

## 12. PALEOENVIRONMENT AND BIOSTRATIGRAPHY OF FORAMINIFERS AT SITES 794, 795, 796, AND 797 IN THE JAPAN SEA<sup>1</sup>

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Biostratigraphy and paleoenvironmental history of deep and surficial waters of the Japan Sea are addressed using sequences recovered from the floor of the backarc basin. The study is divided into two parts: (1) foraminifer biostratigraphy and paleoenvironmental assessment of sedimentary sequences recovered from above igneous basement at the four sites and (2) detailed planktonic foraminifer paleoenvironmental analysis of Quaternary and Pliocene sequences from Sites 794 and 797 in the Yamato Basin.

A total of 253 samples were examined for the foraminifer biostratigraphy and 325 samples for the detailed paleoenvironmental study of Quaternary and Pliocene sequences. Low abundance and sporadic occurrence of foraminifers limited interpretation of results. Foraminifer-bearing intervals were correlated where possible to diatom and calcareous nannofossil zonations, and the sequences were successfully assigned to the foraminifer zonation of Matsunaga. Unfortunately, extensive barren intervals and sporadic occurrences of planktonic foraminifers prevented zonation of Quaternary and Pliocene intervals, although some interesting conclusions about paleoenvironment were possible and are listed below.

A sequence of Neogene (*sensu lato*) paleoenvironmental events were identified: (1) deepening of the Yamato basins to middle bathyal depths by the early to middle Miocene, an event contemporaneous with the age of some deep basins known from uplifted sections adjacent to the Japan Basin; (2) cooling of the Japan Sea in the early middle Miocene; (3) oxygenation of deep waters in the late Miocene; (4) further cooling of surficial water masses between the Olduvai Subchron and the Brunhes/Matuyama Boundary; and (5) extermination of lower middle bathyal faunas and replacement by upper middle bathyal faunas near the base of the Quaternary.

### INTRODUCTION

A fundamental objective long sought in the Japan Sea region is a continuous biostratigraphic and paleoenvironmental record of the marginal sea. The scientific reward from such a sequence includes issues of multidisciplinary interest. The paleoenvironmental record of the backarc basin could detail the events surrounding the opening and subsidence of the nascent basin, its maturation, and the effects of compression that may lead ultimately to its destruction. Rotation of the island arc during Miocene basin widening along with formation of sills across passages to the open Pacific Ocean probably are recorded by assemblage changes in the biota of both the upper water column and in bottom waters. The late Pliocene and Quaternary facies (light and dark lithologic cycles) suggest that the basin may have acted like an amplifier in response to glacial climatic cycles. The development of a continuous biostratigraphy correlated to the global time scale could place these events in historical perspective relative to those in the Pacific Ocean and elsewhere.

The taxonomy of Japan foraminifers, the foraminifer biostratigraphy, and paleoenvironments of uplifted marine sections on western Honshu and Hokkaido have been discussed by many workers (i.e., Asano, 1950-1951; Saito, 1963; Matsunaga, 1963; Asano, et al., 1969; Burckle and Todd, 1976; Kurihara, 1976; Tsuchi et al., 1984; Oda, 1986). Several major events in the history of the Japan Sea were identified from these sequences.

1. Uplifted bathyal basins are as old as the late early Miocene, a date that marks a youngest age for bathyal depth basins during the birth process of the backarc basin (i.e., Matoba, 1984).

2. The nascent Japan Sea supported a warm subtropical planktonic fauna in the early Miocene, but was cool by the late middle Miocene (i.e., Asano et al., 1969; Saito, 1963; Matoba, 1984; Tsuchi et al., 1984). This cooling event may be related to clockwise rotation of the

island arc, a process that closed southerly passages and opened northerly passages to the Pacific Ocean (Chinzei, 1986).

3. The sedimentary sequence between the early Miocene and Pliocene contains sporadic occurrences of foraminifers, making it very difficult to piece together a history during basin growth and maturity (i.e., Matsunaga, 1963).

4. Middle Miocene to late Pliocene agglutinated foraminifer faunas of the Onnagawa and Funakawa Formations indicate low oxygen conditions in the deep waters of the bathyal basins (i.e., Matoba, 1984). The overlying Pleistocene fauna, which is dominated by calcareous benthic foraminifers, marks a change in deep water to more oxygenated conditions.

5. Matoba (1984, and references therein) has noted that the late Pliocene to early Pleistocene fauna typified in the Kitaura and Wakimoto Formations is quite different from the latest Quaternary fauna recovered in piston cores, and he suggests that a drastic change in bathyal oceanographic conditions triggered a major faunal turnover in the late Pleistocene.

The objective of this paper is to assess the capability of the data set to address the goals listed above, to expand on the history known from uplifted sections, and to identify additional significant events since the birth of the marginal sea.

### METHODS

#### Neogene Biostratigraphy and Paleoenvironmental Assessment

Core-catcher samples were prepared from sediment cores of the four sites, and in a few instances samples were taken from within cores. 253 samples approximately 20 cm<sup>3</sup> in volume were dried, soaked in a hot 1% Calgon solution, washed on a sieve of 63- $\mu$ m openings, and inspected for foraminifers. In most samples, all specimens were picked and identified to genus or species. In samples with common to abundant foraminifers, representatives of each species present were picked (see Tables 2 and 3 in the Biostratigraphy section of each site chapter in Tamaki, Pisciotta, Allan, et al., 1990). The species ranges and assemblages were compared with the zonation of Matsunaga (1963).

<sup>1</sup> Pisciotta, K. A., Ingle, J. C., Jr., von Breymann, M. T., Barron, J., et al., 1992. *Proc. ODP, Sci. Results*, 127/128, Pt. 1: College Station, TX (Ocean Drilling Program).

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## Detailed Quaternary and Pliocene Biostratigraphy and Paleoenvironmental Analysis

Samples were taken from each section of the hydraulically piston-cored portions at Sites 794 and 797. As many as five samples per section were taken in the top five and six cores respectively, and one sample per section from deeper in the sequences. Samples were weighed, dried, and soaked in a hot 1% Calgon solution for about 3 hr. The disaggregated sediment was washed on a sieve of 63- $\mu$ m openings, and the sand-size residue was dried, weighed, and inspected for foraminifers. Samples with abundant planktonic foraminifers were split into about 300 specimens using an Otto microsplitter. Planktonic foraminifers were identified to species and counted, benthic foraminifers were counted.

Several parameters were calculated from the measured data: sand percent by weight, planktonic and benthic foraminifer numbers (number of specimens per gram of sediment), benthic/planktonic ratio (number of benthic specimens/total number of foraminifer specimens), the coiling ratio of *Neogloboquadrina pachyderma* (number of sinistral forms/total number of *Neogloboquadrina pachyderma* tests), and relative frequency of 11 planktonic foraminifer species and counting groups. Q-mode cluster analysis was used to objectively separate planktonic foraminifer assemblages. The procedure used a simple Euclidean distance coefficient applied to the relative species frequency data and amalgamated samples using the smallest average distance between groups. The results were compared to the biostratigraphy of Maiya et al. (1976) and Lagoe and Thompson (1988).

### RESULTS OF NEOGENE FORAMINIFER BIOSTRATIGRAPHY

Foraminifers are generally rare (Table 1) and samples with common to abundant foraminifers are, with a few notable exceptions, limited to the Quaternary and upper Pliocene. Of 65 samples examined at Site 794 (Tables 1 and 2), 27 are barren, 20 have fewer than 10 specimens, and only 4 from the Quaternary sequence have more than 100 specimens, which are dominated by calcareous planktonic foraminifers. Of 68 samples examined at Site 795 (Tables 1 and 3), 25 are barren, 7 have fewer than 10 specimens, and 20 have more than 100 specimens, which, in general, are dominated by agglutinated foraminifers. One sample from the middle Miocene sequence bears more than 100 calcareous foraminifers. Of 53 samples examined from Site 796 (Tables 1 and 4), 23 are barren, 11 have fewer than 10 specimens, and 6 have greater than 100 specimens. One of the latter samples is upper Miocene, and the others are Quaternary and upper Pliocene. Of 67 samples from Site 797 (Tables 1 and 5), 23 are barren, 12 have fewer than 10 specimens, and 13 have more than 100 specimens. Three of these lie in the Miocene, whereas the other 10 are from the Quaternary and upper Pliocene.

#### Quaternary Foraminifers

The Quaternary sequences (Koizumi, this volume; L. Vigliotti and J. Wipperm, pers. comm., 1990) at all sites bear several features in

common (Tables 2 through 5). They contain almost no agglutinated foraminifers, and have several intervals with abundant subarctic to arctic planktonic foraminifers. The sequences contain some miliolids like *Pyrgo*, *Nummuloculina*, *Quinqueloculina*, and other genera, and they have assemblages with frequent *Globocassidulina subglobosa*, *Islandiella norcrossi*, *Stainforthia complanata*, *Brizalina pacifica*, *Epistominella pacifica*, *Fursenkoina seminuda*, *Bulimina striata* var. *mexicana*, and *Trifarina*. There are too few foraminifers in this set of data to clearly distinguish benthic assemblages within the Quaternary.

#### Pliocene Foraminifers

The most distinctive feature of the Pliocene intervals is the consistent range of *Miliammina echigoensis* throughout the four sites (Tables 2 through 5). At all holes except Hole 796B, the top of the range of this taxon lies within the *Neodenticula koizumii* Diatom Zone (Koizumi, this volume). At all holes except Hole 796B, the bottom of the range lies in the *Thalassiosira oestrupii* Diatom Zone (Koizumi, this volume). The deepest occurrence at Site 794 (Table 2) is a single specimen, which lies in the older *Neodenticula kamtschatica* Diatom Zone (Koizumi, this volume). This occurrence could be contamination from upsection as the next occurrence of *Miliammina echigoensis* lies within the *Thalassiosira oestrupii* Diatom Zone (Koizumi, this volume).

Species that occur in the Pliocene (Koizumi, this volume) at all four sites (Tables 2 through 5) include the agglutinated species *Martinottiella communis*, *eggerella bradyi*, and *eggerella* sp. A, and the calcareous species *Melonis pompilioides*. Species that occur at Sites 795, 796, and 797 include *Chilostomella oolina* and *Globobulimina auriculata*. The two sites from the Japan Basin also share *Quinqueloculina akneriana* and *Oolina globosa*. The two sites from the Yamato Basin, however, are difficult to compare because Site 794 has the worst calcium carbonate preservation and lowest diversity of the four sites, whereas Site 797 has the best calcium carbonate preservation and highest diversity of the four sites.

#### Upper Miocene Foraminifers

In the Japan Basin, the sequence within the *Neodenticula kamtschatica* Diatom Zone (Koizumi, this volume) is nearly barren of foraminifers. In the Yamato Basin, the upper Miocene sediments of Sites 794 and 797 are also near barren except at the base of the zone where Sample 127-797-31X-CC, is enriched with well preserved *Globigerina bulloides*, *Globobulimina auriculata*, *Sigmavirgulina* sp., *Cibicides lobatulus*, *Elphidium subincertum*, and traces of other species. This sample may be displaced from shallower depth.

Correlation of foraminifers to the diatom zonation of Koizumi (this volume) is difficult below the uppermost Miocene because of diagenesis below the opal-A/opal-CT transition, which lies at various levels within the upper Miocene at all four sites. Diatom zones are recognized where diatoms are preserved in carbonate concretions. Additionally, calcareous nannofossils provide zonal assignments at sporadic intervals (Rahman, this volume). With this caveat in mind, some statements can be made with caution about time and intracore correlations.

The lower part of the upper Miocene sequence in the Japan Basin, approximately equivalent to the *Denticulopsis dimorpha* Diatom Zone (Koizumi, this volume) at Site 795 (Table 3), contains a distinctive assemblage of agglutinated and calcareous foraminifers. The agglutinated foraminifers include *Cyclammina* cf. *C. tani*, *Cyclammina pusilla*, other *Cyclammina* species, more than six species of *Haplophragmoides*, more than three species of *Ammodiscus*, *Trochammina* spp., *Martinottiella communis*, *Martinottiella nodulosa*, and *eggerella* sp. A. The calcareous foraminifers include *Melonis pompilioides*, *Gyroidina soldanii*, and other *Gyroidina* spp., *Cibicides wuellerstorfi*, *Globobulimina auriculata*, and *Globigerina bulloides*.

Table 1. Frequency of samples bearing foraminifers.

Site	Frequency of Samples with Specified Numbers of Foraminifer Tests				Total Number of Samples
	Barren	<10 Tests	10-99 Tests	>99 Tests	
794	27	20	14	4	65
795	25	7	16	20	68
796	23	11	13	6	53
797	23	12	19	13	67

Site 796 (Table 4), also from the Japan Basin, bears a similar agglutinated assemblage near its base. The base may be early late Miocene in age based on extrapolation of sedimentation rates from datums higher in the sequence (see Sediment Accumulation Rates section, Site 796 chapter in Tamaki, Pisciotto, Allan, et al. (1990). The calcareous assemblage at Site 796 contains *Globobulimina auriculata*, *Gyroidina lamarckiana*, *Nonionella miocenica*, *Chilostomella oolina*, *Valvulineria* spp., and *Globigerina woodi* among a few others, and looks different from the assemblage at Site 795. However, we caution that this conclusion is reached based on very few specimens.

The lower part of the upper Miocene sequence in the Yamato Basin is assigned to the *Rouxia californica* Diatom Zone at Site 797 (Koizumi, this volume). The zone at this site is truncated by a disconformity at its base. The interval (Table 5) includes one specimen of *Cyclammina*, four species of *Haplophragmoides*, *Martinottiella communis*, and *Eggerella* sp. A and is generally similar to the agglutinated assemblage of the Japan Basin. The calcareous foraminifers include *Gyroidina lamarckiana*, *Pullenia salisburyi*, *Globobulimina auriculata*, and other *Globobulimina* spp., *Neoglobobulimina asanoi*, and *Neoglobobulimina himiensis*. This list of species is different from those of the Japan Basin.

The lower part of the upper Miocene sequence at Site 794 is assigned to the *Rouxia californica* Diatom Zone through the *Denticulopsis katayamae* Diatom Zone (Koizumi, this volume) above the opal-A/opal-CT transition, which lies in Core 127-794A-31X. The base of the upper Miocene is placed near Sample 127-794A-14R-CC, based on extrapolation of sedimentation rates and the occurrence of the *Discoaster hamatus* Calcareous Nannofossil Zone in Sample 127-794B-12R-CC. Unfortunately, the foraminifers are too rare at Site 794 (Table 2) to compare with those in Site 797 (Table 5).

### Middle Miocene Foraminifers

The deepest, foraminifer-bearing unit at Site 795 in the Japan Basin falls within the *Denticulopsis praedimorpha* and *Denticulopsis hustedii* Diatom Zones (Koizumi, this volume). The latter zone lies near the base of the middle Miocene. The sequence (Table 3) bears *Cyclammina* cf. *C. tani* and *Cyclammina* spp. with *Eggerella* sp. A, several species of *Haplophragmoides*, *Martinottiella communis*, *Martinottiella nodulosa*, and *Spirosigmoilinella compressa*. With the exception of the last species, the assemblage of agglutinated foraminifers is similar to the lower upper Miocene agglutinated assemblage at Sites 795 and 796. The calcareous foraminifers at Site 795 include *Globobulimina auriculata*, *Cibicides wuellerstorfi*, *Elphidium subincertum*, *Gyroidina lamarckiana*, *Gyroidina orbicularis*, *Pullenia bulloides*, and pieces of nodosarids and single specimens of *Melonis pompilioides* *Nonionella* spp. and other species. The most common planktonic species are *Globigerina bulloides* and *Globigerinita glutinata*, species commonly associated with cool surficial water masses.

### Middle to Lower (?) Miocene Foraminifers

In the Yamato Basin, the age of foraminifer-bearing sediment near basement at Sites 794 and 797 appears coincident. The intervals at Sites 794 (Cores 127-794B-24R and -25R) and 797 (Cores 127-797B-47X through -52X) contain the calcareous nannofossil, *Sphenolithus heteromorphus* (Rahman, this volume), which ranges in age from 14.4 to 17.1 Ma (Berggren et al., 1985). Its range crosses the lower Miocene/middle Miocene boundary. The ranges of several planktonic foraminifers support this conclusion. At Site 797, Samples 127-797B-52X-CC, and -797C-3R-CC, contain *Catapsydrax parvulus*, which ranges in age from Zone N7 to within Zone N15 (Kennett and Srinivasan, 1983), about 17.6 to 10.2 Ma (Berggren et al., 1985), and *Globorotalia praescitula*, which ranges in age from Zone N10 (Kennett and Srinivasan, 1983), about 14–15 Ma (Berggren et al., 1985), to 17.7 Ma (Berggren et al., 1985). Additionally, Samples 127-797B-51X-CC, -797B-52X-CC, and -794B-24R-CC, are dominated by the

species *Globobulimina venezuelana* of the warm subtropics, which suggests that the region was much warmer than assemblages higher in the sequences. The paleoenvironmental cooling occurred in the early middle Miocene (Saito, 1963; Chinzei, 1986).

Sites 794 and 797 have similar assemblages of foraminifers. Site 794 (Table 2) contains the agglutinated species *Cyclammina cancellata*, *Cyclammina japonica*, *Cyclammina pusilla*, *Ammodiscus* spp., more than four species of *Haplophragmoides*, *Martinottiella communis*, *Martinottiella nodulosa*, *Spirosigmoilinella compressa*, and *Trochammina* spp. The same agglutinated assemblage occurs at Site 797 (Table 5) with the additional species, *Eggerella* sp. A, four additional species of *Haplophragmoides*, and four additional species of *Ammodiscus*. Site 794 (Table 2) contains the calcareous species *Chilostomella oolina*, *Gyroidina orbicularis*, *Gyroidina* sp. A, *Nonionella miocenica*, and *Oridorsalis tener*. Site 797 (Table 5) contains the same calcareous species with *Globobulimina auriculata* and other *Globobulimina* species, *Cibicides wuellerstorfi*, *Eilohedra rotunda*, additional *Chilostomella* species, *Pullenia bulloides*, *Valvulineria sadonica*, and other species.

Most of the calcareous benthic species that occur at Sites 794 and 797 (Tables 2 and 5) of the Yamato Basin also occur at Site 795 (Table 3) of the Japan Basin. However, the Yamato Basin assemblage is much more diverse, and the agglutinated assemblages differ in their cyclamminid species. The planktonic specimens at Site 795 are few in abundance and poorly preserved in this interval so comparisons with those at Sites 794 and 797 are unclear. Further work is suggested to test if this interval of Site 795 is correlative with the middle to lower(?) Miocene intervals of the Yamato Basin.

It is interesting to note that the deepest foraminifer-bearing interval at Sites 794 and 797 (Tables 2 and 5) is overlain by a distinct barren interval as are the middle Miocene foraminifer-bearing interval at 795 (Table 3) and the upper Miocene foraminifer-bearing intervals at all four sites (Tables 2 through 5).

