22. NEOGENE SILICOFLAGELLATES FROM DEEP SEA DRILLING PROJECT SITE 543, WESTERN TROPICAL ATLANTIC OCEAN[1]

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ABSTRACT

The upper lower Miocene silicoflagellate assemblage in Core 19 from DSDP Hole 543 in the western Atlantic Ocean contains the greatest concentration (41%) of deflandroid *Dictyocha pulchella* yet observed. The deflandroid morphology in *Dictyocha* persisted through the Eocene and Oligocene at middle and high latitude, but virtually disappeared in the late Oligocene, only to reappear as a short-lived variant of *D. pulchella* near the end of the early Miocene or the beginning of the middle Miocene at several low-latitude sites. Correlations with coeval tropical silicoflagellate and diatom assemblages from the tropical eastern Pacific and eastern Atlantic suggest that this deflandroid morphotype may be stratigraphically useful. A new diatom, *Craspedodiscus barronii* Bukry, found in Core 543-19, is described.

SILICOFLAGELLATE CORRELATION AND DIATOM EVIDENCE

Investigation of Miocene biosiliceous radiolarian sediment from Hole 543 (15°42.726′N, 58°39.243′W, water depth 5633 m) showed that most samples are barren of silicoflagellates. Of 19 samples examined from Cores 17 to 32 (161–313 m sub-bottom), only three contain silicoflagellates and none contain coccoliths. The silicoflagellates are characteristic of the lower and middle Miocene *Corbisema triacantha* Zone (Bukry, 1981), and occur only in Cores 18 and 19. These cores are assigned to the upper lower Miocene *Calocycletta costata* Zone of radiolarians (Renz, this volume). The associated diatom assemblage with *Actinocyclus ehrenbergii, Annellus californicus, Coscinodiscus lewisianus, Craspedodiscus coscinodiscus, Rossiella paleacea, Triceratium cinnamomeum* var. *minor*, and *Denticulopsis nicobarica*, without *Actinocyclus ingens*, is also assigned to the upper lower Miocene (John A. Barron, personal communication, 1981).

The silicoflagellates (Table 1) are distinguished by the abundant occurrence of deflandroid specimens of *Dictyocha pulchella*. The deflandroid morphology (Plate 1, Figs. 7–11)—apical bar modified into a plate—has previously been noted in specimens from coeval samples from DSDP Holes 369A, 370, 391A, 415, and 416A, all in the tropical North Atlantic Ocean (Bukry, 1978a, 1978b, 1980). Maximum abundances are only 5% to 9%, instead of the high 41% for Hole 543. The specimens from Hole 543 are unique in the flattening of the struts and the ring apices on many specimens, in addition to the usual central bar flattening. The presence of deflandroid *D. pulchella* with *Corbisema triacantha* and *Mesocena elliptica*, in the absence of *Naviculopsis* and *Dictyocha brevispina ausonia* or *D. pons*, suggests that the Hole 543 population is older than the populations sampled from Holes 416A and 415, off northwest Africa, which contain lower middle Miocene (coccolith Zone CN4) deflandroid *D. pulchella*. The lack of diatom *Actinocyclus ingens* and the presence of the older square-profiled form of var. *californicus* (see Barron, 1981) also support a greater age and an assignment to the upper lower Miocene for the Hole 543 samples. The diatoms are correlative with the tropical assemblages recovered in Cores 25 to 27 from DSDP Hole 77B in the equatorial Pacific.

Table 1. Silicoflagellate percentages in upper lower Miocene samples from Hole 543, Cores 18 and 19.

	Sample[a]		
	18-6, 40–41 (178)	19-1, 23–24 (180)	19-2, 23–24 (182)
Corbisema triacantha			2
Dictyocha sp. cf. *D. brevispina ausonia*			<1
D. fibula s. ampl.			1
D. pulchella	X	X	34
D. pulchella [deflandroid]			41
D. pulchella [deflandroid, flat rim]			1
Distephanus crux parvus		X	*
D. speculum patulus			1
D. speculum speculum			2
Macrora stella			<1
Mesocena elliptica			17
Total specimens	4	2	300

Note: X = present but too sparse for percentages. * = recorded after count completed.

[a] Sub-bottom depth in meters (within parentheses).

