Paull, C.K., Matsumoto, R., Wallace, P.J., and Dillon, W.P. (Eds.), 2000
Proceedings of the Ocean Drilling Program, Scientific Results, Vol. 164

35. *DATA REPORT:* LATE MIOCENE TO PLEISTOCENE DIATOMS FROM THE BLAKE RIDGE, SITE 997[1]

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INTRODUCTION

Ocean Drilling Program Site 997 is located on the Blake Ridge, which underlies a periphery of the subtropical central gyre and is under the profound influence of the warm saline Gulf Stream as well as the Western Boundary Undercurrent (WBUC), which carried the clastic materials to the Blake Ridge as sediment drift (Fig. 1). The shipboard study of nannofossils and sedimentary particles revealed a downward increase in sedimentation rate and a higher concentration of diatoms in three stratigraphic intervals (Shipboard Scientific Party, 1996). Thus, the stratigraphic change in diatom accumulation rate is important to understand the paleoceanographic and depositional history of this region.

We have been studying the time-progressive change of diatom flora at Site 997 by quantitatively observing the flora in 141 samples selected from the entire sequence recovered from Holes 997A and 997B. These samples were chosen to represent a time interval of 50 k.y. Some of the results currently obtained through this study are presented in this data report.

METHODS AND PROCEDURES

A set of strewn slides was prepared by a modified technique of the one described in Koizumi (1980, 1992). After drying in an oven at 50°C for 24 hr, 0.1g (± 5%) of the sample was boiled in a 100-mL beaker with ~10 mL of hydrogen peroxide solution (15% strength) for several minutes, and then 20 mL of 10% hydrochloric acid solution was added. After boiling 5 min, the beaker was filled with distilled water and left to stand for 5 hr. The supernatant of the suspension was poured off, and the beaker was filled again with distilled water. This decanting process was repeated four times to dilute acid from the suspension. The residue was diluted with 100 mL of distilled water and homogenized for about 3 seconds in an ultrasonic bath. By using a micropipette, 0.5 mL of this solution was spread on a square cover glass (18 × 18 mm) and dried on a hot plate at 50°C. The prepared cover glass was mounted on a glass slide by using Pleurax.

All diatoms were identified and counted under a light microscope with magnification of 600× until the total number exceeded 200 (resting spores of *Chaetoceros* spp. were not included). The counting was accomplished by observing up to ten traverses spanning the entire width of cover glass. For slides with low concentrations of diatoms, the total counts did not reach 200 specimens. Specimens representing more than one-half of a valve of centric diatom were counted, except for genus *Rhizosolenia* and *Proboscia* for which caryptrae were counted. For the pennate diatoms, one half of the observed number of the end parts were counted as the respective valves. Because the weight of sediment on a cover glass is calculable, the abundance of diatom valves (#/g) was obtained from a number of transects and the total counts of diatom valves. The result obtained from this counting procedure is presented in Table 1.

DIATOM ABUNDANCE AND SEDIMENTATION RATE

The diatom abundance fluctuates significantly between 0 and several millions per 1 g of sediment (Fig. 2). In the lower sequence (Miocene and lower Pliocene, 750–300 mbsf), the occurrence of diatoms is generally high between 400 and 600 mbsf but is greatly diminished both below and above this interval. In the upper 300-m sequence corresponding to the upper Pliocene and Quaternary, meanwhile, there are four short intervals showing particularly high diatom numbers: 240–270, 150–180, 70–120, and 40–60 mbsf. In the other intervals, the abundance drops to very low levels ($<1 \times 10^6$).

According to the shipboard investigation of smear slides (Shipboard Scientific Party, 1996), calcareous nannofossils occupy 10% of the sediment throughout the entire sequence except in the uppermost 20 m, where they occupy 20% of the sedimentary composition (Fig. 2). Clay minerals, meanwhile, fluctuate greatly between 40% and 80%, and there seems a reversed relationship between the diatom number and clay mineral abundance. Although the shipboard party postulated an increased supply of diatoms as the cause of the increased sedimentation rate, the diatom number is fairly high in some intervals of the upper 110-m sequence where the sedimentation rate is significantly slow.

A comparison in distribution of the averaged diatom abundances within the upper 110-m sequence and in the lower sequence revealed an opposite trend (Fig. 3). The diatom abundance shows a negative trend with the decreased sedimentation rate within the upper sequences, whereas the relationship is positive in the lower sequence. The negative correlation in the upper sequence means that the increase of sedimentary particles other than diatoms had contributed to the increased sedimentation rate. Also, the abundance of clay-size particles decreases drastically in some intervals of the upper sequence, contrasting sharply with the relatively stable trend observed in the lower sequence (Fig. 2). Such a drastic reduction of the clay-sized particles indicates winnowing in the upper sequence.

On the other hand, the weak but definitely positive correlation between the averaged diatom abundance and sedimentation rate means that an increased supply of diatoms had contributed to the increased sedimentation rate for the uppermost Miocene to lowest Pliocene sequence, where the diatom abundance is significantly higher than the adjoining intervals (Fig. 2). This interpretation is also supported by the significant increase in resting spores of genus *Chaetoceros* in this high sedimentation–rate interval (Fig. 4).

STRATIGRAPHIC DISTRIBUTION OF MAJOR SPECIES

Age assignment based on the calcareous nannofossil biostratigraphy (Okada, Chap. 33, this volume) was the basis for the age model used in this study: the oldest sediment recovered from Hole 997B is

[1]Paull, C.K., Matsumoto, R., Wallace, P.J., and Dillon, W.P. (Eds.), 2000. *Proc. ODP, Sci. Results,* 164: College Station, TX (Ocean Drilling Program).

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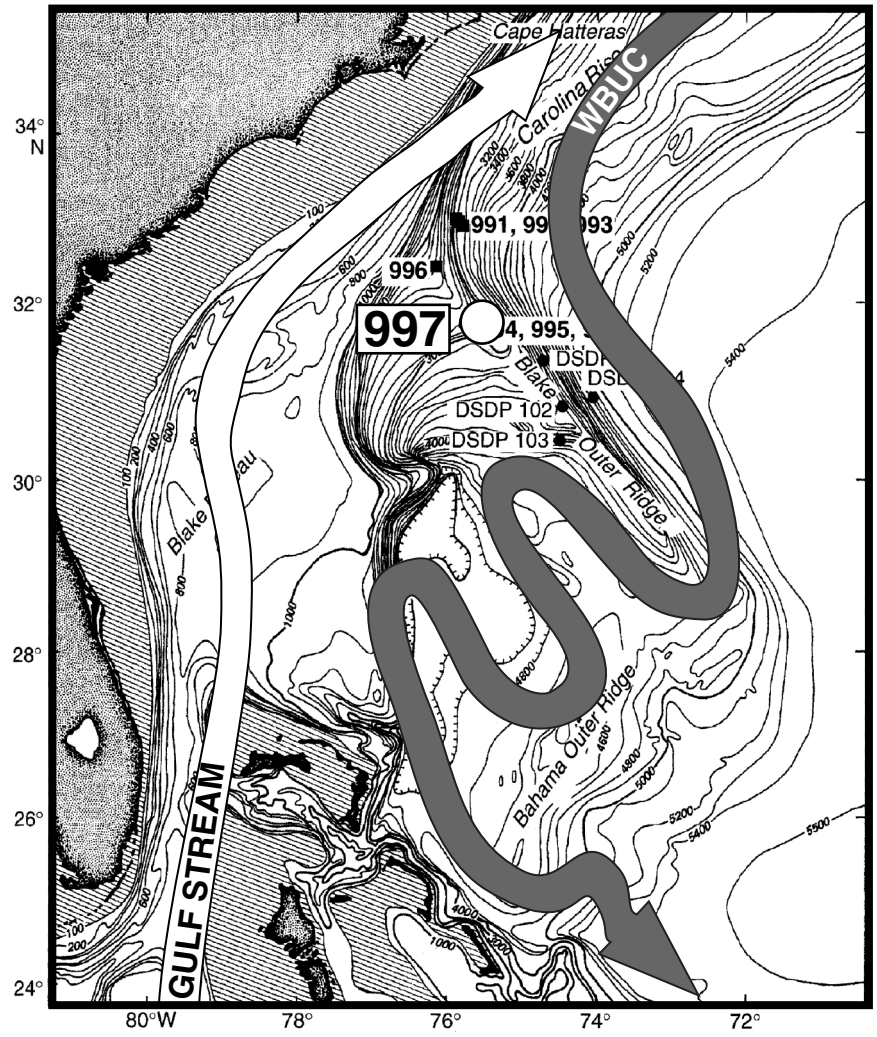

Figure 1. Location of Leg 164 Site 997 and the course of the two major current systems. The course of the Western Boundary Undercurrent (WBUC) and the Gulf Stream is adopted from Faugères et al. (1993).

6.6Ma. The most abundant species in Holes 997A and 997B is *Paralia sulcata*, a typical shallow-water species, and there are other shallow-water species also occur as major components of the flora (Fig. 4). The cold-water species such as *Actinocyclus curvatulus* and *Coscinodiscus marginatus* are present, but their numbers are limited (Table 1). Although the absolute abundance is low, a group of freshwater species such as *Achnanthes* spp., *Aulacoseira* spp., *Cocconeis* spp., and *Opephora* spp. register temporary increases at 3.2, 2.6, 2.4, and 1.1 Ma (Table 1). This evidence indicates a heavy reworking of diatoms. Probably the majority of reworked diatoms were transported from nearby shallow areas and not from the subarctic Atlantic by the WBUC.

Taxa indicating high primary production, such as *Thalassionema nitzschioides* and resting spores of genus *Chaetoceros,* are abundant in the intervals corresponding to the time periods of 6.0–4.8 and 3.0–2.8 Ma. Because the total diatom abundance is also high within these intervals, it is postulated that the primary production was increased during these time intervals at this site. The increased abundance of reworked brackish water species *P. sulcata* and *Melosira westii* in these intervals may also indicate an increased productivity at a shallow source area. Other major taxa include warm-water species such as *Thalassiosira eccentrica*, *Azpeitia nodulifera*, *Fragilariopsis doliola,* and *Planktoniella sol*. The distribution characteristics of these major taxa is correlative to the sea-level curve of Haq et al. (1987) in the upper sequence, but the relationship is not clear in the lower sequence. The floral succession of the last six and a half million years is summarized into five stages.

