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1. QUANTITATIVE NANNOFOSSIL BIOSTRATIGRAPHY OF QUATERNARY SEQUENCES FROM GUYOTS IN THE CENTRAL AND WESTERN PACIFIC OCEAN[1]

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ABSTRACT

Quantitative analysis of calcareous nannofossils was performed on Quaternary sediments recovered during Leg 144 at Sites 880 (Takuyo-Daisan Guyot), 871 (Limalok Guyot), 872 (Lo-En Guyot), and 873 (Wodejebato Guyot). For each sample, at least 500 specimens were counted with the light microscope and the relative abundance of taxa was computed as percentages. Calcareous nannofloras are very abundant and well preserved. Assemblages are dominated by the gephyrocapsid group, which was subdivided using a simplified taxonomy based on morphologic and morphometric characters that are easily applicable during light microscope investigations. Quantitative analysis of nannofloras revealed distinctive changes in the abundance patterns, especially within the *Gephyrocapsa* group, at all sites. These events seem to be coeval on a global scale and were used for high-resolution biostratigraphy. Most nannofossil events and biozones previously proposed for the Quaternary were recognized.

The sequence recovered at Site 880 is almost complete, but a hiatus was detected in the upper Pleistocene, where the *G. oceanica* Zone is extremely short. At Site 871, the Quaternary sequence seems to be complete and all the nannofossil events and biozones were detected. Also at Site 872, a complete sequence of nannofossil events was recognized, but the Quaternary section is very thin and suggests very low sedimentation rates and/or the occurrence of minor hiatuses that cannot be determined with biostratigraphy. The spacing of nannofossil events at Sites 800, 871, and 872 is quite different, suggesting variable sedimentation rates and minor gaps caused by the strong currents on top of these guyots. At Site 873, most of the Quaternary is missing; detection of only the lower Pleistocene nannofossil events suggests that the accumulation of recent sediments on Wodejebato Guyot is strongly affected by current activity.

Major changes in the composition of Pleistocene nannofloras appear to be coeval on a global scale across a wide latitudinal range within the tropical to equatorial belts. However, the nannofossil records at Sites 871, 872, 873, and 880 indicate that some taxa were locally and temporarily influenced by the specific oceanographic conditions. Further investigations on the distribution of specific taxa, such as the smallest specimens of *Gephyrocapsa* (2–2.5 μm) and *Florisphaera profunda,* may help in separating global vs. local/regional effects.

INTRODUCTION

Ocean Drilling Program (ODP) Leg 144 was devoted to the exploration of guyots in the central and western Pacific, in order to reconstruct the geological history of Cretaceous and Paleogene atolls that progressively subsided to present water depths between 1084 and 1525 m below seafloor (mbsf) (Table 1). The five guyots investigated are aligned along a southeast-northwest transect in a wide latitude band ranging from 5°33.13′N to 34°12.53′N (see Frontispiece and Table 1). Major objectives of Leg 144 included the construction of the volcanic edifice, the onset of marine sedimentation, and the development of carbonate platforms on the volcanic pedestal; the demise of shallow-water sedimentation; and the Cenozoic history of pelagic sediments capping the guyots.

Tertiary and Quaternary pelagic caps were recovered on Limalok Guyot (Site 871), Lo-En Guyot (Site 872), Wodejebato Guyot (Site 873), MIT Guyot (Site 878), and Takuyo-Daisan Guyot (Site 880). Shipboard investigations (Premoli Silva, Haggerty, Rack, et al., 1993) revealed that these pelagic sequences are characterized by several unconformities that resulted from the strong currents winnowing the nannofossil-foraminifer oozes on top of the guyots. As the Quaternary appeared to be well represented at most sites, a special study was dedicated to this interval.

This paper documents the calcareous nannofossil distribution in the Quaternary sequences recovered at Sites 871, 872, 873, and 880. Site 878 was not studied because only a very thin (3.2 m) Pleistocene to Miocene pelagic section was penetrated. The upper part of this section is extremely soupy and contains mixed nannofossil assemblages of late Pliocene and early Pleistocene age that hampered detailed investigations (Premoli Silva, Haggerty, Rack, et al., 1993; Watkins et al., this volume).

A detailed study was applied to Site 880 (Takuyo-Daisan Guyot), which was specifically drilled to recover the pelagic cap on the northernmost guyot of the transect. Although the limited time allocated to this site prevented reaching the contact between the pelagic cap and the underlying platform limestone, a complete Holocene to uppermost Pliocene section was penetrated. The sediments recovered at this site are undisturbed and magnetostratigraphy was obtained (Rack et al., this volume). On the contrary, at Sites 871, 872, and 873 paleomagnetic studies were performed throughout the pelagic caps, but no magnetostratigraphic interpretation was possible owing to the generally soupy texture of the sediments (Premoli Silva, Haggerty, Rack, et al., 1993). Because the Quaternary section at Site 800 yields the most complete data set, with both biostratigraphy and magnetostratigraphy, this site will be presented and discussed first, whereas Sites 871, 872, and 873 will be discussed later.

Because the use of Quaternary nannofossil events allow us to obtain a high-resolution biostratigraphy, the present study will be used to correlate the four investigated sites and estimate possible hiatuses related to current activity vs. accumulation at various guyots in the central and western Pacific. Moreover, changes in nannofloral composition will be used for ecologic/oceanographic interpretations.

MATERIALS AND METHODS

At Site 880 sampling has a resolution of 20 cm throughout the core (Table 2), whereas at Sites 871, 872, and 873 samples were analyzed every 50 cm (Tables 3–5). Raw material was permanently mounted using Norland Optical Adhesive; sediments were not ultrasonically cleaned or centrifuged so that we could retain the original sediment and assemblage composition. A quantitative study of calcareous nannofos-

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Table 1. Latitude, longitude, and water depth of Sites 871, 872, 873, 878, and 880 drilled during Leg 144.

Site	Guyot	Latitude (N)	Longitude (E)	Water depth (m)
871	Limalok	5°33.13′	172°20.66′	1255
872	Lo-En	10°05.85′	162°51.96′	1084
873	Wodejebato	11°53.84′	164°55.20′	1334
878	MIT	27°19.143′	151°53.028′	1323
880	Takuyo-Daisan	34°12.53′	144°18.74′	1525

sils was performed with the polarizing light microscope, at 1250× magnification on smear slides prepared using standard techniques. Nannofossils were quantified by counting at least 500 specimens in each sample, and single taxa abundance is reported in Tables 2 through 5 as counts and percentages of total nannoflora. Qualitative investigation was extended to 100 additional fields of view to search for rare but biostratigraphically important taxa.

Because the genus *Gephyrocapsa* is dominant through the Pleistocene, the composition of this group was quantified as suggested by Raffi et al. (1993). These authors proposed to use relative abundances (percentages) of gephyrocapsid classes in counts of at least 100 gephyrocapsid specimens. In the Quaternary sequences of Sites 880, 871, 872, and 873, much more than 100 gephyrocapsids were identified in counts of 500 specimens of total nannofloras. Therefore, the percentages of single classes within the genus *Gephyrocapsa* were calculated on the original counts.

TAXONOMIC REMARKS

Pleistocene calcareous nannofloras are usually dominated by groups represented by small-sized coccoliths. In particular, the *Gephyrocapsa* group shows very high abundances and is extensively used for biostratigraphy. However, despite their abundance, there is no standard taxonomy for gephyrocapsids, and very little agreement on their taxonomy and nomenclature exists among biostratigraphers. Discrepancies also result from the use of a scanning electron microscope vs. a light microscope for the analysis of morphologic variations within the genus *Gephyrocapsa.* Recently, Raffi et al. (1993) discussed the gephyrocapsid taxonomy and the various criteria that have been proposed for the classification of this group (Gartner, 1977; Rio, 1982; Takayama and Sato, 1987; Matsuoka and Okada, 1989). For the present study, the informal, morphometric taxonomic concepts of Rio (1982) and Raffi et al. (1993) were followed. In fact, this simplified taxonomy is readily applicable using the light microscope and was proven to give reliable and reproducible results in the Atlantic and Pacific oceans (Raffi et al., 1993) as well as in the Mediterranean Sea (Rio et al., 1990; Castradori, 1993a).

For the *Reticulofenestra* group, the morphometric taxonomic concepts proposed by Matsuoka and Okada (1989) were partially adopted, as discussed below.

Gephyrocapsid Group

In agreement with Rio (1982), for the present study, specimens of the genus *Gephyrocapsa* were subdivided as follows:

1. Small *Gephyrocapsa:* specimens with a maximum length shorter than 3.5 µm;
2. Large *Gephyrocapsa:* specimens with a maximum length longer than 5.5 µm;
3. Medium-sized *Gephyrocapsa:* specimens with a maximum length between 3.5 and 5.5 µm.

The last subgroup is further subdivided into three species: *G. caribbeanica, G. oceanica* s.l., and *Gephyrocapsa* sp. 3. *G. caribbeanica* has a small central area spanned by a short bar. In the material studied, most specimens are 3.5 to 4 µm in size. *G. oceanica* s.l. has an open central area spanned by a diagonal bar (Rio et al., 1990). *Gephyrocapsa* sp. 3 has an open central area spanned by a bar that is nearly parallel to the short axis of the ellipse (< 20°). *Gephyrocapsa* sp. 3 is a synonym of *G. omega* and *G. parallela* (see Raffi et al., 1993, for discussion) and is equivalent to "*G. oceanica* (vertical)" of Matsuoka and Okada (1989).

Reticulofenestrid Group

The taxonomy of the Pleistocene reticulofenestrids has been discussed by various workers (Pujos, 1985a, 1985b; Takayama and Sato, 1987; Matsuoka and Okada, 1989). For the present study, specimens of the genus *Reticulofenestra* were subdivided as follows:

1. Small *Reticulofenestra:* specimens with a maximum length shorter than 4 µm;
2. Medium-sized *Reticulofenestra:* specimens with a maximum length between 4 and 6.5 µm;
3. Large *Reticulofenestra:* specimens with a maximum length between 6.5 and 8 µm.

The latter specimens are close to *R. asanoi* of Sato and Takayama (1990), but most specimens are elliptical and not circular.

In all of the tables the small- and the medium-sized *Reticulofenestra* are reported in the same column because they are equally abundant in the lower Pleistocene and are mainly represented by specimens close to 4 µm in size. The large *Reticulofenestra* group is comparable to the "*Reticulofenestra* A (large variety)" of Matsuoka and Okada (1989).

Pseudoemiliania lacunosa Group

Pseudoemiliania lacunosa is abundant in the lower Pleistocene and fluctuates in abundance before its disappearance in the middle Pleistocene. In the present study, specimens were subdivided as follows:

1. *P. lacunosa* E: elliptical specimens;
2. *P. lacunosa* C: circular specimens.

In all the Quaternary sequences at Sites 880, 871, 872, and 873, specimens of the *P. lacunosa* E group are much more abundant than specimens of the *P. lacunosa* C group, but their stratigraphic range is identical (Tables 2–5).

RESULTS

Very abundant nannofossil assemblages were observed throughout the Quaternary sequences at Sites 880, 871, 872, and 873. Because of the relatively shallow depths of the sites studied, nannofloras are nicely to moderately preserved and the tiny and delicate species, which are prone to dissolution, are common. Gephyrocapsids are dominant and, at all sites, a gradual increase in abundance of the *Gephyrocapsa* group was observed from the lower to the upper Pleistocene (Figs. 1–4). Only in the uppermost Pleistocene, gephyrocapsids decrease in abundance and are progressively outnumbered by *Emiliania huxleyi.* In the lowermost Pleistocene reticulofenestrids are abundant, but this group becomes rare from the middle Pleistocene upward.

Within the genus *Gephyrocapsa,* different morphogroups show variable abundance through the Pleistocene, as pointed out by the gephyrocapsid composition illustrated in Figures 1 through 4. These changes in the proportions of gephyrocapsid taxa are extremely useful for biostratigraphy and are discussed below.

Pseudoemiliania lacunosa is generally more abundant in the lower than in the middle Pleistocene, and its progressive decline is paralleled by the increase in abundance of gephyrocapsids. However, at Site 880, two abundance peaks of *Pseudoemiliania lacunosa* with values up to

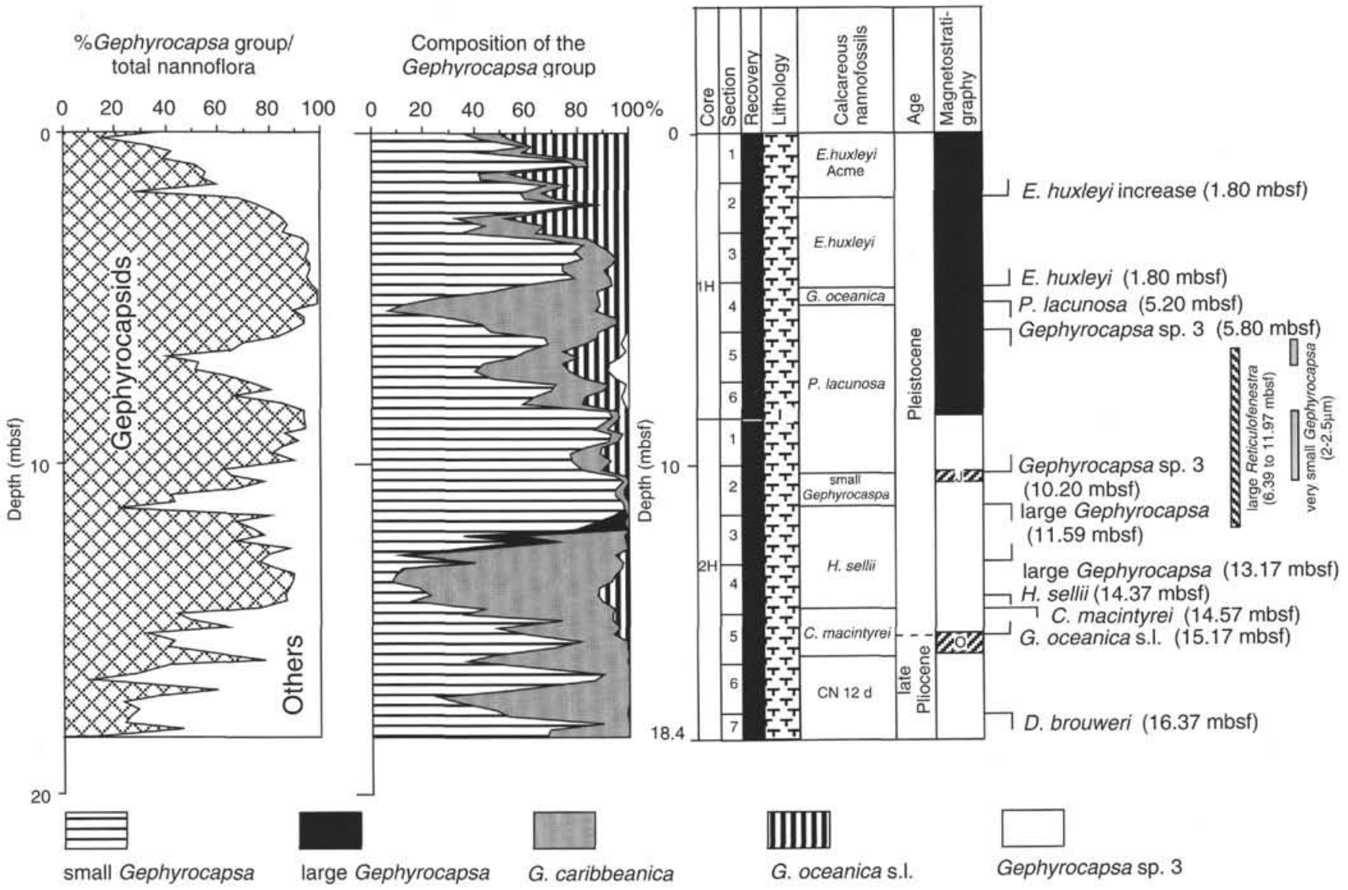

Figure 1. Abundance of gephyrocapsids vs. other nannofossils and composition (percentages) of various taxonomic classes within the *Gephyrocapsa* group at Site 880 (Takuyo-Daisan Guyot). On the right are the biostratigraphic results of quantitative analyses of nannofloras correlated with the magnetostratigraphy provided by Rack et al. (this volume). The Jaramillo and Olduvai subchrons are plotted in a diagonal pattern because they were tentatively recognized.

approximately 50% of the total nannoflora were detected in the middle Pleistocene. Also at Site 871, *P. lacunosa* shows an increase in abundance (approximately 25% of the total nannoflora) in the middle Pleistocene, and in coeval sediments at Site 872 this taxon increases to approximately 23% of the total nannoflora.