### Paleodepth Analysis

Eighteen calcareous species of benthic foraminifers were selected as paleodepth indicators based on the work of Matoba (1977), Keller (1980), and Thompson (1980), in the Japan region and that of Ingle and Keller (1980), Culver and Buzas (1986), and Ingle et al. (1980) along the eastern rim of the Pacific Ocean. Occurrences of depth indicators were tabulated (Table 6) by basin and geologic series. Our inspection of Table 6 reveals the assumptions made about paleodepth indicators, and inspection of Tables 1 through 5 reveals the small sample size used to draw these conclusions. Sequences bearing benthic foraminifers have lain at lower middle bathyal depths since the lower to middle Miocene in the Yamato Basin in units that lie within 0.55 m (Site 794) and 0.65 m (Site 797) of igneous basement. The basal middle Miocene sequence at Site 795 was also deposited at lower middle bathyal depths in a foraminifer-bearing unit that lies 19 m above igneous basement.

### Range of the Low Oxygen Facies

At all four sites the lower, middle, and lower upper Miocene sequences bear sedimentary structures suggestive of low oxygen. The structures consist of predominance of horizontally oriented burrows in bioturbated sections interspersed with laminated intervals where bioturbation is absent. The features are described in the barrel sheets of the *Initial Reports* volumes. The ranges of these structures correspond very well with the ranges of the agglutinated benthic foraminifer-facial assemblage bearing *Cyclammina*, *Haplophragmoides*, and *Ammodiscus*, an assemblage associated with low oxygen conditions (Matoba, 1984). At all four sites the association appears near the bases of the sedimentary sequences above igneous basement (Table 7). In the Japan Basin the association continues to the *Neodenticula kamtschatica* Diatom Zone in the upper upper Miocene of both sites. In the Yamato

Table 2. Range chart of foraminifers from Site 794 arranged alphabetically within the taxonomic groups, agglutinated, miliolid, rotalid, and planktonic.

Core-section interval (cm)	<i>Agglutinated indeterminates</i>	<i>Ammodiscus</i> spp.	<i>Cyclamina cancellata</i>	<i>Cyclamina japonica</i>	<i>Cyclamina pusilla</i>	<i>Cyclamina</i> spp.	<i>Eggerella bradyi</i>	<i>Eggerella</i> sp. A	<i>Eggerella</i> spp.	<i>Haplophragmoides compressum</i>	<i>Haplophragmoides</i> sp. A	<i>Haplophragmoides</i> sp. C	<i>Haplophragmoides</i> sp. D	<i>Haplophragmoides</i> spp.	<i>Karreriella</i> sp. A	<i>Martinottiella communis</i>	<i>Martinottiella nodulosa</i>	<i>Martinottiella</i> sp.	<i>Milammina echigoensis</i>	<i>Spirosigmolinella</i> cf. <i>S. compressa</i>	<i>Spirosigmolinella compressa</i>	<i>Textularia</i> spp.	<i>Trochammina</i> spp.	<i>Mitilinelina</i> cf. <i>M. oblonga</i>	<i>Nummuloculina</i> sp. A	
A-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-2H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-3H-02, 94-96	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-3H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-4H-05, 90-92	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-4H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-5H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-6H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-7H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-8H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-9H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-10H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-11H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-12H-CC	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.
A-13H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-14H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.
A-15X-CC	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.
A-16X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-17X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-18X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-19X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-20X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-21X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-22X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-23X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-24X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-25X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-26X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-27X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-28X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.
A-29X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-30X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.
A-31X-CC	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
A-32X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-33X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-34X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-35X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-36X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-37X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-1R-CC	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
B-2R-CC	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.	.	.	.	.
B-3R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-4R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-5R-CC	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
B-6R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-7R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-8R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-9R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-10R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-11R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-12R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-13R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	2	.	3	.	1	1	.	.	.
B-14R-CC	1	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	2	.	2	.	.	.	.	.
B-15R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-16R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-17R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-18R-CC	3	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	1	.	.	.	.	1	.	.	.	.
B-19R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-20R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-21R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-24R-CC	.	5	.	5	.	.	.	.	.	.	.	1	.	1	.	4	1	.	.	.	.	3	1	1	1	
B-25R-CC	3	1	.	.	1	15	.	1	.	.	1	6	.	7	.	1	.	.	.	.	5	.	.	.	.	
B-26R-02, 8-9	3	1	2	3	.	5	.	.	.	1	2	.	2	.	.	2	.	.	.	.	5	.	.	.	.	

Table 2 (continued).

Core-section interval (cm)	<i>Nummoloculina</i> sp. B	<i>Pyrgo</i> sp.	<i>Quinqueloculina</i> cf. <i>Q. aberniana</i>	<i>Anomalina glabrata</i>	<i>Bulimina pagoda</i>	<i>Bulimina striata</i> var. <i>mexicana</i>	<i>Calcareous benthic indeterminates</i>	<i>Cassidulinoides</i> sp.	<i>Cassidulinoides tenuis</i>	<i>Chilostomella oolina</i>	<i>Chilostomella</i> sp.	<i>Fissurina</i> cf. <i>F. exculpta</i>	<i>Fissurina</i> sp. B	<i>Fonbofia wuellerstorfi</i>	<i>Globobulimina auriculata</i>	<i>Globobulimina</i> cf. <i>G. pupoides</i>	<i>Globobulimina pacifica</i>	<i>Globobulimina</i> spp.	<i>Globocassidulina subglobosa</i>	<i>Gyroidina orbicularis</i>	<i>Gyroidina</i> sp. A	<i>Gyroidina</i> spp.	<i>Islandiella</i> cf. <i>I. californica</i>	<i>Lagena</i> cf. <i>L. elongata</i>	<i>Melonis nicobarense</i>
A-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-2H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-3H-02, 94-96	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.	.	.	.	.
A-3H-CC	.	1	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	2	.	.	.	.	.	.	.
A-4H-05, 90-92	.	.	.	.	2	7	1	.	.	.	.	.	.	.	.	.	.	14	.	.	.	.	.	.	.
A-4H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
A-5H-CC	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.
A-6H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-7H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-8H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-9H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-10H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-11H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-12H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-13H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-14H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-15X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-16X-CC	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.
A-17X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-18X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-19X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-20X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-21X-CC	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-22X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.
A-23X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-24X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-25X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.
A-26X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-27X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.
A-28X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.
A-29X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-30X-CC	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.
A-31X-CC	.	.	1	.	.	.	.	.	.	.	.	1	.	R	.	.	.	1	.	.	.	.	.	.	.
A-32X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.
A-33X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-34X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-35X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-36X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-37X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-1R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
B-2R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-3R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-4R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
B-5R-CC	.	.	.	.	.	.	1	.	.	2	.	.	.	2	.	.	.	.	.	1	.	.	.	1	.
B-6R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-7R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-8R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-9R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-10R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-11R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-12R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-13R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-14R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-15R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-16R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-17R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-18R-CC	.	.	1	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
B-19R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-20R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-21R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-24R-CC	1	.	.	.	.	.	2	.	.	2	7	.	.	.	.	.	.	.	.	2	.	.	.	1	.
B-25R-CC	.	.	.	.	.	.	4	1	1	6	.	.	.	.	.	1	.	.	.	.	2	.	.	.	.
B-26R-02, 8-9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 2 (continued).

Core-section interval (cm)	<i>Melomix pompilioides</i>	<i>Nonion pacificum</i>	<i>Nonionella mioecenia</i>	<i>Oridorsalis tener</i>	<i>Parafissurina curta</i>	<i>Pseudonodosaria</i> sp.	<i>Pullenia bulloides</i>	<i>Pullenia quinqueloba</i>	<i>Pullenia salisburyi</i>	<i>Rectobolivina raphana</i>	<i>Rectoglandulina torrida</i>	<i>Rosalina</i> spp.	<i>Stainforthia complanata</i>	<i>Uvigerina</i> cf. <i>U. senitcosa</i>	<i>Uvigerina senitcosa</i>	<i>Globigerina bulloides</i>	<i>Globigerina</i> cf. <i>G. bulloides</i>	<i>Globigerina clarkei</i>	<i>Globigerina obesa</i>	<i>Globigerina quinqueloba</i>	<i>Globigerina rubescens</i>	<i>Globigerina</i> spp.	<i>Globigerina woodi</i>	<i>Globigerinita glutinata</i>	<i>Globoquadrina</i> cf. <i>G. venezuelana</i>
A-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	1	.	.	.	.	.
A-2H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
A-3H-02, 94-96	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	.	5	.	11	.	.	.	.	.
A-3H-CC	.	.	.	.	.	1	.	.	.	.	3	.	.	.	.	6	.	.	.	6	.	1	.	.	.
A-4H-05, 90-92	.	.	.	.	.	.	.	.	.	.	.	5	1	.	.	.	.	9	.	20	.	.	.	.	.
A-4H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	1	.	.	.	.	.	.	.
A-5H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	1	.	.	.	.	.
A-6H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
A-7H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
A-8H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
A-9H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-10H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-11H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-12H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-13H-CC	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-14H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-15X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-16X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-17X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-18X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-19X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-20X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-21X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-22X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-23X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-24X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-25X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-26X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-27X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-28X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-29X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-30X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-31X-CC	.	.	.	.	1	.	.	2	1	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.
A-32X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-33X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-34X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-35X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-36X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-37X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-1R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	1	1	.	1	.	.	.
B-2R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-3R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-4R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-5R-CC	.	1	.	.	1	.	.	.	1	.	.	.	.	3	4	.	.	.	.	.	.	4	.	.	.
B-6R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-7R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-8R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-9R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-10R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-11R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-12R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-13R-CC	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-14R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-15R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-16R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-17R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-18R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-19R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
B-20R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-21R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-24R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
B-25R-CC	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	1	.	.	.	38
B-26R-CC, 8-9	.	.	6	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	10

Table 2 (continued).

Core-section interval (cm)	<i>Globoquadrina venezuelana</i>	<i>Neogloboquadrina acostaensis</i>	<i>Neogloboquadrina cf. N. asanoi</i>	<i>Neogloboquadrina dutertrei</i>	<i>Neogloboquadrina humerosa</i>	<i>Neogloboquadrina pachyderma</i> (dextral)	<i>Neogloboquadrina pachyderma</i> (sinistral)	<i>Tenuitella parkerae</i>
A-1H-CC	.	.	.	.	.	4	27	.
A-2H-CC	.	.	.	.	.	.	3	1
A-3H-02, 94-96	.	.	.	.	.	.	11	.
A-3H-CC	.	.	.	.	.	25	12	.
A-4H-05, 90-92	.	.	.	7	.	28	11	13
A-4H-CC	.	.	.	.	.	.	12	.
A-5H-CC	.	.	.	.	.	6	18	.
A-6H-CC	.	.	.	.	.	.	1	.
A-7H-CC	.	.	.	.	.	.	.	.
A-8H-CC	.	.	.	.	.	2	1	.
A-9H-CC	.	.	.	.	.	.	.	.
A-10H-CC	.	.	.	.	.	.	.	.
A-11H-CC	.	.	.	.	.	.	.	.
A-12H-CC	.	.	.	.	.	.	.	.
A-13H-CC	.	.	.	.	.	.	.	.
A-14H-CC	.	.	.	.	.	.	.	.
A-15X-CC	.	.	.	.	.	.	.	.
A-16X-CC	.	.	.	.	.	.	.	.
A-17X-CC	.	.	.	.	.	.	.	.
A-18X-CC	.	.	.	.	.	.	.	.
A-19X-CC	.	.	.	.	.	.	.	.
A-20X-CC	.	.	.	.	.	.	.	.
A-21X-CC	.	.	.	.	.	.	.	.
A-22X-CC	.	.	.	.	.	.	.	.
A-23X-CC	.	.	.	.	.	.	.	.
A-24X-CC	.	.	.	.	.	.	.	.
A-25X-CC	.	.	.	.	.	.	.	.
A-26X-CC	.	.	.	.	.	.	.	.
A-27X-CC	.	.	.	.	.	.	.	.
A-28X-CC	.	.	.	.	.	.	.	.
A-29X-CC	.	.	.	.	.	.	.	.
A-30X-CC	.	.	.	.	.	.	.	.
A-31X-CC	.	.	.	.	.	.	.	.
A-32X-CC	.	.	.	.	.	.	.	.
A-33X-CC	.	.	.	.	.	.	.	.
A-34X-CC	.	.	.	.	.	.	.	.
A-35X-CC	.	.	.	.	.	.	.	.
A-36X-CC	.	.	.	.	.	.	.	.
A-37X-CC	.	.	.	.	.	.	.	.
B-1R-CC	.	.	22	.	.	.	26	.
B-2R-CC	.	.	.	.	.	.	.	.
B-3R-CC	.	.	.	.	.	.	.	.
B-4R-CC	.	.	.	.	.	.	.	.
B-5R-CC	.	.	.	.	.	.	.	.
B-6R-CC	.	.	.	.	.	.	.	.
B-7R-CC	.	.	.	.	.	.	.	.
B-8R-CC	.	.	.	.	.	.	.	.
B-9R-CC	.	.	.	.	.	.	.	.
B-10R-CC	.	.	.	.	.	.	.	.
B-11R-CC	.	.	.	.	.	.	.	.
B-12R-CC	.	.	.	.	.	.	.	.
B-13R-CC	.	.	.	.	.	.	.	.
B-14R-CC	.	.	.	.	.	.	.	.
B-15R-CC	.	.	.	.	.	.	.	.
B-16R-CC	.	.	.	.	.	.	.	.
B-17R-CC	.	.	.	.	.	.	.	.
B-18R-CC	.	.	.	.	.	.	.	.
B-19R-CC	.	.	.	.	.	.	.	.
B-20R-CC	.	.	.	.	.	.	.	.
B-21R-CC	.	.	.	.	.	.	.	.
B-22R-CC	.	.	.	.	.	.	.	.
B-23R-CC	.	.	.	.	.	.	.	.
B-24R-CC	2	1	.	.	6	.	.	.
B-25R-CC	.	.	.	.	.	.	.	.
B-26R-CC, 8-9	.	.	.	.	.	.	.	.

Basin, the shallowest occurrence of the association lies within the range of calcareous nannofossil, *Discoaster hamatus*, at Site 794 of the lower upper Miocene and within the *Rouxia californica* Diatom Zone of the middle upper Miocene at Site 797.

### RESULTS OF HIGH-RESOLUTION PIOCENE AND QUATERNARY BIOSTRATIGRAPHIC AND PALEOENVIRONMENTAL STUDY

Planktonic foraminifers are limited to a few intervals at Sites 794 and 797 in the Yamato Basin. Of 325 samples examined, only 37 samples have more than 100 specimens, and 18 have fewer than 100 specimens picked from the entire sediment sample (Table 8).

There are 37 samples with planktonic foraminifer numbers greater than 40 tests/g (Fig. 1). Visual inspection of the sand-size fraction (Table 9) reveals that planktonic foraminifers are the most abundant constituents of the sand-size fraction in 29 of the 37 samples, including two samples that have sand-size gypsum and anhydrite crystals, which may have precipitated from the pore water upon drying in the laboratory and one sample dominated by authigenic pyrite with foraminifers as the next most common constituent. There is a clear relationship between above average sand content and large foraminifer number. All samples with greater than 4,000 planktonic foraminifers/g have above average sand content, average being 2% for all 325 samples of the data set. There is some relationship between above average sand content and samples enriched with foraminifers. Sixteen samples are above average in sand content, and 11 are average or below average.

Eight of the 37 samples (Table 9) are dominated by mineral grains, authigenic pyrite with mineral grains, ash or pumice, or sponge spicules. Four of these also have an unusually large ratio of benthic to planktonic foraminifers, a condition that can indicate shallow source.

The coiling ratio of *Neogloboquadrina pachyderma* estimates relative paleotemperature of surface waters. All samples with 30 or more specimens of *Neogloboquadrina pachyderma* were considered (Table 10). At Site 794 (Fig. 2), all 8 samples have 90% or more sinistrally coiled forms. In contrast, Site 797 (Fig. 2) has 34 samples, 26 of which have 90% or more sinistrally coiled forms, 7 have between 80% and 89%, and one sample, which lies within the Olduvai, has 63% sinistrally coiled forms.

Q-mode cluster analysis was used to distinguish planktonic foraminiferal assemblages in all samples in which 100 or more specimens were counted (Table 11). Four clusters were resolved (Fig. 3). Cluster 1 is composed of 11 samples, which are dominated (>81%) by sinistral *Neogloboquadrina pachyderma*. The species has high production rates when the upper water column is cold, isothermal, and nutrient rich (Sautter and Thunell, 1989; Reynolds and Thunell, 1986). It is also associated with dissolution because sinistral *Neogloboquadrina pachyderma* is the most solution resistant of the high-latitude species (Coulbourn et al., 1980; Sautter and Thunell, 1989).

Cluster 2 is composed of 15 samples dominated by sinistral *Neogloboquadrina pachyderma* with significant amounts of other species, which subdivide the cluster into three groupings, a, b, and c. Cluster 2a includes accessory *Globigerina quinqueloba*, a species associated with the spring bloom, Cluster 2b includes accessory *Globigerina bulloides*, a species associated with upwelling and a wide range of thermal conditions, and Cluster 2c includes accessory *Globigerina bulloides* and dextral *Neogloboquadrina pachyderma*, the latter of which is associated with the stratified upper water column of the temperate fall. The assemblage is consistent with one produced in subarctic waters during seasonal alternation of isothermal and stratified conditions. The fauna is, subsequently, only moderately biased by dissolution (Sautter and Thunell, 1989; 1991).

Cluster 3 is composed of four samples and consists of near equal proportions of sinistral *Neogloboquadrina pachyderma* and

Table 3. Range chart of foraminifers from Site 795 arranged alphabetically within the taxonomic groups, agglutinated, miliolid, rotalid, and planktonic.

Core-section interval (cm)	Agglutinated indeterminates																										
	<i>Abeolophragmium</i> sp. A	<i>Anmodiscus incertus</i>	<i>Anmodiscus</i> sp. A	<i>Anmodiscus</i> sp. B	<i>Anmodiscus</i> sp. C	<i>Anmodiscus</i> spp.	<i>Cribrostomoides</i> sp. A	<i>Cyclammina</i> cf. <i>C. tari</i>	<i>Cyclammina pusilla</i>	<i>Cyclammina</i> spp.	<i>Eggerella brauzyi</i>	<i>Eggerella</i> sp. A	<i>Eggerella</i> sp. B	<i>Haplophragmoides compressum</i>	<i>Haplophragmoides</i> sp. A	<i>Haplophragmoides</i> sp. B	<i>Haplophragmoides</i> sp. C	<i>Haplophragmoides</i> sp. E	<i>Haplophragmoides</i> sp. F	<i>Haplophragmoides</i> sp. G	<i>Haplophragmoides</i> spp.	<i>Karrerella</i> sp. A	<i>Martinottiella communis</i>	<i>Martinottiella nodulosa</i>	<i>Miliammina echigoensis</i>		
A-1H-CC																											
A-2H-CC																											
A-3H-CC																											
A-4H-CC																											
A-5H-CC																											
A-6H-CC																											
A-7H-CC																											
A-8H-CC																											
A-9H-CC																											
A-10H-CC																											
A-11H-CC																											
A-12H-CC							2				1	2											6			7	
A-13H-CC											4												1			2	
A-14H-CC																							7			3	
A-15H-CC																										9	
A-16H-CC																										15	
A-17H-CC																											
A-18H-CC																										1	
A-19H-CC		1																									
A-20X-CC																											
A-21X-CC																											
A-22X-CC																							1			4	
A-23X-CC																											
A-24X-CC																											
A-25X-CC												1												11		10	
A-26X-CC												2											6			3	
A-27X-CC											31	5											12				
A-28X-CC											16	4											8			2	
A-29X-CC											14															4	
A-30X-CC											15																
A-31X-CC											4																
A-34X-CC																							14				
A-35X-CC																							15				
A-36X-CC																											
A-37X-CC																											
A-38X-CC																											
A-39X-CC																											
B-1R-CC																											
B-2R-CC																											
B-3R-CC																											
B-4R-CC																											
B-5R-CC																											
B-6R-CC																											
B-7R-CC							4				3			4			8										
B-8R-CC																											
B-9R-CC																										4	
B-10R-CC																										3	
B-11R-CC	1					1		2		4			1	1		9		1		1				13		5	
B-12R-CC	3	1	6	1	1	1		6				1		1		9		1		1		2		1			
B-13R-CC	5	1	2	1	1			1				1	1	1		2	1						2	1			
B-14R-CC	7		1	4	1							5		1	1	9						3		7	1		
B-15R-CC	6		2	2	1			3						1		1	1	1					3	3	3		
B-16R-CC	4		2	1						2		2		1								5	5				
B-17R-CC	3		1					1														3	6				
B-18R-CC	7		1	2				2	2	1		3									5		6				
B-19R-CC	7																						17				
B-20R-CC	2		3																				6				
B-21R-CC	3																						5				
B-22R-CC											1	2										1	5				
B-23R-CC	4		1					1		1		1										1	9				
B-24R-CC	5			1							1												12				
B-25R-CC																						1	5				
B-26R-CC	2																						1				
B-27R-CC	4																						4	1		1	
B-28R-CC	12		2																				8				
B-29R-CC	1											3										12	15				
B-30R-CC	2																						6				
B-31R-CC	8																						5				



Table 3 (continued).

