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LATE PLEISTOCENE SEA-SURFACE TEMPERATURES IN THE AGULHAS CURRENT REGION

by

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Abstract

Late Pleistocene Sea-Surface Temperatures in the Agulhas Current Region

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Late Pleistocene, high-resolution time series of foraminifera census counts, faunal assemblages, and estimated sea-surface temperatures from South Atlantic cores sited at the northern edge of the West Wind Drift poleward of the Subtropical Convergence (STC) and beneath the present day position of the Agulhas Current indicate that the STC migrated north from its present position, during glacials, in response to orbitally paced variations in high-latitude ice volume. However, the northerly migration of the STC did not prevent the transfer of heat and salt from the Indian Ocean to the South Atlantic Ocean during glacial climatic intervals. Warm water from the Agulhas Current continued to flow around the southern terminus of Africa. Transfer of mass and energy through this important interhemispheric gateway was continuous throughout the last 700,000 years. The application of a new, regionally-specific, taxonomic criteria for the South Atlantic that differentiates individuals of the *N. pachyderma-N. dutertrei* intergrade (P/D) from the planktic foraminifera species *Neogloboquadrina dutertrei* and *Neogloboquadrina pachyderma* (dextral) resolves long-standing uncertainties regarding regional sea-surface temperature estimation.

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Introduction

The ocean corridor around South Africa is a critical gateway for the global-scale transport of heat and salt from the Indian Ocean to the South Atlantic Ocean. In this area, the warm saline Agulhas Current flows into the South Atlantic Ocean. The Agulhas Current is the most energetic western boundary current within the Southern Hemisphere and is warmer than the adjacent Atlantic Ocean by 7°C [Grunlingh, 1980; Gordon, 1985; Toole and Raymer, 1985; Shuman, 1987; Winter and Martin, 1990]. A branch of the warm Agulhas Current carries Indian Ocean water into the South Atlantic Ocean by leakage from the Agulhas Current into the Benguela Current which flows northward along the western coast of Africa (Figure 1). This makes the Atlantic Ocean unique as it receives heat at its southern polar region [Gordon, 1986]. This advection is a vital component of the conveyor belt hypothesis [Broecker and Denton, 1989] and has been examined using two deep-sea piston cores (Table 1) sited beneath differing oceanic regimes of the South Atlantic Ocean. Detailed time series of planktic foraminifera census counts, statistically defined faunal assemblages, and transfer function estimates of sea-surface temperatures (SST) were used to reconstruct, by proxy, the climatically induced transfer of heat from the Indian Ocean into the Atlantic Ocean during the Late Pleistocene.

Methods

Core Sites

Core RC11-86 (35°8'S, 18°5'E, 2829 m) is sited on the Agulhas Bank at the northwest edge of the Agulhas Retroflection and bathed by the warm waters of the Agulhas Current. The Agulhas Bank extends ~500 km south of Cape Agulhas, at its greatest width, and narrows considerably off the Natal Coast so that a steep continental slope stretches northeast-southwest forming a constriction for the Agulhas Current [Grundlingh, 1978; Lutjeharms, 1981; Olson and Evans, 1986: Lutjeharms and Roberts, 1988; Goshen and

Shuman, 1990]. Today, the mean modern SST at this site is 16°C for Tc (warm SST end member) and 23°C for Tw (cold SST end member) [Hoflich, 1984]. Core V34-157 (41°9'S, 26°4'E, 3636 m) is located on the Agulhas Plateau beneath the colder waters of the West Wind Drift. The Agulhas Plateau is located at latitude 37°-42°S, longitude 24°-29°E and rises to within 2500 m of the sea surface [Taljaard and Van Loon, 1984]. Today, the mean modern SST at this site has been documented at 10°C for Tc and 18°C for Tw [Hoflich, 1984].

Faunal Sample Preparation

Sediment samples, with a mass of ~2-3 gm, were cut from each core at 5.0 cm intervals. The sequence of sample processing is diagrammed in Figure 2. The samples were oven dried at 40°C. This low temperature prevents any isotopic exchange [Shackleton and Opdyke, 1973]. The samples were then weighed on a Mettler AE420 balance and placed in 125 ml Erlenmeyer flasks containing a 50 ml solution of 1000 ml demineralized water prefiltered through a 0.45 µm Millipore® filter and 4.0 gm sodium metaphosphate ($NaHPO_4$). The flasks were then placed in a Precision Scientific Reciprocal Shaking Bath Model 50 set at 140 oscillations per minute for 3 hours or until the sample completely disaggregated. Each sample slurry was poured through a 63 µm sieve attached to the rim of a 1000 ml beaker. The sieve was washed three times (twice with deionized water and once with distilled water) or until all the fine fraction (e.g., <63 µm) was sieved into the beaker. Sieves containing the coarse fraction (e.g., >63 µm) were oven dried 40°C and stored in a dessicator until reaching ambient temperature. The coarse fraction was then weighed on a Mettler balance, split into two equal fractions with a sediment microsplitter, and placed into two 1.0 dram vials labeled with core name, depth, and size fraction. One vial was labeled FNL for faunal counts and a second vial was labeled O18 for oxygen isotope analysis. Raw faunal samples were then sieved through a 150 µm mesh sieve. These samples were then dry sieved using a 250 µm and a

150 μm mesh sieve. Census counts of forams were conducted from both the 250 μm and 150 μm fractions using a WILD M3Z binocular microscope. Each planktic foraminifera split contained a minimum of 300-400 individuals necessary for statistical analysis [Imbrie *et al.*, 1973; Molfino *et al.*, 1982]. Individual foraminifera were fixed to standard 60 hole micropaleontological slides with their umbilical side oriented up so that the axis of coiling was in the vertical position.

All planktic foram species were identified and counted for this study (Table 2, Appendix A) following established methods and taxonomies [Parker, 1962; Bé, 1967; Imbrie and Kipp, 1971; Kipp, 1976; Bé, 1977; Climate Long Range Investigation, Mapping and Prediction (CLIMAP), 1981; Hembleben *et al.*, 1989] except for the P/D intergrade, as discussed later. Twenty-nine of these species are used in factor analysis. Census counts for this study numbered 455 samples. Additionally, the number of planktic foraminifera fragments as well as whole benthic foraminifera, diatoms, and radiolarian were counted.

Calcium Carbonate Analysis

Calcium carbonate in each core was analyzed at 10 cm intervals at Lamont Doherty Earth Observatory using coulometric titrimetry following acidification with hydrochloric acid [American Society for Testing Materials, 1982] with a UIC Coulometrics CM-5012 CO_2 Coulometer coupled to the CM5130 Acidification Module. Analytical precision was ±0.5% [Verardo, 1992].

Stable Isotopes

Approximately twenty adult *Globigerina bulloides* tests, weighing a minimum of 0.5 mg, were picked from the >355 μm size fraction of the O18 vial from each core at a sampling interval of 10 cm (Appendix B). *G. bulloides* were used for stable isotope analyses because they are abundant in both RC11-86 and V34-157. Adults were chosen because at maturity, after gametogenesis, individuals no longer precipitate calcium carbonate tests. Therefore, the oxygen isotopic signal of the calcareous test, initially precipitated in equilibrium with seawater, is preserved. Each test was briefly sonicated in distilled water to clear the chambers of sediment. Stable oxygen isotopic ($\delta^{18}O$) measurements were made with an automatic carbonate preparation system coupled to a Finnigan MAT-251 mass spectrometer at the Oregon State University Stable Isotope Mass Spectrometry Laboratory. Calibration to the PDB standard was by National Institute of Standards and Technology standards NBS-16, NBS-17, NBS-19, and NBS-20. Analytical precision was better than ±0.06‰ [Mix *et al.*, 1991].

Chronostratigraphy

The $\delta^{18}O$ record from planktic forams in deep-sea sediments primarily reflects high-latitude ice volume [Shackleton and Opdyke, 1973]. Changes in $\delta^{18}O$ are globally synchronous in open ocean cores and provide a framework for chronostratigraphy over the last 1.0 million years limited only by regional ocean mixing and bioturbation [Shackleton and Opdyke, 1973]. Intercore stratigraphic correlation in RC11-86 and V34-157 was established using $\delta^{18}O$ records of the planktic foraminifera *G. bulloides*. This species lives in shallow water [Bé, 1977] and reflects changes in water temperature and global ice volume [Malgrem and Kennett, 1976]. Age models (Table 3) for each core were produced by identifying isotopic events in each $\delta^{18}O$ isotopic record according to the criteria originally defined in the Spectral Mapping Project (SPECMAP) [Pisias *et al.*, 1984; Imbrie *et al.*, 1984]. Each core's isotopic record was correlated to the SPECMAP oxygen isotope stacked record of Imbrie *et al.*, [1984] using the chronology of Martinson *et al.*, [1987]. Each core's isotope record (Figure 3) is coherent and in phase with the SPECMAP stack (Table 4) at the primary Milankovitch periods. While the $\delta^{18}O$ in RC11-86 does not mimic the SPECMAP record in some intervals, all the major transitions are present as evidenced by its strong coherency and phasing with the SPECMAP signal.

Cores RC11-86 and V34-157 are from different oceanographic regions and differ in their sedimentation rates. The mean sedimentation rate in RC11-86 is 1.62 cm/kyr and 3.80 cm/kyr in V34-157. Plots of depth-age relationships for each core do not contain any marked discontinuities and indicate these cores are characterized by continuous sedimentation over their length (Figure 4). Glacial and interglacial periods are delineated by isotopic stages with their boundaries defined as follows [Imbrie *et al*, 1984]: interglacial stage 1, 1-12 Ka; glacial stage 2, 12-24 Ka; glacial stage 3, 24-59 Ka; glacial stage 4, 59-71 Ka; interglacial stage 5, 71-128 Ka; glacial stage 6, 128-186 Ka, interglacial stage 7, 186-245 Ka; glacial stage 8, 245-303 Ka; interglacial stage 9, 303-339 Ka; glacial stage 10, 339-362 Ka; interglacial stage 11, 362-423 Ka; glacial stage 12, 423-478 Ka; interglacial stage 13, 428-524 Ka; glacial stage 14, 524-565 Ka; interglacial stage 15, 565-620 Ka; glacial stage 16, 620-659 Ka; and interglacial stage 17, 659-689 Ka.

Taxonomy

The problem of the *Neogloboquadrina pachyderma-Neogloboquadrina dutertrei* intergrade (P/D) was first introduced by Kipp [1976]. Although the P/D intergrade has been used extensively in census counts it was never formally taxonomically defined or illustrated by Kipp. Initial examination of the planktic forams in RC11-86 showed that distinctive criteria were needed to differentiate individuals of *N. dutertrei* and *N. pachyderma* (dextral) from P/D and thus, it was necessary to refine the taxonomy. Sea surface temperature estimates in RC11-86, using Kipp's unpublished criteria for P/D in RC11-86, yielded cooler SST when compared to the modern world [Hoflich, 1984; Gordon, 1985] and paleo SST estimates from the western Indian Ocean show warm temperatures in the Agulhas Current region [Prell and Hutson, 1979]. *N. dutertrei* is a subtropical species and *N. pachyderma* (dextral), a subpolar species. A large number of P/D will produce cooler SST because P/D are factored into the temperature equation as a subpolar "species". The taxonomic criteria for P/D in the Agulhas region were scrutinized and revised for this study to develop a taxonomy that reflects the morphology of the local fauna.

N. pachyderma (Ehrenberg) is a small (~0.45 mm), compact trochospiral foraminifera with a thickened test and highly variable morphology [Srinivasan and Kennett, 1976; Kennett and Srinivasan, 1980] (Figure 5). This species has thicker-walled tests in high latitudes [Parker, 1962; Kennett, 1968]. It is nonspinose although spines are found on juvenile individuals [Bé, 1967]. The test shape is quadrate to subquadrate with ~4-4.5 subquadrate chambers in the peripheral whorl [Kennett and Srinivasan, 1980]. The umbilicus is shallow, relatively small and thin, and consistently umbilical-extraumbilical with the maximum dimension always confined to its umbilical region and a distinct lip on the final chamber [Cifelli and Smith, 1970; Srinivasan and Kennett, 1976] (Figure 6). The early stage coils are flattened while later stages show a slight tendency to become conically coiled, although considerably less than *N. dutertrei* [Cifelli and Smith, 1970]. Adults have a coarse crystalline texture and coil both sinistrally (left) and dextrally (right). The dextral morphotype is found in subpolar to temperate waters (5°-14°C) while the sinistral variety is found primarily in polar regions (0°-5°C) [Bandy *et al.*, 1967; Kennett, 1968; Reynolds and Thunell, 1986].

N. dutertrei (d'Orbigny) is a large (~0.75 mm) foraminifera which is nonspinose and coarsely pitted (Figure 5). In tropical specimens, the test wall is uniformly to moderately perforate with distinct pore pits. In subtropical specimens, the pore pits are partly to fully constricted by euhedral calcite crystals [Srinivasan and Kennett, 1976]. The large test is low trochospiral and has five to seven large hemispherical chambers in its peripheral whorl [Cifelli and Smith, 1970]. The arched aperture is of average height and remains umbilical-extraumbilical throughout ontogeny. Often the apertural plate is reduced to an apetural lip exposing the umbilicus. Teeth are not always present [Cifelli and Smith, 1970; Srinivasan and Kennett, 1976] and later chambers encircle the umbilicus. Sutures are deeply incised on the umbilical side, and much more incised than *N. pachyderma* (Figure 6). The early stages begin as flat, compressed coiled forms which become conical with growth [Cifelli and Smith, 1970]. Predominantly dextrally coiled, *N. dutertrei* is most often found in subtropical waters (12°-24°C) and boundary currents [Parker, 1962; Bandy *et al.*, 1967, Bé and Hutson, 1977].

Kipp [1976] classified P/D as any foraminifera that did not fit precisely into either the *N. dutertrei* or *N. pachyderma* (dextral) taxonomies. Unpublished taxonomic guides of P/D only explained foraminifera from tropical Atlantic and North Atlantic Ocean sediments and differed from the taxonomy of individuals from the Southern Ocean [Kipp, unpublished data for RC11-86].

In the Cape Agulhas region, *N. pachyderma* and *N. dutertrei* have variable morphologies. For example, *N. pachyderma* (dextral) is not always as quadrate as typical *N. pachyderma* and the aperture tends to be larger. The most important characteristic of *N. pachyderma* (dextral) is that the test can have up to 4.5 chambers in the final whorl as long as the test remains subquadrate and compact. The final chamber is approximately the same size as the preceding chamber. These criteria apply only to the dextral morphotypes. In the Agulhas region, *N. dutertrei* rarely resemble the large, round individuals that are often cited [Saito *et al.*, 1981; Kennett and Srinivasan, 1983]. Rather, *N. dutertrei* are smaller, compressed, and show less relief than their tropical counterparts. In addition, they do not always have a complete final whorl of hemispheric chambers. However, the final chamber is always larger than the preceding chamber and contains more relief [Cifelli and Smith, 1970]. The aperture continues to be centrally located although it is often not as wide or as deep as a typical *N. dutertrei*. If the foraminifera is difficult to identify but possesses the characteristic *N. dutertrei* texture (e.g., coarsely pitted), it is labeled as *N. dutertrei*.

A gradational and continuous genetic series may exist from *N. pachyderma* (sinistral) from polar waters to *N. pachyderma* (dextral) from subpolar waters and finally to *N. dutertrei* from subtropical waters. The *Neogloboquadrina* species are linked within a geographical cline and differences between the species are environmental rather than genetic [Bé and Tolderlund, 1971; Kennett and Srinivasan, 1980]. The greatest number of P/D in the Agulhas region occurs within transitional waters where the northern range of *N. pachyderma* (dextral) overlaps the southern range of *N. dutertrei*. The P/D in this region are a localized morphotype because more P/D are found in RC11-86 than in V34-157. V34-157 has a lower mean SST than RC11-86, contains more *N. pachyderma* (dextral and sinistral), and less *N. dutertrei*. If SST is warm, there are greater numbers of *N. dutertrei*. If SST is cooler, there are greater numbers of *N. pachyderma* (dextral).

Consequently, in the Agulhas Current region P/D is described as: 1) close in size to *N. pachyderma* (dextral) and only occasionally larger than 250 μm; 2) tests are compressed, and not as quadrate as *N. pachyderma* (dextral); 3) the umbilicus is relatively large, often with an apertural lip; and 4) the final chamber is the same size as or smaller than the preceding chamber, and the texture is crystalline on the final whorl (Figures 5 and 6).

RC11-86 and V34-157 were recounted according to the new P/D criteria and the resulting SST were compared with the regional modern SST to examine how well the paleo-estimates approximate modern measurements. In the modern world, SST at the sites of RC11-86 and V34-157 are derived from regionally extrapolated ship measurements from the South Atlantic Ocean [Hoflich, 1984]. In V34-157, modern SST measurements are 10°C for Tc and 18°C for Tw while core top (e.g., 1.5 Ka) estimated SST are 8.0°C for Tc and 18.4°C for Tw. A direct comparison of modern temperature measurements and core top estimated SST in RC11-86 is difficult because the core top was depleted by prior sampling. The highest stratigraphic level available for sampling was at 3.0 cm (e.g., 2.8 Ka.) At this level, SST was estimated as 16.5° for Tc and 25.4°C for Tw as compared to modern measurements of 16°C for Tc and 23°C for Tw. Modern

SST measurements and paleo-estimates at both sites compare favorably, caveats regarding core-top ages and regionally extrapolated ship measurements notwithstanding.

A comparison of the resulting estimated SST in RC11-86 using both Kipp's P/D criteria and the new P/D criteria yielded correlation coefficients between the time series of 0.90 for Tc and 0.40 for Tw. The largest SST departure was in glacial isotope stages 2-4 where Tw differs by as much as 5°C (Figure 7). The only difference from the two foram counting techniques are the quantities of *N. dutertrei*, P/D, and *N. pachyderma* (Appendix C).

Results

All data are presented in the time domain rather than the depth domain to maintain consistency with temporal forcing functions.

Planktic Foraminifera Abundance

In the Agulhas Current region, a single planktic foraminifera species cannot describe either modern or paleoceanographic conditions. However, examination of the time series of the dominant planktic species in each core can provide insights as to surface water conditions. The relative abundance (%) of each planktic species was calculated by dividing the number of individuals of a species by the total number of forams in a sample. The downcore planktic foraminifera census of RC11-86 consists of 28 species, 1 intergrade group, and 1 "other" group, composed of unidentified planktic foraminifera (Figure 8). In RC11-86, *Globorotalia inflata*, *Neogloboquadrina pachyderma* (dextral), *Globigerina bulloides*, *Neogloboquadrina dutertrei*, and the P/D intergrade account for the majority (e.g., 77.6%) of planktic foraminifera (Table 5) as discussed below. The dominant species in RC11-86 is *G. inflata* which varies from 10-49% and is indicative of transitional waters, which are surface waters with properties intermediate between subpolar and subtropical waters [Bé and Tolderlund, 1971; Hutson, 1977]. The second most abundant species, *N. pachyderma* (dextral), varies from 3-33%. On the basis of the changes in its abundance signal, *G. bulloides* shows differing characteristics in the intervals 688-300 Ka and 300-2.8 Ka. In the interval 688-300 Ka, *G. bulloides* ranges in abundance from 11.9-29.6%. Over the interval 300-2.8 Ka, its abundance varies from 6.6-20.2%. Both *N. pachyderma* (dextral) and *G. bulloides* are indicators of subpolar waters.

The subtropical species, *N. dutertrei* exhibits differing abundance in the intervals 688-300 Ka, 300-134 Ka, and 134-2.8 Ka. In the interval 688- 300 Ka, *N. dutertrei* varies in abundance from 4.9-22.4%. Over the interval 300-134 Ka, it decreases in abundance from 14.3-4.4%. In the interval 134-2.8 Ka, *N. dutertrei* increases its abundance from 4.8-26.6%. The abundance signal of P/D, a subpolar group, is characterized by three distinct intervals. In the interval 688-300 Ka its abundance increases from 0.3-10.3% while in the interval 300-128 Ka, P/D abundance decreases from 9.8-2.1%. In the upper part of the core, P/D increases its abundance from 0.8-8.9%. *Globigerinoides ruber*, an indicator of tropical waters, increases in abundance during interglacial stage 5 as well as increases its abundance with an average of 3% in the interval 688-300 Ka to an increasing abundance from 4-8% in the interval 300 Ka-present. *Globigerinoides sacculifer*, an indicator of subtropical waters, also increases in abundance during interglacial stage 5 as well as increases its abundance from 1% in the interval 688-300 Ka to 2.5% in the interval 300 Ka-present. In addition, *Globigerina falconensis*, *Globorotalia truncatulinoides* (sinistral), *Orbulina universa*, *Globigerinella aequilateralis* and *P. obiquiloculata* exhibit greater abundances during interglacials.

