

22. PALEOGENE SILICOFLAGELLATES AND EBRIDIANS FROM THE GOBAN SPUR, NORTHEASTERN ATLANTIC¹

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INTRODUCTION

During Leg 80 of the Deep Sea Drilling Project in the northeastern Atlantic, Paleogene sediments were penetrated at all four of the sites (Figs. 1 and 2). Although the area had been drilled during two previous cruises, Legs 12 and 48, silicoflagellates and ebridians had not been examined until Leg 80. Subsurface sediments from Site 549 (49°05.28'N, 13°05.88'W, water depth 2538 m) were selected for this study of these siliceous microfossils because of the thickness of the Paleogene section and its lithological character.

Samples were processed by standard acidization techniques to separate the siliceous microfossils from the calcareous and organic material, followed by sieving through a 74 μ m screen. Slides were made from the finer fraction using 22 \times 40 mm cover slips and Canadian balsam as a mounting medium.

All of the examinations, including photomicrography, were made with a Zeiss photomicroscope. The locations of illustrated specimens on the slides were indicated with application of an England Finder, as in previous studies (e.g., Ling, 1977). All the slides examined will be kept permanently in the micropaleontology collection at the Department of Geology, Northern Illinois University.

RESULTS

The relative abundances (in percent) of silicoflagellates and ebridians in the samples are shown in Table 1. These were made on the basis of the total population count, thus reflecting the abundance of these siliceous microfossils in the samples and facilitating comparison to coeval deposits from other areas.

Among 24 samples from Cores 549-2 through 549-20, only two samples (549-4-5, 93-95 cm, and 549-2-1, 42-44 cm) yielded silicoflagellates. Sample 549-4-5 contains only specimens of *Dictyochoa hexacantha*. Because this species was never abundant throughout its range, its mere presence seems to indicate that the sediments belong to the late middle Eocene *D. hexacantha* Zone of Bukry and Foster (1974) and Bukry (1981). Sample 549-2-1 contains well-preserved silicoflagellates specimens, and the microfossil assemblage is similar to that observed in Hole 549A.

Among the nine samples examined from Cores 549A-10 through 549A-18, five samples from Cores 13 through

17 contained silicoflagellates and ebridians. The assemblage composition and the complete absence of both *Dictyochoa grandis* and *D. deflandrea* strongly suggest that the examined sediments are of late middle Eocene to earliest Oligocene age, which corresponds to the upper part of the *D. hexacantha* Zone through the *Corbisema apiculata* Zone of Bukry (1981). It also equates with the "Unzoned" interval and a part of the *Mesocena occidentalis* Zone of Shaw and Ciesielski (1983) from Leg 71 located in higher latitude parts of the South Atlantic Ocean.

MICROFOSSIL TAXONOMIC LIST

The microfossils recovered from the examined sediments have been described or discussed during the past several years, and references are readily available. Consequently, the preferred names used during the investigation are listed in alphabetical order, followed by the original epithets of the taxa. Only limited additional comments are presented for those taxa.

Silicoflagellates

Corbisema apiculata (Lemmermann) Hanna, 1931, p. 198, pl. D, fig. 2 [= *Dictyochoa triacantha* var. *apiculata* Lemmermann, 1901, p. 259, pl. 10, figs. 19 and 20] (Plate 1, Fig. 1).

Corbisema bimucronata Deflandre, 1950, pp. 63/82, 64/82, figs. 174-177 (Plate 1, Figs. 2 and 3).

Corbisema inermis inermis (Lemmermann) Bukry, 1976, p. 892, pl. 5, Figs. 1-3 [= *Dictyochoa triacantha* var. *inermis* Lemmermann, 1901, p. 259, pl. 10, Fig. 21] (Plate 1, Fig. 4).

Corbisema recta (Schulz) Ling, 1972, pp. 155, 156, pl. 24, figs. 6 and 7 [= *Dictyochoa triacantha* var. *recta* Schulz, 1928, p. 250, fig. 32a and b; and *Phyllodictyochoa recta* (Schulz) Deflandre, 1946, pp. 335-337, fig. 1] (Plate 1, Fig. 11).