Several other nannofossil genera were observed, but they are usually represented by rare to few specimens. The complete nannofloral distribution in the Quaternary sequences at Sites 880, 871, 872, and 873 is reported in Tables 2 through 5.

Site 880 (Takuyo-Daisan Guyot)

The distribution of calcareous nannofossils in the Quaternary sequence at Site 880 is reported in Table 2. Percentages of biostratigraphically important taxa as well as those of the most abundant forms are plotted in Figure 5, and the abundance and composition of the gephyrocapsid group are illustrated in Figure 1.

Small and medium-sized *Reticulofenestra* and *Pseudoemiliania lacunosa* are abundant in the lower Pleistocene and both decline through the middle Pleistocene. Two abundance peaks of *Pseudoemiliania lacunosa* with values up to approximately 50% of the total nannoflora were detected in the middle Pleistocene, at 12.97–10.97 and 7.98–6.39 mbsf. Also, the reticulofenestrids show a relative increase in abundance between 11.97 and 6.39 mbsf where they are represented exclusively by the large specimens.

Gephyrocapsids gradually increase in abundance upward and overwhelm over all the other nannofossils in the middle to upper Pleistocene, but markedly decrease in abundance in the uppermost Pleistocene, where they are outnumbered by *Emiliania huxleyi*. Within the *Gephyrocapsa* group, the various taxa show marked changes in abundance (Fig. 1). The small *Gephyrocapsa* and *G. caribbeanica* dominate the lowermost Pleistocene, where *G. oceanica* s.l. appears and increases in abundance, but is never dominant. Between 13.17 and 11.59 mbsf, the large *Gephyrocapsa* spp. are common, but absent below or above this interval. The disappearance of the large *Gephyrocapsa* coincides with the base of dominant small *Gephyrocapsa* that constitute up to 97% of the gephyrocapsid group. In the interval immediately underlying the base of the small *Gephyrocapsa* Zone, the medium-sized specimens are virtually absent, whereas the large-sized ones are common.

Within the small gephyrocapsid class, specimens of 2 to 2.5 µm in length become dominant at the base of the small *Gephyrocapsa* Zone (11.59–11.97 mbsf), in the lowermost part of the *P. lacunosa* Zone (8.40–10.54 mbsf), and in a short interval (6.19–6.59 mbsf) close to the end of the large *Reticulofenestra* interval.

At 10.20 mbsf, the medium-sized gephyrocapsids reenter the section and are represented by *G. caribbeanica, G. oceanica* s.l., and *Gephyrocapsa* sp. 3. The latter taxon was observed only between 10.20 and 5.80 mbsf, whereas both *G. caribbeanica* and *G. oceanica* s.l. occur in the remainder of the Pleistocene. A marked change in nannofloral composition was detected at 4.80 mbsf, where *Emiliania huxleyi* was first observed. At this level, *G. caribbeanica* sharply decrease in abundance, whereas the small specimens become dominant again within the *Gephyrocapsa* group.

Eleven biostratigraphic events and eight biozones were recognized at this site (Table 6); the depths of the nannofossil events are reported in Table 7. The calibration of nannofossil biostratigraphy with magnetostratigraphy (Rack et al., this volume) is illustrated in

Table 2. Quantitative distribution of Quaternary calcareous nannofossils at Site 880 (Takuyo-Daisan Guyot).

Core, section, interval (cm)	Depth (mbsf)	*E. huxleyi*	*E. huxleyi* (%)	Small *Gephyrocapsa*	Small *Gephyrocapsa* (%)	Large *Gephyrocapsa*	Large *Gephyrocapsa* (%)	*G. caribbeanica*	*G. caribbeanica* (%)	*G. oceanica* s.l.	*G. oceanica* s.l. (%)	*H. carteri*	*H. carteri* (%)	*C. leptoporus*	*C. leptoporus* (%)	*C. annula*	*C. annula* (%)	*Thoracosphaera*	*Thoracosphaera* (%)	*Rhabdosphaera*	*Rhabdosphaera* (%)	*C. pelagicus*	*C. pelagicus* (%)	*Syracosphaera* spp.
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1H-1, 0–2	0.01	236	42.29	72	12.90	0	0.00	28	5.02	103	18.46	53	9.50	53	9.50	10	1.79	1	0.18	1	0.18	1	0.18	0
1H-1, 20–22	0.20	380	72.66	33	6.31	0	0.00	9	1.72	36	6.88	13	2.49	30	5.74	9	1.72	0	0.00	3	0.57	3	0.57	4
1H-1, 40–42	0.40	295	58.19	98	19.33	0	0.00	4	0.79	63	12.43	12	2.37	18	3.55	7	1.38	0	0.00	6	1.18	2	0.39	1
1H-1, 59–61	0.59	189	32.03	103	17.46	0	0.00	41	6.95	101	17.12	82	13.90	53	8.98	9	1.53	1	0.17	0	0.00	9	1.53	0
1H-1, 81–83	0.81	233	45.60	150	29.35	0	0.00	15	2.94	34	6.65	46	9.00	18	3.52	5	0.98	0	0.00	2	0.39	8	1.57	0
1H-1, 100–102	1.00	194	37.89	208	40.63	0	0.00	12	2.34	42	8.20	13	2.54	26	5.08	5	0.98	0	0.00	0	0.00	12	2.34	0
1H-1, 120–122	1.20	128	25.40	116	23.02	0	0.00	33	6.55	129	25.60	11	2.18	70	13.89	12	2.38	0	0.00	0	0.00	4	0.79	1
1H-1, 140–142	1.40	135	26.52	116	22.79	0	0.00	53	10.41	106	20.83	24	4.72	57	11.20	9	1.77	1	0.20	1	0.20	2	0.39	1
1H-2, 10–12	1.60	105	20.47	206	40.16	0	0.00	25	4.87	74	14.42	33	6.43	55	10.72	2	0.39	1	0.19	1	0.19	7	1.36	3
1H-2, 30–32	1.80	282	54.76	82	15.92	0	0.00	12	2.33	48	9.32	39	7.57	35	6.80	2	0.39	0	0.00	4	0.78	6	1.17	1
1H-2, 50–52	2.00	52	9.85	216	40.91	0	0.00	44	8.33	100	18.94	42	7.95	57	10.80	9	1.70	0	0.00	0	0.00	8	1.52	0
1H-2, 68–70	2.18	75	14.59	317	61.67	0	0.00	20	3.89	47	9.14	23	4.47	15	2.92	2	0.39	1	0.19	0	0.00	6	1.17	5
1H-2, 90–92	2.40	49	8.46	287	49.57	0	0.00	28	4.84	155	26.77	1	0.17	40	6.91	0	0.00	0	0.00	0	0.00	19	3.28	0
1H-2, 110–112	2.60	23	4.56	142	28.17	0	0.00	81	16.07	203	40.28	4	0.79	38	7.54	9	1.79	1	0.20	0	0.00	2	0.40	0
1H-2, 130–132	2.80	3	0.59	196	38.51	0	0.00	103	20.24	144	28.29	9	1.77	42	8.25	3	0.59	0	0.00	0	0.00	8	1.57	1
1H-3, 1–3	3.01	13	2.55	150	29.47	0	0.00	126	24.75	158	31.04	10	1.96	42	8.25	1	0.20	0	0.00	0	0.00	7	1.38	0
1H-3, 20–22	3.20	13	2.30	354	62.65	0	0.00	92	16.28	79	13.98	8	1.42	9	1.59	5	0.88	1	0.18	0	0.00	3	0.53	0
1H-3, 40–42	3.40	12	2.37	396	78.26	0	0.00	28	5.53	57	11.26	2	0.40	5	0.99	1	0.20	0	0.00	0	0.00	5	0.99	0
1H-3, 59–61	3.59	11	2.20	377	75.40	0	0.00	62	12.40	38	7.60	2	0.40	10	2.00	0	0.00	0	0.00	0	0.00	0	0.00	0
1H-3, 78–80	3.78	16	3.19	384	76.65	0	0.00	63	12.57	24	4.79	1	0.20	11	2.20	0	0.00	0	0.00	0	0.00	2	0.40	0
1H-3, 100–102	4.00	8	1.59	357	70.83	0	0.00	93	18.45	32	6.35	3	0.60	8	1.59	0	0.00	1	0.20	0	0.00	1	0.20	1
1H-3, 118–120	4.18	13	2.58	357	70.83	0	0.00	78	15.48	47	9.33	2	0.40	3	0.60	0	0.00	0	0.00	1	0.20	2	0.40	1
1H-3, 140–142	4.40	17	3.39	372	74.25	0	0.00	66	13.17	35	6.99	10	2.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.20	0
1H-4, 10–12	4.60	6	1.18	281	55.42	0	0.00	175	34.52	33	6.51	1	0.20	5	0.99	0	0.00	1	0.20	2	0.39	2	0.39	1
1H-4, 30–32	4.80	5	1.00	228	45.42	0	0.00	206	41.04	60	11.95	0	0.00	0	0.00	0	0.00	1	0.20	0	0.00	1	0.20	1
1H-4, 48–50	4.98	0	0.00	133	26.60	0	0.00	302	60.40	58	11.60	0	0.00	2	0.40	0	0.00	0	0.00	0	0.00	1	0.20	0
1H-4, 70–72	5.20	0	0.00	59	11.71	0	0.00	380	75.40	57	11.31	0	0.00	2	0.40	0	0.00	0	0.00	0	0.00	0	0.00	0
1H-4, 90–92	5.40	0	0.00	28	5.58	0	0.00	364	72.51	57	11.35	3	0.60	15	2.99	0	0.00	0	0.00	0	0.00	0	0.00	0
1H-4, 110–112	5.60	0	0.00	149	29.80	0	0.00	294	58.80	23	4.60	1	0.20	4	0.80	0	0.00	0	0.00	0	0.00	0	0.00	0
1H-4, 130–132	5.80	0	0.00	201	40.04	0	0.00	245	48.80	21	4.18	0	0.00	10	1.99	0	0.00	0	0.00	0	0.00	0	0.00	0
1H-5, 1–3	6.01	0	0.00	207	40.91	0	0.00	186	36.76	51	10.08	8	1.58	8	1.58	0	0.00	0	0.00	1	0.20	3	0.59	0
1H-5, 19–21	6.19	0	0.00	284	55.69	0	0.00	87	17.06	44	8.63	4	0.78	20	3.92	0	0.00	0	0.00	0	0.00	0	0.00	0
1H-5, 39–41	6.39	0	0.00	245	47.76	0	0.00	52	10.14	48	9.36	1	0.19	10	1.95	0	0.00	0	0.00	0	0.00	1	0.19	0
1H-5, 59–61	6.59	0	0.00	198	38.75	0	0.00	47	9.20	81	15.85	5	0.98	30	5.87	0	0.00	0	0.00	0	0.00	5	0.98	0
1H-5, 80–82	6.80	0	0.00	116	22.10	0	0.00	52	9.90	34	6.48	18	3.43	17	3.24	5	0.95	1	0.19	6	1.14	15	2.86	2
1H-5, 98–100	6.98	0	0.00	122	22.76	0	0.00	87	16.23	51	9.51	29	5.41	7	1.31	9	1.68	1	0.19	0	0.00	9	1.68	2
1H-5, 120–122	7.20	0	0.00	109	20.60	0	0.00	99	18.71	40	7.56	36	6.81	21	3.97	3	0.57	0	0.00	2	0.38	8	1.51	0
1H-5, 140–142	7.40	0	0.00	162	30.68	0	0.00	125	23.67	44	8.33	30	5.68	39	7.39	6	1.14	0	0.00	2	0.38	8	1.52	0
1H-6, 10–12	7.60	0	0.00	275	52.78	0	0.00	78	14.97	25	4.80	10	1.92	12	2.30	10	1.92	0	0.00	5	0.96	5	0.96	1
1H-6, 30–32	7.80	0	0.00	297	56.14	0	0.00	85	16.07	35	6.62	11	2.08	21	3.97	18	3.40	1	0.19	0	0.00	5	0.95	0
1H-6, 48–50	7.98	0	0.00	213	41.68	0	0.00	67	13.11	47	9.20	7	1.37	0	0.00	5	0.98	0	0.00	0	0.00	0	0.00	0
1H-6, 71–73	8.21	0	0.00	252	49.61	0	0.00	101	19.88	69	13.58	2	0.39	0	0.00	22	4.33	0	0.00	0	0.00	6	1.18	0
1H-6, 90–92	8.40	0	0.00	440	86.44	0	0.00	16	3.14	19	3.73	2	0.39	6	1.18	2	0.39	1	0.20	4	0.79	9	1.77	0
1H-6, 110–112	8.60	0	0.00	441	87.50	0	0.00	12	2.38	15	2.98	2	0.40	5	0.99	6	1.19	0	0.00	0	0.00	0	0.00	0
2H-1, 5–7	8.95	0	0.00	407	81.08	0	0.00	24	4.78	38	7.57	0	0.00	13	2.59	2	0.40	0	0.00	0	0.00	1	0.20	0
2H-1, 20–22	9.10	0	0.00	406	79.92	0	0.00	18	3.54	9	1.77	4	0.79	16	3.15	3	0.59	0	0.00	1	0.20	1	0.20	0
2H-1, 40–42	9.30	0	0.00	427	84.22	0	0.00	16	3.16	19	3.75	5	0.99	7	1.38	2	0.39	0	0.00	1	0.20	2	0.39	0
2H-1, 59–61	9.49	0	0.00	353	70.32	0	0.00	26	5.18	44	8.76	4	0.80	18	3.59	2	0.40	0	0.00	1	0.20	1	0.20	1
2H-1, 80–82	9.70	0	0.00	345	62.39	0	0.00	54	9.76	47	8.50	0	0.00	28	5.06	1	0.18	0	0.00	0	0.00	4	0.72	0
2H-1, 100–102	9.90	0	0.00	358	69.38	0	0.00	70	13.57	31	6.01	2	0.39	6	1.16	3	0.58	0	0.00	0	0.00	14	2.71	0
2H-1, 130–132	10.20	0	0.00	256	50.59	0	0.00	25	4.94	31	6.13	2	0.40	24	4.74	2	0.40	0	0.00	0	0.00	7	1.38	0
2H-2, 10–12	10.37	0	0.00	312	61.54	0	0.00	13	2.56	5	0.99	2	0.39	22	4.34	4	0.79	0	0.00	0	0.00	0	0.00	0
2H-2, 27–29	10.54	0	0.00	382	75.94	0	0.00	8	1.59	1	0.20	8	1.59	33	6.56	1	0.20	0	0.00	0	0.00	1	0.20	0
2H-2, 50–52	10.77	0	0.00	320	63.24	0	0.00	11	2.17	7	1.38	5	0.99	8	1.58	1	0.20	1	0.20	0	0.00	2	0.40	0
2H-2, 70–72	10.97	0	0.00	199	39.48	0	0.00	7	1.39	4	0.79	0	0.00	43	8.53	3	0.60	0	0.00	0	0.00	1	0.20	0
2H-2, 90–92	11.17	0	0.00	216	42.02	0	0.00	4	0.78	1	0.19	4	0.78	29	5.64	10	1.95	0	0.00	0	0.00	4	0.78	0
2H-2, 110–112	11.37	0	0.00	103	20.32	0	0.00	2	0.39	0	0.00	0	0.00	71	14.00	4	0.79	0	0.00	0	0.00	1	0.20	0
2H-2, 132–134	11.59	0	0.00	396	74.72	25	4.72	3	0.57	0	0.00	2	0.38	9	1.70	1	0.19	1	0.19	2	0.38	3	0.57	0
2H-3, 1–3	11.78	0	0.00	315	58.01	41	7.55	5	0.92	1	0.18	0	0.00	19	3.50	2	0.37	0	0.00	1	0.18	0	0.00	0
2H-3, 20–22	11.97	0	0.00	344	58.11	89	15.03	1	0.17	2	0.34	5	0.84	34	5.74	1	0.17	0	0.00	0	0.00	2	0.34	0
2H-3, 40–42	12.17	0	0.00	168	27.68	103	16.97	191	31.47	10	1.65	2	0.33	34	5.60	1	0.16	0	0.00	0	0.00	2	0.33	0
2H-3, 58–60	12.35	0	0.00	257	39.18	59	8.99	115	17.53	6	0.91	9	1.37	63	9.60	1	0.15	0	0.00	0	0.00	4	0.61	0
2H-3, 80–82	12.57	0	0.00	153	28.02	41	7.51	283	51.83	3	0.55	0	0.00	21	3.85	0	0.00	1	0.18	0	0.00	3	0.55	0
2H-3, 97–99	12.74	0	0.00	46	8.98	10	1.95	328	64.06	23	4.49	1	0.20	36	7.03	0	0.00	0	0.00	0	0.00	2	0.39	0
2H-3, 120–122	12.97	0	0.00	147	28.71	8	1.56	224	43.75	9	1.76	8	1.56	21	4.10	2	0.39	0	0.00	1	0.20	1	0.20	0
2H-3, 140–142	13.17	0	0.00	48	9.32	7	1.36	353	68.54	14	2.72	3	0.58	31	6.02	1	0.19	0	0.00	0	0.00	7	1.36	0
2H-4, 10–12	13.37	0	0.00	42	8.30	0	0.00	385	76.09	25	4.94	2	0.40	28	5.53	0	0.00	0	0.00	0	0.00	2	0.40	2
2H-4, 30–32	13.57	0	0.00	33	6.56	0	0.00	383	76.14	31	6.16	2	0.40	19	3.78	0	0.00	0	0.00	0	0.00	0	0.00	1
2H-4, 50–52	13.77	0	0.00	79	15.61	0	0.00	313	61.86	52	10.28	3	0.59	28	5.53	0	0.00	0	0.00	0	0.00	4	0.79	2
2H-4, 72–74	13.99	0	0.00	99	19.41	0	0.00	285	55.88	55	10.78	5	0.98	22	4.31	1	0.20	0	0.00	0	0.00	5	0.98	2
2H-4, 90–92	14.17	0	0.00	65	12.95	0	0.00	325	64.74	45	8.96	1	0.20	20	3.98	0	0.00	0	0.00	0	0.00	2	0.40	0
2H-4, 110–112	14.37	0	0.00	168	33.14	0	0.00	195	38.46	22	4.34	7	1.38	32	6.31	0	0.00	0	0.00	0	0.00	6	1.18	0
2H-4, 130–132	14.57	0	0.00	80	15.75	0	0.00	128	25.20	15	2.95	8	1.57	46	9.06	0	0.00	0	0.00	0	0.00	3	0.59	0
2H-5, 0–2	14.77	0	0.00	184	36.22	0	0.00	48	9.45	17	3.35	2	0.39	31	6.10	0	0.00	0	0.00	0	0.00	3	0.59	0