Lower Miocene/middle Miocene boundary assemblages of silicoflagellates have been cored six times in the southern Indo-Pacific at Sites 206, 266, 274, 278, and 323, and at northeastern Pacific Site 495, but deflandroid *Dictyocha pulchella* has been recorded only at Site 495, off Guatemala. This indicates an ecologically limited Atlantic and easternmost Pacific distribution for this morphotype, or removal of this stratigraphic level by hiatus in the Indo-Pacific (see NH2 of Keller and Barron, 1983). Hiatus NH2 is described by Keller and

[1] Biju-Duval, B., Moore, J. C., et al., *Init. Repts. DSDP*, 78A: Washington (U.S. Govt. Printing Office).

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Barron to be associated with tectonic constriction of flow between the Atlantic and Pacific oceans in the Central American region. This effect could contribute to the known Atlantic and easternmost Pacific distribution pattern of deflandroid *Dictyocha pulchella*.

Although only one silicoflagellate-rich level from the upper lower Miocene is available for study at Site 543 (and it is speculative to generalize from a single sample), several stratigraphic and ecologic relations can be explored through this assemblage. Biostratigraphically, the lack of cosmopolitan *Actinocyclus ingens* and *Naviculopsis* indicates a brief interval of deposition just below the lower Miocene/middle Miocene boundary. But the species array of the assemblage is unusual because of the combined paucity of *Corbisema triacantha* and *Distephanus crux* s. ampl., and the absence of *Mesocena apiculata curvata*, which can be rather common in upper lower Miocene assemblages. The common *Mesocena elliptica* helps to suggest a level of comparison to other assemblages. For example, DSDP Core 370-3 contains *Corbisema triacantha, Dictyocha pulchella* [deflandroid], and *M. elliptica*, but is predominated by *Distephanus crux*, which is considered to be favored in waters of temperate coastal influence (Bukry and Foster, 1973). Although the genus *Corbisema* is considered to have favored warmer waters than *Distephanus*, the DSDP sites having maximum abundances of the terminal species, *Corbisema triacantha*, in the *C. triacantha* Zone are also temperate coastal locations, such as Sites 415 and 470. Lower-latitude DSDP Sites 158 and 495 and open-ocean DSDP Site 66 have less abundant *C. triacantha*. Therefore, the high paleotemperature value (*Ts*)—based on relative abundances of warm and temperate genera (Bukry, 1983)—of 91 for Site 543 and the paucity of those higher-latitude taxa are appropriate to its more tropical and oceanic location to the north-northeast of Barbados.

Site 495, in the eastern Pacific off Guatemala, is located at lat 12°N, slightly farther south than Site 543 at lat 16°N. Upper lower Miocene strata of Core 495-26 have been assigned to the *Calocycletta costata* Zone of radiolarians and the *Helicosphaera ampliaperta* Zone of coccoliths. The silicoflagellates studied from there are remarkably similar to those in coeval samples from Hole 543, with *Dictyocha pulchella, D. pulchella* (deflandroid), and *Mesocena elliptica* as the dominant species (Table 2). No *Corbisema triacantha* was found at Site 495, but relative paleotemperature values of *Ts* = 80 for Section 495-26-1 and *Ts* = 95 for Section 495-26-3 support the tropical high value of *Ts* = 91 for Site 543. The only obvious difference between the assemblages is that the one from Site 543 has a greater number of deflandroid *D. pulchella* with the plate elongate parallel to the major axis. Among the diatoms, the main difference at Site 495 is the absence of *Craspedodiscus barronii* and *Denticulopsis nicobarica*. A lack of *Craspedodiscus* and *Denticulopsis*, coupled with the relatively fewer deflandroid *D. pulchella* at Site 495, suggests it was in a somewhat warmer regime than Site 543 (J. A. Barron, oral communication, 1982).

Table 2. Silicoflagellate percentages in upper lower Miocene samples from Hole 495, Core 26.

	Sample[a]	
	26-1, 75-79 (248)	26-3, 75-79 (251)
Dictyocha sp. cf. *D. brevispina ausonia*	2	2
D. fibula s. ampl.	<1	2
D. pulchella	46	55
D. pulchella [deflandroid]	13	30
Distephanus speculum haliomma	<1	
Mesocena elliptica	38	12
Total specimens	300	60

[a] Sub-bottom depth in meters (within parentheses).

