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6. Pliocene–Pleistocene Paleoceanography in the East Pacific off Costa Rica Determined by Planktonic Foraminifers[1]

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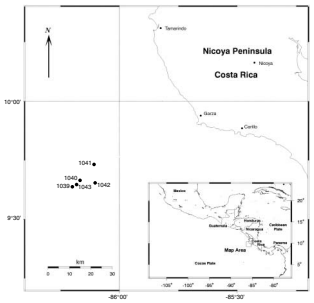
ABSTRACT

Biostratigraphic and paleoceanographic analyses using planktonic foraminifers were made on a total of 148 samples from Ocean Drilling Program (ODP) Leg 170, Cores 170-1039B-1H through 18X (~160 m in thickness), and a total of 92 samples from Cores 170-1043A-18X through 30X (~130 m in thickness). The sediments from Cores 170-1039B-1H through 18X are assignable to Zones N19–N23 (Pliocene to Pleistocene) and sediments from Cores 170-1043A-18X through 30X to Zones N17–N23 (late Miocene to Pleistocene). In Zone N19, surface seawater temperature temporarily and abruptly drops and high salinity–tolerant species decrease. The divergence of both surface- and intermediate-water dwellers is recognized around the base of Zone N22. These changes in planktonic foraminiferal assemblages might be related to the closing of the Central American Seaway.

INTRODUCTION

The drill sites of Ocean Drilling Program (ODP) Leg 170 are located on the lower continental slope and the bottom of the Middle American Trench off the Nicoya Peninsula, Costa Rica (Fig. F1) (Kimura, Silver, Blum, et al., 1997). Based on planktonic foraminiferal analyses, the sediments of Cores 170-1039B-18X through 1H are assignable to Zones N19–N23, which are Pliocene to Pleistocene in age, and those of Cores

F1. Location of ODP Leg 170 drill sites off the Nicoya Peninsula, Costa Rica, p. 8.



[1]Ibaraki, M., 2000. Pliocene–Pleistocene paleoceanography in the East Pacific off Costa Rica determined by planktonic foraminifers. *In* Silver, E.A., Kimura, G., and Shipley, T.H. (Eds.), *Proc. ODP, Sci. Results,* 170, 1–28 [Online]. Available from World Wide Web: <http://www-odp.tamu.edu/publications/170_SR/VOLUME/CHAPTERS/SR170_06.PDF>. [Cited YYYY-MM-DD]
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170-1043A-30X through 18X are included in Zones N17–N23, which are late Miocene to Pleistocene in age. As areas off Costa Rica are located in low latitudes (~9°N), planktonic foraminiferal components typically are assemblages rich in warm-water species.

In this article, biostratigraphic and chronostratigraphic analyses and quantitative examinations of planktonic foraminifers on ODP samples are made and paleoceanographic changes during the Pliocene–Pleistocene are suggested.

LITHOFACIES OF HOLES 1039B AND 1043A

Hole 1039B is located at 9°38.405´N, 12°037´W on the bottom of the Middle American Trench at a water depth of 4353 m (Fig. F2). Two sedimentary units are recognized in Cores 170-1039B-1H through 18X. Unit U1 consists of dark olive-green diatomaceous ooze with ash layers. Subunit U1A (0–5.55 meters below seafloor [mbsf]) is distinguished by abundant graded sand layers interpreted as turbidities. This subunit grades downward into Subunit U1B (5.55–84.4 mbsf), in which graded sand layers are sparse to absent. Below a sharp contact, Unit U2 is distinguished by a sharp decrease in biogenic sediments. Subunit U2A (84.43–132.87 mbsf) consists of dark olive-green silty clay and grades downward into Subunit U2B (132.87–152.49 mbsf). Subunit U2B is dark olive-green silty clay interbedded with light olive-green calcareous clay; ash layers are common throughout Unit U2 (Fig. F3). An age-depth model calculated from the combined last and/or first occurrence datums of index microfossils yields average sedimentation rates of about 46 m/m.y. (0–120 mbsf) for the Pleistocene and 6 m/m.y. for the late Miocene and Pliocene interval (120–200 mbsf).

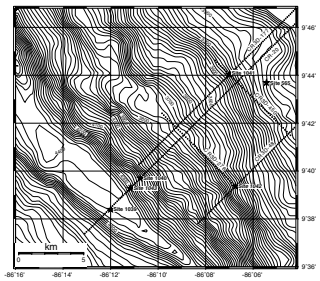
Hole 1043A is located at 9°39.273´N, 86°11.160´W on the lowest continental slope of the Middle American Trench at a water depth of 4312.7 m (Fig. F2). Four lithologic units are recognized: T1, U1, U2, and U3, in descending order. Unit T1 consists mainly of thick clay and silty clay interbedded with a relatively thin matrix-supported breccia. Subunit U1A consists of turbidite-rich facies that are 5.55 m thick. Subunit U1B consists of olive-green to grayish green diatomaceous ooze with disseminated volcanic glass. Subunit U2A consists of olive-green to grayish green clay and silty clay with minor interbeds of vitric and crystal-vitric volcanic ash. Subunit U2B consists of olive-green silty clay interbedded with lighter green siliceous nannofossil ooze and calcareous clay with nannofossils. Subunit U3A consists of ivory white siliceous nannofossil ooze interbedded with light green calcareous clay and dark-colored clay with diatoms. In Unit U1 (150–194 mbsf), age-depth rates range from 52–40 m/m.y.; in Unit U2 (194–263 mbsf), the rate is 15 m/m.y.; and in Unit U3 (below 263 mbsf), the rate is <12 m/m.y. (Kimura, Silver, Blum, et al., 1997).

WORKING METHODS

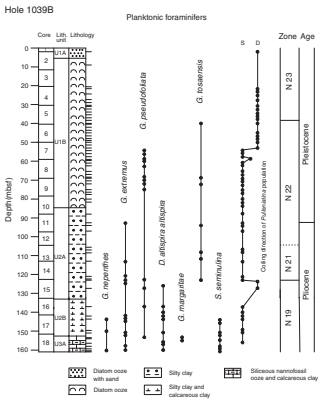
Biostratigraphic and chronostratigraphic analyses of planktonic foraminifers presented here were made by the author's shipboard examinations of all core-catcher samples and subsequent onshore examinations of additional samples.

Samples of 10 cm³ (except core-catcher samples) were washed through a 250-mesh screen (0.062 mm) and dried in an oven. Plank-

F2. Bathymetric map of the Middle American Trench and the lower continental slope off the Nicoya Peninsula, Costa Rica, p. 9.



F3. Planktonic foraminiferal biostratigraphy of Cores 170-1039B-1H through 18X, p. 10.



tonic foraminifers >0.125 mm were selected from the washed residue, and the frequency of occurrence of each species was calculated.

The biostratigraphic zonation of planktonic foraminifers is that of Blow (1969), and chronologic calibrations of Blow's zones are based on those given by Berggren et al. (1995).

PLANKTONIC FORAMINIFERAL BIOSTRATIGRAPHY OF HOLES 1039B AND 1043A

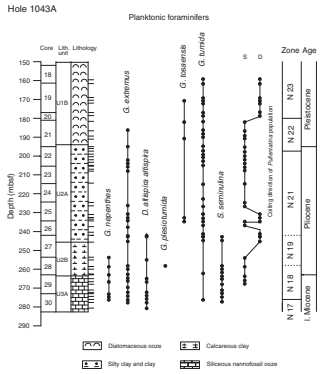
Sediments of Cores 170-1039B-18X through 1H correspond to Zones N19–N23, which are Pliocene to Pleistocene in age (Fig. **F3**). From Cores 170-1039B-1H through 18X, a total of 148 samples were examined. Percentages of respective species to the total planktonic foraminiferal assemblage are shown in Table **T1.** The last occurrence (LO) of *Globigerina nepenthes* is recognized in Sample 170-1039B-17X-2, 46–49 cm, which indicates an age of 4.2 Ma. The first appearance of *Globorotalia tosaensis* is recognized in Sample 170-1039B-15X-1, 46–48 cm, which indicates an age of 3.35 Ma, assignable to the base of Zone N21 of the Pliocene. Therefore, the lower sequences, Core 170-1039B-18X through the middle part of Core 15X, are assignable to Zone N19 of the Pliocene. In this interval, occurrences of *G. nepenthes, Dentoglobigerina altispira altispira, Globorotalia margaritae,* and *Sphaeroidinellopsis seminulina* are examined. The top of Zone N21 cannot be established; however, the horizon is tentatively assignable to the base of Section 170-1039B-12X-CC. The LO of *Globigeinoides extremus* is recognized in Sample 170-1039B-11H-5, 46–49 cm, indicating that the sample is approximately correlative with the Pliocene/Pleistocene boundary (1.77 Ma). The LO of *G. tosaensis* is recognized in Sample 170-1039B-5H-7, 45–47 cm, which indicates an age of 0.65 Ma, correlating to the base of Zone N23. Changes in the coiling direction of *Pulleniatina* are recognized at three intervals (Fig. **F3**). The coiling change from sinistral to dextral between Samples 170-1039B-16X-4, 46–49 cm, and 15X-4, 46–48 cm, is estimated at 3.95 Ma (Berggren et al., 1995).

Cores 170-1043A-30X through 18X correspond to Zones N17–N23, late Miocene to Pleistocene in age (Fig. **F4**). Planktonic foraminifers were obtained from 92 of the 108 samples examined. Percentages of respective species are shown in Table **T2.**

The base of Zone N18 is recognized in Sample 170-1043A-30X-3, 45–47 cm (276.05 mbsf), in which the first appearance of *Globorotalia tumida* is examined. The sequences below Zone N18 are, therefore, assignable to Zone N17 of late Miocene age. The Miocene/Pliocene boundary is located in Sample 170-1043A-28X-4, 45–47 cm, based on the occurrence of abruptly decreased Miocene planktonic foraminifers. Samples 170-1043A-28X-4, 45–47 cm, through 26X-CC are assigned to Zone N19 based on the LO of *G. nepenthes* and the coiling change from sinistral to dextral in *Pulleniatina*. Samples 170-1043A-26X-CC through 22X-2, 45–47 cm, are assigned to Zone N21, based on the occurrence of *G. tosaensis, S. seminulina,* and dextral-coiling *Pulleniatina*. Samples 170-1043-22X-2, 45–47 cm, through 20X-2, 45–47 cm, are assignable to Zone N22, as horizons above this one are assigned to Zone N23 based on the dextral-coiling *Pulleniatina* and the absence of *G. tosaensis*. Sample 170-1043A-21X-CC contains well-preserved specimens of *G. extremus,* of which the LO is 1.77 Ma, corresponding to the Pliocene/Pleistocene boundary. In Cores 170-1043A-30X through 18X, changes

T1. Percentages of planktonic foraminifers in Samples 170-1039B-1H-CC through 18X-CC, p. 19.

F4. Planktonic foraminiferal biostratigraphy of Cores 170-1043A-18X through 30X, p. 11.



T2. Percentages of planktonic foraminifers in Samples 170-1043A-18X-2, 46–48 cm, through 30X-6, 46–48 cm, p. 25.

in the coiling direction of *Pulleniatina* are recognized in five intervals (Fig. F4). The coiling change from sinistral to dextral between Samples 170-1043A-27X-CC and 27X-2, 44–46 cm, is estimated at 3.95 Ma (Berggren et al., 1995).

PLIOCENE–PLEISTOCENE PALEOCEANOGRAPHY OFF COSTA RICA

Planktonic foraminiferal analyses were made on samples from the Pliocene to Pleistocene sediments of Holes 1039B and 1043A. The total number of planktonic foraminifers in each sample, the ratio of warm-water planktonic foraminifers to the assemblage, the ratio of *Globigerinoides sacculifer,* the ratio of surface-water dwellers (*Globigerinoides* group), and the ratio of intermediate-water dwellers (*Neogloboquadrina* group and *Globorotalia menardii*) have been estimated.

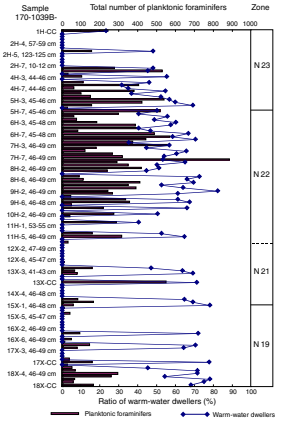
In Cores 170-1039B-18X through 1H, planktonic foraminifers in each sample are barren or rare in Zone N19 and Zone N21. In younger horizons, however, they are continuously and commonly found in each sample (Fig. F5). The ratio of warm-water planktonic foraminifers to the total assemblage temporarily decreases in Sample 170-1039B-18X-2, 46–49 cm, which is assignable to Zone N19 (Fig. F6). The horizon is estimated at older than 4.2 Ma, prior to the LO of *G. nepenthes*. It is suggested that the sea-surface temperature temporarily and abruptly drops in this horizon. In Zone N21, there is a high percentage of warm-water dwellers. These are recognized in fluctuations in Zone N22 and gradually decrease from Zone N19 to Zone N23.

G. sacculifer is a high salinity–tolerant, warm surface-water species. In the Caribbean Sea, the species became enriched at about 4.6 Ma, coincident with the closing of the Central American Seaway (Keller et al., 1989; Farrell et al., 1995). In Hole 1039B, the ratio of *G. sacculifer* shows ~10% percent through Zones N19–N23 (Fig. F6). No salinity change is therefore recognized on the East Pacific side in the duration. The maximum divergence of both surface- and intermediate-water dwellers of Hole 1039B begins in the lower part of Zone N22 and continues up to the present (Fig. F7).