Table 2 (continued).

Syracosphaera spp. (%)	*S. fossilis*	*S. fossilis* (%)	*U. irregularis*	*U. irregularis* (%)	*O. antillarum*	*O. antillarum* (%)	*Gephyrocapsa* sp. 3	*Gephyrocapsa* sp. 3 (%)	*H. sellii*	*H. sellii* (%)	*C. macintyrei*	*C. macintyrei* (%)	*D. brouweri*	*D. brouweri* (%)	*P. lacunosa* C	*P. lacunosa* C (%)	*P. lacunosa* E	*P. lacunosa* E (%)	Large *Reticulofenestra*	Large *Reticulofenestra* (%)	Small+medium *Reticulofenestra*	Small+medium *Reticulofenestra* (%)	Total
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	558
0.76	1	0.19	2	0.38	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	523
0.20	0	0.00	1	0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	507
0.00	0	0.00	2	0.34	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	590
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	511
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	512
0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	504
0.20	1	0.20	3	0.59	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	509
0.58	0	0.00	1	0.19	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	513
0.19	0	0.00	2	0.39	2	0.39	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	515
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	528
0.97	2	0.39	1	0.19	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	514
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	579
0.00	0	0.00	1	0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	504
0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	509
0.00	0	0.00	2	0.39	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	509
0.00	1	0.18	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	565
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	506
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	500
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	501
0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	504
0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	504
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	501
0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	507
0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	502
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	3	0.60	1	0.20	0	0.00	0	0.00	500
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.20	5	0.99	0	0.00	0	0.00	504
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	20	3.98	15	2.99	0	0.00	0	0.00	502
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	17	3.40	12	2.40	0	0.00	0	0.00	500
0.00	0	0.00	0	0.00	0	0.00	3	0.60	0	0.00	0	0.00	0	0.00	5	1.00	17	3.39	0	0.00	0	0.00	502
0.00	0	0.00	0	0.00	0	0.00	3	0.59	0	0.00	0	0.00	0	0.00	14	2.77	25	4.94	0	0.00	0	0.00	506
0.00	0	0.00	0	0.00	0	0.00	8	1.57	0	0.00	0	0.00	0	0.00	19	3.73	44	8.63	0	0.00	0	0.00	510
0.00	0	0.00	0	0.00	0	0.00	12	2.34	0	0.00	0	0.00	0	0.00	22	4.29	112	21.83	10	1.95	10	1.95	513
0.00	0	0.00	0	0.00	0	0.00	5	0.98	0	0.00	0	0.00	0	0.00	12	2.35	123	24.07	5	0.98	5	0.98	511
0.38	1	0.19	0	0.00	0	0.00	8	1.52	0	0.00	0	0.00	0	0.00	26	4.95	224	42.67	0	0.00	0	0.00	525
0.37	2	0.37	0	0.00	0	0.00	21	3.92	0	0.00	0	0.00	0	0.00	20	3.73	176	32.84	0	0.00	0	0.00	536
0.00	0	0.00	0	0.00	0	0.00	23	4.35	0	0.00	0	0.00	0	0.00	26	4.91	162	30.62	0	0.00	0	0.00	529
0.00	0	0.00	0	0.00	0	0.00	18	3.41	1	0.19	0	0.00	0	0.00	12	2.27	81	15.34	0	0.00	0	0.00	528
0.19	0	0.00	0	0.00	0	0.00	6	1.15	0	0.00	0	0.00	0	0.00	15	2.88	79	15.16	0	0.00	0	0.00	521
0.00	0	0.00	0	0.00	0	0.00	8	1.51	0	0.00	0	0.00	0	0.00	1	0.19	47	8.88	0	0.00	0	0.00	529
0.00	0	0.00	0	0.00	0	0.00	10	1.96	0	0.00	0	0.00	0	0.00	15	2.94	111	21.72	33	6.46	33	6.46	511
0.00	0	0.00	0	0.00	0	0.00	9	1.77	0	0.00	0	0.00	0	0.00	6	1.18	38	7.48	3	0.59	3	0.59	508
0.00	0	0.00	0	0.00	0	0.00	2	0.39	0	0.00	0	0.00	0	0.00	2	0.39	6	1.18	0	0.00	0	0.00	509
0.00	0	0.00	0	0.00	0	0.00	3	0.60	0	0.00	0	0.00	0	0.00	10	1.98	10	1.98	0	0.00	0	0.00	504
0.00	0	0.00	0	0.00	0	0.00	1	0.20	0	0.00	0	0.00	0	0.00	2	0.40	13	2.59	0	0.00	0	0.00	502
0.00	1	0.20	0	0.00	0	0.00	3	0.59	0	0.00	0	0.00	0	0.00	12	2.36	34	6.69	0	0.00	0	0.00	508
0.00	0	0.00	0	0.00	0	0.00	1	0.20	0	0.00	0	0.00	0	0.00	6	1.18	16	3.16	5	0.99	5	0.99	507
0.20	0	0.00	0	0.00	0	0.00	2	0.40	0	0.00	0	0.00	0	0.00	8	1.59	37	7.37	5	1.00	5	1.00	502
0.00	0	0.00	0	0.00	0	0.00	2	0.36	0	0.00	0	0.00	0	0.00	15	2.71	48	8.68	9	1.63	9	1.63	553
0.00	0	0.00	0	0.00	0	0.00	3	0.58	0	0.00	0	0.00	0	0.00	7	1.36	12	2.33	10	1.94	10	1.94	516
0.00	0	0.00	0	0.00	0	0.00	2	0.40	0	0.00	0	0.00	0	0.00	16	3.16	49	9.68	92	18.18	92	18.18	506
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	11	2.17	35	6.90	103	20.32	103	20.32	507
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	7	1.39	39	7.75	23	4.57	23	4.57	503
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	6	1.19	48	9.49	97	19.17	97	19.17	506
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	23	4.56	131	25.99	93	18.45	93	18.45	504
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	12	2.33	153	29.77	81	15.76	81	15.76	514
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	13	2.56	265	52.27	48	9.47	48	9.47	507
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	5	0.94	77	14.53	6	1.13	6	1.13	530
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	22	4.05	136	25.05	1	0.18	1	0.18	543
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	101	17.06	12	2.03	1	0.17	1	0.17	592
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	4	0.66	92	15.16	0	0.00	0	0.00	607
0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.15	0	0.00	0	0.00	1	0.15	49	7.47	0	0.00	0	0.00	656
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.18	40	7.33	0	0.00	0	0.00	546
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	6	1.17	60	11.72	0	0.00	0	0.00	512
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	3	0.59	88	17.19	0	0.00	0	0.00	512
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	4	0.78	47	9.13	0	0.00	0	0.00	515
0.40	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.20	19	3.75	0	0.00	0	0.00	506
0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	3	0.60	31	6.16	0	0.00	0	0.00	503
0.40	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	4	0.79	21	4.15	0	0.00	0	0.00	506
0.39	0	0.00	0	0.00	2	0.39	0	0.00	0	0.00	0	0.00	0	0.00	5	0.98	29	5.69	0	0.00	0	0.00	510
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	3	0.60	41	8.17	0	0.00	0	0.00	502
0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.20	0	0.00	0	0.00	2	0.39	37	7.30	0	0.00	37	7.30	507
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	4	0.79	0	0.00	10	1.97	75	14.76	0	0.00	139	27.36	508
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	6	1.18	0	0.00	17	3.35	170	33.46	0	0.00	30	5.91	508

Table 2 (continued).

