

14. MIOCENE CORBISEMA TRIACANTHA ZONE PHYTOPLANKTON FROM DEEP SEA DRILLING PROJECT SITES 415 AND 416, OFF NORTHWEST AFRICA

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SUMMARY

Cores 415-4 and 415-5 and Cores 416A-1 and 416A-2, from sites off the northwest coast of Africa (Figure 1), contain diverse Miocene coccoliths, diatoms, and silicoflagellates. All the cores contain silicoflagellate assemblages of the middle- and lower-Miocene *Corbisema triacantha* Zone (Figure 2). One sample from the bottom of Core 415-5 may belong to a new *Naviculopsis ponticula* Zone. Coccoliths of the lower- or middle-Miocene *Helicosphaera ampliaperta* Zone occur in Cores 415-5 and 416A-2; the next higher *Sphenolithus heteromorphus* Zone occurs in Cores 415-4 and 416A-1. Diatom zones are not identified from the assemblages (Figure 3), but the presence of short-ranged *Annellus californicus* and *Raphidodiscus marylandicus* suggests a diatom correlation near the boundary between lower and middle Miocene (Andrews, 1974; Ryan et al., 1974; Schrader and Fenner, 1976).

SILICOFLAGELLATES

Lower and middle Miocene silicoflagellates are common and well preserved at Sites 415 and 416. Like the associated diatoms they are restricted to Cores 4 and 5 in Hole 415 and Cores 1 and 2 in Hole 416A. Siliceous microfossils reported in Core 3 at Hole 416A are mainly sponge spicules — mostly tylostyles (Hyman, 1940, fig. 81-3; Bukry, 1978, pl. 13, figs. 10, 11, 13) broken into 20 to 30 μm lengths in Sample 416A-3-1, 116-117 cm (451 m).

The silicoflagellate assemblages of Sites 415 and 416 differ from those reported at nearby Sites 369 and 370 mainly in changes in relative abundances of species, such as the greater numbers of *Dictyocha brevispina ausonia*. The association of this taxon with early forms of *D. pulchella* (normal and deflandroid) and *M. elliptica* s. str. is characteristic of the *Corbisema triacantha* Zone in this region (Bukry, 1977). The lower-Miocene assemblages of Core 416A-2 are distinguished from all the others by the exclusive occurrence of the naviculoid variant (Deflandre, 1941) of *D. brevispina ausonia*. A majority of these variants have completely lost their minor axis portals but retain the bar and minor axis spines. Transitional specimens of *D. brevispina ausonia* having unusually small portals are present. The variants lack basal pikes and are similar in size and shape to associated *Mesocena elliptica*, suggesting that the exceptional variability of the local *D. brevispina ausonia* group might be a source for polyphyletic *Mesocena*. The exact form of this variant was first illustrated by Ehrenberg (1854; as *Dictyocha pons*) from Oran, Algeria, and

later by Ling (1972; as *Dictyocha ausonia*) from Trinidad in the lower-Miocene *Globigerinatella insueta* Zone. This provides accurate correlation with Hole 416A, because Bramlette and Wilcoxon (1967) studied the coccoliths in the same "radiolarian-rich" locality from the *G. insueta* Zone in Trinidad and established the *Helicosphaera ampliaperta* Zone. The same coccolith zone is associated with the common naviculoid *D. brevispina ausonia* at Hole 416A. Therefore, this silicoflagellate is more than a local variant and has a regional range across the subtropical North Atlantic from Trinidad to Algeria. Its stratigraphic range must be short, because it was not encountered in the parts of the *Naviculopsis lata* Zone and *Corbisema triacantha* Zone that were sampled at nearby Sites 369 and 370. The absence of guide fossil *Distephanus stauracanthus* from the ocean-margin setting that was studied at Sites 415 and 416 supports the conclusion of Ernisse et al. (1977) that this species is restricted to the middle Miocene in the Atlantic basin.

Naviculopsis navicula and *N. ponticula* occur together in the bottom sample from Core 415-5 and suggest that the sample could be assigned to a new lower-Miocene *Naviculopsis ponticula* Zone on the basis of the presence of these two species and the absence of *N. quadrata*. This is tentative, because the relative ranges of *Naviculopsis* in the upper lower Miocene are not established.

Silicoflagellate taxonomy follows that in earlier DSDP volumes, especially volumes 41 and 44 (Bukry, 1978a, 1978b). See also Loeblich et al. (1968) for original references prior to 1968. The Miocene silicoflagellates from Sites 415 and 416 are shown on Plates 1, 2, and 3.

COCCOLITHS

Coccoliths are abundant and have slight to moderate overgrowth in the four cores. The middle-Miocene *Sphenolithus heteromorphus* Zone (Bramlette and Wilcoxon, 1967; Bukry, 1975) is represented by two samples: 415-4-5, 63-65 cm (214 m) and 416A-1-2, 7-8 cm (148 m). The presence of *Cyclicargolithus floridanus*, *Cyclococcolithina macintyreai*, *Discoaster exilis*, and *Sphenolithus heteromorphus*, together with the lack of *Discoaster deflandrei* and *Helicosphaera ampliaperta*, are the basis of the assignment. All of the other, deeper samples examined from Cores 415-5 and 416A-2 contain *D. deflandrei*, *H. ampliaperta*, and *S. heteromorphus*, indicating the lower- or middle-Miocene *Helicosphaera ampliaperta* Zone (Bramlette and Wilcoxon, 1967; Bukry, 1975; Ryan et al., 1974).

