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5. Calcareous Nannofossils from the New Jersey Continental Margin[1]

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ABSTRACT

Calcareous nannofossil range charts for Leg 174A sites on the New Jersey continental margin are presented in this report, and nannofossil biostratigraphy is established. Nannofossil biostratigraphic resolution is low in shallow-water Sites 1071 and 1072, where nannofossils are generally rare or frequently absent. Site 1073 yields generally common to abundant nannofossils, which allows a fairly detailed nannofossil biostratigraphy for the entire Pleistocene through upper Eocene sequence. Quantitative and semiquantitative nannofossil data for the upper Pleistocene section from Site 1073 reveal an average sedimentation rate of about 80 cm/k.y. The unusually high sedimentation rate makes this calcareous section very valuable for high-resolution studies.

INTRODUCTION

Ocean Drilling Program (ODP) Leg 174A drilled a transect of three sites on the continental margin off New Jersey to study sea-level history. The primary goals of Leg 174A "are to (1) date unconformities (sequence boundaries) of Oligocene to Holocene age and to compare this stratigraphic record with the timing of glacial eustatic changes inferred from deep-sea $\delta^{18}O$ variations…." (Leg 174A Scientific Prospectus [http://www-odp.tamu.edu/publications/prosp/174a_prs/174aabstr.html]).
Shipboard studies showed that the primary means of dating the sedimentary sequences recovered during Leg 174A was nannofossil biostratigaphy. However, shipboard nannofossil biostratigraphy was generally based on data from core catcher samples. The purpose of this shore-based study is to examine these core catcher samples in more detail and

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to examine samples within core sections. These analyses will improve the reliability and stratigraphic resolution beyond those of the shipboard biostratigraphy by identifying additional age-diagnostic species (particularly within the cores) and by locating the zonal/subzonal boundaries more precisely. With improved biostratigraphy, we should be able to date the unconformities (sequence boundaries) with better precision and to better correlate the geologic events identified in Leg 174A cores with those recorded in other parts of the world. An improved biostratigaphy is important, as much of the cored intervals do not yield useful magnetostratigraphy due to generally low core recovery and disturbed cores.

Previous studies of Eocene–Pleistocene nannofossils in the vicinity of Leg 174A sites include those of Mountain, Miller, Blum, et al. (1994), Gartner and Shyu (1996), and Aubry (1996).

MATERIALS AND METHODS

Smear slides were made directly from unprocessed samples and were routinely examined using a light microscope at a magnification of 1000×. Abundances of individual species were estimated from each sample. Five levels of abundance were recorded with the following approximate definitions:

R = rare (1 specimen per 51 or more fields of view).
F = few (1 specimen per 11–50 fields of view).
C = common (1 specimen per 2–10 fields of view).
A = abundant (1–10 specimens per field of view).
V = very abundant (>10 specimens per field of view).

Total abundance of calcareous nannofossils for each sample was estimated as follows:

B = barren (no nannofossils found in 500 fields of view).
R = rare (1–10 specimens for 500 fields of view).
F = few (11–50 specimens for 500 fields of view).
C = common (51–2000 specimens for 500 fields of view).
A = abundant (2000–20,000 specimens for 500 fields of view).
V = very abundant (>20,000 specimens for 500 fields of view).

The abundance of reworked nannofossils was recorded in lower case letters, that is, r = rare and f = few.

For quantitative study of *Emiliania huxleyi* abundance relative to other taxa, 300 nannofossil specimens were counted for each sample.

Bibliographic references for the calcareous nannofossil species considered in this paper can be found in Loeblich and Tappan (1966, 1968, 1969, 1970a, 1970b, 1971, 1973), van Heck (1979a, 1979b, 1980a, 1980b, 1981a, 1981b, 1982a, 1982b, 1983), or Steinmetz (1985a, 1985b, 1986, 1987a, 1987b, 1988a, 1988b, 1989). Nannofossil zonation used is that of Bukry (1973, 1975) as codified by Okada and Bukry (1980). Numerical ages used are those compiled by Berggren et al. (1995) to facilitate easy comparison with other studies.

SITE DESCRIPTIONS

Site 1071

Calcareous nannofossils are generally absent or rare at this site because of strong carbonate dissolution and very shallow water conditions that were unfavorable to these planktonic organisms. Thus, nannofossil biostratigraphic resolution is minimal. The oldest sediment is dated as late Miocene–early Pliocene.

Sample 174A-1071A-1H-1, 79–80 cm, yields rare specimens of *E. huxleyi* (Table T1). This suggests an age younger than 0.26 Ma. The true stratigraphic range of this species must have been truncated here, as the underlying samples are barren of nannofossils. The next ~60 m of cores contains only rare specimens of *Coccolithus pelagicus, Gephyrocapsa* spp., and occasionally rare specimens of reworked Paleogene nannofossil taxa. These taxa do not allow useful age assignment for the cores.

T1. Calcareous nannofossil range chart, Site 1071, p. 11.

Sample 174A-1071B-5X-CC, 22–26 cm, contains rare specimens of *Pseudoemiliania lacunosa* and few specimens of *Gephyrocapsa* spp. >4 µm. The presence of the former species indicates an age of older than 0.46 Ma, whereas the presence of the latter taxa suggests an age younger than 0.9 Ma for this sample. The top of Subzone CN14a, drawn between Samples 174A-1071A-5X-5, 80–81 cm, and 5X-CC is not precise, as the upper sample is barren of calcareous nannofossils. Sample 174A-1071C-2X-CC, 35–40 cm, yields *Gephyrocapsa* spp. >4 µm, *P. lacunosa, Calcidiscus leptoporus,* and *Braarudosphaera bigelowii* and can also be assigned an age range of 0.46–0.9 Ma. Samples from Cores 174A-1071C-3X through 10X are barren of calcareous nannofossils.

