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15. RARE AND UNKNOWN NONCALCAREOUS MICROFOSSILS RECOVERED FROM LEG 114 SITES[1]

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ABSTRACT

The genus *Calicipedinium* of the family Actiniscaceae is reported from sediments as old as early Paleocene from sites drilled during ODP Leg 114 in the South Atlantic between 46°50' and 52°S.

Two new species, *Spongebria rudolphi* sp. nov. and *Calicipedinium georgiaensis* sp. nov., and one new combination, *Actiniscus elongatus* var. *pustulatus* var. nov., are described.

INTRODUCTION

Tertiary and Quaternary sediments from holes drilled during Ocean Drilling Program (ODP) Leg 114 along an east-west transect between 46°50′ and 52°S latitude (Table 1) were prepared for diatom analysis (for methods see other contributions of Fenner, this volume). The noncalcareous silt-sized residue of the sediments thus obtained contains rare microfossils, some of which belong to known endoskeletal dinoflagellates, to ebridian species, or to known sponge spicule types or are cysts of chrysophyceae. Others have not been described in the literature before. Some of them cannot even be assigned confidently to any known microfossil group. These microfossils are described and illustrated in this chapter.

Table 1. Position of ODP Leg 114 holes studied.

Hole	Location		Water depth (m)
	Latitude	Longitude	
698A	51°27.51′S	33°05.96′W	2138
699A	51°32.54′S	30°40.62′W	3705
700B	51°31.98′S	30°16.69′W	3601
701C	51°59.08′S	23°12.70′W	4637
702B	50°56.79′S	26°22.12′W	3084
703A	47°03.04′S	07°53.68′E	1796
704B	46°52.78′S	07°25.23′E	2532

SPONGE SPICULES

Throughout the Paleogene to Holocene sediments sponge spicules occur only rarely and sporadically. Their diversity—especially in the Neogene—is low. In the Paleocene sponge spicule abundance is slightly higher, and the sporadic occurrence of spicule types (e.g., isochele, sigma) of shallow-water species causes an increased diversity. These shallow-water sponge spicules are not considered autochthonous but are thought to have been displaced from shallow-water areas not too far away.

Pentactins and Tetractines (Pl. 5, Figs. 16–18)

Pentactin and tetractine microscleres were found only in Neogene subantarctic deep-sea sediments. Their abundance is as low as that of the other sponge spicules occurring there, such as spheraster-, pycnaster-, and amphiox-type spicules.

The easily recognizable axial canals in the pentactins and tetractins form a cross in the center. Both spicule types sporadically occur in lumps together, which could mean that they were formed by the same species of hexactinellids. In some spicules, small lateral spines that seem to help hold the network of spicules together were also observed (e.g., Pl. 5, Fig. 18).

Genus et Species Indet. (Pl. 5, Fig. 15)

This microfossil could be either a cast of a diatom resting spore reworked from the Paleogene or Cretaceous or a sponge spicule. In the former case the line indicating where the two valves overlap must lie at or beneath one end of the cylindrical part. Only a single such specimen was found.

EBRIDIANS

Studies with the scanning electron microscope show that the siliceous skeleton of least one genus, *Ammodochium*, of the order *Ebriales*, is in part hollow (Pl. 3, Figs. 1 and 2). The compactness of the skeleton thus may not be characteristic for all members of this order.

Class EBRIOPHYCEAE Loeblich, 1970
Order *EBRIALES* Honigberg et al., 1964
Genus *AMMODOCHIUM* Hovasse, 1932

Ammodochium doliolum Hovasse, 1932(Pl. 5, Fig. 1)

Description. Hovasse, 1932, p. 462.

Remarks. This species was found with frequent occurrence in the upper Paleocene recovered from Sites 698, 700, and 702.

Ammodochium rectangulare (Schulz) Deflandre, 1932
(Pl. 5, Figs. 3 and 2?)

Synonym. *Ebria antiqua* var. *rectangularis* Schulz in parte. Schulz, 1928, p. 274, fig. 72a, non figs. 19–21.

Remarks. This species occurs commonly in Paleocene and lower Eocene diatomaceous sediments recovered during Leg 114.

Ammodochium serotinum Locker et Martini, 1985
(Pl. 5, Figs. 4 and 5)

Description. Locker and Martini, 1985, p. 943, pl. 2, figs. 1, 2.

Remarks. This species was found sporadically in the lower Pliocene and Miocene at Site 704.

Triods of Ammodochium

Triods similar to the ones illustrated and described in the following occur commonly in Paleocene diatomaceous sediments recovered during Leg 114. Others are also found in the Neogene up into the lower Pliocene. Hovasse (1932) considered these skeletal elements as the central tripod of *Ammodochium*, and this opinion is supported by observations of

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different degrees of fragmentation and dissolution of *Ammodochium* by the author.