Core-section interval (cm)	<i>Spirosguioinella compressa</i>	<i>Textularia candeiana</i>	<i>Trochammina</i> spp.	<i>Miliolinella</i> sp. A	<i>Nummoloculina</i> sp. A	<i>Nummoloculina</i> sp. B	<i>Pyrgo murrhina</i>	<i>Quinqueloculina akneriana</i>	<i>Quinqueloculina</i> spp.	<i>Triloculina rotunda</i>	<i>Triloculina</i> sp. A	<i>Triloculinella circularis</i>	<i>Bulimina rostrata</i>	<i>Calcareous benthic indeterminates</i>	<i>Chilostomella oolina</i>	<i>Cibicides aknerianus</i>	<i>Cibicides</i> sp. A	<i>Cibicides</i> sp. B	<i>Cibicides</i> sp. C	<i>Cibicides</i> sp. D	<i>Cibicides</i> spp.	<i>Eilohedra rotunda</i>	<i>Elphidium subincertum</i>	<i>Fissurina</i> cf. <i>F. exculpta</i>	<i>Fissurina kerguelensis</i>	<i>Fissurina</i> sp. A	
A-1H-CC																											
A-2H-CC																											
A-3H-CC																											
A-4H-CC							1							2													
A-5H-CC																											
A-6H-CC																											
A-7H-CC																											
A-8H-CC																											
A-9H-CC																											
A-10H-CC																											
A-11H-CC																											
A-12H-CC																											
A-13H-CC																											
A-14H-CC					2						1																
A-15H-CC																											
A-16H-CC					1	1																					
A-17H-CC																											
A-18H-CC																											
A-19H-CC																											
A-20X-CC																											
A-21X-CC																											
A-22X-CC					6			1	1																		
A-23X-CC																											
A-24X-CC																											
A-25X-CC					1																						
A-26X-CC											1			1						2						1	
A-27X-CC										1	1																
A-28X-CC														1													
A-29X-CC																											
A-30X-CC																											
A-31X-CC																											
A-34X-CC																											
A-35X-CC																											
A-36X-CC																											
A-37X-CC																											
A-38X-CC																											
A-39X-CC																											
B-1R-CC																											
B-2R-CC																											
B-3R-CC																											
B-4R-CC																											
B-5R-CC																											
B-6R-CC																											
B-7R-CC																											
B-8R-CC																											
B-9R-CC																											
B-10R-CC																											
B-11R-CC																											
B-12R-CC								6									2										
B-13R-CC									1							1			1								
B-14R-CC																											
B-15R-CC																											
B-16R-CC																											
B-17R-CC																											
B-18R-CC																											
B-19R-CC																											
B-20R-CC																											
B-21R-CC																											
B-22R-CC																											
B-23R-CC																											
B-24R-CC																											
B-25R-CC																	2										
B-26R-CC													1	3													
B-27R-CC	2			1				3						3		1		1			1				1		
B-28R-CC																	3					1					
B-29R-CC																											
B-30R-CC	1																										
B-31R-CC																											

Table 3 (continued).

Core-section interval (cm)	<i>Cibicides wuellerstorfi</i>	<i>Globobulimina auriculata</i>	<i>Globobulimina cf. G. pacifica</i>	<i>Globobulimina cf. G. pupoides</i>	<i>Globocassidulina subglobosa</i>	<i>Gyroidina lamarkiana</i>	<i>Gyroidina orbicularis</i>	<i>Gyroidina soldanii</i>	<i>Gyroidina</i> sp. A	<i>Gyroidina</i> sp. B	<i>Gyroidina tumidulus</i>	<i>Lagena elongata</i>	<i>Lenticulina lucidus</i>	<i>Lenticulina</i> sp. A	<i>Melonis nicobarense</i>	<i>Melonis pompilioides</i>	<i>Nodosarids</i>	<i>Nonionella</i> spp.	<i>Oolina globosa</i>	<i>Oridorsalis tener</i>	<i>Parafissurina cf. P. curta</i>	<i>Pseudoparrella</i> sp. A	<i>Pullenia bulloides</i>	<i>Pullenia quinqueloba</i>	<i>Pullenia salisburyi</i>	<i>Pullenia</i> spp.
A-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-2H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-3H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-4H-CC	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-5H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-6H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-7H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-8H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-9H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-10H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-11H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-12H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
A-13H-CC	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-14H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-15H-CC	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-16H-CC	.	.	.	.	.	10	.	.	.	.	.	.	1	.	6	.	.	.	.	.	.	.	.	.	.	.
A-17H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-18H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-19H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-20X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.
A-21X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-22X-CC	.	3	.	.	.	6	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.
A-23X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-24X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-25X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-26X-CC	.	1	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	2	.	.	.	.	.
A-27X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-28X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-29X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-30X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-31X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-34X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
A-35X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-36X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
A-37X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-38X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-39X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-1R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-2R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-3R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-4R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-5R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-6R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-7R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-8R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-9R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-10R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-11R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-12R-CC	4	7	.	.	.	.	.	8	1	.	.	1	.	8	.	.	.	.	.	.	.	.	.	1	.	.
B-13R-CC	1	1	.	.	.	.	.	6	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.
B-14R-CC	.	.	.	.	1	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
B-15R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-16R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-17R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-18R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-19R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-20R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-21R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
B-22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
B-23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-24R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-25R-CC	2	3	.	.	.	1	.	.	.	.	.	1	.	1	.	.	.	.	.	2	.	.	1	1	.	.
B-26R-CC	.	1	.	.	.	.	.	3	.	.	.	.	.	.	2	.	.	.	.	2	.	.	.	.	.	.
B-27R-CC	12	26	2	.	.	4	8	1	.	.	1	1	1	1	.	.	5	1	6	5	.	.	3	1	.	
B-28R-CC	1	2	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	2	.	2	.	.	.	.	.
B-29R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-30R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-31R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 3 (continued).

Core-section interval (cm)	<i>Rectoglandulina torrida</i>	<i>Sphaeroidina bulloides</i>	<i>Sphaeroidina</i> spp.	<i>Stainforthia complanata</i>	<i>Stainforthia rotundata</i>	<i>Uvigerina hispida</i>	<i>Uvigerina semicososa</i>	<i>Valvulineria</i> spp.	<i>Globigerina bulloides</i>	<i>Globigerina obesa</i>	<i>Globigerina quinqueloba</i>	<i>Globigerina umbilicata</i>	<i>Globigerinita glutinata</i>	<i>Globorotalia inflata</i>	<i>Globorotalia puncticulata</i>	<i>Neoglobobiquadrina asanoi</i>	<i>Neoglobobiquadrina pachyderma</i> (dextral)	<i>Neoglobobiquadrina pachyderma</i> (sinistral)
A-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
A-2H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-3H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-4H-CC	4	.	.	4	.	.	.	.	9	3	.	.	.	.	.	.	15	8
A-5H-CC	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	15	23
A-6H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-7H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-8H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-9H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
A-10H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-11H-CC	.	.	.	6	1	.	.	.	.	.	.	.	.	.	.	.	.	.
A-12H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-13H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-14H-CC	.	.	.	.	.	.	.	.	.	.	1	.	.	2	.	36	.	.
A-15H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-16H-CC	.	.	.	.	.	.	.	.	2	1	.	.	.	.	4	3	4	.
A-17H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-18H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-19H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-20X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-21X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-22X-CC	.	.	.	.	.	.	.	.	2	.	3	.	.	.	.	4	.	.
A-23X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-24X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-25X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-26X-CC	.	.	.	.	.	.	.	.	2	.	.	.	2	.	.	5	.	.
A-27X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-28X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-29X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
A-30X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-31X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-34X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-35X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-36X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-37X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-38X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A-39X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-1R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-2R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-3R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-4R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-5R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-6R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-7R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-8R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-9R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-10R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-11R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-12R-CC	.	.	1	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.
B-13R-CC	.	.	.	.	.	.	.	.	15	.	.	.	.	.	.	.	.	.
B-14R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-15R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-16R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-17R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-18R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-19R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-20R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-21R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-24R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-25R-CC	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
B-26R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-27R-CC	.	2	1	.	.	.	.	1	53	5	1	.	19	.	.	.	.	.
B-28R-CC	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
B-29R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-30R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-31R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 4. Range chart of foraminifers from Site 796 arranged alphabetically within the taxonomic groups, agglutinated, milliolid, rotalid, and planktonic.

Core-section interval (cm)	Agglutinated indeterminates					Martinottiella nodulosa	Martinottiella sp.	Miliammina echigoensis	Quinqueloculina abneriana	Quinqueloculina cf. Q. vulgaris	Calcareous benthic indeterminates				Globobulimina auriculata	Globobulimina elongata	Globocassidulina spp.	Globocassidulina subglobosa	Melonis pompilioides	Oolina globosa	Parafissurina curta	Pullenia bullioides	Uvigerina hispidocostata	Globigerina bullioides	
	Agglutinated indeterminates	Ammodiscus spp.	Eggerella braadyi	Eggerella sp. A	Martinottiella communis						Calcareous benthic indeterminates	Chilostomella oolina	Cibicides sp. A	Fissurina cf. F. orbignyana											Fissurina sp. B
A-1H-CC	6									7													99		
A-2H-CC																									
A-3H-CC																							15		
A-4H-CC																							15		
A-5H-CC																									
A-6H-CC																									
A-8X-CC																									
A-9X-CC																									
A-10X-CC			1										1										4		
A-11X-CC																									
A-12X-CC																									
A-14X-CC																									
A-15X-CC																									
A-16X-CC																									
A-17X-CC																									
A-18X-CC			9																						
A-19X-CC																									
A-20X-CC																									
A-21X-CC			2										8												
A-22X-CC														1											
A-23X-CC																									
A-24X-CC																									
A-25X-CC																									
A-26X-CC																									
A-27X-CC	3	3	1		3	1	2	1					1						3						
Core-section interval (cm)	Agglutinated indeterminates					Ammodiscus spp.	Cyclammina cf. C. tani	Cyclammina spp.	Eggerella sp. A	Haplophragmoides compressum	Haplophragmoides sp. A	Haplophragmoides sp. C.	Haplophragmoides sp. D	Haplophragmoides spp.	Martinottiella communis	Martinottiella nodulosa	Martinottiella sp.	Miliammina echigoensis	Nummuloculina sp. C	Quinqueloculina abneriana	Quinqueloculina seminula	Bolivina seminuda	Calcareous benthic indeterminates	Cassidulinoides sp.	Cassidulinoides tenuis
	Agglutinated indeterminates	Ammodiscus incertus	Ammodiscus sp. A	Ammodiscus sp. B	Ammodiscus sp. D																				
B-1R-CC																									
B-2R-CC																									
B-3R-CC																									
B-4R-CC																									
B-5R-CC																									
B-6R-CC																									
B-7R-CC																									
B-9R-CC																									
B-10R-CC																									
B-11R-CC																									
B-12R-CC																									
B-13R-CC																									
B-14R-CC																									
B-15R-CC																									
B-16R-CC																									
B-17R-CC																									
B-18R-CC																									
B-19R-CC																									
B-20R-CC																									
B-24R-CC																									
B-28R-CC	5	2	4			1		1		4															
B-29R-CC	1							3		1															
B-30R-CC																									
B-31R-CC																									
B-32R-03, 31-33	2																								
B-32R-04, 143-145																									
B-32R-05, 24-26																									
B-33R-02, 34-36	3																								

Table 4 (continued).

Core-section interval (cm)	<i>Globigerina</i> cf. <i>G. bulloides</i>	<i>Globigerina obesa</i>	<i>Globigerina quinqueloba</i>	<i>Globigerina</i> spp.	<i>Globigerina woodi</i>	<i>Neogloboquadrina humerosa</i>	<i>Neogloboquadrina pachyderma</i> (dextral)	<i>Neogloboquadrina pachyderma</i> (sinistral)															
A-1H-CC	.	3	.	.	.	.	2	12															
A-2H-CC	.	.	.	.	.	.	.	.															
A-3H-CC	19	.	1	.	.	.	.	7															
A-4H-CC	.	.	.	.	.	.	11	35															
A-5H-CC	.	.	.	.	.	.	.	.															
A-6H-CC	.	.	.	.	.	.	.	.															
A-8X-CC	.	.	3	.	.	2	35	.															
A-9X-CC	.	.	.	.	.	.	.	.															
A-10X-CC	.	.	.	.	.	.	.	.															
A-11X-CC	.	.	.	.	.	.	.	.															
A-12X-CC	.	.	.	.	.	.	.	.															
A-14X-CC	.	.	.	.	.	.	.	.															
A-15X-CC	.	.	.	.	.	.	.	.															
A-16X-CC	.	.	.	.	.	.	.	.															
A-17X-CC	.	.	.	.	.	.	.	.															
A-18X-CC	.	.	.	.	.	.	.	.															
A-19X-CC	.	.	.	.	.	.	.	.															
A-20X-CC	.	.	.	.	.	.	.	.															
A-21X-CC	.	.	.	1	.	.	.	.															
A-22X-CC	.	.	.	.	.	.	.	.															
A-23X-CC	.	.	.	.	.	.	.	.															
A-24X-CC	.	.	.	.	.	.	.	.															
A-25X-CC	.	.	.	.	.	.	.	.															
A-26X-CC	.	.	.	.	.	.	.	.															
A-27X-CC	.	.	.	1	1	.	.	.															
Core-section interval (cm)	<i>Chilostomella oolina</i>	<i>Cibicides aknerianus</i>	<i>Elphidium</i> cf. <i>E. hughesi foraminosum</i>	<i>Globobulimina auriculata</i>	<i>Globobulimina elongata</i>	<i>Globobulimina</i> spp.	<i>Globocassidulina subglobosa</i>	<i>Gyroldina lamarkiana</i>	<i>Gyroldina orbicularis</i>	<i>Gyroldina</i> sp. A	<i>Islandiella norcrossi</i>	<i>Melonis nicobarense</i>	<i>Melonis pompilioides</i>	<i>Nonion</i> spp.	<i>Nonionella miocenica</i>	<i>Parafissurina curta</i>	<i>Pullenia salisburyi</i>	<i>Robertina</i> sp. A	<i>Sphaeroidina</i> spp.	<i>Stainforthia complanata</i>	<i>Uvigerina yabai</i>	<i>Valvulinaria</i> spp.	<i>Globigerina bulloides</i>
B-1R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
B-2R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
B-3R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
B-4R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-5R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-6R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-7R-CC	.	1	3	1	.	.	.	.	.	.	.	1	1	.	.	.	.	.	1	.	.	.	.
B-9R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.
B-10R-CC	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
B-11R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-12R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-13R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-14R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-15R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-16R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-17R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-18R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-19R-CC	.	.	.	.	.	.	8	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.
B-20R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-24R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-28R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-29R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-30R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-31R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-32R-03, 31-33	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	.
B-32R-04, 143-145	8	.	.	2	.	.	.	.	.	34	.	.	.	.	.	.	.	2	.	1	.	1	.
B-32R-05, 24-26	5	.	.	.	1	.	.	.	.	24	.	.	.	.	.	.	.	1	.	.	.	5	.
B-33R-02, 34-36	16	.	.	.	.	11	.	51	.	.	.	.	.	.	3	.	1	.	.	.	.	2	.

Table 4 (continued).

Core-section interval (cm)							
A-1H-CC							
A-2H-CC							
A-3H-CC							
A-4H-CC							
A-5H-CC							
A-6H-CC							
A-8X-CC							
A-9X-CC							
A-10X-CC							
A-11X-CC							
A-12X-CC							
A-14X-CC							
A-15X-CC							
A-16X-CC							
A-17X-CC							
A-18X-CC							
A-19X-CC							
A-20X-CC							
A-21X-CC							
A-22X-CC							
A-23X-CC							
A-24X-CC							
A-25X-CC							
A-26X-CC							
A-27X-CC							
Core-section interval (cm)	<i>Globigerina</i> cf. <i>G. bulloides</i>	<i>Globigerina quinqueloba</i>	<i>Globigerina</i> spp.	<i>Globigerina umbilicata</i>	<i>Globigerina woodi</i>	<i>Neogloboquadrina pachyderma</i> (dextral)	<i>Neogloboquadrina pachyderma</i> (sinistral)
B-1R-CC	.	.	.	.	.	.	.
B-2R-CC	.	.	.	.	.	.	1
B-3R-CC	1	1	1	4	.	12	6
B-4R-CC	1	.	.	.	.	7	15
B-5R-CC	.	.	.	.	1	.	.
B-6R-CC	.	.	.	.	.	.	.
B-7R-CC	.	.	.	.	1	.	.
B-9R-CC	.	.	.	.	1	.	.
B-10R-CC	.	.	.	.	.	.	.
B-11R-CC	.	.	.	.	.	.	.
B-12R-CC	.	.	.	.	.	.	.
B-13R-CC	.	.	.	.	.	.	.
B-14R-CC	.	.	.	.	.	.	.
B-15R-CC	.	.	.	.	.	.	.
B-16R-CC	.	.	.	.	.	.	.
B-17R-CC	.	.	.	.	.	.	.
B-18R-CC	.	.	.	.	.	.	.
B-19R-CC	.	.	.	.	1	.	.
B-20R-CC	.	.	.	.	.	.	.
B-24R-CC	.	.	.	.	.	.	.
B-28R-CC	.	.	.	.	.	.	.
B-29R-CC	.	.	.	.	.	.	.
B-30R-CC	.	.	.	.	.	.	.
B-31R-CC	.	.	.	.	.	.	.
B-32R-03, 31-33	.	.	.	.	1	.	.
B-32R-04, 143-145	.	.	5	.	2	.	.
B-32R-05, 24-26	.	.	.	.	1	.	.
B-33R-02, 34-36	.	.	6	.	.	.	.

*Globigerina bulloides*. This association is found in present-day surficial sediments in the subarctic North Pacific Ocean at water depths from 3,300 to 4,300 m (Coulbourn et al., 1980). The assemblage is produced under the same production conditions as that of Cluster 2, but it is subsequently more strongly dissolved (Sautter and Thunell, 1989).