Stage 1: Low-Productivity Stage (6.6–6.0 Ma)

Diatoms are scarce, and the maximum abundance reaches only to 1.1×10^6/g.

Stage 2: High-productivity Stage (6.0–4.8 Ma)

Diatoms are generally high but fluctuating throughout this interval (on the order of 10^6–10^7). In addition to the shallow-water species *P. sulcata* and *M. westii*, *T. nitzschioides*, a high-productivity indicator, and *T. eccentrica*, a pelagic warm-water species, are abundant. Therefore, it is likely that the productivity was high at this site as well as at nearby continental shelves, possibly because of an eastward shift of gyre margin. This high-productivity period doesn't correlate to the sea-level curve that shows a gradual rise of sea level throughout this period.

Stage 3: Low-productivity Stage (4.8–3.6 Ma)

Diatom abundance is consistently low (in the order of 10^4–10^5/g), and the maximum value recorded in this interval is 1.9×10^6. The abundance pattern also doesn't show a significant correlation with the sea-level curve.

Stage 4: Fluctuating Productivity Stage (3.6–0.8 Ma)

Diatom abundance fluctuates as in Stage 2, but the wave length is longer and the degree of fluctuation is much greater. There seems to

Table 1. Distribution chart of diatom species at Site 997.

Core, section, interval (cm)	Depth (mbsf)	Age (Ma)	Abundance (10^4/g)	*Actinocyclus curvatulus*	*A. elongatus*	*A. ingens*	*A. octonarius*	*A.* spp.	*Actinoptychus heliopelta*	*A. intermedius*	*A. senarius*	*A. splendens*	*A. vulgaris*	*Asterolampra* sp.	*Asteromphalus arachne*	*Azpeitia africana*	*A. nodulifera*	*A. vetustissima*	*A. tabularis*	*Bacillaria paxillifer*	*Bacteriastrum* spp.	*Biddulphia* spp.	*Cavitatus jouseana*	*Coscinodiscus aff. antinimos*	*C. denarius*	*C. marginatus*	*C. nitidus*	*C. obsculus*	*C. oculusiridis*	*C. perforatus*	*C. plicatus*	*C. radiatus*	*C.* spp.	*Cyclotella striata*	*C. stylorum*	*C.* sp. 1	*C.* sp.	*Cymatosira immunis*	*C.* sp.
164-997A-																																							
1H-1, 39-41	0.39	0.02	11.50																								1						2					
1H-CC, 0-1	2.75	0.11	17.57								1																1				1		1					
2H-2, 114-116	5.54	0.22	5.12				1										2																					
2H-4, 39-41	7.79	0.29	18.86				1				1																											
2H-5, 114-116	10.04	0.35	172.87				7				10	1					1					1			1	10		2	1	1	6							
3H-1, 39-41	12.79	0.43	57.93				5				2	1										1				1	1			1	2		3					
3H-2, 114-116	15.04	0.48	3.94																																			
3H-4, 114-116	18.04	0.53	0.25																																			
3H-6, 39-41	20.29	0.58	4.36																																	1		
4H-1, 114-116	23.04	0.62	311.68				2				1						1											1										
4H-3, 39-41	25.29	0.67	3.99				1																															
4H-6, 114-116	30.54	0.76	0.00																																			
5H-2, 39-41	33.29	0.81	538.12				4				1													2		6			2			4						
5H-3, 114-116	35.54	0.85	273.74				1				2		5				1	2	1		1			1		1			1			2						
5H-5, 39-41	37.79	0.89	455.78				4				10		1				1	3	2		1			2		1						3						
5H-6, 114-116	40.04	0.93	467.42	3			6				2		9													2						22		1				
6H-2, 39-41	42.79	0.98	341.33				1				11							2										1				1						
6H-4, 39-41	45.79	1.08	239.26								2		1				2		1		1	1					1											
6H-5, 114-116	48.04	1.26	724.10								2		2														1			1	22						
6H-7, 39-41	50.29	1.32	804.96								3						1			1		2				1		1			4						
8H-2, 114-116	55.54	1.46	0.97																			1															
8H-4, 49-51	57.94	1.50	0.73				2																															
8H-5, 114-116	60.09	1.52	0.00																																			
9H-1, 114-116	62.54	1.56	0.00																																			
9H-3, 114-116	65.54	1.60	0.00																																			
9H-5, 49-51	67.89	1.63	0.00																																			
9H-6, 114-116	70.04	1.65	0.61																																			
10H-2, 49-51	72.79	1.69	19.72																																			
10H-4, 49-51	75.74	1.79	479.14	1							3						2					1				1					3						
10H-5, 114-116	77.89	1.86	326.21								4						1					1				1					1		1	1				
10H-7, 49-51	80.24	1.94	129.82														1					1												1	3	1		
11H-1, 114-116	81.54	1.97	524.58				3				3						3					1				6					3						
11H-2, 114-116	83.04	2.00	95.41				2				4																											
11H-4, 49-51	85.39	2.04	431.02				6				1				1		1					1				21					1			1				
11H-5, 114-116	87.54	2.08	83.54									1														7					1						
11H-CC, 29-30	90.39	2.14	35.07					1																		1					1						
12H-2, 114-116	92.54	2.18	73.66								2	1							1			2										1				1		
12H-4, 114-116	95.54	2.24	121.43				1				3											2									2						
12H-6, 49-51	97.81	2.28	9.40														1																					
13H-1, 49-51	99.89	2.32	139.68				5											1				3				3					2				1		
13H-3, 114-116	102.62	2.37	344.17				1				1						12	1			1	2				9	1		1		2						
13H-5, 114-116	105.62	2.43	260.93					1			1						15									3		1			1				2	1	
13H-7, 49-51	107.97	2.48	200.94				1				2						2					1		2			1		1		1						
14H-2, 114-116	110.37	2.51	251.01	2			5				10						2		2		1					1				1	3			1		1	
14H-4, 49-51	112.72	2.52	82.20	1							2											2															
14H-6, 114-116	115.72	2.54	388.35	2			4			2	9						2				1	1									8						
14H-7, 114-116	117.87	2.55	338.18	1			1			2	5						1					1									4						
15H-2, 49-51	120.39	2.56	316.43	1			1				11								3								1				3						
15H-3, 114-116	122.54	2.57	323.91	4							4									1	1			2			1				3				1	1	
15H-5, 114-116	125.54	2.59	34.90	1							1											1					1										
15H-7, 49-51	127.89	2.61	211.22	2	1						3																				6						
16H-2, 49-51	129.89	2.62	37.98								2												1			1											
16H-4, 49-51	132.89	2.64	18.52	2			1				1															1											
16H-5, 114-116	135.04	2.65	7.95								1																											
17H-1, 49-51	137.89	2.67	17.42								1																											
17H-2, 114-116	140.04	2.68	32.88								2																											
17H-4, 114-116	143.04	2.70	50.08	2			3		3		2						1				1	1									1					3	
17H-6, 49-51	145.29	2.72	362.85	1			2				3						2				1	2															
19H-1, 49-51	148.39	2.74	335.57	1			2				3	1					2		1			1				1					3						
19H-3, 114-116	151.37	2.76	82.42	2		1	4				2											3	1			3					3						
20H-2, 49-51	159.39	2.80	370.21	1			2				3						5		1							2					3						
20H-7, 49-51	166.89	2.85	554.55				3				5						2		1												2						
22X-2, 31-33	174.41	2.89	629.45				4				4						13				1	1							1		2		1				
22X-7, 28-30	181.27	2.92	652.67	3			1				3						3		1			2									1		1				
26X-1, 38-40	203.78	3.05	8.15				1																														
27X-1, 30-32	212.3	3.09	44.23				1				1																										
27X-6, 30-32	219.44	3.13	10.96																																		
28X-CC, 0-1	225.06	3.16	22.70								1																										
30X-2, 29-31	234.09	3.21	135.13				7				2	1					2					1			1		1				1						
31X-1, 60-62	241.5	3.25	198.01				1				5																									3	
31X-CC, 0-1	248.59	3.29	618.86	1			4				2										1	1									3						
32X-5, 27-29	256.77	3.33	12.31														1																				
34X-3, 27-29	264.3	3.38	14.37																												1						
35X-2, 29-31	271.24	3.41	493.92	2			4				2	3							1			1									2		2			1	
36X-2, 30-32	279.85	3.46	44.75								2											1				1											
36X-CC, 30-32	285.53	3.49	188.45				7				2	2										1					1				3					1	
37X-4, 30-32	293.7	3.54	26.98				1				1																								1		
38X-3, 30-32	301.8	3.58	15.15								2																											
39X-1, 30-32	308.4	3.62	12.44																																			
39X-6, 30-32	315.9	3.67	68.35								1	2			1				1			1															

Table 1 (continued).

