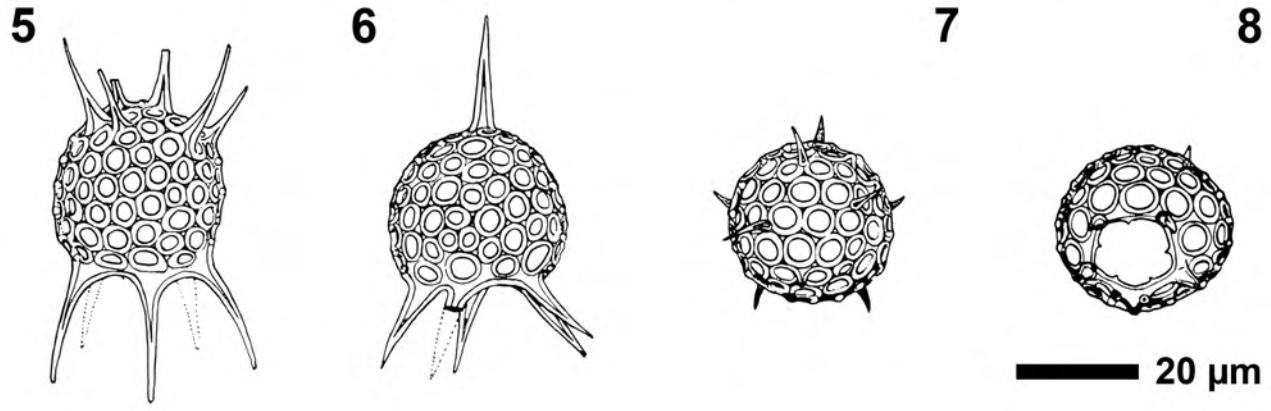

5
6
7
8
20 µm

Plate 5

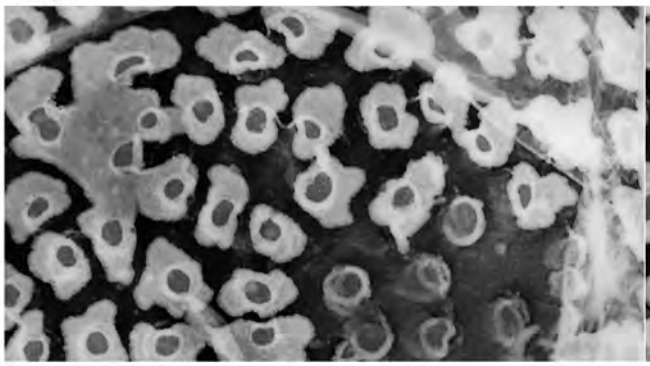
Fig. 1: *Artisphaeridium fragile* STRADNER. Holotype, reversed print as figured in HAJÓS (1975: Pl. 39, Fig. 4), Coll. No. GBA 1975/016/0001 (TEM Plates No. 5136 and 5137, stereo pair, Elmilab GBA).

Figs. 2a, b: Stereo pair of *Artisphaeridium fragile* STRADNER, detail of Fig. 1 of this plate, carbon-coated cyst surface, length of single picture equivalent to 2.7 µm. Top view showing single and joined mushroom-shaped protrusions.

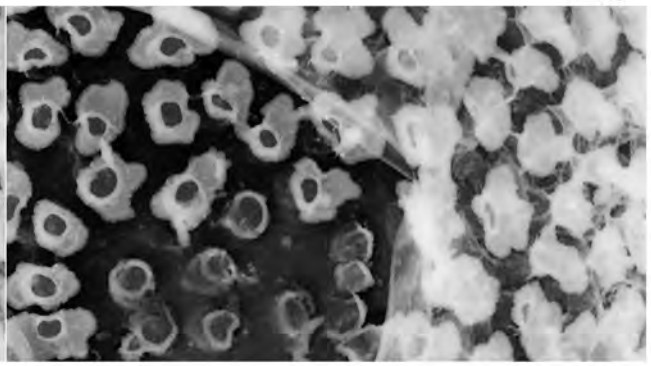
Figs. 3a, b: Stereo pair of *Artisphaeridium fragile* STRADNER, detail Fig. 1 of this plate, carbon-coated cyst surface, length of single picture equivalent to 2.7 µm. Side view showing mushroom-shaped protrusions.
(Stereo projections optimized for Zeiss Aerotopograph pocket stereoscope, interorbital distance = 5.6 cm).

