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46. *DATA REPORT:* MIOCENE PLANKTONIC FORAMINIFERS FROM THE EASTERN EQUATORIAL PACIFIC[1]

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INTRODUCTION

Neogene calcareous sediments were recovered at 11 sites along two north-south transects in the eastern equatorial Pacific Ocean during Ocean Drilling Program (ODP) Leg 138. An overview of planktonic foraminifer distribution in these sediments was presented in Mayer, Pisias, Janecek, et al. (1992) based on a preliminary examination of core-catcher samples. In general, the preservation state of the foraminifers is poor throughout most of the sedimentary sequences, making this microfossil group here of much less value for biostratigraphy than other microfossil groups. Pliocene–Pleistocene planktonic foraminifers from several sites have been analyzed in great detail for their oxygen and carbon isotope composition in various high-resolution studies (Farrell et al., this volume; Mix et al., this volume; Ravello et al., this volume; Shackleton et al., this volume). Planktonic foraminiferal datums of biostratigraphic value have been identified in several of these studies. This report presents planktonic foraminiferal distribution in selected Miocene sediments.

Samples of approximately 10 cm^3 each were collected at a sampling interval of about 1.5 m from one hole at each site. All sedimentary sequences, however, were not examined at equal resolution. Stratigraphic intervals examined and the resolution of samples analyzed were selected according to the preservation state of the calcareous sediments and to objectives looked for, that is, identification of biostratigraphic datums and zonal boundaries. Upper Miocene and upper middle Miocene sediments often were tentatively zoned or left unzoned in the foraminiferal study based on core-catchers samples given in Mayer, Pisias, Janecek, et al. (1992) because of the rarity of reliable biostratigraphic datums. This stratigraphic interval (Zones N17 through N14) has not been treated in detail here, whereas middle middle Miocene, lower middle Miocene, and lower Miocene sediments were analyzed in greater detail, especially in the expanded sections of the eastern transect (Sites 844 through 846; Table 1).

Samples were disaggregated by soaking 24 hr in buffered Calgon solution at room temperature and washed over a 63-mm mesh sieve. Dried samples were weighted before and after washing to obtain the percentage of sand-sized components, which is given in Tables 2 through 6 at the right of each table. A visual estimate of the abundance of planktonic foraminifers is given in these tables, with the abbreviations B (barren), R (rare), F (few), C (common), and A (abundant); an estimate of the foraminiferal fauna preservation state is reported using the following qualitative preservation scale: G (good), M (moderately good), and P (poor). These abundance and preservation schemes have been defined in the "Explanatory Notes" chapter in Mayer, Pisias, Janecek, et al. (1992). An estimate of the abundance of various biogenic components other than planktonic foraminifers also is given. The distribution of selected planktonic key species in the holes studied is reported in Tables 2 through 6, where the occurrence of a species in a sample is indicated with a capital X, whereas a virgule (/) indicates that this species is extremely rare or presents some taxonomic ambiguity.

Taxonomic concepts used in this study follow those of Vincent and Toumarkine (1990), who gave an annotated species list. The zonation applied is that of Blow (1969), as emended for the definition of the base of Zone N13 by Kennett and Srinivasan (1983), who used the last occurrence of *Globorotalia fohsi lobata* and *G. fohsi robusta* (called "top *G. fohsi* group" in the biostratigraphic summary of Shackleton et al., this volume) to define the Zone N12/N13 boundary.

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Table 1. Holes from Leg 138 analyzed for Miocene planktonic foraminifers.

	Hole	Latitude	Longitude	Water depth (m)
Eastern transect	844B	7°55.279′N	90°28.846′W	3414.5
	845A	9°34.950′N	94°35.448′W	3704.2
	846B	3°5.696′S	90°49.078′W	3295.8
Western transect	848B	2°59.634′S	110°28.791′W	3855.6
	852B	5°17.566′N	110°4.579′W	3859.9

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*Abbreviations for names of organizations and publications in ODP reference lists follow the style given in *Chemical Abstracts Service Source Index* (published by American Chemical Society).

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Table 2. Distribution of Miocene planktonic formanifers in sediments of Hole 844B.

Series	Zone	Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	*Candeina nitida*	*Globigerinatella insueta*	*Globigerinella siphonifera*	*Globigerinoides altiaperturus*	*Gs. conglobatus*	*Gs. dimidatus*	*Gs. obliquus* s.l.	*Gs. quadrilobatus* s.l.	*Gs. ruber* s.l.	*Praeorbulina sicana*	*Pr. transitoria*	*Pr. glomerosa curva*	*Pr. glomerosa glomerosa*	*Pr. glomerosa circularis*	*Orbulina suturalis*	*O. universa*	*Globorotalia mayeri* s.l.	*G. praescitula*	*Gr. scitula*	*Gr. peripheronunda*	*Gr. peripheroacuta*	*Gr. praefohsi*	*Gr. fohsi fohsi*	*Gr. fohsi lobata*	*Gr. fohsi robusta*	*Gr. archeomenardii*	*Gr. praemenardii*	*Gr. menardii*	*Gr. limbata*	*Gr. plesiotumida*	*G. tumida*	*Globorotaloides hexagona*	*Gd. suteri*	*Gd. variabilis*	*Clavatorella bermudezi*	*Dentoglobigerina altispira altispira*	*D. altispira globosa*	*Globoquadrina baroemoenensis*	*Gq. dehiscens*	*Gq. praedehiscens*	*Gq. venezuelana*	*Globaturborotalita nepenthes*	*Neogloboquadrina acostaensis*	*Sphaeroidinellopsis disjuncta*	*Ss. kochi*	*Ss. seminulina*	Benthic foraminifers	Ostracodes	Diatoms	Radiolarians	Sponge spicules	Fish remains	Planktonic foraminifers—abundance	Planktonic foraminifers—preservation	Sand-size fraction > 63 µm (%)
Pliocene	N18	4H-CC	33.00	36.65																												/	/		/														/	A		C	A	C	R	F	P	
upper Miocene	N17 to N15	5H-3, 85–89	36.85	40.50	/				X		X	X								X												/				X				X					/		/		X	C		A	A	A		C	M/P	3.6
		5H-CC	42.50	46.60			/				X	X								X													X							/	X				X		/		X	A		A	A	R	R	C	M/P	
		6H-4, 80–85	47.80	51.90			X				/	X								X																			X					X				X	F		A	A			F	M/P	5.5
		6H-6, 80–85	50.80	54.90			/				X	X								X	/												/							/	X	/		/				/	/	R		A	A	C		F	M	9.5
middle Miocene	N14	6H-CC	52.00	58.70																																																							B		
		7H-2, 80–85	54.30	61.00																																																						B		7.1
		7H-5, 80–85	58.80	65.50																																																						B		4.7
		7H-CC	61.50	68.65																																																						B		
		8H-2, 80–84	63.80	70.95																																																						B		4.2
		8H-3, 84–88	65.34	72.49																/																									/				/	F		A	A	A			R	P	3.5
		8H-4, 80–84	66.81	73.96							X	X							X	X	X										X	X							/					X	/		/	X	R		A	A	F		F	P	4.2
		8H-5, 80–84	68.32	75.47							/	X								/	X												/											/	/			/	C		A	A	C		R	P	3.7
	N13	8H-6, 80–84	69.82	76.97								X								X	X																			/				X			/	X	F		A	A	C		F	M/P	3.9
		8H-CC	71.00	79.65																																																						B		
		9H-2, 81–86	73.31	81.96																/																													F		A	A	C		R	P	3.7
		9H-4, 81–86	76.31	84.96								/							/	/	X											/												X					F		A	A	C		R	P	3.0
		9H-5, 81–86	77.81	86.46							/	X							X	X	X		/								/												X				/	F	R	A	A	A		R	P	2.7
		9H-6, 81–86	79.31	87.96							/	X								X	X		/									/			/						/	/	X			/	/	C	R	A	A	F		R	P	2.4
		9H-CC	80.50	91.13								X								X	X		X									X					X		/	/	/		X			X	X	C	F	A	A	R	F	C	M/P	
		10H-1, 79–84	81.29	91.92								X							X	X	X		X								X	/	/		/			/	X	/	X			X			X	C		A	A	A		F	M/P	2.5
	N12	10H-2, 79–84	82.79	93.42								X	X						X	/	X		/					/	/		X						/		/	/	X	X		X			X	X	C	R	A	A	A	R	F	M/P	2.7
		10H-4, 79–84	85.79	96.42							/	X	X						X	X	X		X								/						X		X	/	X	X		X			X	X	C	R	A	A	A		C	M	4.0
		10H-5, 79–84	87.29	97.92								X	X						X	X	X		X				/	/			/	X							X		X	X		X			X	R		A	A	F		C	M	3.9
		10H-6, 79–84	88.79	99.42								X	X						X	X	X		X				/	/	/		X	X			/				X	X	X	X		X			X	R		A	A	R		A	M	10.4
		10H-CC	90.00	103.50								X	X							X	X		/				X	/			X								X	X	X	X		X			X	F		C	A	F	R	C	M	
		11H-1, 80–85	90.80	104.30								X	/						X	X	X		X								X								X	X	X	X		X			X	F		A	A	R		C	M	6.1
		11H-2, 80–85	92.30	105.80								X	/						X	X	X		/					/								X			X	X	/	/		X			X	F		A	A	C		A	G	7.7
		11H-3, 80–85	93.80	107.30							/	X	X						X	X	X										X							X		X	X	X		X			X	R		A	A	F		C	M	7.0
		11H-5, 85–90	96.85	110.35			/					X	X						X	X	X		X				/	/			X								X		X	X		X			X	R	R	C	A	F		C	M	12.8
		11H-6, 80–85	98.30	111.80							/	X	/						X	X	X		X						/		/						X		/	/	X	X		X			X	F		C	A	F	R	C	M	6.2
		11H-7, 54–59	99.54	113.04			/					X	X						X	X	X		X				X	X			X								X	/	X	X		X			X	C		A	A	A	R	A	M/G	8.5
		11H-CC	99.50	113.03								X	X							X	X						X	X			X								X		X	X		X			X	R		C	A	F		A	G	
		12H-5, 80–85	106.30	119.83			X					X	X						X	X	X						X	X			X							X		X	X	X	X		X						A	A	A	R			8.6
		12H-CC	109.00	122.80																																															F		A	A			B		
		13H-4, 78–83	114.28	128.08			X					X	X						X	X	X					X	X	X			X							X		/	/	X	X		X						A	A	A		C	M	8.8
		13H-CC	118.50	133.33							X	X	X						X	X	X					X	X	X			X								X		X			X			X	F			A	F		A	M	
		14H-2, 80–84	120.80	135.63			X				X	X	X						X	X	X				/		X	X			X							X		X	X	X	X		X				R		A	A	C				8.8
		14H-CC	128.00	143.00							X	X	X						X	X	X					X	X	X			X								X		/	/		X			/	X	C		A	A	R		A	M/P	
		15H-5, 78–83	134.78	149.78							X	X	X						X								X	X	/		X					X				X		X			X		X		F		F	A	R		A	M	7.6
		15H-CC	137.50	153.68							/	X	/						X	X	X						X	X			X								X	X	X	X		X				F		C	A	F		A	M	
		16H-1, 80–85	138.30	154.48							X	X	X						X	X	X						X	X			X								X		X	X		X			X	F		A	A	F		A	M	9.5
		16H-2, 80–85	139.80	155.98							X	X	X						X	X	X						X	X			X					/		/	X	/	X	X		X			X	F		C	A	F		A	M	8.1
		16H-3, 80–85	141.30	157.48								X	X						X	X	X						X	/			X					X		X	X					X		/	/	F		F	A	F	R	A	M	6.1
		16H-4, 80–85	142.80	158.98							/	X	/						X	X	X					X	X				X								X		X	X		X		/		F		F	C	C		A	M	11.7
		16H-5, 80–85	144.30	160.48								X	X						/		X					X	X				X								X		X	/		X			X	F		A	A	A		C	M	5.0
		16H-CC	147.00	162.60							X	X	X						X	X	X	X				X	X				X								X	X	X	X		X		X		F		C	A	F		A	G/M	
		17H-1, 78–83	147.78	163.38							/	X	/						/	/	X						X				X								X	/	X	X		X				F	R	C	A	A	R	C	M	4.6
		17H-4, 78–83	152.28	167.88								X									X					X	X				X								X	/	X	/		X			X	F		C	A	C		C	M	5.2
		17H-CC	156.50	173.55							X	X							X	X	X	X				X	/				X								X	X	X	X		X		X		F		C	A	F		A	G/M	
		18H-2, 80–84	158.80	175.85							/	X							/	/	X					X	X				X								X	X	X	/		X		/		R	R	C	A	F		C	M	5.4
	N11	18H-3, 80–84	160.30	177.35							X	X							X	/	X					X					X								X		X	X		X		X	X	R	R	F	C	R		C	M	10.1
		18H-4, 80–84	161.80	178.85							X	X							X		X					/					X								X		X	/		X		X	X	R	R	C	A	F		C	M/P	7.5
		18H-CC	166.00	183.20							X	X							X	X	X					X					X								X		X	X		X		X		F		F	C	R		A	M	
		19H-1, 80–85	166.80	184.00								X							X	/	X				/	/					X								X	/	/	/		X		/	/	R	R		C	R		C	M	9.6
		19H-2, 80–85	168.30	185.00								X							X		X				/	X					X						/		X		X	/		X				F	R	C	A	F		C	M	5.0
		19H-3, 80–85	169.80	187.00							X	X																																												A	M	8.3
		19H-4, 80–85	171.30	188.50							/	X							X		X				/	X					/					/	X		X	/	X	X		X		X		R	R	F	F	R	R	A	M/G	10.6
		19H-6, 80–85	174.30	191.50								X							X		X				/	X					X						/				X	X		X		X								A	M/G	7.8
		19H-CC	175.50	194.13							X	X							X		X	X							X										X	/	X	X		X		X		R		C	C	R		A	MD	
		20H-1, 80–84	176.30	194.93							X	X							X		X					X													X		X	X		X		X		F	R	F	C	F		A	M/G	8.2
		20H-2, 80–84	177.80	196.43							X	X							X		X				/	X													X		X	X		X		/										9.5

