

48. CORRELATION OF EOCENE-OLIGOCENE CALCAREOUS NANNOFOSSIL ASSEMBLAGES FROM PISTON CORES TAKEN NEAR DEEP SEA DRILLING SITES 511 AND 512, SOUTHWEST ATLANTIC OCEAN¹

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ABSTRACT

Calcareous nannofossil assemblages recovered in four *Islas Orcadas* piston cores along the northern margin of the Maurice Ewing Bank on the eastern Falkland Plateau are correlated with lower Oligocene and middle Eocene sections at Deep Sea Drilling Project Sites 511 and 512, respectively. Results indicate that the Paleogene section near the piston core stations is generally more calcareous and complete than at the Leg 71 drill sites and could provide a valuable high-latitude biostratigraphic reference locality if drilled at some future date.

INTRODUCTION

During April 1978, a series of *Islas Orcadas* Cruise 16 piston cores were taken along the heavily eroded northern margin of the Maurice Ewing Bank on the eastern Falkland (Malvinas) Plateau (Wise et al., 1978) in order to trace the outcrop belt of older (pre-Pliocene) sediments thought to be exposed there (Ciesielski and Wise, 1977). Basal sediments of the 13 piston cores taken along the northern margin range from Paleocene to Miocene in age (Jones et al., 1979) and suggest the presence of a high-latitude Paleocene to Oligocene section of mixed calcareous-siliceous oozes over 200 meters thick.

It was originally hoped that DSDP Site 512 could be located at a shallow depth (about 1500 m) somewhere along the steeply sloping northern margin of the Maurice Ewing Bank so that the exposed Oligocene-Paleocene section could be sampled by hydraulic piston coring. Unfortunately, there were no seismic profiles adequate to evaluate sufficiently potential hydrocarbon hazards, and the site was eventually relocated some distance to the southeast in about 1850 meters of water, where the older sediment section is more abbreviated.

Nevertheless, the *Islas Orcadas* piston cores near the initially proposed drill site do provide a valuable insight into the nature of the sediments higher up on the Maurice Ewing Bank. Among those cores are four which are closely correlative in age with the materials obtained at the Leg 71 drill sites (see Fig. 1). The objective of this paper is to describe and correlate the coccolith assemblages from those piston cores with the assemblages described from the Leg 71 drill cores (Wise, this volume). Gombos (1982) recently described three new genera of ebridians from these same cores and provided general age determinations based on diatoms.

RESULTS

Figure 2 shows the lithologies of the four piston cores taken along the northern Maurice Ewing Bank that can be closely correlated with the middle Eocene and lower Oligocene sections cored at DSDP Sites 512 and 511, respectively (lithologies condensed from Kaharooddin et al., 1982). The calcareous nannofossil stratigraphies are given in Tables 1 and 2. A list of species encountered is given in the Appendix.

It should be borne in mind that isolated piston cores must necessarily be examined out of the context of the sections from which they were retrieved. The short intervals recovered in older piston cores (usually no more than a meter or two in length) constitute only a small fraction of the total section that would be obtained in the same locality by drill cores, and variations in species abundances may lead to false conclusions about the stratigraphies or the dates of the isolated piston core sections. Nevertheless, the general age assignments given these cores on the basis of coccoliths agree with the middle Eocene and early Oligocene ages suggested by Gombos (1982), who examined the diatoms.

Islas Orcadas (IO) Core 16-43 contains abundant *Chiasmolithus solitus* and *Reticulofenestra umbilica*, which together define the *Discoaster bifax* Subzone of Bukry (1973a). Rare *D. bifax* were noted at the base of the core, and forms here attributed to *R. bisecta bisecta* are few to abundant throughout. Individuals of the latter species are small, about 9 to 10 μm long (about the size of the holotype of the species) and exhibit a low-order yellow interference color in crossed polarized light. Such forms were encountered only in Cores 8 and 9 at DSDP Site 512, where they were lumped under the name *Reticulofenestra* sp. cf. *R. hesslandii* (Wise, this volume, Table 5). Some other forms lower down in the section at Site 512 were included under that taxonomic heading, but these are smaller; they do not exhibit a yellow interference color, and are not the same species as those in *Islas Orcadas* Core 16-43.

¹ Ludwig, W. J., Krashennnikov, V. A., et al., *Init. Repts. DSDP*, 71: Washington (U.S. Govt. Printing Office).

