17. CALCAREOUS NANNOPLANKTON–LEG 43, DEEP SEA DRILLING PROJECT

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INTRODUCTION

During Leg 43, six holes (Sites 382-387) were drilled in the western part of the North Atlantic Ocean; locations of sites are shown in Figure 1. Lower Cretaceous to Quaternary calcareous nannofossils were found in 127 of 189 cores recovered during the leg. The ages and zonal assignments of these fossiliferous cores based upon light-microscopical observation are given in Table 1. An almost continuous succession of nannofossil assemblages of the lower Maestrichtian to upper Paleocene is present at Site 384. A detailed investigation was conducted on samples at this site, and the evolution of approximately 50 species is documented through almost the entire Paleocene epoch.

The following nannoplankton species are considered in this report, listed in alphabetical order of species epithets:

Cenozoic

Cyclicargolithus abisectus (Müller, 1970) Bukry, 1973
Chiphragmalithus acanthodes Bramlette and Sullivan, 1961
Fasciculithus alanii Perch-Nielsen, 1971
Chiasmolithus altus Bukry and Percival, 1971
Sphenolithus anarrhopus Bukry and Bramlette, 1969
Scyphosphaera apsteinii Lohmann, 1902
Markalius astroporous (Stradner, 1963) Hay and Mohler, 1967
Discoaster asymmetricus Gartner, 1969
Discoaster aulakos Gartner, 1967
Discoaster barbadiensis Tan Sin Hok, 1927
Sphenolithus belemnos Bramlette and Wilcoxon, 1967
Discoaster berggrenii Bukry, 1971
Chiasmolithus bidens (Bramlette and Sullivan, 1961) Hay and Mohler, 1967
Discoaster bifax Bukry, 1971
Braarudosphaera bigelowii (Gran and Braarud, 1935) Deflandre, 1947
Zygrhablithus bijugatus (Deflandre, 1954) Deflandre, 1959
Discoaster binodosus Martini, 1958
Dictyococcites bisectus (Hay, Mohler and Wade, 1966) Bukry and Percival, 1971
Prinsius bisulcus (Stradner, 1963) Hay and Mohler, 1967
Discoaster braarudii Bukry, 1971
Cyclolithus bramlettei Hay and Towe, 1962
Tribrachiatus bramlettei (Bronnimann and Stradner, 1960) Proto-Decima, Roth, and Todesco, 1975
Discoaster brouweri Tan Sin Hok, 1927
Chiphragmalithus calathus Bramlette and Sullivan, 1961
Rhomboaster calcitrapa Gartner, 1971
Chiasmolithus californicus (Sullivan, 1964) Hay and Mohler, 1967
Heliolithus cantabriae Perch-Nielsen, 1971
Sphenolithus capricornutus Bukry and Percival, 1971
Gephyrocapsa caribbeanica Boudreaux and Hay, 1967
Triquetrorhabdulus carinatus Martini, 1965
Helicosphaera carteri (Wallich, 1877) Kamptner, 1954
Discoaster challengeri Bramlette and Riedel, 1954
Sphenolithus ciperoensis Bramlette and Wicoxon, 1967
Rhabdosphaera clavigera Murray and Blackman, 1898
Fasciculithus clinatus Bukry, 1971
Neosphaera coccolithomorpha Lecal-Schlauder, 1950
Helicosphaera compacta Bramlette and Wilcoxon, 1967
Neochiastozygus concinnus (Martini, 1961) Perch-Nielsen, 1971
Heliolithus conicus Perch-Nielsen, 1971
Chiasmolithus consuetus (Bramlette and Sullivan, 1961) Hay and Mohler, 1967
Tribrachiatus contortus (Stradner, 1958) Bukry, 1972
Coccolithus crassus Bramlette and Sullivan, 1961
Toweius craticulus Hay and Mohler, 1967
Coccolithus cribellum (Bramlette and Sullivan, 1961) Stradner, 1962
Ceratolithus cristatus Kamptner, 1950
Rhomboaster cuspis Bramlette and Sullivan, 1961
Chiasmolithus danicus (Brotzen, 1959) Hay and Mohler, 1967
Discoaster deflandrei Bramlette and Riedel, 1954
Thoracosphaera deflandrei Kamptner, 1956
Campylosphaera dela (Bramlette and Sullivan, 1961) Hay and Mohler, 1967
Discoaster delicatus Bramlette and Sullivan, 1961
Discoaster diastypus Bramlette and Sullivan, 1961
Reticulofenestra dictyoda (Deflandre and Fert, 1954) Stradner, 1968
Biscutum? dimorphosum Perch-Nielsen, 1969
Braarudosphaera discula Bramlette and Riedel, 1954
Sphenolithus dissimilis Bukry and Percival, 1971
Sphenolithus distentus (Martini, 1965) Bramlette and Wilcoxon, 1967
Ellipsolithus distichus (Bramlette and Sullivan, 1961) Sullivan, 1964
Discoaster distinctus Martini, 1958
Crenalithus doronicoides (Black and Barnes, 1961) Roth, 1973
Discoaster druggii Bramlette and Wilcoxon, 1967
Neococcolithus dubius (Deflandre, 1954) Black, 1967
Discoaster elegans Bramlette and Sullivan, 1961
Toweius eminens (Bramlette and Sullivan, 1961) Gartner, 1971
Campylosphaera eodela Bukry and Percival, 1971
Chiasmolithus eograndis Perch-Nielsen, 1971
Coccolithus eopelagicus (Bramlette and Riedel, 1954) Bramlette and Sullivan, 1961
Helicosphaera euphratis Haq, 1966
Discoaster exilis Martini and Bramlette, 1963
Chiasmolithus expansus (Bramlette and Sullivan, 1961) Gartner, 1970
Discoaster falcatus Bramlette and Sullivan, 1961
Cyclicargolithus floridanus (Roth and Hay, 1967) Bukry, 1971
Goniolithus fluckigeri Deflandre, 1957
Syracosphaera formosa Bukry and Bramlette, 1969
Cyclococcolithus formosus Kamptner, 1963
Oolithotus fragilis (Lohmann, 1912) Okada and McIntyre, 1977
Nannotetrina fulgens (Stradner, 1960) Achuthan and Stradner, 1969
Sphenolithus furcatolithoides Locker, 1967
Cyclococcolithus gammation (Bramlette and Sullivan, 1961) Sullivan, 1964
Reticulofenestra gartneri Roth and Hay in Hay et al., 1967
Discoaster gemmifer Stradner, 1961
Discoaster germanicus Martini, 1958
Chiasmolithus gigas (Bramlette and Sullivan, 1961) Radomski, 1968
Rhabdosphaera gladius Locker, 1967
Chiasmolithus grandis (Bramlette and Riedel, 1954) Radomski, 1968

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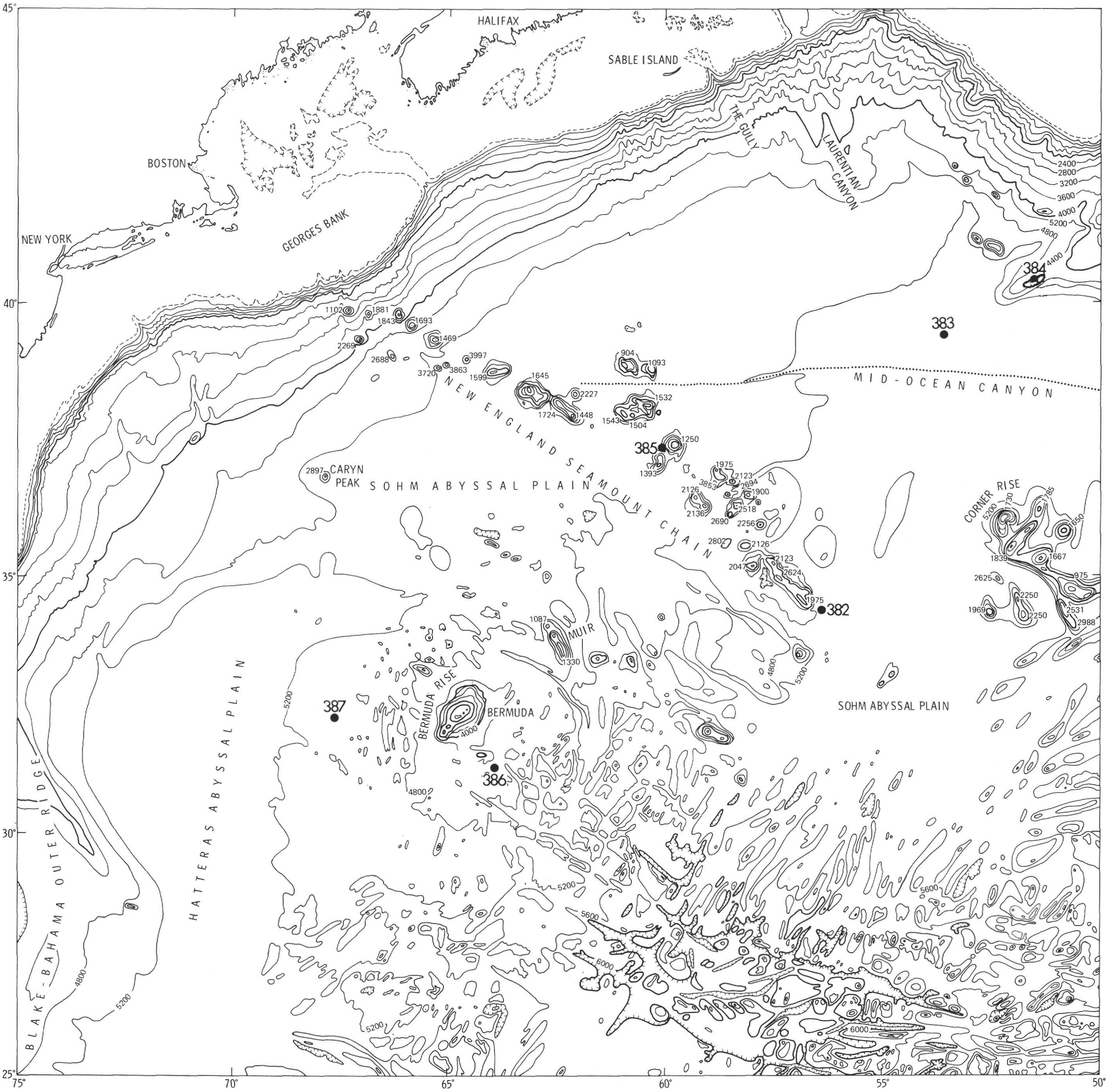

Figure 1. *Location of sites (382-387) drilled in the western North Atlantic Ocean, Leg 43.*

Fasciculithus hayi Haq, 1971
Sphenolithus heteromorphus Deflandre, 1953
Reticulofenestra hillae Bukry and Percival, 1971
Emiliania huxleyi (Lohmann, 1902) Hay and Mohler in Hay et al., 1967
Neochiastozygus imbriei Haq and Lohmann, 1976
Braarudosphaera imbricata Manivit, 1966
Rhabdosphaera inflata Bramlette and Sullivan, 1961
Discoaster intercalaris Bukry, 1971
Helicosphaera intermedia Martini, 1965
Triquetrorhabdulus inversus Bukry and Bramlette, 1969
Fasciculithus involutus Bramlette and Sullivan, 1961
Discolithina japonica Takayama, 1967
Neochiastozygus junctus (Bramlette and Sullivan, 1961) Perch-Nielsen, 1971
Cyclolithella kariana Bukry, 1971
Cyclococcolithus kingii Roth, 1970
Heliolithus kleinpellii Sullivan, 1964
Discoasteroides kuepperi (Stradner, 1959) Bramlette and Sullivan, 1961
Syracosphaera labrosa Bukry and Bramlette, 1969
Pseudoemiliania lacunosa (Kamptner, 1963) Gartner, 1969
Ellipsolithus lajollaensis Bukry and Percival, 1971
Pedinocyclus larvalis (Bukry and Bramlette, 1969) Loeblich and Tappan, 1973
Discoaster latus Hay in Hay et al., 1967
Discoaster lenticularis Bramlette and Sullivan, 1961
Cyclococcolithus leptopora (Murray and Blackman, 1898) Kamptner, 1954
Discoaster lodoensis Bramlette and Riedel, 1954
Discoaster loeblichii Bukry, 1971
Helicosphaera lophota (Bramlette and Sullivan, 1961) Jafar and Martini, 1975
Ellipsolithus macellus (Bramlette and Sullivan, 1961) Sullivan, 1964

TABLE 1A
Zonal and Geologic Age Assignments of Leg 43 Cores Based on Calcareous Nannofossils

Age		Zone	Subzone	DSDP Site 382	383	384	385	386	387
Pleistocene		*Emiliania huxleyi*			1-1		1-1	1-1	1-1
		Gephyrocapsa oceanica	*Ceratolithus cristatus*	1-1/1, CC					
			Emiliania ovata	2-2/4, CC				1-3	
		Crenalithus doronicoides	*Gephyrocapsa caribbeanica*					1-4/1-5	
			Pseudoemiliania lacunosa						
Pliocene	Upper	*Discoaster brouweri*	*Cyclococcolithus macintyrei*	5-1					
			Discoaster pentaradiatus						
			Discoaster surculus						
			Discoaster tamalis	5-2/5-3					
	Lower	*Reticulofenestra pseudoumbilica*	*Discoaster asymmetricus*						
			Sphenolithus neoabies						
		Ceratolithus tricorniculatus	*Ceratolithus rugosus*						
			Ceratolithus acutus						
			Triquetrorhabdulus rugosus						
Miocene	Upper	*Discoaster quinqueramus*	*Ceratolithus primus*	7-1/8-6				2-1	
			Discoaster berggrenii						
		Discoaster neohamatus	*Discoaster neorectus*						
			Discoaster bellus						
		Discoaster hamatus	*Catinaster calyculus*						
			Helicosphaera carteri						
	Middle	*Catinaster coalitus*							
		Discoaster exilis	*Discoaster kugleri*						
			Coccolithus miopelagicus						
		Sphenolithus heteromorphus						4-1	
	Lower	*Helicosphaera ampliaperta*							
		Sphenolithus belemnos							
		Triquetrorhabdulus carinatus	*Discoaster druggii*					4-4/4-5	
			Discoaster deflandrei					4-6	
Oligocene	U		*Cyclicargolithus abisectus*					4, CC	
		Sphenolithus ciperoensis	*Dictyococcites bisectus*					5-1/5,CC	
			Cyclicargolithus floridanus						
	M	*Sphenolithus distentus*						6-2/9, CC	
		Sphenolithus predistentus						10, CC	
	L	*Helicosphaera reticulata*	*Reticulofenestra hillae*						
			Cyclococcolithus formosus					11-3/11, CC	
			Coccolithus subdistichus					12-2/12-3	
Eocene	L	*Discoaster barbadiensis*	*Isthmolithus recurvus*					12-4/12, CC	
			Chiasmolithus oamaruensis					13-2	
	Middle	*Reticulofenestra umbilica*	*Discoaster saipanensis*						
			Discoaster bifax			1-1		14-1/14, CC	8-1
		Nannotetrina fulgens	*Coccolithus staurion*			1-1/1-2		15-1, 16, CC	8, CC/10-3
			Chiasmolithus gigas			1-3/3, CC		17-1/18-4	10-5/13-1
			Discoaster strictus			4-1/4-6		28, CC/25-3	14-2/17-2
	Lower	*Discoaster sublodoensis*	*Rhabdosphaera inflata*			4-6/5-1		26-2/28-2	18-1/19-2
			Discoasteroides kuepperi			5-1/5-3		18, CC/29-4	20-1/20, CC
		Discoaster lodoensis				5-3/5, CC		30-2/30, CC	21-1/21, CC
		Tribrachiatus orthostylus						31-1/32, CC	22-2/23-2
		Discoaster diastypus	*Discoaster binodosus*					33-1/33-3	23-3/23-4
			Tribrachiatus contortus					33-3/34-2	
								34-3/34, CC	
Paleocene	U	*Discoaster multiradiatus*	*Campylosphaera eodela*			6-1			
			Chiasmolithus bidens			6-1			
		Discoaster nobilis				6-1/7-5			
	M	*Discouster mohleri*				7-6/8-3		35-1	
		Heliolithus kleinpellii				8-4/8, CC			
		Fasciculithus tympaniformis				9-1/10-2			
	L	*Ellipsolithus macellus*				10-3/12-2			24-1/26-2
		Chiasmolithus danicus				12-2/12-6			
		Cruciplacolithus tenuis				12-6/13-3	11-2		

TABLE 1B
Age Assignments of Leg 43 Cores on the Basis of Mesozoic Calcareous Nannofossils

Age	Events	382	384	385	386	387
Maestrichtian	base *M. mura* + *N. frequens*		13-3/13, CC	12-1/13-2	35-4	27-2/28, CC
	base *L. quadratus*		14-1/15-3		35-5	
	top *T. trifidus*		15-3/15, CC	13-3/13, CC		29-2
Campanian	base *T. trifidus*	16-2/16-5				
	base *T. aculeus*	16-2/23-2				
	base *B. parca*					
Santonian			16-1			
Coniacian						
	base *M. furcatus*					
Turonian						
	base *G. obliquum*					
Cenomanian					44-4/49-3	
	base *L. alatus*				50-2/55-6	
Albian	base *E. turriseiffeli*				57-1/65-1	
	base *P. cretacea*					
Aptian	base *P. angustus*					
Barremian	top *H. radiatus*					38-1/40-1
	top *C. cuvillieri*					40-2
Hauterivian	base *L. bollii*					40-2/46-2
	top *R. wisei* + *D. rectus*					47-1/48, CC
Valanginian	base *C. oblongata*					49-3/49-5
	base *T. verenae*					
	base *B. colligatus*					49, CC/50-2
Berriasian	base *C. angustiforatus*					

Cyclococcolithus macintyrei Bukry and Bramlette, 1969
Discoaster mediosus Bramlette and Sullivan, 1961
Discoaster megastypus Bramlette and Sullivan, 1961
Triquetrorhabdulus milowii Bukry, 1971
Conococcolithus minutus Hay and Mohler, 1967
Coccolithus miopelagicus Bukry, 1971
Discoaster mirus Deflandre in Deflandre and Fert, 1954
Lophodolithus mochlophorus Deflandre in Deflandre and Fert, 1954
Discoaster mohleri Bukry and Percival, 1971
Discoaster moorei Bukry, 1971
Sphenolithus moriformis (Bronnimann and Stradner, 1960) Bramlette and Wilcoxon, 1967
Discolithina multipora (Kamptner ex Deflandre, 1959) Martini, 1965
Discoaster multiradiatus Bramlette and Riedel, 1954
Claciosolenia murrayi Gran in Murray and Hjort, 1912
Lophodolithus nascens Bramlette and Sullivan, 1961
Crepidolithus neocrassus Perch-Nielsen, 1968
Coronocyclus nitescens (Kamptner, 1963) Bramlette and Wilcoxon, 1967
Discoaster nobilis Martini, 1961
Discoaster nonaradiatus Klumpp, 1953
Chiasmolithus oamaruensis (Deflandre, 1954) Hay, Mohler and Wade, 1966
Helicosphaera obliqua Bramlette and Wilcoxon, 1967
Sphenolithus obtusus Bukry, 1971
Toweius occulatus (Locker, 1967) Perch-Nielsen, 1971
Gephyrocapsa oceanica Kamptner, 1943
Transversopontis ocellatus (Bramlette and Sullivan, 1961) Sherwood, 1974
Thoracosphaera operculata Bramlette and Martini, 1964
Tribrachiatus orthostylus Shamrai, 1963
Emiliania ovata Bukry, 1975
Striatococcolithus pacificus Bukry, 1971
Transversopontis panarium (Deflandre, 1954) Locker, 1968
Helicosphaera papillata (Bukry and Bramlette, 1969) Jafar and Martini, 1975
Coccolithus pelagicus (Wallich, 1877) Schiller, 1930
Discoaster pentaradiatus Tan Sin Hok, 1927
Helicosphaera perch-nielseniae (Haq, 1971) Jafar and Martini, 1975
Hayaster perplexus (Bramlette and Riedel, 1954) Bukry, 1973
Fasciculithus pileatus Bukry, 1973
Discolithina plana (Bramlette and Sullivan, 1961) Levin, 1965
Zygodiscus plectopons Bramlette and Sullivan, 1961
Sphenolithus predistentus Bramlette and Wilcoxon, 1967
Cruciplacolithus primus Perch-Nielsen, 1977
Crenalithus productellus Bukry, 1975
Thoracosphaera prolata Bukry and Bramlette, 1969
Cyclicargolithus pseudogammation (Bouché, 1962) Bukry, 1973
Sphenolithus pseudoradians Bramlette and Wilcoxon, 1967
Reticulofenestra pseudoumbilica (Gartner, 1967) Gartner, 1969
Transversopontis pulcher (Delflandre, 1954) Perch-Nielsen, 1967
Transversopontis pulchriporus (Reinhardt, 1967) Sherwood, 1974
Discoaster quinqueramus Gartner, 1969
Sphenolithus radians Deflandre, 1952
Helicosphaera recta (Haq, 1966) Jafar and Martini, 1975
Isthmolithus recurvus Deflandre in Deflandre and Fert, 1954
Markalius reinhardtii Perch-Nielsen, 1968
Lophodolithus reniformis Bramlette and Sullivan, 1961
Helicosphaera reticulata Bramlette and Wilcoxon, 1967
Fasciculithus richardii Perch-Nielsen, 1971

Heliolithus riedelii Bramlette and Sullivan, 1961
Discolithina rimosa (Bramlette and Sullivan, 1961) Levin and Joerger, 1967
Cyclolithella robusta (Bramlette and Sullivan, 1961) Stradner, 1969
Ceratolithus rugosus Bukry and Bramlette, 1968
Discoaster saipanensis Bramlette and Riedel, 1954
Reticulofenestra samodurovii (Hay, Mohler and Wade, 1966) Roth, 1970
Thoracosphaera saxea Stradner, 1961
Fasciculithus schaubii Hay and Mohler, 1967
Dictyococcites scrippsae Bukry and Percival, 1971
Discolithina segmenta Bukry and Percival, 1971
Helicosphaera sellii (Bukry and Bramlette, 1969) Jafar and Martini, 1975
Helicosphaera seminulum (Bramlette and Sullivan, 1961) Jafar and Martini, 1975
Bramletteius serraculoides Gartner, 1969
Umbilicosphaera sibogae (Weber-van Bosse, 1901), Gaarder, 1970
Zygodiscus sigmoides Bramlette and Sullivan, 1961
Discoaster signus Bukry, 1971
Zygodiscus simplex (Bramlette and Sullivan, 1961) Hay and Mohler, 1967
Chiasmolithus solitus (Bramlette and Sullivan, 1961) Locker, 1968
Biantholithus sparsus Bramlette and Martini, 1964
Blackites spinosus (Deflandre and Fert, 1954) Hay and Towe, 1962
Cruciplacolithus staurion (Bramlette and Sullivan, 1961) Gartner, 1971
Coccolithus subdistichus (Roth and Hay, 1967) Bukry in Bukry et al., 1971
Discoaster sublodoensis Bramlette and Sullivan, 1961
Ericsonia subpertusa Hay and Mohler, 1967
Cruciplacolithus subrotundus Perch-Nielsen, 1969
Discoaster surculus Martini and Bramlette, 1963
Discoaster tamalis Kamptner, 1967
Discoaster tanii nodifer Bramlette and Riedel, 1954
Discoaster tanii ornatus Bramlette and Wilcoxon, 1967
Discoaster tanii tanii Bramlette and Riedel, 1954
Ceratolithus telesmus Norris, 1965
Biscutum? tenuiculum Okada and Thierstein, n. sp.
Cruciplacolithus tenuiforatus Clocchiatti and Jerkovic, 1970
Cruciplacolithus tenuis Hay and Mohler, 1967
Rhabdosphaera tenuis Bramlette and Sullivan, 1961
Umbellosphaera tenuis (Kamptner, 1937) Paasche in Markali and Paasche, 1955
Chiasmolithus titus Gartner, 1970
Toweius tovae Perch-Nielsen, 1971
Ceratolithus tricorniculatus Gartner, 1967
Discoaster trinidadensis Hay in Hay et al., 1967
Discoaster triradiatus Tan Sin Hok, 1927
Rhabdosphaera truncata Bramlette and Sullivan, 1961
Fasciculithus tympaniformis Hay and Mohler, 1967
Fasciculithus ulii Perch-Nielsen, 1971
Reticulofenestra umbilica (Levin, 1966) Martini and Ritzkowski, 1968
Discoaster variabilis Martini and Bramlette, 1963
Discolithina versa Haq, 1968
Helicosphaera wallichii (Lohmann, 1902) Okada and McIntyre, 1976

Cretaceous

Vagalapilla aachena Bukry, 1969
Tetralithus aculeus (Stradner, 1961) Gartner, 1968
Lithraphidites alatus Thierstein, 1972
Podorhabdus albianus Black, 1967
Hayesites albiensis Manivit, 1971
Cretarhabdus angustiforatus (Black, 1971) Bukry, 1973
Parhabdolithus angustus (Stradner, 1963) Stradner, Adamiker and Maresch, 1968
Reinhardtites anthophorus (Deflandre, 1959) Perch-Nielsen, 1968
Parhabdolithus asper (Stradner, 1963) Manivit, 1971
Watznaueria barnesae (Black, 1959) Perch-Nielsen, 1968
Flabellites biforaminis Thierstein, 1973
Braarudosphaera bigelowii (Gran and Braarud, 1935) Deflandre, 1947
Watznaueria biporta Bukry, 1969
Discorhabdus biradiatus (Worsley, 1971) Thierstein, 1973
Lithraphidites bollii (Thierstein, 1971) Thierstein, 1973
Watznaueria britannica (Stradner, 1963) Reinhardt, 1964
Lithraphidites carniolensis Deflandre, 1963
Lucianorhabdus cayeuxii Deflandre, 1959
Cruciellipsis chiastia (Worsley, 1971) Thierstein, 1972
Markalius circumradiatus (Stover, 1966) Perch-Nielsen, 1968
Bipodorhabdus colligatus (Black, 1971) Thierstein, 1976
Nannoconus colomi (de Lapparent, 1931) Kamptner, 1938
Watznaueria communis Reinhardt, 1964
Vagallapilla compacta Bukry, 1969
Cretarhabdus conicus Bramlette and Martini, 1964
Biscutum constans (Górka, 1957) Black, 1967
Cretarhabdus coronadventis Reinhardt, 1966a
Prediscosphaera cretacea (Arkhangelsky, 1912) Gartner, 1968
Cruciellipsis cuvillieri (Manivit, 1966) Thierstein, 1971
Arkhangelskiella cymbiformis Vekshina, 1959
Microrhabdulus decoratus Deflandre, 1959
Podorhabdus decorus (Deflandre, 1954) Thierstein, 1972
Octopodorhabdus decussatus (Manivit, 1959) Manivit, 1971
Cyclagelosphaera deflandrei (Manivit, 1966) Roth, 1973
Podorhabdus dietzmannii (Reinhardt, 1965) Reinhardt, 1967
Zygodiscus diplogrammus (Deflandre, 1954) Gartner, 1968
Cribrosphaerella ehrenbergii (Arkhangelsky, 1912) Deflandre, 1952
Zygodiscus elegans Gartner, 1968 emend. Bukry, 1969
Parhabdolithus embergeri (Noël, 1958) Stradner, 1963
Broinsonia enormis (Shumenko, 1968) Manivit, 1971
Corollithion exiguum Stradner, 1961
Reinhardtites fenestratus (Worsley, 1971) Thierstein, 1972
Lithastrinus floralis Stradner, 1962
Scapholithus fossilis Deflandre, 1954
Nephrolithus frequens Górka, 1957
Marthasterites furcatus (Deflandre, 1954) Deflandre, 1959
Tranolithus gabalus Stover, 1966
Tetralithus gothicus Deflandre, 1959
Lithrapidites helicoideus (Deflandre, 1959) Deflandre, 1963
Sollasites horticus (Stradner, Adamiker and Maresch, 1966) Black, 1968
Parhabdolithus infinitus (Worsley, 1971) Thierstein, 1972
Assipetra infracretacea (Thierstein, 1973) Roth, 1973
Stephanolithion laffittei Noël, 1957
Broinsonia lata (Noël, 1969) Noël, 1970
Diazomatolithus lehmanii Noël, 1965
Chiastozygus litterarius (Górka, 1957) Manivit, 1971
Kamptnerius magnificus Deflandre, 1959
Rucinolithus magnus Bukry, 1975
Tetralithus malticus Worsley, 1971
Cyclagelosphaera margerelii Noël, 1965
Vagalapilla matalosa (Stover, 1966) Thierstein, 1971
Conusphaera mexicana Trejo, 1969
Micula mura (Martini, 1961) Bukry, 1973
Zeugrhabdotus noelae Rood, Hay, and Barnard, 1971
Gartnerago obliquum (Stradner, 1963) Noël, 1970
Calcicalathina oblongata (Worsley, 1971) Thierstein, 1971
Tetralithus obscurus Deflandre, 1959
Micrantholithus obtusus Stradner, 1963
Vagalapilla octoradiata (Górka, 1957) Bukry, 1969
Tranolithus orionatus (Reinhardt, 1966a) Reinhardt, 1966b
Broinsonia orthocancellata Bukry, 1969
Broinsonia parca (Stradner, 1963) Bukry, 1969
Manivitella pemmatoidea (Deflandre ex Manivit, 1965) Thierstein, 1971
Lithraphidites quadratus Bramlette and Martini, 1964
Hayesites radiatus (Worsley, 1971) Thierstein, 1975
Parhabdolithus regularis (Górka, 1957) Bukry, 1969
Corollithion rhombicum (Stradner and Adamiker, 1966) Bukry, 1969
Discorhabdus rotatorius (Bukry, 1969) Thierstein, 1973
Broinsonia signata (Noël, 1969) Noël, 1970
Corollithion signum Stradner, 1963
Prediscosphaera spinosa (Bramlette and Martini, 1964) Gartner, 1968
Zygodiscus spiralis Bramlette and Martini, 1964
Parhabdolithus splendens (Deflandre, 1953) Noël, 1969
Micula staurophora (Gardet, 1955) Stradner, 1963
Tegumentum stradneri Thierstein, 1972

Vagalapilla stradneri (Rood, Hay and Barnard, 1971) Thierstein, 1973
Cretarhabdus surirellus (Deflandre, 1954) Reinhardt, 1970
Eiffellithus trabeculatus (Górka, 1957) Reinhardt and Górka, 1967
Tetralithus trifidus (Stradner, 1961) Bukry, 1973
Eiffellithus turriseiffeli (Deflandre, 1954) Reinhardt, 1965
Tubodiscus verenae Thierstein, 1973
Rucinolithus wisei Thierstein, 1971
Cylindralithus spp.

BIOSTRATIGRAPHY

The Cenozoic nannofossil zones and subzones used in this paper are essentially those of Bukry (1973, 1975), except for further subdivision of his *Cruciplacolithus tenuis* Zone (lower Paleocene) into three independent zones following Martini's (1970, 1971) standard zonation. The lower boundaries of these three zones of the lowermost Cenozoic (*Cruciplacolithus tenuis* Zone, *Chiasmolithus danicus* Zone, and *Ellipsolithus macellus* Zone) are defined by the first occurrences of *Cruciplacolithus tenuis, Chiasmolithus danicus*, and *Ellipsolithus macellus*, respectively.

The Mesozoic biostratigraphy is based on the ranges given by Thierstein (1973, 1975).

Table 1 shows the biostratigraphic subdivisions used and the correlated intervals recovered at the various Leg 43 sites.

SITE SUMMARIES

Site 382 (Tables 2A and 2B)

(Eastern flank of Nashville Seamount, 34°25,04′N, 56°32.25′W, water depth 5526 m, penetration 520.5 m, 25 cores recovered.)

Quaternary to upper Miocene and Campanian nannofossils were recovered at this site. Preservation is moderate to poor except in Core 1 where it is good.