Core V34-157 has a lower diversity of planktic foraminifera than RC11-86 (Figure 9) and is composed of 26 species, 1 intergrade group and 1 "other" group. Both *Globorotalinoides hexagona* and *Tenuitella iota* are absent from V34-157. In V34-157, *N. pachyderma* (dextral and sinistral), *G. bulloides*, and *G. inflata* account for the majority (e.g., 83.9%) of planktic foraminifera (Table 6) as documented below. The time series of foram abundance in V34-157 differed markedly from those of RC11-86. The dominant species in V34-157 is the subpolar species, *N. pachyderma* (dextral), which varies from 13-50%. The abundance of *G. bulloides*, also indicative of subpolar waters, has a mean abundance of 24.8% with a range of 14.0-40.8%. *G. inflata* decreases in abundance in the interval 330-40 Ka from 32.1-5.1% then increases to 22.0% into the Holocene. *N. pachyderma* (sinistral) exhibits the greatest variability of any species in the core. Abrupt shifts in its relative abundance are evident at glacial/interglacial boundaries with greater abundances occurring in glacials, especially in stage 6. The subpolar foram, *Tenuitella quinqueloba*, increases in relative abundance from 0% at 330 Ka to 7.1% in the Holocene. In addition, *Globorotalia truncatulinoides* (sinistral), *Orbulina universa*, *Globigerinella calida* and *Globigerinoides ruber* exhibit greater abundances during interglacial stage 5.

Factor Analysis

Planktic foraminifera biogeographies were expressed in terms of six assemblages (e.g. tropical, subtropical, transitional, subpolar, polar, upwelling) derived from Q-mode factor analysis [Imbrie *et al*, 1989]. Q-mode factor analysis was applied to the core top planktic census counts thereby defining these foraminiferal assemblages. Past studies have shown that foraminifera assemblages represent specific oceanographic environments [Imbrie and Kipp, 1971]. Results of factor analysis in RC11-86 and V34-157 are summarized by the varimax factor matrix (Appendix D) and the factor score matrix, AOF20 [SPECMAP Archive 1, 1989]. Varimax assemblages, calculated with transfer function equation AOF20, are delineated by the factor score matrix. Species with the highest factor loading are the dominant species in each assemblage. Equation AOF20 is composed of 29 species from core tops of the North and South Atlantic Ocean to ~10°S latitude [SPECMAP Archive 1, 1989]. Those species with the highest factor loadings are the dominant species in the assemblage. Although several species comprise a single foram assemblage, environmental conditions may favor one or only a few species because the assemblages lies within the species' ecologic optima, as in RC11-86 and V34-1567. The tropical assemblage is characterized by the dominance of *G. ruber*. The dominant species for the subtropical assemblage are *G. sacculifer*, *N. dutertrei* and *G. menardii*. *G. inflata* dominates the transitional assemblage while the subpolar assemblage is dominated by *G. bulloides*, *N. pachyderma* (dextral) and P/D. The dominant species in the polar assemblage is *N. pachyderma* (sinistral). The species exhibiting the greatest factor loading in the upwelling assemblage is *G. bulloides*.

In RC11-86, paleo-SST estimation is primarily controlled by two assemblages. The transitional assemblage is the dominant factor in RC11-86 and accounts for 55.4% of the total variance (Table 7; Figure 10). The next significant factor belongs to the subpolar assemblage which accounts for 22.8% of the total variance. Other assemblages in RC11-86 include the subtropical assemblage which accounts for 3.2%, the tropical assemblage which accounts for 1.1%, and the polar assemblage which accounts for 0.5% of the total variance. Both the subtropical and polar assemblages have consistently low factor loadings throughout the entire core length. The upwelling assemblage, although highly variable through time, exhibits low factor loadings accounting for 1.1% of the total variance.

Like RC11-86, V34-157 is primarily influenced by two assemblages (Table 7). However, the dominant factor in V34-157 is the subpolar assemblage which projects a strong and steady influence (e.g., 51.6% of total variance) over time (Figure 11). The transitional assemblage accounts for 13.8% of the total variance, and exhibits slightly increased factor loadings in interglacials. The polar assemblage accounts for 8.1% of the total variance and shows abrupt changes. Although not a dominant assemblage (e.g., 1.7% of total variance) the upwelling assemblage is highly variable during the last 150,000 years. The tropical assemblage and the subtropical assemblage account for 0.07% and 0.04% of total variance, respectively.

Communality (Figure 12) is the sum of squared factor loadings for each sample and explains how well each sample reflects the faunal composition of the coretop factor matrix (AOF20). The six assemblage model for RC11-86 has a mean communality of 0.839 and a range of 0.948 to 0.565. Mean communality in V34-157 is 0.748 and ranges from 0.917 to 0.612. Mean communality in both cores reflects the faunal character of the AOF20 factor matrix, which consists of planktic foraminifera from core tops of the North and South Atlantic Oceans, as far south as 10°S latitude. At present, there is no transfer function specific to the Agulhas Current region that reflects input from the Indian Ocean. This situation arises out of the paucity of core top coverage in the region. Therefore, AOF20 was used as it was the best available transfer function.

Estimated Sea-Surface Temperatures

Planktic foraminifera were used to measure the surface ocean's response to varying climatic and oceanographic conditions with the assumption that the modern world is equivalent to the warm end member of climate [McIntyre *et al.*, 1989] and because individual species adapt to water mass properties such as temperature, salinity, and nutrients [Bé, 1977]. Sea surface temperatures were estimated by applying transfer function AOF20 (Table 7) to the foraminifera assemblages [Kipp, 1976; SPECMAP Archive 1, 1989]. Estimates of SST are expressed in terms of warm and cold temperature end members that are abbreviated Tw for warm and Tc for cold temperature equations. The error of estimate in SST using AOF20 is ±1.5°C [SPECMAP Archive 1, 1989]

The estimated sea surface temperature signals from V34-157 and RC11-86 differ greatly (Figure 13; Appendix E). SST signals from V34-157 are characterized by high-amplitude variation in both Tc and Tw signals. The maximum and minimum for Tc are 11.7°C and 6.4°C, respectively, while those for Tw are 18.6°C and 11.2°C. In V34-157, signals of Tc and Tw are highly correlative (r=0.90). The temperature range is 5.3°C in Tc and 7.4°C in Tw. The signals of Tc and Tw show similar structure in winter and summer temperatures. Both SST signals in V34-157 record an increase in SST during interglacials and a corresponding decrease in temperature during glacials.

Conversely, in RC11-86, SST are poorly correlative (r=0.48) (Figure 13). The maximum and minimum for Tc are 16.9°C and 11.3°C, while those for Tw are 25.3°C and 18.4°C. In RC11-86, the temperature range is 5.6°C in Tc and 7.9°C in Tw. The Tc signal in RC11-86 shows a glacial-interglacial structure, but not as pronounced as Tc in V34-157. Furthermore, SST signals in RC11-86 show a warming trend of 3.5°C in Tc and 2.8°C in Tw over the interval 688 Ka-present, as calculated with a least-squares line. Part of this warming trend results from biasing of the SST signal by dissolution of solution-prone planktic foraminifera species, as discussed later. V34-157 shows no warming-cooling trend in SST.

Seasonality (Figure 13) is a measure of the annual range of SST variability (e.g., Tw minus Tc). Seasonality in RC11-86 ranges from 5.3°C to 11.6°C with a mean of 9.0°C. The seasonality of RC11-86 is greatest in glacials and is primarily controlled by fluctuations in Tc. Seasonality in V34-157 ranges from 3.9°C to 7.5°C with a mean of 5.7°C. The seasonality in V34-157 is less variable, except for an excursion in stage 9 to 4°C. The correlation coefficient between seasonality signals in RC11-86 and V34-157 is low (r=0.35) underscoring the dissimilarity of seasonality between the core sites.

Discussion

Dissolution

The extent of dissolution of calcium carbonate in RC11-86 and V34-157 was examined to evaluate its potential biasing effect on the fossil foram assemblage and SST even though both RC11-86 and V34-157 are above the present lysocline, as defined by Takahashi *et al.*, [1980]. Berger [1976] showed that foram species vary in their resistance to carbonate dissolution so that increased dissolution could preferentially eliminate solution prone species. Although there is no single unambiguous dissolution index, five separate lines of inquiry were followed to examine carbonate dissolution in the Agulhas Current area (Figure 14); (a) downcore bulk calcium carbonate (Appendix F); (b) abundance of the planktic foraminifera species, *Pulleniatina obliquiloculata* [Kipp, 1976] (c) abundance of planktic foraminifera fragments, using the ratio of the number of planktic forams to the number of planktic forams plus planktic foram fragments [Thunell, 1976] (Appendix G); (d) abundance of benthic foraminifera, using the ratio of the number of whole benthic forams to the number of whole planktic forams plus whole benthic forams [Crowley, 1983; Tappa and Thunell, 1984]; and (e) dissolution sensitivity test.

Downcore calcium carbonate concentration in RC11-86 (Figure 14a) varies from 46.5-91.2% with a mean of 73.7%. In glacial stage 14, calcium carbonate concentration is much lower. If stage 14 carbonate minima is removed, the mean becomes 75.9%. Calcium carbonate in V34-157 (Figure 14b) varies downcore from 64.6-86.7% with a mean of 80.8%. The correlation coefficient between carbonate concentration in RC11-86 and V34-157 is low (r=0.21) and illustrates the dissimilarity of calcium carbonate records between both sites. Carbonate records of the Southern Ocean show higher concentration of $CaCO_3$ in interglacials than in glacials [Howard and Prell, 1994]. Carbonate signals in RC11-86 and V34-157 do not show such distinctive interglacial maxima and glacial minima except in glacial stage 14 in RC11-86. Since the calcium carbonate content in marine sediments is controlled by the balance between productivity, dissolution, and dilution by non-carbonate sedimentary components, variation in carbonate concentration alone is not a reliable index of dissolution [Berger, 1976; Thompson, 1976; Howard and Prell, 1994].

Using the relative abundance of the thick walled planktic foraminifera *P. obliquiloculata* in a foraminifera assemblage, Kipp [1976] suggested that a relative abundance >5% for *P. obliquiloculata* may indicate intervals of carbonate dissolution. The relative abundance of *P. obliquiloculata* never exceeds 2% in either RC11-86 (Figure

6) or V34-157 (Figure 7) indicating that, by this evidence alone, carbonate dissolution is minimal at these sites.

Planktic foraminifera fragmentation was calculated as the ratio of planktic foram fragments to whole planktic forams plus fragments. The number of planktic foram fragments alone is not a decisive indication of dissolution as fragments may result from mechanical breakage during processing. The fragmentation ratio in V34-157 (Figure 14d) varies little from 0.25 throughout the core length although at the bottom of the core, in the interval 330-275 Ka, the signals contain isolated maxima. This low ratio and its constancy over time indicates that calcium carbonate dissolution is negligible in V34-157. However, in RC11-86 (Figure 14c) the foram fragmentation data indicates a different dissolution history. In this core, the data indicates a trend towards decreasing fragmentation from the oldest to youngest sections of the core (e.g., from 0.60 to 0.20). Furthermore, there is greater fragmentation in the interval 688-300 Ka than from 300 Ka-present. The correlation coefficient (e.g., least-squares linear regression) between calcium carbonate concentration and the fragment ratio is 0.33 over the entire core length. If the core is divided into the two sections described above, however, then $r=0.24$ in the interval 688-300 Ka and $r=0.04$ for 300 Ka-present. This indicates greater relative dissolution in RC11-86 within the older section of the core.

Benthic to planktic foram ratios have been used to evaluate calcium carbonate dissolution which selectively favors the preservation of larger and thicker walled benthic forams. A ratio of ≥ 0.5 is presumed to indicate carbonate dissolution [Crowley, 1983]. Variation in benthic foram abundance, however, could also be related to differing deep water masses and associated benthic ecology [Thunell, 1976]. The ratio of benthic foraminifera to total planktic forams plus benthic forams in both cores was low (e.g., <0.2) (Figure 14e, f). A relatively high correlation between planktic fragments and benthic foraminifera ratios may indicate some carbonate dissolution at the site of RC11-86 assuming fragmentation is due to thinning of the tests. When the planktic foram fragment ratio was regressed against the benthic foraminifera ratio in RC11-86, the resulting correlation coefficient was r=0.69 (n=215) for the entire core. In the interval 300 Ka-present, the correlation coefficient was r=0.51 (n=128) and in the interval 688-300 Ka, r=0.69 (n=87). Although these intervals sample different data populations, the stronger covariance between fragments and benthics, in the interval 688-300 Ka, indicates greater dissolution than in the younger section. On the basis of the fragmentation and benthic data, calcium carbonate dissolution appears to be weak in V34-157 but somewhat more aggressive in RC11-86 in the interval 688-300 Ka.

Two tropical-subtropical solution-prone planktic foraminifera species, *G. ruber* and *G. sacculifer*, have greater abundances in the interval 300 Ka-present compared to 688-300 Ka in RC11-86. In the interval 300 Ka-present, *G. ruber* has a mean abundance of 4.13% and *G. sacculifer* has a mean abundance of 1.45%. In the interval 688-300 Ka, the mean abundance in *G. ruber* and *G. sacculifer* decreased to 2.53% and 0.71%, respectively. The changes in mean abundance for *G. ruber* and *G. sacculifer* represent 63% and 100% increases, respectively, from older to the younger sections of the core. These solution-prone species were used in a sensitivity experiment to determine if SST was modified by their dissolution. Two end-members (e.g., 10% and 100%) were chosen to bracket the response of SST to solution of these foram species. The original faunal counts of *G. ruber* and *G. sacculifer* in RC11-86 were increased by 10% and 100% over the entire core length, and these new counts were entered into AOF20. This produced a modified SST in which Tc increased by 0.09°C and Tw by 0.08°C for the 10% test and by 0.98°C and 0.70°C, respectively, for the 100% increase. The results of this sensitivity test indicate that dissolution of the warm water species *G. ruber* and *G. sacculifer* in RC11-86 decreased SST by as much as ~1°C.

Taken as a whole, these five independent lines of evidence for calcium carbonate dissolution indicate that dissolution of calcareous tests in V34-157 was minimal but greater in RC11-86, especially in the older section of the core. Consequently, dissolution of solution-prone warm water foraminifera species decreased SST in RC11-86.

Modern Oceanography

The ocean corridor poleward of South Africa is a critical link in the interhemispheric transport of oceanic heat and salt at the surface [Gordon, 1986] and at depth [Broecker and Peng, 1982]. The Agulhas Current is the only source of warm, high salinity water south of 30°S in the western Indian Ocean [Hutson, 1980; Gordon, 1985, 1988]. The bulk of the Agulhas flow is associated with a strong anticyclonic gyre situated west of 45°E between 27°-40°S in the Indian Ocean [Wyrtki *et al.*, 1971; Gordon, 1985, 1986]. The Agulhas Current receives water from the South Equatorial Current at the northern tip of Madagascar where it then receives additional input from the East Madagascar and Mozambique Currents [Wyrtki *et al.*, 1971; Harris, 1972; Lutjeharms, 1976, 1981; Hutson; 1980; Saetre and daSilva, 1984; Gordon, 1986]. Estimates of volume transport for the Agulhas Current vary from ~44-75 sv (1 sv =10^6 m^3/s) [Grunlingh, 1980; Toole and Raymer, 1985]. The Agulhas Current turns westward as it follows the southern margin of the African continent and separates from the continental margin near 27°E. The Current curls back into the Indian Ocean causing lateral disturbances and producing mesoscale variabilities causing shedding of large anticyclonic rings further downstream in the Agulhas Retroflection [Bang and Pearce, 1970; Harris *et al.*, 1978; Grundlingh and Lutjeharms, 1979; Lutjeharms and Baker, 1980; Lutjeharms, 1981; Taljaard and Van Loon, 1984; Gordon, 1985, 1988; Olson and Evans, 1986; Gordon *et al.*, 1987; Ludjeharms and Gordon, 1987; Ludjeharms and van Ballegooyen, 1984; 1988, Ludjeharms & Valentine, 1988; Gordon and Haxby, 1990]. These rings, estimated to be the largest in the world, are introduced at the eastern boundary of the South Atlantic Ocean and are a source of inter-basin heat and salinity exchange [Olson and Evans, 1986; Olson *et al.*, 1992]. The volume flux of Indian Ocean waters via the Agulhas Current eddies is estimated at ~6.3 Sv for waters warmer than 10°C and ~7.3 Sv for waters warmer than 8°C [van Ballegooyen *et al.*, 1994].

The most southerly penetration of the Agulhas Current is directly associated with the position of the Subtropical Convergence (STC), which exhibits well developed latitudinal gradients of temperature and salinity at the sea surface and at depth while separating warm Indian Ocean water from cool, subpolar water [Prell *et al.*, 1979; Lutjeharms, 1985]. Ocean temperatures vary from 17.9°C to 10.6°C [Prell *et al.*, 1980; Lutjeharms and Valentine, 1984] and salinity ranges from 35.5‰ to 34.3‰ [Lutjeharms, 1985]. In the modern world, the STC is located at 41°S and its position is linked to circulation patterns in the Southern Indian Ocean [Prell *et al.*, 1979; Lutjeharms and Valentine, 1984]. At present, there is a persistent front at 39°S and a secondary front at 41°S. The northernmost front is the Agulhas Front and the southernmost frontal boundary is the Agulhas Return Current, with the area between the two fronts consisting of eddies and meanders [Lutjeharms, 1985; Olson and Evans, 1986]. Not all Agulhas Current water returns to the Indian Ocean via the Agulhas Retroflection and the West Wind Drift. As much as 60% of Agulhas water that flows into the South Atlantic Ocean is transported northward via the Benguela Current [Gordon, 1985, 1986, 1988; Gordon *et al.*, 1987; Gordon and Haxby, 1990; Gordon *et al.*, 1992]. This estimate includes both Current flow and eddy transport. The South Atlantic Ventilation Experiment (SAVE) Leg 4 provided strong evidence of significant exchange between Atlantic and Indian Ocean thermocline waters within the inter-ocean conduit south of Africa [Gordon *et al*, 1992]. Approximately two thirds of the water in the 9°-14°C thermocline stratum and all surface water warmer than 14°C is derived from the Indian Ocean. One-half of the lower thermocline and the Antarctic Intermediate Water (AAIW) is derived from the Indian Ocean. At greater depths there appears to be no water mass linkage between the Atlantic and Indian circulation gyres [Gordon *et al.*, 1992]. It is likely that the transfer of warm Indian Ocean water into the Atlantic Ocean contributes to the equatorwards heat advection north of 18°S and may mark the northern limit of direct contact of Indian Ocean water with the eastern South Atlantic Ocean [Gordon, 1985].

Faunal Assemblages

The distribution of foraminifera species reflects the interaction between living populations, geographical barriers, and surface ocean characteristics (e.g., temperature, salinity, nutrients). Planktic foraminifera are well adapted to specific physical and chemical characteristics of surface and near surface waters and are useful tracers of water masses and oceanic fronts. Changes in the biogeography of assemblages reflect changing oceanic environments [Kipp, 1976; Bé, 1977; Prell *et al.*, 1980]. For example, the equatorwards migration of polar dominant fauna indicates the equatorwards migration of cold, polar water masses [Howard and Prell, 1992].

