

## SAMPLES

This section consists of two parts:

**1. List of Samples: Tropical Radiolarian Zonation and Middle-Latitude Radiolarian Zonation.** First is a sample list showing zone, slide identification number, sample designation, and area from which the sample was obtained. Samples are identified by sequential "R" numbers from the uppermost low-latitude sample to the lowermost middle-latitude sample. Three sets of slides were prepared for this project. One set resides on the ship while the other two are kept in reserve in case of loss or breakage. Hence, each slide has a further numerical designation which indicates to which set of slides it belongs. For example, the uppermost Quaternary low-latitude zone is the *Buccinosphaera invaginata* Zone. Slides for this zone are labelled R 1.1 (first set of slides), R 1.2 (second set of slides) and R 1.3 (third set of slides). There is no stratigraphic significance to the number and they should not be confused with "NR" numbers used by some radiolarian stratigraphers. All samples were sieved at 63  $\mu\text{m}$  and prepared using the method described in Sanfilippo et al. (1985).

In four cases, the generic designation of the taxa used for the zonal name has been changed (or is controversial) since the time of the original description of the zone. The slides are marked with the original name, but the documentation herein uses the more recent nomenclature. Please note that *Artostrobium miralestensis* is now *Botryostrobus aquilonaris*, *Axoprunum angelinum* is more commonly referred to as *Stylatractus universus*, *Cryptoprora ornata* is now *Cryptocarpium ornatum* and *Carpocanistrum azyx* is now *Cryptocarpium azyx*.

As far as possible, samples were selected from previously described core material from a single oceanic region: the Equatorial Pacific for most of the low-latitude zones and the North Pacific for all of the middle-latitude zones. We deviated from this principle in the case of the low-latitude Eocene material, which shows much better preservation in the Caribbean, and in the case of the lowermost Eocene and Paleocene material, which is best preserved in North Atlantic sediments. We have selected samples that are characteristic of the zone and that include the

zonal biomarkers. In some cases, this means that species that occur over a short time span or that are very rare are not present in the reference slides.

**2. Specimen Locations: Reference Slides.** We have identified one or more specimens of zonal markers and other stratigraphically useful species in each slide. These specimens are located according to England Finder coordinates (Riedel and Foreman, 1961). An England Finder can be found in the box of reference slides. In using the England Finder, the radiolarian slide label and the England Finder label should be positioned to the left side of the microscope stage.

**List of Samples:**  
**Tropical Radiolarian Zonation**  
(Nigrini, 1971; Riedel and Sanfilippo, 1978a)

	Slide	Sample	Area
<b>Quaternary</b>			
<i>Buccinosphaera invaginata</i>	R1	85-573-1-1, 8-10	Eq. Pacific
<i>Collosphaera tuberosa</i>	R2	85-573-2-3, 130-131	Eq. Pacific
<i>Amphirhopalum ypsilon</i>	R3	85-573-2-CC	Eq. Pacific
<i>Anthocyrtidium angulare</i>	R4	85-573-3-CC	Eq. Pacific
<b>Pliocene</b>			
<i>Pterocanium prismatium</i>	R5	85-573-5-3, 130-131	Eq. Pacific
<i>Spongaster pentas</i>	R6	85-573-8-3, 69-71	Eq. Pacific
<b>Miocene</b>			
<i>Stichocorys peregrina</i>	R7	85-573-10-CC	Eq. Pacific
	R8	85-573-12-CC	Eq. Pacific
	R9	85-573-13-4, 65-66	Eq. Pacific
<i>Didymocyrtis penultima</i>	R10	85-573-14-3, 65-66	Eq. Pacific
	R11	85-573-15-CC	Eq. Pacific
<i>Didymocyrtis antepenultima</i>	R12	85-573-17-3, 61-62	Eq. Pacific
	R13	85-573-17-CC	Eq. Pacific
	R14	85-573-18-CC	Eq. Pacific
<i>Diartus petterssoni</i>	R15	85-573B-3-CC	Eq. Pacific
	R16	85-573B-6-3, 61-63	Eq. Pacific
<i>Dorcadospyrus alata</i>	R17	85-573B-9-2, 61-63	Eq. Pacific

	Slide	Sample	Area
	R18	85-573B-10-3, 61-63	Eq. Pacific
	R19	85-573B-11-3, 61-63	Eq. Pacific
<i>Calocycletta costata</i>	R20	85-573B-12-3, 61-63	Eq. Pacific
	R21	85-573B-13-CC	Eq. Pacific
<i>Stichocorys wolffii</i>	R22	85-573B-14-3, 61-63	Eq. Pacific
	R23	85-573B-14-CC	Eq. Pacific
<i>Stichocorys delmontensis</i>	R24	85-573B-15-3, 61-63	Eq. Pacific
	R25	85-573B-15-CC	Eq. Pacific
	R26	85-573B-16-CC	Eq. Pacific
<i>Cyrtocapsella tetrapera</i>	R27	85-573B-17-3, 60-62	Eq. Pacific
<b>Oligocene</b>			
<i>Lychnocanoma elongata</i>	R28	85-573B-19-CC	Eq. Pacific
	R29	85-573B-20-CC	Eq. Pacific
<i>Dorcadospyris ateuchus</i>	R30	85-573B-21-CC	Eq. Pacific
	R31	85-573B-29-CC	Eq. Pacific
	R32	85-573B-33-CC	Eq. Pacific
<i>Theocyrtis tuberosa</i>	R33	85-573B-34-CC	Eq. Pacific
	R34	85-573B-35-CC	Eq. Pacific
	R35	85-573B-37-CC	Eq. Pacific
<b>Eocene</b>			
<i>Cryptoprora ornata*</i>	R36	41-366-10-5, 53-60	Eq. Pacific
<i>Calocyclas bandyca</i>	R37	17-167-28-4,107-112	Eq. Pacific
<i>Carpocanistrum azyx**</i>	R38	8-69A-10-6, 130-132	Eq. Pacific

# 6

	Slide	Sample	Area
<i>Podocyrtris goetheana</i>	R39	16-162-6-2, 126-134	Eq. Pacific
<i>Podocyrtris chalara</i>	R40	16-162-8-3, 83-89	Eq. Pacific
<i>Podocyrtris mitra</i>	R41	10-94-17-1, 121-128	Carib.
<i>Podocyrtris ampla</i>	R42	10-94-18-4, 109-117	Carib.
<i>Thyrsoyrtris triacantha</i>	R43	10-94-20-2, 70-77	Carib.
<i>Dictyoprora mongolfieri</i>	R44	10-94-22-3, 44-52	Carib.
<i>Theocotyle cryptocephala</i>	R45	10-94-25-3, 95-102	Carib.
<i>Phormocyrtis striata striata</i>	R46	10-94-28-1, 110-117	Carib.
<i>Buryella clinata</i>	R47	10-94-30-1, 43-50	Carib.
<i>Bekoma bidartensis</i>	R48	43-384-6-3, 102-109	N. Atlantic
<b>Paleocene</b>			
<i>Bekoma campechensis</i>	R49	43-384-7-6, 119-125	N. Atlantic

\* = *Cryptocarpium ornatum*

\*\* = *Cryptocarpium azyx*

**List of Samples:**  
**Middle-Latitude Radiolarian Zonation**  
(Hays, 1970; Kling, 1973; Foreman, 1975)

	Slide	Sample	Area
<b>Quaternary</b>			
<i>Artostrobium miralestensis*</i>	R50	18-173-2-2, 46-49	N. Pacific
<i>Axoprunum angelinum**</i>	R51	18-173-4-4, 46-50	N. Pacific
<i>Eucyrtidium matuyamai</i>	R52	18-173-5-CC	N. Pacific
<b>Pliocene</b>			
<i>Lamprocyrtis heteroporos</i>	R53	18-173-9-3, 24-30	N. Pacific
<i>Sphaeropyle langii</i>	R54	32-310-7-2, 83-90	N. Pacific
<b>Miocene</b>			
<i>Stichocorys peregrina</i>	R55	32-310-7-5, 63-70	N. Pacific
<i>Didymocyrtis penultima</i>	R56	32-310-8-5, 139-146	N. Pacific
<i>Didymocyrtis antepenultima</i>	R57	18-173-18-3, 35-40	N. Pacific
<i>Diartus petterssoni</i>	R58	18-173-22-4, 18-24	N. Pacific
<i>Dorcadospyrus alata</i>	R59	18-173-26-3, 37-43	N. Pacific
<i>Calocyclella costata</i>	R60	18-173-29-2, 126-132	N. Pacific

\* = *Botryostrobus aquilonaris*

\*\* = *Stylatractus universus*

## Specimen Locations: Reference Slides

*Buccinosphaera invaginata* Zone

Reference Slide R 1

Sample	Slide		
85-573-1-1, 8-10 cm	R1.1	R1.2	R1.3
<b>ZONAL MARKERS</b>			
<i>Buccinosphaera invaginata</i>	P27/2	O43/4	S38/4 T11/3
<b>OTHER SPECIES</b>			
<i>Collosphaera tuberosa</i>	E20/4	F24/3	W27/2
	M35/3	D40/4	U9/2
<i>Pterocorys hertwigii</i>	D23/4	S20/2	

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and well preserved in this sample. Diatoms and sponge spicules are numerous and there is some reworking.

