17. RADIOLARIA, LEG 12, DEEP SEA DRILLING PROJECT

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INTRODUCTION

The stratigraphic distribution, abundance, and degree of preservation of radiolarians recovered at Leg 12 sites are given in Figure 1. The absolute ages are from Perch-Nielsen (this volume) and are based on the distribution of calcareous nannoplankton. Details of the distribution and preservation of Radiolaria in each hole drilled are given in the paleontology sections of each Site Report.

In general, radiolarians are not overwhelming abundant in sample residues from any of the sites because of their dilution due to relatively high sedimentation rates. Most of the Leg 12 sites either received large influxes of terrigenous sediment in comparison with deeper water areas farther removed from continental land masses or were characterized by high rates of nonsiliceous pelagic sediment accumulation, often under the influence of bottom contour currents. As a result no new information on the zonal schemes as proposed by Riedel and Sanfilippo (1970 and in press) and Moore (in press) is available from the stratigraphic distribution of radiolarians at Leg 12 sites.

STRATIGRAPHIC DISTRIBUTION AND PRESERVATION

Nearly all assemblages, whether well-preserved or not, are dominated by long-ranging spheroidal and discoidal spumellarians. Standard radiolarian zones established for low to intermediate latitudes (Riedel and Sanfilippo, 1970, in press; Moore, in press) were recognized at only three sites. At Site 116 these include the *Spongaster pentas, Stichocorys peregrina/Ommatartus penultimus, Cannartus* (?) *petterssoni, Dorcadospyris alata, Calocycletta virginis* and *Lychnocanium bipes* Zones (Table 1); at Site 118, one sample (12-1, bottom) has an assemblage typical of the *Calocycletta virginis* Zone; and, at Site 119, fossils characteristic of the *Calocycletta costata* and *C. virginis* Zones are present (Table 2). The zone not only best represented by stratigraphically significant fossils, but also the only one recognized at all three sites, is the *C. virginis* Zone of early Miocene age. Although the assemblages from this zone are quite diverse at Site 116, slightly greater total radiolarian diversity and a greater abundance of diagnostic fossils characterize the zone at Site 119 in the Bay of Biscay to the south. This apparently reflects the normal latitudinal diversity gradient.

Except for one poorly-developed assemblage of middle Miocene age at Site 112, no other Miocene radiolarian faunas were cored; therefore, comparisons of the Rockall--Biscay sites with those in the Labrador Sea are impossible. If comparison were possible one might expect more diverse radiolarian development in the former area because of the influence of the Gulf Stream.

The increasingly poorer representation of low latitude species and the dominance of high latitude or cosmopolitan species in middle Miocene through Pleistocene sediments (zones younger than the *C. virginis* Zone) apparently reflect the deterioration in late Tertiary climatic conditions. Most Pliocene-Pleistocene assemblages are quite similar in that robust spumellarians dominate and stratigraphically significant fossils are absent.

Radiolarian assemblages from sediments older than Miocene are either poorly developed, poorly preserved or, when well-developed, reflect the influence of high latitudes in that diagnostic low latitude species are lacking.

The only significant accumulation of well-preserved Oligocene radiolarians is at Site 112 in the Labrador Sea. The assemblages, however, are almost entirely lacking in the stratigraphically significant species which are used to define zones established for low latitude occurrences. Apparently the Oligocene at Site 112 was characterized by a high latitude fauna, as was the situation in the later Tertiary. Dominance of assemblages by spongodiscids and robust spumellarians lends support to this conclusion. The only other significant occurrence of Oligocene Radiolaria is from Site 119, but all specimens are zeolitized and consequently unidentifiable. Replacement of biogenous silica by zeolite may reflect the influence of volcanism and subsequent diagenetic alteration of volcanic ash as discussed by Gibson and Towe (1971).

Eocene and Paleocene assemblages are represented by poorly to moderately preserved specimens. Corroded and silicified skeletons generally are identifiable, and in nearly all instances they are rare; whereas, unidentifiable zeolitized radiolarians may reach abundant proportions of the sample residues. In Figure 1 where poorly preserved assemblages are noted as being common to abundant they are comprised of unidentifiable zeolitized skeletons. In the corroded or silicified assemblages, *Lithocampium* sp. A from the Paleocene of Hole 119 is the only species with silicified skeletons common in some samples. All others are rare to very rare.

The only occurrence of Mesozoic Radiolaria is in Hole 118, where abundant zeolitized late Cretaceous forms are present in sediments of late Paleocene-early Eocene age (Plate 3). They may have been derived from submarine outcrops of Upper Cretaceous sediments either on nearby sea-floor prominences or perhaps from as far away as the French or Spanish continental margins.

Data from Leg 12 suggest that corrosion and/or silicification of radiolarian skeletons are a function of geologic age and that zeolitization may be related to diagenetic alteration of volcanic ash. Not enough data was collected to test the hypothesis of a silica-compensation level (Kling, 1971, p. 1279-80) in the Tertiary North Atlantic. Observations on the diagenetic mobilization of

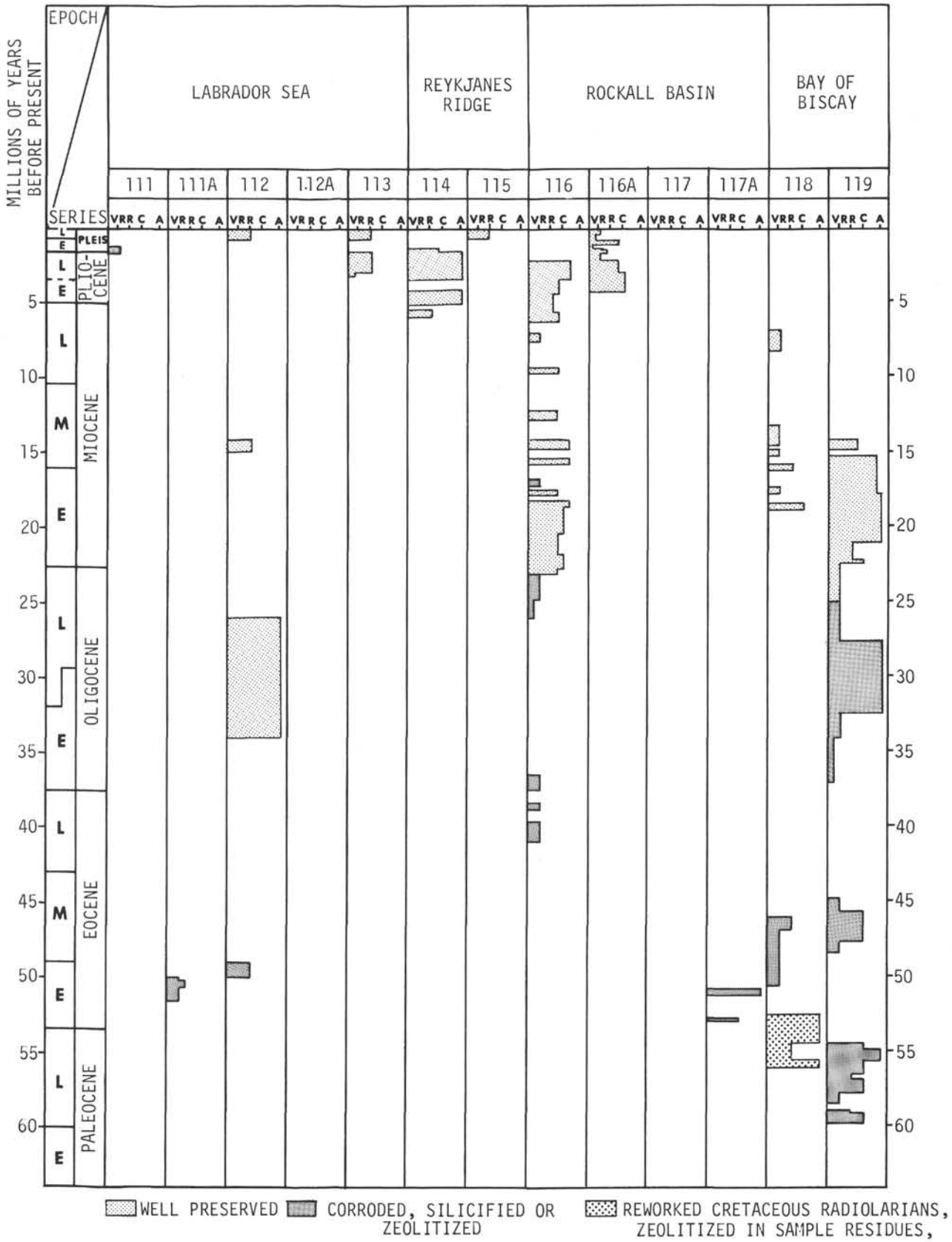

Figure 1. *Stratigraphic distribution, abundance, and preservation of radiolarians in sample residues, Leg 12. Absolute ages based on calcareous nannoplankton.*

TABLE 1
Stratigraphic Distribution of Neogene Radiolaria, Hole 116. Abundance Defined by Number of Specimens per Microscope Slide as Follows: 1-5, VR; 6-20, R; 21-50, C; More Than 50, A

AGE	SAMPLE	ZONE	SPECIES	*Spongaster* sp. cf. *S. tetras*	*Spongaster tetras*	*Lamprocyclas heteroporos*	*Calocyclas margatensis*	*Stichocorys peregrina*	*Androngalea gamphonycha*	*Stichocorys delmontensis*	*Cyrtocapsella tetrapera*	*Cyrtocapsella cornuta*	*Cyrtocapsella japonica*	*Ommatartus antepenultimus*	*Cannartus laticonus*	Digitately branched *Druscena*	*Druscena* flat spines curved,	*Cyrtocapsella elongata*	*Carpocanopsis cristatum?*	*Lithopera renaae*	*Lithopera neolaena*	*Stichocorys armata*	*Cyclampterium* (?) *tanythorax*	*Cyclampterium* (?) *leptetrum*	*Carpocanopsis bramlettei*	*Lychnocanium bipes*	*Cyclampterium* (?) *pegetrum*	*Doroadospyris simplex*	*Doroadospyris ateuchus*	*Cyclampterium*(?) sp. cf. *C.*(?) *milowi*	*Cannartus prismaticus*	*Stichocorys diplocomus*	*Theocorys spongoconum*	*Theocyrtis annosa*	*Carpocanopsis cingulatum*	*Artophormis gracilis*
LATE PLIOCENE	1-1, 69-71 cm	?		VR	VR																														
	1-2, 79-80 cm			R																															
	1-3, 78-79 cm			R																															
	1-4, 81-82 cm			R		VR																													
	1-5, 78-79 cm			R			?																												
	1-6, 77-78 cm			VR																															
	1-CC			VR	VR																														
EARLY PLIOCENE	2-1, 76.5-77.5 cm																																		
	2-2, 79-80 cm																																		
	2-3, bottom	*Spongaster pentas*						R																											
	2-4, bottom							VR																											
	2-5, bottom					VR		VR																											
	2-6, bottom																																		
	2-CC							R	?																										
LATE MIOCENE	3-1, 81-82 cm	?																																	
	3-3, 79.5-81.0 cm																																		
	3-4, 88-90 cm																																		
	3-5,bottom							?		VR																									
	3-6, 76-77 cm																																		
	3-CC									VR																									
	4-1, 119-120 cm																																		
	4-2, 97-98 cm	*Stichocorys peregrina* / *Ommatartus penultimus*									VR																								
	4-3, 79-80 cm																																		
	4-4, 81-82 cm						?				VR																								
	4-5, 62-63 cm																																		
	4-6, 89-90 cm											?																							
	4-CC							VR	?	VR	VR		?																						
	5-0, bottom						VR	R		VR		VR		VR																						
	5-1, 33-34 cm							R		R		VR																							
	5-2, 127-128 cm							R		R	VR			VR																					
	5-3, 103-104 cm							R		R																									
	5-4, 80-81 cm							R		R	VR	VR		VR																					
	5-5, 93-94 cm									VR				VR																					
	5-6, bottom							R		R	VR		VR	VR																					
	5-CC						VR			R	VR			?	?																				
	6-1, 78-79 cm	?					?																												
	6-2, 78-79 cm									VR																									
	6-3, 79-80 cm									VR																									
	6-4, 61-62 cm										VR																								
	6-CC									VR	VR			?	?																				
MIDDLE MIOCENE	7-1, 80-81 cm	*Cannartus (?) pettersoni*								VR		VR	VR			VR																			
	7-2, 78-79 cm												VR			VR	VR																		
	7-3, 72-73 cm												VR				R																		
	7-4, bottom									VR			C			VR	C																		
	7-5, bottom						VR	?		VR			C				C																		
	7-6, 84-85 cm						?						R			VR	R																		
	7-CC						R			VR	VR	VR	A	?	?	VR	C	R																	
	8-2, 81-82 cm									VR			C			R																			
	8-3, 79-80 cm						C			R	R	R	R			R			?																
	8-CC						VR			VR	VR		R			VR																			
	9-1, 79-80 cm	*Doroadospyris alata*					?			VR	C	C	VR			VR					VR														
	9-2, 70-71 cm										C	R				VR					VR														
	9-3, 115-116 cm						VR			VR	A	R					VR																		
	9-CC						VR			VR	A	VR	VR		?	VR					VR	VR													
	10-0, bottom						R			R	A	R									VR	?													
	10-1, 83-84 cm						VR			VR	R	VR																							
	10-2, 128-130 cm						R			VR	C	VR									VR	VR													
	10-3, 69-71 cm						R			VR	C										VR		VR												

(continued)