Table 2 (continued).

Series	Zone	Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	*Candeina nitida*	*Globigerinatella insueta*	*Globigerinella siphonifera*	*Globigerinoides altiaperturus*	*Gs. conglobatus*	*Gs. diminutus*	*Gs. obliquus* s.l.	*Gs. quadrilobatus* s.l.	*Gs. ruber* s.l.	*Praeorbulina sicana*	*Pr. transitoria*	*Pr. glomerosa curva*	*Pr. glomerosa glomerosa*	*Pr. glomerosa circularis*	*Orbulina saturalis*	*O. universa*	*Globorotalia mayeri* s.l.	*G. praescitula*	*Gr. scitula*	*Gr. peripheroronda*	*Gr. peripheroacuta*	*Gr. praefohsi*	*Gr. fohsi fohsi*	*Gr. fohsi lobata*	*Gr. fohsi robusta*	*Gr. archeomenardii*	*Gr. praemenardii*	*Gr. menardii*	*Gr. limbata*	*Gr. plesiotumida*	*Gr. tumida*	*Globorotaloides hexagona*	*Gd. sateri*	*Gd. variabilis*	*Clavatorella bermudezi*	*Dentoglobigerina altispira altispira*	*D. altispira globosa*	*Globoquadrina baroemoenensis*	*Gq. dehiscens*	*Gq. praedehiscens*	*Gq. venezuelana*	*Globorubrotalita nepenthes*	*Neogloboquadrina acostaensis*	*Sphaeroidinellopsis disjuncta*	*Ss. kochi*	*Ss. seminulina*	Benthic foraminifers	Ostracodes	Diatoms	Radiolarians	Sponge spicules	Fish remains	Planktonic foraminifers—abundance	Planktonic foraminifers—preservation	Sand-size fraction > 63 µm (%)
middle Miocene	N10	20H-3, 80–84	179.30	197.93								X							X		X				/					X									/	X		X	X		X			/			F		F	C	F		A	M	9.5
		20H-5, 80–84	182.30	200.93		/					/	X									X			/						/								/	/		/	X		X						F		A	A	A		F	P	2.0
		20H-6, 80–84	183.80	202.43								X						/	X		X	X			X					/	/							X	/		X	X		X						R		R	F	R		A	M	14.7
		20H-CC	185.00	203.63								X						X	X		X	X		X						X								X	X		X	X		X						F		F	C	F		C	P	
		21X-1, 80–85	185.80	204.43		/						X							X		X			X	/					X						X	/	X	X	X		/	X		X						C		C	A	F		C	P	5.1
		21X-2, 80–85	187.30	205.93			/				X	X									X	X			X					X						X			X	X		X	X		X						R		F	A	F		C	M/P	6.1
	N9	21X-4, 80–85	190.30	208.93								/									/																					/		X						C		A	A	C	R	R	P	3.7
		21X-CC	194.60	213.23								X									X	X		X						/							X	X	/		X	/		X						R		A	A	C		R	P	
		22X-1, 80–85	195.40	214.03								X							/		X	/		/						/	/					/		/	/	X		X	X		X						F	R	F	C	F		C	M	13.8
		22X-3, 80–85	198.40	217.03			X				/	X							X		X	X		/						X								X	X		X	X		X			X				R	R	C	F		A	M	9.8
lower Miocene	N8	22X-5, 80–85	201.40	220.03								X		/				X			X			/						/	/							X	X	X		X	X		X			X			F		F	C	A		A	M/P	6.8
		22X-6, 80–85	202.90	221.53								X		/				/			X			X						/	/							X	X	X		X	X		X			X			C	R	F	C	A		C	M	7.7
		22X-CC	204.30	222.93			/					X		/		/	/				X	X		X						X									X	/		X	/		X			X			R		A	A	F		C	P	
		23X-1, 80–84	205.10	223.73							/	X									X	/		X						X									X	X		X	X		X					/	F	R	C	A	C	R	C	M/P	11.8
		23X-2, 80–84	206.60	225.23							/	X						/			X			/						X									X	X		X	/		X			/			C	R	F	C	F		C	M/P	8.4
		23X-3, 80–84	208.10	226.73								X		/							X	/		/						/								/	X	X		X	X		X						F		C	A	F		C	M	8.7
		23X-4, 80–84	209.60	228.23								X		/				/			X									X									X	X		X	X		X						F		C	A	C		C	P	5.5
		23X-CC	213.90	232.53								X		/		/	/				X	X		X						X								/	/			X	X		X						R		C	C	C		C	P	
		24X-2, 78–82	216.18	234.81								X		/							X	X		X						X									/			X	/		X						C	R	C	A	C	R	C	M/P	2.6
		24X-3, 78–82	217.68	236.31								X	X	/		/	/				X	/		X						X									X			X			X						R		F	C	R		A	M/P	7.6
		24X-4, 78–82	219.18	237.81								X		X		X	X				X	/		/						X									X			X	X		X						R		C	A	C		A	M	8.0
		24X-5, 78–82	220.68	239.31								X		/		/	/				X	X		X						X										X		/	/		X						F		C	A	C		C	M/P	4.8
		24X-CC	223.60	242.23		/				/		X		X		X	/				X	X								X							X					X	X		X						R		R	C	R		A	P	
		25X-3, 80–85	227.40	246.03								X	X	X		X	/				X	X		X						X							X		X			X	X		X						R	R	F	C	F		A	P	16.0
		25X-CC	233.30	251.93		/					/	X	X	/		/	/				X	/		/													X		X			X	/	/	X						F		R	F	R		A	M	
		26X-2, 80–85	235.60	254.23							/	X	X	X		X	/				X	X								X						X		X		X		X	X		X						F	R	F	C	F		A	M/P	15.8
		26X-4, 85–87	238.65	257.23								X	X	X		X					X	/		/														X		X		X	X		X						R		F	A	C		A	M/P	10.4
		26X-5, 78–80	240.08	258.71								X	X	X		X					X			/						X								X		X		X	X		X			/			F		F	A	R		A	M/P	10.4
		26X-5, 82–84	240.12	258.75								X	X	/		X					X	X		/						/								X		X		X	X		X						R		R		C		A	M/P	10.4
		26X-6, 78–80	241.58	260.21								X	/								X	/		X						/						X		X		X		X	X		X						F		F	C	F		C	P	15.2
		26X-6, 82–84	241.62	260.25						/		X	X								X	X		/						X								X		X		X	X		X			/			F		F	A	F		C	P	11.2
		26X-CC	242.90	261.53		/						X	X	X		X					X	/								/								X		X		X	X		X						F		F	A	R		A	P	
		28X-1, 80–85	253.40	272.03								X	X	/		/					X									/								X		X		X	X		X						F		C	C	F		C	M/P	9.1
		28X-3, 79–84	256.39	275.02								X	X	X							X									/								/		/		X	/		X						F		F	C	R		C	P	11.5
		28X-CC	261.90	280.53								X		X							X	/																	/		X	X		X						F		F	A	F		A	M/P	
		28X-1, 79–84	262.69	281.32								X	X	/							X	/																X		X		X	X		X						F		F	C	F		A	M	11.4
		28X-3, 79–84	265.69	284.32								X	X	/							X																	X		X		X	X		X						F		F	A	R	R	A	M	13.1
		28X-5, 80–85	268.70	287.33								X	X	X							X	/								/									X		X	X		X						C		A	A	C		A	M	14.0
		28X-7, 34–38	271.24	289.87						X		X	X	X							X																		X		X	X		X						C		C	A	F		C	P	6.7
		28X-CC	271.60	290.23						X		X	X								X															X					X	X		X						A		C	A	F	R	F	P	
		30X-1, 74–79	272.34	290.97						/		X	X	X							X			X																	X	X		X						C		C	A	F		F	P	6.8
		30X-4, 75–80	276.85	295.48								X	X								X			X																	/		X						F		A	A	F		F	P	4.4
		30X-5, 78–83	278.38	297.01								/		/							/																						/						R		A	A	F		R	P	3.5
		30X-6, 79–84	279.89	298.52								X	/	X							X			X															/		/	/		X						C	R	A	A	F		F	P	5.8
	N7	30X-CC	281.20	299.83						X		X	X								X															X						X		X			/			A		C	A	R		F	P	
		31X-2, 80–84	283.50	302.13								/									X																													C		A	A	R		R	P	3.8
		31X-4, 80–84	286.50	305.13								X	/								X			X															/			X	X							C		C	A	R		C	P	9.5
		31X-5, 80–84	288.00	306.63						/		X									X			X																		X	X							C		C	A	F		C	P	7.1
		31X-6, 80–84	289.50	308.13				/		/		X									X			X												/	/					/	/							C		R	R	F	F	F	P	1.5

Note: An explanation of symbols used has been given in the text.