Core, section, interval (cm)	Depth (mbsf)	Age (Ma)	Abundance (10^4/g)	*Delphineis angustata*	*D. surirella*	*D.* spp.	*Denticulopsis dimorpha*	*D. hustedtii*	*Diploneis* spp.	*Epithemia* spp.	*Fragilariopsis doliola*	*Glyphodesmis acus*	*Goniothecium* sp.	*Grammatophora* spp.	*Hantzschia amphioxys*	*Hemiaulus* spp.	*Hemidiscus cuneiformis*	*H. ovalis*	*Hyalodiscus* sp. A	*Hyalodiscus* sp. B	*Koizumia adaroi*	*K. tatsunokuchiensis*	*Lylella henneedyi*	*Melosira architecturaris*	*M. westii*	*M.* spp.	*Neodelphineis pelagica*	*Neodenticula kamchatica*	*N. seminae*	*Nitzschia constricta*	*N. cylindrica*	*N. granulata*	*N.* fossilis	*N. jouseae*	*N. lorenziana*	*N. marina*	*N. miocenica*	*N. pandriformis*	*N. reinholdii*
164-997A-																																						
1H-1, 39-41	0.39	0.02	11.50											2										2								1							
1H-CC, 0-1	2.75	0.11	17.57						1		2			2					2						2	1					1							
2H-2, 114-116	5.54	0.22	5.12																						2													
2H-4, 39-41	7.79	0.29	18.86																													1	1						
2H-5, 114-116	10.04	0.35	172.87		1				2					2					3																1			
3H-1, 39-41	12.79	0.43	57.93		1				3					1					7						2							1						
3H-2, 114-116	15.04	0.48	3.94																																			
3H-4, 114-116	18.04	0.53	0.25																																			
3H-6, 39-41	20.29	0.58	4.36																																			
4H-1, 114-116	23.04	0.62	311.68		7				4					1					1				1			1												
4H-3, 39-41	25.29	0.67	3.99		1										2										1												
4H-6, 114-116	30.54	0.76	0.00																																			
5H-2, 39-41	33.29	0.81	538.12						2					1					2							1						1						
5H-3, 114-116	35.54	0.85	273.74		1				5					1					2				1			1						1						
5H-5, 39-41	37.79	0.89	455.78		1				6	1	3									1						1		1						1			
5H-6, 114-116	40.04	0.93	467.42						8		1			2					2													4						
6H-2, 39-41	42.79	0.98	341.33						10										3						2										2			
6H-4, 39-41	45.79	1.08	239.26		1	1			6					1					1													3						
6H-5, 114-116	48.04	1.26	724.10		7				1					1																	11				1		
6H-7, 39-41	50.29	1.32	804.96	1	6				2					1					1						1							1						
8H-2, 114-116	55.54	1.46	0.97																																			
8H-4, 49-51	57.94	1.50	0.73																																			
8H-5, 114-116	60.09	1.52	0.00																																			
9H-1, 114-116	62.54	1.56	0.00																																			
9H-3, 114-116	65.54	1.60	0.00																																			
9H-5, 49-51	67.89	1.63	0.00																																			
9H-6, 114-116	70.04	1.65	0.61																																			
10H-2, 49-51	72.79	1.69	19.72																						1													
10H-4, 49-51	75.74	1.79	479.14		4				6					2			1								30							3			2			
10H-5, 114-116	77.89	1.86	326.21		10				2					1											35							1		1				
10H-7, 49-51	80.24	1.94	129.82		5				1					1										1	43						1	1						
11H-1, 114-116	81.54	1.97	524.58		8				8					1											21							2			1			
11H-2, 114-116	83.04	2.00	95.41		6					1				1									1		14	1												
11H-4, 49-51	85.39	2.04	431.02		4				4	1				1											18						2							
11H-5, 114-116	87.54	2.08	83.54		4				1										1				1		13							1						
11H-CC, 29-30	90.39	2.14	35.07		2																		1	2	6											1		
12H-2, 114-116	92.54	2.18	73.66		2				3					1					1				1	1	10						2	1						
12H-4, 114-116	95.54	2.24	121.43		3				4										1	1					16													
12H-6, 49-51	97.81	2.28	9.40		1																				3													
13H-1, 49-51	99.89	2.32	139.68		8				3	1				2					1						8							1		1	1			
13H-3, 114-116	102.62	2.37	344.17		10				6					1					2			1		3	7		2							2		1	1
13H-5, 114-116	105.62	2.43	260.93		5	2			1					1				1	1					2	19		1							1			
13H-7, 49-51	107.97	2.48	200.94		9				2					1	1				1					3	13		1				1						1
14H-2, 114-116	110.37	2.51	251.01		1	5			2					2				2	1					1	5		2				2	2		1	2	2
14H-4, 49-51	112.72	2.52	82.20		2									1					2	2					19						1	1					
14H-6, 114-116	115.72	2.54	388.35		11				4					3			1		1			1			12							2						2
14H-7, 114-116	117.87	2.55	338.18		5				6					2					2						19	1												1
15H-2, 49-51	120.39	2.56	316.43		8				7																8		2					1						
15H-3, 114-116	122.54	2.57	323.91		16			1	9			1		2								3			7							1				2	1	
15H-5, 114-116	125.54	2.59	34.90																					2	7				1									
15H-7, 49-51	127.89	2.61	211.22	2	12				7								1					7			9		2						1			1		
16H-2, 49-51	129.89	2.62	37.98		1				1																2		1											
16H-4, 49-51	132.89	2.64	18.52		1				2					1											1		1											
16H-5, 114-116	135.04	2.65	7.95																						5													
17H-1, 49-51	137.89	2.67	17.42						1																6													
17H-2, 114-116	140.04	2.68	32.88											1											7													
17H-4, 114-116	143.04	2.70	50.08	1	1				4	1				1					1	1					9							1						1
17H-6, 49-51	145.29	2.72	362.85	1	4	1			2					2					2	1		1			20					1	1	1						1
19H-1, 49-51	148.39	2.74	335.57	3	2	1			4					1		1			1	1		12			8							1	1		1			1
19H-3, 114-116	151.37	2.76	82.42		3	1			1							1			1				1		7							2			1			
20H-2, 49-51	159.39	2.80	370.21	2	6	1			8	1									1			4			8							2			1			1
20H-7, 49-51	166.89	2.85	554.55	1	5				2								2					2			11		1					2	1					
22X-2, 31-33	174.41	2.89	629.45	2	3				5							1	1								15		1			1		3	2					3
22X-7, 28-30	181.27	2.92	652.67		4	3			2	1							3		1			3		1	4		1		1			2						1
26X-1, 38-40	203.78	3.05	8.15																					1	2													
27X-1, 30-32	212.3	3.09	44.23	1														1	1						7													
27X-6, 30-32	219.44	3.13	10.96											1											1													
28X-CC, 0-1	225.06	3.16	22.70		1				1						1						1				3													
30X-2, 29-31	234.09	3.21	135.13		1		1		6					1				2	1					1	22													
31X-1, 60-62	241.5	3.25	198.01	1	7				4					3			1						1	1	12							1	1						
31X-CC, 0-1	248.59	3.29	618.86		2				6					1					1						14							1	1		1				
32X-5, 27-29	256.77	3.33	12.31		1									1																								
34X-3, 27-29	264.3	3.38	14.37		2				1																1													
35X-2, 29-31	271.24	3.41	493.92	1	9				2									3							15		1											
36X-2, 30-32	279.85	3.46	44.75	3	3				1									2							5					1				1				
36X-CC, 30-32	285.53	3.49	188.45	1	3				6					1		1		2	1			2			34													
37X-4, 30-32	293.7	3.54	26.98												1										6													
38X-3, 30-32	301.8	3.58	15.15											1										1	1													
39X-1, 30-32	308.4	3.62	12.44						1																1													
39X-6, 30-32	315.9	3.67	68.35																1			4			6							1			1			

Table 1 (continued).