Cenozoic

All sections of Core 1 contain moderately rich, well-preserved Pleistocene assemblages of nannofossils. Absence of *Emiliania huxleyi, Emiliania ovata*, and *Pseudoemiliania lacunosa* in this core indicates late Pleistocene age (*Ceratolithus cristatus* Subzone). Abundant occurrences of moderately preserved *Gephyrocapsa oceanica, e. ovata*, and *P. oacunosa* in Cores 2 to 4 define the middle to upper Pleistocene (*Emiliania ovata* Subzone). The upper three sections of Core 5 contain abundant to common, moderately well preserved upper Pliocene assemblages. The only *Discoaster* species in Core 5, Section 1, is *D. brouweri*, suggesting an uppermost Pliocene date (*Cyclococcolithus macintyrei* Subzone). Sections 2 and 3 of Core 5 contain *Discoaster tamilis* with several other *Discoaster* species and thus are assigned to the *Discoaster tamalis* Subzone. Many samples in these five cores contain very abundant moderately well preserved upper Cretaceous nannofossils. These reworked nannoliths are presumably derived from the slope of Nashville Seamount. The interval between Core 5, Section 4, and Sample 6, CC is barren of nannofossils. Portions of Cores 7 and 8 contain abundant to few poorly preserved assemblages of the upper Miocene *Discoaster quinqueramus* Zone. No reworked Cretaceous fossils were observed in these cores. Cores 9 through 15 contain barren greenish clays.

Mesozoic

The occurrence of *Tetralithus aculeus* in the upper half of Core 16 is indicative of the upper Campanian. Its absence in otherwise similar assemblages below, (down to Core 23), suggests that this interval is lower Campanian. Preservation deteriorates rapidly below Core 17.

TABLE 2A
Neogene Distribution of Calcareous Nannofossils at Site 382

Age	Nannofossil Zone or Subzone	Core (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Reworking	*Ceratolithus cristatus*	*Ceratolithus rugosus*	*Ceratolithus tricorniculatus*	*Coccolithus eopelagicus*	*Coccolithus pelagicus*	*Crenalithus doronicoides*	*Crenalithus productellus*	*Cyclococcolithus leptopora*	*Cyclococcolithus macintyrei*	*Discoaster asymmetricus*	*Discoaster berggrenii*	*Discoaster braarudii*	*Discoaster brouweri*	*Discoaster challengeri*	*Discoaster intercalaris*	*Discoaster loeblichii*	*Discoaster pentaradiatus*	*Discoaster quinqueramus*	*Discoaster surculus*	*Discoaster tamalis*	*Discoaster triradiatus*	*Discoaster variabilis*	*Discolithina japonica*	*Emiliania ovata*	*Gephyrocapsa caribbeanica*	*Gephyrocapsa oceanica*	*Helicosphaera carteri*	*Helicosphaera wallichii*	*Neosphaera coccolithomorpha*	*Pseudoemiliania lacunosa*	*Reticulofenestra pseudoumbilica*	*Rhabdosphaera clavigera*	*Scyphosphaera apsteinii*	*Thoracosphaera saxea*	*Umbilicosphaera sibogae*
Pleistocene	*Ceratolithus cristatus*	1-1, 79-80	51.26	C	G E-1	C					C	A	C	C	F																C	A						F			C
		1, CC	59.70	C	G						C	A	A	C	F																C	A						F			F
	Emiliania ovata	2-2, 49-50	109.20	F	M E-1	C	F				C	A	C	C	F															A	C	C			F	A					F
		3, CC	183.00	F	M E-1	D					F	A		F																A	F	C			F	A					
		4, CC	211.50	F	M E-1	D					F			C																A	F	C			F	A	F				
U. Pliocene	*C. macintyrei*	5-1, 62-63	231.63	C	M E-1			R			C	A		C	F				R										F	A			C		F	A				R	C
	Discoaster tamalis	5-2, 16-17	232.67	A	M E-1	C	R	R	R		F	A		C	C	R			C				F		F	R	F		R	C			F	F	F	A	R	R	R	R	F
		5-3, 37-38	234.38	A	M E-1		R				C	A		C	F	F			A				C		F	F	R			C			R			C					
U. Miocene	*Discoaster quinqueramus*	7-1, 55-56	269.91	A	P E-2					F	A			C	C	F	C	C	A	R	F	C	R	F	F		C	A					C	F							
		8-2, 53-54	281.09	C	P E-3						F			F	F	F	C	C	A	R	F	F	F	C			C	A									F				
		8-6, 55-56	282.61	F	P E-3												F	C	A		C						C	A													

Note: Distribution Chart: A = abundant (more than 10% of total Cenozoic forms); C = common (more than 1% and less than 10% of total Cenozoic forms); F = few (more than 0.1% and less than 1% of total Cenozoic forms); R = rare (less than 0.1% of total Cenozoic forms). Abundance: A = abundant, C = common; F = few; R = rare. Preservation: G = good; M = moderate; P = poor see Roth [1974], p. 970 for explanation of preservation). Reworking: D = dominant (>50% reworked Mesozoic specimens); A = abundant (5-50% reworked Mesozoic specimens; C = common (1-5% reworked Mesozoic specimens); F = few (0.1-1% reworked Mesozoic specimens, R = rare (<0.1% reworked Mesozoic specimens).

TABLE 2B
Distribution of Mesozoic Nannoliths at Site 382

Age	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Etching	Overgrowth	*V. aachena*	*T. aculeus*	*P. angustus*	*Z. anthophorus*	*P. asper*	*W. barnesae*	*L. carniolensis*	*L. cayeuxii*	*V. compacta*	*C. conicus*	*B. constans*	*P. cretacea*	*A. cymbiformis*	*M. decoratus*	*P. decorus*	*Z. diplogrammus*	*C. ehrenbergi*	*Z. elegans*	*P. embergeri*	*B. enormis*	*C. exiguum*	*E. eximius*	*S. fossilis*	*L. helicoideus*	*S. laffittei*	*C. litterarius*	*R. magnus*	*V. matalosa*	*G. obliquum*	*V. octoradiata*	*T. orionatus*	*B. parca*	*M. pemmatoidea*	*P. regularis*	*D. rotatorius*	*C. signum*	*P. spinosa*	*Z. spiralis*	*P. splendens*	*M. staurophora*	*T. stradneri*	*V. stradneri*	*C. surirellus*
Late Campanian	16-3, 83	358.63	A	G	1	1		C	R	R		A	F		F	F	C	A	R	F	F	C	C	F		F		C		F	F	C	C		F	R	F	F	R	F	C	F	F		R	F	R	R	C
Early Campanian	17-1, 136	365.36	A	G	1	1	R			F		C	C	F	F	F	F	A		R	F	C	C	F	F			F	R	F	F	C		R	R	R	F	F	F	F	F	F	F	F	F	C	F	F	C
	17-4, 96	369.86	A	G	1	1				F	F	A	C			F	C	A		F		C	C		R		R	F		F	F	C			R	F	F	F	F	F	C	F	R			C		F	A
	18-2, 91	376.21	A	M	2	1						A	F				C	A		F		F	C		F	F		R			F	A			R	R	F	C	F	F		F		F		F			A
	20-4, 36	407.16	C	M	2	1						A	F		F		R	A				F	F					R			F	F			R		F	F								C			C
	20-5, 107	409.37	F	P	3	2						A				R		A		R		R										F						F	R							A			A
	21-2, 108	414.28	R	P	3	1						A										F										R						F	R							A		R	F
	21-3, 108	415.78	R	P	3	1						A																					R					C	F							A			
	23-1, 133	470.23	F	P	3	1						A	F					C				R	R	F								C						C	F							C			
	23-2, 37	470.77	F	P	3	2						F						R																				R	R							R			R
	23-3, 55	472.45	R	P	3	3						R																																		R			

Note: Distribution chart: A = abundant (more than 100% of total nannolith assemblages); G = common (more than 1% and less than 10%); F = few (more than 0.1% and less than 1%); R = rare (less than 0.1%). Abundance : A = abundant; C = common; F = few; R = rare. Preservation: G = good; M = moderate; P = poor. Etching and overgrowth: 1 = little; 2 = moderate; 3 = strong.

The Mesozoic nannofloras recovered at this site, drilled near the southeasternmost seamount of the Kelvin chain, indicate that the latest volcanic activity of Nashville Seamount took place during the early Campanian (about 77 m.y. ago). The nannoliths in Core 23 (unit 3F, volcanogenic variegated siltstone, claystone, and sandstone) are early (Campanian age (i.e., 77-82 m.y. old; Thierstein, 1976). On the basis of the lowermost occurrences of *Tetralithus aculeus* (358.63 m sub-bottom depth) and *Broinsonia parca* (470.77 m sub-bottom depth) a minimum accumulation rate (ignoring compaction) of 22.5 m/m.y. can be calculated for this interval using the time scale proposed by Thierstein (1976).

The lithologic evidence for sediment transport observed in Cores 17 through 23 is confirmed by the poor preservation of the nannofossils only. No reworking of pre-Campanian taxa was observed.

Site 383

(Sohm Abyssal Plain, 39°14.88′N, 53°21.18′W, water depth 5277 m, penetration 120.3 m, 1 core recovered.)

Only one core consisting of very coarse to fine sand was recovered at this site. Abundant *Emiliania huxleyi* and *Gephyrocapsa oceanica* with other well-preserved common placoliths indicate the uppermost Pleistocene or Holocene. A few reworked Late Cretaceous nannoliths are also present, including *Cretarhabdus conicus, Micula staurophora*, and *Zygodiscus diplogrammus.*

Site 384 (Tables 3A, 3B, and 3C)

(*J*-Anomaly Ridge, 40°21.65′N, 51°39.80″W, water depth 3910 m, penetration 330.3 m, 22 cores recovered.)

The first 15 cores at this site were taken continuously from 51 to 193 meters and represent a lower Maestrichtian to middle Eocene sediment sequence with a major hiatus in the lower Eocene.

Cenozoic

The top of Core 1 yields few *Discoaster bifax* and rare *Reticulofenestra umbilica*, indicating the middle Eocene (*D. bifax* Subzone). The lower portion of Core 1, Section 1, through the upper half of Core 4, Section 6, contain assemblages of the *Nannotetrina fulgens* Zone. The lowermost occurrence of *Chiasmolithus gigas* is recognized in Sample 3, CC. Therefore, Core 4 belongs to the *Discoaster strictus* Subzone. Samples from the interval between Samples 4-6, 144 cm, and 5-1, 50 cm, yield common *Rhabdosphaera inflata*, characteristic of the upper lower Eocene *R. inflata* Subzone. Rare *N. fulgens* are interpreted as downward contaminants. Assemblages of the *Discoasteroides kuepperi* Subzone occur in Samples 5-1, 125 cm, through 5-3, 40 cm. Abundant but poorly preserved nannofossils possibly representing the *Discoaster lodoensis* Zone occur in Samples 5-3, 140 cm and 5, CC. The interval between Core 6, Section 1, through Core 13, Section 3, represents an apparently complete sequence through the Paleocene. Nannofossils are abundant and generally well preserved in these cores, making possible a detailed study of evolutionary trends. At the very top of Core 6, Section 1, rare *Campylosphaera eodela* are recognized, thus indicating the presence of the uppermost Paleocene *C. eodela* Subzone at this site. This observation also suggests the presence of a hiatus of approximately four million years at the Paleocene-Eocene boundary between Cores 5 and 6. *Discoaster multiradiatus* consistently occurs above Sample 6-1, 110 cm, defining the base of *Chiasmolithus bidens* Subzone at this level. Assemblages of the characteristic *Discoaster nobilis* Zone occur in Samples 6-1, 150 cm, through 7-5, 60 cm. *Fasciculithus alanii* and *Discoaster* aff. *delicatus* appear in the upper part of this zone. *Cyclolithella robusta* becomes distinctively larger in the upper half of this zone. Samples from 7-6, 50 cm, to 8-3, 125 cm, yield assemblages of the upper middle Paleocene *Discoaster mohleri* Zone. *Ellipsolithus distichus* becomes distinctively different from *Ellipsolithus macellus* in the upper portion of this zone. *Heliolithus kleinpellii* suddenly disappears in the middle of this zone. The first consistent occurrence of *Heliolithus kleinpelli* in Sample 8, CC marks the base of the *H. kleinpellii* Zone. *Heliolithus conicus* and *Sphenolithus anarrhopus* also first occur at the base of this zone. *Fasciculithus tympaniformis* and *Fasciculithus ulii* become common members of the flora in Sample 10-2, 120 cm, indicating the base of the middle Paleocene *F. tympaniformis* Zone. *Toweius*

TABLE 3A
Eocene Distribution of Calcareous Nannofossils at Site 384

Age		Nanno-Fossil Zone or Subzone	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	*Bramletteius serraculoides*	*Campylosphaera dela*	*Chiasmolithus consuetus*	*Chiasmolithus expansus*	*Chiasmolithus gigas*	*Chiasmolithus grandis*	*Chiasmolithus solitus*	*Chiasmolithus titus*	*Chiphragmalithus acanthoides*	*Chiphragmalithus calathus*	*Coccolithus aff. crassus*	*Coccolithus cribellum*	*Coccolithus eopelagicus*	*Coccolithus pelagicus s. l.*	*Cruciplacolithus staurion*	*Cruciplacolithus tenuiforatus*	*Cyclicargolithus floridanus*	*Cyclicargolithus pseudogammation*	*Cyclococcolithus formosus*	*Cyclococcolithus gammation*	*Cyclococcolithus kingii*	*Cyclolithella kariana*	*Cyclolithus bramlettei*	*Discoaster barbadiensis*	*Discoaster binodosus*	*Discoaster bifax*	*Discoaster distinctus*	*Discoaster elegans*	*Discoaster lenticularis*	*Discoaster lodoensis*
Eocene	Middle	*D. bifax*	1-1, 24-25	51.05	A	M E-1 O-1	C	C	F			F	C					F	C	A	F		F	F	A			R	C	C		F			F	
		Coccolithus staurion	1-1, 109-110	51.90	A	M E-1 O-1	F	C	F	R		C	F					F	C	A	C		R	C	A			F	C	C					F	
			1-2, 49-50	52.80	A	M E-1 O-1	F	C		R	R	C	C					F	C	A	C			F	C			R	F	C					F	
		Chiasmolithus gigas	1-3, 49-50	54.30	A	M E-1 O-1	F	C		F	F	C	C	F				F	C	A	C			C	A		C	R	C	C	R				F	
			1, CC	59.80	A	G O-1	F	C		F	F	F	F	F				F	F	A	F			F	C		C	F	C	C	R					
			2-1, 49-50	61.22	A	G O-1	F	C		F	F	C	C	F				F	C	A	C			C	A		F	R	F	C					F	
			2-2, 49-50	62.72	A	G O-1	F	C		F	F	C	C	F				F	C	A	F			C	C		F	R	F	C			F		F	
			2-3, 49-50	64.22	A	M E-1 O-1	R	C	R	F	F	C	C	F				F	F	A	F			C	A		R	R	C	C			F		F	
			2-4, 49-50	65.72	A	M E-1 O-1	R	F	R	F	F	C	C	C				F	F	A	F	R		A	A			R	C	C			F		F	
			2-5, 49-50	67.22	A	M E-1 O-1		F	F	F	F	C	C	C				F	C	A	F			C	C	R	R	R	C	C			F		F	
			2-6, 49-50	68.72	A	M E-1 O-1		R	R	F	F	F	C	C				F	F	A	F			A	A			R	C	C	F		F	R		
			3-1, 49-50	70.50	A	M E-1 O-1		F	F	F	F	C	C	C				F	F	A	F			A	C			R	F	C	F		F	R	F	
			3, CC	79.00	A	M E-1 O-1		F	C	F	F	C	C	C				F	F	A	F	F		C	C			R	C	C	F		F	F	F	
		Discoaster strictus	4-1, 54-55	80.47	A	M E-1 O-1		F	C	F		F	C	F				R	R	A	F	F		C	C			F	F	C	R		F	F	F	
			4-2, 45-46	81.88	A	M E-1 O-1		F	C	F		F	C	C				R	R	A	F	F		C	C			R	F	C	F		R	F	F	R
			4-3, 49-50	83.42	A	M E-1 O-1		R	C	F		C	C	F				R	F	A	F	F		C	C	R		F	F	C	R		F	R	F	R
			4-4, 49-50	84.92	A	M E-1 O-1		R	C	F		F	C	F				R	R	A	F	F		C	A	R		F	F	C	F		R	R	F	R
			4-5, 49-50	86.42	A	M E-1 O-2		R	F	C		F	C	F				R	F	A	F	F		A	A	F		R	C	C	F			R	R	R
			4-6, 49-50	87.92	A	M E-1 O-2		F	F	F		F	C	F				R	F	A	F	F		A	C	F	R	F	C	C	F		R	F	F	F
	Lower	*R. inflata*	4-6, 143-144	88.86	A	M E-1 O-2		F	F	F		F	C	F	F	F		R	C	A	R	F		A	A	C		F	C	C	F			R	R	F
			5-1, 49-50	89.50	A	M E-1 O-2		F	F	R		C	A	F	F	F		F	F	A	R			A	A	C		F	C	C	C			F	F	F
		Discoaste-roides kuepperi	5-1, 124-125	90.25	A	M E-1 O-2		C	F	R		F	C	F	F	F		F	F	A		R		A	C	C		F	F	C	F			R	R	C
			5-2, 54-55	91.05	A	M E-1 O-2		C	F	R		C	C	F	F	F		F	C	A				A	C	C		F	F	C	C				F	F
			5-2, 119-120	91.70	A	M E-1 O-2		C	F	R		F	C	F	F	F		F	F	A				A	A	C		F	F	C	F				F	F
			5-3, 39-40	92.40	A	M E-1 O-2		C	F			C	C	F	F	F	R	C	C	A				A	A	C		F	F	C	F				F	F
		Discoaster lodoensis	5-3, 139-140	93.40	A	P E-2 O-2		C	F			F	C	F			F	C	C	A				C	A	C		C	C	C	F			R	F	A
			5, CC	98.00	A	P E-2 O-2		C	F			F	C	F			F	C	C	A				F	C	C		C	C	C	F					A

Note: Distribution chart: A = abundant (more than 10% of total Cenozoic forms); C = common (more than 1% and less than 10% of total Cenozoic forms); F = few (more than 0.1% and less than 1% ot total Cenozoic forms); R = rare (less than 0.1% of total Cenozoic forms). Abundance: A = abundant; C = common; F = few; R = rare. Preservation: G = good; M = moderate; P = poor (see Roth [1974], p. 970 for explanation of preservation). Reworking: D = dominant (50% reworked Mesozoic specimens); A = abundant (5-50% reworked Mesozoic specimens) C = common (1-5% reworked Mesozoic specimens); F = few (0.1-1% reworked Mesozoic specimens) R = rare (0.1% reworked Mesozoic specimens).

eminens and *T. tovae* first occur in the middle part of this zone. *Chiasmolithus californicus* and *Fasciculithus* aff. *richardii* first consistently occur in the lower part of this zone. *E. macellus* occurs first in Core 12, Section 2, thus enabling the assignment of the interval between Samples 10-3, 50 cm, and 12-2, 52 cm, to the upper lower Paleocene E. *macellus* Zone. The earliest evolving members of the genera *Fasciculithus* and *Sphenolithus, F. pileatus* and *S. moriformis*, have their lowermost occurrences within this zone. *Chiasmolithus bidens, C. consuetus, Cruciplacolithus subrotundus*, and *Toweius craticulus* also occur first within this zone. Assemblages of the *Chiasmolithus danicus* Zone occur in Samples 12-2, 110 cm, to 12-6, 50 cm. *Prinsius bisulcus* first occur in the middle part of this zone. The nannoflora of the lower half of this zone is characterized by the dominance of the very small placolith species *Biscutum? tenuiculum*, which constitutes more than 90 per cent of the nannoflora in some samples. Rare but consistent occurrences of reworked Cretaceous forms are also recognized through the entire portion of this zone and the lower half of the overlying zone. *Cruciplacolithus tenuis* first occurs in Sample 13-3,32 cm. Thus, the interval between Samples 13-3, 32 cm, and 12-6, 110 cm, is assigned to the *Cruciplacolithus tenuis* Zone of the lowermost Paleocene. The two ubiquitous Paleocene species *Coccolithus pelagicus* and *Ericsonia subpertusa* first occur in the middle of this zone. Another characteristic Paleocene species, *Neochiastozygus concinnus*, appears in the lower portion of this zone. Reworked Cretaceous fossils become more abundant downward and dominate the Cenozoic specimens below Sample 13-3, 8 cm.

Mesozoic

The Cretaceous-Tertiary boundary was recovered in Section 3 of Core 13, and appears to be continuous (see Thierstein and Okada, this volume). The Maestrichtian assemblage becomes replaced by the Danian assemblage within less than 1 meter of sediment thickness. Abundance and preservation of the nannoliths are remarkable throughout the transition. A complete Maestrichtian nannofossil sequence is present below: upper Maestrichtian: Samples 13-3 36 cm, to 13, CC; middle Maestrichtian: Core 14, Section 1, to Core 15, Section 3; lower Maestrichtian: Core 15, Section 4, to Sample 15, CC. Nannoliths are abundant and well-preserved throughout. High latitude *Nephroli-*

TABLE 3A – *Continued*

Age		Nanno-Fossil Zone or Subzone	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	*Discoaster saipanensis*	*Discoaster sublodoensis*	*Discoaster tanii ornatus*	*Discoaster tanii tanii*	*Discoasteroides kuepperi*	*Discolithina rimosa*	*Discolithina segmenta*	*Ellipsolithus aff. lajollaensis*	*Helicosphaera compacta*	*Helicosphaera lophota*	*Helicosphaera seminulum*	*Lophodolithus mochlophorus*	*Markalius astroporus*	*Nannotetrina fulgens*	*Neochiastozygus concinnus*	*Neococcolithus dubius*	*Reticulofenestra dictyoda*	*Reticulofenestra samodurovii*	*Reticulofenestra umbilica*	*Rhabdosphaera inflata*	*Sphenolithus furcatolithoides*	*Sphenolithus moriformis*	*Sphenolithus radians*	*Striatococcolithus pacificus*	*Syracosphaera formosa*	*Thoracosphaera deflandrei*	*Thoracosphaera prolata*	*Tribrachiatus orthostylus*	*Triquetrorhabdulus inversus*	*Zygrhablithus bijugatus*
Eocene	Middle	*D. bifax*	1-1, 24-25	51.05	A	M E-1 O-1	C		R						F	F	R			R		F	F	A	R		C	C	F	F	A		R		F	F
		Coccolithus staurion	1-1, 109-110	51.90	A	M E-1 O-1	R		R						R	F			R	R		R	F	A			C	C	F	F	A	R			C	F
			1-2, 49-50	52.80	A	M E-1 O-1	R									R	R			F		R	F	A			C	C	R	F	C	R			C	F
		Chiasmolithus gigas	1-3, 49-50	54.30	A	M E-1 O-1	F									F	R	R	F	F		R	F	A			C	C	F	F	A	R	R		C	F
			1, CC	59.80	A	G O-1	F									F	R	R	R	F		R	C	A			C	C	F	R	C		R		F	C
			2-1, 49-50	61.22	A	G O-1	C		R	R						F		F	R	F		R	C	A			C	C	F	F	A		R		F	C
			2-2, 49-50	62.72	A	G O-1	C		F	F						R		F	R	F		R	C	A			C	C	F	R	C				F	F
			2-3, 49-50	64.22	A	M E-1 O-1	C		F	R	F		R			R	R	R	R	C		R	C	A			C	C	F	R	A		R		C	F
			2-4, 49-50	65.72	A	M E-1 O-1	C			R	F					R	R	R	R	F		R	C	A			C	C	F	R	A				C	F
			2-5, 49-50	67.22	A	M E-1 O-1	C				F		R			R		R	R	F		F	C	A			F	C	F	F	C				F	F
			2-6, 49-50	68.72	A	M E-1 O-1	C				F	R	R	R		R	R	R	R	F		F	C	A			F	F	F	F	A				F	C
			3-1, 49-50	70.50	A	M E-1 O-1	C				F		R			F		F	R	F		R	C	A			F	F	F	R	C				F	F
			3, CC	79.00	A	M E-1 O-1	F				F	R				F	R	R		F		F	C	A			F	F	F	F	C		R		F	C
		Discoaster strictus	4-1, 54-55	80.47	A	M E-1 O-1	F				F		R	F		F	R	R		F		F	C	A			F	F	C	R	C		R		C	C
			4-2, 45-46	81.88	A	M E-1 O-1	C	R			F	R		F		F	R	R		F		F	C	A		R	C	F	C	R	C	R			F	C
			4-3, 49-50	83.42	A	M E-1 O-1	F				F	R		R		F		R	R	F		F	C	A		R	F	C	F	R	C				C	C
			4-4, 49-50	84.92	A	M E-1 O-1	F	R			F		F	R		F	R	R	R	F		F	C	A			F	C	C	F	A				C	C
			4-5, 49-50	86.42	A	M E-1 O-2	F				F	R	R	F		F	R	R	R	F	F	F	A	A		R	F	C	F	R	A				C	C
			4-6, 49-50	87.92	A	M E-1 O-2	F				F	R		R		F		R		F	R	F	A	C		R	F	C	F	F	C				C	C
		R. inflata	4-6, 143-144	88.86	A	M E-1 O-2			C		F	R		F		C	R			R	F	F	A	F		C		F	F	F	A		R		F	C
			5-1, 49-50	89.50	A	M E-1 O-2			C		F		F	F		C		R	R	R	C	F	A	F		F		F	C	F	A				F	C
	Lower	*Discoasteroides kuepperi*	5-1, 124-125	90.25	A	M E-1 O-2			C		C	F				C		R	R		F	F	A	R				C	C	F	C				F	F
			5-2, 54-55	91.05	A	M E-1 O-2			F		F	R		R		C	F		R		F	F	A					C	C	F	C		R		F	F
			5-2, 119-120	91.70	A	M E-1 O-2			F		F	R				C	F		R		F	F	A					C	C	F	A				F	C
			5-3, 39-40	92.40	A	M E-1 O-2			F		F	R		R		F	F	F	R		F	F	C					C	C	F	A				F	C
		Discoaster lodoensis	5-3, 139-140	93.40	A	P E-1 O-2					C	R					R		R			F	F					F	C	F	A			R	R	C
			5, CC	98.00	A	P E-1 O-2					C	R		R			R		F			C	R					C	C	F	C	F		C	R	C

thus frequens and low latitude *Micula mura* occur together and have identical stratigraphic ranges in the upper Maestrichtian interval. A few poorly preserved nannofossils were observed in Core 16, Section 1; their range is within the Coniacian to Santonian stages. No nannofossils were found in smear slides from deeper cores.

Site 385 (Table 4)

(North flank of Vogel Seamount, 37°22.17′N, 60°09.45′W, water depth 4936 m, penetration 392.9 m, 24 cores.)

Cenozoic

The 15-cm-thick calcareous ooze in Core 1, Section 1, contains abundant and well-preserved *Emiliania huxleyi* together with common upper Quaternary placoliths of the *E. huxleyi* Zone. A few reworked Upper Cretaceous specimens were also observed. Samples from the interval below, down to Core 11, Section 1, are barren of nannoplankton. Three samples from Core 11, Section 2, at 130, 135, and 140 cm, contain common but poorly preserved assemblages of the lowermost Paleocene *Cruciplacolithus tenuis* Zone, with *Cruciplacolithus primus, C. tenuis Markalius astroporus, Thoracosphaera* spp., and *Zygodiscus sigmoides.* Rare to few *Biantholithus sparsus* and abundant reworked Upper Cretaceous nannofossils were also observed. Abundant and moderately preserved nannofossils occur at 145 and 150 cm in Core 11, Section 2. The nannofossil assemblages in these two samples are very similar to those above at 130-140 cm, except for the absence of *C. tenuis.* This clearly indicates that these two samples belong to the lowermost part of the *C. tenuis* Zone.

Mesozoic

Core 12 and the first two sections of Core 13 contain moderately to strongly dissolved assemblages with abundant *Micula mura* (uppermost Maestrichtian). No *Nephrolithus frequens* were encountered.

The oldest recovered nannofossil assemblages in Core 13, from 241.0 meters sub-bottom depth, are middle Maestrichtian (approximately 66-68 m.y.B.P.). Below this, an interval of 70 meters of vitric silty clay with a basalt layer in its middle part overlies 70 meters of basaltic silty sand and 60 meters of volcaniclastic breccias. Using the minimum sediment accumulation rate calculated for the volcanogenic unit at Site 382, the top of the volcaniclastic breccias would be Campanian. The cessation of volcanic activity at this site thus appears to have occurred at about the same time as at Site 382, drilled at the southeastern end of the Kelvin Seamount Chain.

Site 386 (Tables 5A, 5B, and 5C)

(Central Bermuda Rise, 31°11.21′N, 64°14.94′W, water depth 4782 m, penetration 973.8 m, 66 cores recovered.)