Sample 174A-1071C-11X-1, 19–20 cm, contains rare specimens of *C. pelagicus, Reticulofenestra pseudoumbilicus,* and *Sphenolithus* spp. The presence of the last two taxa suggests an age of early Pliocene or older. On the other hand, the absence of *Cyclicargolithus floridanus,* a generally abundant species in the middle Miocene and older marine sediments worldwide, indicates an age of late Miocene or younger for this sample. A number of samples downhole also yield rare specimens of *R. pseudoumbilicus* and/or *Sphenolithus* spp., whereas *C. floridanus* is absent. These samples can be assigned a general age of late Miocene–early Pliocene.

Samples from Hole 1071F are barren of calcareous nannofossils, and no nannofossil biostratigraphy can be established.

Site 1072

As at Site 1071, Site 1072 was drilled in very shallow water (110 m). Calcareous nannofossils and other planktonic fossils are generally rare and frequently absent in the sediments recovered from Site 1072 (Table T2). The identification of some age-diagnostic taxa in a few samples provides some useful biostratigraphic information.

T2. Calcareous nannofossil range chart, Site 1072, p. 13.

Sample 174A-1072A-1R-1, 79–80 cm, yields only rare specimens of reworked Paleogene nannofossils (*Chiasmolithus solitus*), whereas the core catcher sample (1R-CC, 15–20 cm) is barren of nannofossils. Sample 174A-1072A-2R-1, 79–80 cm, contains rare specimens of *Gephyrocapsa* spp. >4 µm. The absence of *E. huxleyi* may suggest that the sample is older than 0.26 Ma. However, this age estimate is not firm, as the abundance of nannofossils in the sample is very low.

Sample 174A-1072A-9R-CC, 0–8 cm, contains rare specimens of *P. lacunosa* together with *Gephyrocapsa* spp. >4 µm and *Gephyrocapsa* spp. <4 µm. The presence of *P. lacunosa* constrains the age to be older than 0.45 Ma, whereas the presence of *Gephyrocapsa* spp. >4 µm indicates an age younger than 0.9 Ma. A similar assemblage is also present in Samples 174A-1072A-12R-CC, 0–3 cm, and 26R-CC, 0–5 cm, and these samples can also be assigned an age range of 0.45–0.9 Ma.

Rare specimens of *R. pseudoumbilicus* and/or *Sphenolithus* spp. occur sporadically from Samples 174A-1072A-32R-CC, 0–10 cm, through 47R-CC. These taxa indicate an age of early Pliocene or older (>3.8 Ma). The absence of *C. floridanus,* a generally ubiquitous species in middle Miocene to Eocene marine sediments, suggests that the stratigraphical interval is late Miocene or younger in age.

Site 1073

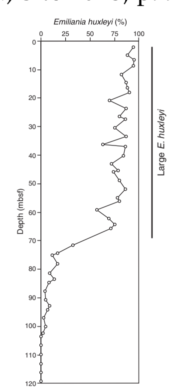
Site 1073 was drilled in much deeper water (651 m) than at Sites 1071 and 1072, and, correspondingly, it yielded much more abundant calcareous nannofossils.

Calcareous nannofossils are generally common to abundant and relatively diverse at this site. They allow a fairly detailed biostratigraphy for the entire sequence, which spans from the Pleistocene through upper Eocene.

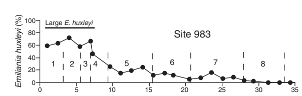
Shipboard studies indicate that the Neogene section at Site 1073 is very expanded, and the upper Pleistocene section appears to be very valuable for high-resolution studies because it is one of the few calcareous sequences that has extremely high sedimentation rates. In order to work out as detailed a nannofossil biostratigraphy as possible for the upper Pleistocene, a quantitative analysis of nannofossils was carried out in this study.

The relative abundance of *E. huxleyi* vs. other nannofossil taxa for the top 120-m sequence is plotted in Figure F1. *E. huxleyi* first occurs at about 120 meters below seafloor (mbsf). This marks the base of Zone CN15 with an age of 0.26 Ma or oxygen isotope Stage 8 (Thierstein et al., 1977). *E. huxleyi* increases abruptly in abundance around 70 mbsf. This marks the beginning of the *E. huxleyi* acme zone, and it correlates with oxygen isotope Stage 4 (Thierstein et al., 1977) with an age of about 85 ka. This indicates an average sedimentation rate of about 80 cm/k.y. This result is in contrast with the Leg 150 findings that oxygen isotope Stages 1–4 are missing in all Leg 150 sites (Mountain, Miller, Blum, et al., 1994). In order to further test the presence of oxygen isotope Stage 4 and younger sediment at Site 1073, large *E. huxleyi* (>5 µm) was carefully recorded at Site 1073. Its first occurrence coincides with the beginning acme of *E. huxleyi* (Fig. F1). This relationship has been observed in the Mediterranean (Flores et al., 1997). To further confirm this relationship, I have counted the abundance of *E. huxleyi* vs. other coccoliths at another North Atlantic ODP Site, Site 983, carefully recorded large *E. huxleyi*, and plotted them against the oxygen isotope stratigraphy of Channell et al. (1997) (Fig. F2). This comparison also confirms that the first occurrence of large *E. huxleyi* coincides with the beginning acme of *E. huxleyi,* and they correlate with oxygen isotope Stage 4.

F1. Abundance and distribution of *E. Huxleyi,* Site 1073, p. 9.



F2. Abundance and distribution of *E. Huxleyi,* Site 983, p. 10.