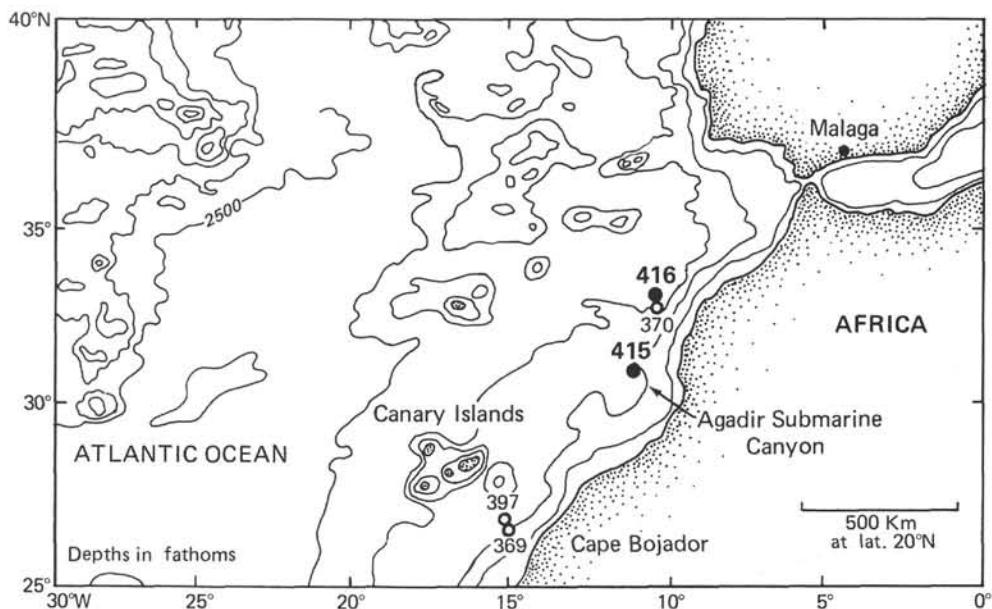


Figure 1. Locations of Sites 415 and 416, drilled during DSDP Leg 50. Nearby Sites 369 and 370 were drilled during Leg 41 and Site 397 during Leg 47.

DIATOMS

Diatoms are abundant and diverse in the four cores. They are slightly to moderately dissolved in all cores except Core 415-5, in which the diatoms are well preserved. The co-occurrence and overlap of many distinctive species in the cores assures the correctness of correlation with the upper lower Miocene or lower middle Miocene. Diatom zonation of this interval is unsettled, because the relative ranges, and even the presence, of key guide fossils appear to be subject to ecologic conditions at the time of deposition (Abbott, 1978). This variability can be appreciated by comparing the occurrence patterns of such taxa as *Actinocyclus ingens*, *A. lanceolatus*, *Annellus californicus*, *Cestodiscus* spp., *Coscinodiscus lewisianus*, *Craspedodiscus coscinodiscus*, *Denticula hustedtii*, *D. nicobarica*, *Raphidodiscus marylandicus*, and species of the *Rhaphoneis* group between various regions (Kanaya, 1971; Bukry and Foster, 1973; Bukry, 1973, 1978b; Schrader, 1973a, 1974; Lohman, 1974; Gombos, 1975; Barron, 1976; Ernisse et al., 1977; Abbott, 1978). Differences between presumably coeval assemblages exist even at two closely spaced sites such as 415 and 416 (approximately 180 km apart). For example, short-ranged *Annellus californicus* and *Raphidodiscus marylandicus* occur together in Cores 415-5 and 416A-2, but *Craspedodiscus coscinodiscus*, which is common in 415-5, is missing from 416A-2. Other differences, including the greater abundances of *Paralia*, *Stephanopyxis*, sponge spicules, and nonbiogenic clastics, suggest slightly shallower water at Site 416 during late early Miocene.

The taxonomy used to tabulate the selected species (Figure 3) comes variously from the following studies: Abbott, 1978; Andrews, 1974, 1975, 1976; Barron, 1976; Bukry and Foster, 1973; Ehrenberg, 1854; Gombos, 1975; Hanna, 1932; Kanaya, 1971; Kolbe, 1954; Lohman, 1948, 1974; Schrader, 1973a, 1973b, 1976;

Wornardt, 1967. Some of the *Cestodiscus* species in Sample 415-5-2, 58-60 cm (276 m) appear to approach the form of *Actinocyclus ingens* (see Kanaya, 1971; Lohman, 1974) (Plate 4, Figure 7). The Miocene diatoms from Leg 50 are shown on Plates 3, 4, and 5.

CONCLUSIONS

Diverse phytoplankton from the boundary between the lower and middle Miocene at DSDP Sites 415 and 416 permit correlation between diatom guide fossils *Annellus californicus*, *Craspedodiscus coscinodiscus*, *Coscinodiscus lewisianus*, *Denticula hustedtii*, *D. nicobarica*, and *Raphidodiscus marylandicus* and coccolith and silicoflagellate zones. *A. californicus*, *D. lewisianus*, and *D. nicobarica* occur in both the lower- or middle-Miocene *Helicosphaera ampliaperta* Zone and the middle-Miocene *Sphenolithus heteromorphus* Zone. *C. coscinodiscus* and *R. marylandicus* occur only in the *H. ampliaperta* Zone and *D. hustedtii* only in the *S. heteromorphus* Zone. All the diatom species occur within the *Corbisema triacantha* Zone or *Naviculopsis ponticula* Zone of silicoflagellates. The naviculoid variant of *Dictyocha brevispina ausonia* occurs at the same stratigraphic level in the upper lower Miocene on both sides of the Atlantic Ocean and is not a local aberration. Concurrent treatment of phytoplankton groups from the same samples will help distinguish cosmopolitan and ecologically controlled ranges for silicoflagellate and diatom guide fossils.

ACKNOWLEDGMENTS

I thank John Barron, U.S. Geological Survey, for discussions on Miocene diatom ranges and Yves Lancelot, University of Paris, for authorization to study additional core materials from Sites 415 and 416. The manuscript was improved by the reviews of Naja Mikkelsen, Scripps Institution of Oceanography, and John Barron, U.S. Geological Survey.