Corbisema triacantha (Ehrenberg) Hanna, 1931, p. 198, pl. D, fig. 1 [= *Dictyochoa triacantha* Ehrenberg, 1844, p. 80] (Plate 1, Fig. 5).

Dictyochoa aspera aspera Bukry, 1976, p. 723 [= *Dictyochoa fibula* var. *aspera* Lemmermann, 1901, p. 260, pl. 10, figs. 27 and 28] (Plate 1, Fig. 6).

Dictyochoa aspera martinii Bukry, 1975, p. 854, pl. 2, figs. 5-8 (Plate 1, Fig. 9).

Dictyochoa fibula Ehrenberg, 1839, p. 129. Remarks: A broad species concept is applied for this taxon to include basal ring from rhombic to close to square outline and apical axis either along major or minor axis (Plate 1, Figs. 7 and 8).

Dictyochoa hexacantha Schulz, 1928, p. 255, fig. 43 (Plate 1, Fig. 10).

Distephanus crux (Ehrenberg) Haeckel, 1887, p. 1563 [= *Dictyochoa crux* Ehrenberg, 1840, pp. 307 and 308]. Remarks: In these northeastern Atlantic samples, all the specimens belonging to this taxon are within the size range of those illustrated in Plate 1. Two forms, however, can be distinguished on the basis of alignment of an apical ring, which is either perpendicular or diagonal to the major axis. These two forms are combined in the present population count (Plate 1, Figs. 12 and 13).

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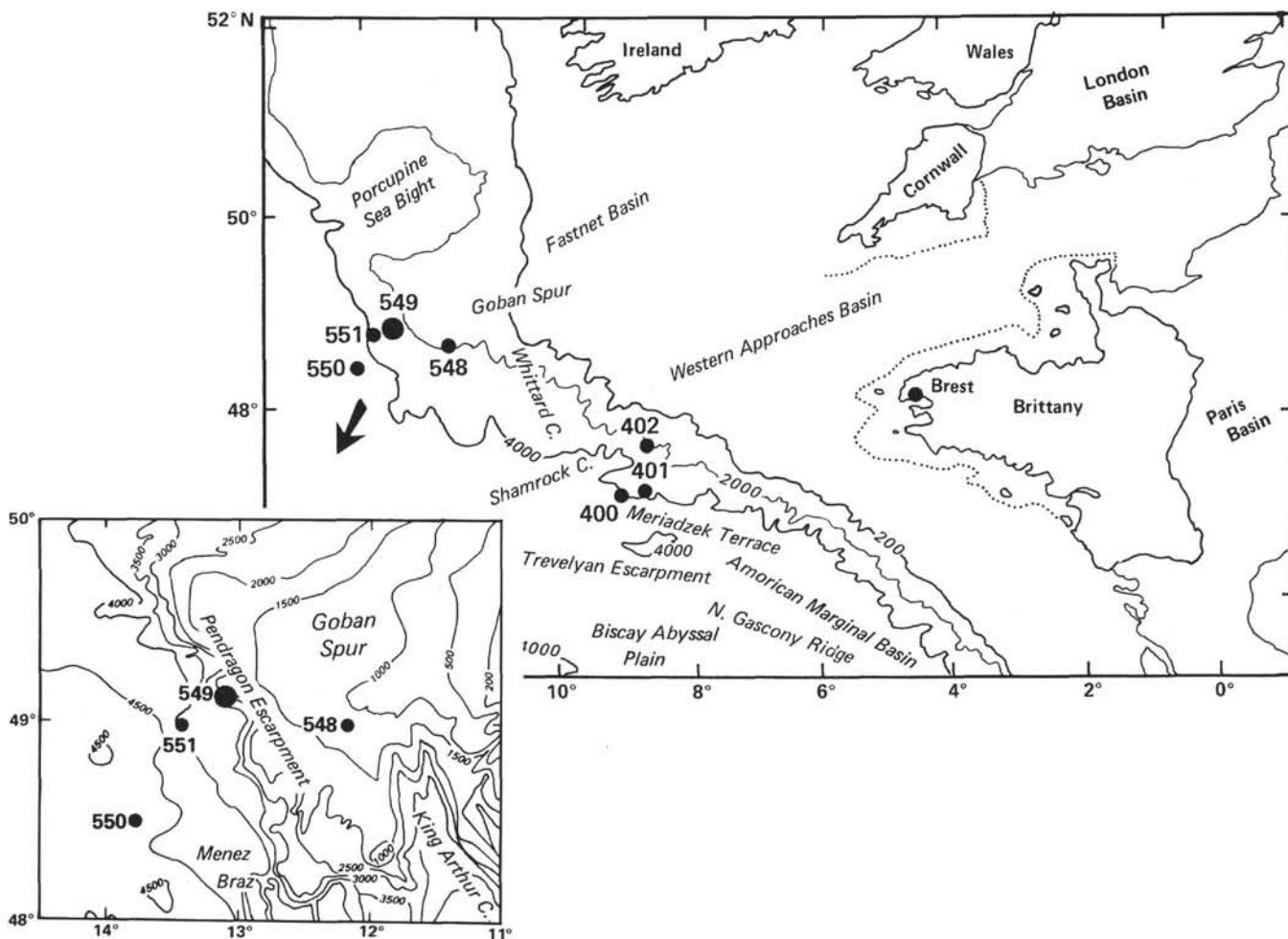