Core, section, interval (cm)	Depth (mbsf)	Age (Ma)	Abundance (10^4/g)	*N. rolandii*	*N. bicapitata* group	*N.* spp.	*Odontella* sp.	*Paralia sulcata*	*Plagiogramma* sp.	*Planktoniella sol*	*Pleurosigma* spp.	*Porosira glacilis*	*P. pseudodenticulata*	*Proboscia alata*	*Pseudopodosira* spp.	*Pseudotriceratium wallichii*	*Raphoneis amphiceros*	*R. parilis*	*R.* spp.	*Rhizisolenia bergonii*	*R. hebetata*	*R. setigera*	*R. styliformis*	*R.* spp.	*Rossiella paleacea*	*R.* spp.	*Roperia tesselata*	*Stauroneis* spp.	*Stephanopyxsis turris*	*S.* spp.	*Stictodiscus* spp.	*Synedra indica*	*S. ulna*	*Tetracyclus emarginatus*	*Thalassionema bacillaris*	*T. hirosakiensis*	*T. nitzschioides*	*T. nitzschioides v. parva*
164-997A-																																						
1H-1, 39-41	0.39	0.02	11.50					31							5					1									3										
1H-CC, 0-1	2.75	0.11	17.57					30							7					1									1								2		
2H-2, 114-116	5.54	0.22	5.12					16																															
2H-4, 39-41	7.79	0.29	18.86					47							20														2								1		
2H-5, 114-116	10.04	0.35	172.87		1			76		1			2		7					1							2		16								7		2
3H-1, 39-41	12.79	0.43	57.93					148							23														4	1							2		
3H-2, 114-116	15.04	0.48	3.94					6							8		1																						
3H-4, 114-116	18.04	0.53	0.25					1																															
3H-6, 39-41	20.29	0.58	4.36					14							1														1										
4H-1, 114-116	23.04	0.62	311.68		1			166		2					10								1						38	1									2
4H-3, 39-41	25.29	0.67	3.99					8							2																						1		
4H-6, 114-116	30.54	0.76	0.00																																				
5H-2, 39-41	33.29	0.81	538.12		1			141		3					2					1			1						8	1							2		
5H-3, 114-116	35.54	0.85	273.74		1			100		7					9					6			2				2		11				1				8		
5H-5, 39-41	37.79	0.89	455.78					168		9				1	6		1			12		1	1			2	4		31	3			1		1		9		
5H-6, 114-116	40.04	0.93	467.42		1			172					1	1	5					2	2	1	5	2			2		26	1		1					19		1
6H-2, 39-41	42.79	0.98	341.33			1		180			1				2					1					2				18								6		1
6H-4, 39-41	45.79	1.08	239.26					145						1						2			1						5								2		
6H-5, 114-116	48.04	1.26	724.10					135		2					2							3							14								13		
6H-7, 39-41	50.29	1.32	804.96					238		2									2	2			1						6								19		
8H-2, 114-116	55.54	1.46	0.97					3																															
8H-4, 49-51	57.94	1.50	0.73																																				
8H-5, 114-116	60.09	1.52	0.00																																				
9H-1, 114-116	62.54	1.56	0.00																																				
9H-3, 114-116	65.54	1.60	0.00																																				
9H-5, 49-51	67.89	1.63	0.00																																				
9H-6, 114-116	70.04	1.65	0.61					1																															
10H-2, 49-51	72.79	1.69	19.72					26							3																								
10H-4, 49-51	75.74	1.79	479.14			1		94		1					3		1			1		1			3				7						1		31		
10H-5, 114-116	77.89	1.86	326.21					125							3					1			5						5								11		
10H-7, 49-51	80.24	1.94	129.82					137							9		1												4								2		
11H-1, 114-116	81.54	1.97	524.58					123							1		1								1				21	1		1	1				17		
11H-2, 114-116	83.04	2.00	95.41			1		86							7								2						1			1					14		
11H-4, 49-51	85.39	2.04	431.02					113							2		2			1																	11		
11H-5, 114-116	87.54	2.08	83.54					86																				1	2						1		11		
11H-CC, 29-30	90.39	2.14	35.07					38							3																					1		
12H-2, 114-116	92.54	2.18	73.66					72							9																					3		
12H-4, 114-116	95.54	2.24	121.43		1			136							8		2												1								7		
12H-6, 49-51	97.81	2.28	9.40					7							3																								
13H-1, 49-51	99.89	2.32	139.68		4			130							5		3		1						1					1						1	7		
13H-3, 114-116	102.62	2.37	344.17		2			102					1	1	4		2	1	1				2						2			3	1			1	10		
13H-5, 114-116	105.62	2.43	260.93		1			133	1				1		4		1		1																1	1	11		
13H-7, 49-51	107.97	2.48	200.94					140							4		1						1									1					5		
14H-2, 114-116	110.37	2.51	251.01					47							3		1		1			2	2		1		1		1			1			2		45		4
14H-4, 49-51	112.72	2.52	82.20					86							2		1	1											2								5		
14H-6, 114-116	115.72	2.54	388.35		1			88						1	5		1	1		1			1		1				2	2		1					17		
14H-7, 114-116	117.87	2.55	338.18		1			128							1		2			1									3	1		2					16		
15H-2, 49-51	120.39	2.56	316.43		1			70		3				1						1					1				3			1			1		35		
15H-3, 114-116	122.54	2.57	323.91		3			42		4					2							2			2				6			1			2		40		2
15H-5, 114-116	125.54	2.59	34.90					32							3														1								5		
15H-7, 49-51	127.89	2.61	211.22	1	3			74				1			2			1							4				5						1		34		
16H-2, 49-51	129.89	2.62	37.98					46					1					1											2								4		
16H-4, 49-51	132.89	2.64	18.52					11																	2				2								5		
16H-5, 114-116	135.04	2.65	7.95					3										1											1								2		
17H-1, 49-51	137.89	2.67	17.42					14																					2	1							2		
17H-2, 114-116	140.04	2.68	32.88					27					1		1		1	1				1			1				3			1					6		
17H-4, 114-116	143.04	2.70	50.08												4		2						1						8								13		
17H-6, 49-51	145.29	2.72	362.85					77						1	5		1	1	1										23			1		1			22		
19H-1, 49-51	148.39	2.74	335.57					70							5		2		1	1									31						3		30		2
19H-3, 114-116	151.37	2.76	82.42					51							3		3			1	1						1		3						1		21		
20H-2, 49-51	159.39	2.80	370.21		1			53					1		1				1				1	1					20			1			1	1	34		16
20H-7, 49-51	166.89	2.85	554.55		1			67		1					2		1												13			1			1		36		4
22X-2, 31-33	174.41	2.89	629.45					65		1					1		3												9								25		6
22X-7, 28-30	181.27	2.92	652.67		2			46							1						2								12			1			1		62		7
26X-1, 38-40	203.78	3.05	8.15					9																													1		
27X-1, 30-32	212.3	3.09	44.23					53							1		1																				2		
27X-6, 30-32	219.44	3.13	10.96					11							1		2												1								1		
28X-CC, 0-1	225.06	3.16	22.70					28							1						1																2		
30X-2, 29-31	234.09	3.21	135.13					114		1				1	2		2	2											3			1					14		2
31X-1, 60-62	241.5	3.25	198.01					116							2		2	4					1	1					2						1	1	21		4
31X-CC, 0-1	248.59	3.29	618.86		2			105							2			1					1	2					3	1					1		32		
32X-5, 27-29	256.77	3.33	12.31					10							3		1																				3		
34X-3, 27-29	264.3	3.38	14.37					16							1		1																				1		
35X-2, 29-31	271.24	3.41	493.92					89		2			2		1		3	2											3								29		13
36X-2, 30-32	279.85	3.46	44.75					31						1	2		6	2												1							5		1
36X-CC, 30-32	285.53	3.49	188.45					89							2		4	2					2						3								11		7
37X-4, 30-32	293.7	3.54	26.98					26		1							1					1															5		
38X-3, 30-32	301.8	3.58	15.15					14									1												1								3		
39X-1, 30-32	308.4	3.62	12.44					12						1	1														2								2		
39X-6, 30-32	315.9	3.67	68.35					72							2		1						1						2								8		

Table 1 (continued).

Core, section, interval (cm)	Depth (mbsf)	Age (Ma)	Abundance (10^4/g)	*T. schraderi*	*T.* sp.	*Thalassiosira anguste-lineata*	*T. convexa*	*T. cf. deicipiens*	*T. eccentrica*	*T. ferelineata*	*T. jouseae*	*T. leptopus*	*T. lineata*	*T. manifesta*	*T. miocenica*	*T. nidulus*	*T. oestrupii*	*T. pacifica*	*T. plicata*	*T. praeoestrupii*	*T. symbolophora*	*T. symmetrica*	*T. tetraoestrupii*	*T. trifulta*	*T. zabellinae*	*T.* sp. A	*T.* sp. B	*T.* sp. C	*T.* spp.	*Thalassiothrix acuta*	*T. frauenfeldii*	*T. longissima*	*T. robusta*	*Trachyneis aspera*	*Triceratium* spp.	*Trigonium alternans*	Freshwater species	Total number of diatoms	*Chaetoceros* resting spores
164-997A-																																							
1H-1, 39-41	0.39	0.02	11.50														3																				0	48	8
1H-CC, 0-1	2.75	0.11	17.57						1																			2				3			1	8	71	7
2H-2, 114-116	5.54	0.22	5.12																																	0	21	5
2H-4, 39-41	7.79	0.29	18.86						2								3																			0	78	2
2H-5, 114-116	10.04	0.35	172.87						7		2		5				29									1		3			1					3	214	136
3H-1, 39-41	12.79	0.43	57.93						2				3				5											2						3	2	8	234	22
3H-2, 114-116	15.04	0.48	3.94																																	2	16	2
3H-4, 114-116	18.04	0.53	0.25																																	0	1	3
3H-6, 39-41	20.29	0.58	4.36														1																			0	18	2
4H-1, 114-116	23.04	0.62	311.68						1			1					4								1			2					3		1	6	258	25
4H-3, 39-41	25.29	0.67	3.99																																	1	17	2
4H-6, 114-116	30.54	0.76	0.00																																	0	0	0
5H-2, 39-41	33.29	0.81	538.12						16	1			1				10					2						3			1		1	1		1	223	34
5H-3, 114-116	35.54	0.85	273.74						12				2				23					1				10		4					1			0	228	109
5H-5, 39-41	37.79	0.89	455.78						21				1				26					2					24	4						1	2	1	372	116
5H-6, 114-116	40.04	0.93	467.42						18		1	4	1				15	4			1	1	2	1		12	13	1					2			4	382	120
6H-2, 39-41	42.79	0.98	341.33						12				2				9					3		1		7										3	280	30
6H-4, 39-41	45.79	1.08	239.26										1				11									2										9	201	32
6H-5, 114-116	48.04	1.26	724.10						26			1	4				25	4								18										3	297	26
6H-7, 39-41	50.29	1.32	804.96						16								8					2				6									1	0	328	27
8H-2, 114-116	55.54	1.46	0.97																																	0	4	1
8H-4, 49-51	57.94	1.50	0.73											1																						0	3	0
8H-5, 114-116	60.09	1.52	0.00																																	0	0	0
9H-1, 114-116	62.54	1.56	0.00																																	0	0	0
9H-3, 114-116	65.54	1.60	0.00																																	0	0	1
9H-5, 49-51	67.89	1.63	0.00																																	0	0	0
9H-6, 114-116	70.04	1.65	0.61																																	0	1	0
10H-2, 49-51	72.79	1.69	19.72																																1	1	32	2
10H-4, 49-51	75.74	1.79	479.14						4		1						16							1			1		2					2		4	233	51
10H-5, 114-116	77.89	1.86	326.21						2		1						2																			0	213	20
10H-7, 49-51	80.24	1.94	129.82						1								2														1					1	216	26
11H-1, 114-116	81.54	1.97	524.58						3	1			1				16	1					2	2		1		1			1		1	1		5	260	34
11H-2, 114-116	83.04	2.00	95.41										2				3	2													1					6	154	30
11H-4, 49-51	85.39	2.04	431.02						2								21	1																		1	215	47
11H-5, 114-116	87.54	2.08	83.54						1								2									1										2	137	59
11H-CC, 29-30	90.39	2.14	35.07														1															1				0	58	9
12H-2, 114-116	92.54	2.18	73.66										1															1								7	122	8
12H-4, 114-116	95.54	2.24	121.43														3	3										1					2	1	1	5	202	13
12H-6, 49-51	97.81	2.28	9.40						1																											0	16	6
13H-1, 49-51	99.89	2.32	139.68										3				4	3								1										8	208	62
13H-3, 114-116	102.62	2.37	344.17							1			8				5					1				4					1		3			7	225	73
13H-5, 114-116	105.62	2.43	260.93				1		1								1	1																		4	218	51
13H-7, 49-51	107.97	2.48	200.94						1	2																1							1			1	200	28
14H-2, 114-116	110.37	2.51	251.01			1	5		2			1	6				8	1								6		1			1		2			5	203	140
14H-4, 49-51	112.72	2.52	82.20				1		1				1					1																		1	134	26
14H-6, 114-116	115.72	2.54	388.35						4	1		2	21				7	3																	1	0	223	34
14H-7, 114-116	117.87	2.55	338.18			1			1				7				3						2										2			3	224	32
15H-2, 49-51	120.39	2.56	316.43				2		6		1		23				6									5					3					2	209	50
15H-3, 114-116	122.54	2.57	323.91				1		9	5		1	3				7	5			1					1				2			5	1	1	10	213	109
15H-5, 114-116	125.54	2.59	34.90								1																								1	0	57	10
15H-7, 49-51	127.89	2.61	211.22			2	1		6				5				5	2						3						1			1		3	3	208	56
16H-2, 49-51	129.89	2.62	37.98														1																			0	62	14
16H-4, 49-51	132.89	2.64	18.52									1				1																				0	31	19
16H-5, 114-116	135.04	2.65	7.95														1																			0	13	3
17H-1, 49-51	137.89	2.67	17.42										1																			1				0	29	10
17H-2, 114-116	140.04	2.68	32.88														1																			1	54	11
17H-4, 114-116	143.04	2.70	50.08				2		1				1				4									1		1				2				7	82	51
17H-6, 49-51	145.29	2.72	362.85								2		2	1			11	1				1		2							2		1		1	1	201	59
19H-1, 49-51	148.39	2.74	335.57			1			3				1				9	1	1					1									1		1	6	218	66
19H-3, 114-116	151.37	2.76	82.42				1		2		1		3				7														1			1		3	136	37
20H-2, 49-51	159.39	2.80	370.21						2				3				15	1						1	1						1		1			2	208	64
20H-7, 49-51	166.89	2.85	554.55						3	2	1	2	19				7	2								1					1					2	203	58
22X-2, 31-33	174.41	2.89	629.45				4		6				8				12															1	2		1	0	206	74
22X-7, 28-30	181.27	2.92	652.67						9				17				7	1				1	2										2		1	1	212	104
26X-1, 38-40	203.78	3.05	8.15																																	0	14	0
27X-1, 30-32	212.3	3.09	44.23						1				1									1														1	1	73	6
27X-6, 30-32	219.44	3.13	10.96								1																									0	18	5
28X-CC, 0-1	225.06	3.16	22.70																																	0	38	4
30X-2, 29-31	234.09	3.21	135.13				2		4				4				2														1				3	2	209	45
31X-1, 60-62	241.5	3.25	198.01						3				2				3	2														1			2	2	208	45
31X-CC, 0-1	248.59	3.29	618.86						3				1				6																2			1	5	205	43
32X-5, 27-29	256.77	3.33	12.31																																	1	20	3
34X-3, 27-29	264.3	3.38	14.37																																	0	24	3
35X-2, 29-31	271.24	3.41	493.92						1								6							1							1			2		3	205	33
36X-2, 30-32	279.85	3.46	44.75														1	3										1								1	74	19
36X-CC, 30-32	285.53	3.49	188.45								1		2				4									5	1	1	1		1				2	1	204	39
37X-4, 30-32	293.7	3.54	26.98																														1			0	44	7
38X-3, 30-32	301.8	3.58	15.15																															1		0	25	5
39X-1, 30-32	308.4	3.62	12.44																							1										0	21	3
39X-6, 30-32	315.9	3.67	68.35						1				1				2									1					1	1	1		1	0	111	33