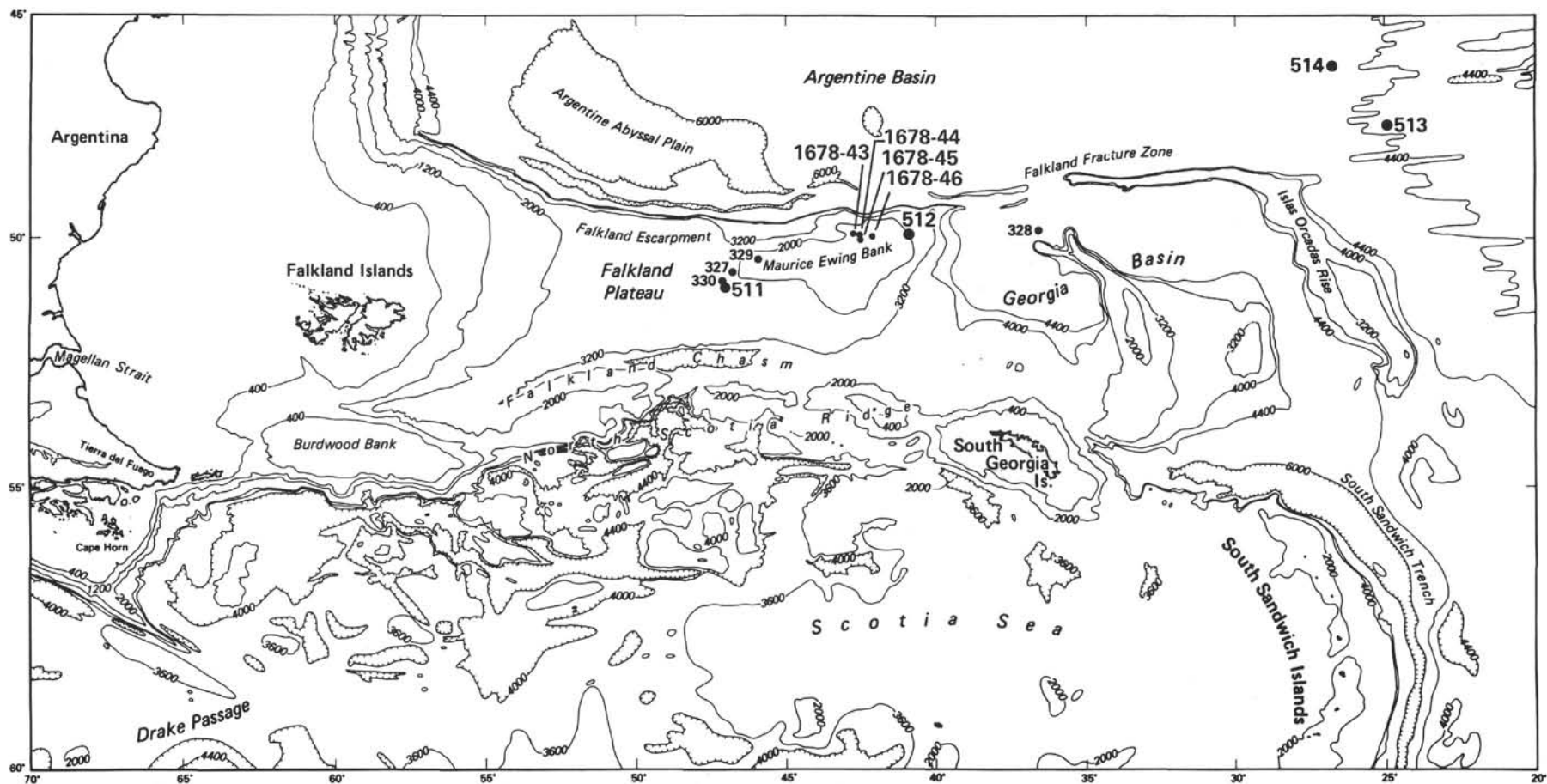


Figure 1. Locations of DSDP Sites 511 and 512 and of *Islas Orcadas* piston cores used in this study.

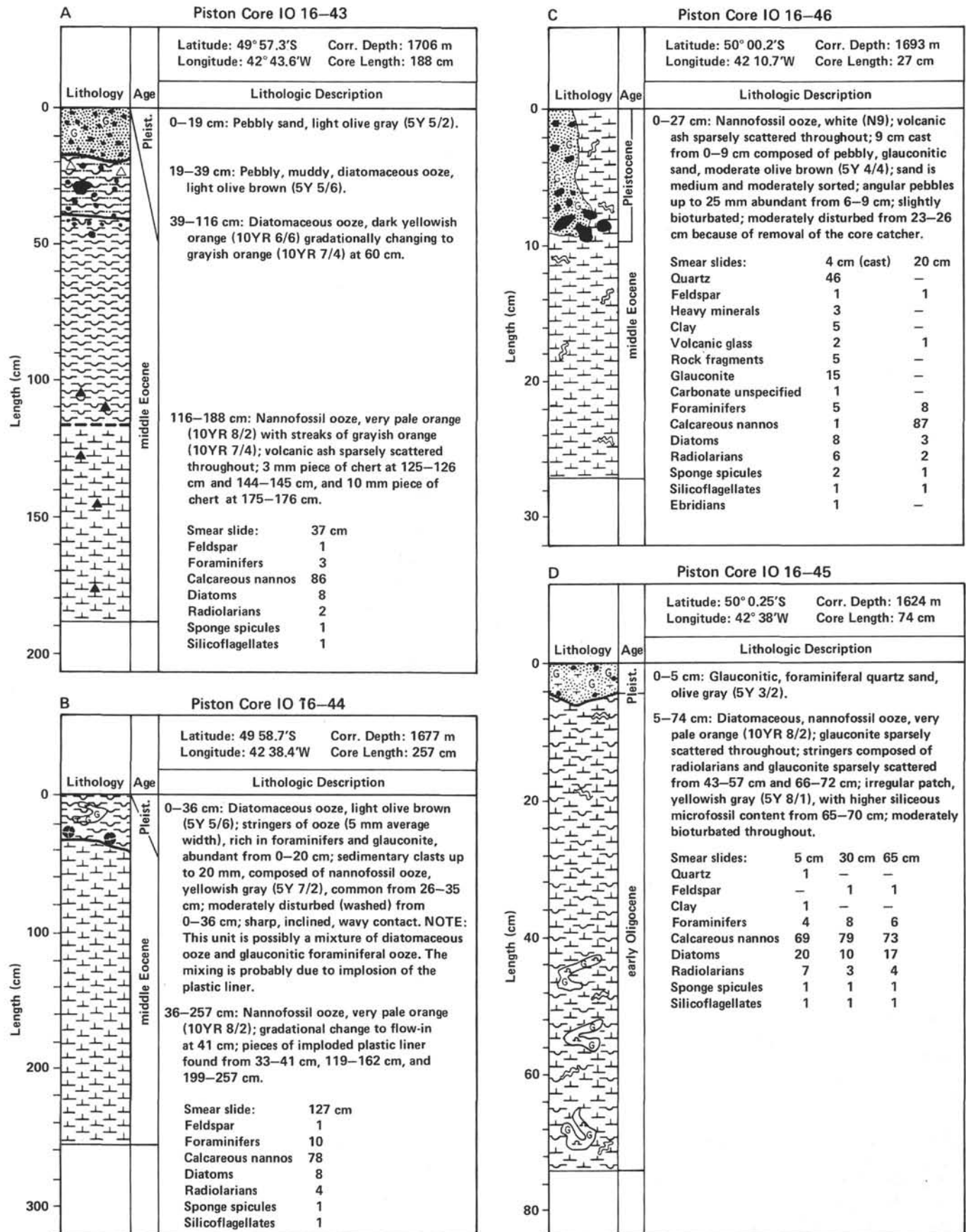
Figure 2. Lithologies of *Islas Orcadas* (IO) Cruise 16 piston cores 16-43, 16-44, 16-46, and 16-45 (from Kaharooddin et al., 1982).

