

## 11. NOTES ON NEOGENE CALCAREOUS NANNOFOSSIL BIOSTRATIGRAPHY OF THE ONTONG JAVA PLATEAU AND SIZE VARIATIONS OF *RETICULOFENESTRA COCCOLITHS*<sup>1</sup>

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### ABSTRACT

A total of 35 calcareous nannofossil datums were found in the Neogene sediments recovered at five sites (Sites 803–807) on the Ontong Java Plateau in the equatorial Pacific during Ocean Drilling Program Leg 130. Among them, 12 datums in the Pleistocene–upper Pliocene sequences were correlated with magnetostratigraphy. Pliocene and Miocene calcareous nannofossil assemblages in 289 samples obtained from Holes 804C, 805B, 805C, and 806B were studied. *Reticulofenestra* coccolith size distribution patterns in these Pliocene–Miocene sediments were also revealed through the present investigation.

### INTRODUCTION

Leg 130 of the Ocean Drilling Program (ODP) began at Apra, Guam, on 23 January 1990 and ended at the same harbor on 26 March 1990. Over 4800 m of core were recovered from 16 holes drilled at 5 sites along a depth transect on the Ontong Java Plateau (Fig. 1 and Table 1).

This report deals with the study of the calcareous nannofossils recovered from the Neogene sequences at the Ontong Java Plateau sites drilled during Leg 130 (Sites 803 through 807). Its main purposes are (1) to present the calcareous nannofossil datums in the Neogene sequences, (2) to discuss the basis for the biostratigraphic age assignments at all sites, and (3) to describe in detail the Pliocene and Miocene calcareous nannofossil assemblages in Holes 804C, 805B, 805C, and 806B.

In 1990, Young presented data on *Reticulofenestra* coccolith size distribution patterns in middle Miocene to Pliocene samples from the western Indian Ocean and the Red Sea. This data clearly showed a dramatic size reduction event occurring in the late Miocene nannofossil Zone NN10 of Martini's (1971) zonal scheme. Another main object of the present investigation is to present data on size variation of Pliocene–Miocene *Reticulofenestra* coccoliths at Sites 804, 805, and 806 as Young's report (1990).

### METHODS

Standard smear slides were made for all samples using either ENTELLAN new or Eukitt as a mounting medium. The calcareous nannofossils were examined in the smear slides by standard light microscopy techniques (plane polarized light and/or cross polarized light at approximately 1500× magnification). For the Pliocene–Miocene samples only from Holes 804C, 805B, 805C, and 806B, counts of 200 specimens per sample were made in straight transects across the smear slides and were listed to determine the relative frequencies of occurrence of the species and their stratigraphic changes. The counts did not include *Florisphaera profunda*. After this examination, these slides were continuously scanned for the presence of other important species.

### ZONES AND DATUMS

#### Zones

From the several calcareous nannofossil zonal schemes available for the subdivision of Cenozoic sediments (e.g., Martini, 1971; Okada and Bukry, 1980), I chose the scheme proposed by Martini (1971). His scheme does not represent the ultimate resolution that can be achieved in Cenozoic deep-sea sediments, because deep-sea biostratigraphy has developed rapidly over the past two decades and still continues to do so. However, this zonal scheme does provide a simple picture of biostratigraphic relationships in the cored sequences. I also think that the fact that most marine geologists are familiar with Martini's scheme also adds to its value as an initial framework for Leg 130 nannofossil biostratigraphy.

#### Datums

Table 2 summarizes the nannofossil datums considered in this report and their estimated ages. Among them, a total of 35 datums are useful for the Neogene sequences. As a matter of convenience, I will number these datums in descending order from 1 to 35. Some of these datums are used as boundary markers for of Martini's (1971) zonation. However, the others are not in Martini's zonal boundary definitions. These additional events represent a resource that creates a substantially improved biostratigraphic and biochronologic resolution, which becomes important, for example, in the reconstruction of Cenozoic sediment accumulation rates.

### BIOSTRATIGRAPHIC SUMMARY

During Leg 130, a total of 16 holes were drilled at 5 sites (Sites 803–807) along a depth transect on the Ontong Java Plateau, equatorial Pacific Ocean (Fig. 1 and Table 1). Cenozoic sediments were recovered primarily by continuous advanced hydraulic piston coring (APC) and use of the extended core barrel (XCB) after the refusal of the APC. Very abundant and moderately preserved coccoliths and discoasters were found throughout the cores studied.

#### Pleistocene

With regard to Pleistocene sequences, I only tried to detect the calcareous nannofossil datums at all sites. The stratigraphic positions of these datums are tabulated in Tables 3–7. Pleistocene magneto- and biostratigraphic relationships for each site are shown in Figure 2. The magnetostratigraphy in this area is not well established and is still

<sup>1</sup> Berger, W.H., Kroenke, L.W., Mayer, L.A., et al., 1993. *Proc. ODP, Sci. Results*, 130: College Station, TX (Ocean Drilling Program).

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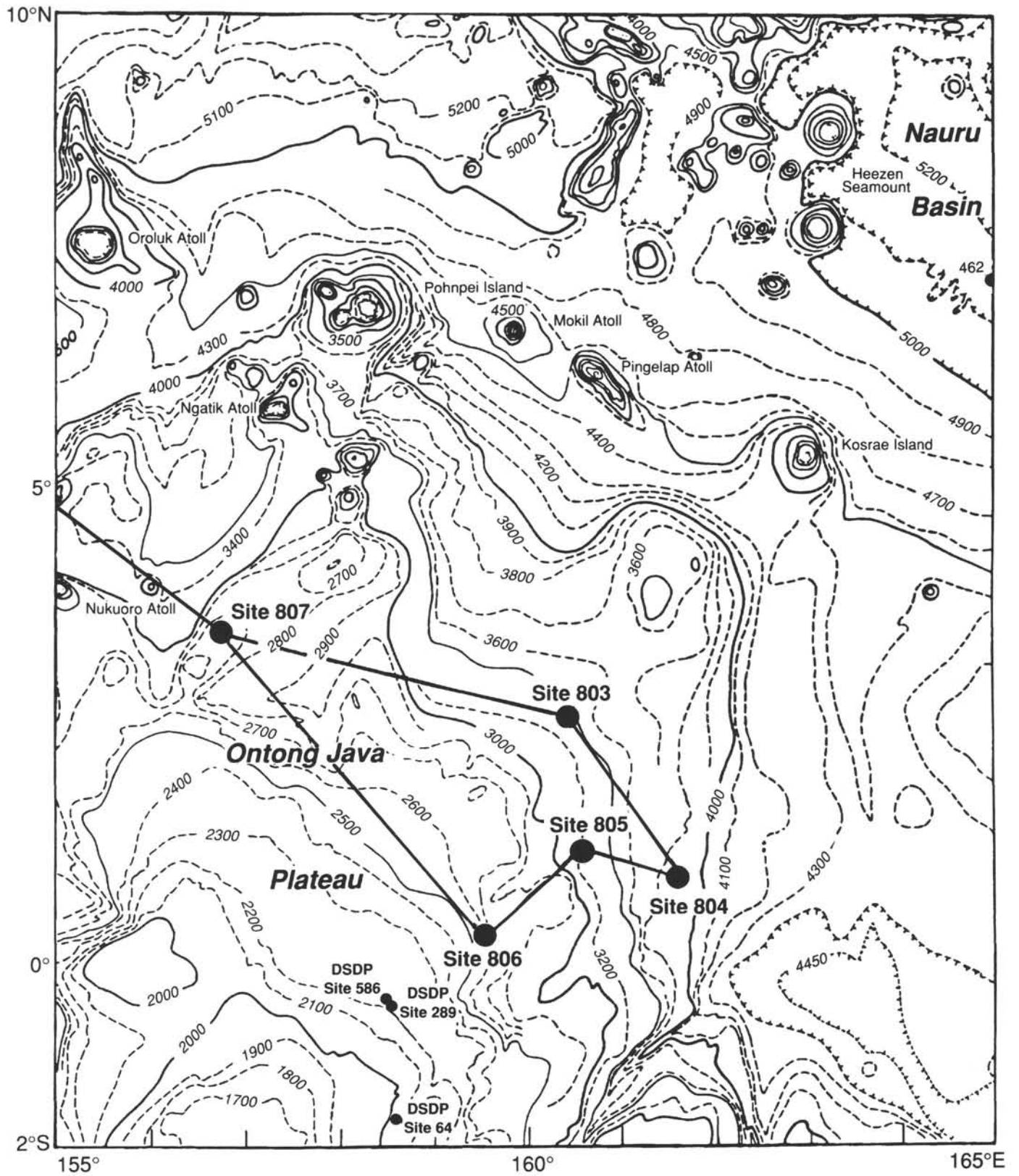


Figure 1. Bathymetric map (in meters) of the northwestern part of the Ontong Java Plateau (after Mammerickx and Smith, 1985) and locations of Leg 130 drill sites. Sites drilled on DSDP Leg 7 (Site 64), Leg 30 (Site 289), and Leg 89 (Site 586) are also provided for reference.

**Table 1. Locations of Leg 130 holes studied.**

Holes	Latitude	Longitude	Water depth (m)
803D	2°25.98'E	160°32.46'E	3412.2
804C	1°00.28'N	161°35.62'E	3861.1
805B	1°13.68'N	160°31.76'E	3186.8
805C	1°13.69'N	160°31.77'E	3187.7
806B	0°19.11'N	159°21.69'E	2519.9
807A	3°36.42'N	156°37.49'E	2803.8

tentative. Therefore, the relationship between the magnetostratigraphy and biostratigraphy is not clear. As is evident from Figure 2, however, Datum 4 FAD (first appearance datum) of *Gephyrocapsa parallela* is detected somewhere around the estimated Jaramillo Event and the Datum 11 FAD of *Gephyrocapsa caribbeanica* may be placed slightly above the estimated Olduvai Event.

### Pliocene/Pleistocene Boundary

The paleontological investigation of the Vrica section in Italy, which is the boundary stratotype for the base of the Pleistocene series, was conducted by many workers. Among these various investigations, Sato et al. (1988) concluded as follows:

Because reworked discoasters are present throughout the Pliocene-Pleistocene sequence at the Vrica section, the position of LAD (last appearance datum) *Discoaster brouweri* (Datum 12 in this chapter) is not clear. Therefore, the most reliable and nearest datum to the Pliocene/Pleistocene boundary is the FAD of *Gephyrocapsa caribbeanica* (Datum 11 in this chapter). This datum is about 20 m above the Pliocene/Pleistocene boundary and about 30 m above the top of the Olduvai Event. One can conclude that it is better to use the FAD of *Gephyrocapsa caribbeanica* as the Pliocene/Pleistocene boundary marker instead of LAD *Discoaster brouweri*.

Based on this evidence, the Pliocene/Pleistocene boundary in the holes studied is placed slightly below Datum 11 (FAD *Gephyrocapsa caribbeanica*). As is obvious from Tables 3–7, for example, this boundary in Holes 804C, 805C, and 806B can be detected in Cores 130-804C-3H, 130-805C-4H, and 130-806B-5H, respectively.

### Pliocene and Miocene

At the start, I detected the important calcareous nannofossil datums (Table 2) in the Pliocene and Miocene sequences at all sites. The stratigraphic positions of these datums are given in Tables 8–13 and illustrated in Figure 3. Then I described successively the sequential changes of the calcareous nannofossil assemblages at selected sites; that is, at the shallowest (Site 806), intermediate (Site 805), and deepest (Site 804) sites, based on two samples including core-catcher materials from each core. Occurrence tables were prepared for these selected sites (Tables 14–17). These tables show the number of coccoliths counted at random in each sample during the 200-specimen count; a plus sign (+) indicates the trace of a species in a sample, and a question mark (?) indicates the questionable presence of a species.

The overall sequential changes of nannofossil floras throughout the Pliocene-Miocene sequences at Sites 806, 805, and 804 are illustrated in Figure 4. The stratigraphic changes of relative abundances of *Coccolithus pelagicus* (and its related forms such as *C. miopelagicus*), *Cyclicargolithus floridanus*, *Discoaster* spp., *Sphenolithus* spp. and *Reticulofenestra* spp., which are dominant and important groups of the calcareous nannofossils at these selected sites are shown separately in Figures 5–9. As a matter of course, the pattern of floral changes at Sites 806, 805, and 804 are quite similar to each other.

Based on these floral changes, the Pliocene-Miocene sequence at the Ontong Java Plateau was divided into three parts: upper, middle, and lower. As evident from Figure 9, the upper part of the Pliocene-

Miocene sequence (NN18–NN10) is characterized by the remarkable dominance of *Reticulofenestra* specimens. It is noteworthy that the lower half of the upper part contains abundant sphenoliths (Fig. 8). At the boundary between the upper and the middle parts, the relative abundance of *Reticulofenestra* specimens decreases abruptly and becomes almost barren (Fig. 9); as a result, sphenoliths become dramatically dominant. Therefore, this horizon is characterized by the bloomlike abundance of small *Sphenolithus abies* (Fig. 8). In the middle part of the Neogene sequence (NN10–middle NN5/NN4), very abundant *Reticulofenestra* occurs again together with *Coccolithus pelagicus* and such related forms as *C. miopelagicus* (Figs. 5 and 9). In the lower half of the middle part, *Cyclicargolithus floridanus* and discoasters increase their relative abundances (Figs. 6 and 7). At the boundary between the middle and the lower parts, *Reticulofenestra* again becomes rare (Fig. 9); *Cyclicargolithus floridanus* and discoasters are abundant at this horizon (Figs 6 and 7). The lower part (middle NN5/NN4–NN1) is characterized by relatively diversified floras. However, the lower half of this part is characterized by fairly abundant *Cyclicargolithus floridanus* (Fig. 6).

The nannofossil assemblages at Sites 806, 805, and 804 are discussed in detail in what follows. Each calcareous nannofossil zone is considered separately, and biostratigraphic age assignments are discussed. As already mentioned above, nannofossil assemblages in Hole 806B are quite similar to those in Holes 804C, 805B, and 805C. Therefore, I will describe the nannofossil floras in these holes, stressing those in the longest core from Hole 806B drilled at the shallowest site on the Ontong Java Plateau.

### Pliocene

#### Lowest NN19 Pseudoemiliana lacunosa Zone (Datums 11–12)

Hole 806B: 35.5–42.39 mbsf; Samples 130-806B-5H-1, 26–27 cm, to -5H-6, 26–27 cm  
 Hole 805C: 27.02–32.74 mbsf; Samples 130-805C-4H-1, 23–24 cm, to -4H-5, 23–24 cm  
 Hole 804C: 16.67–18.85 mbsf; Samples 130-804C-3H-1, 90–91 cm, to -3H-3, 14–15 cm

In the present investigation only two samples from Holes 805C and 806B were available for the floral analysis. These samples contained neither *Gephyrocapsa caribbeanica* nor *Discoaster brouweri* and were assigned to the lowest NN19 Zone (latest Pliocene) (between Datum 11 FAD *G. caribbeanica* and Datum 12 LAD *D. brouweri*). The floras are characterized by very abundant small *Reticulofenestra* specimens and comparatively abundant *Calcidiscus leptoporus*. In Sample 130-805C-4H-5, 23–24 cm, small forms of *Gephyrocapsa* are abundant.

#### NN18 Discoaster brouweri Zone (Datums 12–13)

Hole 806B: 43.81–54.00 mbsf; Samples 130-806B-5H-7, 26–27 cm, to -6H-CC  
 Hole 805C: 34.18–40.95 mbsf; Samples 130-805C-4H-6, 23–24 cm, to -5H-4, 23–24 cm  
 Hole 804C: 19.22–25.30 mbsf; Samples 130-804C-3H-3, 52 cm, to -3H-CC

Based on the presence of *Discoaster brouweri* and the absence of *D. pentaradiatus*, the samples mentioned above were assigned to the late Pliocene NN18 Zone (between Datum 12 LAD *D. brouweri* and Datum 13 LAD *D. pentaradiatus*). In Samples 130-806B-5H-CC, 130-805C-4H-CC, and 130-804C-3H-CC, I also found *Discoaster triradiatus*. It is well known that the upper part of this zone is generally characterized by the abundant occurrence of this species (Takayama, 1969; Backman and Pestiaux, 1986; and others). In the holes studied, however, the acme of *D. triradiatus* was not recog-

Table 2. Calcareous nannofossil datums and their assigned age estimates.

Event	Species	Datum	Zone (top)	Age (Ma)	References
OA	<i>Emiliana huxleyi</i>			0.09	1
FAD	<i>Emiliana huxleyi</i>	Datum 1	NN20	0.28	1
LAD	<i>Pseudoemiliana lacunosa</i>	Datum 2	NN19	0.46	1
LAD	<i>Reticulofenestra asanoi</i>	Datum 3		0.83	2
FAD	<i>Gephyrocapsa parallela</i>	Datum 4		0.90	2
FAD	<i>Reticulofenestra asanoi</i>	Datum 5		1.06	2
LAD	Large <i>Gephyrocapsa</i>	Datum 6		1.10	2
LAD	<i>Helicosphaera sellii</i>	Datum 7		1.19	2
FAD	Large <i>Gephyrocapsa</i>	Datum 8		1.36	2
LAD	<i>Calcidiscus macintyreii</i>	Datum 9		1.45 (1.57)	3 (2)
FAD	<i>Gephyrocapsa oceanica</i>	Datum 10		1.57	2
FAD	<i>Gephyrocapsa caribbeanica</i>	Datum 11		1.66	2
Pliocene/Pleistocene boundary				1.66	4, 5
LAD	<i>Discoaster brouweri</i>	Datum 12	NN18	1.89	3
LAD	<i>Discoaster triradiatus</i>			1.89	3
OA	<i>Discoaster triradiatus</i>			2.07	6
LAD	<i>Discoaster pentaradiatus</i>	Datum 13	NN17	2.35	3
LAD	<i>Discoaster surculus</i>	Datum 14	NN16	2.41	3
LAD	<i>Reticulofenestra ampla</i>			2.62	2
LAD	<i>Discoaster tamalis</i>			2.65	3
LAD	<i>Sphenolithus</i> spp.	Datum 15		3.45	3
LAD	<i>Reticulofenestra pseudoubilica</i>	Datum 16	NN15	3.56	3
LAD	<i>Amaurolithus tricorniculatus</i>		NN14	3.7	7
FAD	<i>Discoaster asymmetricus</i>		NN13	4.1	7
LAD	<i>Amaurolithus primus</i>			4.4	7
FAD	<i>Ceratolithus rugosus</i>	Datum 17	NN12	4.6	3
LAD	<i>Ceratolithus acutus</i>	Datum 18		4.6	3
FAD	<i>Ceratolithus acutus</i>	Datum 19		4.9 (4.85)	8
LAD	<i>Triquetrorhabdulus rugosus</i>	Datum 20		4.9	8
Miocene/Pliocene boundary				4.9	9
LAD	<i>Discoaster quinquerramus</i>	Datum 21	NN11	5.0	8
LAD	<i>Amaurolithus amplificus</i>			5.4	10
FAD	<i>Amaurolithus amplificus</i>			6.0	10
FAD	<i>Amaurolithus primus</i>			6.7	10
FAD	<i>Discoaster quinquerramus</i>	Datum 22	NN10	7.5	8
FAD	<i>Discoaster berggrenii</i>			8.2	7
LAD	<i>Discoaster hamatus</i>	Datum 23	NN9	8.7	8
LAD	<i>Catinaster</i> spp.	Datum 24		8.8	8
FAD	<i>Discoaster neohamatus</i>			9.0	8
FAD	<i>Catinaster calyculus</i>	Datum 25		10.0	7
FAD	<i>Discoaster hamatus</i>	Datum 26	NN8	10.5	8
FAD	<i>Catinaster coalitus</i>	Datum 27	NN7	11.1	8
FAD	<i>Discoaster kugleri</i>		NN6	12.2	8
LAD	<i>Coronocyclus nitescens</i>	Datum 28		12.8	10
LAD	<i>Cyclicargolithus floridanus</i>	Datum 29		13.1	8
LAD	<i>Sphenolithus heteromorphus</i>	Datum 30	NN5	13.6	8
LAD	<i>Helicosphaera ampliaperta</i>		NN4	16.0	7
TA	<i>Discoaster deflandrei</i> group			16.1	10
FAD	<i>Sphenolithus heteromorphus</i>	Datum 31		18.6	8
LAD	<i>Sphenolithus belemnus</i>	Datum 32	NN3	18.8	8
LAD	<i>Triquetrorhabdulus carinatus</i>	Datum 33	NN2	19.5	8
FAD	<i>Sphenolithus belemnus</i>	Datum 34		20.0	8
FAD	<i>Discoaster druggii</i>	Datum 35	NN1	23.6	8
TA	<i>Sphenolithus delphix</i>			23.6	11
Oligocene/Miocene boundary				23.7	7

Notes: FAD = first appearance datum, LAD = last appearance datum, OA = onset acme, and TA = termination acme. Zonal codes are those of Martini (1971). Age column references represent (1) Thierstein et al. (1977); (2) Sato et al. (1991), Sato and Takayama (1992); (3) Backman and Shackleton (1983); (4) Sato et al. (1988); (5) Rio et al. (in press); (6) Backman and Pestiaux (1986); (7) Berggren et al. (1985); (8) Backman et al. (1990); (9) Zijdeveld et al. (1986); (10) Rio et al. (1990); (11) Fornaciari et al. (1990).



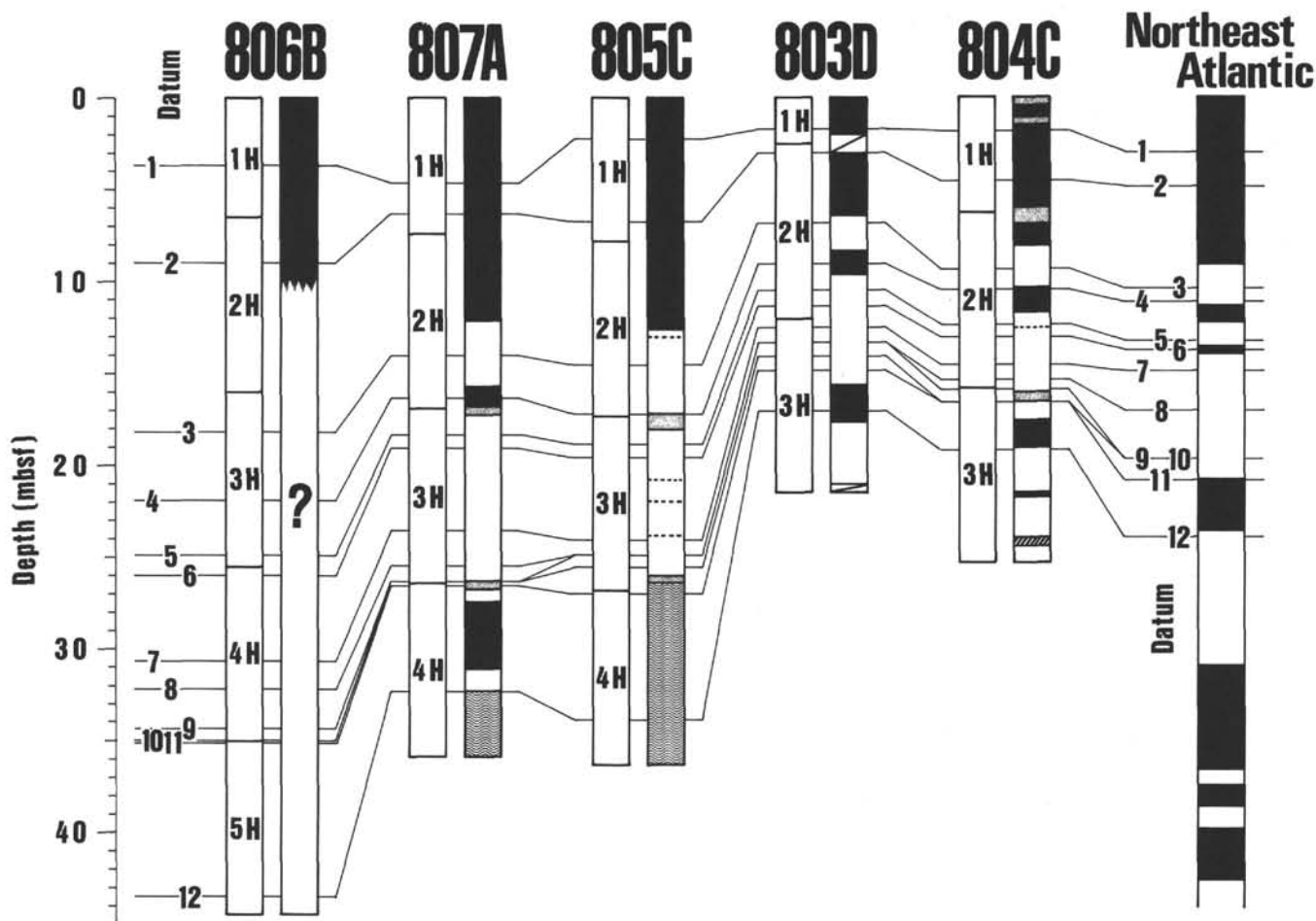


Figure 2. Quaternary magneto- and biostratigraphic relationships at each site of Leg 130. Refer to Table 2 for key to datum numbers.

nized. In Hole 805C, *Discoaster asymmetricus* and *D. blackstockae* are present. In this zone, *Reticulofenestra* is very dominant; it forms nearly 75% of the flora in all samples. In Hole 805C, a few specimens of *Reticulofenestra pseudumbilica* were found (in Sample 130-805C-5H-3, 23–24 cm). However, it is considered to be reworked based on its state of preservation. Sporadic occurrences of *Ceratolithus rugosus* were also recognized.

#### NN17 *Discoaster pentaradiatus* Zone (Datums 13–14)

Hole 806B: 54.51–64.53 mbsf; Samples 130-806B-7H-1, 106–107 cm, to -8H-1, 106–107 cm  
 Hole 805C: 42.42–43.89 mbsf; Samples 130-805C-5H-5, 23–24 cm, to -5H-6, 23–24 cm  
 Hole 804C: 29.01 mbsf; Sample 130-804C-4H-3, 90–91 cm

In the samples mentioned above, *Discoaster brouweri* and *D. pentaradiatus* co-occur. Small-sized *Reticulofenestra* specimens predominate. I observed the presence of *Reticulofenestra pseudumbilica* in Sample 130-804C-4H-3, 90–91 cm. Judging from the state of the coccolith preservation, however, it is considered to be reworked. Sediments belonging to this zone (between Datum 13 LAD *D. pentaradiatus* and Datum 14 LAD *D. surculus*) are very thin at all sites.

#### NN16 *Discoaster surculus* Zone (Datums 14–16)

Hole 806B: 65.99–93.66 mbsf; Samples 130-806B-8H-2, 106–107 cm, to -11H-2, 26–27 cm

Holes 805B and 805C: 45.80–73.20 mbsf; Samples 130-805C-5H-CC to 130-805B-8H-CC  
 Hole 804C: 30.44–34.80 mbsf; Samples 130-804C-4H-4, 90–91 cm, to -4H-CC

In this zone, *Discoaster surculus* occurs for the first time. However, the upper part of this zone contains a few specimens of *D. surculus*. Consequently, it is difficult to detect the boundary between Zones NN17 and NN16 (Datum 14 LAD *D. surculus*). Samples from the lower part of this zone (such as Sample 130-806B-10H-CC, Samples 130-805B-8H-4, 23–24 cm, and -8H-CC, and Sample 130-804C-4H-CC) yield such diversified discoaster species as *Discoaster asymmetricus*, *D. brouweri*, *D. challengerii*, *D. decorus*, *D. surculus*, *D. triradiatus*, and *D. variabilis*. Throughout this zone, *Discoaster tamalis* is almost absent. Moreover, only a few questionable specimens of *Reticulofenestra ampla* were observed in Samples 130-806B-8H-3, 106–107 cm, and -8H-CC. Therefore, calcareous nannofossil events LAD *R. ampla* and LAD *D. tamalis* were not detected at the Ontong Java Plateau. In some samples from the lower part of this zone (e.g., Sample 130-805B-8H-CC), *Gephyrocapsa aperta* and small specimens of *Gephyrocapsa* were found. In Holes 806B and 805B, Datum 15 (LAD *Sphenolithus* spp.) was detected at the lowest part of Zone NN16, slightly above Datum 16 (LAD *Reticulofenestra pseudumbilica*). As same as overlying zones, reticulofenestrid specimens are very abundant throughout this interval. *Reticulofenestra pseudumbilica* occurs in Samples 130-805C-6H-4, 23–24 cm, and -6H-CC, 130-805B-7H-CC, and 130-804C-4H-CC of this zone. Their numbers of specimen are limited; therefore, they are considered to be reworked.

