35. RADIOLARIANS FROM DEEP SEA DRILLING PROJECT LEG 96[1]

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ABSTRACT

Radiolarians are present in samples from six of the seven Deep Sea Drilling Project Leg 96 sites examined. The age of the siliceous fauna in these samples ranges from late Pleistocene through Holocene, with some Cretaceous radiolarians redeposited in Pleistocene sequences. Radiolarian preservation is discontinuous at these sites except for intraslope basin Site 618, where the sediments throughout the first five cores contain radiolarians.

INTRODUCTION

On Deep Sea Drilling Project (DSDP) Leg 96, we examined sediment sequences at sites located on the middle and lower Mississippi Fan and in the Orca and Pigmy intraslope basins (see Introduction, this volume). Sedimentation rates at these sites range from 2.5 to 1000 cm/1000 yr., with the major sediment component being terrigenous in nature. The biosilica preserved in the sediment record is highly diluted by the large volumes of terrigenous material, with the result that radiolarians are very rare or absent in all but a small number of the samples examined from seven of the sites (Fig. 1) drilled on this leg.

Most radiolarian assemblages from sites drilled on DSDP Leg 96 are representative of the Pleistocene/Holocene. Rare displaced Cretaceous radiolarians occur in some of the Wisconsin-age (late Pleistocene) sequences.

METHODS

Samples were taken at sites where initial shipboard paleontological examination indicated the presence of radiolarians. Because of the high terrigenous sand/silt content of the samples, relatively large quantities of core material were processed, with dry weights of samples ranging from 3.7 to 20.2 g. After disaggregation, slides of the greater than 63 μm fraction of each sample were prepared according to the random settling technique described by Moore (1973). Radiolarian preservation, based upon visual examination, varied from good (more than half the specimens unbroken with little evidence of dissolution) to moderate (approximately half the specimens broken with signs of dissolution) to poor (more than half the specimens broken with a high degree of dissolution).

Apparent discrepancies between radiolarian presence/absence data presented in this chapter and the data in Kohl (this volume) and Kohl et al. (1985) occurred because of the much larger size samples (dry weights ranging from 28 to 210 g) analyzed in the latter two studies. Holocene radiolarian fauna was distinguished from late Pleistocene fauna on the basis of the foraminifer biostratigraphy outlined in the individual site chapters.

Table 1 shows the relative abundances of radiolarians per gram of sediment (rounded to the nearest thousand radiolarians per gram) as well as their preservation in samples from Hole 618. Abundances of individual species given in Table 1 are based on examination of a minimum of 300 radiolarians per sample with abbreviations defined as follows: R, rare (<1%); F, few (1–3%); C, common (3–10%); A, abundant (>10%); +, one specimen present; −, species sought but not found.

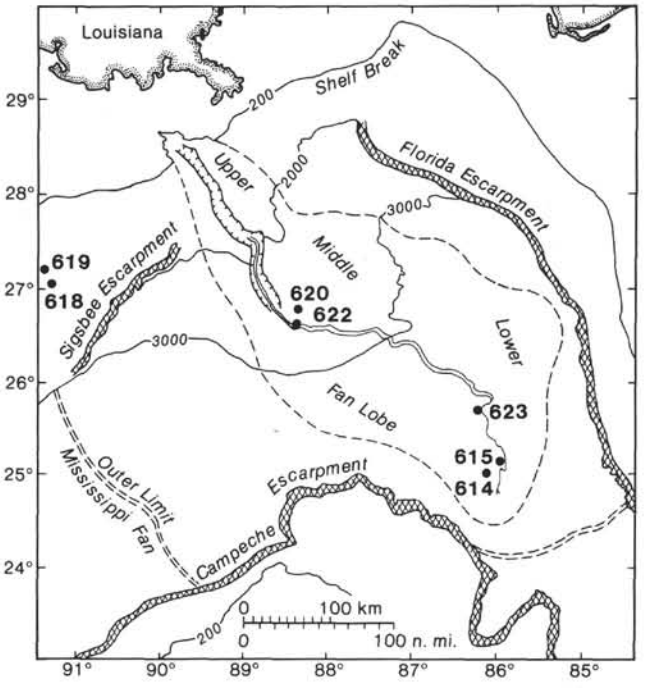

Figure 1. Sites drilled on DSDP Leg 96 that were examined for presence of radiolarians.