Table 1. Distribution of middle Eocene calcareous nannofossils in *Islas Orcadas* (IO) Cores 16-43, 16-44, and 16-46.

Age	Zone or Subzone	Sample (interval in cm)	Abundance	Preservation	<i>Blackites spinosus</i>	<i>Calcidiscus leptoporus</i>	<i>Chiasmolithus expansus</i>	<i>C. grandis</i>	<i>C. solitus</i>	<i>Clausicoccus fenestratus</i>	<i>Coccolithus formosus</i>	<i>C. pelagicus</i>	<i>C. staurion</i>	<i>C. sp. cf. C. pseudogammation^a</i>	<i>Discoaster barbadiensis</i>	<i>D. bifax</i>	<i>D. binodosus</i>	<i>D. distinctus</i>	<i>D. saipanensis</i>	<i>Ellipsolithus distichus</i>	<i>Helicosphaera carteri</i>	<i>Markalius inversus</i>	<i>Neococcolithes dubius</i>	<i>Pontosphaera pectinata</i>	<i>P. plana</i>	<i>P. pulcheroides</i>	<i>Reiculfenestra bisecta bisecta</i>	<i>R. sp. cf. R. hesslandii</i> (small)	<i>R. omusta</i>	<i>R. samodurovi</i>	<i>R. umbilica</i>	Reticulofenestrids (other small)	<i>Sphenolithus moriformis</i>	<i>Zygrhablithus bijugatus</i>					
middle Eocene	<i>Reticulofenestra umbilica</i>	<i>Discoaster bifax</i>	IO 16-43, 120	A	M, E, O	F	F	?	A	C	A	V	F	F	F	A	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F		
			IO 16-43, 130	A	M, E, O	C	F	F	A	A	A	V	V	C	F	F	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F		
			IO 16-43, 140	A	G, E, O	C	C	F	F	A	A	C	V	C	F	F	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
			IO 16-43, 150	A	G, E, O	C	C	F	F	A	A	C	V	C	F	F	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
			IO 16-43, 160	A	G, E, O	C	C	F	F	A	A	C	V	C	F	F	C	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
			IO 16-43, 170	A	G, E, O	F	F	F	F	A	A	F	V	F	F	F	?	R	R	R	R	R	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
			IO 16-43, 180	A	G, E, O	F	F	F	F	A	A	F	V	F	F	F	R	R	R	R	R	R	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
	<i>Nannotetrina quadrata</i>	<i>Coccolithus staurion</i>	IO 16-44, 5	F	M, E	f	C	F	A	A	F	C	F	F	R	R	F	F	F	F	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f		
			IO 16-44, 15	F	M, E	C	C	C	C	C	C	F	C	F	F	R	R	F	F	F	F	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	
			IO 16-44, 25	F	M, E	R	C	C	C	C	C	F	A	F	F	R	R	F	F	F	F	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
			IO 16-44, 35	C	M, E	C	C	C	C	C	C	C	V	C	V	R	R	F	R	F	F	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
			IO 16-44, 50 FI	A	M, E	A	A	A	A	A	A	A	V	A	V	R	R	F	F	F	F	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
			IO 16-46, 5	A	M, E, O	A	A	A	A	A	A	F	V	F	F	A	R	R	F	F	F	R	C	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
			IO 16-46, 15	A	M, E, O	F	A	A	A	A	A	F	F	A	A	A	R	R	F	F	F	R	C	A	fr	A	A	A	A	A	A	A	A	A	A	A	A	A	A

Note: V = very abundant; H = highly abundant; A = abundant; C = common; F = few; R = rare; fr = fragment; P = poor; M = moderate; G = good; E = etched; O = overgrown; FI = flow-in. Abundances in lowercase denote reworked or contaminant specimens.
^a *Cyclargolithus* sp.

Table 2. Distribution of early Oligocene calcareous nannofossils in *Islas Orcadas* (IO) Core 16-45.

Age	Zone	Sample (interval in cm)	Abundance	Preservation	<i>Blackites spinosus</i>	<i>Chiasmolithus altus</i>	<i>C. oamaruensis</i>	<i>Clausicoccus fenestratus</i>	<i>Coccolithus pelagicus</i>	<i>Cyclargolithus floridanus</i>	<i>Discoaster adamanteus</i>	<i>D. deflandrei</i>	<i>D. sp.</i>	<i>Isthmolithus recurvus</i>	<i>Lapideacassis</i> sp.	<i>Reiculfenestra bisecta bisecta</i>	<i>R. bisecta flewitzi</i>	<i>R. daviesi</i>	<i>R. hesslandii</i>	<i>R. hillae</i>	<i>R. umbilica</i>	<i>Sphenolithus moriformis</i>	<i>Zygrhablithus bijugatus</i>
early Oligocene	<i>Blackites spinosus</i>	IO 16-45, 5	A	G, E	A	A	C	V			F	F			R	A	A	A	A	C	A	F	C
		IO 16-45, 15	A	G, E	A	V	C	V		C						A	A	A	A	C	A	F	F
		IO 16-45, 25	A	G, E	A	A	F	V						F	R	A	A	A	A	A	C	F	F
		IO 16-45, 35	A	G, E	A	A	F	V		F	R					A	A	A	A	A	A	A	A
		IO 16-45, 45	A	G, E	A	V	A	R	V	C	R					A	C	A	A	A	A	A	A
		IO 16-45, 55	C	G, E	A	A	A	A	A					C		A	C	A	A	A	A	A	A
		IO 16-45, 65	C	G, E, O	A	A	A	A	A	C	R			C		A	C	A	C	C	A	A	F
		IO 16-45, 73	C	M, E, O	A	A	C	A	A					F		A	C	A	C	C	A	A	F

Note: V = very abundant; A = abundant; C = common; F = few; R = rare; P = poor; M = moderate; G = good; E = etched; O = overgrown.

Bukry (1973a) indicates that *R. bisecta bisecta* makes its first appearance somewhere within the *D. bifax* Subzone. On the Falkland Plateau this appears to be the case with the species first appearing in the upper portion of the section at Site 512. It is not present above Core 512-8, however, so its occurrence here may be sporadic in the lower part of its range. Its occurrence in Core IO 16-43 is quite consistent, perhaps indicating that this core represents a stratum slightly younger than the section at Site 512.