Ammodochium sp. 1 (triod)
(Pl. 3, Fig. 1; Pl. 5, Fig. 6)

Description. The triods found are triangular with straight sides and have a star-shaped triangular depression in the center and bifurcate protrusions at each corner.

Genus SPONGEBRIA Deflandre, 1950
Spongebria rudolphi sp. nov.
(Pl. 5, Fig. 14)

Description. The triod consists of a round central body with a knobby surface from which three arms protrude. All three arms lie in one plane. Two circles of robust spines are present at the distal end of each arm. This species was found sporadically in upper Miocene sediments at Site 702.

This species is named after Frank Rudolph, who helped counting siliceous microfossil groups in Leg 114 sediments and first discovered this species.

Differential diagnosis. This species differs from other species of the genus *Spongebria* by the regularly shaped ends of the triod.

Holotype. Sample 114-702A-3H-3, 110–111 cm (Pl. 5, Fig. 14).

ENDOSKELETAL DINOFLAGELLATES

Order GYMNODINIALES Lindemann, 1928
Family *ACTINISCACEAE* Kützing, 1844
Genus *ACTINISCUS* Ehrenberg, 1840

Actiniscus elongatus Dumitrică, 1968
(Pl. 5, Fig. 9)

Description. Dumitrică, 1968, p. 240, pl. 4, figs. 22, 26.

Actiniscus elongatus var. *pustulatus* var. nov.
(Pl. 2, Fig. 4)

Description. In outline and shape this siliceous skeleton is an elongate pentagon with rounded corners and concave sides. Two corners are at one end, three at the other end. The central thin siliceous membrane is fringed by a thick marginal rib. Tiny, roughly radially arranged short ribs can be recognized on the central siliceous membrane with the SEM. Although the fringing rib is smooth the rounded corners are covered with small granules, giving it a knobby appearance. At one of the corners the specimen illustrated is slightly broken, and it appears as if at least the corners are hollow structures.

Differential diagnosis. This early Pliocene variety differs from *A. elongatus* var. *elongatus* in that the five corners are not extended into long downward-bent arms but are broadly rounded.

Holotype. Sample 114-704B-23X-4, 90–91 cm (Pl. 2, Fig. 4). GPI Kiel Scanning Electron Microscope Photo Archive No. 3672/33.

Actiniscus pentasterias Ehrenberg, 1854
(Pl. 4, Fig. 4)

Description. Ehrenberg, 1854, pl. 18, fig. 61; pl. 19, fig. 45; pl. 20, fig. 48; pl. 33 (XVII), fig. 1; pl. 35A (XXIII), fig. 1; pl. 36, fig. 36. Dumitrică, 1973, p. 822, pl. 2, figs. 2, 3, 6–11, 14; pl. 3, figs. 13, 14, pl. 5, figs. 6–8.

Actiniscus sp. 1
(Pl. 5, Fig. 8)

Remarks. This species resembles *A. pentasterias* in its outline and alveolar structure. It differs from *A. pentasterias* by the presence of a network of arched siliceous bars forming a domelike structure over the central alveola. A single specimen of this species was found in the upper Pliocene at Site 704.

Genus CALICIPEDINIUM Dumitrică, 1973
Calicipedinium georgiaensis sp. nov.
(Pl. 3, Figs. 4 and 5; Pl. 5, Fig. 13)

Description. The star-shaped, siliceous skeleton consists of five solid ribs that radiate from a common center and taper toward the distal end. All ribs lie in one plane. The ribs are flanked and connected by siliceous flanges. The skeleton is slightly asymmetrical, with axial rays not of equal length and angles between the rods also slightly unequal. In one sector, generally the one with the widest angle and bound to one especially long ray, the flanges are not spread in a plane parallel to the one of the rays but are bent downward or are very narrow. This asymmetry continues in the central, raised buttonlike plate, which is characteristic for this genus. The plate is not circular but indented in the same sector in which the flanges leave free a wider, open space. Sporadic double skeletons were found. Both platelets lie with the concave side toward each other, forming a closed, star-shaped capsule. The skeletal elements differ in that one has the central raised ray with the buttonlike plate on top and the other one has only a triangular spine in the center. These two different skeletal elements generally were found separated in the sample.

For living *Actiniscus pentasterias*, Zimmermann (1930) described the stellate spicules as lying separately in the cell, capping the organic membrane that surrounds the nucleus. For the organism producing the skeletal element called *Calicipedinium* this does not seem to be true.

C. georgiaensis was found only in lower and upper Paleocene sediments of Leg 114.

Differential diagnosis. This species differs from *C. quadripes* by the number of rays and the asymmetry of the skeleton. It differs from *C. hexastylus* by its noncircular, raised, buttonlike plate.

Holotype. Sample 114-700B-30R-4, 27–28 cm (Pl. 3, Fig. 4). GPI Kiel Scanning Electron Microscope Photo Archive No. 3603/18.