*Collospheara tuberosa* Zone

## Reference Slide R 2

Sample	Slide		
85-573-2-3, 130-131 cm	R2.1	R2.2	R2.3
<b>ZONAL MARKERS</b>			
<i>Collospheara tuberosa</i> *	T46/2	J17/1	V5/0 X13/0
<b>OTHER SPECIES</b>			
<i>Amphirhopalum ypsilon</i>	E35/0	G39/0	E17/0
<i>Centrobotrys thermophila</i>	C22/0	L27/2	K21/2
<i>Lamprocyrtis nigrinae</i>	E43/1	B14/4	G36/3
<i>Pterocorys hertwigii</i>	M34/4	J8/0	C45/1

\* Specimens are not entirely typical. See sample **R 1**.

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common, but only moderately well preserved with some dissolution. Diatoms are common.



*Amphirhopalum ypsilon* Zone

## Reference Slide R 3

Sample	Slide		
	R3.1	R3.2	R3.3
85-573-2-CC	R3.1	R3.2	R3.3
<b>ZONAL MARKERS</b>			
<i>Amphirhopalum ypsilon</i>	D13/0	F15/0	E7/4
<b>OTHER SPECIES</b>			
<i>Botryostrobus aquilonaris</i>	G43/1	C21/3	E28/1
<i>Didymocyrtis tetrathalamus</i> <i>tetrathalamus</i>	C26/1	G42/0	P42/4
<i>Lamprocyrtis nigrinia</i>	H15/4	W8/0	U29/3
	J45/0	W16/0	X40/1
<i>Pterocorys hertwigii</i>	S35/2	C5/0	C8/2
	V20/1	M25/0	W17/3
<i>Spongaster tetras tetras</i>	D24/4	Q30/4	G19/0
<i>Stylatractus universus</i>	P21/2	F26/4	K21/4
<i>Theocorythium trachelium</i>	B11/4	J31/0	K45/4

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample. There is some minor reworking.

*Anthocyrtidium angulare* Zone

## Reference Slide R 4

Sample	Slide		
85-573-3-CC	R4.1	R4.2	R4.3
<b>ZONAL MARKERS</b>			
<i>Anthocyrtidium angulare</i>	T31/4	K26/2	W41/3
	H33/4	Q10/0	X32/4
	S38/3	Q20/2	
<b>OTHER SPECIES</b>			
<i>Amphirhopalum ypsilon</i>	V31/0	U22/0	W14/0
<i>Centrobotrys thermophila</i>	S37/0		
<i>Didymocyrtis tetrathalamus</i> <i>tetrathalamus</i>	K24/0	S8/0	C18/0
<i>Lamprocyrtis neoheteroporos</i>	G19/3	D17/1	D21/3
<i>Lamprocyrtis nigrinia</i>	W8/1		
<i>Lithopera bacca</i>	V42/3	N23/3	P15/4
<i>Phormostichoartus corbula</i>	P9/1	M22/2	T33/0
<i>Pterocorys campanula</i>	L9/2	T23/0	K36/0
<i>Spongaster tetras tetras</i>	F36/1	W14/2	W31/1
<i>Stylatractus universus</i>	O29/0	T23/1	U22/4
<i>Theocorythium trachelium</i>	R32/0	S11/3	C28/1
<i>Theocorythium vetulum</i>	Q26/3	E32/0	M31/4

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and moderately well preserved in this sample. There are signs of dissolution and some minor reworking.

*Pterocanium prismatium* Zone

## Reference Slide R 5

Sample	Slide		
85-573-5-3, 130-131 cm	R5.1	R5.2	R5.3
<b>ZONAL MARKERS</b>			
<i>Pterocanium prismatium</i>	V8/0	C35/3	W37/2
	Q32/3	W41/3	R9/3
	R34/2	V34/2	R20/4
<b>OTHER SPECIES</b>			
<i>Amphirhopalum ypsilon</i>	N16/1	F5/4	M19/3
<i>Didymocyrtis tetrathalamus</i> <i>tetrathalamus</i>	V29/0	D13/3	U27/0
	S42/0	P12/4	S24/0
<i>Lamprocyrtis neoheteroporos</i>	H24/0	C19/2	O38/3
		H18/0	T35/4
<i>Lithopera bacca</i>	V35/0		G11/3
<i>Phormostichoartus corbula</i>	L23/1	U7/0	R30/1
<i>Spongaster tetras tetras</i>	Q40/0	U32/3	E26/1
<i>Stylatractus universus</i>	R6/1	E30/2	P32/1
<i>Theocorythium vetulum</i>	U38/3	M38/0	
		D38/2	

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and moderately well preserved in this sample.

There is minor reworking and a few diatoms are present.

*Spongaster pentas* Zone

## Reference Slide R 6

Sample	Slide		
85-573-8-3, 69-70 cm	R6.1	R6.2	R6.3
<b>ZONAL MARKERS</b>			
<i>Spongaster pentas</i>	E20/2		V24/4
<i>Stichocorys peregrina</i>	C8/0	D15/1	F40/2
	Q24/0	D40/1	Y13/0
	E46/0	H9/0	X21/0
<b>OTHER SPECIES</b>			
<i>Didymocyrtis avita</i>	Q15/2	H38/0	E26/2
	W20/3	D17/4	H22/1
	U33/0	D18/4	
<i>Lithopera bacca</i>	R39/0	Q25/2	X42/3
<i>Phormostichoartus doliolum</i>	G37/0	W33/0	D16/0
	C24/0	M13/3	E31/1
<i>Pterocanium prismatium</i>	H28/4	E24/4	J10/2
	M39/0	O19/1	K5/2

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample. Diatoms are also common.

*Stichocorys peregrina* Zone

## Reference Slide R 7

Sample	Slide		
85-573-10-CC	R7.1	R7.2	R7.3
<b>ZONAL MARKERS</b>			
<i>Stichocorys peregrina</i>	W23/0	W39/1	U30/2
<i>Spongaster berminghami</i>	M5/3	S30/0	G8/2
	F32/2	S6/0	Q15/2
<b>OTHER SPECIES</b>			
<i>Didymocyrtis penultima</i>	N9/2	X10/0	N29/1
	N35/4	U7/4	
<i>Lychnodictyum audax</i>	Q25/4	R38/4	U6/0
<i>Phormostichoartus doliolum</i>	O36/3	U14/4	U6/0
<i>Phormostichoartus fistula</i>	M16/0	F19/1	
<i>Siphostichartus corona</i>	H13/3	F38/0	U30/3
<i>Solenosphaera omnitubus</i>	U34/3	X35/1	U35/3
<i>omnitubus*</i>			
<i>Solenosphaera omnitubus procera</i>	W32/2	X35/1	U35/3

\*end of lineage with tubes tapered distally

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample. There are a few diatoms present.

*Stichocorys peregrina* Zone

## Reference Slide R 8

Sample	Slide		
85-573-12-CC	R8.1	R8.2	R8.3
<b>ZONAL MARKERS</b>			
<i>Stichocorys peregrina</i>	C17/2	B25/0	N39/0
	F11/1	E10/1	C40/0
	E20/3	H28/4	B39/3
	H26/2	H5/0	C34/1
<b>OTHER SPECIES</b>			
<i>Lithopera bacca</i>	V34/1		H19/2
<i>Phormostichoartus doliolum</i>	O35/0	K10/2	B37/0
	B19/2	L31/2	A33/0
<i>Siphostichartus corona</i>	F21/2	E38/1	L9/1
	F25/0	R16/2	J10/1
<i>Solenosphaera omnitubus</i>	E3/1	B20/4	R42/3
<i>omnitubus</i>	H18/0	G2/4	R2/2

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample. Diatoms are also common.