Table 3. Distribution of Miocene planktonic foraminifers in sediments of Hole 845A.

Series	Zone	Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	*Candeina nitida*	*Globigerinatella insueta*	*Globigerinatella siphonifera*	*Globigerinoides altiaperturus*	*Gs. conglobatus*	*Gs. diminutus*	*Gs. obliquus* s.l.	*Gs. quadrilobatus* s.l.	*Gs. ruber* s.l.	*Praeorbulina sicana*	*Pr. transitoria*	*Pr. glomerosa curva*	*Pr. glomerosa glomerosa*	*Pr. glomerosa circularis*	*Orbulina suturalis*	*O. universa*	*Globorotalia mayeri* s.l.	*G. praescitula*	*Gr. scitula*	*Gr. peripheroronda*	*Gr. peripheroacuta*	*Gr. praefohsi*	*Gr. fohsi fohsi*	*Gr. fohsi lobata*	*Gr. fohsi robusta*	*Gr. archeomenardii*	*Gr. praemenardii*	*Gr. menardii*	*Gr. limbata*	*Gr. plesiotumida*	*Gr. tumida*	*Globorotaloides hexagona*	*Gr. suteri*	*Gd. variabilis*	*Clavatorella bermudezi*	*Dentoglobigerina altispira altispira*	*D. altispira globosa*	*Globoquadrina baroemoenensis*	*Gq. dehiscens*	*Gq. praedehiscens*	*Gq. venezuelana*	*Globoturborotalita nepenthes*	*Neogloboquadrina acostaensis*	*Sphaeroidinellopsis disjuncta*	*Ss. kochi*	*Ss. seminulina*	Benthic foraminifers	Ostracodes	Diatoms	Radiolarians	Sponge spicules	Fish remains	Planktonic foraminifers—abundance	Planktonic foraminifers—preservation	Sand-size fraction > 63 µm (%)
Pliocene	N18	9H-CC	83.60	91.61							X	X																				/	/		X																F		R	A	C	F	R	P	
		10H-3, 80–85	87.40	95.88																/														/																F		C	C			R	P	13.0
		10H-CC	93.10	102.86																																													F		F	A	F		B		
upper Miocene	N17	11H-3, 80–82	96.90	106.66																																													F		A	A	F		B		4.1
		11H-CC	102.60	113.93							X	X																						/						X					X				/	F	R	C	A	F		R	P	
		12H-4, 78–82	107.88	119.21			X				X	X								X												X	X			X					/	/	/		X					R		A	A	R	R	F	P	3.0
		12H-CC	112.10	124.71								X								X														X															/	F			A	F		R	P	
		13H-4, 77–82	117.37	129.98																																															A	A	F	R	B		9.1
		13H-CC	121.60	135.58																																															A	A	F	R	B		
		14H-3, 80–85	125.40	139.38																																																		B		13.5
		14H-CC	131.10	146.96																																														C	A	C	R	B		
?	?	15H-3, 81–85	134.91	150.77																																														A	A	C		B		5.4
		15H-CC	140.60	158.33																																													F	R	R	A	C	R	B		
		16H-1, 80–85	141.40	159.13																																																		B		2.0
		16H-CC	150.10	168.91																																													C		F	A	C	C	B		
		17H-1, 80–84	150.90	169.71								/									X															/		X							X			/	X	C		C	A	F	F	R	P	0.7
		17H-4, 44–49	155.04	173.85								/									/										X							X		/					X			/	X	C	R	A	C	F	F	R	P	1.1
		17H-5, 64–69	156.74	175.55								X	/						X	/	/																					/		/	X			/	X	C		A	A	F	R	R	P	1.6
		17H-6, 24–29	157.84	176.55								X	X							X	X		X									X						X		X	X	X	/	X				X	F		A	A	F		F	M	2.3
	N13	17H-6, 123–128	158.83	177.64							/	X	/							X	X		/									/						X		X	/	/	X	X			/	X	R		C	C	F	R	F	P	2.8
		17H-7, 3–8	159.13	177.94								X	/							/	X		X								/					/		X		/	/	/		X			/	X	C		A	C	F		F	P	2.5
		17H-7, 23–28	159.33	178.14								X	X						X	X	X		X															X		X	/	X	X	X			X	X	R	R	C	C	F		C	M	2.3
		17H-7, 48–53	159.58	178.39								X	/							X			/								/							/		/		/	/	X			X		F	R	C	C	F	R	R	P	2.5
		17H-CC	159.60	178.88																																													C		C	A	F	F	B		
		18H-1, 3–8	159.63	178.91								X									/							/			/							/		X	/	X	/	X				X	C	R	A	A	F	F	R	P	1.9
middle Miocene		18H-1, 23–28	159.83	179.11								X								X	/		/						/	X								/		X	/	X	X	X			/	X	F	R	C	C	F		F	P	2.5
		18H-1, 43–48	160.03	179.31								/	/							X																/		/		X		X	X	X				X	F		F	C	F		F	P	2.7
		18H-1, 66–71	160.26	179.54			/					X	X						/	X							/				/							X		X		X		X			/	X	R		R	F	R		C	P	4.7
		18H-1, 142–147	161.02	180.30								X								X	X		/				/	/			/									X		X	X	X				X	R		C	A	F		F	P	3.0
		18H-2, 80–85	161.90	181.18								X	X							X	X		X			X	X				X									X		X	X	X			X	X	C	F	C	A	F	R	F	P	3.2
		18H-3, 43–48	163.03	182.31								X	/						/	X	X		X				X				X									X		X	X	X			/	X	C		F	A	F	R	C	P	4.7
		18H-4, 3–8	164.13	183.41								X	X							X	X						X				X						X			X		X	X	X			/	X	C		C	A	F				4.6
		18H-4, 80–85	164.90	184.18							/	X	X						X	X	X						X	X			X								/	X		X	X	X			/	X	F		C	C	F		C	M	4.6
		18H-5, 3–8	165.63	184.91								X	X							X	X						/	X			X						X			X		X	X	X				/	C		A	A	F		F	P	3.8
		18H-6, 3–8	167.13	186.41								X	X							X	X						X	X			X						/			/		/	X	X			/	X	C		F	C	F		F	P	2.4
		18H-6, 141–146	168.51	187.79								X	/						/	X			/				/	X								/				/		/	X	X				X	C		F	C	F	R	F	P	2.3
		18H-7, 43–48	169.03	188.31								X	/							X	X						X	X			/					X				X		X	X	X				X	C	R	F	A	F		C	P	3.8
		18H-CC	169.10	189.76								X									X						/	/												X		X	X	X				X	A	R	A	A	F		R	P	
		19H-1, 3–8	169.13	189.79								X	X								X						X	X			/									X	X		X	X				X	C		A	A	F		C	M	3.6
		19H-1, 143–148	170.53	191.19								X	X								X		/				/	X								/				/		/	X					C	R	A	A	F		C		2.2
	N12	19H-2, 3–8	170.63	191.29								X	X							X	X						/	X			/									X		/	X				X	R		A	A	F		C	M	3.3
		19H-2, 23–28	170.83	191.49								X	X							X	X						/	X			/									X	X	X	X	X			X	X	R	R	A	A	C		A	M	4.6
		19H-3, 3–8	172.13	192.79								X	X						/	X	X		X				X	X			X				/					X		X	X	X				X	F		C	C	R		A	M	3.2
		19H-3, 123–128	173.33	193.99								X								X	X						X	X			X									/	/		X	X				X	R		C	C	F		A	M	4.1
		19H-4, 103–108	174.63	195.29								X	X							X	X		/				X	X			X									X	/	/	/	X					X	R	R	C	C	F		A	M	4.9
		19H-5, 80–85	175.90	196.56								X	X							X	X						/	/			X									X		X	X	X				X	X	C	F	A	A	C		C	M	3.1
		19H-6, 103–108	177.63	198.29								X	X							X	X						X	X			/									X		X	X	X					C		C	A	F		C	P	2.9
		19H-7, 21–26	178.31	198.97							/	X	X						/	/							X	X												X	/	/		X			/	X	F		A	A	F		C	M/P	3.5
		19H-CC	178.60	200.93								X	X						/	X	X						X	X			/									X	/	X	/	X			X	X	/	F	R	C	A	F		C	M/P	
		20H-1, 61–66	179.21	201.54								X	X						X	/	X						X	X			/					/			/	/		X	X			/	/	F		C	C	F		C	M	4.7
		20H-2, 41–46	180.51	202.84								X	/						X		X						X	X			/									/		/		X			/	/	F		A	A	F		C	M	4.3
		20H-3, 41–46	182.01	204.34								X	X						X		X						X	X			X									X	X	/	X	X			/		F		A	A	F		A	M/P	5.8
		20H-4, 80–85	183.90	206.23															X	/	X						X	X			/					/				X		X		X			/		R		A	A	F		A	M	6.0
		20H-6, 3–8	186.13	208.46							/	X	/								X						/	X												X	X	X		X			/		F		A	A	F	F	F	P	4.3
		20H-7, 75–80	183.90	206.23							/	X	X						X		X					/	X	X			X				/					X	X	/		X			X		R		A	A	R		A	M	5.7
		20H-CC	188.10	211.33							/									/						/									/											/	/		A	R	C	A	F		R	P	
		21H-1, 143–148	189.53	212.76								X	X						X		X					/	X	X			X					/					X	X	X	X	X			X	/	R		C	C	R				9.8
		21H-2, 143–148	191.03	214.26								X								X						X	/														X	X	/	X					R		R	C			C	M/P	8.8
		21H-4, 3–8	192.63	215.86								X							X	/	X					X	X				/									X	/	X	/	X			/	X	R	R	A	A	R		A	M	9.7
		21H-6, 143–148	197.03	220.26								X							X		X						X													X	/	X	/	X			/	/	R		C	C	F		C	M	8.8
		21H-CC	197.60	222.83								X	/								X					X	/													X	X	X	/	X			X		A		F	A	F		F	M/P	
		22H-1, 3–8	197.63	222.86																																																								3.7
		22H-1, 143–148	199.03	224.26								X							X	/	X		X			/	X				X									X	X	X	/	X			/	X				C	C	F		A	M	12.8

Table 3 (continued).