Table 1 (continued).

Core, section, interval (cm)	Depth (mbsf)	Age (Ma)	Abundance (10^4/g)	*Actinocyclus curvatulus*	*A. elongatus*	*A. ingens*	*A. octonarius*	*A.* spp.	*Actinoptychus heliopelta*	*A. intermedius*	*A. senarius*	*A. splendens*	*A. vulgaris*	*Asterolampra* sp.	*Asteromphalus arachne*	*Azpeitia africana*	*A. nodulifera*	*A. vetustissima*	*A. tabularis*	*Bacillaria paxillifer*	*Bacteriastrum* spp.	*Biddulphia* spp.	*Cavitatus jouseana*	*Coscinodiscus* aff. *antiminos*	*C. denarius*	*C. marginatus*	*C. nitidus*	*C. obsculus*	*C. oculusiridis*	*C. perforatus*	*C. plicatus*	*C. radiatus*	*C.* spp.	*Cyclotella striata*	*C. stylorum*	*C.* sp. 1	*C.* sp.	*Cymatosira immunis*	*C.* sp.
164-997A-																																							
41X-4, 29-31	323.49	3.72	8.57														1															1							
42X-2, 30-32	329.2	3.88	9.20	1			1				1						1																					
43X-2, 26-28	338.7	4.43	19.30														1					1															1	
44X-1, 32-34	347.02	4.49	109.71				2				2														2													
44X-6, 30-32	354.5	4.54	2.46																																			
46X-1, 30-32	366.2	4.63	27.43				1				2																					2						
46X-3, 26-28	368.91	4.65	17.60				1				1																											
47X-1, 30-32	375.9	4.69	15.10															1				1			1													
48X-1, 27-29	385.57	4.76	19.28				1															1																
48X-5, 27-29	391.57	4.81	26.81								1												1		1								1					
50X-CC, 0-1	399.47	4.86	100.17				4				5														1									1				
52X-1, 29-31	405.79	4.91	289.95				14				7									1					1							1	2				2	
52X-7, 18-19	414.68	4.97	118.29	2			9				1						1			1			1		3												1	
54X-1, 28-30	423.98	5.02	99.45				4				7						1					1			2							1	1					
54X-5, 28-30	429.66	5.05	104.43				5				13											1										1					1	
164-997B-																																						
4X-1, 0-1	414.2	4.97	155.15	2			10				3						3					1			4							1				1	1	
5X-1, 31-33	424.11	5.02	194.14	1		1	7				10										1				2											1	
5X-3, 29-31	426.85	5.03	296.61	3			2				11														1							2				2	2	
8X-1, 29-31	443.29	5.11	271.96			1	6				7						1					2		1	3											1	1	
8X-2, 28-30	444.78	5.12	76.19				1				2						1					3															1	1	
8X-6, 28-30	450.68	5.14	76.70				7				8						3								3	1											1	
11X-1, 30-32	463.5	5.20	441.20				11				18	2	1				4				1	1			3				1			1						
11X-3, 30-32	466.5	5.21	181.78			1	2				4						4							1	2											1		
12X-3, 30-32	474.41	5.25	529.87				6				3						7							1	1								1				2	
13X-1, 30-32	481.8	5.28	414.17	1			9				3						5								2				2			1					4	
14X-1, 30-32	491.4	5.32	357.51			1	8				1						11					1							1			8					2	
14X-CC, 23-24	496.24	5.35	685.29	1			5				4	2					22							1	6		1		2			4				2	1	
16X-2, 29-31	503.59	5.38	370.58				11				10						13							1	1				1			1						
16X-7, 30-32	511.1	5.41	205.52	1			6				1						10								1		1					2					1	1
18X-1, 30-32	520.3	5.45	264.60				4				6	2					10						6		3							1					1	
18X-5, 30-32	526.3	5.48	778.24	3			12				13	1					17				1	3	4		3							4	1	2			1	
19X-4, 30-32	534.4	5.52	605.84			1	11										17				1		2		8					1		2			1			
20X-2, 30-32	541	5.55	386.03				3				9	3					6					1	3					1				6				1	1	
22X-2, 28-30	551.58	5.59	84.31				9				7						3						1			1						5						
22X-5, 30-32	556.1	5.63	720.11				5				5						9						2		1							10	2				2	
23X-5, 30-32	564.7	5.72	190.26				17				13	1					23						3			1		1				2	1			1	3	
24X-3, 30-32	571.3	5.79	331.09				11				6						5				1	2	3									2	1				2	
26X-1, 30-32	578.9	5.86	653.38				9				9						5						5									1	1					
27X-1, 30-32	587.6	5.92	213.75				22				14						4					1	1	1	1	1	1					3	1				2	
27X-5, 30-32	593.6	5.95	296.17	1			16				15						4						12									3						
28X-4, 28-30	600.85	5.98	228.84				15				8						2				1		7						1	1		2	1				1	
29X-3, 30-32	609.8	6.01	13.70																																			
30X-1, 30-32	616.4	6.04	41.30				2				4																					1						
31X-1, 30-32	626	6.08	1.19																																			
31X-5, 30-32	631.93	6.11	6.35																																			
33X-3, 30-32	638.77	6.14	29.93				1				4																											
34X-CC, 0-1	646.45	6.17	40.14				1				1						2					1																
35X-1, 30-32	654.8	6.20	0.00																																			
35X-7, 30-32	661.71	6.23	3.05																																			
37X-3, 30-32	668.4	6.26	32.97				1										1																					
38X-2, 30-32	675.6	6.29	42.01								2						1								1													
39X-1, 30-32	683.7	6.32	15.91																						1													
39X-6, 30-32	691.2	6.36	18.40																													1						
42X-1, 30-32	702.9	6.40	59.06				2				1														1							1						
42X-CC, 0-1	706.42	6.42	19.54				1				1																											
43X-2, 27-29	713.97	6.45	56.72				2				4														2		1											
43X-CC, 25-26	720.76	6.48	18.88								3																										1	
45X-5, 29-31	728.95	6.51	17.77				1				1														1													
46X-5, 30-32	736.54	6.55	0.61																																			
47X-3, 31-33	744.41	6.58	13.84																			1										1						
47X-CC, 0-1	749.64	6.60	113.18				2				4						4					1			16		1									1		

Table 1 (continued).

