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2. Diatom Biostratigraphy of Sites 1039–1043, Costa Rica Margin[1]

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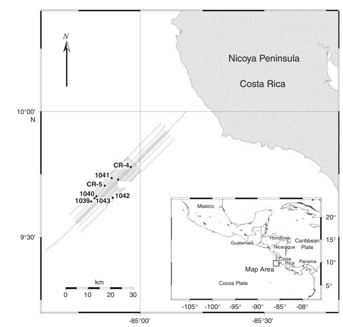
ABSTRACT

The following data paper summarizes diatom biostratigraphic data from sediments drilled in the Costa Rica accretionary wedge during Ocean Drilling Program Leg 170. Quaternary through lower Miocene diatom zones characteristic of the equatorial Pacific region are recognized in the reference section, Site 1039, which was drilled on the downgoing Cocos plate. At Sites 1040–1043, where the recovered silty clay units are primarily wedge and apron sediments that overlie the underthrust sections, diatoms are generally low in abundance, and complete zonation of the cores was not possible above the décollement surface.

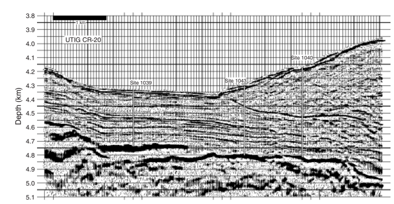
INTRODUCTION

Sites 1039–1043 of Ocean Drilling Program (ODP) Leg 170 were drilled along the active Pacific margin of Costa Rica in the western equatorial Pacific (Figs. F1, F2). The primary objectives of the leg were to better characterize the structural, sedimentological, and geochemical parameters within this dynamic margin (Kimura, Silver, Blum, et al., 1997); the age of sediments is a crucial factor in determining the rates of these and related processes. Neogene diatom biostratigraphy is very well defined for the equatorial Pacific region and has been developed over the years by a number of researchers. The diatom biostratigraphic zonation for the equatorial Pacific used during Leg 170 is that of Baldauf and Iwai (1995). This scheme was developed during ODP Leg 138 and is a revision of the scheme proposed by Barron (1985a, 1985b) and Baldauf (1985), which is partly based on the direct calibration of di-

F1. Map of Costa Rica Margin, p. 7.



F2. Depth migrated seismic line CR-20 showing the locations of Sites 1039, 1040, and 1043, p. 8.



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atom datums to magnetostratigraphic datums by Burckle (1972, 1977, 1978). This paper adheres to the most recent geomagnetic polarity time scale of Berggren et al. (1995a, 1995b). The calibration of the diatom datums follows that of Shackleton et al. (1995) as listed in Table T1 (Shipboard Scientific Party, 1997).

T1. Calibration and ages of Neogene diatom datums, p. 9.

METHODS

Core-catcher samples from each site were analyzed on board the *JOIDES Resolution* by placing 3 cm^3 of material in a snap-cap vial, adding distilled water, agitating the vial, and removing part of the upper to middle suspended material with a pipette. The material from the pipette was then strewn onto a coverslip and mounted to a glass slide using Hyrax mounting media. During the postcruise phases of the research, ~200 additional samples were analyzed for diatom abundance and preservation between the core-catcher intervals. These samples were processed using a standard diatom preparation acid treatment technique whereby ~5 cm^3 of material was placed in hydrogen peroxide and boiled until disaggregation of the sediments occurred. Hydrochloric acid was then added to dissolve the carbonate fraction, and the samples were centrifuged three times and rinsed with distilled water to neutralize the fluid. Strewn slides were then prepared and examined at a magnification of 500× for stratigraphic markers. Abundances of diatoms was based on the number of specimens observed per field of view at 500×.

Diatom abundances are recorded as follows:

A = abundant, two or more specimens per field of view;
C = common, one specimen per two fields of view;
F = few, one specimen per each vertical traverse;
R = rare, less than one specimen per each vertical traverse; and
B = barren, no diatoms present.

Preservation of diatoms was determined as follows:

G = good, both finely silicified and heavily robust forms are present and no fragmentation or dissolution of frustules is observed;
M = moderate, finely silicified forms are present but show some fragmentation and/or dissolution; and
P = poor, finely silicified forms are absent or rare and fragmented, and the assemblage is dominated by robust forms.

Tables T2, T3, T4, T5, and T6 are the result of this work and mainly show the occurrence of stratigraphically significant diatoms from Sites 1039 to 1043. Additional information about the nature of the sediments recovered from these cores is highlighted in the site report chapters in Kimura, Silver, Blum, et al. (1997). The data from the tables is summarized in the following section.

T2. Diatom range distribution chart for Site 1039, p. 10.

T3. Diatom range distribution chart for Site 1040, p. 13.

T4. Diatom range distribution chart for Site 1041, p. 17.

T5. Diatom range distribution chart for Site 1042, p. 20.

T6. Diatom range distribution chart for Site 1043, p. 21.

SUMMARY OF DIATOM DATA

Site 1039

Diatoms recovered from the reference section, Site 1039, represent a nearly continuous stratigraphic record from the Quaternary *Fragilariopsis doliolus* Zone to the lower Miocene *Crucidenticula nicobarica* Zone (Table T2). Reworked diatoms are frequently present in the Quaternary diatomaceous sediments where numerous turbidites and sandy ash layers are observed (Kimura, Silver, Blum, et al., 1997). This is particularly true of *Rhizosolenia praebergonii* var. *robusta,* which has a last occurrence near the Pliocene/Pleistocene boundary, making resolution of the *Nitzschia reinholdii* Subzone A/B boundary difficult. Furthermore, the poor preservation of diatoms in silty clay units that are present between depths of approximately 85–150 mbsf prevents placement of the *Nitzschia marina* Subzone A/B boundary. Siliceous nannofossil ooze and chalk are present between approximately 150 and 420 mbsf, above a gabbro intrusion (Kimura, Silver, Blum, et al., 1997), and diatoms are common to abundant and show moderate to good preservation. This interval spans the *Nitzschia jouseae* to *C. nicobarica* zones (Table T2). Recognition of many of the subzone boundaries within the *Thalassiosira convexa* through *Thalassiosira yabei* zones is hampered by the slow age-depth rate (6 m/m.y.) estimated for the lower Pliocene through upper Miocene section (Kimura, Silver, Blum, et al., 1997).

Site 1040

Drilling at Site 1040 penetrated the sediment wedge in the toe of slope, through the décollement (371 mbsf) and the underthrust sedimentary section (Fig. F2). The Quaternary *F. doliolus* Zone is recognized between Samples 170-1040A-4X-CC and 9X-CC, but the majority of samples analyzed above the décollement surface are barren of diatoms (Table T3). Where diatoms are present, they are few to rare and consist of poorly preserved frustules of *Actinoptychus senarius* and other long-ranging benthic taxa (Table T3). The age of this sedimentary wedge (0–371 mbsf) is estimated to be Pliocene/Pleistocene, based on scattered nannofossil and planktonic foraminiferal data from the cores (Kimura, Silver, Blum, et al., 1997). Below the décollement surface, beginning with Sample 170-1040C-23R-2, 124–125 cm (373.74 mbsf), and continuing to Section 170-1040C-50R-6 (638.28 mbsf), diatoms are consistently present. The abundance, preservation, and recognition of the Quaternary through middle Miocene diatom zones is similar to that observed at Site 1039, including the lack of differentiation of the *N. marina* through *T. yabei* zones because of the slow age-depth rate between approximately 483 and 487 mbsf (Table T3).

Site 1041

Diatoms continue to show variable states of abundance and preservation in the cores recovered at Site 1041 (Table T4). Some age-diagnostic taxa are present and suggest a Pleistocene to possibly a late Miocene age for the cores (up to *Nitzschia miocenica* Zone)(Table T4), but the cores are generally of low quality with poor recovery and extensive biscuiting common. Significant reworking of middle and early Miocene diatoms is observed.

The upper Pleistocene *F. doliolus* Zone (0–0.62 Ma) is recognized down to 4.01 mbsf. Below that, although Pleistocene and Pliocene taxa are present (*Nitzschia fossilis, N. reinholdii, T. oestrupii, R. praebergonii* var. *robusta*), their abundance and states of preservation are too variable to zone the cores from 4.01 to 208.67 mbsf with any confidence.