Three samples cluster above the cutoff value and are not sufficiently similar to be regarded a cluster. They are most similar to cluster 3. One sample bears a high relative frequency of a species rare in all other samples, *Tenuitella parkerae*. One sample contains near equal proportions of sinistral *Neogloboquadrina pachyderma*, *Globigerina bulloides*, and *Globigerina quinqueloba* with accessory dextral *Neogloboquadrina pachyderma*. The last sample is dominated by sinistral *Neogloboquadrina pachyderma* with significant but small proportions of *Globigerina bulloides*, *Tenuitella parkerae*, and *Turborotalita humilis*.

Cluster 4 is composed of three samples and is dominated by *Globigerina bulloides*. These samples are the most different from all other samples of the data subset. *Globigerina bulloides* production is accelerated during upwelling events (Thunell, pers. comm., 1990) but thrives in a wide range of environments and is not limited to upwelling habitats especially in temperate and subpolar waters (Sautter and Thunell, 1991).

The Quaternary lithologic sequences at all four sites bear distinctive alternations in color between dark chocolate brown, medium brown, and light putty gray. It is interesting to note that each planktonic cluster has some samples from each color interval (Table 11).

## DISCUSSION

### Foraminifer Biostratigraphy

The benthic foraminifer sequences described above can be assigned to the biostratigraphy of Matsunaga (1963) (Table 12), which was further described by Matoba (1984) and Matoba et al. (1990) for the oil fields of Northern Japan. The low abundance of foraminifers at Sites 794 through 797 does not justify comparison to the zonules defined by Matsunaga (1963).

#### *Globorotalia* cf. *G. fohsi* Zone

The middle or lower(?) Miocene foraminifer-bearing sequences at Sites 794 and 797 are tentatively assigned to the *Globorotalia* cf. *G. fohsi* Zone. The absence of the subtropical marker species, *Globorotalia* cf. *G. fohsi*, precludes certain assignment, but the occurrence of *Globorotalia praescitula* supports the conclusion. The dominance of a subtropical planktonic foraminifer assemblage suggests that the Japan Sea was open to southern waters during deposition of the sequences, a situation expected within the zone. The benthic species listed are similar to the bathyal fauna of the Nishikurosawa stage described by Matoba (1984). Some planktonic species listed (Tables 4 and 5) are reported from the Nishikurosawa by Saito and Maiya (1973), although some taxonomic questions need resolution.

#### *Spirosigmoinella compressa* Zone

The barren interval above the *Globorotalia* cf. *G. fohsi* Zone at Sites 794 and 797, the middle Miocene sequence at Site 795, and the upper Miocene sequences at all four sites including the barren interval within the *Neodenticula kamtschatica* Diatom Zone fit the definition of the zone. At all four sites, the lower Pliocene, foraminifer-bearing intervals below the first occurrence of *Miliammina echigoensis* are also assigned to this zone. Evidence from the planktonic foraminifer fauna support the assignment. The cold-water fauna confirms that surficial waters had become isolated from subtropical waters that flowed on the Pacific margin of the Japanese islands during deposition of these sequences.

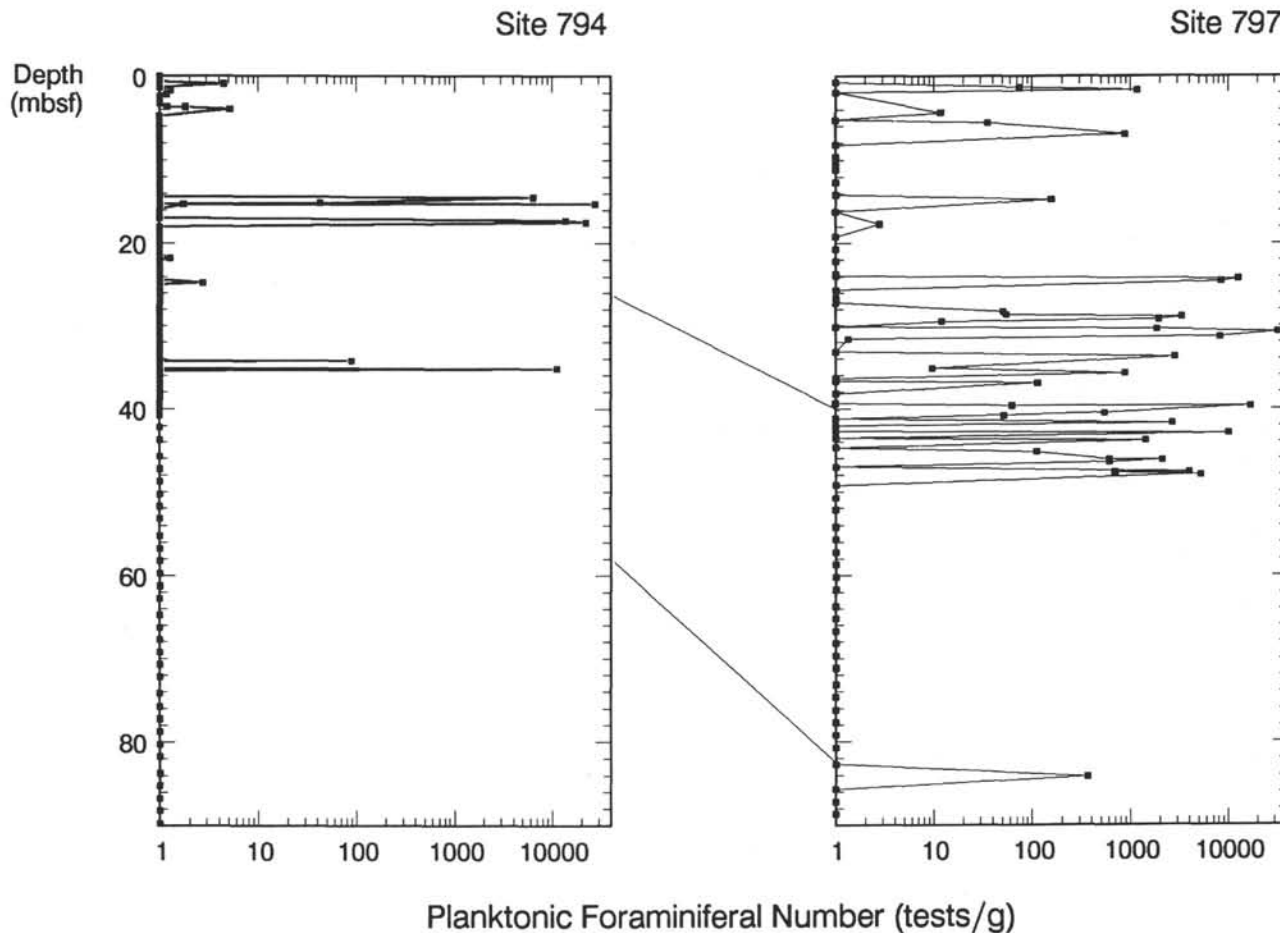


Figure 1. Planktonic foraminifer number (number of tests/g of sediment) plotted with depth in core in Hole 794A and Hole 797B. All samples plotted on the y axis are barren of planktonic foraminifers. The two lines connecting the graphs denote the Brunhes/Matuyama Boundary and the top of the

#### *Miliammina echigoensis* Zone

The Pliocene sequence that includes the range of *Miliammina echigoensis* is assigned to the *Miliammina echigoensis* Zone. The interval extends from the *Thalassiosira oestrupii* Zone at its base to the uppermost *Neodenticula koizumii* Diatom Zone.

The Quaternary interval is not similar to the zonation described by Matsunaga. The species list, however, is similar to those reported by Ingle (1975), Matoba (1984), Ujiie et al. (1983), and Kato (1989).

#### Event: Deepening of the Nascent Backarc Basin

The Yamato Basin has lain at lower middle bathyal depths since the middle or early(?) Miocene, and the Japan Basin has been at a similar depth at least since the middle Miocene (Table 6). Others (Guber and Merrill, 1983; Matoba, 1984) have similarly concluded that some sections in the Hokuroku District and other regions surrounding Akita were bathyal and lower bathyal in depth as early as the early to middle Miocene. Neritic, upper bathyal, and middle bathyal elements are mixed with lower bathyal species in all of the Miocene sequences. Further, there is no clear change in paleodepth in either the Yamato or Japan basins from the middle or lower(?) Miocene sequences through the Pliocene section. Apparently, subsidence of the basin occurred very rapidly after emplacement of the igneous "basement" or during emplacement of the igneous "basement." No foraminifers at Sites 794, 795, or 797 are preserved that record the subsidence in sediments above the igneous basement or in sediment intercalated amid the igneous basement units.

#### Event: Early Middle Miocene Cooling

The accuracy of the date of change from subtropical to cold surficial water in the Japan Sea is not increased by this data set and is essentially no different from that cited by Matoba et al. (1990). It occurs above the base of the *Sphenolithus heteromorphus* Zone and within or below the base of the *Denticulopsis praedimorpha* Diatom Zone of the middle middle Miocene based on paleoenvironmental interpretation of the planktonic foraminifers at Sites 794, 795, and 797 (Tables 2, 3, and 5). Samples in the *Sphenolithus heteromorphus* Zone at Site 794 and 797 contain subtropical species. Two samples, 127-795B-27R-CC, and 127-795B-13R-CC, contain no subtropical species and are dominated by *Globigerina bulloides* and *Globigerina* cf. *G. bulloides*, which are characteristic of transitional faunas. An assemblage that includes high-latitude *Neogloboquadrina pachyderma* appears at Site 794 within or below the *Denticulopsis katayamae* Diatom Zone of the late Miocene. Like land-based sections, the ODP sequences are plagued with barren intervals and unconformities.

#### Event: Oxygenation of Stagnant Miocene Deep Water

Matoba (1984) and others relate the range of agglutinated assemblages in the Miocene to low-oxygen conditions. The ranges of *Cyclammina-Ammodiscus-Haplophragmoides* assemblages in the Miocene correspond with the occurrence of distinctive intervals dominated by horizontal burrows (Table 7) described by the shipboard sedimentologists (Tamaki, Pisciotto, Allan, et al., 1990). The uppermost occurrence of the association lies in the upper upper Miocene

Table 5. Range chart of foraminifers from Site 797 arranged alphabetically within the taxonomic groups, agglutinated, miliolid, rotalid, and planktonic.

Core-section interval (cm)	<i>Agglutinated indeterminates</i>	<i>Ammodiscus incertus</i>	<i>Ammodiscus</i> sp. A	<i>Ammodiscus</i> sp. B	<i>Ammodiscus</i> sp. C	<i>Ammodiscus</i> spp.	<i>Cribrostomoides</i> sp. A	<i>Cyclammina cancellata</i>	<i>Cyclammina japonica</i>	<i>Cyclammina pusilla</i>	<i>Cyclammina</i> spp.	<i>Eggerella bradyi</i>	<i>Eggerella</i> sp. A	<i>Haplophragmoides</i> cf. <i>H. compressum</i>	<i>Haplophragmoides compressum</i>	<i>Haplophragmoides</i> sp. A	<i>Haplophragmoides</i> sp. B	<i>Haplophragmoides</i> sp. C	<i>Haplophragmoides</i> sp. D	<i>Haplophragmoides</i> sp. E	<i>Haplophragmoides</i> sp. H	<i>Haplophragmoides</i> spp.	<i>Martinottiella communis</i>	<i>Martinottiella nodulosa</i>	<i>Miliammina echigoensis</i>
A-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-2H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-3H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-4H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-5H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-6H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-7H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-8H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-9H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-10H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-11H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-12H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-13H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-14H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-15H-CC	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	13	.	5
B-16H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.
B-17H-CC	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
B-18H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-19H-CC	2	.	.	.	.	.	.	.	.	.	.	7	.	2	.	.	.	.	.	.	.	.	5	.	13
B-20X-CC	1	.	.	.	.	.	.	.	.	.	.	3	.	2	.	.	.	.	.	.	.	.	1	.	6
B-21X-CC	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	12	.	2
B-22X-CC	.	.	.	.	.	.	.	.	.	.	.	1	.	2	.	.	.	.	.	.	.	.	12	.	.
B-23X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-24X-CC	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
B-25X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-26X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	.
B-27X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-28X-CC	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	.	.
B-29X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-30X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-31X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-32X-CC	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-33X-CC	2	.	.	.	.	.	.	.	.	.	1	.	.	2	.	.	.	3	1	6	.	.	7	.	.
B-34X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-35X-CC	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	2	.	.	.	3	.	.
B-36X-CC	3	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	1	.	.	.	.	4	.	.
B-37X-CC	4	.	.	.	.	.	1	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	14	.	.
B-38X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-39X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-40X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-41X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-42X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-43X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-44X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-45X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-46X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-47X-CC	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-48X-CC	2	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	2	.	.	.	9	.	.
B-49X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-50X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-51X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	3	1	.
B-52X-CC	2	1	2	.	.	.	.	.	.	7	.	2	.	6	3	3	3	1	.	.	.	.	4	.	.
C-1R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-2R-CC	2	.	.	.	.	.	.	.	.	.	.	1	.	5	2	1	.	.	.	.	.	1	.	.	.
C-3R-CC	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
C-6R-CC	3	1	4	1	.	.	.	1	.	3	.	.	.	.	3	16	3	.	.	.	5	.	8	1	.
C-7R-CC	6	1	3	.	1	.	.	1	6	6	3	.	.	.	11	6	.	.	.	4	.	1	.	.	.
C-8R-02, 36-38	.	2	3	2	.	.	.	1	.	5	1	2	.	5	8	2	.	.	.	.	8	6	1	.	.
C-18R-01, 88-90	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-20R-02, 42-44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-25R-06, 33-35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-27R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-33R-03, 42-44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-34R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.



Table 5 (continued).

Core-section interval (cm)	<i>Miliammina</i> spp.	<i>Spirosigmoilinella</i> cf. <i>S. compressa</i>	<i>Spirosigmoilinella compressa</i>	<i>Textularia</i> sp.	<i>Trochammina</i> cf. <i>T. inflata</i>	<i>Trochammina</i> spp.	<i>Pyrgo</i> cf. <i>P. formasinii</i>	<i>Pyrgo murrhina</i>	<i>Pyrgo</i> sp.	<i>Quinqueloculina daititensis</i>	<i>Quinqueloculina</i> spp.	<i>Quinqueloculina vulgaris</i>	<i>Triloculina laevigata</i>	<i>Triloculina</i> sp. A	<i>Triloculina tricarinata</i>	<i>Bolivina pacifica</i>	<i>Bolivina seminuda</i>	<i>Brizalina</i> cf. <i>B. pacifica</i>	<i>Brizalina pacifica</i>	<i>Bulimina</i> cf. <i>B. inamurai</i>	<i>Calcareous benthic indeterminates</i>	<i>Caribbeanella</i> cf. <i>C. ogitensis</i>	<i>Caribbeanella</i> cf. <i>C. polystoma</i>	<i>Cassidulina japonica</i>	<i>Cassidulinoides sasakaensis</i>	<i>Cassidulinoides</i> sp.
A-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-2H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-3H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-4H-CC	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-5H-CC	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	11	.	.	.	.	.	.	.
B-6H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-7H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-8H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-9H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-10H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-11H-CC	.	.	.	.	.	1	.	.	.	.	1	.	.	1	.	1	.	.	.	.	.	.	1	.	.	.
B-12H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-13H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-14H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-15H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-16H-CC	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-17H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-18H-CC	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-19H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-20X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-21X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-22X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-23X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-24X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-25X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-26X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-27X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-28X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-29X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-30X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-31X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	1	.	1	1	1
B-32X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-33X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	1	1
B-34X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-35X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-36X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-37X-CC	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
B-38X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-39X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-40X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-41X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-42X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-43X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-44X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-45X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-46X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-47X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-48X-CC	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
B-49X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-50X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-51X-CC	.	1	.	.	.	.	5	9	1	.	.	6	.	.	.	.	.	.	.	.	.	3	1	.	.	.
B-52X-CC	.	1	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-1R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-2R-CC	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
C-3R-CC	1	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
C-6R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-7R-CC	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-8R-02, 36-38	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-18R-01, 88-90	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-20R-02, 42-44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-25R-06, 33-35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-27R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-33R-03, 42-44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-34R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 5 (continued).

Core-section interval (cm)	<i>Chilostomella</i> cf. <i>C. czizeki</i>	<i>Chilostomella oolina</i>	<i>Cibicides aknerianus</i>	<i>Cibicides asanoi</i>	<i>Cibicides</i> cf. <i>C. lobatulus</i>	<i>Cibicides lobatulus</i>	<i>Cibicides</i> sp. A	<i>Cibicides</i> spp.	<i>Eilohedra rotunda</i>	<i>Elphidium advenum</i>	<i>Elphidium hanzawai</i>	<i>Elphidium</i> sp.	<i>Elphidium subincertum</i>	<i>Epistominella pacifica</i>	<i>Fissurina</i> cf. <i>F. circulo-costa</i>	<i>Fissurina</i> cf. <i>F. exculpta</i>	<i>Fissurina</i> cf. <i>F. orbignyana</i>	<i>Fissurina</i> cf. <i>F. semimarginata</i>	<i>Fissurina</i> sp. A	<i>Cibicides</i> cf. <i>C. wuellerstorfi</i>	<i>Cibicides wuellerstorfi</i>	<i>Fursenkoina seminuda</i>	<i>Glabratellina</i> sp. A	<i>Globobulimina auriculata</i>	<i>Globobulimina</i> cf. <i>G. pacifica</i>	<i>Globobulimina</i> cf. <i>G. pupoides</i>
A-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-2H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-3H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-4H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-5H-CC	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-6H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-7H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-8H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-9H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-10H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-11H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-12H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-13H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-14H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-15H-CC	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-16H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-17H-CC	.	1	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
B-18H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-19H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-20X-CC	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-21X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-22X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-23X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-24X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-25X-CC	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-26X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-27X-CC	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-28X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-29X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-30X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-31X-CC	.	.	.	.	.	10	.	.	.	.	1	6	.	.	.	2	1	.	1	.	.	1	13	.	.	.
B-32X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-33X-CC	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-34X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-35X-CC	.	1	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	3
B-36X-CC	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	6
B-37X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-38X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-39X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-40X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-41X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-42X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-43X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-44X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-45X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-46X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-47X-CC	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-48X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-49X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-50X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-51X-CC	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	1
B-52X-CC	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
C-1R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-2R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
C-3R-CC	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-6R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-7R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-8R-02, 36-38	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-18R-01, 88-90	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-20R-02, 42-44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-25R-06, 33-35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-27R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-33R-03, 42-44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-34R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 5 (continued).