Figure 1. Index map showing the Goban Spur area of the northeastern Atlantic.

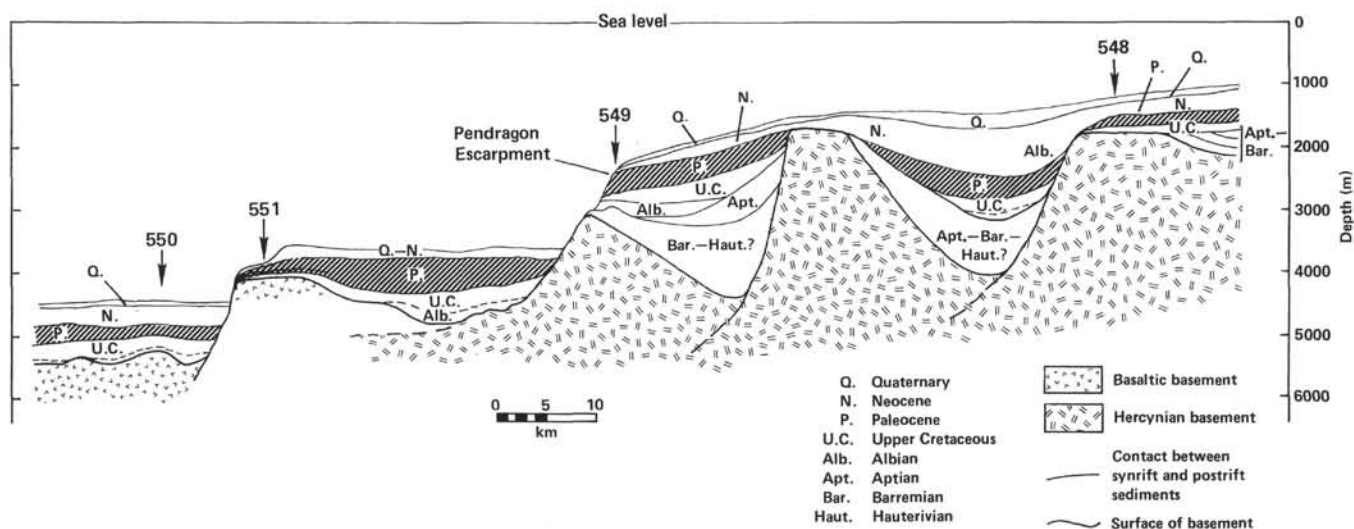


Figure 2. Cross section showing the geologic setting of the Leg 80 drilling sites.

Table 1. Paleogene silicoflagellates and ebridians (in %) from Site 549.