*Stichocorys peregrina* Zone

## Reference Slide R 9

Sample	Slide		
85-573-13-4, 65-66 cm	R9.1	R9.2	R9.3
<b>ZONAL MARKERS</b>			
<i>Spongaster berminghami</i>	N18/3	U24/0	H30/1
	H35/4	T8/8	
<i>Stichocorys peregrina</i> *	J44/0	D39/3	J4/4
	F43/2	D24/0	E25/3
<b>OTHER SPECIES</b>			
<i>Acrobotrys tritubus</i>	G13/0	J20/0	T12/2
<i>Calocycletta caeпа</i>	G43/3	X2/2	T37/0
<i>Didymocyrtis penultima</i>	U12/4	W12/3	L7/0
<i>Lithopera bacca</i>		Q4/2	J15/3
<i>Lychnodictyum audax</i>	S7/4	V22/0	X26/1
<i>Phormostichoartus doliolum</i>	B21/4	Q27/3	E24/2
<i>Phormostichoartus fistula</i>	H17/3	Q19/2	O26/2
<i>Solenosphaera omnitubus</i> <i>omnitubus</i>	J22/4		O22/2
<i>Stichocorys delmontensis</i> *	K24/1	W11/0	S27/0
	C42/0	Q18/2	D23/0
<i>Stichocorys johnsoni</i>	K18/3	Y22/1	

\*Many transitional forms present in this sample.

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are few to common and well preserved in this sample.

Sponge spicules, diatom fragments, and Orosphaerid spines are also present.

*Didymocyrtis penultima* Zone

## Reference Slide R 10

Sample	Slide		
85-573-14-3, 65-66 cm	R10.1	R10.2	R10.3
<b>ZONAL MARKERS</b>			
<i>Stichocorys delmontensis</i> *	U29/0	U27/1	W13/1
	L35/0	X15/1	O13/2
<b>OTHER SPECIES</b>			
<i>Acrobotrys tritubus</i>		Q19/3	M9/0
<i>Calocyclus caepa</i>	O4/0	D42/0	S13/3
<i>Centrobotrys thermophila</i>	M20/3	W25/3	T31/0
<i>Didymocyrtis penultima</i>	L12/0	X38/1	Q22/1
<i>Lychnodictyum audax</i>	N23/4		J42/0
<i>Siphostichartus corona</i>	O29/1	J19/2	E30/0
<i>Solenosphaera omnitubus</i>	F35/0	U38/2	U24/1
<i>omnitubus</i>			
<i>Stichocorys johnsoni</i>	F44/1	K8/1	U22/1

\*late morphotypes

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample. There are a few diatoms and numerous Orosphaerid spines present.



*Didymocyrtis penultima* Zone

## Reference Slide R 11

Sample	Slide		
85-573-15-CC	R11.1	R11.2	R11.3
<b>ZONAL MARKERS</b>			
<i>Stichocorys delmontensis</i>	V21/2	U25/2	U32/0
	S24/3	W13/1	C40/4
<b>OTHER SPECIES</b>			
<i>Acrobotrys tritubus</i>	X12/0	F14/1	P29/0
<i>Calocycletta caepa</i>	T15/0	W26/0	W29/1
<i>Calocycletta cladara</i>	V9/4	W14/1	O29/0
<i>Didymocyrtis antepenultima</i>	X13/2	G13/2	
	S29/0		
<i>Didymocyrtis penultima</i>	W13/3	K9/2	Y13/1
	F12/4	W25/0	T23/4
<i>Lychnodictyum audax</i>	S24/3	O40/2	
<i>Siphostichartus corona</i>	O32/0	W36/2	W40/3
<i>Stichocorys johnsoni</i>	R6/0	N5/1	O26/1
	J20/1	N11/3	N2/4

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample. Diatoms, sponge spicules, and Orosphaerid spines are also present.

*Didymocyrtis antepenultima* Zone

## Reference Slide R 12

Sample	Slide		
85-573-17-3, 61-12 cm	R12.1	R12.2	R12.3
<b>ZONAL MARKERS</b>			
<i>Diartus hughesi</i>	U29/3	R30/0	P31/0
	E14/1	W18/2	R3/1
<b>OTHER SPECIES</b>			
<i>Calocyclus caepa</i>	L28/0	P25/4	C3/1
<i>Calocyclus cladara</i>	M3/0	M25/2	D42/0
<i>Dictyocoryne ontongensis</i>	J7/3	W21/4	
<i>Didymocyrtis antepenultima</i>	U27/0	D12/1	Y37/0
	Q23/0	J31/4	C35/4
<i>Didymocyrtis laticonus</i>	M40/0	C11/3	L8/4
	P9/4	O34/0	H40/2
<i>Lithopera neotera</i>	E31/3	G35/2	S21/2
<i>Lychnodictyum audax</i>	D25/2	B26/4	C29/2
<i>Spongaster berminghami</i>	P33/0	T17/0	
<i>Stichocorys delmontensis</i>	U12/2	P27/1	X36/0
<i>Stichocorys johnsoni</i>	M39/1	L23/2	B8/4

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Didymocyrtis antepenultima* Zone

## Reference Slide R 13

Sample	Slide		
85-573-17-CC	R13.1	R13.2	R13.3
<b>ZONAL MARKERS</b>			
<i>Diartus hughesi</i>	W24/2	W38/1	V40/4
	P29/3	V23/0	U35/3
<b>OTHER SPECIES</b>			
<i>Botryostrobus miralestensis</i>	U15/0	V16/0	P22/4
	T6/0		
<i>Calocycletta caepa</i>	S28/0	V25/0	U4/3
	R38/1	Q31/3	J22/2
<i>Didymocyrtis antepenultima</i>	V37/0	C30/3	U23/0
	R5/2	V37/2	D14/4
<i>Didymocyrtis laticonus</i>	T35/4	D32/4	R23/4
<i>Spongaster berminghami</i>	J16/4	O43/1	P11/1
<i>Stichocorys delmontensis</i>	Y23/1	U34/0	K15/0
<i>Stichocorys johnsoni</i>	T20/4	W39/2	S18/1
	C24/2	Y16/4	D24/1

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Didymocyrtis antepenultima* Zone

## Reference Slide R 14

Sample	Slide		
85-573-18-CC	R14.1	R14.2	R14.3
<b>ZONAL MARKERS</b>			
<i>Diartus hughesi</i>	U45/3	F33/3	W24/3
<b>OTHER SPECIES</b>			
<i>Botryostrobus miralestensis</i>	X24/3	V32/4	N14/0
<i>Calocyclella caepa</i>	T31/2	X41/2	J42/2
<i>Diartus petterssoni</i>	T34/4	T43/3	W19/0
	S30/0	O34/1	P39/0
<i>Didymocyrtis antepenultima</i>	T32/0	W34/2	F13/0
<i>Didymocyrtis laticonus</i>	S42/2	S11/2	S39/0
<i>Lithopera neotera</i>	U15/1	S37/0	W28/0
<i>Phormostichoartus corbula</i>	X14/0	O26/0	F38/2
<i>Phormostichoartus fistula</i>	F27/1	R25/0	Q23/3
<i>Stichocorys delmontensis</i>	V12/4	S29/3	S14/1

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Diartus petterssoni* Zone

## Reference Slide R 15

Sample	Slide		
85-573B-3-CC	R15.1	R15.2	R15.3
<b>ZONAL MARKERS</b>			
<i>Diartus petterssoni</i> *	T4/3	W30/4	P6/4
	C6/4	N14/1	N11/4
<b>OTHER SPECIES</b>			
<i>Botryostrobus miralestensis</i>	W18/4	O30/4	R37/3
<i>Calocyclella caepa</i>	R24/4	T13/1	J6/3
<i>Didymocyrtis antepenultima</i>	F16/0	Q43/0	O37/2
<i>Lithopera neotera</i>	W34/1	T23/4	C8/1
	X20/1		
<i>Phormostichoartus corbula</i>	U5/4	S33/1	M31/0
<i>Phormostichoartus fistula</i>	O37/1	K23/1	
<i>Stichocorys wolffii</i> **	R18/3	U18/0	U24/1
	O7/0	X18/3	P42/3

\*many morphotypes transitional to *D. hughesi* in this sample

\*\**S. delmontensis* morphotypes in this sample exhibit reduced numbers of thoracic pores. *S. wolffii* is present in the sample, but care must be taken to distinguish it from the above mentioned *S. delmontensis*. Smaller, more hyaline specimens are *S. wolffii*.