TABLE 3B
Paleocene Distribution of Calcareous Nannofossils at Site 384

Age	Nanno-Fossil Zone or Subzone	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Reworking	*Biantholithus sparsus*	*Biscutum ? aff. dimorphosum*	*Biscutum ? tenuiculum*	*Braarudosphaera bigelowii*	*Braarudosphaera discula*	*Braarudosphaera imbricata*	*Bramletteius* sp. 1	*Campylosphaera eodela*	*Chiasmolithus bidens*	*Chiasmolithus californicus*	*Chiasmolithus consuetus*	*Chiasmolithus danicus*	*Chiasmolithus* sp. 1	*Coccolithus eopelagicus*	*Coccolithus pelagicus* s. l.	*Crepidolithus* spp.	*Cruciplacolithus primus*	*Cruciplacolithus subrotundus*	*Cruciplacolithus tenuis*	*Cyclolithella robusta*	*Discoaster* aff. *delicatus*	*Discoaster lenticularis*	*Discoaster mohleri*	*Discoaster multiradiatus*	*Discoaster nobilis*	*Discoaster* sp. 1	*Discoaster* sp. 2	*Discolithina plana*	*Discolithina rimosa*	*Ellipsolithus distichus*	*Ellipsolithus macellus*
Paleocene, Upper	*C. eodela*	6-1, 14-15	98.75	A	M E-1 O-1									R	C	F	C		C	F	A	C			F		C	F	F	C	C			R		C	F
	Chiasmolithus bidens	6-1, 39-40	99.00	A	M E-1 O-1										C	F	C		C	F	A	C			F	F	F	F	F	A	C			R	F	C	C
		6-1, 74-75	99.35	A	M E-1 O-1										C	C	C		F	R	A	F			F	C	C	F	F	F	C	F	R	R	F	F	C
		6-1, 109-110	99.70	A	M E-1 O-1										F	C	C		F	R	A	F			F	C	C	F	F	F	F	F	R	F		F	F
	Discoaster nobilis	6-1, 149-150	100.10	A	M E-1 O-1										F	C	F		F		A	C			C	C	F	R	F		C	F	R	R	R	F	F
		6-2, 39-40	100.50	A	M E-1 O-1										F	C	C		F	R	A	F			C	C	F	R	F		F	F	F	R	R	F	C
		6-2, 109-110	101.20	A	M E-1 O-1										F	F	C		F		A	C			C	C			F		F	R	F			F	F
		6-3, 39-40	102.00	A	M E-1 O-1										F	F	C		F	R	A	C			C	C			F		C	F	F	R	R	C	F
		6-3, 99-100	102.60	A	M E-1 O-1											C	C		R	R	A	C			C	C			F		C	F	F		F	F	F
		6-4, 13-14	103.24	A	M O-1											C	C		F	R	A	C			C	C			F		C	C		R	R	R	C
		6-4, 109-110	104.20	A	M O-1										R	F	C		F		A	F			F	C			C		C	C			R	F	C
		6, CC	107.90	A	M O-1										F	C	C		C		A	F			C	F			C		C	C		R		F	C
		7-1, 69-70	108.70	A	M O-1										F	C	C		C		A	F			C	R			C		C	F		R	R	F	C
		7-2, 49-50	110.00	A	M O-1										F	C	C		C		A	F			F	R			C		C			R		F	F
		7-3, 49-50	111.50	A	M O-1										F	C	C		C		A	F			F	R			C		C			R		F	C
		7-4, 49-50	113.00	A	G										C	C	C		C		A	F			F	F			C		C			R		R	C
		7-5, 59-60	114.60	A	G										F	C	C		F		A	F			F	R			C		F					R	R
Paleocene, Middle	*Discoaster mohleri*	7-6, 49-50	116.00	A	G										C	C	C		F		A	F			F	R			C		R					R	F
		7-6, 109-110	116.60	A	G										C	C	C		C		A	F			C	R			C		R					R	C
		7, CC	117.30	A	G										C	C	C		C		A	R			C	F			C			R		R		R	C
		8-1, 99-100	118.30	A	G										C	C	C		C		A				C	F			C					F	R		C
		8-2, 49-50	119.30	A	M O-1										F	C	F		C		A	R			F	R			C					R			F
		8-2, 124-125	120.05	A	M O-1										C	C	C		F		A				F	R			C					F	R	R	C
		8-3, 49-50	120.80	A	M E-1 O-1										C	C	C		F		A	R			C	F			C					F			F
		8-3, 124-125	121.55	A	M E-1 O-1										F	C	F		F		A				C	R			F					R			F
	Heliolithus kleinpellii	8-4, 49-50	122.30	A	M E-1 O-1										C	C	C		F		A				C				R					F	R		F
		8-4, 129-130	123.10	A	M E-1 O-1										F	C	C	R	R		A				F									R			F
		8-5, 59-60	123.90	A	M E-1 O-1										F	C	C	R			A				F									R			R
		8-5, 149-150	124.80	A	M E-1 O-2										F	C	F				A				F	F											R
		8, CC	126.60	A	M E-1 O-2										F	C	C		R		A				F	F											R
	Fasciculithus tympaniformis	9-1, 4-5	127.48	A	M O-1										C	C	C	R			A			R	C	R								R		R	R
		9-1, 49-50	127.93	A	M E-1 O-1										F	C	C	R	R		A				C	R								R		R	F
		9-1, 124-125	128.68	A	M O-1										F	C	C	F	R		A			R	F												F
		9-2, 49-50	129.43	A	M O-1										F	F	C	F			A				F									R			F
		9-2, 124-125	130.18	A	M O-1										C	C	C	F			A				F												F
		9-3, 49-50	130.93	A	M O-1										F	C	C	F			A				F												R
		9-4, 59-60	132.53	A	M O-1								F		F	F	C	F			A			R	C												F
		9-5, 49-50	133.93	A	M O-1								F		F	C	C	F			A				C	R										R	F
		9-6, 49-50	135.43	A	M O-1		R						R		F	F	C	F			A				C									R		R	F
		9, CC	136.43	A	M O-1								R		F	F	C	F			A				C									R		R	R
		10-1, 45-46	136.86	A	M O-1								F		F	F	C	F			A				C									R			R
		10-2, 49-50	138.40	A	M O-1								F		F	R	C	F			A		R	R	C												R
		10-2, 119-120	139.10	A	M O-1								F		F	R	C	F			A			R	C	R											F
Paleocene, Lower	*Ellipsolithus macellus*	10-3, 49-50	139.90	A	M O-1								R		C		C	F			A			R	C									R	R		F
		10-4, 55-56	141.56	A	M O-1								R		C	R	C	C			A			F	C									R			R
		10-5, 54-55	142.95	A	M O-1	R		F					R		F		C	C			A		R	F	C	R											F
		10-6, 59-60	144.50	A	M O-1	R		C					F		F		C	C			A		F	F	C	R											F
		10, CC	145.70	A	M O-1	R		C	R				C		R		C	C			A		R	R	C												R
		11-1, 69-70	146.40	A	M O-1			A					F		R		C	C			A		F	R	C												F
		11-2, 43-44	147.64	A	M O-1			A					F		R		C	C			A		F	F	C												F
		11-3, 49-50	149.20	A	M E-1 O-1			A	R				C				F	C			A		F	F	C												R
		11-4, 49-50	150.70	A	M E-1 O-1	R		A	F				F				F	F			A		F	R	C										R		R
		11, CC	155.00	A	M E-1 O-1	R		A	F								F	C			A		F	R	C									R			R
		12-1, 79-80	155.80	A	M E-1 O-1	R		A	F								R	C			A		F		C												R
		12-2, 51-52	157.02	A	M E-1 O-1	R		C	F									C			A		F		C												R
	Chiasmolithus danicus	12-2, 109-110	157.60	A	M E-1 O-1	R		C	C				R					C			A		C		C												
		12-3, 29-30	158.30	A	M E-1 O-1	R		C	C				R					C			A		C		C												
		12-3, 109-110	159.10	A	M E-1 O-1	R		C	C									C			A		C		C												
		12-4, 49-50	160.00	A	G O-1	R		F	A									F			A		C		C												
		12-4, 119-120	160.70	A	M E-1	R		F	A									C			A		C		C												
		12-5, 54-55	161.55	A	G	R			A									F			A		C		C												
		12-5, 129-130	162.30	A	M E-1	R			A									F			A		C		C												
		12-6, 49-50	163.00	A	M E-1	R	R		A									F			A	R	C		C												
	Cruciplacolithus tenuis	12-6, 109-110	163.60	A	M E-1	R			A												A		C		A												
		12, CC	164.30	A	M E-1	F			A												A	R	A		C												
		13-1, 144-145	166.05	A	M E-1	F			F	R											A	F	A		A												
		13-2, 19-20	166.30	A	M E-1	F			F	R											A	F	A		A												
		13-2, 39-40	166.50	A	G	F	R		F	R		R									C	F	A		A												
		13-2, 59-60	166.70	A	M E-1	C	R		R	R		F									R	C	A		A												
		13-2, 79-80	166.90	A	M E-1	C	R			R	R	F										C	A		C												
		13-2, 99-100	167.10	A	M E-1	C				R	R	F										C	A		C												
		13-2, 117-118	167.28	A	M E-1	C	R			C	R	C										F	A		C												
		13-2, 133-134	167.44	A	M E-1	C	R			F	R	C										C	A		C												
		13-2, 145-146	167.56	A	M E-1 O-1	A			R	F	R	A										F	A		F												
		13-3, 7-8	167.68	A	M E-1 O-1	D	R			C	R	C										F	A		F												
		13-3, 19-20	167.80	A	M E-1 O-1	D	F		R	C	R	A										F	A		R												
		13-3, 31-32	167.92	A	M E-1 O-1	D	R			C	R	C										F	A		R												

Note: See Table 2A for explantion of symbols.

TABLE 3B – *Continued*

Ericsonia subpertusa s. l.	*Fasciculithus alanii*	*Fasciculithus crinatus*	*Fasciculithus hayi*	*Fasciculithus pileatus*	*Fasciculithus* aff. *richardii*	*Fasciculithus tympaniformis*	*Fasciculithus ulii*	*Fasciculithus* sp. 1	*Goniolithus fluckigeri*	*Heliolithus cantabriae*	*Heliolithus conicus*	*Heliolithus kleinpellii*	*Heliolithus riedelii*	*Markalius astroporus*	*Markalius* sp. 1	*Neochiastozygus concinnus*	*Neochiastozygus imbriei*	*Neochiastozygus junctus*	*Prinsius bisulcus*	*Sphenolithus anarrhopus*	*Sphenolithus moriformis*	*Toweius craticulus*	*Toweius eminens*	*Toweius tovae*	*Thoracosphaera deflandrei*	*Thoracosphaera operculata*	*Thoracosphaera saxea*	*Zygodiscus plectopons*	*Zygodiscus simplex*	*Zygodiscus sigmoides*
A	C	R	F		F	A									R	C		F	C		C	A	A	C	F			F		F
A	A	F	C		R	C									R	F		R	C		C	A	A	C	F			R		F
A	R	R	F		F	C							F		R	F		R	C	F	C	C	A	C	F			R		F
A	R	F	F		F	A							C		R	F		R	C	F	C	A	A	C	R			F		R
A	R	F	F		F	A							F			F			C	C	C	A	A	C	R					
A	R	R	F		F	C							C		R	F		R	C	C	A	C	A	C	F			R		R
A		F	F		F	C							F	R		F		R	C	C	A	A	A	C	F		R			F
A		R	R		F	C							F			F		R	C	C	C	A	C	C	F		R	R		F
A		R	R		C	C							R		R	C		R	C	C	C	A	A	C	F		R			F
A		F	R		F	C							F		R	C			C	C	A	A	A	C	R					F
A		R			F	C							R			F		R	C	C	C	A	C	F				R		F
A		R			R	C							R	R	R	F		R	C	C	C	A	A	F				R		F
A		R	R		R	C							R		R	F		F	C	C	C	A	C	C	R			R		C
A		R			R	C							F		R	F		F	C	C	C	A	C	C	R		R	F		F
A		F			F	C							R			F		F	C	C	C	A	C	C	R		R	F	F	C
A		F			R	C							F			F	R	F	C	C	C	A	C	C	F		R	R	C	A
A		F	R		F	C							F		R	F		F	C	C	C	A	C	C	R			R	F	C
A		F	R		F	C							R	R	R	F		F	C	C	C	A	A	C	R		R	R	C	C
A		R			F	C							R			R		R	C	C	C	C	C	C	R				F	C
A		R			F	C						C			R	R		R	C	C	C	A	C	C	R		R		F	C
A		F	R		R	C						F	F	R	R	F		R	C	C	C	C	C	C	F				F	C
A		R			F	C						C	R		R	F			C	C	C	C	C	C	R				F	C
A		R			F	C						F				F		R	C	C	C	C	C	C	F				C	A
A		R			C	C						F		R	R	F		R	C	C	C	A	C	C					C	A
A					F	C				R		C	R			F		R	C	C	C	A	C	C					C	A
A					F	C		R			F	A	F	R		R			C	C	C	A	C	C					F	C
A					R	C					R	C	F			R			C	C	C	A	C	C	R				F	A
A			R		F	C		R		R	F	C	R			R			C	F	C	A	C	C					C	A
A					F	C		R		R	R	C			R				C	C	A	C	C	C					C	C
A					C	C				R	F	C	F						C	F	A	C	C	C					F	C
A					C	C		R		R						R		R	F		C	C	F	C	R				F	C
A					F	C				R				R		R			A		C	C	R	C					F	C
A					C	C		R		R				F		R			A		C	C	R	C					C	C
A					C	C		R		R				F		R			C		A	C	R	C					C	C
A					F	C								R		F			C		A	C	R	C					F	C
A					F	C	F							F		F			A		C	C	R	C					F	F
A				C	C	C	F	R						F		C			A		A	C	R	C	R				F	C
A				C	F	C	C							F		C			A		A	C		F	F				C	C
A				C	R	C	C							F		C		R	A		A	C			F		R		C	C
A				C	R	C	C							R		F			A		A	C			F	R	R		F	C
A				F	R	C	C							F		F			A		A	C			R	R	R		F	C
A				F		F	C	R						F		C			A		C	C			R		R		F	C
A				F		C	C							R		C			A		C	C			R		R		F	C
A				R		R								F	R	C			A		C	C			F		F		F	C
A				R		R								F		C			A		C	C			F		F		F	C
A				R										F		C			A		F	C			F	R	F		F	C
A				R										F		C			A			C			F	R	R		F	C
A				R										F		C			A			C			C	R	F		F	C
A				R										R		C			C			C			F	F	F		F	C
A				R										R		F			C			F			F		F		F	C
A				R										R		F			C			F			F		R		F	C
A				R										F		C			C			F			C	R	F		F	C
A														F		F			C			R			F	R	F		F	C
A														F		F			C			R			F	R	F		F	C
A														F		C			C						F	F	F		F	C
A														F		C			F						F	F	F		F	C
A														F		F	R		F						F	F	F		R	C
A														F		F			F						F	R	R		R	C
A														F		F			R						F	F	F		R	C
A														F		F									F	R	F		R	C
A														F		R									R	R	F		R	C
A														F		R									R	R	F			C
A														F		F									R	R	C			C
A														F		F									F	F	F			C
A														F		C									C	F	F			C
A														F		C									F	F	F			C
C														C		C									C	C	F			C
R														C		C									C	C	F			C
									R					F		F									F	C	F			C
														F		R										F	R			C
														C		R										C	R			C
														C		R									F	C	F			A
									R					C											F	C	F			A
														C											F	C	C			A
														C											C	C	C			A
									R					A											F	A	C			A

TABLE 3C
Distribution of Mesozoic Nannoliths at Site 384

Age	Sample (Interval in cm)	Sub-Bottom Depth (m)	Abundance	Preservation	Etching	Overgrowth	*V. aachena*	*T. aculeus*	*P. angustus*	*Z. anthophorus*	*W. barnesae*	*L. carniolensis*	*L. cayeuxii*	*W. communis*	*V. compacta*	*C. conicus*	*B. constans*	*C. coronadventis*	*P. cretacea*	*A. cymbiformis*	*M. decoratus*	*P. decorus*	*O. decussatus*	*Z. diplogrammus*	*C. ehrenbergi*	*Z. elegans*	*P. embergeri*	*B. enormis*	*C. exiguum*	*L. floralis*	*N. frequens*
	13-3, 34	167.94	A	G	1	0	F	F			A	C			F		A		A	F	C				C		R				
	13-3, 35	167.95	A	G	1	0	F				A	C				F	A		A	F	C				C						
	13-3, 36	167.96	A	G	1	0	F	F	R		A	F		R		R	C		A	C	C				C		R				
	13-3, 38	167.98	A	G	0	0	F	F			A	C			C		A		A		C	R			C						R
	13-3, 40	168.00	A	G	0	0		F			A	C			F	R	C		A	C	C	F			C		R				F
	13-3, 42	168.02	A	G	1	0		F	R		A	C				F	C		A	C	C				C	R	F				F
	13-3, 44	168.04	A	G	1	0		F			A	C				F	A		A	C	C				C						F
	13-3, 46	168.06	A	G	1	1	R	F			A	C		R	R		C		A	C	C				C						F
	13-3, 48	168.08	A	G	1	0					A	C			F	R	A		A	C	C	R			C						F
	13-3, 50	168.10	A	G	1	1					A	C			F	R	A		A	C	C	F			C			R	R		
	13-3, 55	168.15	A	G	1	0	F	R			A	C			F		A		A	C	C	R			C						
Upper	13-3, 60	168.20	A	G	0	0		F			A	C			F		A		A	F	C	R			C	R	R				R
Maestrichtian	13-3, 70	168.30	A	G	0	0					A	C			F	R	A		A	F	C				C			F			
	13-3, 80	168.40	A	G	1	0					A	C			F	R	A		A	F	C				C					R	
	13-3, 90	168.50	A	G	1	1					A	C			F	F	C		A	F	C	R			C						
	13-3, 100	168.60	A	G	1	0					A	C			F	F	C		A	F	C				C		R	R			
	13-3, 110	168.70	A	G	1	0		R			A	C			R		C		A	C	C				C						
	13-3, 120	168.80	A	G	0	1					A	C				R	C		A	C	C	R			C			R			R
	13-3, 130	168.90	A	G	1	1		F			A	C			R	R	A		A	C	C	F			C						F
	13-3, 135	168.95	A	G	1	1	F	C			A	C				R	C		A	C	C				C						F
	13-4, 40	169.00	A	M	2	2	F	C			A	C				F	C	R	A	C	C				C						C
	13-5, 40	170.50	A	M	2	2		C		R	A	C					C		A	C	C				C						
	13-6, 40	172.00	A	G	1	1		C		F	A	C				F	C		A	C	C			R	C						F
	13, CC	173.60	A	G	1	1		C	R	R	A	C				F	C	R	A	C	C				C						
	14-1, 70	174.30	A	G	1	1		C		R	A	C			F	C	C		A	C	C				C		R	F			
	14-2, 40	175.50	A	G	1	1		F			A	C			F	F	C		A	C	C		R		C		F	C			
	14-3, 40	177.00	A	G	1	1	R	C			A	C			F	R	C		A	C	C				C			F			
	14-4, 60	178.70	A	G	1	1		C		R	A	C			F		C		A		C				C		R				
	14, CC	183.20	A	G	1	1		C			A	C			F		C		A	F	C				C		R	F			
Middle	15-1, 40	183.60	A	G	1	1		C			A	C			F	C	C		A	F	C			R	C						
Maestrichtian	15-2, 40	185.10	A	G	1	1		C			A	C	R		F	F	C	R	A	F	C			R	C		R	F			
	15-3, 40	186.60	A	G	1	1	F	C			A	A			F	F	A		A	F	C				C						
	15-4, 40	188.10	A	G	1	1		C			A	A				C	C		A	C	C				C		R	C			
	15-5, 40	189.60	A	G	1	1		C		R	A	C			F	F	A		A	C	C				C			F			
	15-6, 22	190.92	A	G	1	1		F		F	A	C			F	F	C		A	C	C	R		F	C			C			
	15, CC	192.70	A	G	1	1	R	F		R	A	C				F	C		A	C	C			C	C		F	C			
	16-1, 70	202.92	F	P	3	3													R												

Note: See Table 2B for explanation of symbols.

Most cores at this site (53 of 66) contain generally abundant nannofossils. Quaternary to Albian species assemblages are present.

Cenozoic

The upper five sections of Core 1 contain well-preserved Pleistocene assemblages. Sample 1-1, 130 cm, yields abundant *Emiliania huxleyi* with common *Pseudoemiliania lacunosa* and *Emiliania ovata*. The sediments in Core 1, Sections 1-3, are strongly disturbed. Sample 1-3, 35 cm, does not contain *E. huxleyi* and is assigned to the upper Pleistocene *E. ovata* Subzone. *Gephyrocapsa oceanica* is absent from Sections 4 and 5 of Core 1, indicating lower Pleistocene (*Gephyrocapsa caribbeanica* Subzone). Core 2, Section 1, with few moderately well preserved nannofossils, is assignable to the upper Miocene (*Discoaster quinqueramus* Zone). No nannoliths were found between Core 2, Section 5, and Sample 3, CC. Core 4, Section 1, contains abundant and moderately well preserved nannofossils of the lower Miocene *Sphenolithus hetermorphus* Zone. Sections 2 and 3 of Core 4 are again barren of nannofossils. The interval between Core 4, Section 4, and Sample 5, CC, contains abundant and moderately well preserved uppermost Oligocene to lowermost Miocene nannofossils (*Sphenolithus ciperoensis* and *Triquetrorhabdulus carinatus* zones). Cores 6 through 10 yield poorly preserved assemblages of the middle Oligocene *Sphenolithus predistentus* and *Sphenolithus distentus* zones. Abundant but poorly

TABLE 3C – *Continued*

M. furcatus	*T. gabalus*	*L. helicoideus*	*S. laffittei*	*C. litterarius*	*K. magnificus*	*C. margerelii*	*V. matalosa*	*M. mura*	*G. obliquum*	*T. obscurus*	*V. octoradiata*	*T. orionatus*	*B. parca*	*M. pemmatoidea*	*L. quadratus*	*P. regularis*	*D. rotatorius*	*B. signata*	*P. spinosa*	*Z. spiralis*	*P. splendens*	*M. staurophora*	*T. stradneri*	*V. stradneri*	*C. surirellus*	*E. trabeculatus*	*E. turriseiffeli*	*Cylindralithus* spp.	*C. danicus*	*M. astroporus*	*Z. sigmoides*	*Braarudosphaera* spp.	*Crepidolithus* spp.	*Thoracosphaera* spp.
		F	C	C		C		C			C			R	C	C	F		C	C	C	C		C	C		C	C		R	F	R		R
		C	C	C		F		C							C	C	F		C	C	F	C		C	C	F	C	C		R	F			R
			C	C		F		F			F				C	C	C		F	C	F	C		C	C		C	C			F			
		C	C	C		F		F							F	C	C		F	C	R	C		C	C		C	C			R			R
			C	C	R	C		C							C	C	C			C	R	C		F	C		C	C		R				
	R		F	C	R	R		C				R	R		C	C	F		C	C	F	C		C	C		C	C		R				
		C	C	C		R		C	R						C	C	C		C	C	F	C		C	C		C	C	R		R		R	
		C	C	C		R		F							C	C	C		F	C	C	C	R	F	C	R	C	C		R			F	R
		F	C	C		F		C							C	C	C		F	C	F	C		C	C		C	C		R				R
			C	C		F		F	R						C	C	C		F	C	F	C		F	C	F	C	C						
			C	C	F	F		F							C	C	C		C	C	C	C		C	C	F	C	C		R				R
	R	R	F	C	F	F		F							C	C	C		F	C	C	A		C	C	R	C	C						R
			F	C	R			F	R						C	C	C		C	C	F	A		C	C		C	C						
			C	C		F		C							C	C	F			C	C	C		F	C		C	C						
		R	C	C		R		C							C	C	F		R	C	C	A	R	F	C		C	C						
			C	C				C							C	C	F		F	C	C	C		F	C		C	C						
			F	C		R		F						R	C	C	F		C	C	F	A		R	C		C	C						
			C	C	R	C		C							C	C	F		F	C	F	A			C	R	C	C						
			C	C	R	C		C							C	C	F		F	C		A		F	C		C	F						
			C	C	F	F		C	R						C	C	C		C	C	F	A		F	C		C	C						
			C	C	F	F		C							C	C	C		F	C	C	A		C	C		C	C						
			F	C	F	F		C							C	C	F		F	C	F	A		F	C		C	C						
				F	R	F		F	F			R				C	F		C	C	C	A			A		C	C						
				F	R			F	F						F	C	F		F	C	C	A		R	C		C	C						
		R	R	C	F	F									F	C	C		F	C	C	C			C		C	C						
				C	F		R		R						C	C	F		C	C	F	A			C		C	F						
	R		R	C	R	F									C	C	F		C	C	C	A		R	C		C	C						
				C	R					R	F				C	C	C		C	C	C	C		F	A		C	C						
				C	F									R	F	C	C		F	C	C	C		F	C		C	C						
		F	R	C	F				F					F	R	C	C	R	C	C	C	C		F	A		C	C						
				F	R						F			R	R	C	C		F	C	C	C		F	C		C	C						
	R			C	R				F		R				R	C	C		F	C	C	C		C	C		C	C						
				C	F	F			F		F					C	C		C	C	C	C		C	C		C	C						
				C	F	R			R							C	C		C	C	C	C		C	C	R	C	C						
			F	C	F	F			F		R	F		R		C	C		C	C	C	C		F	C		C	C						
			R	C		F			F			R	F			C	C		F	C	C	C	F	F	C	R	C	C						
A																						A												

preserved assemblages of the lower Oligocene (*Coccolithus subdistichus* and *Cyclococcolithus formosus* Subzones occur between Core 11, Section 3, and Core 12, Section 3. Overgrown *Isthmolithus recurvus* occur in Core 12, Section 4, and Sample 12, CC indicating uppermost Eocene (*I. recurvus* Subzone). Core 13 yielded sparse and very poorly preserved nannofossils. This core probably belongs to either the *Discoaster saipanensis* Subzone or the *Chiasmolithus oamaruensis* Subzone (middle to upper Eocene).

Cores 14 through 34 represent a continuous sequence of uppermost Paleocene to upper middle Eocene. In these cores, nannofossils are mostly abundant and moderately well preserved. Reworked Cretaceous forms were also observed in many samples. Core 14 is assigned to the *Discoaster bifax* Subzone with both key species of the subzone, *Discoaster bifax* and *Reticulofenestra umbilica*, present. The assemblages in Cores 15 to 25 indicate the *Nannotetrina fulgens* Zone of the middle Eocene. Although scarce, *Chiasmolithus gigas* consistently occurs between Core 17, Section 1, and Core 18, Section 4, enabling the subdivision of this zone into three subzones. Cores 26 to 29 yielded assemblages of the upper lower Eocene (*Discoaster sublodoensis* Zone). The first occurrence of *Rhabdosphaera inflata* identifies the base of the *R. inflata* Subzone in Core 28, Section 2. The *Discoaster lodoensis* and *Tribrachiatus orthostylus* zones were recognized in Core 30 and Cores 31 and 32, respectively. Core 33 and Core 34, Section 2, yield assemblages of the lowermost Eocene *Discoaster diastypus* Zone. The disappearance of *Tribrachiatus contortus* in Section 3

TABLE 4
Distribution of Mesozoic Nannoliths at Site 385

Age	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Etching	Overgrowth	*T. aculeus*	*W. barnesae*	*L. carniolensis*	*C. conicus*	*B. constans*	*P. cretacea*	*A. cymbiformis*	*M. decoratus*	*Z. diplogrammus*	*C. ehrenbergii*	*B. enormis*	*S. laffittei*	*C. litterarius*	*C. margerelii*	*M. mura*	*M. pemmatoidea*	*L. quadratus*	*P. regularis*	*D. rotatorius*	*P. spinosa*	*Z. spiralis*	*P. splendens*	*M. staurophora*	*V. stradneri*	*C. surirellus*	*T. trifidus*	*E. turriseiffeli*	*Cylindralithus* spp.
Upper Maestrichtian	12-1, 100	213.50	A	M	2	0		A	C	R		A	C	C		C			F	C	C	R	C	C			C	F	A		C		F	C
	12-1, 149	213.99	A	M	2	0		A	C	F	F	A	C			C		R	F	C	C		C	F		R	C	F	A	R	C		F	C
	12-2, 15	214.15	A	P	3	0	F	A	C	R	R	A	C	R		F			F	C	C		F	F	R		C	F	A	R	C			C
	12, CC	222.00	A	M	2	0	C	A	C			A	C	R		C			C	C	C	F	F	F			F	C	A		C			C
	13-2, 90	234.00	A	M	2	0	C	A	C	R		C	C	F		F	F	R		C	C	R	F	F			F	F	A		C			C
Lower-Middle Maestrichtian	13-3, 26	234.86	A	M	2	0	C	A	C			A	C	C		C	F		C	C				C			C	F	A	R	C	R		C
	13-4, 145	237.55	A	M	2	1	C	A	C	C	R	A	C		R	C	C		R								F	C	A		C		R	C
	13, CC	241.00	A	P	3	0	C	A	C	F		C	F			F				F								F	C		C			

Note: See Table 2B for explanation of symbols.

of Core 33 marks the base of *Discoaster binodosus* Subzone. The lower sections of Core 34 contain nannofossils of the uppermost Paleocene *Campylosphaera eodela* Subzone. The top of Core 35, Section 1, contains moderately preserved nannofossils of the upper middle Paleocene *Discoaster mohleri* Zone. Sections 2 and 3 of Core 35 are barren of nannofossils.

Mesozoic

Micula mura, which characterizes the uppermost Maestrichtian, occurs in Section 4 of Core 35. Core 5 is middle Maestrichtian. Preservation of these assemblages is poor. Cores 36 through 44 are barren except for a moderately etched pre-Turonian assemblage in Section 4 of Core 44. Well-preserved Cenomanian nannoliths (including *Lithraphidites alatus*) alternate with moderately well preserved assemblages in Cores 45 through 49.

Upper Albian nannofossils of varying preservation are present in Cores 50 through 57. Cores 58 through 60 are middle Albian (*Prediscosphaera cretacea* Zone); Cores 61 through 64 are barren, but one sample (65-1, 130 cm) again contains a moderately well preserved nannofossil assemblage of the *Prediscosphaera cretacea* Zone. This assemblage dates the sediments only 3 meters above the underlying basalts at approximately 101 m.y.B.P. (Thierstein, 1976). Positive evidence for reworking of older nannoliths into the Albian through Cenomanian assemblages in Cores 44 through 64 is missing.

Site 387 (Tables 6A, and 6B)

(Western Bermuda Rise, 32°19.2′N, 67°40′W, water depth 5118 m, penetration 794.5 m, 50 cores recovered.)

Quaternary and middle Eocene through Lower Cretaceous nannofossils occur at this site. Preservation is generally moderate, and core recovery was rather poor.

Cenozoic

The uppermost 30 cm of Core 1 consist of pale brown calcareous clay. Well-preserved *Emiliania huxleyi* together with *Gephyrocapsa caribbeanica* and *Gephyrocapsa oceanica* are common in this interval, indicating uppermost Pleistocene to Holocene (*E. huxleyi* Zone). The remainder of Core 1 and Cores 2 through 7 are barren of nannofossils.

Cores 8 through 23 represent the lower to middle Eocene. Preservation of nannofossils in these cores is generally better with less overgrowth than in contemporaneous assemblages at Site 386. Core 8, Section 1, contains few *Discoaster bifax* and scarce *Reticulofenestra umbilica*, and is assigned to the *D. bifax* Subzone of the middle Eocene. Samples from 8, CC, down to Core 17 yield assemblages of the lower middle Eocene *Nannotetrina fulgens* Zone. As at Sites 384 and 386, *Chiasmolithus gigas* occurs frequently here, enabling the subdivision of this zone into three subzones. *Rhabdosphaera inflata* occurs in Cores 18 and 19, fixing these two cores as upper lower Eocene (*R. inflata* Subzone). Assemblages of the *Discoasteroides kuepperi* Subzone were recognized in Core 20. Sediments from Core 21 and from Core 22 to Core 23, Section 2, belong to the lower Eocene *Discoaster lodoensis* Zone and *Tribrachiatus orthostylus* Zone, respectively. Sections 3 and 4 of Core 22 contain common to abundant *Tribrachiatus bramlettei* and *Tribrachiatus contortus* and thus represent the lowermost Eocene *T. contortus* Subzone. Assemblages of the *Discoaster binodosus* Subzone were not recognized in Core 23. This may indicate a short hiatus within an otherwise complete lower to middle Eocene sequence Because the base of the *D. binodosus* Subzone is defined by the last occurrence of *T. contortus*, upward reworking of that species would make the identification of the subzone impossible. On the other hand, the presence of abundant *T. bramlettei* and *T. contortus* in Sample 23-2, 30 cm, and their absence in Sample 23-2, 107 cm, makes the presence of a short hiatus more likely than reworking. Cores 24 to 26 contain poorly to moderately preserved assemblages of the lower Paleocene *Ellipsolithus macellus* Zone. Although there are approximately 10 meters of uncored sediment between Cores 23 and 24, this unrecovered interval is obviously too thin to accommodate the entire sequence of middle to upper Paleocene. Thus, a hiatus is very likely between Cores 23 and 24. The unrecovered interval between Cores 26 and 27 and the barren sample at 134-137 cm in Section 1 of Core 27 presumably represent the earliest Danian.

Mesozoic

Core 27, Section 2, through Core 28 belong to the uppermost Maestrichtian *Micula mura* Zone with sporadic *Nephrolithus frequens* present. One poorly preserved assemblage of the uppermost Campanian/lower Maestrichtian *Tetralithus trifidus* Zone was encountered in Core 29, Section 2. Cores 30 through 37 are barren. The stratigraphic overlap of the ranges of *Lithraphidites bollii* and *Cruciellipsis cuvillieri* in Core 40, Section 2, dates it as middle Hauterivian. The interval between Cores 40 and 46 yields moderately to poorly preserved nannoliths of the upper Valanginian to lower Hauterivian. Middle Valanginian assemblages in Cores 47 and 48 are characterized by the overlap of the ranges of *Calcicalathina oblongata, Diadorhombus rectus, Tubodiscus verenae*, and *Rucinolithus wisei.* Abundant lower Valanginian nannoliths, including *Bipodorhabdus colligatus* are present in Core 49, Sections 2 through 5. The lowermost nannofossils in Sample 49, CC, and Core 50, Section 2, at 88 cm (sediment pocket in basalt) correlate with the upper Berriasian to lower Valanginian *Cretarhabdus angustiforatus* Zone. The best estimate for the age of the crust, which lies at the boundary between magnetic anomalies *M*-15 and *M*-16, is around 134 m.y. (Thierstein, 1976). The overall succession of Lower Cretaceous nannofossil assemblages at this site is very similar to that of Site 105 (Thierstein, 1975).

TAXONOMY

Only new species and possible new species are described in this chapter. All other nannoplankton species used in this report are listed in the introduction and have been described and illustrated in the literature.

Genus BISCUTUM Black, 1959

Biscutum? tenuiculum Okada and Thierstein n. sp.
(Plate 1, Figures 1, 2; Plate 9, Figures 1-8)

Descrption of coccosphere: Spherical to subspherical, consisting of approximately 20 to 40 partly interlocked placoliths. Size ranges from 4.5 to 7.0 μm along the longer axis.

Description of coccoliths: This is one of the smallest nannofossil species found in the lower Cenozoic. The circular to subcircular placoliths have a small central opening. The distal shield consists of 8 to 14 sinistrally imbricating elements and is slightly larger than the proximal shield, which is formed by the same number of nonimbricated elements. The central column is constructed of dextrally imbricated elements whose number always equals that of the shield elements. Size ranges from 1.9 to 4.0 μm along the longer axis.