Today the tropical assemblage is found primarily north of 10°S, as well as within the Agulhas Current, and is associated with the continuous southward flow of warm (e.g., 24°-30°C), high salinity water along the African coast (Figure 15). This indicates that the tropical Indian Ocean is the warm water source [Bé and Hutson, 1977; Prell *et al.*, 1979]. In the modern world, the subtropical assemblage inhabits water of 18°-24°C and is present from the equator to ~37°S. During the Last Glacial Maxima (LGM), its range was greatly decreased to ~25°S [Prell *et al.*, 1980]. The tropical and subtropical assemblages are not common in either RC11-86 or V34-157 as the cores do not lie within the assemblage's biologic optima. The transitional assemblage is found in high salinity water of 10°-18°C between 30°-42°S [Bé and Hutson, 1977; Prell *et al.*, 1979; Thunnell and Belyea, 1982]. Changes in the abundance of transitional species indicate that advection of warm water into the South Atlantic Ocean was less intense and/or more variable during glacials than today [Hutson, 1980]. Using this assemblage, Prell *et al.*, [1980] suggested that at the LGM, the southern boundary of the transitional assemblage was approximately 2°-5° north of its present position in the Indian Ocean. The distribution of Southern Hemisphere radiolarian, foraminifera, and diatom assemblages also indicates that the glacial STC was 2°-5° north of its present position [Luz, 1977; Morley and Hayes, 1979 a, b; Prell and Hutson, 1979; CLIMAP, 1981]. At present, subpolar waters (e.g., 5°-10°C) are found between latitudes 41°-51°S [Prell *et al.*, 1979]. During the LGM, the subpolar assemblage occupied a zone extending across the western Indian Ocean from 36°-50°S. The boundary between the subtropical and subpolar assemblages closely corresponds to the location of transitional waters and the STC [Prell *et al.*, 1979, 1980; Hutson, 1980]. The polar assemblage is found primarily south of 52°S. This assemblage dominates the southernmost Southern Ocean in both modern and glacial worlds [Prell *et al.*, 1980; Labeyrie *et al.*, 1986]. These faunal-temperature relationships underscore the utility of using foram assemblages to monitor climate and ocean changes as delineated by the geographic migration of the assemblages.

The dominance of the subpolar assemblage in V34-157 indicates that this core has been south of the STC for the last ~300,000 years. The relative increase in factor loading of the transitional assemblage during interglacials in V34-157 indicates surface water warming as the STC migrated south. The predominance of the transitional assemblage in RC11-86 indicates that this site has been primarily influenced by relatively warm transitional surface waters over the last ~700,000 years. However, at specific intervals in glacial stages 2 (e.g., 14.4-19.2 Ka), 8 (e.g., 264 Ka, 270 Ka, and 290 Ka), 12 (e.g., 434 Ka and 464 Ka), and 14 (e.g., 550.5 Ka and 567 Ka) the transitional assemblage was supplanted by the subpolar assemblage. The increased factor loading of the subpolar assemblage during glacials indicates surface water cooling by northward migration of subpolar waters. Species diversity in RC11-86 was high during interglacials and reflects an increase in abundance of subtropical forams as subtropical flow increased from the Indian Ocean to the South Atlantic Ocean.

Planktic foram assemblages in RC11-86 and V34-157 demonstrate the response of surface biota to oceanographic conditions. In RC11-86, the persistence of the transitional assemblage over time indicates consistent delivery of warm water to this site despite the climate-induced northward migration of the STC, as discussed below.

Spectral Analysis

The SST signals from RC11-86 and V34-157 were spectrally analyzed to examine the influence of Milankovitch forcing on the Late Pleistocene regional thermal history. All spectra used in this study, unless otherwise stated, are linear variance spectra of time series at the 95% confidence interval, with no prewhitening, using linear detrend, an autocovariance function, a variable number of data points (N), a Tukey-Hanning variable lag window (M=N+3), and a fixed time interval (T) of 1.0 kyr [Jenkins and Watts, 1968; Bloomfield, 1976; Imbrie *et al.*, 1989].

Spectral analysis of SST in V34-157 shows power at the precessional (23 kyr) period accounting for 20% of the total variance in Tc (Figure 16). Power at the precessional period is embedded within a broad band peak in Tw. Prewhitening of the Tw spectra in V34-157 shows power at the precessional period that accounts for 9% of total variance (Figure 16). In RC11-86, Tc exhibits a well defined low frequency periodicity (~100 kyr) with power at the precessional period comprising 12% of total variance while Tw shows power at the precessional period that accounts for 15% of total variance (Figure 17). Seasonality exhibits significant power (e.g., 9% of total variance) at the precessional period in V34-157, yet, in RC11-86 seasonality exhibits little power (e.g., 3% of total variance) at the precessional period. Power at the obliquity (41 kyr) period is absent.

When the signals of Tc and Tw in RC11-86 are split into two temporal intervals of 2.8-300 Ka and 300-688 Ka, a striking pattern of spectral power distribution emerges (Figure 18). The basis for this temporal split is the increased abundance of planktic fragments, benthic forams, and *G. bulloides* and decreased abundance of *G. sacculifer*, *G. ruber* and P/D, with age. The power spectra of Tc shows slight modification in power distribution in both intervals. Tw, however, shows greater power variation. For example, in the interval 2.8-300 Ka, Tw exhibits power at the 18 kyr period that accounts for 19% of total variance. In the interval 300-688 Ka, high frequency periodicity in Tw manifests itself as power at 21 kyr that accounts for 7% of total variance. Tw in the interval 300-688 Ka exhibits a lower frequency periodicity than Tw in the interval 2.8-300 Ka. The older section of the core also showed greater carbonate dissolution as reflected by the decreased abundance of *G. ruber* and *G. sacculifer* (that alters SST by ~1°C) and increased abundance of the subpolar foram *G. bulloides*.

Cross spectral analysis between SST signals and the SPECMAP stacked $\delta^{18}O$ record (Table 8) were conducted to examine the possible relationship between SST and the SPECMAP stack, a proxy signal of high latitude ice volume. In this analysis, the underlying assumption is that if two signals are significantly coherent and phase locked, then the dependent variable is linearly forced by the independent variable (e.g., ice volume) at that frequency [Pisias, 1983; Pisias and Leinen, 1984]. Phasing between signals corresponds to time by dividing the phase (in degrees) by 360° and then multiplying by the Milankovitch period (kyr). For example, a 48° phase lead is equivalent to ~5.4 kyr at the obliquity period (41 kyr). By convention, orbital geometry associated with forcing toward an interglacial climatic mode is chosen as the zero phase [Imbrie *et al.*, 1989].

In V34-157, Tc is in phase with the SPECMAP stack (Figure 19a) and hence high latitude ice volume at both the 21 kyr and 100 kyr Milankovitch periods yet leads ice volume by ~5.4 kyr at the 41 kyr period. Tw shows marginally coherent response (80% confidence interval) to minimum ice volume at the 21 kyr and 100 kyr periods and leads ice volume by ~5.1 kyrs at the 41 kyr (Figure 19b). This observed lead of ice volume by SST is consistent with other SST records of the southern hemisphere [Howard and Prell, 1992]. In RC11-86, Tc leads SPECMAP $\delta^{18}O$ by 12 kyrs at 100 kyr and shows no coherent response to ice forcing at either 41 kyr or 21 kyrs (Figure 19c). Tw shows no coherent response to ice volume at any of the primary orbital periods (Figure 19d).

In summary, SST signals in RC11-86 show no coherent response to ice volume at 41 kyr - the primary period for direct orbital forcing of high latitude ice volume. Conversely, SST in V34-157 show a strong response to ice volume which suggests a mechanistic link between SST and high latitude ice. This observation is discussed in terms of how northern high latitude ice volume influences SST records of the South Atlantic and how SST is forced by ice volume in V34-157.

V34-157 is south of the present position of the STC. As southern hemisphere sea ice increased during glacials, polar and subpolar water masses moved equatorward and displaced the STC northward [Prell *et al.*, 1979]. Antarctic sea ice seasonal distribution is nearly equal in area to the Antarctic continent and is linked to the STC by variation in the circumpolar westerly winds [Oglesby, 1990]. Seasonal upwelling of relatively warm Circumpolar Deep Water (CPDW) provides the impetus for seasonal meltback of sea ice [Gordon and Huber, 1990; Martinson, 1990]. The modern CPDW acquires its temperature-salinity properties from NADW [Weyl, 1968; Corliss, 1982; Oppo and Fairbanks, 1987; Crowley and Parkinson, 1988; Broecker and Denton, 1989; Howard and Prell, 1992]. The connection between NADW and CPDW provides an interhemispheric link from the north to the south that contributes to seasonal variations in sea ice by controlling latitudinal temperature gradients and the strength of westerly winds [Howard and Prell, 1992]. This connection is evident in records of benthic foraminifera $\delta^{13}C$ gradients between the North and South Atlantic Oceans and the deep Pacific Ocean [Oppo *et al.*, 1990; Raymo *et al.*, 1990] and cadmium-calcium ratios in benthic foraminifera [Boyle, 1984; Boyle and Kegwin, 1985]. The flux of NADW and the attendant export of heat and salt to the southern hemisphere is paced by Milankovitch forcing at orbital periods [Imbrie *et al.*, 1989; Oppo *et al.*, 1990; Raymo *et al.*, 1990]. Variations in the flux of NADW to the South Atlantic provided the mechanism for the growth and decay of sea ice in the Southern Ocean which, in turn, forced the STC north and south in response. V34-157 is well positioned to record this climate-induced migration of the STC and indeed, the SST record records this phenomenon. Both Tc and Tw are influenced by sea ice volume changes that were controlled, in part, by fluctuations in NADW and move in a synchronous fashion in response to glacial/interglacial migrations of the STC. SST in V34-157 show the migration of the STC, not the flow of deep warm Agulhas Return Current water, as it is located on the Agulhas Plateau and is too shallow to be influenced by the Agulhas Return Current.

As the STC migrated northward, the site of RC11-86 was affected during cold seasons, especially during glacial stage 12 as evidenced by the decrease in SST. A similar pattern of cold temperatures in stage 12 was reported from RC17-69, off the Natal coast (31°30'S, 35°01'E), by Prell *et al.*, [1979]. Prell *et al.*, [1980] examined SST from RC11-86 for the interval 0-300 Ka and suggested the core has always been north of the STC. They also noted that the STC traveled no further north than 38°S in the western Indian Ocean during the last glacial period and that the Agulhas was cooler, probably shallower, and had greater seasonal variation during glacials.

Evidence for cooling of the Agulhas Current comes from several independent lines of evidence. Hutson [1980] compared fossil planktic foraminifera from the core top in RC17-69 to the modern data set. He concluded that, during glacials, the Agulhas Current continued to flow around Africa but may have changed some of its physical and chemical characteristics due to cooling in winter. Specifically, the Agulhas was mixed with cooler subtropical waters in winter months and the flow was weakly developed in summer months. Using mollusc species of the Algoa taxa, collected from a South African postglacial marine transgressive sequence, Pether [1994] suggested that the warm Agulhas Current continued to advect heat into the southwestern Atlantic Ocean during glacials. Winter and Martin [1990] used oxygen isotopes to show that, while the Agulhas Current did lose heat (e.g., ~2°C) while flowing south along the African coast, the Current remained warmer than adjoining waters during the past 150 Ka. When their isotope records were converted to temperature, they fell within the range of modern day summer SST (e.g., 20°-26°C) for the Agulhas Current [Vincent and Shackleton, 1980; Levitus, 1982]. The estimated SST for Tw in RC11-86 shows a range of 18°-25° and is in concordance with estimates of Vincent and Shackleton [1980].

SST signals in RC11-86 show persistent flow of warm Agulhas Current water around the southern tip of Africa and that the Agulhas Current was not barred from this path during glacial periods by impingement of the STC on the African coast. If the STC had impinged on the African coast in glacials, then the SST signals of RC11-86 would record a change in water mass temperatures in both Tc and Tw signals simultaneously. The Tc signal in RC11-86 monitors seasonal changes through time within well defined warm and cold SST intervals. The Tw signal remained warm with neither extreme cold or warm temperature departures through time. Therefore, the STC did not intersect the African coast at 35°S but did migrate northward from its present position at 41°S. Both the Tc signal and faunal assemblage data indicate that the Agulhas mixed with cooler subtropical Indian Ocean water during glacials and had greater seasonal variability. The cool water mass lowered the mean temperature of the Agulhas Current during cold seasons although warm water continued to flow around Africa. Consequently, the Benguela Current was then cooled during glacials by seasonal cooling and not from the complete cessation of Agulhas flow.

Conclusions

Planktic foraminifera assemblages and estimated SST in deep-sea cores V34-157 and RC11-86 record a decoupled response of the surface ocean to varying climatic and oceanographic conditions in differing oceanic regimes during the Late Pleistocene. SST signals in V34-157 record the glacial-interglacial migrations of the STC over the past ~300,000 years that result from sea ice expansion and contraction paced by high northern latitude ice volume. This forcing signal was transmitted south via NADW flow.

However, the equatorwards migration of the STC during glacial periods did not prevent the transfer of heat and salt from the Indian Ocean to the South Atlantic Ocean. SST signals in RC11-86 record the flow of warm Agulhas water into the South Atlantic Ocean and document persistent interhemispheric transport of heat and salt over the past ~700,000 years.

Table 1. Core location, depth, studied length, age of core bottom, and mean sedimentation rate.

Core	Latitude	Longitude	Depth, (m)	Length, (cm)	Age, (Ka)	Mean Sedimentation Rate, cm/kyr
RC11-86	35° 8'S	18° 5'E	2829	945	688	1.62
V34-157	41° 9'S	26° 4'E	3636	1135	332	3.80

Table 2. Species of planktic foraminifera used in this study.

Globigerina bulloides d'Orbigny, 1826
Globigerina falconensis Blow, 1959

Globigerinella aequilateralis (Brady), 1897
Globigerinella calida (Parker), 1962
Globigerinella humilis (Brady), 1884

Globigerinita bradyi Weisner, 1931
Globigerinita glutinata (Egger), 1893

Globigerinoides conglobatus (Brady), 1879
Globigerinoides ruber (white and pink varieties) (d'Orbigny), 1839
Globigerinoides sacculifer (with sac and without sac) (Brady), 1877

Globorotalia crassaformis (Galloway and Wissler), 1927
Globorotalia hirsuta (d'Orbigny), 1839
Globorotalia inflata (d'Orbigny), 1839
Globorotalia menardii (Parker, Jones and Brady), 1865
Globorotalia scitula (Brady), 1882
Globorotalia truncatulinoides (dextral and sinestral) (d'Orbigny), 1839

Globorotaloides hexagona (Natland), 1938

Globoturbotalita rubescens Hofker, 1956
Globoturbotalita tenella (Parker), 1958

Neogloboquadrina dutertrei (d'Orbigny), 1839
Neogloboquadrina pachyderma (dextral and sinestral) (Ehrenberg), 1861

Orbulina universa d'Orbigny, 1839

P/D intergrade

Pulleniatina obliquiloculata (Parker and Jones), 1865

Tenuitella iota (Parker), 1962

Turborotalita digitata (Brady), 1879
Turborotalita quinqueloba (Natland), 1938

Table 3. Age models used in this study.

Depth (cm)	Age (Ka)	Sedimentation Rate (cm/kyr)	Isotopic Event
	V34-157 Age 11		
0	1.5	-	1.0
80	19.0	4.57	2.0
220	43.9	5.62	3.0
260	50.2	6.32	-
280	65.0	1.35	4.0
340	99.4	1.74	5.0
350	108.5	1.09	-
400	123.8	3.26	-
480	152.6	7.78	6.0
605	181.5	4.31	-
730	215.5	3.67	7.0
760	229.0	2.22	-
800	240.2	3.57	-
850	258.0	2.80	8.0
900	270.0	4.16	-
930	286.5	1.81	-
940	288.0	6.66	-
960	296.0	2.50	-
1000	310.0	2.85	9.0
1120	330.0	6.00	-
	RC11-86 Age 8		
0	1.5	-	1.0
38	17.9	2.32	2.0
40	19.2	1.48	-
61	23.2	5.29	-
124	50.2	2.33	3.0
155	66.0	1.96	4.0
195	79.3	3.00	5.0
235	99.4	1.99	-
285	123.8	2.04	-
325	152.0	1.41	6.0
335	175.0	0.43	-
405	200.0	2.80	7.0
425	230.0	0.66	-
455	240.0	3.00	-
475	251.0	1.81	8.0
485	258.0	1.42	-
505	270.0	1.66	-
515	290.0	0.50	-
525	300.0	1.00	-
550	314.0	1.78	9.0
555	322.0	0.62	-
565	330.0	1.25	-
605	342.0	3.33	10.0
630	351.0	2.77	-
640	369.0	0.55	11.0
665	409.0	0.62	-
695	434.0	1.20	12.0

Table 3. continued.

Depth (cm)	Age (Ka)	Sedimentation Rate (cm/kyr)	Isotopic Event
704	463.0	0.31	-
725	480.0	1.23	-
738	501.0	0.61	13.0
745	512.0	0.63	-
785	521.0	4.44	-
805	540.0	1.05	14.0
815	561.0	0.47	-
825	573.0	0.83	15.0
845	584.0	1.81	-
855	596.0	0.83	-
895	618.0	1.81	-
915	630.0	1.66	16.0
935	669.0	0.51	-

Table 4. Cross-spectral analysis between downcore isotopes ($\delta^{18}O$) and SPECMAP stack.

		23 kyr			41 kyr			100 kyr		
Core	r	k	ϕ	error	k	ϕ	error	k	ϕ	error
RC11-86	0.77	0.88	+12	±20.7	0.91	+10	±18.1	0.89	-1	±19.4
V34-157	0.81	0.89	-10	±19.0	0.85	+17	±22.6	0.92	+6	±16.3

r is correlation coefficient, test statistics for significance are k= 0.79 at 95% Confidence Interval (CI) and k=0.65 at 80% CI; phasing in degrees is measured clockwise 0°-180° where plus indicates lag and minus indicates lead with respect to SPECMAP Stack; error refers to phase estimates in degrees and corresponds to time by dividing the phase (degrees) by 360° and then multiplying by the Milankovitch period (kyr).

Table 5. Summary of planktic foraminifera abundance (%) in RC11-86.

Species	Maximum	Minimum	Mean
G. inflata	49.01	10.26	28.03
N. pachyderma (dextral)	33.75	3.16	17.83
G. bulloides	29.58	6.58	14.63
N. dutertrei	26.37	4.44	12.08
P/D intergrade	10.33	0.32	5.02
G. glutinata	10.12	0.00	4.32
G. ruber (total)	11.11	0.30	3.49
G. falconensis	10.54	0.00	2.50
G. truncatulinoides (sinestral)	6.47	0.00	2.10
N. pachyderma (sinestral)	6.48	0.00	1.37
G. sacculifer (total)	4.50	0.00	1.16
O. universa	3.69	0.00	0.83
G. aequilateralis	3.15	0.00	0.73
G. crassaformis	4.86	0.00	0.59
G. calida	2.40	0.00	0.48
G. hirsuta	2.28	0.00	0.48
G. scitula	2.57	0.00	0.42
G. truncatulinoides (dextral)	2.68	0.00	0.28
T. quinqueloba	1.70	0.00	0.21
G. menardii	1.50	0.00	0.20
P. obliquiloculata	1.54	0.00	0.19
G. tenella	0.99	0.00	0.09
G. rubescens	0.53	0.00	0.05
G. conglobatus	0.81	0.00	0.02
G. hexagona	0.61	0.00	0.02
G. humilis	0.97	0.00	0.01
T. digitata	0.33	0.00	0.005
T. iota	0.32	0.00	0.005
G. bradyi	0.34	0.00	0.002

Table 6. Summary of planktic foraminifera abundance (%) in V34-157.

Species	Maximum	Minimum	Mean
N. pachyderma (dextral)	50.56	13.06	34.79
G. bulloides	40.75	13.96	24.75
G. inflata	32.14	5.15	13.84
N. pachyderma (sinestral)	29.83	0.72	10.61
G. glutinata	15.14	0.27	7.33
T. quinqueloba	7.19	0.00	2.74
G. truncatulinoides (sinestral)	7.44	0.00	1.64
G. falconensis	3.82	0.00	0.62
N. dutertrei	9.87	0.00	0.61
G. ruber (total)	2.96	0.00	0.45
G. hirsuta	2.53	0.00	0.44
P/D intergrade	4.19	0.00	0.42
G. scitula	2.00	0.00	0.34
O. universa	1.94	0.00	0.26
G. crassaformis	2.37	0.00	0.22
G. calida	1.61	0.00	0.18
G. truncatulinoides (dextral)	0.88	0.00	0.06
G. sacculifer (total)	0.99	0.00	0.03
G. aequilateralis	0.64	0.00	0.03
G. rubescens	0.70	0.00	0.02
G. tenella	0.79	0.00	0.01
T. digitata	0.33	0.00	0.006
P. obliquiloculata	0.31	0.00	0.004
G. humilis	0.32	0.00	0.002
G. bradyi	0.35	0.00	0.002
G. conglobatus	0.32	0.00	0.001

Table 7. AOF20 factor matrix and variance of assemblages for RC11-86 and V34-157.