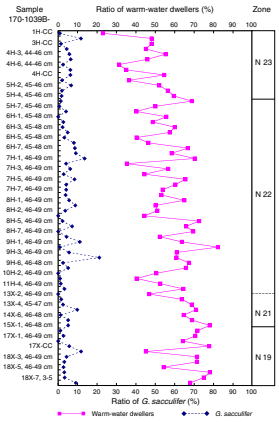
In Cores 170-1043A-30X through 18X, planktonic foraminifers are barren or rare in Zone N19 and in the middle part of Zone N21 (Fig. F8). The ratio of warm-water planktonic foraminifers to the total assemblage abruptly decreases in Sample 170-1043A-27X-CC of Zone N19. In the horizon, there is a high percentage of cold-water planktonic foraminifers and the upwelling dweller *Globigerinita glutinata* is commonly found. The horizon is estimated at ~4.2–3.95 Ma, based on the coiling direction of *Pulleniatina* and the LO of *G. nepenthes*. The occurrence of *G. sacculifer* abruptly decreases in the lower part of Zone N18 and continues to Zone N19, temporarily increasing in the lower part of Zone N21 (Fig. F9). It appears that the surface seawater conditions changed in Zone N19. The maximum divergence of both surface- and intermediate-water dwellers in Hole 1043A is recognized in two horizons. Abundances of surface-water dwellers are recognized in Zone N17 and the lower to middle part of Zone N18, and the abundances of intermediate-water dwellers are recognized in the duration from the top part of Zone N21 to Zone N23 (Fig. F10).

Holes 1039B and 1043A can be correlated with each other based on planktonic foraminiferal biochronostratigraphy (Fig. F11). In Holes

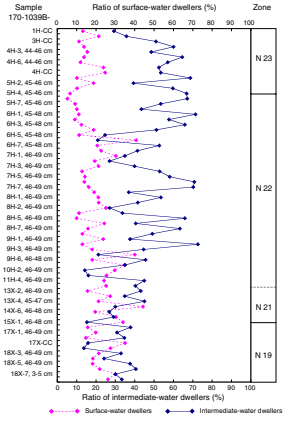
F5. Total numbers of planktonic foraminifers and the ratio of warm-water dwellers to the total assemblage in Cores 170-1039B-1H through 18X, p. 12.



F6. The ratio of warm-water dwellers to the total assemblage and ratio of *G. sacculifer* in Cores 170-1039B-1H through 18X, p. 13.



F7. Ratios of surface- and intermediate-water dwellers to the total assemblage in Cores 170-1039B-1H through 18X, p. 14.



1039B and 1043A, planktonic foraminifers are barren or rare in Zones N19 and N21 and are commonly found in most samples of Zones N22 through N23. Planktonic foraminiferal components of sediments consist of rich warm-water specimens. The ratio of warm-water planktonic foraminifers to the total assemblage temporarily decreases in four horizons (i.e., in Zone N19, the top part of Zone N21, the lower part of Zone N22, and the top part of Zone N22, respectively) in both holes (Fig. F11). These ratios indicate that the surface seawater temperature probably changed in those horizons. The surface seawater temperature drops in Zone N19 are dated at 4.2–3.95 Ma in Hole 1039B and 5–4.2 Ma in Hole 1043A. Those cooling events of Zone N19 are considered to be related to the closing of the Central American Seaway.

During the Pliocene to Pleistocene, the emergence of the Panama Isthmus is estimated to have occurred, separating the equatorial Pacific and Atlantic Oceans and the Caribbean Sea. This event strongly influenced peripheral regions, seawater temperature, ocean circulation, surface-water salinity, and faunal changes of planktonic foraminifers and radiolarians (Saito, 1976; Keigwin, 1982a, 1982b; Keller et al., 1989; Moore et al., 1993; Coates et al., 1992; Ibaraki, 1992, 1997).

The ratio of warm-water dwellers to the total assemblage gradually drops from the Pliocene to Pleistocene. *G. sacculifer,* a high salinity–tolerant species, has low occurrences in Zone N19. No salinity change is recognized on the East Pacific side.

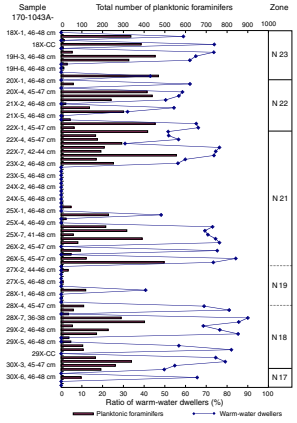
Maximum divergence of both surface- and intermediate-water dwellers in Holes 1039B and 1043A begins at the top of Zone N21. This event considered to be related to the final closure of the Central American Seaway at that time.

The planktonic foraminiferal fauna changes ~4.6 Ma in the Caribbean Sea and changes in the planktonic foraminiferal assemblage in Zone N19 off Costa Rica might be related to the closing of the Central American Seaway.

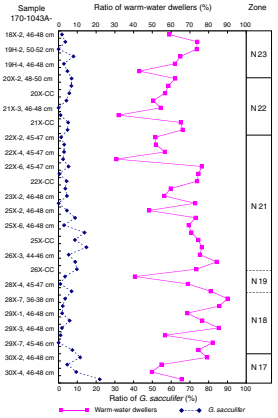
SUMMARY

Pliocene to Pleistocene planktonic foraminifers from Holes 1039B and 1043A have been quantitatively analyzed. In Zone N19, few occurrences of planktonic foraminifers and an abruptly decreasing ratio of warm-water planktonic foraminifers are recognized. This suggests that drops of the surface seawater temperature in Zone N19 are dated at 4.2–3.95 Ma in Hole 1039B and 5–4.2 Ma in Hole 1043A. *G. sacculifer,* a high salinity–tolerant species, is rarely found in Zone N19; therefore, no salinity change is recognized on the East Pacific side. The divergence of both surface- and intermediate-water dwellers is recognized around the top of Zone N21 in Hole 1039B. In Hole 1043A, the divergence is recognized in two horizons, that is from Zone N17 to the lower part of Zone N18 and the upper part of Zone N21. These changes in the planktonic foraminiferal assemblages might be related to the closing of the Central American Seaway. The maximum divergence of both surface- and intermediate-water dwellers in the basal part of Zone N22 might also be related to the final phase of the closing of the Central American Seaway.

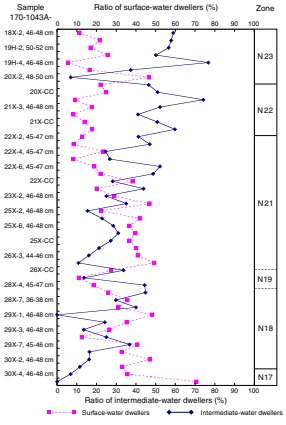
F8. Total numbers of planktonic foraminifers and the ratio of warm-water dwellers to the total assemblage in Cores 170-1043A-18X through 30X, p. 15.



F9. The ratio of warm-water dwellers to the total assemblage and ratio of *G. sacculifer* in Cores 170-1043A-18X through 30X, p. 16.



F10. Ratios of surface- and intermediate-water dwellers to the total assemblage in Cores 170-1043A-18X through 30X, p. 17.



ACKNOWLEDGMENTS

I wish to express my cordial thanks to the crew and the scientific party of Leg 170 for their hard work and generous collaboration.

F11. Biochronologic correlation of Holes 1039B and 1043A. Ratio of warm-water planktonic foraminifers and *G. sacculifer* to the total assemblage are indicated, p. 18.

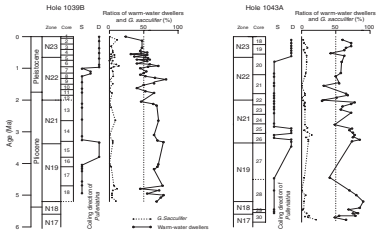


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Figure F1. Location of ODP Leg 170 drill sites off the Nicoya Peninsula, Costa Rica.

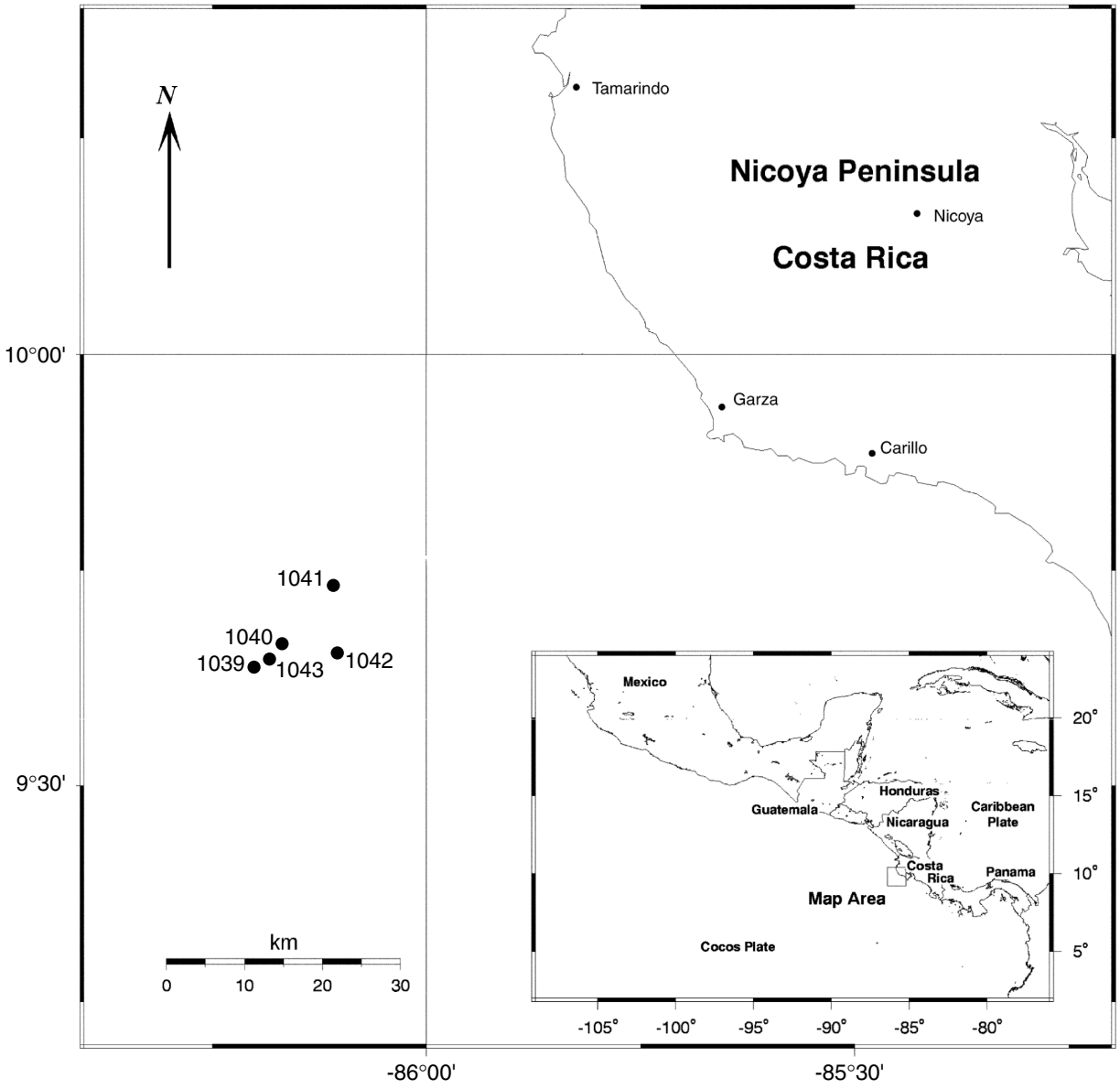

Figure F2. Bathymetric map of the Middle American Trench and the lower continental slope off the Nicoya Peninsula, Costa Rica. Dotted lines show the locations of seismic lines, including line CR-20 on which Sites 1039, 1040, and 1043 are positioned. Contour interval is 20 m (Kimura, Silver, Blum, et al., 1997).

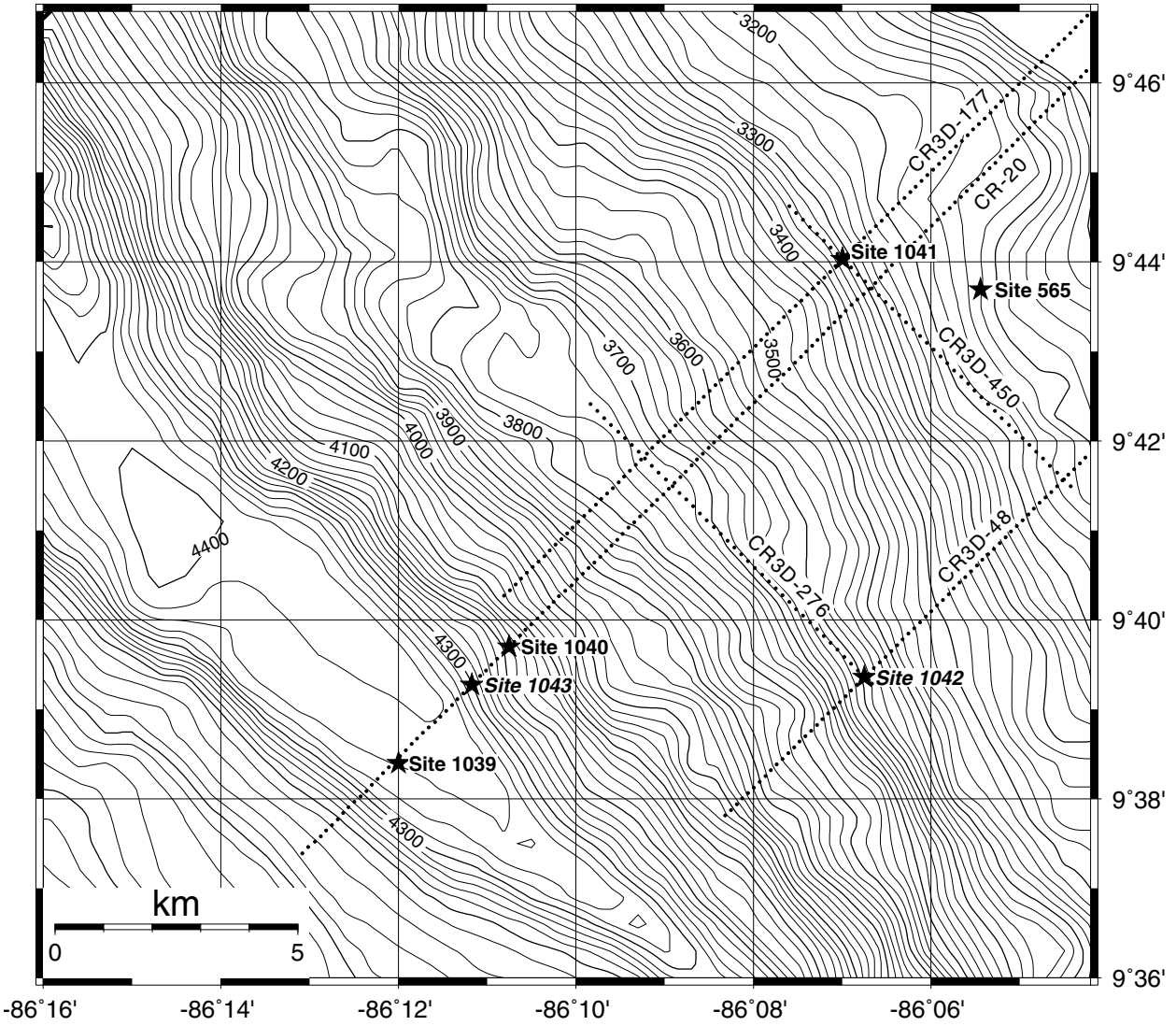

Figure F3. Planktonic foraminiferal biostratigraphy and lithology of Cores 170-1039B-1H through 18X. S = sinistral, and D = dextral.