Locality: Pacific Ocean, DSDP Leg 29, Site 275, Lithologic Unit 1, sample 2-1, interval 130–132 cm.

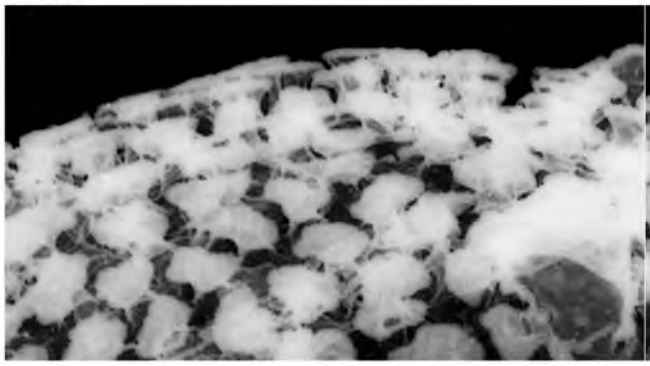
2a



2b



3a



3b

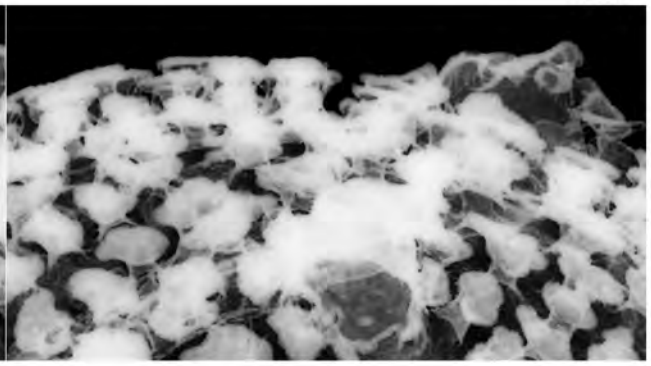


Plate 6

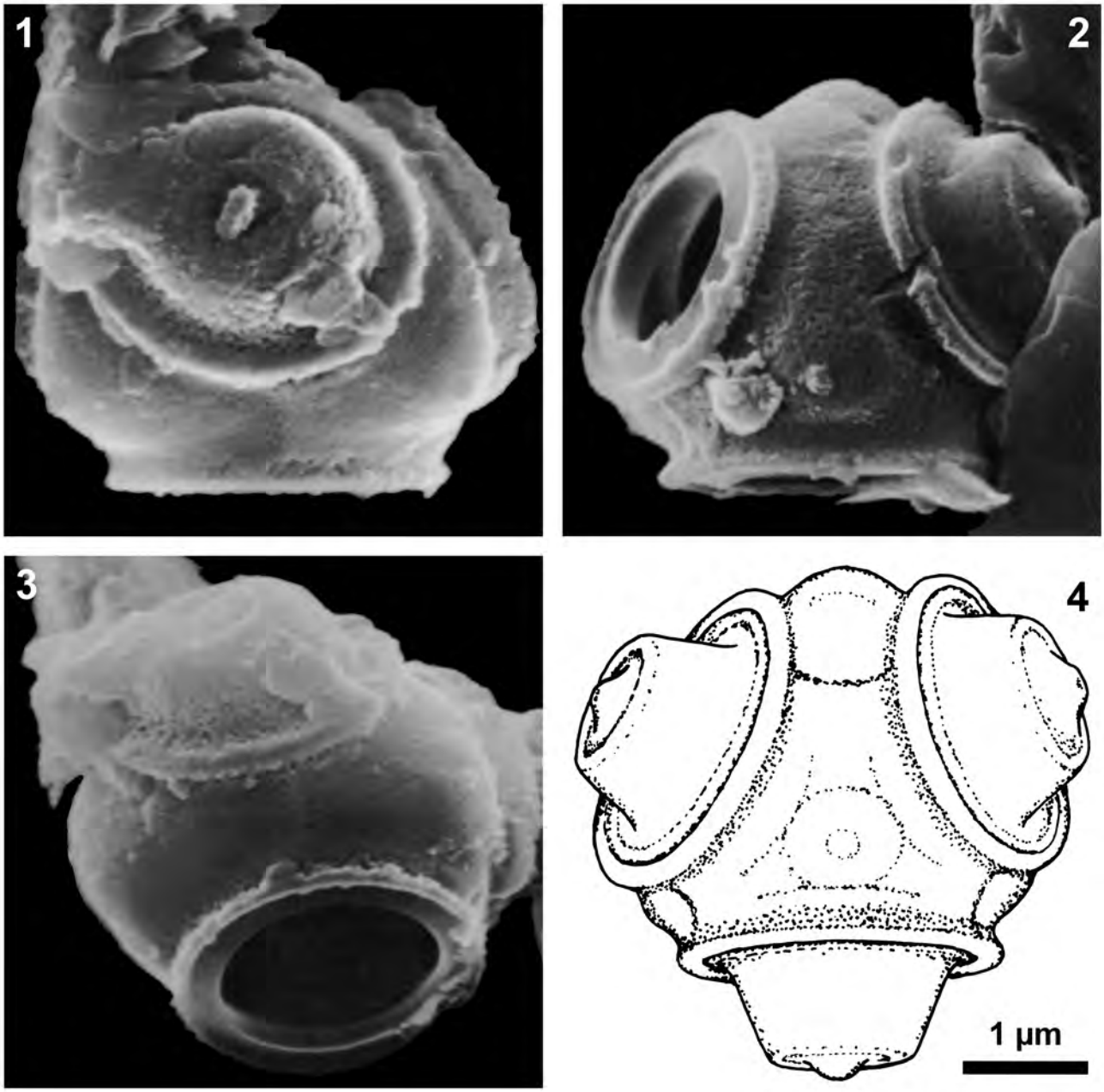
Enigmatic siliceous cyst (Choanoflagellate cyst) described and illustrated by STRADNER & ALLRAM (1981). GBA SEM-Film 15, Picture 19. Reproduced and modified from the original publication (STRADNER & ALLRAM, 1981: Pl. 1).

Fig. 1: Cyst with shield from above.

Fig. 2: Same specimen tilted to show flange surrounding a circular opening (escape window).

Fig. 3: Cyst showing framework of body plates, shield and flanges.

Fig. 4: Reconstruction of complete cyst.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Appendix

Choanoflagellate cyst described and illustrated by Stradner & Allram, 1981

Pl. 6, Figs. 1–4

Reference Material: GBA SEM-Film 15, Picture 19.

Original description (Stradner & Allram, 1981: 641): "The siliceous cyst is a hollow 'spheroid' showing tetrahedral symmetry and consisting of four hexagonal, curved body plates that support four subcircular flanges enclosing a large opening. Fitting into these flanges are four domed, hat-shaped plates (or shields) that seal the four subcircular openings of the cyst and can be thrown off upon evacuation of the living contents of the cyst. The four body plates are connected by the shorter flanks of their hexagonal outline. The alternating longer flanks seem to contribute to the construction of the flanges. Each flat flange has an elevated rim, as if to keep the shield from sliding off. The shields, which fit snugly into the flanges, have reinforced rims, conical walls, and flattened tops decorated by small central knobs. Also, the hexangular body plates have flat humps with a tiny knob in the center. Dimensions are 4 to 5 µm in diameter."

Occurrence: First SEM documentation of an enigmatic siliceous cyst found in cores of the Eastern Pacific, Middle American Trench, DSDP Leg 66, Hole 490, Sample 490-1-4, 25–26 cm, Zone NN20, Quarternary. Autochthony possible but not certain (Stradner & Allram, 1981: 641).

Comments: They are probably cysts of acanthoecacean choanoflagellates (cf. Silver et al., 1980). According to Marchant & McEldowney (1986) who studied the cell contents of living choanoflagellates from Antarctica, such cysts are formed by cells containing chloroplasts and, therefore, can be assigned to autotrophic planctonic flagellates. It is noteworthy that many morphologic details had already been described and illustrated by Stradner & Allram (1981), that are the four body plates and the sutures between them.

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