Core IO 16-44 is rather badly disturbed. Pleistocene glacial marine sediments in the top 40 cm are contaminated with middle Eocene coccoliths from the nannofossil ooze below because the plastic core liner im-

ploded during core retrieval. Most of the nannofossil ooze contained in the remainder of the core is flow-in material which was drawn into the liner during core retrieval. Pleistocene coccoliths are represented by a few *Calcidiscus leptoporus* and *Helicosphaera carteri* in the top 35 cm of the core. Middle Eocene coccoliths include common to abundant *Chiasmolithus solitus* and *R. umbilica* but no *R. bisecta*. The absence of the latter could mean that the core sampled a lower stratigraphic level than that of Core IO 16-43. The evidence for this could be considered ambiguous, however, since *R. bisecta* is not consistently present in the upper part of the section at Site 512. No *Sphenolithus furcatolithoides* or *S. radians* were noted. This core, therefore, probably repre-

sents a stratum lying somewhere above Section 512-19-1 and below Core 512-9.

In Core IO 16-46, *C. solitus* is abundant, but no confirmed specimens of *R. umbilica* have been found. Instead, the assemblage contains abundant *R. samodurovi*, which is similar to *R. umbilica* in appearance but is smaller. Bukry (1973a) considers *R. samodurovi* to be the progenitor of the larger *R. umbilica*, but does not specify what size difference he uses to distinguish the two. We attribute all forms larger than 14 μm to *R. umbilica*. In Core IO 16-46, there are rare fragments of forms which must have approached 14 μm in length, but no confirmed examples of *R. umbilica* were found. Since *R. umbilica* was consistently present through the section at Site 512, it would seem that Core IO 16-46 should probably be assigned to Bukry's (1973a) middle Eocene *Coccolithus staurion* Subzone. One specimen of *C. staurion* was noted in Sample 16-46, 5 cm (Table 1; Fig. 3). This species can also occur, however, in the *D. bifax* Subzone (Bukry, 1973a). *Nannotetrina quadrata* was not observed.

Core IO 16-45 is dated as early Oligocene by the presence of *Clausicoccus fenestratus* and *Isthmolithus recurvus* in the absence of *D. saipanensis* and *R. oamaruensis*. In this respect, the core is equivalent to the *Blackites spinosus* Zone cored in a long sequence at DSDP Site 511. A single specimen of *D. saipanensis* was noted in an intermediate sample taken at 40 cm in Core IO 16-45 (not shown in Table 2). This specimen, however, is apparently reworked, Gombos (1982, text-fig. 1) also suspected reworking at this interval. Neither *C. fenestratus* nor *I. recurvus* occur in the topmost 15 cm of the core. Because of the high sedimentation rate in this area, it is doubtful, however, that the upper boundary of the *B. spinosus* Zone is actually present in this core, although that remains a possibility. Strong fluctuations in the abundances of *C. fenestratus* were noted in the equivalent section at DSDP Site 511 (Wise, this volume, Table 1A), and this fact may account for its apparent absence at the top of Core 16-45. Scanning electron micrographs revealed exceptionally clear ultrastructural details for some of the Oligocene coccoliths of Core IO 16-

45. The *Isthmolithus recurvus* in Plate 1, Figures 1-3 are composed of a paper-thin wall constructed of narrow vertical laths. In one specimen (Plate 1, Figs. 1 and 2), the wall is folded into a small loop at one end (right side of specimen) and then overlapped along an oblique suture just beyond that point. This wall construction is markedly different from that of *Neococcolithes dubius* (Plate 4, Fig. 9) which has a wall composed of robust, strongly inclined elements (a characteristic eiffellithalid rim). There seems to be no reason to suppose that there is some sort of evolutionary link (or intermediate connecting form) between these two taxa as has sometimes been suggested in the literature.

DISCUSSION

Correlation of middle Eocene piston and drill cores from the Maurice Ewing Bank suggest that the piston cores represent fragments of a broader stratigraphic interval than that sampled at Site 512. *Islas Orcadas* Piston Cores 16-43 and 16-46 may represent, respectively, strata slightly younger and slightly older than the section at Site 512. On the basis of coccoliths the correct sequence of cores from youngest to oldest, is IO 16-43, 16-44, and 16-46. A. M. Gombos (pers. comm., 1982) reports that this sequence is in accord with his diatom data when measured against the diatom stratigraphy of Site 512 (Gombos, this volume).

Based on these data, the following sequence of calcareous nannofossil datums within or bounding the *Discoaster bifax* Subzone of the *Reticulofenestra umbilica* Zone can be suggested for the area of the Falkland Plateau (they are listed in descending stratigraphic order): LAD, *Chiasmolithus solitus*; FAD, *Reticulofenestra bisecta bisecta*; LAD, *Sphenolithus furcatolithoides*; FAD, *R. umbilica*. Since the entire *D. bifax* Subzone was not drilled or cored at any one locality, we cannot fully ascertain the reliability of these datums in this region. Further drilling would be required. Nor can we ascertain the duration of time encompassed by the *D. bifax* Subzone in this region. On the basis of Bukry's (1973b) calculations, the subzone spans only about 1 m.y. If that is correct, then the sedimentation rate at Site 511 during that