Core, section, interval (cm)	Depth (mbsf)	Age (Ma)	Abundance (10^4/g)	*Delphineis angustata*	*D. surirella*	*D.* spp.	*Denticulopsis dimorpha*	*D. hustedtii*	*Diploneis* spp.	*Epithemia* spp.	*Fragilariopsis doliola*	*Glyphodesmis acus*	*Goniothecium* sp.	*Grammatophora* spp.	*Hantzschia amphioxys*	*Hemiaulus* spp.	*Hemidiscus cuneiformis*	*H. ovalis*	*Hyalodiscus* sp. A	*Hyalodiscus* sp. B	*Koizumia adaroi*	*K. tatsunokuchiensis*	*Lylella henneedyi*	*Melosira architecturis*	*M. westii*	*M.* spp.	*Neodelphineis pelagica*	*Neodenticula kamchatica*	*N. seminae*	*Nitzschia constricta*	*N. cylindrica*	*N. granulata*	*N.* fossilis	*N. jouseae*	*N. lorenziana*	*N. marina*	*N. miocenica*	*N. pandriformis*	*N. reinholdii*
164-997A-																																						
41X-4, 29-31	323.49	3.72	8.57																																			
42X-2, 30-32	329.2	3.88	9.20																						4													
43X-2, 26-28	338.7	4.43	19.30																		2				3							1					
44X-1, 32-34	347.02	4.49	109.71						1			1		3											20	1											
44X-6, 30-32	354.5	4.54	2.46																					1													
46X-1, 30-32	366.2	4.63	27.43						2																3												
46X-3, 26-28	368.91	4.65	17.60						1																4		1										
47X-1, 30-32	375.9	4.69	15.10						1							1									5												
48X-1, 27-29	385.57	4.76	19.28											1										1	3												
48X-5, 27-29	391.57	4.81	26.81										1	1											1					1							
50X-CC, 0-1	399.47	4.86	100.17		1				1										1			2			12												
52X-1, 29-31	405.79	4.91	289.95		2											1		2	1						13		1										
52X-7, 18-19	414.68	4.97	118.29											2					2						22		1										
54X-1, 28-30	423.98	5.02	99.45			1			1				1					1	1		1	2		1	29												
54X-5, 28-30	429.66	5.05	104.43						2													1		1	28		1										
164-997B-																																						
4X-1, 0-1	414.2	4.97	155.15						1					1					4		2	1	2	1	26	1	2											
5X-1, 31-33	424.11	5.02	194.14						4					1				1	3			2		1	16								1					
5X-3, 29-31	426.85	5.03	296.61																			1		1	27												
8X-1, 29-31	443.29	5.11	271.96															1	1			1		1	20		1										
8X-2, 28-30	444.78	5.12	76.19						1					1					1		1	1			17		1											
8X-6, 28-30	450.68	5.14	76.70					1	5										1			1		2	10												
11X-1, 30-32	463.5	5.20	441.20						5									2			1	5			12						1				1		
11X-3, 30-32	466.5	5.21	181.78		1		1		2					2					4			1		1	18		1									1	
12X-3, 30-32	474.41	5.25	529.87						5				1	3			1					1			18		2					3					
13X-1, 30-32	481.8	5.28	414.17						5																13		2					2					
14X-1, 30-32	491.4	5.32	357.51						3									3	4			1		1	10		3							2			
14X-CC, 23-24	496.24	5.35	685.29		1		1		7									3				4			3	1	3					1					
16X-2, 29-31	503.59	5.38	370.58						3				1	1					1			4		1	12		1					3		1			
16X-7, 30-32	511.1	5.41	205.52		1				4				1	3				1	1					1	13			1				2			2		
18X-1, 30-32	520.3	5.45	264.60						8				1						1						22										1	1	
18X-5, 30-32	526.3	5.48	778.24		1				10			1	2					1	1			4			18						2	3		1			
19X-4, 30-32	534.4	5.52	605.84						2				1									1			22							1					
20X-2, 30-32	541	5.55	386.03						3				2	1				2				3			6						2						
22X-2, 28-30	551.58	5.59	84.31		2				5				1	1					1			1			18	1											
22X-5, 30-32	556.1	5.63	720.11	3	3		2		5				1	1			1					13			14			1				4		2	5		
23X-5, 30-32	564.7	5.72	190.26	2					4										2						11			2			2	10		1			
24X-3, 30-32	571.3	5.79	331.09		1				8				3	2					1				3		18	2	2				2	2		2	1		
26X-1, 30-32	578.9	5.86	653.38	1	4				7				2				1		1		2				15		2				2	5			1		2
27X-1, 30-32	587.6	5.92	213.75		2				6				3	1											23						1	4					
27X-5, 30-32	593.6	5.95	296.17	1	1				2				3												24	1						8					
28X-4, 28-30	600.85	5.98	228.84	1	1				4					2			1								36							1					
29X-3, 30-32	609.8	6.01	13.70					1																	3												
30X-1, 30-32	616.4	6.04	41.30		1				2																12												
31X-1, 30-32	626	6.08	1.19																																			
31X-5, 30-32	631.93	6.11	6.35																						2												
33X-3, 30-32	638.77	6.14	29.93						1																9												
34X-CC, 0-1	646.45	6.17	40.14		1				1					1											12												
35X-1, 30-32	654.8	6.20	0.00																																			
35X-7, 30-32	661.71	6.23	3.05											1											3												
37X-3, 30-32	668.4	6.26	32.97						2				2								1		1	1	5	1		1										
38X-2, 30-32	675.6	6.29	42.01						1				1	1										1	3												
39X-1, 30-32	683.7	6.32	15.91										1											3	3			1									
39X-6, 30-32	691.2	6.36	18.40						1																2												
42X-1, 30-32	702.9	6.40	59.06						3				1	3										1	10												
42X-CC, 0-1	706.42	6.42	19.54											1										1	1												
43X-2, 27-29	713.97	6.45	56.72						2					2											6												
43X-CC, 25-26	720.76	6.48	18.88					1																	3												
45X-5, 29-31	728.95	6.51	17.77														1								1												
46X-5, 30-32	736.54	6.55	0.61																																			
47X-3, 31-33	744.41	6.58	13.84					1																	1		1										
47X-CC, 0-1	749.64	6.60	113.18	1					9																15	1											

Table 1 (continued).

Core, section, interval (cm)	Depth (mbsf)	Age (Ma)	Abundance (10^4/g)	*N. rolandii*	*N. bicapitata* group	*N.* spp.	*Odontella* sp.	*Paralia sulcata*	*Plagiogramma* sp.	*Planktoniella sol*	*Pleurosigma* spp.	*Porosira glacilis*	*P. pseudodenticulata*	*Proboscia alata*	*Pseudopodosira* spp.	*Pseudotriceratium wallichii*	*Raphoneis amphiceros*	*R. parilis*	*R.* spp.	*Rhizisolenia bergonii*	*R. hebetata*	*R. setigera*	*R. styliformis*	*R.* spp.	*Rossiella paleacea*	*R.* spp.	*Roperia tesselata*	*Stauroneis* spp.	*Stephanopyxis turris*	*S.* spp.	*Stictodiscus* spp.	*Synedra indica*	*S. ulna*	*Tetracyclus emarginatus*	*Thalassionema bacillaris*	*T. hirosakiensis*	*T. nitzschioides*	*T. nitzschioides v. parva*
164-997A-																																						
41X-4, 29-31	323.49	3.72	8.57					9																												1			
42X-2, 30-32	329.2	3.88	9.20																										1							5	1
43X-2, 26-28	338.7	4.43	19.30					18									1					1							1							2	
44X-1, 32-34	347.02	4.49	109.71					150						1	1		3	1				1	1						3							8	
44X-6, 30-32	354.5	4.54	2.46					3																														
46X-1, 30-32	366.2	4.63	27.43					31							1																					1	
46X-3, 26-28	368.91	4.65	17.60					17							1														1							3	
47X-1, 30-32	375.9	4.69	15.10					13										1																			
48X-1, 27-29	385.57	4.76	19.28					19							1														1							2	
48X-5, 27-29	391.57	4.81	26.81					31							1			1	1																	2	
50X-CC, 0-1	399.47	4.86	100.17					99							1		1	6		1									2						1	13	
52X-1, 29-31	405.79	4.91	289.95					103									1	18											1							27	1
52X-7, 18-19	414.68	4.97	118.29					92							4		4	24					1						6							13	1
54X-1, 28-30	423.98	5.02	99.45					92							3		2	7	1		1		1						2							17	
54X-5, 28-30	429.66	5.05	104.43					74							3			19		1										1						7	
164-997B-																																						
4X-1, 0-1	414.2	4.97	155.15					62							2		3	13	1			1							2	2						27	2
5X-1, 31-33	424.11	5.02	194.14					94		1					3		1	3											3							25	1
5X-3, 29-31	426.85	5.03	296.61					92		1					3		1	31											4			1		1		17	
8X-1, 29-31	443.29	5.11	271.96					84			1						3	15			1								11		1					13	
8X-2, 28-30	444.78	5.12	76.19					63		2					4			3											11							10	
8X-6, 28-30	450.68	5.14	76.70					54							2		1	5	3										4							8	
11X-1, 30-32	463.5	5.20	441.20					70							2		2	6	2										3					1		42	
11X-3, 30-32	466.5	5.21	181.78					112							1		2	2					1						4			1		1		24	
12X-3, 30-32	474.41	5.25	529.87					74							3			4			1	1							6		1		1	2		36	1
13X-1, 30-32	481.8	5.28	414.17		1		1	84	1	1					1			3			2		2						6		1					38	
14X-1, 30-32	491.4	5.32	357.51			1		37		1					2		2	6	2										6		1	1				69	
14X-CC, 23-24	496.24	5.35	685.29					37							2			3	2				1						6					1		58	
16X-2, 29-31	503.59	5.38	370.58		1	1		30					1				1	4	2		2								5	2		1				71	
16X-7, 30-32	511.1	5.41	205.52					61		1					2	1	1	2											8							40	
18X-1, 30-32	520.3	5.45	264.60					86		1					1		1	4			1								1	2					2	33	
18X-5, 30-32	526.3	5.48	778.24		1	2		35									1	6			1						1		9	1		1		2		45	
19X-4, 30-32	534.4	5.52	605.84		2			48										15											7	1					1	43	
20X-2, 30-32	541	5.55	386.03		2			37		2							2	5	1										14	1					1	44	
22X-2, 28-30	551.58	5.59	84.31					34							1		2	3											1							27	
22X-5, 30-32	556.1	5.63	720.11		2			23		1				1			1	1											10					4		63	
23X-5, 30-32	564.7	5.72	190.26					36							2		2	1											2					2		36	
24X-3, 30-32	571.3	5.79	331.09		3			48							1			1	6										1			1		3	1	42	2
26X-1, 30-32	578.9	5.86	653.38		1			32									4	1											2	2			1			56	2
27X-1, 30-32	587.6	5.92	213.75					41										1	2										5						1	28	4
27X-5, 30-32	593.6	5.95	296.17					37							1			4	2										4	2				1		40	
28X-4, 28-30	600.85	5.98	228.84					55	1						4		1	1	1										8	1				2		38	5
29X-3, 30-32	609.8	6.01	13.70					15										1												1						1	
30X-1, 30-32	616.4	6.04	41.30					23							2															1						3	
31X-1, 30-32	626	6.08	1.19					2																														
31X-5, 30-32	631.93	6.11	6.35					8																														
33X-3, 30-32	638.77	6.14	29.93					23																													6	1
34X-CC, 0-1	646.45	6.17	40.14					23							1			1	1																		9	2
35X-1, 30-32	654.8	6.20	0.00																																			
35X-7, 30-32	661.71	6.23	3.05																																			
37X-3, 30-32	668.4	6.26	32.97					23	1						1				2																		2	1
38X-2, 30-32	675.6	6.29	42.01					37							2		1	1																		16	
39X-1, 30-32	683.7	6.32	15.91					14																												4	
39X-6, 30-32	691.2	6.36	18.40					16																												5	1
42X-1, 30-32	702.9	6.40	59.06					57							2		1																			10	
42X-CC, 0-1	706.42	6.42	19.54					19									2													1							2	
43X-2, 27-29	713.97	6.45	56.72					57										1											1							10	
43X-CC, 25-26	720.76	6.48	18.88					20																												2	
45X-5, 29-31	728.95	6.51	17.77					19							1														1							4	
46X-5, 30-32	736.54	6.55	0.61					1																														
47X-3, 31-33	744.41	6.58	13.84					15							1																					1	
47X-CC, 0-1	749.64	6.60	113.18					107							1		4												3							11	

Table 1 (continued).