Synonymies and discussions for silicoflagellate taxa are available in my previous DSDP publications for Legs 16 to 68. *Macrora* is an extinct genus of uncertain affinities which is treated as a silicoflagellate (Bukry, 1978c). See Barron (1980, 1981) for diatom synonymies and discussions. Some representative silicoflagellates and diatoms from Hole 543 are shown in Plates 1–3. Below is a summary list of the taxa cited.

SPECIES CONSIDERED

Silicoflagellates

Corbisema triacantha (Ehrenberg) Hanna
Dictyocha brevispina ausonia (Deflandre) Bukry
D. fibula Ehrenberg
D. pons Ehrenberg
D. pulchella Bukry
Distephanus crux parvus (Bachmann) emended Bukry
D. speculum patulus Bukry
D. speculum speculum (Ehrenberg) Haeckel
Macrora stella (Azpeitia) Hanna
Mesocena apiculata curvata Bukry
Mesocena elliptica (Ehrenberg) Ehrenberg

Diatoms

Actinocyclus cubitus Hanna et Grant
A. ehrenbergii Ralfs
A. ingens Rattray
Annellus californicus var. *californicus* Tempere
Cestodiscus pulchellus Greville
Coscinodiscus lewisianus Greville
Craspedodiscus coscinodiscus Ehrenberg
Denticulopsis nicobarica (Grunow) Simonsen
Rossiella paleacea (Grunow) Desikachary et Maheshwari
Triceratium cinnamomeum var. *minor* Grunow

NEW DIATOM TAXONOMY

Genus *CRASPEDODISCUS* Ehrenberg, 1845

***Craspedodiscus barronii* Bukry, n. sp.**
(Plate 2, Figs. 13–15; Plate 3, Figs. 1–5)

Craspedodiscus coscinodiscus Ehrenberg, Bukry, 1980 (in part), p. 520, pl. 5, fig. 1 (not fig. 2).

Description. *Craspedodiscus barronii* is large and circular with a moderate-sized, shallow, circular depression that occupies a half or slightly less of the valve diameter. Hexagonal areolae are arranged in radial rows; from a small solid center, the areolae enlarge gradually up the sides of the central depression and are largest (3–5 μm) for a sequence of five areolae just outside the upper edge of the depression. At the margin, one or two smaller areolae end the radial lines. The valve surface slopes slightly away from the central depression and

steepens at the margin. The transition from central depression to peripheral valve surface is not marked by any demarcation line.

Remarks. *Craspedodiscus barronii* is distinguished from *Craspedodiscus coscinodiscus* by regular radial lines of areolae from center point to margin, by secondary spiral, and by the absence of a sharp demarcation boundary between central and peripheral areas. Specimens of the population studied are broken.

Occurrence. *Craspedodiscus barronii* is known from the upper lower Miocene *Corbisema triacantha* Zone of Sample 543-19-2, 23–24 cm (182 m sub-bottom), recovered in the western tropical Atlantic, north-northeast of Barbados, and Sample 415-5-2, 58–60 cm (276 m sub-bottom), taken in the eastern Atlantic off Morocco.

Size. Maximum diameters, rim 145 μm, central depression 70 μm.

Holotype. USNM 339713 (Plate 3, Fig. 2).

Isotypes. USNM 339714 to 339719.

Type locality. Western tropical Atlantic Ocean, DSDP Sample 543-19-2, 23–24 cm (182 m sub-bottom).