It is possible that the upper Miocene *T. convexa* Zone (5.12–6.55 Ma) to *N. miocenica* Zone (6.55–7.27 Ma) is present between depths of 213.02 and 273.24 mbsf, where diatoms are more common and better preserved, allowing for improved recognition of datums (Table **T4**). This is based on the presence of *T. convexa, N. miocenica,* and *Thalassiosira praeconvexa* in cores from this interval. However, the persistence of common *T. oestrupii* through this interval, which has a first occurrence (B) at 5.63 Ma, could mean that some of the late Miocene taxa are reworked.

Site 1042

Poor core recovery also characterized coring at Site 1042, with the recovery of mostly silty clay and sandy units, including sandy limestone breccia. Samples from cores recovered at Site 1042 are barren or show few diatoms. When the abundance of diatoms is common, preservation is poor, preventing detailed diatom biozonation of the cores (Table **T5**). Rare and poorly preserved diatoms in Samples 170-1042A-1R-CC (49.93 mbsf) through 3R-CC (156.26 mbsf) did not yield age-significant taxa. In Samples 170-1042A-4R-2, 48–49 cm (203.44 mbsf), through 7R-2, 48–50 cm (231.18), diatom abundance ranges from common to few and diatoms are poorly to moderately preserved. The samples contain a mix of *N. reinholdii, T. convexa* var. *aspinosa, T. praeconvexa,* and *N. miocenica* (last occurrence = 6.07 Ma), suggesting an age of late Miocene, correlating to *T. convexa* or *N. miocenica* zones. Diatoms observed in Sample 170-1042B-4R, 73–75 cm (334.01 mbsf), are few and moderately preserved but are suggestive of the middle Miocene *Coscinodiscus lewisianus* Zone. *Denticulopsis hustedtii*, *C. nicobarica, C. lewisianus,* and *Cestodiscus pulchellus* are characteristic of the *C. lewisianus* Zone that ranges between 12.86 and 14.03 Ma. Given the lithologic variations at this site, it is possible that a significant amount of material is reworked or not in place (Kimura, Silver, Blum, et al., 1997). Unfortunately, diatoms recovered from Samples 170-1042B-5R-2, 27–28 cm, through 8R-CC (Table **T5**) are only rare and very poorly preserved, preventing an age assignment for this part of the site.

Site 1043

Diatoms are variable in abundance and preservation at Site 1043 but show distinctive characteristics above and below the décollement surface (~150 mbsf). Table **T6** shows the abundance and zonal distribution of diatom assemblages from this site. Sediments present above the décollement surface are silty clays similar to the wedge sediments recovered at Site 1040. However, it is possible at Site 1043 that several faults are present in the wedge sediments and that diatomaceous material from the downgoing plate has been accreted in fault slices (Kimura, Silver, Blum, et al., 1997). Diatoms present in Samples 170-1043A-2H-2, 124–125 cm (10.74 mbsf); 13X-2, 49–50 cm, through 13X-4, 49–50 cm (111.49–114.49 mbsf); and 15X-CC (130.31 mbsf) are all characteristic of the Pleistocene *F. doliolus* or *N. reinholdii* Zone. Species such as *F. doliolus, T. oestrupii, Azpeitia nodulifer, N. marina,* and *N. fossilis* indicate that thin intervals of upper Pleistocene diatomaceous clay has been faulted into the slope wedge (Kimura, Silver, Blum, et al., 1997).

Within Core 170-1043A-17X at approximately 150 mbsf, the décollement surface is present. Below the décollement, Samples 170-1043A-17X-CC through 30X-CC are characteristic of the Pleistocene through upper Miocene diatom zones recognized at the reference section (Site 1039) and the section underthrust at Site 1040 (Table **T6**).

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Figure F1. Map of the Costa Rica Margin showing the location of Sites 1039–1043 in relationship to the 2-D and 3-D seismic reflection surveys carried out offshore of the Nicoya Peninsula. Proposed Sites CR-4 and CR-5 are shown for reference purposes. Two-dimensional lines are shown as lines. Three-dimensional data set is within the shaded rectangular area.

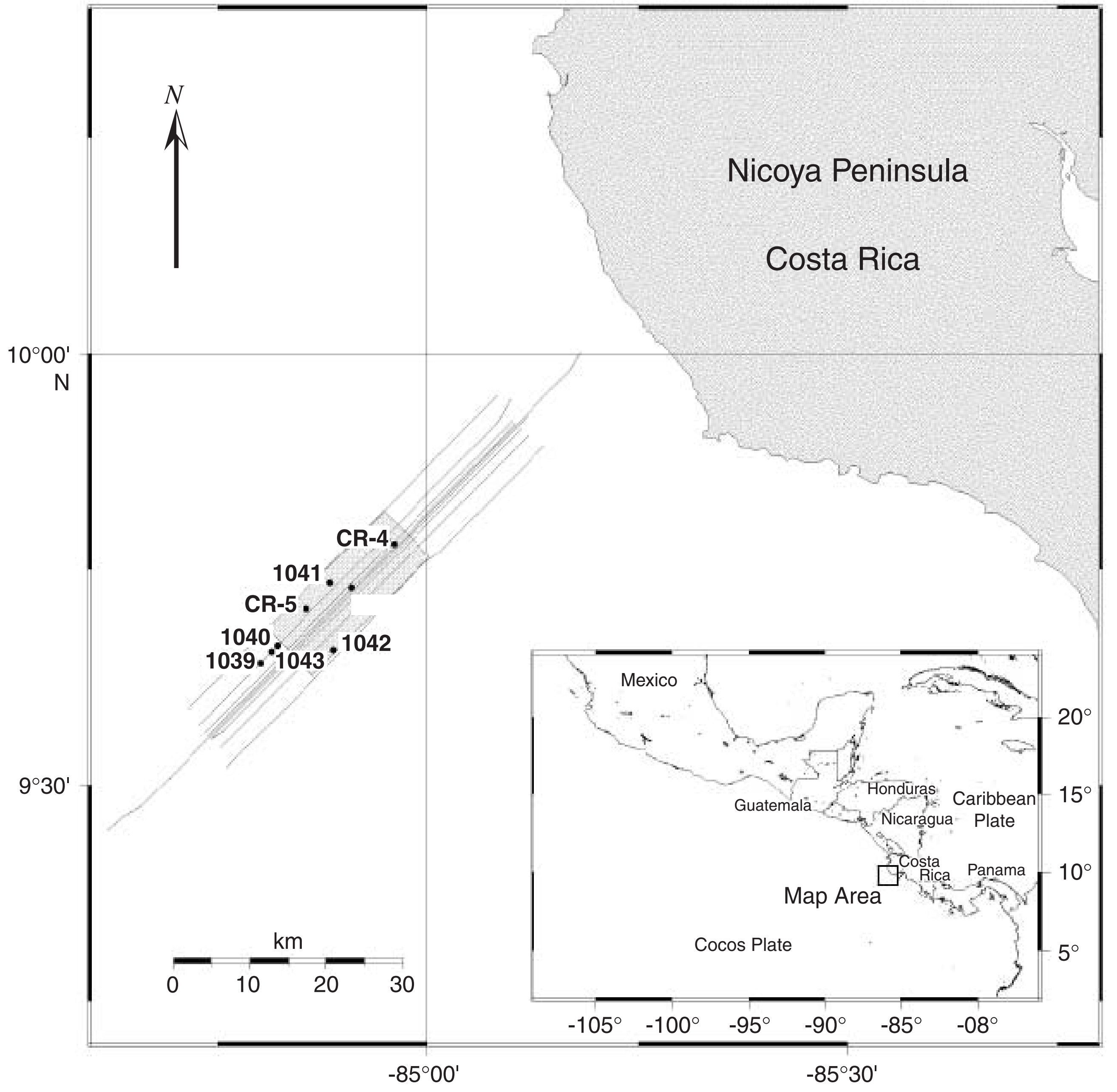

Figure F2. Depth migrated seismic Line CR-20 showing the locations of Sites 1039, 1040, and 1043. Note the high-amplitude reflector between 4.4 and 4.55 km depth marking the décollement surface separating the underthrust section that was drilled at Site 1039 from the wedge sediments drilled at Sites 1040 and 1043. Sites 1041 and 1042 were also drilled in wedge on the upper plate and are located upslope from Sites 1040 and 1043 (see Fig. **F1** and site chapters in Kimura, Silver, Blum, et al., 1997).