Core, section, interval (cm)	Depth (mbsf)	Age (Ma)	Abundance (10^4/g)	*T. schraderi*	*T.* sp.	*Thalassiosira anguste-lineata*	*T. convexa*	*T. cf. deicipiens*	*T. eccentrica*	*T. fenelineata*	*T. jouseae*	*T. leptopus*	*T. lineata*	*T. manifesta*	*T. miocenica*	*T. nidulus*	*T. oestrupii*	*T. pacifica*	*T. plicata*	*T. praeoestrupii*	*T. symbolophora*	*T. symmetrica*	*T. tetraoestrupii*	*T. trifulta*	*T. zabellinae*	*T.* sp. A	*T.* sp. B	*T.* sp. C	*T.* spp.	*Thalassiothrix acuta*	*T. frauenfeldii*	*T. longissima*	*T. robusta*	*Trachyneis aspera*	*Triceratium* spp.	*Trigonium alternans*	Freshwater species	Total number of diatoms	*Chaetoceros* resting spores
164-997A-																																						
41X-4, 29-31	323.49	3.72	8.57										1			1																				0	14	3
42X-2, 30-32	329.2	3.88	9.20																												1					0	15	16
43X-2, 26-28	338.7	4.43	19.30																																	1	32	10
44X-1, 32-34	347.02	4.49	109.71										1																1			1				0	202	42
44X-6, 30-32	354.5	4.54	2.46																																	0	4	0
46X-1, 30-32	366.2	4.63	27.43																										1		1					0	45	7
46X-3, 26-28	368.91	4.65	17.60																																	0	29	11
47X-1, 30-32	375.9	4.69	15.10														1														1					1	25	5
48X-1, 27-29	385.57	4.76	19.28								1																		1				1			0	32	8
48X-5, 27-29	391.57	4.81	26.81						2		1																									1	45	15
50X-CC, 0-1	399.47	4.86	100.17						2				2				3	2									1		1	2		1				2	165	41
52X-1, 29-31	405.79	4.91	289.95						5				2				4										1					2		1		1	213	55
52X-7, 18-19	414.68	4.97	118.29						4				1				1													1		2		1		5	203	71
54X-1, 28-30	423.98	5.02	99.45					1	5				1				6															4				3	199	62
54X-5, 28-30	429.66	5.05	104.43	2					2		1		1				4	1										1				1				0	172	68
164-997B-																																						
4X-1, 0-1	414.2	4.97	155.15						5		1	1	3			1	2														2	2		1			4	202	88
5X-1, 31-33	424.11	5.02	194.14						6				3				6	1									1				3					5	205	41
5X-3, 29-31	426.85	5.03	296.61						12		2		1				8							2			1				2				3	0	232	78
8X-1, 29-31	443.29	5.11	271.96					1	6				8				7	1				1									2		2			2	205	36
8X-2, 28-30	444.78	5.12	76.19										2																							0	125	27
8X-6, 28-30	450.68	5.14	76.70						4								3							1							2					2	129	18
11X-1, 30-32	463.5	5.20	441.20			2			10				2					2													2		1		1	2	217	52
11X-3, 30-32	466.5	5.21	181.78						1				1				1						1				2	1			2				3	4	208	36
12X-3, 30-32	474.41	5.25	529.87										3									2						4		2	1	8	1			1	210	39
13X-1, 30-32	481.8	5.28	414.17			1			4								1							1							3	2	1			3	202	36
14X-1, 30-32	491.4	5.32	357.51				1		5				1		1		2			3			1	1			2		2			5	2	1		2	216	69
14X-CC, 23-24	496.24	5.35	685.29			2			22				2				1					2	2				6		1		2	5			1	0	226	40
16X-2, 29-31	503.59	5.38	370.58			1			3		2		5				1	2		1		1	1			1			2		1	2	2			1	208	60
16X-7, 30-32	511.1	5.41	205.52						11	1			6							5			2		1		3		1		1	1				2	202	46
18X-1, 30-32	520.3	5.45	264.60			1			6				2		1					2							4		2	1		2	1	1		1	218	35
18X-5, 30-32	526.3	5.48	778.24		3				14	1			8		1			2								1	2		2		3	1	4			0	252	44
19X-4, 30-32	534.4	5.52	605.84					1	9				1					1					1													0	200	38
20X-2, 30-32	541	5.55	386.03						22	2			4					3					5	1			3		1		2	1	4	1		1	208	83
22X-2, 28-30	551.58	5.59	84.31						3	4			1					1						2			4					1				2	140	17
22X-5, 30-32	556.1	5.63	720.11			1			13	1			7					3								2	1	2			5				3	232	36
23X-5, 30-32	564.7	5.72	190.26						9				1										1			2		4	1	1	2	3			2	201	25
24X-3, 30-32	571.3	5.79	331.09						11				2	1					1		2		3			1	1	2		3	1	2			2	218	23
26X-1, 30-32	578.9	5.86	653.38					1	13				5										2			6		1		5		5	1		0	211	32
27X-1, 30-32	587.6	5.92	213.75						7				7	1							1		4			6	2	1		2	4	2	1		2	209	33
27X-5, 30-32	593.6	5.95	296.17						7				1			2			4		1		1			1				4	2	4	3		0	208	30
28X-4, 28-30	600.85	5.98	228.84					1	9				2						1				2			4				1	1	2	1		2	223	11
29X-3, 30-32	609.8	6.01	13.70																												1					1	23	5
30X-1, 30-32	616.4	6.04	41.30										13			1												1			1					1	67	9
31X-1, 30-32	626	6.08	1.19																																	0	2	0
31X-5, 30-32	631.93	6.11	6.35																												1					0	11	0
33X-3, 30-32	638.77	6.14	29.93	1									2																		1		1			1	51	9
34X-CC, 0-1	646.45	6.17	40.14					1	5				1	1														1			1					0	65	7
35X-1, 30-32	654.8	6.20	0.00																																	0	0	0
35X-7, 30-32	661.71	6.23	3.05																					1												0	5	0
37X-3, 30-32	668.4	6.26	32.97						2														1			2		3								0	53	16
38X-2, 30-32	675.6	6.29	42.01						1				1																							0	69	16
39X-1, 30-32	683.7	6.32	15.91																																	0	27	7
39X-6, 30-32	691.2	6.36	18.40						1																			2			1					0	31	5
42X-1, 30-32	702.9	6.40	59.06						1			1												1							1					1	97	11
42X-CC, 0-1	706.42	6.42	19.54						2																									2		0	32	9
43X-2, 27-29	713.97	6.45	56.72						2				1																	1	1			1		1	94	12
43X-CC, 25-26	720.76	6.48	18.88						2																											1	32	2
45X-5, 29-31	728.95	6.51	17.77																																	0	30	1
46X-5, 30-32	736.54	6.55	0.61																																	0	1	1
47X-3, 31-33	744.41	6.58	13.84																																	1	23	0
47X-CC, 0-1	749.64	6.60	113.18									1	3																		1	1		1		3	190	15