Remarks: This new species differ from *Biscutum? dimorphosum* by being circular to subcircular instead of elliptical to semi-elliptical and by having only two instead of three cycles of elements on the distal surface. This species is generally smaller and usually has fewer shield elements than *Biscutum? dimorphosum*. The original illustration of *Biscutum? dimorphosum* shows a poorly preserved specimen and is hard to distinguish from this new species (Perch-Nielsen, 1969a). However, the subsequent illustration of *Biscutum? dimorphosum* by the original author (Perch-Nielsen, 1969b) clearly shows the characteristic features of the species. Apparently *Biscutum? dimorphosum* represent a transitional form between *Biscutum? tenuiculum* and *Prinsius bisulcus*. We did not separate *Prinsius martinii* from *Prinsius bisulcus* in this report.

TABLE 5A
Neogene Distribution of Calcareous Nannofossils at Site 386

Age	Nannofossil Zone or Subzone	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Reworking	*Braarudosphaera bigelowii*	*Calciosolenia murrayi*	*Ceratolithus cristatus*	*Ceratolithus telesmus*	*Coccolithus eopelagicus*	*Coccolithus miopelagicus*	*Coccolithus pelagicus* s.l.	*Coronocyclus nitescens*	*Crenalithus doronicoides*	*Crenalithus productellus*	*Cyclicargolithus abisectus*	*Cyclicargolithus floridanus*	*Cyclococcolithus leptopora*
Pleistocene	*E. huxleyi*	1-1, 129-130	53.90	A	G E-1	C	F	C	R	R			C		A	A			C
	E. ovata	1-3, 34-35	55.95	A	G E-1			C	F	F			C		A	A			C
	Gephyrocapsa caribbeanica	1-4, 99-100	58.10	A	G			F	R				F		A	A			C
		1-5, 109-110	59.70	A	G			C					F		A	C			C
U. Miocene	*D. quinqueramus*	2-1, 134-135	101.45	F	M E-2	F							A						A
L. Miocene	*S. heteromorphus*	4-1, 99-100	148.20	A	M E-2 O-1		F				C	C	A	F			F	A	F

Note: See Table 2A for explanation of symbols.

Holotype: Plate 9, Figure 5. Negative ON-101, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York.

Type locality and level: Sample 384, 12, CC; *Cruciplacolithus tenuis* Zone (Danian).

Known range: lower to middle Danian.

Genus CRUCIPLACOLITHUS Hay and Mohler, 1967

Cruciplacolithus primus Perch-Nielsen, 1977
(Plate 1, Figure 5, 6; Plate 9, Figure 12-14; Plate 10, Figure 1, 2)

Cruciplacolithus primus Perch-Nielsen, 1977, pl. 17, fig. 7, 8; pl. 50, fig. 11, 12.

Description of coccoliths: Elliptical to semi-elliptical placoliths with a large central opening spanned by a delicate axial cross structure, convex distally, concave proximally. Similar in basic construction to *C. tenuis* but differing from it by being smaller and by having a proportionally larger central opening. Element counts in the shields range from 32 to 36. Sizes range from 3.4 to 5.0 μm along the longer axis and from 2.4 to 3.6 μm along the shorter axis.

Remarks: The separation of this species from *C. tenuis* is somewhat artificial and there are many transitional forms between the two at certain levels. However, the relative abundances of *C. primus* and *C. tenuis* seem to be a good indicator of the age for the earliest part of the Danian. We specify the vaguely defined differential diagnosis by Perch-Nielsen (1977) between *C. primus* and *C. tenuis* as being at 5 μm largest diameter. *C. primus* is clearly the evolutionary predecessor of *C. tenuis.*

Known range: lower Danian.

Genus CHIASMOLITHUS Hay, Mohler, and Wade, 1966

Chiasmolithus sp. 1
(Plate 2, Figure 6; Plate 11, Figure 3)

Remarks: This small placolith has a semi-elliptical to semi-circular periphery instead of the usual elliptical configuration of the related species. The central opening is small and spanned by a short cross structure whose arms are straight. The maximum diameter is between 6.0 and 7.0 μm.

Known range: middle to upper Paleocene.

Genus MARKALIUS Bramlette and Martini, 1964

Markalius sp. 1
(Plate 3, Figure 2; Plate 12, Figures 6, 7)

Remarks: This form closely resembles the type species of the genus, *Markalius astroporus.* The only difference between the two is that the present form has a clear central opening while the central area of *M. astroporus* is filled by a complicated central structure. This difference could be a result of dissolution or evolution, and further study is needed.

Known range: upper Paleocene.

Genus BRAMLETTEIUS Gartner, 1969

Bramletteius sp. 1
(Plate 7, Figure 8; Plate 18, Figure 8)

Remarks: This form closely resembles *Bramletteius serraculoides. B. serraculoides* is, however, known to occur only in middle to upper Eocene sediments, while this form is observed only in the lower to middle Paleocene of Site 384. Some specimens of this form have a much more slender configuration than the type specimen of *B. serraculoides.*

Known range: upper lower to lower middle Paleocene.

Genus CREPIDOLITHUS Noël, 1965

Crepidolithus sp. 1
(Plate 18, Figures 9, 10)

Remarks: This form has fewer wall elements than the other two unnamed forms of the genus encountered in this investigation. The suture lines on the outer side of the wall are almost perpendicular to the bottom.

Known range: lower Paleocene.

Crepidolithus sp. 2
(Plate 18, Figures 11, 12)

Remarks: This form has about 40 wall elements whose outer suture lines are moderately inclined to the bottom.

Known range: lower Paleocene.

TABLE 5A – *Continued*

Cyclococcolithus macintyrei	*Discoaster aulakos*	*Discoaster berggrenii*	*Discoaster brouweri*	*Discoaster deflandrei*	*Discoaster exilis*	*Discoaster lautus*	*Discoaster moorei*	*Discoaster pentaradiatus*	*Discoaster quinqueramus*	*Discoaster sigmus*	*Discoaster trinidadensis*	*Discoaster triradiatus*	*Discoaster variabilis*	*Discolithina japonica*	*Emiliania huxleyi*	*Emiliania ovata*	*Gephyrocapsa caribbeanica*	*Gephyrocapsa oceanica*	*Hayaster perplexus*	*Helicosphaera carteri*	*Helicosphaera intermedia*	*Helicosphaera wallichii*	*Oolithotus fragilis*	*Pseudoemiliania lacunosa*	*Reticulofenestra pseudoumbilica*	*Rhabdosphaera clavigera*	*Scyphosphaera apsteinii*	*Sphenolithus belemnos*	*Sphenolithus ciperoensis*	*Sphenolithus distentus*	*Sphenolithus heteromorphus*	*Sphenolithus moriformis*	*Sphenolithus predistentus*	*Thoracosphaera deflandrei*	*Thoracosphaera saxea*	*Triquetrorhabdulus milowii*	*Umbellosphaera tenuis*	*Umbilicosphaera sibogae*
														F	A	C	C	C		C		R	F	C		F								F			R	C
														R		C	A	C		C		R	C	F		F								F			R	F
R														F		A	C			C		R	F	C		C									F			F
F														F		C	F			C		R	C	A		C	F								R			C
C		F	A					C	C		C		A												A													
F	A			C	F	F	F			C		F	F							R	F				F			F	F	R	A	C	F			C		

Crepidolithus sp. 3
(Plate 19, Figures 1, 4)

Remarks: This form has very fine and strongly inclined outer suture lines formed by 100 or more wall elements. Its stratigraphic range is different from that of the other two forms mentioned above.
Known range: upper Paleocene

Genus DISCOASTER Tan Sin Hok, 1927

Discoaster sp. 1
(Plate 5, Figure 6; Plate 15, Figure 11)

Remarks: Medium sized discoaster with 5 to 7 thick rays whose inner halves are joined together. The outer half of each ray is tapered and terminates in cut-off straight edges. The generally straight rays are symmetrically arranged.
Known range: upper Paleocene.

Discoaster sp. 2
(Plate 5, Figure 7; Plate 15, Figure 12)

Remarks: Large discoaster with 4 to 6 slender rays. The rays are generally straight and their arrangement often asymmetrical.
Known range: upper Paleocene.

Genus FASCICULITHUS Bramlette and Sullivan, 1961

Fasciculithus sp. 1
(Plate 6, Figure 10; Plate 17, Figure 8)

Remarks: This form closely resembles *Fasciculithus pileatus* but differs from it by having a cylindrical body instead of a tapered one and by having a much thinner basal plate.
Known range: middle Paleocene.

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TABLE 5B
Distribution of Cenozoic Calcareous Nannofossils at Site 386

Age		Nannofossil Zone or Subzone	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Reworking	*Braarudosphaera* spp.	*Bramletteius serraculoides*	*Campylosphaera dela*	*Campylosphaera eodela*	*Chiasmolithus altus*	*Chiasmolithus bidens*	*Chiasmolithus californicus*	*Chiasmolithus consuetus*	*Chiasmolithus eograndis*	*Chiasmolithus expansus*	*Chiasmolithus gigas*	*Chiasmolithus grandis*	*Chiasmolithus oamaruensis*	*Chiasmolithus solitus*	*Chiasmolithus titus*	*Chiphragmalithus calathus*	*Coccolithus* aff. *crassus*	*Coccolithus cribellum*	*Coccolithus eopelagicus*	*Coccolithus miopelagicus*
L. Miocene		*Discoaster druggii*	4-4, 93-94	152.64	A	M E-1 O-1		R																		C	C
			4-5, 79-80	154.00	A	P E-1 O-2																				F	F
Oligocene	Upper	*D. deflandrei*	4-6, 49-50	155.20	A	M E-1 O-1		R				F														C	C
		C. abisectus	4, CC	156.20	A	P E-1 O-2						R														C	F
		D. bisectus	5-1, 79-80	157.60	A	M O-2																				C	
			5-3, 99-100	160.80	A	P E-1 O-2																				C	
		C. floridanus	5, CC	165.80	A	P E-2 O-3																				C	
	Middle	*Sphenolithus distentus*	6-2, 119-120	169.00	C	P E-2 O-3																				C	
			7, CC	184.80	F	P E-1 O-3																				C	
			8, CC	194.30	C	P E-1 O-2		R																		C	
			9-2, 130-131	207.11	C	P E-1 O-3																			F	F	
			9, CC	213.30	A	P E-1 O-3		F																	F	C	
		S. predistentus	10, CC	232.30	C	P E-2 O-3																				F	
	Lower	*C. formosus*	11-3, 69-70	255.60	C	P E-1 O-2		F																	F	C	
			11, CC	260.90	A	P E-2 O-3			C											R					F	C	
		Coccolithus subdistichus	12-2, 99-100	282.90	A	P E-1 O-2			C											R					C	C	
			12-3, 89-90	284.30	A	P E-1 O-2			F											R		R			C	C	
Eocene	Upper	*Isthmolithus recurvus*	12-4, 139-140	286.30	A	P E-1 O-3			R											R					F	C	
			12, CC	289.40	A	P E-1 O-3			R											R		R			F	C	
		C. oamaruensis																									
	Middle	*D. saipanensis*	13-2, 14-15	310.65	F	P E-2 O-3																				C	
		Discoaster bifax	14-1, 99-100	329.42	A	M E-1 O-1	F		R						F		F		F		C	F			F	F	
			14-3, 109-110	332.52	A	M E-1 O-1	F	R							R		R		F		C	F			F	C	
			14, CC	337.00	A	M E-1 O-1									F		F		F		C	F			F	C	
		Coccolithus staurion	15-1, 108-109	348.39	A	M E-1 O-1	F			F					C		F	R	F		C	C			F	C	
			15-5, 98-99	354.29	A	P E-1 O-2	R	F		F					F		R	R	F		F	C			F	C	
			16-2, 67-68	368.18	A	M E-1 O-1	R			R					F		R	R	C		C	C			R	F	
			16, CC	375.00	A	M E-1 O-1	R			F					F		F	R	F		C	C			F	C	
		Chiasmolithus gigas	17-1, 97-98	391.01	A	P E-1 O-2		F		F					F		R	F	F		C	F			F	F	
			17, CC	399.03	A	P E-1 O-2		R		F					F		R	F	F		C	F				F	
			18-1, 99-100	405.15	C	P E-1 O-2	F			F					C		R	R	F		C	C				C	
			18-4, 99-100	409.65	A	P E-1 O-2	F	R		F					C		R	R	F		C	C			R	C	
		Discoaster strictus	18, CC	413.15	C	P E-2 O-2	F	R		F					C				F		C	C				C	
			19, CC	422.60	C	P E-2 O-2	F			F					C				F		C	F				F	
			22, CC	451.10	A	M E-1 O-1	C			F					C				F		C	F				F	
			23-5, 99-100	458.70	A	P E-1 O-2	C			F					F				C		C	F				F	
			24-3, 118-119	465.39	A	P E-2 O-2	C			F					F				F		C	F				F	
			25-3, 74-75	475.00	A	M E-1 O-1	F			F					F				F		C	F			F	F	
	Lower	*Rhabdosphera inflata*	26-2, 50-51	482.31	A	P E-2 O-2	C			C	R				F				F		C	F			F	F	
			27-4, 116-117	495.47	A	P E-1 O-2	R			F	R				F				C		C	F			F	F	
			28-2, 79-80	501.70	A	P E-1 O-2	R			F					F				C		C	F			F	F	
		Discoasteroides kuepperi	28, CC	508.40	A	P E-1 O-2				C				R	F				F		C	F		F	F	C	
			29-2, 59-60	511.00	A	P E-1 O-2	R			C					F				C		A	F		R	F	C	
			29-4, 26-27	513.67	A	M E-1 O-1	R			C	R		R		F				F		C	F		F	F	C	
		Discoaster lodoensis	30-2, 85-86	520.76	A	M E-1 O-1	R			C					F				F		C	F		F	F	F	
			30-4, 98-99	523.89	A	P E-1 O-2				C	F				F				C		C	F		F	F	C	
			30, CC	527.40	C	M E-1 O-1	F			F	F				F				C		C	F		F	R	F	
		Tribrachiatus orthostylus	31-1, 4-5	537.86	A	M E-1 O-1	R			F	R			F	F				F		R		R	R	F	F	
			31-3, 84-85	541.66	C	M E-1 O-1	C			F	R		R	F	C				F		R		F	R	F	F	
			31, CC	546.81	C	M E-1 O-1	F			F	F			F	C				F				F		F	F	
			32-1, 9-10	556.69	A	M E-1 O-1	F			C	F			R	F				F				F		F	F	
			32-4, 62-63	561.72	C	M E-1 O-1	R			F	F			F	C				F				F		F	C	
			32, CC	565.20	A	M E-1 O-1	F			C				F	F				F				F		C	F	
		Discoaster binodosus	33-1, 48-49	575.69	A	M E-1 O-1	F			F	F			F	F				F				F		F	F	
			33-2, 49-50	577.20	A	M E-1 O-1	F			F			F	F	F				F							F	
			33-2, 105-106	577.76	A	M E-1 O-1	F			F			F	F	F				R						R	F	
			33-3, 45-46	578.66	A	M E-1 O-1	F			F	F		F	C	C	F										F	
		Tribrachiatus contortus	33-3, 81-82	579.02	A	M E-1 O-1	F			F	F		C	F	F	F										F	
			33, CC	584.20	C	M E-1 O-1	F				F		C	F	C	F										F	
			34-1, 78-79	604.94	C	M E-1	F						R	F	R	F										R	
			34-2, 71-72	606.37	C	M E-1	F						C	F	F	F											
U. Paleocene		*Campylosphaera eodela*	34-3, 82-83	607.98	C	M E-1	C						C	F	F	F											
			34-5, 49-50	610.65	A	M E-1	C	R			F		C	F	F	F											
			34, CC	612.70	C	M E-1	C				R		C	F	F	F											
		D. mohleri	35-1, 40-41	632.41	C	M E-2	C						F	F	C												

Note: See Table 2b for explanation of symbols.

TABLE 5B – *Continued*

Coccolithus pelagicus s.l.	*Coccolithus subdistichus*	*Cruciplacolithus staurion*	*Cruciplacolithus tenuiforatus*	*Cruciplacolithus tenuis*	*Cyclicargolithus abisectus*	*Cyclicargolithus floridanus*	*Cyclicargolithus pseudogammation*	*Cyclococcolithus formosus*	*Cyclococcolithus gammation*	*Cyclococcolithus kingi*	*Cyclolithella kariana*	*Cyclolithella robusta*	*Cyclolithus bramlettei*	*Dictyococcites bisectus*	*Dictyococcites scrippsae*	*Discoaster barbadiensis*	*Discoaster bifax*	*Discoaster binodosus*	*Discoaster deflandrei* s.l.	*Discoaster diastypus*	*Discoaster distinctus*	*Discoaster druggii*	*Discoaster elegans*	*Discoaster falcatus*	*Discoaster lenticularis*	*Discoaster lodoensis*	*Discoaster mediosus*	*Discoaster mohleri*	*Discoaster multiradiatus*	*Discoaster mirus*	*Discoaster nobilis*	*Discoaster saipanensis*	*Discoaster sublodoensis*	*Discoaster tanii tanii*	*Discoasteroides kuepperi*	*Discolithina multipora*	*Discolithina plana*	*Discolithina rimosa*	*Discolithina versa*	*Ellipsolithus distichus*	*Ellipsolithus* aff. *lajollaensis*	*Ellipsolithus macellus*
A					F	A													C																							
A					F	A								R					C			F																				
A					C	A								R					A																							
A					A	A								F					C																							
A					C	A								C	C				C																							
A					F	A								C	C				C																							
C					F	A								F	C				F																							
C					R	A								F	C				F																							
C						A								F	C				C																							
A	R					A				R				F	C				F																							
A						A								F	C				F																							
A	R					A								F	C				F																							
A						A								C	C				F																							
A	R					A		R						C	C				F																							
A						A		R						C	C				F															R								
A	C					A		C		C				C	C				F															R			R					
A	C					A		C		C			R	C	C				F																	R	R					
A						A		C		C			R	C	C	C																					R		R			
A						A		C		C			F	C	C	C																				R	F					
A						A		C		F			F	F	C	C																F				F						
A						A	F	C		F			R		C	C	F	R			F				R							F		R								
C		R				C	F	C		F			F		C	C	C	R			F				R							F				F						
A		R				C	C	C		F			F		F	C	C	R			F				R							F		R		F			R			
A		F				A	C	C	F	F	F		F			C	R	F			F				F							F				F	F					
C		F	F			C	A	C		F	R		R			C					R				R											C			R			
C		R	R			C	C	C	F	F			F			C					F				R							F				F						
A		F	F			C	C	C	R	F	R		F			F		F			C		F									F				C						
A		F	F			C	C	C		F	R		F			C																C				C			R			
A		F	F			C	A	C	R	R	R		F			C																C				F			R		R	
A		R	C			C	A	A	F		F		R			C					F				F							F				R			R			
A		F	C			C	C	C	C				R			C					F				F							C				R						
A		R	C			C	A	C	F							C					F				F							C							R			
A						C	A	C					R			F																				F						
A		R	F			C	A	C	F							F		F			F				F	F						F	F			F	F					
A		R	R			F	A	A								C							C		R	R						F	F		F	F	R		R			
A		F					A	C	F							C							C			R						F	F		F	R						
A		R					A	C	F							F		F			F		F		R	R						R	F		C		R					
A		R					A	C	F				F												R								C		C	R		R			R	R
A							A	C	F				F			C		C			F		F		R	C				F			F		C		R	R				
A							A	C	C				F			C		F			F		F		R	C				R			R		C		F	R				
A							A	C	F				R			C		F			F				R	C				R			R		C		F				R	
A							A	C	C				R			C		F			R					C				R			R		C	R	F	R	F		R	
A							A	C	C		F					C		F			F		R			C				R			F		C	F	R	R	R		R	
A							C	C	C		F		F			C		F		F	F					C				R					C	R	R	F			R	
A							F	C	C		F		F			C		F		R	F				R	C								F	C	R	R	R				
A				R			F	C	C		F		F			F		F		R	F					C				R					C	F	R	R				
A							R	C	F		F		F			C		C		F						C									C	R	R	R				
A			R				R	C	F		F		F			F		C		F						C									C		R	R				R
A			R					C	F		F		F			C		F		F						C									C			R				R
A			R					C	F		R		F			C				F						C								R	C			R				R
A								C			F		F			F				F						C									C			R				R
A			F					C			R		F			C		F		F						C									C		F		F			R
A								C					F			C		C		F											R				C		F	R		R		C
A								C				R	F			F		C		F									R		R				C		R	F				C
A								F					F			F		C		C											R				F		F	R	R			C
A								F				F	F			F		C		C									R		F				F		R	R		F		F
A								F				F				R		C		C				R					F		F				F			F		R		C
A								F										C		C				F			C		C		F				F			R		F		F
A								F												R				F	R		R		C		F									F		
A								F												R				F	R				C		C									C		F
A								F				C												F	F			R	C		C							R		C		F
A								R				F												F	F			R	C		F							R		C		F
A								R				C												F	F			R	C		C							R		R		C
A				F								F																F										F				F

TABLE 5B – *Continued*

Age		Nannofossil Zone or Subzone	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Reworking	*Ericsonia subpertusa*	*Fasciculithus aff. alanii*	*Fasciculithus involutus*	*Fasciculithus schaubii*	*Fasciculithus tympaniformis*	*Helicosphaera compacta*	*Helicosphaera euphratis*	*Helicosphaera intermedia*	*Helicosphaera lophota*	*Helicosphaera obliqua*	*Helicosphaera papillata*	*Helicosphaera perch-nielseniae*	*Helicosphaera recta*	*Helicosphaera reticulata*	*Helicosphaera seminulum*	*Helicosphaera wilcoxonii*	*Heliolithus kleinpellii*	*Heliolithus riedelii*	*Isthmolithus recurvus*	*Lophodolithus mochlophorus*	*Lophodolithus nascens*
L. Miocene		*Discoaster druggii*	4-4, 93-94	152.64	A	M E-1 O-1							R	F	F					R								
			4-5, 79-80	154.00	A	P E-1 O-2							R	F	F													
		D. deflandrei	4-6, 49-50	155.20	A	M E-1 O-1								C	F					R								
Oligocene	Upper	*C. abisectus*	4, CC	156.20	A	P E-1 O-2								F	F													
		D. bisectus	5-1, 79-80	157.60	A	M O-2							F	F			F											
			5-3, 99-100	160.80	A	P E-1 O-2							F	F			F											
		C. floridanus	5, CC	165.80	A	P E-2 O-3							F															
	Middle	*Sphenolithus distentus*	6-2, 119-120	169.00	C	P E-2 O-3							C		R													
			7, CC	184.80	F	P E-1 O-3							C	F			F											
			8, CC	194.30	C	P E-1 O-2							C	F	R		R											
			9-2, 130-131	207.11	C	P E-1 O-3							F	R			F		F	F								
			9, CC	213.30	A	P E-1 O-3							C	F			F		F	F			R					
		S. predistentus	10, CC	232.30	C	P E-2 O-3																						
	Lower	*C. formosus*	11-3, 69-70	255.60	C	P E-1 O-2							C	F							R							
			11, CC	260.90	A	P E-2 O-3							C	F							R							
		Coccolithus subdistichus	12-2, 99-100	282.90	A	P E-1 O-2							F	C							F		F			F		
			12-3, 89-90	284.30	A	P E-1 O-2							F	F		R							F			R		
Eocene	Upper	*Isthmolithus recurvus*	12-4, 139-140	286.30	A	P E-1 O-3							R	C									F			R		
			12, CC	289.40	A	P E-1 O-3							R										R			R		
		C. oamaruensis *D. saipanensis*	13-2, 14-15	310.65	F	P E-2 O-3							C															
	Middle	*Discoaster bifax*	14-1, 99-100	329.42	A	M E-1 O-1	F						R			F		R				R						
			14-3, 109-110	332.52	A	M E-1 O-1	F						R			F						F						
			14, CC	337.00	A	M E-1 O-1							R			F						R						
		Coccolithus staurion	15-1, 108-109	348.39	A	M E-1 O-1	F									C		F				R					R	
			15-5, 98-99	354.29	A	P E-1 O-2	R									F						R						R
			16-2, 67-88	368.18	A	M E-1 O-1	R									F						F						
			16, CC	375.00	A	M E-1 O-1	R									F						F						
		Chiasmolithus gigas	17-1, 97-98	391.01	A	P E-1 O-2										F						F						R
			17, CC	399.03	A	P E-1 O-2										F						F					R	
			18-1, 99-100	405.15	C	P E-1 O-2	F									F						F						
			18-4, 99-100	409.65	A	P E-1 O-2	F									F						F						
		Discoaster strictus	18, CC	413.15	C	P E-2 O-2	F									F						F					R	
			19, CC	422.60	C	P E-2 O-2	F																					
			22, CC	451.10	A	M E-1 O-1	C									F						F						
			23-5, 99-100	458.70	A	P E-1 O-2	C																					
			24-3, 118-119	465.39	A	P E-2 O-2	C									F						F						
			25-3, 74-75	475.00	A	M E-1 O-1	F									F											R	
	Lower	*Rhabdosphera inflata*	26-2, 50-51	482.31	A	P E-2 O-2	C									F												
			27-4, 116-117	495.47	A	P E-1 O-2	R									F						F						
			28-2, 79-80	501.70	A	P E-1 O-2	R									F						F					R	
		Discoasteroides kuepperi	28, CC	508.40	A	P E-1 O-2										F						F						R
			29-2, 59-60	511.00	A	P E-1 O-2	R									F						F						
			29-4, 26-27	513.67	A	M E-1 O-1	R									F						C						
		Discoaster lodoensis	30-2, 85-86	520.76	A	M E-1 O-1	R									F						C						R
			30-4, 98-99	523.89	A	P E-1 O-2										R						F						
			30, CC	527.40	C	M E-1 O-1	F									R						C						
		Tribrachiatus orthostylus	31-1, 4-5	537.86	A	M E-1 O-1	R																				R	F
			31-3, 84-85	541.66	C	M E-1 O-1	C																				R	F
			31, CC	546.81	C	M E-1 O-1	F																					F
			32-1, 9-10	556.69	A	M E-1 O-1	F																					F
			32-4, 62-63	561.72	C	M E-1 O-1	R																					R
			32, CC	565.20	A	M E-1 O-1	F																				F	F
		Discoaster binodosus	33-1, 48-49	575.69	A	M E-1 O-1	F																				F	F
			33-2, 49-50	577.20	A	M E-1 O-1	F																				R	F
			33-2, 105-106	577.76	A	M E-1 O-1	F																					F
			33-3, 45-46	578.66	A	M E-1 O-1	F	F																				F
		Tribrachiatus contortus	33-3, 81-82	579.02	A	M E-1 O-1	F	F			R																	F
			33, CC	584.20	C	M E-1 O-1	F	F		R	R																	R
			34-1, 78-79	604.94	C	M E-1	F	F		F	R																	
			34-2, 71-72	606.37	C	M E-1	F	C		F	R	R													R			
U. Paleocene		*Campylosphaera eodela*	34-3, 82-83	607.98	C	M E-1	C	C	F	F	F	F												R	R			
			34-5, 49-50	610.65	A	M E-1	C	C	F	F	C	F												R	F			
			34, CC	612.70	C	M E-1	C	C	F	F	C	F												R	F			
		D. mohleri	35-1, 40-41	632.41	C	M E-2	C	A		F		F												C	F			

Note: See Table 2A for explanation of symbols.

TABLE 5B – *Continued*

Lophodolithus reniformis	*Markalius astroporus*	*Nannotetrina fulgens*	*Neochiastozygus concinnus*	*Neococcolithus dubius*	*Pedinocyclus larvalis*	*Prinsius bisulcus*	*Reticulofenestra dictyoda*	*Reticulofenestra gartneri*	*Reticulofenestra hillae*	*Reticulofenestra samodurovii*	*Reticulofenestra umbilica*	*Rhabdosphaera inflata*	*Rhabdosphaera tenuis*	*Rhabdosphaera truncata*	*Rhomboaster calcitrapa*	*Sphenolithus capricornutus*	*Sphenolithus ciperoensis*	*Sphenolithus dissimilis*	*Sphenolithus distentus*	*Sphenolithus furcatolithoides*	*Sphenolithus moriformis*	*Sphenolithus obtusus*	*Sphenolithus predistentus*	*Sphenolithus pseudoradians*	*Sphenolithus radians*	*Striatococcolithus pacificus*	*Thoracosphaera* spp.	*Toweius craticulus*	*Toweius eminens*	*Toweius occulatus*	*Toweius tovae*	*Transversopontis ocellatus*	*Transversopontis panarium*	*Transversopontis pulcher*	*Transversopontis pulchriporus*	*Tribrachiatus bramlettei*	*Tribrachiatus contortus*	*Tribrachiatus orthostylus*	*Triquetrorhabdulus carinatus*	*Triquetrorhabdulus milowii*	*Zygodiscus sigmoides*	*Zygrhabilithus bijugatus*
																F	F	C	F		C		F																F	C		
																F	F	C	F		C		C																C	F		
																	C	C	F		C		C																C			
																	F	F	F		C		C																R			
								C									C		C		C		C	R															R			
								C									C		F		C		C																R			
								C									C		F		C		F																F			
								C											C		C		C																F			
								C											R		C		C																F			
								F											F		C		C																			
								F											F		C		C	R																		
					F			F											F		C		C	R			F															
													F								C		C																			
									F	F	F										C		C				F															
									F	F	F										C		C																			F
					R				C	F	C		R								C		F	R		R																F
					R				C	F	C		F								C		F	F																		F
									C	C.	C		R								C					F																
									C	C	C										C					F									R							
										A	C										C						R															
	F			C						A	F		F	R						C	F	F			F	F						F		F	R							C
	R			C						A	F		F							C	C	F			F	F								C	R							C
	R	R		C			F			A	F		F							F	F	R				F	F					F	F	C	R							C
	R	R		F			C			A			F							F	C				R	R						F	R	C	F							C
	R	F		F			C			A			F							C	C				F	R								F								C
		F		C			C			A			F							F	C				R	R	F						R	C	R							F
	R	R		C			F			A			F							F	F				R	R	R					R	R	C	F							C
	R	R		C			C			A			F								F											R	R	C	F							F
	R	F		F			C			A			F	R							F						R	R					F	C	R							F
		F		F			C			A			F	R							F				R		R	R				F	R	C	R							C
	R	F		F			C			A			F								C				F			F				R		F	R							F
		F					C			A			F	F							F							C				R		C	R							C
				F			C			A											F						R	C														
	R	R		C			C			A		F	F	F							F							C				F	F	C	F							F
	R			C			C			A		R	F								F							C														F
	R			C			C			A		R	F								F							C				R	R	F								F
		R		F			C			C		F	F	F														C				R		C	F							F
	R			F			A			C		F	R	F							R					R		C														F
				F			C			A		R		F							F					F		F					R	F	R							C
			R	F		R	C			A		R		F							F					F		F		F				F	R							C
	R		R	C			C			C											F					F		C		F				F								C
R				C			C			C											F					F	R	F		C		R	R	C	F							C
	R		R	C			C			C				R							F					F		C		F		R	R	C	R							C
	R			C		R	C			A											F					F		C		F		F	F	C	R							C
	R			C						F											F					F		C		C		R	F	C	F							C
	R		F	F			R			F				F							F					C		C		C			C	F	R			R				C
F	R		F	C		F	R														F					R		A		C			R	F			R	C			R	C
R	R		F	F		F								R							F						R	A		F			R	F				C			R	F
			F	F		F															F					R		A					R	F				C				F
R	R		F	F		F															F					F		A					R	F	R			C				C
	F		F	C		F								F							C					R		A		F		R	R	F	R	R		C				C
	R		C	C		C								F							C					R		A		F		F	F	R	R	R		C				F
	F		C	F		C								R							F					R		A				F	F	F	R			C				F
	F		C	F		C															C							A				R	F	R	R			C				F
	R		F	F		C															F							A		F		R	F	R	R			C				F
			F	F		C															F							A		F		R					F	C				
			C	F		F															F							A								F	C					
			F			C									C						C							A	F	C	F					C	F				R	
	R		F			C									C						F					R		A	C	C	C					F	F				F	
	R		F			C									C						C							A	C	F	F					F					R	
	R		F			C															C							A	C		F										R	
			F			A															C							A	C		F										F	
	F		F			C															C					R		A	C		F										F	
	F					C															C							C	F		C										C	

TABLE 5C
Distribution of Mesozoic Nannoliths at Site 386

Age	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Etching	Overgrowth	*C. achylosum*	*T. aculeus*	*L. alatus*	*P. albianus*	*H. albiensis*	*C. angustiforatus*	*P. angustus*	*Z. anthophorus*	*P. asper*	*W. barnesae*	*F. biforaminis*	*W. britannica*	*L. carniolensis*	*L. cayeuxii*	*C. chiastia*	*M. circumradiatus*	*W. communis*	*V. compacta*	*C. conicus*	*B. constans*	*C. coronadventis*	*P. cretacea*	*A. cymbiformis*
Upper Maestrichtian	35-4, 13	236.63	C	P	3	2		C								R												C	
	35-4, 30	236.80	C	M	2	2		C								A			C						F	C		A	C
	35-4, 46	236.96	C	M	2	2		F						R		A			A						F	C		A	C
	35-4, 115	237.65	A	M	1	2		F								A			C						F	C		A	F
M. Maestrichtian	35-5, 48	238.48	C	M	2	2		C							R	A			C	R					C			A	F
Cenomanian	44-4, 64	750.94	C	M	2	0	R			R						A			F							F		C	
	45-2, 36	766.56	A	G	1	0			F				F		F	A			F		F			R		A		C	
	47-4, 35	788.65	A	M	2	0	R			R			F		F	A	F	R	F				R	R		A		C	
	49-3, 80	806.60	A	G	1	0			R	R			R		F	C	F		F							A	R	C	
Upper Albian	50-2, 77	814.57	A	G	1	0	F			F			R		F	A	F		F		R					A	R	C	
	51-1, 36	822.26	A	G	1	1	F			R		R			F	A	F		F							A	R	C	
	52-1, 70	832.10	A	G	1	0						R			C	A	F		F		F					A			
	53-1, 50	841.40	A	G	1	0					F		F		C	A	F	R	F		F	R				A		C	
	54-2, 87	857.77	A	G	1	1							F		C	A	R		C		F			R	R	A	F	F	
	55-6, 45	867.85	A	G	1	1	F			R			F		C	A	F		C		F					A	R	C	
Middle Albian	57-1, 103	879.93	A	M	1	2				R			R		C	A	R		C							C		C	
	57, CC	888.30	A	G	1	1						R	F		C	C	F		F		F		R	R		C	R	C	
	58-1, 72	889.02	C	M	2	1	R				R		F		C	A	F		F		R		R	R		F	R	F	
	59-1, 63	898.33	C	G	1	0	F			F	F		F		C	C	F	R	C		F		F	R		C	R	C	
	59-5, 120	904.90	F	M	2	1					F				C	A			F		F					F		R	
	60-5, 28	913.30	C	M	2	2									F	A						R							
	65-1, 130	956.10	A	M	1	2	R						F		C	A	R	R			F			F		C	F	F	

Note: See Table 2B for explanation of symbols.