Core-section interval (cm)	<i>Globbulimina elongata</i>	<i>Globbulimina</i> spp.	<i>Globocassidulina</i> cf. <i>G. subglobosa</i>	<i>Globocassidulina norvangi</i>	<i>Globocassidulina setanaensis</i>	<i>Globocassidulina subglobosa</i>	<i>Gyroidina</i> cf. <i>G. lamarkiana</i>	<i>Gyroidina lamarkiana</i>	<i>Gyroidina nitidulus</i>	<i>Gyroidina orbicularis</i>	<i>Gyroidina soldanii</i>	<i>Gyroidina</i> sp. A	<i>Gyroidina tumidulus</i>	<i>Islandiella norrossi</i>	<i>Lagena asanoi</i>	<i>Lenticulina lucidus</i>	<i>Melonis nicobarense</i>	<i>Melonis pompilioides</i>	<i>Nonion</i> spp.	<i>Nonionella mitocentica</i>	<i>Nonionella</i> spp.	<i>Oridorsalis tener</i>	<i>Parafissurina</i> cf. <i>P. curta</i>	<i>Pseudoglandulina laevigata</i>	<i>Pullenia bullioides</i>	<i>Pullenia quinqueloba</i>
A-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-1H-CC	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-2H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-3H-CC	.	.	.	.	3	2	.	.	.	.	.	.	.	17	.	.	.	.	.	.	.	.	.	.	.	.
B-4H-CC	.	.	.	.	.	6	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
B-5H-CC	.	.	.	.	.	3	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	.
B-6H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-7H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-8H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-9H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-10H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.
B-11H-CC	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	.	.	.	.	
B-12H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-13H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
B-14H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-15H-CC	.	.	.	.	.	.	17	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
B-16H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-17H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-18H-CC	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	6	.	.	1	.	.	.	.	.
B-19H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-20X-CC	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.
B-21X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
B-22X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-23X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-24X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-25X-CC	.	.	.	.	.	2	.	2	.	.	.	1	.	.	.	.	.	4	.	.	.	.	.	.	.	.
B-26X-CC	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-27X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-28X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-29X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-30X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-31X-CC	2	.	1	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.	.	1	.	.	.	.	.
B-32X-CC	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-33X-CC	5	.	.	.	5	.	.	.	6	.	2	.	.	.	.	.	.	1	.	.	.	.	.	2	.	.
B-34X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-35X-CC	1	2	.	.	.	2	18	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
B-36X-CC	3	.	.	.	.	.	.	.	.	.	3	.	.	.	.	1	.	.	.	1	.	.	.	1	.	.
B-37X-CC	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	2	.	.	.	.	.	.	.	1	.	.
B-38X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-39X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-40X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-41X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-42X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-43X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-44X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-45X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-46X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-47X-CC	.	.	.	.	.	.	.	.	1	.	4	.	.	.	.	.	1	.	.	.	1	.	.	3	.	.
B-48X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-49X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-50X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
B-51X-CC	1	.	.	.	.	.	.	.	6	1	1	.	.	.	.	1	2	.	.	5	.	12	1	11	2	.
B-52X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-1R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-2R-CC	.	.	.	.	.	.	.	.	1	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.
C-3R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-6R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-7R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-8R-02, 36-38	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-18R-01, 88-90	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-20R-02, 42-44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-25R-06, 33-35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-27R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-33R-03, 42-44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C-34R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 5 (continued).

Core-section interval (cm)	<i>Pullenia salisburyi</i>	<i>Sigmavirgulina</i> sp. A	<i>Sphaeroidina bulloides</i>	<i>Stainforthia</i> cf. <i>S. bradyi</i>	<i>Stainforthia complanata</i>	<i>Stainforthia</i> sp.	<i>Stilostomella</i> spp.	<i>Trifarina</i> cf. <i>T. kokozuraensis</i>	<i>Trifarina hughesi</i>	<i>Trifarina kokozuraensis</i>	<i>Trochulina</i> spp.	<i>Truncoheronallenia</i> sp. A	<i>Uvigerina akitaensis</i>	<i>Uvigerina excellens</i>	<i>Uvigerina proboscidea</i>	<i>Valvulinaria sadonica</i>	<i>Catapsydrax parvulus</i>	<i>Globigerina bulloides</i>	<i>Globigerina</i> cf. <i>G. bulloides</i>	<i>Globigerina clarkei</i>	<i>Globigerina falconensis</i>	<i>Globigerina obesa</i>	<i>Globigerina quinqueloba</i>	<i>Globigerina</i> spp.	<i>Globigerina umbilicata</i>	<i>Globigerina woodi</i>	
A-1H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.		
B-1H-CC	.	.	.	.	17	.	.	.	.	.	.	.	.	.	.	.	.	13	.	.	.	.	3	.	1	.	
B-2H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	
B-3H-CC	1	.	.	.	1	.	.	4	1	2	.	.	1	1	.	.	.	7	.	1	.	.	3	.	2	.	
B-4H-CC	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	5	.	.	.	.	1	1	5	.	
B-5H-CC	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	5	.	
B-6H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-7H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-8H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-9H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	
B-10H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16	.	.	.	1	.	5	.	1	.
B-11H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	.	.	.	.	.	.	.	
B-12H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-13H-CC	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-14H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-15H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-16H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-17H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-18H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-19H-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-20X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-21X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-22X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-23X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-24X-CC	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-25X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	
B-26X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-27X-CC	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-28X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-29X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-30X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-31X-CC	1	11	.	.	.	.	.	.	.	.	1	.	.	2	.	1	.	29	.	.	1	.	2	.	.	.	
B-32X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-33X-CC	4	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2	.	3	.	.	.	
B-34X-CC	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-35X-CC	7	.	.	.	.	.	.	.	.	.	.	.	.	.	4	3	.	.	12	.	.	4	.	8	.	.	
B-36X-CC	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	
B-37X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-38X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-39X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-40X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-41X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-42X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-43X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-44X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-45X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-46X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-47X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-48X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-49X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	.	
B-50X-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
B-51X-CC	3	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	4	.	.	
B-52X-CC	.	.	.	3	.	1	.	.	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	.	.	.	
C-1R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-2R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	
C-3R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	3	
C-6R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-7R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-8R-02, 36-38	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-18R-01, 88-90	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-20R-02, 42-44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-22R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-23R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-25R-06, 33-35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-27R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-33R-03, 42-44	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
C-34R-CC	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

Table 5 (continued).

Core-section interval (cm)	<i>Globigerinita glutinata</i>	<i>Globigerinita uvula</i>	<i>Globoquadrina</i> cf. <i>G. venezuelana</i>	<i>Globoquadrina venezuelana</i>	<i>Globorotalia praescitula</i>	<i>Neogloboquadrina asanoi</i>	<i>Neogloboquadrina himiensis</i>	<i>Neogloboquadrina humerosa</i>	<i>Neogloboquadrina pachyderma</i> (dextral)	<i>Neogloboquadrina pachyderma</i> (sinistral)	<i>Neogloboquadrina</i> spp.	<i>Tenuitella parkerae</i>
A-1H-CC	.	.	.	.	.	.	.	2	9	.	.	
B-1H-CC	.	.	.	.	.	.	.	.	8	1	.	
B-2H-CC	.	.	.	.	.	.	.	.	10	2	.	
B-3H-CC	1	.	.	.	.	.	.	1	7	.	.	
B-4H-CC	.	.	.	.	.	.	.	.	7	.	.	
B-5H-CC	.	1	.	.	.	.	.	5	2	.	2	
B-6H-CC	.	.	.	.	.	.	.	3	19	.	.	
B-7H-CC	.	.	.	.	.	.	.	.	2	.	.	
B-8H-CC	.	.	.	.	.	.	.	6	10	.	.	
B-9H-CC	.	.	.	.	.	.	.	1	2	.	.	
B-10H-CC	.	.	.	.	.	13	.	.	3	.	.	
B-11H-CC	.	.	.	.	.	8	.	7	2	.	.	
B-12H-CC	.	.	.	.	.	.	.	.	.	.	.	
B-13H-CC	.	.	.	.	.	.	.	.	.	.	.	
B-14H-CC	.	.	.	.	.	.	.	.	.	.	.	
B-15H-CC	.	.	.	.	.	2	1	1	.	.	.	
B-16H-CC	.	.	.	.	.	.	.	.	.	.	.	
B-17H-CC	.	.	.	.	.	.	.	.	1	.	.	
B-18H-CC	.	.	.	.	.	.	.	1	1	.	.	
B-19H-CC	.	.	.	.	.	.	.	.	.	.	.	
B-20X-CC	.	.	.	.	.	1	1	.	1	.	.	
B-21X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-22X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-23X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-24X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-25X-CC	.	.	.	.	.	.	.	.	3	.	.	
B-26X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-27X-CC	.	.	.	.	.	.	.	.	1	.	.	
B-28X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-29X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-30X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-31X-CC	.	2	.	.	.	.	.	.	.	.	.	
B-32X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-33X-CC	.	.	.	.	.	.	.	1	.	.	.	
B-34X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-35X-CC	.	.	.	.	.	.	6	5	.	9	.	
B-36X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-37X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-38X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-39X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-40X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-41X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-42X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-43X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-44X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-45X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-46X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-47X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-48X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-49X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-50X-CC	.	.	.	.	.	.	.	.	.	.	.	
B-51X-CC	.	.	16	23	.	.	.	.	.	.	.	
B-52X-CC	.	.	.	6	1	.	.	.	.	.	.	
C-1R-CC	.	.	.	.	.	.	.	.	.	.	.	
C-2R-CC	.	.	.	.	.	.	.	.	.	.	.	
C-3R-CC	.	.	.	.	1	.	.	.	.	.	.	
C-6R-CC	.	.	.	.	.	.	.	.	.	.	.	
C-7R-CC	.	.	.	.	.	.	.	.	.	.	.	
C-8R-02, 36-38	.	.	.	.	.	.	.	.	.	.	.	
C-18R-01, 88-90	.	.	.	.	.	.	.	.	.	.	.	
C-20R-02, 42-44	.	.	.	.	.	.	.	.	.	.	.	
C-22R-CC	.	.	.	.	.	.	.	.	.	.	.	
C-23R-CC	.	.	.	.	.	.	.	.	.	.	.	
C-25R-06, 33-35	.	.	.	.	.	.	.	.	.	.	.	
C-27R-CC	.	.	.	.	.	.	.	.	.	.	.	
C-33R-03, 42-44	.	.	.	.	.	.	.	.	.	.	.	
C-34R-CC	.	.	.	.	.	.	.	.	.	.	.	

**Table 6. Summary of benthic foraminifer upper depth limits and species distribution in the Yamato and Japan Basins.**

Upper Depth Limit	Species	Yamato Basin					Japan Basin				
		Quaternary	Pliocene	upper upper Miocene	lower upper Miocene	mid-lower Miocene	Quaternary	Pliocene	lower upper Miocene	mid Miocene	
N	<i>Cibicides lobatulus</i>			X							
N	<i>Elphidium subincertum</i>			X						X	
N	<i>Nonionella miocenica</i>					X			X	X	
UB	<i>Epistominella pacifica</i>	X					X				
<UMB	<i>Chilostomella oolina</i>					X			X		
<UMB	<i>Stainforthia complanata</i>	X					X				
>UMB	<i>Gyroidina orbicularis</i>					X				X	
UMB	<i>Bulimina striata</i>	X					X				
>UMB	<i>Cibicides wuellerstorfi</i>					X			X	X	
>UMB	<i>Oridorsalis tener</i>					X					
<MB	<i>Pullenia salisburyi</i>				X						
MB	<i>Islandiella norcrossi</i>	X					X				
LMB	<i>Eggerella bradyi</i>		X					X			
LMB	<i>Globobulimina auriculata</i>		X	X	X	X		X	X	X	
>LMB	<i>Martinottiella communis</i>		X					X			
>LMB	<i>Pullenia bulloides</i>					X				X	
>LMB	<i>Melonis pompilioides</i>		X					X	X	X	
>LMB	<i>Gyroidina soldanii</i>								X		
N	neritic depth (<200 m)										
UB	upper bathyal depth (150–500 m)										
<UMB	upper middle bathyal to shallower depths (<1,500 m)										
UMB	upper middle bathyal depth (500–1,500 m)										
>UMB	upper middle bathyal to greater depths (>500 m)										
<MB	middle bathyal to shallower depths (<2,500 m)										
MB	middle bathyal depth (500–2,500 m)										
LMB	lower middle bathyal depth (1,500–2,500 m)										
>LMB	lower middle bathyal to greater depths (>1,500 m)										

in the Japan Basin and the lower, upper, and middle upper Miocene in the Yamato Basin. Based on this evidence, low-oxygen bottom waters persisted through much of the Miocene but oxygenated bottom waters were well established by the uppermost Miocene, and similar conditions persisted throughout the Pliocene sequence. It is interesting to consider whether or not high-latitude Late Miocene cooling might have driven renewal of Japan Sea deep water.

#### Event: Appearance of Anomalously Shallow Quaternary Fauna

The Quaternary fauna appears shallower than that of the older sequences (Table 6) because it bears middle to upper bathyal species, but the present lower bathyal depth of the basin argues against such a shallowing. The anomalous fauna is either entirely displaced from shallow depth, or unusual conditions in the silled Japan Sea have excluded a lower bathyal fauna. The change to this unusual Quaternary fauna that was originally pointed out by Matoba (1984, and references therein) occurs near the Pliocene/Pleistocene Boundary rather than in the upper Pleistocene. The event may be related to shallowing of sills, which exclude from the marginal sea the deep fauna on the Pacific side of the Japan islands, and to altered bathyal conditions that exterminated the Pliocene fauna.

#### Detailed Pliocene and Quaternary Planktonic Foraminifer Biostratigraphy

Correlation of the Japan Sea sequences to the assemblage zones of Maiya et al. (1976) is not possible because abundant occurrences of planktonic foraminifers are limited mostly to the upper Quaternary. Furthermore, preservation is sporadic with many gaps within the upper Quaternary sequence. The deepest sample that bears planktonic foraminifers at Site 797 contains only *Neogloboquadrina pachyderma* with no *Neogloboquadrina asanoi* and lies within the uppermost Olduvai Subchron. This is consistent with the date of the last

appearance of *Neogloboquadrina asanoi* at the base of the Olduvai Subchron as reported by Maiya et al. (1976) and confirmed by Lagoe and Thompson (1988).

Correlation to the coiling direction zones of Lagoe and Thompson (1988) is not possible because all Quaternary samples are dominated (>80%) by sinistral *Neogloboquadrina pachyderma* (Table 10), and no dextral coiling intervals were found even though both sequences contain the Brunhes/Matuyama Boundary (at 38.4 mbsf in Hole 797B and at 24.6 or 34.1 mbsf in Hole 794A; L. Vigliotti and J. Wippen, pers. comm., 1990) at which the CD8/CD9 coiling change boundary is expected from near 90% sinistral forms above to near 50% sinistral forms below. The ratio of 63% sinistral forms in the Olduvai sample of Site 797 is higher than predicted if it lies with Zone CD11, which spans the middle and upper Olduvai sequence. The Holocene interval of dextral coiling is absent either due to disturbance during the drill-string entry into the bottom or due to dissolution beneath the CCD, which lies between 1,500 and 2,000 m water depth (Ichikura and Ujiie, 1976) in the Holocene Japan Sea.

#### Character of the Upper Water Column during the Quaternary

Cluster analysis separates four distinct groupings of planktonic foraminifers in this data set (Fig. 3, Table 11). Cluster 1 is a cold subarctic fauna produced during isothermal subarctic conditions, Cluster 2 is a well-preserved subarctic fauna produced by seasonal alternation of isothermal and stratified conditions, Cluster 3 is a subarctic fauna that appears similar to the more-dissolved end member of Cluster 2, and Cluster 4 is an upwelling(?) fauna.

The succession of clusters up-hole can be interpreted environmentally (Fig. 4). The deepest sample at Hole 797B is an unclustered sample with an assemblage most like that of the present-day transitional biogeographic province (Coulbourn et al., 1980). Between 50 and 40 mbsf, samples alternate between the cold, subpolar Cluster 1 and the seasonal, well-preserved subpolar Cluster 2. Near the

**Table 7. Cores bearing a low oxygen facies determined by style of bioturbation and by foraminifer assemblage.**

Yamato Basin		Japan Basin	
Occurrences of horizontally flattened burrows and laminations	Occurrences of <i>Cyclammina-Haplophragmoides-Ammodiscus</i> assemblage	Occurrences of horizontally flattened burrows and laminations	Occurrences of <i>Cyclammina-Haplophragmoides-Ammodiscus</i> assemblage
Hole 794B	Hole 794B	Hole 796B	Hole 796B
12R		11R	
13R	13R	12R	
14R	14R	14R	
15R		15R	
16R		18R	
17R			19R
	18R	28R	28R
20R		29R	29R
21R		30R	
22R			31R
24R	24R	32R	32R
25R	25R		
26R	26R		
Hole 797C	Hole 797C	Hole 795B	Hole 795B
	33X	1R	
34X		2R	
	35X	3R	
	36X	7R	7R
	37X	10R	10R
41X		11R	11R
43X		12R	12R
44X		13R	13R
46X		14R	14R
47X	47X	15R	15R
48X	48X	16R	16R
49X		17R	17R
51X	51X	18R	18R
52X	52X	19R	
2R	2R		20R
	3R	21R	21R
5R		22R	
6R	6R	23R	23R
	7R	24R	24R
8R	8R	25R	
		26R	
		27R	
		28R	28R
		29R	29R
		30R	30R
		31R	
		32R	

Brunhes/Matuyama boundary at 38.40 mbsf, samples alternate between the cold subpolar Cluster 1 and the seasonal, somewhat dissolved Cluster 3. Between 35 and 28 mbsf, approximately 0.57 Ma, the surface-water column alternates between the seasonal subarctic conditions represented by Cluster 2 and upwelling(?) conditions represented by Cluster 4. Above 25 mbsf, conditions return to those seen deeper in the core (between 50 and 40 mbsf) and alternate between the cold, subpolar Cluster 1 and the seasonal, well-preserved subpolar Cluster 2. A similar alternation of these two clusters is observed in the upper Pleistocene sequence of Hole 794A.

The four assemblages defined by the cluster analysis resemble the assemblages in latest Pleistocene piston cores from the Japan Sea, including the *Globigerina bulloides* enriched assemblage of Cluster 4 (Ujiié and Ichikura, 1973; Ichikura and Ujiié, 1976; Kato, 1984). In contrast, the Olduvai sample of Hole 797B has no latest Pleistocene or Holocene analog in the Japan Sea, but resembles the fauna of the modern transitional North Pacific Ocean (Coulbourn et al., 1980).

## CONCLUSIONS

1. The abundance of foraminifers, in general, is low at all sites in the deep Japan and Yamato basins. Preservation, diversity, and abundance of the calcareous fauna are best at Site 797 and worst at Site 794. The assemblages of agglutinated foraminifers are best developed at Sites 795 and 796 in the Japan Basin.

2. The succession of benthic foraminifers in the Neogene sequences can be assigned to the zonation of Matsunaga (1963), whereas the planktonic foraminifers of the Quaternary cannot be assigned to the zonations of Maiya et al. (1976) or Lagoe and Thompson (1988).

3. Both the Japan and Yamato basins had subsided to lower middle bathyal depths by the time the first foraminifer-bearing sediments were deposited above igneous basement at the three sites where basement was drilled.

4. The Miocene cooling of the Japan Basin occurred in the early middle Miocene. The data set does not yield improved resolution of the event compared to land-based sequences.