Semiquantitative abundance data for Core 174A-1073A-14H downhole are presented in Table T3. The highest occurrence of *P. lacunosa* is found in Sample 174A-1073A-37X-CC. This marks the top of Subzone CN14a at 0.46 Ma. This boundary is likely to be stratigraphically higher but is not possible to determine with precision, as the overlying sediment is barren of calcareous nannofossils. The next nannofossil datum

T3. Calcareous nannofossil range chart, Site 1073, p. 15.

recognized is the highest occurrence of *Helicosphaera sellii* (1.3 Ma) in Sample 174A-1073A-57X-4, 54–55 cm. Again, the precise location of this datum is hindered by the overlying barren interval. *Calcidiscus macintyrei* is present in Sample 174A-1073A-57X-6, 56–57 cm. This indicates an age older than 1.6 Ma. The first occurrence of *Gephyrocapsa* spp. >4 µm is between Samples 174A-1073A-57X-6, 56–57 cm, and 57X-CC, 28–33 cm. This datum is known to be slightly older than the last occurrence of *C. macintyrei* (Wei, 1993). The last occurrence of *Discoaster brouweri* is in Sample 174A-1073A-58X-4, 54–55 cm. This sample is older than 1.9 Ma. The Pliocene/Pleistocene boundary lies between the last occurrences of *D. brouweri* and *C. macintyrei.* Shipboard study based on core catcher samples suggested an unconformity between Samples 174A-1073A-56X-CC and 57X-CC. However, shore-based study of additional samples within the core shows a sequence of datums and thus does not reveal an unconformity, even though it may be present, or the interval represents a condensed section.

Discoater tamalis is first encountered in Sample 174A-1073A-59X-3, 68–69 cm. This suggests an age older than 2.7 Ma. The upper boundary of this datum is not well defined, as the overlying sediment is barren of calcareous nannofossils. In the bottom of this core in Sample 174A-1073A-59X-CC, 34–39 cm, a lower Pliocene nannofossil assemblage is identified, as the presence of *R. pseudoumbilicus* indicates an age of 3.6 Ma or older.

The next age-diagnostic assemblage was found in Sample 174A-1073A-62X-CC, 39–44 cm, which contains *C. floridanus*. The presence of this species in the absence of *Sphenolithus heteromorphus* suggests an age of 12.5–13.5 Ma (middle Miocene). Thus, a major unconformity lies above Sample 174A-1073A-62X-CC. The highest occurrence of *S. heteromorphus* is in Sample 174A-1073A-64X-4, 54–55 cm, which marks the upper zonal boundary of CN4 (13.5 Ma). This species is present down to Sample 174A-1073A-67X-CC, which represents the lower zonal boundary of CN3 (18.2 Ma). Sample 174A-1073A-68X-4, 57–58 cm, contains an index fossil, *Sphenolithus belemnos*. This indicates an age within Zone CN2, with an age range of 18.5–20.6 Ma.

Sample 174A-1073A-70X-2, 62–63 cm, contains *Reticulofenestra bisecta* but no *Sphenolithus ciperoensis* or *Chiasmolithus altus* and can be assigned an age of 23.9–25.5 Ma (latest Oligocene).

Eocene assemblages were first encountered in Sample 174A-1073A-71X-CC, 35–36 cm, which contains *Discoaster saipanensis* and *Isthmolithus recurvus*. This suggests a latest Eocene age (34.2–35.0 Ma). The truncation of the last occurrences of *D. saipanensis* and *I. recurvus* marks a major unconformity, which encompasses the uppermost Eocene through lower Oligocene. This unconformity is likely to be the result of sea-level drops in the earliest Oligocene and near the early Oligocene/late Oligocene boundary (Haq et al., 1987), corresponding to the global oxygen isotope events Oi1 and Oi2 (Miller et al., 1996).

Reticulofenestra reticulata is present from Samples 72X-4, 56–57 cm, through the bottom of the hole (Sample 72X-CC). This interval is dated as 35.0–36 Ma based on the presence of this species. This interval correlates with the Leg 150 interval that yielded microtektites (Mountain, Miller, Blum, et al., 1994).

SUMMARY AND CONCLUSIONS

Examination of samples within cores and construction of nannofossil range charts from all Leg 174A sites have resulted in improved nannofossil biostratigraphy. Calcareous nannofossils are generally rare and frequently absent in the very shallow-water Sites 1071 and 1072. A few age-diagnostic nannofossils present provide some useful age assignments. The oldest sediments at the two sites are dated as late Miocene–early Pliocene. The deeper-water Site 1073 generally yields common to abundant nannofossils. They allow a fairly detailed nannofossil biostratigraphy for the entire Pleistocene through upper Eocene sequence. Quantitative and semiquantitative nannofossil data for the upper Pleistocene section at Site 1073 provide a solid foundation for the interpretation of oxygen isotope stratigraphy (C. McHugh and H. Olson, pers. comm., 2000). These data reveal an average sedimentation rate of about 80 cm/k.y. The unusually high sedimentation rate makes this calcareous section very valuable for high-resolution studies.

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Figure F1. Percentage of *Emiliania huxleyi* within the total coccolith assemblage plotted against depth for the upper 120 m at Site 1073. Distribution of large *E. huxleyi* is also shown.