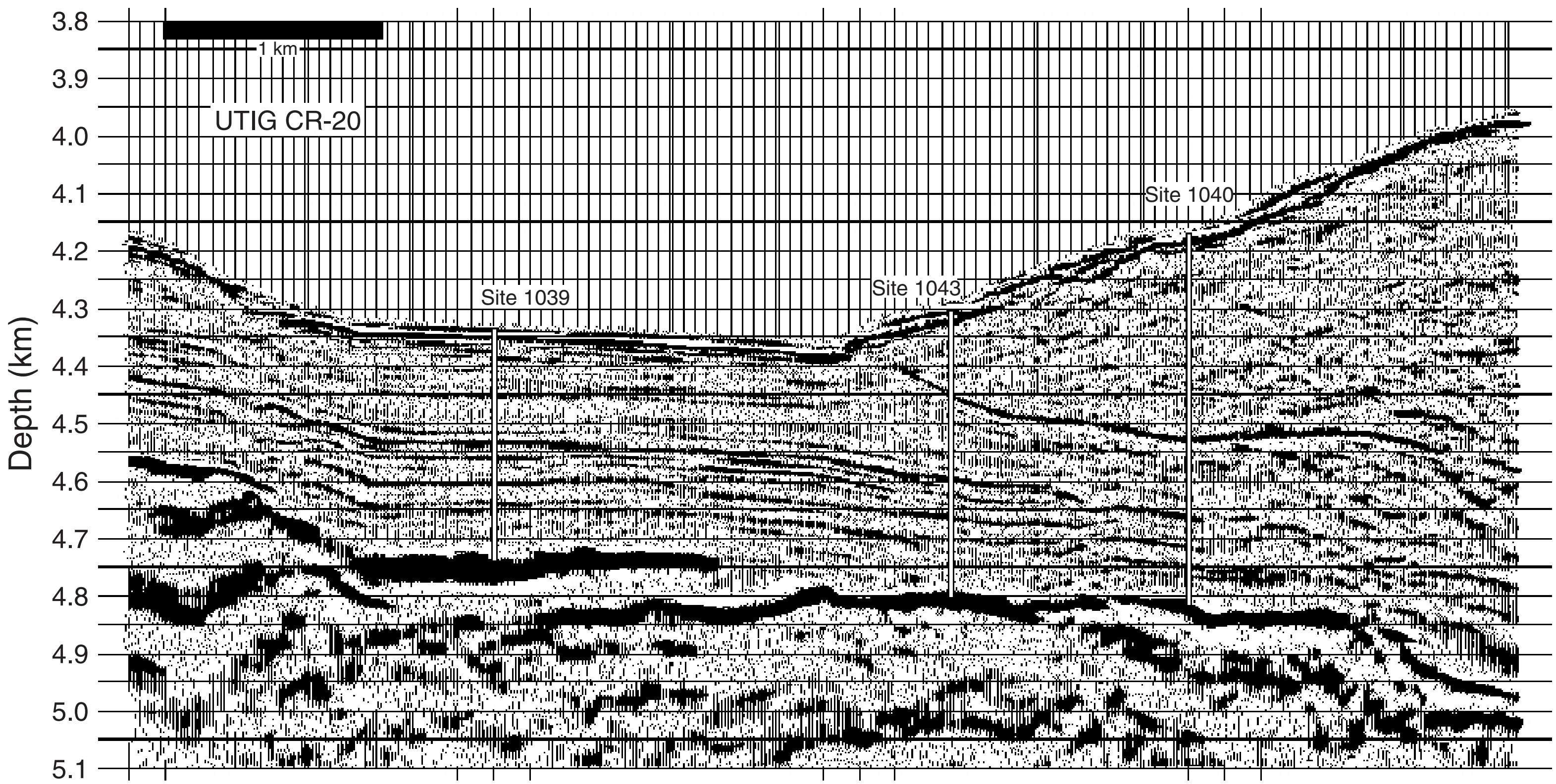

Table T1. Magnetic calibration and the estimated ages of Neogene primary and secondary diatom datums for the equatorial Pacific Ocean that were used during Leg 170.

Datum	Chron	Age (Ma)	Zone (base)
T. *Nitzschia reinholdii*	Brunhes	0.62	*F. doliolus*
T. *Nitzschia fossilis*		0.70	
T. *Rhizosolenia praebergonii* var. *robusta*	Matuyama	1.72	A/B boundary
B. *Fragilariopsis doliolus*	Olduvai	2.01	*N. reinholdii*
T. *Rhizosolenia praebergonii*	Olduvai	2.01	
T. *Thalassiosira convexa*	Matuyama	2.43	A/B boundary
T. *Nitzschia jouseae*	Gauss	2.78	*N. marina*
B. *Rhizosolenia praebergonii*	Gauss	3.18	
B. *Thalassiosira convexa* var. *convexa*	Gilbert	3.83	
B. *Asteromphalus elegans*	Gilbert	4.01	
T. *Nitzschia cylindrica*	Gilbert	4.87	
B. *Nitzschia jouseae*	Gilbert	5.12	*N. jouseae*
B. *Thalassiosira oestrupii*	Gilbert	5.63	
T. *Thalassiosira miocenica*	Gilbert	5.83	B/C boundary
T. *Asterolampra acutiloba*	C3An1	6.07	
T. *Nitzschia miocenica*	C3An1	6.07	
T. *Thalassiosira praeconvexa*	C3An2	6.17	A/B boundary
T. *Rossiella praepaleacea*	C3An2	6.52	
B. *Thalassiosira miocenica*	C3An2	6.54	
B. *Thalassiosira convexa* var. *aspinosa*	C3An2	6.55	*T. convexa*
B. *Thalassiosira praeconvexa*	C3An2	6.69	A/B boundary
T. *Nitzschia porteri*	C4n1	7.14	
B. *Nitzschia miocenica*	C4n1	7.27	*N. miocenica*
B. *Nitzschia reinholdii*	C4n1	7.30	
T. *Rossiella paleacea*	C4n1	7.37	
T. *Actinocyclus ellipticus* var. *javanicus*	C4n2	7.75	
T. *Thalassiosira burckliana*	C4n2	7.81	A/B boundary
B. *Nitzschia marina*		7.92	
T. *Thalassiosira yabei*	C4n3	8.17	*N. porteri*
B. *Nitzschia fossilis*		8.40	
T. *Coscinodiscus loeblichii*		8.79	
B. *Thalassiosira burckliana*	C4An1	8.84	A/B boundary
B. *Coscinodiscus loeblichii*		9.55	
T. *Denticulopis hustedtii*	C4An3	9.6	
T. *Actinocyclus moronensis*	C4An3	9.66	*T. yabei*
B. *Actinocyclus ellipticus* f. *lanceolata*		10.35	
T. *Crasepedodiscus coscinodiscus*		11.34	*A. moronensis*
T. *Cavitatus jouseana*		11.41	
B. *Hemidiscus cuneiformis*	C5n3	11.5	
B. *Thalassiosira brunii*		12.06	*C.coscinodiscus*
B. *Rossiella praepaleacea*		12.10	
T. *Actinocyclus ingens*		12.12	
T. *Cestodiscus pulchellus*		12.14	
T. *Crucidenticula nicobarica*		12.4	
T. *Coscinodiscus lewisianus*	C5An4	12.86	*C. gigas v. diorama*
T. *Thalassiosira tappanae*	C5ABn	13.2	
B. *Azpeitia nodulifer*	C5ABn	13.4	
T. *Cestodiscus peplum*	C5ADn	14.03	*C. lewisianus*
B. *Actinocyclus ellipticus*		14.04	
T. *Coscinodiscus blysmos*		14.34	
B. *Thalassiosira tappanae*	C5ADn	14.6	
T. *Annellus californicus*		15.0	A/B boundary
B. *Actinocyclus ingens*		15.5	
T. *Coscinodiscus lewisianus* var. *simillis*		15.7	
B. *Cestodiscus peplum*	C5Cn1	16.4	*C. peplum*
T. *Raphidodiscus marylandicus*	C5Cn2	16.49	
T. *Thalassiosira bukryi*	C5Cn3	16.7	A/B boundary
B. *Coscinodiscus blysmos*	C5Cn3	16.75	
T. *Triceratium pileus*	C5Dn1	17.8	
B. *Crucidenticula nicobarica*	C5Dn1	18.12	*C. nicobarica*

Note: Datums are based on the timescale of Berggren et al. (1995a, 1995b) as presented in Shackleton et al. (1995). B = base; T = top.