**Table 8. Listing of data including total sediment weight, weight of sand-size fraction, percent sand-size material by weight, fraction (split) of sample examined for foraminifers, planktonic and benthic foraminifer numbers, benthic/planktonic ratio, coiling ratio of *Neoglobobadrina pachyderma*, the number of planktonic and benthic tests counted, and relative frequency taxa of planktonic foraminifers.**

Sample 127-	Depth (mbsf)	Sand Weight	Sed Weight	Sand %	Split	Pla Num	Ben Num	B/P Rat	Coil Rat	# Pla	# Ben	PacL %	PacR %	Bul %	Umb %	Qui %	Glu %	Min %	Uvu %	Par %	Hum %	Ind %
794A-1H-1, 2-4 cm	0.02	0.1183	6.8940	1.72	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-1H-1, 62-64	0.62	0.0107	4.5130	0.24	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-1H-1, 93-98	0.93	0.0431	13.2410	0.33	1.0000	3	0	0	100	46	0	24	0	74	0	2	0	0	0	0	0	0
794A-1H-1, 135-137	1.35	0.01957	20.4730	0.96	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-1H-2, 21-24	1.71	0.2101	10.2760	2.04	1.0000	0	0	0	0	3	0	0	0	100	0	0	0	0	0	0	0	0
794A-1H-2, 65-67	2.15	0.0852	5.6200	1.52	1.0000	0	0	0	100	1	0	100	0	0	0	0	0	0	0	0	0	0
794A-1H-2, 93-98	2.43	0.3309	13.2630	2.49	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-1H-2, 133-136	2.83	0.1333	8.8800	1.50	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-1H-3, 26-28	3.26	0.3270	10.8710	3.01	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-1H-3, 65-67	3.65	0.0105	5.2680	0.20	1.0000	0	0	0	1	0	0	0	0	0	0	100	0	0	0	0	0	0
794A-1H-3, 69-70	3.69	0.0253	2.3920	1.06	1.0000	1	0	0	100	2	0	50	0	0	0	50	0	0	0	0	0	0
794A-1H-3, 93-98	3.93	0.1156	11.4460	1.01	1.0000	4	0	8	100	48	4	85	0	12	0	2	0	0	0	0	0	0
794A-1H-4, 26-31	4.76	0.0275	23.0630	0.12	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-1H-4, 56-58	5.06	0.0104	7.3590	0.14	1.0000	0	0	100	0	0	1	0	0	0	0	0	0	0	0	0	0	0
794A-1H-4, 92-94	5.42	0.0093	6.9860	0.13	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-1H-4, 136-138	5.86	0.0192	7.2040	0.27	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-1H-5, 3-5	6.03	0.0000	11.5100	0.00	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-1H-5, 25-27	6.25	0.6584	11.1990	5.88	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-1, 22-24	7.02	0.0220	10.9710	0.20	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-1, 50-53	7.30	0.0131	8.1950	0.16	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-1, 96-98	7.76	0.1209	9.8870	1.22	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-1, 118-120	7.98	0.0648	10.8450	0.60	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-1, 142-144	8.22	0.1935	11.4960	1.68	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-2, 10-12	8.40	0.2570	12.8400	2.00	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-2, 50-52	8.80	0.2041	12.3210	1.66	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-2, 113-116	9.43	0.0973	9.6230	1.01	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-2, 136-138	9.66	0.0936	11.7460	0.80	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-3, 8-11	9.88	0.0505	10.8840	0.46	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-3, 56-58	10.36	0.0166	8.9580	0.19	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-3, 96-98	10.76	0.0019	9.8430	0.02	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-3, 127-129	11.07	0.1009	12.4930	0.81	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-3, 135-138	11.15	0.1010	9.3420	1.08	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-4, 17-20	11.47	0.1638	12.1510	1.35	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-4, 46-49	11.76	0.0883	11.8170	0.75	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-4, 87-89	12.17	0.0062	7.9228	0.08	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-4, 96-98	12.26	0.0000	7.3570	0.00	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-4, 132-135	12.62	0.0039	9.3340	0.04	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-5, 10-12	12.90	0.0052	8.2900	0.06	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-5, 39-42	13.19	0.0191	7.1140	0.27	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-5, 77-79	13.57	0.0398	9.2140	0.43	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-5, 96-98	13.76	0.1380	8.3130	1.66	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-5, 126-128	14.06	0.1262	10.4854	1.20	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-6, 8-10	14.38	0.1267	8.1140	1.56	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-6, 17-20	14.47	0.3739	12.0690	3.10	0.0039	6416	191	3	98	302	9	92	2	6	0	0	0	0	0	0	0	0
794A-2H-6, 84-87	15.14	0.0608	10.6740	0.57	1.0000	42	0	0	94	444	0	38	2	58	1	1	0	0	0	0	0	0
794A-2H-6, 91-93	15.21	0.2146	7.1680	2.99	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-6, 96-98	15.26	0.8340	10.9830	7.59	0.0010	27770	1457	5	92	305	16	51	4	13	0	6	0	0	1	10	13	1
794A-2H-6, 99-102	15.29	0.0213	6.8260	0.31	1.0000	1	0	0	100	5	0	40	0	60	0	0	0	0	0	0	0	0
794A-2H-7, 8-10	15.88	0.0164	8.4150	0.19	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-2H-7, 48-50	16.28	0.0077	6.6374	0.12	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-1, 23-25	16.53	0.0252	7.6680	0.33	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-1, 65-67	16.95	0.1296	9.7010	1.34	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-1, 94-99	17.24	1.2430	21.1400	5.88	0.0012	13836	394	3	99	351	10	67	1	14	0	17	0	0	0	1	0	0



Table 8 (continued).

Sample 127-	Depth (mbsf)	Sand Weight	Sed Weight	Sand %	Split	Pla Num	Ben Num	B/P Rat	Coil Rat	# Pla	# Ben	PacL %	PacR %	Bul %	Umb %	Qui %	Glu %	Min %	Uvu %	Par %	Hum %	Ind %
794A-3H-1, 117-120	17.47	1.0276	10.8870	9.44	0.0020	22366	1056	5	98	487	23	77	1	18	0	1	0	0	0	2	0	0
794A-3H-2, 19-22	17.99	0.1002	10.1460	0.99	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-2, 65-67	18.45	0.1938	11.4190	1.70	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-2, 119-121	18.99	0.0210	6.8491	0.31	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-3, 5-7	19.35	0.0083	9.1821	0.09	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-3, 46-49	19.76	0.0386	12.9780	0.30	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-3, 119-121	20.49	0.2012	5.0730	3.97	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-4, 24-26	21.04	0.3263	14.7640	2.21	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-4, 51-53	21.31	0.7120	12.5220	5.69	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-4, 94-99	21.74	0.0767	21.8600	0.35	1.0000	0	0	0	100	6	0	100	0	0	0	0	0	0	0	0	0	0
794A-3H-4, 119-122	21.99	0.0901	10.2760	0.88	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-5, 31-33	22.61	0.0804	10.4860	0.77	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-5, 65-67	22.95	0.0755	12.8380	0.59	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-5, 93-98	23.23	0.0841	20.5460	0.41	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-5, 116-118	23.46	0.1282	13.0280	0.98	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-6, 25-27	24.05	0.0080	9.6983	0.08	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-6, 56-58	24.36	0.0179	9.0520	0.20	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-6, 94-98	24.74	0.5728	23.4020	2.45	1.0000	2	0	0	90	41	0	22	2	76	0	0	0	0	0	0	0	0
794A-3H-6, 117-119	24.97	0.1818	12.9180	1.41	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-7, 24-26	25.54	0.0152	8.0380	0.19	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-7, 33-35	25.63	0.0697	9.8020	0.71	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-3H-7, 54-58	25.84	0.0342	18.2240	0.19	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-1, 29-32	26.09	0.0094	7.6150	0.12	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-1, 65-67	26.45	0.2063	14.3060	1.44	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-1, 93-99	26.73	0.5280	28.3840	1.86	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-1, 117-119	26.97	0.2016	12.7540	1.58	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-2, 47-49	27.77	1.0410	9.5660	10.88	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-2, 74-77	28.04	0.1622	8.6340	1.88	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-2, 99-105	28.29	0.4163	22.4460	1.85	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-2, 144-146	28.74	0.0318	10.2830	0.31	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-3, 29-31	29.08	0.0178	8.2210	0.22	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-3, 64-67	29.44	0.0541	9.1447	0.59	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-3, 94-100	29.74	0.0180	17.6190	0.10	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-3, 142-144	30.22	0.0279	9.5600	0.29	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-4, 38-41	30.68	0.1317	10.6340	1.24	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-4, 47-50	30.77	0.1843	11.4590	1.61	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-4, 90-95	31.20	3.4746	18.9880	18.30	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-4, 132-134	31.62	0.0440	9.5920	0.46	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-5, 12-15	31.92	0.1102	10.9580	1.01	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-5, 46-49	32.26	0.0307	9.1940	0.33	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-5, 118-121	32.98	0.0090	9.0480	0.10	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-6, 17-20	33.47	0.0036	9.4236	0.04	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-6, 92-94	34.22	0.1648	9.3352	1.77	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-6, 95-100	34.25	0.0000	22.1000	0.00	0.1563	89	0	0	90	306	0	65	7	26	1	0	0	0	0	0	0	0
794A-4H-6, 99-102	34.29	0.1506	7.5660	1.99	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-7, 32-34	35.12	0.1281	14.9181	0.86	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-4H-7, 40-42	35.20	1.5219	14.5880	10.43	0.0020	11276	171	1	96	329	5	91	4	0	0	4	0	0	0	0	0	0
794A-5H-1, 15-17	35.45	0.2325	9.5742	2.43	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-1, 80-83	36.10	0.0922	11.1410	0.83	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-1, 92-97	36.22	0.4781	20.8400	2.29	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-1, 134-136	36.64	0.0228	8.5430	0.27	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-2, 13-16	36.93	0.0332	8.0790	0.41	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-2, 71-73	37.51	0.1928	14.7470	1.31	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-2, 93-97	37.73	0.4293	25.2900	1.70	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-2, 142-145	38.22	0.0579	9.1830	0.63	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 8 (continued).

Sample 127-	Depth (mbsf)	Sand Weight	Sed Weight	Sand %	Split	Pla Num	Ben Num	B/P Rat	Coil Rat	# Pla	# Ben	PacL %	PacR %	Bul %	Umb %	Qui %	Glu %	Min %	Uvu %	Par %	Hum %	Ind %
794A-5H-3, 27-30	38.57	0.3220	8.6360	3.73	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-3, 66-68	38.96	0.2613	10.1020	2.59	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-3, 93-97	39.23	0.3170	25.1400	1.26	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-3, 135-137	39.65	0.1702	8.0100	2.12	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-4, 8-10	39.88	0.0042	7.2040	0.06	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-4, 22-25	40.02	0.1934	7.3970	2.61	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-4, 54-57	40.34	0.1360	13.7300	0.99	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-4, 92-97	40.72	0.0079	17.5960	0.04	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-5, 93-98	42.23	0.0381	18.4650	0.21	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-5H-6, 93-98	43.73	0.0205	17.9360	0.11	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-6H-1, 92-97	45.72	0.0364	15.9320	0.23	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-6H-2, 92-97	47.22	0.1392	24.2810	0.57	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-6H-3, 90-96	48.70	0.6192	17.9850	3.44	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-6H-4, 92-97	50.22	0.0375	17.6260	0.21	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-6H-5, 93-98	51.73	0.0759	16.9340	0.45	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-6H-6, 84-89	53.14	0.0000	25.4201	0.00	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-7H-1, 92-96	55.22	0.0102	24.7570	0.04	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-7H-2, 94-96	56.72	0.0069	27.3080	0.03	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-7H-3, 92-96	58.22	0.0378	20.8740	0.18	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-7H-4, 92-96	59.72	0.0505	0.0000	----	1.0000	---	---	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-7H-5, 92-96	61.22	0.0197	20.1683	0.10	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-7H-6, 92-96	62.72	0.0093	22.5660	0.04	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-8H-1, 93-97	64.73	0.0197	16.2930	0.12	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-8H-2, 93-97	66.23	0.2196	19.0710	1.15	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-8H-3, 93-97	67.73	0.1284	19.6380	0.65	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-8H-4, 93-97	69.23	0.0354	15.8860	0.22	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-8H-5, 93-97	70.73	0.0174	14.9130	0.12	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-8H-6, 94-98	72.24	0.1601	18.6000	0.86	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-9H-1, 93-97	74.23	0.1392	14.4710	0.96	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-9H-2, 93-97	75.73	0.1029	16.4890	0.62	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-9H-3, 93-97	77.23	0.1090	16.3740	0.67	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-9H-4, 93-97	78.73	0.1955	13.6440	1.43	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-9H-5, 93-97	80.23	0.6952	13.7090	5.07	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-9H-6, 93-97	81.73	0.8620	10.3830	8.30	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-10H-1, 93-97	83.73	0.2433	11.6026	2.10	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-10H-2, 93-97	85.23	0.1919	14.6610	1.31	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-10H-3, 93-97	86.73	0.6580	17.4930	3.76	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-10H-4, 93-97	88.23	0.9842	11.9200	8.26	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-10H-5, 93-97	89.73	0.0289	17.7790	0.16	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-10H-6, 93-97	91.23	1.1983	19.3350	6.20	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-11H-1, 92-96	93.22	0.1795	17.8190	1.01	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-11H-2, 92-96	94.72	0.4521	17.2420	2.62	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-11H-3, 91-95	96.21	0.0914	15.7830	0.58	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-11H-4, 93-97	97.73	0.2431	16.5090	1.47	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-11H-5, 93-97	99.23	0.1375	17.7390	0.78	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-11H-6, 93-97	100.73	0.4570	13.6480	3.35	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-12H-1, 93-97	102.73	0.0645	15.1980	0.42	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-12H-2, 93-97	104.23	0.1182	15.0920	0.78	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-12H-3, 93-97	105.73	0.8137	16.0650	5.07	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-12H-4, 93-97	107.23	0.8430	21.7810	3.87	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-12H-5, 93-97	108.73	0.2903	14.5240	2.00	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-12H-6, 93-97	110.23	0.1672	16.6970	1.00	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-13H-1, 92-97	112.22	0.6059	16.2370	3.73	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-13H-2, 92-97	113.72	0.2070	17.8700	1.16	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-13H-3, 93-97	115.22	0.1849	15.6080	1.18	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 8 (continued).

Sample 127-	Depth (mbsf)	Sand Weight	Sed Weight	Sand %	Split	Pla Num	Ben Num	B/P Rat	Coil Rat	# Pla	# Ben	PacL %	PacR %	Bul %	Umb %	Qui %	Glu %	Min %	Uvu %	Par %	Hum %	Ind %
794A-13H-4, 92-97	116.72	0.0586	16.6000	0.35	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-13H-5, 92-97	118.22	0.4459	19.1420	2.33	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-13H-6, 92-97	119.72	0.0224	26.2900	0.09	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-14H-1, 92-97	121.72	0.0856	23.7480	0.36	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-14H-2, 92-97	123.22	0.0674	36.8020	0.18	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-14H-3, 92-97	124.72	0.0806	21.6609	0.37	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-14H-4, 92-97	126.22	0.2995	23.8909	1.25	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-14H-5, 92-97	127.72	0.0611	17.1691	0.36	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
794A-14H-6, 92-97	129.22	0.1991	20.9693	0.95	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797A-1H-1, 76-78	4.16	0.0000	9.4899	0.00	1.0000	4	0	0	100	38	0	71	0	29	0	0	0	0	0	0	0	0
797A-1H-2, 76-78	5.66	0.2384	5.4890	4.34	1.0000	4	0	4	86	22	1	86	14	0	0	0	0	0	0	0	0	0
797A-1H-3, 76-78	7.16	0.0531	7.4573	0.71	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797A-1H-4, 76-78	8.66	0.0109	4.9982	0.22	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797A-1H-5, 76-78	10.16	0.1192	4.5166	2.64	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-1H-1, 76-78	0.76	0.0835	8.6160	0.97	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-1H-1, 134-136	1.34	0.0412	3.3695	1.22	1.0000	73	0	0	91	245	1	69	7	24	0	0	0	0	0	0	0	0
797B-1H-2, 13-15	1.63	0.0209	1.2748	1.64	0.2500	1174	69	6	96	374	22	91	3	1	0	1	1	0	2	1	0	0
797B-1H-2, 44-46	1.94	0.0101	1.6600	0.61	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-1H-3, 134-136	4.34	0.0096	3.0612	0.31	1.0000	11	0	0	91	33	0	64	6	30	0	0	0	0	0	0	0	0
797B-1H-4, 74-76	5.24	0.0240	4.8229	0.50	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-1H-4, 104-106	5.54	0.0280	3.1292	0.89	1.0000	35	11	24	98	108	34	97	2	1	0	0	0	0	0	0	0	0
797B-1H-1, 102-104	6.92	0.1146	2.7719	4.13	0.1250	877	35	4	98	304	12	71	1	28	0	0	0	0	0	0	0	0
797B-2H-2, 76-78	8.16	0.0000	5.4783	0.00	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-2H-3, 74-76	9.64	0.2544	4.5686	5.57	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-2H-3, 76-78	9.66	0.3885	7.2654	5.35	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-2H-4, 14-16	10.54	0.0358	2.3550	1.52	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-2H-4, 76-78	11.16	0.0917	9.3926	0.98	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-2H-5, 76-78	12.66	0.0106	5.9251	0.18	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-2H-6, 76-78	14.16	0.4081	8.5711	4.76	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-2H-6, 134-136	14.74	0.1101	2.0578	5.35	1.0000	155	0	0	98	319	0	83	2	0	0	1	0	0	4	10	0	0
797B-3H-1, 77-79	16.17	0.0891	10.3619	0.86	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-3H-2, 77-79	17.67	0.0387	7.2258	0.54	1.0000	2	0	0	20	13	0	8	31	54	0	8	0	0	0	0	0	0
797B-3H-3, 77-79	19.17	0.1350	7.1800	1.88	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-3H-4, 77-79	20.67	0.0350	6.1081	0.57	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-3H-5, 77-79	22.17	0.1702	7.1258	2.39	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-3H-6, 77-79	23.67	0.0999	7.5471	1.32	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-3H-6, 103-105	23.93	0.0093	3.8248	0.24	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-3H-6, 135-137	24.25	0.1371	3.5552	3.86	0.0156	12585	108	1	97	698	6	77	2	12	0	5	0	0	0	3	0	1
797B-3H-7, 14-16	24.54	0.0799	3.7423	2.14	0.0156	8428	1593	16	95	492	93	32	2	0	0	7	4	1	0	52	0	2
797B-4H-1, 77-79	25.67	0.0327	5.4682	0.60	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-4H-2, 20-22	26.60	0.0027	2.8818	0.09	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-4H-2, 77-79	27.17	0.0439	4.9804	0.88	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-4H-3, 44-46	28.34	0.0353	0.7667	4.60	1.0000	50	38	43	80	38	29	11	3	21	0	50	0	0	16	0	0	0
797B-4H-3, 77-79	28.67	0.0571	4.9549	1.15	1.0000	54	0	0	75	268	0	1	0	99	0	0	0	0	0	0	0	0
797B-4H-3, 102-104	28.92	0.0838	3.2582	2.57	0.0313	3344	1255	27	56	341	128	1	1	80	0	16	0	0	1	1	0	0
797B-4H-3, 135-137	29.25	0.8097	3.2370	25.01	0.0469	1943	198	9	98	295	30	74	1	8	0	16	0	0	1	1	0	0
797B-4H-4, 13-15	29.53	0.0093	3.1689	0.29	1.0000	11	23	68	100	35	73	100	0	0	0	0	0	0	0	0	0	0
797B-4H-4, 77-79	30.17	0.0661	8.1956	0.81	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-4H-4, 102-104	30.42	0.0721	2.3006	3.13	0.0781	1864	189	9	80	335	34	6	1	87	2	3	0	0	0	0	0	0
797B-4H-4, 135-137	30.75	0.2588	1.7763	14.57	0.0078	32407	144	0	98	449	2	72	1	21	1	3	0	0	1	1	0	0
797B-4H-5, 43-45	31.33	0.1124	1.6416	6.85	0.0234	8304	234	3	98	319	9	75	2	20	0	1	0	0	0	0	0	2
797B-4H-5, 74-76	31.64	0.0193	5.7512	0.34	1.0000	0	0	0	2	0	0	0	0	100	0	0	0	0	0	0	0	0
797B-4H-6, 77-79	33.17	0.0300	3.3954	0.88	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-4H-6, 135-137	33.75	0.0319	3.3955	0.94	0.0625	2837	19	1	96	602	4	82	4	3	0	11	0	0	0	0	0	0
797B-5H-1, 78-80	35.18	0.0927	9.5903	0.97	1.0000	9	0	0	93	83	0	52	4	45	0	0	0	0	0	0	0	0

Table 8 (continued).