SPECIES	FACTOR (1) TROPICAL	(2) TRANSITIONAL	(3) POLAR	(4) SUBTROPICAL	(5) SUBPOLAR	(6) UPWELLING
O.universa	0.019	0.032	-0.001	0.036	0.010	-0.052
G.conglomerata	0.023	0.007	0.001	0.013	-0.008	0.003
G.ruber P	0.102	-0.037	0.003	0.076	0.020	-0.060
G.ruber W	**<u>0.929</u>**	0.019	0.023	-0.138	-0.027	-0.002
G.tenellus	0.044	0.009	-0.001	-0.033	-0.001	0.010
G.sacculifer T	0.251	-0.061	0.010	**<u>0.534</u>**	0.013	-0.106
S.dehiscens	-0.003	0.004	0.000	0.039	-0.005	0.007
G.aequilateralis	0.096	0.011	-0.001	0.031	-0.001	0.011
G.calida	0.029	0.016	-0.003	-0.000	0.001	0.005
G.bulloides	-0.039	0.029	0.065	0.068	**<u>0.620</u>**	**<u>0.659</u>**
G.falconensis	0.074	0.305	-0.033	-0.115	-0.084	0.371
T.digitata	0.006	0.010	-0.000	0.019	-0.003	-0.002
G.rubescens	0.034	-0.002	-0.000	-0.014	0.004	0.001
T.quinqueloba	-0.005	-0.066	0.119	-0.002	0.167	0.058
N. pachyderma L	-0.012	0.001	**<u>0.989</u>**	-0.013	-0.050	-0.034
N.pachyderma R	-0.019	0.118	-0.001	-0.046	**<u>0.506</u>**	-0.405
N.dutertrei	-0.016	0.059	-0.001	**<u>0.453</u>**	-0.021	0.031
P.obliquiloculata	-0.003	0.003	-0.001	0.241	-0.008	0.033
G.inflata	-0.019	**<u>0.904</u>**	0.018	0.051	-0.084	-0.059
G.truncatulinoides L	0.033	0.127	-0.003	-0.027	-0.031	0.169
G.truncatulinoides R	0.050	0.070	-0.006	-0.039	-0.012	0.034
G.crassaformis	0.005	0.011	0.001	0.055	-0.008	0.003
P-D intergrade	-0.017	0.156	-0.001	0.009	**<u>0.423</u>**	-0.440
G.hirsuta	0.020	0.092	-0.007	-0.026	-0.021	0.079
G.scitula	0.016	0.048	-0.010	-0.020	0.017	0.053
G.menardii	0.015	0.014	0.003	**<u>0.625</u>**	-0.043	0.056
G.glutinada	0.189	-0.060	-0.029	-0.008	0.360	0.027
<u>% Variance</u>						
RC11-86	1.11	55.42	0.51	3.22	22.83	1.13
V34-157	0.07	13.83	8.12	0.04	51.64	1.73

AOF20 factor matrix is from SPECMAP, 1989; dominant species from each assemblage are underlined and in bold type.

Table 8. Cross spectral analysis between estimated sea surface temperatures and SPECMAP stack.

		23 kyr			41 kyr			100 kyr		
Core	r	k	ϕ	error	k	ϕ	error	k	ϕ	error
					Tc					
V34-157	0.74	0.70	-23	±34	0.81	-48	±26	0.84	-21	±23
RC11-86	(0.64)	(0.18)	-23	±75	(0.50)	-130	±49	0.86	-43	±22
					Tw					
V34-157	0.66	0.66	-23	±38	0.67	-45	±37	0.67	-16	±37
RC11-86	(0.40)	(0.12)	-57	±80	(0.54)	-50	±46	(0.36)	-83	±60

Tc, Tw and seasonality refer to cold estimated sea surface temperature, warm sea surface temperature and Tw minus Tc, respectively; r is correlation coefficient, test statistics for significance are k= 0.79 at 95% Confidence Interval (CI) and k=0.65 at 80% CI with parenthesis highlighting k<80% CI; phasing in degrees is measured clockwise 0°-180° where plus indicates lag and minus indicates lead with respect to SPECMAP Stack; error refers to phase estimates in degrees and corresponds to time by dividing the phase (degrees) by 360° and then multiplying by the Milankovitch period (kyr).

FIGURE CAPTIONS

Figure 1	Map showing cores and surface currents. Solid circles (•) indicate core locations and open circles (o) delineate the present day position of the Subtropical Convergence.
Figure 2	Flowchart of faunal sample preparation.
Figure 3	Downcore signals of oxygen isotopes ($\delta^{18}O$) in RC11-86, V34-157 and the SPECMAP stack versus age (Ka). Isotopic stages indicated to the right of plots in these and all subsequent figures.
Figure 4	Core depth (cm) versus modeled age (Ka) in RC11-86 and V34-157.
Figure 5	Comparative morphologies of *Neogloboquadrina pachyderma* (dextral), the P/D intergrade, as defined in this paper, and *Neogloboquadrina dutertrei.*
Figure 6	Scanning electron micrographs of *Neogloboquadrina pachyderma* (dextral) (Ehrenberg), the P/D intergrade, and *Neogloboquadrina dutertrei* (d'Orbigny). Scale bar is 100 µm. Umbilical view; (a) *N. pachyderma*, RC11-86, 35 cm, x240 magnification; (b) P/D, RC11-86, 120 cm, x240; c) *N. dutertrei*, V34-157, 40 cm, x120. Spiral view; (d) *N. pachyderma*, V34-157, 60 cm, x200; (e) P/D, RC11-86, 35 cm, x220; (f) *N. dutertrei*, RC11-86, 290 cm, x94. Lateral view; (g) *N. pachyderma*, RC11-86, 385 cm, x220; (h) P/D, V34-157, 185 cm, x220; (i) *N. dutertrei*, RC11-86, 185 cm, x150.
Figure 7	Comparison between Verardo's and Kipp's estimated sea-surface temperatures (°C) versus age (Ka) in RC11-86 based on differing criteria for P/D. Tc is cold and Tw is warm temperature estimate.
Figure 8	Planktic foraminifera abundance (%) versus age (Ka) in RC11-86. Abundance-axis varies with species. Right coiling (dextral) species are noted with R, left-coiling (sinistral) species are noted with an L.
Figure 9	Planktic foraminifera abundance (%) versus age (Ka) in V34-157. Abundance-axis varies with species. Right coiling (dextral) species are noted with an R, left-coiling (sinistral) species are noted with an L.
Figure 10	Factor assemblages based on transfer function equation AOF20 versus age (Ka) in RC11-86. Assemblages are as follows: factor 1-tropical; factor 2-transitional; factor 3-polar; factor 4-subtropical; factor 5-subpolar; factor 6-upwelling.
Figure 11	Factor assemblages based on transfer function equation AOF20 versus age (Ka) in V34-157. Assemblages are as follows: factor 1-tropical; factor 2-transitional; factor 3-polar; factor 4-subtropical; factor 5-subpolar; factor 6-upwelling.
Figure 12	Communality versus age (Ka) in RC11-86 and V34-157.

Figure 13	Estimated sea-surface temperatures (°C) and seasonality versus age (Ka) in RC11-86 and V34-157 where Tc is cold and Tw is warm temperatures.
Figure 14	Dissolution indicies; (a-b) calcium carbonate concentration in RC11-86 and V34-157; (c-d) ratio of planktic foraminifera fragments to whole planktic foraminifera plus planktic fragments in RC11-86 and V34-157; and (e-f) ratio of benthic foraminifera to planktic foraminifera in RC11-86 and V34-157 versus age (Ka).
Figure 15	Map delineating boundaries of modern planktic foraminifera assemblages. AC is Agulhas Current, BC is Benguela Current, and WWD is West Wind Drift.
Figure 16	Linear spectrum plots of variance density versus frequency (l/period) for (a) Tc, (b) Tw, (c) seasonality, and (d) prewhitened (0.8) Tw in V34-157. Spectral peaks are in kiloyears and numbers in parenthesis indicate percent variance of peak compared to total variance of spectrum in this and subsequent figures. Spectra (a-c) are calculated at the 95% confidence interval with an autocovariance function, linear detrend, and no prewhitening.
Figure 17	Linear spectrum of variance density versus frequency (l/period) for (a) Tc, (b) Tw, and (c) seasonality in RC11-86. The spectra are calculated at the 95% confidence interval with an autocovariance function, linear detrend, and no prewhitening.
Figure 18	Linear spectrum of variance density versus frequency (l/period) for (a) Tc, 2.8-300 Ka (b) Tw, 2.8-300 Ka (c) Tc, 300-688 Ka and (d) Tw, 300-688 Ka in RC11-86. The spectra are calculated at the 95% confidence interval with an autocovariance function, linear detrend, and no prewhitening.
Figure 19	Coherency spectrum of V34-157 for (a) Tc and (b) Tw and RC11-86 for (c) Tc and (d) Tw versus SPECMAP stacked oxygen isotope record. Coherency (k) is measured along the vertical axis; frequency and period along the horizontal axis. Statistical significance is 0.79 at the 95% confidence interval and 0.65 at the 80% interval.

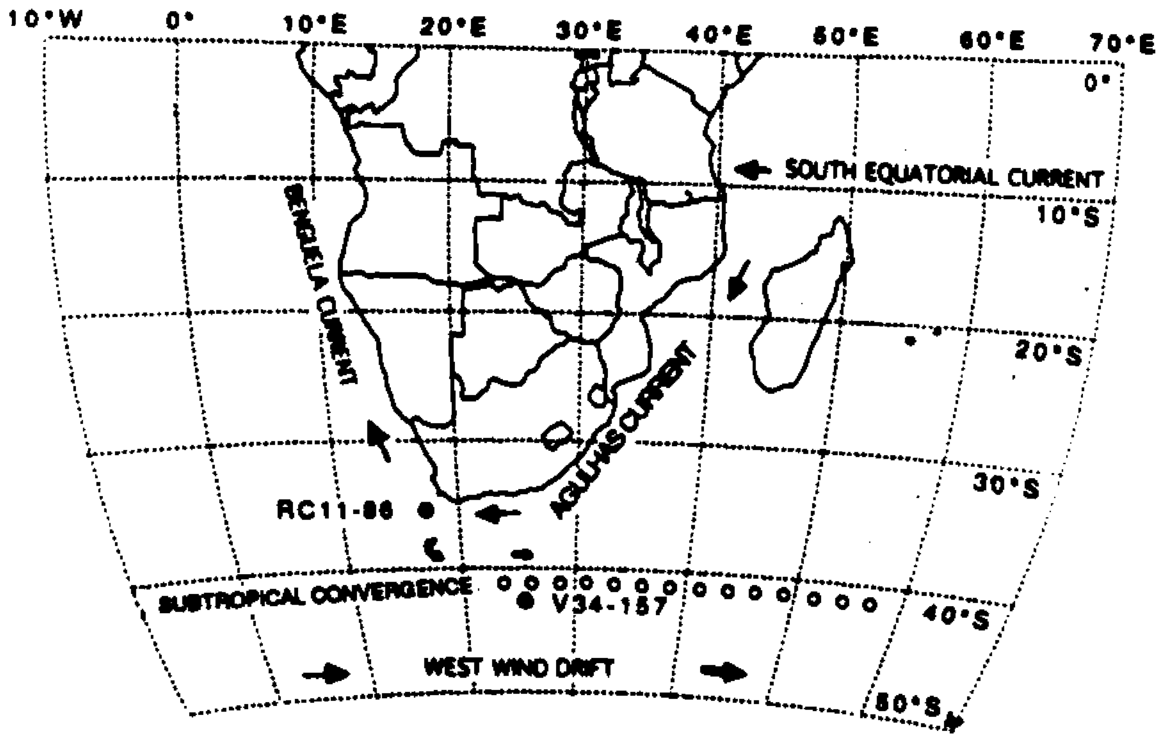

10°W
0°
10°E
20°E
30°E
40°E
50°E
60°E
70°E
0°
SOUTH EQUATORIAL CURRENT
10°S
BENGUELA CURRENT
20°S
AGULHAS CURRENT
30°S
RC11-86
SUBTROPICAL CONVERGENCE
V34-157
40°S
WEST WIND DRIFT
50°S

Figure 1

FAUNAL SAMPLE PREPARATION

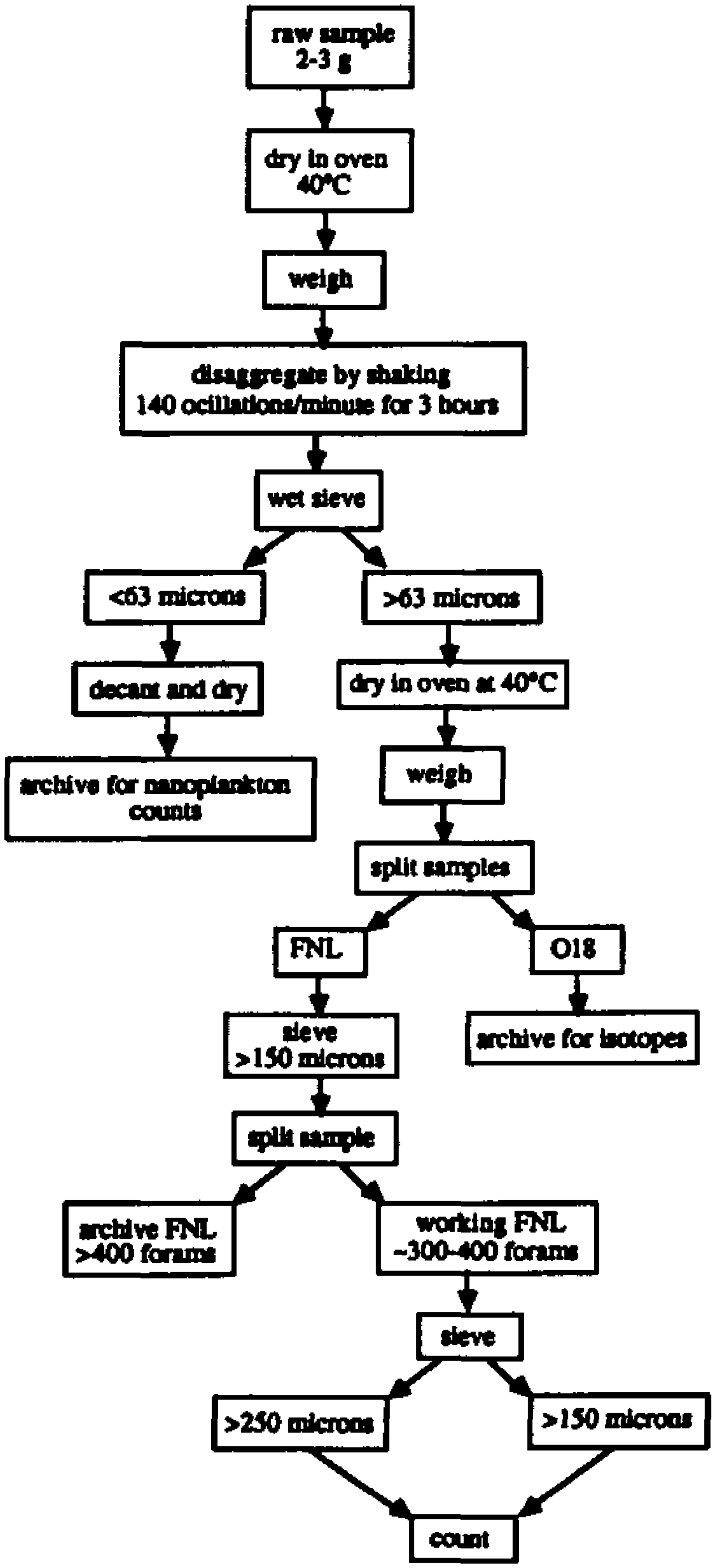


Figure 2

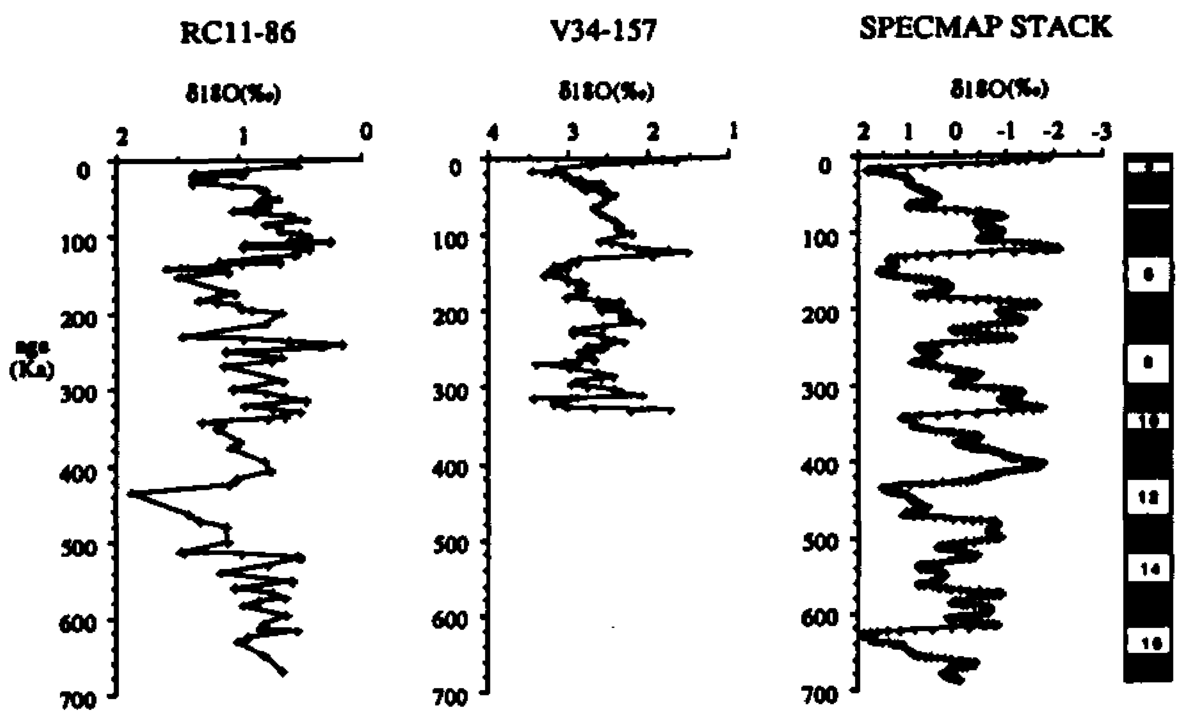

RC11-86
V34-157
SPECMAP STACK
δ18O(‰)
δ18O(‰)
δ18O(‰)
age
(Ka)
0
100
200
300
400
500
600
700
2
1
0
4
3
2
1
2
1
0
-1
-2
-3
6
8
10
12
14
16