MISSISSIPPI FAN SITES

Middle Fan

Preliminary shipboard descriptions suggested the presence of siliceous microfossils in sediments from Hole 620 (Site 620 chapter, this volume). However, because of the smaller dry weights (ranging from 7.8 to 17.0 g) of the samples analyzed from this hole compared to shipboard samples, no radiolarians were found in any of the 24 samples taken at various levels from Cores 620-3 through 620-25. Of the few samples analyzed from Hole 622, only an occasional radiolarian specimen was found

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Table 1. Radiolarian abundances and preservation in Hole 618 samples.

Core-Section (interval in cm)	Radiolarian abundance (thousands per gram of sediment)	Preservation (poor, moderate, good)	*Polysolenia murrayana*	*Polysolenia spinosa*	*Polysolenia flammabunda*	*Polysolenia lappacea*	*Distolenia quadrata*	*Siphonosphaera* sp.	*Collosphaera tuberosa*	*Cenosphaera* sp.	*Larcospira quadrangula*	*Hexacontium* sp.	*Heliodiscus asteriscus*	*Tetrapyle octacantha*	*Didymocyrtis tetrathalamus*	*Pterocorys campanula*	*Axoprunum stauraxonium*	*Lamprocyclas maritalis*	*Pterocorys zancleus*	*Stylatractus* sp.	*Anthocyrtidium ophirense*	*Pterocanium praetextum praetextum*	*Lithopera bacca*	*Liriospyris reticulata*	*Spongopyle osculosa*	*Spongocore puella*	*Euchitonia* sp.	*Ommatodiscus* sp.	*Stylodictya validispina*	*Lithelius minor*	*Spongotrochus glacialis*	*Spongaster tetras*
1-5, 30-32	2	M	R	R	R	F	+	F	–	R	+	R	R	C	F	C	R	R	F	R	R	C	F	R	R	+	F	F	R	F	C	F
3-1, 10-12	3	M	R	+	R	R	R	F	+	R	+	R	R	A	R	C	–	R	C	R	R	C	R	R	R	+	+	R	R	F	C	F
3-2, 10-12	1	M	R	R	R	R	–	F	+	R	+	F	+	C	F	C	–	F	C	R	F	C	R	R	R	R	R	R	R	F	C	R
3-2, 115-120		P	R	C	–	F	R	F	F	R	–	R	R	C	R	F	R	C	F	F	+	R	C	R	C	–	–	R	R	R	C	–
3-3, 10-12	2	M	F	F	+	R	R	F	+	R	+	F	R	C	C	C	–	F	C	R	R	F	R	R	+	+	+	R	R	R	F	R
3-4, 10-12	2	M	–	R	+	R	R	R	+	R	+	R	R	A	F	R	+	R	C	R	R	C	R	R	R	–	R	F	R	R	C	R
3-7, 10-12	3	G	R	R	R	R	R	F	+	F	+	F	R	A	R	C	+	R	C	R	R	C	R	R	–	R	R	F	R	R	C	R
3,CC	3	G	+	R	R	R	R	F	+	R	R	F	R	C	F	C	–	R	F	R	R	F	R	F	+	+	R	R	R	R	C	R
4-2, 42-45	3	M	R	R	R	R	F	F	–	R	–	R	R	A	F	C	+	F	F	R	R	C	R	F	R	R	R	F	R	F	C	R
4-3, 42-45	1	M	R	R	R	R	F	F	+	R	+	R	R	C	F	C	+	R	C	R	R	C	R	R	+	R	F	R	R	R	C	R
5-3, 10-15		P	–	C	–	–	–	C	–	F	–	R	R	C	C	+	+	C	+	–	–	R	–	R	+	—	—	—	—	—	A	F

Note: Cores 6–11 are barren of radiolarians.

per sample. All radiolarians identified at Site 622 were Cretaceous in age, being redeposited in the thick late Pleistocene Mississippi Fan sedimentary sequence.

Lower Fan

Samples were taken for analysis from three lower fan holes (Holes 614A, 615, and 623). Holocene/Pleistocene radiolarians were identified in only one lower fan sample at Hole 623 (Sample 623-2-4, 35–40 cm). The few radiolarians present in the remaining samples examined from the Pleistocene sequences from the lower fan sites were all of Cretaceous age. These data, when combined with radiolarian presence/absence data presented by Kohl et al. (1985), suggest that radiolarian productivity was lower and/or terrigenous sedimentation rates were higher during the late Pleistocene compared to Holocene and latest Pleistocene levels. Most likely the latter explanation accounts for the very low occurrence of Pleistocene radiolarians throughout all but the latest Pleistocene, since Pleistocene sedimentation rates are so much greater than Holocene and latest Pleistocene rates (Wetzel and Kohl, this volume).