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Diartus petterssoni* Zone

## Reference Slide R 16

Sample	Slide		
85-573B-6-3, 61-3 cm	R16.1	R16.2	R16.3
<b>ZONAL MARKERS</b>			
<i>Diartus petterssoni</i>	B43/1	D30/3	R34/1
	G18/1	T34/2	B19/0
	V21/0	D30/3	K15/1
<b>OTHER SPECIES</b>			
<i>Botryostrobus miralestensis</i>	V28/3	X41/3	S35/3
<i>Calocyclus caepa</i>	L45/3	H9/0	G5/4
<i>Carpocanopsis cristata</i>	U30/0	U3/3	T35/0
	T10/0	V8/0	P20/3
<i>Cyrtocapsella japonica</i>	W31/4	W12/0	X34/3
<i>Didymocyrtis laticonus</i>	W6/0	W35/1	X28/0
	T5/4	C24/2	W34/3
	R38/2		E6/0
<i>Lithopera neotera</i>	W43/2	T28/1	X33/0
<i>Lithopera thornburgi</i>	N34/4	F8/2	B27/4
		P32/2	S44/4
<i>Stichocorys wolffii</i>	V43/0	S20/3	S45/1

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and well preserved in this sample. Large diatom fragments are also present.

*Dorcadospyris alata* Zone

## Reference Slide R 17

Sample	Slide		
85-573B-9-2, 61-3 cm	R17.1	R17.2	R17.3
<b>ZONAL MARKERS</b>			
<i>Dorcadospyris alata</i> *	E15/0	O7/0	D26/0
	D9/0	M36/0	D23/3
	U27/0	O16/0	G17/2
<b>OTHER SPECIES</b>			
<i>Carpocanopsis cristata</i>	J41/0	E19/2	P42/0
<i>Cyrtocapsella tetrapera</i>	F43/4	B43/4	F23/3
<i>Didymocyrtis mammifera</i>	E17/2	E23/4	P44/2
		K18/0	
<i>Lithopera neotera</i>	C17/4	E27/3	R49/0
<i>Lithopera renzae</i>	C6/0	H25/2	H32/4
<i>Stichocorys johnsoni</i>	G44/0	H44/1	G32/1

\*Complete, unbroken specimens of *D. alata* are always extremely rare.

The specimens identified above are almost all broken, but the species can be recognized easily from such fragments, which is what you will probably have in your sample.

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and well preserved in this sample.

*Dorcadospyris alata* Zone

## Reference Slide R 18

Sample	Slide		
85-573B-10-3, 61-63 cm	R18.1	R18.2	R18.3
<b>ZONAL MARKERS</b>			
<i>Dorcadospyris alata</i> *	N24/3	H30/1	F35/4
	N36/1	D12/3	O35/3
	C41/4		
<b>OTHER SPECIES</b>			
<i>Calocycletta virginis</i>	R14/0	E11/1	W4/0
<i>Carpocanopsis cristata</i>	J42/3	P14/0	R6/2
<i>Cyrtocapsella tetrapera</i>	O32/2	W12/0	W43/3
<i>Didymocyrtis mammifera</i>	M41/2	J39/3	X40/0
<i>Didymocyrtis tubaria</i>	G11/2		
<i>Didymocyrtis violina</i>	E27/1	C16/1	D19/1
<i>Liriospyris parkerae</i>	P9/3	T12/2	V40/4
<i>Lithopera renzae</i>	U28/0	N37/0	S30/2
<i>Phormostichoartus fistula</i>			M11/0

\*Complete, unbroken specimens of *D. alata* are extremely rare. The specimens identified above are almost all broken, but the species can be recognized easily from fragments, which is what you will probably have in your sample.

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and well preserved in this sample.



*Dorcadospyris alata* Zone

## Reference Slide R 19

Sample	Slide		
85-573B-11-3, 61-63 cm	R19.1	R19.2	R19.3
<b>ZONAL MARKERS</b>			
<i>Dorcadospyris alata</i> *	B29/4	V39/3	E40/4
	L5/0	S41/0	W36/4
	J4/3	P19/4	V36/2
<b>OTHER SPECIES</b>			
<i>Calocyclus costata</i>	K23/2		V3/0
<i>Calocyclus virginis</i>	Q11/1	S41/1	N17/2
	O38/4	P36/1	
<i>Carpocanopsis bramlettei</i>	J11/4	M39/0	W35/3
<i>Carpocanopsis cristata</i>		L11/2	M29/3
<i>Cyrtocapsella cornuta</i>	T38/0	F36/0	
<i>Cyrtocapsella tetrapera</i>	V19/0	S42/0	U42/0
<i>Didymocyrtis mammifera</i>	O16/3	H8/0	L15/1
<i>Didymocyrtis violina</i>	C7/4		K40/3
<i>Liriospyris parkerae</i>	L30/1	S33/1	V13/1
<i>Lithopera renzae</i>	S14/3	U15/3	U3/0
	L28/4	H16/2	

\*Complete, unbroken specimens of *D. alata* are extremely rare. The specimens identified above are all broken, but the species can be recognized easily from fragments, which is what you will probably have in your sample.

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

Collospheerids are abundant.

*Calocyclus costata* Zone

## Reference Slide R 20

Sample	Slide		
85-573B-12-3, 61-63 cm	R20.1	R20.2	R20.3
<b>ZONAL MARKERS</b>			
<i>Dorcadospyris dentata</i>			
<i>Calocyclus costata</i>	M26/4	D27/3	M39/3
	K5/2	T12/0	T20/2
	L37/2	T9/1	V33/0
<b>OTHER SPECIES</b>			
<i>Didymocyrtis mammifera</i>	L35/4	F36/0	F33/1
		P33/1	F20/0
<i>Didymocyrtis violina</i>	C27/1	D41/2	N12/4
<i>Liriospyris stauropora</i>	C24/0	F40/0	Q21/0
	L21/1	O23/4	K22/0
<i>Lithopera renzae</i>	E10/1	C20/3	U22/3
	S25/0	F25/2	P27/0

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well to moderately well preserved in this sample.

*Calocycletta costata* Zone

## Reference Slide R 21

Sample	Slide		
85-573B-13-CC	R21.1	R21.2	R21.3
<b>ZONAL MARKERS</b>			
<i>Calocycletta costata</i>	D19/2	N38/4	C31/0
	D26/1	E43/0	O37/0
	J40/2		X41/0
<i>Dorcadospyris dentata</i> *	B10/2	B42/3	D30/2
<b>OTHER SPECIES</b>			
<i>Calocycletta virginis</i>	V12/3	H29/0	C11/1
	C5/4	R33/3	G27/0
	C38/2	N43/3	J29/1
<i>Carpocanosis favosa</i>	C32/0		
<i>Didymocyrtis tubaria</i>	E12/0	W36/0	C24/0
	D11/3	R38/0	G31/3
<i>Didymocyrtis violina</i>	H30/0	J29/0	T26/0
		X14/2	

\*Complete, unbroken specimens of *D. dentata* are extremely rare. The specimens identified above are all broken, but the species can be recognized easily from fragments, which is what you will probably have in your sample.

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well to moderately preserved in this sample. Some delicate specimens are dissolved.

*Stichocorys wolffii* Zone

## Reference Slide R 22

Sample	Slide		
85-573B-14-3, 61-63 cm	R22.1	R22.2	R22.3
<b>ZONAL MARKERS</b>			
<i>Stichocorys wolffii</i>	M21/2	R23/1	G24/2
	C16/3	K24/3	R22/1
	B6/4	R19/3	F17/3
	K6/2	C7/0	W4/1
<b>OTHER SPECIES</b>			
<i>Calocyclus virginis</i>	X5/2	E24/2	O25/2
		E23/0	
<i>Cyrtocapsella cornuta</i>	S7/1	F31/3	W21/0
<i>Cyrtocapsella tetrapera</i>	M21/1	B9/3	M25/2
		G30/1	D23/3

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well to moderately well preserved in this sample. Some delicate specimens are dissolved.