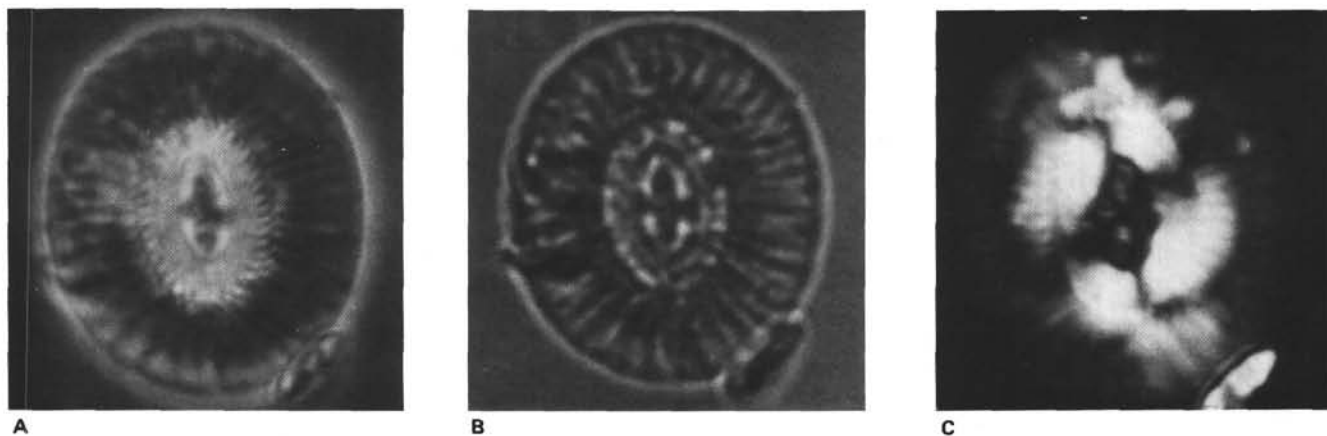


Figure 3. *Coccolithus staurion* Bramlette and Sullivan; *Islas Orcadas* Sample 16-46, 5 cm, $\times 3200$. A, phase contrast light; B, transmitted light; C, cross-polarized light.

time would have been a phenomenal 70 m/m.y. (Wise, this volume). An alternative explanation is that the interval actually spans a greater amount of time. If *C. solitus* persisted longer in the higher latitudes than in the tropics where Bukry's (1973a) zonation is grounded, then the subzone would encompass a greater amount of section.

Many of these questions could best be answered by further drilling in the vicinity of the *Islas Orcadas* piston cores discussed here. The section there is shallower and is far more calcareous in the Oligocene than the equivalent section at DSDP Site 511. In addition, exposure of progressively older sediments down the long northern slope of the Maurice Ewing Bank places the entire Tertiary section within sampling range of the hydraulic piston corer. The acquisition of such a section would be of great value to high-latitude biostratigraphy.

ACKNOWLEDGMENTS

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APPENDIX

Calcareous Nannofossil Species Considered in This Report, Listed in Alphabetical Order of Species Epithets

- The bibliographic references for these species are provided in Wise (this volume), Loeblich and Tappan (1966, 1968, 1969, 1970a, b, 1971, 1973) and Heck (1979a, b, 1980a, b, 1981a, b, 1982).
- Discoaster adamanteus* Bramlette and Wilcoxon, 1967
- Chiasmolithus altus* Bukry and Percival, 1971
- Discoaster barbadiensis* Tan Sin Hok, 1927
- Discoaster bifax* Bukry, 1971
- Zygrhablithus bijugatus* (Deflandre) Deflandre, 1959
- Discoaster binodosus* Martini, 1958
- Reticulofenestra bisecta bisecta* (Hay, Mohler, and Wade) Roth, 1970
- Reticulofenestra bisecta filewiczii* Wise and Wiegand in Wise, this volume
- Helicosphaera carteri* (Wallich) Kamptner, 1954
- Reticulofenestra daviesii* (Haq) Haq, 1971
- Discoaster deflandrei* Bramlette and Riedel, 1954
- Ellipsolithus distichus* (Bramlette and Sullivan) Sullivan, 1964
- Discoaster distinctus* Martini, 1958
- Neococcolithes dubius* (Deflandre) Black, 1967
- Chiasmolithus expansus* (Bramlette and Sullivan) Gartner, 1970
- Clausicoccus fenestratus* (Deflandre and Fert) Prins, 1979
- Cyclicargolithus floridanus* (Roth and Hay) Bukry, 1971
- Coccolithus formosus* (Kamptner) Wise, 1973
- Sphenolithus furcatolithoides* Locker, 1967
- Chiasmolithus grandis* (Bramlette and Riedel) Gartner, 1970
- Reticulofenestra hesslandii* (Haq) Roth, 1970
- Reticulofenestra* sp. cf. *R. hesslandii* (small) (Haq) Roth, 1970
- Reticulofenestra hillae* Bukry and Percival, 1971
- Markalius inversus* (Deflandre) Bramlette and Martini, 1964
- Calcidiscus leptoporus* (Murray and Blackman) Loeblich and Tappan, 1978
- Sphenolithus moriformis* (Brönnimann and Stradner) Bramlette and Wilcoxon, 1967
- Cyclicargolithus* sp. cf. *C. pseudogammation* (Bouche) Bukry, 1973
- Chiasmolithus oamaruensis* (Deflandre) Hay, Mohler and Wade, 1966
- Reticulofenestra oamaruensis* (Deflandre) Stradner and Edwards, 1968
- Reticulofenestra onusta* (Perch-Nielsen) Wise, n. comb.
- Pontosphaera pectinata* (Bramlette and Sullivan) Proto Decima, Roth, and Todesco, 1975
- Coccolithus pelagicus* (Wallich) Schiller, 1930
- Pontosphaera plana* (Bramlette and Sullivan) Haq, 1971
- Pontosphaera pulchroides* (Sullivan) Romein, 1979
- Nannotetrina quadrata* (Bramlette and Sullivan) Bukry, 1973
- Isthmolithus recurvus* Deflandre in Deflandre and Fert, 1954
- Discoaster saipanensis* Bramlette and Riedel, 1954
- Reticulofenestra samodurovi* (Hay, Mohler, and Wade) Bukry and Percival, 1971
- Chiasmolithus solitus* var. *inversus* Wise and Weigand in Wise, this volume
- Blackites spinosus* (Deflandre and Fert) Hay and Towe, 1962
- Coccolithus staurion* Bramlette and Sullivan, 1961
- Reticulofenestra umbilica* (Levin) Martini and Ritzkowski, 1968