Table 3. Quaternary calcareous nannofossil datums, Hole 803D.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)		
CN15	NN21	1. FAD <i>Emiliania huxleyi</i>	0.28	1H-1,90-91/1H-CC	0.89/2.50		
CN14b	NN20	2. LAD <i>Pseudoemiliania lacunosa</i>	0.46	2H-1,15-16/2H-1,90-91	2.64/3.36		
CN14a	NN19	3. LAD <i>Reticulofenestra asanoi</i>	0.83	2H-3,90-91/2H-4,15-16	6.23/6.95		
		4. FAD <i>Gephyrocapsa parallela</i>	0.90	2H-5,15-16/2H-5,90-91	8.38/9.10		
		5. FAD <i>Reticulofenestra asanoi</i>	1.06	2H-6,15-16/2H-6,90-91	9.81/10.53		
		6. LAD Large <i>Gephyrocapsa</i>	1.10	2H-6,90-91/2H-7,15-16	10.53/11.25		
		7. LAD <i>Helicosphaera sellii</i>	1.19	3H-1,15-16/3H-1,90-91	12.14/12.87		
		8. FAD Large <i>Gephyrocapsa</i>	1.36	3H-1,90-91/3H-2,15-16	12.87/13.59		
		9. LAD <i>Calcidiscus macintyreii</i>	1.45	3H-1,90-91/3H-2,15-16	12.87/13.59		
		10. FAD <i>Gephyrocapsa oceanica</i>	1.57	3H-2,15-16/3H-2,90-91	13.59/14.32		
		CN13b		11. FAD <i>Gephyrocapsa caribbeanica</i>	1.66	3H-2,90-91/3H-3,15-16	14.32/15.04
		CN13a		12. LAD <i>Discoaster brouweri</i>	1.89	3H-4,15-16/3H-4,90-91	16.49/17.21
CN12d	NN18						

NN15 *Reticulofenestra pseudoumbilica* Zone–NN13 *Ceratolithus rugosus* Zone (Datums 16–17)

Hole 806B: 95.08–137.43 mbsf; Samples 130-806B-11H-3, 26–27 cm, to -15H-6, 26–27 cm

Hole 805B: 73.42–104.93 mbsf; Samples 130-805B-9H-1, 23–24 cm, to -12H-3, 23–24 cm

Hole 804C: 39.48–44.30 mbsf; Samples 130-804C-5H-4, 90–91 cm, to -5H-CC

Relatively abundant, very large-sized reticulofenestrid species, *Reticulofenestra pseudoumbilica*, and *R. gelida* occur in and below Zone NN15. As stated above, *Reticulofenestra pseudoumbilica* occurs in several samples of Zones NN18, NN17, and NN16. However, judging from the limited numbers of specimens and their preservation state, these *Reticulofenestra pseudoumbilica* are considered to be reworked. The interval from Zones NN15 through NN13 (between Datums 16 LAD *R. pseudoumbilica* and 17 FAD *Ceratolithus rugosus*) was not subdivided because members of *Amaurolithus* and *Discoaster asymmetricus* are rare or absent in this region. Therefore, I placed the above-mentioned samples tentatively in the NN15–NN13 zonal interval. As compared with the overlying zones, *Reticulofenestra* species decrease their numbers, but still they form more than 50% of the total flora in all samples (Fig. 9). *Ceratolithus rugosus* occurs almost throughout this zonal interval. Comparatively large-sized *Discoaster variabilis* is present in samples belonging to the upper part of this NN15–NN13 interval.

NN12 *Amaurolithus tricorniculatus* Zone (Datums 17–21)

Hole 806B: 138.87–161.60 mbsf; Samples 130-806B-15H-7, 26–27 cm, to -18H-3, 26–27 cm

Hole 805B: 106.43–120.92 mbsf; Samples 130-805B-12H-4, 23–24 cm, to -14H-1, 23–24 cm

Hole 804C: missing.

The above-mentioned samples are characterized by the absence of *Ceratolithus rugosus* and *Discoaster quinqueramus* and, therefore,

are assigned to early Pliocene NN12 Zone (between Datum 17 FAD *C. rugosus* and Datum 21 LAD *D. quinqueramus*). In Hole 804C, this zone is completely missing; an early Pliocene hiatus is inferred at Site 804. As shown in Figure 8, some samples in this zone contain fairly abundant sphenoliths (e.g., in Samples 130-806B-16H-4, 26–27 cm, and -17H-CC). *Triquetrorhabdulus rugosus*, whose LAD defines Datum 20, was found as high as Samples 130-806B-17H-4, 26–27 cm, and 130-805B-13H-CC. It is remarkable that the interval ranging from Samples 130-806B-15H-CC through -16H-CC and Samples 130-805B-12H-4, 23–24 cm, through -13H-3, 123–124 cm, contain *Ceratolithus acutus*. Therefore, we can detect the important Datums 18 and 19 above and below these sample intervals, respectively.

### Miocene

NN11 *Discoaster quinqueramus* Zone (Datums 21–22)

Hole 806B: 163.02–283.65 mbsf; Samples 130-806B-18H-4, 26–27 cm, to -31H-2, 24–25 cm

Hole 805B: 122.36–218.82 mbsf; Samples 130-805B-14H-2, 23–24 cm, to -24H-3, 23–24 cm

Hole 804C: 44.63–71.45 mbsf; Samples 130-804C-6H-1, 90–91 cm, to -8H-6, 90–91 cm

Judging from the existence of *Discoaster quinqueramus*, the above-mentioned samples were assigned to Zone NN11 (between Datums 21 LAD *D. quinqueramus* and 22 FAD *D. quinqueramus*). However, the characteristic central stem in this species is not so well developed in the oldest and youngest associations of this species, often making precise determination of its entry and exit levels difficult. The top of this zone (Datum 21) approximately indicates the position of the Miocene/Pliocene boundary. *Discoaster berggrenii* is also present throughout this interval. *Calcidiscus premacintyreii* occurs consistently in and below this zone, although the sporadic occurrences of this species were recognized in the overlying NN12 Zone. *Amaurolithus* specimens are consistently rare in the lower Pliocene and upper Miocene sediments, and primary morphological characters are typically masked by substantial calcite growth. Therefore, the LAD and FAD of

Table 4. Quaternary calcareous nannofossil datums, Hole 804C.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)		
CN15	NN21	1. FAD <i>Emiliana huxleyi</i>	0.28	1H-2,15-16/1H-2,52	1.65/2.20		
CN14b	NN20	2. LAD <i>Pseudoemiliana lacunosa</i>	0.46	1H-3,127/1H-4,15-16	4.26/4.64		
CN14a	NN19	3. LAD <i>Reticulofenestra asanoi</i>	0.83	2H-2,127/2H-3,15-16	8.93/9.29		
		4. FAD <i>Gephyrocapsa parallela</i>	0.90	2H-3,90-91/2H-3,127	10.00/10.36		
		5. FAD <i>Reticulofenestra asanoi</i>	1.06	2H-4,127/2H-5,15-16	11.78/12.14		
		6. LAD Large <i>Gephyrocapsa</i>	1.10	2H-5,52/2H-5,90-91	12.49/12.85		
		7. LAD <i>Helicosphaera sellii</i>	1.19	2H-6,52/2H-6,90-91	13.92/14.28		
		8. FAD Large <i>Gephyrocapsa</i>	1.36	2H-6,127/2H-7,15-16	14.63/14.99		
		9. LAD <i>Calcidiscus macintyreii</i>	1.45	2H-7,65/2H-CC	15.34/15.80		
		10. FAD <i>Gephyrocapsa oceanica</i>	1.57	3H-1,52/3H-1,90-91	16.31/16.67		
		CN13b		11. FAD <i>Gephyrocapsa caribbeanica</i>	1.66	3H-1,52/3H-1,90-91	16.31/16.67
		CN13a		12. LAD <i>Discoaster brouweri</i>	1.89	3H-3,14-15/3H-3,52	18.85/19.22
CN12d	NN18						

*A. amplificus* and the FAD of *A. primus*, which were expected in Zone NN11, cannot be recognized in this area. The lowest occurrence of *Amaurolithus* was observed in Sample 130-806B-26H-CC, which lies in the middle part of Zone NN11. In Holes 804C and 805B, *Discoaster neohamatus* occurs continuously in and below the lower part of this zone, but it is not clearly noticeable in Hole 806B.

#### NN10 *Discoaster calcaris* Zone (Datums 22–23)

Hole 806B: 285.09–338.96 mbsf; Samples 130-806B-31H-3, 26–27 cm, to -36X-7, 26–27 cm  
 Hole 805B: 220.27–266.43 mbsf; Samples 130-805B-24H-4, 23–24 cm, to -29X-3, 23–24 cm  
 Hole 804C: 72.80–114.70 mbsf; Samples 130-804C-8H-CC to -13H-3, 90–91 cm

This zone is represented by the stratigraphic interval ranging from the FAD of *Discoaster quinqueramus* (Datum 21) down to the LAD of *D. hamatus* (Datum 23). Therefore, samples in this zone are characterized by the absence of *D. quinqueramus* and *D. hamatus*. In Hole 804C, however, Samples 130-804C-11H-CC, -12H-3, 90–91 cm, and -12H-CC contain *Discoaster hamatus*. Therefore, it seems that the base of Zone NN10 must be placed between Samples 130-804C-11H-3, 90–91 cm, and -11H-CC. However, I considered *D. hamatus* in these samples to be reworked because the number of its specimens is very limited and some of these samples also contain *Discoaster exilis* and forms similar to *Discoaster deflandrei*. As is evident from Figures 4 and 9, the similarity of the floral changes among these holes supports this conclusion.

It is noteworthy that the abundance of reticulofenestrid coccoliths drastically decreases in the upper part of this zone. Finally, they become almost barren in Samples 130-806B-33H-CC and 130-805B-26H-CC, which are in the middle of Zone NN10. On the other hand, in Hole 804C *Reticulofenestra* are very rare in Sample 130-804C-10H-CC. Therefore, this sample may be placed in the middle of Zone NN10. In contrast to *Reticulofenestra*, sphenoliths are very abundant at this horizon. In particular, Samples 130-806B-32H-4, 26–27 cm,

and -33H-4, 26–27 cm, Samples 130-805B-25H-CC, -26H-4, 23–24 cm, and -27H-4, 23–24 cm, and Sample 130-804C-9H-3, 90–91 cm, are characterized by bloomlike abundances of tiny specimens of *Sphenolithus abies*. The most striking changes in the calcareous nannofossil assemblages in Cenozoic sequences on the Ontong Java Plateau can be recognized in Samples 130-806B-34H-4, 26–27 cm, 130-805B-27H-4, 23–24 cm, and 130-804C-11H-3, 90–91 cm, in which *Reticulofenestra* again increases in the number of specimens (particularly very large-sized *Reticulofenestra* specimens) toward the bottom of these holes. In other words, only the lower part of Zone NN10 contains very large-sized (>7 µm in diameter of coccolith) *Reticulofenestra* specimens. This dramatic event in the size change of *Reticulofenestra* coccoliths takes place in the middle part of Zone NN10 not only in Holes 806B and 805B but also in Hole 804C. *Coccolithus pelagicus* is comparatively abundant in this zone. In addition, *Coccolithus miopelagicus* is present almost consistently in and below this zone, although its sporadic occurrences are recognized above this zone in Holes 805B and 804C (Fig. 5).

#### NN9 *Discoaster hamatus* Zone (Datums 23–26)

Hole 806B: 339.34–366.56 mbsf; Samples 130-806B-36X-CC to -39X-6, 26–27 cm  
 Hole 805B: 267.93–282.73 mbsf; Samples 130-805B-29X-4, 23–24 cm, to -31X-1, 23–24 cm  
 Hole 804C: 120.30–149.70 mbsf; Samples 130-804C-13H-CC to -17X-1, 90–91 cm

The samples mentioned above are characterized by continuous occurrences of *Discoaster hamatus*, whose total range defines Zone NN9 (between Datums 23 LAD *D. hamatus* and 26 FAD *D. hamatus*). In this zone, sphenoliths decrease in the number of their specimens and reticulofenestrid coccoliths become dominant again (Figs. 8 and 9). In this zone, Datums 24 (LAD *Catinaster* spp.) and 25 (FAD *Catinaster calyculus*) are easily detected. For example, *Catinaster* spp. is found below Sample 130-806B-37X-CC, and *C. calyculus* occurs only in Samples 130-806B-37X-CC through -39X-3, 26–27 cm. Therefore, Datums 24 and 25 are

Table 5. Quaternary calcareous nannofossil datums, Hole 805C.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)		
CN15	NN21	1. FAD <i>Emiliana huxleyi</i>	0.28	1H-2,23-24/1H-2,123-124	1.73/2.73		
CN14b	NN20	2. LAD <i>Pseudoemiliana lacunosa</i>	0.46	1H-5,23-24/1H-5,123-124	6.23/7.23		
CN14a	NN19	3. LAD <i>Reticulofenestra asanoi</i>	0.83	2H-5,23-24/2H-5,123-124	13.79/14.75		
		4. FAD <i>Gephyrocapsa parallela</i>	0.90	2H-7,23-24/2H-CC	16.68/17.30		
		5. FAD <i>Reticulofenestra asanoi</i>	1.06	3H-1,123-124/3H-2,23-24	18.53/19.03		
		6. LAD Large <i>Gephyrocapsa</i>	1.10	3H-2,23-24/3H-2,123-124	19.03/20.03		
		7. LAD <i>Helicosphaera sellii</i>	1.19	3H-5,23-24/3H-5,123-124	23.53/24.53		
		8. FAD Large <i>Gephyrocapsa</i>	1.36	3H-5,123-124/3H-6,23-24	24.53/25.03		
		9. LAD <i>Calcidiscus macintyreii</i>	1.45	3H-5,123-124/3H-6,23-24	24.53/25.03		
		10. FAD <i>Gephyrocapsa oceanica</i>	1.57	3H-6,23-24/3H-6,123-124	25.03/26.03		
		CN13b		11. FAD <i>Gephyrocapsa caribbeanica</i>	1.66	3H-CC/4H-1,23-24	26.70/27.02
		CN13a		12. LAD <i>Discoaster brouweri</i>	1.89	4H-5,23-24/4H-6,23-24	32.74/34.18
CN12d	NN18						

placed above Sample 130-806B-37X-CC and below Sample 130-806B-39X-3, 26–27 cm. In comparison with these datums, the FAD of *Discoaster neohamatus* is not clear. In Hole 804C, *D. neohamatus* is found in the upper four samples of this zone, and the FAD of *D. neohamatus* is most probably placed between Samples 130-804C-15X-2, 90–91 cm, and -15X-CC. In Hole 806B, however, *D. neohamatus* is found only in Sample 130-806B-36X-CC, which is the uppermost sample in Zone NN9. In Hole 805B, this datum looks like it can be placed in Zone NN10 between Samples 130-805B-28H-4, 23–24 cm, and -28H-CC. The large-sized specimen of a typical *Calcidiscus macintyreii* was found only in the upper part of this zone (e.g., above Sample 130-806B-37X-CC).

#### NN8 *Catinaster coalitus* Zone (Datums 26–27)

Hole 806B: 367.53–374.76 mbsf; Samples 130-806B-39X-CC to -40X-5, 26–27 cm  
 Hole 805B: 284.23–285.73 mbsf; Samples 130-805B-31X-2, 23–24 cm, to -31X-3, 23–24 cm  
 Hole 804C: 151.20 mbsf; Sample 130-804C-17X-2, 90–91 cm

This zone is characterized by the presence of *Catinaster coalitus* and the absence of *Discoaster hamatus* (between Datums 26 FAD *D. hamatus* and 27 FAD *C. coalitus*), and it is a very thin zone in all holes. In this zone, only three samples from Hole 806B and two samples from Hole 805B were examined; no sample was available from Hole 804C for the present faunal analysis.

#### NN7 *Discoaster kugleri* Zone–NN6 *Discoaster exilis* Zone (Datums 27–30)

Hole 806B: 375.96–472.03 mbsf; Samples 130-806B-40X-CC to -50X-CC  
 Hole 805B: 287.23–325.23 mbsf; Samples 130-805B-31X-4, 23–24 cm, to -35X-4, 23–24 cm  
 Hole 804C: 152.70–176.30 mbsf; Samples 130-804C-17X-3, 90–91 cm, to -19X-CC

The NN7/NN6 boundary is defined by the FAD of *Discoaster kugleri*. Typical specimens of this species were recognized in Samples 130-806B-43X-4, 26–27 cm, 130-805B-33X-CC, and 130-804C-18X-3, 90–91 cm. Therefore, these samples were assigned to Zone NN7. Except for these samples, however, the nominate species *D. kugleri* was almost absent throughout the interval. Therefore, I tentatively placed the samples mentioned above in the NN7–NN6 zonal interval (between Datums 27 FAD *C. coalitus* and 30 LAD *Sphenolithus heteromorphus*).

In the same manner as in the overlying zones, this zonal interval contains very dominant *Reticulofenestra* specimens (Fig. 9). Furthermore, *Coccolithus pelagicus* and its related forms are also comparatively abundant (Fig. 5).

In this NN7–NN6 interval, two important datums were easily recognized in the holes studied: Datums 28 (LAD *Coronocylus nitescens*) and 29 (LAD *Cyclicargolithus floridanus*). In Hole 806B, *Coronocylus nitescens* and *Cyclicargolithus floridanus* were continuously found below Samples 130-806B-45X-CC and -50X-3, 26–27 cm, respectively. Therefore, Datums 28 and 29 were detected between Samples 130-806B-45X-3, 26–27 cm, and -45X-CC and between Samples 130-806B-49X-CC and 130-806B-50X-3, 26–27 cm, respectively. Similarly in Hole 805B, *C. nitescens* and *C. floridanus* occur continuously below Samples 130-805B-33X-CC and -34X-CC. On the other hand, although Datum 28 was placed between Samples 130-804C-18X-3, 90–91 cm, and -18X-CC, *C. floridanus* was not found throughout this interval, which suggests that the lower part of this zonal interval is missing.

*Discoaster exilis* occurs continuously throughout this interval, and *Discoaster deflandrei* was found in and below the lower part of this interval.

#### NN5 *Sphenolithus heteromorphus* Zone–NN4 *Helicosphaera ampliaptera* Zone (Datums 30–32)

Hole 806B: 473.56–579.30 mbsf; Samples 130-806B-51X-1, 26–27 cm, to -61X-CC



Table 6. Quaternary calcareous nannofossil datums, Hole 806B.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)		
CN15	NN21	1. FAD <i>Emiliania huxleyi</i>	0.28	1H-3,32-33/1H-3,103-104	3.32/4.03		
CN14b	NN20	2. LAD <i>Pseudoemiliania lacunosa</i>	0.46	2H-2,26-27/2H-3,26-27	8.20/9.65		
CN14a	NN19	3. LAD <i>Reticulofenestra asanoi</i>	0.83	3H-2,26-27/3H-2,106-107	17.67/18.43		
		4. FAD <i>Gephyrocapsa parallela</i>	0.90	3H-4,106-107/3H-5,26-27	21.29/21.95		
		5. FAD <i>Reticulofenestra asanoi</i>	1.06	3H-6,106-107/3H-7,26-27	24.14/24.80		
		6. LAD Large <i>Gephyrocapsa</i>	1.10	3H-CC/4H-1,107-108	25.50/26.05		
		7. LAD <i>Helicosphaera sellii</i>	1.19	4H-4,26-27/4H-4,107-108	30.06/30.84		
		8. FAD Large <i>Gephyrocapsa</i>	1.36	4H-5,26-27/4H-5,106-107	31.50/32.26		
		9. LAD <i>Calcidiscus macintyreii</i>	1.45	4H-6,106-107/4H-7,26-27	33.70/34.37		
		10. FAD <i>Gephyrocapsa oceanica</i>	1.57	4H-7,66-67/4H-CC	34.75/35.00		
		CN13b		11. FAD <i>Gephyrocapsa caribbeanica</i>	1.66	4H-CC/5H-1,26-27	35.00/35.25
		CN13a		12. LAD <i>Discoaster brouweri</i>	1.89	5H-6,26-27/5H-7,26-27	42.39/43.81
CN12d	NN18						

Hole 805B: 326.73–389.75 mbsf; Samples 130-805B-35X-5, 23–24 cm, to -42X-2, 25–26 cm

Hole 804C: 178.60–206.16 mbsf; Samples 130-804C-20X-1, 90–91 cm, to -22X-CC

The boundary between Zones NN6 and NN5 was easily detected by the LAD of *Sphenolithus heteromorphus* (Datum 30). *Helicosphaera ampliaperata*, whose last occurrence defines the top of Zone NN4, has not been found in any of the Leg 130 samples taken from the pertinent stratigraphic interval and must have been ecologically excluded from this region. It follows that the combination of Zones NN5 and NN4 results in a long biostratigraphic interval that straddles the lower/middle Miocene boundary. Therefore, I am forced to place the above-mentioned samples in the NN5–NN4 zonal interval (between Datums 30 LAD *S. heteromorphus* and 32 LAD *S. belemnos*).

Throughout this interval, *Coccolithus pelagicus* and *C. miope-lagicus* are relatively abundant (Fig. 5). In Holes 806B and 805B, the upper part of this interval still contains abundant reticulofenestrid coccoliths. In addition, *Cyclicargolithus floridanus* becomes dominant, although the number of specimens decreases temporarily in the middle of this interval (Fig. 6).

Compared with the upper part of this interval, the flora in the lower part is more diversified. The main reason for this is the abrupt decrease in *Reticulofenestra* spp. As in Zone NN10, reticulofenestrid coccoliths are rare in the lower part of the NN5/NN4 zonal interval (Fig. 9). For example, *Reticulofenestra* spp. below Sample 130-806B-57X-4, 26–27 cm, in Hole 806B are rare; it is almost barren in Samples 130-806B-57X-4, 26–27 cm, -59X-4, 26–27 cm, and -60X-3, 26–27 cm. Similarly, *Reticulofenestra* spp. below Sample 130-805B-40X-CC in Hole 805B are rare. On the other hand, all samples belonging to this NN5–NN4 zonal interval from Hole 804C (except for uppermost Sample 130-804C-20X-3, 90–91 cm) contain a small number of specimens of reticulofenestrid coccoliths (Fig. 9C).

*Sphenolithus heteromorphus* occurs continuously down to Sample 130-806B-61X-4, 26–27 cm. Consequently, Datum 31 (FAD *S. heteromorphus*) was placed between Samples 130-806B-61X-4,

26–27 cm, and -61X-CC, which is slightly above the NN4/NN3 boundary. In Hole 805B, this datum corresponds with the NN4/NN3 boundary. In Hole 804C, a few specimens of *Sphenolithus belemnos* were found in Samples 130-804C-22X-2, 90–91 cm, and -22X-3, 90–91 cm. However, they occur together with *S. heteromorphus*. Therefore, I consider *S. belemnos* as reworked. *Sphenolithus* spp. is not bloomlike as in Zone NN10, but it is fairly abundant (Fig. 8).

Discoasters are also abundant throughout, although their relative abundances vary from horizon to horizon (Fig. 7). Most of them are *Discoaster deflandrei*, *D. exilis*, and *D. variabilis*. In addition to these species, many asteroliths are lumped under *Discoaster* spp. because these specimens cannot be identified at the species level by reason of their severe dissolution and/or secondary overgrowth with primary features largely destroyed. Bukry's (1973) end-of-acme concept of *Discoaster deflandrei*, which was quantified and redefined by Rio et al. (1990) recently as the decrease to <30% of *D. deflandrei* of the total discoaster assemblage, allows splitting of the NN5/NN4 zonal interval into two parts of approximately equal duration. In Holes 806B and 805B, *Discoaster deflandrei* is common in the lower part of this interval. For example, in Hole 806B, this species is dominant below Sample 130-806B-53X-CC. Therefore, the top of acme (TA) of *Discoaster deflandrei* seems to be placed between Samples 130-806B-53X-2, 26–27 cm, and -53X-CC. In Hole 805B, however, the TA of the *Discoaster deflandrei* group is not so clear as in Hole 806B. In Hole 804C, all samples that belong to this interval contain fairly abundant *D. deflandrei*, and these samples are most probably assigned to the lower part of this interval. Based on the floral changes mentioned above, I conclude that the upper part of the NN5–NN4 zonal interval in Hole 804C is missing.

#### NN3 *Sphenolithus belemnos* Zone (Datums 32–33)

Hole 806B: 579.56–588.56 mbsf; Samples 130-806B-62X-1, 26–27 cm, to -62X-7, 26–27 cm

Hole 805B: very thin or missing

Hole 804C: very thin or missing

Table 7. Quaternary calcareous nannofossil datums, Hole 807A.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)		
CN15	NN21	1. FAD <i>Emiliania huxleyi</i>	0.28	1H-4,8-10/1H-4,18-20	4.58/4.68		
CN14b	NN20	2. LAD <i>Pseudoemiliania lacunosa</i>	0.46	1H-CC,8-10/1H-CC	7.28/7.37		
CN14a	NN19	3. LAD <i>Reticulofenestra asanoi</i>	0.83	2H-5,24-25/2H-5,104-105	13.39/14.16		
		4. FAD <i>Gephyrocapsa parallela</i>	0.90	2H-6,104-105/2H-7,24-25	15.60/16.27		
		5. FAD <i>Reticulofenestra asanoi</i>	1.06	3H-1,104-105/3H-2,24-25	17.90/18.57		
		6. LAD Large <i>Gephyrocapsa</i>	1.10	3H-2,24-25/3H-2,104-105	18.57/19.34		
		7. LAD <i>Helicosphaera sellii</i>	1.19	3H-5,24-25/3H-5,104-105	22.88/23.65		
		8. FAD Large <i>Gephyrocapsa</i>	1.36	3H-6,24-25/3H-6,104-105	24.32/25.09		
		9. LAD <i>Calcidiscus macintyreii</i>	1.45	3H-7,24-25/3H-CC	25.76/26.40		
		10. FAD <i>Gephyrocapsa oceanica</i>	1.57	3H-7,24-25/3H-CC	25.76/26.40		
		CN13b		11. FAD <i>Gephyrocapsa caribbeanica</i>	1.66	3H-CC/4H-1,24-25	26.40/26.24
		CN13a		12. LAD <i>Discoaster brouweri</i>	1.89	4H-4,104-105/4H-5,24-25	31.70/32.37
CN12d	NN18						

This zone was recognized by the presence of *Sphenolithus belemnos* and the absence of *Triquetrorhabdulus carinatus*. In Hole 806B, the interval assigned to this zone (between Datums 32 LAD *S. belemnos* and 33 LAD *T. carinatus*) is thin, only about 9 m in thickness. The flora of only one sample from this hole (Sample 130-806B-62X-4, 26–27 cm) was examined. This flora is characterized by the occurrence of *Sphenolithus belemnos* together with abundant *Coccolithus pelagicus*, *Cyclicargolithus floridanus*, *Discoaster deflandrei*, and *Sphenolithus moriformis*. In Holes 804C and 805B, this zone is very thin or missing; an early Miocene hiatus is probably inferred at Sites 805 and 804.

#### NN2 *Discoaster druggii* Zone (Datums 33–35)

Hole 806B: 589.00–627.50 mbsf; Samples 130-806B-62X-CC to -66X-CC

Hole 805B: 391.23–426.73 mbsf; Samples 130-805B-42X-3, 23–24 cm, to -46X-1, 23–24 cm

Hole 804C: 207.70–249.30 mbsf; Samples 130-804C-23X-1, 90–91 cm, to -27X-3, 90–91 cm

This zone is defined by the co-occurrence of *Triquetrorhabdulus carinatus* and *Discoaster druggii* (between Datums 33 LAD *T. carinatus* and 35 FAD *D. druggii*). However, in the holes studied, *D. druggii* was very rare and occurred sporadically throughout this zone. Therefore, it was very difficult to detect the base of this zone (Datum 35). In this investigation, I tentatively placed the NN2/NN1 boundary just below the deepest sample in which I found *D. druggii* in each hole. As is evident in Figure 4C, this zone of Hole 804C is summarized as follows: In the upper part of this zone, *Reticulofenestra* spp. becomes dominant again and *Cyclicargolithus floridanus* becomes rare. In the lower part of this zone, *Reticulofenestra* spp. decreases in the number of its specimens drastically and *C. floridanus* abruptly becomes dominant again.

On the other hand, in Holes 806B and 805B, *Reticulofenestra* spp. is rather dominant throughout this zone. Furthermore, it is continuously abundant down to the upper part of underlying Zone NN1 (Figs. 4A and 4B). Therefore, it is quite within the bounds of possibility that

the NN2/NN1 boundary (Datum 35) in Holes 806B and 805B can be placed at deeper levels in these holes. Samples 130-806B-62X-CC through -64X-1, 43–44 cm, contain *Sphenolithus belemnos*; therefore, these four samples belong to the interval between Datums 33 (LAD *Triquetrorhabdulus carinatus*) and 34 (FAD *Sphenolithus belemnos*). Datum 34 in Hole 805B was placed between Samples 130-805B-43X-3, 23–24 cm, and -43X-CC. As is obvious from Table 9, sediments in Hole 804C that correspond to the interval between these two datums are very thin. *Triquetrorhabdulus carinatus* occurs continuously throughout this zone in each hole; in particular, it is rather abundant in Hole 804C. Sporadic occurrences of this species in the overlying zones are considered to be reworked. It is noteworthy that samples below Datum 34 contain *Sphenolithus dissimilis*.

#### NN1 *Triquetrorhabdulus carinatus* Zone (below Datum 35)

Hole 806B: below 627.76 mbsf; below Sample 130-806B-67X-1, 26–27 cm

Hole 805B: below 428.23 mbsf; below Sample 130-805B-46X-2, 23–24 cm

Hole 804C: 250.80–253.98 mbsf; Samples 130-804C-27X-4, 90–91 cm, to -27X-CC

The samples mentioned above contain neither *Discoaster druggii* nor *Sphenolithus ciperensis* and are assigned to early Miocene Zone NN1 (below Datum 35 FAD *D. druggii*). As mentioned above, however, the NN2/NN1 boundary (Datum 35) is tentative. The absence of *D. druggii* in these sequences does not necessarily imply a position within Zone NN1 because of the problem of calcite overgrowth. The nannofossils in this zone are abundant but moderate to poorly preserved, monotonous assemblages composed mainly of abundant *Discoaster deflandrei*, *Cyclicargolithus floridanus*, and *Sphenolithus moriformis*. It is noteworthy, in particular, that *Cyclicargolithus floridanus* among these species is fairly abundant in the lower part of this zone in Holes 805B and 806B, whereas in Hole 804C this species is rich in the lower part of Zone NN2 (Fig. 6). It seems most probable that the NN2/NN1 boundary (Datum 35) in Holes 806B and 805B must

Table 8. Neogene calcareous nannofossil datums, Hole 803D.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)
CN13a	NN19	12. LAD <i>Discoaster brouweri</i>	1.89	3H-4,15-16/3H-4,90-91	16.49/17.21
CN12d	NN18	13. LAD <i>Discoaster pentaradiatus</i>	2.35	4H-2,15-16/4H-3,15-16	23.07/24.49
CN12c	NN17	14. LAD <i>Discoaster surculus</i>	2.41	4H-4,15-16/4H-5,15-16	25.92/27.34
CN12b CN12a	NN16	15. LAD <i>Sphenolithus</i> spp.	3.45	6H-2,15-16/6H-3,15-16	41.44/42.29
CN11b CN11a		16. LAD <i>Reticulofenestra pseudumbilica</i>	3.56	6H-4,15-16,6H-5,15-16	43.14/43.99
	NN15 NN13	17. FAD <i>Ceratolithus rugosus</i>	4.6	7H-CC/8H-2,15-16	55.60/56.71
CN10b	NN12	18. LAD <i>Ceratolithus acutus</i>	4.6	8H-2,15-16/8H-3,15-16	57.18/58.61
		19. FAD <i>Ceratolithus acutus</i>	4.9	8H-CC/9H-1,15-16	65.10/65.25
CN10a		20. LAD <i>Triquetrorhabdulus rugosus</i>	4.9	8H-CC/9H-1,15-16	65.10/65.25
	NN11	21. LAD <i>Discoaster quinquerramus</i>	5.0	9H-1,15-16/9H-2,15-16	65.25/66.70
CN9b CN8a		22. FAD <i>Discoaster quinquerramus</i>	7.5	16H-4,15-16/16H-5,15-16	136.22/137.70
	NN10	23. LAD <i>Discoaster hamatus</i>	8.7	19H-CC/20H-1,15-16	169.60/169.74
CN7b	NN9	24. LAD <i>Catinaster</i> spp.	8.8	20H-1,15-16/20H-2,15-16	169.74/171.17
		25. FAD <i>Catinaster calyculus</i>	10.0	21H-3,15-16/21H-4,15-16	182.07/183.49
CN7a		26. FAD <i>Discoaster hamatus</i>	10.5	21H-6,15-16/21H-7,15-16	186.32/187.74
CN6	NN8	27. FAD <i>Catinaster coalitus</i>	11.1	21H-6,15-16/21H-7,15-16	186.32/187.74
CN5b	NN7	28. LAD <i>Coronocyclus nitescens</i>	12.8	22H-CC/23H-1,15-16	198.10/198.24
	NN6	29. LAD <i>Cyclicargolithus floridanus</i>	13.1	24H-6,15-16/24H-7,15-16	214.87/216.30
CN5a		30. LAD <i>Sphenolithus heteromorphus</i>	13.6	25X-2,15-16/25X-3,15-16	218.75/220.25
CN4 CN3	NN5 NN4	31. FAD <i>Sphenolithus heteromorphus</i>	18.6	28X-1,12-13/28X-2,15-16	246.02/247.55
		32. LAD <i>Sphenolithus belemnus</i>	18.8	28X-1,12-13/28X-2,15-16	246.02/247.55
	NN3	33. LAD <i>Triquetrorhabdulus carinatus</i>	19.5	28X-1,12-13/28X-2,15-16	246.02/247.55
CN2		34. FAD <i>Sphenolithus belemnus</i>	20.0	28X-CC/29X-1,15-16	252.80/255.65
CN1c	NN2				
CN1b	NN1	35. FAD <i>Discoaster druggii</i>	23.6	35X-3,13-14/35X-4,14-15	316.13/317.64

be at deeper horizons. In Hole 804C, the two deepest samples (Samples 130-804C-28X-3, 86–87 cm, and -28X-CC) were assigned to the Oligocene because of the occurrence of *Sphenolithus ciperoensis*. Therefore, the Oligocene/Miocene boundary can be placed in the upper part of Core 130-804C-28X.