Core, section, interval (cm)	Depth (mbsf)	*E. huxleyi*	*E. huxleyi* (%)	Small *Gephyrocapsa*	Small *Gephyrocapsa* (%)	Large *Gephyrocapsa*	Large *Gephyrocapsa* (%)	*G. caribbeanica*	*G. caribbeanica* (%)	*G. oceanica* s.l.	*G. oceanica* s.l. (%)	*H. carteri*	*H. carteri* (%)	*C. leptoporus*	*C. leptoporus* (%)	*C. annula*	*C. annula* (%)	*Thoracosphaera*	*Thoracosphaera* (%)	*Rhabdosphaera*	*Rhabdosphaera* (%)	*C. pelagicus*	*C. pelagicus* (%)	*Syracosphaera* spp.
2H-5, 20–22	14.97	0	0.00	157	31.03	0	0.00	155	30.63	12	2.37	8	1.58	28	5.53	0	0.00	0	0.00	0	0.00	9	1.78	0
2H-5, 40–42	15.17	0	0.00	102	19.54	0	0.00	58	11.11	10	1.92	2	0.38	26	4.98	0	0.00	0	0.00	0	0.00	13	2.49	0
2H-5, 62–64	15.39	0	0.00	180	34.88	0	0.00	40	7.75	2	0.39	1	0.19	36	6.98	0	0.00	0	0.00	0	0.00	3	0.58	0
2H-5, 80–82	15.57	0	0.00	150	28.74	0	0.00	60	11.49	2	0.38	11	2.11	35	6.70	0	0.00	0	0.00	0	0.00	5	0.96	1
2H-5, 100–102	15.77	0	0.00	162	28.98	0	0.00	180	32.20	0	0.00	5	0.89	25	4.47	1	0.18	0	0.00	0	0.00	10	1.79	1
2H-5, 120–122	15.97	0	0.00	150	29.01	0	0.00	253	48.94	2	0.39	1	0.19	5	0.97	0	0.00	0	0.00	0	0.00	5	0.97	0
2H-5, 136–138	16.13	0	0.00	118	22.96	0	0.00	93	18.09	0	0.00	8	1.56	28	5.45	0	0.00	0	0.00	0	0.00	0	0.00	0
2H-6, 1–12	16.37	0	0.00	135	25.76	0	0.00	15	2.86	0	0.00	8	1.53	45	8.59	2	0.38	0	0.00	0	0.00	14	2.67	0
2H-6, 30–32	16.57	0	0.00	50	9.42	0	0.00	8	1.51	0	0.00	1	0.19	77	14.50	3	0.56	0	0.00	0	0.00	11	2.07	3
2H-6, 60–62	16.87	0	0.00	163	31.05	0	0.00	151	28.76	0	0.00	18	3.43	28	5.33	0	0.00	0	0.00	0	0.00	12	2.29	1
2H-6, 81–83	17.08	0	0.00	50	9.38	0	0.00	144	27.02	0	0.00	1	0.19	62	11.63	0	0.00	0	0.00	0	0.00	14	2.63	0
2H-6, 97–99	17.24	0	0.00	42	8.08	0	0.00	78	15.00	0	0.00	1	0.19	55	10.58	0	0.00	0	0.00	0	0.00	5	0.96	1
2H-6, 120–122	17.47	0	0.00	78	14.08	0	0.00	83	14.98	1	0.18	3	0.54	38	6.86	0	0.00	0	0.00	0	0.00	5	0.90	0
2H-6, 139–141	17.66	0	0.00	73	13.75	0	0.00	65	12.24	1	0.19	1	0.19	77	14.50	0	0.00	0	0.00	0	0.00	16	3.01	0
2H-7, 10–12	17.87	0	0.00	113	21.24	0	0.00	13	2.44	0	0.00	5	0.94	72	13.53	0	0.00	0	0.00	0	0.00	12	2.26	0
2H-7, 30–32	18.07	0	0.00	167	31.87	0	0.00	75	14.31	0	0.00	1	0.19	35	6.68	0	0.00	0	0.00	0	0.00	16	3.05	0
2H-7, 52–54	18.29	0	0.00	48	8.91	0	0.00	23	4.27	0	0.00	2	0.37	40	7.42	0	0.00	0	0.00	0	0.00	8	1.48	0

Figure 1. The Brunhes/Matuyama boundary falls above the base of *Gephyrocapsa* sp. 3, within the *P. lacunosa* Zone. The substantial vertically oriented overprint acquired during drilling makes recognition of the normal subchrons within the Matuyama difficult, and both the Jaramillo and the Olduvai subchrons were tentatively recognized on the basis of declination changes (for more details, see Rack et al., this volume). The base of *Gephyrocapsa* sp. 3 correlates with the top of the Jaramillo, and the base of *G. oceanica* s.l. occurs at the top of the Olduvai.

Site 871 (Limalok Guyot)

Quaternary calcareous nannofloras at Site 871 are very similar to those observed at Site 880 (Table 3 and Fig. 2). In the lower Pleistocene, assemblages consist of abundant small and medium-sized *Reticulofenestra, Pseudoemiliania lacunosa,* and small *Gephyrocapsa.* Through the lower and middle Pleistocene, although reticulofenestrids and *P. lacunosa* decrease in abundance, the gephyrocapsid group becomes gradually dominant. Also at this site, in the uppermost Pleistocene, *Emiliania huxleyi* outnumbers all the other nannofossil taxa.

In the middle Pleistocene, the *Gephyrocapsa* group shows a relative decrease in abundance that is paralleled by a relative increase of *P. lacunosa* (12.25–8.3 mbsf) and of *Reticulofenestra,* which is represented exclusively by a large variety (11.8–8.85 mbsf) (Table 3 and Fig. 2).

Within the *Gephyrocapsa* group, the small *Gephyrocapsa* and *G. caribbeanica* dominate in the lowermost Pleistocene, whereas *G. oceanica* s.l. appears and gradually increases in abundance upward. The large *Gephyrocapsa* were observed only between 13.35 and 12.25 mbsf, and their top coincides with the base of dominant small *Gephyrocapsa.* As observed at Site 880, the medium-sized gephyrocapsids are virtually absent in the interval immediately underlying the base of the small *Gephyrocapsa* Zone. *G. oceanica* s.l. reenters the section at 9.25 mbsf, where *Gephyrocapsa* sp. 3 was first observed. The latter taxon is present up to 6.80 mbsf.

The first occurrence of *Emiliania huxleyi* (2.9 mbsf) coincides with a marked change in the gephyrocapsid composition (Fig. 2). In fact, at this level, *G. caribbeanica* sharply decreases in abundance, whereas the small *Gephyrocapsa* become dominant. In the upper 1.70 m of the section, a few specimens of large *Gephyrocapsa* and *Gephyrocapsa* sp. 3 were observed. The topmost sample (Sample 144-871A-1H-1, 20–21 cm) also contains very rare specimens of *P. lacunosa* that indicate reworking of older material. However, no evidence of reworking was noticed between 0.82 and 1.70 mbsf, and therefore the occurrence of large *Gephyrocapsa* and *Gephyrocapsa* sp. 3 might indicate a reentrance of these morphotypes in the latest Pleistocene.

Eleven biostratigraphic events and eight biozones were recognized at this site (Table 6); the depths of the nannofossil events are reported in Table 7.

Site 872 (Lo-En Guyot)

Although the Quaternary section at Site 872 is much shorter than at Sites 880 and 871, 11 nannofossil events and 8 biozones were detected (Table 6 and Fig. 3). The complete sequence of biostratigraphic events suggests that the Pleistocene is complete but characterized by a low sedimentation rate and/or by minor hiatuses that biostratigraphy cannot distinguish. As discussed in Premoli Silva, Haggerty, Rack, et al. (1993), these possible hiatuses may be related to the strong currents that remove even large quantities of unconsolidated sediments from the top of elevated features such as guyots.

Calcareous nannofloras at this site are very similar to those observed at Sites 880 and 871. In fact, small and medium *Reticulofenestra* and *Pseudoemiliania lacunosa* decrease in abundance from the lower to the middle Pleistocene, whereas the gephyrocapsid group becomes gradually dominant. *Emiliania huxleyi* also becomes very abundant at this site in the uppermost Pleistocene. In the lowermost Pleistocene, between 7.30 and 8.35 mbsf, *Florisphaera profunda* is common.

As previously reported for Sites 880 and 871, the *Gephyrocapsa* group shows a relative decrease in abundance in the middle Pleistocene, where both *P. lacunosa* (6.25–4.25 mbsf) and large *Reticulofenestra* (5.85–3.25 mbsf) become more abundant (Table 4 and Fig. 3).

Distribution patterns similar to those at Sites 880 and 871 were also detected within the *Gephyrocapsa* group (Fig. 3). In the lowermost Pleistocene, the small *Gephyrocapsa* dominate, *G. caribbeanica* is frequent, and *G. oceanica* s.l. is rare. The large *Gephyrocapsa* were observed in a short interval (7.30–6.25 mbsf) below the small *Gephyrocapsa* Zone where the small specimens are dominant. *G. caribbeanica* gradually increases in abundance in the upper part. The top of the small *Gephyrocapsa* Zone is marked by the reentrance of *G. oceanica* s.l. (4.95 mbsf), which coincides with the appearance of

Table 2 (continued).

Syracosphaera spp. (%)	*S. fossilis*	*S. fossilis* (%)	*U. irregularis*	*U. irregularis* (%)	*O. antillarum*	*O. antillarum* (%)	*Gephyrocapsa* sp. 3	*Gephyrocapsa* sp. 3 (%)	*H. sellii*	*H. sellii* (%)	*C. macintyrei*	*C. macintyrei* (%)	*D. brouweri*	*D. brouweri* (%)	*P. lacunosa* C	*P. lacunosa* C (%)	*P. lacunosa* E	*P. lacunosa* E (%)	Large *Reticulofenestra*	Large *Reticulofenestra* (%)	Small+medium *Reticulofenestra*	Small+medium *Reticulofenestra* (%)	Total
0.00	0	0.00	0	0.00	0	0.00	0	0.00	6	1.19	6	1.19	0	0.00	10	1.98	115	22.73	0	0.00	0	0.00	506
0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	0.38	8	1.53	0	0.00	18	3.45	115	22.03	0	0.00	168	32.18	522
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	13	2.52	0	0.00	10	1.94	108	20.93	0	0.00	123	23.84	516
0.19	0	0.00	0	0.00	0	0.00	0	0.00	2	0.38	15	2.87	0	0.00	16	3.07	82	15.71	0	0.00	143	27.39	522
0.18	0	0.00	0	0.00	0	0.00	0	0.00	8	1.43	5	0.89	0	0.00	15	2.68	67	11.99	0	0.00	80	14.31	559
0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.19	8	1.55	2	0.39	3	0.58	25	4.84	0	0.00	62	11.99	517
0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	0.39	10	1.95	2	0.39	11	2.14	109	21.21	0	0.00	133	25.88	514
0.00	0	0.00	0	0.00	0	0.00	0	0.00	5	0.95	2	0.38	1	0.19	20	3.82	122	23.28	0	0.00	155	29.58	524
0.56	0	0.00	0	0.00	0	0.00	0	0.00	3	0.56	8	1.51	1	0.19	22	4.14	177	33.33	0	0.00	167	31.45	531
0.19	0	0.00	0	0.00	0	0.00	0	0.00	4	0.76	7	1.33	1	0.19	10	1.90	48	9.14	0	0.00	82	15.62	525
0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	0.38	8	1.50	7	1.31	15	2.81	108	20.26	0	0.00	122	22.89	533
0.19	0	0.00	0	0.00	0	0.00	0	0.00	1	0.19	8	1.54	3	0.58	12	2.31	149	28.65	0	0.00	165	31.73	520
0.00	0	0.00	0	0.00	0	0.00	0	0.00	11	1.99	29	5.23	8	1.44	3	0.54	117	21.12	0	0.00	178	32.13	554
0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	0.38	8	1.51	5	0.94	3	0.56	58	10.92	0	0.00	222	41.81	531
0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	0.38	15	2.82	5	0.94	8	1.50	180	33.83	0	0.00	107	20.11	532
0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.19	3	0.57	2	0.38	7	1.34	97	18.51	0	0.00	120	22.90	524
0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.19	13	2.41	10	1.86	47	8.72	134	24.86	0	0.00	213	39.52	539

Gephyrocapsa sp. 3 . The latter taxon was observed up to 3.85 mbsf. Tiny specimens of *Gephyrocapsa* (2–2.5 µm maximum length) become dominant between 6.85 and 8.35 mbsf at the base of the small *Gephyrocapsa* Zone.

G. caribbeanica sharply decreases in abundance at 1.35 mbsf, where *Emiliania huxleyi* was first observed. From this level upward, the small specimens dominate the *Gephyrocapsa* group and *G. oceanica* s.l. is common. As previously reported for Site 872, a few specimens of large *Gephyrocapsa* and *Gephyrocapsa* sp. 3 were observed in the uppermost Pleistocene.

Site 873 (Wodejebato Guyot)

At Site 873, the Quaternary consists of a thin section of foraminifer-nannofossil ooze (4.97 m). Calcareous nannofossil biostratigraphy (Fig. 4) indicates that only the lower Pleistocene is represented. The abundance of single nannofossil taxa is reported in Table 5, and the composition of the *Gephyrocapsa* group is illustrated in Figure 4.

The lower portion of the Quaternary contains abundant small and medium-sized *Reticulofenestra, Pseudoemiliania lacunosa,* and small *Gephyrocapsa.* Both *G. caribbeanica* and *G. oceanica* s.l. are represented by frequent specimens. From 3.07 mbsf upward, the large *Gephyrocapsa* observed indicate that the top of the pelagic cap at Site 873 is older than the small *Gephyrocapsa* Zone. *Helicosphaera sellii* was observed throughout the sequence, and therefore its top was not detected at this site (Table 5 and Fig. 4). As noted at Site 872, *Florisphaera profunda* is common in the lower Pleistocene (1.24–4.47 mbsf).

PLEISTOCENE CALCAREOUS NANNOFOSSIL BIOSTRATIGRAPHY

The quantitative analysis of the calcareous nannofossils at Sites 880, 871, 872, and 873 resulted in a high-resolution biostratigraphy for the Quaternary. Eleven events and eight biozones were identified (Figs. 1–4). Figure 6 illustrates the correlation of the sites studied based on nannofossil biostratigraphy.

The same sequence of nannofossil events was reproduced at Sites 880, 871, and 872, although the spacing between biohorizons is extremely variable. This reflects the intense current activity on top of guyots, resulting in winnowed nannofossil foraminifer oozes with variable accumulation rates and minor hiatuses that cannot be precisely estimated with biostratigraphy. At Site 873, most of the Quaternary section is missing; only the lower Pleistocene nannofossil events were determined, thus suggesting that the accumulation of recent sediments on Wodejebato Guyot is strongly affected by current activity.

The ages estimated by various authors for nannofossil marker events at Sites 871, 872, 873, and 880 are given in Table 6, and the depths for these events are given in Table 7. As previously concluded by Matsuoka and Okada (1989, 1990), most of the Pleistocene nannofossil events are reliable and reproducible in different oceans; therefore, they can be used for global correlations. It must be noted that the top of *Helicosphaera sellii* is the less precise event in this study because of its very low abundance and apparent diachrony of the last occurrence. Similar patterns were also observed by Raffi et al. (1993) and Wei (1993) and suggest that this event is not reliable for biostratigraphic correlations.

COMPARISON WITH PREVIOUS RESULTS FROM THE PACIFIC OCEAN AND OTHER BASINS

Quaternary nannofossil assemblages are very similar at the four sites investigated in the present study, suggesting that nannofloras are not affected by latitudinal gradients between 5° and 34°N. The influence of local oceanographic conditions on assemblage composition is possibly reflected in temporarily restricted increases in the abundance of particular taxa, such as very small *Gephyrocapsa* at Sites 880 and 872 and of *Florisphaera profunda* at Sites 872 and 873. To understand the distribution of Pleistocene calcareous nannofossils and their sensitivity to different water masses better, the data collected during this study were compared with the nannofloral record at other sites in the Pacific Ocean and in other oceanic basins.

Quaternary deposits from the high-productivity area of the central equatorial Pacific were investigated by Pujos (1985a) for their nannofossil content. This semiquantitative study was mainly biostratigraphically oriented, and it is difficult to use the data for ecologic interpretations. A direct comparison is also hampered by the different taxonomic concepts used by Pujos with respect to those adopted in the present study. At Sites 571 and 575, Pujos (1985a) documented the dissolution and reworking of Tertiary taxa at various levels in the Quaternary sections. These events are explained by the episodic influence of corrosive deep-water masses.