Age	Miocene								
	Mid	Early or Mid	Mid	Early or Mid					
Depth (m)	214	276	278	281	148	299	300	301	303
Site 415 and 416 Samples (Interval in cm)	415-4-5, 63-65	415-5-2, 58-60	415-5-4, 42-44	415-5-6, 18-20	416A-1-2, 37-39	416A-2-1, 80-81	416A-2-2, 76-78	416A-2-3, 33-34	416A-2-4, 17-18
Species									
<i>Cannopilus schulzii</i>					2	1	1		1
<i>Corbisema triacantha triacantha</i>	14	48	14	24	15	21	11	10	19
<i>Dictyocha brevispina ausonia</i> s. str.	35	3			13	39	6	33	25
<i>D. sp. cf. D. brevispina ausonia</i>	8	10			5	7	35	10	7
<i>D. sp. cf. D. brevispina ausonia</i> [naviculopsoid]					*	10	6	9	16
<i>D. fibula</i>					1				
<i>D. pulchella</i>	3	19	1		23				
<i>D. pulchella</i> [deflandroid]	1	2			9				
<i>D. pulchella</i> [deflandroid & fibuloid]					3				
<i>D. sp. [large, asperoid]</i>			7		2	2	1	2	2
<i>Distephanus crux</i> s. ampl.	31	15	70	53	24	16	14	22	20
<i>D. crux</i> [dictyochoid]				1					1
<i>D. sp. cf. D. hawaii</i>				8					
<i>D. sp. cf. D. longispinus</i>	2			2					
<i>D. schauinslandii</i>					1				
<i>D. speculum binoculus</i>					3				
<i>D. speculum speculum</i> s. ampl.	5	2	2	2	2	1	3	2	2
<i>D. speculum triommata</i>	1		1	5			1		3
<i>D. sp. cf. D. speculum hemisphaericus</i> [large]									
<i>Mesocena apiculata curvata</i>			1			1	6	2	
<i>M. elliptica</i> s. str.						1		3	2
<i>M. sp. cf. M. elliptica</i> [quadrate, smooth]	1								
<i>M. triodon</i>			1						
<i>Naviculopsis</i> sp. cf. <i>N. lata</i>			1						
<i>N. navicula</i>				2					
<i>N. ponticula</i> s. ampl.					1				1
<i>N. sp. aff. N. quadrata</i>						1			
(<i>Planifolia tribachiata</i>)	X	X	X		X	X	X	X	X
Total specimens	100	100	100	100	100	100	100	100	100

Figure 2. Silicoflagellates, recorded in per cent, from Miocene sediments in Cores 415-4 and 415-5 and Cores 416A-1 and 416A-2. All samples are assigned to the *Corbisema triacantha* Zone, except 415-5-6, 18-20 cm, which may belong to the *Naviculopsis ponticula* Zone. * = specimens encountered after the count. X = presence of the endoskeletal dinoflagellate *Planifolia tribachiata* (Ernisse, 1976).

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Age	Miocene								
	Mid	Early or Mid		Mid	Early or Mid				
Depth (m)	214	276	278	281	148	299	300	301	303
Site 415 and 416 Samples (Interval in cm)									
Species									
<i>Actinocyclus ehrenbergii</i>			X		X		X	X	X
<i>A. lanceolatus</i>	X	X	X	X	X		X	X	X
<i>Actinoptychus senarius</i>						X	X	X	X
<i>A. sp. cf. A. marylandicus</i>	X	X	X	X		X	X	X	X
<i>Annellus californicus</i>									
<i>Asterolampra marylandicus</i> [6-, 7-segments]		■		X				X	
<i>Asteromphalus</i> sp.		X						X	X
<i>Auliscus</i> sp. A	X	X	X	X	X	X	X	X	X
<i>Biddulphia</i> spp. s. ampl.									
<i>Cestodiscus kugleri</i>									
<i>C. spp.</i>		X	X				X	X	
<i>Cocconeis</i> spp.	X	X	X	X	X			X	
<i>Coscinodiscus lewisianus</i>		■	X	X				X	
<i>Craspedodiscus coscinodiscus</i>	X	X			X	X	X	X	X
<i>Cussia paleacea</i>									
<i>Denticula hustedtii</i>	X	■	X		X				
<i>D. nicobarica</i>		X	X	X	X	X			X
<i>Diploneis</i> sp. A		X	X	X	X	X			X
<i>Eucampia balaustium</i>									
<i>Liradiscus</i> sp. cf. <i>L. bipolaris</i>									X
<i>Paralia sulcata</i> s. ampl.					■	X	■	■	■
<i>Raphidodiscus marylandicus</i>	X	X	X			X	X		X
<i>Rhaphoneis amphiceros</i>				■					
<i>R. diamantella</i>					X		X	X	X
<i>R. fossile</i>									
<i>R. gemmifera</i>			X			X	X	X	
<i>R. sachalinensis</i>	X	X	X						
<i>R.?</i> sp. A		X	X						
<i>Sceptroneis grandis</i>									
<i>Stephanogonia</i> spp.	X	X	X	X	X	X	X	X	X
<i>Stephanopyxis</i> spp.	X	X	X	X	■	■	■	■	■
<i>Synedra jouseana</i>	X	X	X	X	X	X	X	X	X
<i>Xanthopyxis cingulata</i>									
<i>X. oblonga</i>									
<i>X. ovalis</i>	X		X			X		X	X

Figure 3. Presence of selected diatom taxa in Miocene samples from Sites 415 and 416. X = present. Notable abundances of certain species are indicated (■).

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PLATE 1

Miocene Silicoflagellates from Sites 415 and 416

Figures 1-5, 7-16 magnified 800 \times ; scale bar equals 10 μm .
Figure 6 magnified 550 \times ; scale bar equals 10 μm .