CYSTS OF CHRYSOPHYCEAE

(Pl. 3, Fig. 3; Pl. 4, Figs. 1–3; Pl. 5, Fig. 12)

Rare specimens of different species were found throughout the Neogene, during which period open oceanic conditions existed at all Leg 114 sites. In the diatom-rich Paleocene sediments Archaeomonadaceae are present in frequent to common abundance, possibly indicating a more neritic environment. In some samples with higher silica dissolution, they even become the dominant biosiliceous component. Species were not differentiated.

Genus ACANTHOSPHAERIDIUM Hajós et Stradner, 1975

Description. The shell is made of opal-A and consists of a hollow round to oval body that is unperforated and has one large aperture. From around this aperture emerge long, crooked spines that are hollow at least in their broad basal part.

Discussion. Hajós and Stradner (1975) assigned these shells tentatively to the Archaeomonadaceae, cysts of Chrysophyta. On the other hand, *Acanthosphaeridium* exhibits some similarity with the podamphora stage of ebridians. Further, it is similar to *Cornua gothica*, which Hovasse (1932) described from the upper Eocene of Oamaru and considered an ebridian. It differs, however, from the latter by its structure and the possession of more than three spines ("stalactites" of Hovasse, 1932).

Acanthosphaeridium reticulatum Hajós et Stradner, 1975
(Pl. 1, Figs. 3 and 4)

Description. The round, hollow capsule is smooth on the inside and sculptured on the outside by a multitude of irregularly arranged small knobs, which are linked with each other by small ridges. The large aperture is rimmed by a peristome and surrounded by four hollow spines. Also, all of the specimens illustrated by Hajós and Stradner (1975) have four spines—not three, four, or five. The spines are connected by a structureless collar with a wavy outline. The diameter of the specimens observed in the South Atlantic Paleocene varies between 14 and 18 μm.

Paleogeographic and stratigraphic occurrences. This species up to now was recorded only from the high southern latitudes. It was found sporadically in lower and upper Paleocene sediments at Sites 700 and 702. Hajós and Stradner (1975) described this species from the Upper Cretaceous of Deep Sea Drilling Project Site 275 on the Campbell Plateau. The species producing this shell accordingly ranges at least from the late Campanian (*Patulibracchium dickensonii* Zone) to the late Paleocene, and thus survived the Cretaceous/Tertiary boundary event.

NONCALCAREOUS MICROFOSSILS OF UNCERTAIN ASSIGNMENT

Genus et Species indet.
(Pl. 1, Fig. 1)

Description. This specimen, which was found in lower Paleocene sediments at Hole 700B, seems to be a siliceous cast of a microfossil. The specimen is broken on one margin. It is fixed to the coverslip in such a way that no additional information could be obtained by rotating it.

Genus et Species indet.
(Pl. 2, Figs. 1 and 2)

Description. Only a single fragment of this siliceous skeleton was found. It is a circular valve with a high margin. On one side it is open. The other side is perforated by holes arranged in two parallel rows and has several lobed flaps attached to it laterally. Broken spines can be recognized around the open side.

Genus et Species indet. 1
(Pl. 2, Fig. 3)

Description. This tiny siliceous skeleton is nearly round, hollow, and has four rimmed openings of trilobate shape. Only a single specimen with such trilobate openings (Pl. 2, Fig. 3) was found in early Pliocene age sediments from Site 704. Specimens with round openings (not illustrated) occur repeatedly, though the low abundance, in sediments of early Miocene to Holocene age at Sites 704 and 701. The spheroids are similar to the skeletal elements of the dinoflagellate *Pavillardinium kofoidii*. On the other hand, Silver et al. (1980) described siliceous cysts in plankton samples from the North Pacific, equatorial Pacific, and southern Weddell Sea, which after the loss of the sealing plates very much resemble the skeletal remains found in Leg 114 sediments and which these authors considered to be cysts of choanoflagellates.

Egg of ?
(Pl. 1, Fig. 2; Pl. 5, Fig. 11)

Description. Single specimens of these microfossils, consisting of a smooth, thin organic skin and hollow inside, were found throughout Tertiary and Quaternary sediments. They have no pore or pores.