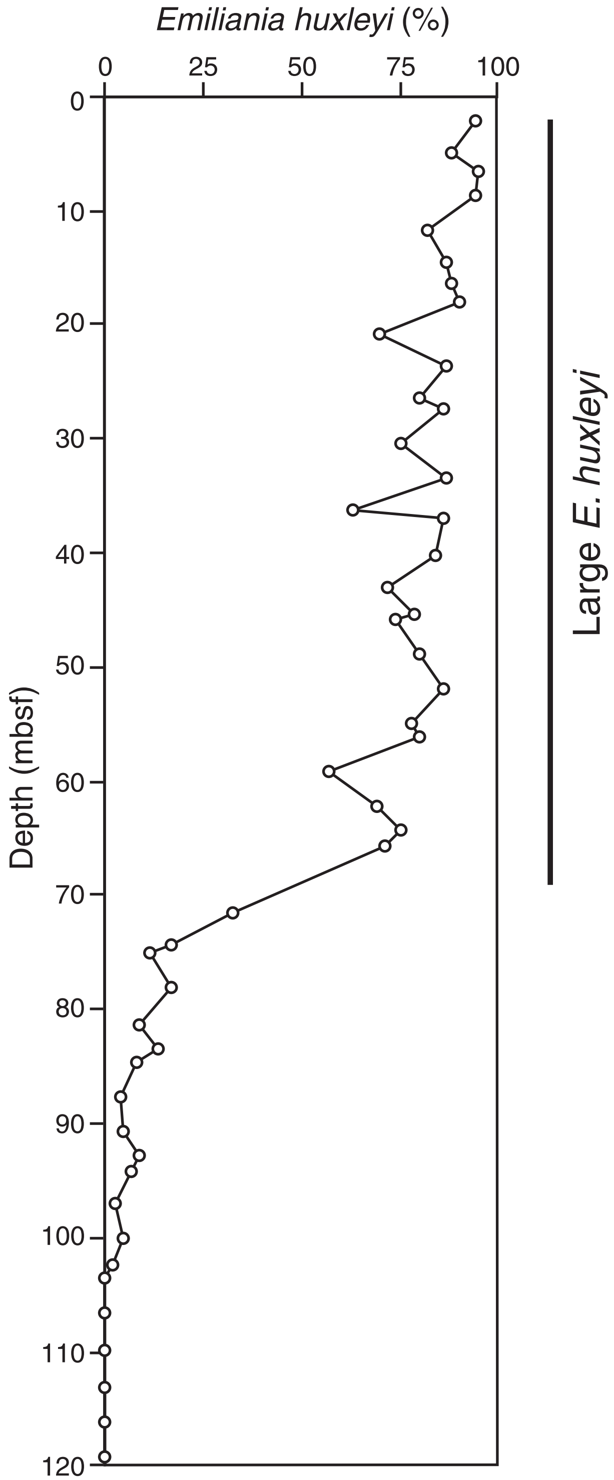

Figure F2. Percentage of *Emiliania huxleyi* within the total coccolith assemblage plotted against depth for the upper 35 m at Site 983. Distribution of large *E. huxleyi* is also documented. Numbers 1–8 = oxygen isotope Stages 1–8 as established by Channell et al. (1997). The beginning acme of *E. huxleyi* and the first occurrence of large *E. huxleyi* correlate with oxygen isotope Stage 4.

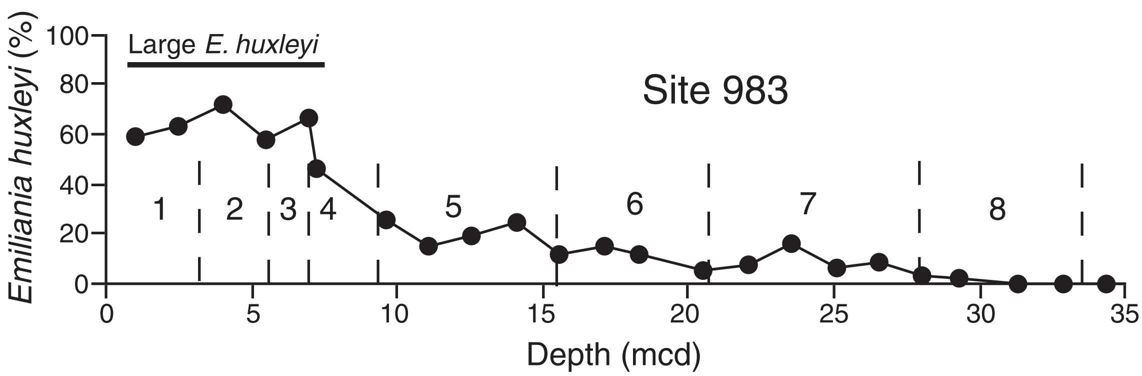

Table T1. Calcareous nannofossil range chart, Site 1071. (See table note. Continued on next page.)

Age	Nannofossil zone/subzone	Core, section, interval (cm)	Depth (mbsf)	Abundance	*Braarudosphaera bigelowi*	*Calcidiscus leptoporus*	*Coccolithus pelagicus*	*Emiliania huxleyi*	*Gephyrocapsa* spp. (>4 µm)	*Gephyrocapsa* spp. (<4 µm)	*Pseudoemiliania lacunosa*	*Reticulofenestra pseudoumbilicus*	*Sphenolithus abies*	*Chiasmolithus solitus*	*Effilithus turiseiferi*	*Reticulofenestra bisecta*	*Reticulofenestra umbilicus*	*Zygrhablithus bijugatus*
	CN15	1071A 1H-1 79-80	0.79	R	.	.	.	R	.	.	.	.	.	.	.	.	.	.
		1071A 1H-3 79-80	3.79	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 1H-CC 10-14	5.12	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 2H-1 79-80	5.89	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 2H-2 79-80	7.39	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 2H-CC 23-27	7.83	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 3H-1 79-80	8.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 3H-3 79-80	11.69	R	.	.	.	.	R	.	.	.	.	.	.	.	.	.
		1071A 3H-CC 15-19	12.00	R	.	.	R	.	R	.	.	.	.	.	.	.	.	.
		1071A 4H-1 79-80	12.79	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 4H-3 77-78	15.77	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 4H-CC 29-33	16.16	R	.	.	R	.	.	.	.	.	.	.	.	r	.	.
		1071A 5H-1 90-91	17.10	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pleistocene		1071A 5H-CC 10-14	25.83	R	.	.	.	.	.	R	.	.	.	.	.	.	.	.
	?	1071A 6H-1 67-68	26.37	R	.	.	.	.	R	.	.	.	.	.	.	.	.	.
		1071A 6H-CC 27-31	26.77	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 7H-1 68-70	27.48	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 8X-CC 15-18	36.45	R	.	.	R	.	.	.	.	.	.	.	.	.	.	.
		1071A 9X-CC 0-5	39.90	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071A 10X-1 43-44	49.73	B	.	.	.	.	.	.	.	.	.	r	.	.	.	.
		1071A 10X-CC 25-29	50.13	r	.	.	.	.	.	.	.	.	.	.	r	.	.	.
		1071B 2X-1 79-80	40.59	R	.	.	R	.	R	.	.	.	.	.	.	.	.	.
		1071B 2X-CC 0-5	41.85	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071B 3X-CC 10-15	49.74	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071B 4X-1 15-16	53.05	R	.	.	.	.	R	.	.	.	.	.	.	.	.	.
		1071B 4X-CC 0-5	53.46	R	.	.	.	.	R	.	.	.	.	r	.	.	.	.
		1071B 5X-1 79-80	59.19	r	.	.	.	.	.	.	.	.	.	r	.	.	.	.
		1071B 5X-3 79-80	62.19	F	.	R	.	.	F	F	.	.	.	.	.	.	.	.
		1071B 5X-5 80-81	65.20	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071B 5X-CC 22-26	65.69	C	.	.	.	.	F	F	R	.	.	.	.	.	.	.
	CN14a	1071B 6X-CC 34-37	68.14	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 2X-1 79-80	59.19	R	.	.	.	.	R	.	.	.	.	.	.	.	.	.
		1071C 2X-2 79-80	60.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 2X-3 79-80	62.19	F	.	.	.	.	F	F	.	.	.	.	.	.	.	.
	?	1071C 2X-CC 35-40	64.42	C	R	R	.	.	R	C	R	.	.	.	.	.	.	.
		1071C 3X-1 34-35	68.14	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 3X-CC 20-24	68.46	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 6X-1 11-12	96.31	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 6X-CC 29-33	97.17	r	.	.	.	.	.	.	.	.	.	.	.	.	r	.
		1071C 7X-CC 37-41	105.97	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
?		1071C 8X-1 78-79	115.68	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 8X-CC 27-32	116.44	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 9X-1 80-81	125.30	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 9X-3 79-80	128.29	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 9X-CC 31-36	129.15	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 10X-CC 36-41	134.36	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	CN11`	1071C 11X-1 19-20	143.29	R	.	.	R	.	.	.	.	R	R	.	.	.	.	.
		1071C 11X-3 79-80	147.29	R	.	.	.	.	.	.	.	.	R	.	.	.	.	.
		1071C 11X-CC 46-51	149.45	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 12X-1 79-80	149.29	r	.	.	.	.	.	.	.	.	.	.	.	.	r	.
late Miocene - early Pliocene	?	1071C 12X-3 79-80	152.29	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 12X-CC 43-48	153.63	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 13X-1 79-80	153.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 13X-3 79-80	156.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 13X-CC 23-28	157.38	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 14X-1 79-80	158.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table T1 (continued).