Table T2. Diatom range distribution chart for Site 1039. (See table notes. Continued on next two pages.)

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus*	*Actinocyclus ellipticus* f. *lanceolata*	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ingens*	*Actinocyclus moronensis*	*Actinoptychus senarius* + *A. minutus*	*Annellus californicus*	*Asterolampra acutiloba*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cavitatus jouseanus*	*Cestodiscus peplum*	*Cestodiscus pulchellus*	*Cestodiscus pulchellus* var. *maculatus*	*Coscinodiscus gigas* var. *diorama*	*Coscinodiscus lewisianus*	*Coscinodiscus lewisianus* var. *similis*	*Coscinodiscus marginatus*	*Craspedodiscus coscinodiscus*	*Crucidenticula nicobarica*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia cylindrica*	*Nitzschia fossilis*	*Nitzschia jouseae*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Raphidodiscus marylandicus*	*Rhizosolenia praebergonii*	*Rhizosolenia praebergonii* var. *robusta*	*Rossiella paleacea*	*Rossiella praepaleacea*	*Thalassionema nitzschioides*	*Thalassiosira brunii*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira grunowii*	*Thalassiosira miocenica*	*Thalassiosira oestrupii*	*Thalassiosira tappanae*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Triceratium pileus*	Benthics + *Chaetoceros*
	170-1039B-																																																	
Fragilariopsis doliolus	1H-CC	1.9	C	M					r	R		F	F	C								R				F					F					r				F					C			F		F
	2H-5	8.19	A	G						R				C												C	F				F									C					F			F		F
	3H-CC	20.43	A	M						F		F	F	C										r		F	F				F						r			F					C			r	r	F
	4H-1, 49-50	21.49	A	G										C												C	F				F						r			F					A					
	4H-CC	31.03	C	M										F												C	R				F						r								F				r	F
	5H-1, 49-50	30.99	A	G						F				F												C	F		R		F						r			F					A					
	5H-CC	40.38	A	G						R				F												C					C														C					
	6H-6, 123-124	48.73	A	M										R								F				F	R				C									C					C				r	F
Nitzschia reinholdii	6H-CC	49.78	A	G										R													R				F			R						C					C					
	7H-2, 127-128	52.27	A	G						R			F	R								C				F	F		R		F			R			r			C					A				R	F
	7H-6, 124-125	58.24	C	P									R	R								R			r	F	R		R		R			R			r			F					F					
	7H-CC	59.48	A	M								R	R	F												F			R		F						r			C					F				r	F
	8H-1, 49-50	59.49	A	M										C								F				F			R		F						r								A					F
	8H-CC	68.88	F	M									R	F															R		R						r								F					
	9H-5, 124-125	75.77	C	P									R	F												F			R		F						r			R					F				r	F
	9H-CC	78.37	C	M						R				F												R			R		R			R			r			F					F				r	F
	10H-3, 49-50	81.52	C	P										F												R			R		F						r			F										F
	10H-CC	87.98	F	P										F												R	R		R		R			R						F					F			F		R
Undetermined	11H-1, 55-56	88.05	F	P										R															R		R														R				r	
	11H-2, 49-50	89.49	R	P																											R			R																R
	11H-4, 124-125	93.24	B																																															
	11H-5, 124-125	94.74	R	P																																														R
	11H-CC	97.37	B																																															
	12X-1, 123-124	98.23	R	P																											R			R																R
	12X-5, 123-124	104.23	R	P																																														R
	12X-CC	106.71	R	P																																				R								R		
	13X-6, 49-50	111.49	F	P										F															R					R											R		r			R
	13X-CC	113.09	F	M						F		R	R	F													F		F		R			R			R								F			R		
	14X-2, 124-125	115.84	F	P										R											r		F		R		F			R			R			R					F					R
	14X-4, 124-125	118.84	R	P										R																										R										R
	14X-5, 124-125	120.34	R	P																																				R										R
	14X-CC	122.7	F	P																											R			R																
	15X-4, 124-125	128.44	B																																															
	15X-CC	132.42	B																																															
	16X-4, 124-125	137.94	B																																															
	16X-CC	141.77	B																																															
	17X-1, 124-125	143.04	B																																															

Table T2 (continued).

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus*	*Actinocyclus ellipticus* f. *lanceolata*	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ingens*	*Actinocyclus moronensis*	*Actinoptychus senarius* + *A. minutus*	*Annellus californicus*	*Asterolampra acutiloba*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cavitatus jouseanus*	*Cestodiscus peplum*	*Cestodiscus pulchellus*	*Cestodiscus pulchellus* var. *maculatus*	*Coscinodiscus gigas* var. *diorama*
Undetermined	17X-3, 49-50	145.29	B																
	17X-4, 124-125	147.54	R	P															
	17X-3, 49-50	145.29	B																
	17X-4, 124-125	147.54	R	P															
	17X-5, 49-50	148.29	B																
	17X-5, 124-125	149.04	F	P										F		r			
	17X-6, 49-50	149.79	R	P															
Nitzschia jouseae	17X-CC	151.19	C	M	r				r					F					
	18X-1, 49-50	151.89	C	M										C					
	18X-3, 124-125	154.14	C	P										F					
	18X-4, 118-119	157.08	C	M										C					
Thalassiosira convexa	18X-CC	160.97	A	M						R				R					
	19X-2, 44-45	163.04	A	M									R						
	19X-4, 124-125	166.84	A	G					r	R			R	C					
	19X-6, 49-50	169.09	C	M										F					
Nitzschia miocenica to *Nitzschia porteri*	19X-CC	170.73	A	M															
	20X-2, 123-124	173.33	A	G										F		r			
	20X-5, 49-50	177.09	A	G										C					
Thalassiosira yabei	20X-CC	180.37	A	G						R									
Actinocyclus moronensis	21X-2, 124-125	182.94	A	G		R			F	R									
	21X-5, 49-50	186.69	A	G						F									
Craspedodiscus coscinodiscus	21X-CC	189.87	A	G									R						
	22X-4, 123-124	195.5	A	G															
	22X-CC	198.65	A	G				R											
Coscinodiscus gigas var. *diorama*	23X-CC	208.76	A	G															
	24X-CC	218.43	A	G					F						F				R
Coscinodiscus lewisianus	25X-CC	228.27	A	M										R					
	26X-CC	238	A	M				F											
	27X-CC	247.56	A	M													R		
	28X-CC	257.27	A	G		R		F							R				
	29X-CC	266.84	A	M															

Core, section, interval (cm)	Depth (mbsf)	*Coscinodiscus lewisianus*	*Coscinodiscus lewisianus* var. *similis*	*Coscinodiscus marginatus*	*Craspedodiscus coscinodiscus*	*Crucidenticula nicobarica*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia cylindrica*	*Nitzschia fossilis*	*Nitzschia jouseae*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*
17X-3, 49-50	145.29															
17X-4, 124-125	147.54															
17X-3, 49-50	145.29															
17X-4, 124-125	147.54															
17X-5, 49-50	148.29															
17X-5, 124-125	149.04			R												
17X-6, 49-50	149.79			R												
17X-CC	151.19											F	R			F
18X-1, 49-50	151.89			F								R	R			
18X-3, 124-125	154.14								F			R	R			
18X-4, 118-119	157.08			R					F			F	F			R
18X-CC	160.97			R					R				R	R		R
19X-2, 44-45	163.04		r						F	F			F	R		
19X-4, 124-125	166.84	r							F	F			F			
19X-6, 49-50	169.09	r					r									
19X-CC	170.73	r												R		
20X-2, 123-124	173.33			F			R		F							
20X-5, 49-50	177.09								F						R	
20X-CC	180.37						F		R							
21X-2, 124-125	182.94			F			F		R							
21X-5, 49-50	186.69			F			F		R						R	
21X-CC	189.87	r			R		F									
22X-4, 123-124	195.5	r			F		F									
22X-CC	198.65															
23X-CC	208.76	r			C		C									
24X-CC	218.43	r	r				C									
25X-CC	228.27	F			F	F	C									
26X-CC	238	F			F	C	F									
27X-CC	247.56				F	A	F									
28X-CC	257.27	F	r		R	R	C									
29X-CC	266.84	C				C	C									