Series	Zone	Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	*Candeina nitida*	*Globigerinatella insueta*	*Globigerinella siphonifera*	*Globigerinoides altiaperturus*	*Gs. conglobatus*	*Gs. diminutus*	*Gs. obliquus* s.l.	*Gs. quadrilobatus* s.l.	*Gs. ruber* s.l.	*Praeorbulina sicana*	*Pr. transitoria*	*Pr. glomerosa curva*	*Pr. glomerosa glomerosa*	*Pr. glomerosa circularis*	*Orbulina suturalis*	*O. universa*	*Globorotalia mayeri* s.l.	*G. praescitula*	*Gr. scitula*	*Gr. peripheroronda*	*Gr. peripheroacuta*	*Gr. praefohsi*	*Gr. fohsi fohsi*	*Gr. fohsi lobata*	*Gr. fohsi robusta*	*Gr. archeomenardii*	*Gr. praemenardii*	*Gr. menardii*	*Gr. limbata*	*Gr. plesiotumida*	*Gr. tumida*	*Globorotaloides hexagona*	*Gr. suteri*	*Gd. variabilis*	*Clavatorella bermudezi*	*Dentoglobigerina altispira altispira*	*D. altispira globosa*	*Globoquadrina baroemoenensis*	*Gq. dehiscens*	*Gq. praedehiscens*	*Gq. venezuelana*	*Globoturborotalita nepenthes*	*Neogloboquadrina acostaensis*	*Sphaeroidinellopsis disjuncta*	*Ss. kochi*	*Ss. seminulina*	Benthic foraminifers	Ostracodes	Diatoms	Radiolarians	Sponge spicules	Fish remains	Planktonic foraminifers—abundance	Planktonic foraminifers—preservation	Sand-size fraction > 63 µm (%)
middle Miocene		22H-4, 22–27	202.32	227.55							/	X	X						X	/	X		X			X	/											X		X	/	X	/		X			X	X		R	R	R	C	C	F	A	M	7.6
		22H-5, 143–148	205.03	230.26							/	X							X		X					X	X				X									X	X	X	/		X			X	X		F		F	F	R	R	A	M	11.7
		22H-6, 143–148	206.53	231.76							/	X							/		X				/	X	X				X									X	X	X	X		X			X	X		F		C	C	F		C	M/P	5.8
	N11	22H-7, 43–48	207.03	232.26							/	X	/								X				X	X					X									X	/	X	X		X			X	X		F		A	A	C		F	P	3.1
		22H-7, 66–71	207.21	232.44								X							/		X				/	X					/									/	/	X	/		X			X			C		A	A	F		F	M/P	1.6
		22H-CC	207.59	232.82							/	X							X		X	/			/	X					X									X	X	X	X		X			X	X		C		C	C	R		C	M	
		23X-1, 80–85	207.90	233.13							X	X							X		X				X	X				X	/									X		X	/		X			X	/		C		C	C	R	R	F	P	1.3
		23X-2, 80–85	209.40	234.63							/	X							X		X		/		X	X				X	/									X	X	X	X		X			X	X		R		R	F	R		A	M	13.9
		23X-3, 80–85	210.90	236.13							/	X							X		X				X	X				X										X		X	/		X			X	X		R		F	F	R		A	M	6.1
		23X-4, 80–85	212.40	237.63							/	X							X		X		/		X	X				/	/									X		X			X			X	X		R	R	F	C	R		C	M/P	8.1
		23X-CC	216.80	242.03							/	X							/		X					/				X										X	/	X	X		X			X			C	R	F	C	R		F	P	
		24X-1, 80–85	217.60	242.83							/	X							-X		X				X	X				/										X	/	X	X		X			X			R		F	C	R		A	M	9.3
		24X-CC	226.50	251.73							X	X							X		X				X	X														X		X	X		X			X	X		R	R	R	R	R		A	M/G	
	N10	25X-1, 81–86	227.31	252.54							/	/					/		/		/			/	X					X									/	X		/	/		X			/			F		R	R	R	R	C	P	7.7
		25X-2, 80–85	228.80	254.03							X	X		/				/	X		X			X	/					X						/				X		X	X		X						F	R	F	A	R		C	M	3.9
	N9	25X-3, 81–86	230.31	255.54								X							X		X			X						X										X		X	X		X						R	F	F	R			A	M	10.0
		25X-6, 81–86	234.81	260.04								X		X			/	/	X		X			X						/										X		X	X		X						F	R	R	F	R		A	M	6.8
		25X-CC	236.10	261.33								X		/					/		X			X																X		X	X		X			X			C			C	F	R	R	P	
lower Miocene	N8	26X-1, 80–85	236.90	262.13								X		X			/				X																		/	X		X	X		X						C		C	A	C		F	P	1.9
		26X-2, 80–85	238.40	263.63								X		/							X	X								/												X	X		X						F	R	F	A	C		F	P	2.6
		26X-3, 80–85	239.90	265.13								X		X			X	/			X									X										X		X	X		X						F	R	R	C	F	R	A	M/P	4.5
		26X-4, 80–85	241.40	266.63		X						X	X	X			X	X			X	/		X						X						/			/	X		X	X		X						R	R	R	F	R		A	M	12.5
		26X-5, 80–85	242.90	268.13		X				/		X	X	X			X				X	/		X						X									/	X		X	X		X								C	A		R	C	M	2.9
		26X-6, 80–85	244.40	269.63		X						X	X	/			X				X			X						X										/		/	/		X						C		C	A	F		C	M	5.2
		26X-CC	245.80	271.03		X															/	/		/														/						/	/		/						C		C	A	C	C	R	P	
		27X-1, 78–83	246.58	271.81		X						X	X	/							X			/						/								/					/	/		X						C	R	C	A	F		F	P	2.5
		27X-3, 78–83	249.58	274.81		X						X	X	X			/				X			X						X										X		X	X		X						R	R	F	C	R		A	M	14.2
		27X-CC	255.00	280.23						/		/	/			X					X			/																		/	X		X						C		C	A	F	R	R	P	
		28X-1, 78–83	255.78	281.01		X						X	X	X		X					X			X						X						/				X		X	/		X						R			F	R		A	M	13.8
		28X-4, 78–83	260.28	285.51		X				X		X	X	X		X					X			X						/										/		X	X		X						R		F	F	R		A	M	18.0
		28X-CC	264.60	289.83		X				X		X	X	X							X			X																X		X	X		X						F		F	C	F		A	M	
		29X-1, 80–85	265.40	290.63		/						X	X	X							X			/																		X	X		X						R	R	R	F	R		C	M	15.1
		29X-4, 78–83	269.88	295.11		X				/	/	X	X	X		/					X			X													X	/		X		X	X		X						R		R	F	R		A	M	14.6
		29X-6, 80–85	272.90	298.13		/						X	X	X							X																					X	X		X						R		C	C	F		F	M	14.6
		29X-CC	274.20	299.43						/		/									X																					/	/		X						C		F	A	F	R	R	P	
		30X-4, 80–84	279.50	304.73		X					/	X	X	X							X	/															X			X		X	X		X						R	R	C	C	F		C	M	16.4
		30X-CC	283.90	309.13		/				X		X	/	/							X			/																/		X	X		X						F			F	F		C	M	
		31X-3, 80–84	287.70	312.93		/						X	X	/							X			X													/			/		X	X		X			/			F		F	C	F		C	M	7.9
		31X-4, 78–82	289.18	314.83		X						/	/	/							X			X													X			/		/	/		X			/			F	R					F	P	8.0
		31X-CC	291.60	316.14																	X																								X			/			A					R	R	P	

Table 4. Distribution of Miocene planktonic foraminifers in sediments of Hole 846B.