#### SIZE VARIATION OF *RETICULOFENESTRA* COCCOLITH

##### Observation

The genus *Reticulofenestra* is an elliptical placolith constructed of elements that are not imbricate or only slightly so, with a central area that is either open or spanned by many small laths that may form a reticulum. Therefore, this genus is recognized by its rim structure and central area.

*Reticulofenestra* specimens occur in Eocene through Holocene sediments and dominate coccolith assemblages in the Neogene. These Neogene reticulofenestrid specimens have, however, no characteristic structures except for the size of the placolith diameter and the size of the central opening. Consequently, the nomenclatural taxonomy of *Reticulofenestra* is extremely confused. This serious problem has been discussed by Backman (1980), Pujos (1987), Driever (1988), Gallagher (1989), Young (1990), and others. In the present investigation, these reticulofenestrid coccoliths are identified tentatively to *R. gelida*, *R. haqii*, *R. minuta*, *R. minutula*, *R. pseudumbilica*, and others mainly based on Young's (1990) taxonomic concept.

In 1990, *Reticulofenestra* size variations in the Neogene deep-sea sediments of the western Indian Ocean and the Red Sea were systematically observed by Young. He presented a surprisingly simple, consistent, and biostratigraphically useful pattern for the size vari-

Table 9. Neogene calcareous nannofossil datums, Hole 804C.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)
CN13a	NN19	12. LAD <i>Discoaster brouweri</i>	1.89	3H-3,14-15/3H-3,52	18.85/19.22
CN12d	NN18	13. LAD <i>Discoaster pentaradiatus</i>	2.35	3H-CC/4H-3,90-91	25.30/29.01
CN12c	NN17	14. LAD <i>Discoaster surculus</i>	2.41	4H-3,90-91/4H-4,90-91	29.01/30.44
CN12b CN12a	NN16	15. LAD <i>Sphenolithus</i> spp.	3.45	4H-CC/5H-4,90-91	34.80/39.48
CN11b CN11a	NN15 NN13	16. LAD <i>Reticulofenestra pseudoumbilica</i>	3.56	4H-CC/5H-4,90-91	34.80/39.48
CN10b	NN12	17. FAD <i>Ceratolithus rugosus</i>	4.6	5H-CC/6H-1,90-91	44.30/44.63
		18. LAD <i>Ceratolithus acutus</i>	4.6	not recognized	—————
		19. FAD <i>Ceratolithus acutus</i>	4.9	not recognized	—————
CN10a		20. LAD <i>Triquetrorhabdulus rugosus</i>	4.9	5H-CC/6H-1,90-91	44.30/44.63
CN9b CN8a	NN11	21. LAD <i>Discoaster quinqueramus</i>	5.0	5H-CC/6H-1,90-91	44.30/44.63
	NN10	22. FAD <i>Discoaster quinqueramus</i>	7.5	8H-6,90-91/8H-CC	71.45/72.80
CN7b	NN9	23. LAD <i>Discoaster hamatus</i>	8.7	13H-3,90-91/13H-CC	114.70/120.30
		24. LAD <i>Catinaster</i> spp.	8.8	13H-3,90-91/13H-CC	114.70/120.30
		25. FAD <i>Catinaster calyculus</i>	10.0	15X-CC/16X-1,90-91	134.55/140.20
CN7a		26. FAD <i>Discoaster hamatus</i>	10.5	17X-1,90-91/17X-2,90-91	149.70/151.20
CN6	NN8	27. FAD <i>Catinaster coalitus</i>	11.1	17X-2,90-91/17X-3,90-91	151.20/152.70
CN5b	NN7	28. LAD <i>Coronocyclus nitescens</i>	12.8	18X-4,90-91/18X-5,90-91	163.70/165.20
CN5a	NN6	29. LAD <i>Cyclicargolithus floridanus</i>	13.1	19X-6,56-57/19X-CC	176.06/176.30
		30. LAD <i>Sphenolithus heteromorphus</i>	13.6	19X-CC/20X-1,90-91	176.30/178.60
CN4 CN3	NN5 NN4	31. FAD <i>Sphenolithus heteromorphus</i>	18.6	22X-CC/23X-1,90-91	206.16/207.70
CN2	NN3	32. LAD <i>Sphenolithus belemnos</i>	18.8	22X-CC/23X-1,90-91	206.16/207.70
		33. LAD <i>Triquetrorhabdulus carinatus</i>	19.5	22X-CC/23X-1,90-91	206.16/207.70
CN1c	NN2	34. FAD <i>Sphenolithus belemnos</i>	20.0	23X-1,90-91/23X-2,90-91	207.70/209.20
CN1b	NN1	35. FAD <i>Discoaster druggii</i>	23.6	27X-3,90-91/27X-4,90-91	249.30/250.80

ations of reticulofenestrid coccoliths. In the present investigation, I have made similar systematic observations on the size variations of reticulofenestrid coccoliths not only in the middle Miocene to Pliocene but also throughout the Miocene to Pliocene sequences at Sites 804, 805, and 806 on the Ontong Java Plateau.

The sizes of all reticulofenestrid coccoliths (except for *Dictyococites productus*) encountered during counts of 200 calcareous nannofossil specimens in each sample were measured under an ordinary light microscope using an eyepiece graticule. After measurements were taken, all reticulofenestrid coccoliths were classified into the following four groups:

Very large reticulofenestrid coccoliths: larger than 7  $\mu\text{m}$   
Large reticulofenestrid coccoliths: 7–5  $\mu\text{m}$

Small reticulofenestrid coccoliths: 5–3  $\mu\text{m}$

Very small reticulofenestrid coccoliths: smaller than 3  $\mu\text{m}$

The relative abundances of each group in Holes 806B, 805C, 805B, and 804C with geological ages are shown in Figure 9.

As is evident from this figure, roughly speaking, the relative abundance of reticulofenestrid coccoliths gradually decreases toward the bottom of each core. For example, in Hole 806B they form nearly 80% in the upper part of the hole, but only a few percent of the flora are present or are barren altogether at the base of the hole. The general decrease in the relative abundance is interrupted by remarkable and abrupt drops in abundances of reticulofenestrid coccoliths at two horizons. To state this differently, *Reticulofenestra* specimens are abundant in three stratigraphic intervals in the Pliocene-Miocene se-



Table 10. Neogene calcareous nannofossil datums, Hole 805C.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)
CN13a	NN19	12. LAD <i>Discoaster brouweri</i>	1.89	4H-5,23-24/4H-6,23-24	32.74/34.18
CN12d	NN18	13. LAD <i>Discoaster pentaradiatus</i>	2.35	5H-4,23-24/5H-5,23-24	40.95/42.42
CN12c	NN17	14. LAD <i>Discoaster surculus</i>	2.41	5H-6,23-24/5H-CC	43.89/45.80
CN12b CN12a	NN16	15. LAD <i>Sphenolithus</i> spp.	3.45		
CN11b CN11a		NN15 NN13	16. LAD <i>Reticulofenestra pseudumbilica</i>	3.56	
CN10b	NN12	17. FAD <i>Ceratolithus rugosus</i>	4.6		
		18. LAD <i>Ceratolithus acutus</i>	4.6		
CN10a	NN12	19. FAD <i>Ceratolithus acutus</i>	4.9		
		20. LAD <i>Triquetrorhabdulus rugosus</i>	4.9		
CN9b CN8a	NN11	21. LAD <i>Discoaster quinquerramus</i>	5.0		
	NN10	22. FAD <i>Discoaster quinquerramus</i>	7.5		
CN7b	NN9	23. LAD <i>Discoaster hamatus</i>	8.7		
		24. LAD <i>Catinaster</i> spp.	8.8		
CN7a	NN9	25. FAD <i>Catinaster calyculus</i>	10.0		
CN6		NN8	26. FAD <i>Discoaster hamatus</i>	10.5	
CN5b	NN7	27. FAD <i>Catinaster coalitus</i>	11.1		
CN5a	NN6	28. LAD <i>Coronocyclus nitescens</i>	12.8		
		29. LAD <i>Cyclicargolithus floridanus</i>	13.1		
CN4 CN3	NN5 NN4	30. LAD <i>Sphenolithus heteromorphus</i>	13.6		
CN2	NN3	31. FAD <i>Sphenolithus heteromorphus</i>	18.6		
		32. LAD <i>Sphenolithus belemnos</i>	18.8		
CN1c	NN2	33. LAD <i>Triquetrorhabdulus carinatus</i>	19.5		
		34. FAD <i>Sphenolithus belemnos</i>	20.0		
CN1b	NN1	35. FAD <i>Discoaster druggii</i>	23.6		

quence. For convenience, I will designate these intervals as Intervals A, B, and C, in descending order. The characteristics of these intervals in Holes 806B, 805C, and 805B are as follows (Figs. 9 and 10):

Interval A: lowest NN19–middle NN10  
Hole 806B: down to Sample 130-806B-32H-CC  
Hole 805B: down to Sample 130-805B-25H-CC

In this interval the relative abundances of reticulofenestrid coccoliths gradually decrease downward. In Holes 806B and 805B, its highest abundances are 88.5% (in Sample 130-806B-8H-CC) and 90% (in Sample 130-805C-6H-CC) of the total floras recognized in Zone NN16. This interval is particularly characterized by the abundant occurrence of very small *Reticulofenestra* (<3 µm in diameter).

Based on the relative abundances of these very small reticulofenestrid coccoliths, this interval has been subdivided into upper (A<sub>1</sub>) and lower (A<sub>2</sub>) intervals as follows:

Interval A<sub>1</sub>: lowest NN19–upper NN12  
Hole 806B: down to Sample 130-806B-15H-CC  
Hole 805B: down to Sample 130-805B-12H-4, 23–24 cm

This interval is characterized by the consistently predominant occurrence of very small reticulofenestrid specimens. It accounts for consistently more than 24.5% of the total flora: its average relative abundances are 59.3% and 48.2% in Holes 806B and 805B, respectively. Only in the lower part of Interval A<sub>1</sub> (below Samples 130-806B-11H-4, 26–27 cm, and 130-805B-9H-4, 23–24 cm), very large

Table 11. Neogene calcareous nannofossil datums, Hole 805B.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)
CN13a	NN19	12. LAD <i>Discoaster brouweri</i>	1.89		
CN12d	NN18	13. LAD <i>Discoaster pentaradiatus</i>	2.35		
CN12c	NN17	14. LAD <i>Discoaster surculus</i>	2.41		
CN12b CN12a	NN16	15. LAD <i>Sphenolithus</i> spp.	3.45	8H-4,23-24/8H-5,23-24	68.27/69.72
CN11b CN11a	NN15	16. LAD <i>Reticulofenestra pseudoumbilica</i>	3.56	8H-CC/9H-1,23-24	73.20/73.42
	NN13	17. FAD <i>Ceratolithus rugosus</i>	4.6	12H-3,23-24/12H-4,23-24	104.93/106.43
CN10b	NN12	18. LAD <i>Ceratolithus acutus</i>	4.6	12H-2,23-24/12H-3,23-24	103.43/104.93
		19. FAD <i>Ceratolithus acutus</i>	4.9	13H-3,123-124/13H-4,123-124	115.26/116.70
CN10a		20. LAD <i>Triquetrorhabdulus rugosus</i>	4.9	13H-4,123-124/13H-5,123-124	116.70/118.15
	NN11	21. LAD <i>Discoaster quinqueramus</i>	5.0	14H-1,23-24/14H-2,23-24	120.92/122.36
CN9b CN8a		NN10	22. FAD <i>Discoaster quinqueramus</i>	7.5	24H-3,23-24/24H-4,23-24
	NN9	23. LAD <i>Discoaster hamatus</i>	8.7	29X-3,23-24/29X-4,23-24	266.43/267.93
CN7b		24. LAD <i>Catinaster</i> spp.	8.8	29X-3,23-24/29X-4,23-24	266.43/267.93
CN7a		25. FAD <i>Catinaster calyculus</i>	10.0	30X-5,23-24/30X-6,23-24	279.13/280.63
CN6	NN8	26. FAD <i>Discoaster hamatus</i>	10.5	31X-1,23-24/31X-2,23-24	282.73/284.23
		27. FAD <i>Catinaster coalitus</i>	11.1	31X-3,23-24/31X-4,23-24	285.73/287.23
CN5b	NN7	28. LAD <i>Coronocyclus nitescens</i>	12.8	33X-6,23-24/33X-CC	309.13/310.37
CN5a	NN6	29. LAD <i>Cyclicargolithus floridanus</i>	13.1	34X-4,23-24/34X-5,23-24	315.73/317.23
		30. LAD <i>Sphenolithus heteromorphus</i>	13.6	35X-4,23-24/35X-5,23-24	325.23/326.73
CN4 CN3	NN5 NN4	31. FAD <i>Sphenolithus heteromorphus</i>	18.6	41X-CC/42X-1,23-24	385.77/388.23
CN2		NN3	32. LAD <i>Sphenolithus belemnos</i>	18.8	42X-2,25-26/42X-3,23-24
	33. LAD <i>Triquetrorhabdulus carinatus</i>		19.5	42X-2,25-26/42X-3,23-24	389.75/391.23
CN1c	NN2	34. FAD <i>Sphenolithus belemnos</i>	20.0	43X-5,23-24/43X-6,23-24	403.93/405.43
CN1b		NN1	35. FAD <i>Discoaster druggii</i>	23.6	46X-1,23-24/46X-2,23-24

reticulofenestrid coccoliths (>7 µm in diameter) are found. The top of this lower part provides for the top of Zone NN15.

Interval A<sub>2</sub>: middle NN12–upper NN10

Hole 806B: Samples 130-806B-16H-4, 26–27 cm, to -32H-CC

Hole 805B: Samples 130-805B-12H-CC to -25H-CC

Generally speaking, this interval also contains abundant, very small reticulofenestrid coccoliths. Compared with Interval A<sub>1</sub>, however, their relative abundances increase and decrease frequently, and average abundances are 47.5% in Hole 806B and 46.1% in Hole 805B, which are not so high as in Interval A<sub>1</sub>. The lower part of this interval (below Samples 130-806B-26H-4, 26–27 cm, and 130-805B-20H-CC) contains no more very large reticulofenestrid coccoliths (Fig. 10A).

Between Intervals A and B: middle NN10

Hole 806B: Samples 130-806B-33H-4, 26–27 cm, to -33H-CC

Hole 805B: Samples 130-805B-26H-4, 23–24 cm, to -26H-CC

The first remarkable and abrupt drop in the relative abundance of reticulofenestrid coccoliths that divides Intervals A and B occurs in the late Miocene (in Zone NN10). At this horizon, reticulofenestrid coccolith forms account for only about 1% of the total flora; instead of *Reticulofenestra* spp., the flora is characterized by bloomlike, high abundances of small sphenoliths (*Sphenolithus abies*). A remarkable upward size reduction event in the reticulofenestrid coccolith population takes place at this horizon.

Interval B: lower NN10–middle NN5/NN4

Hole 806B: Samples 130-806B-34H-4, 26–27 cm, to -56X-CC

Table 12. Neogene calcareous nannofossil datums, Hole 806B.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)
CN13a	NN19	12. LAD <i>Discoaster brouweri</i>	1.89	5H-6,26-27/5H-7,26-27	42.34/43.81
CN12d	NN18	13. LAD <i>Discoaster pentaradiatus</i>	2.35	6H-CC/7H-1,106-107	54.00/54.51
CN12c	NN17	14. LAD <i>Discoaster surculus</i>	2.41	8H-1,106-107/8H-2,106-107	64.53/65.99
CN12b CN12a	NN16	15. LAD <i>Sphenolithus</i> spp.	3.45	10H-3,26-27/10H-4,26-27	85.66/87.11
CN11b CN11a	NN15 NN13	16. LAD <i>Reticulofenestra pseudoumbilica</i>	3.56	11H-2,26-27/11H-3,26-27	93.66/95.08
CN10b	NN12	17. FAD <i>Ceratolithus rugosus</i>	4.6	15H-6,26-27/15H-7,26-27	137.43/138.87
		18. LAD <i>Ceratolithus acutus</i>	4.6	15H-6,26-27/15H-7,26-27	137.43/138.87
		19. FAD <i>Ceratolithus acutus</i>	4.9	17H-2,26-27/17H-3,26-27	150.69/152.13
CN10a		20. LAD <i>Triquetrorhabdulus rugosus</i>	4.9	17H-3,26-27/17H-4,26-27	152.13/153.56
CN9b CN8a	NN11	21. LAD <i>Discoaster quinqueramus</i>	5.0	18H-3,26-27/18H-4,26-27	161.60/163.02
	NN10	22. FAD <i>Discoaster quinqueramus</i>	7.5	31H-2,24-25/31H-3,26-27	283.65/285.09
CN7b CN7a	NN9	23. LAD <i>Discoaster hamatus</i>	8.7	36X-7,26-27/36X-CC	338.96/339.34
		24. LAD <i>Catinaster</i> spp.	8.8	37X-4,26-27/37X-5,26-27	344.16/345.66
		25. FAD <i>Catinaster calyculus</i>	10.0	39X-3,26-27/39X-4,26-27	362.06/363.56
CN6	NN8	26. FAD <i>Discoaster hamatus</i>	10.5	39X-6,26-27/39X-CC	366.56/367.53
CN5b CN5a	NN7	27. FAD <i>Catinaster coalitus</i>	11.1	40X-5,26-27/40X-CC	374.76/375.96
	NN6	28. LAD <i>Coronocyclus nitescens</i>	12.8	45X-6,26-27/45X-CC	424.66/426.27
CN4 CN3	NN5 NN4	29. LAD <i>Cyclicargolithus floridanus</i>	13.1	49X-CC/50X-1,26-27	463.60/463.86
CN2	NN3	30. LAD <i>Sphenolithus heteromorphus</i>	13.6	50X-CC/51X-1,26-27	472.03/473.56
		31. FAD <i>Sphenolithus heteromorphus</i>	18.6	61X-7,26-27/61X-CC	578.86/579.30
		32. LAD <i>Sphenolithus belemnos</i>	18.8	61X-CC/62X-1,26-27	579.30/579.56
CN1c	NN2	33. LAD <i>Triquetrorhabdulus carinatus</i>	19.5	62X-7,26-27/62X-CC	588.56/589.00
CN1b	NN1	34. FAD <i>Sphenolithus belemnos</i>	20.0	64X-2,30-31/64X-CC	600.40/601.63
		35. FAD <i>Discoaster druggii</i>	23.6	66X-CC/67X-1,26-27	627.50/627.76

Hole 805B: Samples 130-805B-27H-4, 23–24 cm, to -40X-3, 23–24 cm

In this interval, reticulofenestrid coccoliths are again abundant. Based on the occurrences of very large and very small reticulofenestrid coccoliths, this interval is divided into three parts: Intervals B<sub>1</sub>, B<sub>2</sub>, and B<sub>3</sub> in descending order.

Interval B<sub>1</sub>: lower NN10–upper NN7/NN6

Hole 806B: Samples 130-806B-34H-4, 26–27 cm, to -44X-4, 26–27 cm

Hole 805B: Samples 130-805B-27H-4, 23–24 cm, to -32X-3, 23–24 cm

Interval B<sub>1</sub> is characterized by the fairly abundant occurrence of reticulofenestrid coccoliths. However, very small specimens of *Reticulofenestra* are almost absent (Fig. 10B).

Interval B<sub>2</sub>: middle and lower NN7/NN6

Hole 806B: Samples 130-806B-44X-CC to -50X-CC

Hole 805B: Samples 130-805B-32X-CC to -35X-3, 23–24 cm

In this interval, very large and very small reticulofenestrid specimens are present, although their relative abundances compared to the total flora are not high (Fig. 10).

Interval B<sub>3</sub>: upper and middle NN5/NN4

Table 13. Neogene calcareous nannofossil datums, Hole 807A.

Zone		Species	Age (Ma)	Core, section, interval (cm)	Depth (mbsf)
CN13a	NN19	12. LAD <i>Discoaster brouweri</i>	1.89	4H-4,104-105/4H-5,24-25	31.70/32.37
CN12d	NN18	13. LAD <i>Discoaster pentaradiatus</i>	2.35	5H-3,104-105/5H-4,104-105	39.80/41.24
CN12c	NN17	14. LAD <i>Discoaster surculus</i>	2.41	5H-4,104-105/5H-5,104-105	41.24/42.69
CN12b CN12a	NN16	15. LAD <i>Sphenolithus</i> spp.	3.45	8H-6,24-25/8H-7,24-25	71.79/73.23
CN11b CN11a	NN15 NN13	16. LAD <i>Reticulofenestra pseudoumbilica</i>	3.56	9H-3,104-105/9H-4,24-25	77.86/78.54
CN10b	NN12	17. FAD <i>Ceratolithus rugosus</i>	4.6	12H-CC/13H-1,24-25	111.90/112.14
		18. LAD <i>Ceratolithus acutus</i>	4.6	12H-CC/13H-1,24-25	111.90/112.14
		19. FAD <i>Ceratolithus acutus</i>	4.9	13H-CC/14H-1,23-24	121.40/121.62
CN10a		20. LAD <i>Triquetrorhabdulus rugosus</i>	4.9	14H-1,23-24/14H-2,23-24	121.62/123.07
CN9b CN8a	NN11	21. LAD <i>Discoaster quinqueramus</i>	5.0	14H-6,23-24/14H-7,23-24	128.86/130.31
	NN10	22. FAD <i>Discoaster quinqueramus</i>	7.5	26H-2,24-25/26H-3,24-25	237.07/238.51
CN7b CN7a	NN9	23. LAD <i>Discoaster hamatus</i>	8.7	30X-3,24-25/30X-4,24-25	277.04/278.54
		24. LAD <i>Catinaster</i> spp.	8.8	30X-5,24-25/30X-6,24-25	280.04/281.54
		25. FAD <i>Catinaster calyculus</i>	10.0	32X-2,24-25/32X-3,24-25	294.44/295.94
CN6	NN8	26. FAD <i>Discoaster hamatus</i>	10.5	32X-CC/33X-1,24-25	300.72/302.54
CN5b CN5a	NN7	27. FAD <i>Catinaster coalitus</i>	11.1	33X-3,24-25/33X-4,24-25	305.54/307.04
	NN6	28. LAD <i>Coronocyclus nitescens</i>	12.8	36X-3,24-25/36X-4,24-25	334.14/335.64
CN4 CN3	NN5 NN4	29. LAD <i>Cyclicargolithus floridanus</i>	13.1	40X-2,24-25/40X-3,24-25	371.44/372.94
CN2	NN3	30. LAD <i>Sphenolithus heteromorphus</i>	13.6	40X-7,24-25/40X-CC	378.94/379.32
		31. FAD <i>Sphenolithus heteromorphus</i>	18.6	49X-4,24-25/49X-5,24-25	461.54/463.04
		32. LAD <i>Sphenolithus belemnos</i>	18.8	49X-5,24-25/49X-CC	463.04/464.73
CN1c CN1b	NN2	33. LAD <i>Triquetrorhabdulus carinatus</i>	19.5	50X-6,24-25/50X-7,24-25	474.14/475.64
		34. FAD <i>Sphenolithus belemnos</i>	20.0	50X-CC/51X-1,24-25	475.85/476.34
	NN1	35. FAD <i>Discoaster druggii</i>	23.6	61X-6,24-25/61X-CC	580.04/581.14

Hole 806B: Sample 130-806B-51X-4, 26–27 cm, to -56X-CC  
Hole 806B: Sample 130-805B-35X-CC to -40X-3, 23–24 cm

Interval B<sub>3</sub> is clearly distinguished from Interval B<sub>2</sub> by the almost absence of very large specimens of *Reticulofenestra*. Therefore, it is clear that another dramatic change in *Reticulofenestra* coccolith size occurs between Intervals B<sub>2</sub> and B<sub>3</sub>; that is, a size increase event (Fig. 10A). As very small reticulofenestrid specimens are present but rare and occasional in this interval (Fig. 10B), the most dominant specimens are between 5 and 3 μm in diameter.

Between Intervals B and C: lower NN5/NN4–upper NN2  
Hole 806B: Samples 130-806B-57X-4, 26–27 cm, to -62X-CC

Hole 805B: Samples 130-805B-40X-CC to -42X-CC

The second abrupt drop in the relative abundance of reticulofenestrid coccoliths that divides Intervals B and C takes place in the early Miocene (in the lower NN5/NN4 zonal interval down to the upper NN2 Zone). The reduction in the reticulofenestrid coccolith abundance at this horizon, however, is not so remarkable as at the first one. *Reticulofenestra* specimens form about 8% of the total foras in Holes 806B and 805B. Instead of *Reticulofenestra* spp., discoasters and *Cyclicargolithus floridanus* are dominant at this horizon.

Interval C: middle NN2–upper NN1  
Hole 806B: Samples 130-806B-63X-4, 26–27 cm, to -70X-CC



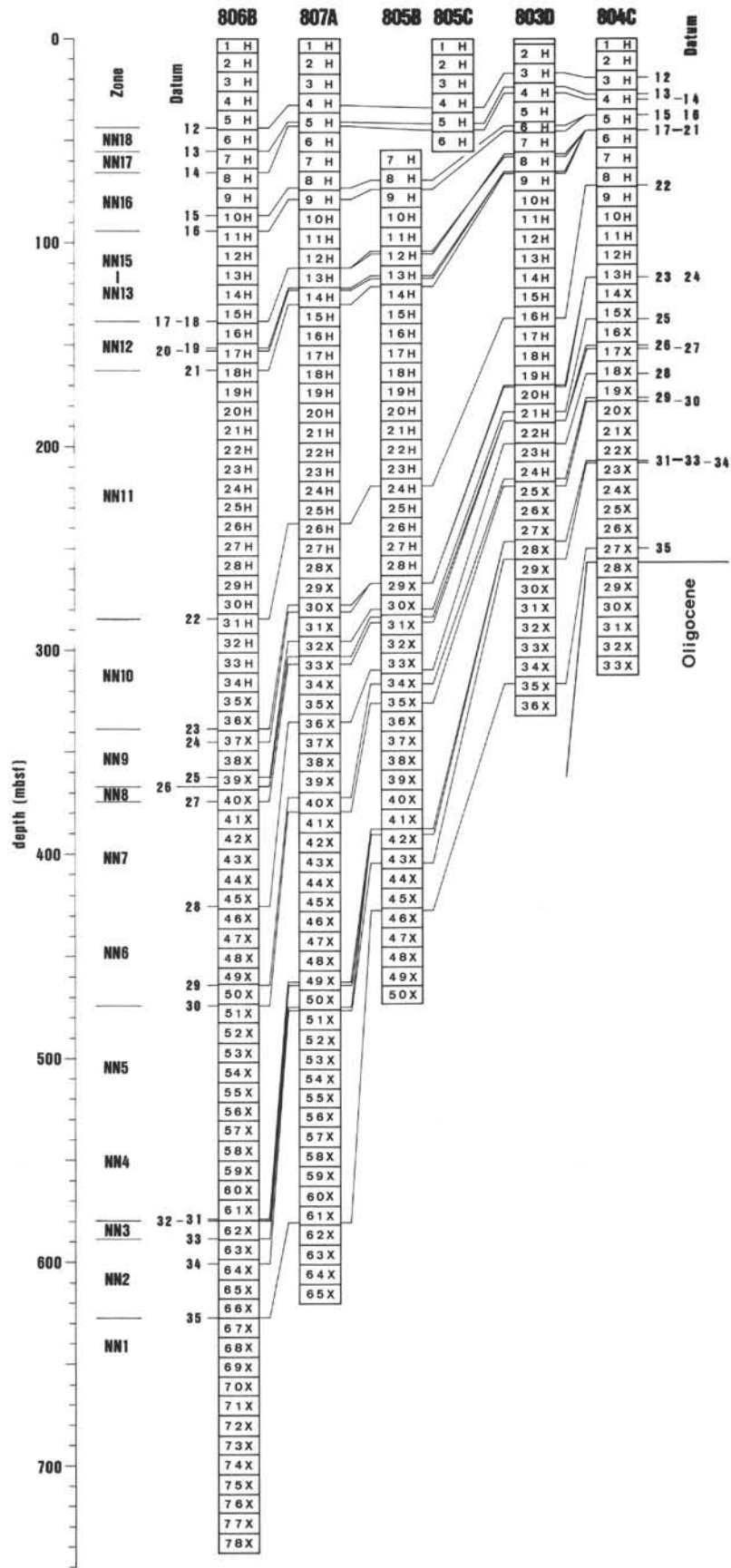


Figure 3. Neogene biostratigraphic relationships at each site of Leg 130. Refer to Table 2 for key to datum numbers.