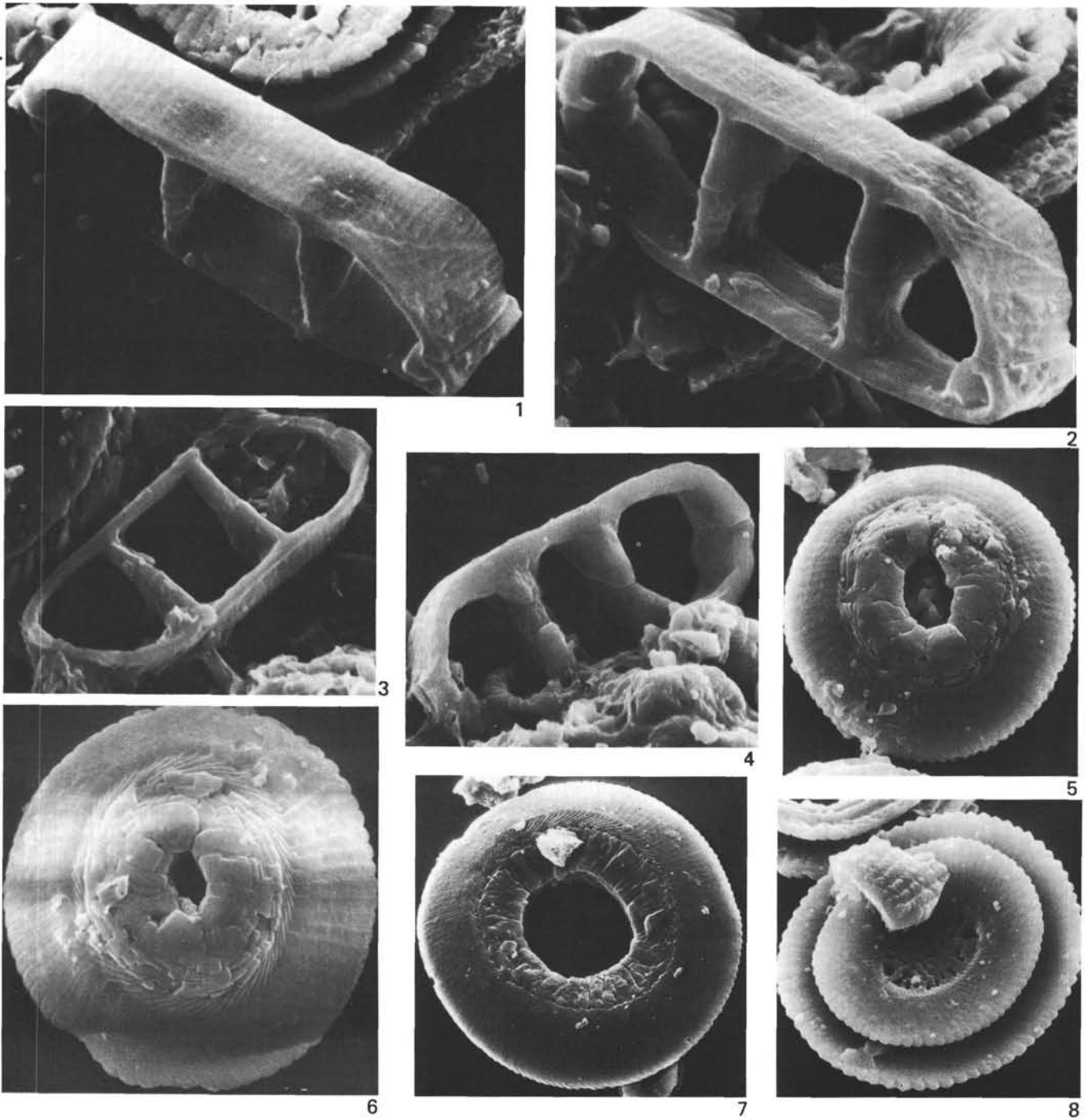


Plate 1. Lower Oligocene calcareous nannofossils, SEM. 1-4. *Isthmolithus recurvus* Deflandre (1-2) $\times 10,500$, Sample IO 16-45, 20 cm, (3) $\times 7500$, Sample IO 16-45, 60 cm, (4) $\times 8000$, Sample IO 16-45, 20 cm. 5-6, 8. *Reticulofenestra bisecta filewiczii* Wise and Wiegand, Sample IO 16-45, 40 cm, (5-6) (5, distal views, $\times 4400$; 6, $\times 7000$), (8) proximal view, $\times 5500$. 7. *Reticulofenestra umbilica* (Levin) Martini and Ritzkowski; distal view, $\times 3200$, Sample IO 16-45, 40 cm.