Series	Zone	Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	*Candeina nitida*	*Globigerinatella insueta*	*Globigerinatella siphonifera*	*Globigerinoides altiaperturus*	*Gs. conglobatus*	*Gs. diminutus*	*Gs. obliquus* s.l.	*Gs. quadrilobatus* s.l.	*Gs. ruber* s.l.	*Praeorbulina sicana*	*Pr. transitoria*	*Pr. glomerosa curva*	*Pr. glomerosa glomerosa*	*Pr. glomerosa circularis*	*Orbulina suturalis*	*O. universa*	*Globorotalia mayeri* s.l.	*G. praescitula*	*Gr. scitula*	*Gr. peripheroronda*	*Gr. peripheroacuta*	*Gr. praefohsi*	*Gr. fohsi fohsi*	*Gr. fohsi lobata*	*Gr. fohsi robusta*	*Gr. archeomenardii*	*Gr. praemenardii*	*Gr. menardii*	*Gr. limbata*	*Gr. plesiotumida*	*Gr. tumida*	*Globorotaloides hexagona*	*Gd. suteri*	*Gd. variabilis*	*Clavatorella bermudezi*	*Dentoglobigerina altispira altispira*	*D. altispira globosa*	*Globoquadrina baroemoenensis*	*Gq. delicescens*	*Gq. praedehiscens*	*Gq. venezuelana*	*Globoturborotalita nepenthes*	*Neogloboquadrina acostaensis*	*Sphaeroidinellopsis disjuncta*	*Ss. kochi*	*Ss. seminulina*	Benthic foraminifers	Ostracodes	Diatoms	Radiolarians	Sponge spicules	Fish remains	Planktonic foraminifers—abundance	Planktonic foraminifers—preservation	Sand-size fraction > 63 µm (%)
Pliocene	N18	20H-CC	187.50	214.45			/				X	X								X											/	X			X					/		/			/	/			X	A	F	A	A			C	P	
upper Miocene		21H-1, 79–84	188.29	215.24			/			/	X	X							/	/											X	/				/				X					X			/	X			A	A	C				2.0
		21H-CC	197.00	227.45							X	X								X											X		X		X										X				/	A			A	A			C	M	
		22H-CC	206.50	240.50							X	X								X			/								/		/		X				/						X				/	A			A	A			F	P	
	N17	23X-CC	216.20	251.60							X	X							/	/											X		X	/							/		X		X			X	A	R	A	A		F	P		
		24X-CC	225.90	260.80							X	X								X			/								X		X		/				/		X		X		X			X	A	R	A	A		R	C	M	
		25X-CC	235.60	270.70							X	X								X											/	X	X										X		X			X	C	R	A	A			R	P	
		26X-CC	245.20	280.30							X	X								X			/									/	X		/					/	X		X		X			X	C		A	A	C		R	P	
		27X-1, 80–85	246.00	281.10							X	X								X											/		/		/				X	/	X	/	X		X			/	A	R	A	A	C	R	F	M	2.1
		27X-3, 80–85	249.00	284.10			/				X	X							/	X											X				X				X	X	X	/	X		X			X	C		A	A	A		C	M	2.1
		27X-CC	254.90	290.00							X	X								/											X	X			X				X	X	X		X		X			/	A		A	A	C		C	P	
	N17?	28X-3, 80–85	258.70	293.80							X	X							/	X			/								X				X				/		X	/	X		/				A		A	A	C		C	M/P	3.3
		28X-CC	264.20	299.30							X	X																			/		/		X		/				/		X		/		X	/	A		A	A	F		F	P	
	N16–15	29X-3, 80–85	268.00	303.10							X	X								X			/												/				/	/	/		X		X				C		A	A	F		F	M/P	5.7
middle Miocene		29X-CC	273.90	309.00							X	X								X	/										X				/		/		/	/	X		/						C	R	C	A	R	R	F	P	
	N14	30X-2, 80–85	276.20	311.30							/	X								X	/		X								X												X		/			/	C		A	A	R		F	M/P	4.7
		30X-CC	283.50	318.60							X	X								X											/				X						X		/				/	/	A		A	A	R		F	P	
		31X-4, 90–95	288.90	324.00							X	X							X	/																			/	/	/		X				/		F		A	A	C		F	M/P	4.5
		31X-CC	293.10	328.20							X	X							X	X	X																			/	/	/		/				/		A		A	A	R	R	C	M	
		32X-3, 80–85	296.90	332.00							X	X							/	/	/		/												X									/			/		C		A	A	F		F	M	3.2
	to	32X-CC,	302.80	337.90								/									/																												C		C	A	F		R	P	
		33X-4, 78–83	308.08	343.18			/				X	X							X	/											/										X	X	/	/						F		A	A	A		F	M	3.8
		33X-CC	312.40	347.50							/	X							/		/																												C		C	C	R	R	R	P	
		34X-2, 80–85	314.70	349.80							/	X									X																												A		A	A	C		R	P	2.6
	N13	34X-3, 81–86	316.21	351.31							X	X							X	/	X										X										/		/			/			C		A	A	F		F	P	3.7
		34X-5, 80–85	319.20	354.30							X	X							X		X										/								/									F		A	A	C		F	P	2.9
		34X-CC	322.00	357.10								X						/	X		X		/							/	X				X		/		X	X	X		/				/	A		C	C	F		C	P	
		35X-1, 80–85	322.80	357.90								X	X						X		X										/	X								/	X	X	/	X			/	/	C		A	F	C		C	M	2.3
	N13	35X-2, 80–85	324.30	359.40																																		/					/					C		A	F	F		R	P	3.0
		35X-3, 80–85	325.80	360.90							/	X	X						X	/	X										/	X								/	/	X	/	X			X	/	C		A	F	F		F	M	4.4
		35X-4, 80–85	327.30	362.40								X	X						X		X										/					/				X	/	X		X					F		A	F	F		C	M/P	4.5
		35X-5, 80–85	328.80	363.90								X	X						X	/	X		/																	X	/	X	/	/					C		A	C	C		C	M	7.1
		35X-6, 80–85	330.30	365.40							/	X	X						X		X			X				/	/		X	X								X	/	X	/	X			/		F		A	C	C	R	C	M	5.8
		35X-7, 45–50	331.45	366.55								X	X						X		X						/	/												/	/	X	X	X					C		A	A	C		F	M/P	5.1
		35X-CC	331.70	366.80							/	X	X						X		X			X			X	X			X									X	/	X	X	X			X	/	A		C	A	R		A	M	
		36X-1, 78–83	332.48	367.58								X	X						X		X			/				/			/							X		X		X	/	X			/	/	C		A	A	C		F	M	3.9
		36X-2, 78–83	333.98	369.08								X	X						X		X						/				X							/		X		X	X	X					C		A	A	C		C	P	4.0
		36X-3, 77–82	335.47	370.57								X	X						X		X					/	/				X							X		/		X	/	X					R	R	A	A	A		F	M	3.2
		36X-4, 78–83	336.98	372.08								/	X						X		/					/	/				/				X			X		X		X	/	X		/			C	R	A	A	C		F	P	2.9
		36X-5, 79–84	338.49	373.59								X	X						X		X						/													X		X	X	X					F		A	A	C		F	P	2.3
		36X-6, 78–83	339.98	375.08								X	X						X	/	X						/				/									X	/	X							C	R	A	A	C		C	P	4.0
		36X-7, 46–51	341.16	376.20								/	/						/	/	/										/									/									C		A	A	C		F	P	2.7
	N12	36X-CC	341.30	376.40								X	X						X		X				X		/											X				X	/	X					A		A	A	F		C	M/G	
		37X-1, 78–83	342.08	377.18								X	X						X	X	X							X	X											/	X	X	/	X					F						C	M/P	7.1
		37X-2, 78–83	343.58	378.68								X	X						X		X							X	X		X	X								/	X	/		X					R		C	C	F		C	P	8.1
		37X-3, 32–37	344.62	379.72			/				X	X	X						X		X					/	/			X											/	/		X			/		F	R	A	A	C	R	C	P	5.5
		27X-CC	351.00	386.10							X	X									X															/														A		F	A	R		R	P	
		38X-1, 80–85	351.80	386.90								X	X						X	X	X					/	X	X			X					/				X	/	X	/	X					F		A	A	C		C	M	3.3
		38X-2, 80–85	353.30	388.40								X	X						/		X						/				/										/	X		X			/		C		A	A	F	R	P	2.2
		38X-3, 80–85	354.80	389.90							/	X	X						X		X					X	X			/	X									/	X	X		X					F	R	A	A	F		C	M	2.8
		38X-4, 80–85	356.30	391.40								X	X						X		X			X				X														X		X					F		A	A	F		C	M	5.0
		38X-5, 80–85	357.80	392.90								X	X						X		X						X	X			X					/				/	/	X		X					F		A	A	C			P	3.4
		38X-CC	360.60	395.70							X	X	X				/				X					/	X									/					/	X	X		X		/			A		F	A	R	R	F	P	
	N11	40X-1, 80–85	371.10	406.20								X							X		X					X	/			/										X		X	X		X				F						C	P	6.4
		40X-2, 80–85	372.60	407.70								X					/	/	X		X					/	/															X	/				/	C						C	P	5.0
		40X-3, 80–85	374.10	409.20								X							X		X			/	/					/	/					/				/		/	X		X			/	F						C	P	4.1
	N10	40X-5, 80–85	377.10	412.20								X							/		X			X	X					/												X	X		X				F						R	P	1.3
		40X-CC	379.90	415.00								X		/			/		/		X				X										X			X				X	X		X				A					F	C	M	

Table 4 (continued).

Series	Zone	Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	*Candeina nitida*	*Globigerinatella insueta*	*Globigerinella siphonifera*	*Globigerinoides altiaperturus*	*Gs. conglobatus*	*Gs. diminutus*	*Gs. obliquus* s.l.	*Gs. quadrilobatus* s.l.	*Gs. ruber* s.l.	*Praeorbulina sicana*	*Pr. transitoria*	*Pr. glomerosa curva*	*Pr. glomerosa glomerosa*	*Pr. glomerosa circularis*	*Orbulina suturalis*	*O. universa*	*Globorotalia mayeri* s.l.	*G. praescitula*	*Gr. scitula*	*Gr. peripheroronda*	*Gr. peripheroacuta*	*Gr. praefohsi*	*Gr. fohsi fohsi*	*Gr. fohsi lobata*	*Gr. fohsi robusta*	*Gr. archeomenardii*	*Gr. praemenardii*	*Gr. menardii*	*Gr. limbata*	*Gr. plesiotumida*	*Gr. tumida*	*Globorotaloides hexagona*	*Gd. suteri*	*Gd. variabilis*	*Clavatorella bermudezi*	*Dentoglobigerina altispira altispira*	*D. altispira globosa*	*Globoquadrina baroemoenensis*	*Gq. dehiscens*	*Gq. praedehiscens*	*Gq. venezuelana*	*Globoturborotalita nepenthes*	*Neogloboquadrina acostaensis*	*Sphaeroidinellopsis disjuncta*	*Ss. kochi*	*Ss. seminulina*	Benthic foraminifers	Ostracodes	Diatoms	Radiolarians	Sponge spicules	Fish remains	Planktonic foraminifers—abundance	Planktonic foraminifers—preservation	Sand-size fraction > 63 µm (%)
	N9	41X-1, 78–84	380.68	415.78								X					/		X		X			/						/						X						/	/	X						C						C	M/P	2.2
		41X-2, 78–82	382.18	417.28							/	X		/				X			X			X						X						/			/	/		X	X		X					F	R					C	M	2.8
		41X-3, 80–83	383.70	418.80								X						X			X			X						X						/			X	/		X	X		X			X		C	R					C	M/P	2.0
		41X-4, 85–89	385.25	420.35							/	X		/		/	/	X			X			X						X									/	X		X	X		X						R					C	M	8.9
		41X-5, 70–74	386.60	421.70								X		X			/	X			X									X									/			X	X		X					C						C	M	8.4
		41X-CC	389.60	424.70																																																								
lower Miocene	N8	42X-1, 79–83	390.39	425.49		/						X		X		X	/				X			X						X									/		X		X	X		X						C						A	M	
		42X-CC	399.20	434.30								X	/	/							X	/		/																		/	/		/					A				R	R	P		
		43X-CC	408.90	444.00								X									X									/															/					A		R		F	R	P		
		44X-1, 80–85	409.70	444.80								X	X	X		X					X	/		X						/												/	X		X					F	R					C	M	8.3
		44X-2, 80–85	410.95	446.05								X	/	X		X					X			X															/	/		X	X		X					R						C	M/P	8.4
		44X-3, 75–80	412.40	447.50		X						X	X	X		/	/				X			X																/		X	X		X					R						A	P	16.7
		44X-4, 80–85	413.37	448.47							/	X	/	X		/					X	X		X						/										/		X	X		X					F						C	M/P	11.9
		44X-CC	418.60	453.70							/	X		/							X									/						X	/	/	/		X	X		X					C				R	F	M		

Table 5. Distribution of Miocene planktonic foraminifers in sediments of Hole 848B.