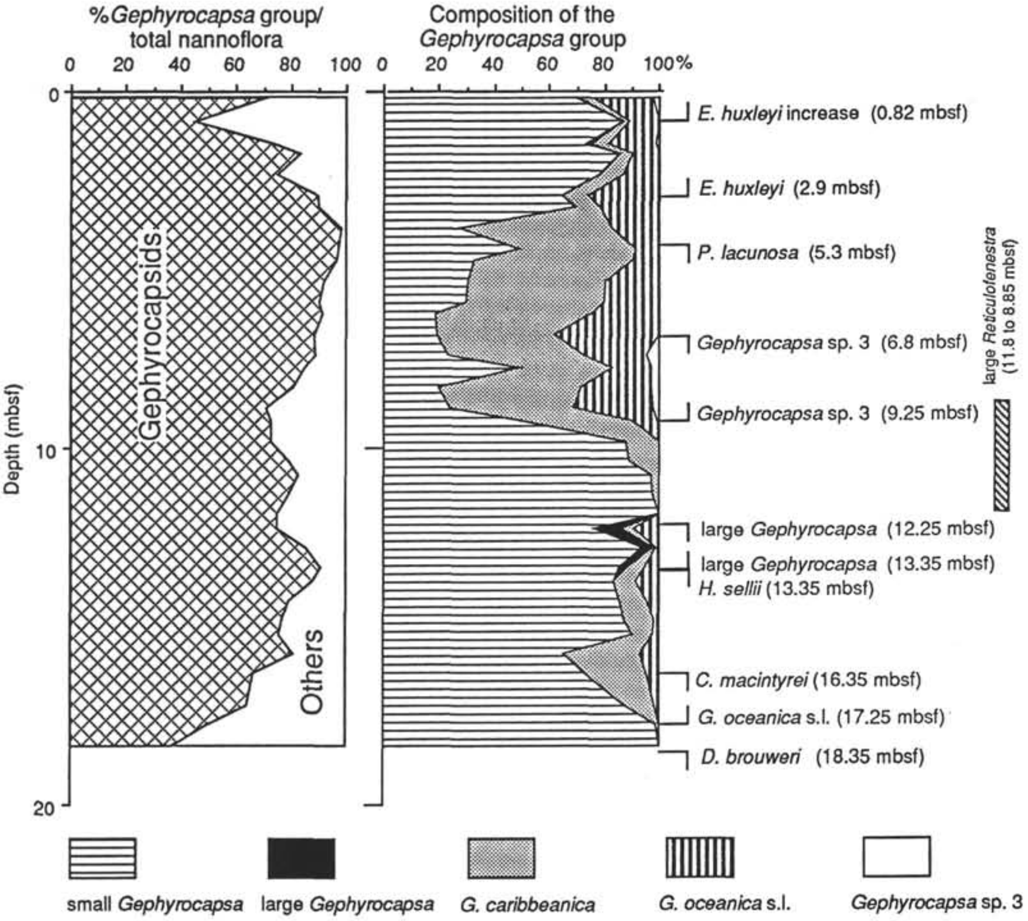

Figure 2. Abundance of gephyrocapsids vs. other nannofossils and composition (percentages) of various taxonomic classes within the *Gephyrocapsa* group at Site 871 (Limalok Guyot). On the right are the biostratigraphic results of quantitative analyses of nannofloras.

Matsuoka and Okada (1989) described Pleistocene assemblages from a core from the subtropical Pacific, at approximately 20°N latitude. Although a direct comparison is difficult because different taxonomic concepts were applied to the *Gephyrocapsa* group, there are strong similarities between the assemblages documented by Matsuoka and Okada (1989) and those described here. In particular, they reported a gradual decrease in the abundance of *Pseudoemiliania lacunosa* through the lower Pleistocene, which is interrupted by a distinctive increase in the middle Pleistocene. Small- and medium-sized reticulofenestrids gradually decrease in abundance upward and the large variety (*Reticulofenestra* A large) was reported only in a short interval within the middle Pleistocene.

At the appearance level of *Emiliania huxleyi,* Matsuoka and Okada (1989) illustrated a marked decrease in the abundance of the *Gephyrocapsa* group, which is most probably equivalent to the *G. caribbeanica* decline reported in the present study. Similar to the record at Sites 880 and 872, marked increases in the abundance of the smallest gephyrocapsids (2.5–3 µm) were noticed at the base of the small *Gephyrocapsa* Zone and close to the last occurrence of large *Reticulofenestra.* This similarity at three sites located at approximately 10°N, 20°N, and 34°N suggests that these abundance peaks are probably time-controlled rather than paleoceanographically driven. However, more data are needed to prove or disprove this interpretation and for eventual use of these abundance changes for biostratigraphy.

The distribution of *Florisphaera profunda* reported by Matsuoka and Okada (1989) does not show significant increases in abundance in the lower Pleistocene as those observed at Sites 872 and 873. At the site studied by Matsuoka and Okada (1989), the abundance curve of this species shows limited fluctuations through the Quaternary, with one peak in the upper Pleistocene at the base of the *Emiliania huxleyi* acme. Increases in abundance of *Florisphaera profunda* may derive from the selective exclusion of species more sensitive to dissolution or to decreases in production of other coccolithophorids in the upper euphotic zone, as also inferred by Matsuoka and Okada (1989). Sites 872 and 873 are located at water depths of 1084 and 1334 mbsf, respectively. It is unlikely that the increase in abundance of *Florisphaera profunda* at these sites result from selective dissolution, because the preservation of calcareous nannofloras is generally very good. Further investigations in the Pacific Ocean are necessary to clarify the oceanographic changes that influenced the local blooms of *Florisphaera profunda* during the Quaternary.

A calibration of nannofossil events with oxygen isotope stratigraphy in the upper Pliocene–lower Pleistocene interval was proposed by Wei (1993). The study was conducted on eight DSDP/ODP sites in the Atlantic, Pacific, and Indian oceans, between 53°N and 41°S latitudes. Although most events are synchronous, most of the early Pleistocene events seem to be slightly diachronous.

Recently, Raffi et al. (1993) quantified calcareous nannofloras in the lower to middle Pleistocene interval of Sites 677 and 504 and Core V28-239 from the eastern equatorial Pacific and calibrated biostratigraphic events as well as changes in assemblage composition (mainly within the *Gephyrocapsa* group) with magnetostratigraphy and oxygen isotope stratigraphy. Although Raffi et al. (1993) used a slightly different subdivision of the gephyrocapsids (e.g., the small specimens are smaller than 4 µm), all the events and compositional changes detected in their investigation compare well with those documented

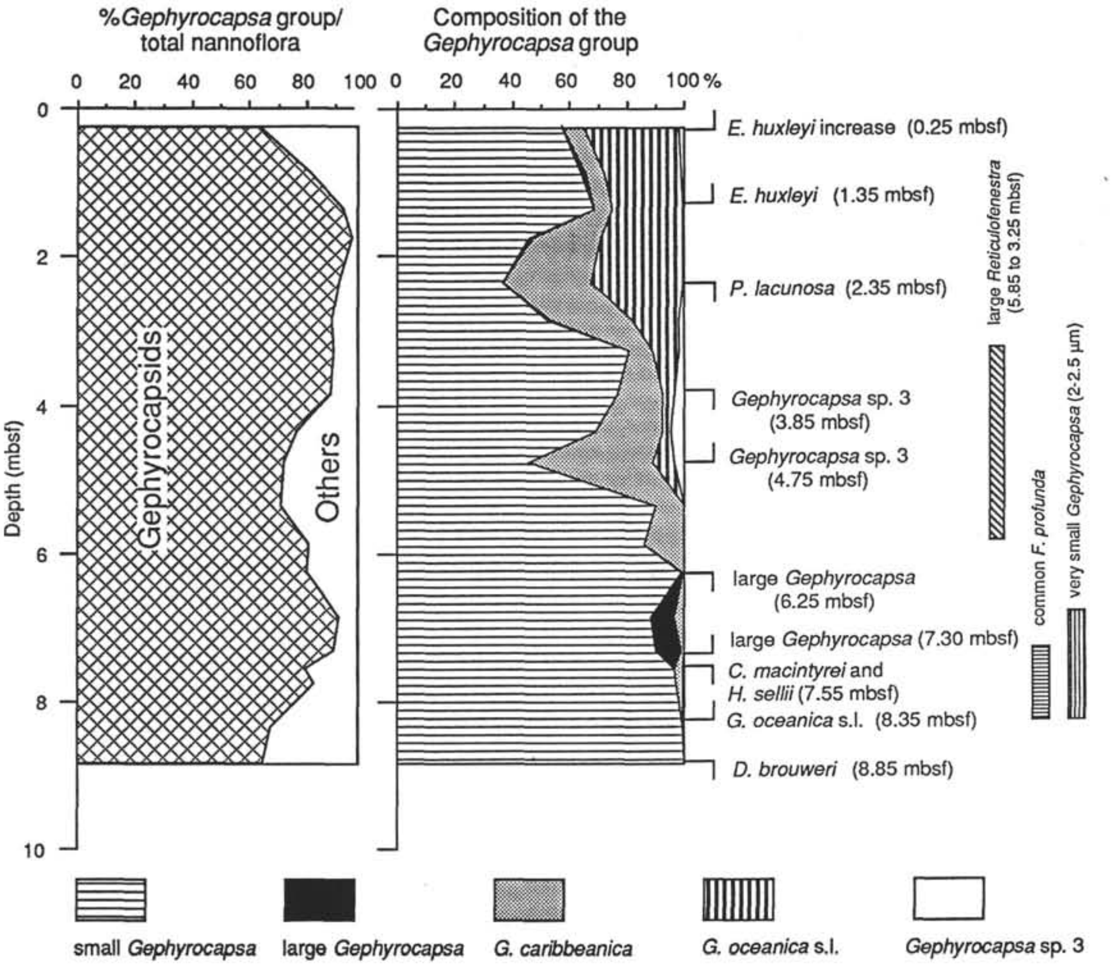

Figure 3. Abundance of gephyrocapsids vs. other nannofossils and composition (percentages) of various taxonomic classes within the *Gephyrocapsa* group at Site 872 (Lo-En Guyot). On the right are the biostratigraphic results of quantitative analyses of nannofloras.

here. In fact, the changes in abundance of the single *Gephyrocapsa* classes occur in the same sequence and in equivalent stratigraphic levels. As proposed by Raffi et al. (1993), the base of the small *Gephyrocapsa* Zone is best characterized by the extinction of the large *Gephyrocapsa* and the virtual absence of the medium-sized specimens. The top of the small *Gephyrocapsa* Zone is difficult to identify if the end of the small gephyrocapsid dominance is used. In agreement with Raffi et al. (1993), the present study documented that the top of this zone is better defined by the reentrance of the medium-sized gephyrocapsids, which coincides with the first occurrence of *Gephyrocapsa* sp. 3. The present study confirms that *Gephyrocapsa* sp. 3 is present in a short interval in the middle Pleistocene, as reported by Raffi et al. (1993), but few specimens were observed in the uppermost Pleistocene at Sites 871 and 872 and may indicate a reentrance of these morphotypes.

Gartner (1977) first outlined the dominance of small *Gephyrocapsa* in the middle Pleistocene of the Pacific Ocean and the Caribbean region, and established a biozone—defined as the interval between the last occurrence of *Helicosphaera sellii* and the end of dominant small *Gephyrocapsa*—where the small (<3 µm) gephyrocapsids dominate the nannofloras. This event was further studied by Gartner (1988), who documented the occurrence of the middle Pleistocene small *Gephyrocapsa* acme on a global scale and interpreted this episode as the response of calcareous nannoplankton to a global change in the oceanic circulation and productivity.

Comparing the distribution patterns of Quaternary nannofossils that have been compiled from different oceans, the relative proportions of single taxa seem to show similar and coeval changes during the Pleistocene, despite the differences in taxonomic concepts adopted by various specialists. In fact, in addition to the worldwide dominance of small gephyrocapsids that was discussed by Gartner (1988), other changes in abundance as well as morphometric variations of Quaternary nannofloras appear to be reproducible in different basins and at different latitudes (in tropical and equatorial areas). In particular, Matsuoka and Okada (1990) recognized in the tropical Indian Ocean the six nannoflora assemblages that were previously determined in the tropical Pacific Ocean (Matsuoka and Okada, 1989). Their quantitative study of calcareous nannofossils at Site 709 resulted in the identification of time-progressive changes in Quaternary assemblages that are consistent with the record in the Pacific Ocean (Matsuoka and Okada, 1989; Erba, this study). In particular, in the tropical Indian Ocean *Reticulofenestra* and *Pseudoemiliania lacunosa* are abundant in the lower Pleistocene and both decline through the middle Pleistocene, whereas gephyrocapsids gradually increase in abundance upward, dominate over all the other nannofossils in the middle to upper Pleistocene, but markedly decrease in abundance in the uppermost Pleistocene, where they are outnumbered mainly by *Emiliania huxleyi.* In addition, a relative increase in the abundance of *Pseudoemiliania lacunosa* was reported for the middle Pleistocene.