TABLE 1 – *Continued*

AGE	SAMPLE	ZONE	*Spongaster* sp. cf. *S. tetras*	*Spongaster tetras*	*Lamprocyclas heteroporos*	*Calocyclas margatensis*	*Stichocorys peregrina*	*Androcyclas gamphonycha*	*Stichocorys delmontensis*	*Cyrtocapsella tetrapera*	*Cyrtocapsella cornuta*	*Cyrtocapsella japonica*	*Ommatartus antepenultimus*	*Cannartus laticonus*	Digitately Branched *Oroscena*	spines curved, flat *Oroscena* spines	*Cyrtocapsella elongata*	*Carpocanopsis cristatum?*	*Lithopera renzae*	*Lithopera neotera*	*Stichocorys armata*	*Cyclampterium (?) tanythorax*	*Cyclampterium (?) leptetrum*	*Carpocanopsis bramlettei*	*Lychnocanium bipes*	*Cyclampterium (?) pegetrum*	*Dorcadospyris simplex*	*Dorcadospyris ateuchus*	*Cyclampterium(?)* sp. cf. *C.(?) milowi*	*Cannartus prismaticus*	*Stichocorys diploconus*	*Theocorys spongoconum*	*Theocyrtis annosa*	*Carpocanopsis cingulatum*	*Artophormis gracilis*
	10-4, 69-70 cm					R			VR	R	VR								VR																
	10-6, 86-87 cm					R			VR	R	VR										VR														
	10-CC					R			VR	A	VR	VR							A	VR	VR	VR	VR												
	11-0, bottom																																		
	11-1, bottom														VR																				
	11-2, 77-78 cm									VR	VR																								
	11-3, bottom	? (CHERTY)								VR	VR																								
	11-4, bottom										VR				VR																				
	11-5, bottom																																		
	11-6, 77-78 cm										VR																								
	11-CC					VR																													
	12-1, 66-67 cm					R			VR	C	R	VR																							
	12-2, 91-92 cm					R				C	VR	VR																							
	12-3, 80-81 cm					R			VR	C	VR													VR											
	12-4, 72-73 cm					R			VR	R	VR																								
	12-5, bottom					R			VR	C	R																								
	12-6, 83-84 cm					R			VR	C	VR																								
	12-CC					C			R	A	C	VR									R		VR		VR	VR									
EARLY MIOCENE	13-CC					R			VR	C	VR																VR	?	VR						
	14-CC					VR			VR	C	R																VR	VR	VR	VR					
	15-0, bottom					R			VR	C	R														VR										
	15-1, 81-82 cm					R			R	A	C	VR									VR														
	15-3, 77-78 cm					R				A	R																VR				?	VR			
	15-5, 79-80 cm								VR	C	R														VR		VR								
	15-6, 76-77 cm								VR	C	R														VR						VR				
	15-CC								R	C	C														VR				VR						
	16-0, bottom					VR				C	R																VR				VR				
	16-2, 74-75 cm	*Calocycletta virginis*				VR			VR	R																							VR		
	16-3, bottom					VR			VR	C	C										VR				VR										
	16-4, 76-77 cm									C	R														VR				VR						
	16-CC					VR			VR	C	C																			VR					
	17-0, bottom					VR				C	C														VR										
	17-3, bottom					VR				R	R																			VR					
	17,4, 81-82 cm					VR			?	R	VR														VR				VR						
	17-6, 82-83 cm					VR			?	R	VR										?														
	17-CC					VR				R	R														VR	VR	VR	?				VR			
	18-0, bottom					VR			VR	C	C																VR		VR	VR					
	18-3, bottom					VR			VR	R	R														VR										
	18-4, 74-75 cm									R	VR																								
	18-CC					VR			VR	R	R												?		VR		VR	VR	VR						
	19-1, 105-106 cm					VR				R	VR														VR			VR	VR						
	19-2, 44-46 cm					VR			VR	R	R							?			?				VR		VR	VR	VR						
	19-3, bottom					VR				VR	VR																		VR						
	19-4, 60-61 cm								?	R	VR																?	VR						VR	
	19-CC					VR				R	C										?				VR	VR	VR	VR	VR	VR				VR	?
	20-1, 46-48 cm									R	VR																							?	
	20-5, 89-92 cm	*Lychnocanium bipes*																																	
	20-CC					VR																			VR			VR							
LATE OLIGOCENE	21-0, bottom																																		
	21-4, 51-52 cm																																		
	21-CC																																		
	22-0, bottom																																		
	22-1, bottom																																		
	22-2, bottom																																		
	22-3, bottom																																		
	22-4, bottom																																		
	22-5, bottom																																		
	22-CC																																		

TABLE 2
Stratigraphic Distribution of Neogene Radiolaria, Hole 119. Abundance Defined by Number of Specimens per Microscope Slide as Follows: 1-5, VR; 6-20, R; 21-50, C; More Than 50, A

AGE	SAMPLE	ZONE \ SPECIES	Digitately branched *Orosceena* spines	*Calocyclas margatensis*	*Cyrtocapsella elongata*	*Cyrtocapsella tetrapera*	*Stichocorys armata*	*Stichocorys wolffii*	*Cyclampterium (?) leptetrum*	*Cannartus tubarius*	*Stichocorys delmontensis*	*Cyrtocapsella cornuta*	*Calocycletta virginis*	*Lychnocanium bipes*	*Carpocanopsis cingulatum*	*Calocycletta costata*	*Tympanidium binoctonum*	*Dorcadospyris simplex*	*Cannartus prismaticus*	*Stichocorys diplocorus*	*Cannartus violina*	*Carpocanopsis cristatum ?*	*Carpocanopsis bramlettei*	*Carpocanopsis favosum*	*Calocycletta* sp. cf. *C. virginis*	*Cyclampterium (?) pegetrum*	*Dorcadospyris ateuchus*	*Cyclampterium (?)* sp. cf. *C. (?) milowi*	*Theocyrtis annosa*	*Theocorys spongoconum*
MIDDLE MIOCENE	5-1, 79-80 cm	?	VR																											
	5-2,74-75 cm		R																											
	5-3, 76-77 cm		R																											
	5 - CC		C	VR	VR	VR																								
EARLY MIOCENE	6-1, 137-138 cm	*Calocycletta costata*		R	R	C	VR	VR	R	VR	R	R	R	VR	VR	VR														
	6-2, 78-79 cm			R	C	R	R	R	R		C	R	R	A	VR	VR	VR	R	VR											
	6-3, 78-79 cm	? *Calocycletta virginis*		R	C	C	VR	VR	R		R	R	R	C	VR		R			VR	VR	VR								
	6-4, 80-81 cm			A	C	A	?	VR	R	VR	A	C	R	R			VR	VR	R		VR		VR							
	6-CC			C	A	A		R	R	R	A	A	R	R	VR		VR	VR	C	R	VR		VR	VR						
	7-1, 78-79 cm				R	R		VR			R	R	C	R	VR		VR	VR		VR										
	7-2, 78-79 cm			R	R	C	VR		R	VR	R	R	C	C				R	VR			VR	VR							
	7-3, 77-78 cm			R	R	C	VR	VR	R	VR	R	R	R	R	R		VR	R	VR				VR							
	7-cc			R	A	A		VR	C	VR	C	C	R	R	R	VR		VR	R	VR	VR	VR	VR							
	8-1, 78-79 cm	*Calocycletta virginis*		R	C	C			R		R	R	C	R	VR			VR	VR			VR			C					
	8-2, 76-77 cm			R	R	C		VR	R		C	C	R	R				VR	VR			VR			C	R				
	8-3, 81-82 cm			R	R	C			R		C	R	R	C				R							C	R	R			
	8-4, 76-77 cm			C		A		VR			R	C	VR	R			VR	R		VR	VR						VR	R		
	8-5, 52-53 cm			VR		C						VR	VR	R			VR	R						VR	VR		VR	R		
	9-1, 139-140 cm			VR	VR	R					VR	VR	VR	VR			VR	R	VR						VR			VR		
	9-2, 80-81 cm			VR		VR						VR		VR			VR								VR		VR			
	9-3, 107-108 cm			VR	VR	R						VR		VR			VR	R				VR			VR	VR	VR			
	10-1, 73-74 cm			VR	VR	VR			VR			VR		VR			VR	VR				VR			VR		VR			
	10-2, 78-79 cm			VR		R						VR		VR			VR	R									VR	VR		
— ? — ? — ? — ? — ?	10-3, 5-6 cm			VR		C		?				R		R			VR	R	VR								R	VR		
	11-1, 69-70 cm			R		C		?	VR		?	C		R	VR			C	C	?		VR					C	VR	VR	VR
LATE OLIGOCENE	11-2, 75-76 cm	?																										R		
	11-3, 51-52 cm																											R		
	12-1, 109-111 cm																											R		
	12-2, 77-78 cm																									VR		R		
	12-3, 82-83 cm			?		?																			?					

biogenous silica are discussed by the author in the lithology section of Chapter 8 (this volume). No seismically traceable chert layer correlative with Horizon A was observed at any of the Leg 12 sites, although in the Lower Eocene of Hole 111A a thin green chert bed was noted in Core 10, Section 1.

TAXONOMIC NOTES, CENOZOIC RADIOLARIA

Species referred to in the radiolarian reports of each site and in the distribution charts are given below but without complete synonymies. The first entry under each species refers to the author of the species, and subsequent entries refer to the species concepts used by various authors and utilized by the writer in identification of Leg 12 material. No attempt was made to classify species into natural genera. Species are listed in alphabetical order under family (or subfamily) designations as proposed by Riedel (1967b).

Order POLYCYSTINA Ehrenberg

Polcystina Ehrenberg, 1838, emend. Riedel, 1967b, p. 291.

Suborder SPUMELLARIA Ehrenberg, 1875

Family OROSPHAERIDAE Haeckel, 1887

Genus *Oroscena* Haeckel, 1887

The two forms of detached orosphaerid spines noted in Leg 12 samples are designated "curved, flat *Oroscena* spines" according to Kling's (1971, p. 1086-7) terminology, and "digitately branched *Oroscena* spines" according to Friend and Riedel's (1967, p. 224) terminology. Illustrations of these two forms are given by Friend and Riedel (1967, Plate 2, Figures 5, 6), Nigrini, (1970, Plate 1, Figures D, E, p. 31), and Kling (1971, Plate 3, Figures 1, 7).

Family COLLOSPHAERIDAE Müller, 1858

Solenosphaera sp.

Solenosphaera sp.; Riedel and Sanfilippo, in press, Plate 1A, Figure 21.

Family ACTINOMMIDAE Haeckel

Actinommidae Haeckel, 1862, emend. Riedel, 1967b, p. 294.

Actinomma antarcticum (Haeckel)

Spongoplegma antarcticum Haeckel, 1887, p. 90.
Actinomma antarcticum (Haeckel); Nigrini, 1967, p. 26, Plate 2, Figures 1a-d.

Actinomma medianum Nigrini

Actinomma medianum Nigrini, 1967, p. 27, Plate 2, Figures 2a, 2b.

Amphisphaera cronos (Haeckel)

Amphisphaera cronos Haeckel, 1887, p. 144, Plate 17, Figure 5.
Xiphatractus cronos (Haeckel); Benson, 1966, p. 182, Plate 7, Figures 12, 13.

Druppatractus acquilonius Hays

Druppatractus acquilonius Hays; Kling, 1971, p. 1086, Plate 1, Figures 5, 6

Druppatractus irregularis Popofsky

Druppotractus irregularis Popofsky (sic.), 1912, p. 114, text-figures 24-26.
Druppatractus irregularis Popofsky; Benson, 1966, p. 180, Plate 7, Figures 7-11.

Druppatractus sp. cf. *D. pyriformis* (Bailey)

(?) *Haliomma* ? *pyriformis* Bailey, 1856, p. 2, Plate 1, Figure 29.
Druppatractus cf. *pyriformis* (Bailey); Benson, 1966, p. 177, Plate 7, Figures 2-6.

Subfamily ARTISCINAE Haeckel

Artiscinae Haeckel, 1881, emend. Riedel, 1967b, p. 294.

Cannartus laticonus Riedel

Cannartus laticonus Riedel, 1959, p. 291, Plate 1, Figure 5; Riedel and Sanfilippo, 1970, p. 520, Plate 14, Figure 2; Kling, 1971, p. 1086, Plate 3, Figure 6.

Cannartus prismaticus (Haeckel)

Pipetella prismatica Haeckel, 1887, p. 305, Plate 39, Figure 6; Riedel, 1959, p. 287, Plate 1, Figure 1.
Cannartus prismaticus (Haeckel); Riedel and Sanfilippo, 1970, p. 520, Plate 15, Figure 1; Kling, 1971, p. 1086, Plate 3, Figure 2.

Cannartus tubarius (Haeckel)

Pipettaria tubaria Haeckel, 1887, p. 339, Plate 39, Figure 15; Riedel, 1959, p. 289, Plate 1, Figure 2.
Cannartus tubárius (Haeckel); Riedel and Sanfilippo, 1970, p. 520, Plate 15, Figure 2; Kling, 1971, p. 1086, Plate 3, Figure 3.

Cannartus violina Haeckel

Cannartus violina Haeckel, 1887, p. 358, Plate 39, Figure 10; Riedel, 1959, p. 290, Plate 1, Figure 3; Riedel and Sanfilippo, 1970, p. 520,; Kling, 1971, p. 1086, Plate 3, Figure 4.

Ommatartus antepenultimus Riedel and Sanfilippo

Ommatartus antepenultimus Riedel and Sanfilippo, 1970, p. 521, Plate 14, Figure 4; Kling, 1971, p. 1086, Plate 3, Figure 10; Moore, in press, Plate 12, Figures 9, 10; Riedel and Sanfilippo, in press, p. 82, Plate 1C, Figures 11, 12.

Family PHACODISCIDAE Haeckel 1881

Heliodiscus asteriscus Haeckel

Heliodiscus asteriscus Haeckel, 1887, p. 445, Plate 33, Figure 8; Nigrini, 1967, p. 32, Plate 3, Figures 1a - b.