Core, section, interval (cm)	Depth (mbsf)	*Raphidodiscus marylandicus*	*Rhizosolenia praebergonii*	*Rhizosolenia praebergonii* var. *robusta*	*Rossiella paleacea*	*Rossiella praepaleacea*	*Thalassionema nitzschioides*	*Thalassiosira brunii*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira grunowii*	*Thalassiosira miocenica*	*Thalassiosira oestrupii*	*Thalassiosira tappanae*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Triceratium pileus*	Benthics + *Chaetoceros*
17X-3, 49-50	145.29																
17X-4, 124-125	147.54																R
17X-3, 49-50	145.29																
17X-4, 124-125	147.54																R
17X-5, 49-50	148.29																
17X-5, 124-125	149.04						R					R					R
17X-6, 49-50	149.79						R										
17X-CC	151.19			R												r	
18X-1, 49-50	151.89						F					F					F
18X-3, 124-125	154.14						C		R						F	r	R
18X-4, 118-119	157.08						F		R						F		F
18X-CC	160.97						A					R			A	r	
19X-2, 44-45	163.04					R	C		F						F		
19X-4, 124-125	166.84						C		F						F		
19X-6, 49-50	169.09						C		F		R			r	F		F
19X-CC	170.73				R		C										
20X-2, 123-124	173.33					R	C										
20X-5, 49-50	177.09				R		C										
20X-CC	180.37						C							F	C		
21X-2, 124-125	182.94						C							F	C		F
21X-5, 49-50	186.69						C							F	C		F
21X-CC	189.87				F									F	A	r	
22X-4, 123-124	195.5				F		A							R	C		
22X-CC	198.65				F		C	R						F	C		
23X-CC	208.76				F		C							F	A		
24X-CC	218.43				F		C							R	A		
25X-CC	228.27				F					F					A		
26X-CC	238						C								C		
27X-CC	247.56				R		C								C		
28X-CC	257.27				R		C						C		A		
29X-CC	266.84						C								A		

Table T2 (continued).

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus*	*Actinocyclus ellipticus* f. *lanceolata*	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ingens*	*Actinocyclus moronensis*	*Actinoptychus senarius* + *A. minutus*	*Annellus californicus*	*Asterolampra acutiloba*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cavitatus jouseanus*	*Cestodiscus peplum*	*Cestodiscus pulchellus*	*Cestodiscus pulchellus* var. *maculatus*	*Coscinodiscus gigas* var. *diorama*	*Coscinodiscus lewisianus*	*Coscinodiscus lewisianus* var. *similis*	*Coscinodiscus marginatus*	*Craspedodiscus coscinodiscus*	*Crucidenticula nicobarica*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia cylindrica*	*Nitzschia fossilis*	*Nitzschia jouseae*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Raphidodiscus marylandicus*	*Rhizosolenia praebergonii*	*Rhizosolenia praebergonii* var. *robusta*	*Rossiella paleacea*	*Rossiella praepaleacea*	*Thalassionema nitzschioides*	*Thalassiosira brunii*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira grunowii*	*Thalassiosira miocenica*	*Thalassiosira oestrupii*	*Thalassiosira tappanae*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Triceratium pileus*	Benthics + *Chaetoceros*
Cestodiscus peplum subzone B	30X-CC	274.15	A	G			R	R								R	F			C			F	C	C															C						F		A		
	31X-CC	286.25	A	M				F	R			R		F		R	F			F		F		C																						F		C	r	
	32X-CC	296.14	A	M				F							F	R	C			F		F	F	C														F		F								A		
	33X-CC	305.67	A	M				C								F						C	F	F														F		F						F		C		
	34X-CC	315.36	A	G				F							F	R	F			R		C	F	F														R		C								A		
	35X-CC	324.86	A	M				F					R		F	R	F					F	R	F														R		F								C		
	36X-CC	334.62	A	M											F	F	F					F		F														R		F								C		
	37X-CC	344.23	A	G				C							C	R	F			C		F																C		F								A		
	38X-CC	353.85	A	M				C		R		R			F		C			F		F	R	R														F		F						R		C		
	39X-CC	363.32	A	M											F	R	A					F		C																F								C		
Cestodiscus peplum subzone A	40X-CC	372.89	A	M							R				C	R	C	C		F				R														F		C								A		
	41X-CC	378.15	B																																															
	170-1039C-																																																	
	1R-4	366.92	A	M				F		R	R		R	F	F	F	F			R		C		F														F								R		A		
	2R-CC	375.85	A	M				F		R	F				C	F				F		F		F														F		F								C		
	3R-CC	386.39	A	M							R		R		C	F				F		F		F														F										C		
Crucidenticula nicobarica	4R-CC	393.6	C	M				R		R	R				C		C			F		F	R	F														F		F								C		
	5R-CC	403.06	C	P							R				R		C			F		F		F											R	R		R										F		
	6R-CC	417.28	A	M								R	R		F		C			F		C	F	F											R			F		F								C		
	7R-1	421.32	A	P							F	F	F		F		C			F		C	R	R														F		F								C		

Notes: Abundance abbreviations: A = abundant, C = common, R = rare, B = barren, r = reworked. Preservation abbreviations: G = good, M = moderate, P = poor. Sz = subzone. The column labeled "Benthics + *Chaetoceros*" records the presence of one or more of the following diatom genera: *Chaetoceros, Cocconeis, Dephineis, Diploneis, Rhaponeis,* and *Paralia.* Shaded intervals reflect uncertainty in placement of zonal boundaries.

Table T3. Diatom range distribution chart for Site 1040. (See table notes. Continued on next three pages.)

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus*	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ingens*	*Actinocyclus moronensis*	*Actinoptychus senarius* + *A. minutus*	*Annellus californicus*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cavitatus jouseanus*	*Cestodiscus peplum*	*Cestodiscus pulchellus*	*Coscinodiscus gigas* var. *diorama*	*Coscinodiscus lewisianus*	*Coscinodiscus lewisianus* var. *similis*	*Coscinodiscus marginatus*	*Craspedodiscus coscinodiscus*	*Crucidenticula nicobarica*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia fossilis*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Rhizosolenia praebergonii* var. *robusta*	*Rossiella paleacea*	*Thalassionema nitzschioides*	*Thalassiosira brunii*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira oestrupii*	*Thalassiosira praeconvexa*	*Thalassiosira tappanae*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Triceratium pileus*	Benthics + *Chaetoceros*
	170-1040B-																																								
	1H-CC	5.49	B																																						
	2H-CC	14.02	B																																						
	3X-CC	14.25	B																																						
	4X-CC	19.44	C	M																			F		r	R				r		C			R						F
Fragilariopsis doliolus	5X-CC	31.89	B																																						
	6X-CC	39.01	R	P					R			R													R	R															R
	7X-CC	46.5	B																																						
	8X-CC	56.4	B																																						
	9X-CC	73.04	C	P								R											R			F				r		R			C						F
	10X-CC	79.63	B																																						
	11X-CC	93.84	B																																						
	12X-CC	98.48	B																																						
	13X-CC	106.9	B																																						
	14X-CC	112.33	B																																						
	15X-CC	120.86	R	P					R																																R
	16X-8	132.43	B																																						
	17X-CC	135.42	B																																						
	18X-CC	147.17	B																																						
	19X-CC	160.7	B																																						
	20X-CC	171.11	B																																						
	21X-CC	179.26	B																																						
	170-1040C-																																								
Undetermined	1R-1, 123-124	160.53	B																																						
	1R-2, 113-114	161.93	R	P																												R									
	1R-2, 118-119	161.98	R	P																												R									
	1R-5, 39-40	165.69	B																																						
	1R-CC	166.94	B																																						
	2R-2, 122-125	171.52	R	P																												R									
	2R-5, 19-20	174.99	B																																						
	2R-CC	175.24	B																																						
	3R-2, 103-104	180.93	B																																						
	3R-CC	184.99	B																																						
	4R-CC	192.85	R	P					R																																R
	5R-2, 124-125	200.34	R	P					R										R													R									R
	5R-5, 49-50	204.09	F	P					F										R																						R
	5R-CC	206.14	B																																						
	6R-2, 124-125	210.04	B																																						

Table T3 (continued).