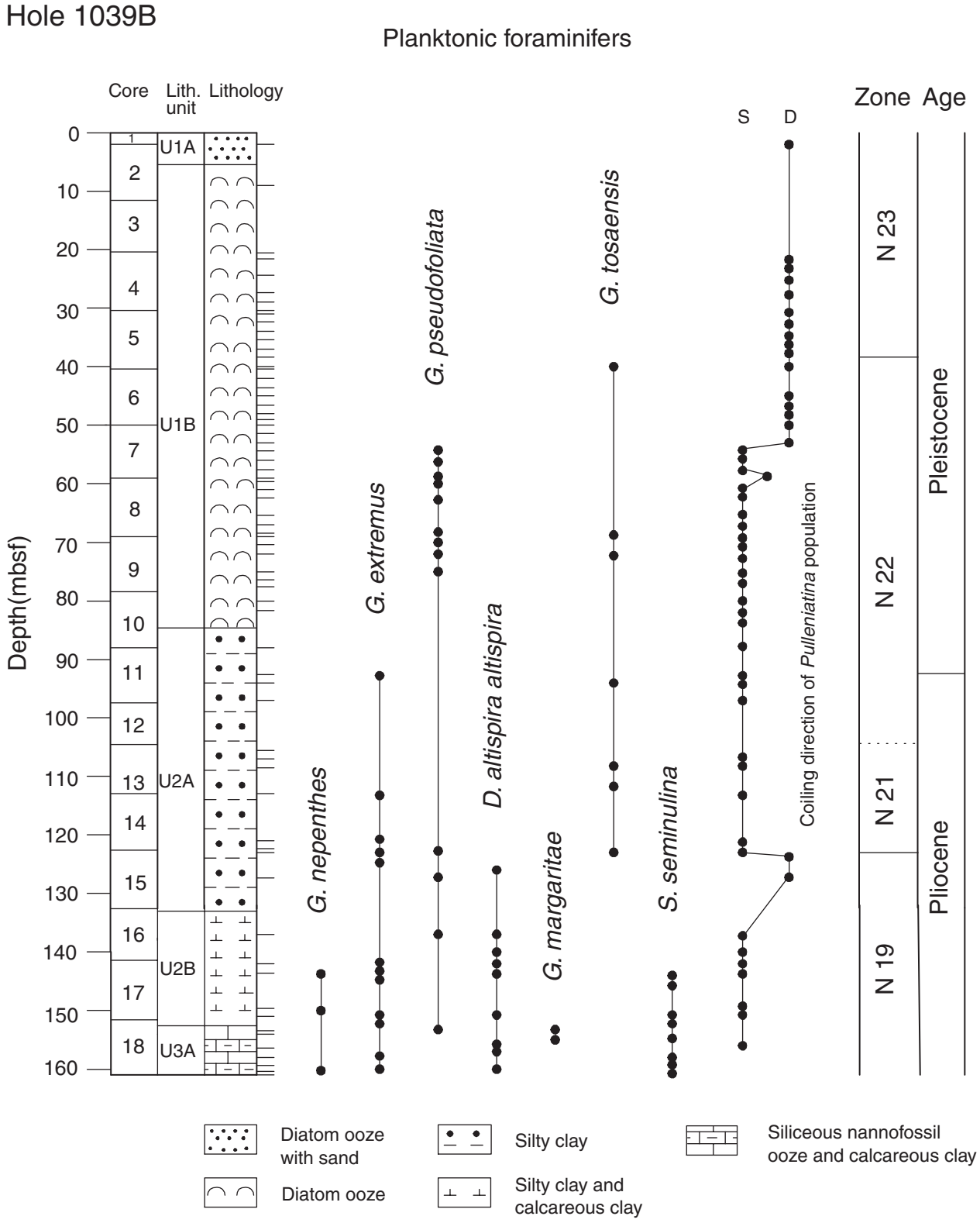

Figure F4. Planktonic foraminiferal biostratigraphy and lithology of Cores 170-1043A-18X through 30X. S = sinistral, and D = dextral.

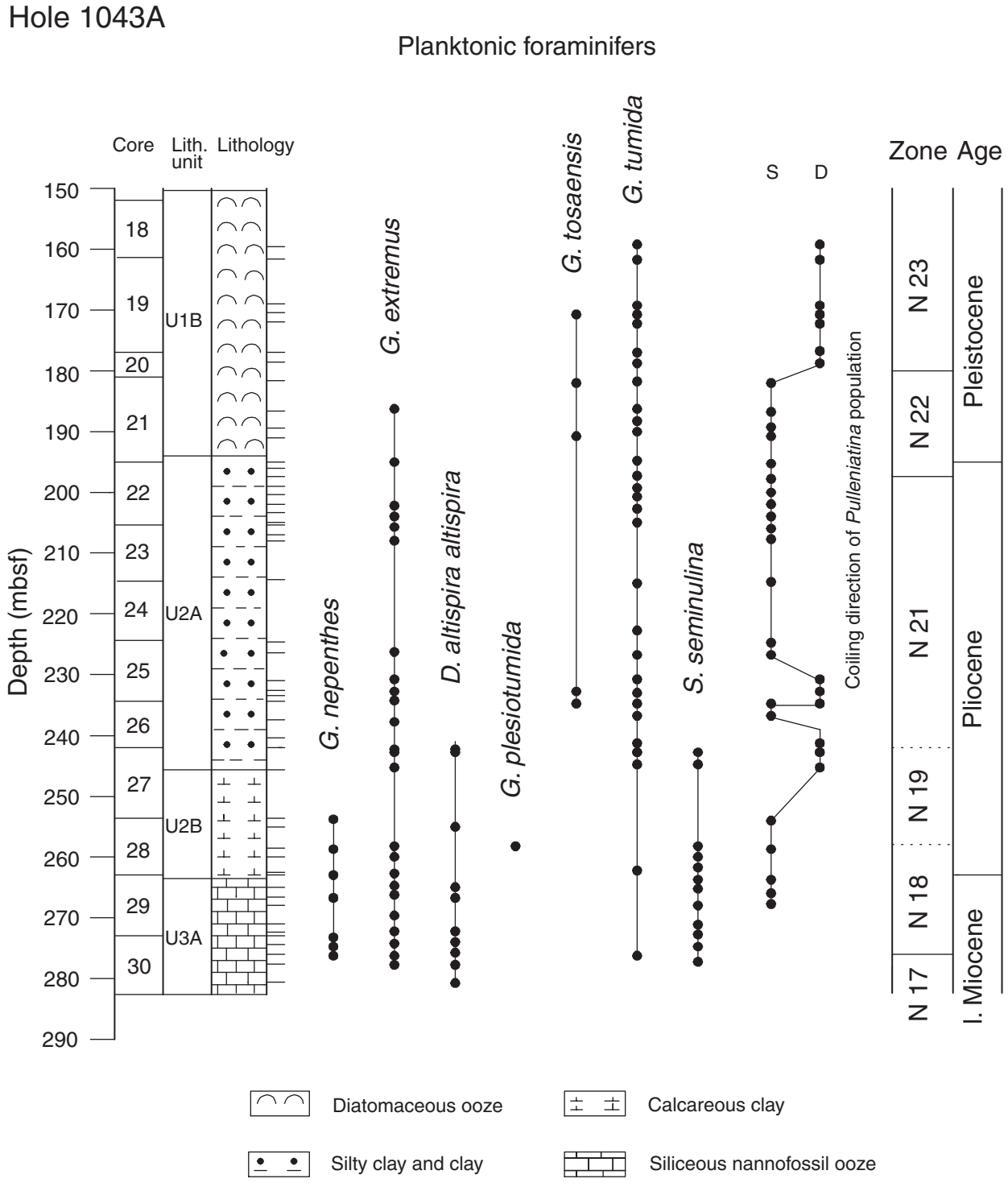

Figure F5. Total numbers of planktonic foraminifers and the ratio of warm-water dwellers to the total assemblage in Cores 170-1039B-1H through 18X.

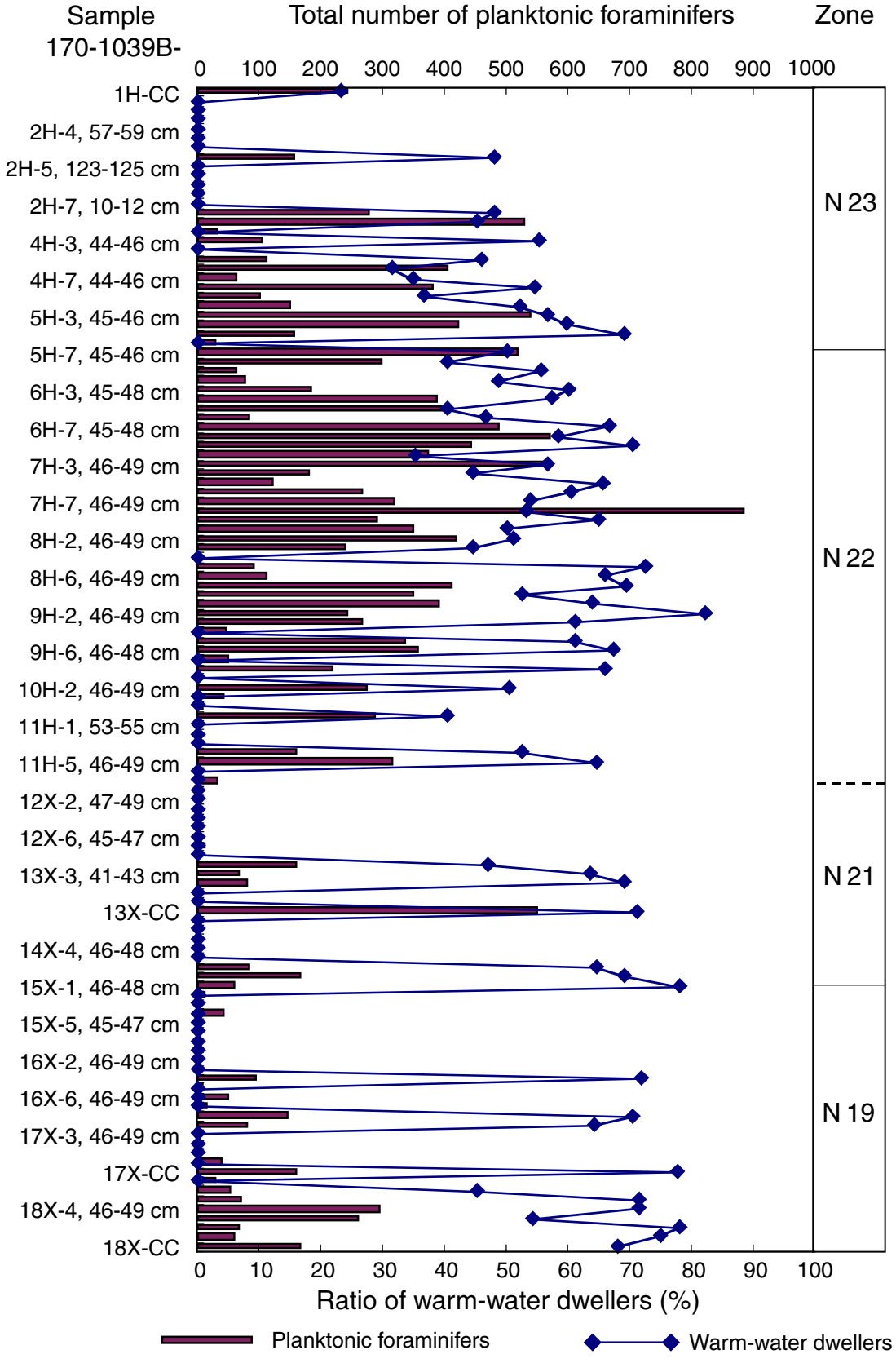

Figure F6. The ratio of warm-water dwellers to the total assemblage and ratio of *G. sacculifer* in Cores 170-1039B-1H through 18X.