Samples (interval in cm)	Number of specimens	Silicoflagellates														Ebridians										
		<i>Corbisema apiculata</i>	<i>C. bimucronata</i>	<i>C. inermis inermis</i>	<i>C. recta</i>	<i>C. triacantha</i>	<i>Dictyocha aspera aspera</i>	<i>D. aspera maritimi</i>	<i>D. fibula</i>	<i>D. hexacantha</i>	<i>Distephanus crux</i>	<i>D. speculum pentagonus</i>	<i>Mesocena apiculata</i>	<i>M. oamaruensis</i>	<i>M. occidentalis</i>	<i>Naviculopsis biapiculata</i>	<i>N. constricta</i>	<i>N. foliacea</i>	<i>N. trispinosa</i>	<i>Ammodoichium rectangulare</i>	<i>Ebriopsis antiqua antiqua</i>	<i>E. antiqua cornuta</i>	<i>E. crenulata</i>	<i>Ebridian gen. et sp. indet.</i>	<i>Macrora sp. cf. M. barbadensis</i>	
Hole 549A																										
10-2, 20-22																										
11-2, 18-20																										
12-1, 70-72																										
13-2, 24-26	92	2	4			39	2		2			2		4	40	2							2			
14-1, 23-25	244	2		2	2	30			2		7	3		2	16	6			+	7	11		+	10	2	+
15-1, 70-72	194	+	5			33	5		2	5	30	+		3	2					7	+			+	7	+
16-1, 73-75	110	4		2		33	2		5	2	9	16			13	2				7	2			4	+	
17-1, 70-72																										
18-1, 54-56																										
Hole 549																										
2-1, 42-44	50	8		8		4					32	4	12			28	4									
2-3, 37-39																										
4-1, 93-95																										
4-5, 93-95																										
5-1, 70-71																										
20-6, 54-55																										

Note: + indicates either a single specimen or an occurrence but the population of the assemblage is too small to measure.

Distephanus speculum pentagonus (Lemmermann) Bukry, 1976, pp. 895-896 [= *Distephanus speculum* var. *pentagonus* Lemmermann, 1901, p. 264, pl. 11, fig. 19] (Plate 1, Fig. 14).

Mesocena apiculata (Schulz) Hanna, 1931, p. 198, pl. D, fig. 3 [= *Mesocena oamaruensis* var. *apiculata* Schulz, 1928, p. 240, fig. 11] (Plate 1, Fig. 15).

Mesocena oamaruensis Schulz, 1928, vol. 21, no. 2, p. 240, fig. 10a and b (Plate 1, Fig. 16).

Mesocena occidentalis Hanna, 1931, p. 200, pl. E, fig. 1 [= *Mesocena oamaruensis* var. *quadrangula* Schulz, 1928, p. 240, figs. 12, 13] (Plate 1, Fig. 17).

Naviculopsis biapiculata (Lemmermann) Frenguelli, 1940, p. 60, figs. 11c and d [= *Dictyocha navicula* var. *biapiculata* Lemmermann, 1901, p. 258, pl. 10, figs. 14(?) and 15] (Plate 2, Figs. 1-4).

Naviculopsis constricta (Schulz) Frenguelli, 1940, figs. 11a and b [= *Dictyocha navicula* var. *biapiculata* fa. *constricta* Schulz, 1928, p. 246, fig. 21] (Plate 2, Figs. 5-7).

Naviculopsis foliacea Deflandre, 1950, pp. 76/82 and 77/82, figs. 235-240 [= *Dictyocha(?) biapiculata* Lemmermann, Hanna, 1931 (part), pl. E, fig. 10 (only)] (Plate 2, Fig. 8).

Naviculopsis trispinosa (Schulz) Glezer, 1966, pp. 258 and 259, pl. 17, fig. 7 [= *Dictyocha navicula* var. *trispinosa* Schulz, 1928, pp. 246 and 247, figs. 23a and b] (Plate 2, Fig. 9).

Ebridians

Ammodoichium rectangulare (Schulz) Deflandre, 1932, pp. 303-305, figs. 1-13 [= *Ebria antiqua* var. *rectangularis* Schulz, 1928, p. 274, figs. 72a-d] (Plate 2, Figs. 10-12).

Ebriopsis antiqua antiqua (Schulz) Ling, 1971 (part), p. 693, pl. 1, figs. 21-23 (only) [= *Ebria antiqua* Schulz, 1928 (part), pp. 273-274, fig. 69b (only)] (Plate 2, Figs. 14 and 15).