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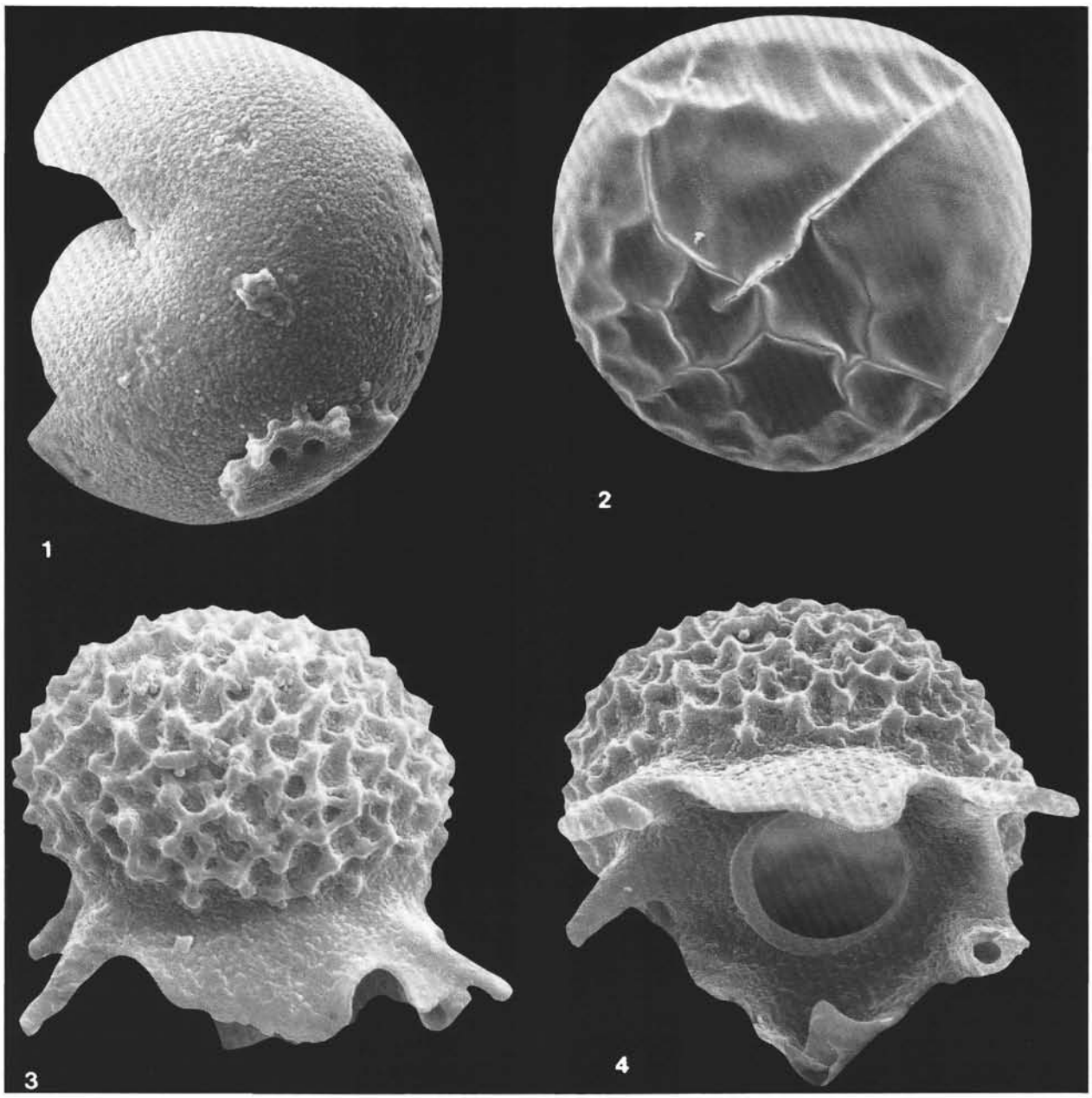

Plate 1. SEM photomicrographs of early Paleocene specimens. **1.** Siliceous cast of Genus et Species indet., broken on the left side, 5500×. Sample 114-700B-31R-6, 32 cm; GPI Kiel Photo Archive No. 3636/31. **2.** Egg of ?, the wrinkles and cracks were produced by leaving the specimen too long in focus in the SEM, 4500×. Sample 114-700B-31R-6, 32 cm; GPI Kiel Photo Archive No. 3637/10. **3** and **4.** *Acanthosphaeridium reticulatum*, specimen tilted in Fig. 4, 4800×. Sample 114-700B-31R-6, 32 cm; GPI Kiel Photo Archive No. 3637/12-13.