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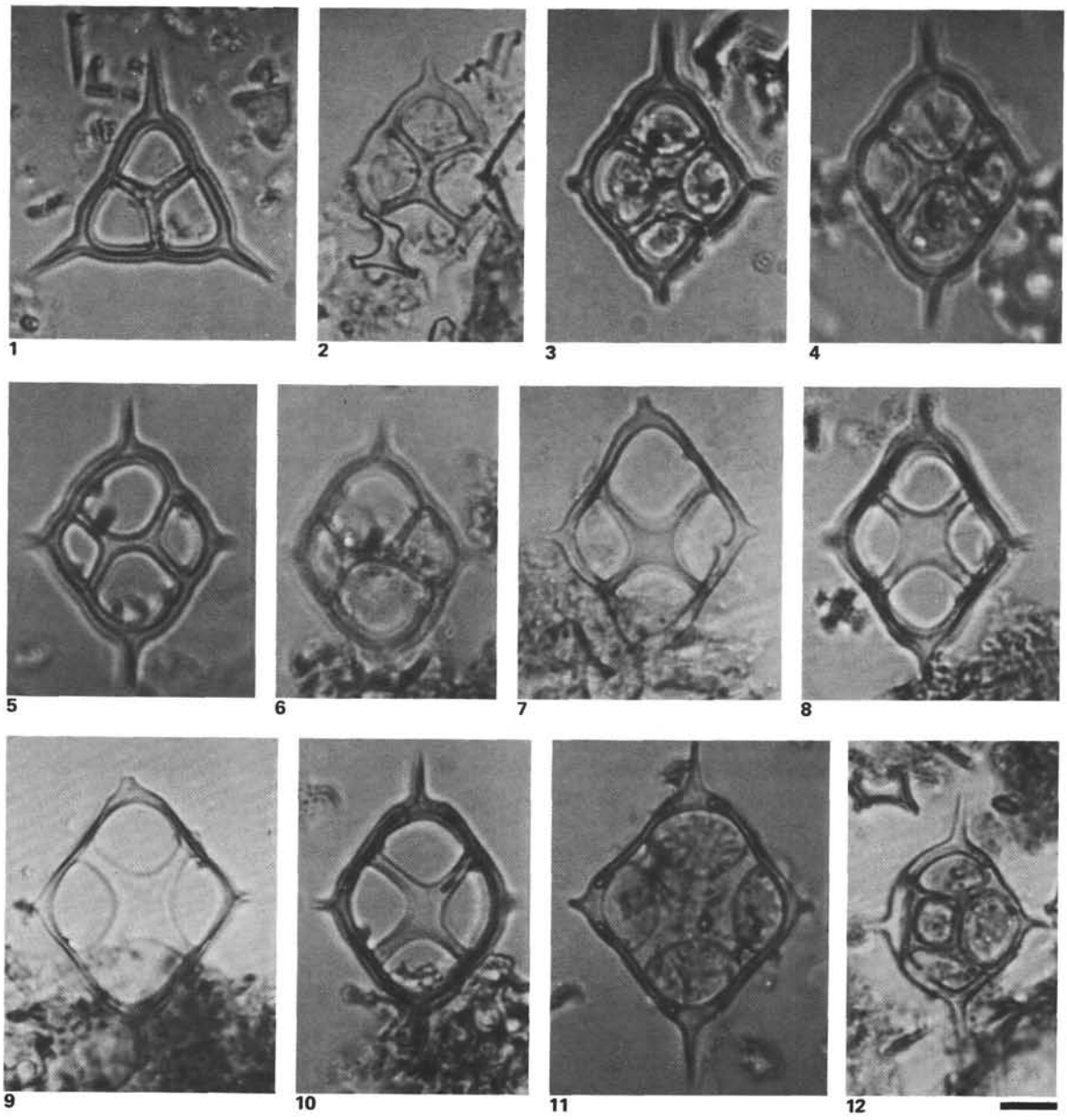

Plate 1. Miocene silicoflagellates from DSDP Hole 543. (All figures are magnified 850×; scale bar = 10 μm. All specimens are from Sample 543-19-2, 23–24 cm, except Fig. 12, which is from Sample 543-19-1, 23–24 cm.) **1.** *Corbisema triacantha* (Ehrenberg). **2.** *Dictyocha fibula* Ehrenberg. **3.** *Dictyocha fibula* Ehrenberg (deflandroid). **4–6.** *Dictyocha pulchella* Bukry. **7–11.** *Dictyocha pulchella* Bukry (deflandroid). **12.** *Distephanus crux parvus* (Bachmann) emended Bukry, 1983.