*Stichocorys wolffii* Zone

## Reference Slide R 23

Sample	Slide		
85-573B-14-CC	R23.1	R23.2	R23.3
<b>ZONAL MARKERS</b>			
<i>Stichocorys wolffii</i>	C32/0	W18/0	G29/0
	A30/0	C12/4	E46/2
	F12/3	C40/0	H41/0
<b>OTHER SPECIES</b>			
<i>Calocycletta virginis</i>	M5/0	E13/2	F38/0
<i>Carpocanopsis cingulata</i>	U33/4	F26/1	A40/0
	Q32/4	K15/1	G32/1
<i>Didymocyrtis tubaria</i>	K35/0	F32/1	D24/1
<i>Dorcadospyris forcipata</i>	V34/0	G24/0	B36/2
<i>Stichocorys delmontensis</i>	C22/0	C37/3	C17/3
	G32/0	F33/0	F44/0

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well to moderately well preserved in this sample. Delicate specimens are usually dissolved. There are rare diatoms and a few Orosphaerid fragments present as well.

*Stichocorys delmontensis* Zone

## Reference Slide R 24

Sample	Slide		
85-573B-15-3, 61-63 cm	R24.1	R24.2	R24.3
<b>ZONAL MARKERS</b>			
<i>Stichocorys delmontensis</i>	L27/1	C15/3	C12/0
	P38/3	E10/3	C33/1
	U8/0	J35/4	H29/0
	F34/2	P15/0	J11/2
NOT <i>S. delmontensis</i> *	F35/2	G10/3	F28/2
<b>OTHER SPECIES</b>			
<i>Calocycletta virginis</i>	T9/4	N11/0	E3/3
<i>Carpocanopsis favosa</i>	W17/0	G34/0	
<i>Cyrtocapsella cornuta</i>	M33/3	E37/2	B31/0
<i>Cyrtocapsella tetrapera</i>	M30/2	E19/3	G10/2
		J23/3	K30/1
<i>Lychnocanoma elongata</i>	F23/0	K11/4	E10/0
	U35/1	D37/1	F7/1
<i>Siphostichartus corona</i>	T10/2		

\*The fourth segment on these unnamed forms is too wide for them to be *S. delmontensis*.

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well to moderately well preserved in this sample, but there are some signs of dissolution.

*Stichocorys delmontensis* Zone

## Reference Slide R 25

Sample	Slide		
85-573B-15-CC	R25.1	R25.2	R25.3
<b>ZONAL MARKERS</b>			
<i>Stichocorys delmontensis</i>	C38/0	D43/3	L4/4
	D9/0	F4/0	M11/0
	H22/3	M18/2	O2/2
	N31/1	T23/2	T30/3
<b>OTHER SPECIES</b>			
<i>Carpocanopsis cingulata</i>	E38/0	M6/3	N35/4
	J23/0	O28/0	K4/2
<i>Carpocanopsis favosa</i>	B20/0	G3/1	C12/0
<i>Cyrtocapsella cornuta</i>	F29/3	D3/4	M10/2
<i>Cyrtocapsella tetrapera</i>	B28/0	R33/3	C34/0
		J23/3	K30/1
<i>Didymocyrtis violina</i>	V38/0	D15/0	J30/1

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well to moderately well preserved in this sample, but there are some signs of dissolution. Spyroids are abundant and there are rare Orosphaerid fragments.

*Stichocorys delmontensis* Zone

## Reference Slide R 26

Sample	Slide		
85-573B-16-CC	R26.1	R26.2	R26.3
<b>ZONAL MARKERS</b>			
<i>Stichocorys delmontensis</i>	B14/2	C4/2	E39/0
	G21/0	H16/3	K39/0
	F10/4	L26/2	L24/0
<b>OTHER SPECIES</b>			
<i>Cyrtocapsella tetrapera</i>	B18/0	A16/0	B26/0
	F15/2	B8/0	E20/3
<i>Eucyrtidium diaphanes</i>	J2/1	F30/1	D16/0
	N14/3	E42/3	F6/0

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and moderately well preserved in this sample, but there are signs of dissolution. Spyroids are abundant and there are Orosphaerid fragments present.



*Cyrtocapsella tetrapera* Zone

## Reference Slide R 27

Sample	Slide		
85-573B-17-3, 60-62 cm	R27.1	R27.2	R27.3
<b>ZONAL MARKERS</b>			
<i>Cyrtocapsella tetrapera</i>	B39/0	C33/2	H12/1
	J16/3	F34/4	K16/0
	C26/0	B39/1	J14/4
<b>OTHER SPECIES</b>			
<i>Carpocanopsis cingulata</i>			F36/2
<i>Carpocanopsis favosa</i>	C11/1	C34/4	E42/3
<i>Cyrtocapsella cornuta</i>	K28/0	K36/1	B32/0
<i>Didymocyrtis prismatica</i>	B39/4	C3/4	H3/3
<i>Eucyrtidium diaphanes</i>	X43/2	D24/0	C18/0
	G19/0	D37/0	G8/2

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well to moderately preserved in this sample. Only robust species are present, Spyroids are abundant, and there are rare Orosphaerid fragments.

*Lychnocanoma elongata* Zone

## Reference Slide R 28

Sample	Slide		
85-573B-19-CC	R28.1	R28.2	R28.3
<b>ZONAL MARKERS</b>			
<i>Lychnocanoma elongata</i>	G35/0	C30/0	D33/1
	E4/3	G22/4	C41/0
	T35/2	M17/3	K28/3
<b>OTHER SPECIES</b>			
<i>Artophormis gracilis</i>	H11/0	M32/2	H41/4
	E24/3	J7/2	
<i>Calocyclus robusta</i>	C21/0	U7/0	B6/3
	F30/0	D33/1	G18/1
<i>Didymocyrtis tubaria</i>		M42/1	C38/4
<i>Theocyrtis annosa</i>			L13/1

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and moderately well preserved in this sample. Only robust species are present and many are broken. There are a few Orosphaerid fragments.

*Lychnocanoma elongata* Zone

## Reference Slide R 29

Sample	Slide		
85-573B-20-CC	R29.1	R29.2	R29.3
<b>ZONAL MARKERS</b>			
<i>Lychnocanoma elongata</i>	P27/4	W15/3	
<b>OTHER SPECIES</b>			
<i>Calocyclus robusta</i>	D38/3	J10/2	E19/0
<i>Dorcadospyris ateuchus</i>	B31/3	N25/0	F42/2
	K13/0	X30/0	L36/4
<i>Dorcadospyris papilio</i>	B10/3	K28/0	C18/0
	N36/0		F6/0
<i>Theocyrtis annosa</i>	Q19/0	F24/3	E19/0
	E20/3		J21/1

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and moderately well preserved in this sample, but there are some signs of dissolution.

*Dorcadospyris ateuchus* Zone

## Reference Slide R 30

Sample	Slide		
85-573B-21-CC	R30.1	R30.2	R30.3
<b>ZONAL MARKERS</b>			
<i>Dorcadospyris ateuchus</i>	A42/3	B14/2	H35/0
	B21/1	E35/3	M40/2
	E14/1	E43/0	
<b>OTHER SPECIES</b>			
<i>Artophormis gracilis</i>	N42/3	W39/3	C2/2
<i>Calocycletta robusta</i>	T27/2	K26/3	F16/0
<i>Theocyrtis annosa</i>	J14/0	L32/0	J15/4

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and moderately well preserved, but somewhat dissolved in this sample.

*Dorcadospyris ateuchus* Zone

## Reference Slide R 31

Sample	Slide		
85-573B-29-CC	R31.1	R31.2	R31.3
<b>ZONAL MARKERS</b>			
<i>Dorcadospyris ateuchus</i>	U25/3	D31/1 M12/3	H28/3 H27/0
<b>OTHER SPECIES</b>			
<i>Artophormis gracilis</i>	N23/0	C19/2	
<i>Centrobotrys petrushevskayae</i>	B28/4	E12/1	C6/4
<i>Didymocyrtis prismatica</i> *	H16/0		J19/2
<i>Theocyrtis annosa</i>	G33/2	X29/0 D21/1	O22/0 V25/0

\*early spherical morphotype

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and moderately well to poorly preserved in this sample.

*Dorcadospyris ateuchus* Zone

## Reference Slide R 32

Sample	Slide		
85-573B-33-CC	R32.1	R32.2	R32.3
<b>ZONAL MARKERS</b>			
<i>Dorcadospyris ateuchus</i>	C11/2	X35/0	
<b>OTHER SPECIES</b>			
<i>Artophormis gracilis</i>	X17/2	P41/0	U27/1
	M14/0		X32/0
<i>Didymocyrtis prismatica</i> *	G35/0		

\*early spherical morphotype

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common, but poorly preserved in this sample.