Calibration of quantitative Pleistocene nannofossil biostratigraphy with oxygen isotope stratigraphy and magnetostratigraphy proved that nannofossil events may be diachronous in different areas (Raffi et al., 1993; Wei, 1993). However, the reproducibility of major changes in

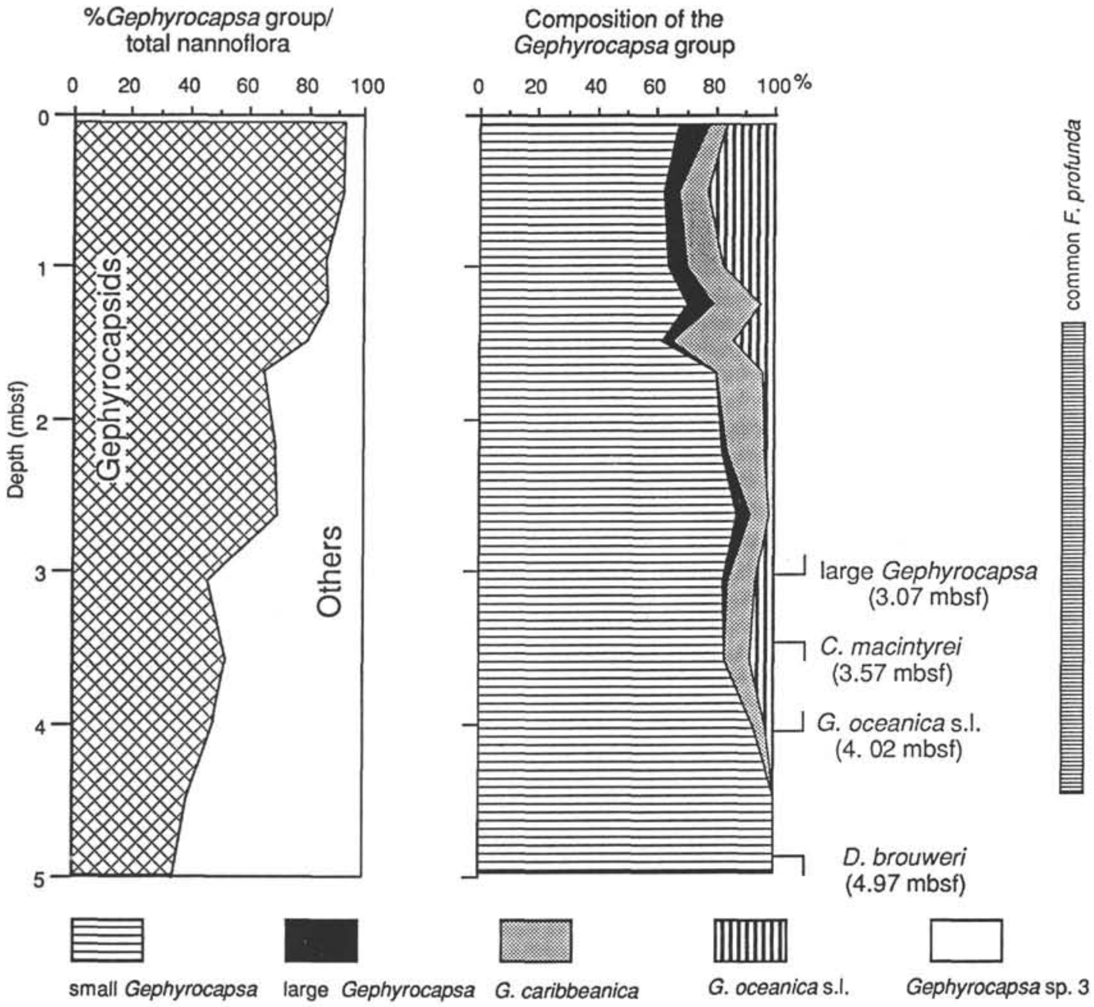

Figure 4. Abundance of gephyrocapsids vs. other nannofossils and composition (percentages) of various taxonomic classes within the *Gephyrocapsa* group at Site 873 (Wodejebato Guyot). On the right are the biostratigraphic results of quantitative analyses of nannofloras.

distribution patterns of early and middle Pleistocene nannofloras in the Pacific and Atlantic oceans, Caribbean Sea, Mediterranean Sea, and Timor Sea was documented (Raffi et al., 1993).

Middle to upper Pleistocene sediments from the eastern Mediterranean were recently studied for their nannofossil content by Castradori (1993a, 1993b), using quantitative methods and taxonomic concepts consistent with those of Rio et al. (1990), Raffi et al. (1993); these were adopted for the present study. This investigation revealed that calcareous nannofloras in the Mediterranean also show compositional changes comparable with those found on a more global scale, although some local effects were noted. In particular, the distribution of *Gephyrocapsa* sp. 3 is consistent with that observed in this study and reported by Raffi et al. (1993). The beginning of the "acme" of small *Gephyrocapsa* close to the first occurrence of *Emiliania huxleyi* is correlatable with the decline of *G. caribbeanica* and the concomitant increase in abundance of small gephyrocapsids that are documented in this study at the base of the *Emiliania huxleyi* Zone.

CONCLUSIONS

Quantitative investigation of calcareous nannofloras at Sites 880, 871, 872, and 873 resulted in a high-resolution biostratigraphy of the Pleistocene and in the characterization of assemblages that display similar changes in composition. The present study suggests that the Pleistocene accumulation of pelagic sediments on guyots in the central and western Pacific is neither continuous or constant. In fact, a small hiatus was detected at Site 880 (Takuyo-Daisan Guyot) in the upper Pleistocene, whereas most of the middle and the upper Pleistocene is missing on Wodejebato Guyot (Site 873). On Lo-En Guyot (Site 872), a complete sequence of nannofossil events was detected, but the limited thickness of the Quaternary section implies possible minor hiatuses that cannot be identified biostratigraphically. As discussed in Premoli Silva, Haggerty, Rack, et al. (1993), sediment accumulation was strongly controlled by currents winnowing the top of these elevated features.

Distinctive changes in the abundance of nannofossil taxa, especially within the *Gephyrocapsa* group, were observed at all sites. They seem to be coeval on a regional, and even a global, scale. This suggests that calcareous nannofloral assemblages are not very sensitive to latitudinal gradients, although local oceanographic effects can influence specific taxa, such as the smallest specimens of *Gephyrocapsa* (2–2.5 µm) and *Florisphaera profunda.*

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I wish to express my gratitude to Isabella Premoli Silva and Janet Haggerty for their enthusiastic leadership during Leg 144. Sincere thanks are extended to Frank Rack and the Leg 144 Scientific Party for discussion and cooperation. A special note of thanks to Jeff Gee for providing paleomagnetic data from Site 880, as well as for suggestions

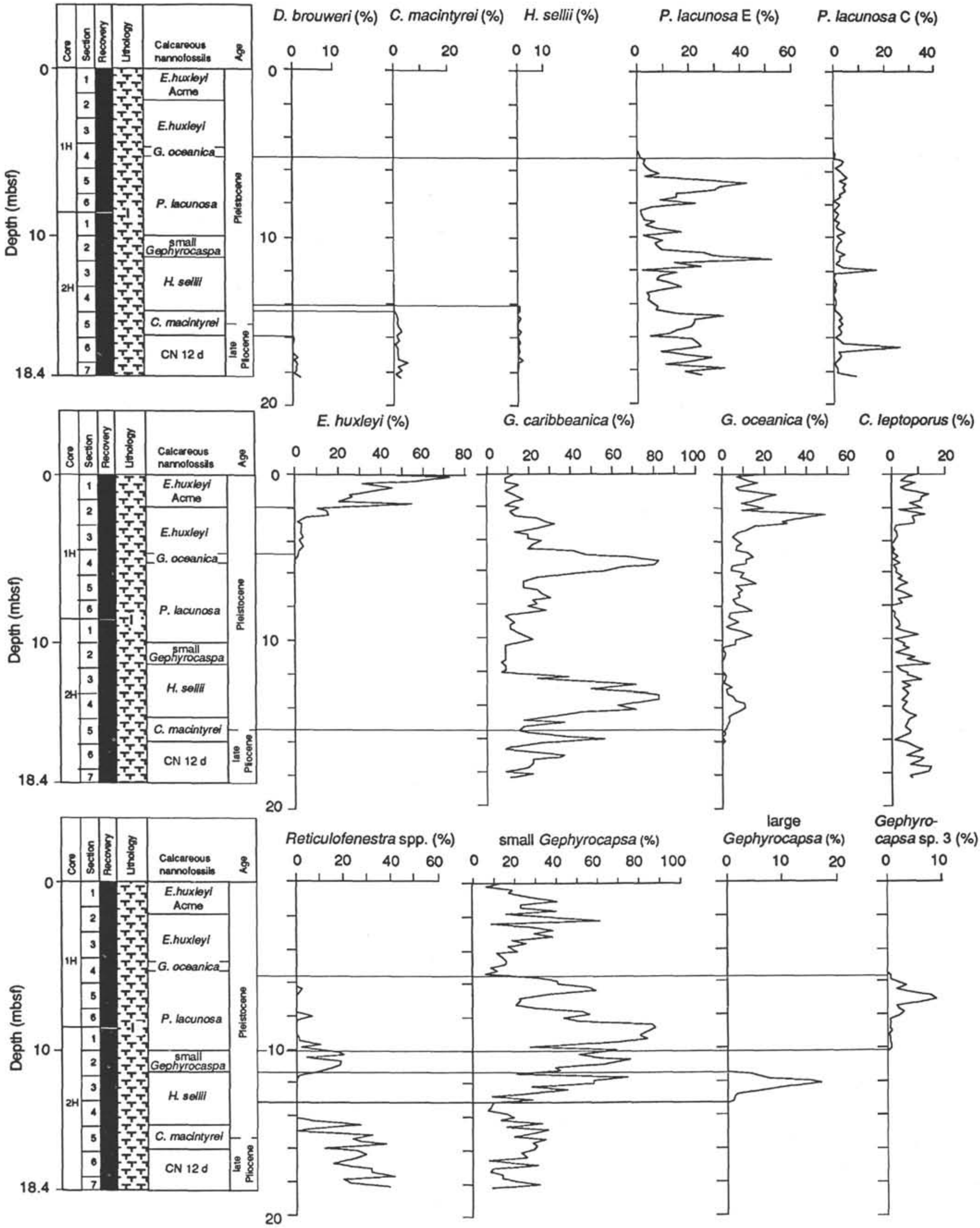

Figure 5. Percentage plots of the biostratigraphically important nannofossil taxa in the Quaternary sediments recovered at Site 880 (Takuyo-Daisan Guyot). Curves of the most abundant taxa are also reported.

Table 3. Quantitative distribution of Quaternary calcareous nannofossils at Site 871 (Limalok Guyot).

Core, section, interval (cm)	Depth (mbsf)	*E. huxleyi*	*E. huxleyi* (%)	Small *Gephyrocapsa*	Small *Gephyrocapsa* (%)	Large *Gephyrocapsa*	Large *Gephyrocapsa* (%)	*G. caribbeanica*	*G. caribbeanica* (%)	*G. oceanica* s.l.	*G. oceanica* s.l. (%)	*H. carteri*	*H. carteri* (%)	*C. leptoporus*	*C. leptoporus* (%)	*C. annula*	*C. annula* (%)	*Thoracosphaera*	*Thoracosphaera* (%)	*Rhabdosphaera*	*Rhabdosphaera* (%)	*C. pelagicus*	*C. pelagicus* (%)	*Syracosphaera*	*Syracosphaera* (%)
144-871A-																									
1H-1, 20–21	0.20	107	19.81	263	48.70	2	0.37	23	4.26	80	14.81	7	1.30	16	2.96	7	1.30	2	0.37	2	0.37	0	0.00	2	0.37
1H-1, 82–83	0.82	237	44.30	208	38.88	0	0.00	5	0.93	27	5.05	2	0.37	5	0.93	13	2.43	2	0.37	2	0.37	0	0.00	3	0.56
1H-1, 143–144	1.43	75	14.31	283	54.01	7	1.34	25	4.77	67	12.79	2	0.38	5	0.95	20	3.82	2	0.38	2	0.38	0	0.00	2	0.38
1H-2, 20–21	1.70	40	7.87	358	70.47	1	0.20	19	3.74	43	8.46	3	0.59	5	0.98	8	1.57	2	0.39	2	0.39	0	0.00	3	0.59
1H-2, 80–81	2.30	73	14.43	295	58.30	0	0.00	33	6.52	52	10.28	8	1.58	7	1.38	5	0.99	1	0.20	1	0.20	0	0.00	1	0.20
1H-2, 140–141	2.90	11	2.19	291	57.85	0	0.00	41	8.15	118	23.46	5	0.99	2	0.40	1	0.20	5	0.99	0	0.00	0	0.00	3	0.60
1H-3, 20–21	3.20	5	0.98	318	62.23	0	0.00	43	8.41	100	19.57	3	0.59	2	0.39	17	3.33	2	0.39	1	0.20	0	0.00	5	0.98
1H-3, 80–81	3.80	0	0.00	135	26.73	0	0.00	272	53.86	88	17.43	1	0.20	2	0.40	3	0.59	1	0.20	0	0.00	0	0.00	1	0.20
1H-3, 140–141	4.40	0	0.00	240	47.06	0	0.00	211	41.37	44	8.63	2	0.39	2	0.39	5	0.98	0	0.00	0	0.00	0	0.00	2	0.39
1H-4, 20–21	4.70	0	0.00	157	31.27	0	0.00	277	55.18	50	9.96	4	0.80	4	0.80	7	1.39	1	0.20	0	0.00	0	0.00	0	0.00
1H-4, 80–81	5.30	0	0.00	143	27.77	0	0.00	233	45.24	95	18.45	1	0.19	10	1.94	6	1.17	0	0.00	0	0.00	0	0.00	6	1.17
1H-4, 140–141	5.90	0	0.00	135	26.68	0	0.00	225	44.47	94	18.58	6	1.19	8	1.58	3	0.59	1	0.20	0	0.00	0	0.00	0	0.00
1H-5, 20–21	6.20	0	0.00	88	17.15	0	0.00	261	50.88	118	23.00	7	1.36	8	1.56	0	0.00	1	0.19	0	0.00	0	0.00	2	0.39
1H-5, 80–81	6.80	0	0.00	85	16.70	0	0.00	193	37.92	170	33.40	2	0.39	2	0.39	3	0.59	0	0.00	0	0.00	0	0.00	0	0.00
1H-CC, 20–21	7.38	0	0.00	110	20.91	0	0.00	228	43.35	108	20.53	4	0.76	4	0.76	5	0.95	0	0.00	0	0.00	0	0.00	3	0.57
2H-1, 25–26	7.75	0	0.00	218	41.29	0	0.00	151	28.60	63	11.93	7	1.33	14	2.65	0	0.00	1	0.19	0	0.00	0	0.00	4	0.76
2H-1, 80–81	8.30	0	0.00	82	16.02	0	0.00	212	41.41	105	20.51	15	2.93	8	1.56	5	0.98	1	0.20	0	0.00	0	0.00	0	0.00
2H-1, 135–136	8.85	0	0.00	90	16.89	0	0.00	168	31.52	110	20.64	4	0.75	8	1.50	2	0.38	0	0.00	0	0.00	0	0.00	0	0.00
2H-2, 25–26	9.25	0	0.00	185	36.06	0	0.00	150	29.24	35	6.82	7	1.36	5	0.97	3	0.58	1	0.19	0	0.00	0	0.00	2	0.39
2H-2, 80–81	9.80	0	0.00	331	63.17	0	0.00	48	9.16	0	0.00	3	0.57	15	2.86	5	0.95	0	0.00	0	0.00	0	0.00	2	0.38
2H-2, 135–136	10.35	0	0.00	373	70.11	0	0.00	46	8.65	2	0.38	7	1.32	8	1.50	5	0.94	0	0.00	0	0.00	0	0.00	1	0.19
2H-3, 25–26	10.75	0	0.00	408	80.00	0	0.00	12	2.35	0	0.00	5	0.98	4	0.78	2	0.39	0	0.00	0	0.00	0	0.00	0	0.00
2H-3, 80–81	11.30	0	0.00	386	76.89	0	0.00	8	1.59	1	0.20	8	1.59	4	0.80	4	0.80	1	0.20	0	0.00	0	0.00	0	0.00
2H-3, 135–136	11.85	0	0.00	386	74.66	0	0.00	0	0.00	0	0.00	2	0.39	4	0.77	2	0.39	0	0.00	0	0.00	0	0.00	1	0.19
2H-4, 25–26	12.25	0	0.00	305	56.80	40	7.45	20	3.72	37	6.89	2	0.37	14	2.61	2	0.37	0	0.00	0	0.00	0	0.00	1	0.19
2H-4, 80–81	12.80	0	0.00	403	79.64	17	3.36	5	0.99	7	1.38	2	0.40	15	2.96	2	0.40	0	0.00	0	0.00	0	0.00	0	0.00
2H-4, 135–136	13.35	0	0.00	388	77.29	12	2.39	30	5.98	24	4.78	15	2.99	11	2.19	2	0.40	1	0.20	0	0.00	0	0.00	0	0.00
2H-5, 25–26	13.75	0	0.00	382	72.49	0	0.00	37	7.02	42	7.97	27	5.12	16	3.04	2	0.38	0	0.00	0	0.00	0	0.00	0	0.00
2H-5, 80–81	14.30	0	0.00	365	67.10	0	0.00	42	7.72	21	3.86	7	1.29	16	2.94	20	3.68	1	0.18	0	0.00	0	0.00	3	0.55
2H-5, 135–136	14.85	0	0.00	360	66.91	0	0.00	45	8.36	8	1.49	5	0.93	7	1.30	12	2.23	0	0.00	1	0.19	0	0.00	3	0.56
2H-6, 25–26	15.25	0	0.00	365	68.10	0	0.00	30	5.60	10	1.87	10	1.87	13	2.43	8	1.49	0	0.00	0	0.00	0	0.00	4	0.75
2H-6, 80–81	15.80	0	0.00	292	52.42	0	0.00	127	22.80	31	5.57	14	2.51	20	3.59	7	1.26	0	0.00	0	0.00	0	0.00	4	0.72
2H-6, 135–136	16.35	0	0.00	283	47.88	0	0.00	90	15.23	18	3.05	11	1.86	25	4.23	48	8.12	1	0.17	0	0.00	0	0.00	3	0.51
3H-1, 25–26	17.25	0	0.00	295	55.66	0	0.00	37	6.98	7	1.32	17	3.21	15	2.83	1	0.19	1	0.19	0	0.00	2	0.38	1	0.19
3H-1, 80–81	17.80	0	0.00	275	48.67	0	0.00	3	0.53	0	0.00	15	2.65	42	7.43	15	2.65	0	0.00	0	0.00	5	0.88	0	0.00
3H-11, 135–136	18.35	0	0.00	195	36.79	0	0.00	0	0.00	0	0.00	7	1.32	9	1.70	5	0.94	1	0.19	0	0.00	0	0.00	2	0.38