TABLE 5C – *Continued*

M. decoratus	*P. decorus*	*P. dietzmannii*	*Z. diplogrammus*	*C. ehrenbergi*	*Z. elegans*	*P. embergeri*	*B. enormis*	*R. fenestratus*	*L. floralis*	*S. fossilis*	*T. gabalus*	*T. gothicus*	*S. horticus*	*P. infinitus*	*S. laffittei*	*B. lata*	*C. litterarius*	*C. loriei*	*C. margereli*	*V. matalosa*	*M. mura*	*G. obliquum*	*T. obscurus*	*T. orionatus*	*B. orthocancellata*	*B. parca*	*M. pemmatoidea*	*L. quadratus*	*P. regularis*	*D. rotatorius*	*B. signata*	*C. signum*	*P. spinosa*	*Z. spiralis*	*P. splendens*	*M. staurophora*	*T. stradneri*	*V. stradneri*	*C. surirellus*	*E. trabeculatus*	*T. trifidus*	*E. turriseiffeli*	*Cylindralithus* spp.	*Nannoconus* spp.
												F									A															A					F	R		
C			R	C			F										C		F		C							C	F					R	F	A			C			F	C	
C				C			F								F		C		F		C	R				R		C	C	F			F	G		A		F	C	R		C	C	
C	F		R	C			C		R						F		C				C	F					R	C	C	C			C	C	C	A		C	C			C	C	
C	F		R			R	C								F		C		C				R	R			R	C		F			F	F	C	A		F	A			C	C	R
			F		F	F			F		R						F							F			F			R	R	R	R				F		C	F		F	R	
			F	R	F	F			F	R	R				R		F			R				R	R		F			F	R	F	F				R		C	F		C		
	F		F	F	C	F	R		F		R				F	F	F			F				F			R			C	R	F	R		R		F	R	C			C		
	F		F	F	C	F			F		F				F	F	F	R		F				F			F			F	R		F				F		C	F		C		
	F	R	F	F	C	F	R		R						C	F	F			F				R			F			C	R	R	F		R		F		C	R		C		
	F		F		F	R			F		F		F		F	F	F			F				F			F			F	R		R				F	R	C	F		A		
	F		C	R	C	F			R		R				C		F	R		R				F			F			F				F			F	F	C			C		
	C	R	C		F	F			R		F			R	C	R	F	R						F			C			F			F	F			C	R	C			C		
	R		C		F	F		R	R	R	R				C		F			F				F			F			F							F		C			C		
	R	R	C		F	F			F		F				C		F			F				C			F			C		F		F			F		F			C		
	F		C		C	F		R	F	F	R				C		F			R				F			F			F							F	F	C	F		R		
			C		C	F			R						C					F				R			F			C		F					F	R	F			R		
			C		C				R	R	R				F		F										F			C							F		F					
			C		C			R	R	F	R				R		F										F			C							F		C					
					F	R																					F			F									F					
					F	F													F								R																	
	F		C		C	F					F				F		R		R											C								F	F	F				F

TABLE 6A
Distribution of Cenozoic Nannoliths at Site 387

Age	Site 387 Nannofossil Zone or Subzone	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Reworking	*Blackites spinosus*	*Campylosphaera dela*	*Campylosphaera eodela*	*Chiasmolithus bidens*	*Chiasmolithus californicus*	*Chiasmolithus consuetus*	*Chiasmolithus danicus*	*Chiasmolithus expansus*	*Chiasmolithus gigas*	*Chiasmolithus grandis*	*Chiasmolithus solitus*	*Chiasmolithus titus*	*Chiphragmalithus acanthoides*	*Coccolithus* aff. *crassus*	*Coccolithus cribellum*	*Coccolithus eopelagicus*	*Coccolithus pelagicus*	*Coccolithus subdistichus*	*Cruciplacolithus staurion*	*Cruciplacolithus primus*	*Cruciplacolithus tenuiforatus*	*Cruciplacolithus tenuis*
Middle Eocene	*D. bifax*	8-1, 144-145	185.65	A	G E-1	F	F	F				C		F		C	C				F	C	A	C	F			
	Coccolithus staurion	8, CC	193.20	C	G E-1	F	F	F				C		C		F	C	R			F	C	A	C	F			
		9-1, 99-100	195.07	A	G E-1	F	C	F				C		F		C	C				C	C	A	C	C			
		9-5, 99-100	201.07	A	G E-1	F	C					C		F		F	C				C	C	A	C	F			
		10-3, 59-60	207.21	C	G E-1	F	C					C		F		F	C	F			C	C	A	C	R			
	Chiasmolithus gigas	10-5, 129-130	210.91	C	M E-1 O-1	F	C	F				C		F	F	C	C	F			F	C	A	C	R			
		12-1, 119-120	223.50	C	M E-1 O-1	F	F	F				C		F	C	C	C	C				C	A	C	R		C	
		13-1, 49-50	232.30	C	M E-1 O-1	F	R	F				C		R	F	F	C	F			R	C	A	C	F		F	
	Discoaster strictus	14-2, 99-100	243.80	C	M E-1 O-1	F	R					C		F		F	C	F			R	C	A	C	R		C	
		16-2, 19-20	261.80	C	M E-1 O-1	F	F					C		R		F	C	C				F	A	C	F		C	
		16, CC	269.10	C	M E-1 O-1	F	F					C		R		F	C	F				F	A	C	F		C	
		17-2, 70-71	271.81	C	M E-1 O-1	F	F	F				F				F	A	F				F	A	C	F		F	
Lower Eocene	*Rhabdosphaera inflata*	18-1, 59-60	289.30	C	M E-2 O-1	C	F	R				C				F	C	F				F	A	C	R		F	
		18, CC	297.70	A	M E-2 O-1	F	F	F		R		C		R		F	C	F				C	A	F	F		F	
		19-2, 98-99	310.19	A	M E-1	F	F	F				F		R		F	C	R				C	A	F	F		C	
	D. kuepperi	20-1, 119-120	327.90	C	M E-1	C		F				F				F	C	F		F	F	C	A	F	R		F	
		20, CC	335.70	C	M E-1 O-1	F		F				F				F	C	F		F	F	C	A				F	
	Discoaster lodoensis	21-1, 114-115	346.85	C	M E-2 O-1	F		C			R	C				F	C	F		F	R	C	A				F	
		21, CC	354.70	A	M E-2 O-1	R		C			F	C				F	C	F		F	F	C	A				F	
	Tribrachiatus orthostylus	22-2, 28-29	356.99	C	M E-2 O-1	F		C			F	C				F		F	F		F	F	A					
		22-3, 148-149	359.69	A	M E-2 O-1	F		C		F	R	C				C					F	C	A					
		23-1, 78-79	375.09	A	M E-2	F		C	F	R	F	F				F					F	C	A					
		23-2, 106-107	376.87	A	M E-2	F		C	F		F	F				F			R		F	C	A					
	Discoaster diastypus	23-3, 29-30	377.60	C	P E-3	C					C	C				F			R			C	A					
		23-3, 118-119	378.49	C	P E-3	C		R	R		F	C				F						C	A					
		23-4, 89-90	379.70	C	P E-3	A					C	C				F						C	A					
Lower Paleocene	*Ellipsolithus macellus*	24-1, 52-53	393.83	C	M E-2	C						C	C										A			F		
		24-1, 134-135	394.65	C	M E-2	C				F		A	C										A			C		C
		25-1, 83-84	403.64	C	M E-2	C						C	C										A			C		C
		25-2, 99-100	405.30	C	M E-2	C						C	C										A			C		C
		25-3, 144-145	407.25	F	P E-3	A						C	C										A			C		C
		26-2, 87-88	414.58	F	P E-3	A						C	C										A			C		C

Note: See Table 2A for explanation of symbols.

TABLE 6A – *Continued*

Cyclicargolithus floridanus	*Cyclicargolithus pseudogammation*	*Cyclococcolithus formosus*	*Cyclococcolithus gammation*	*Cyclolithus bramlettei*	*Discoaster barbadensis*	*Discoaster bifax*	*Discoaster binodosus*	*Discoaster diastypus*	*Discoaster distinctus*	*Discoaster elegans*	*Discoaster falcatus*	*Discoaster germanicus*	*Discoaster lenticularis*	*Discoaster lodoensis*	*Discoaster mediosus*	*Discoaster mohleri*	*Discoaster multiradiatus*	*Discoaster nobilis*	*Discoaster saipanensis*	*Discoaster sublodoensis*	*Discoasteroides kuepperi*	*Discolithina multipora*	*Discolithina plana*	*Ellipsolithus distichus*	*Ellipsolithus aff. lojollaensis*	*Ellipsolithus macellus*	*Ericsonia subpertusa*	*Fasciculithus involutus*	*Fasciculithus schaubii*	*Fasciculithus tympaniformis*	*Helicosphaera compacta*	*Helicosphaera lophota*	*Helicosphaera seminulum*	*Helicosphaera papillata*	*Lophodolithus mochlophorus*	*Lophodolithus nascens*	*Markalius astroporus*	*Nannotetrina fulgens*	*Neochiastozygus concinnus*	*Neococcolithus dubius*	*Prinsius bisulcus*	*Prinsius aff. martinii*	*Reticulofenestra dictyoda*
C	C	C		F	C	F			C	R		F	F						C			F									F	F	R	R			F			C			C
C	C	C		F	F				F	C		F							R			F									F	C	F				R			A			C
F	C	C		F	F				C	C		R							F			C									F	C	C	F			R	R		C			F
C	C	C		F	F				C	C		R	R						F			C	R								R	C	F	F				F		C			C
C	C	C			F				R	C		R		R					F			C									R	C	F	F		R	R	R		C			C
C	C	C		F	F				F	C		F							F			F	F									F	R				R	F		C			C
F	C	C		R	R				F	C		R		R					F			F	R									F	R			R		F		C			F
F	C	C		F	C				F	C		F	F	R					C	R	R	R										C	F				R	F		C			F
	A	C		R	F				F	C		F							F			C			R							C			R			F		C			C
	C	C			C				F	C		R		R								C	F									F	R	R	R	R	R	F		C			C
	A	C			C				F	F			F							R	F	C	F									F						R		F			C
	A	C			F				F	F											F	F	F									F	C					R		C			C
	A	C	R	R	C				F	C				F						C	F	C	F			R						F	C							C			A
	A	C			C				C	F			F	C						C	C	F	F									C	C							C			C
	A	C	F	F	F				F	F			F	C						F	F	F	F									F	C				R			C			C
	A	C	C	F	F		R		F	C		R	F	C						F	C	R	F									F	C		R					C			C
	A	C	C	R	F			F	C	F		R		C						F	C	R	F									R	F		R					C			C
	A	C	F	F	C			F	C	R				C							C	F	F									F	C							F			C
	C	C	F	C	C		F	C		F				C							C	F			R							F	F			R	R		R	C			C
		C	F	F	C		C	F						F							C	R				R										F	F		F	C			
		C		F	C		F	C		R				C							C															F	F		F	C			
		C		F	C		F	F	F		F		R	F							C	R														R	F		F	C			
		C	R	F	C		F	C			F			F				R			C					R			R							F	C		F	C			
		C		C	C		C	A		R	F		F		C		C	F												R						F	C						
		C		C	C		C	A			F				R	F	A	C			R							F	F	F													
		C		F	F		F	C			C		F			C	A	C						F			F	F	C	C							R						
																											A										F				C	A	
																											A														A	A	
																											A														A	A	
																											A														A	A	
																											A																
																											A																

TABLE 6A – *Continued*

Age	Site 387 Nannofossil Zone or Subzone	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Reworking	*Reticulofenestra samodurovi*	*Reticulofenestra umbilica*	*Rhabdosphaera gladius*	*Rhabdosphaera inflata*	*Rhabdosphaera truncata*	*Rhomboaster calcitrapa*	*Rhomboaster cuspis*	*Sphenolithus furcatolithoides*	*Sphenolithus moriformis*	*Sphenolithus radians*	*Striatococcolithus pacificus*	*Toweius craticulus*	*Toweius eminens*	*Toweius occulatus*	*Transversopontis ocellatus*	*Transversopontis panarium*	*Transversopontis pulcher*	*Transversopontis pulchriporus*	*Tribrachiatus bramlettei*	*Tribrachiatus contortus*	*Tribrachiatus orthostylus*	*Zygrhablithus bijugatus*	*Zygodiscus sigmoides*
Middle Eocene	*D. bifax*	8-1, 144-145	185.65	A	G E-1	F	A	R							F	F												F	
	Coccolithus staurion	8, CC	193.20	C	G E-1	F	A								F	R					R		F					C	
		9-1, 99-100	195.07	A	G E-1	F	A								F						F		F	F				C	
		9-5, 99-100	201.07	A	G E-1	F	A		R						F						R		C	F				C	
		10-3, 59-60	207.21	C	G E-1	F	A								F								F	F				C	
	Chiasmolithus gigas	10-5, 129-130	210.91	C	M E-1 O-1	F	A								R	R						F	F	F				C	
		12-1, 119-120	223.50	C	M E-1 O-1	F	A			R	R												C	C				F	
		13-1, 49-50	232.30	C	M E-1 O-1	F	A								F								F					F	
	Discoaster strictus	14-2, 99-100	243.80	C	M E-1 O-1	F	A		R						R	R					F	C	C					C	
		16-2, 19-20	261.80	C	M E-1 O-1	F	A		R		R				F						F	C	F	F				C	
		16, CC	269.10	C	M E-1 O-1	F	C								F						F		C	C				C	
		17-2, 70-71	271.81	C	M E-1 O-1	F	C		R		F				F	F						F	F	C				C	
Lower Eocene	*Rhabdosphaera inflata*	18-1, 59-60	289.30	C	M E-2 O-1	C	C		F	F	F				F	F		F			F	F	C	C				C	
		18, CC	297.70	A	M E-2 O-1	F	C		F	F	F				C	F		F			R	R	C	F				C	
		19-2, 98-99	310.19	A	M E-1	F	C		F	F	F				F	F	F	F		R	F		F	C				C	
	D. kuepperi	20-1, 119-120	327.90	C	M E-1	C	A				R				F	F	F	C					F	F				F	
		20, CC	335.70	C	M E-1 O-1	F	A			R					F	F	R	C		R	R		F	F			R	C	
	Discoaster lodoensis	21-1, 114-115	346.85	C	M E-2 O-1	F	C				R	R	F		F	C	F	C			R		C	C				C	
		21, CC	354.70	A	M E-2 O-1	R	F					R	R	R	F	C	F	C					F	F			R	C	
	Tribrachiatus orthostylus	22-2, 28-29	356.99	C	M E-2 O-1	F								F	F	C	F	A		C	R		F	F			C	F	
		22-3, 148-149	359.69	A	M E-2 O-1	F					R	R		F	F	F		A		C			F	F	R		C	C	
		23-1, 78-79	375.09	A	M E-2	F					F			F	C	C		A		F			F	F			C	C	
		23-2, 106-107	376.87	A	M E-2	F					F			F	C	C		A	R		R		F	F			C	F	
	Discoaster diastypus	23-3, 29-30	377.60	C	P E-3	C						C			C			F							C	A	F		
		23-3, 118-119	378.49	C	P E-3	C						C	F		C			F	F						C	F			
		23-4, 89-90	379.70	C	P E-3	A						C	F		C			F	F						F				
Lower Paleocene	*Ellipsolithus macellus*	24-1, 52-53	393.83	C	M E-2	C									C			C											F
		24-1, 134-135	394.65	C	M E-2	C									F			C											C
		25-1, 83-84	403.64	C	M E-2	C												F											C
		25-2, 99-100	405.30	C	M E-2	C												F											C
		25-3, 144-145	407.25	F	P E-3	A																							
		26-2, 87-88	414.58	F	P E-3	A																							

Note: See Table 2A for explanation of symbols.

TABLE 6B
Distribution of Mesozoic Nannoliths at Site 387

Age	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Etching	Overgrowth	*V. aachena*	*T. aculeus*	*C. angustiforatus*	*P. angustus*	*Z. anthophorus*	*P. asper*	*W. barnesae*	*B. bigelowii*	*W. biporta*	*D. biradiatus*	*L. bollii*	*W. britannica*	*L. carniolensis*	*L. cayeuxii*	*C. chiastia*	*M. circumradiatus*	*B. colligatus*	*N. colomi*	*W. communis*	*V. compacta*	*C. conicus*	*B. constans*
Upper Maastrichtian	27-2, 70	443.00	R	M	2	2							C							R							F	R
	27-2, 149	443.79	A	M	2	1		C					A						C	R							C	F
	27-3, 74	444.54	A	G	1	1		F					A						C									C
	27-4, 70	446.00	A	G	0	0	F	C	R				A						C								R	C
	27-5, 80	447.60	A	G	1	0	R	F	R				A						C	R							R	C
	27-6, 83	449.13	A	G	0	0			R				A						C	F						R	R	C
	27, CC	450.40	F	M	1	2	R	C			F		A		R				C	F					R		F	C
	28-1, 120	461.10	A	G	0	0				F			A						C									C
	28, CC	469.40	A	G	0	0		C					A						C	R						R	R	C
U. Camp. – L. Maastr.	29-2, 59	471.49	C	P	2	3		C			R		A						F									
Lower Barremian – Upper Hauterivian	38-1, 3	593.13	A	G	0	0			C			A	A			R			C		C						F	F
	38, CC	602.60	A	G	0	0			C			A	A					R	A		A	R					F	F
	39-2, 66	673.76	A	G	1	0			C			A	A						C		C	R					F	C
	40-1, 90	632.00	A	G	1	0			F			F	A					R	C		A	R					F	F
M. Hauterivian	40-2, 64	633.24	C	G	1	1			R			F	C		R		R		F		F			R				
Lower Hauterivian – Upper Valanginian	40-2, 115	633.75	C	G	1	1			C			C	A		R			R	C		C	F						F
	40, CC	640.60	R	M	2	1			R			R	R						R									
	41-1, 113	641.73	A	M	2	1			F			C	A					R	C		C	F	F					F
	41, CC	650.20	R	M	2	1							R															
	42-1, 73	650.93	A	M	2	1			F			F	A		R			R	C		C	F						C
	42-1, 145	651.65	C	M	2	1			F			F	A						C		C	F						
	42, CC	659.70	C	G	1	1			R			F	C			R			C		F	R			R			
	44-1, 124	679.94	C	M	2	2			R			R	C					R	R		F		R		R		R	
	46-1, 116	727.16	C	M	2	1			F			F	A					R	F		C		F		F			R
	46-2, 93	728.43	C	M	2	1			R			F	A						F		R	R	R	F	R		R	
	46-2, 117	728.67	C	M	2	1						F	A						C		C	R			F			R
Middle Valanginian	47-1, 121	746.11	A	G	0	1			R			C	A	R		R		R	C		C		R		F		R	R
	48-1, 98	764.88	A	M	2	1						C	A	R					C						F			
	48, CC	773.10	A	M	1	2			F			F	A					F	C		C	F		C	C		R	F
Lower Valanginian	49-3, 94	786.34	A	M	1	2			R			F	A						C		C		R	A	F		R	R
	49-5, 112	789.52	A	G	1	1			R			F	A						R		F		R	R	R		R	
Lower Valanginian Upper Berriasian	49, CC	791.90	C	G	1	1			R			R	A						F		F			R	R			
	50-2, 88	794.28	F	M	2	1			R			R	F						R		R			R	R			

Note: See Table 2B for explanation of symbols.

TABLE 6B – *Continued*

Age	Sample (Interval in cm)	Sub-bottom Depth (m)	Abundance	Preservation	Etching	Overgrowth	*C. coronadventis*	*P. cretacea*	*C. cuvillieri*	*A. cymbiformis*	*M. decoratus*	*P. decorus*	*C. deflandrei*	*P. dietzmannii*	*Z. diplogrammus*	*C. ehrenbergii*	*Z. elegans*	*P. embergeri*	*B. enormis*	*C. exiguum*	*R. fenestratus*	*S. fossilis*	*N. frequens*	*T. gabalus*	*T. gothicus*	*L. helicoideus*	*P. infinitus*	*A. infracretacea*	*S. laffittei*
Upper Maastrichtian	27-2, 70	443.00	R	M	2	2		C		F	R					C													R
	27-2, 149	443.79	A	M	2	1		A		C	C					C													
	27-3, 74	444.54	A	G	1	1		A		C	C	F			F	C		R	C						R				R
	27-4, 70	446.00	A	G	0	0		A		C	C	F			C	C			F	R				R					C
	27-5, 80	447.60	A	G	1	0		A		C	C	R			F	C			R			R	R						C
	27-6, 83	449.13	A	G	0	0		A		C	C	R			F	C	R		R			R							C
	27, CC	450.40	F	M	1	2		A		F	C				F	C		R						R					C
	28-1, 120	461.10	A	G	0	0		A		C	F				R	C			F				R						C
	28, CC	469.40	A	G	0	0		A		C	C					C			F							R			C
U. Camp. – L. Maastr.	29-2, 59	471.49	C	P	2	3		C			R					C			F										
Lower Barremian – Upper Hauterivian	38-1, 3	593.13	A	G	0	0			R					F	F		F	F			F						F	F	F
	38, CC	602.60	A	G	0	0	R							C			C	C			C						F	R	C
	39-2, 66	623.76	A	G	1	0											C	C			F						R	C	
	40-1, 90	632.00	A	G	1	0								R				A										F	F
M. Hauterivian	40-2, 64	633.24	C	G	1	1			R						R			F										R	
Lower Hauterivian – Upper Valanginian	40-2, 115	633.75	C	G	1	1			R				R	F														F	F
	40, CC	640.60	R	M	2	1																							
	41-1, 113	641.73	A	M	2	1			C				F	R				C										F	F
	41, CC	650.20	R	M	2	1																							
	42-1, 73	650.93	A	M	2	1			C				F					C										F	F
	42-1, 145	651.65	C	M	2	1			C				F					C										F	
	42, CC	659.70	C	G	1	1							F		R														F
	44-1, 124	679.94	C	M	2	2			R				R				R	F										R	R
	46-1, 116	727.16	C	M	2	1			C				F				R	F										F	R
	46-2, 93	728.43	C	M	2	1			F				R				R	F											
	46-2, 117	728.67	C	M	2	1			F								R											F	F
Middle Valanginian	47-1, 121	746.11	A	G	0	1			F				R				R	R										R	F
	48-1, 98	764.88	A	M	2	1			F				F				R	R											R
	48, CC	773.10	A	M	1	2			C				F				R	F			R							R	
Lower Valanginian	49-3, 94	786.34	A	M	1	2			C				F				R	F			R								F
	49-5, 112	789.52	A	G	1	1			R				F				R	F											F
Lower Valanginian Upper Berriasian	49, CC	791.90	C	G	1	1			R				C					F			R								
	50-2, 88	794.28	F	M	2	1							R					R											

Note: See Table 2B for explanation of symbols.

TABLE 6B – *Continued*

D. lehmanii	*C. litterarius*	*K. magnificus*	*R. magnus*	*T. malticus*	*C. margerelii*	*V. matalosa*	*C. mexicana*	*M. mura*	*Z. noelae*	*G. obliquum*	*C. oblongata*	*M. obtusus*	*V. octoradiata*	*T. orionatus*	*B. parca*	*M. pemmatoidea*	*L. quadratus*	*H. radiatus*	*D. rectus*	*P. regularis*	*C. rhombicum*	*D. rotatorius*	*B. signata*	*P. spinosa*	*Z. spiralis*	*P. splendens*	*M. staurophora*	*T. stradneri*	*V. stradneri*	*C. surirellus*	*E. trabeculatus*	*T. trifidus*	*E. turriseiffeli*	*T. verenae*	*R. wisei*	*Cylindralithus* spp.	*Nannoconus* spp.	*M. astroporus*	*Thoracosphaera* spp.
	F																							F	F				R	C			F						
	F				F			C								R											A			C		R	F			C			
	C				F			C									C			C		F		C	C	C	A		C	C			C			C			
	C	F			F			F		R			R				C			C		C		C	C	C	A		C	C	C	R	C			C			R
	C	F			R	R		F									C			C		C	R	C	C	C	A		C	C	F		C			C			
	C				R			C									C			F	R	C		C	C	C	A		C	C	F		C			C			
	C	F						F				R		R		F	C			F		C		F	C	C	A		C	C	F	R	F			C			
	C				F			C		F			C				C			C		F		C	C	C	A		C	C	C		C						
	C				R			C					F				C			C		C		C	C	C	A		C	C	C		C			C		R	
			C		R										C	F									R	F	A			C		C				F			
					F											F		F				F						F	F	C							F		
C					C		R					F				F		R	R			F						F	C	A							F		
				R	C							R				F		R												F									
											R	R				F		R				F						R		C									
					F						R	R				F												R	R	R									
R					F							C				F		F				F								C									
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F					F							F				F		R				C								C									
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C					C			F			R																		R	F									
A					C				R		R	F							R			R							F	F					R				
C					C			F			C																												
C					A							F																	R	R				R	C				
C					A		R	R	R			R										R							F	C					F				
C					A				R																										R				
A					C		R															R																	
R					F		R																							R									

PLATE 1

Optical micrographs of Paleocene nannoplankton from Site 384. All figures same magnification. Scale bar in Figure 10b represents 5 μm.

Figures 1,2 — *Biscutum*? *tenuiculum* Okada and Thierstein n. sp.
1. Sample 12-4, 49-50 cm: 1a, cross-polarized light; lb, phase contrast.
2. Coccosphere, Sample 12-4, 49-50 cm: 2a, cross-polarized light; 2b, phase contrast.

Figure 3 — *Coccolithus eopelagicus* (Bramlette and Riedel) Bramlette and Sullivan. Sample 6-1, 39-40 cm; 3a, cross-polarized light; 3b, phase contrast.

Figure 4 — *Coccolithus pelagicus* (Wallich) Schiller. Sample 6-1, 74-75 cm: 4a, cross-polarized light; 4b, phase contrast.

Figures 5,6 — *Cruciplacolithus primus* Perch-Nielsen.
5. Poorly preserved specimen, the central cross structure is missing. Sample 13-3, 19-20 cm: 5a, cross-polarized light; 5b, phase contrast.
6. Well-preserved large specimens. Sample 13-2, 19-20 cm: 6a, cross-polarized light; 6b, phase contrast.

Figures 7-9 — *Cruciplacolithus tenuis* Hay and Mohler.
7. Small specimen with *Zygodiscus sigmoides*. Sample 13-2, 19-20 cm: 7a, cross-polarized light; 7b, phase contrast.
8. Typical medium-sized specimen with small central opening. Sample 13-2, 19-20 cm: 8a, cross-polarized light; 8b, phase contrast.
9. Typical form of middle to late Paleocene age (described as *C. notus* by Perch-Nielsen, 1977), large and has "hook" like structures at the ends of cross elements. Sample 9-3, 49-50 cm: 9a, cross-polarized light; 9b, phase contrast.

Figure 10 — *Cruciplacolithus subrotundus* Perch-Nielsen. Sample 9-4, 49-50 cm: 10a, cross-polarized light; 10b, phase contrast.

PLATE 1

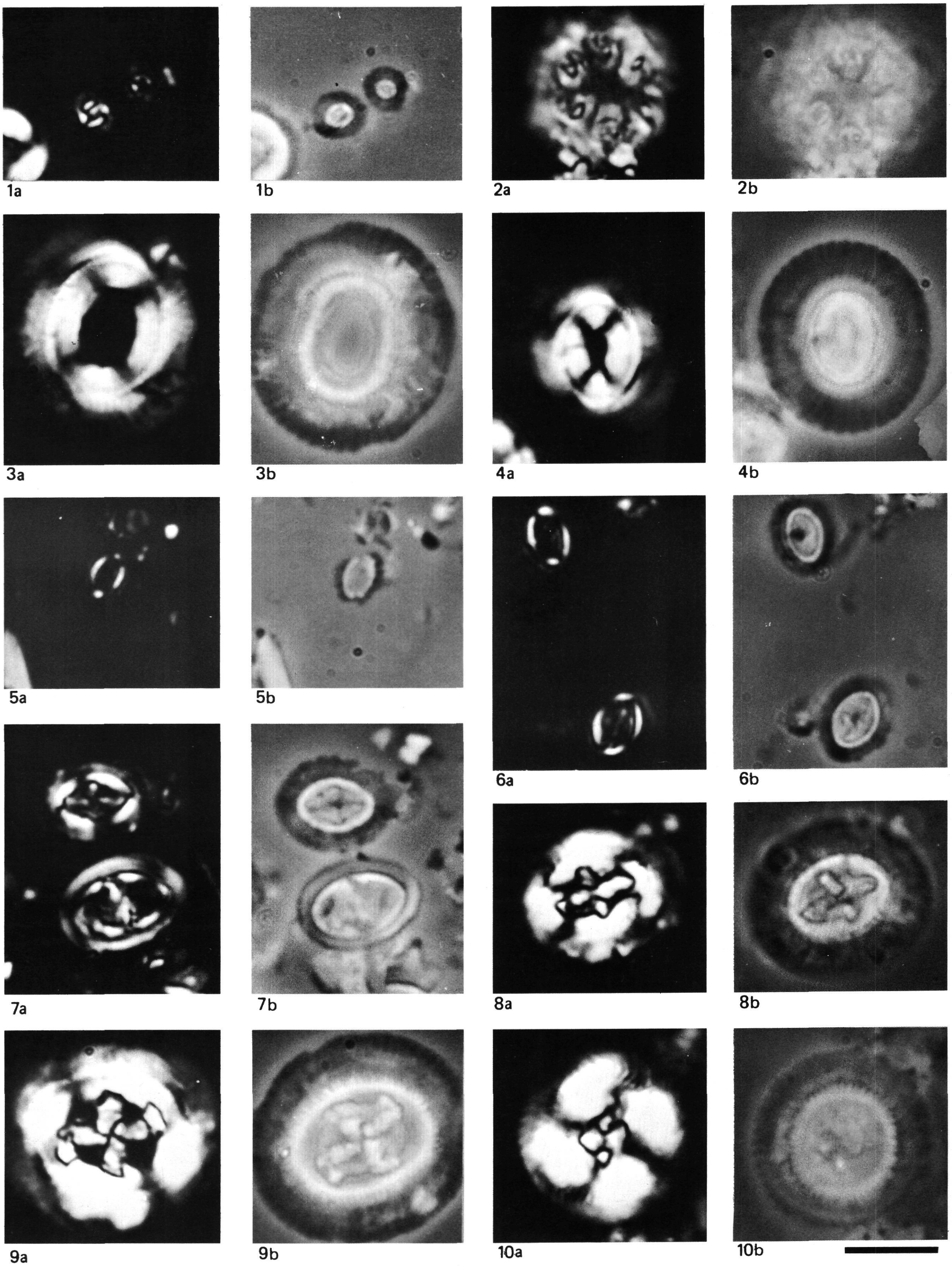


PLATE 2

Optical micrographs of Paleocene nannoplankton from Site 384. All figures same magnification. Scale bar in Figure 10b represents 5 μm.