INTRASLOPE BASIN SITES

Hole 618 was drilled in the Orca Basin, an interdomal basin with a 200-m-thick hypersaline anoxic bottom water layer (Intraslope Basin Introduction and Summary, this volume). Samples were taken at approximately 1.5-m intervals. Sediments in Core 618-1 and part of Core 618-2 (the uppermost 11 m) represent a slump feature of Pleistocene sediments displaced from the basin margin during the Holocene (Site 618 chapter, this volume). Radiolarians were present in only the first 5 of the 11 cores taken at this site (Table 1). The radiolarians are representative of a Pleistocene/Holocene assemblage, with the most abundant species being *Tetrapyle octacantha* followed by *Spongotrochus glacialis, Pterocorys campanula, P. zancleus*, and *Pterocanium praetextum praetextum*.

Only 3 of the 39 samples examined from Site 619 in Pigmy Basin contained radiolarians. In the only sample from Hole 619 where biosiliceous microfauna were found (Sample 619-3-3, 103–108 cm), the radiolarians were highly dissolved. The Pleistocene/Holocene fauna in this sample was dominated by robust varieties of radiolarians (*Stylatractus* sp., *Polysolenia spinosa*). Moderately well preserved radiolarians were present in the uppermost sample from Hole 619A (Sample 619A-1-1, 0–1 cm). These fauna represent a typical Pleistocene/Holocene assemblage. Silica dissolution increased rapidly with depth in Core 619A-1 to the extent that the Pleistocene/Holocene radiolarians found in the sample from the base of this core (Sample 619A-1-1,CC) were poorly preserved. As was the case with the highly dissolved sample from Hole 619, robust species (*Polysolenia spinosa, Stylatractus* sp., *Axoprunum stauraxonium*) were the most common radiolarians in the sample. Although no Cretaceous radiolarians were present in the samples taken from the upper 140 m from Hole 619, Kohl (this volume) found rare reworked Cretaceous radiolarians below 157 m subbottom.

CONCLUSIONS

The only radiolarians present in samples from middle fan sites were representative of a Cretaceous fauna that were redeposited in Pleistocene sediments. The Cretaceous radiolarians were probably originally deposited in Upper Cretaceous rocks of western Kansas, Iowa, South Dakota, and Minnesota. Portions of these outcrops were eroded during recent glaciations and redeposited as drift (Woodward and Thomas, 1895). The Mississippi River and its tributaries have since eroded some of this drift material (Thompson, 1983), redepositing it at various points along the Mississippi as well as across its delta and fan complex.

Pleistocene sequences from the lower fan sites also contain reworked Cretaceous radiolarians. Holocene/Pleistocene radiolarians were present at lower fan Site 623.

The absence of Cretaceous radiolarians in Holocene sediments suggests that redeposition processes were more active during the late Pleistocene than during the Holocene.

The radiolarians present in samples from the intraslope basins are representative of a Pleistocene/Holocene assemblage. No reworked Cretaceous radiolarians were identified in samples of Pleistocene sediment from either Hole 618 or the upper 140 m from Hole 619.

SPECIES LIST

Detailed descriptions of the radiolarian species identified in samples from various DSDP Leg 96 sites have already been presented. Therefore, the following list simply provides a bibliographic reference for the species listed in tables and/or shown in the plates in this chapter. In most cases, only the reference containing the original description is presented, except where this description differs from present consensus or has been revised. The species are listed in alphabetical order.

Anthocyrtidium ophirense (Ehrenberg), Nigrini, 1967, p. 56, pl. 6, fig. 3.

Axoprunum stauraxonium Haeckel, 1887, p. 298, pl. 48, fig. 4; Hays, 1965, p. 170, pl. I, fig. 3.

Collosphaera tuberosa Haeckel, 1887, p. 97; Nigrini, 1971, p. 445, pl. 34.1, fig. 1.

Dictyocephalus macrostoma Rust, 1892, p. 106, pl. 15, fig. 1; Wall, 1975, pl. 11, fig. 12.

Dictyomitra multicostata (Zittel), Pessagno, 1976, p. 52, pl. 14, figs. 4–9.

Didymocyrtis tetrathalamus (Haeckel), Sanfilippo and Riedel, 1980, p. 1010, pl. 1, fig. g.

Disolenia quadrata (Ehrenberg), Nigrini, 1967, p. 19, pl. 1, fig. 5.