- Figures 1, 2 *Cannopilus schulzii* Deflandre.
1. Sample 416A-2-2, 76-78 cm (300 m).
2. Sample 416A-1-2, 37-39 cm (148 m).
- Figures 3, 4 *Corbisema triacantha triacantha* (Ehrenberg).
3. Sample 415-5-2, 58-60 cm (276 m).
4. Variant, Sample 415-5-6, 18-20 cm (281 m).
- Figures 5, 6 *Dictyocha brevispina ausonia* (Deflandre).
5. Sample 416A-1-2, 37-39 cm (148 m).
6. Sample 416A-2-4, 17-18 cm (303 m).
- Figures 7-14 *Dictyocha* sp. cf. *D. brevispina ausonia* (Deflandre) (naviculopsoid). Compare *Dictyocha pons* Ehrenberg.
7, 10. Sample 416A-2-2, 76-78 cm (300 m).
8, 9. Sample 416A-2-4, 17-18 cm (303 m).
11, 14. Sample 416A-2-3, 33-34 cm (301 m).
12, 13. Sample 416A-2-1, 80-81 cm (299 m).
- Figure 15 *Dictyocha* sp. cf. *D. brevispina ausonia* (Deflandre). Intermediate to *D. pulchella* group.
Sample 415-5-2, 58-60 cm (276 m).
- Figure 16 *Dictyocha fibula* Ehrenberg.
Long bar suggests affinity with *D. brevispina ausonia* group.
Sample 415-5-2, 58-60 cm (276 m).

PLATE 1

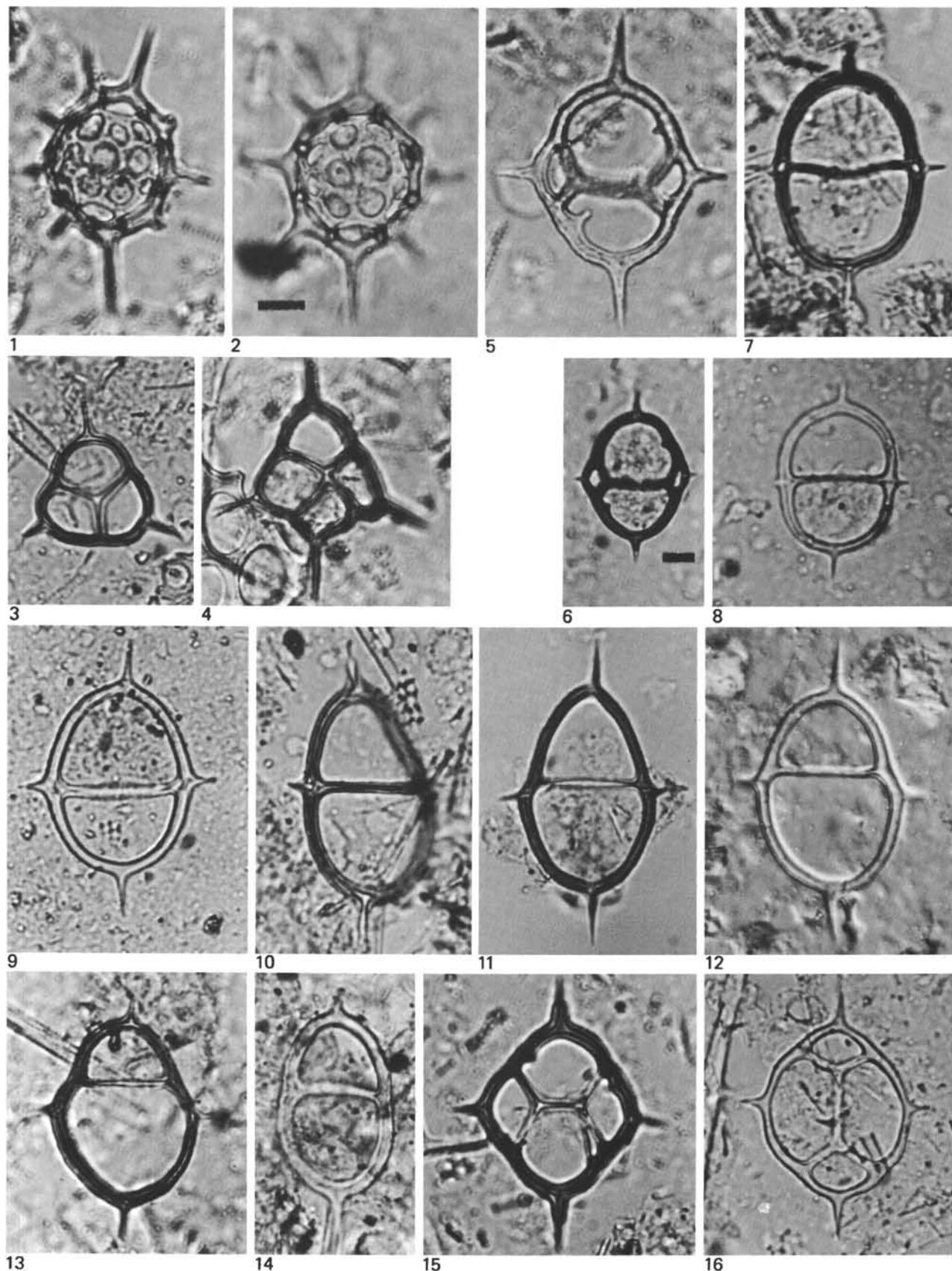


PLATE 2

Miocene Silicoflagellates from Sites 415 and 416
All figures magnified 800 \times ; scale bar equals 10 μm .