Hole 805B: Samples 130-805B-43X-3, 23–24 cm, to -47X-CC

In this interval, *Reticulofenestra* again becomes abundant. The relative abundances, however, are not high compare with Intervals A and B. Maximum abundances are 55.5% and 58% in Holes 806B and 805B, respectively. Only middle-sized specimens (7–3  $\mu\text{m}$  in diameter) are abundant.

Below Interval C: lower NN1

Hole 806B: below Sample 130-806B-71X-2, 26–27 cm

Hole 805B: below Sample 130-805B-48X-3, 23–24 cm

Below Interval C, reticulofenestrid coccoliths are very rare. On the contrary, *Cyclicargolithus floridanus* becomes dominant and takes the place of reticulofenestrid coccoliths.

### Remarks

Because of this investigation, a clear pattern was revealed with a dramatic size reduction event occurring in the late Miocene calcareous nannofossil zone NN10 of Martini's (1971) zonal scheme in the equatorial Pacific. Moreover it became clear that *Reticulofenestra* specimens are very rare or almost absent at this event. One noteworthy characteristic of the assemblage at this event is the bloomlike, high abundance of small sphenoliths (*Sphenolithus abies*).

According to Young (1990), calcareous nannofossil assemblages in the interval above this size reduction event are characterized by the absence of reticulofenestrid specimens  $>5 \mu\text{m}$  in diameter. Young calls this interval the "small *Reticulofenestra* interval." I also recognized this "small *Reticulofenestra* interval" in the sections studied, which corresponds exactly to my lower interval A<sub>2</sub> (Fig. 10).

In this investigation, another dramatic size change in the *Reticulofenestra* coccoliths (size increase event) was recognized between Intervals B<sub>2</sub> and B<sub>3</sub>, which corresponds to the NN6/NN5 boundary.

### PRINCIPAL CONCLUSIONS

Thirty genera and 103 species of calcareous nannofossils were identified during this investigation. A total of 35 calcareous nannofossil datums were detected in the Neogene sequences on the Ontong Java Plateau. Among them, 12 datums in the Pleistocene were tentatively correlated with magnetostratigraphy.

*Reticulofenestra* coccolith size distribution patterns throughout the Pliocene-Miocene sequences were clarified. In these sequences, *Reticulofenestra* specimens were dominant in three stratigraphic intervals, which were termed Intervals A, B, and C in descending order. Based on *Reticulofenestra* size distribution patterns, Intervals A and B were subdivided. A dramatic size reduction event in *Reticulofenestra* specimens that occurred in late Miocene sediments in the western Indian Ocean and the Red Sea was also confirmed in the equatorial Pacific between Intervals A and B. Young's (1990) "small *Reticulofenestra* interval" corresponds exactly to lower Interval A<sub>2</sub> in the present investigation. A dramatic size increase event of *Reticulofenestra* specimens was recognized between Intervals B<sub>2</sub> and B<sub>3</sub>, which corresponds to the NN6/NN5 boundary.

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#### APPENDIX

During this investigation, 30 genera and 103 species were recognized. No new species are described in this report, so no taxonomic discussion and systematic description are included. The species names considered in this report are listed alphabetically below.

- Amaurolithus amplificus* (Bukry and Percival) Gartner and Bukry, 1975  
*Amaurolithus delicatus* Gartner and Bukry, 1975  
*Amaurolithus primus* (Bukry and Percival) Gartner and Bukry, 1975  
*Amaurolithus tricorniculatus* (Gartner) Gartner and Bukry, 1975  
*Calcidiscus leptoporus* (Murray and Blackman) Loeblich and Tappan, 1978  
*Calcidiscus macintyreii* (Bukry and Bramlette) Loeblich and Tappan, 1978  
*Calcidiscus premacintyreii* Theodoridis, 1984  
*Catinaster altus* (Müller) Perch-Nielsen, 1984  
*Catinaster calyculus* Martini and Bramlette, 1963  
*Catinaster coalitus* Martini and Bramlette, 1963  
*Ceratolithus acutus* Gartner and Bukry, 1974  
*Ceratolithus cristatus* Kamptner, 1950  
*Ceratolithus rugosus* Bukry and Bramlette, 1968  
*Ceratolithus simplex* Bukry, 1979  
*Ceratolithus telesmus* Norris, 1965  
*Coccolithus crassipons* Bouché, 1962  
*Coccolithus eopelagicus* (Bramlette and Riedel) Bramlette and Sullivan, 1961  
*Coccolithus miopelagicus* Bukry, 1971  
*Coccolithus pelagicus* (Wallich) Schiller, 1930  
*Coccolithus streckerii* Takayama and Sato, 1987  
*Coronocyclus nitescens* (Kamptner) Bramlette and Wilcoxon, 1967  
*Cyclicargolithus floridanus* (Roth and Hay) Bukry, 1971  
*Cyclolithella annula* (Cohen) McIntyre and Bé, 1967  
*Dictyococcites productus* (Kamptner) Backman, 1980  
*Discoaster adamanteus* Bramlette and Wilcoxon, 1967  
*Discoaster asymmetricus* Gartner, 1969  
*Discoaster bellus* Bukry and Percival, 1971  
*Discoaster berggrenii* Bukry, 1971  
*Discoaster blackstockae* Bukry, 1973  
*Discoaster bollii* Martini and Bramlette, 1963  
*Discoaster braarudii* Bukry, 1971  
*Discoaster brouweri* Tan Sin Hok, 1927  
*Discoaster calcaris* Gartner, 1967  
*Discoaster challengerii* Bramlette and Riedel, 1954  
*Discoaster decorus* (Bukry) Bukry, 1973  
*Discoaster deflandrei* Bramlette and Riedel, 1954  
*Discoaster druggii* Bramlette and Wilcoxon, 1967  
*Discoaster exilis* Martini and Bramlette, 1963  
*Discoaster formosus* Martini and Worsley, 1971  
*Discoaster hamatus* Martini and Bramlette, 1963  
*Discoaster intercalaris* Bukry, 1971  
*Discoaster kugleri* Martini and Bramlette, 1963  
*Discoaster loeblichii* Bukry, 1971  
*Discoaster moorei* Bukry, 1971  
*Discoaster neohamatus* Bukry and Bramlette, 1969  
*Discoaster neorectus* Bukry, 1971  
*Discoaster pansus* (Bukry and Percival) Bukry, 1973  
*Discoaster pentaradiatus* Tan Sin Hok, 1927  
*Discoaster prepentaradiatus* Bukry and Percival, 1971  
*Discoaster pseudovariabilis* Martini and Worsley, 1971  
*Discoaster quadramus* Bukry, 1973  
*Discoaster quinqueramus* Gartner, 1969  
*Discoaster surculus* Martini and Bramlette, 1963  
*Discoaster tamalis* Kamptner, 1967  
*Discoaster triradiatus* Tan Sin Hok, 1927  
*Discoaster tristellifer* Bukry, 1976  
*Discoaster variabilis* Martini and Bramlette, 1963  
*Discolithina japonica* Takayama, 1967  
*Ericsonia obruta* Perch-Nielsen, 1971  
*Gephyrocapsa aperta* Kamptner, 1963  
*Gephyrocapsa sinuosa* Hay and Beaudry, 1973  
*Hayaster perplexus* (Bramlette and Riedel) Bukry, 1973  
*Helicosphaera carteri* (Wallich) Kamptner, 1954  
*Helicosphaera euphratis* Haq, 1966  
*Helicosphaera granulata* Bukry and Percival, 1971  
*Helicosphaera hyalina* Gaarder, 1970  
*Helicosphaera intermedia* Martini, 1965  
*Helicosphaera neogranulata* Gartner, 1977  
*Helicosphaera recta* Haq, 1966  
*Helicosphaera sellii* Bukry and Bramlette, 1969  
*Helicosphaera wallichii* (Lohmann) Boudreaux and Hay, 1969  
*Oolithotus fragilis* (Lohmann) Martini and Müller, 1972  
*Orthorhabdus serratus* Bramlette and Wilcoxon, 1967  
*Pontosphaera* spp.  
*Pseudoemiliana lacunosa* (Kamptner) Gartner, 1969  
*Reticulofenestra ampla* Sato, Kameo and Takayama, 1991  
*Reticulofenestra asanoi* Sato and Takayama, 1992  
*Reticulofenestra gelida* (Geitzenauer) Backman, 1978  
*Reticulofenestra haqii* Backman, 1978  
*Reticulofenestra minuta* Roth, 1970  
*Reticulofenestra minutula* (Gartner) Haq and Berggren, 1978  
*Reticulofenestra pseudoumbilica* (Gartner) Gartner, 1969  
*Rhabdosphaera claviger* Murray and Blackman, 1898  
*Rhabdosphaera stylifer* Lohmann, 1902  
*Scapholithus fossilis* Deflandre, 1954  
*Scyphosphaera* spp.  
*Solidopons petrae* Theodoridis, 1984  
*Sphenolithus abies* Deflandre, 1954  
*Sphenolithus belemnus* Bramlette and Wilcoxon, 1967  
*Sphenolithus ciperoensis* Bramlette and Wilcoxon, 1967  
*Sphenolithus compactus* Backman, 1980  
*Sphenolithus conicus* Bukry, 1971  
*Sphenolithus delphix* Bukry, 1973  
*Sphenolithus dissimilis* Bukry and Percival, 1971  
*Sphenolithus distentus* (Martini) Bramlette and Wilcoxon, 1967  
*Sphenolithus grandis* Haq and Berggren, 1978  
*Sphenolithus heteromorphus* Deflandre, 1953  
*Sphenolithus moriformis* (Brönnimann and Stradner) Bramlette and Wilcoxon, 1967  
*Syracosphaera pulchra* Lohmann, 1902  
*Tetralithides symeonidesii* Theodoridis, 1984  
*Triquetrorhabdulus carinatus* Martini, 1965  
*Triquetrorhabdulus milowii* Bukry, 1971  
*Triquetrorhabdulus rugosus* Bramlette and Wilcoxon, 1967  
*Umbilicosphaera sibogae* (Weber-van Bosse) Gaarder, 1970  
*Zygrhablithus bijugatus* (Deflandre) Deflandre, 1959

Table 14. Calcareous nannofossil occurrences, Hole 806B.

Core	5H	5H	6H	6H	7H	7H	8H	8H	9H	9H	10H	10H	11H
Section	4	CC	4	CC	3	CC	3	CC	4	CC	4	CC	4
Interval (cm)	26-27		26-27		106-107		106-107		26-27		26-27		26-27
Zone (Matini, 1971)	NN19		NN18		NN17				NN16				NN15-13
Amaurolithus amplificus													
Amaurolithus delicatus													
Amaurolithus primus													
Amaurolithus tricomiculatus													
Calcidiscus leptopus	26	25	15	16	13	11	5	8	13	8	13	20	14
Calcidiscus macintyreii	+	+	+	+	+	1	+	?	1	+	1	1	2
Calcidiscus premacintyreii													
Catinaster calyculus													
Catinaster coarctatus													
Ceratolithus acutus													
Ceratolithus rugosus		+		?		+				+			+
Coccolithus crassiporus		+	+	+	+		+	+					
Coccolithus miopelagicus													
Coccolithus pelagicus	+	3	+	2	+	+	+						
Coccolithus streckerii			+				?						
Coronocyclus nitescens													
Cyclargolithus floridanus													
Cyclotella annula					?	5	+	5	5	3	9	2	4
Dictyococcales productus	2		4		2	1	2			1	1		
Discoaster adamantinus													
Discoaster asymmetricus							+	?	?	?		+	+
Discoaster bellus													
Discoaster berggrenii													
Discoaster blackstockae													
Discoaster bollii													
Discoaster brouweri		+	9	8	5	2	9	1	+	3	+	+	+
Discoaster calcaris													
Discoaster challengerii													+
Discoaster decorus										+	+		
Discoaster deflandrei													
Discoaster druggii													
Discoaster exilis													
Discoaster formosus													
Discoaster hamatus													
Discoaster kugleri													
Discoaster loeblichii													
Discoaster neohamatus													
Discoaster neorectus													
Discoaster panus													
Discoaster pentaradiatus					+	+	+	+		+	+	+	+
Discoaster propentariatus													
Discoaster quinqueramus													
Discoaster surculus					?		+	+	+	+	+	+	?
Discoaster tetradiatus		+					+	?	+			?	
Discoaster variabilis													+
Discoaster spp.													
Discolithina japonica		+			?		+						
Ericsonia obruta													
Gephyrocapsa aperta	4		3	1				1					1
Gephyrocapsa sinuosa		1	2										
small Gephyrocapsa	8	2								2			4
Hayaster perplexus						+	+	+	+	+	+	?	
Helicosphaera carteri	+	2	2	1	2	1	+	1	2	3	2	+	1
Helicosphaera euphratis													
Helicosphaera granulata		1											
Helicosphaera hyalina												1	
Helicosphaera intermedia													
Helicosphaera neogranulata				?			?			1		?	?
Helicosphaera solii	5	+	2	2	1	?	+	?		?		?	?
Helicosphaera wallichii		+	+	1	1	+	?	+	+	?		?	?
Oolithus fragilis	1	1	5		1	1	4	5	2	8	4	8	1
Pontosphaera spp.		+	+	+	?	?	?	?	+	+	+	?	
Pseudoemiliania lacunosa	8	8	3	2	1	2	1	+	?	+	?	1	2
Reticulofenestra ampla								?	?				
Reticulofenestra asanoi	1	+	2		?			?		?	1	3	
Reticulofenestra gelida													1
Reticulofenestra haagi						1	6	2		1	2		
Reticulofenestra minuta	86	74	132	108	158	116	160	164	154	109	99	77	95
Reticulofenestra minutula	46	72	15	47	14	48	8	11	20	57	63	62	60
Reticulofenestra pseudoubillica													4
Rhabdosphaera daviger				1	?								
Rhabdosphaera stylifer												?	
Scapholithus fossilis											+		
Scyphosphaera spp.							+		+		+		
Sphenolithus abies							?				+	12	4
Sphenolithus belemnos													
Sphenolithus compactus													
Sphenolithus conicus													
Sphenolithus delphix													
Sphenolithus dissimilis													
Sphenolithus grandis													
Sphenolithus heteromorphus													
Sphenolithus moriformis													
Syracosphaera pulchra	2	1	+	+	+	2	3		1	1		1	1
Tetralithides symeonidesii		1	1	+	+	1			1			1	1
Triquetrorhabdus carinatus													
Triquetrorhabdus milowii													
Triquetrorhabdus rugosus													
Umbilicosphaera sibogae	11	9	5	11	2	2	1	2	1	3	5	11	6
Miscellaneous						6							

Note: + = trace and ? = present but questionable.



Table 14 (continued).

Core	11H	12H	12H	13H	13H	14H	14H	15H	15H	16H	16H	17H	17H	18H	18H	19H	
Section	CC	4	CC	4	CC	4	CC	4	CC	4	CC	4	CC	4	CC	4	
Interval (cm)	26-27		25-26		26-27		26-27		26-27		26-27		26-27		26-27		
Zone (Matini, 1971)	NN15-NN13							NN12					NN11				
Amaurolithus amplificus																	+
Amaurolithus delicatus																	
Amaurolithus pimus																	
Amaurolithus tricomulatus				?			+										
Calcidiscus leptoporus	18	16	2	7	23	6	18	6	16	7	8	8	17	4	8	9	
Calcidiscus macintyreii	2	?	+	1	4	3	1	1	+			2	1	2	2	3	
Calcidiscus premacintyreii									+			1	1	+		?	
Catinaster calyculus																	
Catinaster coalitus																	
Ceratolithus acutus									+	+	+						
Ceratolithus rugosus	?		+	+	+	+	+	+									
Coccolithus crassipons																	+
Coccolithus miopelagicus																	
Coccolithus pelagicus										1	3			+	+	+	
Coccolithus streckeri											?				+	?	
Coronocyclus nitescens							?		?	?							?
Cyclcarpolithus floridanus																	
Cyclolithella annula	11		+	5	7	7	2	4	3	?	+	4	2	1	1	3	
Dicystococcolites productus	1			4	1	2		6	3	3	8	2	3	2	2		
Discoaster adamantus																	
Discoaster asymmetricus	?	?		+	?		+	?		?	?	?					
Discoaster bellus																	
Discoaster berggrenii															+	+	+
Discoaster blackstockae																	
Discoaster bollii																	
Discoaster brouweri	1	2	+	+	2	+	?	?	+	5	1		1	+	+	+	
Discoaster calcaris												+					
Discoaster challengerii	?								+								?
Discoaster docorus																	
Discoaster deflandrei																	
Discoaster druggii																	
Discoaster exilis																	
Discoaster fomesus																	
Discoaster hamatus																	
Discoaster kugleri																	
Discoaster loeblichii																	
Discoaster neohamatus																	
Discoaster neorectus								?	?		?						
Discoaster pansus																	
Discoaster pentaradiatus	?	1	?	?	?	+	?	+	?				?	1	?	?	
Discoaster prepentariatus																	
Discoaster quinqueramus															+	+	5
Discoaster surculus	?		+	+	+	+	+	+	+		1	+	1	+	+	+	
Discoaster triadiatus	?			?	?	+		?	+		?						
Discoaster variabilis	1	?	?	?	?					?						+	+
Discoaster spp.		2								1							1
Discolithina japonica																	
Ericsonia obruta																	
Gephyrocapsa aperta	2		1					?									
Gephyrocapsa sinuosa																	
small Gephyrocapsa	1	1															
Hayaster perplexus			+	+	+	+	+			+		+		+	?	?	
Helicosphaera carteri	2	3	+	5	1	+	1	2	1	4	1	+	1	3	1	1	
Helicosphaera euphratis																	
Helicosphaera granulata																1	2
Helicosphaera hyalina																	
Helicosphaera intermedia										?	?						
Helicosphaera neogranulata					1			?	?	1		?	1	1			
Helicosphaera sollii	?	?	?	?	?												
Helicosphaera wallichii	?			?	1		?		?	?	?		?	2	?	1	
Oolithotus fragilis	3	4				+				1							
Pontosphaera spp.				+	?	1	?	?	+	2	1	?	?	?	+	1	
Pseudoemiliania lacunosa		?	?														
Reticulofenestra ampla																	
Reticulofenestra asanoi												2					
Reticulofenestra gelida	3	2	+	1	8	3	7	2	5	4	6	3	+	2	+	4	
Reticulofenestra haqii					1	15	5	1	8	25	41	23	17	13	19	7	
Reticulofenestra minuta	78	95	169	129	100	133	112	154	106	17	14	34	23	16	109	55	
Reticulofenestra minutula	30	5	5	6	11	10	21	2	29	32	40	55	49	51	29	50	
Reticulofenestra pseudoubillica	5	6	1	5	13	7	18	8	8	17	27	14	2	5	1	3	
Rhabdosphaera daviger																	
Rhabdosphaera stylifer					?	?											
Scapholithus fossilis																	
Scyphosphaera spp.						+					+						
Sphenolithus abies	38	47	19	27	27	13	12	13	20	69	28	54	79	91	26	53	
Sphenolithus belemnos																	
Sphenolithus compactus																	
Sphenolithus conicus																	
Sphenolithus delphix																	
Sphenolithus dissimilis																	
Sphenolithus grandis																	?
Sphenolithus heteromorphus																	
Sphenolithus moriformis	?			4					?	10	5		1	3		1	
Syracosphaera pulchra				+			?	+	+	?							
Tetralithides symeonidesii	+	2	1	3	+		1	+			5	3	+	1	1	+	
Triquetrorhabdus carinatus		1															
Triquetrorhabdus milowii																	
Triquetrorhabdus rugosus													+	+	1	+	+
Umbilicosphaera sibogae	4	12	2	2			2	1		?	5	?					
Miscellaneous		1		1										1			1

Table 14 (continued).

Core Section	19H	20H	20H	21H	21H	22H	22H	23H	23H	24H	24H	25H	25H	26H	26H	27H
Interval (cm)	CC	4	CC	4	CC	4	CC	4	CC	4	CC	4	CC	4	CC	4
Zone (Matini, 1971)	26-27		26-27		26-27		26-27		26-27		26-27		26-27		26-27	
	NN11															
Amaurolithus amplificus			?			+		+								
Amaurolithus delicatus													+			
Amaurolithus primus						+								+	+	
Amaurolithus tricomiculatus																
Calcidiscus leptoporus	5	2	12	8	10	29	14	20	10	14	8	12	10	15	12	15
Calcidiscus macintyreii	+	1	?	?	?	1	3	1	5	3	1	+	+	+	+	+
Calcidiscus premacintyreii	+	2	?	1	+	4	2	4	2	1	+	1	3	1	1	+
Catinaster calyculus																
Catinaster coarctatus																
Ceratolithus acutus																
Ceratolithus rugosus																
Coccolithus crassiporus																
Coccolithus miopelagicus																
Coccolithus pelagicus	+	+	+		1	2	3	5	5	4	2	7	1	2	7	1
Coccolithus streckeri		+							?						1	
Coronocyclus nitescens						?					?	?				?
Cyclargolithus floridanus																
Cyclotella annula	5	?	3	+	3	6	3	6	4	2	+	+	+	1	1	2
Diclyococites productus			4		1	6	3	6	1	3	1	1	2	4		2
Discoaster adamantus																?
Discoaster asymmetricus		?					+	+	+	+			+	?		?
Discoaster bellus													1	+	?	?
Discoaster berggrenii	+		?	1	+	+	2	+	1	+	+	1	+	+	+	?
Discoaster blackstockae													?			
Discoaster bollii																
Discoaster brouweri	+	+	+	+	+	+	1	2	1	1	+	+	1	+	1	+
Discoaster calcaris																
Discoaster challengerii		+	+					1				+				
Discoaster decorus																
Discoaster deflandrei																
Discoaster druggii																
Discoaster oxilis																?
Discoaster formosus																
Discoaster hamatus																
Discoaster kugleri																
Discoaster looblichii																
Discoaster neohamatus				?		?	+	+	+	?						
Discoaster neorectus	?			1		?		+	+			?		+		+
Discoaster pansus								?								
Discoaster pentaradiatus	+	?	+	+	+	+		+				+	+			
Discoaster prepentaradiatus																
Discoaster quinqueramus		+	+	1	+	1	1	+	+	1	+	1		1	1	
Discoaster surculus	+	1	+	+		+	3	1	+	+	+	+	?	1	+	+
Discoaster triaratus		+		?	?	+		?	?			+				
Discoaster variabilis	+	+	+			+	1	+	1	+		+			+	+
Discoaster spp.		3		1								1	1		1	
Discolithina japonica																
Ericsonia obruta																
Gephyrocapsa aperta																
Gephyrocapsa sinuosa																
small Gephyrocapsa																
Hayaster perplexus	1	+	?	+	+	+		1	+	+		+	+	+	+	+
Helicosphaera cartorii	1	+	+	+	+	+	?	1	+	+	+	1	+	1	+	+
Helicosphaera euphratis																
Helicosphaera granulata	1	1	1	+	1	+	2	+	+	1	1	+	1	+	+	+
Helicosphaera hyalina																
Helicosphaera intermedia																
Helicosphaera neogranulata																
Helicosphaera solii																
Helicosphaera wallichii	1			?					?			?		?		
Oolithotus fragilis																
Pontosphaera spp.	+	+	+	+	+				1	+	+		+			+
Pseudoemiliania lacunosa																
Reticulofenestra ampla																
Reticulofenestra asanoi																
Reticulofenestra goida	10	3	+	5	1	16	20	13	29	13	14	10	8	6	7	1
Reticulofenestra haqii	17	7	4	9	6	10	11	9	26	21	18	11	17	17	27	38
Reticulofenestra minuta	50	53	108	72	91	35	13	39	40	52	94	61	71	62	23	37
Reticulofenestra minutula	33	54	29	22	3	19	20	12	7	7	2	12	17	21	52	32
Reticulofenestra pseudumbilica	3	4	2	13	5	10	19	21	11	9	1	11	12	6	9	2
Rhabdosphaera claviger																
Rhabdosphaera styifer																
Scapholithus fossilis																
Scyphosphaera spp.	+	+	+	+	+	+	2	+	1	1	+		+	+	+	+
Sphenolithus abies	73	69	34	63	72	57	68	53	49	62	54	58	53	58	52	62
Sphenolithus belemnos																
Sphenolithus compactus			1	2	3	4	2	3	1	5		4		1	3	4
Sphenolithus conicus																
Sphenolithus delphix																
Sphenolithus dissimilis																
Sphenolithus grandis																
Sphenolithus heteromorphus																
Sphenolithus moriformis			1			+	1						1	+	?	+
Syracosphaera pulchra																
Tetralithes symeonidesii		+		1	1	1			+	2	+			1		1
Triquetrorhabdus carinatus																
Triquetrorhabdus milowii																
Triquetrorhabdus rugosus	+	+	+	+	1	1	2	1	2	+	1	4	1	1	+	1
Umbilicosphaera sibogae																
Miscellaneous			1		1	4	7	7	3	1		4		1	2	2

Table 14 (continued).

Core	27H	28H	28H	29H	29H	30H	30H	31H	31H	32H	32H	33H	33H	34H	34H	35X	
Section	OC	4	OC	4	OC	4	OC	4	OC	4	OC	4	OC	4	OC	3	
Interval (cm)	26-27		26-27		26-27		26-27		26-27		26-27		26-27		26-27		
Zone (Molini, 1971)	NN11								NN10								
Amaurolithus amplifucus																	
Amaurolithus delicatus																	
Amaurolithus primus																	
Amaurolithus tricomiculatus																	
Calcidiscus leptoporus	17	3	12	9	12	12	11	29	21	13	35	28	40	28	21	7	
Calcidiscus macintyrei	1	+	+	2	1	+	3	+	+	1	2	3	4	6	1	2	
Calcidiscus premacintyrei	1	+	+	+	+	1	4	+	6	2	9	5	4	4	2		
Catinaster calyculus																	
Catinaster coalitus																	
Ceratolithus acutus																	
Ceratolithus rugosus																	
Coccolithus crassiporus																	
Coccolithus miopelagicus					?			1	?		2	2		2			
Coccolithus pelagicus	1	3	+	5	8	5	6	12	8	4	8	10	31	19	19	10	
Coccolithus streckerii	?			?	?		?					?	?				
Coronocyclus nitescens	?	1		?	?							+			+		
Cyclargolithus floridanus																	
Cyclolitha annula	2	+	2	2	2	?	1	3		?	1	4	4	2	+	?	
Diclyococclites productus	1	5				1			3	1	2						
Discoaster adamanteus																	
Discoaster asymmetricus					+		?			?							
Discoaster bellus	?	?			?	?	?	?	?	1	?	?	1	?	?	+	
Discoaster berggrenii	+	+	+	+	+	+	+	?									
Discoaster blackstockae																	
Discoaster bollii																	
Discoaster brouweri	+	+	+	+	1	+	+	4	+	1	+	+	4	10	1		
Discoaster calcaris										?				1	+		
Discoaster challengerii	?		+				+			+			+				
Discoaster docorus																	
Discoaster deflandrei								?									
Discoaster druggii																	
Discoaster exilis																	
Discoaster formosus																	
Discoaster hamatus															?		
Discoaster kugleri																	
Discoaster loeblichii																	
Discoaster neohamatus				?	+	+		2	?	?	2	2	2	1	+	+	
Discoaster neorectus	+							?	?	?		2	?	2	?	?	
Discoaster pansus									?								
Discoaster pentaradiatus	+					+			+			+	?				
Discoaster prepentaradiatus															+	1	
Discoaster quinqueramus	+	?	?		1	+	+										
Discoaster surculus	+	+			+		?			?							
Discoaster triadiatus	?				?		?			?							
Discoaster variabilis	+	+	+	+	1	2	+	7	+	1	+	+	1	+	+	5	
Discoaster spp.													5	3			
Discolithina japonica																	
Ericsonia obruta	1	2	1								2	1					
Gephyrocapsa aperta																	
Gephyrocapsa sinuosa																	
small Gephyrocapsa																	
Hayaster perplexus				+				+	+		1	+	1		+		
Helicosphaera carteri	1	1	+	+	2	+	2	+	+	1	+	3	+	+	1	+	
Helicosphaera euphratis																	
Helicosphaera granulata	+	+	1	+	+	1	1	4	3	2	2	7	2	2	+	2	
Helicosphaera hyalina																	
Helicosphaera intermedia				?											+		
Helicosphaera neogranulata																	
Helicosphaera sollii																	
Helicosphaera wallichii			?	?													
Oolithus fragilis																	
Pontosphaera spp.	+	+						1				+	2				
Pseudoemiliania lacunosa																	
Reticulofenestra ampla																	
Reticulofenestra asanoi																	
Reticulofenestra golida				1	1	1		1						7	18	79	
Reticulofenestra hagii	40	40	54	63	41	54	30	26	39	7	5			+	4	3	
Reticulofenestra minuta	46	70	70	47	15	39	27	33	34	17	49	3	1	2			
Reticulofenestra minutula	37	12	20	15	13	9	9	2	2	5				+	1		
Reticulofenestra pseudoubilica								1						+	2	10	25
Rhabdosphaera daviger																	
Rhabdosphaera stylifer																	
Scapholithus fossilis																	
Scyphosphaera spp.	+	+	+	+	+	1	+	1		2	+	1		1	+		
Sphenolithus abies	52	63	39	53	99	70	99	60	65	122	73	117	83	95	94	42	
Sphenolithus belemnos																	
Sphenolithus compactus			1	3	2	2	2	8			4	6	4	4	7	6	
Sphenolithus conicus																	
Sphenolithus dolphix																	
Sphenolithus dissimilis																	
Sphenolithus grandis																	
Sphenolithus heteromorphus																	
Sphenolithus moriformis			+		1	2	4	2	18	15	+	6	3	4	17	13	
Syracosphaera pulchra																	
Tetralithides symeonidesii			+	+							2						
Triquetrorhabdus carinatus																	
Triquetrorhabdus milowii															?	?	
Triquetrorhabdus rugosus	+	+	+	+	+	+	1	3	+	1	1	2	4	3	1	1	
Umbilicosphaera sibogae																	
Miscellaneous									1	4			4	2	3	4	

Table 14 (continued).