Heliodiscus heliastericus Clark and Campbell

Heliodiscus (Heliodiscetta) heliastericus Clark and Campbell, 1942, p. 39, Plate 3, Figures 10 11.

Family COCCODISCIDAE Haeckel 1862

Stylodictya validispina Joergensen

Stylodictya validispina Joergensen, 1905, p. 119, Plate 10, Figure 40; Benson, 1966, p. 203, Plate 9, Figures 5, 6, text-figure 11.

Family SPONGODISCIDAE Haeckel

Spongodiscidae Haeckel, 1862, emend. Riedel, 1967b, p. 295.

Amphicraspedum murrayanum Haeckel

Amphicraspedum murrayanum Haeckel, 1887, p. 523, Plate 44, Figure 10.

Spongaster tetras Ehrenberg

Spongaster tetras Ehrenberg, 1860, p. 833; 1861, p. 301; 1872b, Plate 6, Figure 8; Nigrini, 1967, p. 41, Plate 5, Figures 1a-b, 2; Riedel and Sanfilippo, in press, p. 89, Plate 1D, Figures 2-4.

Spongaster sp. cf. *S. tetras* Ehrenberg
(Plate 1, Figures 3-5)

This species differs from *Spongaster tetras* in that instead of consisting of a quadrangular, spongy discoidal structure with four mutually perpendicular, denser rays it consists of four relatively narrow, distinct arms or rays, with or without a secondarily developed patagium. The four arms of several specimens exhibit a departure from orthogonalism (Plate 1, Figure 3). As discussed in the Site Reports for Sites 114 and 116, the short term presence of this species perhaps represents a migration event which occurred during the nonglacial Pliocene-glacial Pliocene transition in the northeast Atlantic.

Spongasteriscus cruciferus Clark and Campbell

Spongasteriscus (Spongasteriscinus) cruciferus Clark and Campbell, 1942, p. 50, Plate 1, Figures 1-6, 8, 10, 11 (?), 16-18.

Spongocore puella Haeckel

Spongocore puella Haeckel, 1887, p. 347, Plate 48, Figure 6; Benson, 1966, p. 187, Plate 8, Figures 1-3.

Spongodiscus biconcavus (Haeckel) Popofsky

Spongodiscus biconcavus H., Popofsky, 1912, p. 143, Plate 6, Figure 2; Benson, 1966, p. 214, Plate 11, Figure 1, text-figure 14.

Spongopyle osculosa Dreyer

Spongopyle osculosa Dreyer, 1889, p. 118, Plate 11, Figures 99, 100; Riedel, 1958, p. 226, Plate 1, Figure 12; Benson, 1966, p. 215, Plate 11, Figures 2, 3, text-figure 15.

Spongotrochus sp. cf. *S. glacialis* Popofsky

Spongotrochus cf. *glacialis* Popofsky; Benson, 1966, p. 218, Plate 11, Figure 14, text-figure 16.

Spongurus bilobatus Clark and Campbell

Spongurus (Spongurantha) bilobatus Clark and Campbell, 1942, p. 36, Plate 1, Figures 7, 9; 1945, p. 20, Plate 3, figures 5-7.

Family PYLONIIDAE Haeckel 1881

Phorticium pylonium (Haeckel?) Cleve

(?) *Phorticium plyonium* Haeckel, 1887, p. 709, Plate 49, Figure 10.

Phorticium pylonium Haeckel; Cleve, 1899, p. 31, Plate 3, Figures 2a-d.

Phorticium pylonium (Haeckel?) Cleve; Joergensen, 1905, p. 120, Plate 10, Figures 42a-d, Plate 11, Figures 42e-f, 43-45d; Riedel, 1958, p. 229, Plate 2, Figure 5.

Family THOLONIIDAE Haeckel 1887

The presence of very rare specimens of *Amphitholus* sp. in sediments of early Oligocene age in Hole 112 (see below) extends the range of this family from Pliocene to Recent as indicated by Riedel (1967b, p. 295) to Oligocene to Recent. Only a few specimens of members of this family were observed in Leg 12 samples.

Amphitholus sp.
(Plate 2, Figures 1, 2)

The earliest occurrence of specimens referred to the genus *Amphitholus* Haeckel is from the Lower Oligocene of Hole 112 (calcareous nannoplankton zone NP 23: *Sphenolithus predistentus* Zone). In addition, very rare occurrences were noted in Hole 119, the earliest being at 119-8-3, 81 to 82 centimeters from the *Calocycletta virginis* Zone of early Miocene age.

Tholocubus sp.
(Plate 2, Figures 3, 4)

The earliest occurrence of specimens referred to the genus *Tholocubus* Haeckel is from the *Calocycletta virginis* Zone of early Miocene age in Hole 116 (Core 16, CC). Only a few occurrences of this genus were noted in all of the Leg 12 samples.

Family LITHELIIDAE Haeckel 1862

Lithelius minor Joergensen

Lithelius minor Joergensen, 1899, p. 65, Plate 5, Figure 24; Benson, 1966, p. 262, Plate 17, Figures 9, 10, Plate 18, Figures 1-4.

SUBORDER NASSELLARIA Ehrenberg 1875

Family PLAGONIIDAE Haeckel

Plagoniidae Haeckel, 1881, emend. Riedel, 1967b, p. 295.

Helotholus histricosa Joergensen

Helotholus histricosa Joergensen, 1905, p. 137, Plate 16, Figures 86-88; Riedel, 1958, p. 234, Plate 3, Figure 8, text-figure 6.

Lithomelissa thoracites Haeckel

Lithomelissa thoracites Haeckel, 1862, p. 301, Plate 6, Figures 2-8; Benson, 1966, p. 366, Plate 24, Figures 10-13.

Family ACANTHODESMIIDAE Haeckel 1862

Dorcadospyris ateuchus (Ehrenberg)

Ceratospyris ateuchus Ehrenberg, 1873, p. 218; 1875, Plate 21, Figure 4.

Cantharospyris ateuchus (Ehrenberg); Riedel, 1959, p. 294, Plate 2, Figures 3, 4.
Dorcadospyris ateuchus (Ehrenberg); Riedel and Sanfilippo, 1970, p. 523, Plate 15, Figure 4; Kling, 1971, p. 1087, Plate 4, Figure 6; Riedel and Sanfilippo, in press, p. 92, Plate 2D, Figure 6, Plate 3A, Figures 9, 10; Moore, in press, Plate 8, Figures 1, 2.

Dorcadospyris simplex (Riedel)

Brachiospyris simplex Riedel, 1959, p. 293, Plate 1, Figure 10.
Dorcadospyris simplex (Riedel); Riedel and Sanfilippo, 1970, p. 523, Plate 15, Figure 6; Kling, 1971, Plate 4, Figure 1; Moore, in press, Plate 10, Figures 3, 4.

Tristylospyris triceros (Ehrenberg)

Ceratospyris triceros Ehrenberg, 1873, p. 220; 1875, Plate 21, Figure 5.
Tristylospyris triceros (Ehrenberg); Haeckel, 1887, p. 1033; Riedel, 1959, p. 292, Plate 1, Figures 7, 8; Riedel and Sanfilippo, in press, p. 99, Plate 3A, Figures 11, 12.

Tympanidium binoctonum Haeckel

Tympanidium binoctonum Haeckel, 1887, p. 1004, Plate 94, Figure 18; Riedel, 1957, p. 78, Plate 1, Figure 2.

Family THEOPERIDAE Haeckel

Theoperidae Haeckel, 1881, emend. Riedel, 1967b, p. 296.

(?) *Artophormis barbadensis* (Ehrenberg)

(?) *Calocyclas barbadensis* Ehrenberg, 1873, p. 217; 1875, Plate 18, Figure 8.
(?) *Artophormis barbadensis* (Ehrenberg); Riedel and Sanfilippo, 1970, p. 532, Plate 13, Figure 5; Riedel and Sanfilippo, in press, p. 100, Plate 3B, Figures 8, 9.

Single occurrences of questionable representatives of *Artophormis barbadensis* were encountered in Cores 8 and 10 of Hole 112.

Artophormis gracilis Riedel

Artophormis gracilis Riedel, 1959, p. 300, Plate 2, Figures 12, 13; Riedel and Sanfilippo, 1970, p. 532, Plate 13, Figures 6, 7; Riedel and Sanfilippo, in press, p. 101, Plate 3B, Figures 5-7, Plate 6, Figure 7.

The few specimens of *Artophormis gracilis* present in Cores 5 through 10 of Hole 112 correspond to Figure 6, Plate 3B of Riedel and Sanfilippo's synchronopticon (in press). In addition, one specimen corresponding to their Figure 7 of Plate 6 was observed in Core 9.

Bekoma bidarfensis Riedel and Sanfilippo
(Plate 2, Figures 6, 7)

Bekoma bidarfensis Riedel and Sanfilippo, in press, p. 102, Plate 7, Figures 1-7.

The very rare specimens present at Site 119 are referrable to Figures 1, 2 and 7 of Riedel and Sanfilippo's Plate 7 (in press).

Coracalyptra cervus (Ehrenberg)

Eucyrtidium cervus Ehrenberg, 1872a, p. 308; 1872b, Plate 9, Figure 21.
Coracalyptra cervus (Ehrenberg); Popofsky, 1913, p. 383, Plate 34, Figure 3; Benson, 1966, p. 447, Plate 30, Figures 3-5.

Cornutella profunda Ehrenberg

Cornutella clathrata β profunda Ehrenberg, 1854, Plate 35B, Figure 21.
Cornutella profunda Ehrenberg, 1858, p. 31; Riedel 1958, p. 232, Plate 3, Figures 1, 2.

Cyclampterium (?) *leptetrum* Sanfilippo and Riedel

Cyclampterium (?) *leptetrum* Sanfilippo and Riedel, 1970, p. 456, Plate 2, Figures 11, 12; Riedel and Sanfilippo, in press, p. 104, Plate 2D, Figures 9-12.

Cyclampterium (?) *milowi* Riedel and Sanfilippo

Cyclampterium (?) *milowi* Riedel and Sanfilippo, in press, p. 105, Plate 3B, Figure 3, Plate 7, Figures 8, 9.

Cyclampterium (?) sp. cf. *C.* (?) *milowi*
Riedel and Sanfilippo
(Plate 1, Figures 1, 2)

This species resembles *Cyclampterium* (?) *milowi* Riedel and Sanfilippo but differs from it in being generally campanulate rather than subcylindrical, in having a campanulate to truncate conical, not hemispherical thorax, in having a shorter, more inflated, subcylindrical to slightly campanulate abdomen with more regular pore arrangement, and in having a more regular arrangement of the three feet which are three-bladed, latticed, and hollow, proximally, but solid and circular to subtriangular in section distally. Most of the rare occurrences of this species are represented by single feet attached to portions of the abdomen. Only in Sample 119-8-5, 52 to 53 centimeters were sufficient complete forms present to enable the above diagnosis.

The highest stratigraphic occurrence of this species is within the *Calocycletta virginis* Zone (Sites 116 and 119), but it ranges downward into the Lower Oligocene (Site 112). This corresponds with the range of *Cyclampterium* (?) *milowi* as indicated by Riedel and Sanfilippo (in press, Figure 3). Whether or not *C.* (?) sp. cf. *C.* (?) *milowi* is part of a lineage leading from *C.* (?) *milowi* to *C.* (?) *pegetrum* (Riedel and Sanfilippo, in press, p. 105) or simply a high latitude variant of *C.* (?) *milowi* could not be determined from the available data.

Cyclampterium (?) *pegetrum* Sanfilippo
and Riedel

Cyclampterium (?) *pegetrum* Sanfilippo and Riedel, 1970, p. 456, Plate 2, Figures 8-10; Riedel and Sanfilippo, in press, p. 106, Plate 2D, Figures 13, 14, Plate 3B, Figures 1, 2.

Cyclampterium (?) *tanythorax* Sanfilippo and Riedel

Cyclampterium (?) *tanythorax* Sanfilippo and Riedel, 1970, p. 457, Plate 2, Figures 13, 14; Riedel and Sanfilippo, in press, p. 106, Plate 1E, Figures 8-10, Plate 2D, Figures 7, 8.

Cyrtocapsella cornuta Haeckel

Cyrtocapsa cornuta Haeckel, 1887, p. 1513, Plate 78, Figure 9.
Cyrtocapsella cornuta Haeckel; Sanfilippo and Riedel, 1970, p. 453, Plate 1, Figures 19-20; Riedel and Sanfilippo, 1970, p. 531, Plate 14, Figure 8; Kling, 1971, p. 1088, Plate 2, Figure 7; Riedel and Sanfilippo, in press, p. 106, Plate 2E, Figures 1-4.

Cyrtocapsella elongata (Nakaseko)

Theocapsa elongata Nakaseko, 1963, p. 185, Plate 3, Figures 4, 5.
Cyrtocapsella elongata (Nakaseko); Sanfilippo and Riedel, 1970, p. 452, Plate 1, Figures 11, 12; Kling, 1971, p. 1088, Plate 2, Figure 1.

Cyrtocapsella japonica (Nakaseko)

Eusyringium japonicum Nakaseko, 1963, p. 193, Plate 4, Figures 1-3.
Cyrtocapsella japonica (Nakaseko); Sanfilippo and Riedel, 1970, p. 452, Plate 1, Figures 13-15; Riedel and Sanfilippo, 1970, p. 532, Plate 14, Figure 9; Kling, 1971, p. 1088, Plate 2, Figure 2; Riedel and Sanfilippo, in press, p. 107, Plate 1F, Figure 1, Plate 2E, Figure 12.

Cyrtocapsella tetrapera Haeckel

Cyrtocapsa (*Cyrtocapsella*) *tetrapera* Haeckel, 1887, p. 1512, Plate 78, Figure 5.
Cyrtocapsella tetrapera Haeckel; Sanfilippo and Riedel, 1970, p. 453, Plate 1, Figures 16-18; Riedel and Sanfilippo, 1970, p. 530, Plate 14, Figure 7; Kling, 1971, p. 1088, Plate 2, Figure 3; Riedel and Sanfilippo, in press, p. 107, Plate 2E, Figures 5-7.