- Figures 1, 2 *Dictyocha fibula* Ehrenberg.
 Sample 415-5-2, 58–60 cm (276 m).
- Figures 3–6 *Dictyocha pulchella* Bukry.
 3. Sample 415-5-2, 58–60 cm (276 m).
 4, 5. Sample 416A-1-2, 37–39 cm (148 m).
 6. Deflandroid, Sample 416A-1-2, 37–39 cm (148 m).
- Figure 7 *Dictyocha* sp. (large, asperoid).
 Scarce spineless form.
 Sample 416A-2-2, 76–78 cm (300 m).
- Figures 8, 9 *Distephanus crux* (Ehrenberg) s. ampl.
 8. Sample 416A-2-4, 17–18 cm (303 m).
 9. Sample 415-5-6, 18–20 cm (281 m).
- Figures 10, 11 *Distephanus* sp. cf. *D. hannai* (Bukry).
 Sample 415-5-6, 18–20 cm (281 m).
- Figure 12 *Distephanus speculum speculum* (Ehrenberg) s. ampl.
 Sample 415-5-2, 58–60 cm (276 m).
- Figure 13 *Distephanus speculum triommata* (Ehrenberg).
 Sample 415-5-4, 42–44 cm (278 m).
- Figures 14, 15 *Mesocena apiculata curvata* Bukry.
 14. Sample 415-5-2, 58–60 cm (276 m).
 15. Sample 416A-2-3, 33–34 cm (301 m).
- Figure 16 *Mesocena elliptica* (Ehrenberg).
 Sample 416a-2-3, 33–34 cm (301 m).

PLATE 2

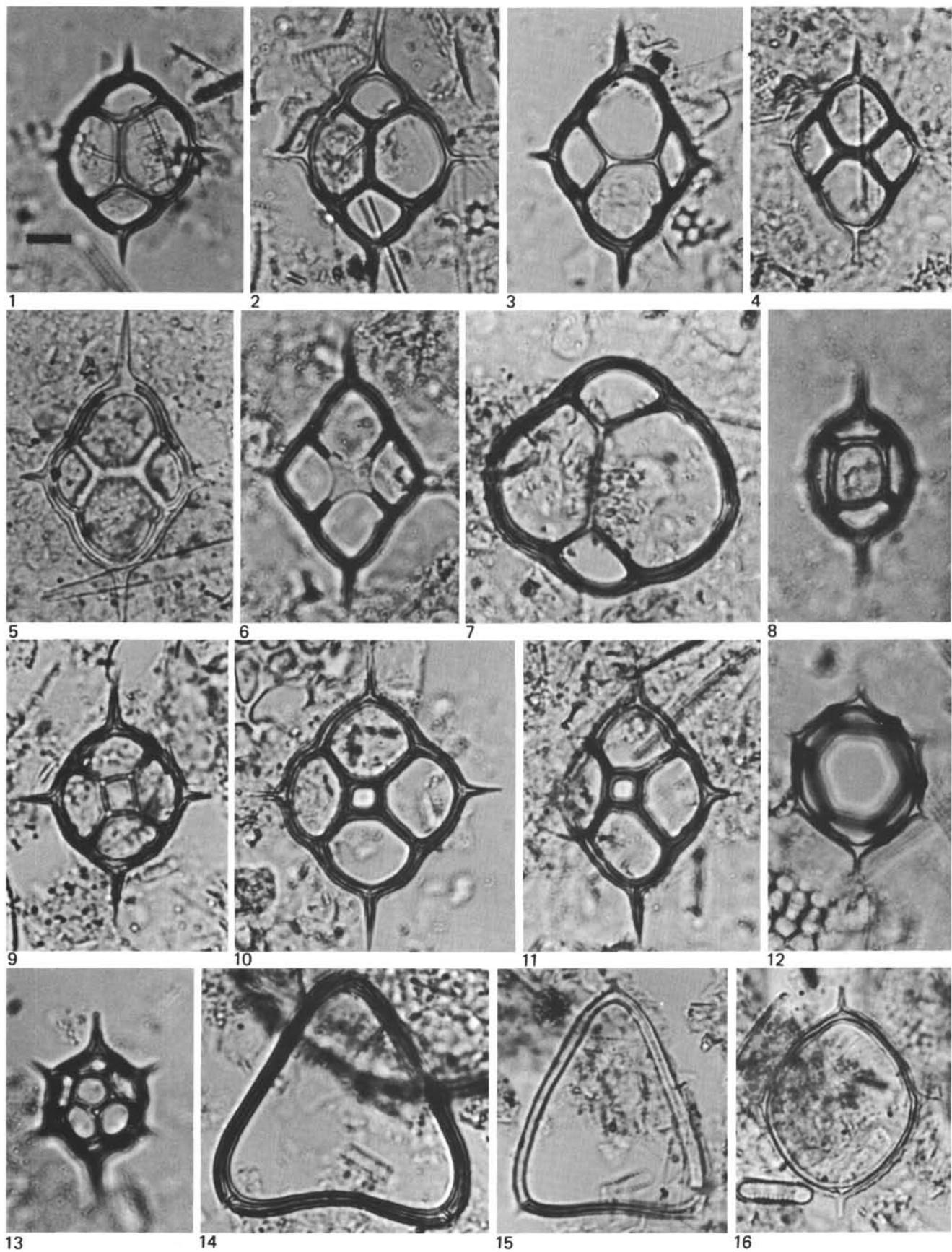


PLATE 3

Miocene Silicoflagellates and Diatoms from Sites 415 and 416

Figure 8 magnified, 1050 \times ; scale bar equals 10 μm .

Figures 1-7, 9-12 magnified 800 \times ; scale bar equals 10 μm .

- Figures 1-3 *Naviculopsis ponticula* (Ehrenberg).
1. Normal, Sample 415-5-6, 18-20 cm (281 m).
2. Spined, Sample 416A-2-4, 17-18 cm (303 m).
3. Variant, Sample 415-5-6, 18-20 cm (281 m).
- Figures 4, 5 *Naviculopsis navicula* (Ehrenberg).
4. Normal, Sample 415-5-6, 18-20 cm (281 m).
5. Variant, Sample 416A-2-1, 30-31 cm (298 m).
- Figure 6 *Actinocyclus ehrenbergii* Ralfs.
Sample 416A-2-4, 17-18 cm (303 m).
- Figure 7 *Actinocyclus lanceolatus* (Castracane).
Sample 415-5-2, 58-60 cm (276 m).
- Figure 8 *Actinoptychus* sp. cf. *A. marylandicus* Andrews.
Sample 416A-2-4, 17-18 cm (303 m).
- Figures 9, 10 *Annellus californicus* Tempere.
Sample 415-5-2, 58-60 cm (276 m).
- Figure 11 *Asteromphalus* sp.
Sample 416A-2-3, 33-34 cm (301 cm).
- Figure 12 *Auliscus* sp. A.
Sample 415-5-2, 58-60 cm (276 m).