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus*	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ingens*	*Actinocyclus moronensis*	*Actinoptychus senarius* + *A. minutus*	*Annellus californicus*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cavitatus jouseanus*	*Cestodiscus peplum*	*Cestodiscus pulchellus*	*Coscinodiscus gigas* var. *diorama*	*Coscinodiscus lewisianus*	*Coscinodiscus lewisianus* var. *similis*	*Coscinodiscus marginatus*	*Craspedodiscus coscinodiscus*	*Crucidenticula nicobarica*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia fossilis*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Rhizosolenia praebergonii* var. *robusta*	*Rossiella paleacea*	*Thalassionema nitzschioides*	*Thalassiosira brunii*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira oestrupii*	*Thalassiosira praeconvexa*	*Thalassiosira tappanae*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Triceratium pileus*	Benthics + *Chaetoceros*
Undetermined	6R-5, 49-50	213.79	B																																						
	6R-CC	215.14	B																																						
	7R-2, 113-114	219.53	B																																						
	7R-CC	222.36	B																																						
	8R-2, 105-106	229.05	B																																						
	8R-5, 49-50	232.99	R	P					R																																R
	8R-CC	233.21	B																																						
	9R-2, 123-124	238.83	R	P					R										R																						R
	9R-5, 52-53	242.68	B																																						
	9R-CC	246.05	B																																						
	10R-2, 123-125	248.53	B																																						
	10R-5, 73-74	252.53	B																																						
	10R-CC	253.31	B																																						
	11R-2, 124-125	258.14	B																																						
	11R-5, 49-50	261.2	B																																						
	11R-CC	264.35	B																																						
	12R-2, 126-127	267.86	B																																						
	12R-5, 48-49	271.58	B																																						
	12R-CC	272.14	B																																						
	13R-2, 123-124	277.43	B																																						
	13R-5, 49-50	280.79	B																																						
	13R-CC	282.7	B																																						
	14R-2, 124-125	287.14	B																																						
	14R-5, 49-50	290.89	B																																						
	14R-CC	291.95	B																																						
	15R-2, 124-125	296.84	B																																						
	15R-5, 49-50	300.59	B																																						
	15R-CC	303.91	B																																						
	16R-1, 122-123	304.92	B																																						
	16R-CC	306.84	B																																						
	17R-1, 123-124	314.53	B																																						
	17R-CC	317.58	B																																						
	18R-2, 109-110	325.59	B																																						
	18R-CC	327.11	B																																						
	19R-1, 119-120	333.79	B																																						
	19R-CC	338.33	B																																						
	20R-2, 121-125	344.91	B																																						
	20R-5, 36-39	348.56	B																																						

Table T3 (continued).

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus*	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ingens*	*Actinocyclus moronensis*	*Actinoptychus senarius* + *A. minutus*	*Annellus californicus*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cavitatus jouseanus*	*Cestodiscus peplum*	*Cestodiscus pulchellus*	*Coscinodiscus gigas* var. *diorama*	*Coscinodiscus lewisianus*	*Coscinodiscus lewisianus* var. *similis*	*Coscinodiscus marginatus*	*Craspedodiscus coscinodiscus*	*Crucidenticula nicobarica*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia fossilis*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Rhizosolenia praebergonii* var. *robusta*	*Rossiella paleacea*	*Thalassionema nitzschioides*	*Thalassiosira brunii*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira oestrupii*	*Thalassiosira praeconvexa*	*Thalassiosira tappanae*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Triceratium pileus*	Benthics + *Chaetoceros*
Undetermined	20R-CC	350.78	B																																						
	21R-2, 124-125	354.54	B																																						
	21R-5, 48-49	358.28	B																																						
	21R-CC	361.64	B																																						
	22R-2, 123-125	364.13	R	P					R																																
	22R-5, 49-50	367.89	B																																						
	22R-CC	371.21	B																																						
	23R-2, 124-125	373.74	C	M					R			R											F	F		F						F			C						F
Fragilariopsis doliolus	23R-CC	376.2	F	M								R											R	R	r	F						F			F						F
	24R-2, 124-125	383.34	A	M																			F	C		F						F			C						
	24R-CC	385.6	C	M					R														F		r	F				r		F			F				R	r	R
	25R-CC	397.88	C	M					R			R		r									F	R	r	F				r		F			C					r	F
	26R-CC	405.74	C	M				r			R												F	R	r	F			r	r		F			F						R
	27R-CC	417.37	A	M	r							R											F			R						F			A						F
N. reinholdii	28R-2,125-150	420.37	F	P							R																		R	r											R
	28R-3,42-43	420.8	F	P								R											R	R		R				r		R			F						
	28R-CC	425.3	R	P																												R			R						F
	29R-3	432.57	F	G					R															R	R	R				r		F			F				R		F
	30R-CC	446.73	B																																						
	31R-CC	454.17	B																																						
	32R-CC	466.26	B																																						
	33R-CC	476.89	R	P															R							R															
	34R-3,125-150	487.96	F	M																							R								R	R			R		R
Undifferentiated *Nitzschia marina* to *Thalassiosira yabei*	34R-CC	483.46	F	M																												R			R				R		R
	35R-3,132-152	487.96	F	P															F					R							R								F		R
Actinocyclus moronensis	35R-4	491.79	C	P	r			R				R					r		F					F							R	R							F		F
	36R-CC	502.33	C	G				R				F					r					F						F			F	F	F					F	F	r	F
Craspedodiscus coscinodiscus	37R-CC	511.76	C	M								F					r			F		F									R		C					F	C		F
Coscinodiscus gigas var. *diorama*	38R-6	523.13	A	G		R						F			r	F	r					F									F	F						F	C	r	F
	39R-5	531.31	C	G			F									R	r	r			R	F									F							R	C	r	
Coscinodiscus lewisianus	40R-CC	544.31	A	M			F		R		R	C			F		C			F	C	F									F	F							C		F
	41R-CC	553.94	A	G			F	R				F					C				A										F	F					F		A		F
	42R-CC	563.46	A	M			C					R			F		F			F	A	F										F					F		A		

Table T3 (continued).

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus*	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ingens*	*Actinocyclus moronensis*	*Actinoptychus senarius* + *A. minutus*	*Annellus californicus*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cavitatus jouseanus*	*Cestodiscus peplum*	*Cestodiscus pulchellus*	*Coscinodiscus gigas* var. *diorama*	*Coscinodiscus lewisianus*	*Coscinodiscus lewisianus* var. *similis*	*Coscinodiscus marginatus*	*Craspedodiscus coscinodiscus*	*Crucidenticula nicobarica*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia fossilis*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Rhizosolenia praebergonii* var. *robusta*	*Rossiella paleacea*	*Thalassionema nitzschioides*	*Thalassiosira brunii*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira oestrupii*	*Thalassiosira praeconvexa*	*Thalassiosira tappanae*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Triceratium pileus*	Benthics + *Chaetoceros*
Cestodiscus peplum subzone B	43R-CC	568.57	A	M			F							R	F		F			F	A	F																	A		
	44R-CC	579.31	A	M			F					F		R	F		F				C																F		A		
	45R-CC	590.02	A	G			C		R					R	C		F		F		A										F	F							A		
	46R-CC	598.86	A	G										R	C					F	A										F								A		
	47R-CC	611.78	A	G			C	R				F		R	F		R		C	F	C										F	F							A		
	48R-CC	621.45	A	M			F						F	R	C		R		F		F	R									R	F							A		
	49R-6	629.99	A	M									F	F	F		F		F		C										R								A		
Cestodiscus peplum subzone A	50R-6	638.28	A	M						R			F						F		C	F									F								A		
	51R-CC	646.55	B																																						

Notes: Abundance abbreviations: A = abundant, C = common, R = rare, B = barren, r = reworked. Preservation abbreviations: G = good, M = moderate, P = poor. Sz = subzone. The column labeled "Benthics + *Chaetoceros*" records the presence of one or more of the following diatom genera: *Chaetoceros, Cocconeis, Dephineis, Diploneis, Rhaponeis,* and *Paralia.* Shaded intervals reflect uncertainty in placement of zonal boundaries.

Table T4. Diatom range distribution chart for Site 1041. (See table notes. Continued on next two pages.)