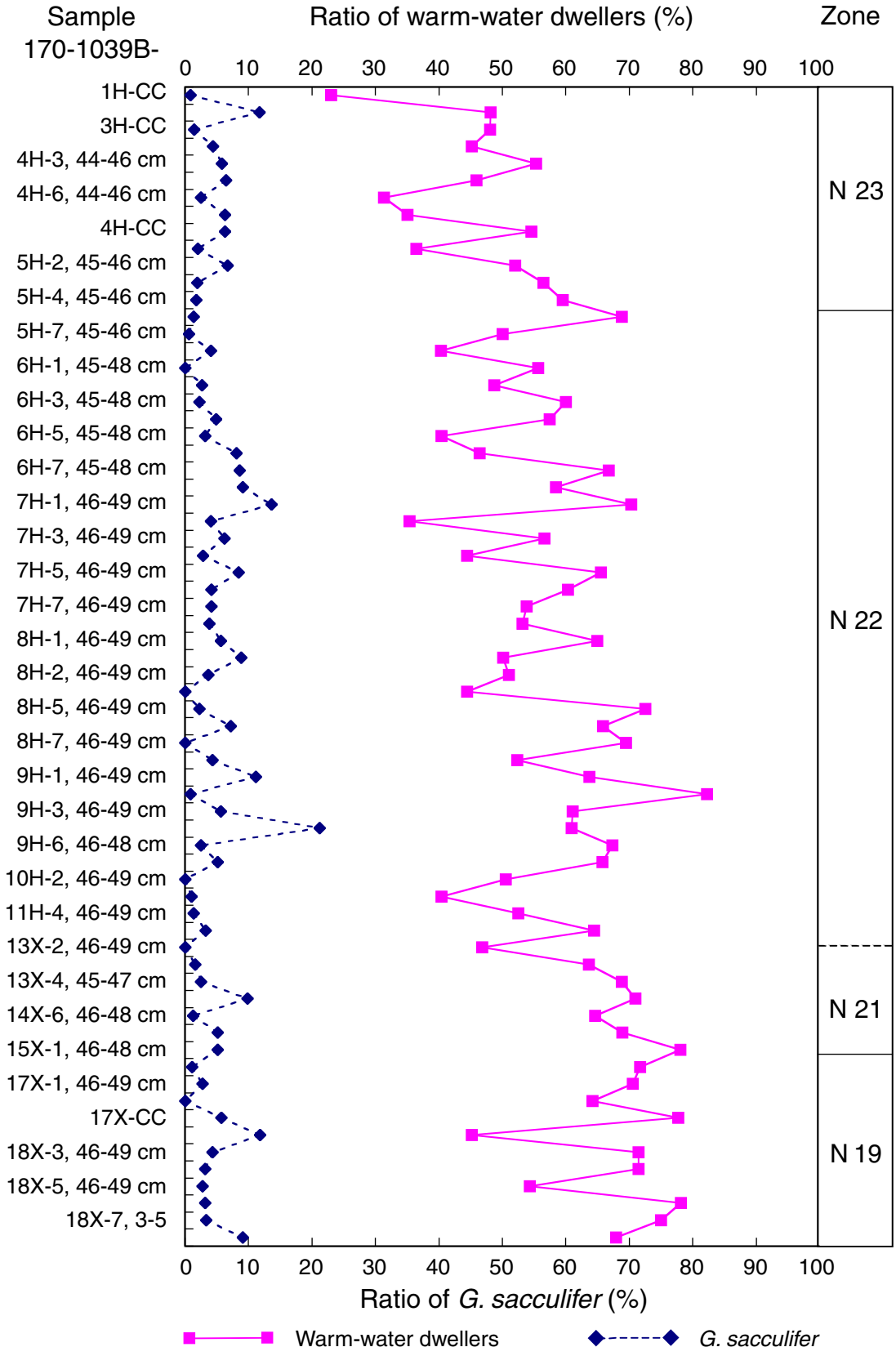

Figure F7. Ratios of surface- and intermediate-water dwellers to the total assemblage in Cores 170-1039B-1H through 18X.

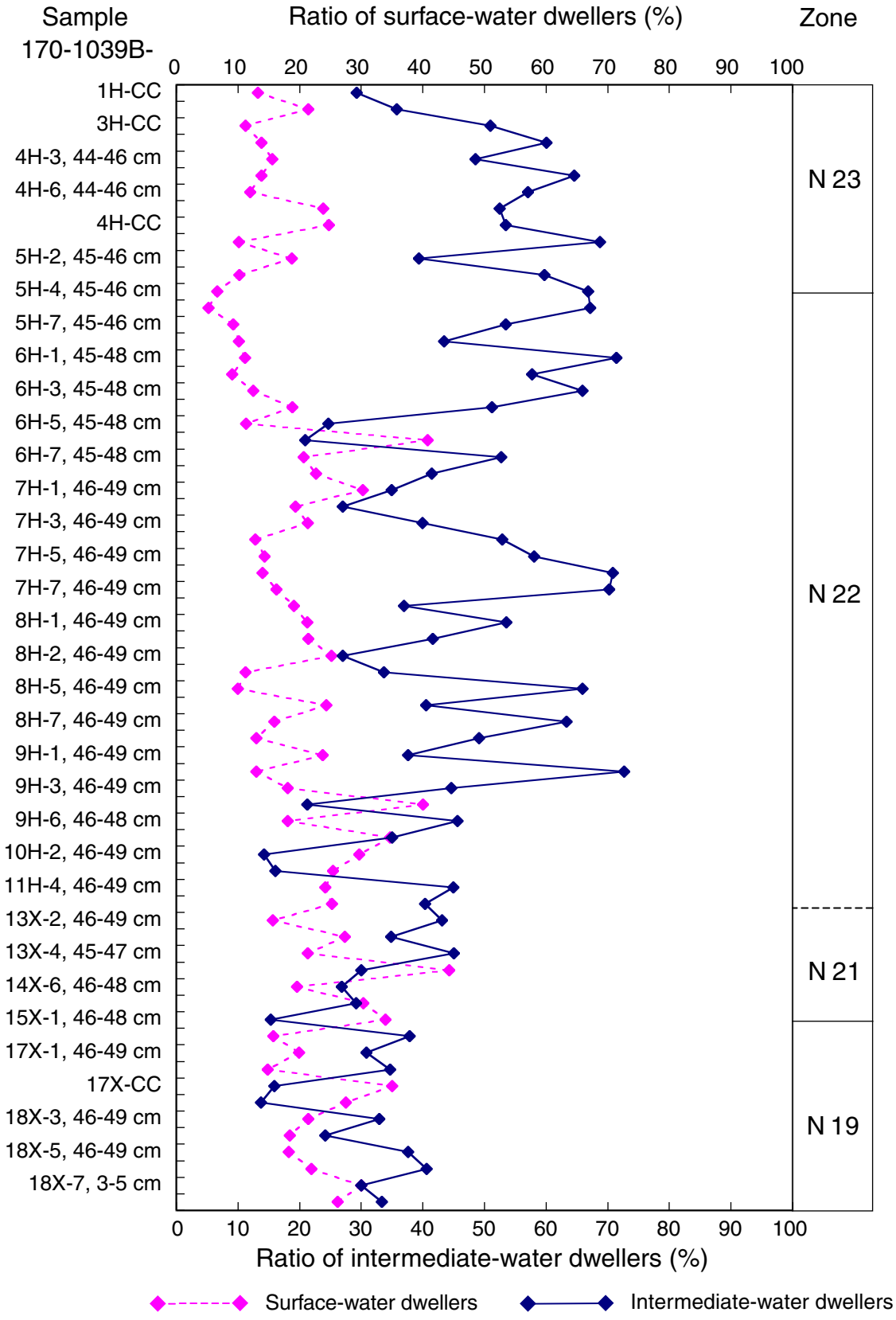

Figure F8. Total numbers of planktonic foraminifers and the ratio of warm-water dwellers to the total assemblage in Cores 170-1043A-18X through 30X.

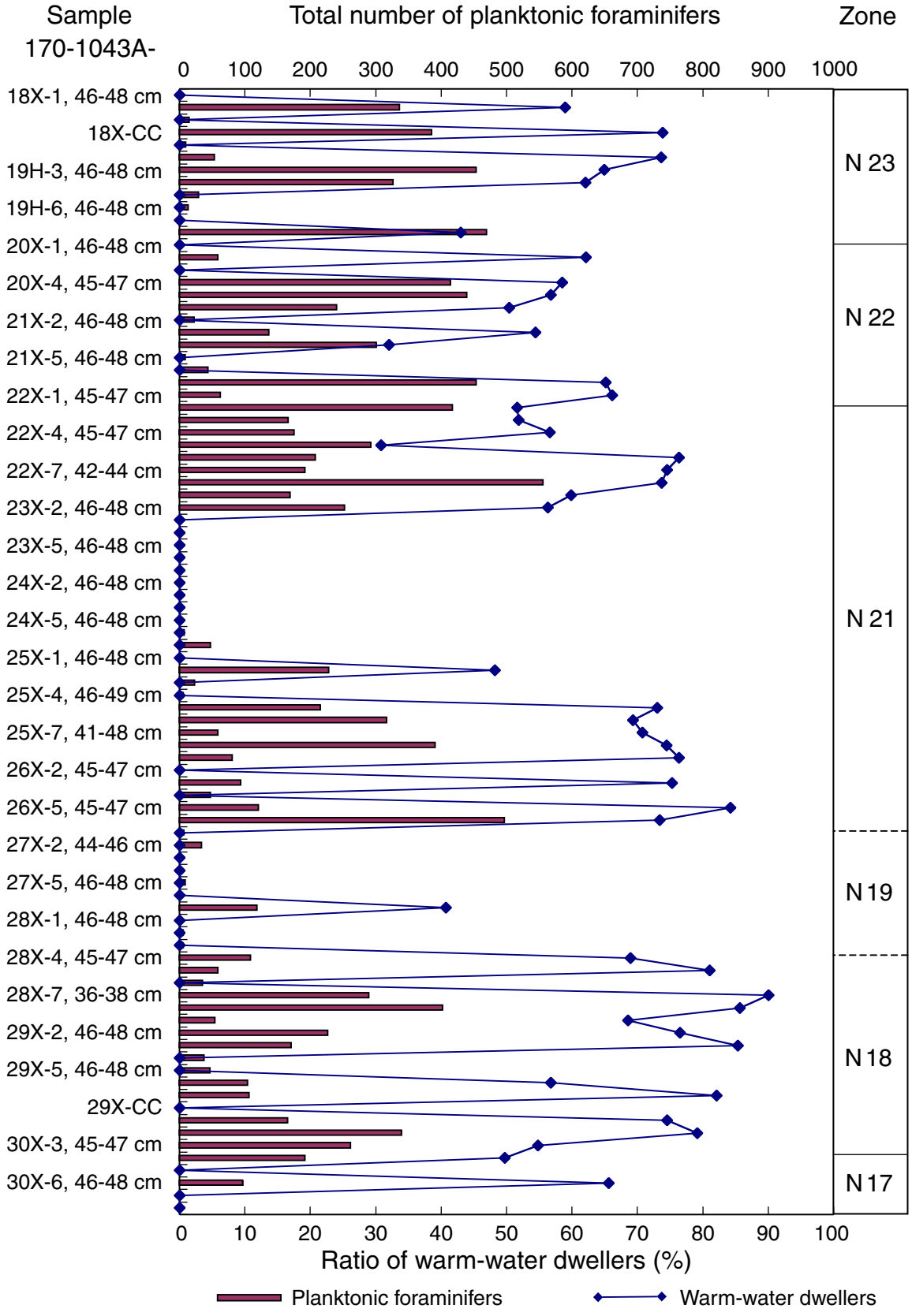

Figure F9. The ratio of warm-water dwellers to the total assemblage and ratio of *G. sacculifer* in Cores 170-1043A-18X through 30X.

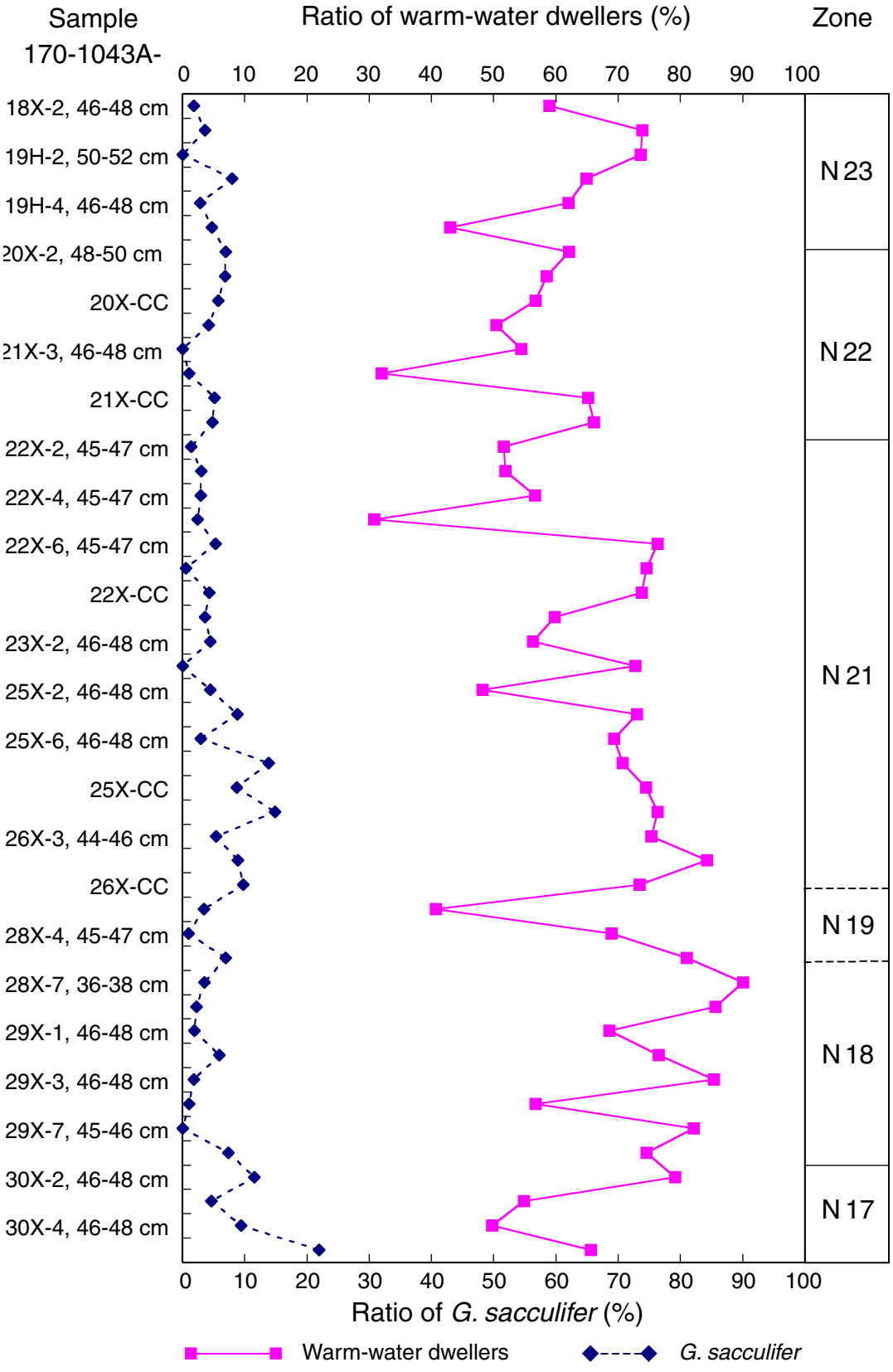

Figure F10. Ratios of surface- and intermediate-water dwellers to the total assemblage in Cores 170-1043A-18X through 30X.