Dictyophimus gracilipes Bailey

Dictyophimus gracilipes Bailey, 1856, p. 4, Plate 1, Figure 8; Benson, 1966, p. 382, Plate 25, Figures 4-6

Eucyrtidium calvertense Martin

Eucyrtidium calvertense Martin, 1904, p. 450, Plate 130, Figure 5; Kling, 1971, p. 1088, Plate 1, Figure 3.

Lithocampium sp. A
(Plate 2, Figures 8, 9)

Lithocampium sp. A, Riedel and Sanfilippo, in press, p. 109, Plate 7, Figure 12.

This species is present only in the Paleocene section of Hole 119, and, although generally rare, it dominates the assemblages. All specimens observed conform to Riedel and Sanfillipo's (in press, Plate 7, Figure 12) illustration in that the pores of the third segment are rectangularly arranged, aligned both longitudinally and transversely in rows.

Lithopera neotera Sanfilippo and Riedel

Lithopera (*Lithopera*) *neotera* Sanfilippo and Riedel, 1970, p. 454, Plate 1, Figures 24-26, 28; Kling, 1971, p. 1088, Plate 2, Figure 11; Sanfilippo and Riedel, in press, p. 111, Plate, 1F, Figures 14, 15, Plate 2E, Figure 19.

Lithopera renzae Sanfilippo and Riedel

Lithopera (Lithopera) *renzae* Sanfilippo and Riedel, 1970, p. 454, Plate 1, Figures 21-23, 27; Riedel and Sanfilippo, in press, p. 111, Plate 2E, Figures 17, 18, Plate 7, Figure 14.

Lophoconus titanothericeraos Clark and Campbell

Lophoconus titanothericeraos Clark and Campbell, 1942, p. 89, Plate 8, Figures 24-26, 28, 30-37.

Lophocyrtis biaurita (Ehrenberg)

Eucyrtidium biauritum Ehrenberg, 1875.
Lophocyrtis biaurita (Ehrenberg); Nigrini, 1970, p. 404, Plate 2, Figures J, K.

Lychnocanium bipes Riedel

Lychnocanium bipes Riedel, 1959, p. 294, Plate 2, Figures 5, 6; Riedel and Sanfilippo, 1970, p. 529, Plate 15, Figure 8; Kling, 1971, p. 1087, Plate 5, Figure 5; Riedel and Sanfilippo, in press, p. 112, Plate 2F, Figures 1, 2.

Peripyramis circumtexta Haeckel

Peripyramis circumtexta Haeckel, 1887, p. 1162, Plate 54, Figure 5; Riedel, 1958, p. 231, Plate 2, Figures 8,9.

Phormocyrtis striata Brandt
(Plate 2, Figure 5)

Phormocyrtis striata Brandt, 1935, *in* Wetzel, 1935, p. 55, Plate 9, Figure 12; Riedel and Sanfilippo, 1970, p. 532, Plate 10, Figure 7; in press, p. 113, Plate 8, Figure 4.

Pterocanium trilobum (Haeckel)

Dictyopodium trilobum Haeckel, 1860, p. 839; 1862, p. 340, Plate 8, Figures 6-10.
Pterocanium trilobum (Haeckel); Haeckel, 1887, p. 1333; Popofsky, 1913, p. 390, text-figures 104-109; Hays, 1965, p. 177, Plate 3, Figure 10; Nigrini, 1967, p. 71, Plate 7, Figures 3a, b.

(?) *Sethochytris babylonis* (Clark and Campbell) group

(?) *Dictyophimus* (*Dictyophimium*) *babylonis* Clark and Campbell, 1942, p. 67, Plate 9, Figures 32, 36; Nigrini, 1970, p. 401, Plate 1, Figure D.
(?) *Sethochytris babylonis* (Clark and Campbell) group; Riedel and Sanfilippo, 1970, p. 528, Plate 9, Figures 1-3.

Because of the presence of three-bladed rather than conical feet, specimens resembling *Sethochytris babylonis* are placed questionably within the species group proposed by Riedel and Sanfilippo (1970). Individuals from Leg 12 samples actually resemble more closely the specimen illustrated by Nigrini (1970, Plate 1, Figure D) and identified as *Dictyophimus babylonis*. This form appears to have three-bladed rather than conical feet.

Stichocorys armata (Haeckel)

Cyrtophormis armata Haeckel, 1887, p. 1460, Plate 78, Figure 17.
Stichocorys armata (Haeckel); Riedel and Sanfilippo, in press, p. 115, Plate 2E, Figures 13-15.

Stichocorys delmontensis (Campbell and Clark)

Eucyrtidium delmontense Campbell and Clark, 1944a, p. 56, Plate 7, Figures 19, 20; Riedel, 1957, p. 93.
Stichocorys delmontensis Sanfilippo and Riedel, 1970, p. 451, Plate 1, Figure 9; Riedel and Sanfilippo, 1970, p. 530, Plate 14, Figure 6; Kling, 1971, p. 1087, Plate 2, Figure 4; Riedel and Sanfilippo, in press, p. 115, Plate 1F, Figures 5-7, Plate 2E, Figures 10, 11; Moore, in press, Plate 13, Figure 7.

Stichocorys diploconus (Haeckel)

Cyrtocapsa diploconus Haeckel, 1887, p. 1513, Plate 78, Figure 6.
Stichocorys diploconus (Haeckel); Sanfilippo and Riedel, 1970, p. 451, Plate 1, Figures 31-32; Kling 1971, p. 1088, Plate 2, Figure 6; Riedel and Sanfilippo, in press, p. 115, Plate 2E, Figure 16.

Stichocorys peregrina (Riedel)

Eucyrtidium elongatum peregrinum Riedel, 1953, p. 812, Plate 85, Figure 2; 1957, p. 94.
Stichocorys peregrina (Riedel); Sanfilippo and Riedel, 1970, p. 451, Plate 1, Figure 10; Riedel and Sanfilippo, 1970, p. 530; Kling, 1971, p. 1087, Plate 2, Figure 13; Riedel and Sanfilippo, in press, p. 116, Plate 1F, Figures 2-4, Plate 8, Figure 5; Moore, in press, Plate 13, Figures 9, 10.

Stichocorys wolffii Haeckel

Stichocorys wolffii Haeckel, 1887, p. 1479, Plate 80, Figure 10; Riedel, 1957, p. 92, Plate 4, Figures 6, 7; Kling, 1971, p. 1087, Plate 2, Figure 5; Riedel and Sanfilippo, in press, p. 116, Plate 2E, Figures 8, 9.

Theocalyptra davisiana (Ehrenberg)

Cycladophora ? *davisiana* Ehrenberg, 1861, p. 297; 1872b, Plate 2, Figure 11.
Theocalyptra davisiana (Ehrenberg); Riedel, 1958, p. 239, Plate 4, Figures 2, 3, text-figure 10; Hays, 1965, p. 180; Benson, 1966, p. 441, Plate 29, Figures 14-16.

Theocorys spongoconum Kling

Theocorys spongoconum Kling, 1971, p. 1087, Plate 5, Figure 6; Riedel and Sanfilippo, in press, p. 116, Plate 2F, Figure 4, Plate 3C, Figure 3.

Theocorythium trachelium (Ehrenberg)

Eucyrtidium trachelius Ehrenberg, 1872a, p. 312; 1872b, p. 293, Plate 7, Figure 8.
Theocorythium trachelium trachelium (Ehrenberg); Nigrini, 1967, p. 79, Plate 8, Figure 2, Plate 9, Figure 2.

Family CARPOCANIIDAE Haeckel

Carponcaniidae Haeckel, 1881, emend. Riedel, 1967b, p. 296.

Carpocanistrum spp.

Carpocanistrum spp.; Riedel and Sanfilippo, in press, p. 119, Plate 1G, Figures 1-6, 8-13, Plate 2F, Figures 5-16, Plate 3D, Figures 1, 2, 6, 7, 9.

Members of this genus are present but generally rare at nearly every Leg 12 site. Without large populations it was impossible to try to apply Riedel and Sanfilippo's (in press) stratigraphic arrangement of these forms as illustrated in their synchronopticon.

Carpocanopsis bramlettei Riedel and Sanfilippo

Carpocanopsis bramlettei Riedel and Sanfilippo, in press, p. 121, Plate 2G, Figures 8-14, Plate 8, Figure 7.

Carpocanopsis cingulatum Riedel and Sanfilippo

Carpocanopsis cingulatum Riedel and Sanfilippo, in press, p. 121, Plate 2G, Figures 17-21, Plate 8, Figure 8.

Carpocanopsis cristatum (Carnevale) ?

? *Sethocorys cristata* Carnevale, 1908, p. 31, Plate 4, Figure 18.
Carpocanopsis cristatum (Carnevale) ?; Riedel and Sanfilippo, in press, p. 122, Plate 1G, Figure 16, Plate 2G, Figures 1-7.

Carpocanopsis favosum (Haeckel)

Cycladophora favosa Haeckel, 1887, p. 1380, Plate 62, Figures, 5, 6.
Carpocanopsis favosum (Haeckel); Riedel and Sanfilippo, in press, p. 123, Plate 2G, Figures 15, 16, Plate 8, Figures 9-11.

Family PTEROCORYIDAE Haeckel

Pterocoryidae Haeckel, 1881, emend. Riedel, 1967b, p. 296.

Androcyclas gamphonycha (Joergensen)

Pterocorys gamphonyxos Joergensen, 1899, p. 86.
Androcyclas gamphonycha (Joergensen); Hays, 1965, p. 178, Plate III, Figure 2.

Anthocyrtidium cineraria Haeckel

Anthocyrtidium cineraria Haeckel, 1887, p. 1278, Plate 62, Figure 16; Riedel, 1957, p. 84, Plate 2, Figures 6-9, text figure 4.

Anthocyrtium ehrenbergii ehrenbergii (Stöhr)

Anthocyrtis ehrenbergi Stöhr, 1880, p. 100, Plate 3, Figures 21a, b.
Anthocyrtium ehrenbergii ehrenbergii (Stöhr); Riedel, 1957, p. 83, Plate 2, Figures 1-3.

Calocyclas margatensis Campbell and Clark

Calocyclas (*Calocycletta*) *margatensis* Campbell and Clark, 1944a, p. 47, Plate 6, Figures 17, 18.
Calocyclas margatensis Campbell and Clark; Riedel, 1953, p. 811, Plate 85, Figure 8.

In hole 116 (Table 1) this species ranges from 20-CC through 5-0, bottom, a range from late Oligocene through late Miocene. Reidel (1953, p. 811) identified this form from the Island of Rotti in samples defined as "very late Tertiary in age, probably Pliocene or Pleistocene" (*op. cit.*, p. 806). Campbell and Clark (1944a, p. 47) originally

defined this species from the Miocene of southern California. Its most persistent occurrence in Leg 12 samples is in early and middle Miocene sediments (Tables 1 and 2). Further work on this species as well as the *Lamprocyclas maritalis* group may lead to eventual lineage determinations of stratigraphic usefulness, but the generally rare occurrences of this form in Leg 12 samples prohibited such a study at this time.

Calocyclas semipolita semipolita Clark and Campbell

Calocyclas (*Calocycletta*) *semipolita semipolita* Clark and Campbell, 1942, p. 83, Plate 8, Figures 12, 14, 17-19, 22, 23.

Calocycletta costata (Riedel)

Calocyclas costata Riedel, 1959, p. 296, Plate 2, Figure 9.
Calocycletta costata (Riedel); Riedel and Sanfilippo, 1970, p. 535, Plate 14, Figure 12; in press, p. 125, Plate 2H, Figures 12-14.

Calocycletta virginis Haeckel

Calocyclas virginis Haeckel, 1887, p. 1381, Plate 74, Figure 4; Riedel, 1959, p. 295, Plate 2, Figure 8.
Calocycletta virginis Haeckel; Riedel and Sanfilippo, 1970, p. 535, Plate 14, Figure 10; in press, p. 125, Plate 2H, Figures 5-11.

Calocycletta sp. cf. *C. virginis* Haeckel

Calocycletta cf. *virginis*; Riedel and Sanfilippo, 1970, Plate 14, Figure 11.
Calocycletta sp. cf. *C. virginis* Haeckel; Riedel and Sanfilippo, in press, p. 125, Plate 8, Figure 12.

Included in this group are specimens having a subspherical thorax, indistinct lumbar stricture, and a distally tapering abdomen terminating in triangular lamellar feet as illustrated by Riedel and Sanfilippo (1970, Plate 14, Figure 11). Some of these may represent the later forms of *Calocycletta robusta* Moore (in press, Plate 10, Figures 5, 6). Also included in this group are forms with subspherical thorax but little or no development of the abdomen. These could represent incompletely developed specimens of *Calocycletta virginis*.

Lamprocyclas heteroporos Hays

Lamprocyclas heteroporos Hays, 1965, p. 179, Plate 3, Figure 1; Kling, 1971, p. 1088, Plate 1, Figure 1.

Lamprocyclas maritalis maritalis Haeckel

Lamprocyclas maritalis Haeckel, 1887, p. 1390, Plate 74, Figures 13, 14.
Lamprocyclas maritalis maritalis Haeckel, Nigrini, 1967, p. 74, Plate 7, Figure 5.

Lamprocyclas maritalis polypora Nigrini

Lamprocyclas maritalis Haeckel *polypora* Nigrini, 1967, p. 76, Plate 7, Figure 6.

Podocyrtis papalis Ehrenberg

Podocyrtis papalis Ehrenberg, 1847, Figure 2; 1854, Plate 36, Figure 23; 1873, p. 251; Nigrini, 1970, p. 403, Plate 1, Figure H.