Ebriopsis antiqua cornuata Ling, 1977, pp. 215 and 216, pl. 3, figs. 19-22 [= *Ebria antiqua*, Schulz, 1928 (part), pp. 273 and 274, figs. 69e and f (only)] (Plate 2, Fig. 13).

Ebriopsis crenulata Hovasse, 1932a, p. 281, fig. 4, I and II (Plate 2, Figs. 16-17).

Ebridian gen. et sp. indet. Remarks: Although closely related to *Craniopsis* Hovasse (1932b), this is apparently a new taxon that requires further detailed examination (Plate 2, Figs. 18 and 19).

Incertain sedis

Macrora sp. cf. M. barbadensis (Deflandre) [= *Pseudorocella barbadensis* Deflandre, 1938 (part), p. 91, figs. 1-10 and 12-16 (only)]. Remarks: Bukry (1977) noted that Hanna (1932) previously recorded a similar form as the diatom genus *Macrora* from the Miocene of California; thus, the latter has a priority over Deflandre's *Pseudorocella*. The specimens observed in this study show a clearly indented or lobed margin like Miocene *Macrora stella*, the type species of the genus, yet the pores in both the peripheral and central areas are fewer, like Eocene *Pseudorocella barbadensis*, which was originally proposed for samples from Barbados and Oamaru, New Zealand (Plate 2, Fig. 20).

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Only the references cited in the text and general references for the ebridians are given in the reference list. For the silicoflagellates, readers are directed to the publications starting with Volume 16 of the *Initial Reports* of the Deep Sea Drilling Project.

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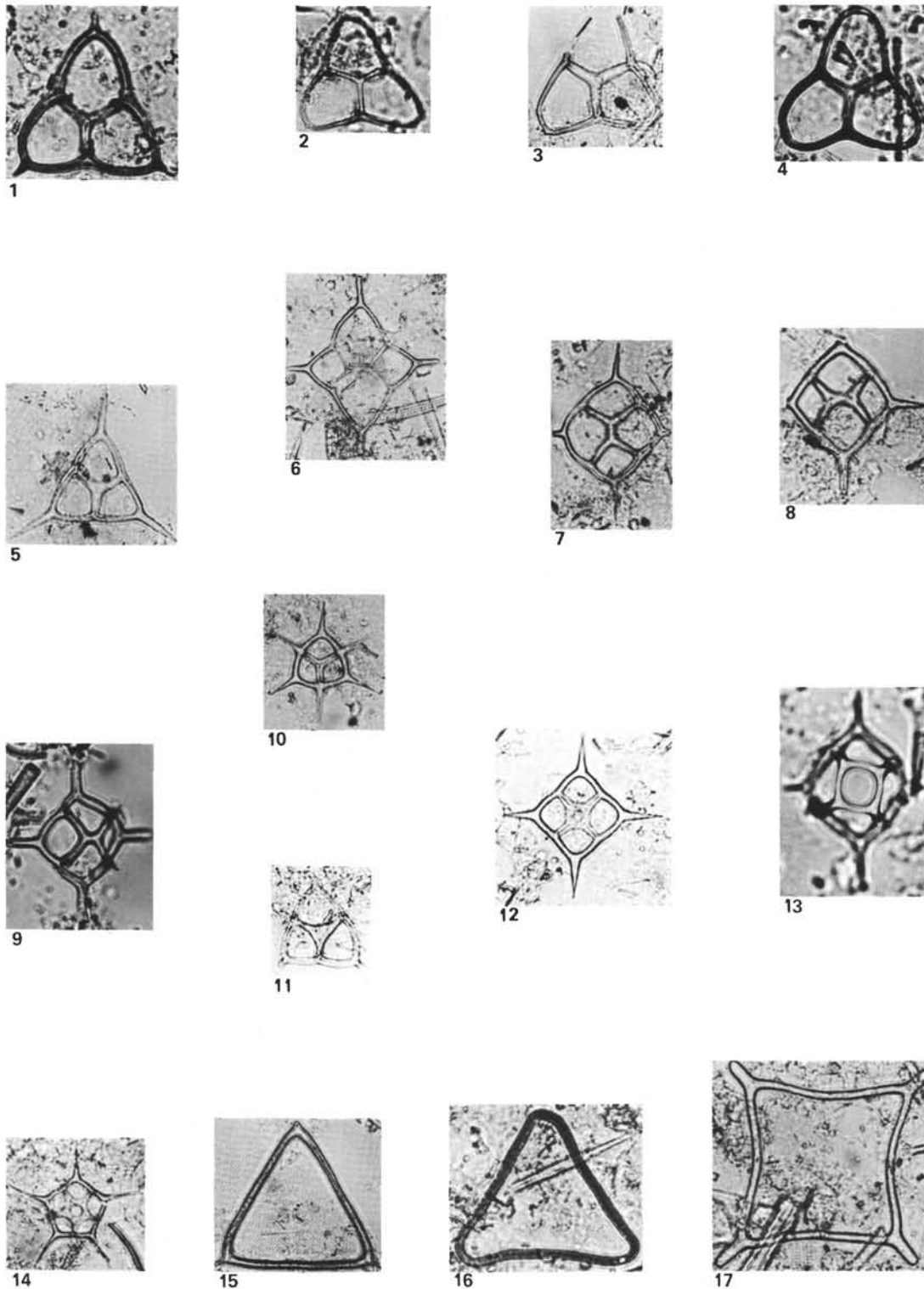