Series	Zone	Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	*Candeina nitida*	*Globigerinatella insueta*	*Globigerinella siphonifera*	*Globigerinoides altiaperturus*	*Gs. conglobatus*	*Gs. diminutus*	*Gs. obliquus* s.l.	*Gs. quadrilobatus* s.l.	*Gs. ruber* s.l.	*Praeorbulina sicana*	*Pr. transitoria*	*Pr. glomerosa curva*	*Pr. glomerosa glomerosa*	*Pr. glomerosa circularis*	*Orbulina suturalis*	*O. universa*	*Globorotalia mayeri* s.l.	*G. praescitula*	*Gr. scitula*	*Gr. peripheronda*	*Gr. peripheroacuta*	*Gr. praefohsi*	*Gr. fohsi fohsi*	*Gr. fohsi lobata*	*Gr. fohsi robusta*	*Gr. archeomenardii*	*Gr. praemenardii*	*Gr. menardii*	*Gr. limbata*	*Gr. plesiotumida*	*Gr. tumida*	*Globorotaloides hexagona*	*Gd. suteri*	*Gd. variabilis*	*Clavatorella bermudezi*	*Dentoglobigerina altispira altispira*	*D. altispira globosa*	*Globoquadrina baroemoenensis*	*Gq. dehiscens*	*Gq. praedehiscens*	*Gq. venezuelana*	*Globoturborotalita rubescens*	*Neogloboquadrina acostaensis*	*Pulleniatina primalis*	*Sphaeroidinellopsis kochi*	*Ss. seminulina*	Benthic foraminifers	Ostracodes	Diatoms	Radiolarians	Sponge spicules	Fish remains	Planktonic foraminifers—abundance	Planktonic foraminifers—preservation	Sand-size fraction > 63 µm (%)
Pliocene	N18	6H-CC	49.70	56.40								X								/													X		X					X								X			X	R	R	A	A	R		C	P	
upper Miocene	N17B	7H-1, 80–85	50.50	57.20					/		/	X								/													/	/		/				/						X			X		X	A	R	A	A	F		C	P	1.6
		7H-4, 80–85	55.00	61.70			/		/		/	X								X			/									X	X	X		X				X	/	X	/		X		X	/		X	C	R	A	A	F		A	P	2.9
		7H-5, 80–85	56.50	63.20					/		/	X								X			X									/	X	/		X				/	/		/		X		X	X		X	C	R	A	A	R		C	P	4.4
		7H-7, 50–55	59.20	65.90					X		X	X								X			/									X	X	/		X				X	/	/			X		X	/	/	X		F	A	A	F		A	P	4.8
		7H-CC	59.20	66.65								/								/												/	/			X		/		/	/	X	/		X		/	/		X	A	F	A	A	F		C	P	
	N17A	8H-1, 84–88	60.04	67.49			/				/	X								X												/	/	X		X				X	X		/		X		X		X	X	C		A	A	C		A	P	4.5
		8H-2, 80–84	61.50	68.95							/	X								/												X	/	X									/		X		X			X	F		A	A	C		F	P	4.2
		8H-4, 80–84	64.50	71.95							/	/								X												X	X							/	/	/			X		X		/	X	C		A	A	A		F	P	3.8
		8H-7, 60–64	68.80	76.25			X		X		/	X								X												/	X	X		X				X		X		X	X		X		X	X	C		A	A	F		A	M/P	3.6
		8H-CC	68.70	78.30							X	/							/													/	/	X		/		/		X	/	X		X	X					X	A	R	A	A	C		C	P	
		9H-4, 80–85	74.00	83.60								/																				X	X	/		/									X		/				A		C	A	F		F	P	6.1
		9H-5, 80–85	75.50	85.10			X					X							X	/												X	X			X		X		X		X			X		X			X	F	R	F	C	R		A	P	6.9
		9H-6, 80–85	77.00	86.60								X							/	/													/	/		X		X		X		/		/	X		X		/	X			R	F	R		F	P	3.0
	N16	9H-7, 46–61	78.16	87.76			/					X							X	X													/			X				X	/	X		/	X		X			X	C		A	A	C		F	P	4.4
		9H-CC	78.20	88.80								/								/												/					X		/	/				X					/	A		C	A	F	R	F	P	
		10H-1, 81–86	79.01	89.61								/								/																	X			/				/					/	C	R	C	A	F		R	P	7.0
		10H-2, 79–84	80.49	91.01								X							X												/	/			X		X		X		X			X	/				A		A	A	C		F	P	3.0
		10H-3, 80–85	82.00	92.60								/							/	/			/								/				X		X		/		/		/	X	/			/	F	F	A	A	C		F	P	4.5
	N15	10H-4, 80–85	83.50	94.10								/								/																	/				/			/					C		C	A	F		R	P	5.7
		10H-5, 79–84	84.99	95.59																																										B		4.4										
		10H-6, 77–82	86.47	97.07																																X		X							/					A					R	R	P	1.0
middle Miocene to	N14	10H-7, 64–69	87.84	98.44								/									X															/		X							X					A						F	P	1.0
		10H-CC	87.70	100.05																																																			B			
		11H-1, 80–85	88.50	100.85							/	X							/	X	X									/	X						/		/	X		X		/					R						A	M/P	6.8
		11H-2, 80–85	90.00	102.35															X		X										/					/		X							X					C						F	P	1.7
		11H-3, 80–85	91.50	103.85							/	/							/		X		X								/							X		/		/			X					C						F	P	1.6
	N13	11H-5, 80–85	92.87	105.22							X	X							X	X	X		X							/	X								/		/			X					/	F	R				A	P	5.9
		11H-CC	93.30	105.65							X	X							X	/	X		/							/	X										X		X											A	P	

Table 6. Distribution of Miocene planktonic foraminifers in sediments of Hole 852B.

Series	Zone	Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	*Candeina nitida*	*Globigerinatella insueta*	*Globigerinella siphonifera*	*Globigerinoides altiaperturus*	*Gs. conglobatus*	*Gs. diminutus*	*Gs. obliquus* s.l.	*Gs. quadrilobatus* s.l.	*Gs. ruber* s.l.	*Praeorbulina sicana*	*Pr. transitoria*	*Pr. glomerosa curva*	*Pr. glomerosa glomerosa*	*Pr. glomerosa circularis*	*Orbulina suturalis*	*O. universa*	*Globorotalia mayeri* s.l.	*G. praescitula*	*Gr. scitula*	*Gr. peripheroronda*	*Gr. peripheroacuta*	*Gr. praefohsi*	*Gr. fohsi fohsi*	*Gr. fohsi lobata*	*Gr. fohsi robusta*	*Gr. archeomenardii*	*Gr. praemenardii*	*Gr. menardii*	*Gr. limbata*	*Gr. plesiotumida*	*Gr. tumida*	*Globorotaloides hexagona*	*Gd. suteri*	*Gd. variabilis*	*Clavatorella bermudezi*	*Dentoglobigerina altispira altispira*	*D. altispira globosa*	*Globoquadrina baroemoenensis*	*Gq. dehiscens*	*Gq. praedehiscens*	*Gq. venezuelana*	*Globoturborotalita nepenthes*	*Neogloboquadrina acostaensis*	*Pulleniatina primalis*	*Sphaeroidinellopsis kochi*	*Ss. seminulina*	Benthic foraminifers	Ostracodes	Diatoms	Radiolarians	Sponge spicules	Fish remains	Planktonic foraminifers—abundance	Planktonic foraminifers—preservation	Sand-size fraction > 63 µm (%)
Pliocene	N18	7H-CC	65.90	72.65							X	X								X													X		X					/					X				X	X	C		A	A	R		C	P	
		8H-1, 90–94	66.80	73.55			/		/		X	X								X													X	X		X				X		X			X		X	X	X	X	C		A	A	R		F	P	3.5
		8H-2, 90–94	68.30	75.05					/		X	X								X			/									X	X	X		X				/		X			X		X	X	X	X	C		A	A	R		C	M/P	5.3
		8H-3, 90–94	69.80	76.55			X		X		X	X								X			X										X	X		X				/		/	/		X		X		X	X	R	R	A	A	R		C	M	5.4
	N17B	8H-4, 90–94	71.30	78.05			/				X	X								X			X									X	X	/		X				X	/	X	/		X		X	/	/	X	R	F	A	A	R		C	P	4.2
		8H-5, 90–94	72.80	79.55					X		X	/								X												/	X	X		X				X	/	X			X		X		X	X	C		A	A	R		C	P	3.7
		8H-6, 90–94	74.30	81.05			/		/		X	X								X			/									X	X	/						/	/	/			X		X		X	X	C	R	A	A	R		F	P	3.2
		8H-7, 47–51	75.37	82.12					/		X	X								X			/									/	X	X		X						/			X		X		/	X	C		A	A	F		F	P	3.0
		8H-CC	75.40	83.90							/	/								/												/	/			/					/				X	/		/		X	C		A	A	F	F	F	P	
		9H-1, 90–95	76.30	84.80							/	X								/												/	X	X		X		X		/		X	/		X		X		/	X	C		C	C	R		F	P	2.0
		9H-2, 90–95	77.80	86.30							X	X								X													X	X		X				/		/	/		X		X		/	X	C	R	A	A	R	R	C	P	5.7
		9H-3, 90–95	79.80	88.30							X	X								/													X	X		/				X	/		/		X		/		/	X	F	R	A	A	C	R	F	P	3.2
		9H-4, 90–95	80.80	89.30			/		/		X	X								X													X	X		X		/		/					X		X			X	F	R	F	A	R		C	M	3.1
		9H-5, 90–95	82.30	90.80							/	X								X												/	X	X		X				X	/	/			X		X			X	F		A	A	R	R	C	M/P	3.1
		9H-6, 90–95	83.80	92.30							X	X								X													X	X		X				/		/			X		/			X	F	R	A	A	R	R	C	P	3.5
		9H-7, 46–51	84.86	93.36			/		/		X	X								X													X	X		X				/		/	/		X		/		/	X	C	R	A	A	R	R	F	P	3.1
		9H-CC,	84.90	94.90					/		X	X																					X	X	/	/				/	/	X			X				/	X	C	R	A	A	R		F	P	
upper		10H-1, 90–95	85.80	95.80					/		X	X								/												X	X	X		/		/			/	X			X		/			X	F		A	A	R	R	F	P	3.1
Miocene	N17A	10H-2, 90–95	87.30	97.30					/		X	X								X			/										/	X		X				/	/	X			X		X			X	C		A	A	F		F	P	4.2
		10H-3, 90–95	88.80	98.80							X	/								/			/										/	/								/			X		/		/	/	C		A	A	F		F	P	6.3
		10H-4, 90–95	90.30	100.30							X	X							X	X			/													/				/	/	X			X	X	X		/	X	F		A	A	R		C	M	7.1
		10H-5, 90–95	91.80	101.80							X	X								X			/									/	X	/		X		/				X			X	/			X	X	F		A	A	C		C	M	6.6
		10H-6, 90–95	93.30	103.30			/				X	X								X			/									X	X	/		X				/	/	X			X	X	X		/	X	C		A	A	F		C	M	4.9
		10H-7, 90–95	94.65	104.65			/				X	/								X			X									/	X	X		/		X		/	X	X	/		X	X	X			X	F		A	A			F	P	5.0
		10H-CC	94.40	105.40			/				X	/								X			/									/	X	X		X		/		X	/	X			X	X	X		X	X	F		A	A	R		A	M	
		11H-1, 87–92	95.27	106.27			/				X	X								X												X	X	X		/									X	/	X		X	X	F		A	A	R		F	P	7.0
		11H-2, 87–92	96.77	107.77			/				X	X								X												X	X	/		/				X	/	X			X	X	X		X	X	F		A	A	F		C	P	9.9
		11H-3, 87–92	98.27	109.27			/				X	X								X												X	X	/		X				/	/	X			X	/	X		X	X	F		A	A	F		C	P	5.3
		11H-4, 87–92	99.77	110.77			/				X	X								X												/	X	/		X				/	/	/			X	X	X		X	X	F	R	A	A	R		C	M	7.1
		11H-5, 87–92	101.27	112.27			X				X	X								X													/	/		X				X	/	X			X	/	X		X	X	F	R	C	C			C	P	7.3
		11H-6, 87–92	102.77	113.27								X								X												/	X	/		/		X		/		/			X	X	X		X	X	F	R	A	A	R		F	P	6.8
		11H-7, 76–81	104.16	115.16								X								X												/	X					X		/	/	X			X	/			X	X	F		A	A	F		F	P	5.5
	N16	11H-CC	103.90	116.10																X													/					/		/	/	/			X	X			X	X	A		A	A	R		R	P	
		12H-1, 90–94	104.80	117.00								X								X																		X		/					X	/			X	X	C		A	A	F	F	F	P	7.2
		12H-2, 90–94	106.30	118.50																																		/											/	/	A		A	A	A	R	A	P	7.8
		12H-3, 90–94	107.80	120.00																																									X					/	A	R	A	A	A	F	R	P	9.0
	to	12H-4, 90–94	109.30	121.50																																									/				/		C		A	A	A	F	R	P	3.4
		12H-5, 90–94	110.80	123.00																/																X		X				/			X	X			X	X	C	R	A	A	C	F	R	P	2.9
		12H-6, 90–94	112.30	124.50							/									/																/		X				/			X	/			X	X	C		A	A	C		R	P	2.7
	N14	12H-7, 71–75	113.61	125.81																																																					B		1.4
middle		12H-CC	113.40	126.14																																																					B		
Miocene	N13	13H-CC	113.40	126.14							X	X							X		X		/									X						X							X					X	R				R		C	P	