Podocyrtis (*Podocyrtis*) *papalis* Ehrenberg; Riedel and Sanfilippo, 1970, p. 533, Plate 11, Figure 1.

Theocyrtis annosa (Riedel)

Phormocyrtis annosa Riedel, 1959, p. 295, Plate 2, Figure 7.
Theocyrtis annosa (Riedel); Riedel and Sanfilippo, 1970, p. 535, Plate 15, Figure 9; in press, p. 128, Plate 2H, Figure 4, Plate 3D, Figures 12, 13; Moore, in press, Plate 7, Figures 6, 7.

Family AMPHIPYNDACIDAE Riedel: 1967a

(?) *Amphipyndax stocki* (Campbell and Clark)
(Plate 2, Figures 10, 11)

(?) *Stichocapsa* (?) *stocki* Campbell and Clark, 1944b, p. 44, Plate 8, Figures 31-33.
(?) *Amphipyndax stocki* (Campbell and Clark); Foreman, 1968, p. 78, Plate 8, Figures 12a-c.

One specimen tentatively identified as this species was observed from the Lower Paleocene of Hole 119 (36-CC). Foreman (1968, Table 1) indicates a Paleocene occurrence of this late Cretaceous form in California from the 175 to 297 foot interval of her Cima Hill locality.

Family ARTOSTROBIIDAE Riedel 1967a

Artostrobium auritum (Ehrenberg) group

Lithocampe aurita Ehrenberg, 1844, p. 84; 1854, Plate 22, Figure 25.
Artostrobium auritum (Ehrenberg) group; Riedel and Sanfilippo, in press, p. 129, Plate 1H, Figures 5-8.

Artostrobium miralestense (Campbell and Clark)

Dictyocephalus miralestensis Campbell and Clark, 1944a, p. 45, Plate 6, Figures 12-14.
Artostrobium miralestense (Campbell and Clark); Riedel and Sanfilippo, in press, p. 131, Plate 1H, Figures 9-17, Plate 2I, Figures 9, 10, Plate 3E, Figure 12.

Because of the rare occurrence of this species no attempt was made to establish identity with the various specimens illustrated in Riedel and Sanfilippo's (in press) synchronopticon.

Lithomitra lineata (Ehrenberg) group

Lithocampe lineata Ehrenberg, 1838, p. 130 (partim); 1854, Plate 22, Figure 26, Plate 36, Figure 16.
Lithomitra lineata (Ehrenberg); Haeckel, 1887, p. 1484.
Lithomitra lineata (Ehrenberg) group; Riedel and Sanfilippo, in press, p. 133, Plate 1I, Figures 1-11, Plate 21, Figures 14-16, Plate 3E, Figure 14.

Radiolaria *Incertae Sedis*

Hataina ovata Huang

Hataina ovata Huang, 1967, p. 178, Plate 17; Figures 1-6; Plate 18, Figures 1-4, Plate 19, Figures 1-6.
Spumellina *incertae sedis* Forma A; Benson, 1966, p. 283, Plate 19, Figures 6-8.

As discussed in the radiolarian report for Site 113 (Chapter 5), *Hataina ovata* is one of several ellipsoidal, thick-walled, siliceous cysts (?) which according to Riedel (personal communication) may be parts of sponge skeletons. Huang (1967), however, suggested that *H. ovata* and presumably other cyst-like bodies similar to it are radiolarians (for example, Spumellina *incertae sedis* Forma B from the Gulf of California: Benson, 1966, p. 284, Plate 19, Figures 9-11). There are about six or seven different types of these cyst-like structures present in Leg 12 samples. Because they appear to have undergone little or no evolutionary change no attention was paid to them except to note their presence. At certain sites (for example, Site 116) they contribute notably to the total biogenous opal. They also are quite resistant to corrosion, being fairly well preserved, whereas radiolarians are nearly obliterated in the same sample.

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Explanation of Plates

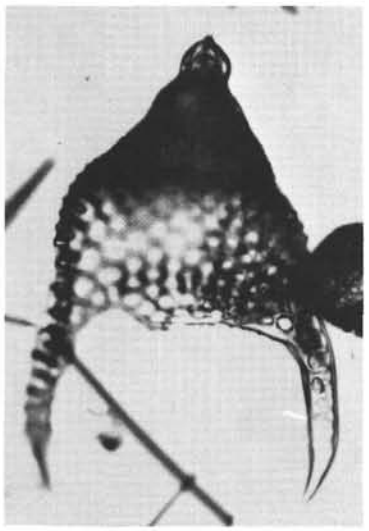
DSDP sample numbers follow the specimen identification and are to be interpreted as follows: 12 (for Leg 12) followed in turn by hole number, core number, section number (or CC for core catcher), interval sampled, and slide number (BN-1, BN-2, etc.). Notation of specimen location on the slide follows the DSDP sample numbers and is indicated by England Finder coordinates (Riedel and Foreman, 1961). The England Finder was used with its label to the observer's left.

PLATE 1
Cenozoic Radiolaria

Figures 1,2 *Cyclampterium* (?) sp. cf. *C.* (?) *milowi* Riedel and Sanfilippo. ×132. 12-119-8-4, 76-77 cm; BN-1; D44/1.

Figures 3, 4, 5 *Spongaster* sp. cf. *S. tetras* Ehrenberg. ×132. 12-114-3-CC; BN-1.
3: Slide location G40/0.
4: Slide location L8/1.
5: Slide location G33/2.

PLATE 1



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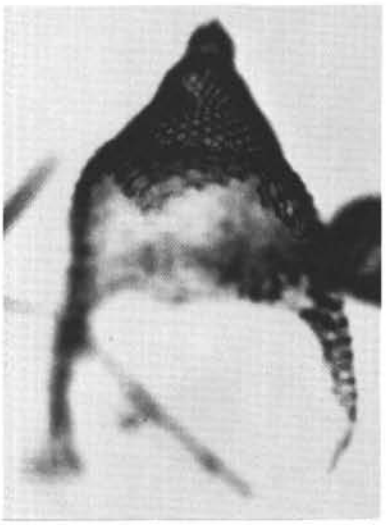

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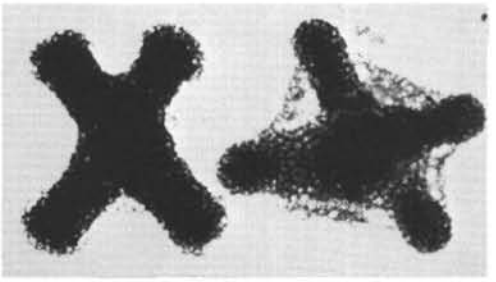


3

4

5

PLATE 2

Family Tholoniidae

Figures 1, 2 — *Amphitholus* sp. ×400. 12-112-9-CC; BN-1; D10/4. From the Lower Oligocene (calcareous nannoplankton zone NP 23: *Sphenolithus predistentus* Zone).

Figures 3, 4 — *Tholocubus* sp. ×400. 12-112-4-CC; BN-2; F15/0. From the Middle Miocene (? calcareous nannoplankton zone NN 6: *Discoaster exilis*).

Paleocene Radiolaria

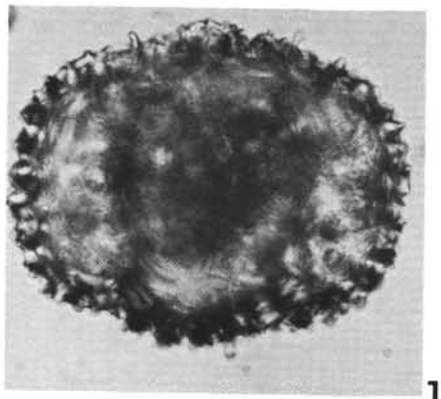
Figure 5 — *Phormocyrtis striata* Brandt. ×200. 12-119-28-CC; BN-1, Z25/1.

Figures 6, 7 — *Bekoma bidarfensis* Riedel and Sanfilippo. ×200. 12-119-28-CC; BN-1.
6: Slide location T48/3.
7: Slide location D21/1.

Figure 8, 9 — *Lithocampium* sp. A. 12-119-29-CC; BN-1.
8: ×400. Slide location T27/4.
9: ×200. Slide location W40/3.

Figure 10, 11 — (?) *Amphipyndax stocki* (Campbell and Clark). 12-119-36-CC; BN-4; D34/4.
10: ×200.
11: ×400.

PLATE 2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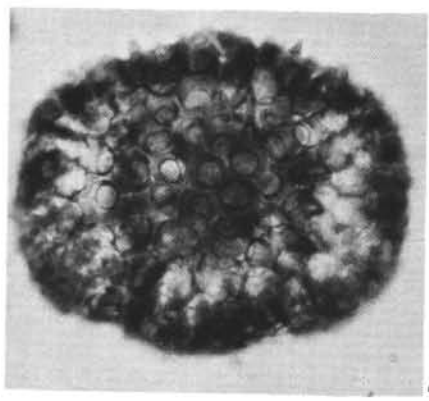
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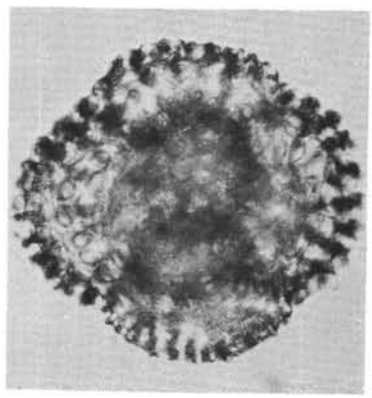
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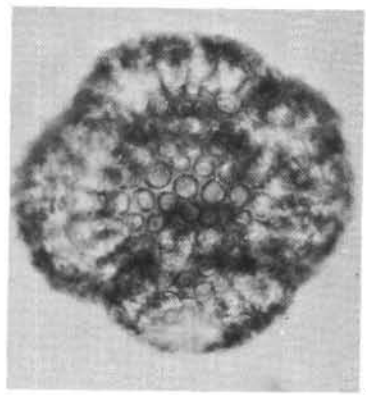
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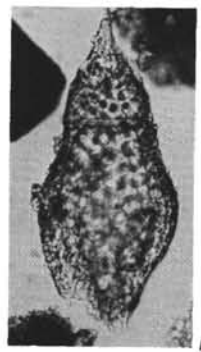
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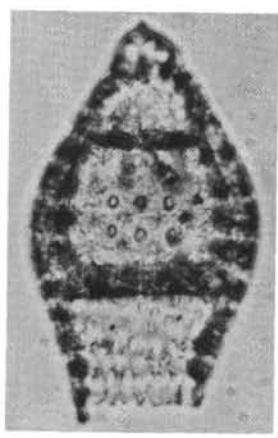
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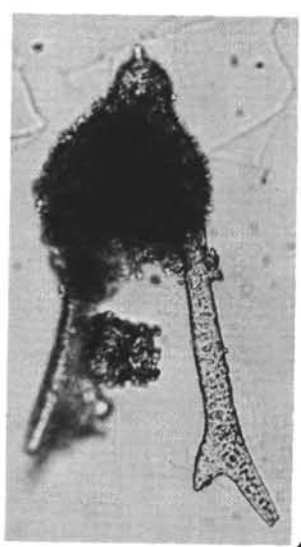
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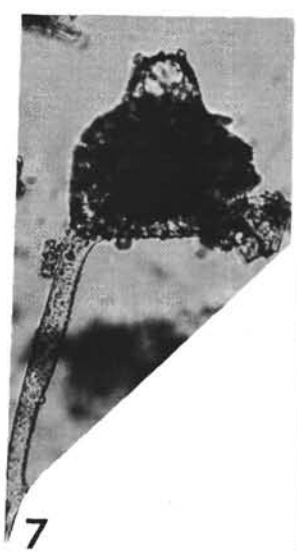
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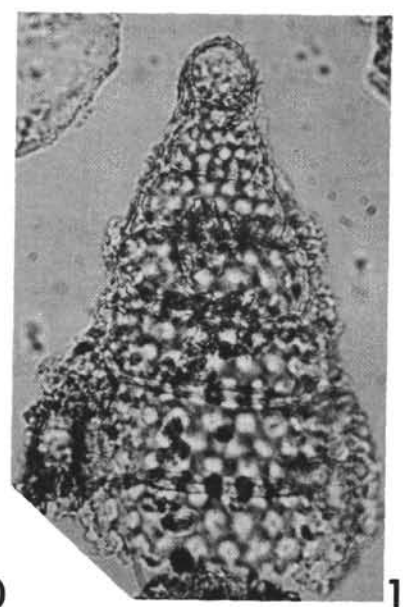

11

PLATE 3

Reworked zeolitized Upper Cretaceous Radiolaria at Site 118

Figures 1, 2, 3 Unidentified theoperids. ×273. 12-118-16-CC; BN-1.

Figure 4 General view of assemblage. ×68. 12-118-16-CC; BN-1.

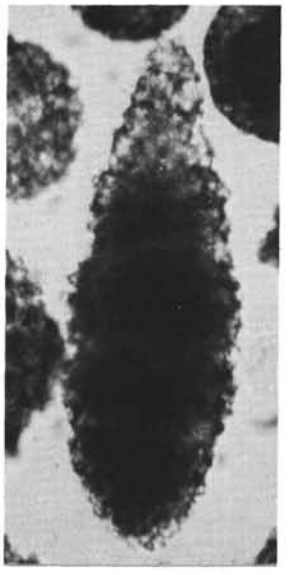
Figure 5 Unidentified hagiastrin. ×273. 12-118-16-CC; BN-1.

Figure 6 Unidentified spumellarian with well-developed zeolite crystals. ×273. 12-118-16-CC; BN-1.