Age	Nannofossil zone/subzone	Core, section, interval (cm)	Depth (mbsf)	Abundance	*Braarudosphaera bigelowi*	*Calcidiscus leptoporus*	*Coccolithus pelagicus*	*Emiliania huxleyi*	*Gephyrocapsa* spp. (>4 µm)	*Gephyrocapsa* spp. (<4 µm)	*Pseudoemiliania lacunosa*	*Reticulofenestra pseudoumbilicus*	*Sphenolithus abies*	*Chiasmolithus solitus*	*Effilithus turiseiferi*	*Reticulofenestra bisecta*	*Reticulofenestra umbilicus*	*Zgrhablithus bijugatus*
late Miocene - early Pliocene	CN11 / ?	1071C 14X-3 129-130	162.19	R	.	.	.	.	.	.	.	R	R	.	.	.	.	.
		1071C 14X-CC 38-40	162.99	R		R	R	.	.	.	.	R	.	.	.	.	.	.
		1071C 15X-1 77-78	163.17	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 15X-3 79-80	166.19	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 15X-5 79-80	169.19	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 15X-7 48-49	171.88	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 15X-CC 37-41	172.27	R	.	.	.	.	.	.	.	.	R	.	.	.	.	r
		1071C 16X-1 79-80	172.59	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 16X-2 80-81	174.10	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 16X-CC 22-26	175.37	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 18X-CC 18-21	190.98	R	R	.	R	.	.	.	.	R	.	.	.	.	.	.
		1071C 19X-1 79-80	200.89	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 19X-CC 16-20	201.32	R	.	.	R	.	.	.	.	R	.	.	.	.	.	.
		1071C 20X-1 79-80	210.29	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 20X-3 79-80	213.29	B		.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 20X-CC 30-37	214.90	R	.	.	.	.	.	.	.	R	.	.	.	.	.	.
		1071C 22X-1 80-81	229.20	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 22X-2 20-21	230.10	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 22X-CC 29-33	230.49	R	.		R	.	.	.	.	R	.	.	.	.	.	.
		1071C 23X-1 79-80	238.49	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 23X-CC 0-4	239.77	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 24X-1 64-65	247.64	B		.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 24X-CC 16-20	247.96	R	.	.	R	.	.	.	.	R	.	.	.	.	.	.
?	?	1071C 25X-2 80-81	253.90	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 25X-3 82-84	255.42	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071C 25X-CC 10-14	257.22	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 1R-1 75-76	252.75	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 1R-2 78-79	254.28	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 6R-1 78-79	320.98	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 7R-1 76-77	330.36	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 8R-1 78-79	339.78	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 8R-CC 0-5	339.99	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 9R-1 44-45	348.94	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 9R-2 53-54	349.83	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 9R-3 114-115	351.30	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 10R-1 79-80	358.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 10R-3 77-78	361.67	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 11R-1 78-79	368.18	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 11R-3 78-79	370.36	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		1071F 11R-3 108-109	370.66	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Note: C = common, F = few, R = rare, B = barren, r = rare reworked.

Table T2. Calcareous nannofossil range chart, Site 1072. (See table note. Continued on next page.)