*Theocyrtis tuberosa* Zone

## Reference Slide R 33

Sample	Slide		
85-573B-34-CC	R33.1	R33.2	R33.3
<b>ZONAL MARKERS</b>			
<i>Lithocyclia angusta</i>	L35/2	N35/2	B16/0
	R36/0	P26/1	H35/0
<i>Lithocyclia aristotelis</i>	M5/1		H23/2
<b>OTHER SPECIES</b>			
<i>Artophormis gracilis</i>	N34/0	P38/1	E37/0
<i>Centrobotrys petrushevskayae</i>	J13/3	B32/0	H3/0
	U24/0	L25/3	H41/3

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and moderately well to poorly preserved in this sample.

*Theocyrtis tuberosa* Zone

## Reference Slide R 34

Sample	Slide		
85-573-35-CC	R34.1	R34.2	R34.3
<b>ZONAL MARKERS</b>			
<i>Lithocyclus angusta</i>			A18/0
<b>OTHER SPECIES</b>			
<i>Artophormis gracilis</i>	G21/0	C21/0	B32/0
<i>Centrotrys gravis</i>	B41/3	C27/2	R41/0
	H6/0	E9/4	B18/2
<i>Theocyrtis tuberosa</i>	E9/0	F19/0	W42/4
	E41/0	E18/4	N15/1

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and moderately well preserved in this sample.



*Theocyrtis tuberosa* Zone

## Reference Slide R 35

Sample	Slide		
85-573B-37-CC	R35.1	R35.2	R35.3
<b>ZONAL MARKERS</b>			
<i>Theocyrtis tuberosa</i>	H26/0	W14/2	U40/0
	M25/0	C12/3	U16/4
	O7/4	F24/3	F13/0
<b>OTHER SPECIES</b>			
<i>Artophormis gracilis</i>	U8/1	E5/0	X39/2
<i>Centrobotrys petrushevskayae</i>	C43/4	V10/1	F18/1
<i>Lithocyclia angusta</i>	D21/3		

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and moderately well preserved in this sample.

***Cryptocarpium ornatum* Zone****Reference Slide R 36**

(= *Cryptoprora ornata* in Maurrasse and Glass, 1976)

<b>Sample</b>	<b>Slide</b>		
41-366-10-5, 53-60 cm	R36.1	R36.2	R36.3
<b>ZONAL MARKERS</b>			
<i>Cryptocarpium ornatum</i>	V29/2	U18/2	H27/1
	U12/3	R19/0	D14/0
	X13/1	D4/4	Q19/4
<b>OTHER SPECIES</b>			
<i>Dictyoprora armadillo</i>	X43/3	W3/3	E23/1
	B12/2	F31/0	L37/3
<i>Dictyoprora pirum</i>	B5/2	M35/4	E12/1
<i>Lithocyclia aristotelis</i>	X10/0	D7/0	C27/1
	H29/0	E17/0	B24/2

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample. Diatoms are also abundant.

*Calocyclus bandyca* Zone

## Reference Slide R 37

Sample	Slide		
17-167-28-4, 107-112 cm	R37.1	R37.2	R37.3
<b>ZONAL MARKERS</b>			
<i>Calocyclus bandyca</i>	O23/3	K26/4	X7/0
	C34/2	J24/0	F15/0
<b>OTHER SPECIES</b>			
<i>Calocyclus turris</i>	N16/3	G42/2	D44/4
	K7/2	G15/1	D39/3
	R6/3	S16/4	V37/3
<i>Cryptocarpium azyx</i>	K37/4	M41/0	M27/0
	X12/0	Q14/0	E7/3
<i>Dictyoprora armadillo</i>	X25/0	N9/0	X42/0
<i>Dictyoprora pirum</i>			H36/2
<i>Lophocyrtis jacchia</i>	G16/4	O42/3	J22/0
	L28/2	X30/0	P13/0
<i>Lychnocanoma amphitrite</i> *	O23/3	R21/0	K21/1
	L28/2	N19/0	X25/3
<i>Thyrsocyrtis bromia</i>	D43/2	B36/3	C44/4
	V24/0	B46/2	G22/2
<i>Thyrsocyrtis lochites</i>	N45/3	R37/1	H33/2
	D9/4	O36/3	Q17/1
<i>Tristylospyris tricerus</i>	W45/1	U27/0	R17/0
	V20/3	O34/2	E29/1

\*Third segment missing, only remnants of spongy layer can be seen. Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

***Cryptocarpium azyx* Zone****Reference Slide R 38**

(= *Carpocanistrum azyx* in Saunders et al., 1985)

<b>Sample</b>	<b>Slide</b>		
8-69A-10-6, 130-132 cm	R38.1	R38.2	R38.3
<b>ZONAL MARKERS</b>			
<i>Cryptocarpium azyx</i>	E42/2	C34/4	E31/3
	D41/0	E43/1	E10/4
	W39/3	U30/3	Q26/0
<b>OTHER SPECIES</b>			
<i>Artophormis barbadensis</i>	U43/2	U6/0	C9/0
<i>Calocyclus turris</i>	E38/0	D12/4	E25/4
	H45/4	L16/2	J36/0
<i>Cryptocarpium ornatum</i>	D36/0	H16/0	F47/0
	J32/0	J22/1	J18/2
<i>Thyrsocyrtis bromia</i>	O26/1	D11/4	H44/0
	H28/4	G7/0	O47/4
<i>Thyrsocyrtis tetracantha</i>		C35/4	

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Podocyrtilis goetheana* Zone

## Reference Slide R 39

Sample	Slide		
16-162-6-2, 126-134 cm	R39.1	R39.2	R39.3
<b>ZONAL MARKERS</b>			
<i>Podocyrtilis goetheana</i>	E17/3	W9/0	D13/0
	D17/0	L9/0	E10/0
	R9/1	J22/2	N10/1
<b>OTHER SPECIES</b>			
<i>Calocyclus hispida</i>	G12/4	W35/1	T43/3
	K14/0	V11/3	R19/0
	O38/3	W9/0	S23/2
<i>Dictyoprora pirum</i>	J9/3		
<i>Podocyrtilis chalara</i>	E9/4	F9/0	L15/0
		N37/4	B10/3

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Podocyrtis chalara* Zone

## Reference Slide R 40

Sample	Slide		
16-162-8-3, 83-89 cm	R40.1	R40.2	R40.3
<b>ZONAL MARKERS</b>			
<i>Podocyrtis chalara</i>	H42/0	J5/1	P27/1
	V37/0	D4/0	K29/2
	V33/0	P17/4	V29/0
<b>OTHER SPECIES</b>			
<i>Podocyrtis papalis</i>	M12/4	W7/4	C26/3
<i>Sethochytris triconiscus</i>	N22/3	Y5/2	J9/3
	B29/3	P32/0	J39/4
<i>Thyrsocyrtis triacantha</i>	P40/2	Q14/3	Q26/0

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample. Some reworked Middle Eocene fauna is present.

*Podocyrtes mitra* Zone

## Reference Slide R 41

Sample	Slide		
10-94-17-1, 121-128 cm	R41.1	R41.2	R41.3
<b>ZONAL MARKERS</b>			
<i>Podocyrtes mitra</i>	S39/3	C12/2	B31/0
	R17/2	K4/4	G8/2
	K35/4	L40/2	N29/0
<b>OTHER SPECIES</b>			
<i>Eusyringium fistuligerum</i>	D39/4	T35.0	N37/4
	W7/1	T28/2	G9/4
	S31/0	O22/0	G12/3
<i>Lithocyclia ocellus</i>	T24/2	Y13/1	S9/2
	J32/4	R37/0	L44/3
<i>Podocyrtes papalis</i>	O25/3	D43/0	S31/4
<i>Podocyrtes trachodes</i>	O6/3	M9/0	O42/0
<i>Spongatractus pachystylus</i>	P19/0	K34/0	J4/3
<i>Thyrsocyrtis hirsuta</i>	W39/2	V33/3	
<i>Thyrsocyrtis rhizodon</i>	V34/4	E12/4	K18/4
	N41/1	E32/1	H42/2

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Podocyrthis ampla* Zone

## Reference Slide R 42

Sample	Slide		
10-94-18-4, 109-117 cm	R42.1	R42.2	R42.3
<b>ZONAL MARKERS</b>			
<i>Podocyrthis ampla</i>	X16/1	S8/3	
<b>OTHER SPECIES</b>			
<i>Dictyoprora mongolfieri</i>	M13/0	L4/2	A34/4
<i>Eusyringium fistuligerum</i> *	F17/1	G13/1	D9/2
	C26/0		
<i>Eusyringium lagena</i>	H17/1	E36/0	D43/4
<i>Podocyrthis papalis</i>	J16/4	X9/0	V43/0
	B23/0	H13/0	
<i>Podocyrthis sinuosa</i>	F37/0	G29/0	V9/1
	P9/1	N12/4	M15/
<i>Theocotylissa ficus</i>	L39/4	L1/2	H17/0

\*early morphotypes

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and moderately well preserved in this sample.