Plate 1. (Magnification $\times 450$ unless otherwise indicated.) 1. *Corbisema apiculata*, Sample 549-2-1, 42-44 cm, L-2 (V17/3). 2-3. *C. bimucronata*, (2) Sample 549A-14-1, L-2 (K8/4), (3) Sample 549A-13-2, L-2 (X11/1). 4. *C. inermis inermis*, Sample 549-2-1, L-2 (N32/3). 5. *C. triacantha*, Sample 549A-16-1, L-2 (G11/3). 6. *Dictyochoa aspera aspera*, Sample 549A-16-1, L-2 (F1/3). 7-8. *D. fibula*, (7) Sample 549A-13-2, L-2 (T20/2), (8) Sample 549A-16-1, L-2 (O11/3). 9. *D. aspera martinii*, Sample 549A-14-1, L-2 (F12/0). 10. *D. hexacantha*, Sample 549-4-5, L-2 (F27/3). 11. *Corbisema recta*, Sample 549A-14-1, L-2 (S32/0). 12-13. *Distephanus crux*, (12) Sample 549A-15-1, L-2 (N36/2), (13) Sample 549-2-1, L-2 (M15/1). 14. *D. quinqueangellus*, Sample 549A-16-1, L-2 (E4/0). 15. *Mesocena apiculata*, Sample 549A-16-1, L-2 (X14/4). 16. *M. oamaruensis*, Sample 549-2-1, L-2 (P31/2). 17. *M. occidentalis*, Sample 549A-14-1, L-2 (P13/1).