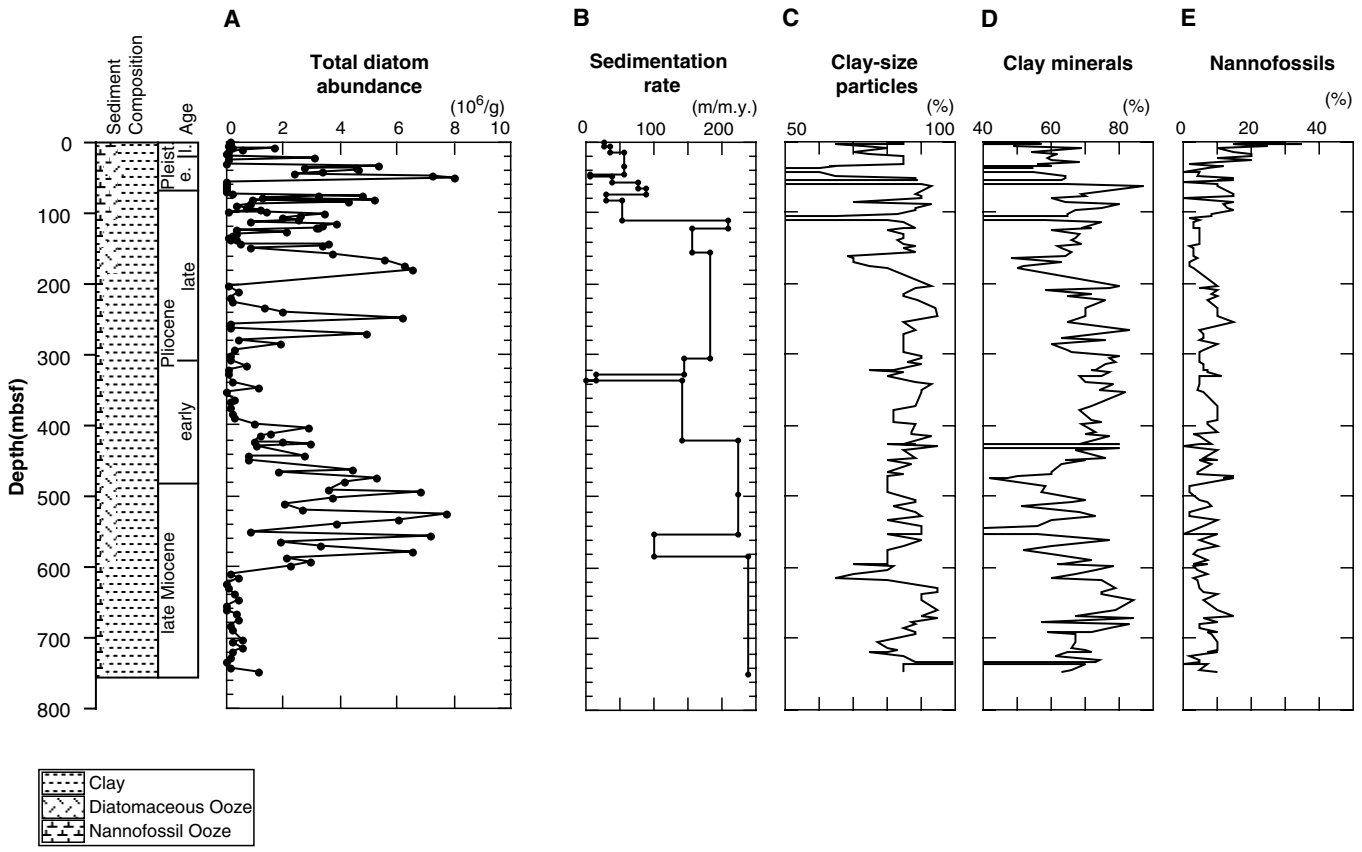

Figure 2. Stratigraphic variations in the total abundance of diatom valves and other related parameters plotted against the sub-bottom depth. The data, except for the diatom abundance, are taken from Shipboard Scientific Party (1996).

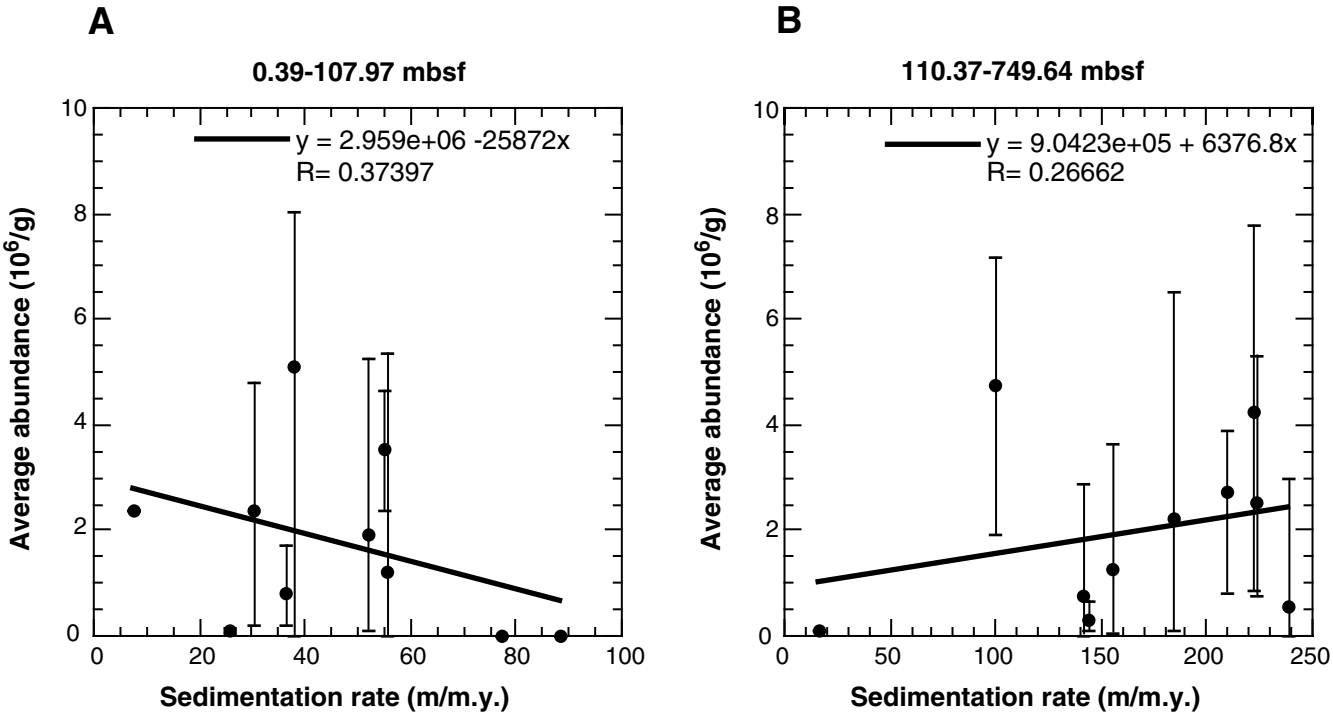

Figure 3. Correlations between the average abundance of diatoms and sedimentation rates in the upper (0–110 mbsf) and lower (110–750 mbsf) sequences.

be some correlation between the diatom abundance and the eustatic curve in the upper part: the higher abundances of 2.1–1.8 Ma and 1.4–0.8 Ma correspond to the highstand phases (Fig. 4). As was discussed above, however, the higher total diatom abundances are result of reduced clay supply but not of increased productivity. Contrary, the higher diatom flux of 3.0–2.8 Ma, which corresponds to regression phase, is a result of the increased supply of diatom valves, possibly because of an increased productivity.

Stage 5. Low-productivity Stage (0.8–0 Ma)

Although there are some short exceptions, the diatom abundance is low. This interval corresponds to the lowstand phase, concordant with the trend observed in the upper part of the underlying stage.

ACKNOWLEDGMENTS

We thank the co-chiefs, shipboard scientists, technicians, and crews of the *JOIDES Resolution* for their assistance and cooperation in obtaining the samples. Our thanks is also extended to Dr. K. Kashima, Kyushu University, for his valuable advice.

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Date of initial receipt: 27 April 1998
Date of acceptance: 13 October 1998
Ms 164SR-231

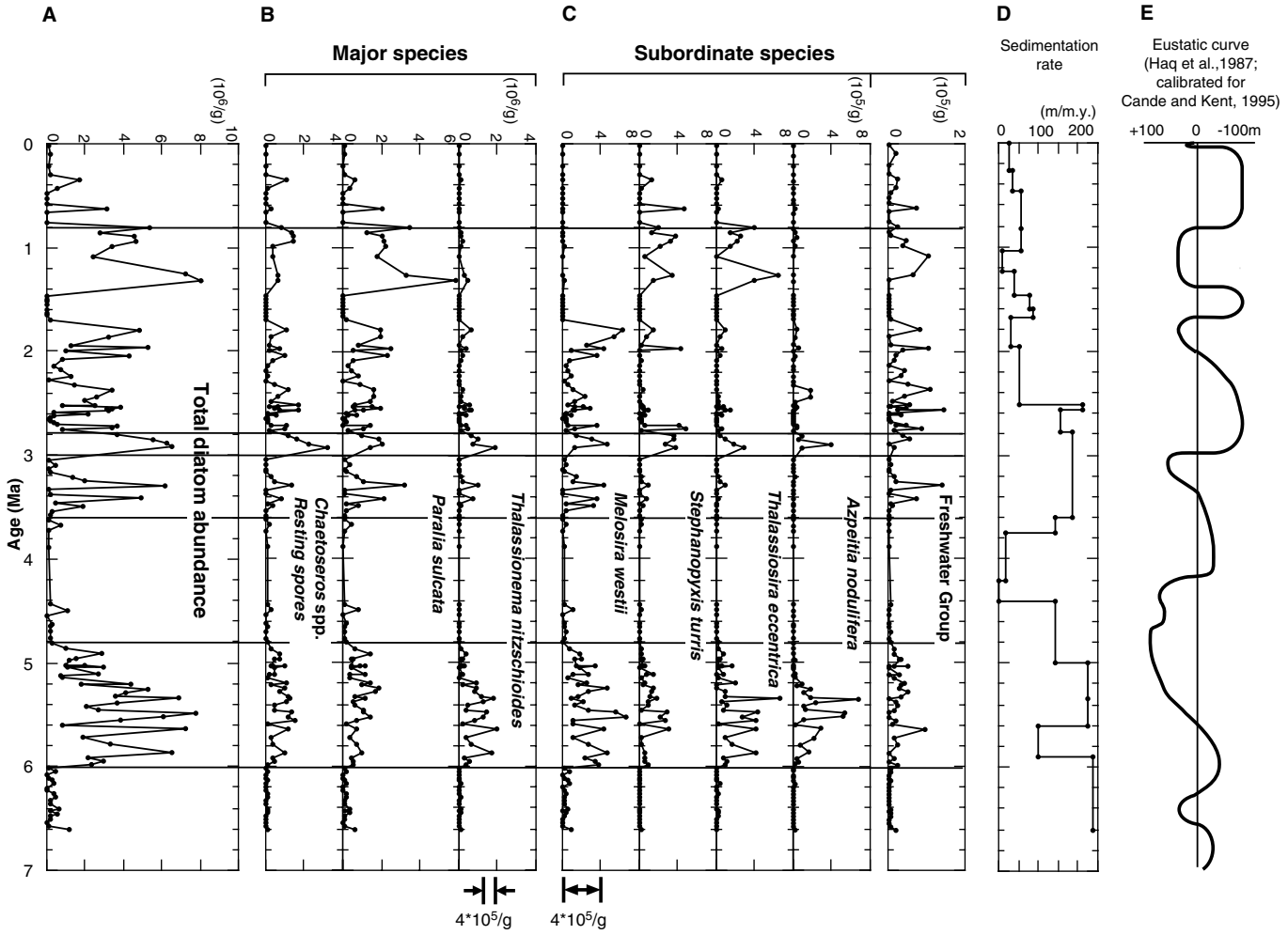

Figure 4. Time series of (**A**) total abundance of diatom valves, (**B**) abundances of the major species, (**C**) abundances of subordinate species, (**D**) sedimentation rate, and (**E**) eustatic curve (Haq et al., 1987). Note the difference in the horizontal (abundance) scales of B and C. The age assignments for the eustatic curve are calibrated by Cande and Kent (1995). The eustatic curve of Haq et al. (1987) is modified by the recent paleomagnetic chronology of Cande and Kent (1995).