Sample 127-	Depth (msf)	Sand Weight	Sed Weight	Sand %	Split	Pla Num	Ben Num	B/P Rat	Coil Rat	# Pla	# Ben	PacL %	PacR %	Bul %	Umb %	Qui %	Glu %	Min %	Uvu %	Par %	Hum %	Ind %
797B-5H-1, 132-134	35.72	0.0666	3.9071	1.70	0.0938	881	134	13	98	323	49	46	1	49	4	0	0	0	0	0	0	0
797B-5H-2, 44-46	36.34	0.0966	2.4283	3.98	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-5H-2, 78-80	36.68	0.2993	8.8424	3.38	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-5H-2, 103-105	36.93	0.0403	3.0209	1.33	1.0000	113	19	14	87	340	56	43	6	48	0	3	0	0	0	0	0	0
797B-5H-3, 78-80	38.18	0.0298	6.2512	0.48	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-5H-4, 43-45	39.33	0.0366	4.2421	0.86	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-5H-4, 74-76	39.64	0.0309	3.8578	0.80	1.0000	61	1	1	98	237	2	95	2	3	0	0	0	0	0	0	0	0
797B-5H-4, 78-80	39.68	1.5850	10.8650	14.59	0.0020	17073	46	0	97	371	1	56	2	41	0	1	0	0	0	0	0	0
797B-5H-5, 11-13	40.51	0.0214	2.7329	0.78	0.5000	544	50	8	98	744	68	87	2	4	0	6	0	0	0	0	0	0
797B-5H-5, 43-45	40.83	0.0330	2.8448	1.16	1.0000	51	73	59	100	144	209	98	0	1	0	1	0	0	1	0	0	0
797B-5H-5, 74-76	41.14	0.0284	3.5086	0.81	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-5H-5, 78-80	41.18	7.1045	9.7598	72.79	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-5H-5, 131-133	41.71	0.0396	2.7038	1.46	0.0469	2689	197	7	81	341	25	70	16	9	0	3	0	0	1	1	0	1
797B-5H-6, 14-16	42.04	0.1587	3.2753	4.85	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-5H-6, 78-80	42.68	0.2103	13.7800	1.53	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-5H-6, 102-104	42.92	0.2136	2.6603	8.03	0.0156	10048	1349	12	96	417	56	71	3	4	0	15	0	0	2	3	0	1
797B-5H-7, 14-16	43.54	0.0553	2.6670	2.07	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-5H-7, 43-45	43.83	0.0725	3.5938	2.02	0.0625	1429	31	2	87	321	7	56	8	20	8	7	0	0	0	0	0	0
797B-6H-1, 78-80	44.68	0.0614	6.6945	0.92	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-6H-1, 132-134	45.22	0.1504	3.2690	4.60	0.1250	110	5	4	100	45	2	73	0	0	13	0	0	0	0	0	0	13
797B-6H-2, 74-76	46.14	0.0427	4.2680	1.00	0.1250	609	6	1	90	325	3	70	8	0	0	10	0	0	0	0	0	12
797B-6H-2, 78-80	46.18	0.1505	7.4428	2.02	0.0234	2107	17	1	94	367	3	90	6	1	0	1	0	0	0	0	0	2
797B-6H-2, 102-104	46.42	0.0918	4.7140	1.95	0.1250	608	15	2	92	358	9	82	8	1	0	3	0	0	0	0	0	7
797B-6H-3, 13-15	47.03	0.0087	2.9910	0.29	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-6H-3, 74-76	47.64	0.2587	2.8960	8.93	0.0313	3961	177	4	80	359	16	62	16	15	0	0	0	0	0	0	0	7
797B-6H-3, 78-80	47.68	0.0746	7.8028	0.96	0.0625	687	14	2	85	335	7	84	14	0	0	1	0	0	0	0	0	1
797B-6H-3, 102-104	47.92	0.1002	2.9110	3.44	0.0234	5197	132	2	91	354	9	87	9	0	0	0	0	0	0	0	0	4
797B-6H-4, 78-80	49.18	0.0725	0.9804	7.39	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-6H-5, 78-80	50.68	0.3409	6.1834	5.51	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-6H-6, 78-80	52.18	0.2606	7.5699	3.44	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-7H-1, 78-80	54.18	0.1997	12.9515	1.54	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-7H-2, 78-80	55.68	0.0524	7.0757	0.74	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-7H-3, 78-80	57.18	0.0914	9.8832	0.92	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-7H-4, 78-80	58.68	0.0503	8.8535	0.57	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-7H-5, 78-80	60.18	0.0328	11.5727	0.28	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-7H-6, 78-80	61.68	0.0482	10.4509	0.46	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-8H-1, 78-80	63.68	0.0566	8.9761	0.63	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-8H-2, 78-80	65.18	0.0405	9.8936	0.41	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-8H-3, 78-80	66.68	0.0037	5.9682	0.06	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-8H-4, 77-79	68.17	0.0150	7.4428	0.20	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-8H-5, 77-79	69.67	0.0172	5.6497	0.30	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-8H-6, 78-80	71.18	0.0099	6.6763	0.15	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-9H-1, 78-80	73.18	0.1971	8.0221	2.46	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-9H-2, 78-80	74.68	0.1170	15.8724	0.74	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-9H-3, 78-80	76.18	0.1912	10.3306	1.85	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-9H-4, 78-80	77.68	0.0544	7.2795	0.75	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-9H-5, 78-80	79.18	0.0091	9.7021	0.09	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-9H-6, 78-80	80.68	0.0199	8.9368	0.22	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-10H-1, 78-80	82.68	0.0276	10.0406	0.27	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-10H-2, 78-80	84.18	0.0519	13.4138	0.39	0.1250	361	1	0	63	606	2	23	13	27	0	24	0	1	4	7	0	1
797B-10H-3, 78-80	85.68	0.0131	9.1135	0.14	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-10H-4, 78-80	87.18	0.0284	8.5812	0.33	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-10H-5, 78-80	88.68	0.1155	15.4300	0.75	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-10H-6, 78-80	90.18	0.0697	8.8998	0.78	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-11H-1, 78-80	92.18	0.0981	8.0499	1.22	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 8 (continued).

Sample 127-	Depth (mbsf)	Sand Weight	Sed Weight	Sand %	Split	Pla Num	Ben Num	B/P Rat	Coil Rat	# Pla	# Ben	PacL %	PacR %	Bul %	Umb %	Qui %	Glu %	Min %	Uvu %	Par %	Hum %	Ind %
797B-11H-2, 78-80	93.68	0.0935	9.6681	0.97	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-11H-3, 78-80	95.18	0.0620	7.5263	0.82	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-11H-4, 78-80	96.68	0.0540	8.3024	0.65	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-11H-5, 78-80	98.18	0.0984	8.5625	1.15	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-11H-6, 78-80	99.68	0.1742	8.5208	2.04	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-12H-1, 78-80	101.68	0.2559	7.7430	3.30	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-12H-2, 78-80	103.18	0.0062	6.4132	0.10	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-12H-3, 78-80	104.68	0.0326	6.6460	0.49	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-12H-4, 78-80	106.18	0.0635	7.6648	0.83	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-12H-5, 78-80	107.68	0.0998	6.3714	1.57	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-12H-6, 78-80	109.18	0.0824	6.0083	1.37	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-13H-1, 78-80	111.18	0.0000	6.6650	0.00	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-13H-2, 78-80	112.68	0.0953	8.9604	1.06	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-13H-3, 78-80	114.18	0.2598	9.9160	2.62	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-13H-4, 78-80	115.68	0.2888	8.5917	3.36	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-13H-5, 78-80	117.18	0.1533	7.8382	1.96	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-13H-6, 78-80	118.68	0.1893	8.3226	2.27	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-14H-1, 78-80	120.68	0.1439	7.6248	1.89	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-14H-2, 78-80	122.18	0.1623	6.9918	2.32	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-14H-3, 78-80	123.68	0.0901	6.8596	1.31	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-14H-4, 78-80	125.18	0.0742	6.1573	1.21	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-14H-5, 78-80	126.68	0.2246	7.4031	3.03	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-15H-1, 79-81	130.19	0.1008	5.2081	1.94	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-15H-2, 79-81	131.69	0.0359	4.6288	0.78	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-15H-3, 79-81	133.19	0.0230	5.3832	0.43	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-15H-4, 80-82	134.70	0.0340	5.2789	0.64	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-15H-5, 79-81	136.19	0.0596	4.4017	1.35	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-15H-6, 79-81	137.69	0.0666	5.1132	1.30	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-16H-1, 80-82	139.70	0.4978	6.7217	7.41	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-16H-2, 80-82	141.20	0.0577	8.0013	0.72	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-16H-3, 80-82	142.70	0.1456	8.8090	1.65	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-16H-4, 80-82	144.20	0.1295	8.3125	1.56	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-16H-5, 77-79	145.67	0.0922	11.7856	0.78	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-16H-6, 79-81	147.19	0.1005	8.1014	1.24	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-17H-1, 79-81	149.19	0.0935	7.4331	1.26	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-17H-3, 40-42	150.60	0.0654	5.8169	1.12	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-17H-4, 79-81	151.56	0.0336	4.3532	0.77	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-17H-5, 79-81	153.06	0.1496	7.3517	2.03	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-17H-6, 79-81	154.56	0.0345	6.1962	0.56	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-17H-7, 79-81	156.06	0.1530	7.6429	2.00	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-18H-1, 80-82	158.70	0.0863	7.3654	1.17	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-18H-2, 80-82	160.20	0.1611	6.6940	2.41	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-18H-3, 70-72	161.60	0.2310	7.4662	3.09	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-18H-4, 80-82	163.20	0.2506	8.6653	2.89	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-18H-5, 80-82	164.70	0.1172	7.3798	1.59	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-18H-6, 60-62	166.00	0.1360	5.5749	2.44	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-19H-1, 79-81	167.19	0.3318	6.5383	5.07	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-19H-2, 79-81	168.69	0.0802	7.6172	1.05	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-19H-3, 79-81	170.19	0.1204	6.9454	1.73	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-19H-4, 79-81	171.69	0.1743	7.1394	2.44	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-19H-5, 79-81	173.19	0.1452	8.0460	1.80	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
797B-19H-6, 79-81	174.69	0.1300	8.3638	1.55	1.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Sand weight weight of >63-µm fraction  
Sed weight weight of the total, dry sediment sample  
Sand % percent by weight of the >63-µm fraction  
Split fraction of the sample counted for foraminifers  
Pla num number of planktonic foraminifer tests per gram of sediment  
Ben num number of benthonic foraminifer tests per gram of sediment  
B/P Rat ratio: 100 × (planktonic)/(planktonic + benthic foraminifers)  
Coil Rat ratio: 100 × (sinistral *Nq. pachyderma*/all *Nq. pachyderma*)  
# Pla number of planktonic foraminifers counted  
# Ben number of benthic foraminifers counted  
PACL % relative frequency of sinistral *Neoglobobulimina pachyderma* in planktonic foraminifer assemblage  
PACR % relative frequency of dextral *Neoglobobulimina pachyderma* in planktonic foraminifer assemblage  
BUL % relative frequency of *Globigerina bulloides* in planktonic foraminifer assemblage  
UMB % relative frequency of *Globigerina umbilicata* in planktonic foraminifer assemblage  
QUI % relative frequency of *Globigerina quinqueloba* in planktonic foraminifer assemblage  
GLU % relative frequency of *Globigerinita glutinata* in planktonic foraminifer assemblage  
MIN % relative frequency of *Globigerinita minuta* in planktonic foraminifer assemblage  
UVU % relative frequency of *Globigerinita uvula* in planktonic foraminifer assemblage  
PAR % relative frequency of *Tenuitella parkerae* in planktonic foraminifer assemblage  
HUM % relative frequency of *Turborotalita humilis* in planktonic foraminifer assemblage  
IND % relative frequency of indeterminate tests in planktonic foraminifer assemblage

Table 9. Constituents of sand-size fraction.

Sample 127-	Depth (mbsf)	Sand (%)	Plank. foram. number (#/g)	Major constituent	Minor constituent-1	Minor constituent-2
794A-2H-6, 17-20 cm	14.47	3.10	6416	Foraminifers	Minerals	
794A-2H-6, 84-87	15.14	0.57	42	Minerals	Lithic fragments	
794A-2H-6, 96-98	15.26	7.59	27770	Foraminifers	Anhydrite	
794A-3H-1, 94-99	17.24	5.88	13836	Foraminifers	Gypsum	
794A-3H-1, 117-120	17.47	9.44	22366	Foraminifers		
794A-4H-6, 95-100	34.25		89	Gypsum	Anhydrite	Foraminifers
794A-4H-7, 40-42	35.20	10.43	11276	Foraminifers	Pyrite	Anhydrite
797B-1H-1, 134-136	1.34	1.22	73	Pyrite	Minerals	
797B-1H-2, 13-15	1.63	1.64	1174	Foraminifers	Minerals	Radiolarians
797B-2H-1, 102-104	6.92	4.13	877	Foraminifers	Pyrite	Radiolarians
797B-2H-6, 134-136	14.74	5.35	155	Pumice	Pyrite	
797B-3H-6, 135-137	24.25	3.86	12585	Foraminifers		
797B-3H-7, 14-16	24.54	2.14	8428	Foraminifers	Spicules	Radiolarians and Diatoms
797B-4H-3, 44-46	28.34	4.60	50	Pumice		
797B-4H-3, 77-79	28.67	1.15	54	Anhydrite	Foraminifers	
797B-4H-3, 102-104	28.92	2.57	3344	Foraminifers		
797B-4H-3, 135-137	29.25	25.01	1943	Pyrite	Foraminifers	
797B-4H-4, 102-104*	30.42	3.13	1864	Foraminifers	Pyrite	
797B-4H-4, 135-137	30.75	14.57	32407	Foraminifers		
797B-4H-5, 43-45	31.33	6.85	8304	Foraminifers	Pyrite	
797B-4H-6, 135-137	33.75	0.94	2837	Foraminifers		
797B-5H-1, 132-134	35.72	1.70	881	Foraminifers	Pyrite	Minerals
797B-5H-2, 103-105*	36.93	1.33	113	Minerals	Pyrite	Foraminifers
797B-5H-4, 74-76	39.64	0.80	61	Minerals		
797B-5H-4, 78-80	39.68	14.59	17073	Foraminifers	Anhydrite	
797B-5H-5, 11-13*	40.51	0.78	544	Minerals	Foraminifers	Spicules
797B-5H-5, 43-45	40.83	1.16	51	Ash	Radiolarians and Diatoms	Foraminifers
797B-5H-5, 131-133	41.71	1.46	2689	Foraminifers		
797B-5H-6, 102-104*	42.92	8.03	10048	Foraminifers	Spicules	Organics
797B-5H-7, 43-45	43.83	2.02	1429	Foraminifers	Pyrite	Minerals
797B-6H-1, 132-134	45.22	4.60	110	Spicules	Pyrite	
797B-6H-2, 74-76	46.14	1.00	609	Foraminifers	Pyrite	Minerals
797B-6H-2, 78-80	46.18	2.02	2107	Foraminifers	Pyrite	Minerals
797B-6H-2, 102-104	46.42	1.95	608	Foraminifers		
797B-6H-3, 74-76	47.64	8.93	3961	Foraminifers	Pyrite	
797B-6H-3, 78-80	47.68	0.96	687	Foraminifers	Radiolarians and Diatoms	Minerals
797B-6H-3, 102-104	47.92	3.44	5197	Foraminifers	Pyrite	Minerals
797B-10H-2, 78-80	84.18	0.39	361	Foraminifers	Pyrite	Minerals

\*thin, foraminifer-rich layer

5. Deep waters of the nascent and mature backarc basin were poorly oxygenated throughout most of the Miocene sequences. Oxygenation improved in the uppermost Miocene and continued through the Pliocene.

6. The Quaternary assemblage of benthic foraminifers appears shallower than the basins they were cored from, based on depth ranges of selected foraminifers. The anomalous assemblage was introduced into the basin near the base of the Pleistocene and persists to the present day.

7. Quaternary planktonic assemblages are similar to assemblages known from the latest Pleistocene of the Japan Sea, whereas the Olduvai assemblage is similar to present-day faunas of the transitional North Pacific Ocean.

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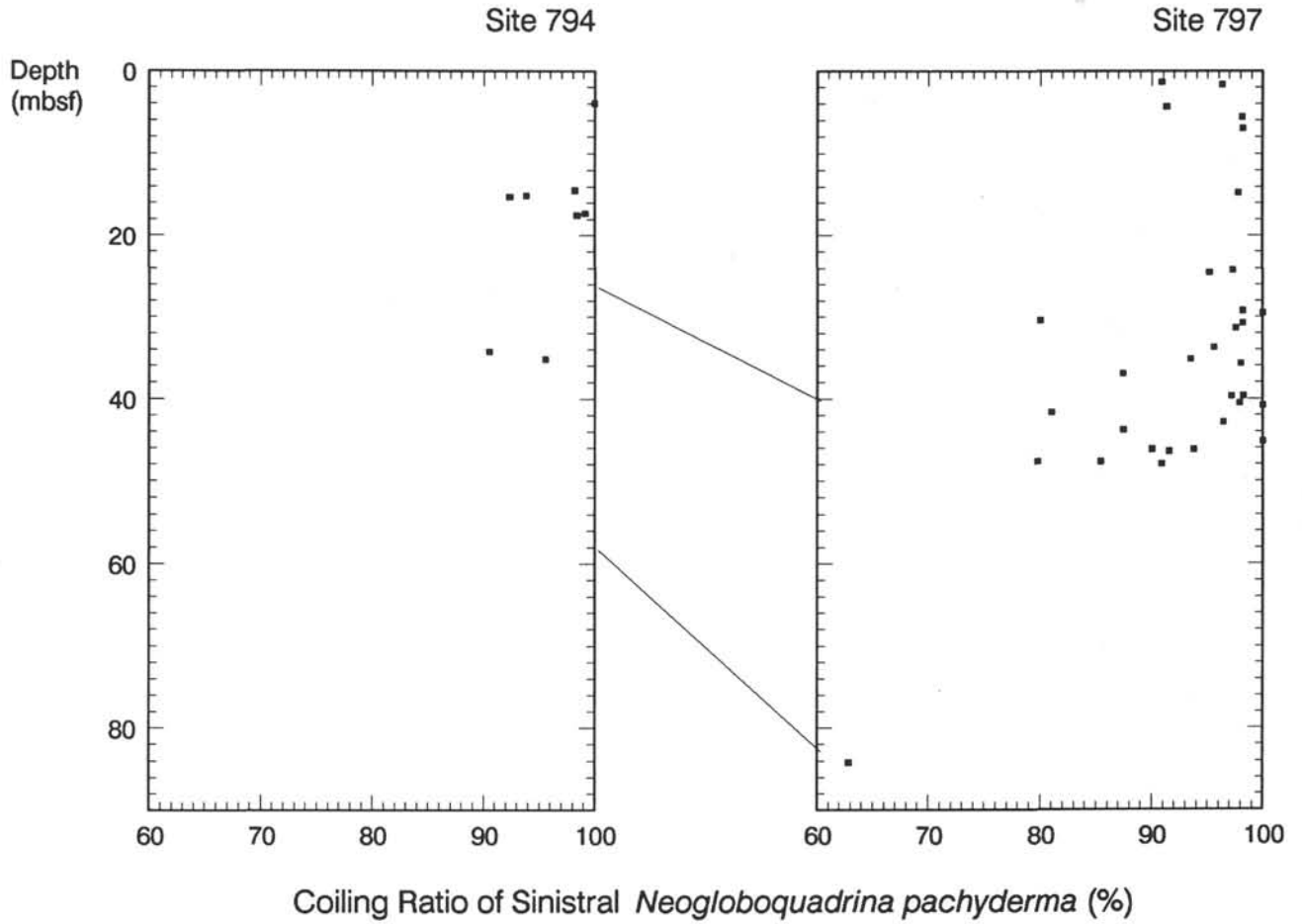


Figure 2. The coiling ratio of *Neogloboquadrina pachyderma* (sinistral forms/total number of *Neogloboquadrina pachyderma* in sample) plotted with depth at Holes 794A and 797B. All samples that plot on the y axis are barren or have fewer than 20 specimens of the species. The two lines connecting the graphs denote the Brunhes/Matuyama boundary and the top of the Olduvai.