Figure 3

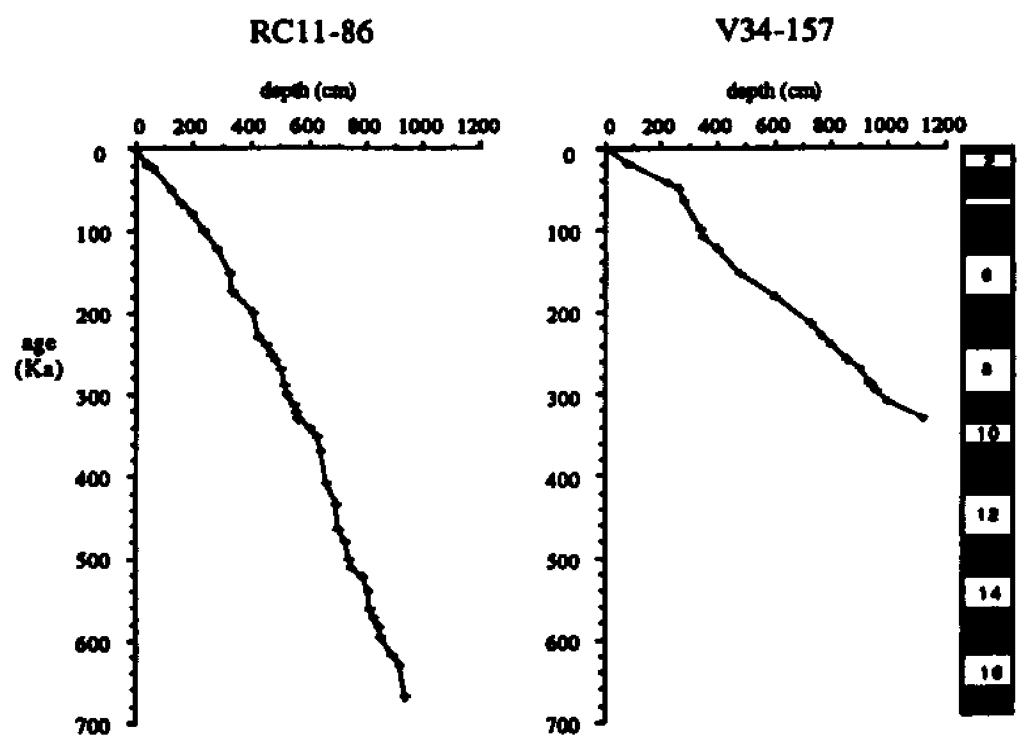
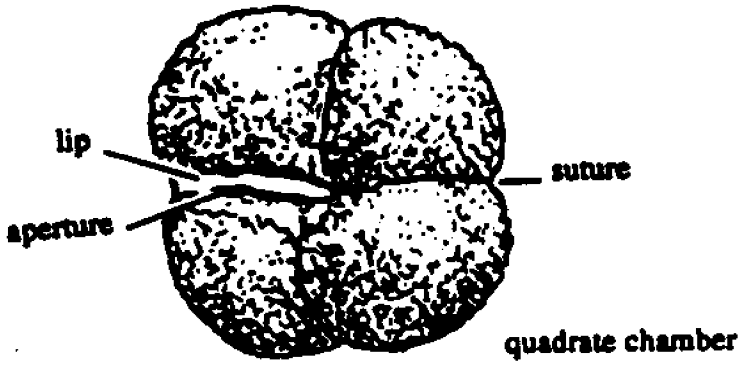
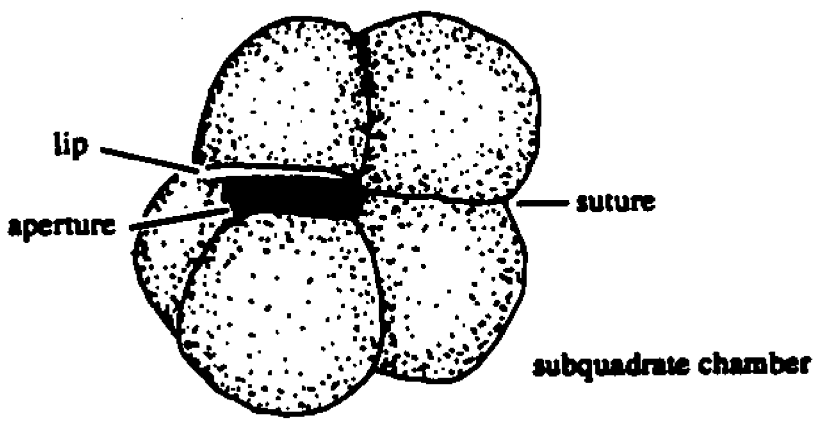

RC11-86
V34-157
depth (cm)
0 200 400 600 800 1000 1200
age (Ka)
0 100 200 300 400 500 600 700
2
6
8
10
12
14
16

Figure 4

Neogloboquadrina pachyderma (dextral)