Core	35X	36X	36X	37X	37X	38X	38X	39X	39X	40X	40X	41X	41X	42X	42X	43X
Section	CC	4	CC	3	CC	2	CC	3	CC	3	CC	3	CC	4	CC	4
Interval (cm)		26-27		26-27		26-27		26-27		26-27		26-27		26-27		26-27
Zone (Matrini, 1971)	NN10					NN9				NN8				NN7-NN6		
<i>Amaurolithus amplifolius</i>																
<i>Amaurolithus dollicatus</i>																
<i>Amaurolithus primus</i>																
<i>Amaurolithus tricomiculatus</i>																
<i>Calcidiscus leptoporus</i>	4	12	5	16	26	29	21	17	23	4	7	7	3	14	10	7
<i>Calcidiscus macintyre</i>	3	3	4	8	16	9	6	5	10	8	11	8	6	3	5	2
<i>Calcidiscus premacintyre</i>	+	+	3	5	1	5	2	1	2	+	2	1	1	2	1	2
<i>Catinaster calyculus</i>					+	+	1	+								
<i>Catinaster coalitus</i>					?		+	+	+	1						
<i>Ceratolithus acutus</i>																
<i>Ceratolithus rugosus</i>																
<i>Coccolithus crassiporus</i>																
<i>Coccolithus miopelagicus</i>	?	11	?	1	2	1	2	9	1	1	6	1	1	+	+	1
<i>Coccolithus pelagicus</i>	11	14	6	4	20	9	7	23	9	12	67	50	22	12	15	24
<i>Coccolithus streckeri</i>			?					?		1					+	+
<i>Coronocyclus nitescens</i>					?		1	1	?	+						
<i>Cyclicargolithus floridanus</i>																
<i>Cyclolithella annula</i>	1		2	?	2	+	?	?	+			?		+	7	+
<i>Dictyococites productus</i>										+	1		1	4	2	
<i>Discoaster adamanteus</i>					1									?		
<i>Discoaster asymmetricus</i>																
<i>Discoaster bellus</i>			?	1	4	4	2	4	?							
<i>Discoaster berggrenii</i>																
<i>Discoaster blackstockae</i>																
<i>Discoaster bollii</i>											?					
<i>Discoaster brouweri</i>	?				1	+	?		?		1					
<i>Discoaster calcaris</i>	+	3	1	1					?							
<i>Discoaster challengerii</i>			2					+	+	1	1					
<i>Discoaster decorus</i>																
<i>Discoaster deflandrei</i>								+	1					?	?	2
<i>Discoaster druggii</i>																
<i>Discoaster oxilis</i>					1				1	1	1	+	1	?	?	1
<i>Discoaster formosus</i>																
<i>Discoaster hamatus</i>		?	+	3	+	1	1	+								
<i>Discoaster kugleri</i>																2
<i>Discoaster loeblichii</i>																
<i>Discoaster neohamatus</i>	1	1	3						?							
<i>Discoaster neorectus</i>																
<i>Discoaster panus</i>			?													
<i>Discoaster pentaradiatus</i>																
<i>Discoaster prepentaradiatus</i>	1		+		?			1		1	1	?	?	1		
<i>Discoaster quinqueramus</i>																
<i>Discoaster surculus</i>				?				?	1							
<i>Discoaster triadiatus</i>																
<i>Discoaster variabilis</i>	+	2	3	1	3	1	+	2	4	4	5	+	6	1	2	3
<i>Discoaster spp.</i>	3	8		5	2		1		5	1	4	1	3			
<i>Discolithina japonica</i>																
<i>Ercosonia obruta</i>										2						
<i>Gephyrocapsa aperta</i>																
<i>Gephyrocapsa sinuosa</i>																
small <i>Gephyrocapsa</i>																
<i>Hayaster perplexus</i>	+		+	2	+	+	1	+	1	+	1	+		+		2
<i>Helicosphaera carteri</i>					+		1	?	2	+		+	+	2	1	
<i>Helicosphaera euphratis</i>																
<i>Helicosphaera granulata</i>	+	+	1	1	4		+	1	1	+	1	+	4	2	3	+
<i>Helicosphaera hyalina</i>																
<i>Helicosphaera intermedia</i>																
<i>Helicosphaera neogranulata</i>																
<i>Helicosphaera solii</i>																
<i>Helicosphaera wallichii</i>																
<i>Oolithothus fragilis</i>																
<i>Pontosphaera spp.</i>		+			+				1							
<i>Pseudoemiliania lacunosa</i>																
<i>Reticulofenestra ampla</i>																
<i>Reticulofenestra asanoi</i>																
<i>Reticulofenestra goida</i>	82	84	103	102	71	109	110	105	102	104	50	105	94	69	72	84
<i>Reticulofenestra haqi</i>	8	1	13	2	1		7	2	3	13	8	5	14	32	32	8
<i>Reticulofenestra minuta</i>			1				1				1			2	1	1
<i>Reticulofenestra minutula</i>		1	7		1	1	3	2	1	4	1	?	1	10	7	2
<i>Reticulofenestra pseudoubilica</i>	10	11	9	10	9	11	24	13	18	21	12	6	13	20	25	48
<i>Rhabdosphaera daviger</i>																
<i>Rhabdosphaera styifer</i>																
<i>Scapholithus fossilis</i>																
<i>Scyphosphaera spp.</i>			+		1		+	1	+			1				
<i>Sphenolithus abies</i>	54	27	17	20	18	12	4	4	2	4	5	6	12	15	12	6
<i>Sphenolithus belemnus</i>																
<i>Sphenolithus compactus</i>	7	6	9	4	7	1		1	2	3	4	3	4	5	1	1
<i>Sphenolithus conicus</i>																
<i>Sphenolithus dolphix</i>																
<i>Sphenolithus dissimilis</i>																
<i>Sphenolithus grandis</i>																
<i>Sphenolithus heteromorphus</i>																
<i>Sphenolithus moriformis</i>	8	1	8	7	1	4	2	6	2	5	5	1	3	3	1	1
<i>Syracosphaera pulchra</i>																
<i>Tetralithides symeonidesii</i>			+										+			
<i>Triquetrorhabdus carinatus</i>																
<i>Triquetrorhabdus milowii</i>		1			1					1						
<i>Triquetrorhabdus rugosus</i>	1	4	2	5	2	2	1	1	2	4	3	1	5	1	+	3
<i>Umbilicosphaera sibogae</i>																
Miscellaneous	6	10	1	2	5	1	2	1	5	5	2	2	6	2	3	



Table 14 (continued).

Core	43X	44X	44X	45X	45X	46X	46X	47X	47X	48X	48X	49X	49X	50X	50X	51X
Section	CC	4	CC	3	CC	4	CC	3	CC	4	CC	4	CC	3	CC	4
Interval (cm)		26-27		26-27		26-27		26-27		26-27		26-27		26-27		26-27
Zone (Matini, 1971)																
Amaurolithus amplifolius																
Amaurolithus delicatus																
Amaurolithus primus																
Amaurolithus tricomaculatus																
Calcidiscus leptoporus	2	19	2	8	8	8	23	5	9	10	4	7	14	1	9	7
Calcidiscus macintyreii	4	2	+	2	1	2	5	1	1	+		1	1	1	+	+
Calcidiscus premadintyreii	?	+	1	4	1	+			+			+	3			1
Catinaster calyculus																
Catinaster coarctatus																
Ceratolithus acutus																
Ceratolithus rugosus																
Coccolithus crassiporus																
Coccolithus miopelagicus	1	4	5	3	5	5	3	7	2	2	16	14	7	8	20	4
Coccolithus pelagicus	22	27	28	18	10	15	18	13	13	21	20	34	30	43	25	2
Coccolithus streckerii		+	1	1		?	?		+	1	1					
Coronocyclus rufescens		?			+	+	7	2	1	+	2	+	+	+	+	1
Cyclargolithus floridanus								1		?					+	+
Cyclolithella annula		4		1	?	9	10		?	9	1	1	1	?	?	1
Dictyococcus productus				1			1		2	4	1		1			
Discoaster adamantus	?					1				?						
Discoaster asymmetricus																
Discoaster bellus																
Discoaster berggrenii																
Discoaster blackstockae																
Discoaster bollii					?	?		1								
Discoaster brouweri																
Discoaster calcaris																
Discoaster challengerii		?														
Discoaster decorus																
Discoaster deflandrei	3	1	2	6	1	4	2	5	3	1	2	2	3	4	6	2
Discoaster druggii											1				?	
Discoaster exilis	1	?	?	+	1	+		1	1	?	?	?	+	?	?	
Discoaster formosus								?								1
Discoaster hamatus																
Discoaster kugleri	?		?	?												
Discoaster loeblichii																
Discoaster neohamatus																
Discoaster neorectus																
Discoaster pansus																
Discoaster pentaradiatus																
Discoaster prepentaradiatus																
Discoaster quinqueramus																
Discoaster surculus																
Discoaster triradiatus																
Discoaster variabilis	1	3	?	4	1	?	1	?	?	?	1	2	2	3	2	2
Discoaster spp.	1	3	1	3				1			2	1	2	3	2	1
Discolithina japonica																
Ericsonia obruta																
Gephyrocapsa aperta																
Gephyrocapsa sinuosa																
small Gephyrocapsa																
Hayaster perplexus	+	1		+				1	1	+	+	+	?	+	+	+
Helicosphaera carteri		2		+	+	1	1	3		+	4	1	3	1	2	
Helicosphaera euphratis																
Helicosphaera granulata	+	3	2	1	1	3	2	1	+	1	1	1	2	2	1	1
Helicosphaera hyalina																
Helicosphaera intermedia																+
Helicosphaera neogranulata																
Helicosphaera sellii																
Helicosphaera wallichii																
Oolithothus fragilis																
Pontosphaera spp.		1				+	+					1	+	1	1	+
Pseudoemiliania lacunosa																
Reticulofenestra ampla																
Reticulofenestra asanoi																
Reticulofenestra gelida	93	61	77	78	109	63	60	58	96	71	67	57	50	62	53	28
Reticulofenestra haqii	28	27	43	27	34	39	16	35	20	31	28	17	32	28	19	80
Reticulofenestra minuta	1		4	3	2	7	10	1	3		12	1	12	3	5	23
Reticulofenestra minutula	7	10	3	6	4	7	1	3		4	3	9	8	3	5	12
Reticulofenestra pseudoubillica	28	21	16	17	10	17	25	25	18	20	20	39	15	29	28	19
Rhabdosphaera daviger																
Rhabdosphaera stylifer																
Scapholithus fossilis																
Scyphosphaera spp.		+	+		1		1	+	+	1	+	+		+		+
Sphenolithus abies	3	3	9	6	6	7	6	23	13	9	7	5	8	6	13	1
Sphenolithus belemnos																
Sphenolithus compactus	1	1	1	1		1	1	3	2	2	2	2	1		1	3
Sphenolithus conicus																
Sphenolithus dolphix																
Sphenolithus dissimilis																1
Sphenolithus grandis																
Sphenolithus heteromorphus									1							6
Sphenolithus moriformis	2	6	4	2	1	2	+	3	8	4	+				2	1
Syracosphaera pulchra																
Tetralithides symeonidesii		?														
Triquetrorhabdus carinatus																
Triquetrorhabdus milowii																
Triquetrorhabdus rugosus	2	1	1	8	2	1	2	6	6	6	5	2	+	4	2	3
Umbilicosphaera sibogae																
Miscellaneous					2	8	5	1		1	1	2	4	1		3

Table 14 (continued).

Core Section	51X	52X	52X	53X	53X	54X	54X	55X	55X	56X	56X	57X	57X	58X	58X	59X
Interval (cm)	CC	3	CC	2	CC	4	CC	4	CC	2	CC	4	CC	4	CC	4
Zone (Matini, 1971)	NN5-NN4															
Interval (cm)	26-27	26-27	26-27	26-27	26-27	26-27	26-27	26-27	26-27	26-27	26-27	26-27	26-27	26-27	26-27	26-27
Amaurolithus amplifucus																
Amaurolithus delicatus																
Amaurolithus primus																
Amaurolithus tricomiculatus																
Calcidiscus leptoporus	3	1	7	5	1	10	10	11	7	2	5	12	7	7	5	4
Calcidiscus macintyreii	1	3	3	+	+	2	3	1	2	1	+	1	1	+	2	
Calcidiscus premacintyreii	1		1			1	2	3	1	+	1		1	+		1
Catinaster calyculus																
Catinaster coalitus																
Ceratolithus acutus																
Ceratolithus rugosus																
Coccolithus crassipons																
Coccolithus miopelagicus	18	1	5	5	8	2	+	9	8	7	9	19	7	7	21	12
Coccolithus pelagicus	22	9	23	22	17	18	3	10	27	19	20	19	50	11	19	9
Coccolithus strockerii					+			1	?			?				
Coronocyclus nitescens	+	+	+	+	1	+		+	2	+	1	?	+	1	1	
Cyclargolithus floridanus	7	44	27	38	28	10	4	9	23	34	40	44	22	46	32	47
Cyclotella annula			6	?	?	?	?		4			2	1	4	1	
Diclyococclites productus	1			1					1							
Discoaster adamantus		1				?							?		?	
Discoaster asymmetricus																
Discoaster bolius																
Discoaster berggrenii																
Discoaster blackstockae																
Discoaster bollii																
Discoaster brouweri																
Discoaster calcaris																
Discoaster challengerii																
Discoaster decorus																
Discoaster deflandrei	1	7	9	9	22	3	6	16	9	17	13	38	11	19	15	23
Discoaster druggii	?		1		1	2		?	1		?	2	3			
Discoaster exilis	?	5	3	?	2	1	?	?	1	1	?	?		1	1	1
Discoaster formosus												?	+			
Discoaster hamatus																
Discoaster kugleri																
Discoaster loeblichii																
Discoaster neohamatus																
Discoaster neorectus																
Discoaster pansus																
Discoaster pentaradiatus																
Discoaster prepentaradiatus																
Discoaster quinqueramus																
Discoaster surculus																
Discoaster tiradiatus																
Discoaster variabilis	5	5	3	4	3	12	?	4	8	4	6	12	1		4	5
Discoaster spp.	6	10	4	3	2	8		7	3	6	4	7	3	2	3	3
Discolithina japonica																
Ericsonia obruta												?				
Gephyrocapsa aperta																
Gephyrocapsa sinuosa																
Small Gephyrocapsa																
Hayaster perplexus		+	2	+	+	2	+	4	1	+	5	1		4	2	3
Helicosphaera carteri	2	+	+	1	3		4	2		1						
Helicosphaera euphratis																
Helicosphaera granulata	1	+	+	1	1	1	+	6	1	2		5	3		+	+
Helicosphaera hyalina																
Helicosphaera intermedia	+						+									
Helicosphaera neogranulata																
Helicosphaera solii																
Helicosphaera wallichii																
Oolithus fragilis																
Pontosphaera spp.		+	+	+		?	+				1		+			
Pseudoemiliania lacunosa																
Reticulofenestra ampla																
Reticulofenestra asanoi																
Reticulofenestra golida	38	9	34	4	19	10	23	8	5	1	5		1	8	8	
Reticulofenestra haqii	36	12		27	18	26	87	38	33	38	55		3	1	4	
Reticulofenestra minuta	1			26			12	15	4	18	10	1	2	2		
Reticulofenestra minutula	5		13	27	15	20	9	20	26	8	3		1	10	4	1
Reticulofenestra pseudoubilica	16	28	12	10	24	18	8	12	10				3	5	3	
Rhabdosphaera daviger																
Rhabdosphaera stylifer																
Scapholithus fossilis																
Scyphosphaera spp.	2	+	1	1	+		+	+	+	1	1	3	2			
Sphenolithus abies	4	4	4	1		2		1		1				1		1
Sphenolithus belemnus																
Sphenolithus compactus	2	2	4	1	3	1	2						1	1	1	3
Sphenolithus conicus	?	10	1	+	2	1	?									
Sphenolithus delphix																
Sphenolithus dissimilis																
Sphenolithus grandis																
Sphenolithus heteromorphus	13	37	18	10	17	30	7	12	13	18	8	15	39	40	18	43
Sphenolithus moriformis	10	6	8	1	1	5	2	1	7	14	10	14	29	26	49	42
Syracosphaera pulchra																
Tetralithes symeonidesii							1	3			+	1	3	1		
Triquetrorhabdus carinatus		?		?								?	1	1	?	
Triquetrorhabdus milowii																
Triquetrorhabdus rugosus	3	6	4	3	4	8	1	2	2	2	2	3	2	1		2
Umbilicosphaera sibogae																
Miscellaneous	2		7		8	7	16	5	1	5	1	1	3	1	7	

Table 14 (continued).

Core	59X	60X	60X	61X	61X	62X	62X	63X	63X	64X	64X	65X	65X	66X	66X	67X	
Section	CC	3	CC	4	CC	4	CC	4	CC	1	CC	3	CC	4	CC	1	
Interval (cm)		26-27		26-27		26-27		26-27		43-44		26-27		26-27		26-27	
Zone (Matini, 1971)		NN5-NN4				NN3				NN2				NN1			
Amaurolithus amplifucus																	
Amaurolithus delicatus																	
Amaurolithus primus																	
Amaurolithus tricomulatus																	
Calcidiscus leptoporus	2	1	6	4	1		1		1	1	2	4	4		1	1	
Calcidiscus macintyreii		1					+	+		1	+	+			2	+	
Calcidiscus promacintyreii							2	1									
Catinaster calyculus																	
Catinaster coalitus																	
Ceratolithus acutus																	
Ceratolithus rugosus																	
Coccolithus crassiporus																	
Coccolithus miopelagicus	8	6	6	9	17	6	7	6	10	8	8	7	11	5	3	5	
Coccolithus pelagicus	16	33	39	14	28	41	38	36	17	31	25	27	34	12	7	5	
Coccolithus strockerii			1					+									
Coronocyclus nitescens	+	1	+	+	1	3	1	1	2	2	1	4	2	1	2	+	
Cyclidargolithus floridanus	27	58	39	26	28	45	58	58	70	64	26	12	30	19	14	23	
Cyclolithella annula	1	?	2		+	?	2	1	?								
Dictyococcites productus										1							
Discoaster adamantus	1		?	2	1			1	?		2	?			2	1	
Discoaster asymmetricus																	
Discoaster bellus																	
Discoaster berggrenii																	
Discoaster blackstockae																	
Discoaster bollii																	
Discoaster brouweri																	
Discoaster calcaris																	
Discoaster challengerii																	
Discoaster decorus																	
Discoaster deffandrii	32	24	16	60	54	43	19	24	16	31	25	17	26	24	12	25	
Discoaster druggii				?			?	+				+		+	+		
Discoaster exilis																	
Discoaster formosus																	
Discoaster hamatus																	
Discoaster kugleri																	
Discoaster loeblichii																	
Discoaster neohamatus																	
Discoaster neorectus																	
Discoaster pansus																	
Discoaster pentaradiatus																	
Discoaster prepentaradiatus																	
Discoaster quinquemurium																	
Discoaster surculus																	
Discoaster tetraradiatus																	
Discoaster variabilis	1	7	2	4	1	4	3	2	?	2	2		2			1	
Discoaster spp.	4	1	1	2		1	1		1	1							
Discolithina japonica																	
Ericsonia obruta	?	1					2			2	6	3	2	4	4	+	
Gephyrocapsa aperta																	
Gephyrocapsa sinuosa																	
small Gephyrocapsa																	
Hayaster perplexus	+	+	4	1	+	+	+	+		2	2	1	1	+	1		
Helicosphaera carteri			+								1	+					
Helicosphaera euphratis									+								
Helicosphaera granulata	+	+	+	+	+					+		+					
Helicosphaera hyalina																	
Helicosphaera intermedia				1													
Helicosphaera neogranulata																	
Helicosphaera sellii																	
Helicosphaera wallichii																	
Oolithus fragilis																	
Pontosphaera spp.				+													
Pseudoemiliania lacunosa																	
Reticulofenestra ampla																	
Reticulofenestra asanoi																	
Reticulofenestra gelida	5	4	14	1	6	1	4	13	19	7	39	30	33	52	28	20	
Reticulofenestra haagi	1		4	9	4	11		11	13	1	6	34	17	29	63	45	
Reticulofenestra minuta	1		5	3							4		1		2	9	
Reticulofenestra minutula	2		4	16	4	2	1	5	2			12	2	14	6	3	
Reticulofenestra pseudoubilica	9	2	13	1	4	7	15	16	11	7	8	6	7	1	12	3	
Rhabdosphaera daviger																	
Rhabdosphaera styfferi																	
Scapholithus fossilis																	
Scyphosphaera spp.		+	+														
Sphenolithus abies					1		1			1	2						
Sphenolithus belemnus						7	5	3	5	9							
Sphenolithus compactus	1	1	1	1	6	1					1	5	3	1	3	3	
Sphenolithus conicus									?			+					
Sphenolithus delphix																	
Sphenolithus dissimilis											5	6	9	7	4	7	
Sphenolithus grandis																	
Sphenolithus heteromorphus	14	10	11	6													
Sphenolithus moriformis	73	46	30	37	40	23	29	17	27	15	26	17	9	24	23	35	
Syracosphaera pulchra																	
Tetraclitides symeonidesii							1				1						
Triquetrorhabdus carinatus			?				4	1	3	7	4	4	1	3	10	9	
Triquetrorhabdus milowii								1			1					3	
Triquetrorhabdus rugosus	2	3	+	2	3	?										+	
Umbilicosphaera sibogae																	
Miscellaneous		1	2	1	1	5	6	3	3	6	4	11	6	4	1	2	

Table 14 (continued).

Core	67X	68X	68X	69X	69X	70X	70X	71X	71X	72X	72X	73X	73X	74X	74X	75X
Section	CC	1	CC	2	CC	2	CC	2	CC	2	CC	4	CC	2	CC	3
Interval (cm)		26-27		26-27		26-27		26-27		26-27		26-27		26-27		26-27
Zone (Matini, 1971)	NN1															
Amaurolithus amplificus																
Amaurolithus delicatus																
Amaurolithus primus																
Amaurolithus tricomiculatus																
Calcidiscus leptoporus	4		5	1		2		2	1	+	3		1	4	2	6
Calcidiscus macintyrei	+					3	1	1	+	+			1			
Calcidiscus premacintyrei					?			4	+	1	+			2		
Catinaster calyculus																
Catinaster coalitus																
Ceratolithus acutus																
Ceratolithus rugosus																
Coccolithus crassipons																
Coccolithus miopelagicus	+	6	2	1	3	2	1	9	5	3	4	1	+	1	+	+
Coccolithus pelagicus	6	16	32	22	10	7	14	6	15	4	6	2	6	5	2	5
Coccolithus streckeri			1	?		1						?		+		
Coronocyclus nitescens	?	+	+	+	1	+		+	2	1	+	+	+	+	+	1
Cyclargolithus floridanus	38	48	53	32	42	90	122	115	116	141	146	149	148	143	153	140
Cyclotella annula																
Dictyococcus productus																
Discoaster adamantus	2		1					?		?		1	?			
Discoaster asymmetricus																
Discoaster bellus																
Discoaster berggrenii																
Discoaster blackstockae																
Discoaster bollii																
Discoaster brouweri																
Discoaster calcaris																
Discoaster challengerii																
Discoaster decorus																
Discoaster deflandroi	20	26	26	15	1	24	6	3	19	15	5	15	12	9	13	5
Discoaster druggii																
Discoaster exilis																
Discoaster formosus																
Discoaster hamatus																
Discoaster kugleri																
Discoaster loeblichii																
Discoaster neohamatus																
Discoaster neorectus																
Discoaster pansus																
Discoaster pentaradiatus																
Discoaster prepentaradiatus																
Discoaster quinquenarius																
Discoaster surculus																
Discoaster tiradatus																
Discoaster variabilis	?	1	+		?	2		?	3	?	?	?	1	?	+	
Discoaster spp.																
Discolithina japonica																
Ericsonia obruta	2	+	1	1	1	1		1	?	2	5	4	1	6	+	1
Gephyrocapsa aperta																
Gephyrocapsa sinuosa																
small Gephyrocapsa																
Hayaster perplexus	1				+						+			+		?
Helicosphaera carteri					+						+			1		
Helicosphaera euphratis																
Helicosphaera granulata	?					1	+	1	+			1	1	+		
Helicosphaera hyalina																
Helicosphaera intermedia						+								?	?	?
Helicosphaera neogranulata																
Helicosphaera solii																
Helicosphaera wallichii																
Oolithotus fragilis																
Pontosphaera spp.								?	?				+	1		
Pseudoemiliania lacunosa																
Reticulofenestra ampla																
Reticulofenestra asanoi																
Reticulofenestra gelida	28	38	28	47	72	7	4	3								6
Reticulofenestra haqii	29	10	21	23	21	12	10	2		5	1			1		3
Reticulofenestra minuta	9	3	3	1	4						3					
Reticulofenestra minutula	3		4		1		3			+	1	1		2		
Reticulofenestra pseudoubilica	1	2	2	4	3				1							
Rhabdosphaera daviger																
Rhabdosphaera stylifer																
Scapholithus fossilis																
Soyphosphaera spp.	+							1								
Sphenolithus abies																
Sphenolithus belemnos																
Sphenolithus compactus	3	+	3	14	3	2	11	6	5	1	5	1	6	+		7
Sphenolithus coricus										1	?	1		1	?	
Sphenolithus delphix																
Sphenolithus dissimilis	12	8	7	8	11	15	18	23	14	15	13	10	8	14	10	3
Sphenolithus grandis																
Sphenolithus heteromorphus																
Sphenolithus mortiformis	29	26	9	27	25	28	8	19	17	5	5	12	8	7	12	17
Syracosphaera pulchra																
Tetraalithes symeonidesii			+				+									
Triquetrorhabdus carinatus	9	14	+	1	2	3	2	2	2	4	2	1	3	+	6	3
Triquetrorhabdus milowii		1		1									1	1	1	1
Triquetrorhabdus rugosus															?	
Umbilicosphaera sibogae																
Miscellaneous	4	1	2	2				2		2	1	1	3	2	1	2



Table 14 (continued).

Core	75X	76X	76X
Section	OC	2	OC
Interval (cm)		18-19	
Zone (Martini, 1971)	NN1		
Amaurolithus amplifucus			
Amaurolithus delicatus			
Amaurolithus primus			
Amaurolithus tricomulatus			
Calcidiscus leptoporus			2
Calcidiscus macintyreii			
Calcidiscus premacintyreii			
Catinaster calyculus			
Catinaster coarctus			
Ceratolithus acutus			
Ceratolithus rugosus			
Coccolithus crassipons			
Coccolithus miopelagicus	4	3	4
Coccolithus pelagicus	4	5	5
Coccolithus streckerii			
Coronocyclus nitescens	1		
Cydicargolithus floridanus	122	123	107
Cyclolithella annula			
Dictyococcites productus			
Discoaster adamantus			
Discoaster asymmetricus			
Discoaster bellus			
Discoaster berggrenii			
Discoaster blackstockae			
Discoaster bollii			
Discoaster brouweri			
Discoaster calcaris			
Discoaster challengerii			
Discoaster decorus			
Discoaster deflandrei	21	10	3
Discoaster druggii			
Discoaster exilis			
Discoaster fimosus			
Discoaster hamatus			
Discoaster kugleri			
Discoaster loeblichii			
Discoaster neohamatus			
Discoaster neorectus			
Discoaster pansus			
Discoaster pentaradiatus			
Discoaster prepentaradiatus			
Discoaster quinquenarius			
Discoaster surculus			
Discoaster triradiatus			
Discoaster variabilis	2	?	
Discoaster spp.			
Discolithina japonica			
Ericsonia obruta	3	1	
Gephyrocapsa aperta			
Gephyrocapsa sinuosa			
small Gephyrocapsa			
Hayaster perplexus			
Helicosphaera carteri			
Helicosphaera euphratis			
Helicosphaera granulata	1		
Helicosphaera hyalina			
Helicosphaera intermedia			
Helicosphaera neogranulata			
Helicosphaera sellii			
Helicosphaera wallichii			
Oolithus fragilis			
Pontosphaera spp.			
Pseudoemiliania lacunosa			
Reticulofenestra ampla			
Reticulofenestra asanoi			
Reticulofenestra goida	3	3	
Reticulofenestra haqii		1	1
Reticulofenestra minuta			
Reticulofenestra minutula			
Reticulofenestra pseudumbilica			
Rhabdosphaera daviger			
Rhabdosphaera styffer			
Scapholithus fossilis			
Scyphosphaera spp.			
Sphenolithus abies			
Sphenolithus belemnos			
Sphenolithus compactus	1	3	2
Sphenolithus conicus			
Sphenolithus delphix		?	2
Sphenolithus dissimilis	6	4	6
Sphenolithus grandis			
Sphenolithus heteromorphus			
Sphenolithus moriformis	25	3	3
Syracosphaera pulchra			
Tetralithides symeonidesii			
Triquetrorhabdus carinatus	3	43	62
Triquetrorhabdus milowii	4	1	3
Triquetrorhabdus rugosus		?	
Umbilicosphaera sibogae			
Miscellaneous			

Table 15. Calcareous nannofossil occurrences, Hole 805C.