There are abundant ash fragments present.



*Thyrsoyrtis triacantha* Zone

## Reference Slide R 43

Sample	Slide		
10-94-20-2, 70-77 cm	R43.1	R43.2	R43.3
<b>ZONAL MARKERS</b>			
<i>Eusyringium lagena</i>	M15/1	C18/0	B16/4
	E28/0	J10/0	U16/4
	F7/3	E25/1	J12/1
<b>OTHER SPECIES</b>			
<i>Podocyrtis dorus</i>	V10/4	G41/4	U25/0
	R8/0	K10/2	T24/0
<i>Podocyrtis papalis</i>	C38/2	R10/0	C24/2
<i>Podocyrtis sinuosa</i>	S13/2	V11/2	K29/0
	X13/0	U10/4	S19/2
<i>Lychnocanoma bellum</i>			L35/0
<i>Theocotyle conica</i>	U29/1	F12/0	Q3/1
	S12/0	B23/3	S17/0
<i>Theocotyle cryptocephala</i>	O7/0	W9/2	C29/2
	K19/2	A14/4	B21/1
<i>Theocotyle venezuelensis</i>	U21/4	K40/4	M30/3
	G18/0	E43/3	F13/4
<i>Theocotylissa ficus</i>	G10/2	P36/3	T10/0
	Q20/0	F44/0	A9/0

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Dictyoprora mongolfieri* Zone

## Reference Slide R 44

Sample	Slide		
10-94-22-3, 44-52 cm	R44.1	R44.2	R44.3
<b>ZONAL MARKERS</b>			
<i>Dictyoprora mongolfieri</i>	H19/4	K11/2	L42/1
	J44/1	C45/0	M26/0
	K38/4	G37/1	D13/0
<b>OTHER SPECIES</b>			
<i>Calocyclus hispida</i>	R42/2	D9/3	G14/0
	L44/4		L36/3
<i>Lamptonium fabaeforme constrictum</i>	D31/1	H39/0	F22/2
<i>Lychnocanoma bellum</i>	E21/4		
	S23/2		
<i>Phormocyrtis striata striata</i>	B14/0	E38/2	S39/0
	K9/2	L29/2	V26/0
<i>Podocyrtis diamesa</i>	Q23/0	J46/0	U39/4
<i>Theocotyle cryptocephala</i>	O22/0	P11/2	H30/1
	H14/3	C21/2	A39/0
	H14/3	K39/3	B24/3
<i>Thyrsocyrtis hirsuta</i>	P20/0	K37/4	E43/3
<i>Thyrsocyrtis rhizodon</i>	L30/3	Q47/3	D24/0
<i>Thyrsocyrtis robusta</i>	L37/1	Y27/1	A43/3
<i>Thyrsocyrtis tensa</i>	H33/0	G12/2	E34/3
	Q12/4	A45/0	B26/4

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Theocotyle cryptocephala* Zone

## Reference Slide R 45

Sample	Slide		
10-94-25-3, 95-102 cm	R45.1	R45.2	R45.3
<b>ZONAL MARKERS</b>			
<i>Theocotyle cryptocephala</i>	M39/1	D31/0	C7/2
	L34/3	H35/2	D8/2
	R40/1	R41/3	G37/3
<b>OTHER SPECIES</b>			
<i>Lamptonium fabaeforme constrictum</i>	O25/0	L40/3	F41/0
<i>Podocyrtis acalles</i>	M13/1	B27/0	A28/0
	W27/2	G34/0	V21/0
<i>Podocyrtis diamesa</i>	R8/0	T36/0	M39/4
		R35/3	E6/0
<i>Thyrsocyrtis hirsuta</i>	D6/2	B8/0	L34/4
	E22/3	L5/0	O25/4

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and moderately well preserved in this sample.

*Phormocyrtis striata striata* Zone

## Reference Slide R 46

Sample	Slide		
10-94-28-1, 110-117 cm	R46.1	R46.2	R46.3
<b>ZONAL MARKERS</b>			
<i>Phormocyrtis striata striata</i>	B23/0	D22/0	O41/0
	E7/4	D24/0	C36/2
	F14/0	D33/4	E33/3
<b>OTHER SPECIES</b>			
<i>Lamptonium fabaeforme chaunothorax</i>	G28/0		
<i>Theocotyle nigriniae</i>			J17/4
<i>Thyrsocyrtis rhizodon</i>	B29/2		

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

Spongodiscids are common, and there is rare contamination by Middle Eocene fauna.

*Buryella clinata* Zone

## Reference Slide R 47

Sample	Slide		
10-94-30-1, 43-50 cm	R47.1	R47.2	R47.3
<b>ZONAL MARKERS</b>			
<i>Buryella clinata</i>	D9/3	L18/4	G38/1
	E13/3	J7/0	S12/0
	M16/4	B18/2	W26/3
<b>OTHER SPECIES</b>			
<i>Calocyclus castum</i>	W32/2	O43/2	W24/1
	G30/3		
<i>Lamptonium fabaeforme chaunothorax</i>	S41/4	J27/0	R34/1
	V6/1		
<i>Lamptonium fabaeforme fabaeforme</i>	S28/0	S23/1	D30/2
	P25/0		E33/1
<i>Phormocyrtis cubensis</i>	P18/3	C18/0	C21/0
	B33/4		
<i>Theocotyle nigrinae</i>	B42/4	B34/3	H25/4
	F15/0	V40/1	E38/0
	C41/0*		
	D38/1*		
<i>Theocotylissa ficus</i> **	H21/0	J18/3	E31/1
	M40/4		

\*small forms, closed distally

\*\*early morphotypes

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Bekoma bidartensis* Zone

## Reference Slide R 48

Sample	Slide		
43-384-6-3, 102-109 cm	R48.1	R48.2	R48.3
<b>ZONAL MARKERS</b>			
<i>Bekoma bidartensis</i>	B22/3	V29/0	D9/2
	D30/2	E6/1	C18/4
	D14/4	J3/2	D22/0
<b>OTHER SPECIES</b>			
<i>Buryella tetradica</i>	F22/1	C22/0	C10/2
	E31/2	E31/4	G43/1
<i>Lamptonium pennatum</i>	C24/0	G11/4	E43/2
	Q45/1	J13/2	M28/0
<i>Phormocyrtis striata exquisita</i>	D9/4	C16/2	K24/0
	D10/0	C10/0	R22/4

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

*Bekoma campechensis* Zone

## Reference Slide R 49

Sample	Slide		
43-384-7-6, 119-125 cm	R49.1	R49.2	R49.3
<b>ZONAL MARKERS</b>			
<i>Bekoma campechensis</i>	S25/1	T22/0	B33/0
	R17/0	M4/0	V30/2
	C21/3	K35/1	B9/0
<b>OTHER SPECIES</b>			
<i>Buryella pentadica</i>	J17/3	W9/0	E28/2
	F23/3	R6/0	E29/1
<i>Buryella tetradica</i>	K16/0	X15/1	C40/0
	E16/2	P15/4	G13/2
<i>Lamptonium pennatum</i>	W19/0	J11/0	B36/4
	U5/0	P26/4	
<i>Phormocyrtis striata exquisita</i>	U5/0	P3/4	D7/0
	P20/1	V38/0	J27/3

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample.

***Artostrobium miralestensis* Zone**

Reference Slide R 50

(= *Botryostrobos aquilonaris* Zone)

Sample	Slide		
18-173-2-2, 46-49 cm	R50.1	R50.2	R50.3
<b>ZONAL MARKERS</b>			
<i>Botryostrobos aquilonaris</i>	C19/4	E15/0	K25/4
	C29/3	B28/3	F15/2
	D29/4	G29/2	J15/0
<b>OTHER SPECIES</b>			
<i>Lamprocyrtis nigrinia</i>	E24/0	F33/0	J38/3
	H26/4	F26/3	M30/0
<i>Sphaeropyle langii</i>	D15/3	P25/0	M31/0

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and moderately well preserved in this sample. There is a mixture of robust and delicate forms indicative of dissolution.