P/D intergrade



Neogloboquadrina dutertrei

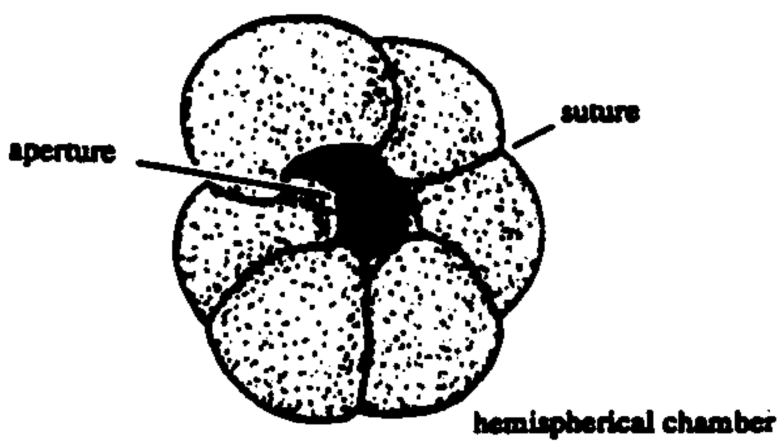


Figure 5

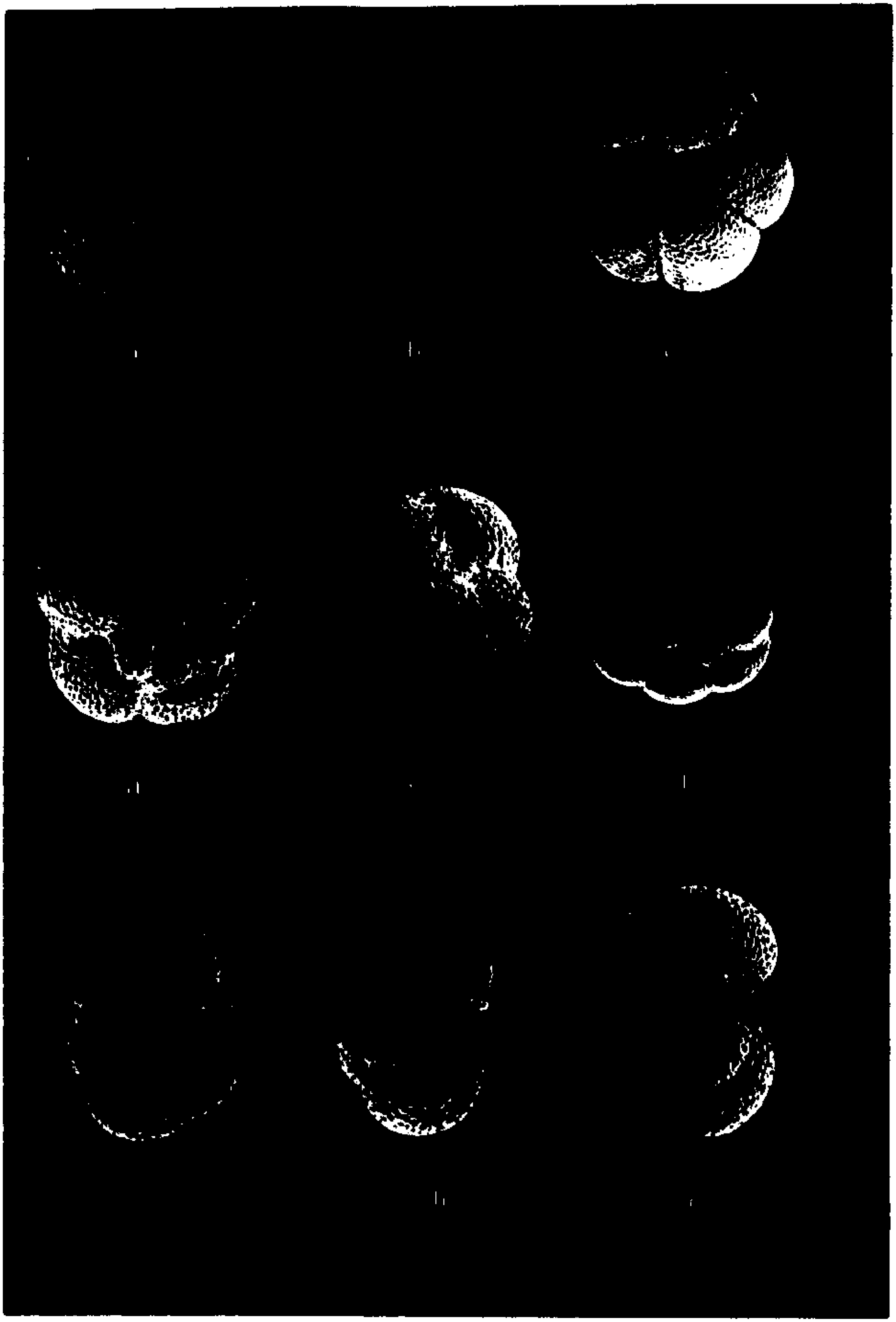


Figure 6

SEA SURFACE TEMPERATURES (°C) COMPARISONS IN RC11-86

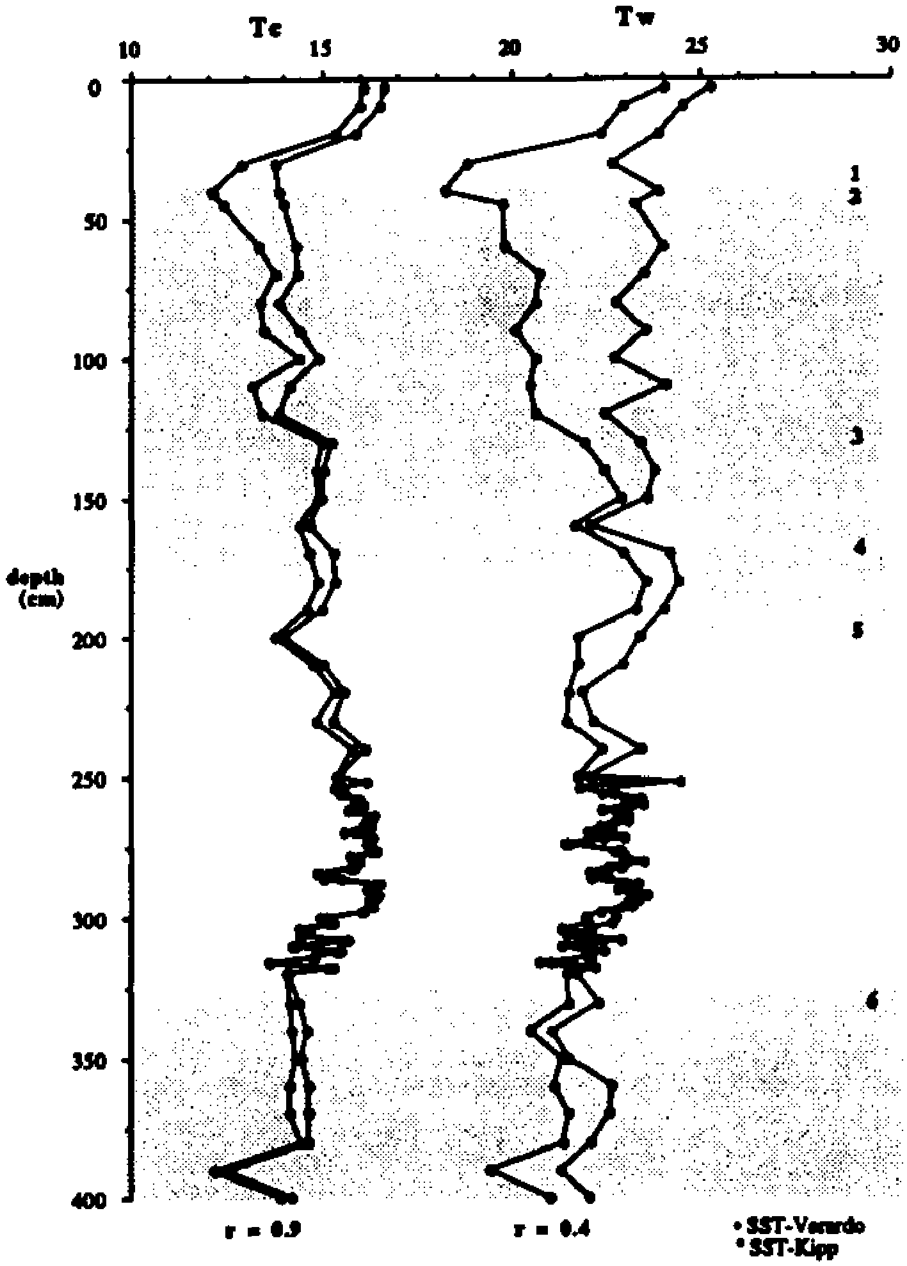


Figure 7

RC11-86
planktic foraminifera abundance

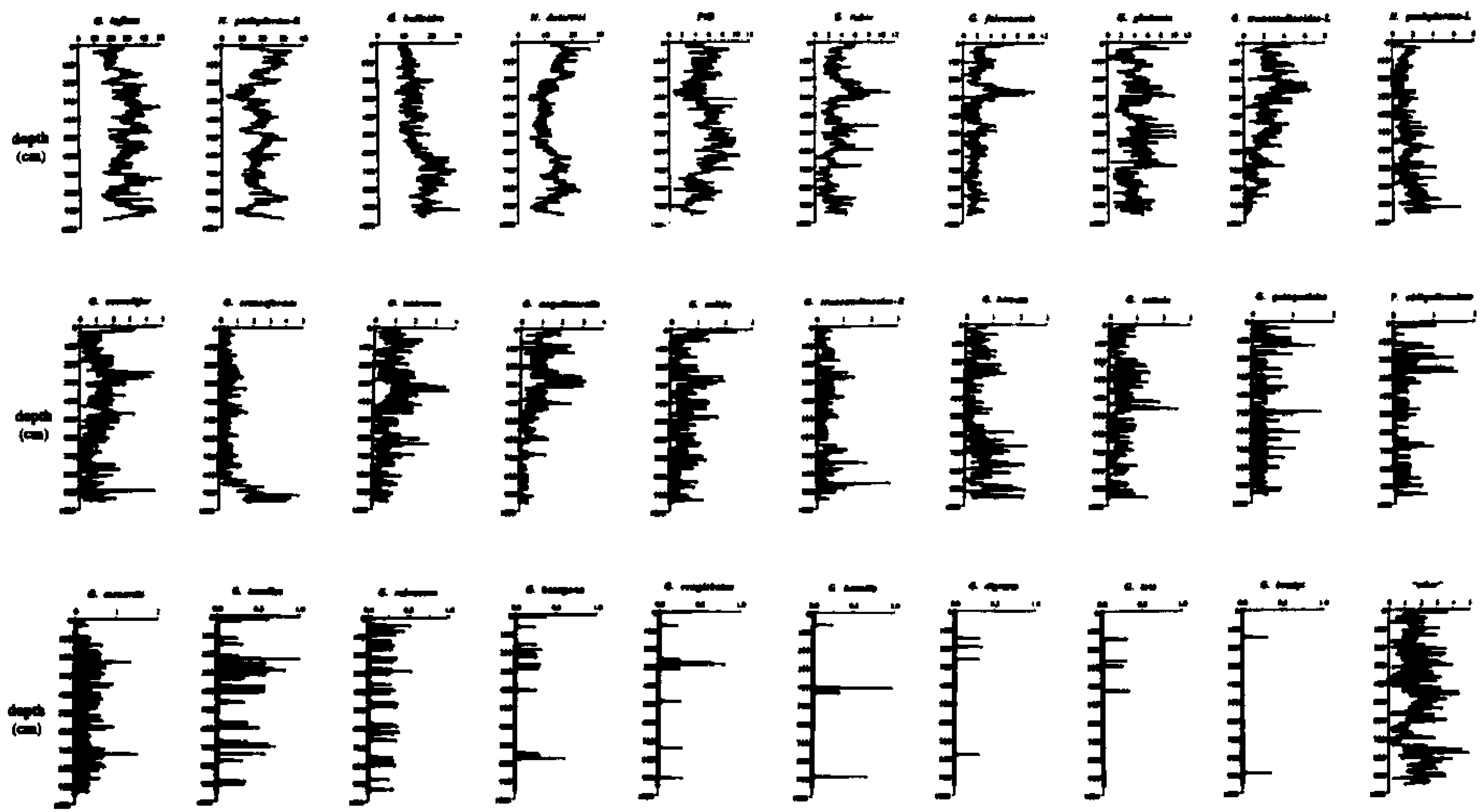


Figure 8

V34-157
planktic foraminifera abundance

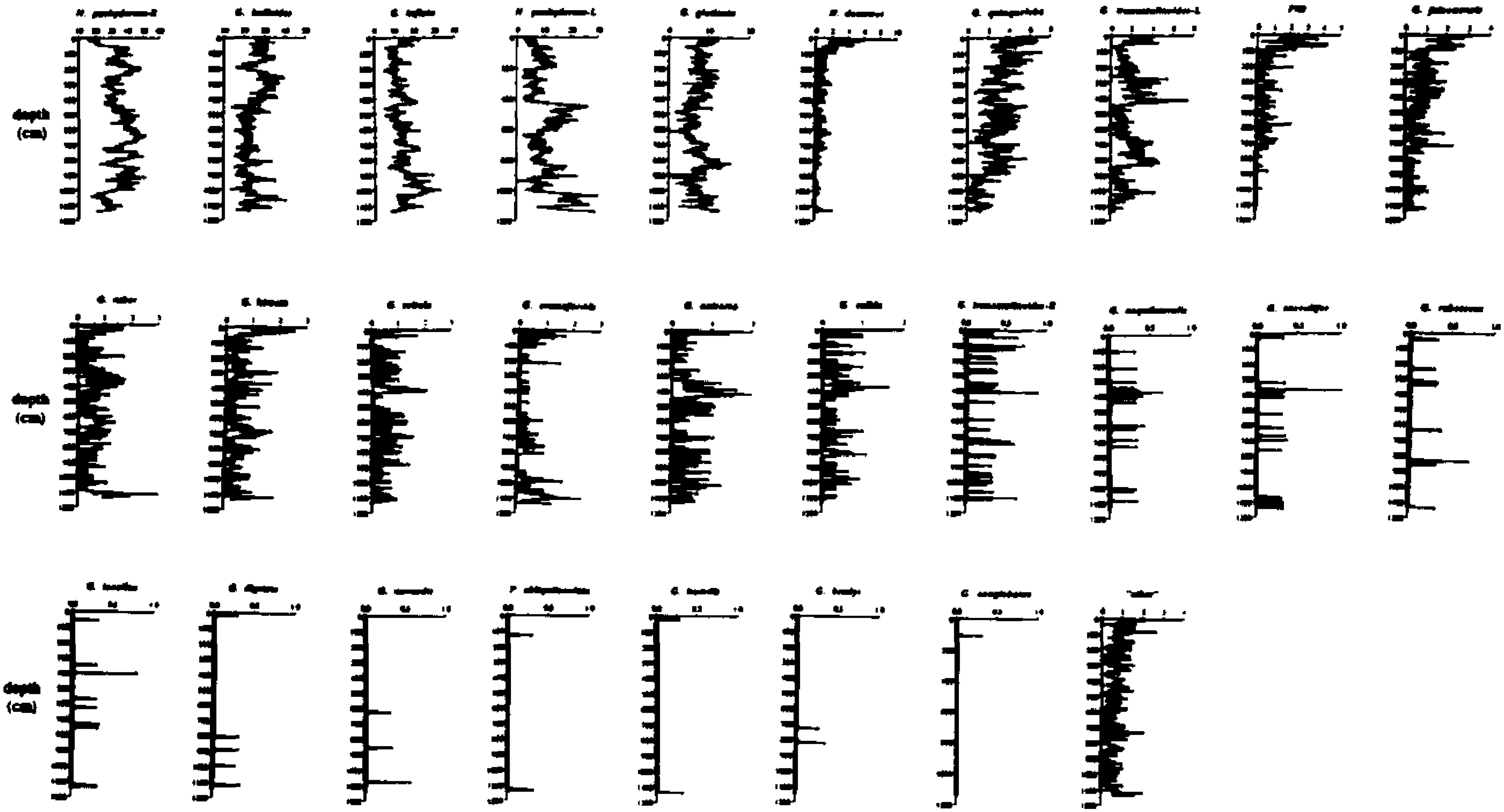


Figure 9

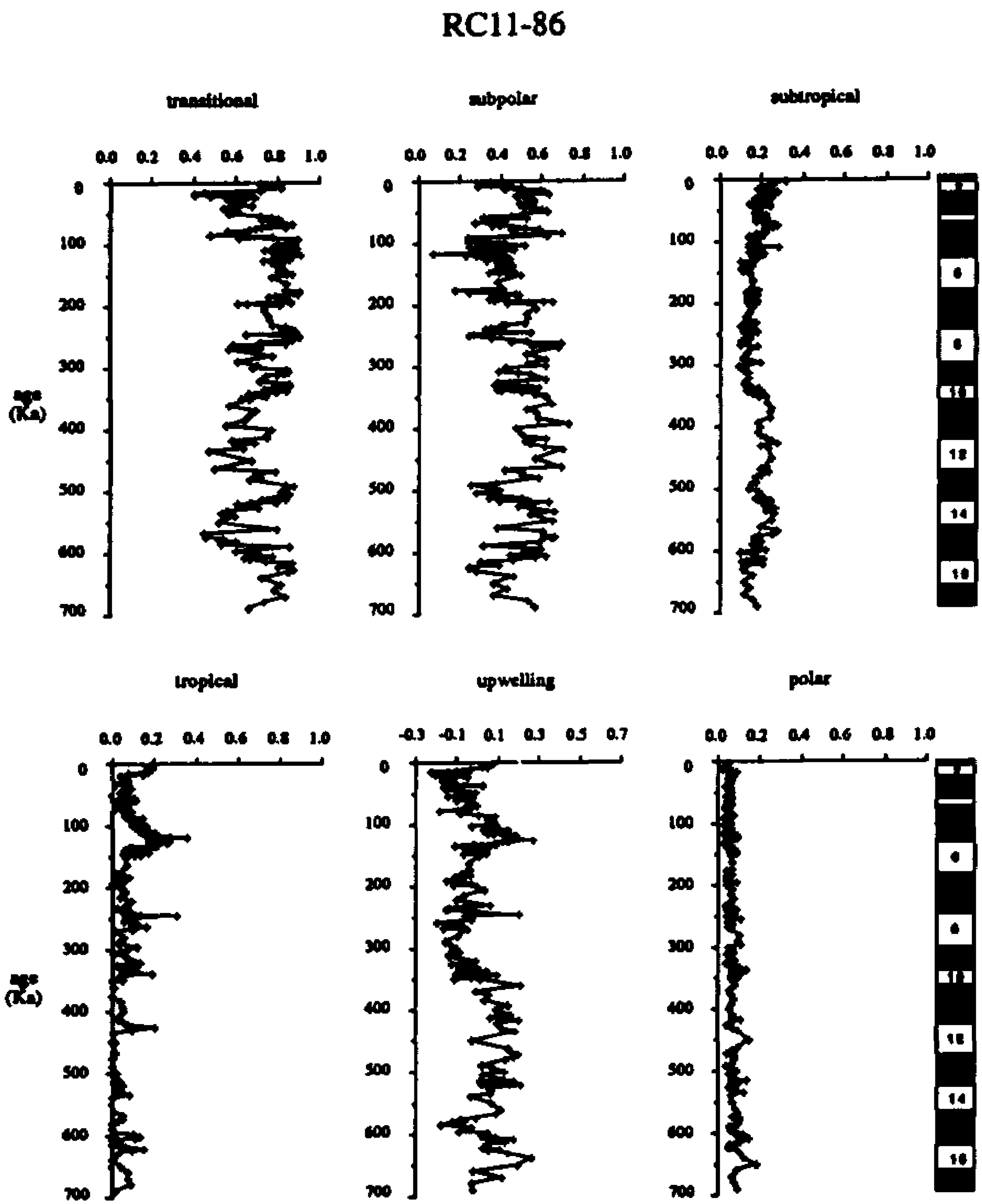
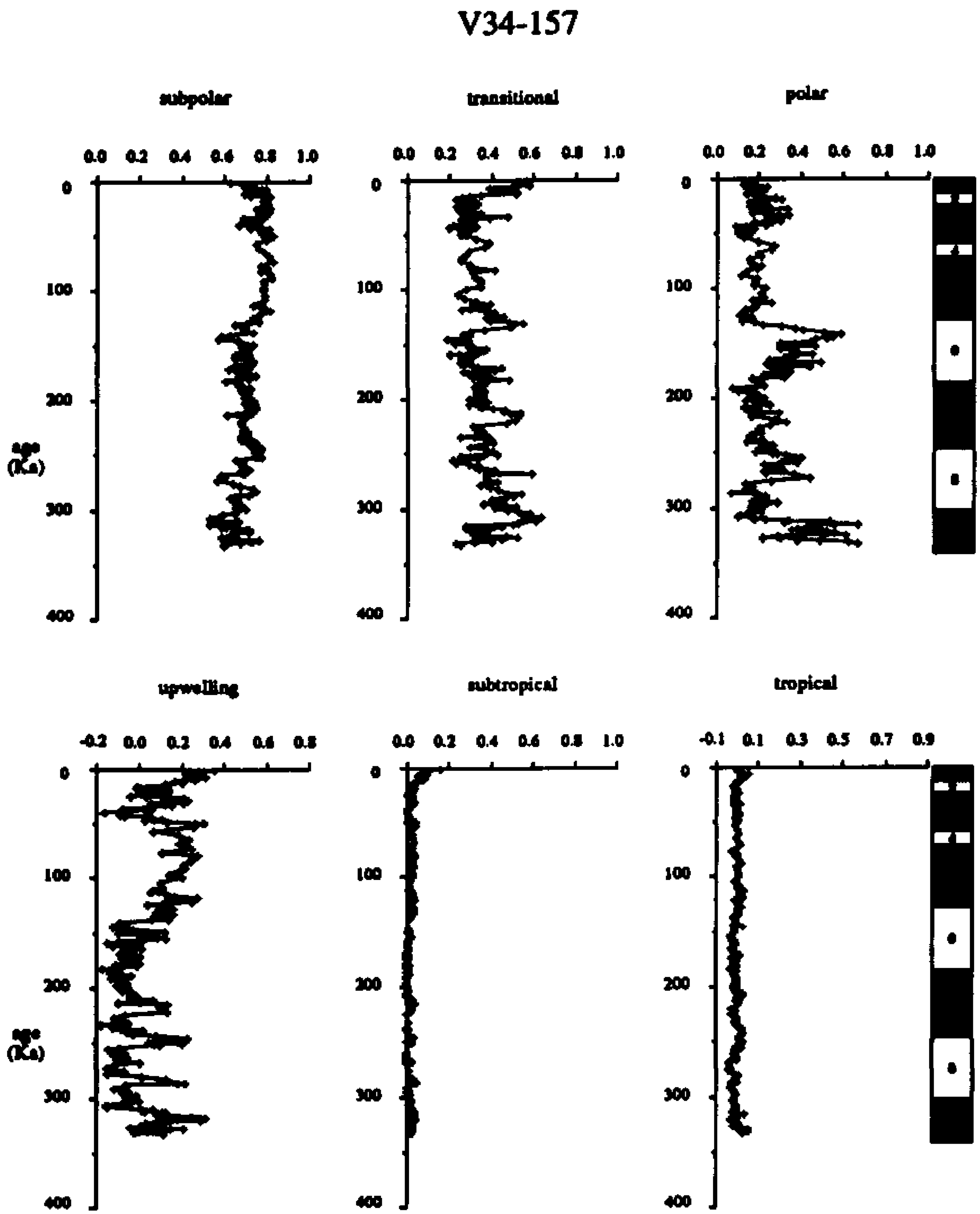
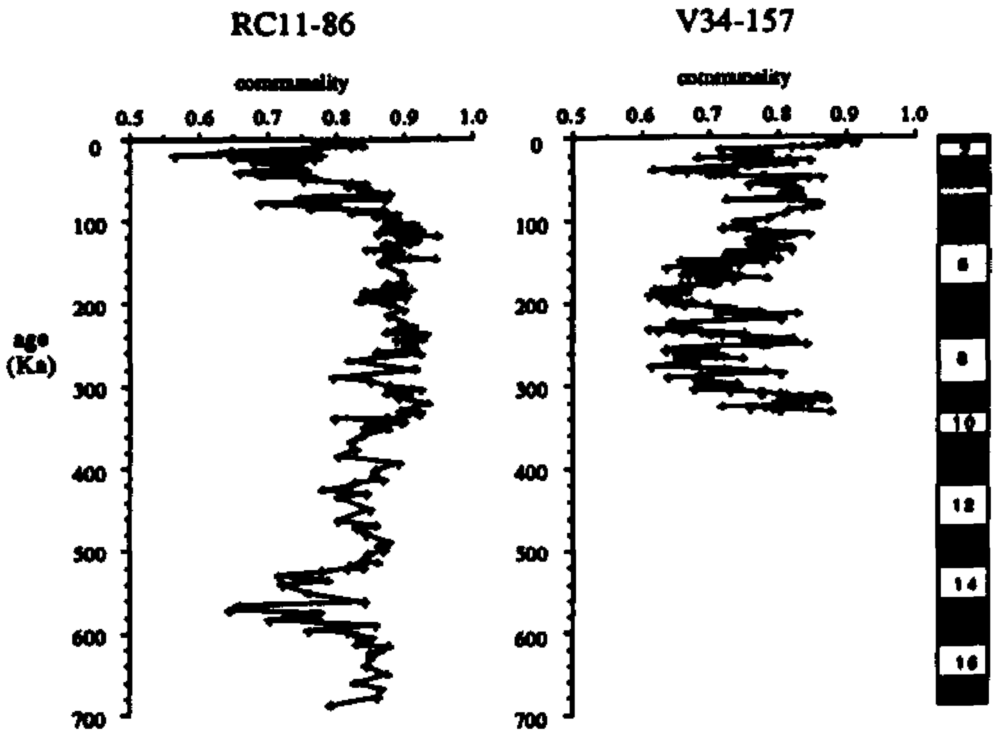

RC11-86
transitional
subpolar
subtropical
tropical
upwelling
polar
age (Ka)
0.0 0.2 0.4 0.6 0.8 1.0
-0.3 -0.1 0.1 0.3 0.5 0.7
0 100 200 300 400 500 600 700

Figure 10



V34-157
subpolar
transitional
polar
upwelling
subtropical
tropical
age (Ka)
0.0 0.2 0.4 0.6 0.8 1.0
-0.2 0.0 0.2 0.4 0.6 0.8
-0.1 0.1 0.3 0.5 0.7 0.9
0 100 200 300 400

Figure 11



RC11-86
V34-157
communality
communality
0.5
0.6
0.7
0.8
0.9
1.0
age
(Ka)
0
100
200
300
400
500
600
700
6
8
10
12
14
16

Figure 12

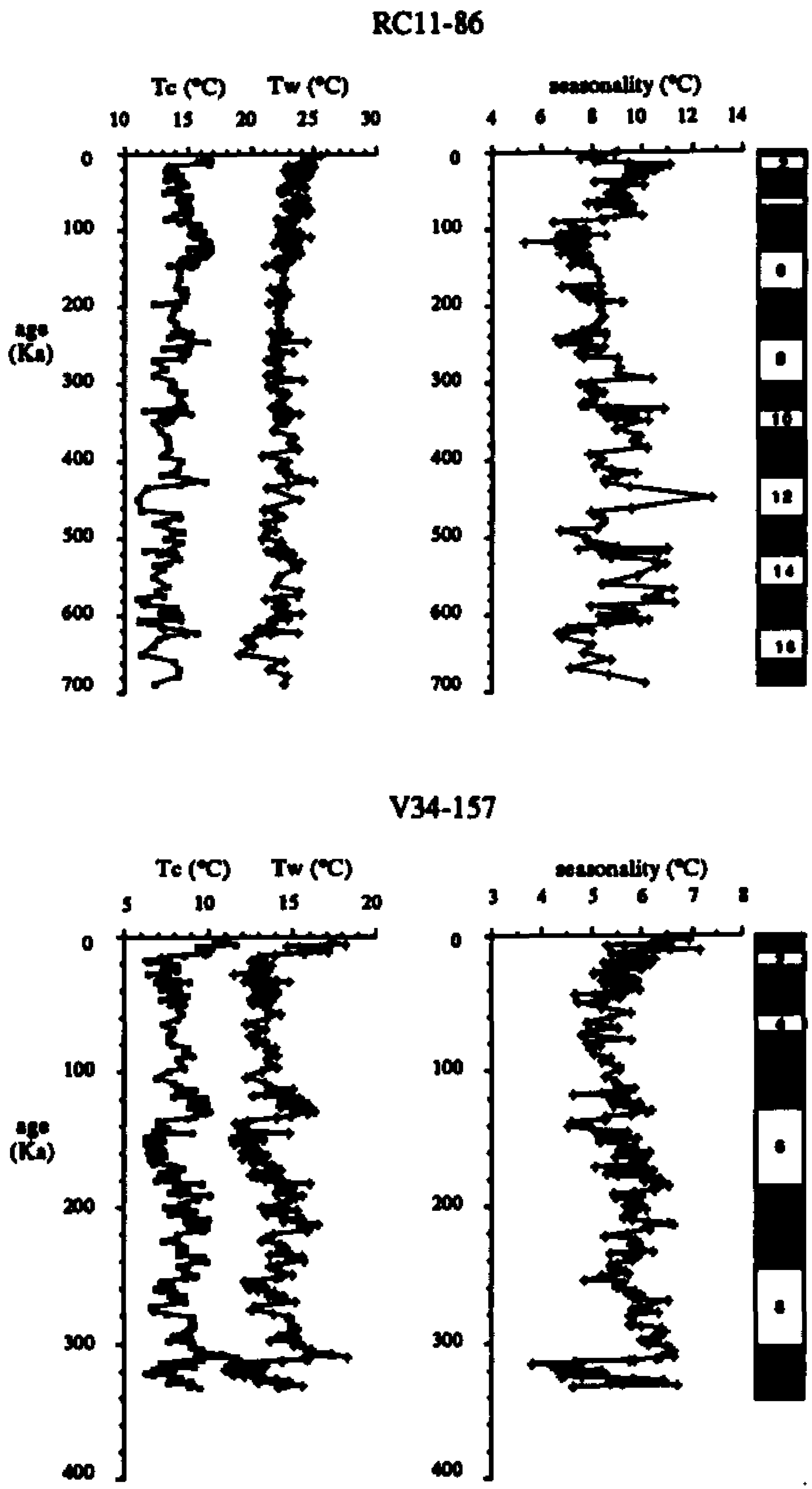

RC11-86
Tc (°C) Tw (°C)
10 15 20 25 30
seasonality (°C)
4 6 8 10 12 14
age (Ka)
0 100 200 300 400 500 600 700
6
8
10
12
14
16
V34-157
Tc (°C) Tw (°C)
5 10 15 20
seasonality (°C)
3 4 5 6 7 8
age (Ka)
0 100 200 300 400
4
6
8

Figure 13

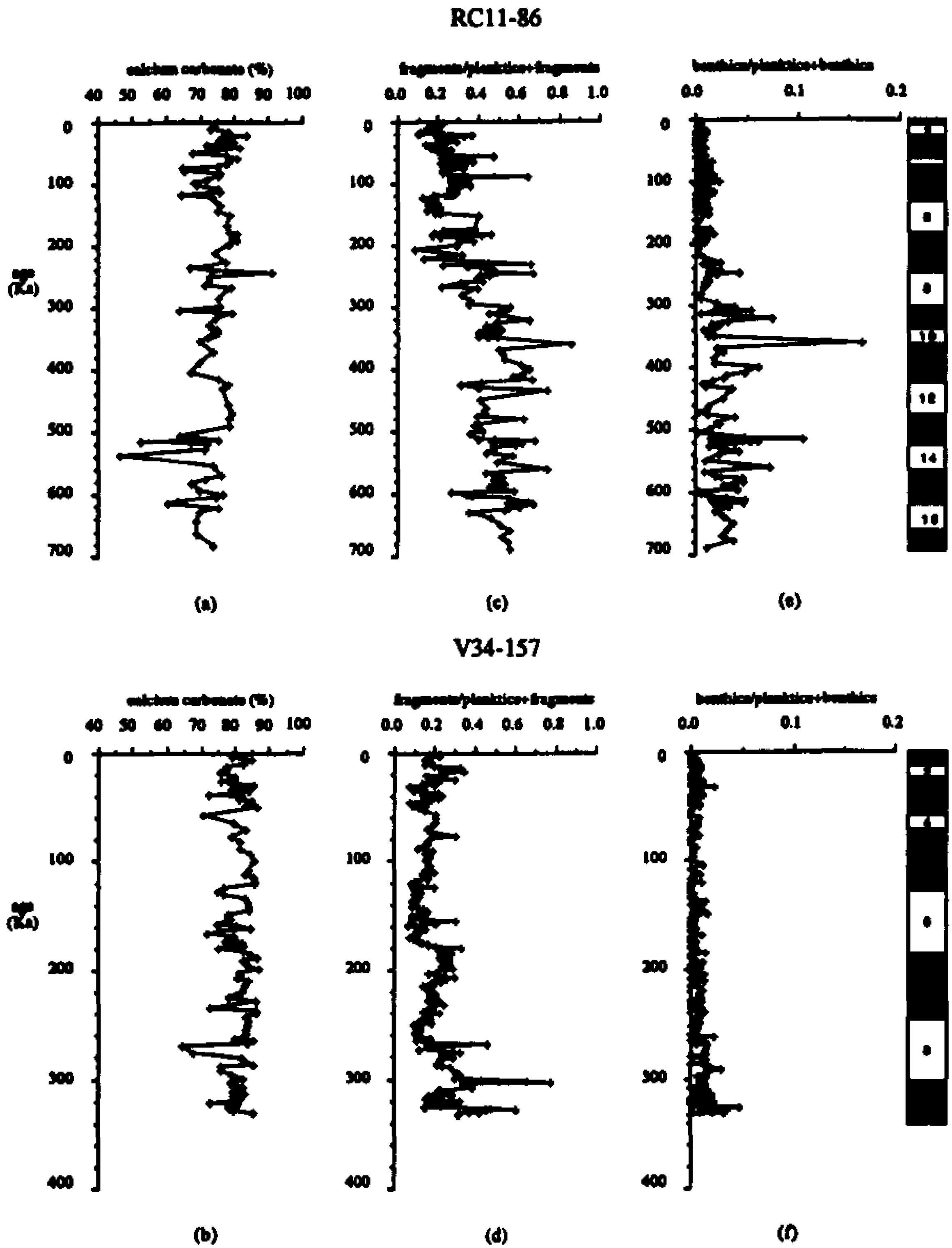
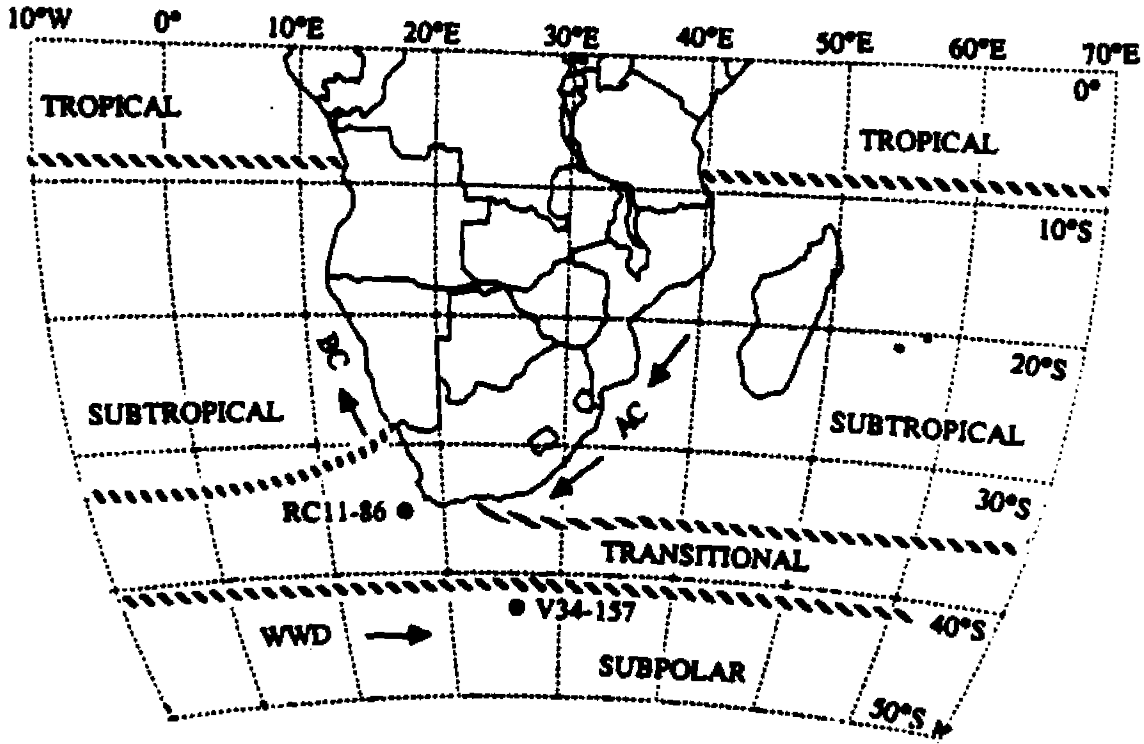