Core	4H	4H	5H	5H	6H	6H
Section	5	CC	3	CC	4	CC
Interval (cm)	23-24		23-24		23-24	
Zone (Martini, 1971)	NN19		NN18		NN18	
Calcidiscus leptoporus	21	13	25	27	9	9
Calcidiscus macintyreii	1	2	1	+	+	+
Ceratolithus rugosus		+	+	+	+	+
Ceratolithus simplex			+	+		+
Ceratolithus telesmus			+			
Coccolithus crassipons	+		+		+	+
Coccolithus pelagicus	+	1	1	+	4	1
Coccolithus streckerii			+	1	+	
Cyclolithella annula	2		+	1	6	+
Dictyococcites productus	5	4	7	2		
Discoaster asymmetricus			+	+	2	+
Discoaster blackstockae			+		+	
Discoaster brouweri		2	4	2	19	3
Discoaster challengerii						+
Discoaster pentaradiatus				1	3	+
Discoaster surculus				+	+	+
Discoaster triradiatus		+			1	+
Gephyrocapsa aperta				1		
small Gephyrocapsa	30	2		2		1
Hayaster perplexus		+	+			
Helicosphaera carteri	+	2	2	+	2	2
Helicosphaera neogranulata	+	+	+	+		+
Helicosphaera sellii	+	+	1	1	+	+
Helicosphaera wallichii	+	+	+	+	+	+
Oolithus fragilis	1		1		+	1
Pontosphaera spp.					+	
Pseudoemiliania lacunosa	2	10	8	1	1	3
Reticulofenestra asanoi		+	1		+	
Reticulofenestra haqii			2		12	20
Reticulofenestra minuta	113	118	97	123	91	82
Reticulofenestra minutula	16	44	40	34	43	78
Reticulofenestra pseudumbilica			+		+	+
Rhabdosphaera daviger		+	1			
Scyphosphaera spp.					1	+
Syracosphaera pulchra	+	+	+	2	1	+
Tetralithides symeonidesii	3		+		+	
Triquetrorhabdus rugosus					+	
Umbilicosphaera sibogae	5	2	4	1	2	
Miscellaneous	1		5	1	3	

Note: + = trace.

Table 16. Calcareous nannofossil occurrences, Hole 805B.

Cone	7H	8H	8H	9H	9H	10H	10H	11H	11H	12H	12H	13H	13H
Section	CC	4	CC	4	CC	4	CC	3	CC	4	CC	3	CC
Interval (cm)		23-24		23-24		123-124		23-24		23-24		123-124	
Zone (Martini, 1971)		NN16			NN15-NN13					NN12			
Amaurolithus amplifolius													
Amaurolithus delicatus													
Amaurolithus primus													
Amaurolithus tricorniculatus													
Calcidiscus leptoporus	12	16	24	22	15	12	26	13	6	11	13	16	7
Calcidiscus macintyreii	1	3	1	2	+	1	1	3	10	+	3	3	6
Calcidiscus promacintyreii		?											
Catinaster altus				+									
Catinaster calyculus													
Catinaster coalitus													
Ceratolithus acutus										+	+	+	
Ceratolithus rugosus		+	+	+	+	?	+	+	+				
Coccolithus eopelagicus													
Coccolithus micropelagicus													
Coccolithus pelagicus								1	1	?	3	+	1
Coccolithus streckerii											+		
Coronocyclus nitescens									?	?			
Cyclargolites floridanus													
Cyclotella annula	10	12	2	3	+	5	2	+	2	3	4	3	+
Dictyococites productus	1					3	1			4	1	2	4
Discoaster adamantus													
Discoaster asymmetricus	+	+	1	+	?		+	?	?		+	?	
Discoaster bellus													
Discoaster berggrenii									?				
Discoaster blackstockae							?						
Discoaster braanudi													
Discoaster brouweri	16	4	6	+	1	1	2	2	1	+	+	+	+
Discoaster calcaris													
Discoaster challengerii			?				?				?		+
Discoaster decorus		+											
Discoaster doffandrii													
Discoaster druggii													
Discoaster exilis													
Discoaster formosus													
Discoaster hamatus													
Discoaster intercalaris											?		
Discoaster kugleri													
Discoaster loeblichii													
Discoaster moorei													
Discoaster neohamatus													
Discoaster neoectus						?		?	?				
Discoaster pansus													
Discoaster pentaradiatus		+	2	+	+	+	1	+	+	+	+	+	+
Discoaster prepentaradiatus													
Discoaster pseudovariabilis													
Discoaster quadramus					+								
Discoaster quinqueramus													
Discoaster surculus	+	+	+		+	+	+	+	2	+	+	3	+
Discoaster tamalis	+												
Discoaster triradiatus	+	+		+		+	+	+				?	
Discoaster tristellifer							+						
Discoaster variabilis		?	+	2	+	+			?		+	?	1
Discoaster spp.	1	1											
Ericsonia obruta													
Gephyrocapsa aperta			13										
small Gephyrocapsa	1		2										
Hayastor perplexus	+	+	1		+	+	+	+		+		+	+
Helicospaera carteri	+	+	+	1	5	+	+	3	2	1	1	+	3
Helicospaera granulata										?	?	+	+
Helicospaera intermedia													
Helicospaera neogranulata	?	?			?	?	?	?	1				
Helicospaera solii	?	?	+	+	?	?	?	?					
Helicospaera wallichii			?	1			?	?	2			+	1
Oolithus fragilis		1	+				+						
Pontospaera spp.	+	+	+		+	?		+	+		+	+	+
Pseudomilliana lacunosa	+	2	4	1	?	1							
Reticulofenestra asanici							+				?		
Reticulofenestra gelida		+		8	3	+	5	11	21	11	13	3	11
Reticulofenestra haqii	10	3	1	2		1		4	10	28	33	26	44
Reticulofenestra minuta	82	69	76	86	126	133	117	107	49	74	10	6	7
Reticulofenestra minutula	65	86	52	50	3	16	12	27	25	18	60	60	55
Reticulofenestra pseudodumbilica	+			13	12	+	2	14	42	10	37	9	36
Scapholithus fossilis									+				
Scyphospaera spp.			+	+	+				+	+	1	1	+
Solidopora petrae													
Sphenolithus abies			6	9	35	23	30	14	24	39	21	64	22
Sphenolithus boeomnos													
Sphenolithus compactus													
Sphenolithus conicus													
Sphenolithus delphix													
Sphenolithus dissimilis													
Sphenolithus grandis													
Sphenolithus heteromorphus													
Sphenolithus moriformis													
Syracosphaera pulchra	+	+				?			+				
Tetralithoides symeonidesii			1	+	+	4	1	1	1			2	?
Triquetrorhabdus carinatus													
Triquetrorhabdus milowii													
Triquetrorhabdus rugosus							?		?				+
Umbilicosphaera sibogae	1	1	8	?					1				
Miscellaneous		2								1		2	2

Note: + = trace and ? = present but questionable.

Table 16 (continued).

Core	14H	14H	15H	15H	16H	16H	17H	17H	18H	18H	19H	19H	20H	20H	21H	21H
Section	4	OC	4	OC	4	OC	4	OC	4	OC	3	OC	4	OC	4	OC
Interval (cm)	23-24		23-24		23-24		23-24		23-24		23-24		23-24		23-24	
Zone (Martini, 1971)	NN11															
Amaurolithus amplificus					?											
Amaurolithus delicatus					?											
Amaurolithus primus								?								
Amaurolithus tricorniculatus																
Calcidiscus leptoporus	24	6	12	14	3	40	20	9	31	12	16	10	13	10	22	10
Calcidiscus macintyrei	6	3	3	?	?	2	5	1	3	+	1	+	2	4	3	+
Calcidiscus promacintyrei	+	+		+	1	2	6	1	1	+	+	+	3	+	+	2
Catinaster albus																
Catinaster calyculus																
Catinaster coalitus																
Ceratolithus acutus																
Ceratolithus rugosus																
Coccolithus eopelagicus									?				1		+	
Coccolithus miopelagicus																
Coccolithus pelagicus	+	3		1	+	4	4	+	1	1	+	4	1	18	+	3
Coccolithus streckerii	?	?						?					?			+
Coronocyclus nitescens		?					?	+								
Cydicargolithus floridanus																
Cycloltheia annula	3	1	3	1	2	5	2	3	3	+	+	+	6	?	1	2
Dictyococcos productus	2			+		1		3	1		3		1	6	6	
Discoaster adamanteus													1			
Discoaster asymmetricus	?				+			?			+	?				
Discoaster bellus										?	?		?		?	
Discoaster berggrenii	+	+	+	+	1	+	+	?	+	?	+	+	+	2	+	+
Discoaster blackstockae	+				+											
Discoaster braunardi																
Discoaster brouweri	+	+	+	+	1	+	2	+		+	?	1	?	3	2	1
Discoaster calcaris																?
Discoaster challengeri		?		+	?											
Discoaster decorus																
Discoaster deflandroi																
Discoaster druggii																
Discoaster exilis					?											
Discoaster formosus																
Discoaster hamatus																
Discoaster intercalaris			?	?												
Discoaster kugleri																
Discoaster loeblichii		?													+	?
Discoaster moorei																
Discoaster neohamatus					1		?		+	+	?	?	+	?	+	+
Discoaster neorectus							?				?	?			?	
Discoaster pansus	?				+											
Discoaster pentaradiatus	+	+		+	+		?	+				?				
Discoaster prepentaradiatus																
Discoaster pseudovariabilis																
Discoaster quadramus																
Discoaster quinquemuratus	3	1	+	1	1	+	2	+	+	+	1	+	+	1	+	1
Discoaster surculus	+	+	+	+	+	1	1	+	+	+	+	?	+	1	+	+
Discoaster tamalis																
Discoaster triradiatus	+			+	1	?					?			?	?	
Discoaster tristolifer																
Discoaster variabilis	+	+	+	+	?	?	?			+		+	+	1	+	1
Discoaster spp.	2		1	1			3					1		3		1
Ericsonia obruta																
Gephyrocapsa aperta																
small Gephyrocapsa																
Hayastrea perplexus	+	+	+	1	+		+	+	+		+	+	+		+	+
Helicosphaera carteri	1	1	+	+	1	+	1	+	+	+	+	+	+	+	+	1
Helicosphaera granulata	?	2	+	+	+	+	2	1	?	+	+	+	1	1	1	+
Helicosphaera intermedia																
Helicosphaera neogranulata																
Helicosphaera sellii																
Helicosphaera wallichii	?	?	?	?	+		?									?
Oolithotus fragilis																
Pontosphaera spp.	+	+		+	+			+	2	+	+					
Pseudomilliana lacunosa																
Reticulofenestra asanoi	?															
Reticulofenestra gelida	5	3	6	2	2	17	16	11	10	7	11	13	1	2	4	
Reticulofenestra haqii	25	11	27	11	5	6	15	27	14	11	13	18	38	35	46	49
Reticulofenestra minuta	25	40	86	76	113	49	11	72	61	87	68	33	29	11	24	46
Reticulofenestra minutula	93	69	34	65	32	7	18	23	11	8	17	15	36	60	32	43
Reticulofenestra pseudumbilica	3	5	1	1	+	16	6	4	5	5	6	27	15	2	5	
Scapholithus fossilis																
Scyphosphaera spp.	+		+		+	1	+	1		+		+	2	1	+	+
Solidopora petrae																
Sphenolithus abies	8	53	27	26	36	49	61	42	63	68	64	73	51	52	51	35
Sphenolithus belemnoides																
Sphenolithus compactus																
Sphenolithus conicus																
Sphenolithus delphix																
Sphenolithus dissimilis																
Sphenolithus grandis		1				?			?						1	
Sphenolithus heteromorphus																
Sphenolithus moriformis		1												?		
Syracosphaera pulchra																
Tetraalithes symeonidesii	+	+			+	+	1	+				+		+	1	
Triquetrorhabdus carinatus																
Triquetrorhabdus milowii																
Triquetrorhabdus rugosus	+	+	?	+	+	+	4	+	1	+	+	2	2	2	1	+
Umbilicosphaera sibogae																
Miscellaneous								2	3	1						

Table 16 (continued).

Core	22H	22H	23H	23H	24H	24H	25H	25H	26H	26H	27H	27H	28H	28H	29X	29X	
Section	4	CC	4	CC	4	CC	4	CC	4	CC	4	CC	4	CC	3	CC	
Interval (cm)	23-24		23-24		23-24		23-24		23-24		23-24		23-24		23-24		
Zone (Martini, 1971)	NN11								NN10								NN9
Amaurolithus amplifucus																	
Amaurolithus delicatus																	
Amaurolithus primus																	
Amaurolithus tricomiculatus																	
Calcidiscus leptoporus	8	7	12	15	20	31	26	30	32	12	31	15	15	9	11	8	
Calcidiscus macintyreii	+	1	+	+	2	3	4	+	3	4	5	1	2	12	11	9	
Calcidiscus premacintyreii	2	1	2	+	1	7	+	3	4	5	1	+	+	3	+	2	
Catinaster altus																	
Catinaster calyculus		?			?											?	
Catinaster coalitus																+	
Ceratolithus acutus																	
Ceratolithus rugosus																	
Coccolithus oopelagicus																	
Coccolithus miopelagicus		1	?	+	1	+	?	1		4	1			2	3	?	
Coccolithus pelagicus	+	1	2	2	2	11	14	3	15	10	4	14	30	19	49	1	
Coccolithus streckerii					?			?		?	+		?	+	?	+	
Coronocyclus nitescens			?	+				+		?							
Cyclidargolithus floridanus																	
Cyclolithella annula	+	?	+	1	+	1	5	2	4	4	3	1	?	?			
Dictyococites productus						2		1				1					
Discoaster adamanteus																	
Discoaster asymmetricus		?															
Discoaster bolus				?		1	?	?	?	12	1					?	
Discoaster berggrenii	1	+	+	?	?												
Discoaster blackstockae																	
Discoaster braarudii										1							
Discoaster brouweri	?	+	+		1	1	1	+	+	12	1					3	
Discoaster calcaris						?				?		?	?				
Discoaster challengerii			+			?									1		
Discoaster decorus																	
Discoaster deflandrei														?			
Discoaster druggii																	
Discoaster exilis			?									?		1			
Discoaster formosus																	
Discoaster hamatus							1									+	
Discoaster intercalaris																	
Discoaster kugleri																	
Discoaster loeblichii		?				?											
Discoaster moorei																	
Discoaster neohamatus	+	?	?	+	+	2	1	+	?	3	+	2	+				
Discoaster neorectus				?	?		?	+		1	+						
Discoaster panus																	
Discoaster pentaradiatus		?				?					?						
Discoaster prepentaradiatus							?	?				+	?	?			
Discoaster pseudovarabilis																	
Discoaster quadramus																	
Discoaster quinquermus	+		?	+													
Discoaster surculus	+	?	+		+												
Discoaster tamalis																	
Discoaster triradiatus					?	?						?					
Discoaster tristellifer																	
Discoaster variabilis	+	+		1	+	+	+	+	3	+	1	+	+	6	7	2	
Discoaster spp.		2			2	3	1	2	+	5		2		5		1	
Ectocarpus obruca							?	2									
Gephyrocapsa aperta																	
small Gephyrocapsa																	
Hayastor perplexus	1	+	+		+	+	+	+	+	2	2			+	+		
Helicosphaera carteri	+	+	1	+	+	3	2	1	2	1	+	1			1		
Helicosphaera granulata	+	+	?	1	1	1	3	2	1	3	1	4	+	+	1	+	
Helicosphaera intermedia																	
Helicosphaera neogranulata																	
Helicosphaera solii																	
Helicosphaera wallichii			?														
Oolithus fragilis																	
Pontosphaera spp.						+				1	1	+					
Pseudomilliana lacunosa																	
Reticulofenestra asanoi																	
Reticulofenestra gelida			1	+		1					6	85	104	103	82	150	
Reticulofenestra haqii	67	50	78	29	39	39	2				1	1	4	7	13	2	
Reticulofenestra minuta	51	62	11	92	79	37	31	28	5		2			1			
Reticulofenestra minutula	25	25	16	7	10	8	1	1			3			2			
Reticulofenestra pseudoubilica											3	16	8	19	6	12	
Scapholithus fossilis																	
Scyphosphaera spp.	+		+	+		+	+	+	+	1	+	+	+				
Solidopons petrae																	
Sphenolithus abies	45	50	77	52	40	37	96	111	114	96	125	40	30	3	5	4	
Sphenolithus balemnos																	
Sphenolithus compactus							3	3	7	7	4	6	2	1			
Sphenolithus conicus																	
Sphenolithus delpix																	
Sphenolithus dissimilis																	
Sphenolithus grandis																	
Sphenolithus heteromorphus																	
Sphenolithus moriformis					?	10	8	9	6	9	1	8	1	1	1	1	
Syracosphaera pulchra																	
Tetralithides symeonidesii					+	+	+										
Triquetrorhabdus carinatus									4								
Triquetrorhabdus milowii																	
Triquetrorhabdus rugosus	+	+	+	+	1	2	1	+		7	1	1	2	5	4	1	
Umbilicosphaera sibogae																	
Miscellaneous					1			1			2	2	2	1	5	4	



Table 16 (continued).

Core	30X	30X	31X	31X	32X	32X	33X	33X	34X	34X	35X	35X	36X	36X	37X	37X	
Section	3	OC	3	OC	3	OC	3	OC	3	OC	3	OC	3	OC	3	OC	
Interval (cm)	23-24		23-24		23-24		23-24		23-24		23-24		22-23		22-23		
Zone (Martini, 1971)	NN9		NN8		NN7-NN6						NN5-NN4						
Amaurolithus amplificus																	
Amaurolithus delicatus																	
Amaurolithus primus																	
Amaurolithus tricomiculatus																	
Calcidiscus leptoporus	9	10	17	6	2	19	6	10	12	3	5	10	+	9	4	2	
Calcidiscus macintyreii	12	7	6	16	11	4	3	3	5	1	1	+	+	+		1	
Calcidiscus premacintyreii		3	1	+	+		+	4	4	+	1	+	2	2	8	14	
Calinaster altus																	
Calinaster calyculus	?																
Calinaster coalitus	+	1	+														
Ceratolithus acutus																	
Ceratolithus rugosus																	
Coccolithus eopelagicus																	
Coccolithus miopelagicus	1	1	4	7	4	2	7	7	19	27	3	6	3	6	5	2	
Coccolithus pelagicus	24	2	18	38	25	12	27	24	23	63	14	10	4	29	20	17	
Coccolithus streckerii			1	2	+	1	?	+	+	1	+	+	+	+	1	1	
Coronocyclus nitescens			?		?			+	+	+	+	+	+	+	1	2	
Cyclodictyon floriculus										1	2	4	3	9	39	36	
Cyclolithella annula	+	1	1	1	+	2		2			?	+	?	?	10	3	
Dicococcolites productus						1	1		5	1	4	5		1	1	1	
Discoaster adamantus						1			?		1		?				
Discoaster asymmetricus																	
Discoaster bellus	3	1															
Discoaster berggrenii																	
Discoaster blackstockae						?											
Discoaster braarudii																	
Discoaster brouweri	?					?										1	
Discoaster calcaris	+	?	1			+											
Discoaster challengerii	?	?	?														
Discoaster decorus																	
Discoaster deflandrei						?	1	3	1	2	+	3	?	11	3	+	
Discoaster druggii														?	1	1	
Discoaster exilis	?	+	+		+	1	3	1	+	?	?	?	?	2	+	2	
Discoaster formosus																	
Discoaster hamatus	+	+															
Discoaster intercalaris																	
Discoaster lugleri							?	2									
Discoaster loeblichii																	
Discoaster moorei																1	
Discoaster neohamatus	?			?													
Discoaster neorectus																	
Discoaster pansus																	
Discoaster pentaradiatus																	
Discoaster propentariatus																	
Discoaster pseudovariabilis		+															
Discoaster quadramus																	
Discoaster quinqueramus																	
Discoaster surculus		?															
Discoaster tamalis																	
Discoaster triadatus				?													
Discoaster tristellifer																	
Discoaster variabilis	3	2	2	3	13	3	7	?	8	4	1	8	3	6	?	1	
Discoaster spp.					1	1	4	2	2		1	4	3	3	1	4	
Eriocsonia obruta																	
Gephyrocapsa aperta																	
small Gephyrocapsa																	
Hayastera perplexus	1	3	+	+	+	+	+	1	3	+	+	+	+		2	1	
Helicosphaera carteri				+		4				3	3		6	3	1	1	
Helicosphaera granulata	+	1	1	1	+	4	3	1	3	4	6	2	4	2	3	2	
Helicosphaera intermedia																	
Helicosphaera neogranulata																	
Helicosphaera sellii																	
Helicosphaera wallichii																	
Oolithus fragilis																	
Pontosphaera spp.								+				1	+				
Pseudoemiliania lacunosa																	
Reticulofenestra asanoi																	
Reticulofenestra goida	127	127	101	101	106	57	83	60	57	50	61	16	36	10	18	8	
Reticulofenestra haqii		3	8	2	8	24	2	40	8	5	21	89	83	32	9	17	
Reticulofenestra minutula						1			1		13	9	2	7		2	
Reticulofenestra minutula		1	8			3	6	12	5	5	9	2	5	12	21	26	
Reticulofenestra pseudumbilica	11	23	22	12	9	33	36	19	23	23	37	11	24	23	18	11	
Scapholithus foecilis																	
Scyphosphaera spp.			+		+	+		1	+		+		+	+			
Solidopora petrae																	
Sphenolithus abies	2	2	2	8	10	4	4	5	4	1	5	5	2		1	3	
Sphenolithus bolemnos																	
Sphenolithus compactus		5	2		2	+			5	1	2	2	2	3	2	5	
Sphenolithus conicus													1		?	?	
Sphenolithus delphix																	
Sphenolithus dissimilis																	
Sphenolithus grandis																	
Sphenolithus heteromorphus													3	5	8	19	26
Sphenolithus moriformis	1		3	+	2	3	+		3	+	8	2	6	14	9	6	
Syracosphaera pulchra																	
Tetraalithides symeonidesii																+	1
Triquetrorhabdus carinatus											?					1	
Triquetrorhabdus mitowii																	
Triquetrorhabdus rugosus	5	3	1	4	4	2	6	+	4	5	?	2	3	2	+	1	
Umbilicosphaera sibogae																	
Miscellaneous	1	4	1		3	18	1	3	5		1	6	6	6		3	

Table 16 (continued).

Core	38X	38X	39X	39X	40X	40X	41X	41X	42X	42X	43X	43X	44X	44X	45X	
Section	3	CC	3	CC	3	CC	3	CC	3	CC	3	CC	3	CC	3	
Interval (cm)	23-24		23-24		23-24		23-24		23-24		23-24		23-24		23-24	
Zone (Martini, 1971)	NN5-NN4								NN2							
Amaurolithus amplifolius																
Amaurolithus delicatus																
Amaurolithus primus																
Amaurolithus tricorniculatus																
Calcidiscus leptoporus	1	2	3	15	7	11	8	10	3		1		1		2	
Calcidiscus macintyreii	2	1	1	3				1	+						+	1
Calcidiscus promacintyreii	4	4	3	10	6	14	12	8	5	2	1	1	3	4	1	
Catinaster altus																
Catinaster calyculus																
Catinaster coalitus																
Ceratolithus acutus																
Ceratolithus rugosus																
Coccolithus eopelagicus																
Coccolithus miopelagicus	10	5	3	7	4	7	6	1	?	1	8	3	6	+	3	
Coccolithus pelagicus	16	27	13	17	9	18	3	19	20	20	14	25	22	20	4	
Coccolithus streckerii																
Coronocyclus nitescens	3		+	1	2		2	+	2	+	+	5	2	1	5	
Cyclargolithus floridanus	7	2	9	18	12	12	39	58	70	90	73	5	18	8	9	
Cyclolithella annula	?	2				2						2	2	3	1	
Diclyococcites productus					3							1				
Discoaster adamanteus		1				?							1	?	1	
Discoaster asymmetricus																
Discoaster bellus																
Discoaster berggronii																
Discoaster blackstockae																
Discoaster braarudii																
Discoaster brouweri																
Discoaster calcaris																
Discoaster challengeri																
Discoaster decorus																
Discoaster dollandrei	3	6	13	8	2	12	9	18	11	12	17	21	10	9	7	
Discoaster druggii	3	4	3		?	2	1	1	1		+	1	1	?		
Discoaster exilis	16	17	14	1	2		1					+				
Discoaster formosus		1		2			3									
Discoaster hamatus																
Discoaster intercalaris																
Discoaster kugleri																
Discoaster loeblichii																
Discoaster moorei												?				
Discoaster neohamatus																
Discoaster neorectus																
Discoaster panus																
Discoaster pentaradiatus																
Discoaster prepentaradiatus																
Discoaster pseudovariabilis																
Discoaster quadramus																
Discoaster quinquaramus																
Discoaster surculus																
Discoaster tamalis																
Discoaster trifidatus																
Discoaster tristellifer																
Discoaster variabilis	6	12	5	6	?	2	2	1	5	4	1	6	1			
Discoaster spp.	8	14	11	2	1	2	8	2	1							
Erosionia obruta		2		1	1	2		3	2	1	1	3	?	13	6	
Gephyrocapsa aperta																
small Gephyrocapsa																
Hayaster perplexus	1	3	1	+	+		2	1	3	+	+	+		2	+	
Helicosphaera carteri	+	1	+	1												
Helicosphaera granulata	2	1	1	1	1	2	2	1							1	
Helicosphaera intermedia				1												
Helicosphaera neogranulata																
Helicosphaera sellii																
Helicosphaera wallichii																
Oolithus fragilis																
Pontosphaera spp.									1		1					
Pseudoemiliania lacunosa																
Reticulofenestra asanoi																
Reticulofenestra gelida	20	4	2	8	6	6		14	4	3	30	55	51	58	58	
Reticulofenestra haqii	1	15	15	20	88	4	6	7			8	12	39	23	29	
Reticulofenestra minuta	1			3	2									6	6	
Reticulofenestra minutula	41	12	31	18	25	2	9	3			2	1	3	12	12	
Reticulofenestra pseudombilica	7	8	3	3		3	1	1	5	4	3	10	7	10	13	
Scapholithus fossilis																
Scoyphosphaera spp.				+												
Solidopons petrae				1												
Sphenolithus abies	3	2	2	1	3		6			1		1				
Sphenolithus belemnos									10	16	8					
Sphenolithus compactus	1	5	8	5	1	16	6	2	12	11	10	15	8	7	12	
Sphenolithus conicus	2	3	18	3	3	4				2						
Sphenolithus dolphix																
Sphenolithus dissimilis									1			11	11	3	6	
Sphenolithus grandis																
Sphenolithus heteromorphus	31	26	22	26	10	33	32	21								
Sphenolithus moriformis	4	10	11	9	3	30	27	23	32	25	15	14	9	20	15	
Syracosphaera pulchra																
Tetralithides symeonidaeii	2			6	4	8	6	1	2	1		1			1	
Triquetrorhabdus carinatus		3						+	4	3	1	6	?	?	3	
Triquetrorhabdus milowii			2	?	?				1						1	
Triquetrorhabdus rugosus	5	8	5	1	1	1	3	1	4	3	4	1	3	1	2	
Umbilicosphaera sibogae																
Miscellaneous		1	1	2	3	7	8	3	1	1	2		2		3	

Table 16 (continued).

Core	45X	46X	46X	47X	47X	48X	48X	49X	49X	50X	50X
Section	OC	3	OC	1	OC	3	OC	3	OC	3	OC
Interval (cm)		23-24		20-21		23-24		22-23		23-24	
Zone (Martini, 1971)											
Amaurolithus amplificus											
Amaurolithus delicatus											
Amaurolithus primus											
Amaurolithus tricomiculatus											
Calcidiscus leptoporus		4		3	4	+	1	7	3	1	+
Calcidiscus macintyreii		+	1			1	+	2		+	+
Calcidiscus promacintyreii	3	3	5	6							
Catinaster altus											
Catinaster calyculus											
Catinaster coarctatus											
Ceratolithus acutus											
Ceratolithus rugosus											
Coccolithus eopelagicus		1	1								
Coccolithus miopelagicus	14	6	10	7	2	6	2	6	1	8	3
Coccolithus pelagicus	10	5	18	15	27	33	3	4	9	6	6
Coccolithus streckerii				+						+	
Coronocyclus nitescens	2	+		1	+		+	1	1	+	+
Cyclargolithus floridanus	27	41	35	46	30	92	113	105	111	146	123
Cyclolithella annula	1		1		2	?					
Dictyococcites productus											
Discoaster adamantus						1					
Discoaster asymmetricus											
Discoaster bellus											
Discoaster berggrenii											
Discoaster blackstockae											
Discoaster braanudi											
Discoaster brouweri											
Discoaster calcaris											
Discoaster challengerii											
Discoaster decorus											
Discoaster doffandrei	19	11	26	18	18	28	30	20	13	13	25
Discoaster druggii	+										
Discoaster exilis	+				+		?				
Discoaster fimosus											
Discoaster hamatus											
Discoaster intercalaris											
Discoaster kugleri											
Discoaster loeblichii											
Discoaster moorei											
Discoaster neohamatus											
Discoaster neoerectus											
Discoaster pansus											
Discoaster pentaradiatus											
Discoaster propentariatus											
Discoaster pseudovariabilis											
Discoaster quadramus											
Discoaster quinquemus											
Discoaster surculus											
Discoaster tamalis											
Discoaster triradiatus											
Discoaster tristellifer											
Discoaster variabilis	4	?	4		3	3	2	?	2		1
Discoaster spp.	1										
Ericsonia obruta	5	4	3	10	1		+	1	10	3	+
Gephyrocapsa aperta											
small Gephyrocapsa											
Hayastor porploxus	1	+	+	+					+	+	
Helicosphaera carteri											
Helicosphaera granulata							?	2			
Helicosphaera intermedia							?			+	
Helicosphaera neogranulata											
Helicosphaera solii											
Helicosphaera wallichii											
Oolithus fragilis											
Pentosphaera spp.		1	+				+				
Pseudoemiliania lacunosa											
Reticulofenestra asanoi											
Reticulofenestra gelida	27	37	31	39	35						
Reticulofenestra haqii	13	22	15	17	30			12	1		
Reticulofenestra minuta		4	1	1				5	1		
Reticulofenestra minutula	9		1	12	2	1					
Reticulofenestra pseudumbilica	9	5	3	10	1						
Scapholithus fossilis											
Scyphosphaera spp.											
Solidopora petrae											
Sphenolithus abies											
Sphenolithus belemnos											
Sphenolithus compactus	14	8	4		11	14	5	5	2	2	1
Sphenolithus conicus						?	1			?	
Sphenolithus delphix								+	?		?
Sphenolithus dissimilis	3	+	6	1	8	5	5	15	21	6	8
Sphenolithus grandis											
Sphenolithus heteromorphus											
Sphenolithus moiformis	18	32	17	8	24	13	38	12	15	9	11
Syracosphaera pulchra											
Tetralithides symeonidesii	1										
Triquetrorhabdus carinatus	17	15	17	6	1	3	?	3	8	2	19
Triquetrorhabdus milowii			1		1				?	2	1
Triquetrorhabdus rugosus	2		+	?							
Umbilicosphaera sibogae											
Miscellaneous		1							2	2	2

Table 17. Calcareous nannofossil occurrences, Hole 804C.