Heliodiscus asteriscus Haeckel, 1887, p. 445, pl. 33, fig. 8; Hays, 1965, p. 171, pl. II, fig. 7; Nigrini, 1967, p. 32, pl. 3, figs. la, b.

Lamprocyclas maritalis Haeckel, 1887, p. 1390, pl. 74, figs. 13, 14.

Larcospira quadrangula Haeckel, 1887, p. 696, pl. 49, fig. 3; Benson, 1966, p. 266, pl. 18, figs. 7, 8.

Lithelius minor Jorgensen, 1899, p. 65, pl. 5, fig. 24; Benson, 1966, p. 262, pl. 17, figs. 9, 10.

Lithopera bacca Ehrenberg, 1872a, p. 314; Riedel and Sanfilippo, 1978, p. 70, pl. 6, fig. 9.

Liriospyris reticulata (Ehrenberg), Goll, 1968, p. 1429, pl. 176, figs. 9, 11, 13.

Polysolenia flammabunda (Haeckel), Nigrini, 1967, p. 15, pl. 1, fig. 2.

Polysolenia lappacea (Haeckel), Nigrini, 1967, p. 16, pl. 1, figs. 3a, b.

Polysolenia murrayana (Haeckel), Nigrini, 1968, p. 52, pl. 1, figs. la, b.

Polysolenia spinosa (Haeckel), Nigrini, 1967, p. 14, pl. 1, fig. 1.

Pterocanium praetextum praetextum (Ehrenberg), Nigrini, 1967, p. 68, pl. 7, fig. 1.

Pterocorys campanula Haeckel, 1887, p. 1316, pl. 71, fig. 3.

Pterocorys zancleus (Müller), Benson, 1966, p. 482, pl. 33, fig. 4.

Spongaster tetras Ehrenberg, 1860, p. 833; 1872b, p. 299, pl. IV(iii), fig. 8.

Spongocore puella Haeckel, 1887, p. 347, pl. 48, fig. 6; Benson, 1966, p. 187, pl. 8, figs. 1–3; Nigrini, 1970, p. 168, pl. 2, fig. 3.

Spongopyle osculosa Dreyer, 1889, p. 42, pl. 11, figs. 99, 100; Riedel, 1958, p. 226, pl. 1, fig. 12.

Spongotrochus glacialis Popofsky, 1908, p. 228, pl. 26, fig. 8, pl. 27, fig. 1, pl. 28, fig. 2; Riedel 1958, p. 227, pl. 2, figs. 1,2, text—fig. 1.

Stylodictya validispina Jorgensen, 1905, p. 119, pl. 10, fig. 40; Petrushevskaya, 1967, p. 33, fig. 17, IV, V.

Tetrapyle octacantha Müller, 1858, p. 33, pl. 2, figs. 12, 13, pl. 3, figs. 1-12; Benson, 1966, p. 245, pl. 15, figs. 3–10, pl. 16, fig. 1, text—fig. 18.