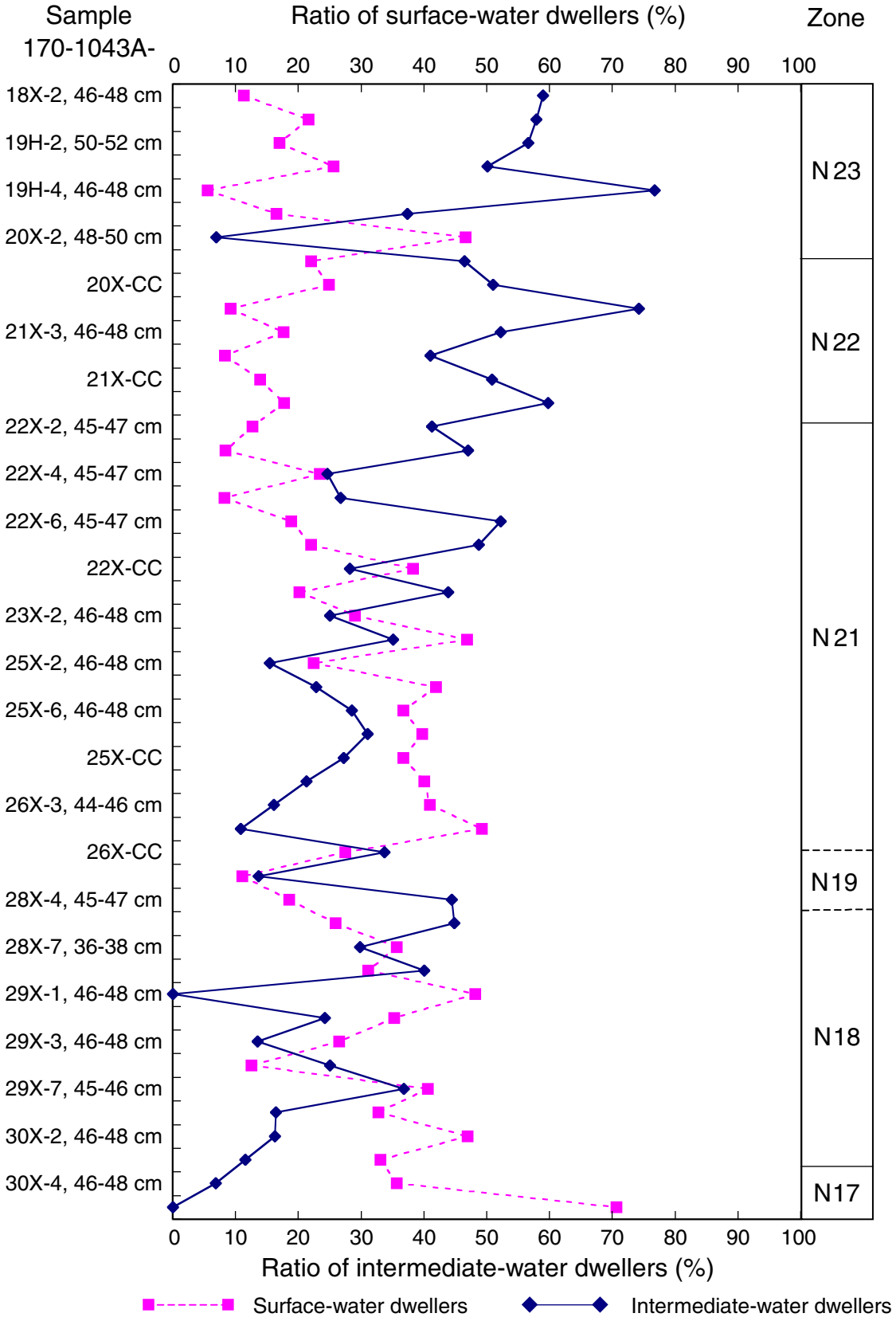

Figure F11. Biochronologic correlation of Holes 1039B and 1043A. Ratio of warm-water planktonic foraminifers and *G. sacculifer* to the total assemblage are indicated for each hole. Solid line = ratio of warm-water dwellers; dotted line = ratio of *G. sacculifer;* S = sinistral; and D = dextral.

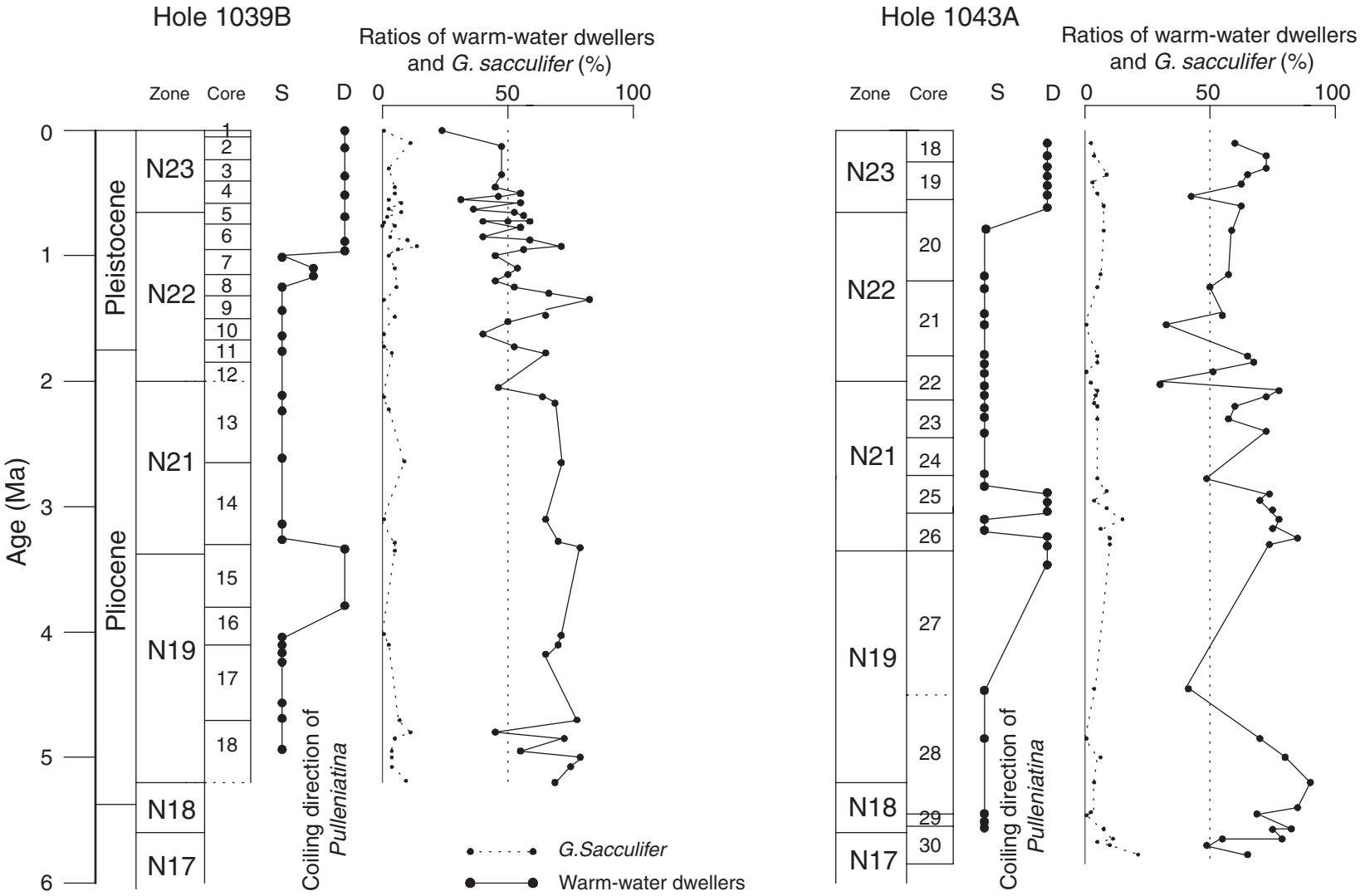

Table T1. Percentages of planktonic foraminifers in Samples 170-1039B-1H-CC through 18X-CC. (**See table note.** Continued on next five pages.)

Core, section interval (cm)	Depth (mbsf)	*Globigerina angustiumbilicata*	*Globigerina apertura*	*Globigerina bulloides*	*Globigerina decoraperta*	*Globigerina falconensis*	*Globigerina foliata*	*Globigerina nepenthes*	*Globigerina quinqueloba*	*Globigerina rubescens*	*Globigerinoides conglobatus*	*Globigerinoides cyclostomus*	*Globigerinoides elongatus*	*Globigerinoides extremus*	*Globigerinoides immaturus*	*Globigerinoides obliquus*	*Globigerinoides pyramidalis*	*Globigerinoides ruber*	*Globigerinoides sacculifer*	*Globigerinoides tenellus*	*Globigerinoides trilobus*	*Globoquadrina baroemoenensis*	*Globoquadrina conglomerata*	*Globoquadrina pseudofoliata*	*Dentoglobigerina altispira altispira*	*Dentoglobigerina altispira globosa*	*Globigerinita glutinata*	*Globigerinita iota*	*Globigerinita parkerae*	*Orbulina bilobata*	*Orbulina suturalis*	*Orbulina universa*	*Globorotalia anfracta*	*Globorotalia bermudezi*	*Globorotalia crassaformis*	*Globorotalia crozetensis*
170-1039B-																																				
1H-CC	1.90			13.2		6.2			11.1	2.5	0.4							11.9	0.8								12.0					2.5				
2H-5	8.19			7.1		1.3			16.2						1.3			8.4	11.7								13.6					1.3				
3H-CC	20.43			11.2		2.2			3.2						0.7			9.0	1.4								14.4					0.4				
4H-1, 44-46	21.44	3.6		6.8		1.9									2.3			7.2	4.4				1.7				4.0				0.4	1.3				
4H-2, 44-46	22.94	*		*	*	*									*			*	*								*									
4H-3, 44-46	24.44	1.0		6.8		1.9				1.0					2.9			5.8	5.8	1.0			1.9				14.6									
4H-5, 44-46	27.44	1.8		5.5		0.9			0.9	0.9					1.8			3.7	6.4		1.8						7.3				0.9					
4H-6, 44-46	28.94	7.2		3.0		1.7				1.5								7.9	2.5	1.5			1.5				9.7					2.0			0.7	
4H-7, 44-46	30.44	1.6		11.1		4.8				1.6		4.8	1.6					11.1	6.3								3.2									
4H-CC	30.50			4.7		3.2									3.2			15.3	6.3								6.1		0.3		0.5	1.6				
5H-1, 45-46	30.95			4.0					4.0						2.0			5.1	2.0	1.0							8.1									
5H-2, 45-46	32.45			4.0		1.3				0.6		1.3	2.0		1.3			5.3	6.7	2.0							27.3									
5H-3, 45-46	33.95	2.8		2.4		1.3			0.2	0.7			0.4		1.7			2.8	1.9	3.5			0.2				10.6					1.7				
5H-4, 45-46	35.45	3.3		4.5		2.6				0.2	0.2		0.2		0.7			3.3	1.7	0.5							4.5				0.2	3.6				
5H-5, 45-46	36.95			3.2		4.5			0.6	0.6								3.9	1.3								11.0									
5H-6, 45-46	38.47												*					*									*									
5H-7, 45-46	39.97	4.0		6.9		2.1				0.6			0.6		0.6			7.1	0.6		0.4						15.6					1.7				
5H-CC	40.38	3.4		7.7		3.7			8.4	0.3					0.7			5.4	4.0								9.8	0.3			0.3	3.7				
6H-1, 45-48	40.45														6.3			3.2		1.6			1.6				6.3					4.8				
6H-2, 45-48	41.95			9.2		1.3									2.6			3.9	2.6								11.8					2.6			2.6	
6H-3, 45-48	43.45			3.8		1.1									1.6			6.0	2.2		1.6						14.7					0.5				
6H-4, 45-48	44.95	2.8		2.3		1.0						1.3	2.6		2.3		0.5	5.7	4.9		2.1		0.5				5.4					3.9				
6H-5, 45-48	46.45	1.9		5.6		0.7			0.5	2.3	0.2		1.4		1.2			4.5	3.1	0.2	0.7		0.2				25.8				1.2	4.5		0.5	1.2	1.2
6H-6, 45-48	47.95	7.0		4.7						1.2			2.3		10.5			12.8	8.1		7.0		1.2				18.6					2.3			2.3	
6H-7, 45-48	49.45			1.9		0.8							2.1		0.6			9.3	8.6		1.0		1.0				4.7					6.0				
6H-CC	49.78			8.1		3.2			1.1	0.5			0.4		5.8			6.1	9.1	0.2	1.1						6.7					6.0				
7H-1, 46-49	49.96			0.7							0.7	0.9	5.7		2.5			6.1	13.6		0.7		2.0				4.5			0.2	2.3	6.8		0.2	0.2	
7H-2, 46-49	51.46	5.6		16.6					2.1	0.8			2.9					11.0	4.0	0.5	0.8						18.7				1.6	3.2				
7H-3, 46-49	52.96			2.3		2.3				1.1	0.5	0.4	2.0		1.8	0.2		7.4	6.2	1.1	2.0						13.1				1.4	3.2	0.2			
7H-4, 46-49	54.46	7.8		6.1		1.1				2.2			0.6		1.7			7.8	2.8					0.6			6.1					0.6				
7H-5, 46-49	55.96																	4.2	8.4		1.7			0.8			15.1				0.8	1.7				
7H-6, 46-49	57.46												0.4		0.4	1.1		7.9	4.1								2.6				0.4	3.4				
7H-7, 46-49	58.96	0.3			0.3								0.3		1.3			10.4	4.1					0.3			3.5									
7H-CC	59.00			2.9		3.7			6.3	3.2	0.2		1.0		0.7	0.2	0.3	12.6	3.8								16.0				0.2	1.2				
8H-1, 46-49	59.46	0.3		1.0		1.4				0.3			2.8		0.7			10.4	5.6	0.3	1.4			1.0			7.6					1.0			0.3	
8H-1, 120-123	60.17	9.1		1.1		0.9				2.0	0.3	1.4	2.0		1.1	0.3	0.6	3.7	8.8		2.6						10.5					4.0		0.3	1.7	
8H-2, 46-49	60.96	11.7		4.3		1.0				1.2			1.4		1.9	0.5	1.0	15.3	3.6		1.4						12.0					1.0				
8H-3, 46-49	62.46			1.3		1.3				0.4		0.8	1.7		0.8			7.9						1.7			40.2					1.3				

Table T1 (continued).