Core	3H	4H	4H	5H	5H	6H	6H	7H	7H	8H	8H	9H	9H	10H	10H	11H	11H	
Section	CC	3	CC	4	CC	3	CC	4	CC	3	CC	3	CC	3	CC	3	CC	
Interval (cm)	90-91		90-91		90-91		90-91		90-91		90-91		90-91		90-91		90-91	
Zone (Martini, 1971)	NN18	NN17	NN16	NN15-NN13		NN11						NN10						
Amaurolithus primus						?												
Calcidiscus leptoporus	20	13	13	27	17	12	25	16	12	17	26	26	36	22	48	8	21	
Calcidiscus machityrei	+	5	+	2	2	3	5	1	1	1	+	4	2	1	11	1	9	
Calcidiscus premacintyreii						1	3	4	+	1	3	5	12	9	5	1	2	
Catinaster calyculus																	+	
Catinaster coalitus																		
Ceratolithus cristatus	+		+															
Ceratolithus rugosus	+	+		2	+													
Coccolithus crassipons	+	+																
Coccolithus eopelagicus																		
Coccolithus miopelagicus								?	?	+	+	?	1		2	+	7	
Coccolithus pelagicus	1	+	+	?		7	7	+	3	11	6	6	11	5	34	16	14	
Coccolithus streckerii									?		+				?			
Coronocyclus nitescens									?					1		?		
Cydicargolithus floridanus																		
Cyclolithella annula	?	?	+	?	1	+	1	1	3	+	5	1	3	4	4	5	+	
Dityococoides productus	5		2	1		2	3		1	1	1	1	2					
Discoaster adamantus																	?	
Discoaster asymmetricus	?	+	1	?		?	?		?			?	?		?	?		
Discoaster bellus											?	?	?	1	1	1	+	
Discoaster berggrenii						?	+	+	+	+	?	?						
Discoaster blackstockae				?	1						+							
Discoaster bollii																		
Discoaster braarudii																	1	
Discoaster brouweri	3	4	5	3	3	6	+	+	+	2	+	1	3	1	13	6	4	
Discoaster calcaris												?		?		+	1	
Discoaster challengerii			+	?	?	1	+	?	+		?	+	?		+	1	+	
Discoaster decorus				1														
Discoaster deflandrei				?														
Discoaster druggii																		
Discoaster exilis																		
Discoaster hamatus																	+	
Discoaster kugleri																		
Discoaster loeblichii											+							
Discoaster neohamatus									+	1	?	+	+	+	2	1	+	
Discoaster neoerectus						?	+	+	+	?				?	2			
Discoaster pansus				?	?			?	+	+	+	1	+	+	?	?	?	
Discoaster pentaradiatus		1	+	4	3			+	+		+	+	+	?	+			
Discoaster prepentaradiatus																+	1	
Discoaster pseudovariabilis																		
Discoaster quadramus							+											
Discoaster quinqueramus				+		+	+	+	+	2	?							
Discoaster surculus	?	?	+	+	?	3	1	+	+	+		+	+		?	+	?	
Discoaster tamalis			?															
Discoaster trifidatus	+	+	+	+	?	?	+			?		?			1	?	+	
Discoaster tristellifer				+														
Discoaster variabilis			1	?	1	+	1	+	+	1	+	3	+	+	6	4	4	
Discoaster spp.				2	1							1			2	2	1	
Ericsonia obruta														5				
Hayaster perplexus	+			1				+			+	?						
Helicosphaera carteri	+		+		+	1	1	+	+	1	2	+	1	+	1	+	1	
Helicosphaera granulata							?	+	+	+	+	+	3	3	2	1	1	
Helicosphaera neogranulata			+															
Helicosphaera recta																		
Helicosphaera sellii	1	+	?	?														
Helicosphaera wallichii	+		?															
Pontosphaera spp.							+	+										
Pseudoemiliania lacunosa	5		+			?												
Reticulofenestra asanoi	3	2	?		1													
Reticulofenestra gelida				3	15	22	16	1								75	81	
Reticulofenestra haqii		1			4	39	10	65	26	36	20	2	1	3		5	5	
Reticulofenestra minuta	150	66	159	130	113	38	71	12	84	72	32	41	46	49	3		1	
Reticulofenestra minutula	10	106	17	5	15	43	10	37	33	28	21	4	1			2	4	
Reticulofenestra pseudumbilica		+	+	11	12	10	9	4	2					+		11	16	
Soyphosphaera spp.							+	+		1	1	?	+	1	?		+	
Sphenolithus abies			?	7	10	11	37	58	35	24	81	103	76	92	60	48	22	
Sphenolithus bolemnos																		
Sphenolithus ciperoensis																		
Sphenolithus compactus																6	3	
Sphenolithus conicus																		
Sphenolithus delphix																		
Sphenolithus dissimilis																		
Sphenolithus distentus																		
Sphenolithus heteromorphus																		
Sphenolithus moriformis									+	+	1	1	1	2	1	1	+	
Syracosphaera pulchra	1	2																
Tetracladites symeonidesii	1	+		1				+			+	+						
Triquetrorhabdus carinatus																		
Triquetrorhabdus milowii																		
Triquetrorhabdus rugosus				?	+	+	1	+	1	1	+	1	1	2	2	2	2	
Umbilicosphaera sibogae			2															
Zygrhabdus bijugatus																		
Miscellaneous					1	1											2	



Table 17 (continued).

Core Section	12H	12H	13H	13H	14X	14X	15X	15X	16X	16X	17X	17X	18X	18X	19X	19X	20X	20X	21X	21X	22X	22X	
Interval (cm)	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	90-91	91-92	91-92	90-91	90-91	
Zone (Martini, 1971)	NN10		NN9						NN7-NN6						NN5-NN4								
Amaurolithus primus																							
Calcidiscus leptoporus	9	20	12	15	21	6	7	18	6	4	6	4	6	4	1	5	5	3	3	2	3	?	
Calcidiscus macintyreii	7	8	16	5	4	12	9	17	15	3	10	7	14	4	1	5		+	2		1	1	
Calcidiscus premacintyreii	1	2	1	+	1	4		2				1			1					1	5	+	
Catnaster calyculus		+		+	+			1															
Catnaster coalitus	+	+				+			3	2													
Ceratolithus cristatus																							
Ceratolithus rugosus																							
Coccolithus crassipons																							
Coccolithus eopelagicus																							
Coccolithus miopelagicus	3	1	?	1	5	4	8	1	9	3	3	11	3	5	15	11	14	17	9	6	2	7	
Coccolithus pelagicus	19	11	21	13	4	5	19	9	14	7	18	15	7	12	16	29	32	20	38	20	25	23	
Coccolithus streckerii		?	?	?	?	1		?				1			+			?					
Coronocyclus nitescens		1			+							?		+	+	+	1	+	?	+	1	3	
Cyclargolithus floridanus																	31	13	33	32	88	102	
Cyclolithella annula	+	+	+	1	1	3			?		2	?			?	2	?	?	1				
Dictyococites productus											2	1				1							
Discoaster adamanteus					1								?	?			?	1				?	
Discoaster asymmetricus																							
Discoaster bellus	1	1	1	1	2	1	?	2	?		?												
Discoaster berggrenii																							
Discoaster blackstockae																							
Discoaster bollii								+	?						1	?							
Discoaster braarudii	?		1				2								?								
Discoaster brouweri	1	1	?	4	1	1	8							7	?	1							
Discoaster calcaris	?	+		+	+	1	16	+	1	2													
Discoaster challengerii	2	2	+	2	2	3	1	2	2	1	+	1	1										
Discoaster decorus																							
Discoaster deflandrei	?	?							+		+	+	1	4	3	1	16	23	6	13	25	17	
Discoaster druggii															1			?	1	3	2	+	
Discoaster exilis	2	?		1	?	1				18	1	1	8	3	+	4	3	?	11	?	1		
Discoaster hamatus	+	+		5	3	2	+	5	2	5													
Discoaster kugleri													?	2									
Discoaster loeblichii																							
Discoaster neohamatus	1	+	+	2	3	+	1																
Discoaster neorectus																							
Discoaster pansus	?			?		?		?	?		?												
Discoaster pentaradiatus																							
Discoaster prepentaradiatus	?	?	1	?	+	?	+	+	?		?	+											
Discoaster pseudovariabilis						?				1													
Discoaster quadramus																							
Discoaster quinqueramus																							
Discoaster surculus	2						?					+											
Discoaster tamalis																							
Discoaster tiradatus	?	?				?		?															
Discoaster tristellifer																							
Discoaster variabilis	4	7	2	1	3	4	6	4	3	6	4	+	9	7	5	3	17	13	13	18	13	1	
Discoaster spp.	3	2	4	1	4	2	9	1		11	2		7	2	3		5		27	1		1	
Ericsonia obruta																						1	?
Hayaster perplexus				2								+								+	1	1	
Helicosphaera carteri	1			1	1	+							1										
Helicosphaera granulata	1	1		+	3	2						3	1		+	1	?	1					
Helicosphaera neogranulata																							
Helicosphaera recta																							
Helicosphaera sellii																							
Helicosphaera wallichii																							
Pontosphaera spp.						+					1						+						
Pseudoemiliania lacunosa																							
Reticulofenestra asanoi																							
Reticulofenestra gelida	91	110	47	101	87	123	77	97	109	99	65	43	80	116	103	78	20	7	12	10		6	
Reticulofenestra haqii	12	3	6	1	2	2	2	1	2		24	57	2	1	3	13	10	1	16	1			
Reticulofenestra minuta											3	1				2							
Reticulofenestra minutula	2	3	4	1	5					2	1	8	4		2	9	5		3	1			
Reticulofenestra pseudoumbilica	33	16	44	13	14	12	25	33	27	28	35	45	50	33	28	18	7	7	3	5	1	1	
Scyphosphaera spp.	+	+		1	1										1								
Sphenolithus ables	2	5	31	12	19	5	5	3			2	1		1	6	9	4	3	3	1			
Sphenolithus belemnus																						2	1
Sphenolithus ciperensis																							
Sphenolithus compactus		2	+	6	5	1		2	+		4	1		?	1	5	1			6	3	9	
Sphenolithus conicus																			1	1	1	+	
Sphenolithus delphix																					2	1	
Sphenolithus dissimilis																							
Sphenolithus distentus																							
Sphenolithus heteromorphus																							
Sphenolithus moriformis			5	4	7	1		+	+	1	1	2	+	2	9	1	15	43	7	39	2	+	
Syracosphaera pulchra																					1	20	
Tetralithides symeonidesii																	1	+		+			
Triquetrorhabdus carinatus																						2	4
Triquetrorhabdus milowii																						1	
Triquetrorhabdus rugosus	3	4	4	2	1	3	5	2	4	6	5	2	2	6	1	2	1	2	8	2	2	4	
Umbilicosphaera sibogae																							
Zygrhabdus bijugatus																							
Miscellaneous				4		1			1	2	1									1	4	3	

Core	22X	23X	23X	24X	24X	25X	25X	26X	26X	27X	27X	28X	28X
Section	CC	3	CC	2	CC	3	CC	3	CC	3	CC	3	CC
Interval (cm)	90-91		90-91		94-95		90-91		90-91		86-87		CC
Zone (Martini, 1971)	NNS-4				NN2				NN1				OLIGOCENE
<i>Amaurolithus primus</i>													
<i>Calcidiscus leptoporus</i>		1		2	1		1	4	2	1			
<i>Calcidiscus macintyreii</i>	?		2	1			2	2					1
<i>Calcidiscus premacintyreii</i>		3	3	4	2	1	1	2	3	9			
<i>Catinaster calyculus</i>													
<i>Catinaster coalitus</i>													
<i>Ceratolithus cristatus</i>													
<i>Ceratolithus rugosus</i>													
<i>Coccolithus crassipons</i>													
<i>Coccolithus eopelagicus</i>													?
<i>Coccolithus miopelagicus</i>	5	3	1	4	1	3	2	5	2	+	+	2	2
<i>Coccolithus pelagicus</i>	15	11	11	2	14	15	34	11	5	4	22	17	29
<i>Coccolithus streckeri</i>													
<i>Coronocyclus nitescens</i>	3	+				5	+	+	2	+		1	
<i>Cydicarolithus floridanus</i>	55	51	8	20	23	29	50	114	105	120	49	79	83
<i>Cyclolithella annula</i>													
<i>Dictyococcites productus</i>													
<i>Discoaster adamanteus</i>										?			1
<i>Discoaster asymmetricus</i>													
<i>Discoaster bellus</i>													
<i>Discoaster berggrenii</i>													
<i>Discoaster blackstockae</i>													
<i>Discoaster bollii</i>													
<i>Discoaster brauerii</i>													
<i>Discoaster brouweri</i>													
<i>Discoaster calcaris</i>													
<i>Discoaster challengerii</i>													
<i>Discoaster decorus</i>													
<i>Discoaster deflandrei</i>	65	60	18	10	4	19	7	9	4	4	27	29	8
<i>Discoaster druggii</i>		5	?		+		1	1	+	+			
<i>Discoaster exilis</i>	?												
<i>Discoaster hamatus</i>													
<i>Discoaster kugleri</i>													
<i>Discoaster loeblichii</i>													
<i>Discoaster neohamatus</i>													
<i>Discoaster neorectus</i>													
<i>Discoaster panus</i>													
<i>Discoaster pentaradiatus</i>													
<i>Discoaster prepentaradiatus</i>													
<i>Discoaster pseudovariabilis</i>													
<i>Discoaster quadramus</i>													
<i>Discoaster quinquaramus</i>													
<i>Discoaster surculus</i>													
<i>Discoaster tamalis</i>													
<i>Discoaster triradiatus</i>													
<i>Discoaster tristellifer</i>													
<i>Discoaster variabilis</i>	2	6	1		2	3	1				5		
<i>Discoaster spp.</i>	2	13	1			1		1			2	3	
<i>Ericsonia obruta</i>			5	4	2	3	3	4	4	2		3	?
<i>Hayaster perplexus</i>			1		+								
<i>Helicosphaera carteri</i>													
<i>Helicosphaera granulata</i>													
<i>Helicosphaera neogranulata</i>													
<i>Helicosphaera recta</i>													?
<i>Helicosphaera sellii</i>													
<i>Helicosphaera wallichii</i>													
<i>Pontosphaera spp.</i>				1									
<i>Pseudoemiliania lacunosa</i>													
<i>Reticulofenestra asanoi</i>													
<i>Reticulofenestra gelida</i>		2	41	41	41	31	31	4	8	5		2	3
<i>Reticulofenestra haqii</i>			28	39	29	17	14	2	2	2			1
<i>Reticulofenestra minuta</i>					5						1		
<i>Reticulofenestra minutula</i>	1		16	2	6	7				+			1
<i>Reticulofenestra pseudoumbilica</i>	2	3	7	6	4	12	6		1				4
<i>Scyphosphaera spp.</i>													
<i>Sphenolithus abies</i>		1	3	3	1								
<i>Sphenolithus belemnos</i>													
<i>Sphenolithus ciperensis</i>												1	2
<i>Sphenolithus compactus</i>	4	3	20	14	16	16	20	12	7	5	1	3	9
<i>Sphenolithus conicus</i>													
<i>Sphenolithus delphix</i>						1			2	+			
<i>Sphenolithus dissimilis</i>	5	1	4	1	6	7	7	3	+	2	3	19	2
<i>Sphenolithus distentus</i>													?
<i>Sphenolithus heteromorphus</i>	9												
<i>Sphenolithus moriformis</i>	22	8	21	19	23	19	13	12	5	3	6	7	32
<i>Syracosphaera pulchra</i>													
<i>Tetralithides symeonidesii</i>	+												
<i>Triquetrorhabdus carinatus</i>	1	23	4	9	13	10	4	13	46	43	84	34	22
<i>Triquetrorhabdus milowii</i>	4	1		1			1		1				
<i>Triquetrorhabdus rugosus</i>	3	4		6	1			1					
<i>Umbilicosphaera sibogae</i>													
<i>Zygrhablithus bijugatus</i>													+
Miscellaneous	2	1	5	11	6	1	2		1				

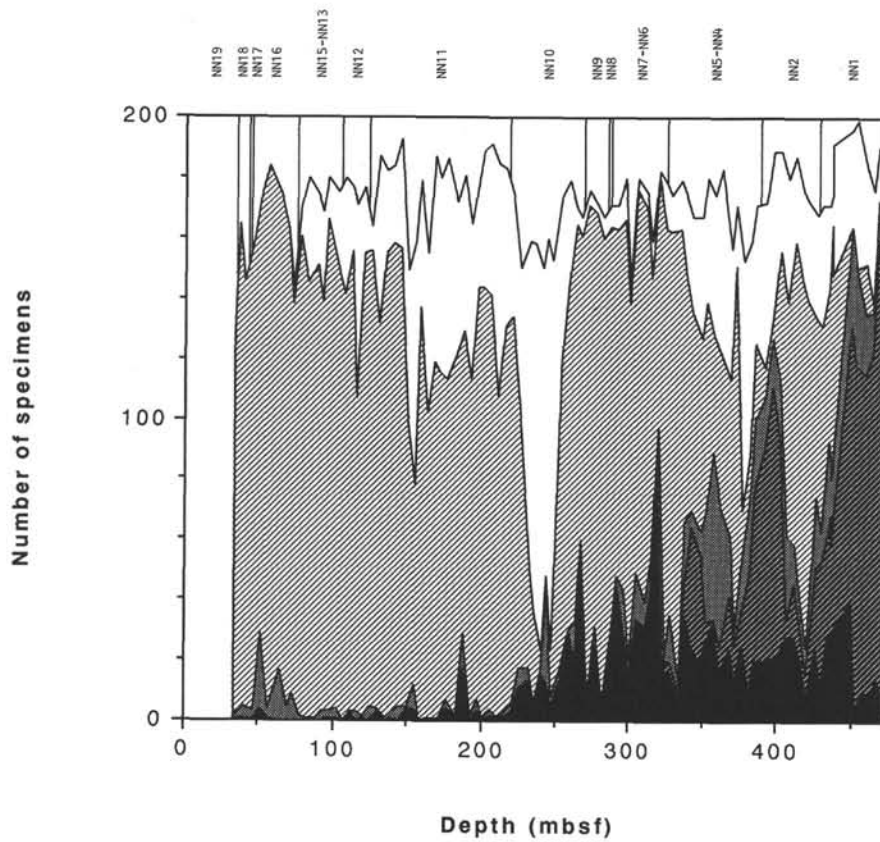
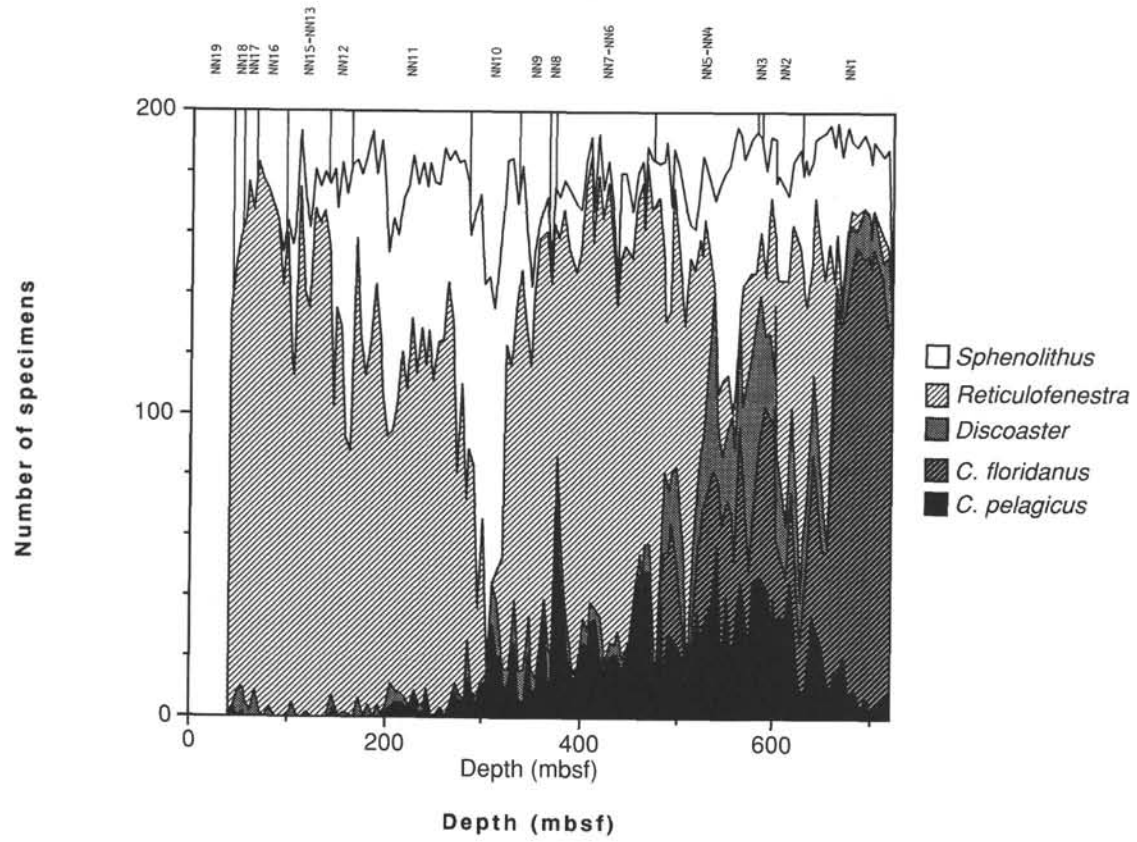


Figure 4. Sequential changes of composition of flora in Holes 806B (A), 805B and 805C (B), and 804C (C).

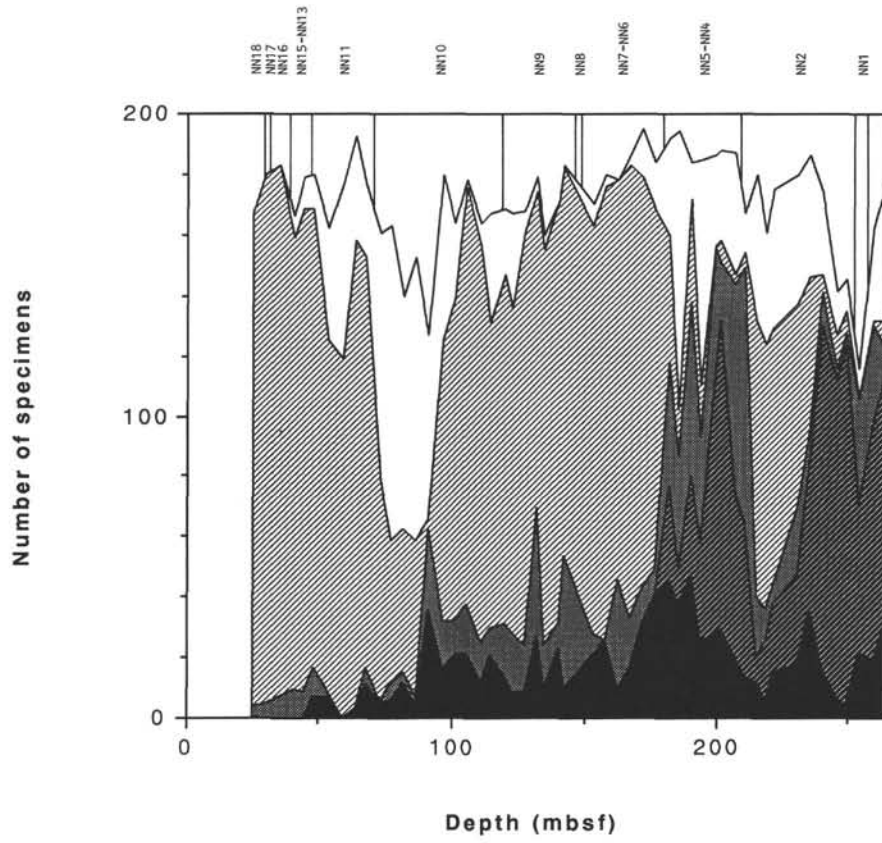


Figure 4 (continued).

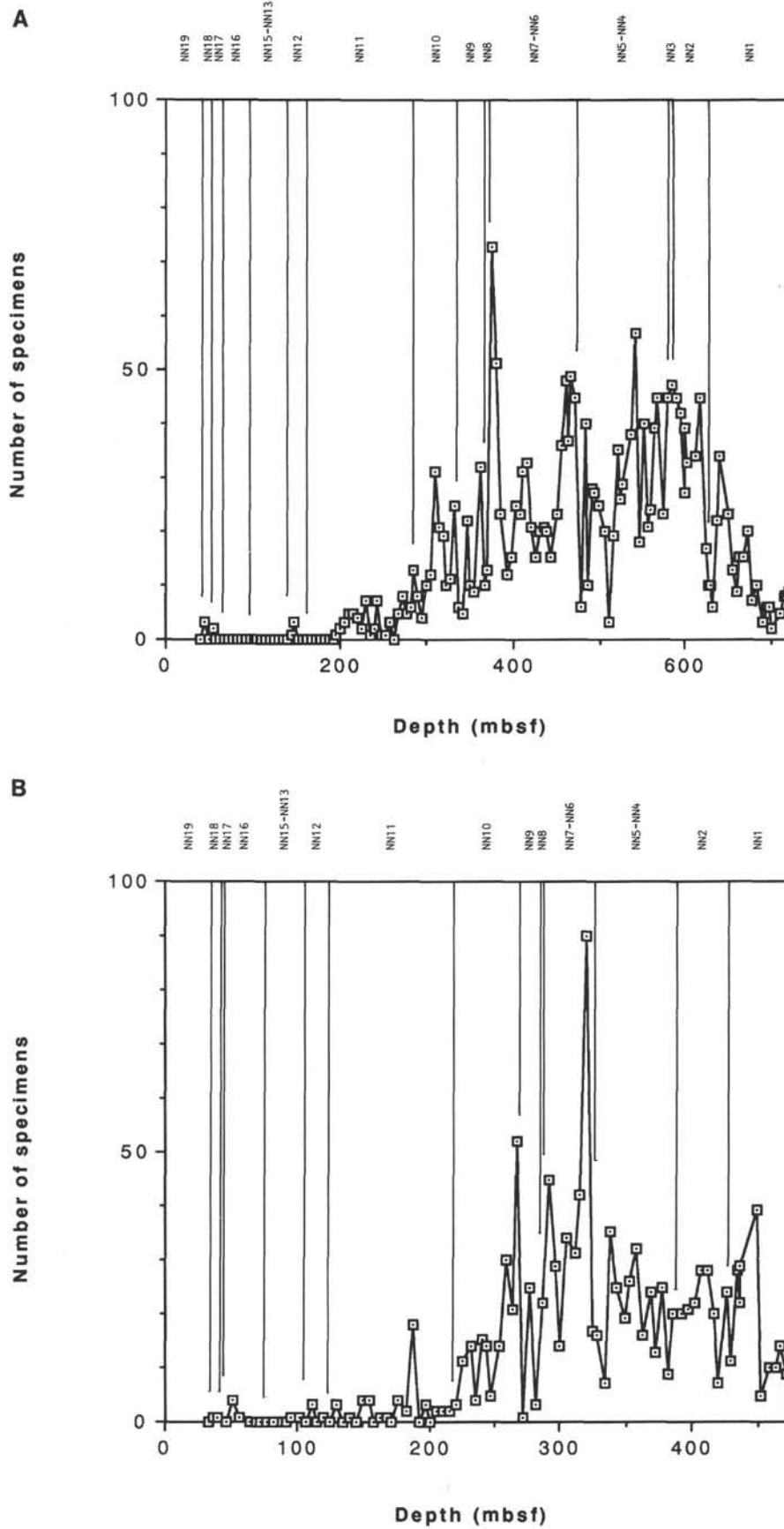


Figure 5. Sequential changes of relative abundance of *Coccolithus pelagicus* and *C. miopelagicus* in Holes 806B (A), 805B and 805C (B), and 804C (C).



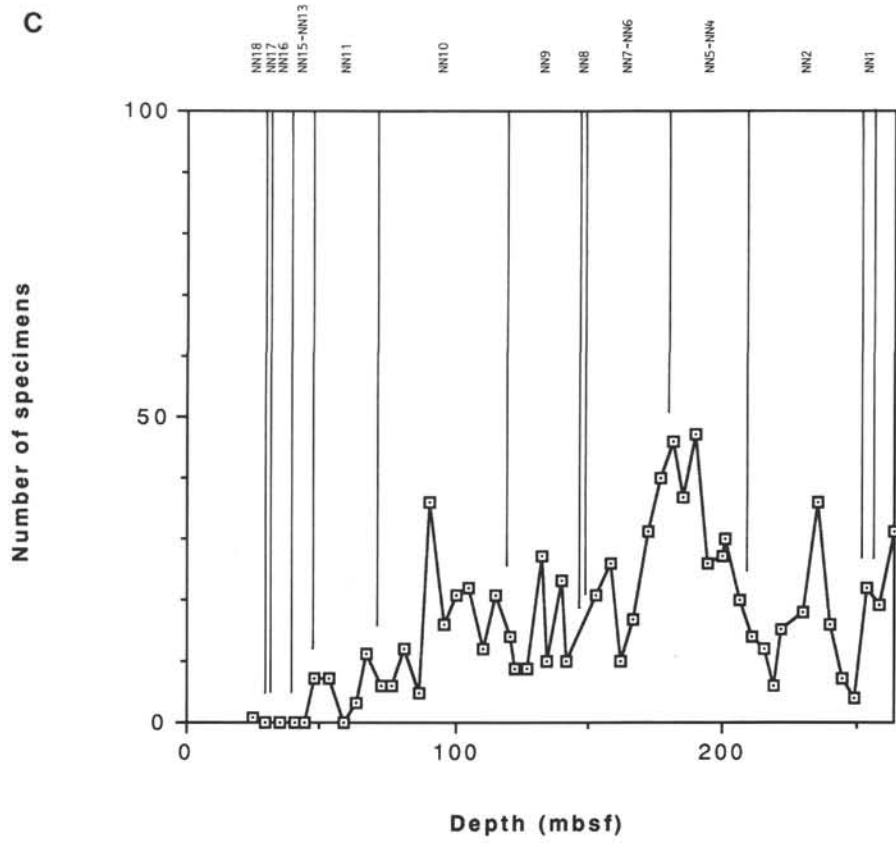


Figure 5 (continued).