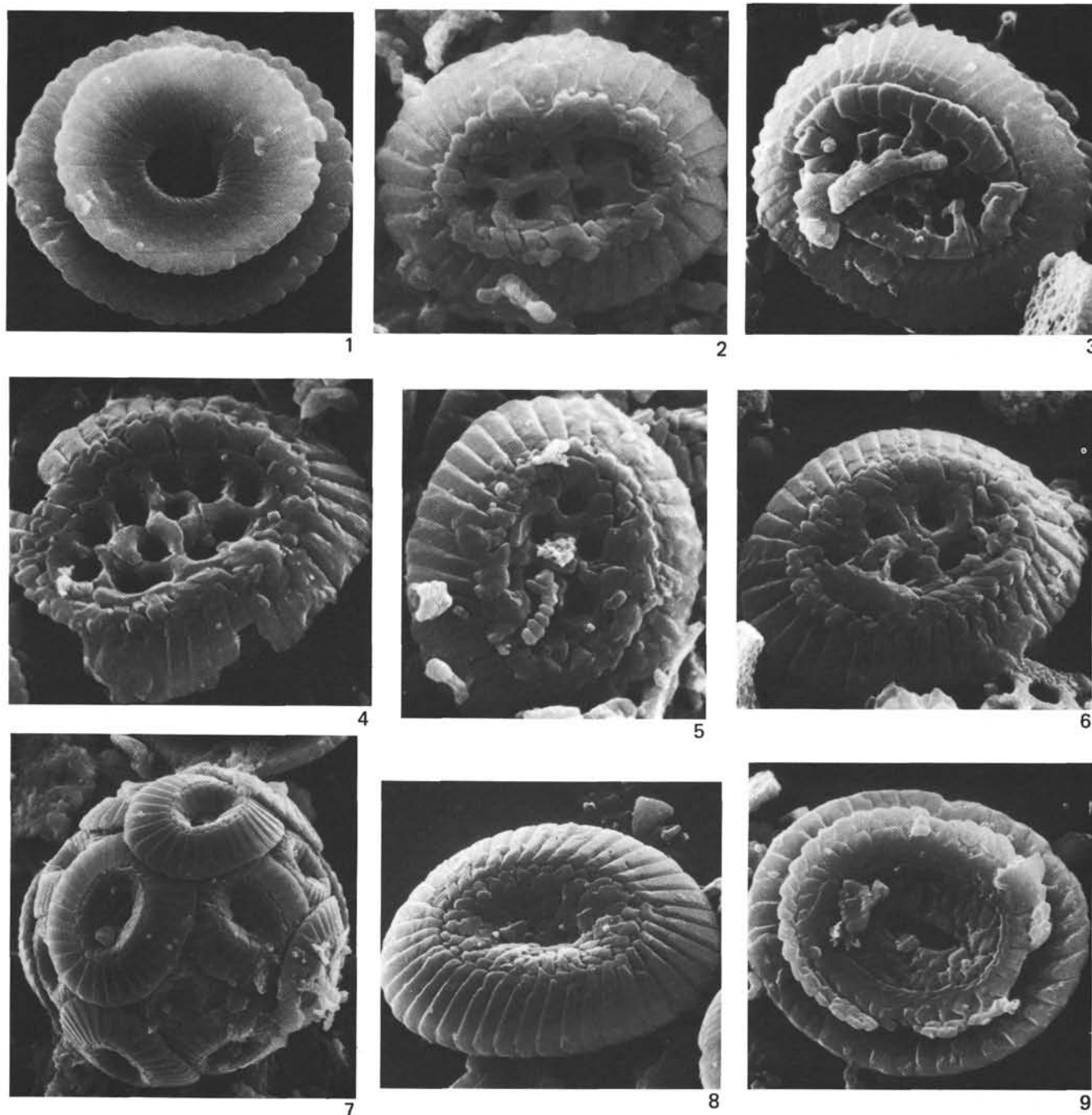


Plate 2. Lower Oligocene calcareous nannofossils, SEM. 1. *Cyclicargolithus floridanus* (Roth and Hay) Bukry; proximal view, $\times 9000$, Sample IO 16-45, 40 cm. 2-6. *Clausicoccus fenestratus* (Deflandre and Fert) Prins, distal views, (2) $\times 8000$, Sample IO 16-45, 20 cm, (3) $\times 11,000$, Sample IO 16-45, 40 cm, (4) $\times 9500$, Sample IO 16-45, 20 cm, (5-6) Sample IO 16-45, 60 cm (5, $\times 9000$; 6, $\times 10,000$). 7-9. *Coccolithus pelagicus* (Wallich) Schiller, (7) coccosphere, $\times 4100$, Sample IO 45-16, 20 cm, (8) distal view, $\times 5000$, Sample IO 16-45, 40 cm, (9) proximal view, $\times 7000$, Sample IO 16-45, 60 cm.