Age	Nannofossil zone/subzone	Core, section, interval (cm)	Depth (mbsf)	Abundance	*Calcidiscus leptoporus*	*Gephyrocapsa* spp. (>4 µm)	*Gephyrocapsa* spp. (<4 µm)	*Helicosphaera carteri*	*Pseudoemiliania lacunosa*	*Reticulofenestra pseudoumbilicus*	*Reticulofenestra* spp. (small)	*Sphenolithus abies*	*Chiasmolithus solitus*	*Effilithus turiseiferi*	*Heliolithus kleinpellii*	*Reticulofenestra bisecta*	*Reticulofenestra umbilicus*
		1072A 1R-1 79-80	0.79	r	.	.	.	.	.	.	.	.	r	.	.	.	.
		1072A 1R-CC 15-20	2.22	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 2R-1 79-80	8.29	R	.	R	.	.	.	.	.	.	.	.	.	.	.
		1072A 2R-CC 8-13	9.59	r	.	.	.	.	.	.	.	.	r	.	.	.	.
		1072A 3R-1 79-80	17.79	B	.	R	.	.	.	.	.	.	.	.	.	.	.
		1072A 3R-2 79-80	19.29	B	.	R	.	.	.	.	.	.	.	.	.	.	.
		1072A 3R-CC 0-5	19.60	R	.	R	R	.	.	.	.	.	.	.	.	.	.
		1072A 4R-1 79-80	27.49	B	.	R	.	.	.	.	.	.	.	.	.	.	.
		1072A 4R-3 81-82	30.51	B	.	R	.	.	.	.	.	.	.	.	.	.	.
		1072A 4R-CC 19-24	30.81	B	.	R	.	.	.	.	.	.	.	.	.	.	.
Pleistocence	?	1072A 5R-1 65-66	36.95	B	.	R	.	R	.	.	.	.	.	.	.	.	.
		1072A 5R-CC 0-5	37.13	R	.	.	R	.	.	.	.	.	.	.	.	.	.
		1072A 6R-CC 8-13	46.08	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 7R-1 78-79	51.78	B	.	R	.	.	.	.	.	.	.	.	.	.	.
		1072A 7R-CC 10-11	53.25	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 8R-1 79-80	56.79	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 8R-CC 29-34	57.79	F	.	R	F	.	.	.	.	.	.	.	.	.	.
		1072A 9R-1 87-88	61.87	R	.	R	R	.	.	.	.	.	.	.	.	.	.
		1072A 9R-3 70-71	64.70	F	.	R	F	.	.	.	.	.	.	.	.	.	.
	CN14a	1072A 9R-CC 0-8	65.00	F	.	R	F	.	R	.	.	.	.	.	.	.	.
		1072A 10R-1 79-80	66.49	F	.	R	F	.	.	.	.	.	.	.	.	.	.
		1072A 10R-3 79-80	69.49	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 10R-CC 0-8	70.22	F	.	R	F	.	.	.	.	.	.	.	.	.	.
		1072A 11R-CC 0-8	71.12	F	.	R	F	R	.	.	.	.	.	.	.	.	.
		1072A 12R-CC 0-3	75.20	C	R	F	C	.	R	.	.	.	.	.	.	.	.
		1072A 14R-CC 0-3	84.70	R	.	.	R	.	.	.	.	.	.	.	.	.	.
	?	1072A 15R-CC 0-8	90.53	R	.	.	R	.	.	.	.	.	.	.	.	.	.
		1072A 16R-1 79-80	94.79	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 16R-CC 0-8	95.14	R	.	.	R	.	.	.	.	.	.	.	.	.	.
?		1072A 17R-CC 8-15	101.96	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 18R-CC 0-8	105.33	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 19R-CC 0-8	112.30	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 20R-1 79-80	113.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 20R-CC 19-27	116.80	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 21R-1 79-80	123.19	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 21R-CC 19-27	126.05	r	.	.	.	.	.	.	.	.	r	r		r	r
		1072A 22R-1 79-80	128.19	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 22R-2 79-80	129.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 22R-CC 0-8	130.80	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 23R-1 79-80	132.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 23R-CC 0-5	135.45	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 24R-1 79-80	137.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 24R-CC 0-5	139.42	r	.	.	.	.	.	.	.	.	r		r	.	.
		1072A 25R-1 79-80	142.09	r	.	.	.	.	.	.	.	.	.	.	r	.	.
		1072A 25R-3 78-79	145.08	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 25R-CC 0-5	145.36	R	.	.	R	.	.	.	.	.	.	.	.	.	.
		1072A 26R-1 79-80	147.09	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 26R-CC 0-5	147.65	R	R	R	R	R	R	.	.	.	.	.	.	.	.
		1072A 27R-CC 0-5	152.08	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 28R-CC 5-8	155.95	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 29R-1 79-80	161.09	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 29R-CC 0-5	163.17	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 30R-CC 10-14	165.40	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 31R-CC 0-10	174.73	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 32R-1 79-80	175.59	B	.	.	.	.	.	.	.	.	.	.	.	.	.

Table T2 (continued).