PLATE 3

1

2



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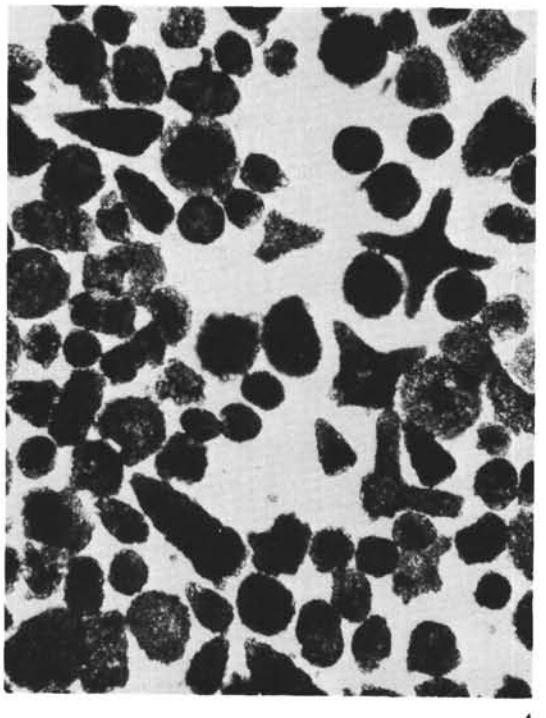

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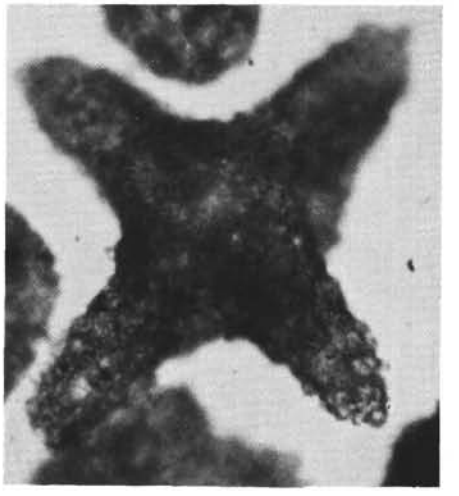

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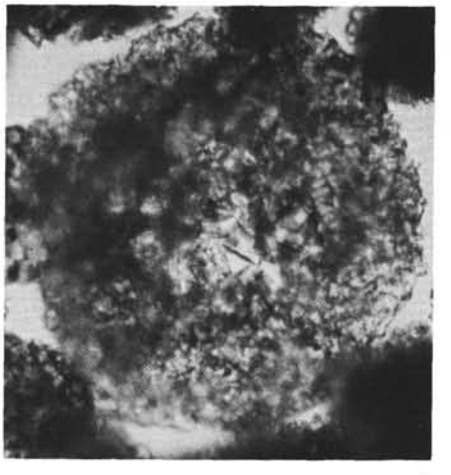

6

INDEX OF RADIOLARIAN NAMES[1]

Only species-group taxa are indexed.

[1] The first number following species name refers to chapter number, this volume; the number following this in parenthesis refers to the site number. If the species name appears in one of the tables or plates of Chapter 17 it is referred to as 17 (T.1), 17 (T.2) or 17 (Pl. 1, Figs. 1-3), respectively.

Tristylospyris triceros 8 (116)
Tympanidium binoctonum 17 (T.2)

APPENDIX TO CHAPTER 17 DEEP SEA DRILLING PROJECT, LEG 12

Table of radiolarian occurrences

In the following table the species as discussed in the taxonomic notes section of Chapter 17 are listed in alphabetical order. Their abundances may be interpreted as follows: VR, 1 to 5 specimens per slide; R, 6 to 20 specimens per slide; C, 21 to 50 specimens per slide; A, more than 50 specimens per slide. Included in the table are only those samples in which one or more of the listed species are present. This does not imply that other samples were not examined because many of these have radiolarians either which, if well preserved, were not considered diagnostic or that are so poorly preserved that identification was impossible.

APPENDIX TO CHAPTER 17

Site	111			112										113				114							115							116																													
Sampled interval (cm)		92.5-93.5	102-105		80-81												106-110							Core Water	(Center bit)	Core Water	Core Water	115-153m	162-175m	Bottom	Drill Bit-Bottom of hole?	69-71	79-80	78-79	81-82	78-79	77-78		76.5-77.5	79-80	Bottom	Bottom	Bottom	Bottom		81-82	79.5-81	88-90	Bottom	76-77		119-120	97-98	79-80	81-82	62-63	89-90		Bottom	33-34	127-128
Section	CC	1	1	CC	2	CC	CC	CC	CC	CC	CC	CC	CC	CC	CC	CC	2	CC	CC	CC	CC	CC	CC		C.B.			C.B.	C.B.			1	2	3	4	5	6	CC	1	2	3	4	5	6	CC	1	3	4	5	6	CC	1	2	3	4	5	6	CC	0	1	2
Core	9	10	10	1	4	4	5	6	7	8	9	10	11	1	4	6	7	1	2	3	4	5	6	8	2	3	4			7		1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5
Hole	111A	111A	111A	112	112	112	112	112	112	112	112	112	112	113	113	113	113	114	114	114	114	114	114	114	115	115	115	115	115	115	115	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116
Species																																																														
Actinomma antarcticum																		R	VR	VR											VR	VR	VR	VR	VR	VR	VR	R			VR								VR												
Actinomma medianum																		R	VR	R			VR	VR							VR																														
Amphicraspedum murrayanum		VR	VR																																																										
(?) *Amphipyndax stocki*																																																													
Amphisphaera cronos				VR														VR	VR		VR	R	VR								?	R	R	VR	R	VR	R		VR	VR	R	R	VR	R		VR	VR	R	R	R	R		R	R	VR	VR	VR	?	R		R
Amphitholus sp.								VR		VR	?	?																					VR	VR	R													R	R	R											
Androcyclas gamphonycha																																													VR													?			
Anthocyrtidium cineraria																																											VR															VR			
Anthocyrtium ehrenbergii ehrenbergii																																																													
(?) *Artophormis barbadensis*										VR	VR																																																		
Artophormis gracilis							VR	VR	VR	VR	VR																																																		
Artostrobium auritum																																VR	VR	VR	R	R	VR	R			VR		VR		R							VR						VR			
Artostrobium miralestense														VR																																															VR
Bekoma bidarfensis																																																													
Calocyclas margatensis					VR	VR																														?																			?				VR		
Calocyclas semipolita semipolita																																																													
Calocycletta costata																																																													
Calocycletta virginis																																																													
Calocycletta sp. cf. *C. virginis*							VR		VR																																																				
Cannartus laticonus						VR																																																							
Cannartus prismaticus																																																													
Cannartus tubarius																																																													
Cannartus violina																																																													
Carpocanistrum spp.					VR	VR	R	R	VR	VR	VR																					R		VR		VR	VR	VR				VR	R				VR					VR						VR		VR	VR
Carpocanopsis bramlettei																																																													
Carpocanopsis cingulatum																																																													
Carpocanopsis cristatum?																																																													
Carpocanopsis favosum																																																													
Coracalyptra cervus																		VR								VR					VR	VR	VR	VR		VR	VR					VR													?						
Cornutella profunda							VR	VR	VR	VR	C	C	C					VR			VR	VR	VR	VR							VR		VR	VR	VR	VR			VR			VR																			
Cyclampterium (?) *leptetrum*																																																													
Cyclampterium (?) *milowi*																																																													
Cyclampterium (?) sp. cf. *C* (?) *milowi*										VR	VR	VR																																																	
Cyclampterium (?) *pegetrum*							?			VR																																																			
Cyclampterium (?) *tanythorax*																																																													
Cyrtocapsella cornuta					VR	VR																																																					VR	VR	
Cyrtocapsella elongata																																																													
Cyrtocapsella japonica					VR	VR																																																				?			
Cyrtocapsella tetrapera					C	C																																															VR		VR		?	VR			VR
Dictyophimus gracilipes														VR		?		R								?					VR			?		VR																									
Dorcadospyris ateuchus							?	VR		VR																																																			
Dorcadospyris simplex																																																													
Druppatractus acquilonius																																VR		VR	VR	VR	VR		R	R	VR	R	R	VR		VR	VR	VR	VR	VR			VR		VR				VR	VR	R
Druppatractus irregularis															C	R				C	R	R	R	R								C	R	R	R	R	VR	R			VR	VR	VR								VR		R	R	R		R	C	R		VR
Druppatractus sp. cf. *D. pyriformis*				VR			C											R																																											

*Some or all of the species in sample may be out of place as a result either of 1) reworking of older species into younger sediments in the marine environment, or 2) downhole movement of younger material during drilling and/or coring operations.

Site	116																																																										
Sampled interval (cm)	103-104	80-81	93-94	Bottom		78-79	78-79	79-80	61-62		80-81	78-79	72-73	Bottom	Bottom	84-85		81-82	79-80		79-80	70-71	115-116		Bottom	83-84	128-130	69-71	69-70	86-87		Bottom	77-78	Bottom	Bottom	77-78		66-67	91-92	80-81	72-73	Bottom	83-84				Bottom	81-82	77-78	79-80	76-77		Bottom	74-75	Bottom	76-77		Bottom	Bottom	81-82
Section	3	4	5	6	CC	1	2	3	4	CC	1	2	3	4	5	6	CC	2	3	CC	1	2	3	CC	0	1	2	3	4	6	CC	1	2	3	4	6	CC	1	2	3	4	5	6	CC	CC	CC	0	1	3	5	6	CC	0	2	3	4	CC	0	3	4
Core	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	7	7	8	8	8	9	9	9	9	10	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	12	13	14	15	15	15	15	15	15	16	16	16	16	16	17	17	17
Hole	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116
Species																																																												
Actinomma antarcticum			VR														cf.																																											
Actinomma medianum																																																												
Amphicraspedum murrayanum																																																												
(?) *Amphipyndax stocki*																																																												
Amphisphaera cronos	R	R				VR	R	R	R	R	R			R	R	R	C	C	R		?																	R		VR		VR																		
Amphitholus sp.	R																																																											
Androcyclas gamphonycha																																																												
Anthocyrtidium cineraria	?	?			VR																										?																													
Anthocyrtium ehrenbergii ehrenbergii																	VR														R																													
(?) *Artophormis barbadensis*																																																												
Artophormis gracilis																																																												
Artostrobium auritum	VR	VR	VR	VR	VR												VR	VR													R													R																
Artostrobium miralestense	VR														VR		VR	VR	R	R		VR	VR	VR	R		R	R	VR		R			VR	VR						VR	VR	VR	R		R						VR								
Bekoma bidarfensis																																																												
Calocyclas margatensis					VR	?									VR	?	R		C	VR	VR		VR	VR	R	VR	R	R	R	R	R						VR	R	R	R	R	R	R	C	R	VR	R	R	R				VR	VR	VR		VR	VR	VR	VR
Calocyclas semipolita semipolita																																																												
Calocycletta costata																																																												
Calocycletta virginis																																																												
Calocycletta sp. cf. *C. virginis*																																																												
Cannartus laticonus					?					?							?							?																																				
Cannartus prismaticus																																														VR											VR		VR	
Cannartus tubarius																																																												
Cannartus violina																																																												
Carpocanistrum spp.	VR		VR	R	R		VR	VR	VR	R	VR			VR	VR		R	VR	R	VR	VR	VR			R	VR	R	R	VR	VR	VR							VR	VR	VR	VR	R	R	R	R	VR	R		R	R	VR	R	R	R	C	R	C	R	R	R
Carpocanopsis bramlettei																																								VR																				
Carpocanopsis cingulatum																																																												
Carpocanopsis cristatum?																			VR																																									
Carpocanopsis favosum																																																												
Coracalyptra cervus																																														?														
Cornutella profunda	VR														R		VR		VR				VR				VR		R										VR		VR		VR	VR	VR	VR	R			VR	VR	VR								
Cyclampterium (?) *leptetrum*																															VR													VR																
Cyclampterium (?) *milowi*																																																												
Cyclampterium (?) sp. cf. *C.* (?) *milowi*																																													**VR**	VR						VR				VR				**VR**
Cyclampterium (?) *pegetrum*																																												VR																
Cyclampterium (?) *tanythorax*																															VR																													
Cyrtocapsella cornuta											VR						VR		R		C	R	R	VR	R	VR	VR		VR	VR	VR		VR	VR	VR	VR		R	VR	VR	VR	R	VR	C	VR	R	R	C	R	R	R	C	R		C	R	C	C	R	**VR**
Cyrtocapsella elongata		VR															R			R																																								
Cyrtocapsella japonica				VR							VR	VR	VR	C	C	R	A	C	R	R	VR			VR							VR							VR	VR					VR																
Cyrtocapsella tetrapera		VR		VR	VR				VR	VR							VR		R	VR	C	C	A	A	A	R	C	C	R	R	A		VR	VR				C	C	C	R	C	C	A	C	C	C	A	A	C	C	C	C	R	C	C	C	C	R	**R**
Dictyophimus gracilipes																																																												
Dorcadospyris ateuchus																																													?	VR														
Doracadospyris simplex																																													VR	VR			VR	VR			VR							
Druppatractus acquilonius	R	VR	VR	VR			VR	VR	VR		VR	VR	C	VR	R	VR			R		VR		VR		R	R	R	VR		R								R	C	R	VR	VR	R		C	VR	R	C	C	R	R		R		C	R	C	R	**C**	**R**
Druppatractus irregularis	R	VR		C											R			VR	C		C	C	C			R	C			C	R			VR					C	R	R	R	R				R			VR		?			R					
Druppatractus sp. cf. *D. pyriformis*			VR			VR		R	R		R	R	VR	C	C	R					VR																								VR												C	R		

*Some or all of the species in sample may be out of place as a result either of 1) reworking of older species into younger sediments in the marine environment, or 2) downhole movement of younger material during drilling and/or coring operations.