Table 3 (continued).

Core, section, interval (cm)	*S. fossilis*	*S. fossilis* (%)	*U. irregularis*	*U. irregularis* (%)	*O. antillarum*	*O. antillarum* (%)	*Gephyrocapsa* sp. 3	*Gephyrocapsa* sp. 3 (%)	*P. lacunosa* C	*P. lacunosa* C (%)	*P. lacunosa* E	*P. lacunosa* E (%)	Large *Reticulofenestra*	Large *Reticulofenestra* (%)	Small+medium *Reticulofenestra*	Small+medium *Reticulofenestra* (%)	*H. sellii*	*H. sellii* (%)	*C. macintyrei*	*C. macintyrei* (%)	Total
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1H-1, 20–21	5	0.93	12	2.22	0	0.00	10	1.85	2	0.37	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	540
1H-1, 82–83	8	1.50	23	4.30	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	535
1H-1, 143–144	4	0.76	25	4.77	0	0.00	5	0.95	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	524
1H-2, 20–21	2	0.39	20	3.94	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	508
1H-2, 80–81	25	4.94	2	0.40	3	0.59	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	506
1H-2, 140–141	2	0.40	24	4.77	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	503
1H-3, 20–21	2	0.39	13	2.54	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	511
1H-3, 80–81	0	0.00	2	0.40	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	505
1H-3, 140–141	2	0.39	2	0.39	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	510
1H-4, 20–21	0	0.00	2	0.40	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	502
1H-4, 80–81	0	0.00	4	0.78	0	0.00	0	0.00	4	0.78	13	2.52	0	0.00	0	0.00	0	0.00	0	0.00	515
1H-4, 140–141	0	0.00	1	0.20	0	0.00	0	0.00	13	2.57	20	3.95	0	0.00	0	0.00	0	0.00	0	0.00	506
1H-5, 20–21	1	0.19	5	0.97	2	0.39	0	0.00	8	1.56	12	2.34	0	0.00	0	0.00	0	0.00	0	0.00	513
1H-5, 80–81	0	0.00	4	0.79	0	0.00	2	0.39	10	1.96	38	7.47	0	0.00	0	0.00	0	0.00	0	0.00	509
1H-CC, 20–21	9	1.71	2	0.38	0	0.00	22	4.18	8	1.52	23	4.37	0	0.00	0	0.00	0	0.00	0	0.00	526
2H-1, 25–26	5	0.95	0	0.00	0	0.00	15	2.84	10	1.89	38	7.20	0	0.00	0	0.00	0	0.00	0	0.00	528
2H-1, 80–81	0	0.00	4	0.78	0	0.00	13	2.54	10	1.95	57	11.13	0	0.00	0	0.00	0	0.00	0	0.00	512
2H-1, 135–136	5	0.94	5	0.94	0	0.00	10	1.88	18	3.38	108	20.26	5	0.94	0	0.00	0	0.00	0	0.00	533
2H-2, 25–26	1	0.19	3	0.58	0	0.00	2	0.39	10	1.95	107	20.86	2	0.39	0	0.00	0	0.00	0	0.00	513
2H-2, 80–81	0	0.00	10	1.91	2	0.38	0	0.00	8	1.53	83	15.84	17	3.24	0	0.00	0	0.00	0	0.00	524
2H-2, 135–136	3	0.56	5	0.94	2	0.38	0	0.00	10	1.88	50	9.40	20	3.76	0	0.00	0	0.00	0	0.00	532
2H-3, 25–26	0	0.00	6	1.18	1	0.20	0	0.00	5	0.98	57	11.18	10	1.96	0	0.00	0	0.00	0	0.00	510
2H-3, 80–81	1	0.20	4	0.80	0	0.00	0	0.00	15	2.99	68	13.55	2	0.40	0	0.00	0	0.00	0	0.00	502
2H-3, 135–136	1	0.19	3	0.58	1	0.19	0	0.00	12	2.32	90	17.41	15	2.90	0	0.00	0	0.00	0	0.00	517
2H-4, 25–26	1	0.19	3	0.56	0	0.00	0	0.00	14	2.61	98	18.25	0	0.00	0	0.00	0	0.00	0	0.00	537
2H-4, 80–81	1	0.20	2	0.40	0	0.00	0	0.00	5	0.99	47	9.29	0	0.00	0	0.00	0	0.00	0	0.00	506
2H-4, 135–136	1	0.20	0	0.00	0	0.00	0	0.00	3	0.60	13	2.59	0	0.00	0	0.00	1	0.20	0	0.00	502
2H-5, 25–26	0	0.00	2	0.38	1	0.19	0	0.00	2	0.38	11	2.09	0	0.00	0	0.00	5	0.95	0	0.00	527
2H-5, 80–81	0	0.00	5	0.92	0	0.00	0	0.00	8	1.47	43	7.90	0	0.00	11	2.02	2	0.37	0	0.00	544
2H-5, 135–136	0	0.00	4	0.74	0	0.00	0	0.00	7	1.30	72	13.38	0	0.00	7	1.30	6	1.12	0	0.00	538
2H-6, 25–26	0	0.00	7	1.31	0	0.00	0	0.00	15	2.80	63	11.75	0	0.00	7	1.31	4	0.75	0	0.00	536
2H-6, 80–81	0	0.00	6	1.08	11	1.97	0	0.00	5	0.90	23	4.13	0	0.00	12	2.15	5	0.90	0	0.00	557
2H-6, 135–136	0	0.00	5	0.85	27	4.57	0	0.00	8	1.35	32	5.41	0	0.00	26	4.40	11	1.86	3	0.51	591
3H-1, 25–26	0	0.00	2	0.38	2	0.38	0	0.00	17	3.21	92	17.36	0	0.00	15	2.83	21	3.96	5	0.94	530
3H-1, 80–81	0	0.00	2	0.35	15	2.65	0	0.00	17	3.01	60	10.62	0	0.00	93	16.46	12	2.12	11	1.95	565
3H-11, 135–136	0	0.00	0	0.00	5	0.94	0	0.00	7	1.32	58	10.94	0	0.00	229	43.21	4	0.75	8	1.51	530

Table 4. Quantitative distribution of Quaternary calcareous nannofossils at Site 872 (Lo-En Guyot).

Core, section, interval (cm)	Depth (mbsf)	*E. huxleyi*	*E. huxleyi* (%)	Small *Gephyrocapsa*	Small *Gephyrocapsa* (%)	Large *Gephyrocapsa*	Large *Gephyrocapsa* (%)	*G. caribbeanica*	*G. caribbeanica* (%)	*G. oceanica* s.l.	*G. oceanica* s.l. (%)	*H. carteri*	*H. carteri* (%)	*C. leptoporus*	*C. leptoporus* (%)	*C. annula*	*C. annula* (%)	*Thoracosphaera*	*Thoracosphaera* (%)	*Rhabdosphaera*	*Rhabdosphaera* (%)	*C. pelagicus*	*C. pelagicus* (%)	*Syracosphaera*	*S. fossilis*	*Syracosphaera* (%)
144-872A–																										
1H-1, 25–26	0.25	152	28.04	199	36.72	1	0.18	25	4.61	115	21.22	5	0.92	3	0.55	13	2.40	1	0.18	5	0.92	0	0.00	6	4	1.11
1H-1, 85–86	0.85	60	11.05	282	51.93	8	1.47	27	4.97	119	21.92	8	1.47	7	1.29	10	1.84	0	0.00	3	0.55	0	0.00	4	3	0.74
1H-1,135–136	1.35	6	1.13	337	63.47	0	0.00	33	6.21	120	22.60	3	0.56	1	0.19	5	0.94	0	0.00	4	0.75	0	0.00	10	5	1.88
1H-2, 2–26	1.75	0	0.00	232	43.94	5	0.95	121	22.92	144	27.27	2	0.38	3	0.57	7	1.33	0	0.00	2	0.38	0	0.00	0	3	0.00
1H-2, 8–86	2.35	0	0.00	182	33.39	0	0.00	152	27.89	157	28.81	10	1.83	3	0.55	5	0.92	0	0.00	4	0.73	0	0.00	5	2	0.92
1H-2, 135–136	2.85	0	0.00	247	46.96	4	0.76	132	25.10	77	14.64	5	0.95	6	1.14	5	0.95	0	0.00	1	0.19	0	0.00	0	3	0.00
1H-3, 25–26	3.25	0	0.00	381	72.30	0	0.00	38	7.21	44	8.35	3	0.57	5	0.95	4	0.76	0	0.00	2	0.38	0	0.00	5	3	0.95
1H-3, 85–86	3.85	0	0.00	348	67.57	0	0.00	72	13.98	18	3.50	6	1.17	5	0.97	4	0.78	0	0.00	2	0.39	0	0.00	2	2	0.39
1H-3, 135–136	4.35	0	0.00	284	52.79	0	0.00	97	18.03	10	1.86	10	1.86	11	2.04	6	1.12	0	0.00	0	0.00	0	0.00	0	4	0.00
1H-4, 25–26	4.75	0	0.00	171	32.88	0	0.00	163	31.35	27	5.19	0	0.00	2	0.38	1	0.19	0	0.00	1	0.19	0	0.00	2	0	0.38
1H-4, 85–86	5.35	0	0.00	342	63.93	0	0.00	38	7.10	0	0.00	4	0.75	5	0.93	12	2.24	0	0.00	1	0.19	0	0.00	2	0	0.37
1H-4, 135–136	5.85	0	0.00	357	69.32	0	0.00	57	11.07	1	0.19	1	0.19	1	0.19	10	1.94	0	0.00	1	0.19	0	0.00	6	0	1.17
1H-5, 25–26	6.25	0	0.00	414	79.31	2	0.38	3	0.57	0	0.00	1	0.19	1	0.19	7	1.34	1	0.19	2	0.38	0	0.00	0	4	0.00
1H-5, 85–86	6.85	0	0.00	406	80.56	37	7.34	16	3.17	0	0.00	7	1.39	5	0.99	2	0.40	0	0.00	2	0.40	0	0.00	0	0	0.00
1H-CC	7.30	0	0.00	418	80.23	40	7.68	7	1.34	0	0.00	5	0.96	11	2.11	6	1.15	1	0.19	4	0.77	0	0.00	4	0	0.77
2H-1, 0–1	7.55	0	0.00	393	76.16	0	0.00	13	2.52	3	0.58	15	2.91	6	1.16	2	0.39	0	0.00	0	0.00	5	0.97	2	0	0.39
2H-1, 25–26	7.75	0	0.00	412	80.31	0	0.00	8	1.56	4	0.78	8	1.56	4	0.78	2	0.39	0	0.00	0	0.00	1	0.19	3	1	0.58
2H-1, 85–86	8.35	0	0.00	365	66.97	0	0.00	0	0.00	3	0.55	4	0.73	15	2.75	11	2.02	0	0.00	0	0.00	5	0.92	5	2	0.92
2H-1, 135–136	8.85	0	0.00	357	64.32	0	0.00	0	0.00	0	0.00	6	1.08	12	2.16	8	1.44	0	0.00	0	0.00	5	0.90	6	2	1.08

Table 4 (continued).