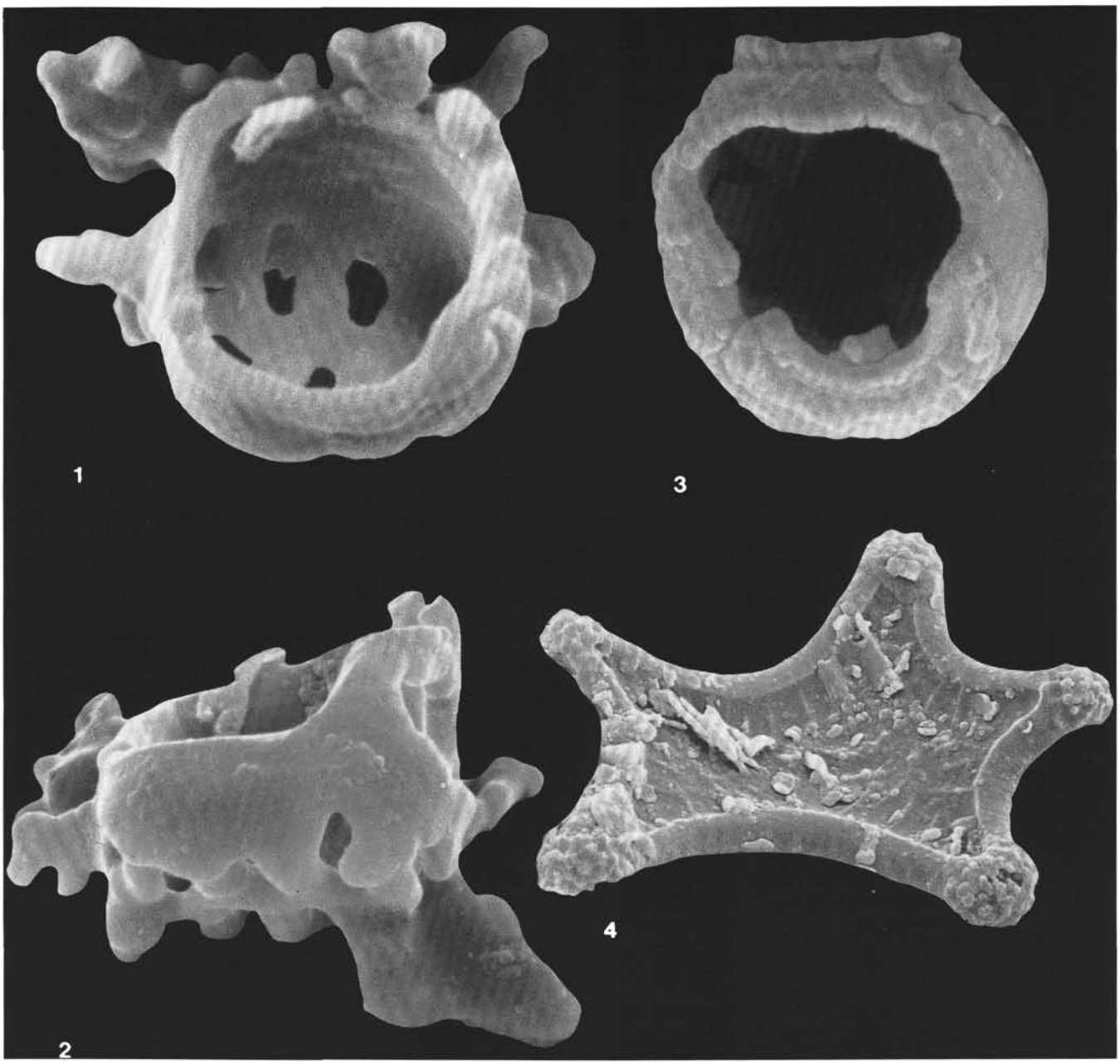

Plate 2. SEM photomicrographs of early Pliocene specimens. **1** and **2.** Genus et Species indet. in different positions, 13,000×. Sample 114-704B-23X-4, 90–91 cm; GPI Kiel Photo Archive No. 3673/11-12. **3.** Genus et Species indet. 1, 18,500×. Sample 114-704B-23X-5, 90–91 cm; GPI Kiel Photo Archive No. 3672/31. **4.** *Actiniscus elongatus* var. *pustulatus* var. nov., holotype, 4750×. Sample 114-704B-23X-4, 90–91 cm; GPI Kiel Photo Archive No. 3672/33.