APPENDIX TO CHAPTER 17 — *Continued*

Species / Site	116																																																						117		118						
Sampled interval (cm)	82-83		Bottom	Bottom	74-75		105-106	44-46	Bottom	60-61		46-48				110-112						93-94	Bottom	Bottom	78-79	79-80	85-86	78-79	78-79	78-79	78-79	77-78	80-81	79-80	78-79	78-79	79-80	78-79	73-74	79-80	79-80	78-79	75-76	75-76	126-129	76-77	76-77	Bottom	79-80	76-77	77-78	77-78	75-76	76-77		Core Water							Bottom
Section	6	CC	0	3	4	CC	1	2	3	4	CC	1	CC	CC	CC	1	CC	CC	CC	CC	CC	1	3	4	5	6	2	4	1	2	3	5	2	4	2	3	4	6	1	2	3	4	5	6	1	5	6	0	1	2	3	4	5	6	CC		CC	CC	CC	CC	CC	CC	1
Core	17	17	18	18	18	18	19	19	19	19	19	20	20	22	23	24	24	25	26	27	28	1	3	3	3	3	5	5	6	6	6	6	7	7	8	8	8	8	9	9	9	9	9	9	10	10	10	11	11	11	11	11	11	11	1	1	6	7	8	9	10	11	12
Hole	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	117	117A	118	118	118	118	118	118	118
Actinomma antarcticum																						R	R	R		VR	VR		VR		VR	R	R	R	R	VR					VR		VR		VR			R				VR											
Actinomma medianum																								R			R	VR	VR	VR			VR	R	VR	VR			VR	cf.	VR																						
Amphicraspedum murrayanum																																																															
(?) *Amphipyndax stocki*																																																															
Amphisphaera cronos																											VR								VR		VR	R	R	VR	R	R	R	R		R	VR	C	R	R	VR	VR	VR										
Amphitholus sp.																																							VR		VR	R	VR		VR	VR		R		R		R	VR										
Androcyclas gamphonycha																								R											VR		VR	VR												?													
Anthocyrtidium cineraira																																						VR					VR					VR															
Anthocyrtium ehrenbergii ehrenbergii																																																							VR								
(?) *Artophormis barbadensis*																																																															
Artophormis gracilis											?																																																				
Artostrobium auritum																								R						VR		R			VR		VR	VR			R					VR	VR	R		VR		VR	VR										
Artostrobium miralestense		R			VR	VR					C		VR					?						VR																																							
Bekoma bidarfensis																																																															
Calocyclas margatensis	VR	VR	VR	VR		VR	VR	VR	VR		VR		VR																																			?															
Calocyclas semipolita semipolita																			VR	VR	?																																										
Calocycletta costata																																																															
Calocycletta virginis																																																															
Calocycletta sp. cf. *C. virginis*																																																															
Cannartus laticonus																																																															
Cannartus prismaticus			VR								VR																																																				
Cannartus tubarius																																																															
Cannartus violina																																																															
Carpocanistrum spp.	R	R	R	R		VR		R			R	VR																													VR	VR		VR		VR		VR									VR	VR					
Carpocanopsis bramlettei											VR																																																				
Carpocanopsis cingulatum										VR	VR	?																																																			
Carpocanopsis cristatum?								VR																																																							
Carpocanopsis favosum																																																															
Coracalyptra cervus																																									VR	VR						VR															
Cornutella profunda		VR									VR							?						VR														VR				VR						VR				VR											
Cyclampterium (?) *leptetrum*						?																																																									
Cyclampterium (?) *milowi*																																																															
Cyclampterium (?) sp. cf. *C.* (?) *milowi*			VR			R	VR	VR	VR		VR							?																																													
Cyclampterium (?) *pegetrum*		VR									VR																																																				
Cyclampterium (?) *tanythorax*																																																															
Cyrtocapsella cornuta	VR	R	C	R	VR	R	VR	R	VR	VR	C	VR																																													VR						
Cyrtocapsella elongata																																																															
Cyrtocapsella japonica																																																									VR						
Cyrtocapsella tetrapera	R	R	C	R	R	R	R	R	VR	R	R	R																																											VR	VR	VR		VR				
Dictyophimus gracilipes																								VR								VR									?																						
Dorcadospyris ateuchus		?				VR	VR	VR			VR		VR																																																		
Dorcadospyris simplex		VR	VR			VR		VR		?	VR																																																				
Druppatractus acquilonius	R	R	C	R	R	C	R	R	R	C	R	R	VR	?	?	VR	?	VR														VR	VR		VR		VR	R	VR	VR	VR	VR	R	VR	VR	VR	VR	VR	VR	VR	VR	VR	VR	VR									
Druppatractus irregularis			R					R			C																					C			R		VR	R	VR	R	C	R	R		VR	VR	VR	R	VR	VR	VR	VR					VR						
Druppatractus sp. cf. *D. pyriformis*		cf.														VR		?																																					VR	VR							

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APPENDIX TO CHAPTER 17 — *Continued*

Species / Site	119																																																											
Sampled interval (cm)	79-80	74-75	76-77		137-138	78-79	78-79	80-81		78-79	78-79	77-78		78-79	76-77	81-82	76-77	52-53	*	139-140	80-81	107-108	*	73-74	78-79	5-6	*	69-70	75-76	51-52	*	109-111	77-78	82-83	*	* 70-71	*	* 77-78	* 72-73	*	* 71-73	*	* 0-1	*	* 94-96	*	* 2-3	*	*	*	* 81-82		11-14	144-145						
Section	1	2	3	CC	1	2	3	4	CC	1	2	3	CC	1	2	3	4	5	CC	1	2	3	CC	1	2	3	CC	1	2	3	CC	1	2	3	CC	3	CC	2	4	CC	4	CC	3	CC	1	CC	3	CC	CC	CC	2	CC	1	1	CC	CC	CC	CC	CC	CC
Core	5	5	5	5	6	6	6	6	6	7	7	7	7	8	8	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	14	14	14	15	15	16	16	17	19	20	21	22	25	26	26	27	27	27	28	29	30	35	36
Hole	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119
Actinomma antarcticum																																																												
Actinomma medianum																																																												
Amphicraspedum murrayanum																																																												
(?) *Amphipyndax stocki*																																																												VR
Amphisphaera cronos																																																												
Amphitholus sp.													VR	VR		VR											VR																																	
Androcyclas gamphonycha																																																												
Anthocyrtidium cineraria																																																												
Anthocyrtium ehrenbergii ehrenbergii					VR														VR								VR				VR															?														
(?) *Artophormis barbadensis*																																																												
Artophormis gracilis																																																												
Artostrobium auritum																																																												
Artostrobium miralestense					VR		VR	VR	VR		R	R	R	R	R	R	R	VR	R								R	VR			R				VR							VR				C		VR								R				
Bekoma bidarfensis																																																					VR							
Calocyclas margatensis				VR	R	R	R	A	C		R	R	R	R	R	R	C	VR	C	VR	VR	VR	R	VR	VR	VR	C	R			C			?	VR							VR				C		VR	VR											
Calocyclas semipolita semipolita																																																												
Calocycletta costata					VR	VR							VR						VR																																									
Calocycletta virginis					R	R	R	R	R	C	C	R	R	C	R	R	VR	VR	C	VR			C				C				R						VR					R				A		VR	R											
Calocycletta sp. cf. *C. virginis*														C	C	C		VR		VR	VR	VR	VR				R				R			?		?						R		VR		R			VR											
Cannartus laticonus																																																												
Cannartus prismaticus						VR		R	C		VR	VR	R	VR	VR				VR	VR			VR			VR	R	C			VR											VR				R														
Cannartus tubarius					VR			VR	R		VR	VR	VR						VR								VR															?				VR														
Cannartus violina							VR	VR	VR				VR				VR		VR								VR															?																		
Carpocanistrum spp.				R		R	VR	VR	C	R	R	R	C	VR	VR	R	R	R	C	VR	VR	VR		VR	VR	R	C	C	VR		R			VR	VR				VR		VR	R		VR		R	VR	R	VR											
Carpocanopsis bramlettei									VR		VR	VR	VR						VR																											VR														
Carpocanopsis cingulatum					VR	VR	VR		VR	VR		R	R	VR													R	VR			VR															R			VR											
Carpocanopsis cristatum?							VR				VR		VR	VR	VR				VR			VR		VR			VR	VR																		VR			VR											
Carpocanopsis favosum									VR									VR	VR																																									
Coracalyptra cervus																																																												
Cornutella profunda					cf.		cf.																																							VR														
Cyclampterium (?) *leptetrum*					R	R	R	R	C		R	R	C	R	R	R			VR				R				R				R											R				C		VR												
Cyclampterium (?) *milowi*																																																											
Cyclampterium (?) sp. cf. *C.* (?) *milowi*																	R	R		VR			VR		VR	VR		VR	R	R	R	R	R							VR		R		VR		VR	VR	VR												
Cyclampterium (?) *pegetrum*															R	R			R		VR	VR	VR	VR			R	VR			VR		VR									VR	?	VR		R		VR												
Cyclampterium (?) *tanythorax*																																																												
Cyrtocapsella cornuta					R	R	R	C	A	R	R	R	C	R	C	R	C	VR	C	VR	VR	VR	C	VR	VR	R	C	C			C									VR		R				C	VR	R												
Cyrtocapsella elongata																							R				C												VR			C		VR		A		VR	VR											
Cyrtocapsella japonica				VR	R	C	C	C	A	R	R	R	A	C	R	R			A	VR		VR		VR							R															VR														
Cyrtocapsella tetrapera				VR	C	R	C	A	A	R	C	C	A	C	C	C	A	C	A	R	VR	R	C	VR	R	C	C	C			C			?	VR	VR	VR				VR	C		R		A		R	R											
Dictyophimus gracilipes																																																												
Dorcadospyris ateuchus																R	VR	VR		R	VR	VR		VR	VR	R	VR	C														VR							VR											
Dorcadospyris simplex						R		VR	VR	VR	R	R	VR	VR	VR	R	R	R	VR	R	R	R	R	VR	R	R	R	C			VR											R		VR		R	VR	VR	R											
Druppatractus acquilonius																																																												
Druppatractus irregularis																																																												
Druppatractus sp. cf. *D. pyriformis*																																																												

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APPENDIX TO CHAPTER 17 — *Continued*

Species / Site	111			112										113				114							115							116																													
Sampled interval (cm)		92.5-93.5	102-105		80-81												106-110							Core Water	(Center bit)	Core Water	Core Water	115-153m	162-175m	Bottom	Drill Bit-Bottom of hole?	69-71	79-80	78-79	81-82	78-79	77-78		76.5-77.5	79-80	Bottom	Bottom	Bottom	Bottom		81-82	79.5-81	88-90	Bottom	76-77		119-120	97-98	79-80	81-82	62-63	89-90		Bottom	33-34	127-128
Section	CC	1	1	CC	2	CC	CC	CC	CC	CC	CC	CC	CC	CC	CC	CC	2	CC	CC	CC	CC	CC	CC		C.B.			C.B.	C.B.			1	2	3	4	5	6	CC	1	2	3	4	5	6	CC	1	3	4	5	6	CC	1	2	3	4	5	6	CC	0	1	2
Core	9	10	10	1	4	4	5	6	7	8	9	10	11	1	4	6	7	1	2	3	4	5	6	8	2	3	4			7		1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5
Hole	111A	111A	111A	112	112	112	112	112	112	112	112	112	112	113	113	113	113	114	114	114	114	114	114	114	115	115	115	115	115	115	115	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116
Eucyrtidium calvertense																					R	VR	VR									VR	VR	VR	VR	VR	VR	VR				VR	VR			VR		VR		VR	VR		VR		VR		VR	R	VR		VR
Hataina ovata																																																														
Heliodiscus asteriscus																		VR				VR				VR			VR	VR					VR	VR	VR	VR																				VR			
Heliodiscus heliastericus																																																													
Helotholus histricosa																		R				VR	VR			VR						VR	VR	VR		VR						VR											?		R		R		R		
Lamprocyclas heteroporos																																			VR								VR																		
Lamprocyclas maritalis maritalis																															?							VR					R	VR	VR				VR												
Lamprocyclas maritalis polypora																						?										VR									VR		VR		R																
Lithelius minor				VR																												R	R	R	C	C	R		R	R	C	R						R					R	R	R	R	R		A		R
Lithocampium sp. *A*																																																													
Lithomelissa thoracites																																	R	C	R	R																					?		?	?	VR
Lithomitra lineata							R		?	?	?	?										R	VR										VR			VR			VR			VR																			
Lithopera neotera																																																													
Lithopera renzae																																																													
Lophoconus titanothericeraos																																																													
Lophocyrtis biaurita	VR	VR																																																											
Lychnocanium bipes																																																													
Ommatartus antepenultimus																																																										VR		VR
Oroscena sp., curved, flat spines																																																													
Oroscena sp., digitately branched spines					R	R																																																							
Peripyramis circumtexta							VR											VR			VR	VR		VR							VR																														
Phormocyrtis striata			VR																																																										
Phorticium pylonium				R										VR	VR			VR	VR	VR		VR	R	R			VR		VR		R	C	C	C	R	R	VR				VR	VR	VR											R	R		R		R		
Podocyrtis papalis	VR																																																												
Pterocanium trilobum																				?				?										VR	VR	VR	VR																								
(?) *Sethochytris babylonis*		VR																																																											
Solenosphaera sp.						VR																																																							
Spongaster tetras																																VR						VR																							
Spongaster sp. cf. *S. tetras*																				A												VR	R	R	R	R	VR	C																							
Spongasteriscus cruciferus	VR	VR																																																											
Spongocore puella																		R													VR			VR	VR	VR	VR																					?			
Spongodiscus biconcavus															C	VR		R			A	A		C					VR		R		VR	C				C																							
Spongopyle osculosa				R										VR	C			R		VR						VR					R			VR	VR			R			VR								VR				VR		VR						
Spongotrochus sp. cf. *S. glacialis*																		R													R	R				VR																									
Spongurus bilobatus																																																													
Stichocorys armata																																																													
Stichocorys delmontensis						R																																					?						VR		VR							VR	VR	R	R
Stichocorys diploconus																																																													
Stichocorys peregrina																						?	?	?																	R	VR	VR		R				?									VR	R	R	R
Stichocorys wolffii																																																													
Stylodictya validispina				VR										VR				R			R	C	C	VR	VR	VR		VR	VR	VR	R	?	?	VR	R	VR			?			R							R						R	R	R	R			
Theocalyptra davisiana				VR										R			VR	C	C	R	VR				VR	R	VR		VR		VR																														
Theocorys spongoconum																																																													
Theocorythium trachelium																				VR											VR	VR	?	VR	VR	VR	VR	VR			?																				
Theocyrtis annosa																																																													
Tholocubus sp.						VR																																																							
Tristylospyris triceros																																																													
Tympanidium binoctonum																																																													