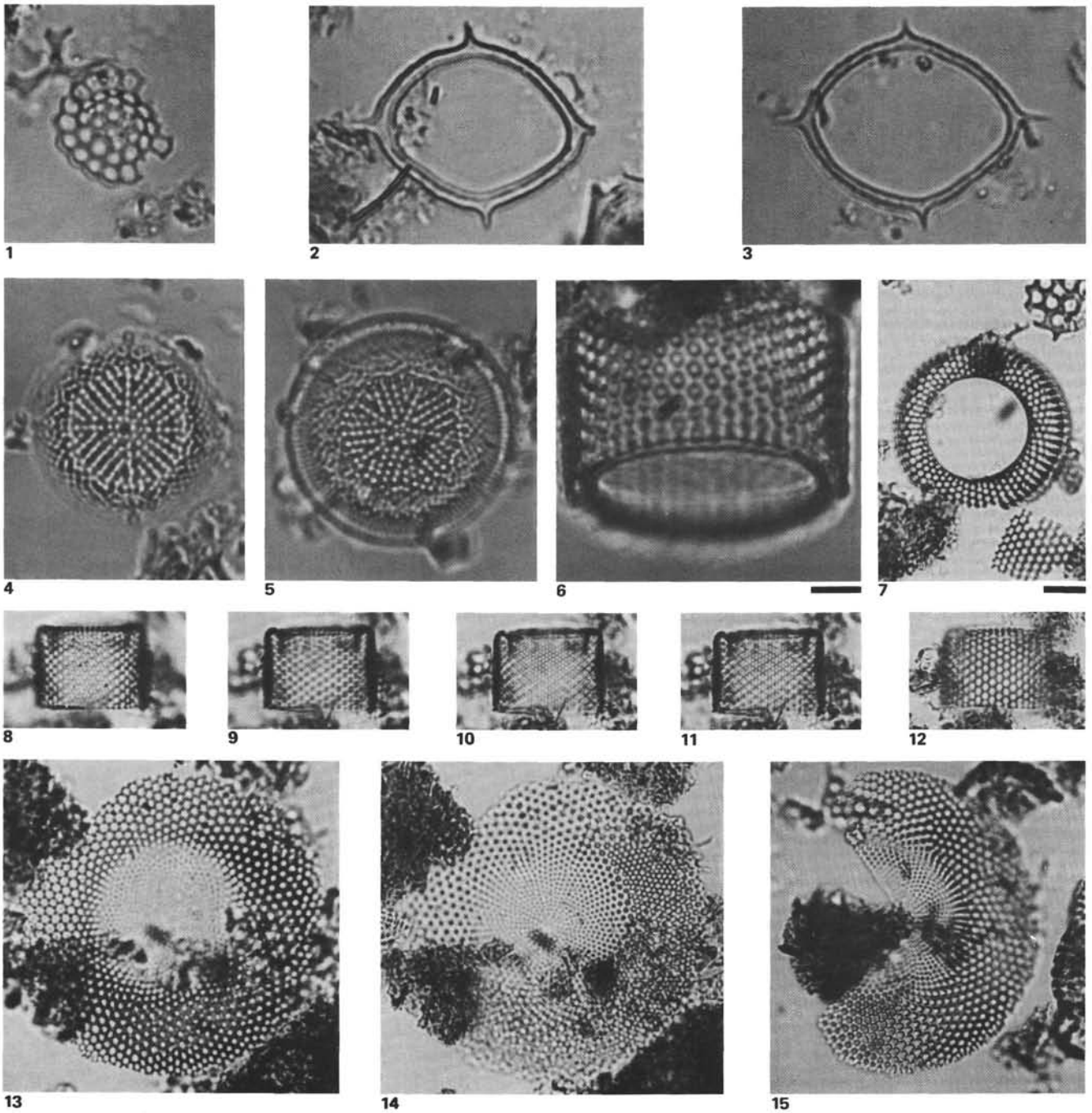

Plate 2. Miocene silicoflagellates and diatoms from DSDP Hole 543. (Figs. 1–6 are magnified 850×; scale bar = 10 μm. Figs. 7–15 are magnified 350×; scale bar = 20 μm. Figs. 1–5 and 13–15 are from Sample 543-19-2, 23–24 cm. Figs. 6–12 are from Sample 543-18-6, 40–41 cm.) **1.** *Macrora stella* (Azpeitia). **2,3.** *Mesocena elliptica* (Ehrenberg). **4,5.** *Actinocyclus cubitus* Hanna et Grant. **6–12.** *Annellus californicus* var. *californicus* Tempere. (8–12) Through-focal series of same specimen. **13–15.** *Craspedodiscus barronii* Bukry, n. sp. (13, 14) USNM 339714, high and low focus, (15) USNM 339715.