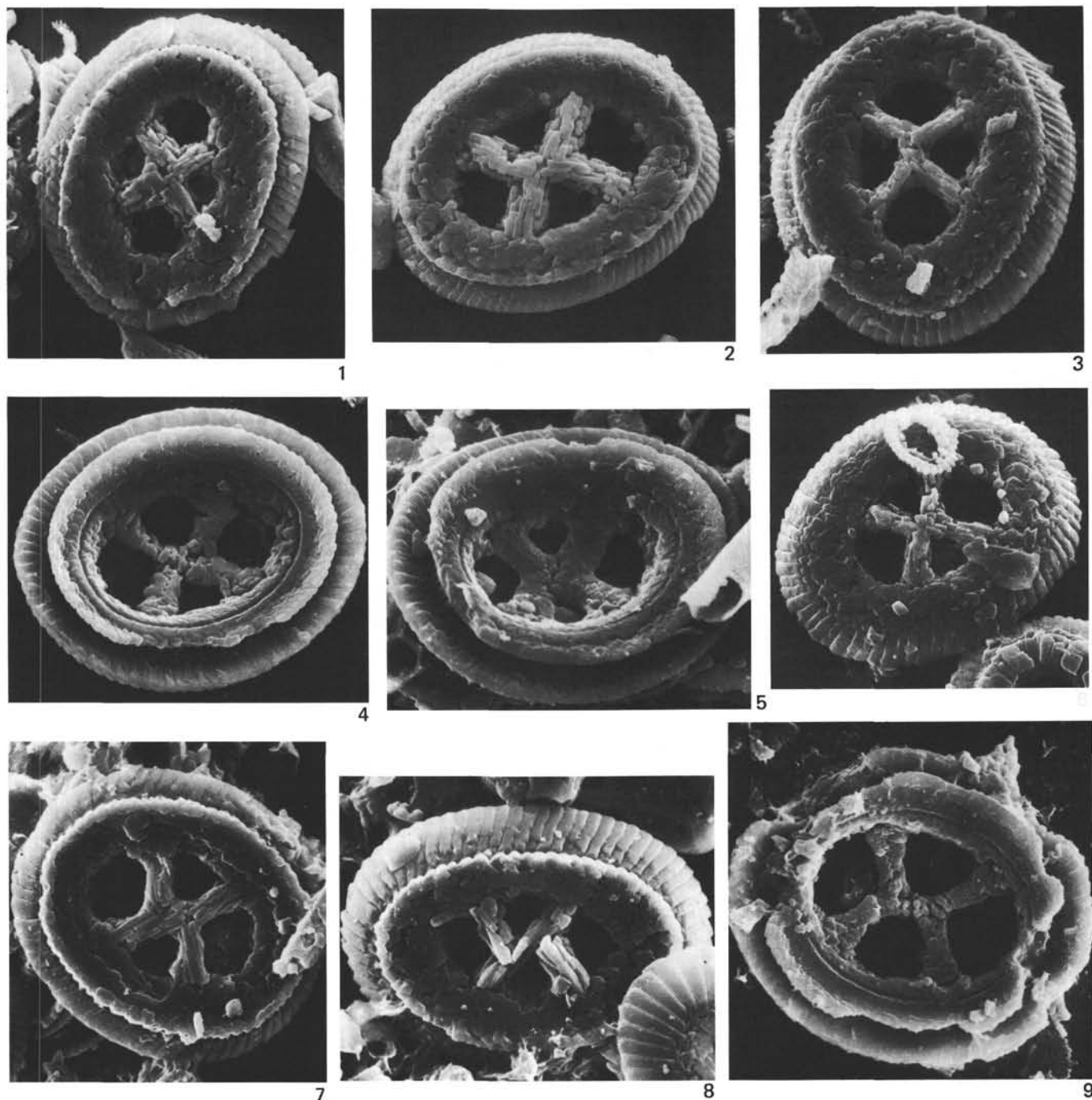


Plate 3. Lower Oligocene and middle Eocene calcareous nannofossils, SEM. 1-6. *Chiasmolithus altus* Bukry and Percival, Lower Oligocene, (1-3) distal views (1, $\times 4200$, Sample IO 16-45, 20 cm; 2, $\times 4100$, Sample IO 16-45, 40 cm; 3, $\times 4400$, Sample IO 16-45, 40 cm), (4-5) proximal views (4, $\times 4800$, Sample IO 16-45, 40 cm; 5, $\times 5500$, IO 16-45, 60 cm), (6) distal view, $\times 5500$, Sample IO 16-45, 20 cm. 7-8. *Chiasmolithus solitus* (Bramlette and Sullivan) Locker, middle Eocene, distal view, Sample IO 16-44, 40 cm, (7) $\times 4100$, (8) $\times 5500$. 9. *Chiasmolithus expansus* (Bramlette and Sullivan) Gartner, middle Eocene, proximal view, $\times 4100$, Sample IO 16-45, 40 cm.

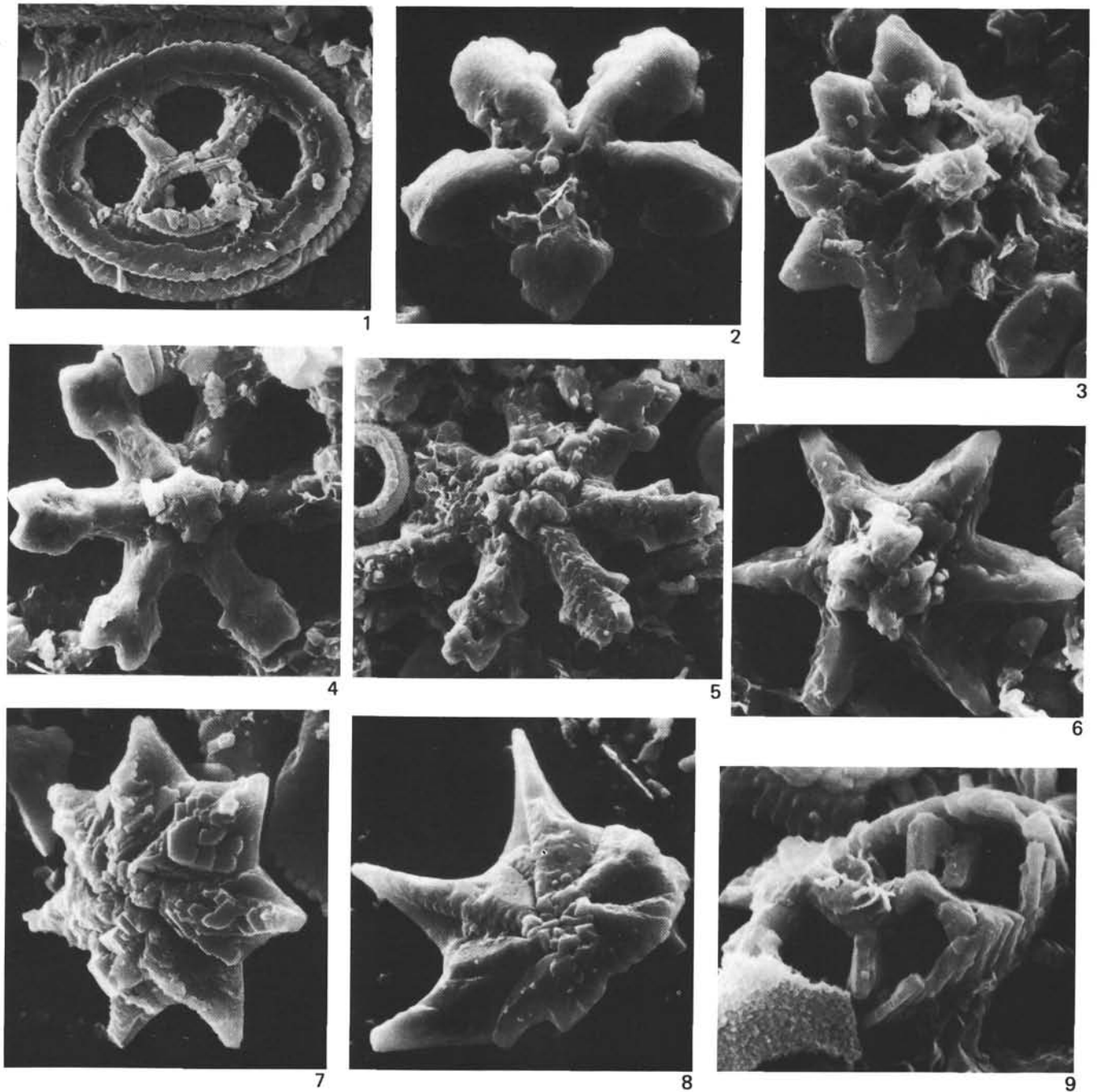


Plate 4. Middle Eocene calcareous nannofossils, SEM, Sample IO 16-44, 40 cm. 1. *Chiasmolithus expansus* (Bramlette and Sullivan) Gartner, distal view, $\times 3500$. 2. *Discoaster* sp., $\times 7600$. 3. *Discoaster barbadiensis* Tan Sin Hok, $\times 6500$. 4. *Discoaster distinctus* Martini, $\times 4300$. 5. *Discoaster binodosus* Martini, $\times 3300$. 6. *Discoaster* sp., $\times 7000$. 7-8. *Discoaster saipanensis* Bramlette and Riedel, (7) $\times 6500$, (8) $\times 6200$. 9. *Neococcolithes dubius* (Deflandre) Black, distal view, $\times 10,000$.