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Site	116																																																											
Sampled interval (cm)	103-104	80-81	93-94	Bottom		78-79	78-79	79-80	61-62		80-81	78-79	72-73	Bottom	Bottom	84-85		81-82	79-80		79-80	70-71	115-116		Bottom	83-84	128-130	69-71	69-70	86-87		Bottom	77-78	Bottom	Bottom	77-78		66-67	91-92	80-81	72-73	Bottom	83-84				Bottom	81-82	77-78	79-80	76-77		Bottom	74-75	Bottom	76-77		Bottom	Bottom	81-82
Section	3	4	5	6	CC	1	2	3	4	CC	1	2	3	4	5	6	CC	2	3	CC	1	2	3	CC	0	1	2	3	4	6	CC	1	2	3	4	6	CC	1	2	3	4	5	6	CC	CC	CC	0	1	3	5	6	CC	0	2	3	4	CC	0	3	4
Core	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	7	7	8	8	8	9	9	9	9	10	10	10	10	10	10	10	11	11	11	11	11	11	12	12	12	12	12	12	12	13	14	15	15	15	15	15	15	16	16	16	16	16	17	17	17
Species / Hole	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116
Eucyrtidium calvertense		VR	VR							R										R	VR				R	R	VR	R	VR	VR									R		VR	VR	VR	VR	cf.	VR	VR		VR	R	VR	R				R	C		R	R
Hataina ovata																																																												
Heliodiscus asteriscus	VR									R																																																		
Heliodiscus heliastericus																																																												
Helotholus histricosa															?			?																																										
Lamprocyclas heteroporos																																																												
Lamprocyclas maritalis maritalis	VR			VR																																																								
Lamprocyclas maritalis polypora																																																												
Lithelius minor	C							R	R		R			R																																														
Lithocampium sp. *A*																																																												
Lithomelissa thoracites	R	R	VR		R													?																																										
Lithomitra lineata	VR			VR	VR										VR		VR		VR	R	VR		R		R		R	R			R							VR	VR	VR	R	R	R	C	VR	R	R	R	R	R	R	R	R	R	R	R	C	R	R	
Lithopera neotera																								VR	?		VR		VR	VR	VR																													
Lithopera renaze																					VR	VR		VR	VR		VR	VR	VR		A																													
Lophoconus titanothericeraos																																																												
Lophocyrtis biaurita																																																												
Lychnocanium bipes																																												VR		VR				VR	VR	VR			VR	VR		VR		VR
Ommatartus antepenultimus		VR	VR	VR	?					?							?																																											
Oroscena sp., curved, flat spines												VR	R	C	C	R	C						VR																																					
Oroscena sp., digitately branched spines											VR	VR		VR		VR	VR	R	R	VR	VR	VR										VR			VR																									
Peripyramis circumtexta																																													cf.															
Phormocyrtis striata																							R																																					
Phorticium pylonium	R		VR				VR							R				VR	VR		VR													?			R	R					R			R											R		R	
Podocyrtis papalis																																																												
Pterocanium trilobum										?																																																		
(?) *Sethochytris babylonis*																																																												
Solenosphaera sp.											VR																																																	
Spongaster tetras																																																												
Spongaster sp. cf. *S. tetras*																																																												
Spongasteriscus cruciferus																																																												
Spongocore puella																																													?	VR						VR					VR			
Spongodiscus biconcavus																																																												
Spongopyle osculosa															VR																																													
Spongotrochus sp. cf. *S. glacialis*																																																												
Spongurus bilobatus																																																												
Stichocorys armata																												VR		VR	VR													R				VR							VR					
Stichocorys delmontensis	R	R	VR	R	R		VR	VR		VR	VR			VR	VR		VR	R		VR	VR		VR	VR	R	VR	VR	VR	VR	VR	VR							VR		VR	VR	VR	VR	R	VR	VR	VR	R		VR	VR	R		VR	VR		VR			?
Stichocorys diploconus																																																	?		VR		VR							
Stichocorys peregrina	R	R		R											?																																													
Stichocorys wolffii																																																												
Stylodictya validispina													VR				VR	R																											?	R			VR			R					C			
Theocalyptra davisiana																																																												
Theocorys spongoconum																																																												
Theocorythium trachelium							cf.	cf.	cf.	cf.				cf.	cf.		cf.																																											
Theocyrtis annosa																																																												
Tholocubus sp.																																																									VR			
Tristylospyris triceros																																																												
Tympanidium binoctonum																																																												

*Some or all of the species in sample may be out of place as a result either of 1) reworking of older species into younger sediments in the

APPENDIX TO CHAPTER 17 — *Continued*

Species	Site	116																																																				117		118						
	Sampled interval (cm)	82-83		Bottom	Bottom	74-75		105-106	44-46	Bottom	60-61		46-48				110-112						93-94	Bottom	Bottom	78-79	79-80	85-86	78-79	78-79	78-79	78-79	77-78	80-81	79-80	78-79	78-79	79-80	78-79	73-74	79-80	79-80	78-79	75-76	75-76	126-129	76-77	76-77	Bottom	79-80	76-77	77-78	77-78	75-76	76-77		Core Water	*						Bottom
	Section	6	CC	0	3	4	CC	1	2	3	4	CC	1	CC	CC	CC	1	CC	CC	CC	CC	CC	1	3	4	5	6	2	4	1	2	3	5	2	4	2	3	4	6	1	2	3	4	5	6	1	5	6	0	1	2	3	4	5	6	CC		CC	CC	CC	CC	CC	CC	1
	Core	17	17	18	18	18	18	19	19	19	19	19	20	20	22	23	24	24	25	26	27	28	1	3	3	3	3	5	5	6	6	6	6	7	7	8	8	8	8	9	9	9	9	9	9	10	10	10	11	11	11	11	11	11	11	1	1	6	7	8	9	10	11	12
	Hole	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	116A	117	117A	118	118	118	118	118	118	118
Eucyrtidium calvertense		R	R		VR	?	R	R	VR	?		R														?			VR				VR				VR			R			VR				VR	VR	VR	R	VR	VR												
Hataina orata																																																																
Heliodiscus asteriscus																									VR	R	VR	R	?		VR																	VR				VR												
Heliodiscus heliastericus																						VR																																										
Helotholus histricosa																									VR	VR		VR											VR	VR	VR		VR	VR						VR	VR	VR	VR	VR										
Lamprocyclas heteroporos																										cf.											?		VR	VR			VR																					
Lamprocyclas maritalis maritalis																										R	VR	VR																		?				VR														
Lamprocyclas maritalis polypora																								?	?	cf.																?																						
Lithelius minor										VR	R				VR							?			R	R									R		R		R	R	R		R	R	R	VR	R	R	R	R	VR	R		R	VR									
Lithocampium sp. *A*																	VR																																														
Lithomelissa thoracites																																		VR							VR		VR				VR							VR										
Lithomitra lineata		R	R	R	R	VR	R	R	R			C																															VR						VR	VR														
Lithopera neotera																																																																
Lithopera renzae																																																																
Lophoconus titanothericeraos																						VR																																										
Lophocyrtis biaurita																																																																
Lychnocanium bipes			VR		VR		VR	VR	VR			VR		VR																																												VR						R
Ommatartus antepenultimus																																																										VR				?		
Oroscena sp., curved, flat spines																																																												VR	VR		VR	
Oroscena sp., digitately branched spines																																																												VR	R	R	VR	
Peripyramis circumtexta																									VR	VR																VR							VR															
Phormocyrtis striata																																							VR																										
Phorticium pylonium			R				R					R														R					VR			VR	?		R		VR		R	R	C	C	C	C	R	R	R	C	VR	R	R	R	VR			?						
Podocyrtis papalis																																																																
Pterocanium trilobum																										VR														?										VR														
(?) *Sethocyrtis babylonis*																				VR																																												
Solenosphaera sp.																																																																
Spongaster tetras																																																																
Spongaster sp. cf. *S. tetras*																																							VR																										
Spongasteriscus cruciferus																				VR																																												
Spongocore puella			VR									VR													VR	R		VR			VR		VR				VR										VR																	
Spongodiscus biconcavus																										VR													VR								VR		C					R										
Spongopyle osculosa										VR																VR													VR						VR			VR	VR	VR		VR		R										
Spongotrochus sp. cf. *S. glacialis*																										VR		VR						VR							VR		VR						VR	R		R		R										
Spongurus bilobatus																				VR																																												
Stichocorys armata		?										?																																																				
Stichocorys delmontensis		?		VR	VR		VR	VR			?																																																VR		R		VR
Stichocorys diploconus																																																																
Stichocorys peregrina																																																										VR				?		
Stichocorys wolffii																																																														VR		VR
Stylodictya validispina			R				R					C				?	?	?	?							C								R			R		R		R		R	R	R	R	R	R	R		VR	R		R		VR								
Theocalyptra davisiana																										VP								VR			R	VR			VR									?														
Theocorys spongoconum			VR																																																													
Theocorythium trachelium																																									cf.									VR				?				VR						
Theocyrtis annosa																																																																
Tholocubus sp.																																																																
Tristylospyris triceros																				VR																																												
Tympanidium binoctonum																																																																

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Site	119																																																										
Sampled interval (cm)	79-80	74-75	76-77		137-138	78-79	78-79	80-81		78-79	78-79	77-78		78-79	76-77	81-82	76-77	52-53		139-140	80-81	107-108		73-74	78-79	5-6		69-70	75-76	51-52		109-111	77-78	82-83		70-71		77-78	72-73		71-73		0-1		94-96		2-3				81-82		11-14	144-145						
Section	1	2	3	CC	1	2	3	4	CC	1	2	3	CC	1	2	3	4	5	CC	1	2	3	CC	1	2	3	CC	1	2	3	CC	1	2	3	CC	3	CC	2	4	CC	4	CC	3	CC	1	CC	3	CC	CC	CC	2	CC	1	1	CC	CC	CC	CC	CC	CC
Core	5	5	5	5	6	6	6	6	6	7	7	7	7	8	8	8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	14	14	14	15	15	16	16	17	19	20	21	22	25	26	26	27	27	27	28	29	30	35	36
Species / Hole	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119
Eucyrtidium calvertense						VR	VR	VR	VR			VR	VR	VR	VR	VR	VR	R	VR						VR	VR	R	R			R															R			VR											
Hataina ovata																																																												
Heliodiscus asteriscus																																																												
Heliodiscus heliastericus																																																												
Helotholus histricosa																																																												
Lamprocyclas heteroporos																																																												
Lamprocyclas maritalis maritalis																																																												
Lamprocyclas maritalis polypora																																																												
Lithelius minor																																																												
Lithocampium sp. *A*																																																			C	A	C	VR	R	A	C	R	VR	VR
Lithomelissa thoracites																																																												
Lithomitra lineata									R	VR			R					VR	VR									VR																		VR														
Lithopera neotera								VR																																																				
Lithopera renzae																			VR																																									
Lophoconus titanothericeraos																																																												
Lophocyrtis biaurita																																																												
Lychnocanium bipes					VR	A	C	R	R	R	C	R	R	R	R	C	R	R	R	VR	VR	VR	R	VR	VR	R	C	R			R						VR		VR			R		VR		C		VR	VR		VR									
Ommatartus antepenultimus																																																												
Oroscena sp., curved, flat spines																																						VR	VR						R															
Oroscena sp., digitately branched spines	VR	R	R	C																																																								
Peripyramis circumtextra																																																												
Phormocyrtis striata																																																			?	VR	VR	?		R				VR
Phorticium pylonium																																																												
Podocyrtis papalis																																																												
Pterocanium trilobum																																																												
(?) *Sethochytris babylonis*																																																			R		C	VR			VR		VR	
Solenosphaera sp.																																																												
Spongaster tetras																																																												
Spongaster sp. cf. *S. tetras*																																																												
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Spongopyle osculosa																																																												
Spongotrochus sp. cf. *S. glacialis*																																																												
Spongurus bilobatus																																																												
Stichocorys armata					VR	?	VR	cf.			VR	VR							R								R															VR				?		VR												
Stichocorys delmontensis					R	C	R	C	A	R	R	R	C	R	C	C	R		R	VR							C	?			R											R				R		R	VR	?										
Stichocorys diploconus						?	VR		R	VR			VR				VR		VR				R					?																					VR											
Stichocorys peregrina															VR																															R														
Stichocorys wolffii					VR	R	VR	VR	R	VR		VR	VR				VR		C				R			VR	C	?			VR											R						VR	VR											
Stylodictya validispina																																																												
Theocalyptra davisiana																																																												
Theocorys spongoconum																												VR																																
Theocorythium trachelium																																																												
Theocyrtis annosa																												VR														VR																		
Tholocubus sp.																																																												
Tristylospyris triceros																																																												
Tympanidium binoctonum						VR	R	VR	VR	VR		VR					VR	VR		VR	VR	VR	VR	VR		VR	R															VR				VR			VR											

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