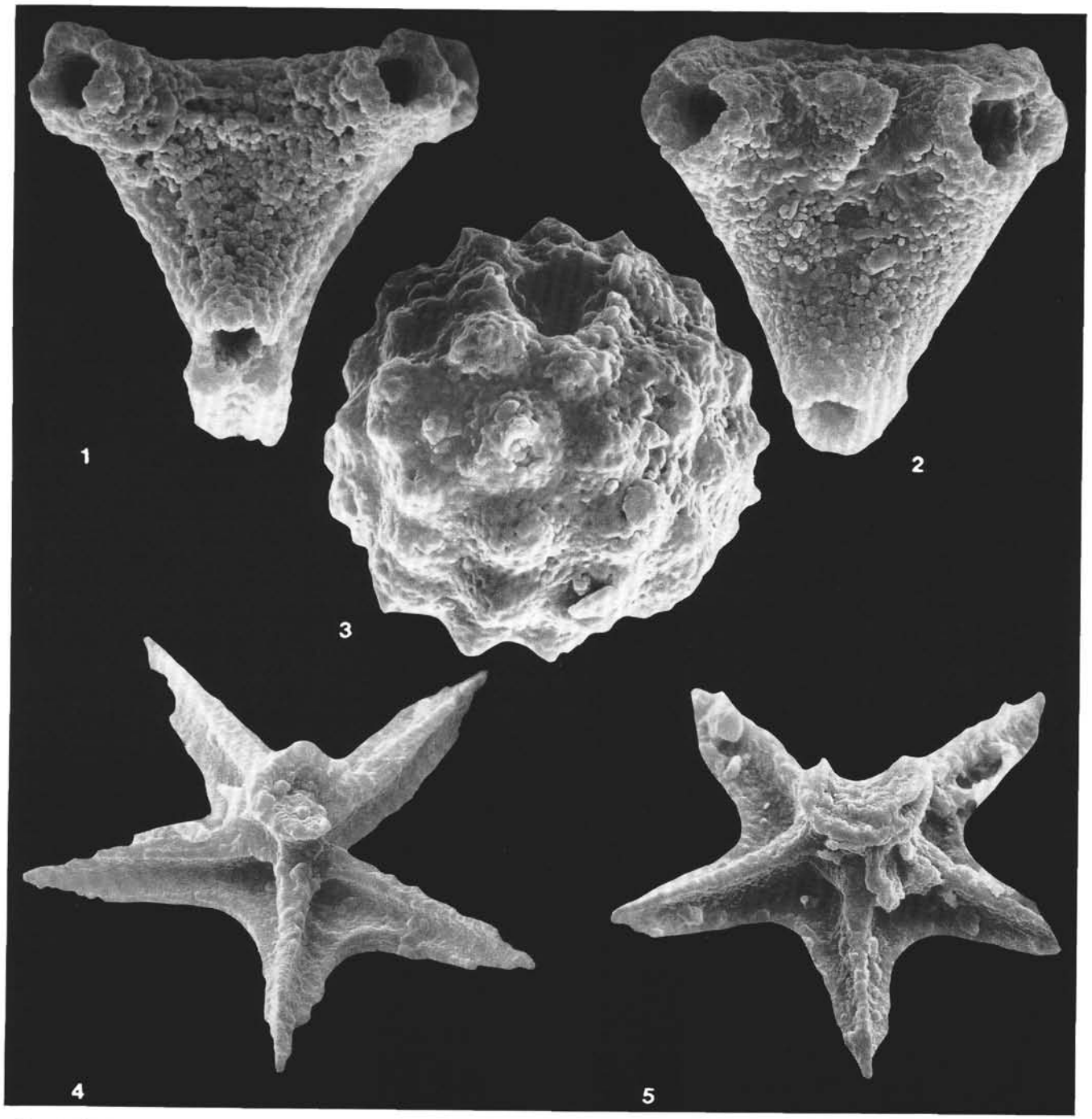

Plate 3. SEM photomicrographs. **1.** *Ammodochium* sp. 1 (triod), early Paleocene, 5750×. Sample 114-700B-31R-6, 32 cm; GPI Kiel Photo Archive No. 3637/8. **2.** *Ammodochium* sp., early Paleocene, 6325×. Sample 114-700B-31R-6, 32 cm; GPI Kiel Photo Archive No. 3637/5. **3.** Chrysophycean cyst, early Paleocene, 7000×. Sample 114-700B-32R-1, 125–126 cm; GPI Kiel Photo Archive No. 3627/5. **4** and **5.** *Calicipedinium georgiaensis* sp. nov., late Paleocene. Fig. 4. Holotype, 4575×. Sample 114-700B-30R-4, 27–28 cm; GPI Kiel Photo Archive No. 3609/18. Fig. 5. 4130×. Sample 114-698A-11R-CC; GPI Kiel Photo Archive No. 3607/24.