RC11-86
calcium carbonate (%)
40 50 60 70 80 90 100
fragments/planktics+fragments
0.0 0.2 0.4 0.6 0.8 1.0
benthics/planktics+benthics
0.0 0.1 0.2
age (Ka)
0 100 200 300 400 500 600 700
(a)
(c)
(e)
V34-157
calcium carbonate (%)
40 50 60 70 80 90 100
fragments/planktics+fragments
0.0 0.2 0.4 0.6 0.8 1.0
benthics/planktics+benthics
0.0 0.1 0.2
age (Ka)
0 100 200 300 400
(b)
(d)
(f)

Figure 14



10°W
0°
10°E
20°E
30°E
40°E
50°E
60°E
70°E
0°
TROPICAL
TROPICAL
10°S
20°S
BC
AC
SUBTROPICAL
SUBTROPICAL
30°S
RC11-86
TRANSITIONAL
V34-157
40°S
WWD
SUBPOLAR
50°S

Figure 15

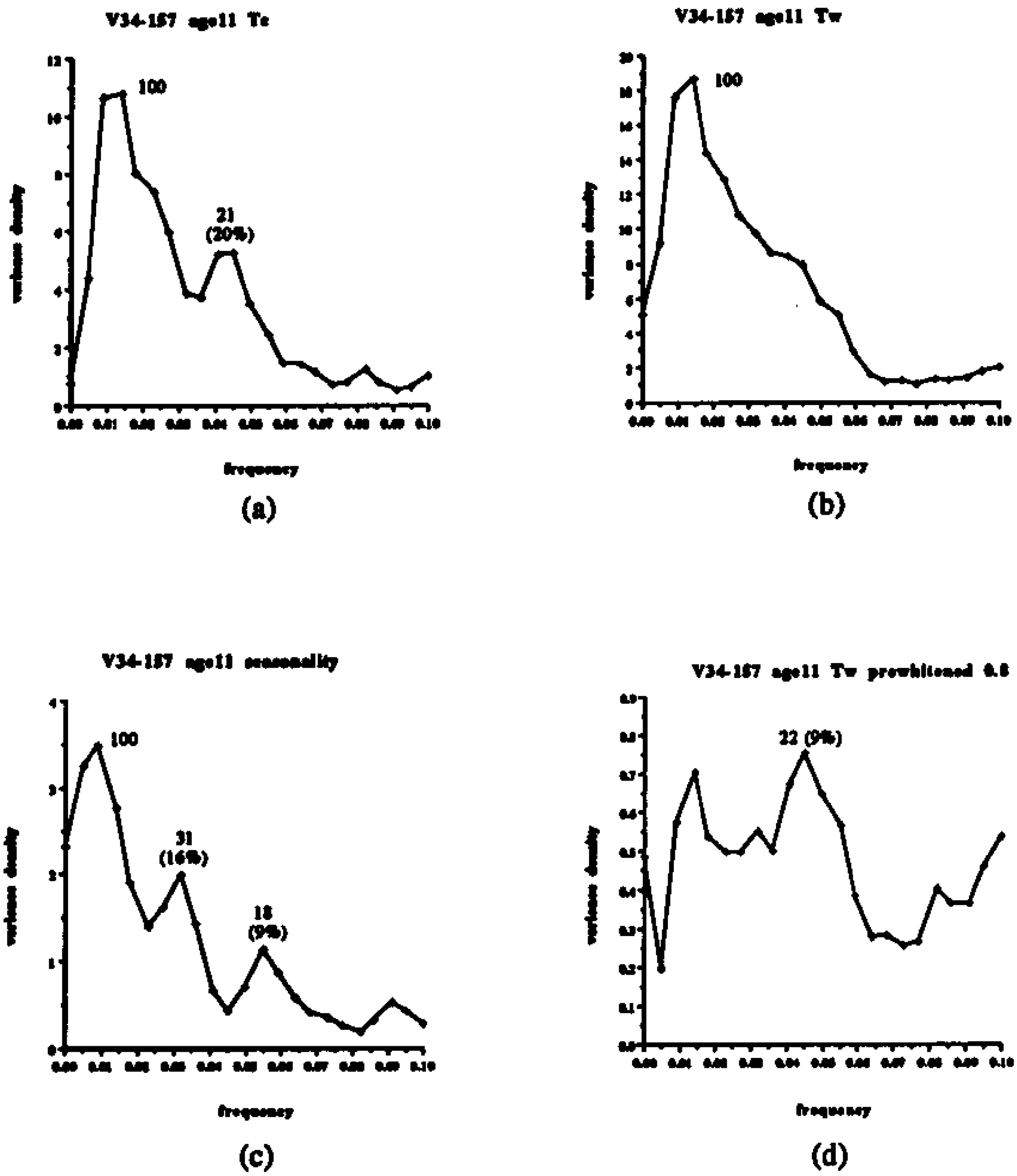

V34-157 age11 Ts
100
21
(20%)
frequency
(a)
V34-157 age11 Tw
100
frequency
(b)
V34-157 age11 seasonality
100
31
(16%)
18
(9%)
frequency
(c)
V34-157 age11 Tw prewhitened 0.8
22 (9%)
frequency
(d)

Figure 16

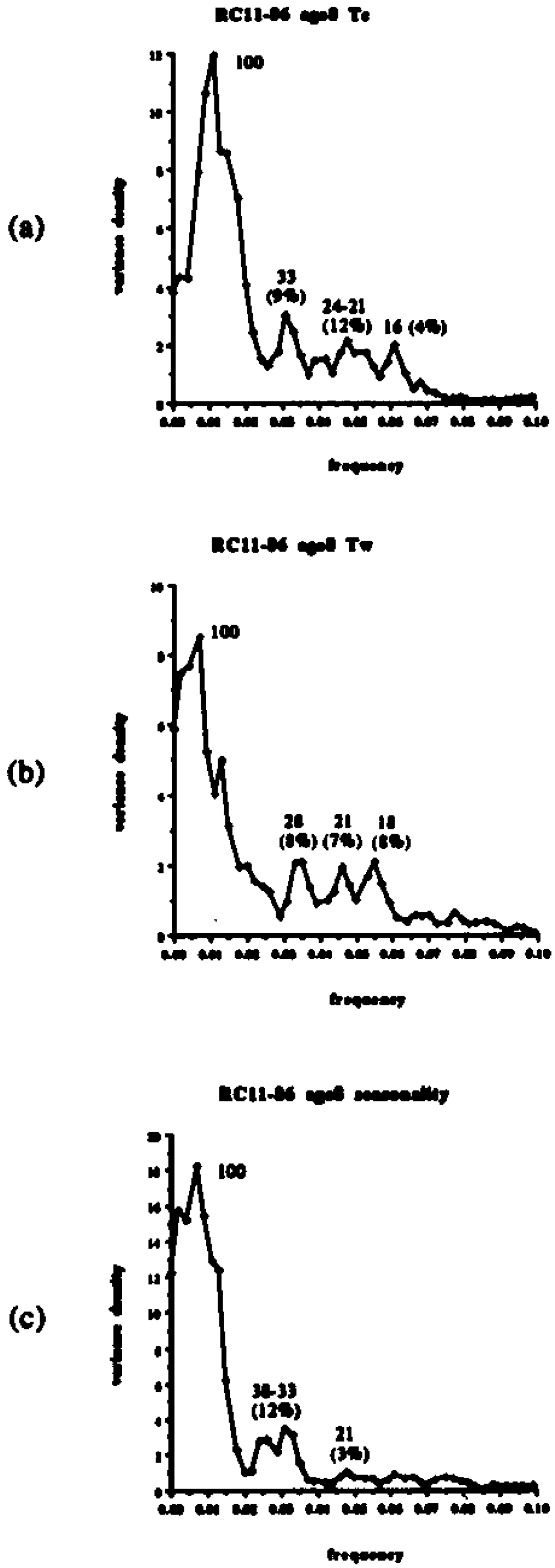


Figure 17

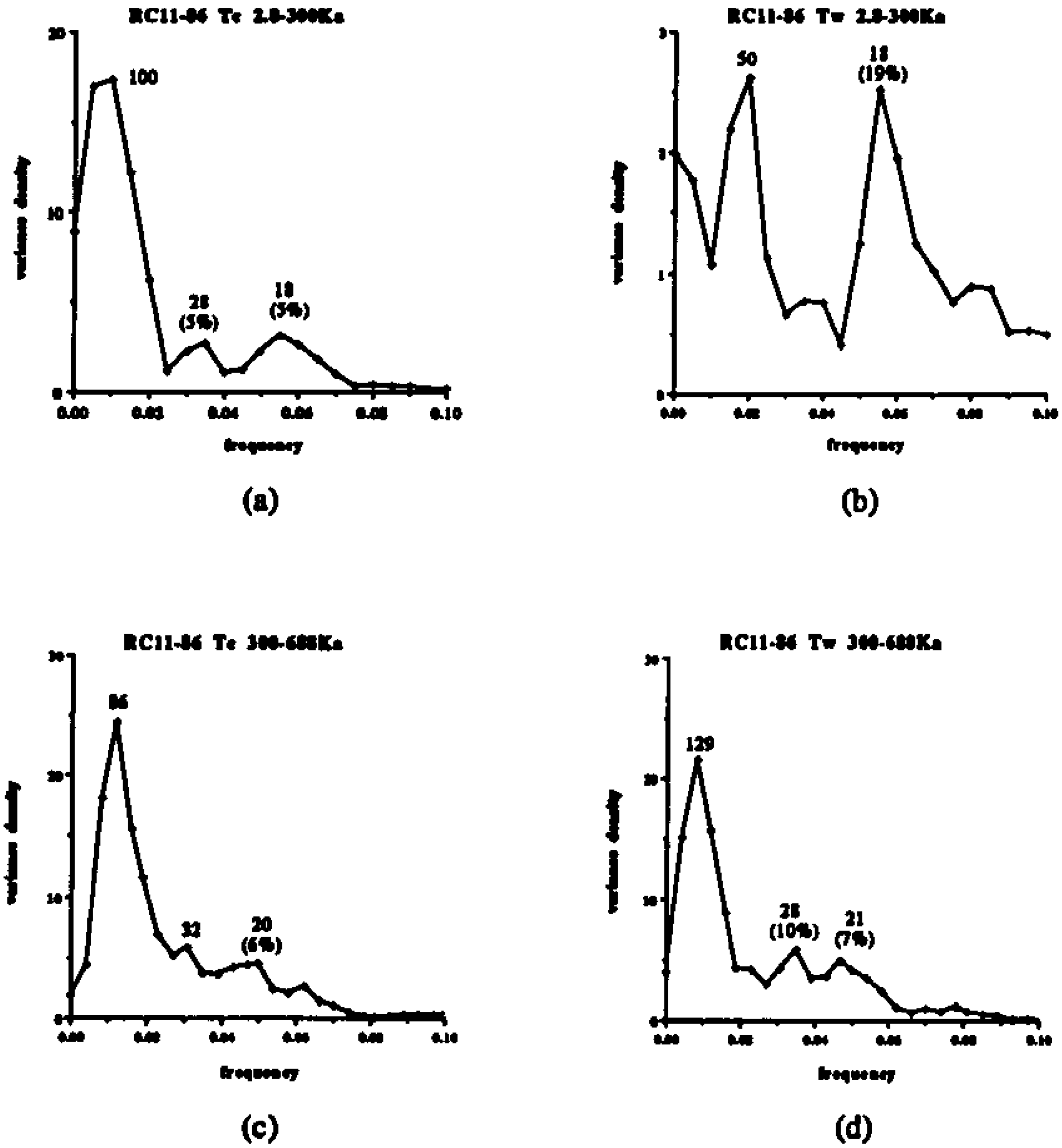
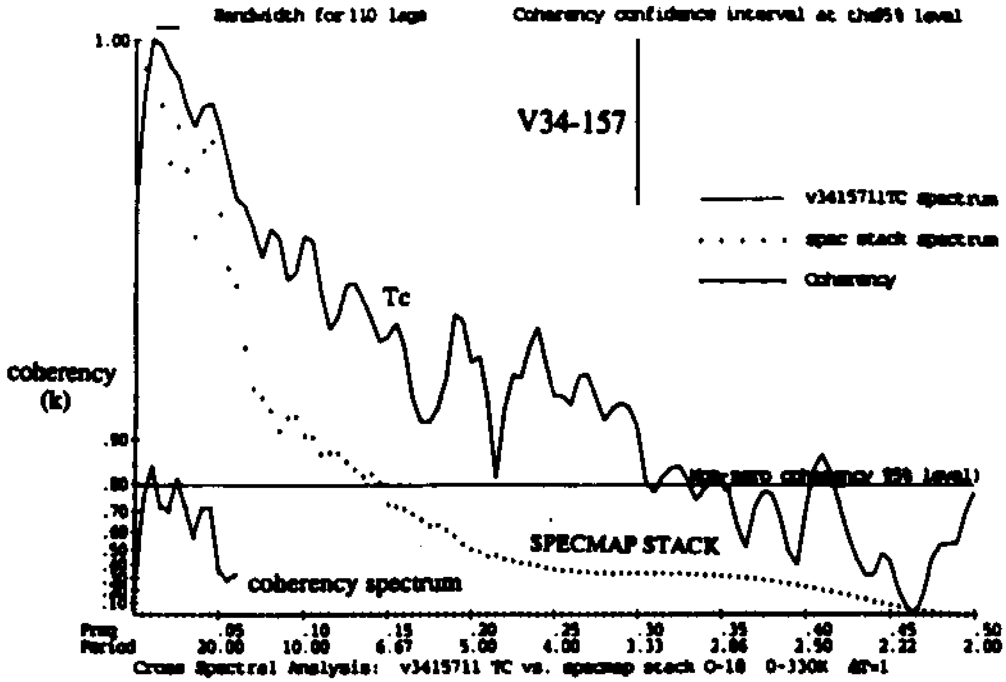
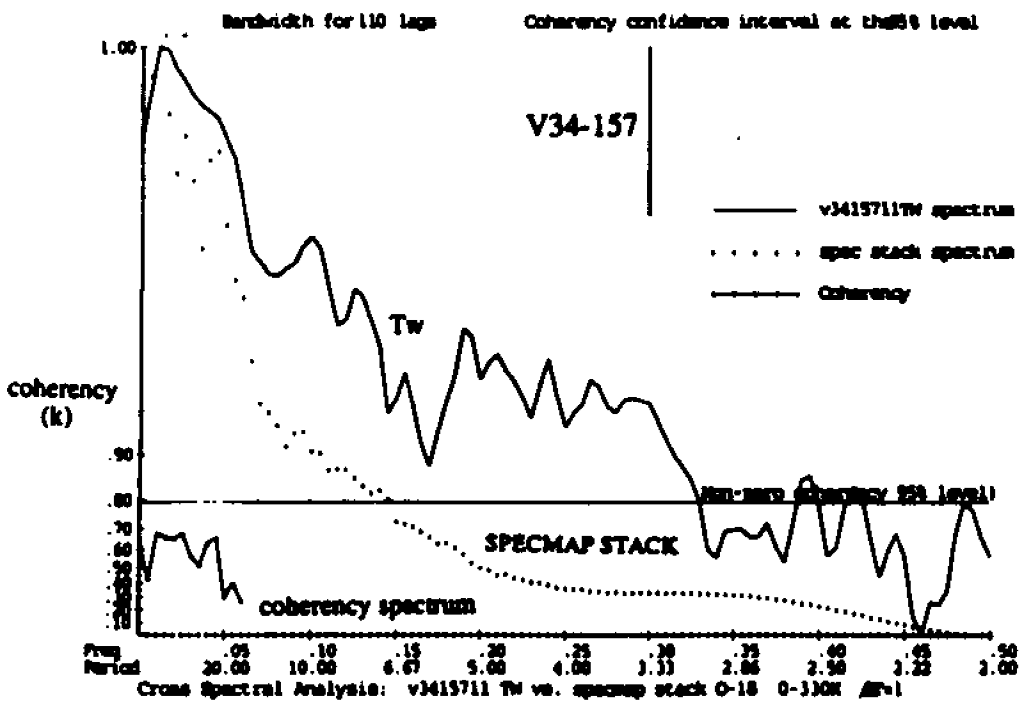

RC11-86 Tc 2.8-300Ka
100
28
(5%)
18
(5%)
frequency
(a)
RC11-86 Tw 2.8-300Ka
50
18
(19%)
frequency
(b)
RC11-86 Tc 300-680Ka
86
32
20
(6%)
frequency
(c)
RC11-86 Tw 300-680Ka
129
28
(10%)
21
(7%)
frequency
(d)

Figure 18

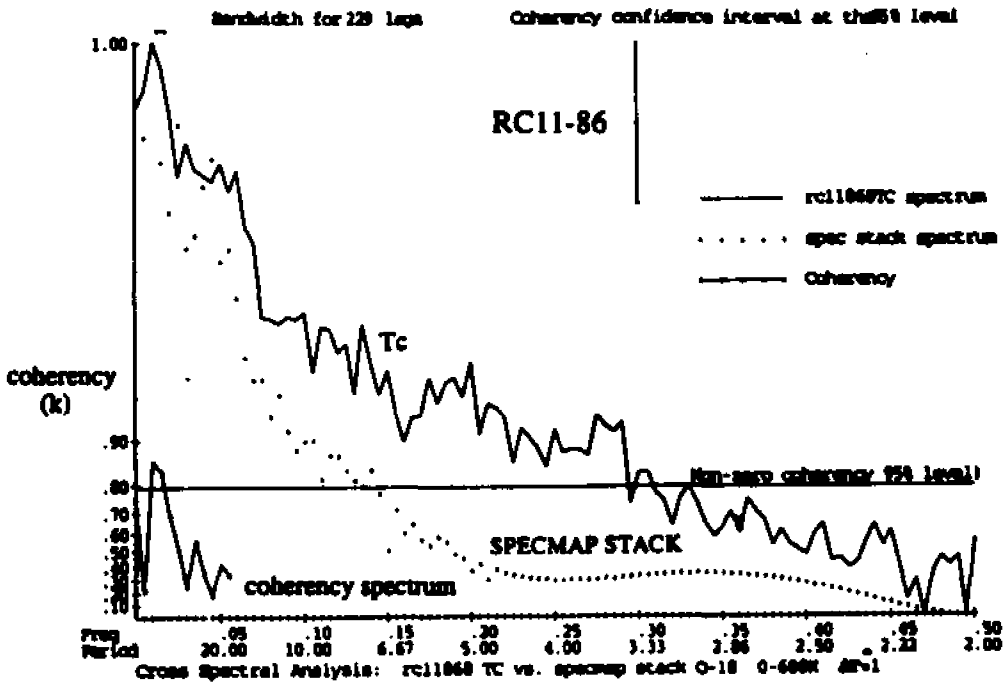

Bandwidth for 110 lags
Coherency confidence interval at the 95% level
V34-157
v3415711TC spectrum
spec stack spectrum
Coherency
Tc
coherency (k)
Non-zero coherency 95% level
SPECMAP STACK
coherency spectrum
Freq
Period
Cross Spectral Analysis: v3415711 TC vs. specmap stack 0-18 0-330K ΔT=1

(a)

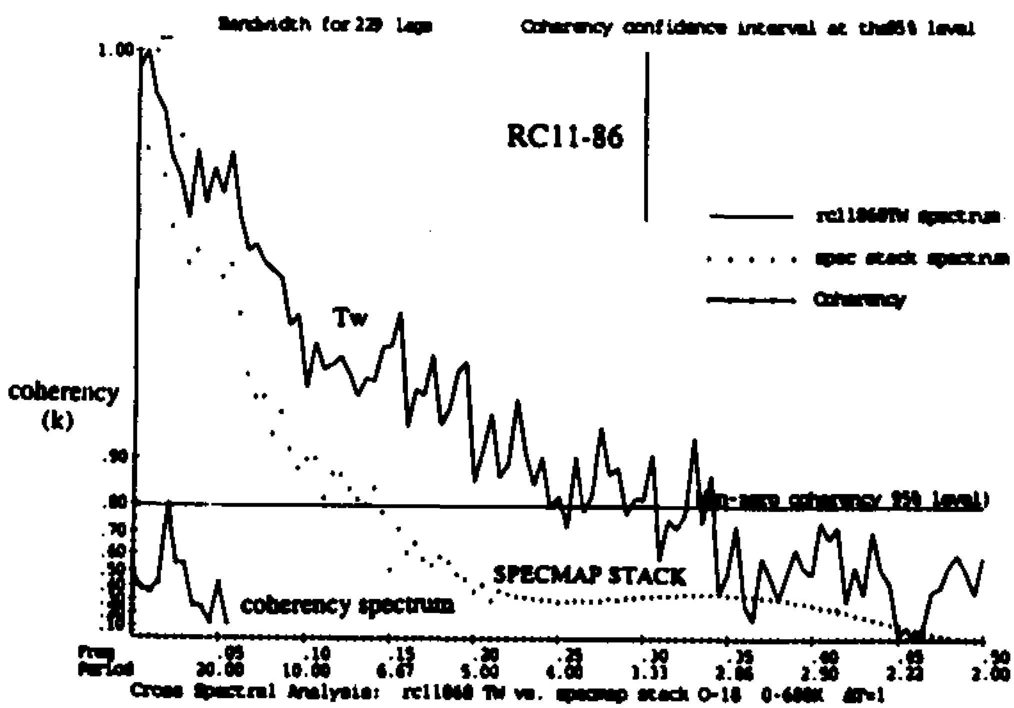

Bandwidth for 110 lags
Coherency confidence interval at the 95% level
V34-157
v3415711TW spectrum
spec stack spectrum
Coherency
Tw
coherency (k)
Non-zero coherency 95% level
SPECMAP STACK
coherency spectrum
Freq
Period
Cross Spectral Analysis: v3415711 TW vs. specmap stack 0-18 0-330K ΔT=1

(b)

Figure 19



(c)



(d)

Figure 19 continued

APPENDIX A

DEPTH (cm) AND ABUNDANCE (%) OF PLANKTIC FORAMINIFERA

Appendix A1. Depth and percent abundance of planktic foraminifera in RC11-86.