*Axoprunum angelinum* Zone

## Reference Slide R 51

(= *Stylatractus universus* Zone)

Sample	Slide		
18-173-4-4, 46-50 cm	R51.1	R51.2	R51.3
<b>ZONAL MARKERS</b>			
<i>Stylatractus universus</i>	M6/3	G42/2	D11/1
	K6/4	D39/0	G13/0
	H33/3	F17/0	P42/0
<b>OTHER SPECIES</b>			
<i>Stylocontarium acquilonium</i>	H4/0	S18/0	K27/3
	C25/4	V25/2	N19/0
<i>Lamprocyrtis neoheteroporos</i> *	Q8/2	T18/0	H36/2
<i>Lamprocyrtis nigrinia</i>	S10/0	N21/1	J32/0
	K6/0	L14/0	P40/2
<i>Sphaeropyle langii</i>	L24/2	N41/0	F15/4
	K39/4	F33/4	F16/0

\*All of these specimens are transitional to *L. nigrinia*.

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample, but there is low diversity.

*Eucyrtidium matuyamai* Zone

## Reference Slide R 52

Sample	Slide		
18-173-5-CC	R52.1	R52.2	R52.3
<b>ZONAL MARKERS</b>			
<i>Eucyrtidium matuyamai</i>	L40/4	G26/0	C8/4
	B33/3	H2/1	G15/4
	J24/3	G29/2	M9/4
<b>OTHER SPECIES</b>			
<i>Lamprocyrtis heteroporos</i>	O40/0	U22/0	F11/2
	B15/4	T17/3	J28/4
<i>Lamprocyrtis neoheteroporos</i>	B14/4	X4/4	K24/3
	Y5/0	Y5/2	K40/0

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and moderately well preserved in this sample. There is a mixture of robust and delicate forms indicative of dissolution.

*Lamprocyrtis heteroporos* Zone

## Reference Slide R 53

Sample	Slide		
18-173-9-3, 24-30 cm	R53.1	R53.2	R53.3
<b>ZONAL MARKERS</b>			
<i>Lamprocyrtis heteroporos</i>	D38/4	O25/0	H21/0
	H23/0	N38/0	R11/0
<b>OTHER SPECIES</b>			
<i>Eucyrtidium calvertense</i> *	G22/3	C9/0	L37/4
	B37/1	Q38/0	M14/0
<i>Stylatractus universus</i>	L3/4		
<i>Theocorythium vetulum</i>			N6/2

\*late morphotypes

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample. Diatoms are common.

*Sphaeropyle langii* Zone

## Reference Slide R 54

Sample	Slide		
32-310-7-2, 83-90 cm	R54.1	R54.2	R54.3
<b>ZONAL MARKERS</b>			
**			
<b>OTHER SPECIES</b>			
<i>Sphaeropyle robusta</i>		N4/3	O8/3
<i>Stichocorys peregrina</i>	B16/2	H27/0	E30/1
	X31/2	D34/1	N28/2
<i>Theocorythium vetulum</i>	D17/0	G18/4	B34/3
	S19/1	M33/0	M28/0

\*\*Subsequent unpublished studies (Kling, pers. comm., 1992) and our own observations suggest that *Sphaeropyle langii* and *Sphaeropyle robusta* are not stratigraphically useful species and that the radiolarian zonation in this part of the time scale will need to be revised.

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and moderately well preserved in this sample, but a high proportion of specimens show signs of dissolution.

*Stichocorys peregrina* Zone

## Reference Slide R 55

Sample	Slide		
32-310-7-5, 63-70 cm	R55.1	R55.2	R55.3
<b>ZONAL MARKERS</b>			
<i>Stichocorys peregrina</i>	M37/3	U19/3	H45/0
	M37/0	V34/0	J34/1
<b>OTHER SPECIES</b>			

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and well preserved in this sample, but the majority of specimens are very delicate.

*Didymocyrtis penultima* Zone

## Reference Slide R 56

Sample	Slide		
32-310-8-5, 139-146 cm	R56.1	R56.2	R56.3
<b>ZONAL MARKERS</b>			
<i>Didymocyrtis penultima</i>			
<b>OTHER SPECIES</b>			
<i>Lithopera bacca</i>	D8/0	D11/0	C38/0
	G30/3	F31/4	B26/0
<i>Stichocorys delmontensis</i>	D32/2	F29/3	S19/1
	F9/0	E21/1	H29/2
<i>Stichocorys peregrina</i>	F6/3	K23/0	R14/0
	N30/3	K15/4	H21/3

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample, but the majority of forms are very delicate.

*Didymocyrtis antepenultima* Zone

Reference Slide R 57

Sample	Slide		
18-173-18-3, 35-40 cm	R57.1	R57.2	R57.3
<b>ZONAL MARKERS</b>			
<i>Diartus hughesi</i>	V6/0		
<b>OTHER SPECIES</b>			
<i>Phormostichoartus corbula</i>		H42/3	
<i>Stichocorys delmontensis</i>	D33/1	C30/4	C13/3
	C41/0	G21/4	
<i>Theocorys redondoensis</i>	H46/4	F40/4	B20/1
	X36/4	G21/4	

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are few and moderately well preserved in this sample.

Diatoms are abundant.

*Diartus petterssoni* Zone

## Reference Slide R 58

Sample	Slide		
18-173-22-4, 18-24 cm	R58.1	R58.2	R58.3
<b>ZONAL MARKERS</b>			
<i>Diartus petterssoni</i>			E32/1 Q10/4 R17/4
<b>OTHER SPECIES</b>			
<i>Didymocyrtis laticonus</i>	B11/4 C14/3	P8/3 X37/4	X39/3
<i>Eucyrtidium inflatum</i>	G17/2	P8/2	X12/1
<i>Lithopera neotera</i>	T33/0		
<i>Lithopera renzae</i>	V40/1	N29/2	U13/0
<i>Phormostichoartus corbula</i>	B15/4	K18/2	F42/1
<i>Stichocorys delmontensis</i>	E19/0 B17/0	Y21/2 Y14/2	B44/0 E23/4
<i>Theocorys redondoensis</i>	M4/4	U30/4	H30/3

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant and well preserved in this sample. Diatoms are also abundant.



*Dorcadospyris alata* Zone

## Reference Slide R 59

Sample	Slide		
18-173-26-3, 37-43 cm	R59.1	R59.2	R59.3
<b>ZONAL MARKERS</b>			
<i>Dorcadospyris alata</i>			
<b>OTHER SPECIES</b>			
<i>Cyrtocapsella tetrapera</i>	W42/3	R15/1	F19/1
	G40/2	C10/1	
<i>Eucyrtidium calvertense ?</i>	F40/0	H14/3	F37/2
	B23/0		H21/3
<i>Eucyrtidium inflatum</i>	U40/0		G39/0
	D28/3		T8/1
<i>Lithopera renzae</i>	P32/4		L25/1
<i>Stichocorys delmontensis</i>	F38/1	J16/2	F31/2
	O36/4	D6/2	V28/0
<i>Theocorys redondoensis</i>	M4/1	C19/3	G28/2
	S36/3		

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are abundant, robust, and well preserved in this sample.

Diatoms are also abundant.

*Calocycletta costata* Zone

## Reference Slide R 60

Sample	Slide		
18-173-29-2, 126-132 cm	R60.1	R60.2	R60.3
<b>ZONAL MARKERS</b>			
<i>Calocycletta costata</i>	G25/3	D40/1	C12/2
<b>OTHER SPECIES</b>			
<i>Cyrtocapsella tetrapera</i>	A36/0	C34/2	C37/4
	A26/3	C36/0	B20/4
<i>Didymocyrtis mammifera</i>		J6/2	B40/4
<i>Lithopera renzae</i>		S4/0	
<i>Lychnocanoma elongata</i>			B19/2
<i>Stichocorys delmontensis</i>	D33/1	C30/4	C13/3
	C41/0	G21/4	
<i>Stylatractus universus</i>	C12/2	S27/0	T23/0
<i>Theocorys redondoensis</i>	H46/4	F40/4	B20/1
	X36/4	G21/4	

Specimens are located using England Finder coordinates; radiolarian slide label positioned to the left.

Radiolarians are common and moderately well preserved in this sample.

Diatoms are abundant.