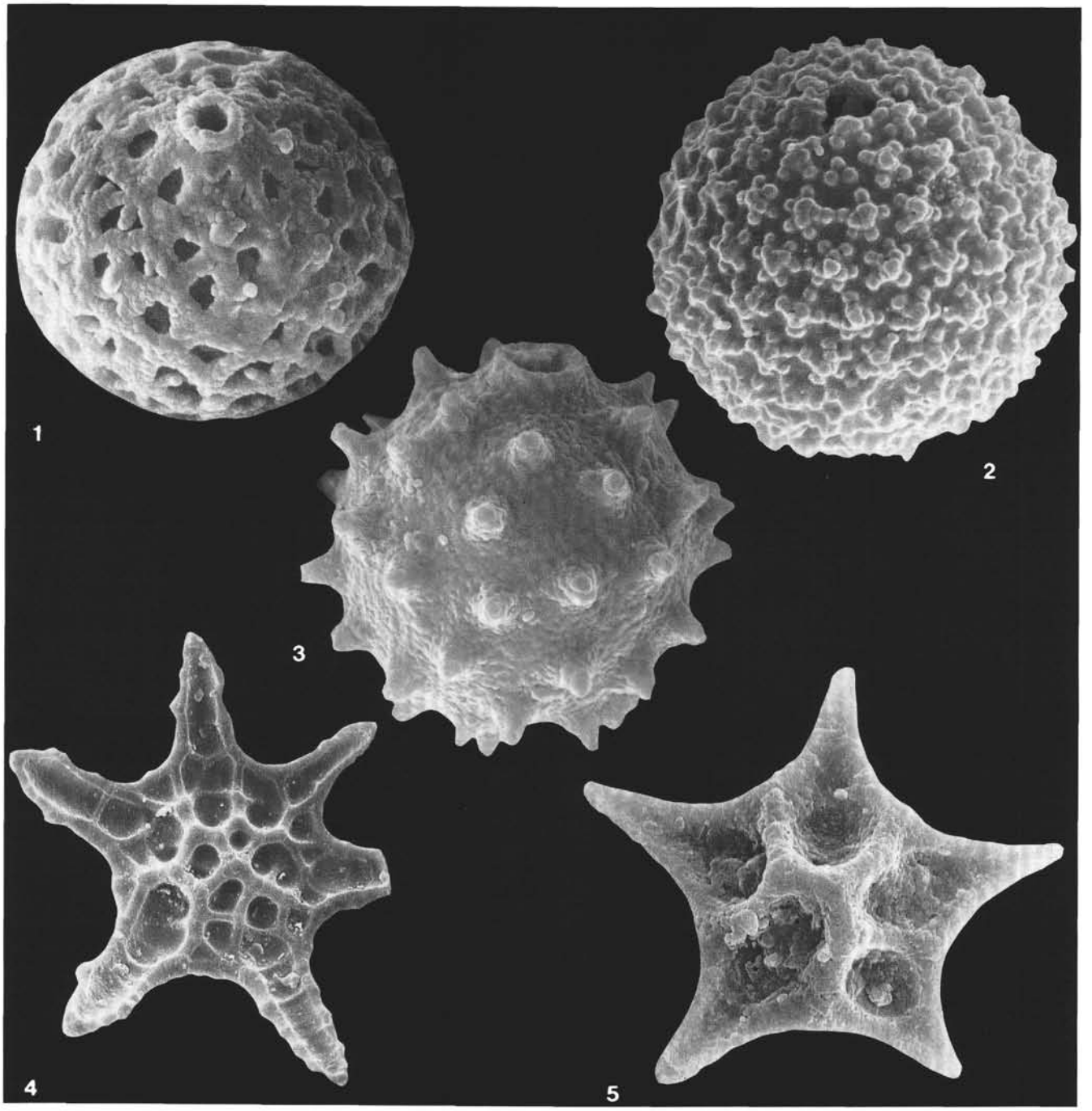

Plate 4. SEM photomicrographs. **1–3.** Early Paleocene Chrysophycean cysts. Fig. 1. 10,000×. Sample 114-700B-31R-3, 125–126 cm; GPI Kiel Photo Archive No. 3627/10. Figs. 2 and 3. Sample 114-700B-31R-6, 32 cm. 2. 7000×, GPI Kiel Photo Archive No. 3636/36; 3. 8000×, GPI Kiel Photo Archive No. 3637/14. **4.** *Actiniscus pentasterias*, ventral view of mature specimen with well-developed network of ribs and nodes on the ventral side, late Pliocene, 2400×. Sample 114-704B-12H-7, 10–12 cm; GPI Kiel Photo Archive No. 3637/22. **5.** Ventral view of *Actiniscus* sp., late Miocene–early Pliocene, 5000×. Sample 114-699A-5H-5, 98–100 cm; GPI Kiel Photo Archive No. 3603/6.