Figure 1	*Chiasmolithus bidens* (Bramlette and Sullivan) Hay and Mohler. Sample 8-2, 124-125 cm: 1a, cross-polarized light; 1b, phase contrast.
Figure 2	*Chiasmolithus californicus* (Sullivan) Hay and Mohler. Sample 7-6, 109-110 cm: 2a, cross-polarized light; 2b, phase contrast.
Figures 3,4	*Chiasmolithus consuetus* (Bramlette and Sullivan) Hay and Mohler. 3. Sample 7-6, 49-50 cm: 3a, cross-polarized light; 3b, phase contrast. 4. Sample 7-1, 69-70 cm: 4a, cross-polarized light, 4b, phase contrast.
Figure 5	*Chiasmolithus danicus* (Brotzen) Hay and Mohler. An early transitional form showing still some features resembling *Cruciplacolithus tenuis*. Sample 12-5, 129-130 cm: 5a, cross-polarized light, 5b, phase contrast.
Figure 6	*Chiasmolithus* sp.1 and *Coccolithus pelagicus* (Wallich) Schiller. Sample 9-5, 49-50 cm: 6a, cross-polarized light; 6b, phase contrast.
Figure 7	*Cyclolithella robusta* (Bramlette and Sullivan) Stradner. Sample 6-4, 13-14 cm: 7a, cross-polarized light; 7b, phase contrast.
Figures 8-10	*Ericsonia subpertusa* Hay and Mohler. 8. Typical early form of middle Danian age. Sample 12-4, 49-50 cm: 8a, cross-polarized light; 8b, phase contrast. 9. Typical form of middle Paleocene age. Sample 9-2, 124-125 cm: 9a, cross-polarized light; 9b, phase contrast. 10. Typical form of late Paleocene age. Sample 6-2, 109-110 cm: 10a, cross-polarized light; 10b, phase contrast.

PLATE 2

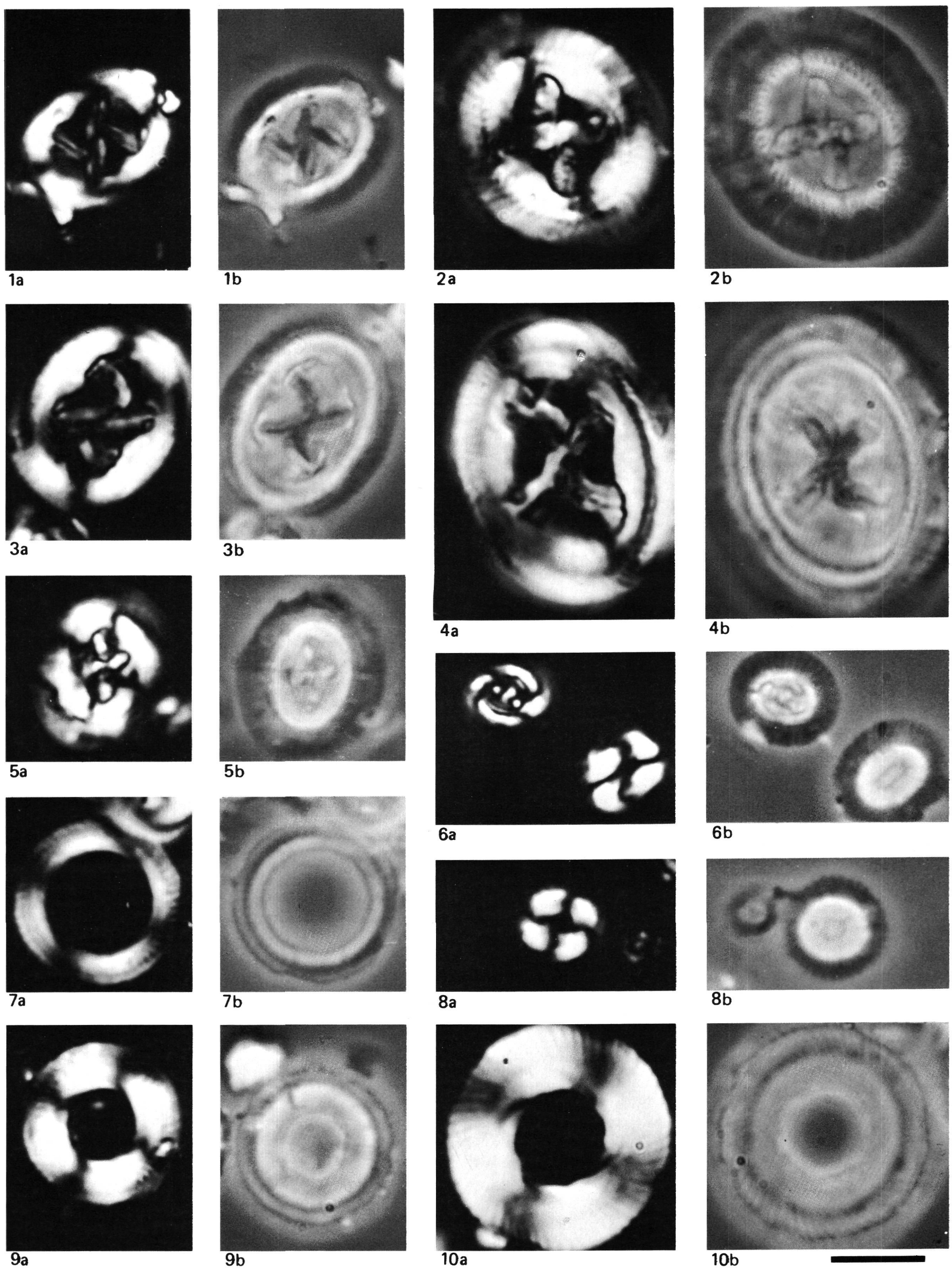


PLATE 3

Optical micrographs of Paleocene nannoplankton from Site 384. All figures same magnification. Scale bar in Figure 10b represents 5 μm.

Figure 1 — *Markalius astroporus* (Stradner) Hay and Mohler. Sample 12-4, 49-50 cm: 1a, cross-polarized light; 1b, phase contrast.

Figure 2 — *Markalius* sp. 1. Sample 6-4, 13-14 cm: 2a, cross-polarized light; 2b, phase contrast.

Figure 3 — *Biscutum*? aff. *dimorphosum* Perch-Nielsen. Sample 11, CC: 3a, cross-polarized light; 3b, phase contrast.

Figures 4,5 — *Prinsius bisulcus* (Stradner) Hay and Mohler.
4. Sample 11-4, 49-50 cm: 4a, cross-polarized light; 4b, phase contrast.
5. Sample 10-1, 45-46 cm: 5a, cross-polarized light; 5b, phase contrast.

Figure 6 — *Toweius craticulus* Hay and Mohler. Sample 7-6, 109-110 cm: 6a, cross-polarized light; 6b, phase contrast.

Figure 7 — *Toweius eminens* (Bramlette and Sullivan) Gartner. Sample 7-6, 109-110 cm: 7a cross-polarized light; 7b, phase contrast.

Figure 8 — *Toweius tovae* Perch-Nielsen. Sample 9-3, 49-50 cm: 8a, cross-polarized light; 8b, phase contrast.

Figures 9,10 — *Ellipsolithus macellus* (Bramlette and Sullivan) Sullivan.
9. Early form of late Danian age. Sample 10-6 59-60 cm: 9a, cross-polarized light; 9b, phase contrast.
10. Later form of late Paleocene age. Sample 6-3, 39-40 cm: 10a, cross-polarized light; 10b, phase contrast.

PLATE 3

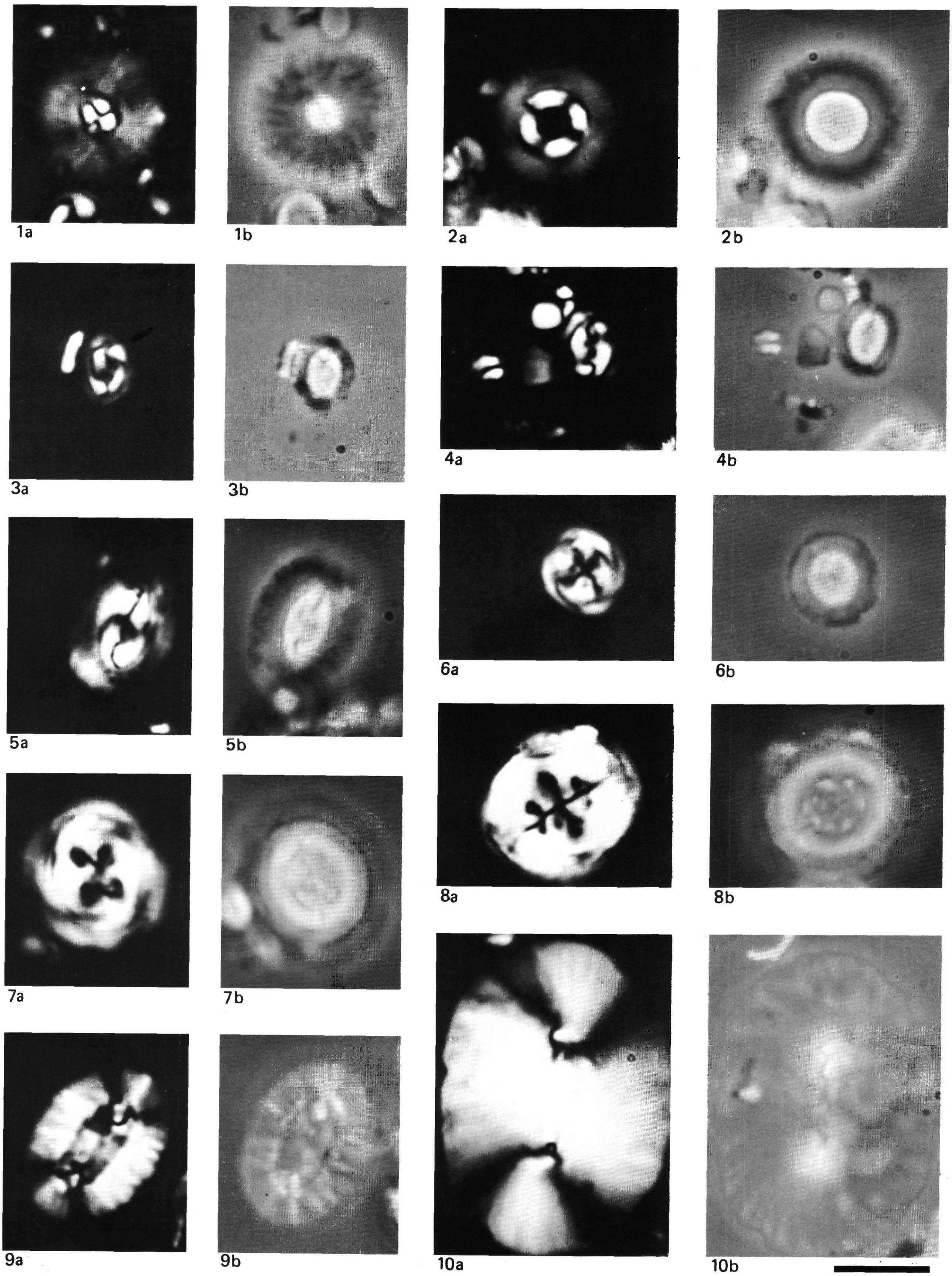


PLATE 4

Optical micrographs of Paleocene nannoplankton from Site 384. All figures same magnification. Scale bar in Figure 8b represents 5 μm.

Figure 1 — *Ellipsolithus distichus* (Bramlette and Sullivan) Sullivan. Sample 7-6, 109-110 cm: 1a, cross-polarized light; 1b, phase contrast.

Figure 2 — *Heliolithus cantabriae* Perch-Nielsen. Sample 8-5, 59-60 cm: 2a, cross-polarized light; 2b, phase contrast.

Figure 3 — *Heliolithus conicus* Perch-Nielsen. Sample 8-5, 59-60 cm: 3a, cross-polarized light; 3b, phase contrast.

Figures 4-6 — *Heliolithus riedelii* Bramlette and Sullivan.

4. Sample 6-1, 74-75 cm: 4a, cross-polarized light; 4b, phase contrast.
5. Sample 7-6, 49-50 cm: 5a, cross-polarized light, high focus; 5b, cross-polarized light, low focus; 5c, phase contrast, high focus; 5d, phase contrast, low focus.
6. Side view. Sample 7-6, 49-50 cm: 6a, cross-polarized light; 6b phase contrast.

Figures 7,8 — *Heliolithus kleinpellii* Sullivan.

7. Sample 8-5, 149-150 cm: 7a, cross-polarized light; 7b phase contrast.
8. Sample 8-4, 129-130 cm: 8a, cross-polarized light; 8b, phase contrast.

PLATE 4

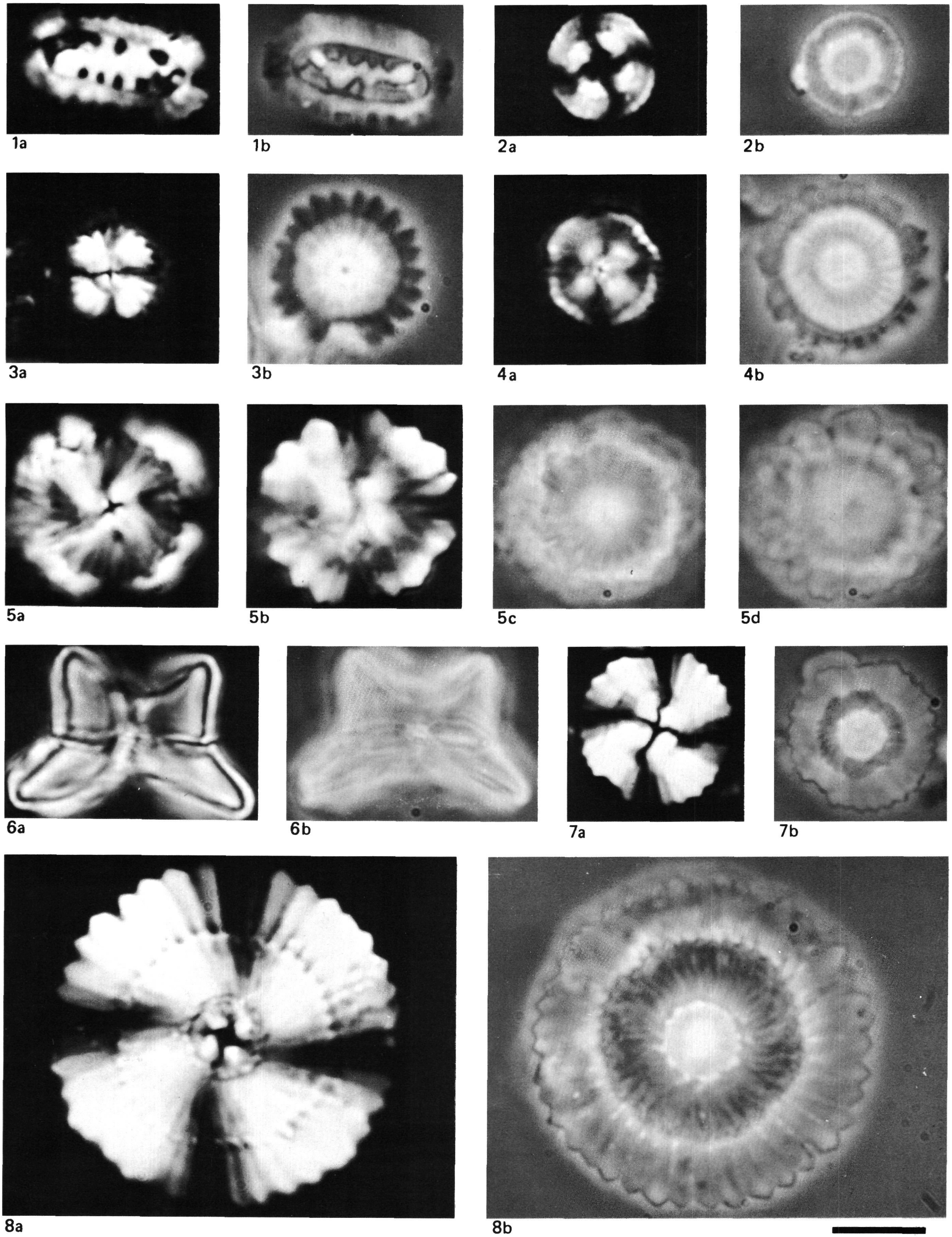


PLATE 5
Optical micrographs of Paleocene nannoplankton from Site 384. All figures same magnification. Scale bar in Figure 11b represents 5 μm.

Figure 1	*Discoaster* aff. *delicatus* Bramlette and Sullivan. Sample 6-1, 74-75 cm. Phase contrast.
Figure 2	*Discoaster lenticularis* Bramlette and Sullivan. Sample 6-1, 39-40 cm. Phase contrast.
Figure 3	*Discoaster mohleri* Bukry and Percival. Sample 7-5, 59-60 cm. Phase contrast.
Figure 4	*Discoaster nobilis* Martini. Sample 6-1, 109-110 cm. Phase contrast.
Figure 5	*Discoaster multiradiatus* Bramlette and Riedel. Sample 6-1, 39-40 cm. Phase contrast.
Figure 6	*Discoaster* sp. 1. Sample 7-1, 69-70 cm. Phase contrast.
Figure 7	*Discoaster* sp. 2. Sample 6-1, 149-150 cm. Phase contrast.
Figure 8	*Sphenolithus moriformis* (Bronnimann and Stradner) Bramlette and Wilcoxson. Sample 8-3, 49-50 cm: 8a, cross-polarized light; 8b, phase contrast.
Figure 9	*Sphenolithus anarrhopus* Bukry and Bramlette. Sample 7-4, 49-50 cm: 9a, cross-polarized light, 45° tilt; 9b, cross-polarized light, parallel to polarizing axis; 9c, phase contrast.
Figure 10	*Fasciculithus alanii* Perch-Nielsen. Sample 6-1, 39-40 cm: 10a, cross-polarized light; 10b, phase contrast.
Figure 11	*Fasciculithus hayi* Haq. Sample 6-1, 39-40 cm: 11a, cross-polarized light; 11b, phase contrast.

PLATE 5

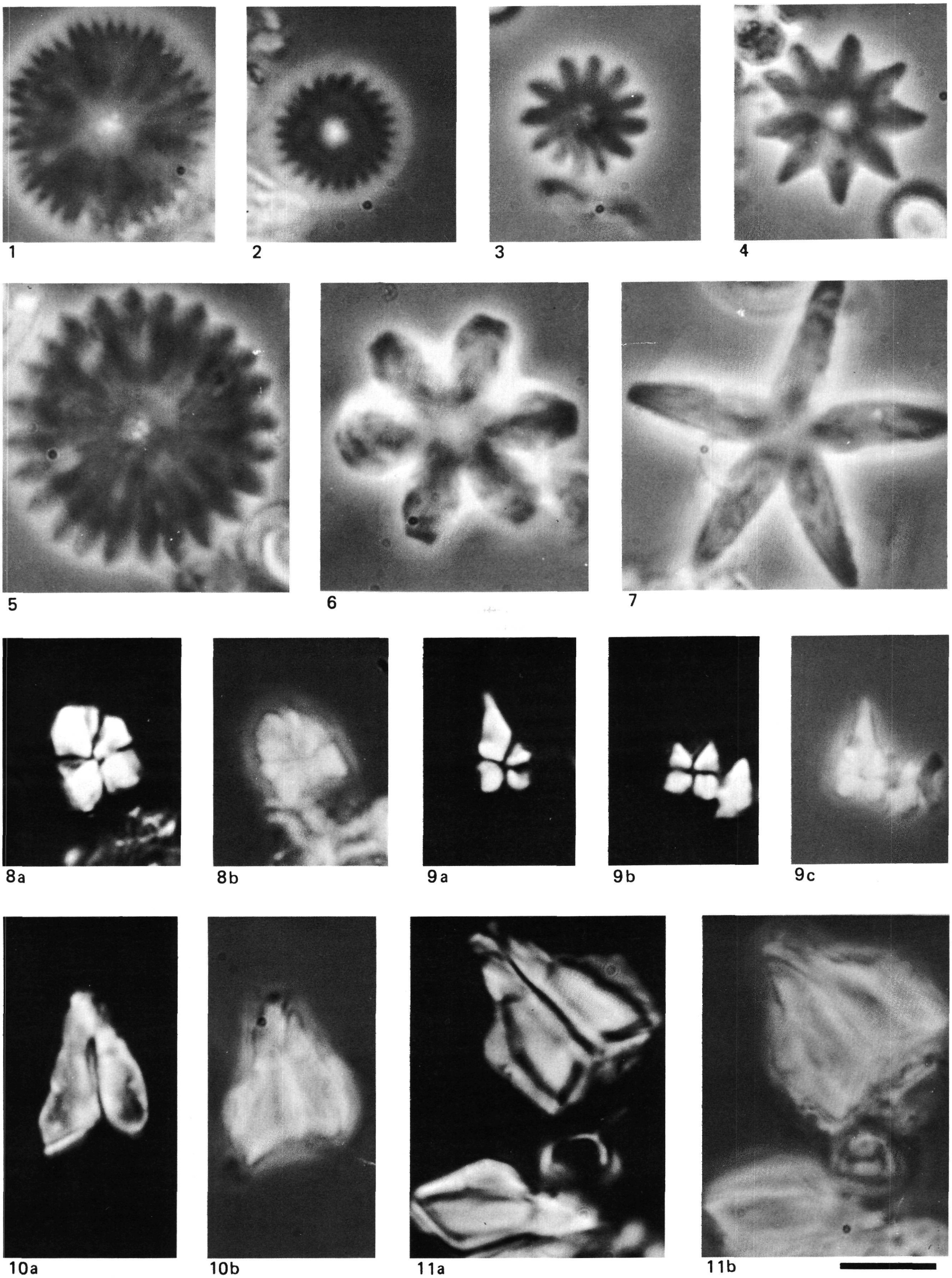


PLATE 6

Optical micrographs of Paleocene nannoplankton from Site 384. All figures same magnification. Scale bar in Figure 10b represents 5 μm.

Figure 1	*Fasiculithus crinatus* Bukry. Sample 6, CC: 1a, cross-polarized light; 1b, phase contrast.
Figures 2,3	*Fasciculithus pileatus* Bukry. 2. Sample 9-6, 49-50 cm: 2a, cross-polarized light; 2b, phase contrast. 3. Sample 9-6, 49-50 cm: 3a, cross-polarized light; 3b, phase contrast.
Figures 4,6	*Fasciculithus* aff. *richardii* Perch-Nielsen. 4. Sample 9-3, 49-50 cm: 4a, cross-polarized light; 4b, phase contrast. 6. Sample 6-1, 39-40 cm: 6a, cross-polarized light; 6b, phase contrast.
Figure 5	*Fasciculithus tympaniformis* Hay and Mohler. Sample 7-6, 49-50 cm: 5a, cross-polarized light; 5b, phase contrast.
Figures 7,8	*Fasciculithus ulii* Perch-Nielsen. 7. Sample 10-1, 45-46, cm: 7a, cross-polarized light; 7b, phase contrast. 8. Sample 10-1, 45-46 cm: 8a, cross-polarized light; 8b, phase contrast.
Figure 9	*Fasciculithus sp.2*. Sample 8, CC: 9a cross-polarized light; 9b, phase contrast.
Figure 10	*Fasciculithus* sp. 1. Sample 8-5, 59-60 cm: 10a, cross-polarized light; 10b, phase contrast.

PLATE 6

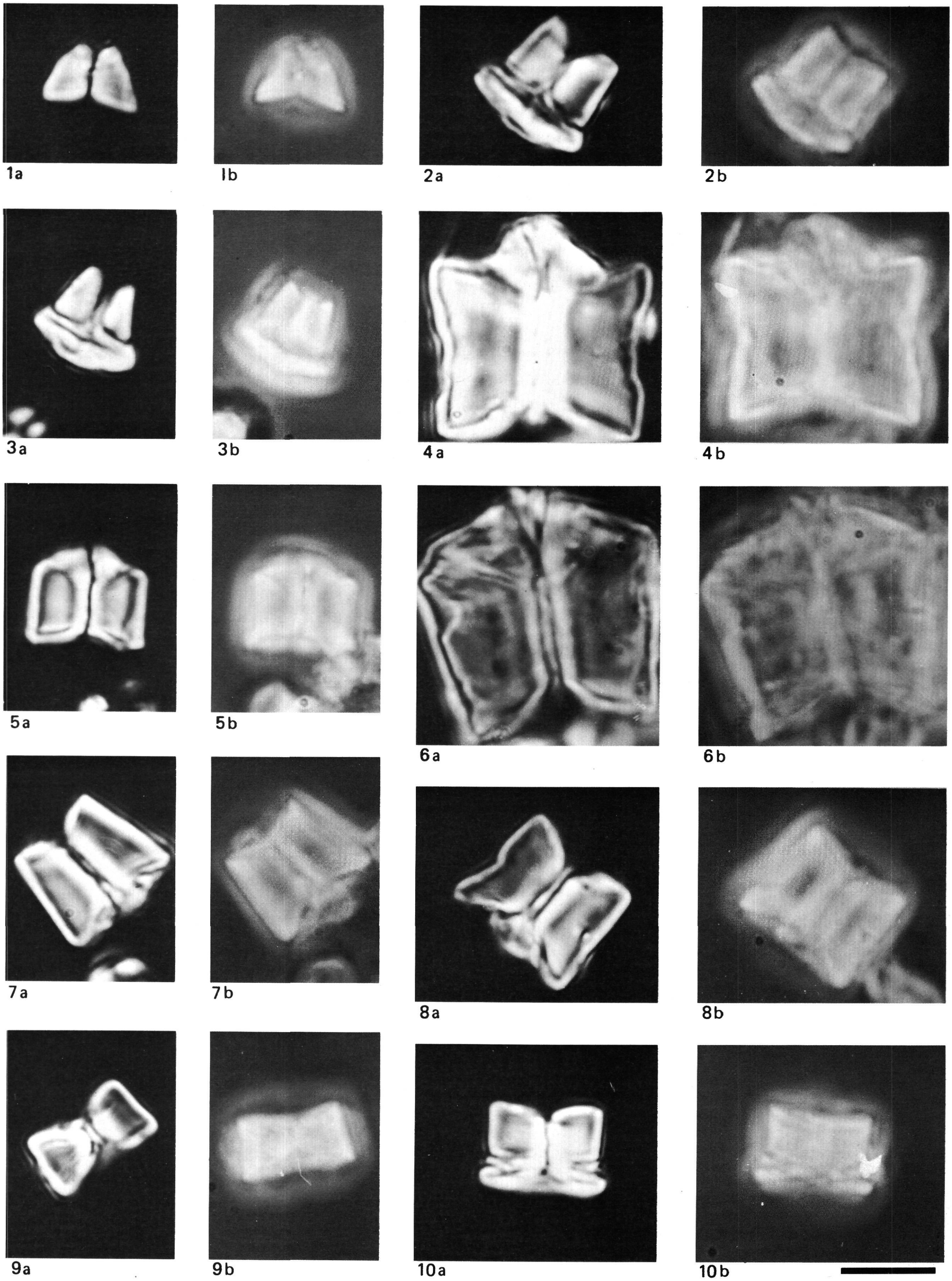


PLATE 7

Optical micrographs of Paleocene nannoplankton from Site 384. All figures same magnification. Scale bar in Figure 11b represents 5 μm.

Figure 1	*Neochiastozygus concinnus* (Martini) Perch-Nielsen and *Coccolithus pelagicus* (Wallich) Schiller. Sample 7-6, 109-110 cm: 1a, cross-polarized light; 1b, phase contrast.
Figure 2	*Neochiastozygus imbriei* Haq and Lohmann. Sample 7-4, 49-50 cm: 2a, cross-polarized light; 2b, phase contrast.
Figure 3	*Neochiastozygus junctus* (Bramlett and Sullivan) Perch-Nielsen. Sample 7-6, 109-110 cm: 3a, cross-polarized light; 3b, phase contrast.
Figure 4	*Zygodiscus sigmoides* Bramlette and Sullivan. Sample 12-4, 119-120 cm: 4a, cross-polarized light; 4b, phase contrast.
Figure 5, 6	*Zygodiscus simplex* (Bramlette and Sullivan) Hay and Mohler. 5. Plan view. Sample 10-1, 45-46 cm: 5a, cross-polarized light; 5b, phase contrast. 6. Side view. Sample 8-5, 149-150 cm: 6a, cross-polarized light; 6b, phase contrast.
Figure 7	*Zygodiscus plectopons* Bramlette and Sullivan. Sample 6-3, 39-40 cm: 7a, cross-polarized light; 7b, phase contrast.
Figure 8	*Bramletteius* sp. 1. Sample 11-3, 49-50 cm: 8a, cross-polarized light; 8b, phase contrast.
Figure 9	*Discolithina plana* (Bramlette and Sullivan) Levin. Sample 11-4, 49-50 cm: 9a, cross-polarized light; 9b, phase contrast.
Figures 10, 11	*Discolithina rimosa* (Bramlette and Sullivan) Levin and Joerger. 10. Sample 11-4, 49-50 cm: 10a, cross-polarized light; 10b, phase contrast. 11. Sample 7-1, 69-70 cm: 11a, cross-polarized light; 11b, phase contrast.