PLATE 3

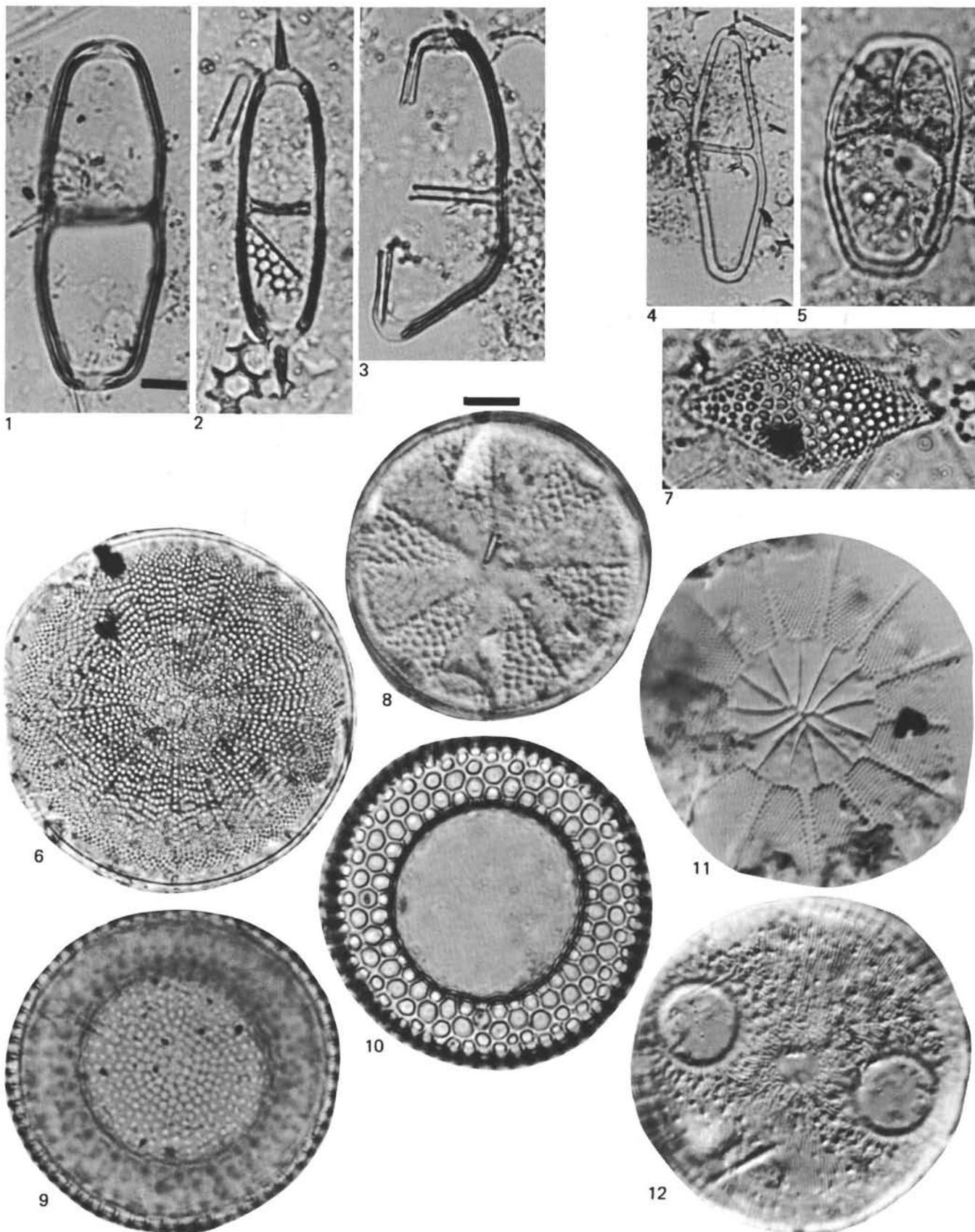


PLATE 4

Miocene Diatoms from Sites 415 and 416

Figures 5-7, 13, 14 magnified 1050 \times ; scale bar equals 10 μm .
Figures 1-4, 8-12, 15 magnified 800 \times ; scale bar equals 10 μm .

- Figures 1, 2 *Biddulphia* sp. s. ampl.
 1. Sample 416A-2-1, 80-81 cm (299 m).
 2. Sample 416A-1-2, 37-39 cm (148 m).
- Figures 3, 4 *Bruniopsis?* sp. fragments. Sample 415-5-6, 18-20 cm (281 m).
- Figures 5, 6 *Cestodiscus kugleri* Lohman.
 5. Sample 415-5-2, 58-60 cm (276 m).
 6. Sample 415-5-6, 18-20 cm (281 m).
- Figures 7-11 *Cestodiscus* spp.
 7. Mimic of *Actinocyclus ingens*, Sample 415-5-2, 58-60 cm (276 m).
 8. Sample 416A-2-3, 33-34 cm (301 m).
 9, 10. Low and high focus, Sample 415-5-2, 58-60 cm (276 m).
 11. Sample 415-5-2, 58-60 cm (276 m).
- Figures 12, 13 *Cocconeis* spp.
 12. Sample 416A-2-3, 33-34 cm (301 m).
 13. Sample 415A-4-5, 63-65 cm (214 m).
- Figures 14-16 *Coscinodiscus lewisiannus* Greville.
 14, 16. Sample 415-5-2, 58-60 cm (276 m).
 15. Sample 415-5-4, 42-44 cm (278 m).