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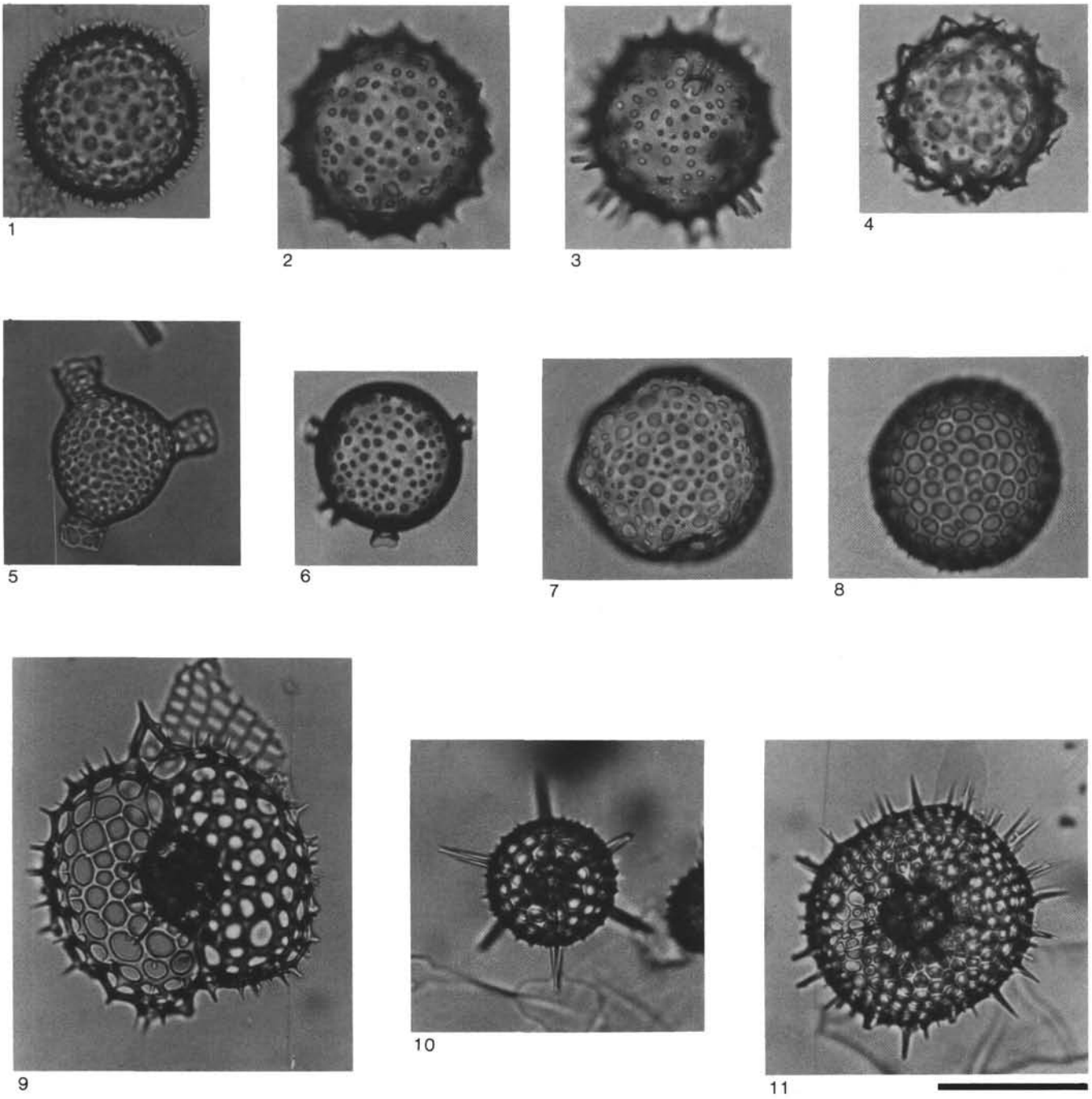


Plate 1. **1.** *Polysolenia murrayana* (Haeckel), Sample 618-3-1, 10–12 cm. **2.** *Polysolenia spinosa* (Haeckel), Sample 619A-1-1, 0–1 cm. **3.** *Polysolenia flammabunda* (Haeckel), Sample 619A-1-1, 0–1 cm. **4.** *Polysolenia lappacea* (Haeckel), Sample 619A-1-1, 0–1 cm. **5.** *Disolenia quadrata* (Ehrenberg), Sample 618-3-1, 10–12 cm. **6.** *Siphonosphaera* sp., Sample 618-3-2, 115–120 cm. **7.** *Collosphaera turberosa* Haeckel, Sample 618-3-2, 115–120 cm. **8.** *Cenosphaera* sp., Sample 618-3-2, 115–120 cm. **9.** *Larcospira quadrangular* Haeckel, Sample 618-3-2, 115–120 cm. **10.** *Hexacontium* sp., Sample 618-3,CC. **11.** *Heliodicus asteriscus* Haeckel, Sample 619-1-1, 0–1 cm. (Scale bar equals 100 μm, magnifications are ×200.)