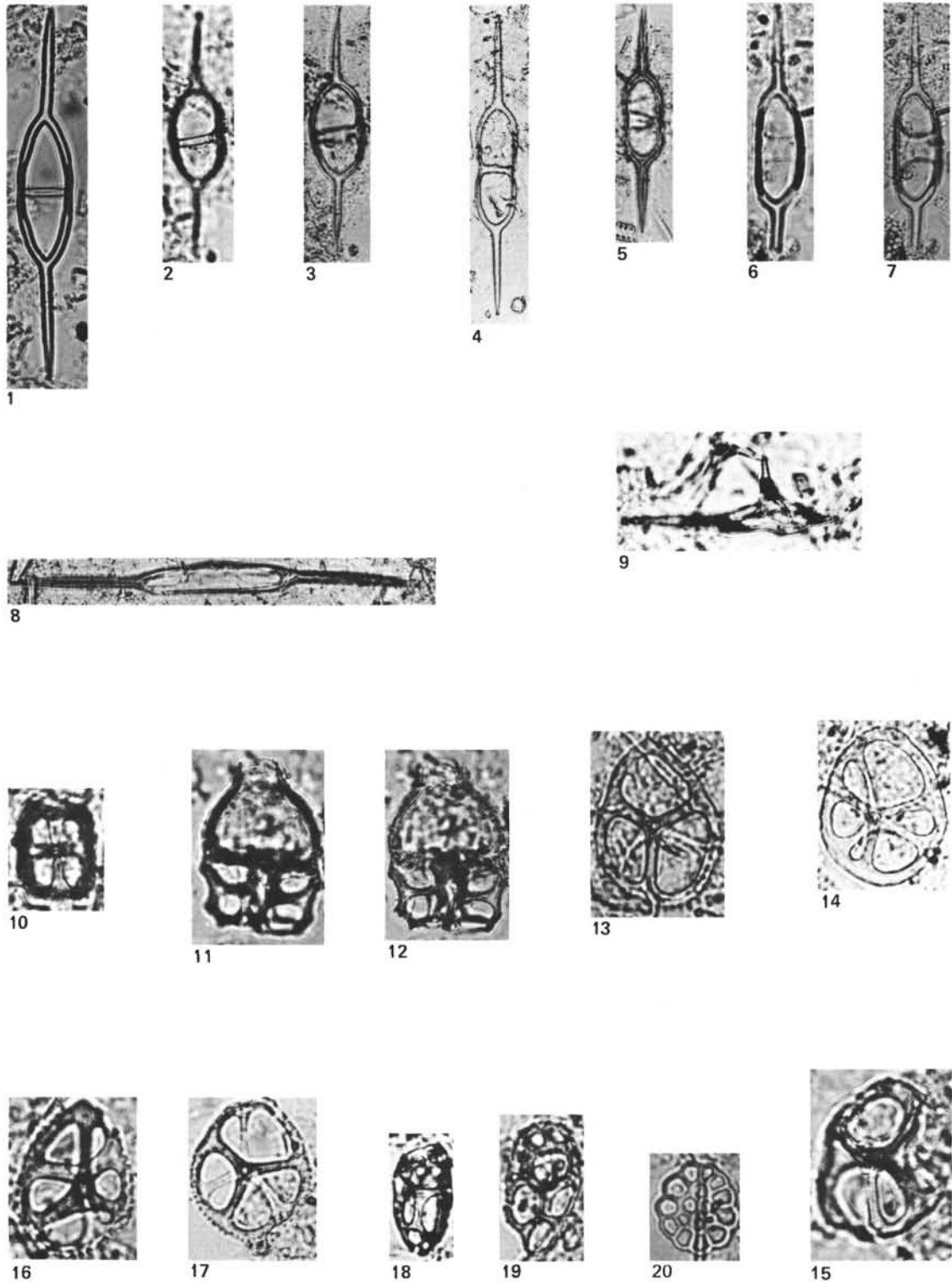


Plate 2. (Magnification $\times 450$ for Figs. 1-9, $\times 720$ for Figs. 10-15. 1-4. *Naviculopsis biapiculata*, (1) Sample 549A-14-1, L-2 (U27/1), (2-3) Sample 549A-16-1, L-2 (G6/0), (4) Sample 549A-14-1, L-2 (G32/1). 5-7. *Naviculopsis constricta*, (5) Sample 549-2-1, L-2 (Q10/1), (6-7) Sample 549A-13-2, L-2 (016/1). 8. *Naviculopsis foliacea*, Sample 549-2-1, L-2 (K30/3). 9. *Naviculopsis trispinosa*, Sample 549A-14-1, L-2 (014/0). 10-12. *Amodochium rectangulare*, (10) Sample 549A-15-1, L-2 (V1/1), (11-12) 549A-16-1, L-2 (V34/0). 13. *Ebriopsis antiqua cornuata*, Sample 549A-14-1, L-2 (J24/0). 14-15. *Ebriopsis antiqua antiqua*, (14) Sample 549A-15-1, L-2 (F23/0), (15) Sample 549A-17-1, L-2 (H5/0). 16-17. *Ebriopsis crenulata*, (16) Sample 549A-14-1, L-2 (Y2/2), (17) Sample 549A-14-1, L-2 (U24/0). 18-19. *Ebriopsis* gen. et sp. indet., (18) 549A-15-1, L-2 (W28/0), (19) Sample 549A-15-1, L-2 (E12/0). 20. *Macrora* sp. cf. *M. barbadosis*, Sample 549A-16-1, L-2 (U21/0).