PLATE 4

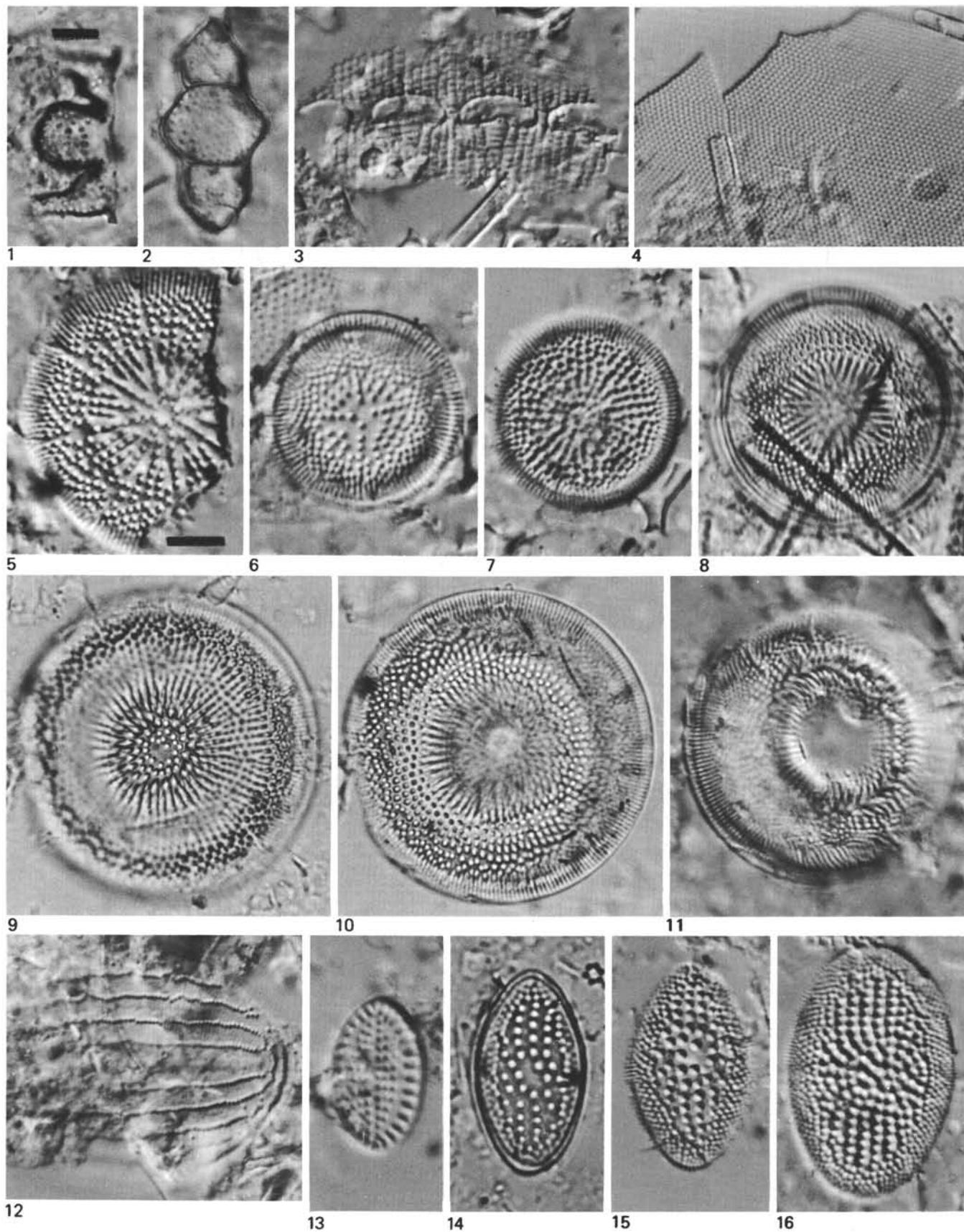


PLATE 5

Miocene Diatoms from Sites 415 and 416

Figures 4, 5, 8-10, 15, 16, 18 magnified 1050 \times ;
scale bar equals 10 μm .

Figures 3, 6, 7, 11, 13, 14, 17 magnified 800 \times ;
scale bar equals 10 μm .

Figures 1, 2, 12 magnified 350 \times ; scale bar equals 20 μm .

Figures 1, 2 *Craspedodiscus coscinodiscus* Ehrenberg.
Sample 415-5-2, 58-60 cm (276 m).

Figure 3 *Cussia paleacea* (Grunow).
Sample 415-5-2, 58-60 cm (276 m).

Figures 4, 5 *Denticula nicobarica* Grunow.
Sample 415-5-2, 58-60 cm (276 m).

Figure 6 *Diploneis* sp. A
Sample 416A-2-4, 17-18 cm (303 m).

Figures 7, 8 *Eucampia balaustum* Castracane.
7. Sample 415-5-6, 18-20 cm (281 m).
8. Sample 415-5-2, 58-60 cm (276 m).

Figure 9 *Hyalodiscus* sp.
Sample 416A-2-4, 17-18 cm (303 m).

Figure 10 *Liradiscus* sp. cf. *L. bipolaris* Lohman.
Sample 415-5-2, 58-60 cm (276 m).

Figure 11 *Pseudopyxilla* sp. cf. *P. directa* (Pantocsek).
Sample 415-4-5, 63-65 cm (214 m).

Figure 12 *Pseudopyxilla* sp. cf. *P. dubia* (Grunow).
Sample 416A-2-4, 17-18 cm (303 m).

Figure 13 *Pseudopyxilla* sp.
Sample 415-5-6, 18-20 cm (281 m).