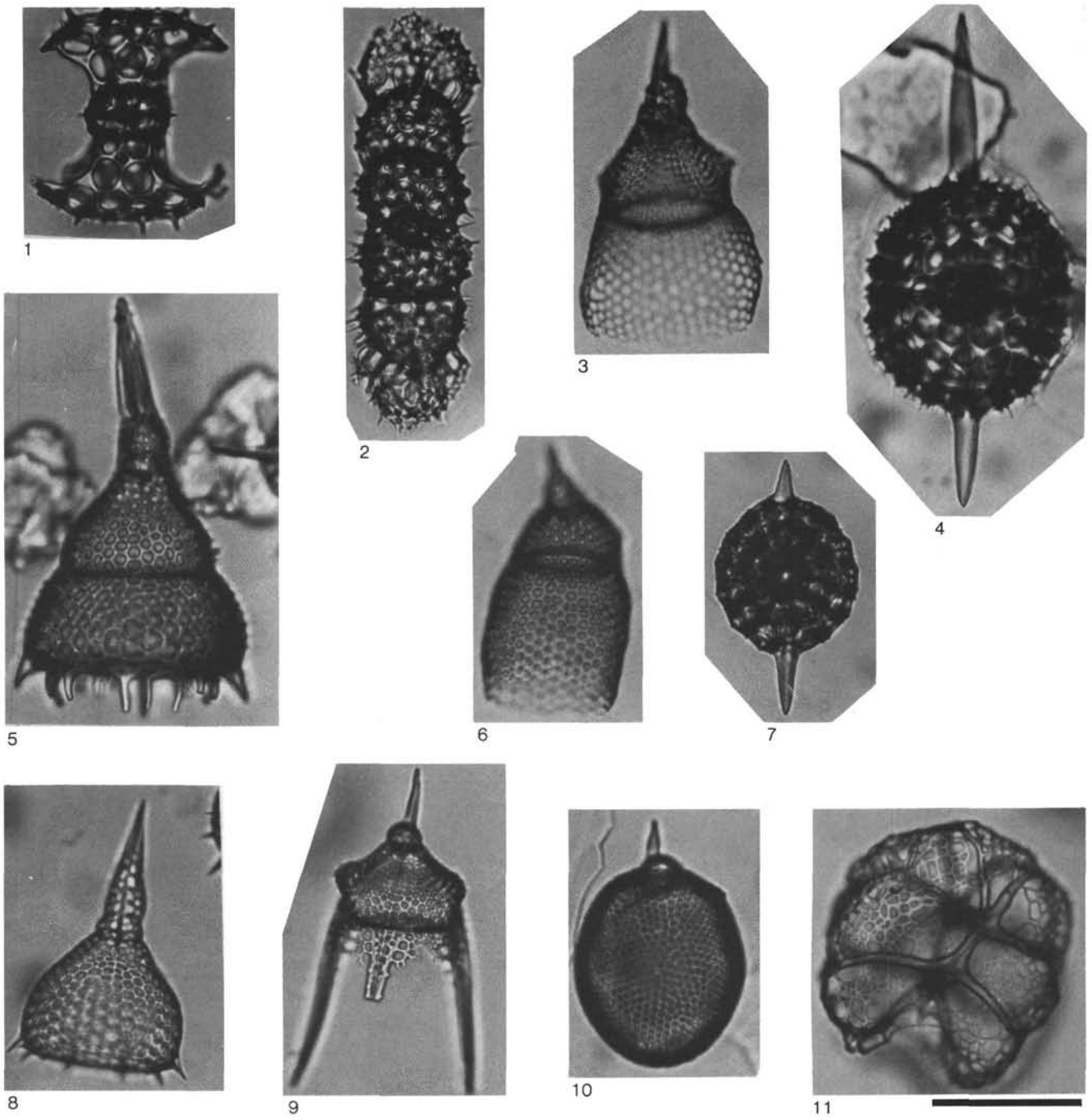
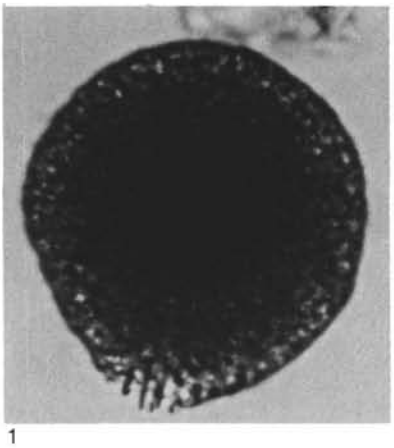


Plate 2. **1.** *Tetrapyle octacantha* Müller, Sample 618-3-2, 115–120 cm. **2.** *Didymocyrtis tetrathalamus* (Haeckel), Sample 618-3-1, 10–12 cm. **3.** *Pterocorys campanula* Haeckel, Sample 618-3-2, 115–120 cm. **4.** *Axoprunum stauraxonium* Haeckel, Sample 618-3-2, 115–120 cm. **5.** *Lamprocyclas maritalis* Haeckel, Sample 618-3,CC. **6.** *Pterocorys zancleus* (Müller), Sample 618-3-2, 115–120 cm. **7.** *Stylatractus* sp., Sample 618-3-2, 115–120 cm. **8.** *Anthocyrtidium ophirense* (Ehrenberg), Sample 618-3,CC.**9.** *Pterocanium praetextum praetextum* (Ehrenberg), Sample 618-3-7, 10–12 cm. **10.** *Lithopera bacca* Ehrenberg, Sample 618-3-1, 10–12 cm. **11.** *Liriospyris reticulata* (Ehrenberg), Sample 618-3,CC. (Scale bar equals 100 μm, magnifications are $\times 200$.)