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus*	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ellipticus* f. *lanceolata*	*Actinocyclus ingens*	*Actinocyclus moronensis*	*Actinoptychus senarius* + *A. splendens*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cestodiscus pulchellus*	*Coscinodiscus lewisianus*	*Coscinodiscus marginatus*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia fossilis*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Rhizosolenia praebergonii* var. *robusta*	*Rhizosolenia praebergonii*	*Rossiella paleacea*	*Rossiella praepaleacea*	*Thalassionema nitzschioides*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira miocenica*	*Thalassiosira oestrupii*	*Thalassiosira praeconvexa*	*Thalassiosira tappanae*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Triceratium pileus*	Benthics + *Chaetoceros*
	170-1041A-																																				
Fragilariopsis doliolus	1H-1	0	A	G								F					C			F				r				F			A				F		
	1H-1, 60-62	0.62	C	M								C					F	F		F				r				R			F				R		
	1H-2, 78-80	2.3	C	M													F	T		F				r				R			C	r					
	1H-2, 124-125	2.74	C	M								F					F	F		F								F			C						
	1H-2, 140-142	2.92	C	M								R					F	R		C					r			R			C				F	r	
	1H-3, 99-101	4.01	C	M								F					F	R		F								R			F				F		
Undetermined	1H-3, 124-126	4.5	B																																		
	1H-CC	7.35	R	P						R																									R		
	2H-1, 135-150	8.85	F	M						R	R	R						R	F	R			R		r			R			F					R	
	2H-2, 123-124	10.13	F	P								R								R						R		R			F						
	2H-CC	14.03	F	P						R		R							F	R			R					R			F				R		
	3X-2, 124-125	17.04	R	P																																	
	3X-CC	21.12	F	P						R						r										r									R		R
	4X-CC	24.92	R	P																											R						
	5X-CC	34.21	B																																		
	6X-3, 144-145	39.84	F	P					r	R					F									R				F			F						F
	6X-CC	41.23	F	P						R								R	R					R				R			R						
	7X-5, 49-50	47.99	F	P															R	F				R				F			F						F
	7X-CC	50.7	R	M															R	R				R							R						
	8X-CC	60.46	R	M														R		R								R			R						
	9X-2, 122-124	62.32	F	P															R	R							R				F						R
	9X-CC	69.22	B																																		
	10X-CC	76.23	R	P						R																											
	11X-1, 125-126	79.45	F	P						R		R							F	R											F						R
	11X-CC	84.99	R	P						R																		R			R						
	12X-CC	96.19	B																																		
	13X-2, 27-29	99.09	R	P																																	R
	13X-CC	100.78	B																																		
	14X-CC	112.18	R	P																																	
	15X-5, 49-50	121.51	R	P																																	R
	15X-CC	125.09	B																																		
	16X-CC	134.25	B																																		
	17X-2, 37-39	137.15	C	G			r			F	R	F		r	F			R			r						F	C			C						F
	17X-CC	137.48	F	P																															F		
	18X-2, 121-125	147.73	R	P						R					R												R				R					r	R
	18X-CC	151.48	R	P																															R		

Table T4 (continued).

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus*	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ellipticus* f. *lanceolata*	*Actinocyclus ingens*	*Actinocyclus moronensis*	*Actinoptychus senarius* + *A. splendens*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cestodiscus pulchellus*	*Coscinodiscus lewisianus*	*Coscinodiscus marginatus*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia fossilis*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Rhizosolenia praebergonii* var. *robusta*	*Rhizosolenia praebergonii*	*Rossiella paleacea*	*Rossiella praepaleacea*	*Thalassionema nitzschioides*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira miocenica*	*Thalassiosira oestrupii*	*Thalassiosira praeconvexa*	*Thalassiosira tappanae*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Triceratium pileus*	Benthics + *Chaetoceros*
	170-1041B-																																				
Undetermined	1R-2, 124-125	157.74	R	P											R													R									R
	1R-CC	161.05	R	P						R				r																							
	2R-2, 122-125	167.32	R	P											R													R									R
	2R-CC	170.76	R	P						R			r																		R				R		
	3R-CC	181.59	R	P						R		R																			R						
	4R-2, 124-125	186.54	F	P						R					R													F									R
	4R-CC	193.38	R	P						R																					R						
	5R-1, 124-125	194.74	F	P			r			F					F					R											F						F
	5R-CC	200.44	R	P						R																											
	6R-2, 124-125	205.64	F	P			r								R																	R					F
	6R-CC	208.67	F	M						R		F																			F						
Thalassiosira convexa	7R-1, 32-33	213.02	A	M				r		F	R	C	r		F			F		F			F				R	A	F		C					r	F
	7R-CC	219.91	C	M		r					R	F	r					R		R		r	F					R		R	F					r	
	8R-2, 52-53	224.15	A	G	r			r		R	F		R							R			F			R		A	R						F		C
	8R-CC	226.59	F	P			r	r	r	R		F	r							R	R		F					R	R	R			r			r	
	9R-1, 122-123	233.12	F	P						R					R													F									F
	9R-CC	236.61	C	M						R		F									F		F					F	F						F		
	10R-1, 124-125	242.84	A	G						R					F					C	C		R						C	R		R		r	F		F
	10R-CC	247.56	C	M					r	R	R	R						R		R	F							R	F			F			R	r	
	11R-CC	258.03	C	M					r	R		F						R		R	F		R					R	F			F		r	F	r	
	12R-CC	268.08	C	P		r			r	R		R	r	r				R		R	F		R					R				F		r	R	r	
	13R-2, 124-125	273.24	C	M						F			r										R					C	F						C		F
Nitzschia miocenica	13R-CC	275.21	F	P						R		R	r					R		R	F										R	R			R		
	14R-CC	285.19	F	P	r							R			R						R							R							R		
	15R-CC	290.39	R	P																								R			R				R		
	16R-CC	304.88	B																																		
	17R-2, 124-125	311.94	B																																		
	17R-CC	314.18	B																																		
	18R-CC	321.3	F	P						R		R			R						R							R			R				R		
	19R-4, 49-50	332.84	B																																		
	19R-CC	333.82	B																																		
	20R-CC	344.47	R	P						R																		R			R				R		
	21R-CC	351.65	R	P								R								R								R							R		
	22R-CC	361.72	R	P	r																							R							R		
	23R-CC	370.49	F	M		r				R		R						R		R	R					F					R	R			R		
	24R-2, 124-125	379.14	A	G			r	r		F	R	R			F						R					F		A	R		R			r	A	r	F
	24R-CC	381.32	F	M																R	R		R			R		F			F				F		

Table T4 (continued).

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus*	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ellipticus* f. *lanceolata*	*Actinocyclus ingens*	*Actinocyclus moronensis*	*Actinoptychus senarius* + *A. splendens*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cestodiscus pulchellus*	*Coscinodiscus lewisianus*	*Coscinodiscus marginatus*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia fossilis*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Rhizosolenia praebergonii* var. *robusta*	*Rhizosolenia praebergonii*	*Rossiella paleacea*	*Rossiella praepaleacea*	*Thalassionema nitzschioides*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira miocenica*	*Thalassiosira oestrupii*	*Thalassiosira praeconvexa*	*Thalassiosira tappanae*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Triceratium pileus*	Benthics + *Chaetoceros*
	25R-CC	388.22	F	P						R			R		R													R			R					r	
	170-1041C-																																				
Nitzschia porteri	1R-1,134-135	389.57	C	M		R				R	R	R								R		R	R			F					F				F		
	1R-CC	397.61	R	P																R											R				R		
	2R-CC	407.51	F	M		R					R									R		R	R			R		F			R				F		
	3R-CC	415.54	F	P																R		R				R					R				R		

Notes: Abundance abbreviations: A = abundant, C = common, R = rare, B = barren, r = reworked. Preservation abbreviations: G = good, M = moderate, P = poor. Sz = subzone. The column labeled "Benthics + *Chaetoceros*" records the presence of one or more of the following diatom genera: *Chaetoceros, Cocconeis, Dephineis, Diploneis*, *Rhaponeis,* and *Paralia.* Shaded intervals reflect uncertainty in placement of zonal boundaries.

Table T5. Diatom range distribution chart for Site 1042.