Figures 14-18 *Raphidodiscus marylandicus* Christian.
14. Sample 415-5-2, 58-60 cm (276 m).
15. Isolated central area, Sample 415-5-6, 18-20
cm (281 cm).
16. Frustule, Sample 415-5-2, 58-60 cm (276 m).
17, 18. Sample 415-5-2, 58-60 cm (276 m).

Figure 19 *Raphoneis amphiceros* (Ehrenberg).
Sample 416A-2-4, 17-18 cm (303 m).

PLATE 5

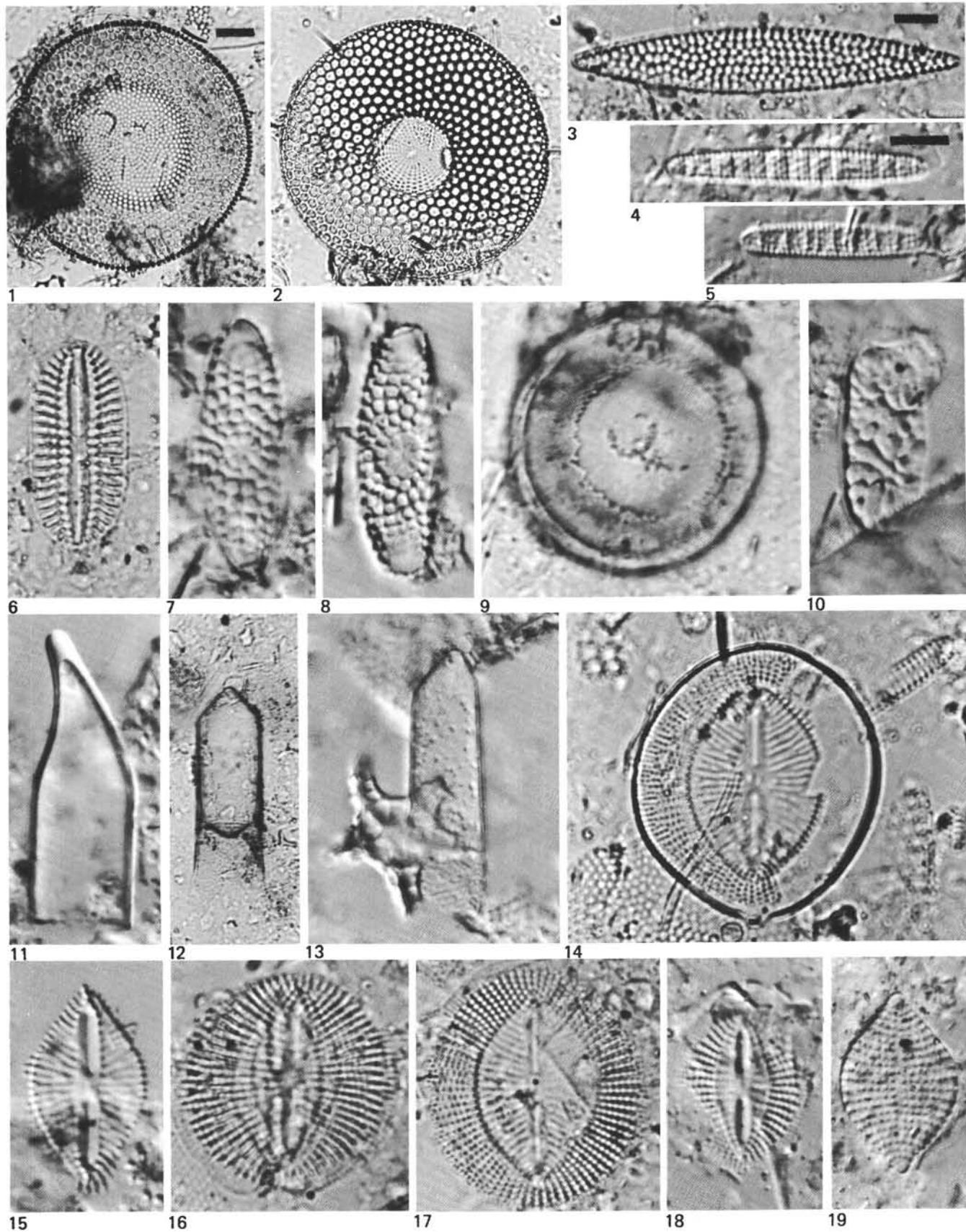


PLATE 6

Miocene Diatoms and *Planifolia* from Sites 415 and 416.

Figures 3, 7-10, 12, 14, 15 magnified 1050 \times ;
scale bar equals 10 μm .

Figures 1, 2, 4-6, 11, 13 magnified 800 \times ;
scale bar equals 10 μm .

Figures 1,2 *Raphoneis diamantella* Andrews.
Sample 415-5-6, 18-20 cm (281 m).

Figures 3-5 *Raphoneis fossile* (Grunow).
3, 4. Sample 416A-2-4, 17-18 cm (303 m).
5. Sample 416A-2-2, 76-78 cm (300 m).

Figure 6 *Raphoneis gemmifera* Ehrenberg.
Sample 415-5-4, 42-44 cm (278 m).

Figures 7, 8 *Raphoneis sachalinensis* Sheshukova-Poretskaya.
7. Sample 416A-2-2, 76-78 cm (300 m).
8. Sample 415-5-2, 58-60 cm (276 m).

Figures 9, 10 *Raphoneis?* sp. A.
Sample 415-5-2, 58-60 cm (276 m).

Figure 11 *Stephanogonia* sp.
Sample 415-5-6, 18-20 cm (281 m).

Figure 12 *Xanthiopyxis cingulata* Ehrenberg.
Sample 415-5-6, 18-20 cm (281 m).

Figure 13 *Xanthiopyxis oblonga* Ehrenberg.
Sample 416A-1-2, 37-39 cm (148 m).

Figures 14, 15 *Planifolia tribrachiata* Ernissee.
14. Sample 416A-2-4, 17-18 cm (303 m).
15. Sample 415-5-2, 58-60 cm (276 m).

PLATE 6