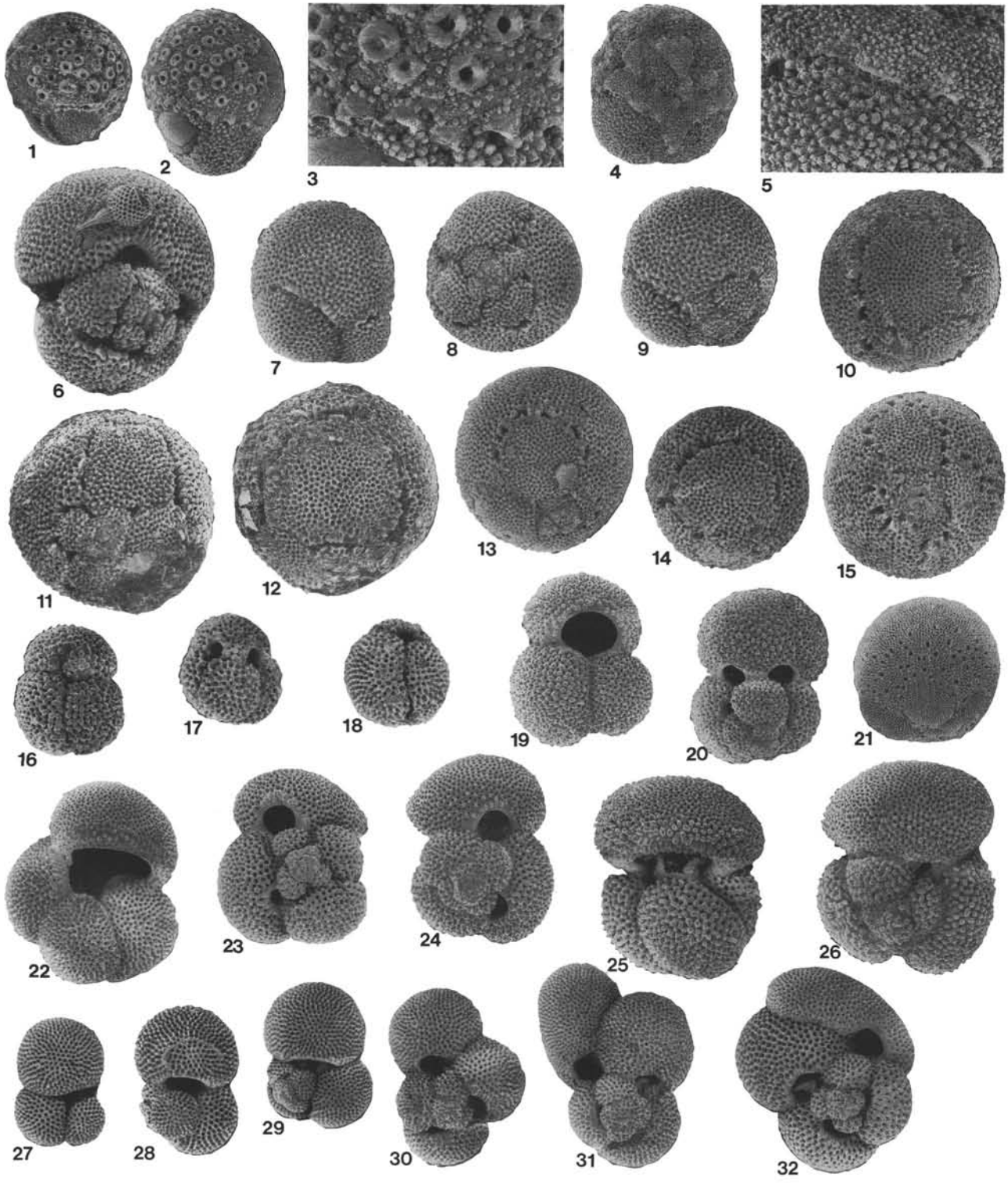

Plate 1. **1–5.** *Globigerinatella insueta.* Sample 138-845A-29X-4, 78–83 cm; (1, 2, 4) 73×; (3, 5) 262×. **6.** *Praeorbulina sicana.* Sample 138-845A-30X-4, 80–84 cm, 73×. **7–9.** *Praeorbulina glomerosa curva.* Sample 138-845A-26X-5, 80–85 cm, 73×. **10–12.** *Praeorbulina glomerosa glomerosa.* (10) Sample 138-845A-26X-4, 80–85 cm, 73×; (11) Sample 138-844B-24X-4, 78–82 cm, 73×; (12) Sample 138-844B-24X-CC, 73×. **13, 14.** *Praeorbulina glomerosa circularis.* (13) Sample 138-845A-26X-3, 80–85 cm, 73×; (14) Sample 138-845A-26X-4, 80–85 cm, 73×. **15, 21.** *Orbulina suturalis.* (15) Sample 138-845A-25X-6, 81–86 cm, 73×; (21) Sample 138-844B-10H-6, 79–84 cm, 48×. **16–18.** *Globigerinoides diminutus.* (16) Sample 138-845A-26X-5, 80–85 cm, 73×; (17, 18) Sample 138-844B-29X-7, 34–38 cm, 73×. **19–20.** *Globigerinoides ruber–G. subquadratus* Group. (19) Sample 138-844B-10H-6, 79–84 cm, 73×; (20) Sample 138-844B-10H-4, 79–84 cm, 73×. **22–24.** *Globigerinoides obliquus obliquus.* Sample 138-845A-12H-4, 78–82 cm, 73×. **25, 26.** *Globigerinoides conglobatus.* Sample 138-848B-8H-7, 60–64 cm, 73×. **27–29.** *Globigerinoides quadrilobatus trilobus.* Sample 138-844B-10H-CC, 48×. **30–32.** *Globigerinoides quadrilobatus sacculifer.* (30, 31) Sample 138-845A-19H-2, 23–28 cm, 48×; (32) Sample 138-848B-7H-7, 50–55 cm.

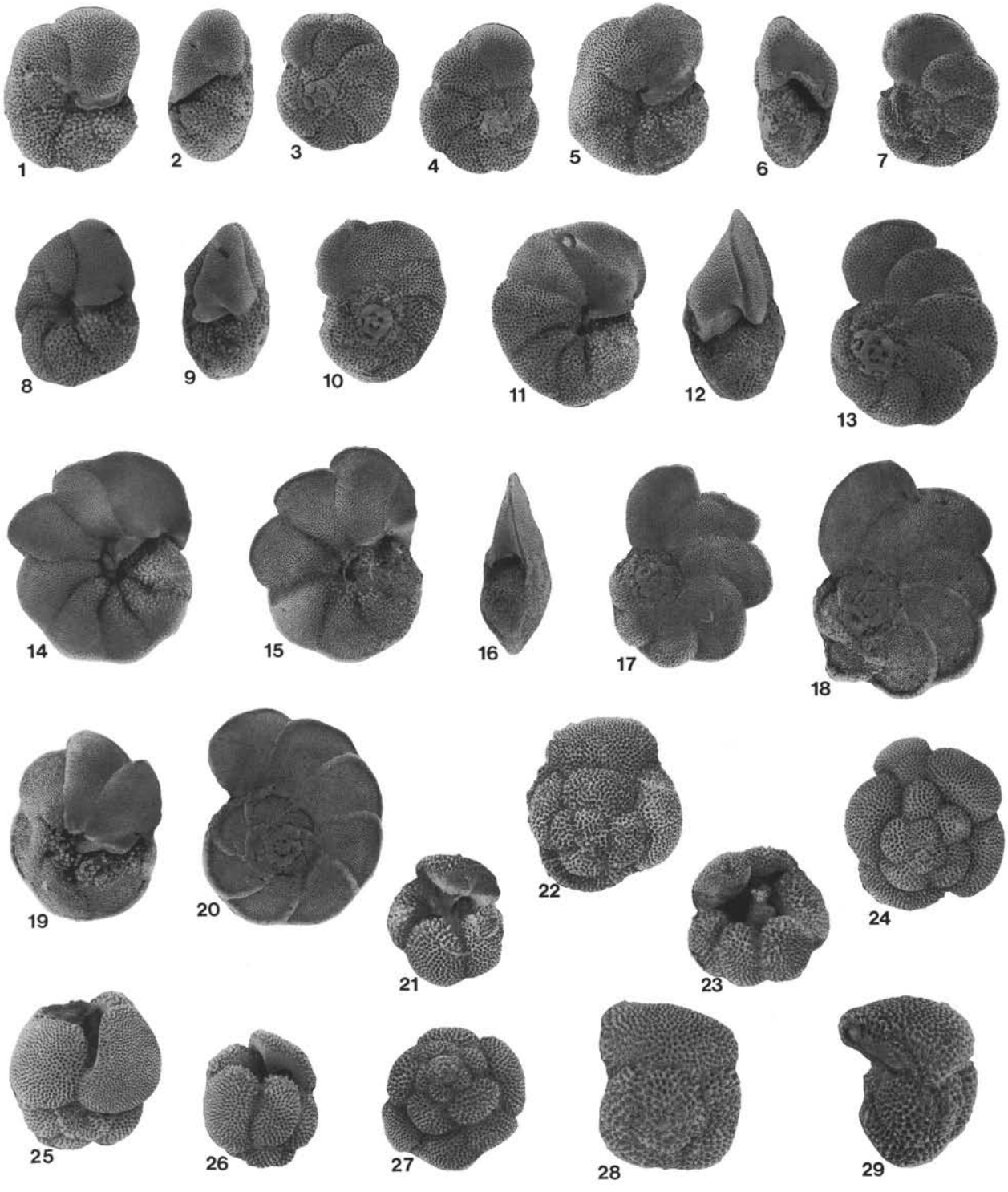

Plate 2. **1–4.** *Globorotalia peripheroronda.* (1–3) Sample 138-845A-26X-5, 80–85 cm, 73×; (4) Sample 138-845A-28X-4, 78–83 cm, 73×. **5–7.** *Globorotalia peripheroacuta.* Sample 138-845A-24X-1, 80–85 cm, 73×. **8–10.** *Globorotalia praefohsi.* Sample 138-844B-17H-4, 78–83 cm, 73×. **11–13.** *Globorotalia fohsi fohsi.* (11, 13) Sample 138-845A-21H-6, 143–148 cm, 73×; (12) Sample 138-845A-20H-7, 75–80 cm, 73×. **14–18.** *Globorotalia fohsi lobata.* (14) Sample 138-845A-20H-3, 41–46 cm, 48×; (15, 18) Sample 138-845A-19H-2, 23–28 cm, 48×; (16) Sample 138-845A-19H-CC, 48×; (17) Sample 138-845A-20H-4, 80–85 cm, 48×. **19.** *Globorotalia fohsi lobata–G. fohsi robusta* transition. Sample 138-844B-10H-5, 79–84 cm, 48×. **20.** *Globorotalia fohsi robusta.* Sample 138-844B-10H-2, 79–81 cm, 48×. **21, 22.** *Globoquadrina baroemoenensis.* Sample 138-845A-21H-2, 143–148 cm, 48×. **23, 24.** *Dentoglobigerina altispira globosa.* (23) Sample 138-845A-20H-4, 80–85 cm, 48×; (24) Sample 138-845A-20H-3, 41–46 cm, 48×. **25–27.** *Dentoglobigerina altispira altispira.* Sample 138-845A-23X-2, 80–85 cm, 48×. **28, 29.** *Globoquadrina dehiscens.* Sample 138-845A-18H-4, 80–85 cm, 73×.