**Table 10. Coiling ratio of *Neogloboquadrina pachyderma* with number of tests of sinistral and dextral forms counted to calculate the ratio.**

Sample 127-	Depth (mbsf)	PacL	PacR	Coil (%)
794A-1H-3, 93-98 cm	3.93	41	0	100
794A-2H-6, 17-20	14.47	27	5	98
794A-2H-6, 84-87	15.14	16	1	94
794A-2H-6, 96-98	15.26	156	13	92
794A-3H-1, 94-99	17.24	232	2	99
794A-3H-1, 117-120	17.47	371	6	98
794A-4H-6, 95-100	34.25	200	21	90
794A-4H-7, 40-42	35.20	301	14	96
797A-1H-1, 76-78	4.16	27	0	100
797A-1H-2, 76-78	5.66	19	3	86
797B-1H-1, 134-136	1.34	169	17	91
797B-1H-2, 13-15	1.63	339	13	96
797B-1H-3, 134-136	4.34	21	2	91
797B-1H-4, 104-106	5.54	105	2	98
797B-2H-1, 102-104	6.92	216	4	98
797B-2H-6, 134-136	14.74	264	6	98
797B-3H-6, 135-137	24.25	526	15	97
797B-3H-7, 14-16	24.54	140	7	95
797B-4H-3, 135-137	29.25	216	4	98
797B-4H-4, 13-15	29.53	35	0	100
797B-4H-4, 102-104	30.42	19	3	80
797B-4H-4, 135-137	30.75	320	6	98
797B-4H-5, 43-45	31.33	240	6	98
797B-4H-6, 135-137	33.75	487	22	96
797B-5H-1, 78-80	35.18	43	3	93
797B-5H-1, 132-134	35.72	148	3	98
797B-5H-2, 103-105	36.93	146	21	87
797B-5H-4, 74-76	39.64	225	4	98
797B-5H-4, 78-80	39.68	208	6	97
797B-5H-5, 11-13	40.51	648	14	98
797B-5H-5, 43-45	40.83	141	0	100
797B-5H-5, 131-133	41.71	238	33	81
797B-5H-6, 102-104	42.92	268	9	96
797B-5H-7, 43-45	43.83	181	26	87
797B-6H-1, 132-134	45.22	33	0	100
797B-6H-2, 74-76	46.14	226	25	90
797B-6H-2, 78-80	46.18	330	22	94
797B-6H-2, 102-104	46.42	292	27	92
797B-6H-3, 74-76	47.64	221	56	80
797B-6H-3, 78-80	47.68	281	48	85
797B-6H-3, 102-104	47.92	308	31	91
797B-10H-2, 78-80	84.18	89	0	63

PacL—number of tests of sinistral *Neogloboquadrina pachyderma* counted

PacR—number of tests of dextral *Neogloboquadrina pachyderma* counted

Coil—ratio of sinistral to total number of specimens of *Neogloboquadrina pachyderma*

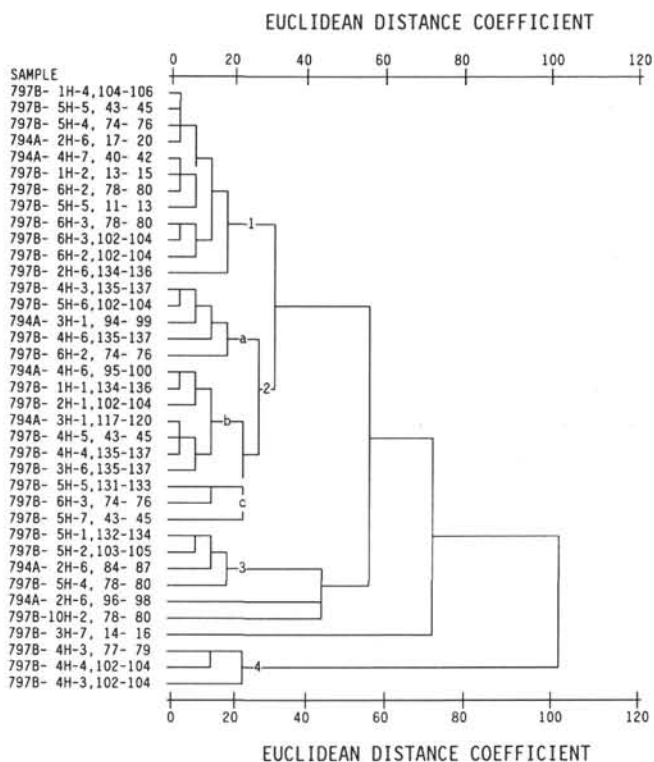


Figure 3. Dendrogram of Q-mode analysis of all samples with 100 or more specimens of planktonic foraminifers.

Table 11. Relative frequencies of planktonic foraminifers in samples arranged by cluster.

Sample 127-	Depth (mbsf)	Col	PacL	PacR	Bul	Umb	Qui	Glu	Min	Uvu	Par	Hum	Oth
Cluster 1													
794A-2H-6, 17-20 cm	14.47	l	92	2	6	0	0	0	0	0	0	0	0
794A-4H-7, 40-42	35.20	l	91	4	0	0	4	0	0	0	0	0	0
797B-1H-2, 13-15	1.63	m	91	3	1	0	1	1	0	2	1	0	0
797B-1H-4, 104-106	5.54	l	97	2	1	0	0	0	0	0	0	0	0
797B-2H-6, 134-136	14.74	m	83	2	0	0	1	0	0	4	10	0	0
797B-5H-4, 74-76	39.64	l	95	2	3	0	0	0	0	0	0	0	0
797B-5H-5, 11-13	40.51	l/d	87	2	4	0	6	0	0	0	0	0	0
797B-5H-5, 43-45	40.83	l	98	0	1	0	1	0	0	1	0	0	0
797B-6H-2, 78-80	46.18	m	90	6	1	0	1	0	0	0	0	0	2
797B-6H-2, 102-104	46.42	m/d	82	8	1	0	3	0	0	0	0	0	7
797B-6H-3, 78-80	47.68	m	84	14	0	0	1	0	0	0	0	0	1
797B-6H-3, 102-104	47.92	l/m	87	9	0	0	0	0	0	0	0	0	4
Cluster 2													
Subgroup a													
794A-3H-1, 94-99	17.24	l	67	1	14	0	17	0	0	0	1	0	0
797B-4H-3, 135-137	29.25	d	74	1	8	0	16	0	0	1	1	0	0
797B-4H-6, 135-137	33.75	m	82	4	3	0	11	0	0	0	0	0	0
797B-5H-6, 102-104	42.92	m	71	3	4	0	15	0	0	2	3	0	1
797B-6H-2, 74-76	46.14	m	70	8	0	0	10	0	0	0	0	0	12
Subgroup b													
794A-3H-1, 117-120	17.47	l	77	1	18	0	1	0	0	0	2	0	0
794A-4H-6, 95-100	34.25	d	65	7	26	1	0	0	0	0	0	0	0
797B-1H-1, 134-136	1.34	m	69	7	24	0	0	0	0	0	0	0	0
797B-2H-1, 102-104	6.92	d	71	1	28	0	0	0	0	0	0	0	0
797B-3H-6, 135-137	24.25	m	77	2	12	0	5	0	0	0	3	0	1
797B-4H-4, 135-137	30.75	m	72	1	21	1	3	0	0	1	1	0	0
797B-4H-5, 43-45	31.33	l	75	2	20	0	1	0	0	0	0	0	2
Subgroup c													
797B-5H-5, 131-133	41.71	l	70	16	9	0	3	0	0	1	1	0	1
797B-5H-7, 43-45	43.83	l/d	56	8	20	8	7	0	0	0	0	0	0
797B-6H-3, 74-76	47.64	d	62	16	15	0	0	0	0	0	0	0	7
Cluster 3													
794A-2H-6, 84-87	15.14	l	38	2	58	1	1	0	0	0	0	0	0
797B-5H-1, 132-134	35.72	l/m	46	1	49	4	0	0	0	0	0	0	0
797B-5H-2, 103-105	36.93	l/m	43	6	48	0	3	0	0	0	0	0	0
797B-5H-4, 78-80	39.68	d	56	2	41	0	1	0	0	0	0	0	0
Cluster 4													
797B-4H-3, 77-79	28.67	d	1	0	99	0	0	0	0	0	0	0	0
797B-4H-3, 102-104	28.92	l	1	1	80	0	16	0	0	1	1	0	0
797B-4H-4, 102-104	30.42	l/d	6	1	87	2	3	0	0	0	0	0	0
Unclustered samples													
794A-2H-6, 96-98	15.26	d	51	4	13	0	6	0	0	1	10	13	1
797B-3H-7, 14-16	24.54	m	32	2	0	0	7	4	1	0	52	0	2
797B-10H-2, 78-80	84.18	m	23	13	27	0	24	0	1	4	7	0	1

Col sediment color  
PacL sinistral *Neogloboquadrina pachyderma*  
PacR dextral *Neogloboquadrina pachyderma*  
Bul *Globigerina bulloides*  
Umb *Globigerina umbilicata*  
Qui *Globigerina quinqueloba*  
Glu *Globigerinita glutinata*  
Min *Globigerinita minuta*  
Uvu *Globigerinita uvula*  
Par *Tenuitella parkerae*  
Hum *Turborotalita humilis*  
Oth other planktonic foraminiferal species  
d dark chocolate brown sediment  
m medium brown sediment  
l light putty gray sediment

Table 12. Correlation of diatom and foraminifer zones.

A. Site 794			
Site 794 Sample	Diatom and Nannofossil Zones	Foraminifer Zone	Epoch
A-1H-CC A-2H-CC A-3H-2, 94-99 A-3H-CC A-4H-5, 90-95 A-4H-CC A-5H-CC A-6H-CC A-7H-CC A-8H-CC A-9H-CC A-10H-CC A-11H-CC A-12H-CC A-13H-CC A-14H-CC A-15H-CC A-16X-CC A-17X-CC A-18X-CC A-19X-CC A-20X-CC A-21X-CC A-22X-CC A-23X-CC A-24X-CC A-25X-CC A-26X-CC A-27X-CC A-28X-CC A-29X-CC A-30X-CC A-31X-CC A-32X-CC A-33X-CC A-34X-CC A-35X-CC A-36X-CC A-37X-CC B-7R-CC B-8R-CC B-9R-CC B-10R-CC B-11R-CC B-12R-CC B-13R-CC B-14R-CC B-15R-CC B-16R-CC B-17R-CC B-18R-CC B-19R-CC B-20R-CC B-21R-CC B-22R-CC B-23R-CC B-24R-CC B-25R-CC B-26R-2, 8-9	<i>Neodenticula seminae</i> <i>Rhizosolenia curvirostris</i> ? <i>Neodenticula koizumii</i> <i>N. koizumii</i> - <i>N. kamschatica</i> <i>Thalassiosira oestrupii</i> <i>Neodenticula kamschatica</i> <i>Rouxia californica</i> <i>Thalassionema schraderi</i> <del><i>Denticulopsis katayamae</i></del> <i>Discoaster hamatus</i> <i>Sphenolithus heteromorphus</i>	? <i>Miliammina echigoensis</i> <i>Spirosigmoinella compressa</i> <i>Globorotalia</i> cf. <i>G. fohsi</i>	Quaternary Pliocene late Miocene middle Miocene

Table 12 (continued).

B. Site 795			
Site 795 Sample	Diatom Zone	Foraminiferal Zone	Epoch
A-1H-CC A-2H-CC A-3H-CC A-4H-CC A-5H-CC A-6H-CC A-7H-CC A-8H-CC A-9H-CC A-10H-CC A-11H-CC A-12H-CC A-13H-CC A-14H-CC A-15H-CC A-16H-CC A-17H-CC A-18H-CC A-19H-CC A-20X-CC A-21X-CC A-22X-CC A-23X-CC A-24X-CC A-25X-CC A-26X-CC A-27X-CC A-28X-CC A-29X-CC A-30X-CC A-31X-CC A-34X-CC A-35X-CC A-36X-CC A-37X-CC A-38X-CC A-39X-CC B-1R-CC B-2R-CC B-3R-CC B-4R-CC B-5R-CC B-6R-CC B-7R-CC B-8R-CC B-9R-CC B-10R-CC B-11R-CC B-12R-CC B-13R-CC B-14R-CC B-15R-CC B-16R-CC B-17R-CC B-18R-CC B-19R-CC B-20R-CC B-21R-CC B-22R-CC B-23R-CC B-24R-CC B-25R-CC B-26R-CC B-27R-CC B-28R-CC B-29R-CC B-30R-CC B-31R-CC	<i>Neodenticula seminae</i> <i>Rhizosolenia curvirostris</i> ? <i>Actinocyclus oculatus</i> <i>Neodenticula koizumii</i> <i>Neodenticula koizumii</i> - <i>Neodenticula kamschatica</i> <i>Thalassiosira oestrupii</i> <del>Opal-A/Opal-CT</del> <i>Neodenticula kamschatica</i> <i>Denticulopsis dimorpha</i> <i>Denticulopsis praedimorpha</i> <i>Denticulopsis praedimorpha</i> <i>Denticulopsis praedimorpha</i> <i>Denticulopsis praedimorpha</i> <i>Denticulopsis praedimorpha</i> <i>Denticulopsis hustedtii</i>	? <i>Miliammina echigoensis</i> <i>Spirosigmoinella compressa</i>	Quaternary Pliocene late Miocene middle Miocene



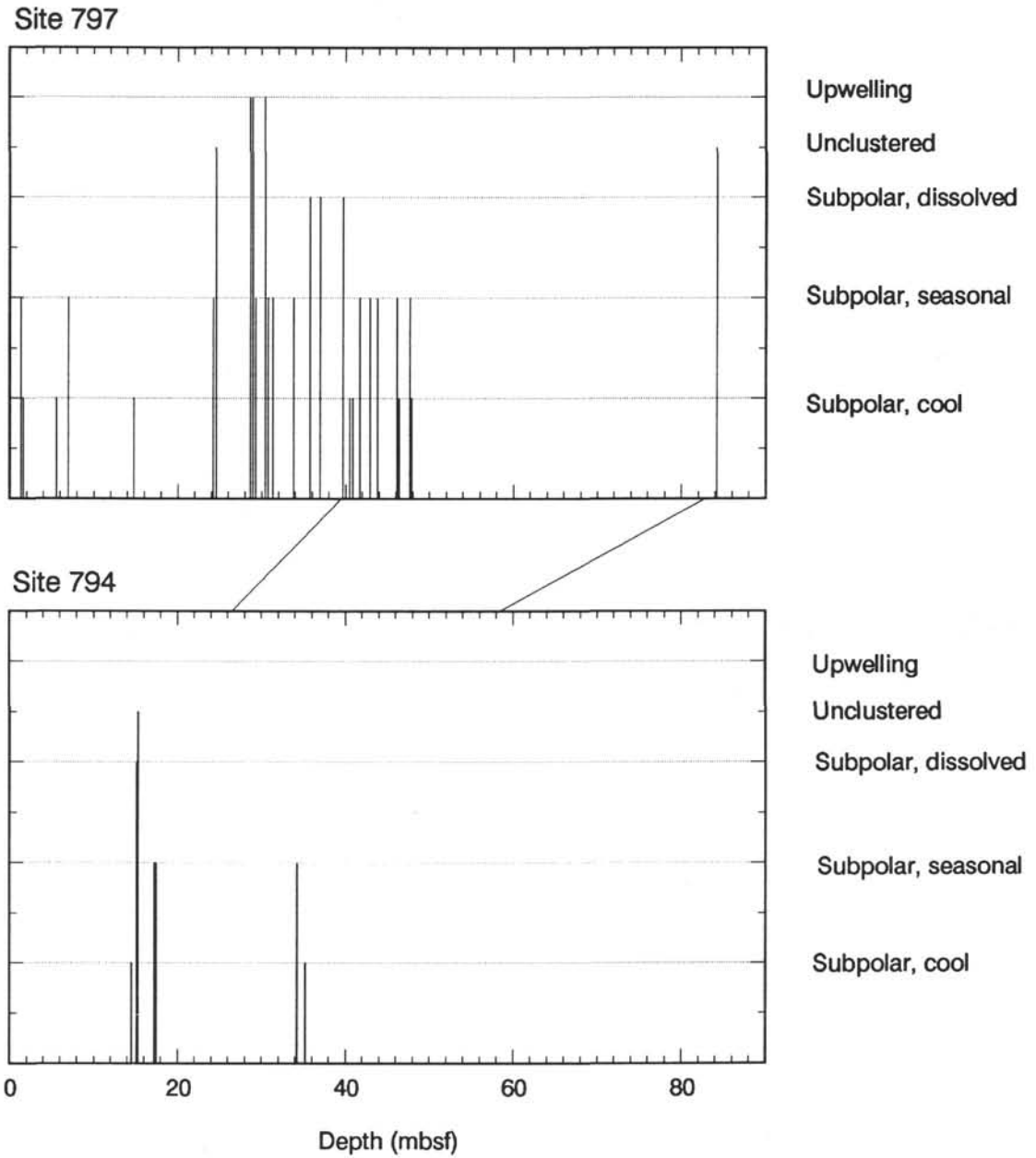


Figure 4. Succession of clusters in Holes 794A and 797B plotted against depth in hole. The subpolar cool assemblage is equivalent to Cluster 1; the subpolar seasonal assemblage is equivalent to Cluster 2; the subpolar, dissolved assemblage is equivalent to Cluster 3; the unclustered samples are those distinctly different from all other samples; and the upwelling(?) assemblage is equivalent to Cluster 4. The two lines connecting the graphs denote the Brunhes/Matuyama Boundary and the top of the Olduvai.