PLATE 7

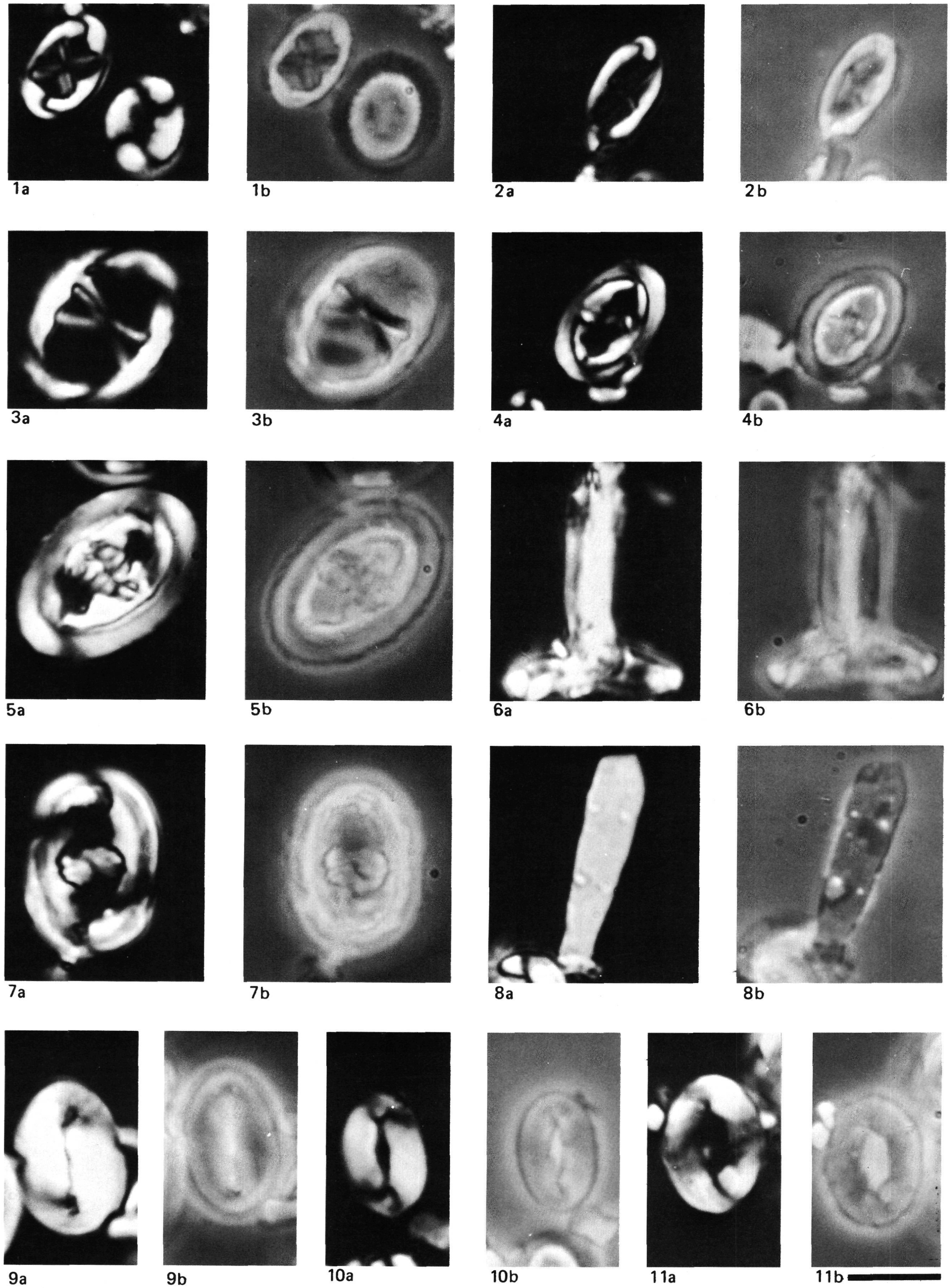


PLATE 8

Optical micrographs of Paleocene nannoplankton from Site 384. All figures same magnification. Scale bar in Figure 8b represents 5 μm.

Figure 1	*Crepidolithus* sp. Sample 13-3, 7-8 cm: 1a, cross-polarized light; 1b, phase contrast.
Figure 2	*Biantholithus sparsus* Bramlette and Martini. Sample 13-3, 7-8 cm: 2a, cross-polarized light; 2b, phase contrast.
Figure 3	*Braarudosphaera imbricata* Manivit. Sample **13-3,** 19-20 cm: 3a, cross-polarized light; 3b phase contrast.
Figure 4	*Braarudosphaera discula* Bramlette and Riedel. Sample 13-3, 7-8 cm: 4a, cross-polarized light; 4b, phase contrast.
Figure 5	*Braarudosphaera bigelowi* (Gran and Braarud) Deflandre. Sample 13-3, 7-8 cm: 5a, cross-polarized light; 5b, phase contrast.
Figure 6	*Thoracosphaera deflandrei* Kamptner. Sample 13-1, 144-145 cm: 6a, cross-polarized light; 6b, phase contrast.
Figure 7	*Thoracosphaera saxea* Stradner. Sample 12-1, 79-80 cm: 7a, cross-polarized light; 7b, phase contrast.
Figure 8	*Thoracosphaera operculata* Bramlette and Martini. Sample 13-2, 19-20 cm: 8a, cross-polarized light; 8b, phase contrast.

PLATE 8

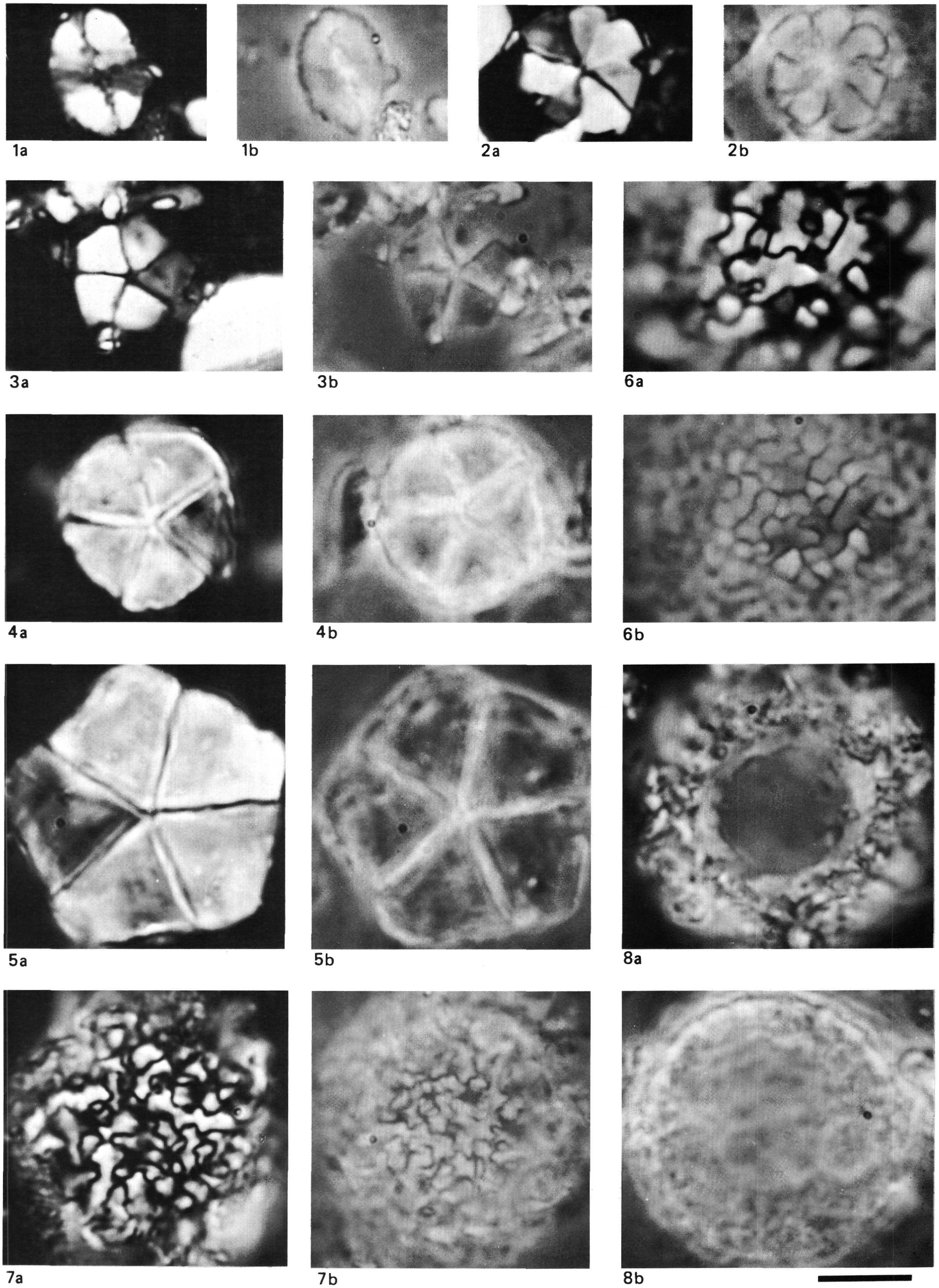


PLATE 9

Transmission electron micrographs of Paleocene nannoplankton from Site 384. Scale bar in each figure represents 3 μm.

Figures 1-8 — *Biscutum? tenuiculum* Okada and Thierstein n. sp.

1. A coccosphere most of whose coccoliths lost distal shields. Sample 12-5, 54-55 cm.
2. A coccosphere whose coccoliths lost most of central collar elements. Sample 12-5, 54-55 cm.
3. A coccosphere consisting of well-preserved coccoliths. Sample 12, CC.
4. Distal view of an isolated proximal shield. Sample 12, CC.
5. Distal view of well-preserved specimen, holotype. Sample 12, CC
6. Proximal view. Sample 12-4, 49-50 cm.
7. Distal view of overgrown specimen. Sample 11-4, 49-50 cm.
8. Distal and proximal views of well-preserved specimens and proximal view of an isolated proximal shield. Sample 12, CC.

Figures 9-11 — *Coccolithus pelagicus* (Wallich) Schiller.

9. Distal view of an early specimen. Sample 13-1, 144-145 cm.
10. Distal view. Sample 7, CC.
11. Proximal view. Sample 6-1, 109-110 cm.

Figures 12-14 — *Cruciplacolithus primus* Perch-Nielsen.

12. Distal view of early Danian specimen, the central cross structure is missing. Sample 13-3, 31-32 cm.
13. Proximal view of poorly preserved specimen. Sample 13-2, 109-110 cm.
14. Distal view, part of the central structure is missing. Sample 13-2, 145-146 cm.

PLATE 9

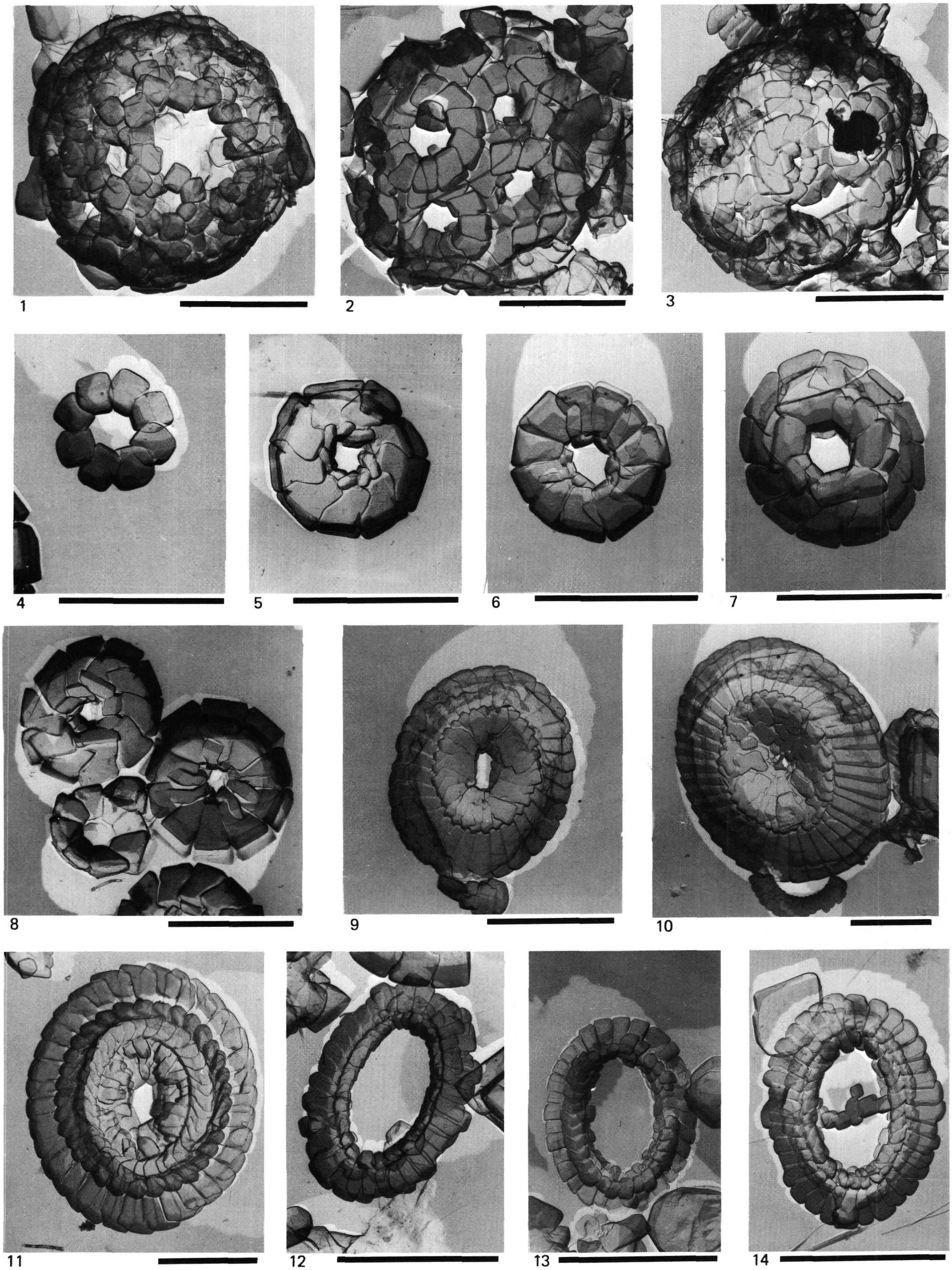


PLATE 10

Transmission electron micrographs of Paleocene nannoplankton from Site 384. Scale bar in each figure represents 3 μm.

Figures 1, 2 — *Cruciplacolithus primus* Perch-Nielsen.
1. Distal view. Sample 13-2, 145-146 cm.
2. Proximal view. Sample 13-2, 145-146 cm.

Figures 3-6 — *Cruciplacolithus tenuis* Hay and Mohler.
3. Distal view of early Danian specimen. Sample 13-2, 145-146 cm.
4. Proximal view of early Danian specimen. Sample 13-2, 109-110 cm.
5. Distal view of late Paleocene specimen. Sample 6, CC.
6. Proximal view of middle Paleocene specimen. Sample 7, CC.

Figures 7, 8 — *Chiasmolithus bidens* Bramlette and Sullivan) Hay and Mohler.
7. Distal view. Sample 8-5, 59-60 cm.
8. Proximal view. Sample 8-5, 59-60 cm.

Figures 9, 10 — *Chiasmolithus danicus* (Brozen) Hay and Mohler.
9. Distal view. Sample 12-3, 29-30 cm.
10. Proximal view. Sample 12-3, 29-30 cm.

Figures 11, 12 — *Chiasmolithus californicus* (Sullivan) Hay and Mohler.
11. Distal view. Sample 6-4, 13-14 cm.
12. Proximal view. Sample 6-1, 109-110 cm.

PLATE 10

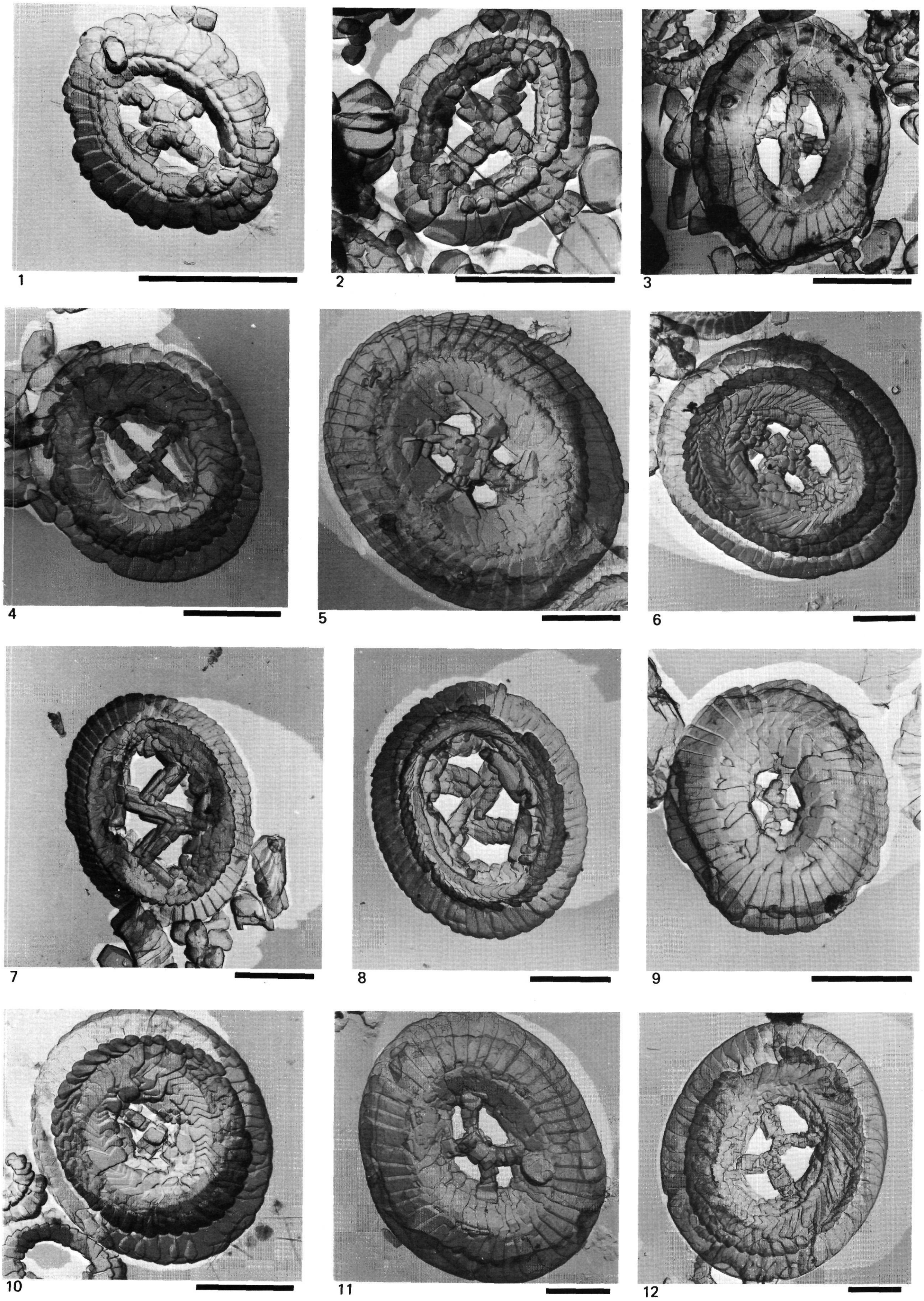


PLATE 11

Transmission electron micrographs of Paleocene nannoplankton from Site 384. Scale bar in each figure represents 3 μm.

Figures 1, 2 — *Chiasmolithus consuetus* (Bramlette and Sullivan) Hay and Mohler.
1. Distal view of late Danian specimen. Sample 10-4, 55-56 cm.
2. Proximal view of large middle Paleocene specimen. Sample 8-3, 49-50 cm.

Figure 3 — *Chiasmolithus* sp. 1. Distal view. Sample 7-4, 49-50 cm.

Figures 4-9 — *Ericsonia subpertusa* Hay and Mohler.
4. Distal view of middle Danian specimen. Sample 12-5, 54-55 cm.
5. Distal view of late Danian specimen. Sample 10-4, 55-56 cm.
6. Distal view of middle Paleocene specimen. Sample 8-3, 49-50 cm.
7. Distal view of late Paleocene specimen. Sample 6, CC.
8. Proximal view of late Danian specimen. Sample 11-2, 43-44 cm.
9. Proximal view of middle Paleocene specimen. Sample 8-3, 49-50 cm.

Figures 10-12 — *Cyclolithella robusta* (Bramlette and Sullivan) Stradner.

10. Distal view. Sample 6-1, 109-110 cm.
11. Proximal view. Sample 6-1, 74-75 cm.
12. Distal view. Sample 6-1, 74-75 cm

PLATE 11

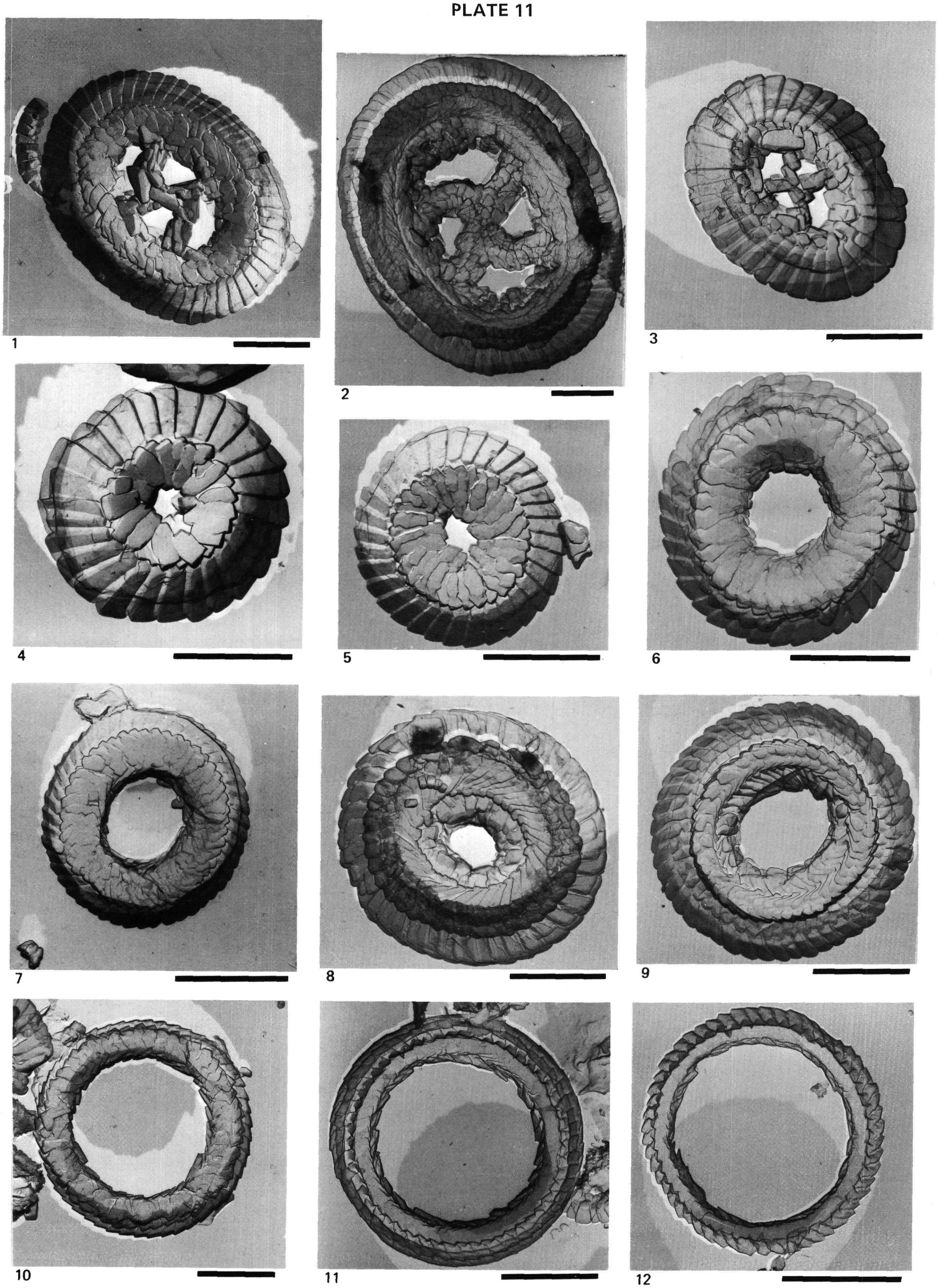


PLATE 12
Transmission electron micrographs of Paleocene nannoplankton from Site 384. Scale bar in each figure represents 3 μm.

Figures 1, 2	*Markalius astroporus* (Stradner) Hay and Mohler. 1. Distal view. Sample 13-2, 109-110 cm. 2. Proximal view. Sample 13-1, 144-145 cm.
Figure 3	*Markalius* aff. *astroporus* (Stradner) Hay and Mohler. Distal view. Sample 13-2, 144-145 cm.
Figures 4, 5	*Markalius reinhardtii* Perch-Nielsen. 4. Distal view. Sample 13-1, 144-145 cm. 5. Proximal view. Sample 13-1, 144-145 cm.
Figures 6, 7	*Markalius* sp. 1. 6. Distal view. Sample 6-1, 74-75 cm. 7. Proximal view. Sample 6-1, 109-110 cm.
Figure 8	*Connococcolithus minutus* Hay and Mohler. Distal view. Sample 13-2, 49-50 cm.
Figures 9-11	*Biscutum*? aff. *dimorphosum* Perch-Nielsen. 9. Distal view. Sample 11-4, 49-50 cm. 10. Proximal view. Sample 12-3, 29-30 cm. 11. Distal view. Sample 12-3, 29-30 cm.
Figures 12-14	*Prinsius bisulcus* (Stradner) Hay and Mohler. 12. Distal view of small Danian specimen. Sample 11-4, 49-50 cm. 13. Distal view of large middle Paleocene specimen. Sample 8-2, 49-50 cm. 14. Proximal view of small Danian specimen. Sample 11-2, 43-44 cm.

PLATE 12

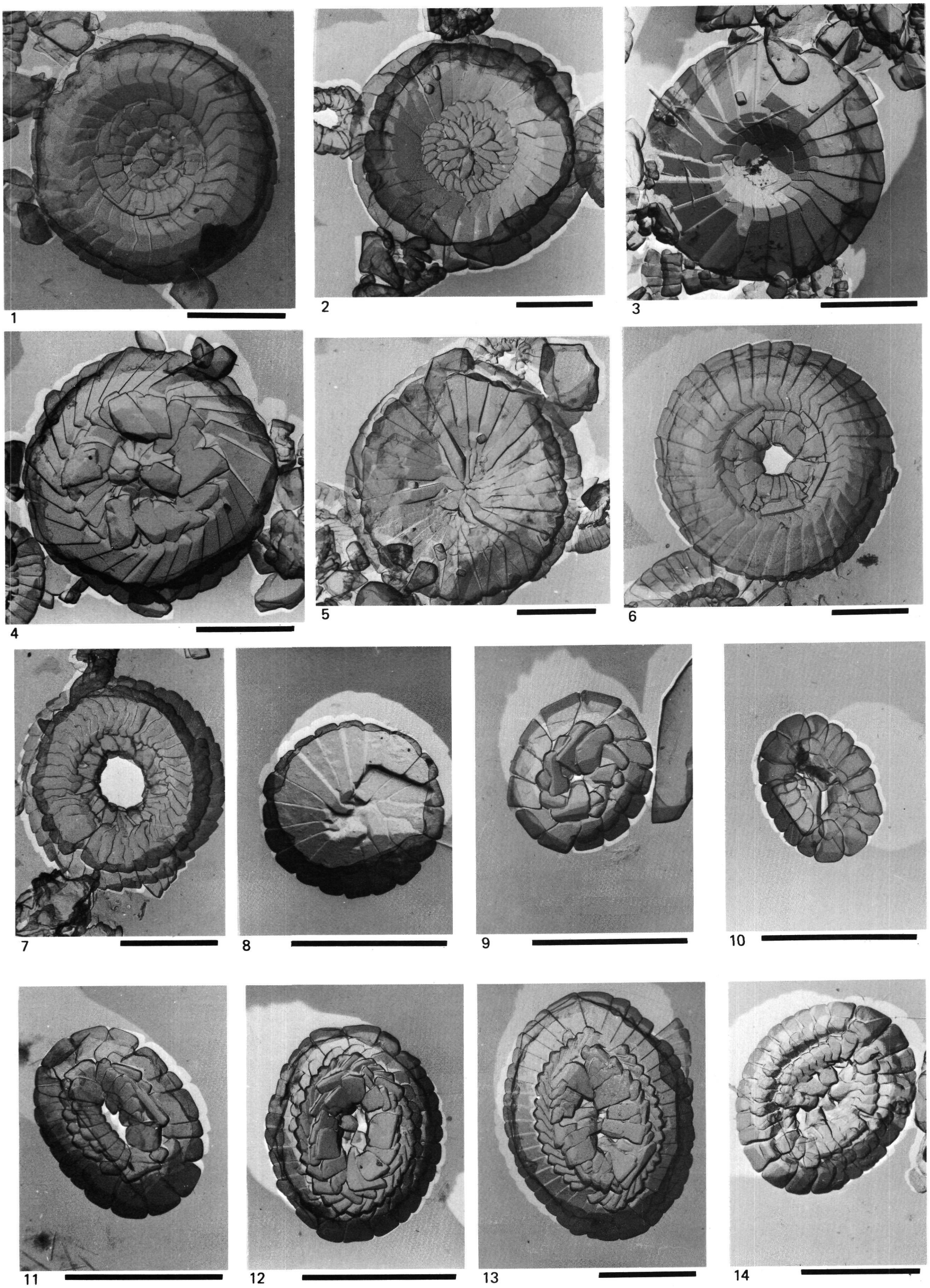


PLATE 13

Transmission electron micrographs of Paleocene nannoplankton from Site 384, Scale bar in each figure represents 3 μm.

Figures 1, 2 — *Toweius craticulus* Hay and Mohler.
1. Distal view. Sample 7-2, 49-50 cm.
2. Proximal view. Sample 11-4, 49-50 cm.

Figures 3, 4 — *Toweius eminens* (Bramlette and Sullivan) Gartner.
3. Distal view. Sample 8-3, 49-50 cm.
4. Proximal view. Sample 6-1, 14-15 cm.

Figures 5, 6 — *Toweius tovae* Perch-Nielsen.
5. Distal view. Sample 6-1, 74-75 cm.
6. Proximal view. Sample 6-1, 74-75 cm.

Figures 7-10 — *Ellipsolithus macellus* (Bramlette and Sullivan) Sullivan.
7. Distal view of Danian specimen. Sample 11-2, 43-44 cm.
8. Distal view of middle Paleocene specimen. Sample 8-4, 49-50 cm.
9. Distal view of late Paleocene specimen. Sample 6-1, 14-15 cm.
10. Proximal view. Sample 8-3, 49-50 cm.

Figures 11, 12 — *Ellipsolithus distichus* (Bramlette and Sullivan) Sullivan.
11. Proximal view of middle Paleocene specimen. Sample 8-3, 49-50 cm.
12. Distal view of late Paleocene specimen. Sample 6-1, 14-15 cm.

PLATE 13

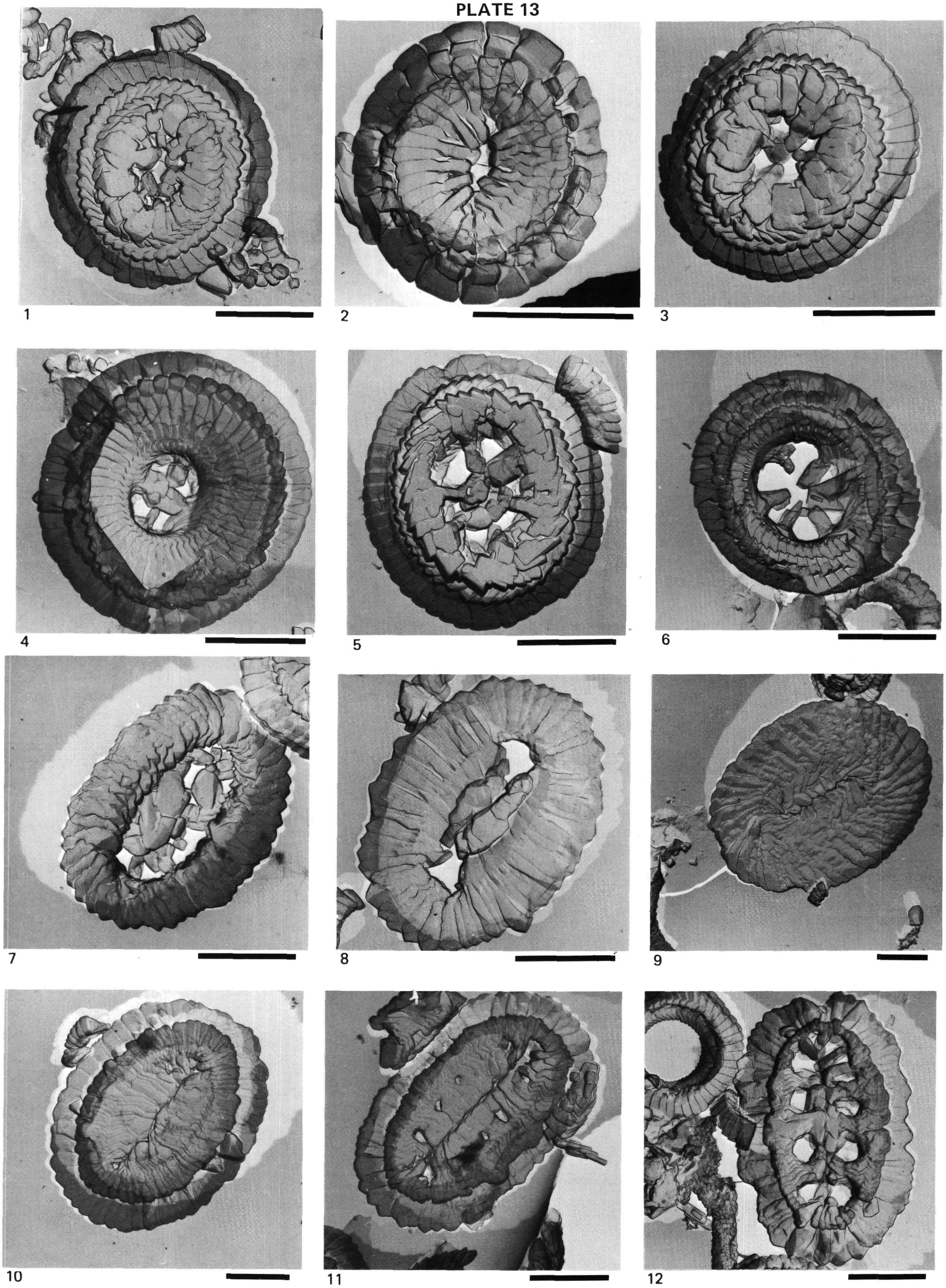


PLATE 14

Transmission electron micrographs of Paleocene nannoplankton from Site 384. Scale bar in each figure represents 3 μm.