Age	Nannofossil zone/subzone	Core, section, interval (cm)	Depth (mbsf)	Abundance	*Calcidiscus leptoporus*	*Gephyrocapsa* spp. (>4 µm)	*Gephyrocapsa* spp. (>4 µm)	*Helicosphaera carteri*	*Pseudoemiliania lacunosa*	*Reticulofenestra pseudoumbilicus*	*Reticulofenestra* spp. (small)	*Sphenolithus abies*	*Chiasmolithus solitus*	*Effilithus turiseiferi*	*Heliolithus kleinpellii*	*Reticulofenestra bisecta*	*Reticulofenestra umbilicus*
late Miocene - early Pliocene	CN11	1072A 32R-CC 0-10	178.27	R	.	.	.	.	.	R	.	R	.	.	.	.	.
		1072A 33R-1 79-80	180.09	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 33R-3 79-80	183.09	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 33R-CC 0-10	184.89	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 34R-1 79-80	185.09	R	.	.	.	.	.	R	.	.	.	.	.	r	.
	?	1072A 34R-3 79-80	188.09	R	.	.	.	.	.	R	.	R	.	.	.	.	.
		1072A 34R-CC 0-10	188.57	R	.	.	.	.	.	.	.	R	.	.	.	.	.
		1072A 35R-1 79-80	189.39	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 35R-3 79-80	192.39	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 35R-CC 0-10	193.99	R	.	.	.	.	.	.	.	R	.	.	.	.	.
		1072A 36R-1 79-81	194.39	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 36R-3 84-85	197.44	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 36R-CC 0-10	197.52	R	.	.	.	.	.	R	R	R	.	.	.	.	.
		1072A 37R-1 79-80	198.69	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 37R-3 80-81	201.70	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 37R-CC 0-10	203.34	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 38R-1 73-74	203.63	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 38R-3 80-81	206.70	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 38R-CC 0-10	207.08	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 39R-1 79-80	208.09	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 39R-3 79-80	211.09	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 39R-CC 0-10	213.80	R	.	.	.	.	.	.	.	R	.	.	.	.	.
		1072A 40R-1 75-76	213.05	R	.	.	.	.	.	R	.	R	.	.	.	.	.
		1072A 40R-2 79-80	214.59	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 40R-CC 0-10	215.90	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 41R-1 80-81	217.50	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 41R-3 79-80	220.49	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 41R-CC 0-10	222.48	R	.	.	.	.	.	.	.	R	.	.	.	.	.
		1072A 42R-1 80-81	222.50	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 42R-3 80-81	225.50	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 42R-CC 0-8	226.43	R	.	.	.	.	.	.	.	R	.	.	.	.	.
		1072A 43R-1 80-81	226.90	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 43R-3 80-81	229.90	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 43R-CC 0-8	231.26	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 44R-1 79-80	231.89	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 44R-3 80-81	234.90	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 44R-CC 0-10	235.47	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 45R-1 79-80	236.29	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 45R-3 79-80	239.29	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 45R-5 79-80	242.29	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 45R-6 49-50	243.49	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 45R-CC 9-19	244.40	R	.	.	.	.	.	.	R	R	.	.	.	.	.
		1072A 46R-1 79-80	245.49	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 46R-3 79-80	248.49	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 46R-5 77-78	251.47	B	.	.	.	.	.	.	.	.	.	.	.	.	.
		1072A 46R-CC 0-12	252.94	F	.	.	.	R	.	R	F	.	.	.	.	.	.
		1072A 47R-CC 0-10	254.65	R	.	.	.	.	.	R	.	.	.	.	.	.	.
		1072A 48R-CC 8-15	263.78	B	.	.	.	.	.	.	.	.	.	.	.	.	.

Note: C = common, F = few, R = rare, B = barren, r = rare reworked.

Table T3. Calcareous nannofossil range chart, Site 1073. (**See table note.** Continued on next page.)

Age	Nannofossil zone/subzone	Core, section, interval (cm)	Depth (mbsf)	Abundance	*Pseudoemiliania lacunosa*	*Gephyrocapsa* spp. (>4 µm)	*Helicosphaera sellii*	*Calcidiscus macintyrei*	*Discoaster brouweri*	*Discoaster tamilis*	*Reticulofenestra pseudoumbilicus*
Pleistocene	CN14b	14H-CC, 90-95	131.38	A	.	R	.	.	.	.	.
		15H-CC, 35-40	140.15	A	.	R	.	.	.	.	.
		16H-CC, 17-22	149.63	A	.	F	.	.	.	.	.
		17H-CC, 42-47	159.33	A	.	F	.	.	.	.	.
		18H-CC, 55-60	169.04	C	.	F	.	.	.	.	.
		19H-CC, 31-36	178.19	C	.	F	.	.	.	.	.
		20H-CC, 21-26	184.69	C	.	F	.	.	.	.	.
		21H-CC, 18-23	193.30	C	.	F	.	.	.	.	.
		22H-CC, 10-15	202.67	A	.	F	.	.	.	.	.
		23H-CC, 23-28	211.77	A	.	F	.	.	.	.	.
		24X-CC	215.70	A	.	C	.	.	.	.	.
		25X-CC, 20-25	221.61	F	.	R	.	.	.	.	.
		26X-CC, 43-45	232.85	C	.	F	.	.	.	.	.
		27X-CC, 14-19	242.61	C	.	F	.	.	.	.	.
		28X-CC, 19-24	251.35	C	.	F	.	.	.	.	.
		29X-CC, 37-42	260.56	C	.	F	.	.	.	.	.
		30X-CC, 55-60	269.61	C	.	F	.	.	.	.	.
		31X-CC, 34-39	279.00	R	.	.	.	.	.	.	.
		32X-CC, 29-34	289.13	C	.	F	.	.	.	.	.
		33X-CC, 34-39	299.99	C	.	F	.	.	.	.	.
		34X-CC, 23-28	308.69	C	.	F	.	.	.	.	.
		35X-CC, 0-8	317.14	F	.	F	.	.	.	.	.
		36X-4, 54-55	323.44	B	.	.	.	.	.	.	.
		36X-CC, 46-51	324.86	R	.	.	.	.	.	.	.
		37X-2, 54-55	329.84	B	.	.	.	.	.	.	.
		37X-4, 54-55	332.84	B	.	.	.	.	.	.	.
	CN14a	37X-CC	337.20	C	R	F	.	.	.	.	.
		38X-CC, 18-23	346.64	C	R	F	.	.	.	.	.
		39X-CC, 42-47	355.26	C	R	F	.	.	.	.	.
		40X-CC, 31-36	364.38	C	R	F	.	.	.	.	.
		41X-CC, 40-45	375.27	R	.	R	.	.	.	.	.
		42X-CC, 35-40	384.65	C	F	F	.	.	.	.	.
		43X-CC	393.60	F	R	F	.	.	.	.	.
		44X-CC, 31-36	400.48	R	.	R	.	.	.	.	.
		45X-CC, 25-30	412.19	F	R	R	.	.	.	.	.
		46X-CC, 35-40	421.23	A	C	F	.	.	.	.	.
		47X-CC, 50-55	431.45	A	C	F	.	.	.	.	.
		48X-CC, 24-29	440.61	C	F	R	.	.	.	.	.
		49X-CC, 33-38	450.21	C	F	R	.	.	.	.	.
		50X-CC, 35-40	459.84	C	F	R	.	.	.	.	.
		51X-CC, 34-39	469.11	A	F	R	.	.	.	.	.
		52X-CC, 46-51	478.16	A	F	R	.	.	.	.	.
		53X-CC, 41-46	487.55	A	C	F	.	.	.	.	.
		54X-CC, 35-40	497.10	C	F	R	.	.	.	.	.
		55X-CC, 44-49	506.59	F	R	.	.	.	.	.	.
		56X-CC, 38-43	515.88	B	.	.	.	.	.	.	.
		57X-2, 53-54	517.33	B	.	.	.	.	.	.	.
		57X-4, 54-55	520.34	F	R	F	R	.	.	.	.
		57X-4, 150	520.80	F	R	R	R	.	.	.	.
		57X-6, 56-57	523.36	F	R	R	R	R	.	.	.
late Pliocene	CN13	57X-CC, 28-33	524.13	F	F	.	.	R	.	.	.
		58X-2, 54-55	526.84	B	.	.	.	.	.	.	.
	CN12	58X-4, 54-55	529.84	F	R	.	.	R	R	.	.
		58X-6, 53-54	532.83	F	R	.	.	R	R	.	.
		58X-CC, 35-40	534.59	B	.	.	.	.	.	.	.
		59X-2, 54-55	536.34	B	.	.	.	.	.	.	.
		59X-3, 68	537.98	A	C	.	.	R	R	R	.
		59X-4, 55-56	539.35	C	R	.	.	R	R	R	.
e. Plio	CN11	59X-CC, 34-39	544.09	A	.	.	.	R	R	.	F