Core, section interval (cm)	Depth (mbsf)	*Globorotalia inflata*	*Globorotalia margaritae*	*Globorotalia menardii*	*Globorotalia multicamerata*	*Globorotalia oceanica*	*Globorotalia pertenuis*	*Globorotalia pumilio*	*Globorotalia puncticulata*	*Globorotalia scitula*	*Globorotalia theyeri*	*Globorotalia tosaensis*	*Globorotalia tumida flexuosa*	*Globorotalia tumida tumida*	*Globorotalia ungulata*	*Globorotalia viola*	*Globorotalia wilesi*	*Globigerinella aequilateralis*	*Globigerinella calida*	*Globigerinella obesa*	*Beella digitata*	*Pulleniatina obliquiloculata*	*Pulleniatina primalis*	*Neogloboquadrina acostaensis*	*Neogloboquadrina asanoi*	*Neogloboquadrina blowi*	*Neogloboquadrina dutertrei*	*Neogloboquadrina eggeri*	*Neogloboquadrina humerosa*	*Neogloboquadrina incompta*	*Neogloboquadrina pachyderma*	*Sphaeroidinella dehiscens*	*Sphaeroidinellopsis seminulina*	*Sphaeroidinellopsis subdehiscens*	*Globorotaloides hexagona*	*Candeina nitida*
170-1039B-																																				
1H-CC	1.90			3.7						0.4								1.2	3.7	1.2		0.4				2.9	20.6			2.1					3.3	
2H-5	8.19			19.5						0.6				4.5								0.6				3.2	8.4								1.3	0.6
3H-CC	20.43			32.5						1.1								1.1								5.8	12.6								4.3	
4H-1, 44-46	21.44			25.2							2.1			0.2				1.7		0.6		0.4				5.7	23.1	1.3		2.1	2.5				1.7	
4H-2, 44-46	22.94			*																*		*				*				*	*				*	
4H-3, 44-46	24.44			29.1											1.0			1.0				5.8				3.9	12.6	1.0		1.9					1.0	
4H-5, 44-46	27.44			36.7						0.9				0.9								0.9				7.3	17.4			0.9	0.9				1.8	
4H-6, 44-46	28.94			13.2						0.7				1.2			1.0									4.2	28.1			1.7	8.5				2.0	
4H-7, 44-46	30.44			8.0																						11.1	27.0				6.3				1.6	
4H-CC	30.50			26.1						0.5				0.3				0.5		1.1		2.1				2.4	24.7								1.3	
5H-1, 45-46	30.95			22.2						1.0				1.0			1.0									3.0	26.3			1.0	15.2				3.0	
5H-2, 45-46	32.45			14.7						0.6				10.0								0.6				4.0	10.0			0.6					7.3	
5H-3, 45-46	33.95			21.2						0.7				16.3	1.3		0.2			1.5		1.1				3.3	15.6			0.2	3.2				5.4	
5H-4, 45-46	35.45			28.2						0.5			0.7	17.1	0.9			0.5				0.5				2.4	16.8				1.7				5.2	
5H-5, 45-46	36.95			33.8			0.6							22.1								3.2				4.5	7.1								3.2	
5H-6, 45-46	38.47			*										*												*	*								*	
5H-7, 45-46	39.97			20.6						0.2	0.4	0.2		14.3	0.4					0.6		0.6				4.6	7.9			1.0	5.0				3.8	
5H-CC	40.38			20.9						0.3				3.4	0.3			0.7		1.3		1.0				2.4	15.5				1.4				5.1	
6H-1, 45-48	40.45			28.6										15.9												14.3	9.5			1.6	1.6	1.6			3.2	
6H-2, 45-48	41.95			34.2						1.3				3.9						2.6						3.9	17.1									
6H-3, 45-48	43.45			41.3										4.3				0.5								7.1	11.4			2.2					1.6	
6H-4, 45-48	44.95			25.7						1.0	5.4			0.3	1.0			0.8				2.1				3.9	21.3					0.3			3.1	
6H-5, 45-48	46.45	2.1		13.9					3.3	1.4	4.9			0.7	0.5			0.7		0.9		0.7				0.7	9.2				0.2				4.0	
6H-6, 45-48	47.95			11.6																		1.2					4.7			2.3	2.3					
6H-7, 45-48	49.45			34.8						0.6				0.4			0.2	1.6				6.8				3.7	13.8								2.1	
6H-CC	49.78			29.3						3.2								0.2		0.9		0.4					11.1			1.1					6.0	
7H-1, 46-49	49.96			24.0						2.0	2.7			0.5				2.5				5.4				0.9	9.5					0.9			4.5	
7H-2, 46-49	51.46			12.6						1.1				0.3	0.5	0.3		0.8		0.5	0.3					2.1	5.3	1.1			5.6				1.6	
7H-3, 46-49	52.96			21.1						1.4				1.1	0.7		0.2	0.9	0.7			3.5				1.1	16.7								7.4	
7H-4, 46-49	54.46			20.0						0.6												4.4			11.1		21.7					0.6			3.9	0.6
7H-5, 46-49	55.96			44.5						1.7				1.7				2.5			0.8	4.2			5.0		6.7									
7H-6, 46-49	57.46			37.5																		7.1			2.2		31.1								1.9	
7H-7, 46-49	58.96			28.2						0.3					0.6							6.3				3.2	34.2			4.4					2.2	
7H-CC	59.00			20.4						2.0				3.3				0.3		1.0	0.1	0.7				4.4	8.8					0.1			6.2	
8H-1, 46-49	59.46			35.1						2.1					0.3			1.4	0.3			3.5			2.4	1.4	13.9	0.7							4.5	
8H-1, 120-123	60.17			21.4		0.9				1.4				0.9						0.3		2.0			0.9	2.6	14.5				1.4				2.8	
8H-2, 46-49	60.96			10.3						1.7					0.5		0.2			0.2		5.3			0.7	2.2	12.4				1.4				8.9	
8H-3, 46-49	62.46			21.8						0.4				2.5								3.3					8.8			0.8					4.2	

Table T1 (continued).

Core, section interval (cm)	Depth (mbsf)	*Globigerina angustiumbilicata*	*Globigerina apertura*	*Globigerina bulloides*	*Globigerina decoraperta*	*Globigerina falconensis*	*Globigerina foliata*	*Globigerina nepenthes*	*Globigerina quinqueloba*	*Globigerina rubescens*	*Globigerinoides conglobatus*	*Globigerinoides cyclostomus*	*Globigerinoides elongatus*	*Globigerinoides extremus*	*Globigerinoides immaturus*	*Globigerinoides obliquus*	*Globigerinoides pyramidalis*	*Globigerinoides ruber*	*Globigerinoides sacculifer*	*Globigerinoides tenellus*	*Globigerinoides trilobus*	*Globoquadrina baroemoenensis*	*Globoquadrina conglomerata*	*Globoquadrina pseudofoliata*	*Dentoglobigerina altispira altispira*	*Dentoglobigerina altispira globosa*	*Globigerinita glutinata*	*Globigerinita iota*	*Globigerinita parkerae*	*Orbulina bilobata*	*Orbulina suturalis*	*Orbulina universa*	*Globorotalia anfracta*	*Globorotalia bermudezi*	*Globorotalia crassaformis*	*Globorotalia crozetensis*
8H-5, 46-49	65.46			2.2											3.3	1.1		3.3	2.2								11.0					2.2				
8H-6, 46-49	66.96	1.8							0.9						6.3			6.3	7.2		4.5						8.1				0.9	6.3				
8H-7, 46-49	68.46			0.2		0.2					1.0				2.0			12.5			0.5			0.2			2.4				0.7	1.7				
8H-CC	68.88								12.3		0.3		0.3		2.9	0.3		4.9	4.3								10.6				0.3	2.0				
9H-1, 46-49	68.96	0.8									0.5		1.3		1.0			9.8	11.1		1.0			0.8			7.7				1.0	3.6				
9H-2, 46-49	70.49										0.4				0.8	0.8		9.5	0.8		0.4			0.4			2.5									
9H-3, 46-49	71.99			0.7		0.4			0.4		1.9		3.0					7.5	5.6					2.6			4.5				2.6	6.0				
9H-4, 46-49	73.49	*		*						*			*					*	*		*						*					*				
9H-5, 46-48	74.99	2.4		2.1		1.2					0.3		0.9		4.5	0.6	0.3	12.5	21.2		1.8			0.9			6.9				1.2	7.8				
9H-6, 46-48	76.49			1.7		1.1					2.5		0.8					11.8	2.5		0.3						16.1					0.8		0.3		
9H-7, 46-48	77.99			*								*	*					*	*								*					*				
9H-CC	78.37					0.9							0.5		0.5			27.8	5.1	0.5			0.5				19.4					0.9				
10H-2, 46-49	79.96	5.1		3.6	1.8	1.1			3.3		0.4	4.4	3.3			0.4	1.5	20.4			0.7						28.1									
10H-3, 46-49	81.49	*		*		*							*		*			*									*				*					
10H-4, 46-49	82.99																																			
10H-CC	87.98	9.4		18.5		1.7			0.7		0.3		3.1		0.7	0.6		19.9	1.0								11.5				0.3	2.4				
11H-4, 46-49	92.46	1.3		5.1	2.5						0.6	1.9	1.9					7.0	1.3		3.8						15.8	0.6			0.6					
11H-5, 46-49	93.96	0.6		1.3						1.6	0.6		4.0	0.3		0.3		16.2	3.2		0.6						12.7					1.6				
11H-CC	97.37									*	*				*			*									*									
12X-CC	106.71																	*																		
13X-1, 46-48	103.96																																			
13X-2, 46-49	105.46	7.6		5.1	2.5	1.3			2.5				2.6		1.3			8.2			2.5						8.9								1.9	
13X-3, 41-43	106.91	1.6		3.0						1.6								24.2	1.6		1.6						16.7							1.6		
13X-4, 45-47	108.45			2.5									2.5		2.5	3.8		8.8	2.5		1.3						7.5									
13X-5, 39-41	109.89																	*																		
13X-6, 43-45	111.43				*																															
13X-CC	113.09			0.7		0.2				1.3	0.4			2.0	6.4			23.1	9.8		3.3		0.7				5.1					1.3				0.2
14X-2, 46-48	115.06					*												*	*																	
14X-6, 46-48	121.06		3.7	2.4	13.4					1.2				2.4				11.0	1.2	1.2	2.4						9.8								1.2	
14X-CC	122.70	1.1		1.7					1.1	2.3			1.1	2.3	2.3	2.9		15.4	5.1		1.1		1.1				9.7					0.6				
15X-1, 46-48	123.16						1.7			5.1				13.6		6.8			5.1		8.5	1.7					10.2									
15X-2, 46-48	124.66																		*																	
15X-3, 46-48	126.16															*									*											
15X-4, 46-48	127.66			*	*	*				*								*			*			*			*									
16X-4, 46-49	137.16				5.4	6.5				8.7						10.9			1.1		4.3			1.1	2.2		14.1					3.3				
16X-5, 46-49	138.66																		*								*									
16X-6, 46-49	140.16			*	*											*					*				*		*						*			
16X-CC	141.77													*	*	*						*				*						*				
17X-1, 46-49	142.26			1.4	17.1									2.1	0.7	13.7			2.7		1.4	3.4			3.4	1.4	13.7					0.7				

Table T1 (continued).