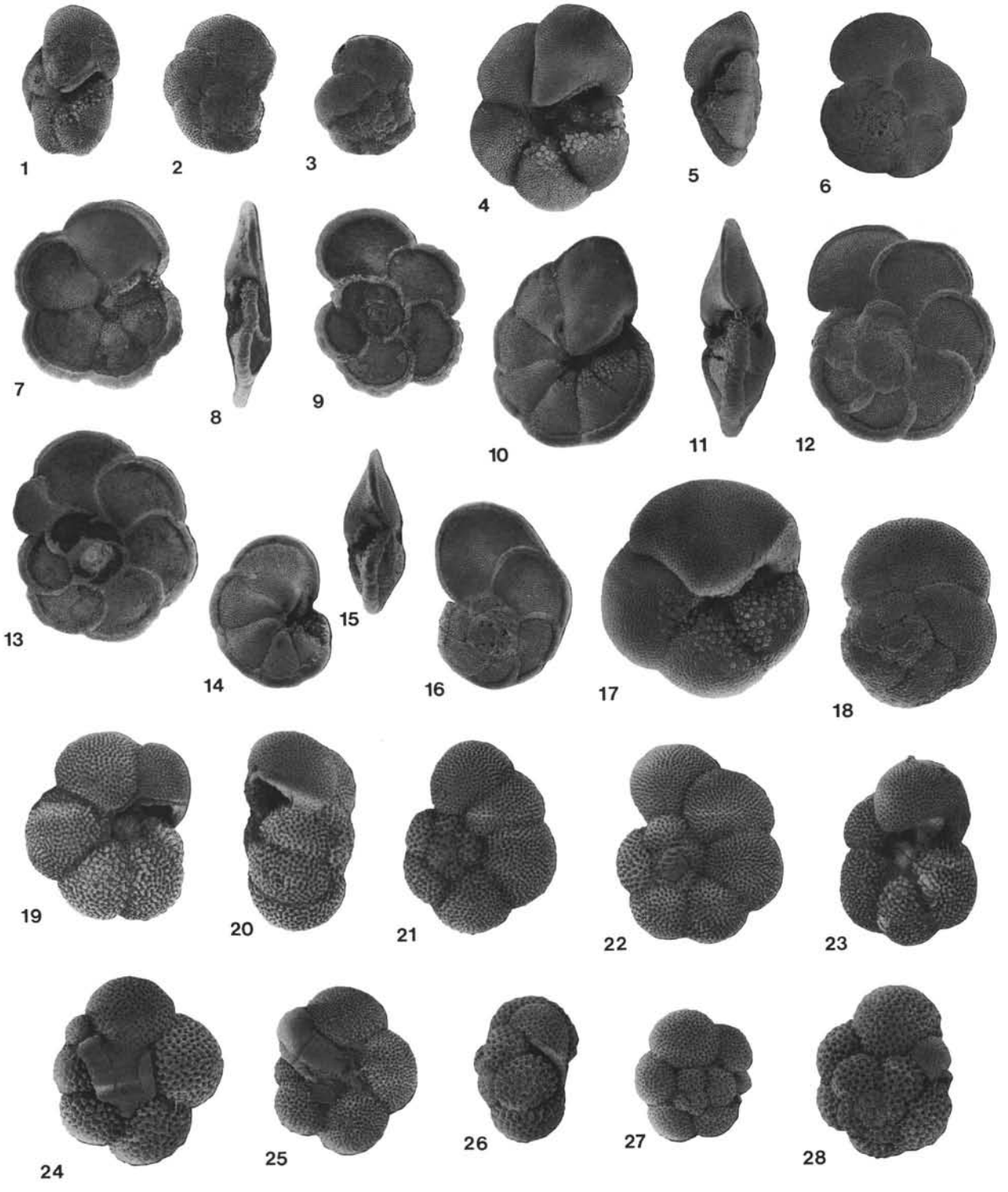

Plate 3. **1–3.** *Globorotalia archeomenardii.* (1) Sample 138-845A-26X-6, 80–85 cm, 73×; (2, 3) Sample 138-844B-24X-CC, 73×. **4–6.** *Globorotalia praemenardii.* Sample 138-845A-20H-3, 41–46 cm, 48×. **7–9.** *Globorotalia menardii.* Sample 138-848B-9H-5, 80–85 cm, 48×. **10–13.** *Globorotalia limbata.* (10, 12) Sample 138-848B-8H-7, 60–64 cm, 48×; (13) Sample 138-848B-9H-5, 80–85 cm, 48×. **14–16.** *Globorotalia plesiotumida.* (14, 15) Sample 138-844B-8H-7, 60–64 cm, 48×; (16) Sample 138-848B-7H-1, 80–85 cm, 48×. **17, 18.** *Globorotalia scitula.* Sample 138-844B-10H-5, 79–84 cm, 73×. **19–23.** *Globorotalia mayeri–G. siakensis* Group. (19, 20) Sample 138-845A-20H-4, 80–85 cm, 73×; (21) Sample 138-845A-20H-6, 3–8 cm, 73×; (22) Sample 138-845A-23X-2, 80–85 cm, 73×; (23) Sample 138-844B-17H-4, 78–83 cm, 73×. **24–28.** *Neogloboquadrina acostaensis.* (24, 25, 27) Sample 138-848B-7H-5, 80–85 cm, 97×; (26, 28) Sample 138-848B-7H-7, 50–55 cm, 97×.

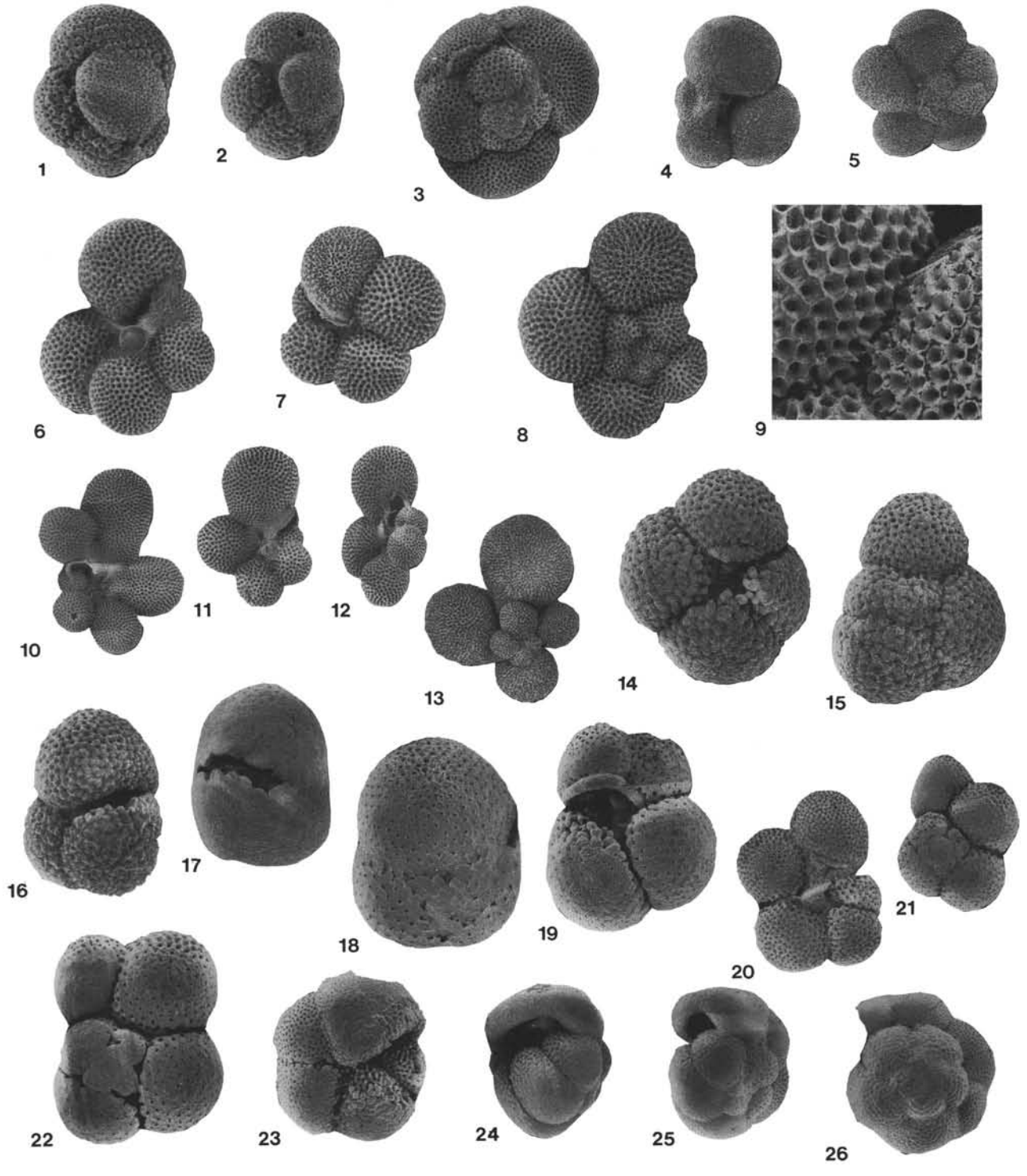

Plate 4. **1–3.** *Globorotaloides suteri.* (1) Sample 138-844B-25X-CC, 73×; (2, 3) Sample 138-844B-19H-4, 80–85 cm, 73×. **4, 5.** *Globorotaloides variabilis.* (4) Sample 138-848B-11H-3, 80–85 cm, 48×; (5) Sample 138-848B-10H-7, 60–64 cm, 48×. **6–9.** *Globorotaloides hexagona.* (6) Sample 138-848B-7H-7, 50–55 cm, 73×; (7–9) Sample 138-848B-8H-1, 84–88 cm; (7, 8) 73×; (9) 218×. **10–13.** *Clavatorella bermudezi.* (10) Sample 138-845A-26X-5, 80–85 cm, 48×; (11, 12) Sample 138-844B-20H-6, 80–84 cm, 48×; (13) Sample 138-845A-18H-4, 80–85 cm, 48×. **14, 15.** *Sphaeroidinellopsis disjuncta.* Sample 138-844B-19H-6, 80–85 cm, 73×. **16–18.** *Sphaeroidinellopsis seminulina.* (16) Sample 138-844B-17H-4, 78–83 cm; (17, 18) Sample 138-848B-7H-4, 80–85 cm. **19–22.** *Sphaeroidinellopsis kochi.* (19, 22) Sample 138-844B-10H-CC, 73; (20) Sample 138-845A-20H-4, 80–85 cm, 48×; (21) Sample 138-845A-20H-3, 41–46 cm, 48×. **23–26.** *Pulleniatina primalis.* (23) Sample 138-848B-7H-CC, 73×; (24, 25) Sample 138-848B-7H-4, 80–85 cm, 73×; (26) Sample 138-848B-7H-5, 80–85, 73×.