Figures 1, 2	*Heliolithus* aff. *cantabriae* Perch-Nielsen. 1. Top view. Sample 8-5, 59-60 cm. 2. Oblique view. Sample 8-5, 59-60 cm.
Figure 3, 4	*Heliolithus conicus* Perch-Nielsen. 3. Top view. Sample 8-5, 59-60 cm. 4. Bottom view. Sample 8-5, 59-60 cm.
Figures 5-7	*Heliolithus kleinpellii* Sullivan. 5. Top view. Sample 8-5, 59-60 cm. 6. Top view. Sample 8-5, 59-60 cm. 7. Bottom view. Sample 8-5, 59-60 cm.
Figures 8, 9	*Heliolithus riedelii* Bramlette and Sullivan. 8. Top view. Sample 7-2, 49-50 cm. 9. Oblique view from bottom side. Sample 7, CC.
Figures 10, 11	*Heliolithus sp.* 10. Top view. Sample 8-5, 59-60 cm. 11. Top view. Sample 9-1, 49-50 cm.
Figure 12	*Discoasteroide*? aff. *bramlettei* Bukry and Percival. Top view. Sample 12-3, 29-31 cm.

PLATE 14

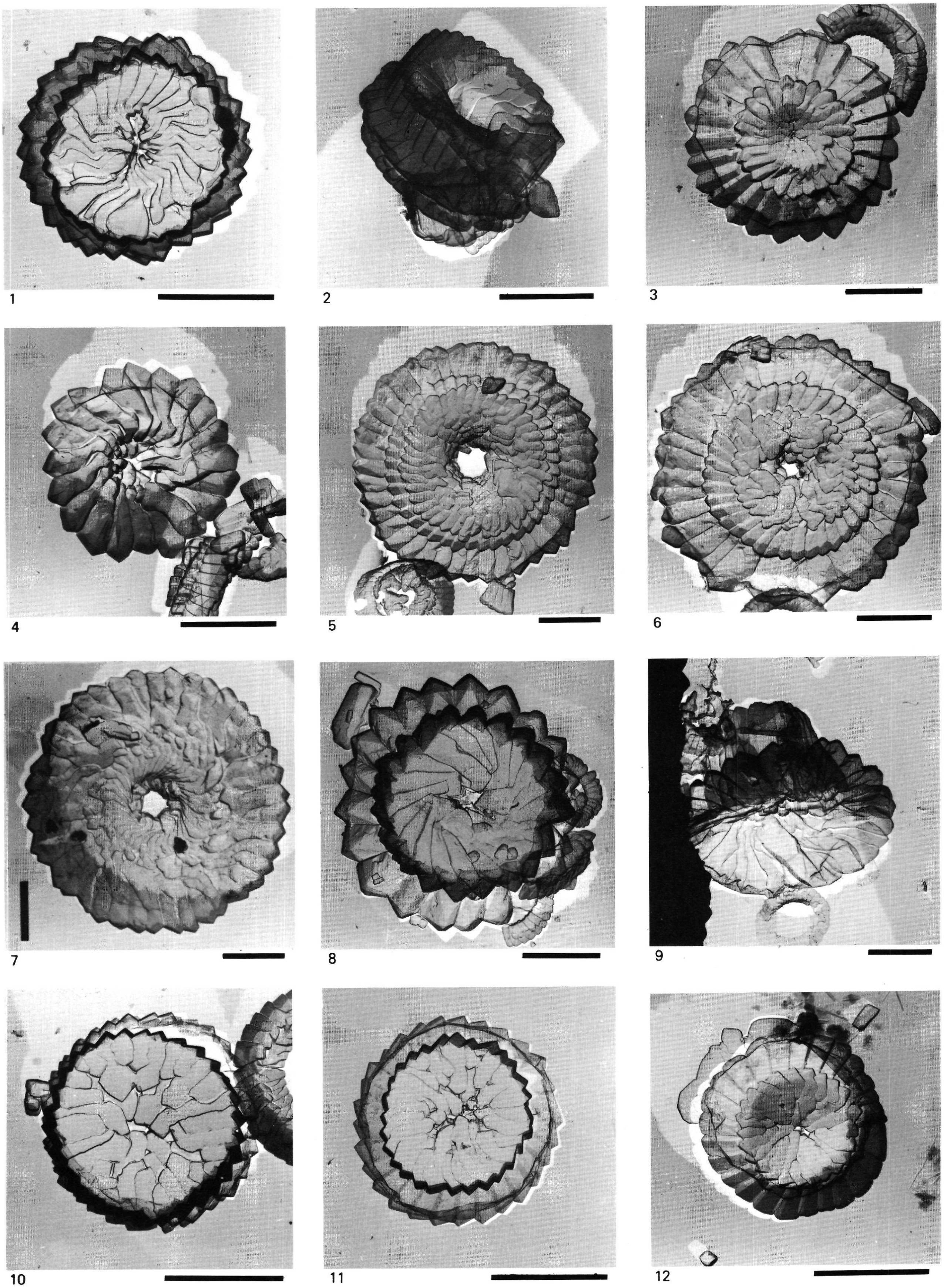


PLATE 15

Transmission electron micrographs of Paleocene nannoplankton from Site 384. Scale bar in each figure represents 3 μm.

Figure 1	*Discoaster*? sp. Sample 6-1, 39-40 cm.
Figure 2	*Discoaster* aff. *delicatus* Bramlette and Sullivan. Sample 6-1, 74-75 cm.
Figures 3-5	*Discoaster mohleri* Bukry and Percival. 3. Top view. Sample 7, CC. 4. Top view. Sample 8-3, 49-50 cm. 5. Bottom view. Sample 7, CC.
Figures 6, 7	*Discoaster nobilis* Martini. 6. Top view. Sample 6-3, 39-40 cm. 7. Bottom view. Sample 6-4, 13-14 cm.
Figures 8-10	*Discoaster multiradiatus* Bramlette and Riedel. 8. Sample 6-1, 14-15 cm. 9. Sample 6-1, 14-15 cm. 10. Sample 6-1, 14-15 cm.
Figure 11	*Discoaster* sp. 1. Sample 6-3, 39-40 cm.
Figure 12	*Discoaster* sp. 2. Sample 6-3, 39-40 cm.

PLATE 15

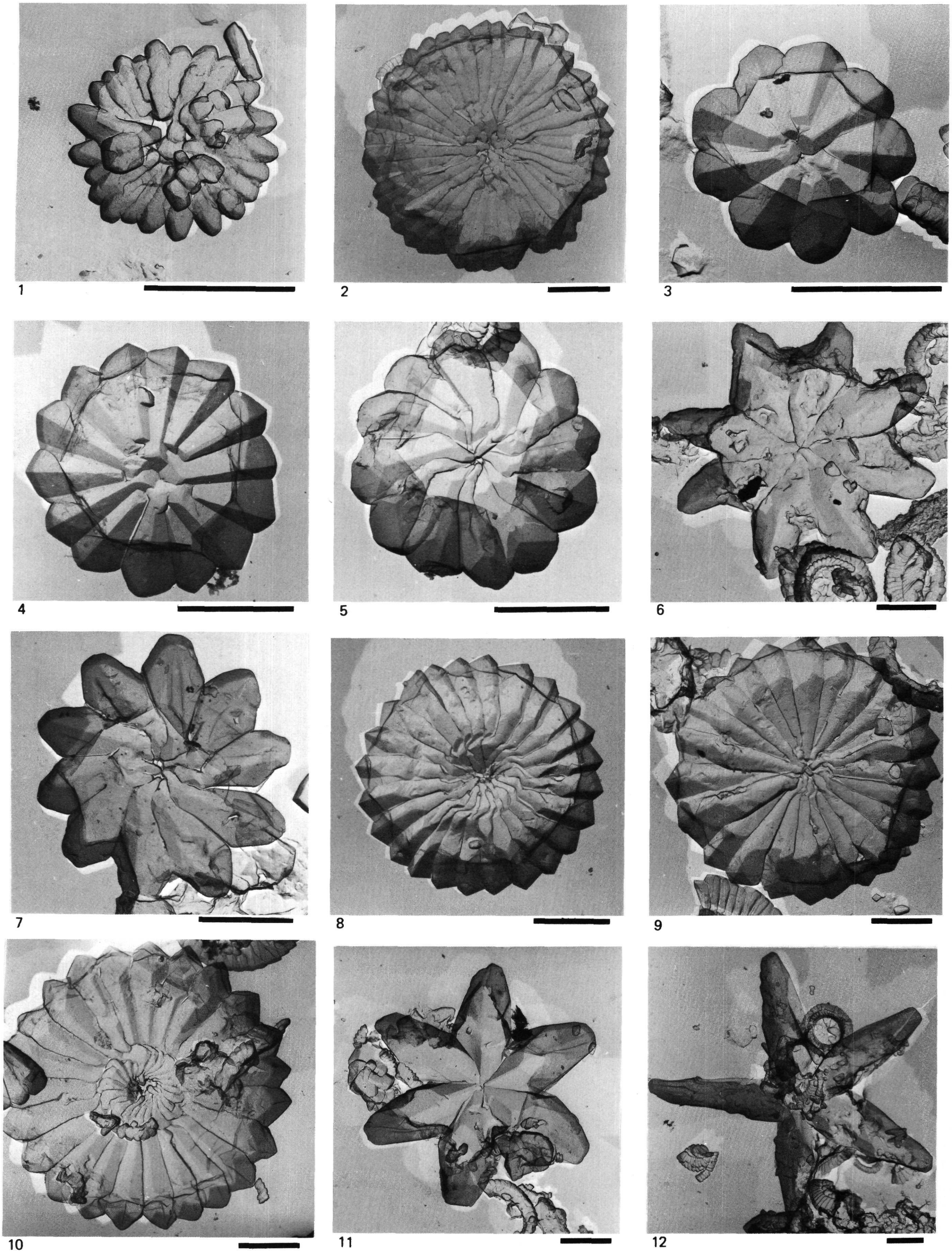


PLATE 16

Transmission electron micrographs of Paleocene nannoplankton from Site 384. Scale bar in each figure represents 3 μm.

Figure 1-4, 9 — *Sphenolithus moriformis* (Bronnimann and Stradner) Bramlette and Wilcoxon.

1. Top view of early form. Sample 10-4, 55-56 cm.
2. Side view of early form. Sample 9-2, 49-50 cm.
3. Side view. Sample 9-1, 49-50 cm.
4. Side view. Sample 8-5, 59-60 cm.
9. Top view. Sample 6-1, 109-110 cm.

Figure 5-8 — *Sphenolithus anarrhopus* Bukry and Bramlette.

5. Side view of early form. Sample 7, CC.
6. Side view. Sample 6-1, 109-110 cm.
7. Side view. Sample 6-1, 109-110 cm.
8. Side view. Sample 6-4, 13-14 cm.

Figures 10, 11 — *Fasciculithus* sp.

10. Top view of *Fasiciculithus* sp. Sample 6-1, 109-110 cm.
11. Bottom view of *Fasciculithus* sp. Sample 6-1, 74-75 cm.

Figure 12 — *Fasciculithus*? sp. Sample 8-4, 49-50 cm.

Figure 13 — *Fasciculithus alanii* Perch-Nielsen. Sample 6-1, 39-40 cm.

Figure 14 — *Fasciculithus hayi* Haq. Sample 6-1, 39-40 cm.

PLATE 16

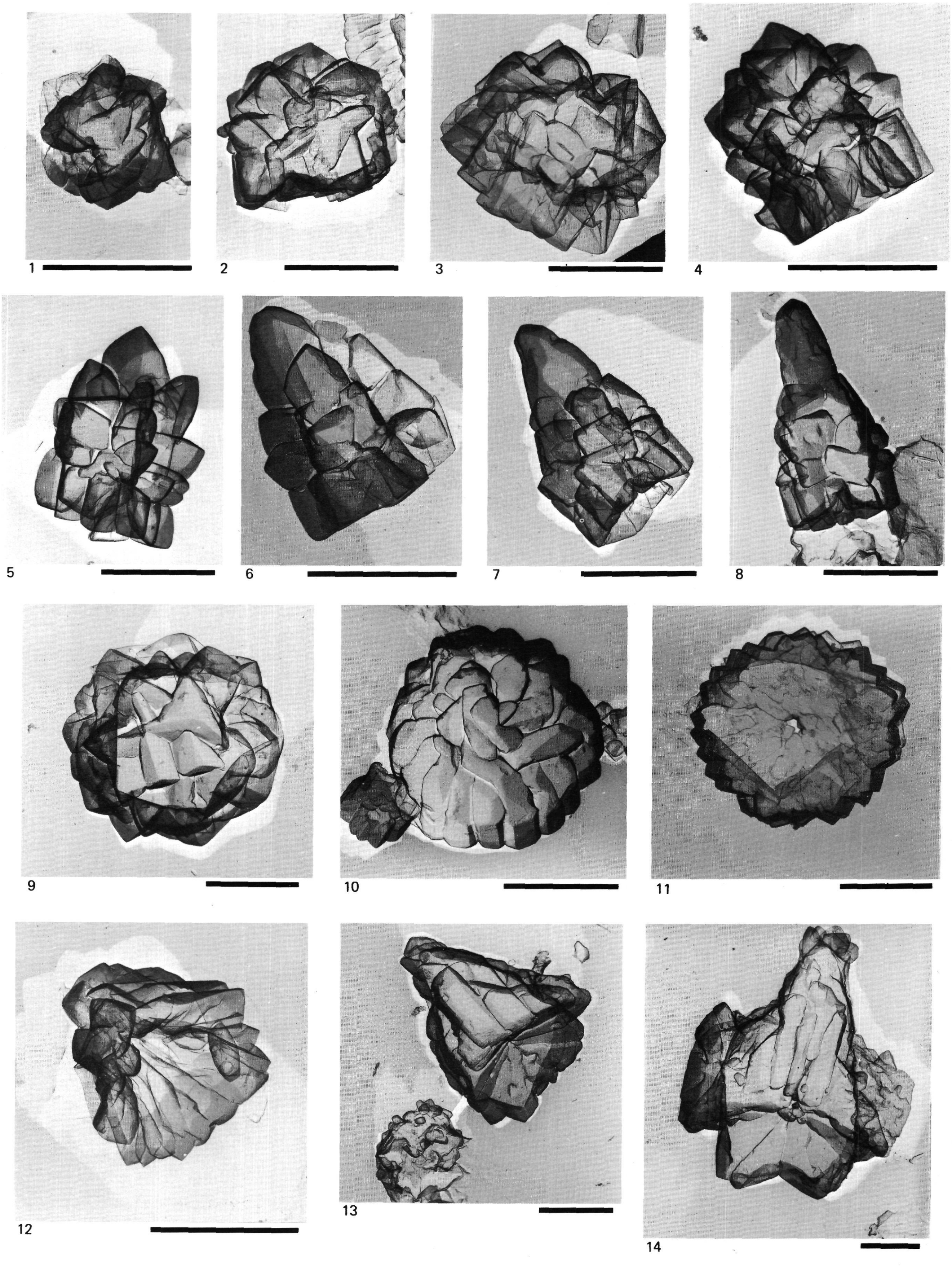
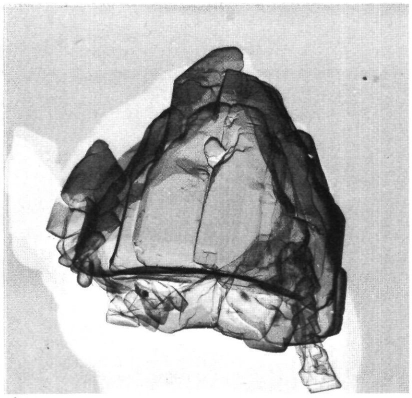


PLATE 17

Transmission electron micrographs of Paleocene nannoplankton from Site 384. Scale bar in each figure represents 3 μm.

Figure 1	*Fasciculithus crinatus* Bukry. Sample 8-2, 49-50 cm.
Figures 2, 3	*Fasciculithus pileatus* Bukry. 2. Side view. Sample 9-6, 49-50 cm. 3. Top view. Sample 10-2, 49-50 cm.
Figure 4	*Fasciculithus* aff. *richardii* Perch-Nielsen. Sample 9-3, 49-50 cm.
Figures 5, 6	*Fasciculithus tympaniformis* Hay and Mohler. 5. Sample 8-5, 59-60 cm. 6. Sample 8-3, 49-50 cm.
Figure 7	*Fasciculithus ulii* Perch-Nielsen. Oblique view. Sample 10-2, 49-50 cm.
Figure 8	*Fasciculithus* sp. 1. Side view. Sample 8-5, 59-60 cm.
Figures 9, 10	*Neochiastozygus concinnus* (Martini) Perch-Nielsen. 9. Early Danian specimen. Sample 13-2, 79-80 cm. 10. Late Danian specimen. Sample 10, CC.
Figure 11	*Neochiastozygus imbriei* Haq and Lohmann. Sample 12-3, 29-30 cm.
Figure 12	*Neochiastozygus junctus* (Bramlett and Sullivan) Perch-Nielsen. Sample 8-3, 49-50 cm.

PLATE 17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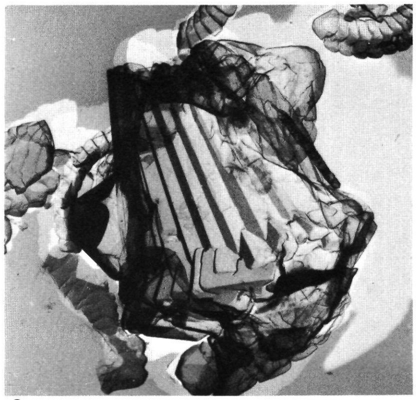
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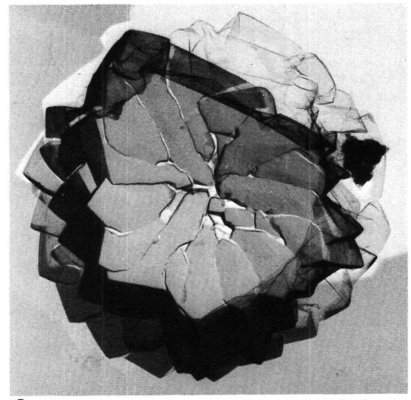
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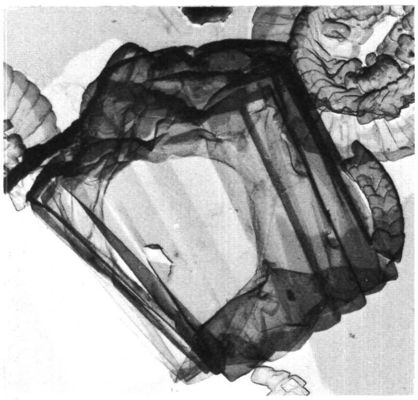
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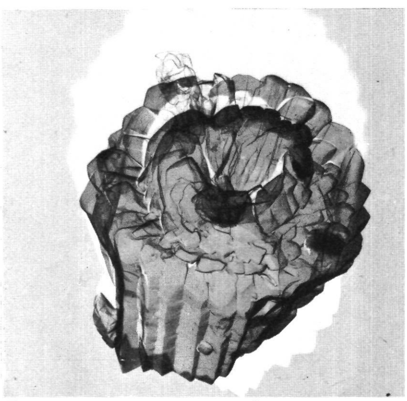
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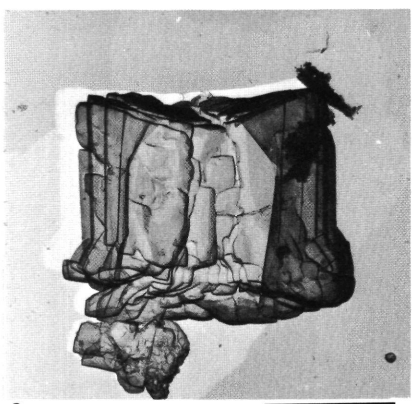
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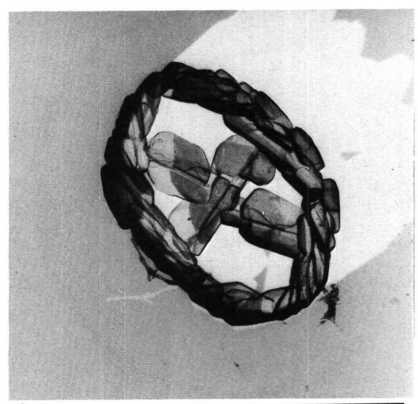
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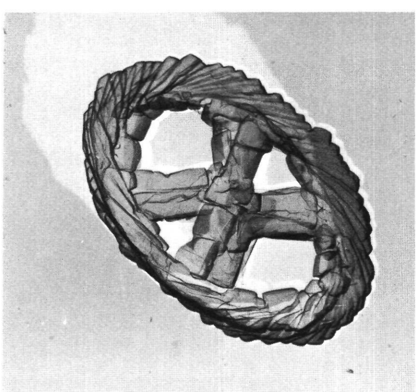
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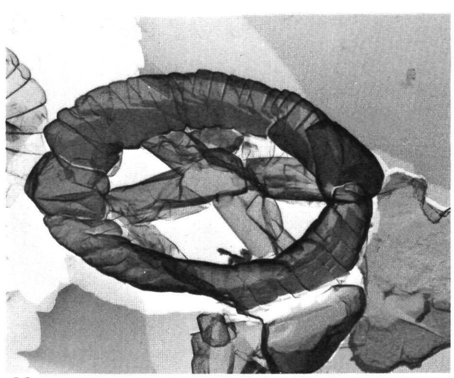
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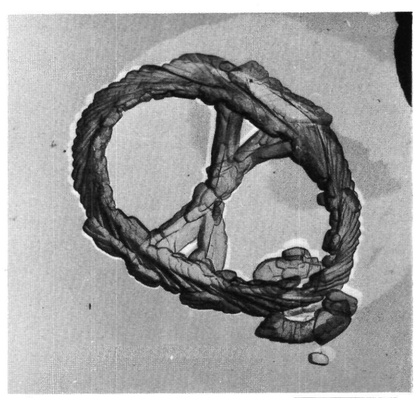
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PLATE 18

Transmission electron micrographs of Paleocene nannoplankton from Site 384. Scale bar in each figure represents 3 μm.

Figures 1-3 — *Zygodiscus sigmoides* Bramlette and Sullivan.
1. Distal view. Sample 13-3, 19-20 cm.
2. Distal view. Sample 13-1, 144-145 cm.
3. Proximal view. Sample 13-1, 144-145 cm.

Figures 4-6 — *Zygodiscus simplex* (Bramlette and Sullivan) Hay and Mohler.
4. Distal view. Sample 9-6, 49-50 cm.
5. Side view. Sample 8-5, 59-60 cm.
6. Side view. Sample 8-5, 59-60 cm.

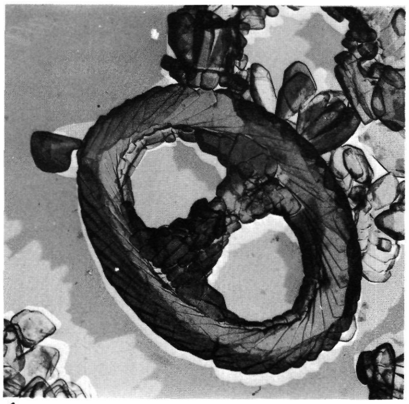
Figure 7 — *Zygodiscus plectopons* Bramlette and Sullivan. Proximal view. Sample 6-1, 14-15 cm.

Figure 8 — *Bramletteius* sp. 1. Sample 9-3, 49-50 cm.

Figures 9, 10 — *Crepidolithus* sp. 1.
9. Top view. Sample 13-2, 109-110 cm.
10. Bottom view. Sample 13-1, 144-145 cm.

Figures 11, 12 — *Crepidolithus* sp. 2.
11. Top view. Sample 13-2, 145-146 cm.
12. Bottom view. Sample 13-3, 31-32 cm.

PLATE 18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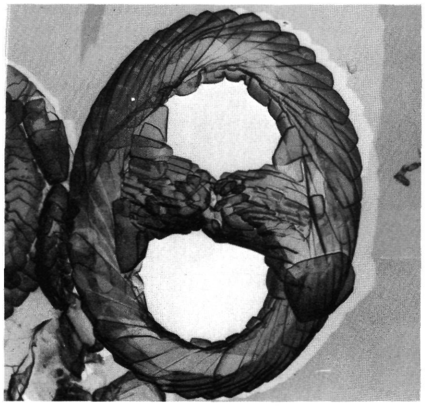
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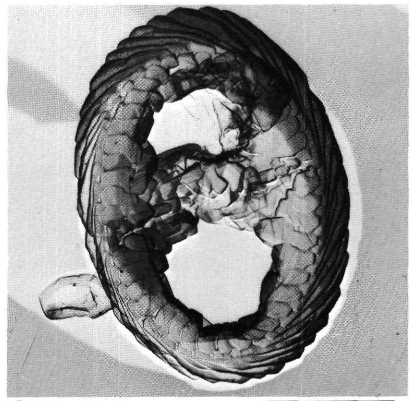
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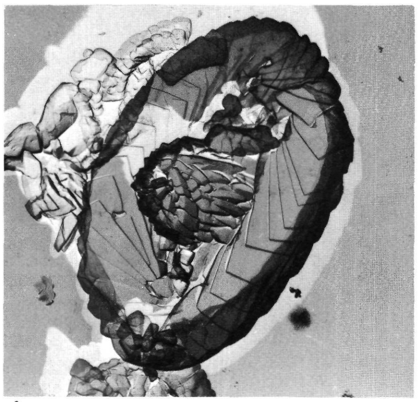
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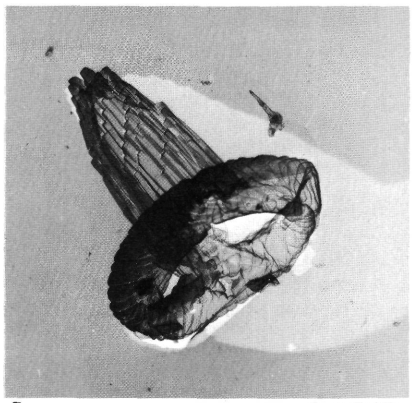
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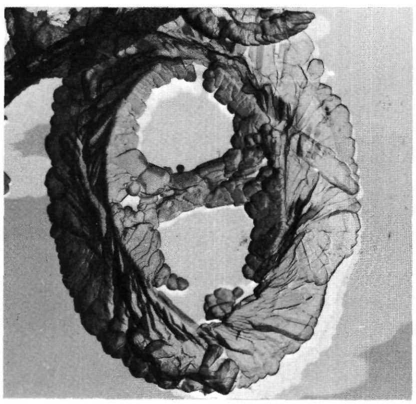
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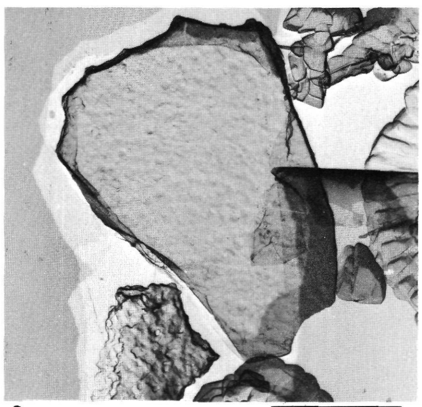
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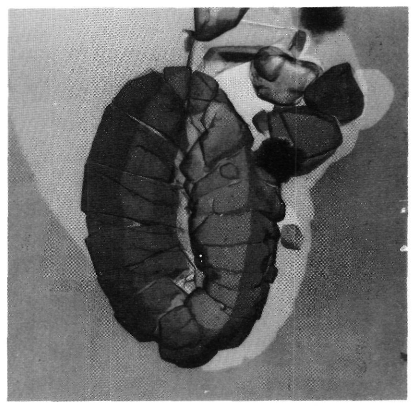
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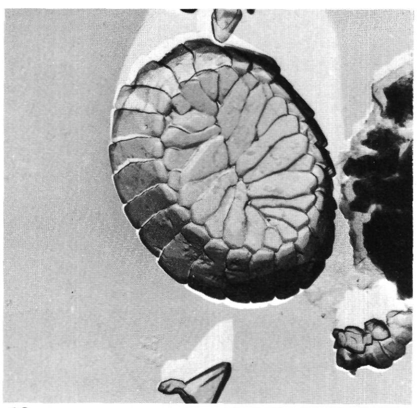
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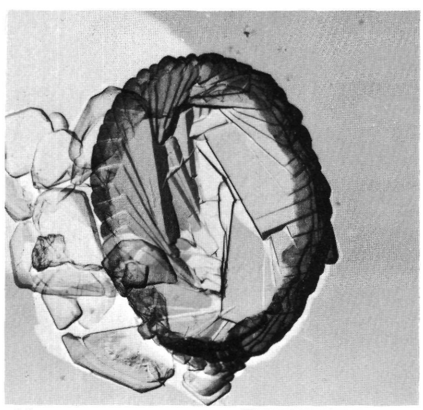
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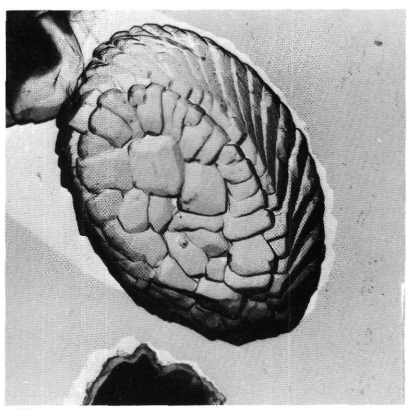
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PLATE 19

Transmission electron micrographs of Paleocene nannoplankton from Site 384. Scale bar in each figure represents 3 μm.

Figures 1, 4	*Crepidolithus* sp. 3. 1. Bottom view. Sample 6-1, 14-15 cm. 4. Oblique view. Sample 6-4, 13-14 cm.
Figures 2, 3	*Crepidolithus* spp. 2. Bottom view. Sample 6-2, 39-40 cm. 3. Bottom view. Sample 6-1, 14-15 cm.
Figure 5	*Biantholithus sparsus* Bramlette and Martini. Sample 13-2, 145-146 cm.
Figure 6	*Braarudosphaera bigelowii* (Gran and Braarud) Delfandre. Sample 13-3, 31-32 cm.
Figure 7	*Braarudosphaerai* aff. *discula* Bramlette and Riedel. Sample 13-2, 79-80 cm.
Figure 8	*Braarudosphaera imbricata* Manivit. Sample 13-3, 19-20 cm.
Figure 9	*Goniolithus fluckigeri* Deflandre. Sample 13-2, 145-146 cm.
Figure 10	*Thoracosphaera deflandrei* Kamptner. Sample 6-3, 39-40 cm.
Figure 11	*Thoracosphaera operculata* Bramlette and Martini. Proximal view of the cap. Sample 10-4, 55-56 cm.
Figure 12	*Thoracosphaera saxea* Stradner. Sample 12-3, 29-30 cm.

PLATE 19