Core, section interval (cm)	Depth (mbsf)	*Globorotalia inflata*	*Globorotalia margaritae*	*Globorotalia menardii*	*Globorotalia multicamerata*	*Globorotalia oceanica*	*Globorotalia pertenuis*	*Globorotalia pumilio*	*Globorotalia puncticulata*	*Globorotalia scitula*	*Globorotalia theyeri*	*Globorotalia tosaensis*	*Globorotalia tumida flexuosa*	*Globorotalia tumida tumida*	*Globorotalia ungulata*	*Globorotalia viola*	*Globorotalia wilesi*	*Globigerinella aequilateralis*	*Globigerinella calida*	*Globigerinella obesa*	*Beella digitata*	*Pulleniatina obliquiloculata*	*Pulleniatina primalis*	*Neogloboquadrina acostaensis*	*Neogloboquadrina asanoi*	*Neogloboquadrina blowi*	*Neogloboquadrina dutertrei*	*Neogloboquadrina eggeri*	*Neogloboquadrina humerosa*	*Neogloboquadrina incompta*	*Neogloboquadrina pachyderma*	*Sphaeroidinella dehiscens*	*Sphaeroidinellopsis seminulina*	*Sphaeroidinellopsis subdehiscens*	*Globorotaloides hexagona*	*Candeina nitida*
8H-5, 46-49	65.46			49.5										4.4								6.6			1.1		11.0					1.1			1.1	
8H-6, 46-49	66.96			24.3				1.8						3.6	1.8					1.8		6.3				1.8	11.0								5.4	
8H-7, 46-49	68.46			35.7						0.2			0.2	3.4				0.7				12.0				7.3	16.6					0.5			1.7	
8H-CC	68.88			26.1						0.6		0.6		2.6				0.9				6.0				5.5	14.9								4.6	
9H-1, 46-49	68.96			11.3						0.3				4.9	0.5			0.5	0.3			20.1				4.4	16.2	0.8							2.1	
9H-2, 46-49	70.49			54.4		0.4								3.7	0.4							10.0				1.7	12.9								0.8	
9H-3, 46-49	71.99			19.1								0.4		6.4				1.1	1.1		0.7	12.4				4.9	14.2								4.5	
9H-4, 46-49	73.49			*										*													*								*	
9H-5, 46-48	74.99	0.3		5.4						0.6				0.9				0.6		0.3		10.7					14.9								1.8	
9H-6, 46-48	76.49			28.7										4.5	0.6			0.3				12.7				1.7	10.7					0.3			2.5	
9H-7, 46-48	77.99			*										*								*													*	
9H-CC	78.37			15.3						0.5				7.9				0.5		0.5		1.9				3.2	8.8								5.6	
10H-2, 46-49	79.96			4.7						0.4				3.3	0.4		0.4		1.1	1.1		4.0					6.2								4.4	
10H-3, 46-49	81.49			*										*						*		*										*				
10H-4, 46-49	82.99													*								*														
10H-CC	87.98			0.3						0.3				0.7								13.2				1.7	11.5			1.7		0.3				
11H-4, 46-49	92.46			19.0						0.6				5.7	0.6					3.2		5.7				3.8	8.9				7.6				2.5	
11H-5, 46-49	93.96			21.6						1.0		0.3		3.2	0.3			1.3	1.0			6.7				0.6	15.2					1.3			3.5	
11H-CC	97.37			*										*						*		*					*								*	
12X-CC	106.71			*						*				*																		*			*	
13X-1, 46-48	103.96																										*									
13X-2, 46-49	105.46			21.5						2.5							0.6			2.5						4.4	17.7								6.3	
13X-3, 41-43	106.91			24.2						1.6				1.6						3.0		3.0							7.6	1.6					6.1	
13X-4, 45-47	108.45			27.5								1.3		3.8						6.3		6.3				3.8	10.0								10.0	
13X-5, 39-41	109.89													*												*	*									
13X-6, 43-45	111.43			*										*																		*			*	
13X-CC	113.09	0.2		9.3				0.9		1.5		0.7		5.8				0.9	0.5	2.0		2.4				3.5	11.5					0.9			5.6	
14X-2, 46-48	115.06																									*										
14X-6, 46-48	121.06			17.1						1.2				3.7						11.0		6.1							6.1			1.2			2.4	
14X-CC	122.70			18.9						0.6				5.1						14.3		1.7							5.1			1.1			5.1	
15X-1, 46-48	123.16			5.1						1.7		1.7		3.4									11.9	1.7					5.1						16.9	
15X-2, 46-48	124.66			*						*																						*			*	
15X-3, 46-48	126.16			*																																
15X-4, 46-48	127.66			*						*				*				*		*			*			*									*	
16X-4, 46-49	137.16			27.2										6.5									5.4	3.3												
16X-5, 46-49	138.66			*	*									*																		*				
16X-6, 46-49	140.16			*	*									*						*			*							*					*	*
16X-CC	141.77			*																*															*	
17X-1, 46-49	142.26			23.3																5.5			0.7	4.1		3.4									0.7	

Table T1 (continued).

Core, section interval (cm)	Depth (mbsf)	*Globigerina angustiumbilicata*	*Globigerina apertura*	*Globigerina bulloides*	*Globigerina decoraperta*	*Globigerina falconensis*	*Globigerina foliata*	*Globigerina nepenthes*	*Globigerina quinqueloba*	*Globigerina rubescens*	*Globigerinoides conglobatus*	*Globigerinoides cyclostomus*	*Globigerinoides elongatus*	*Globigerinoides extremus*	*Globigerinoides immaturus*	*Globigerinoides obliquus*	*Globigerinoides pyramidalis*	*Globigerinoides ruber*	*Globigerinoides sacculifer*	*Globigerinoides tenellus*	*Globigerinoides trilobus*	*Globoquadrina baroemoenensis*	*Globoquadrina conglomerata*	*Globoquadrina pseudofoliata*	*Dentoglobigerina altispira altispira*	*Dentoglobigerina altispira globosa*	*Globigerinita glutinata*	*Globigerinita iota*	*Globigerinita parkerae*	*Orbulina bilobata*	*Orbulina suturalis*	*Orbulina universa*	*Globorotalia anfracta*	*Globorotalia bermudezi*	*Globorotalia crassaformis*	*Globorotalia crozetensis*
17X-2, 46-49	143.76	4.9		1.2		1.2		1.2		7.4				4.9		4.9					4.9				3.7	1.2	7.4					4.9				
17X-3, 46-49	145.26																																			
17X-4, 46-49	146.76																					*														
17X-6, 46-49	149.76			*				*				*				*										*	*				*					
17X-CC	151.19										1.3			1.9	7.6	14.6			5.7		3.8	0.6			1.9		4.5					2.5				
18X-1, 46-49	151.86											*		*		*			*		*											*				
18X-2, 46-49	153.36	7.8			3.9	2.0					3.9					7.8			11.8		3.9			2.0		2.0	11.8									
18X-3, 46-49	154.86				5.7										1.4	12.9			4.3		2.9						7.1					2.9				
18X-4, 46-49	156.36			7.5	4.8	0.3					1.7	0.7				9.5			3.1		3.4				2.0		11.6				0.7	0.7				
18X-5, 46-49	157.86			3.9							0.8	2.7		0.8		6.2			2.7		5.0	0.4	0.4		5.0		10.9					1.2				
18X-6, 46-49	159.36			4.7	1.6			3.1						1.6		15.6			3.1		1.6	3.1				1.6	6.3					1.6				
18X-7, 3-5	160.43			1.7	1.7		1.7		3.3						1.7	16.7			3.3		5.0		1.7				6.7									
18X-CC	160.97			8.5		1.2				0.6					3.0	11.5			9.1		2.4	0.6			0.6		12.7					4.2				

Note: * = Trace (<50 specimens found in sample).

Table T1 (continued).

Core, section interval (cm)	Depth (mbsf)	*Globorotalia inflata*	*Globorotalia margaritae*	*Globorotalia menardii*	*Globorotalia multicamerata*	*Globorotalia oceanica*	*Globorotalia pertenuis*	*Globorotalia pumilio*	*Globorotalia puncticulata*	*Globorotalia scitula*	*Globorotalia theyeri*	*Globorotalia tosaensis*	*Globorotalia tumida flexuosa*	*Globorotalia tumida tumida*	*Globorotalia ungulata*	*Globorotalia viola*	*Globorotalia wilesi*	*Globigerinella aequilateralis*	*Globigerinella calida*	*Globigerinella obesa*	*Beella digitata*	*Pulleniatina obliquiloculata*	*Pulleniatina primalis*	*Neogloboquadrina acostaensis*	*Neogloboquadrina asanoi*	*Neogloboquadrina blowi*	*Neogloboquadrina dutertrei*	*Neogloboquadrina eggeri*	*Neogloboquadrina humerosa*	*Neogloboquadrina incompta*	*Neogloboquadrina pachyderma*	*Sphaeroidinella dehiscens*	*Sphaeroidinellopsis seminulina*	*Sphaeroidinellopsis subdehiscens*	*Globorotaloides hexagona*	*Candeina nitida*
17X-2, 46-49	143.76			22.2						1.2										2.5			6.2	7.4		4.9							3.7		3.7	
17X-3, 46-49	145.26																																*			
17X-4, 46-49	146.76																							*										*		
17X-6, 46-49	149.76			*						*				*						*			*	*											*	
17X-CC	151.19			15.9						1.9							1.3			12.1			0.6										14.0	5.8	3.8	
18X-1, 46-49	151.86			*																				*									*	*		*
18X-2, 46-49	153.36		2.0	7.8						2.0										23.5				5.9											2.0	
18X-3, 46-49	154.86		1.4	28.6						2.9							2.9			11.4				4.3									1.4		10.0	
18X-4, 46-49	156.36			20.1						0.7							0.3	0.3		2.4			22.4	3.4							0.7			0.3	3.4	
18X-5, 46-49	157.86			24.8	0.4					1.2									0.8	15.1				12.8									2.3		2.7	
18X-6, 46-49	159.36			32.8						1.6														3.1						4.7			7.8			
18X-7, 3-5	160.43			20.0						1.7														10.0									15.0		6.6	
18X-CC	160.97			28.5						1.2										1.8						4.8							1.2	3.0	4.2	

Table T2. Percentages of planktonic foraminifers in Samples 170-1043A-18X-2, 46–48 cm, through 30X-6, 46–48 cm. (See table note. Continued on next three pages.)

Core, section, interval (cm)	Depth (mbsf)	*Globigerina angustiumbilicata*	*Globigerina apertura*	*Globigerina bulloides*	*Globigerina decoraperta*	*Globigeirna falconensis*	*Globigerina nepenthes*	*Globigerina quinqueloba*	*Globigerina rubescens*	*Globigerina woodi*	*Globigerinoides bollii*	*Globigerinoides conglobatus*	*Globigerinoides cyclostomus*	*Globigerinoides elongatus*	*Globigerinoides extremus*	*Globigerinoides immaturus*	*Globigerinoides obliquus*	*Globigerinoides quadrilobatus*	*Globigerinoides ruber*	*Globigerinoides sacculifer*	*Globigerinoides tenellus*	*Globigerinoides trilobus*	*Globoquadrina baroemoenensis*	*Globoquadrina conglomerata*	*Globoquadrina dehiscens*	*Globoquadrina venezuelana*	*Dentoglobigerina altispira altispira*	*Dentoglobigerina altispira globosa*	*Globigerinita glutinata*	*Globigerinita uvula*	*Orbulina bilobata*	*Orbulina suturalis*	*Orbulina universa*	*Globorotalia anfracta*	*Globorotalia bermudezi*	*Globorotalia crassaformis*	*Globorotalia hessi*
170-1043A-																																					
18X-2, 46-48	159.46			2.7					1.2				1.2			0.9			6.6	1.8	0.9								10.4				0.9		0.6		0.3
18X-3, 42-44	160.92			*																																	
18X-CC	161.52			4.9		1.3						0.5				2.9	0.3		13.5	3.6				0.8					4.9				1.8	0.3			0.3
19H-1, 46-48	167.56																																				
19H-2, 50-52	169.10												3.8						9.4		3.8								15.1				1.9				
19H-3, 46-48	170.56			6.0		1.5		1.1	0.4			0.4		0.2		5.3			11.7	7.9				0.2					9.9								
19H-4, 46-48	171.76			7.4		0.3								1.8		0.6				2.8									5.2				4.0				
19H-5, 46-48	173.26			*		*			*			*												*					*				*				
19H-6, 46-48	174.76					*													*										*								
19H-CC	176.90	1.1		6.8		2.1								1.5		2.1			6.0	4.7	0.4	1.1		0.6					7.0				1.7		0.6		
20X-2, 48-50	178.58			10.3		1.7			1.7			1.7				8.6			22.4	6.9	6.9								15.5				1.7				
20X-3, 46-48	180.06																																				
20X-4, 46-48	181.56			3.1		0.5		1.4					1.2	3.1		1.4	0.2		9.2	6.8									9.2				2.2		0.2		
20X-CC	181.89			3.0				3.9	0.2			0.2		2.7		0.9	0.9		14.8	5.7		0.7							7.5				0.9				
21X-1, 45-48	186.45	2.5				1.3								0.4	0.8	2.9			0.8	4.2									4.6			0.8	1.3				
21X-2, 46-48	187.96			*															*										*								
21X-3, 46-48	189.46			4.4		2.9		1.5	0.7				1.5			0.7			15.4										17.6								
21X-4, 45-47	190.95			0.3				13.0	3.0				0.3	0.3		1.0			5.7	1.0									17.3				1.3				
21X-5, 46-48	192.46															*													*								
21X-6, 46-48	193.96			*		*		*	*							*			*	*									*				*				
21X-CC	195.13			1.8	0.9	0.7		2.2							0.4	1.1			6.0	5.1		1.3							17.3			0.2	0.7		0.2		
22X-1, 45-47	196.05			1.6		1.6								1.6					11.3	4.8									19.4								
22X-2, 45-47	197.55			1.0		0.2		1.4	1.4					0.2					11.0	1.4									28.8				0.7				
22X-3, 45-47	199.05			3.6		1.8								0.6			0.6		2.4	3.0									29.5								
22X-4, 45-47	200.55			9.1		6.2		1.1						2.2		3.4	1.7		13.1	2.9									21.7							0.6	
22X-5, 45-47	202.05			8.6		1.4			0.3						0.7	0.3	0.3		1.4	2.4									43.8	0.3		0.3	1.0				
22X-6, 45-47	203.55			3.4								1.0			1.4	1.0	3.4		4.8	5.3	2.9								5.8			2.4					
22X-7, 42-44	205.03			8.9				1.0							2.6		0.5		18.3	0.5									6.8				0.5				
22X-CC	205.45			4.0	0.4	1.1		1.8	0.9					0.9	3.1		3.6		25.1	4.3	0.4	0.9		0.5					13.4				2.0				
23X-1, 46-48	205.66			1.8	2.6							0.6			1.2	2.4	0.6		11.8	3.6									24.9				0.6				
23X-2, 46-48	207.16			4.4		2.0		1.6	2.8					3.2		3.6			17.9	4.4									26.2			0.8	1.2				
23X-3, 46-48	208.66														*																						
23X-CC	214.47			2.6												1.3	2.6		39.0			3.9							9.1								
24X-6, 46-48	222.76			*				*											*										*								
24X-CC	224.53			*				*								*	*		*										*				*				
25X-2, 46-48	226.46			5.3	4.8	3.5								0.9	0.9	2.6	1.6		9.6	4.4		2.2							31.6			0.4	0.4				
25X-3, 46-48	227.96			*	*	*							*			*	*			*		*							*								