Table T3 (continued).

Age	Nannofossil zone/subzone	Core, section, interval (cm)	Depth (mbsf)	Abundance	*Cyclicargolithus floridanus*	*Sphenolithus heteromorphus*	*Sphenolithus belemnos*	*Reticulofenestra bisecta*	*Discoaster saipanensis*	*Isthmolithus recurvus*	*Reticulofenestra reticulata*
late Miocene	?	60X-2, 53-54	543.83	B	.	.	.	.	.	.	.
		60X-4, 49-50	546.79	B	.	.	.	.	.	.	.
		60X-6, 47-48	549.77	B	.	.	.	.	.	.	.
		60X-CC, 35-40	551.60	B	.	.	.	.	.	.	.
		61X-4, 53-54	554.95	R	.	.	.	.	.	.	.
		61X-CC, 40-45	561.00	R	.	.	.	.	.	.	.
		62X-2, 54-55	562.14	F	.	.	.	.	.	.	.
	CN5	62X-4, 57-58	565.17	F	.	.	.	.	.	.	.
		62X-6, 53-54	568.13	C	.	.	.	.	.	.	.
middle Miocene		62X-CC, 39-44	569.91	F	R	.	.	.	.	.	.
		63X-2, 53-54	571.43	R	R	.	.	.	.	.	.
		63X-4, 53-54	574.43	F	R	.	.	.	.	.	.
		63X-6, 54-55	577.44	B	.	.	.	.	.	.	.
		63X-CC, 44-49	579.22	R	R	.	.	.	.	.	.
		64X-2, 52-53	580.82	R	R	.	.	.	.	.	.
	CN4	64X-4, 54-55	583.84	C	F	R	.	.	.	.	.
		64X-6, 49-50	586.79	R	R	R	.	.	.	.	.
		64X-CC, 33-38	588.51	F	R	R	.	.	.	.	.
		65X-2, 54-55	590.24	F	R	R	.	.	.	.	.
		65X-4, 53-54	593.23	C	F	F	.	.	.	.	.
		65X-6, 54-55	596.24	A	F	F	.	.	.	.	.
		65X-CC, 39-44	597.95	A	F	R	.	.	.	.	.
early Miocene		66X-2, 50-51	599.80	A	F	F	.	.	.	.	.
		66X-4, 52-53	602.82	A	F	F	.	.	.	.	.
	CN2	66X-6, 51-52	605.81	A	F	F	.	.	.	.	.
		66X-CC, 34-39	607.52	A	C	C	.	.	.	.	.
		67X-2, 51-52	609.21	A	C	C	.	.	.	.	.
		67X-4, 53-54	612.23	A	F	F	.	.	.	.	.
		67X-6, 58-59	615.28	A	C	R	.	.	.	.	.
		67X-CC, 35-40	616.89	A	F	R	.	.	.	.	.
		68X-2, 52-53	618.82	A	C	.	.	.	.	.	.
		68X-4, 57-58	621.87	A	C	.	R	.	.	.	.
	CN1	68X-6, 55-56	624.85	F	F	.	.	.	.	.	.
		68X-CC, 40-45	626.63	B	.	.	.	.	.	.	.
		69X-2, 54-55	628.34	A	F	.	.	.	.	.	.
		69X-4, 52-53	631.32	A	F	.	.	.	.	.	.
		69X-6, 54-55	634.34	A	F	.	.	.	.	.	.
		69X-CC, 28-33	635.90	A	C	.	.	.	.	.	.
late Oligocene	CP19b	70X-2, 62-63	637.92	A	F	.	.	R	.	.	.
		70X-4, 50-51	640.80	A	F	.	.	R	.	.	.
		70X-6, 53-54	643.83	C	F	.	.	R	.	.	.
		70X-CC, 37-42	645.55	A	F	.	.	F	.	.	.
		71X-2, 50-51	646.70	C	F	.	.	F	.	.	.
		71X-4, 57-58	649.77	A	C	.	.	F	.	.	.
		71X-6, 58-59	652.78	A	F	.	.	F	.	.	.
late Eocene	CP15	71X-CC, 35-36	654.36	A	F	.	.	F	F	F	.
		72X-4, 56-57	659.16	A	F	.	.	F	R	R	F
		72X-5, 5-6	660.15	A	F	.	.	F	R	R	F
		72X-6, 39-40	661.99	A	C	.	.	F	R	R	C
		72X-7, 34-35	663.44	A	F	.	.	F	R	R	C
		72X-CC, 43-48	663.91	A	F	.	.	F	R	R	C

Note: A = abundant, C = common, F = few, R = rare, B = barren.