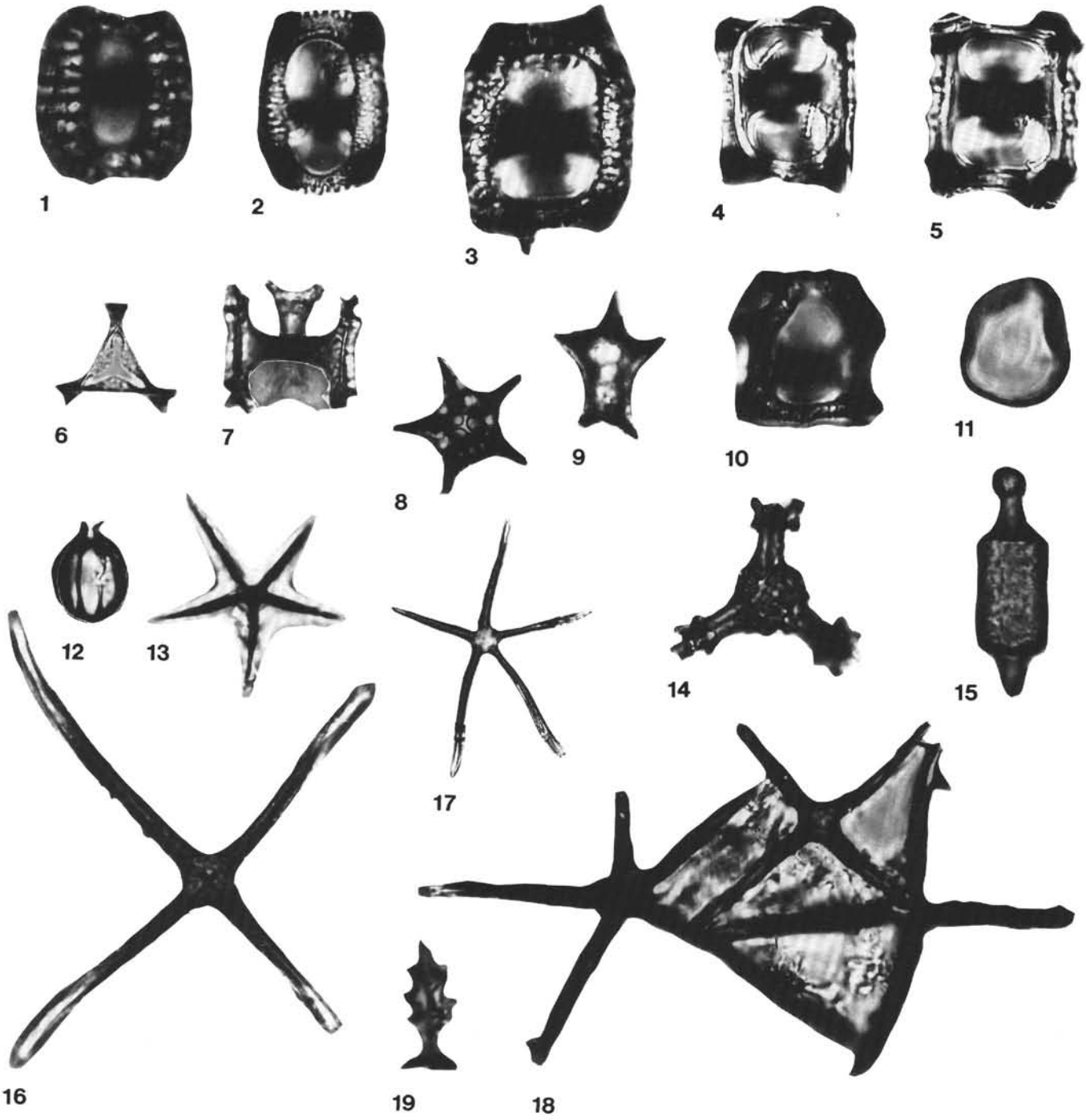

Plate 5. Light microscope photomicrographs. Magnification 1500× unless indicated otherwise. **1.** *Ammodochium doliolum,* early Paleocene. Sample 114-700B-34R-1, 119 cm. **2.** *Ammodochium doliolum–A. rectangulare* (transitional form), early Eocene. Sample 114-698A-3R-1, 75–76 cm. **3.** *Ammodochium rectangulare*, late Paleocene. Sample 114-698A-11R-CC. **4** and **5.** *Ammodochium serotinum*. Fig. 4. Late Pliocene. Sample 114-704B-12H-6, 90–92 cm. Fig. 5. Early Pliocene. Sample 114-704B-13H-4, 110–112 cm. **6.** *Ammodochium* sp. 1, early Eocene. Sample 114-698A-3R-1, 75–76 cm. **7.** *Ammodochium* sp., late Paleocene. Sample 114-698A-10R-1, 66–67 cm. **8.** *Actiniscus* sp. 1, early Pliocene. Sample 114-704A-17X-5, 104–105 cm. **9.** *Actiniscus elongatus*, early Pliocene. Sample 114-704A-23X-4, 90–91 cm. **10.** *Ammodochium* sp., late Paleocene. Sample 114-700B-29R-2, 122–124 cm. **11.** Egg of ?, Quaternary. Sample 114-701C-1H-2, 45–46 cm. **12.** Chrysophycean cyst, late Paleocene. Sample 114-698A-11R-CC. **13.** *Calicipedinium georgiaensis* sp. nov., late Paleocene. Sample 114-700B-30R-4, 27–28 cm. **14.** *Spongebria rudolphi*, holotype, late Miocene. Sample 114-702A-3H-3, 110–111 cm. **15.** Siliceous cast of a diatom spore? or a sponge spicule?, Quaternary. Sample 114-704B-1H-5, 10–12 cm. **16–18.** Sponge spicules: tetractines and pentactins. Fig. 16. Late Pliocene. Sample 114-699A-4H-5, 109–111 cm. Fig. 17. Quaternary, 700×. Sample 114-704B-6H-4, 130–132 cm. Fig. 18. Late Miocene. Sample 114-702A-3H-3, 110–111 cm. **19**. Sponge spicule, dermal pinule of hexactinellidae, late Paleocene. Sample 114-700B-30R-2, 120–121 cm.