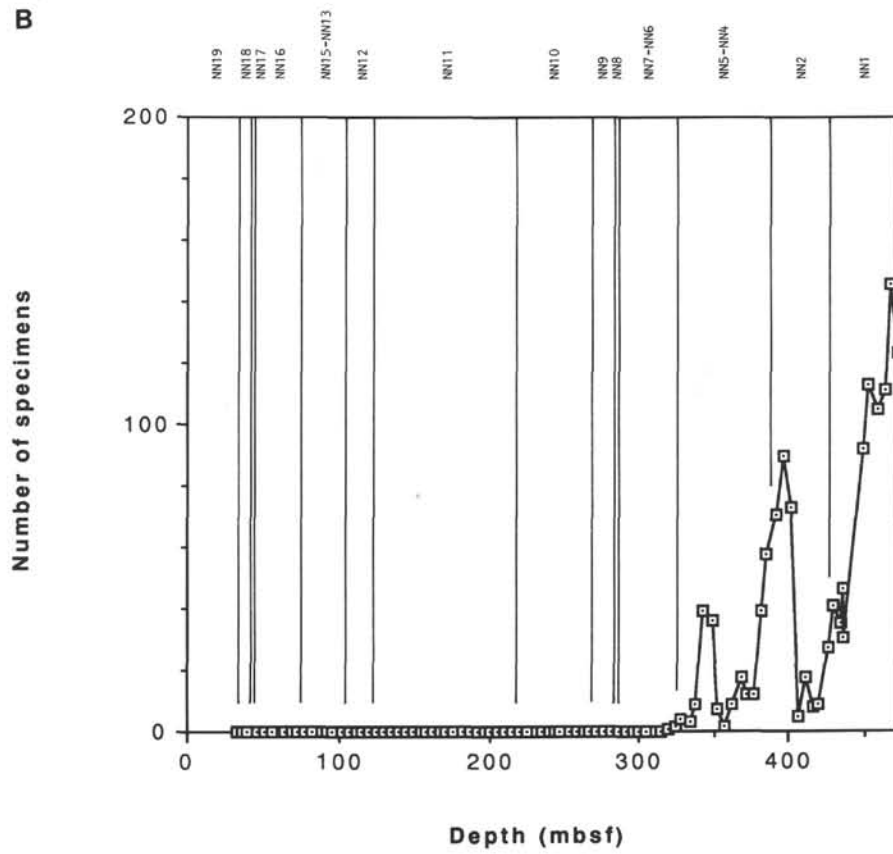
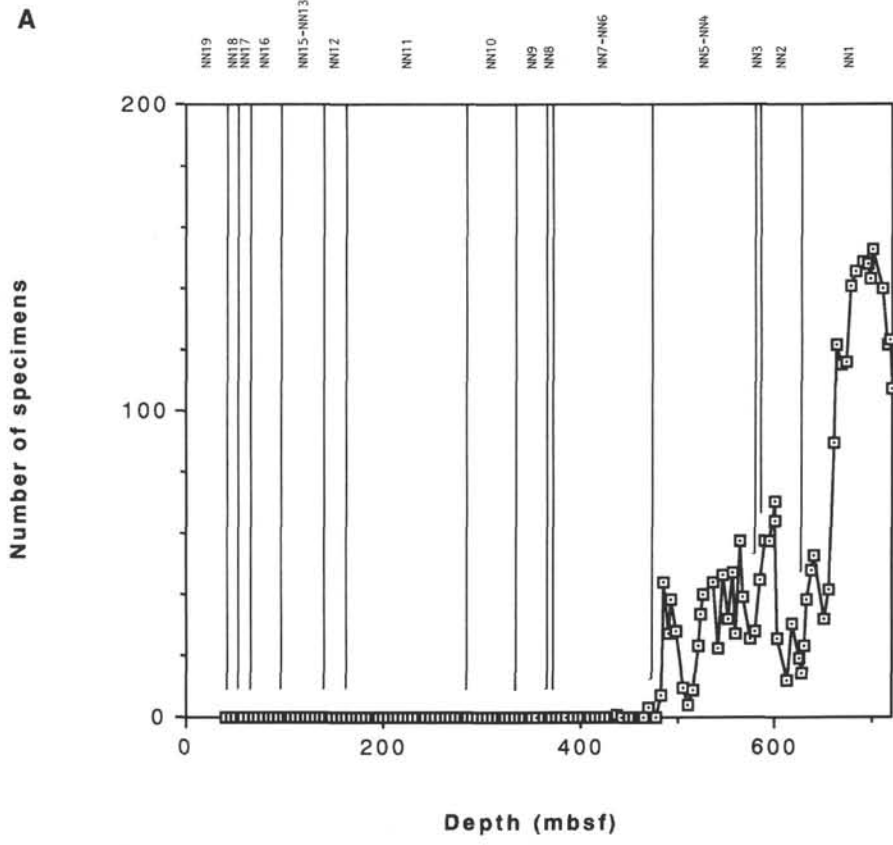


Figure 6. Sequential changes of relative abundance of *Cyclicargolithus floridanus* in Holes 806B (A), 805B and 805C (B), and 804C (C).

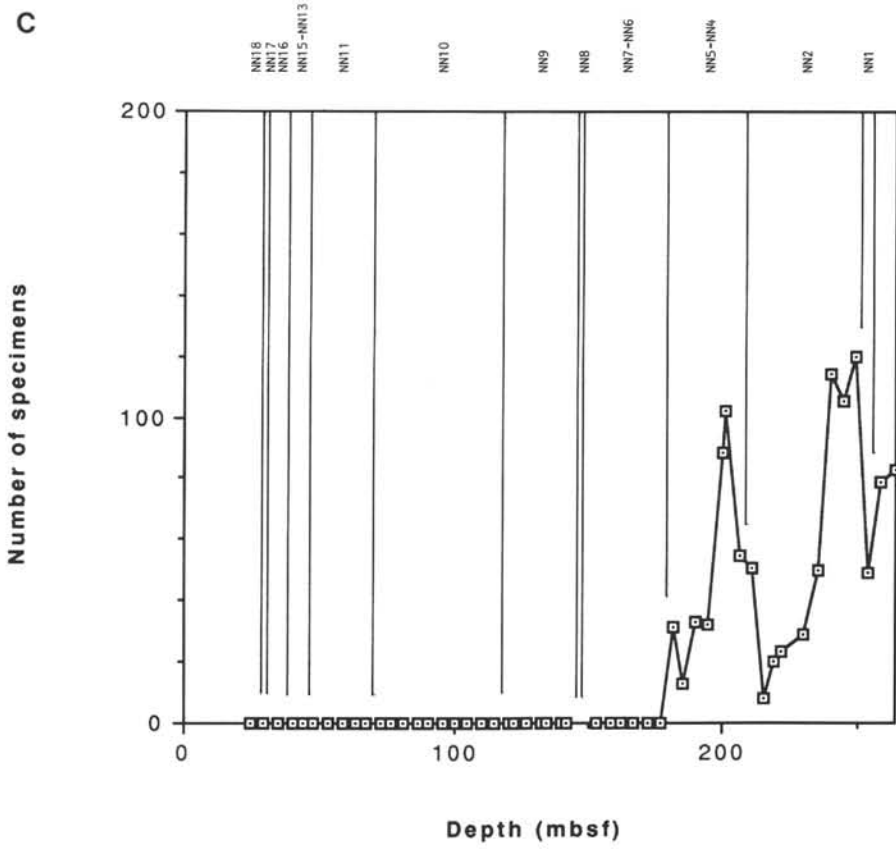


Figure 6 (continued).

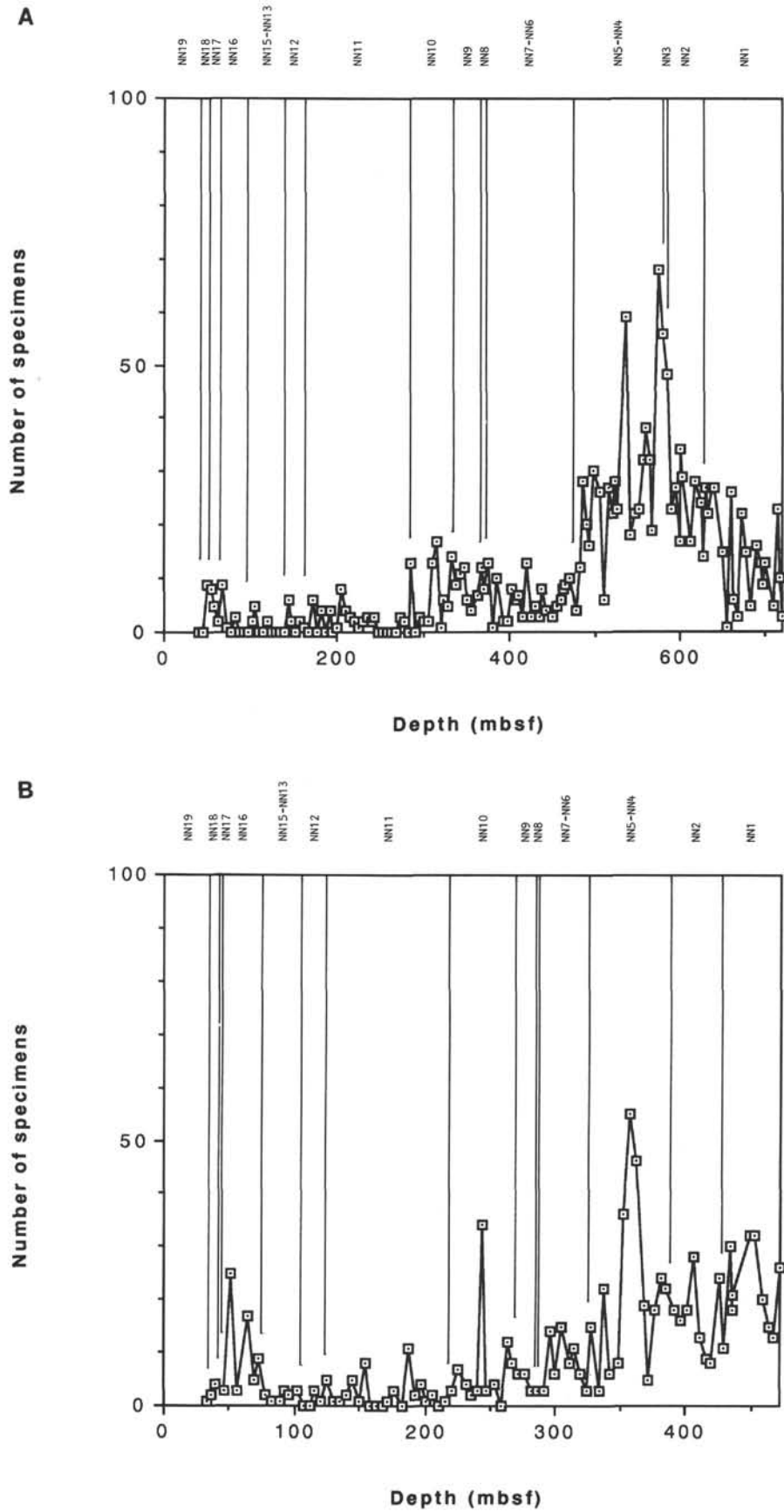


Figure 7. Sequential changes of relative abundance of discoasters in Holes 806B (A), 805B and 805C (B), and 804C (C).

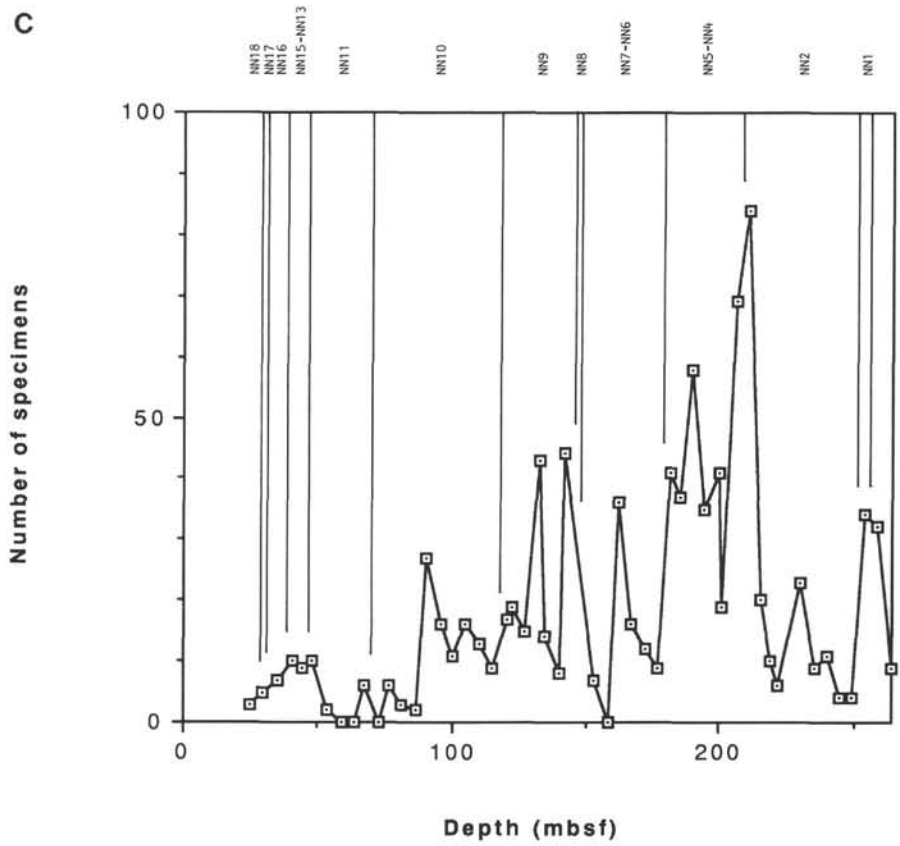


Figure 7 (continued).



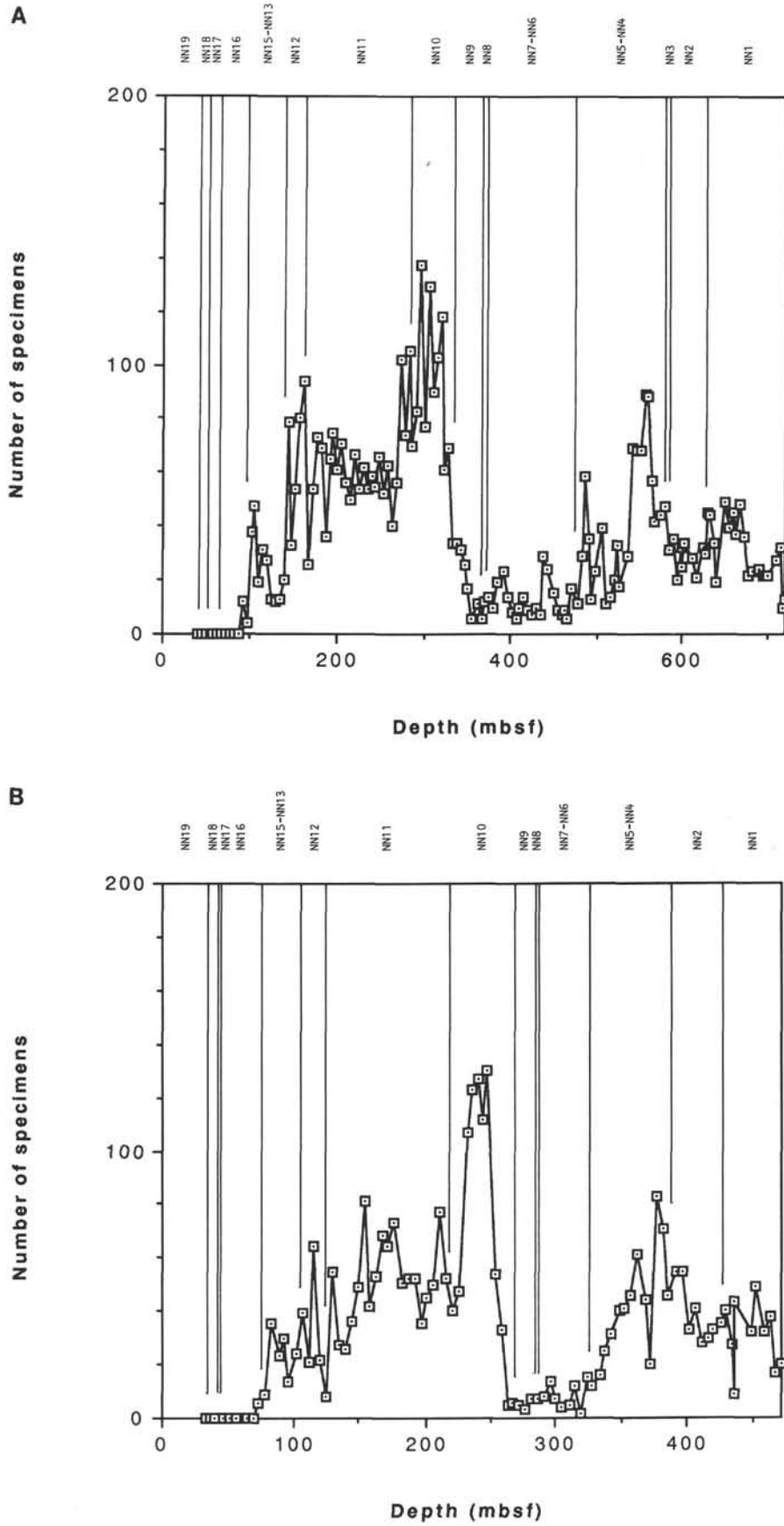


Figure 8. Sequential changes of relative abundance of *Sphenolithus* spp. in Holes 806B (A), 805B and 805C (B), and 804C (C).

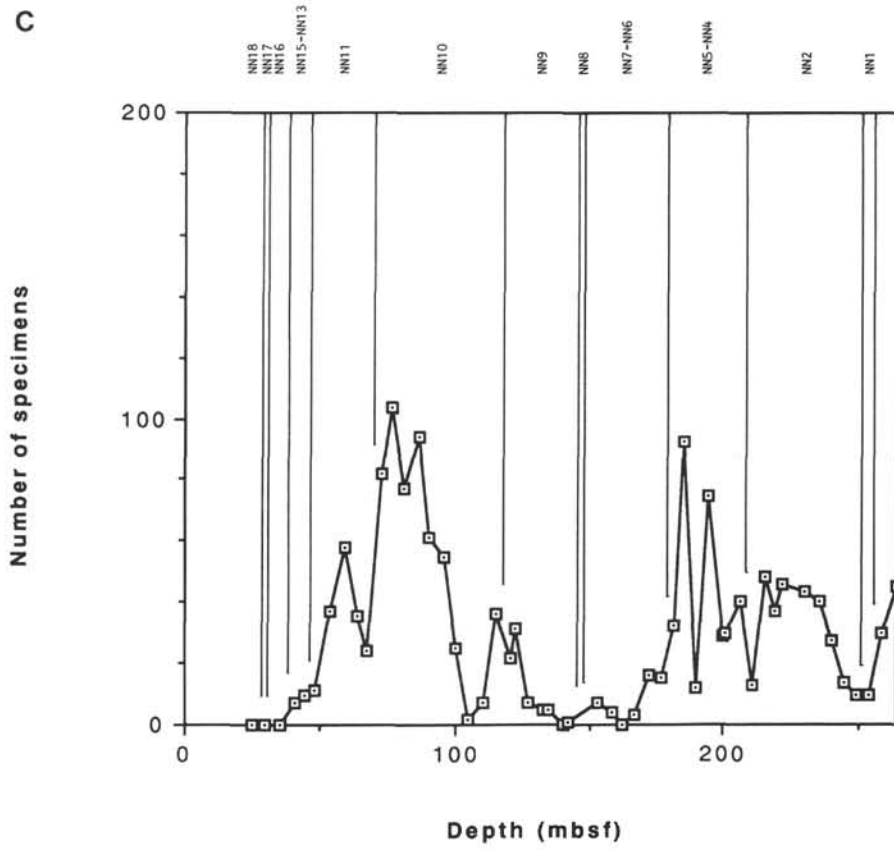


Figure 8 (continued).

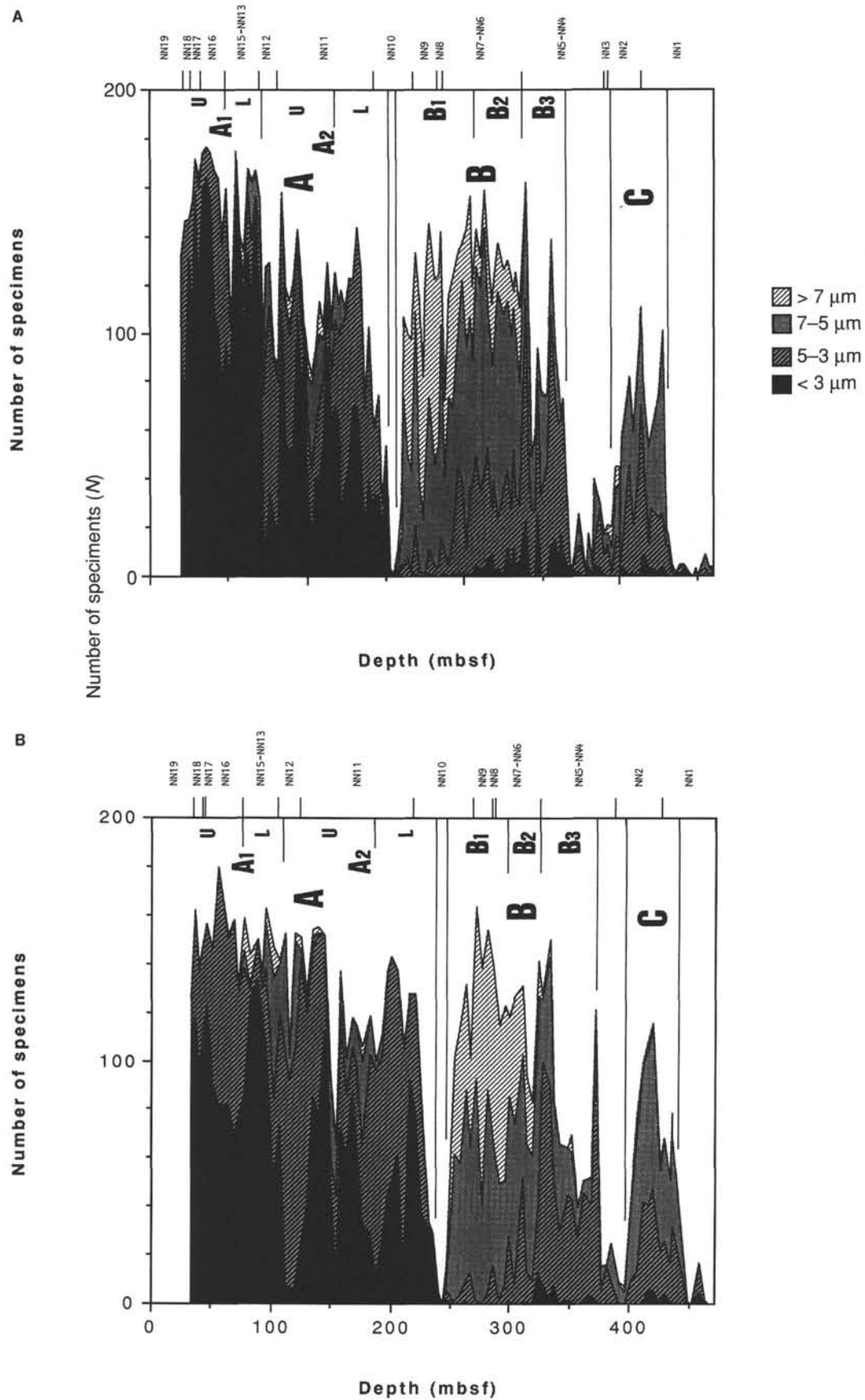


Figure 9. Sequential changes of relative abundance of *Reticulofenestra* and its coccolith size variation in Holes 806B (A), 805B and 805C (B), and 804C (C).

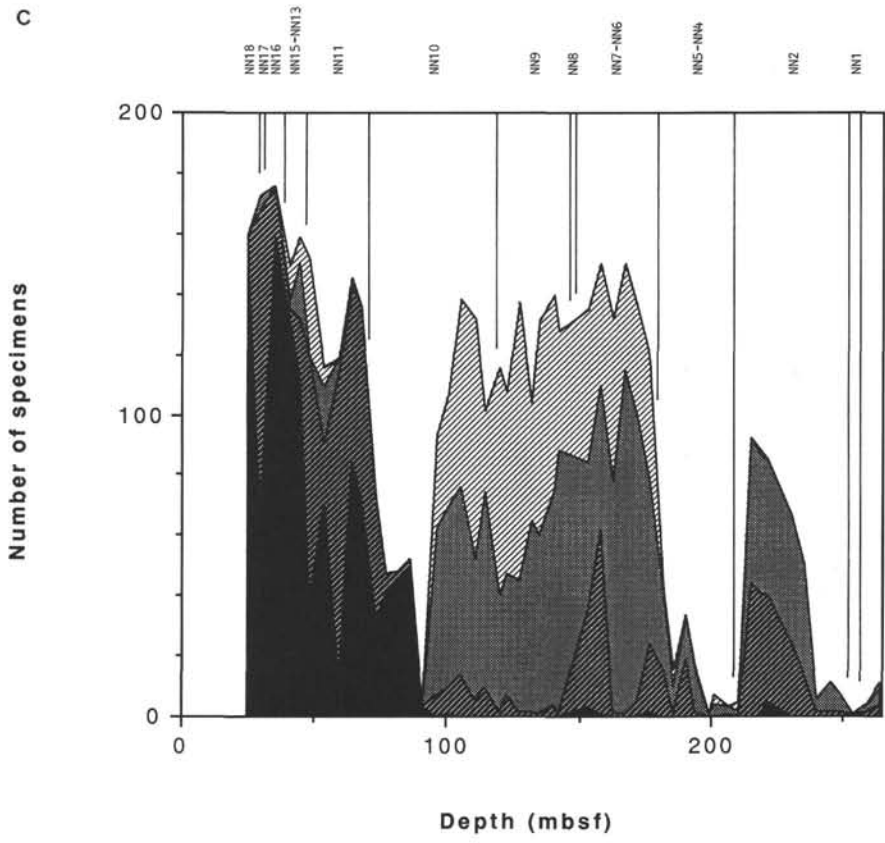


Figure 9 (continued).

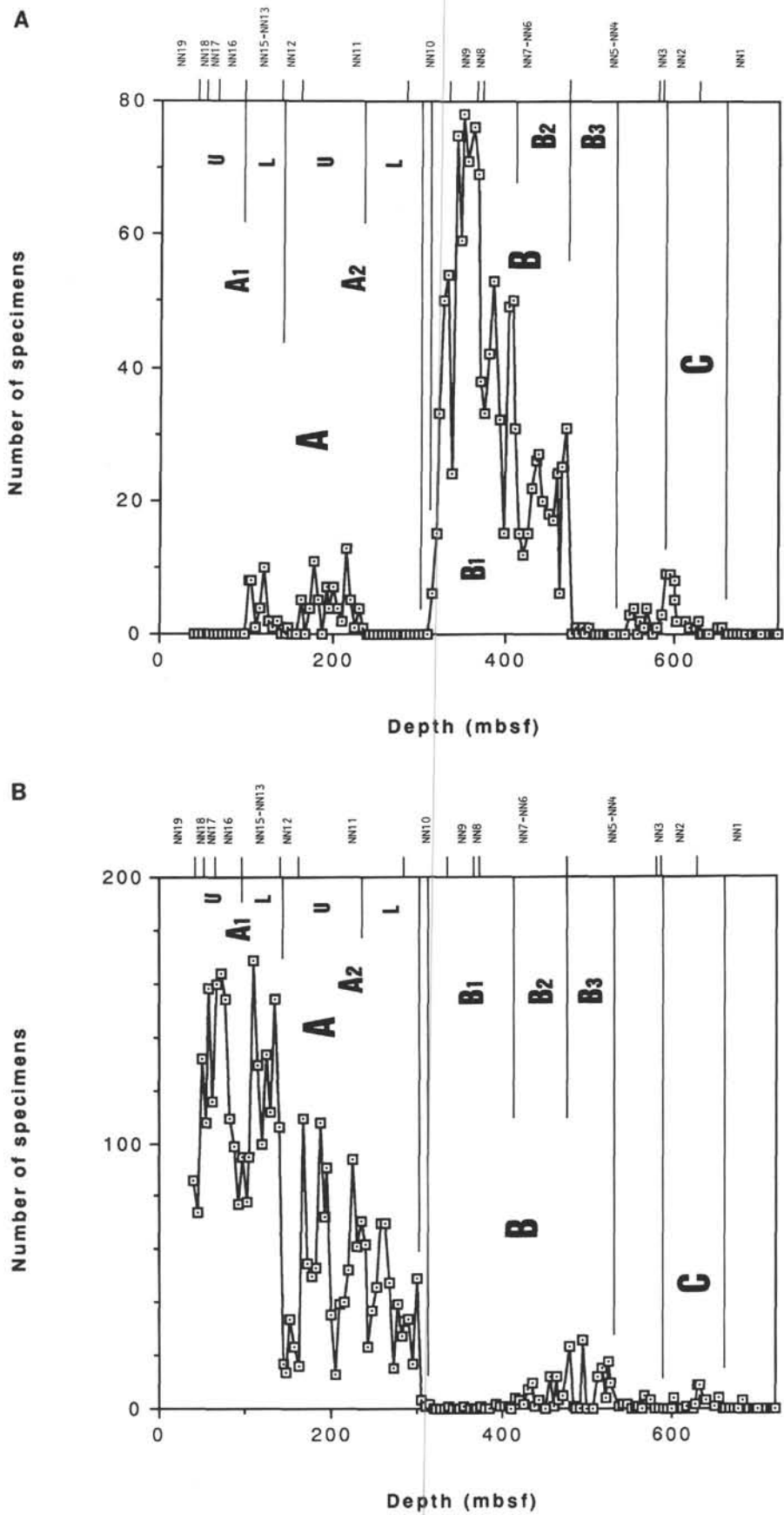


Figure 10. Sequential changes of relative abundance of very large reticulofenestrid coccolith (A) and very small reticulofenestrid coccolith (B) in Hole 806B.