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	*Globorotalia inflata*	*Globorotalia limbata*	*Globorotalia margaritae*	*Globorotalia menardii*	*Globorotalia merotumida*	*Globorotalia multicamerata*	*Globorotalia plesiotumida*	*Globorotalia pseudomiocenica*	*Globorotalia pumilio*	*Globorotalia scitula*	*Globorotalia theyeri*	*Globorotalia tosaensis*	*Globorotalia tumida flexuosa*	*Globorotalia tumida tumida*	*Globorotalia ungulata*	*Globorotalia wilesi*	*Globigerinella aequilateralis*	*Globigerinella calida*	*Globigerinella obesa*	*Pulleniatina obliquiloculata*	*Pulleniatina praecursor*	*Pulleniatina primalis*	*Neogloboquadrina acostaensis*	*Neogloboquadrina asanoi*	*Neogloboquadrina blowi*	*Neogloboquadrina dutertrei*	*Neogloboquadrina eggeri*	*Neogloboquadrina humerosa*	*Neogloboquadrina incompta*	*Neogloboquadrina pachyderma*	*Neogloboquadrina pseudopima*	*Sphaeroidinella dehiscens*	*Sphaeroidinellopsis seminulina*	*Sphaeroidinellopsis subdehiscens*	*Globorotaloides hexagona*	*Candeina nitida*
170-1043A-																																					
18X-2, 46-48	159.46				19.4						2.4	0.6			16.1					0.9						3.6	15.2			1.8	3.0					9.6	
18X-3, 42-44	160.92				*										*											*											
18X-CC	161.52				45.2										1.6	1.8		0.3		0.5	1.3					3.1	8.8									2.3	
19H-1, 46-48	167.56				*																						*			*		*				*	
19H-2, 50-52	169.10				41.5										3.8	1.9					1.9						5.7					3.8				5.7	
19H-3, 46-48	170.56				26.3						1.5		0.3		8.8	0.4					0.9					2.2	9.1	1.8		0.4	1.5					2.2	
19H-4, 46-48	171.76				49.1						0.6				2.7	1.5					0.3					8.0	13.8									2.1	
19H-5, 46-48	173.26				*																						*									*	
19H-6, 46-48	174.76				*																																
19H-CC	176.90				11.1						11.7	6.8			1.1			0.6			0.4					3.6	17.1				4.5		0.2			7.0	
20X-2, 48-50	178.58										3.4				5.2				1.7		5.2							1.7								5.2	
20X-3, 46-48	180.06				*																					*											
20X-4, 46-48	181.56				22.5						1.0				0.2					0.2	2.4						21.3				1.7	0.7				11.4	
20X-CC	181.89				24.6						1.1		0.4		0.9			0.2			3.4						25.5									2.7	
21X-1, 45-48	186.45				35.4										2.1						3.8				1.7	15.0	18.3					1.7				0.4	
21X-2, 46-48	187.96				*						*				*						*						*									*	
21X-3, 46-48	189.46				32.4										1.5					0.7	0.7						14.7				0.7	2.9				1.5	
21X-4, 45-47	190.95				12.3					0.7	1.3		3.7							1.7	4.0					4.0	24.7									4.3	
21X-5, 46-48	192.46				*																																
21X-6, 46-48	193.96				*										*					*						*										*	
21X-CC	195.13	0.2			39.6						0.4				1.8	0.4	0.4	0.4			3.1	0.2				0.9	8.6									5.8	0.2
22X-1, 45-47	196.05				37.1																1.6								3.2			6.5					
22X-2, 45-47	197.55				24.5						0.7				2.2	0.7		0.5		0.5	3.8					1.9	12.2				0.5					6.2	
22X-3, 45-47	199.05				33.1										2.4			0.6		3.0	6.0					3.0	0.6		4.2			3.6	0.6			1.2	
22X-4, 45-47	200.55				11.4										5.1	2.3				0.6	5.1					1.1	1.1		1.7	4.0						5.1	
22X-5, 45-47	202.05				3.8						0.7				6.8						6.2					5.5	8.9			1.7						5.5	
22X-6, 45-47	203.55				15.5						0.5				26.6	1.0					11.1					3.4	2.9		3.9		1.4		0.5			1.9	
22X-7, 42-44	205.03				36.6										2.6						11.5					1.0	0.5		1.0	5.2						2.1	
22X-CC	205.45				18.4				0.2						6.3	0.2					5.4								3.6				0.9			2.5	
23X-1, 46-48	205.66				28.4										3.6			1.2			1.8				1.8	4.1	2.3		1.8			1.8				3.0	
23X-2, 46-48	207.16				13.1									4.4							3.2					1.6	5.2				0.8					4.0	
23X-3, 46-48	208.66																																				
23X-CC	214.47				13.0										6.5	1.3					1.3								15.6							3.9	
24X-6, 46-48	222.76														*														*				*				
24X-CC	224.53				*																*					*			*							*	
25X-2, 46-48	226.46				0.4										3.9						4.4					1.3	2.2		3.5			3.5				11.8	
25X-3, 46-48	227.96				*																															*	

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	*Globigerina angustiumbilicata*	*Globigerina apertura*	*Globigerina bulloides*	*Globigerina decoraperta*	*Globigerina falconensis*	*Globigerina nepenthes*	*Globigerina quinqueloba*	*Globigerina rubescens*	*Globigerina woodi*	*Globigerinoides bollii*	*Globigerinoides conglobatus*	*Globigerinoides cyclostomus*	*Globigerinoides elongatus*	*Globigerinoides extremus*	*Globigerinoides immaturus*	*Globigerinoides obliquus*	*Globigerinoides quadrilobatus*	*Globigerinoides ruber*	*Globigerinoides sacculifer*	*Globigerinoides tenellus*	*Globigerinoides trilobus*	*Globoquadrina baroemoenensis*	*Globoquadrina conglomerata*	*Globoquadrina dehiscens*	*Globoquadrina venezuelana*	*Dentoglobigerina altispira altispira*	*Dentoglobigerina altispira globosa*	*Globigerinita glutinata*	*Globigerinita uvula*	*Orbulina bilobata*	*Orbulina suturalis*	*Orbulina universa*	*Globorotalia anfracta*	*Globorotalia bermudezi*	*Globorotalia crassaformis*	*Globorotalia hessi*
25X-4, 46-48	229.46																												*								
25X-5, 46-48	230.96			2.3	0.9	0.5			3.7			1.4		1.4	2.8	5.1	0.5		21.7	8.8		3.2		0.5					11.5								
25X-6, 46-48	232.46			3.2	1.3				1.0					2.5	1.0	5.1	1.0		22.5	2.9		1.9		0.3					7.9				0.6				
25X-7, 41-48	233.91					3.4							1.7		1.7	6.9			10.3	13.8		5.2							19.0								
25X-CC	234.33				2.8	0.5		0.5							0.5	8.2	3.3		12.5	8.7		3.3		2.0					2.8				0.5				
26X-1, 45-47	234.55			7.4					6.2						1.2	6.2	2.5			14.8		3.7		1.2					13.6								
26X-2, 45-47	236.05																																				
26X-3, 44-46	237.54				6.5				4.3						2.2	2.2	6.5		19.4	5.4		5.4							17.2								
26X-4, 46-48	239.06				*										*	*	*			*		*							*								
26X-5, 45-47	240.55			1.6					4.8						3.2	3.2	2.4		13.7	8.9		16.1	0.8				0.8		13.7								
26X-CC	241.91	1.0		0.6	1.8	0.4		0.8	1.8						1.0		2.6		6.0	9.7		8.1	1.0	0.2			0.8		4.4				1.4				
27X-1, 42-45	244.12																					*															
27X-2, 44-46	245.64														*		*												*								
27X-5, 46-48	250.16			*													*																				
27X-6, 43-45	251.63																*																				
27X-CC	253.55			20.3	1.7		1.7	0.8	5.9								3.4			3.4	4.2								18.6				1.7				
28X-2, 45-47	255.25			*																							*										
28X-3, 45-47	256.75															*																					
28X-4, 45-47	258.25				2.8		1.9		1.9						5.6	1.9	7.5			0.9		2.8				1.9			15.0								
28X-5, 45-47	259.75	3.4													1.7	1.7	10.3			6.9		5.2				1.7			8.6				1.7				
28X-6, 45-47	261.25	*		*	*											*	*			*						*			*			*					
28X-7, 36-38	262.66	0.3		0.7	2.4		0.3				1.0				2.1	0.3	21.8		2.1	3.5		4.8				2.4			5.2			1.0	0.7				
28X-CC	263.13				2.4			0.7	0.5				1.2		2.9	3.4	16.3	0.2	0.5	2.2		3.9				3.9			3.9				2.7				
29X-1, 46-48	263.45				5.6											5.6	37.0			1.9		3.7			1.9				11.1			1.9	3.7				
29X-2, 46-48	264.96	0.8		1.3	1.3										1.3	4.7	15.7			5.9		7.6				1.7	1.7	0.4	7.2				0.4				
29X-3, 46-48	266.46			2.4	7.1		0.6		1.8	4.7		0.6			1.8	1.8	18.2			1.8		2.4				2.4	6.5		6.5				0.6				
29X-4, 46-48	267.96															*	*					*					*						*				
29X-5, 46-48	269.46			*				*		*					*		*												*		*						
29X-6, 46-48	270.96			8.7	5.8			1.0				1.9				1.0	8.7			1.0						3.8		1.9	9.6			1.9	1.0				
29X-7, 45-46	272.45									9.4					1.9	0.9	37.7								1.0		0.9		4.7			1.9	1.9				
30X-1, 46-48	273.06			3.6	11.5	0.6	1.8									3.6	16.4			7.3		5.5				3.6	3.0	4.2	16.4				0.6				
30X-2, 46-48	274.56			5.0	1.8		2.4		1.2						1.5	8.3	18.9	1.2		11.5		6.8	0.3			6.8	1.2		8.0		0.3		0.9				
30X-3, 45-47	276.05	1.9	0.8	6.5	8.0		1.9			1.5			0.4		1.1	3.1	23.8			4.6						1.9	1.5		17.6				0.4				
30X-4, 46-48	277.56		1.0	11.5	1.6					8.9					0.5	2.1	20.0		0.5	9.4		3.1				0.5	4.2		15.7								
30X-6, 46-48	280.56				1.0											11.5	6.3	3.1		21.9		20.8				20.8	2.1		10.4				1.0				

Note: * = trace (<50 specimens found in sample).

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	*Globorotalia inflata*	*Globorotalia limbata*	*Globorotalia margaritae*	*Globorotalia menardii*	*Globorotalia merotumida*	*Globorotalia multicamerata*	*Globorotalia plesiotumida*	*Globorotalia pseudomiocenica*	*Globorotalia pumilio*	*Globorotalia scitula*	*Globorotalia theyeri*	*Globorotalia tosaensis*	*Globorotalia tumida flexuosa*	*Globorotalia tumida tumida*	*Globorotalia ungulata*	*Globorotalia wilesi*	*Globigerinella aequilateralis*	*Globigerinella calida*	*Globigerinella obesa*	*Pulleniatina obliquiloculata*	*Pulleniatina praecursor*	*Pulleniatina primalis*	*Neogloboquadrina acostaensis*	*Neogloboquadrina asanoi*	*Neogloboquadrina blowi*	*Neogloboquadrina dutertrei*	*Neogloboquadrina eggeri*	*Neogloboquadrina humerosa*	*Neogloboquadrina incompta*	*Neogloboquadrina pachyderma*	*Neogloboquadrina pseudopima*	*Sphaeroidinella dehiscens*	*Sphaeroidinellopsis seminulina*	*Sphaeroidinellopsis subdehiscens*	*Globorotaloides hexagona*	*Candeina nitida*
25X-4, 46-48	229.46				*																*												*				
25X-5, 46-48	230.96				8.3						0.9				5.1		0.9			2.3	1.4					3.7			5.5				0.9			6.9	
25X-6, 46-48	232.46				9.5		2.5			1.3	0.3		0.6		2.2						12.7					2.5	12.0		2.2				0.3			2.9	
25X-7, 41-48	233.91				19.0										5.2								1.7						3.4			3.4				5.2	
25X-CC	234.33				8.2						1.5	0.3	0.3		2.8					3.1	7.7						10.2		2.8	3.1			0.3			14.0	
26X-1, 45-47	234.55				8.6						1.2		1.2										7.4	1.2					7.4			3.7				12.3	
26X-2, 45-47	236.05														*																						
26X-3, 44-46	237.54				6.5										2.2								6.5	4.3		3.2										8.6	
26X-4, 46-48	239.06				*										*		*						*	*												*	
26X-5, 45-47	240.55				8.1						2.4				2.4				0.8				8.1											4.0		4.8	
26X-CC	241.91		1.2		20.0						0.6				1.0					5.8			13.5	5.8		0.4			1.2	4.0					0.4	4.2	
27X-1, 42-45	244.12				*															*																	
27X-2, 44-46	245.64				*									*	*								*	*										*		*	
27X-5, 46-48	250.16				*																											*					
27X-6, 43-45	251.63				*																																
27X-CC	253.55			4.2	6.8						5.1									5.9			5.9			1.7				5.1						3.4	
28X-2, 45-47	255.25				*																																
28X-3, 45-47	256.75				*																															*	
28X-4, 45-47	258.25		2.8		28.0			1.9			0.9			0.9									0.9							15.9				2.8	3.7		
28X-5, 45-47	259.75				43.1															5.2														6.9	3.4		
28X-6, 45-47	261.25				*																			*										*	*		
28X-7, 36-38	262.66		1.4		29.8	2.1	2.4								2.1					2.1														5.2	1.0	5.2	
28X-CC	263.13		0.7		35.7		1.0				0.7									4.4										1.7				1.9	2.7	6.6	
29X-1, 46-48	263.45		7.4								3.7									11.1			1.9													3.7	
29X-2, 46-48	264.96		4.2		22.0	0.8					0.8									4.2			0.8	1.3								10.6		2.5		2.5	
29X-3, 46-48	266.46		1.8	1.2	13.5																		21.2											1.2		2.4	
29X-4, 46-48	267.96				*																														*	*	
29X-5, 46-48	269.46		*		*																														*	*	
29X-6, 46-48	270.96		8.7		17.3	3.8														17.3				3.8										1.0		1.9	
29X-7, 45-46	272.45		1.9		35.8																			0.9													0.9
30X-1, 46-48	273.06			0.6	15.2					0.6	1.2									1.8											1.2			1.8			
30X-2, 46-48	274.56		0.6		15.6					0.6	0.6							0.6																5.6		0.6	
30X-3, 45-47	276.05		0.4		1.1						0.8				0.4					6.1				6.9							2.7			5.4		1.1	
30X-4, 46-48	277.56				2.6					0.5	0.5									6.3				4.2								2.1		4.2		1.0	
30X-6, 46-48	280.56																			1.0																	