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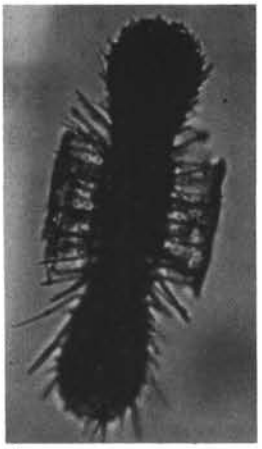

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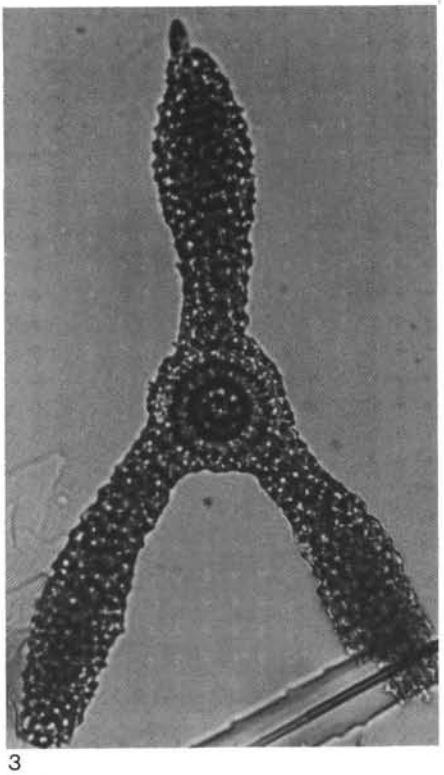

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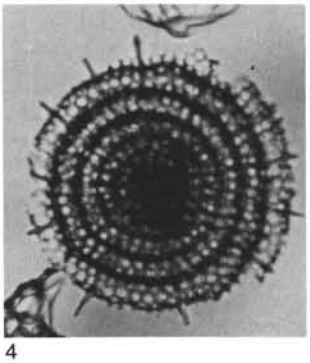

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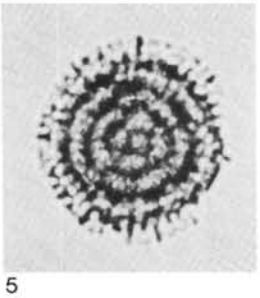

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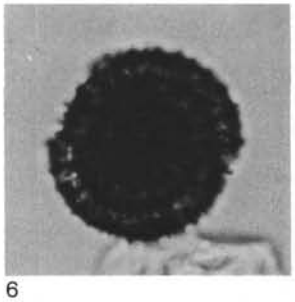

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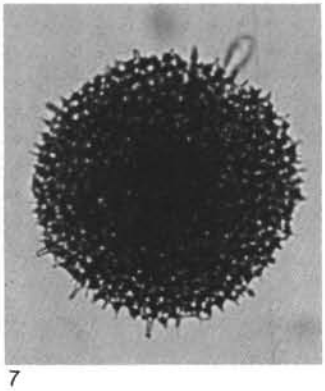

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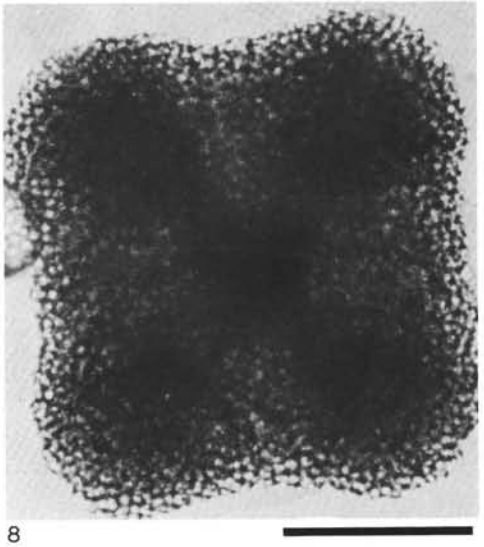
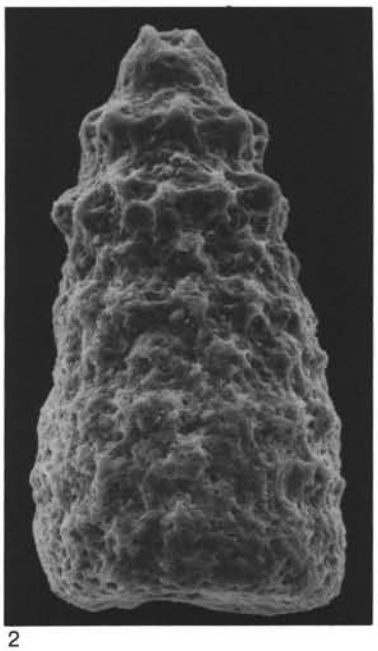