Core, section, interval (cm)	*S. fossilis* (%)	*U. irregularis*	*U. irregularis* (%)	*O. antillarum*	*O. antillarum* (%)	*Gephyrocapsa* sp. 3	*Gephyrocapsa* sp. 3 (%)	*P. lacunosa* C	*P. lacunosa* C (%)	*P. lacunosa* E	*P. lacunosa* E (%)	Large *Reticulofenestra*	Large *Reticulofenestra* (%)	Small+medium *Reticulofenestra*	Small+medium *Reticulofenestra* (%)	*H. sellii*	*H. sellii* (%)	*C. macintyrei*	*C. macintyrei* (%)	*D. brouweri*	*D. brouweri* (%)	Total
144-872A–																						
1H-1, 25–26	0.74	6	1.11	0	0.00	7	1.29	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	542
1H-1, 85–86	0.55	7	1.29	0	0.00	5	0.92	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	543
1H-1,135–136	0.94	4	0.75	0	0.00	3	0.56	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	531
1H-2, 2–26	0.57	3	0.57	2	0.38	3	0.57	1	0.19	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	528
1H-2, 8–86	0.37	0	0.00	0	0.00	5	0.92	5	0.92	15	2.75	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	545
1H-2, 135–136	0.57	4	0.76	0	0.00	4	0.76	14	2.66	24	4.56	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	526
1H-3, 25–26	0.57	4	0.76	4	0.76	5	0.95	7	1.33	22	4.17	3	0.57	0	0.00	0	0.00	0	0.00	0	0.00	527
1H-3, 85–86	0.39	0	0.00	0	0.00	17	3.30	18	3.50	21	4.08	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	515
1H-3, 135–136	0.74	4	0.74	0	0.00	21	3.90	30	5.58	61	11.34	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	538
1H-4, 25–26	0.00	1	0.19	0	0.00	14	2.69	38	7.31	87	16.73	13	2.50	0	0.00	0	0.00	0	0.00	0	0.00	520
1H-4, 85–86	0.00	10	1.87	0	0.00	0	0.00	28	5.23	73	13.64	12	2.24	8	1.50	0	0.00	0	0.00	0	0.00	535
1H-4, 135–136	0.00	5	0.97	0	0.00	0	0.00	18	3.50	47	9.13	4	0.78	7	1.36	0	0.00	0	0.00	0	0.00	515
1H-5, 25–26	0.77	0	0.00	0	0.00	0	0.00	5	0.96	77	14.75	0	0.00	5	0.96	0	0.00	0	0.00	0	0.00	522
1H-5, 85–86	0.00	5	0.99	0	0.00	0	0.00	7	1.39	17	3.37	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	504
1H-CC	0.00	0	0.00	0	0.00	0	0.00	5	0.96	20	3.84	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	521
2H-1, 0–1	0.00	1	0.19	0	0.00	0	0.00	15	2.91	49	9.50	0	0.00	0	0.00	2	0.39	9	1.74	0	0.00	516
2H-1, 25–26	0.19	1	0.19	0	0.00	0	0.00	15	2.92	51	9.94	0	0.00	0	0.00	0	0.00	3	0.58	0	0.00	513
2H-1, 85–86	0.37	2	0.37	0	0.00	0	0.00	32	5.87	71	13.03	0	0.00	13	2.39	4	0.73	13	2.39	0	0.00	545
2H-1, 135–136	0.36	2	0.36	0	0.00	0	0.00	31	5.59	78	14.05	0	0.00	12	2.16	6	1.08	15	2.70	10	1.80	555

Table 5. Quantitative distribution of Quaternary calcareous nannofossils at Site 873 (Wodejebato Guyot).

Core, section, interval (cm)	Depth (mbsf)	*E. huxleyi*	*E. huxleyi* (%)	Small *Gephyrocapsa*	Small *Gephyrocapsa* (%)	Large *Gephyrocapsa*	Large *Gephyrocapsa* (%)	*G. caribbeanica*	*G. caribbeanica* (%)	*G. oceanica* s.l.	*G. oceanica* s.l. (%)	*H. carteri*	*H. carteri* (%)	*C. leptoporus*	*C. leptoporus* (%)	*C. annula*	*C. annula* (%)	*Rhabdosphaera*	*Rhabdosphaera* (%)
144-873B-																			
1H-1, 5–6	0.05	0	0	323	61.88	49	9.39	28	5.36	79	15.13	5	0.96	6	1.15	6	1.15	3	0.57
1H-1, 50–51	0.50	0	0	300	56.60	25	4.72	48	9.06	109	20.57	10	1.89	3	0.57	3	0.57	1	0.19
1H-1, 100–101	1.00	0	0	307	54.43	31	5.50	59	10.46	85	15.07	7	1.24	6	1.06	4	0.71	0	0.00
1H-2, 5–6	1.24	0	0	311	59.92	37	7.13	72	13.87	22	4.24	5	0.96	5	0.96	9	1.73	0	0.00
1H-2, 24–25	1.48	0	0	252	48.93	15	2.91	85	16.50	58	11.26	12	2.33	11	2.14	6	1.17	1	0.19
1H-2, 50–51	1.69	0	0	265	51.76	0	0.00	52	10.16	14	2.73	5	0.98	4	0.78	4	0.78	0	0.00
1H-2, 100–101	2.19	0	0	299	55.78	5	0.93	48	8.96	13	2.43	8	1.49	5	0.93	4	0.75	4	0.75
1H-3, 5–6	2.62	0	0	308	59.81	17	3.30	23	4.47	7	1.36	17	3.30	6	1.17	6	1.17	7	1.36
1H-3, 50–51	3.07	0	0	190	37.18	3	0.59	22	4.31	15	2.94	9	1.76	8	1.57	5	0.98	4	0.78
1H-3, 100–101	3.57	0	0	221	42.50	0	0.00	23	4.42	22	4.23	21	4.04	13	2.50	6	1.15	0	0.00
1H-4, 5–6	4.02	0	0	227	43.82	0	0.00	10	1.93	7	1.35	12	2.32	4	0.77	0	0.00	2	0.39
1H-4, 50–51	4.47	0	0	207	38.33	0	0.00	1	0.19	0	0.00	12	2.22	7	1.30	55	10.19	0	0.00
1H-4, 100–101	4.97	0	0	210	38.89	0	0.00	0	0.00	0	0.00	10	1.85	6	1.11	45	8.33	2	0.37

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

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Table 5 (continued).

C. pelagicus	*C. pelagicus* (%)	*Syracosphaera*	*Syracosphaera* (%)	*S. fossilis*	*S. fossilis* (%)	*U. irregularis*	*U. irregularis* (%)	*O. antillarum*	*O. antillarum* (%)	*Gephyrocapsa* sp. 3	*Gephyrocapsa* sp. 3 (%)	*P. lacunosa* C	*P. lacunosa* C (%)	*P. lacunosa* E	*P. lacunosa* E (%)	*Scyphosphaera*	*Scyphosphaera* (%)	Large *Reticulofenestra*	Large *Reticulofenestra* (%)	*H. sellii*	*H. sellii* (%)	*C. macintyrei*	*C. macintyrei* (%)	Total
0	0.00	5	0.96	2	0.38	3	0.57	0	0.00	0	0.00	3	0.57	9	1.72	0	0.00	0	0.00	1	0.19	0	0.00	522
0	0.00	6	1.13	2	0.38	4	0.75	0	0.00	0	0.00	5	0.94	8	1.51	0	0.00	0	0.00	6	1.13	0	0.00	530
0	0.00	5	0.89	1	0.18	5	0.89	1	0.18	0	0.00	13	2.30	35	6.21	0	0.00	0	0.00	5	0.89	0	0.00	564
0	0.00	2	0.39	1	0.19	0	0.00	2	0.39	0	0.00	19	3.66	31	5.97	0	0.00	0	0.00	3	0.58	0	0.00	519
0	0.00	3	0.58	2	0.39	0	0.00	0	0.00	0	0.00	28	5.44	39	7.57	0	0.00	0	0.00	3	0.58	0	0.00	515
0	0.00	0	0.00	2	0.39	1	0.20	0	0.00	0	0.00	44	8.59	116	22.66	0	0.00	3	0.59	2	0.39	0	0.00	512
0	0.00	5	0.93	1	0.19	1	0.19	0	0.00	0	0.00	37	6.90	101	18.84	0	0.00	2	0.37	3	0.56	0	0.00	536
1	0.19	10	1.94	1	0.19	1	0.19	0	0.00	0	0.00	27	5.24	82	15.92	0	0.00	0	0.00	2	0.39	0	0.00	515
0	0.00	0	0.00	3	0.59	0	0.00	0	0.00	0	0.00	57	11.15	193	37.77	0	0.00	0	0.00	2	0.39	0	0.00	511
0	0.00	3	0.58	0	0.00	2	0.38	2	0.38	0	0.00	89	17.12	102	19.62	2	0.38	0	0.00	3	0.58	11	2.12	520
7	1.35	3	0.58	2	0.39	0	0.00	0	0.00	0	0.00	52	10.04	175	33.78	0	0.00	0	0.00	2	0.39	15	2.90	518
2	0.37	6	1.11	2	0.37	0	0.00	3	0.56	0	0.00	103	19.07	114	21.11	1	0.19	0	0.00	11	2.04	15	2.78	540
8	1.48	5	0.93	2	0.37	2	0.37	4	0.74	0	0.00	105	19.44	120	22.22	1	0.19	0	0.00	12	2.22	17	3.15	540

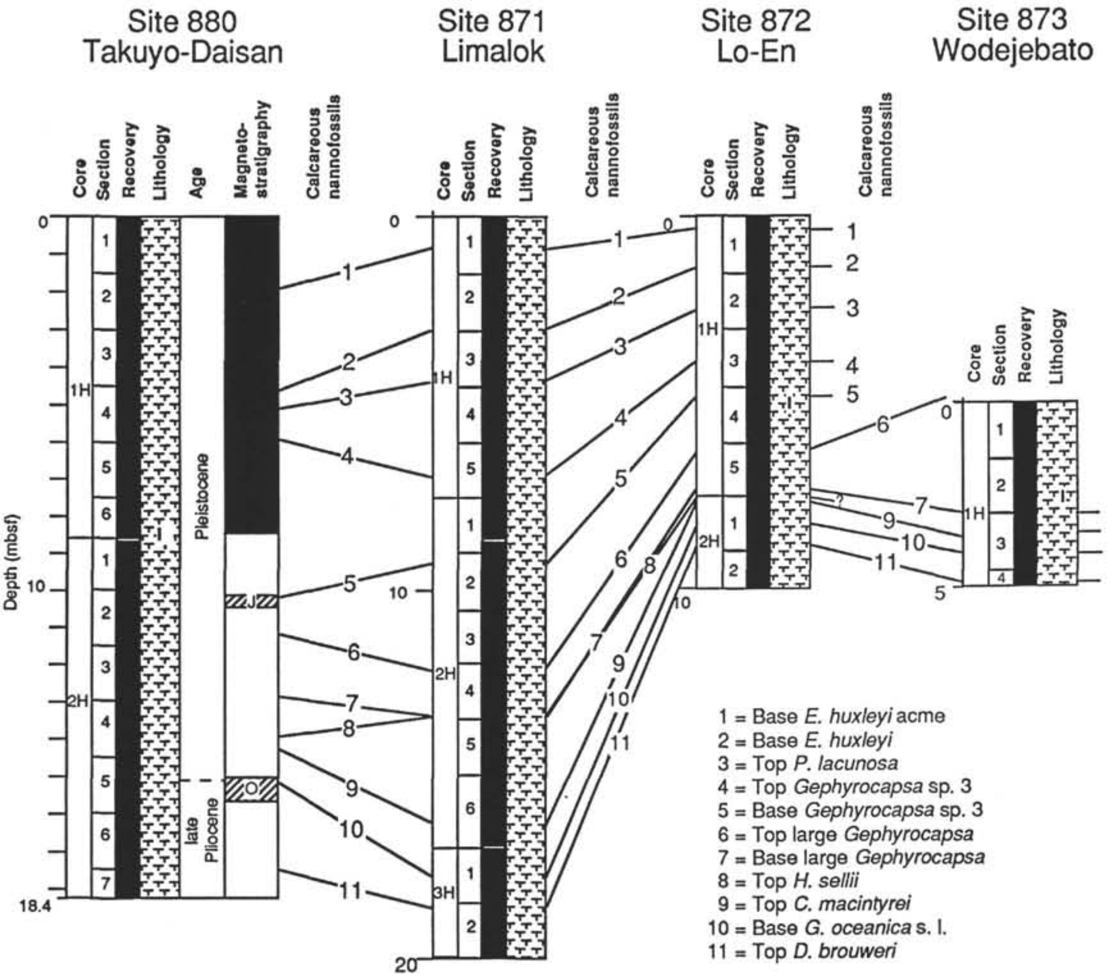

Figure 6. Correlation of Sites 800, 871, 872, and 873 based on nannofossil quantitative biostratigraphy.

Table 6. Ages (in k.y.) of Quaternary nannofossil events at Sites 880, 871, 872, and 873, as published by previous workers.

Author	Area	Base *E. huxleyi* acme	Base *E. huxleyi*	Top *P. lacunosa*	Top *Gephyrocapsa* sp. 3	Top large *Reticulofenestra*	Base *Gephyrocapsa* sp. 3/ Top small *Gephyrocapsa*	Base large *Reticulofenestra*	Top large *Gephyrocapsa*/ Base small *Gepyrocapsa*	Base large *Gephyrocapsa*	Top *H. sellii*	Top *C. macintyrei*	Base *G. oceanica* s. l.	Top *D. brouweri*
Bukry, 1975	Northwest Pacific		200	300										
Gartner, 1977	Caribbean and Pacific	70	270	440			920		1220			1510		1650
Thierstein et al., 1977	Global	73–85	268	458										
Berggren et al., 1985	Global		275	474			900							
Hills and Thierstein, 1989	Global		230	350								1350		1870
Rio et al., 1990	West Mediterranean						950							
Matsuoka and Okada, 1989	Pacific	120	270	460		810	920	980	1100		1200			
Takayama and Sato, 1987	North Atlantic		240	390		830	890		1100	1360	1190	1570	1660	1910
Castradori, 1993a	East Mediterranean		265	468	584		944							
Pujos, 1985b	North Atlantic			475							1200	1650		
Pujos, 1985a	Central equatorial Pacific										1230	1500		2000
Raffi et al., 1993	Pacific						1028		1240	1470	1470	1597	1670	
Raffi et al., 1993	North Atlantic						957		1227	1479	1241	1640	1700	1950
Wei, 1993*	Global					880		1020–1170	1230	1440–1530	1260–1440	1600–1640	1680	1950–1960

*Ages after Shackleton et al. (1990).

Table 7. Depths (in mbsf) of nannofossil events recognized in this study at Sites 880, 871, 872, and 873.

Site	Guyot	Base *E. huxleyi* acme	Base *E. huxleyi*	Top *P. lacunosa*	Top *Gephyrocapsa* sp. 3	Top large *Reticulofenestra*	Base *Gephyrocapsa* sp. 3/ Top small *Gephyrocapsa*	Base large *Reticulofenestra*	Top large *Gephyrocapsa*/ Base small *Gepyrocapsa*	Base large *Gephyrocapsa*	Top *H. sellii*	Top *C. macintyrei*	Base *G. oceanica* s. l.	Top *D. brouweri*
871	Limalok	0.82	2.9	5.3	6.8	8.85	9.25	11.8	12.25	13.35	13.35	16.35	17.25	18.35
872	Lo-En	0.25	1.35	2.35	3.85	3.25	4.75	8.85	6.25	7.3	7.55	7.55	8.35	8.85
873	Wodejebato									3.07		3.57	4.02	4.97
880	Takuyo-Daisan	1.8	4.8	5.2	5.8	6.39	10.2	12.17	11.59	13.17	14.37	14.57	15.97	16.37