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus moronensis*	*Actinoptychus senarius*	*Azpeitia nodulifer*	*Cestodiscus pulchellus*	*Coscinodiscus lewisianus*	*Coscinodiscus marginatus*	*Crucidenticula nicobarica*	*Denticulopsis hustedtii*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia reinholdii*	*Rossiella paleacea*	*Thalassionema nitzschioides*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira miocenica*	*Thalassiosira oestrupii*	*Thalassiosira praeconvexa*	*Thalassiothrix longissima*	Benthics + *Chaetoceros*
Undetermined	170-1042A-																						
	1R-CC	49.93	R	P													R					R	
	2R-2, 1-2	96.93	B																				
	2R-CC	97.73	B																				
	3R-1, 124-125	154.94	B																				
	3R-CC	156.26	R	P		R											R					R	
Thalassiosira convexa to *Nitzchia miocenica*?	4R-2, 48-49	203.44	C	M										R			C		r				F
	4R-CC	203.92	R	P		R											R					R	
	5R-CC	212.88	C	P				r		R				R	R	r	F	F		r		F	
	6R-CC	223.18	F	M		R								F	R		R	R		r	F	R	
	7R-2, 48-50	231.18	F	P									R	R									F
Undetermined	7R-CC	231.65	R	P	r			r	r								R					R	
	170-1042B-																						
	1R-1, 0-4	316	R	P																			
	3R-CC	333.26	R	P																		R	
Coscinodiscus lewisianus?	4R-1, 73-75	334.01	F	M				R	R		R	F											
Undetermined	5R-2, 27-28	352.3	B																				
	5R-3, 54-55	354.33	R	F						R													R
	5R-CC	354.72	R	P			R			R							R					R	
	6R-CC	363.14	B																				
	8R-CC	383.47	R	P						R													

Notes: Abundance abbreviations: A = abundant, C = common, R = rare, B = barren, r = reworked. Preservation abbreviations: G = good, M = moderate, P = poor. Sz = subzone. The column labeled "Benthics + *Chaetoceros*" records the presence of one or more of the following diatom genera: *Chaetoceros, Cocconeis, Dephineis, Diploneis, Rhaponeis,* and *Paralia.* Shaded intervals reflect uncertainty in placement of zonal boundaries.

Table T6. Diatom range distribution chart for Site 1043. (See table notes. Continued on next page.)

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ellipticus* f. *lanceolata*	*Actinocyclus moronensis*	*Actinoptychus senarius*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cestodiscus pulchellus*	*Coscinodiscus lewisianus*	*Coscinodiscus marginatus*	*Crucidenticula nicobarica*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia cylindrica*	*Nitzschia fossilis*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Thalassionema nitzschioides*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira oestrupii*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Rhizosolenia praebergonii* var. *robusta*	*Rossiella praepaleacea*	Benthics + *Chaetoceros*
	170-1043A-																														
	1H-2, 124-125	2.74	F	P																						F		F			
	1H-5, 49-50	6.49	F	P						F						R										F		R			
	1H-CC	7.99	F	P						R	r	r	R											R		R		R			
Fragilariopsis doliolis	2H-2, 124-125	10.74	A	G						F						F				F						A		C			
Undetermined	2H-5, 49-50	14.49	B																												
	2H-CC	16.89	B																												
	3X-2, 123-124	19.63	B																												
	3X-CC	21.5	B																												
	4X-1, 60-61	25	R	P											r									R		R					
	4X-2, 124-125	27.14	R	P										r										R							
	4X-5, 48-49	29.38	R	P																				R							
	4X-CC	29.76	B																												
	5X-2, 122-125	36.12	R	P																				R							
	5X-CC	38.93	B																												
	6X-CC	48.63	F	P																R				R		R		R	r		
	7X-2, 120-123	54.81	B																												
	7X-5, 48-49	58.47	B																												
	7X-CC	59.68	R	P				R																					r		
	8X-2, 123-124	64.33	B																												
	8X-5, 48-49	67.98	B																												
	8X-CC	69.48	R	P				R																							R
	9X-2, 118-119	73.88	B																												
	9X-5, 48-49	77.69	R	P				R																							
	9X-CC	80.69	B																												
	10X-1, 124-125	81.94	B																												
	10X-4, 49-50	85.69	R	P																											R
	10X-CC	86.18	R	P																				R	R			R			
	11X-1, 123-124	91.53	R	P																				R							R
	11X-CC	94.82	R	P																				R				R			
	12X-2, 123-124	102.63	R	P																											R
	12X-5, 47-48	106.73	F	P												R			F	R						F					
	12X-CC	109.71	R	P						R					r									R		R		R	r		
Fragilariopsis doliolis to *Nitzschia reinholdii*	13X-2, 49-50	111.49	C	M						R						R				F				F		F		F			
	13X-2, 123-125	112.23	C	M						R						R			R	F				F		F		F			F
	13X-4, 49-50	114.49	C	M						R						R			R	F				F		F		F			F
Undetermined	13X-CC	117.14	B																												
	14X-2, 124-125	121.94	F	P																				F		R					
	14X-5, 48-49	125.68	F	P																R						F					
	14X-CC	126.35	B																												
	15X-1, 49-50	129.19	F	P									F							F			R			F					
Fragilariopsis doliolis	15X-CC	130.31	C	M						R						R				F				F		F		F			
Undetermined	16X-2, 48-51	140.28	R	P				R																							R
	16X-2, 122-125	141.02	B																												
	16X-3, 45-48	141.75	R	P									R																		
	16X-4, 48-50	143.28	B																												
	16X-CC	144.52	R	P																				R							
	17X-1, 121-122	149.11	R	P																											R
Fragilariopsis doliolis	17X-CC	151.81	A	M		r		R	R	F						F				F				C		C		F	r		
	18X-1, 124-125	158.74	A	G				R	R	F						F				F				C		C		F	r		
	18X-3, 48-49	160.98	A	G				R	R	F						F				F				C		C		F	r		
	18X-CC	161.52	C	M					R							F	R			F				F		F		R	r		
	19H-CC	176.9	C	M						F						F				F				F		C		R			
	20X-CC	181.89	C	P												R				F				R		F		R			
	21X-CC	195.13	F	P												R			R	R				R		R		R	r		
Nitzschia reinholdii	22X-CC	205.45	F	P						R						R			R	F			R	F		F			r		
	23X-CC	214.47	B																												
	24X-CC	224.53	R	P															R	R				R		R			R		

Table T6 (continued).

Diatom zone	Core, section, interval (cm)	Depth (mbsf)	Abundance	Preservation	*Actinocyclus ellipticus* var. *javanica*	*Actinocyclus ellipticus* f. *lanceolata*	*Actinocyclus moronensis*	*Actinoptychus senarius*	*Asteromphalus elegans*	*Azpeitia nodulifer*	*Cestodiscus pulchellus*	*Coscinodiscus lewisianus*	*Coscinodiscus marginatus*	*Crucidenticula nicobarica*	*Denticulopsis hustedtii*	*Fragilariopsis doliolus*	*Hemidiscus cuneiformis*	*Nitzschia cylindrica*	*Nitzschia fossilis*	*Nitzschia marina*	*Nitzschia miocenica*	*Nitzschia porteri*	*Nitzschia reinholdii*	*Thalassionema nitzschioides*	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira oestrupii*	*Thalassiosira yabei*	*Thalassiothrix longissima*	*Rhizosolenia praebergonii* var. *robusta*	*Rossiella praepaleacea*	Benthics + *Chaetoceros*
Nitzschia marina	25X-CC	234.33	R	P															R	R				R	R	R		R			
	26X-CC	241.91	B																												
	27X-CC	253.55	B																												
	28X-CC	263.13	F	P						R									R					F		F		F			
Thalassiosira convexa	29X-CC	272.84	A	G						F		r						R			R	R		C				C		R	
Actinocyclus moronensis	30X-CC	282.26	A	G	F	R	R				r				C		F					R		C			R	A			

Notes: Abundance abbreviations: A = abundant, C = common, R = rare, B = barren, r = reworked. Preservation abbreviations: G = good, M = moderate, P = poor. Sz = subzone. The column labeled "Benthics + *Chaetoceros*" records the presence of one or more of the following diatom genera: *Chaetoceros, Cocconeis, Dephineis, Diploneis, Rhaponeis,* and *Paralia.* Shaded intervals reflect uncertainty in placement of zonal boundaries.