8

Plate 3. **1.** *Spongopyle osculosa* Dreyer, Sample 618-3,CC. **2.** *Spongocore puella* Haeckel, Sample 618-3,CC. **3.** *Euchitonia* sp., Sample 618-3,CC. **4.** *Ommatodiscus* sp., Sample 619-1-1, 0–1 cm. **5.** *Stylodictya validispina* Jorgensen, Sample 618-3,CC. **6.** *Lithelius minor* Jorgensen, Sample 618-3,CC. **7.** *Spongotrochus glacialis* Popofsky, Sample 618-3-2, 115–120 cm. **8.** *Spongaster tetras* Ehrenberg, Sample 618-3,CC. (Scale bar equals 100 μm, magnifications are ×200.)

1



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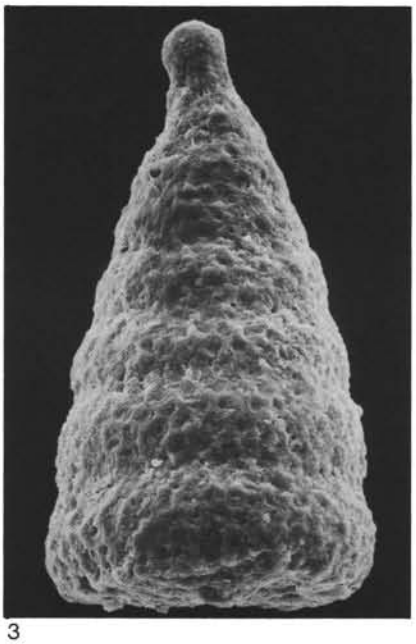

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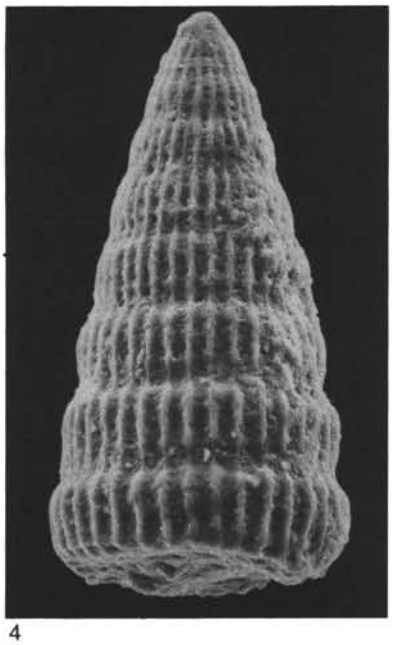

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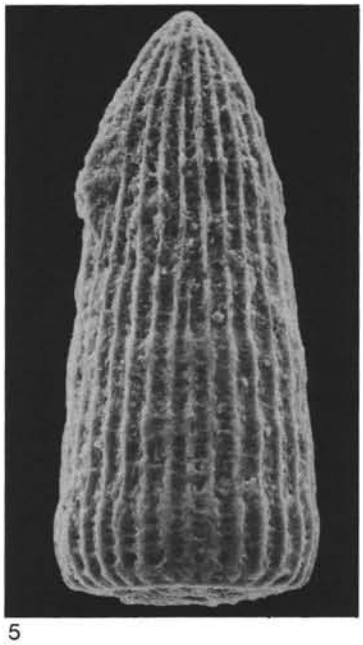

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Plate 4. **1.** *Dictyocephalus marcrostoma* Rust, Sample 615-24,CC, ×650. **2.** *Amphipyndax*? sp., Sample 622-17,CC, ×280. **3.** *Amphipyndax*? sp., Sample 614A-5-1, 110–116 cm, ×375. **4.** *Dictyomitra multicostata* (Zittel), Sample 614A-2-4, 40–46 cm, ×350. **5.** *Dictyomitra multicostata* (Zittel), Sample 615-24,CC, ×315.