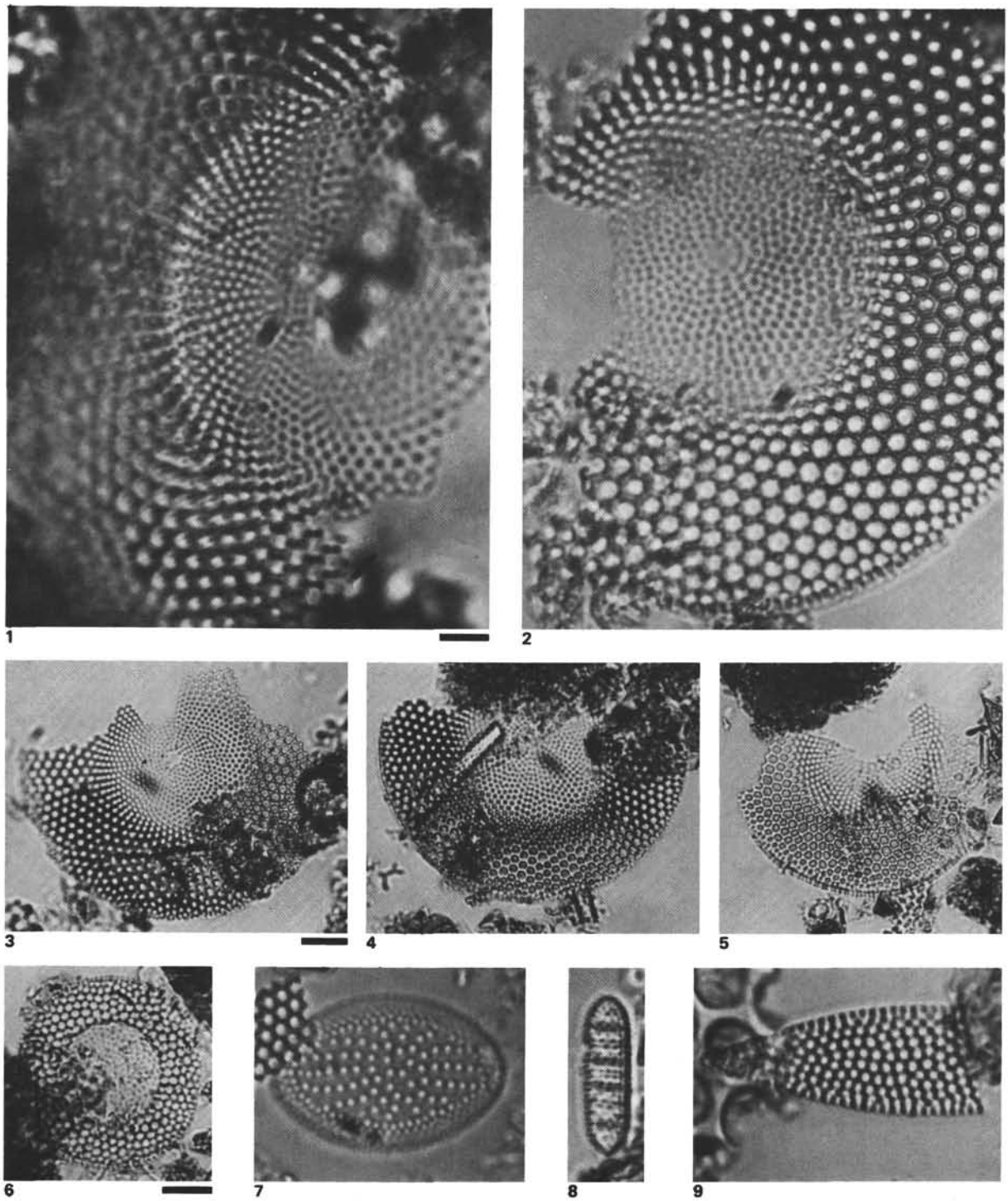

Plate 3. Miocene diatoms from DSDP Hole 543. (Figs. 1, 2, 7–9 are magnified 850×; scale bar = 10 μm. Figs. 3–5 are magnified 350×; scale bar = 20 μm. Fig. 6 is magnified 400×; scale bar = 20 μm. All specimens are from Sample 543-19-2, 23–24 cm.) **1–5.** *Craspedodiscus barronii* Bukry, n. sp. (1) USNM 339716, (2) Holotype, USNM 339713, (3) USNM 339717, (4) USNM 339718, (5) USNM 339719. **6.** *Craspedodiscus coscinodiscus* Ehrenberg. **7.** *Coscinodiscus lewisianus* Greville. **8.** *Denticulopsis nicobarica* (Grunow). **9.** *Rossiella paleacea* (Grunow).