DEPTH (cm)	*O. universa*	*G. conglobatus*	*G. ruber*	*G. tenellus*	*G. sacculifer* w/o sac	*G. sacculifer* w/sac	*G. sacculifer* total	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*
3.0	1.13	0.38	5.08	0.19	2.07	1.69	3.77	1.88	0.75	9.23	7.34
10.0	0.90	0.00	5.95	0.00	2.34	0.18	2.52	1.80	0.72	10.81	5.77
15.0	1.20	0.00	4.79	0.60	1.50	1.80	3.29	1.20	2.40	8.68	5.39
20.0	0.87	0.00	5.03	0.00	0.87	1.21	2.08	1.39	0.69	10.75	4.68
25.0	0.26	0.00	5.71	0.26	2.86	0.26	3.12	0.78	1.30	7.79	2.08
30.0	0.83	0.00	3.54	0.00	0.83	0.42	1.25	1.88	0.21	9.38	1.88
35.0	1.47	0.00	5.28	0.00	0.00	0.00	0.00	0.29	1.17	11.73	2.64
40.0	0.94	0.00	2.45	0.00	0.38	0.00	0.38	1.32	0.19	9.98	3.01
45.0	1.27	0.00	2.53	0.00	0.25	0.00	0.25	0.76	0.25	9.11	2.78
51.0	0.30	0.00	2.98	0.00	1.19	0.00	1.19	0.89	0.30	12.50	1.19
55.0	0.57	0.00	2.27	0.00	0.00	0.57	0.57	0.85	0.00	9.63	1.70
60.0	0.46	0.00	3.92	0.00	0.23	0.00	0.23	0.92	1.38	10.14	2.76
65.0	2.31	0.00	3.47	0.00	0.46	0.23	0.69	0.69	0.00	12.50	1.85
70.0	0.92	0.00	3.38	0.00	1.23	0.00	1.23	0.92	0.00	9.54	3.08
74.5	1.52	0.22	3.70	0.00	0.43	0.00	0.00	0.00	0.43	10.22	2.83
80.0	2.09	0.00	3.66	0.00	0.52	0.52	1.04	0.78	0.26	11.49	2.61
84.5	0.54	0.00	1.63	0.00	0.00	0.00	0.00	1.36	0.00	11.92	1.90
90.0	1.42	0.00	4.48	0.00	0.94	0.00	0.94	2.36	0.24	12.97	3.77
95.0	1.88	0.00	3.13	0.00	0.63	0.00	0.63	0.94	0.31	14.06	4.69
100.0	1.29	0.00	4.12	0.00	0.00	0.26	0.26	1.55	0.00	9.54	4.12
105.0	1.37	0.00	2.05	0.00	0.34	0.00	0.34	0.00	0.68	10.62	4.11
110.0	0.97	0.00	2.90	0.00	0.00	0.48	0.48	2.17	0.24	10.39	0.48
115.0	0.63	0.00	1.88	0.00	0.31	0.00	0.31	0.31	0.31	13.17	4.08
120.0	0.23	0.00	2.71	0.23	0.68	0.68	1.35	1.13	0.00	15.35	4.29
125.0	1.72	0.00	1.72	0.00	0.57	0.57	1.15	0.57	0.57	14.94	2.30
130.0	1.79	0.00	3.57	0.00	0.26	0.26	0.51	2.55	0.00	8.16	3.57
135.0	0.26	0.00	1.53	0.00	0.51	0.00	0.51	0.26	0.26	12.24	4.34
140.0	0.97	0.00	5.19	0.00	0.32	0.00	0.32	1.30	0.65	7.47	0.97
145.0	0.16	0.00	3.49	0.00	0.95	0.16	1.11	0.79	0.48	12.38	1.27
150.0	0.30	0.00	3.65	0.30	0.61	0.00	0.61	1.52	0.91	10.94	3.04
155.0	0.56	0.00	1.69	0.00	0.28	0.28	0.56	0.56	0.28	13.80	1.97
160.0	0.72	0.00	3.14	0.00	0.48	0.72	1.21	0.97	0.00	10.87	1.93

Appendix A1. continued.

DEPTH (cm)	*O. universa*	*G. conglobatus*	*G. ruber*	*G. tenellus*	*G. sacculifer* w/o sac	*G. sacculifer* w/sac	*G. sacculifer* total	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*
165.0	1.40	0.00	3.08	0.00	1.68	0.28	1.96	0.84	0.00	12.89	1.12
170.0	1.20	0.00	2.10	0.00	0.60	0.60	1.20	1.20	0.00	9.91	2.40
175.0	1.08	0.00	1.62	0.00	0.00	0.27	0.27	0.54	0.27	11.86	1.08
180.0	0.64	0.00	3.54	0.00	0.64	0.32	0.96	0.96	0.00	12.86	0.00
185.0	0.56	0.00	3.61	0.00	1.39	0.56	1.94	0.56	0.28	11.39	1.94
190.0	0.00	0.00	3.67	0.00	0.00	0.00	0.00	0.92	0.00	7.65	2.14
195.0	1.66	0.00	2.66	0.00	0.66	0.33	1.00	0.66	0.00	14.29	1.66
200.0	0.48	0.00	2.41	0.00	0.48	0.48	0.96	1.20	0.96	12.77	2.41
205.0	0.00	0.00	3.16	0.00	1.90	0.00	1.90	0.00	0.32	20.25	1.58
210.0	0.58	0.00	5.56	0.00	0.88	0.00	0.88	1.17	0.29	15.20	1.75
215.0	0.71	0.00	3.33	0.24	1.19	0.48	1.67	0.00	0.00	18.81	0.71
220.0	0.94	0.00	4.09	0.00	1.26	0.00	1.26	1.26	0.94	11.32	1.89
222.0	0.34	0.00	5.42	0.00	0.34	0.68	1.02	0.68	0.00	14.58	1.69
227.5	0.34	0.00	6.76	0.00	0.68	0.34	1.01	1.35	1.01	13.85	1.35
230.0	1.49	0.00	4.22	0.99	0.74	0.25	0.99	1.74	0.50	10.92	4.22
235.0	1.65	0.00	6.60	0.00	0.66	0.33	0.99	1.32	0.00	15.18	1.98
240.0	1.87	0.00	5.08	0.27	0.53	0.00	0.53	1.07	0.27	9.09	4.81
242.5	1.96	0.00	5.03	0.00	2.51	0.28	2.79	0.84	0.28	13.13	3.63
247.5	0.30	0.00	4.45	0.00	1.19	0.30	1.48	0.59	0.00	16.91	3.86
250.0	0.89	0.00	4.73	0.00	2.37	0.89	3.25	1.78	0.00	12.43	3.85
252.0	1.33	0.00	4.67	0.00	3.33	1.11	4.44	0.89	0.00	14.00	5.78
254.0	0.94	0.00	5.39	0.23	0.70	0.47	1.17	1.17	0.70	12.18	5.39
256.0	0.29	0.00	4.29	0.57	0.00	1.14	1.14	1.14	1.14	13.16	6.57
258.0	0.72	0.24	6.76	0.00	0.72	0.72	1.45	2.90	1.93	12.80	5.07
260.0	1.44	0.00	6.90	0.00	0.86	0.86	1.72	1.15	0.29	13.51	3.16
262.0	0.70	0.00	5.39	0.23	1.41	0.70	2.11	1.41	1.17	11.01	7.03
264.0	1.05	0.00	6.58	0.00	1.84	1.05	2.89	2.11	0.53	10.26	6.32
266.0	0.29	0.00	5.88	0.00	1.18	0.29	1.47	0.59	1.47	7.06	7.94
268.0	2.02	0.22	5.38	0.00	0.90	0.22	1.12	1.35	1.12	7.85	10.54
270.0	0.86	0.00	8.33	0.00	1.44	0.86	2.30	2.01	0.86	14.66	5.17
272.0	1.14	0.00	5.14	0.29	0.86	1.14	2.00	2.86	0.86	12.00	10.29
274.0	1.32	0.26	9.74	0.00	3.16	1.05	4.21	2.11	0.00	6.58	10.26

Appendix A1. continued.

DEPTH (cm)	*O. universa*	*G. conglobatus*	*G. ruber*	*G. tenellus*	*G. sacculifer* w/o sac	*G. sacculifer* w/sac	*G. sacculifer* total	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*
276.0	1.23	0.62	6.46	0.31	2.46	0.62	3.08	1.23	0.62	10.77	6.46
278.0	1.63	0.00	11.11	0.54	1.63	1.36	2.98	1.63	0.81	9.49	9.21
280.0	0.54	0.27	6.54	0.00	2.72	1.09	3.81	1.91	0.82	16.08	3.81
282.0	0.22	0.00	7.96	0.66	1.77	1.11	2.88	2.65	1.99	11.50	6.19
284.0	0.92	0.23	5.54	0.00	2.08	0.46	2.54	1.62	1.39	13.86	5.77
286.0	0.00	0.00	6.02	0.29	1.43	2.01	3.44	3.15	1.72	11.75	7.74
288.0	0.81	0.81	7.74	0.41	1.83	0.61	2.44	1.43	1.02	15.68	8.96
290.0	1.64	0.00	7.38	0.82	1.91	0.27	2.19	1.91	0.82	15.30	3.01
292.0	1.32	0.00	7.92	0.53	1.58	1.06	2.64	1.32	1.58	12.93	5.01
294.0	0.89	0.22	7.14	0.45	0.89	0.67	1.56	2.90	1.34	12.72	4.24
296.0	0.64	0.00	6.82	0.00	1.28	1.28	2.56	2.13	1.49	13.65	2.77
298.0	1.06	0.00	6.61	0.26	1.32	0.53	1.85	2.12	1.06	11.64	2.12
300.0	1.65	0.00	5.20	0.24	0.47	0.95	1.42	1.18	0.47	13.00	0.71
302.0	1.67	0.00	4.18	0.56	1.39	0.00	1.39	1.95	0.56	11.42	0.28
304.0	1.13	0.00	3.40	0.57	0.28	1.13	1.42	0.85	0.28	15.8	4.25
306.0	2.55	0.00	3.25	0.00	0.70	0.23	0.93	1.86	0.70	15.55	2.32
308.0	1.37	0.00	6.41	0.23	1.14	0.46	1.60	1.37	0.46	14.65	2.29
310.0	1.80	0.00	4.11	0.26	0.77	0.00	0.77	1.54	1.03	14.91	1.29
312.0	1.00	0.25	7.02	0.50	0.25	0.25	0.50	3.01	1.25	10.03	2.01
314.0	3.07	0.00	5.12	0.00	1.71	1.02	2.73	1.71	0.68	12.63	4.44
316.0	1.69	0.00	2.25	0.56	0.28	0.56	0.85	0.85	1.13	14.08	3.94
318.0	3.53	0.00	5.79	0.00	0.25	1.01	1.26	2.52	1.26	11.08	2.77
320.0	1.38	0.00	5.52	0.23	1.84	0.46	2.30	1.15	0.46	15.17	1.61
325.0	1.48	0.00	3.56	0.00	0.59	0.00	0.59	0.30	0.30	16.32	1.48
330.0	0.94	0.00	2.81	0.00	0.63	0.63	1.25	0.31	0.31	11.25	1.56
335.0	0.92	0.00	1.85	0.31	1.23	0.31	1.54	0.92	0.62	11.38	2.46
340.0	3.69	0.00	1.06	0.26	0.79	0.53	1.32	0.53	0.79	8.97	0.53
345.0	1.22	0.00	2.43	0.00	0.61	1.22	1.82	1.22	0.00	8.81	0.91
350.0	1.80	0.00	2.40	0.00	0.30	1.20	1.50	1.20	0.90	8.98	0.60
355.0	1.43	0.00	5.00	0.00	1.07	0.00	1.07	0.36	0.36	15.71	2.50
360.0	0.85	0.00	3.41	0.00	0.85	0.28	1.14	0.57	0.28	11.36	0.85
365.0	2.12	0.00	3.17	0.00	1.32	0.53	1.85	0.53	0.53	13.76	1.06

Appendix A1. continued.

DEPTH (cm)	*O. universa*	*G. conglobatus*	*G. ruber*	*G. tenellus*	*G. sacculifer* w/o sac	*G. sacculifer* w/sac	*G. sacculifer* total	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*
370.0	1.73	0.00	2.02	0.00	0.58	0.58	1.16	0.58	0.00	12.72	0.58
375.0	0.67	0.00	2.68	0.00	1.68	1.01	2.68	1.01	0.34	10.40	2.01
380.0	1.40	0.00	2.51	0.56	0.84	0.28	1.12	1.12	0.28	8.38	1.12
385.0	1.64	0.00	0.98	0.00	0.33	0.33	0.66	0.00	0.66	12.46	1.64
390.0	1.32	0.00	2.11	0.00	1.32	0.26	1.58	0.00	1.32	16.09	0.53
395.0	1.55	0.00	1.24	0.00	0.62	0.62	1.24	0.62	0.31	17.65	2.17
400.0	0.56	0.00	2.25	0.56	1.12	0.84	1.97	1.40	1.40	10.96	1.12
405.0	0.59	0.00	2.66	0.00	0.30	0.30	0.59	1.48	0.00	18.05	1.48
410.0	1.94	0.00	2.18	0.48	0.97	0.24	1.21	2.42	0.97	16.95	2.18
415.0	0.32	0.00	1.90	0.00	0.63	0.00	0.63	0.32	1.27	14.92	0.32
420.0	2.32	0.00	3.87	0.00	1.29	0.26	1.55	0.77	1.29	12.89	1.80
425.0	0.63	0.00	1.89	0.00	1.58	0.32	1.89	0.32	0.32	16.40	2.52
430.0	0.00	0.00	3.81	0.00	0.63	0.00	0.63	0.95	0.32	13.02	0.95
435.0	0.32	0.00	1.61	0.00	0.32	0.00	0.32	0.32	1.29	13.50	1.93
440.0	1.89	0.00	2.21	0.00	1.26	0.00	1.26	1.26	0.32	9.15	0.95
445.0	0.00	0.00	2.91	0.00	0.65	0.32	0.97	0.65	0.65	8.41	1.62
450.0	0.33	0.00	1.64	0.00	1.64	0.00	1.64	0.99	0.66	9.21	3.29
455.0	0.00	0.00	3.57	0.00	1.65	0.00	1.65	0.00	0.27	10.44	3.57
460.0	0.27	0.00	4.83	0.27	1.07	0.80	1.88	0.54	0.80	11.53	4.83
465.0	1.93	0.00	9.32	0.32	1.61	0.32	1.93	0.64	0.00	16.08	3.54
470.0	0.00	0.00	5.30	0.00	1.06	0.35	1.41	0.35	0.00	8.83	2.47
475.0	0.00	0.00	3.02	0.00	2.02	1.26	3.27	0.25	0.50	10.33	2.27
480.0	0.29	0.00	2.65	0.00	0.88	1.18	2.06	0.29	1.76	12.06	2.94
485.0	0.00	0.00	4.93	0.00	0.99	0.00	0.99	0.00	0.66	8.55	2.96
490.0	0.27	0.27	3.80	0.00	0.54	0.00	0.54	0.82	1.36	10.33	4.89
495.0	0.37	0.00	5.97	0.00	0.75	0.00	0.75	0.37	0.37	15.30	0.75
500.0	0.97	0.00	4.14	0.00	0.73	0.24	0.97	0.00	0.00	10.46	2.43
505.0	1.17	0.00	1.17	0.00	2.35	0.00	2.35	0.59	0.59	18.77	0.88
510.0	0.25	0.00	2.75	0.00	0.50	0.00	0.50	0.00	0.50	12.25	3.25
515.0	0.60	0.00	1.81	0.00	0.30	0.00	0.30	0.00	0.00	13.29	0.60
520.0	1.16	0.00	4.91	0.00	1.73	0.58	2.31	0.29	0.00	11.85	1.16
525.0	0.92	0.00	1.53	0.00	1.23	0.31	1.53	0.31	0.92	12.27	2.15

Appendix A1. continued.

DEPTH (cm)	*O. universa*	*G. conglobatus*	*G. ruber*	*G. tenellus*	*G. sacculifer* w/o sac	*G. sacculifer* w/sac	*G. sacculifer* total	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*
530.0	1.12	0.00	2.51	0.00	0.84	0.00	0.84	0.28	0.00	12.01	1.12
535.0	0.26	0.00	1.58	0.00	0.53	0.00	0.53	0.00	0.26	13.95	1.32
540.0	0.47	0.00	3.28	0.00	1.17	0.47	1.64	0.23	0.00	9.84	1.87
545.0	0.00	0.00	3.65	0.00	0.66	0.33	1.00	0.66	0.66	12.96	1.33
550.0	0.59	0.00	4.13	0.00	0.00	0.00	0.00	0.00	0.00	12.68	0.29
555.0	0.67	0.00	4.33	0.00	1.67	0.33	2.00	0.67	0.00	16.00	2.33
560.0	0.00	0.00	2.32	0.00	0.33	0.33	0.66	0.00	0.00	11.59	1.32
565.0	0.56	0.00	2.53	0.00	0.84	0.00	0.84	0.56	0.28	14.89	0.56
570.0	0.00	0.00	5.71	0.36	0.36	0.36	0.71	0.36	0.00	13.57	3.21
575.0	0.00	0.00	3.38	0.00	1.23	0.00	1.23	0.31	0.92	12.92	2.15
580.0	0.92	0.00	5.21	0.31	1.53	0.00	1.53	0.31	0.00	18.10	0.92
585.0	1.31	0.00	3.92	0.33	0.65	0.00	0.65	0.33	0.00	13.07	3.59
590.0	0.71	0.00	2.84	0.00	0.35	0.00	0.35	0.71	0.00	14.54	2.84
595.0	0.78	0.00	8.53	0.00	0.78	0.39	1.16	1.16	0.78	14.73	1.55
600.0	0.50	0.00	2.51	0.50	1.00	0.00	1.00	0.50	0.00	13.28	3.01
605.0	2.25	0.00	2.89	0.00	0.32	0.64	0.96	0.29	0.64	15.76	1.93
610.0	0.85	0.00	1.99	0.00	1.70	0.00	1.70	0.00	0.85	19.60	1.42
615.0	0.00	0.00	1.62	0.00	0.00	0.00	0.00	0.00	0.32	19.09	1.94
620.0	0.37	0.00	2.23	0.00	1.12	0.37	1.49	0.37	1.12	15.99	3.35
625.0	0.35	0.00	2.45	0.00	0.70	0.00	0.70	0.00	0.35	14.34	3.15
630.0	0.61	0.00	0.91	0.00	0.91	0.00	0.91	0.00	0.91	19.45	0.61
635.0	2.71	0.00	1.02	0.00	0.00	0.00	0.00	0.00	1.02	25.76	1.02
640.0	0.30	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.60	16.72	1.49
645.0	1.42	0.00	0.71	0.00	0.35	0.00	0.35	0.00	0.35	18.44	2.13
650.0	0.57	0.00	2.59	0.00	0.29	0.00	0.29	0.00	0.00	18.10	1.72
655.0	0.84	0.00	2.25	0.00	0.56	0.00	0.56	0.00	0.00	25.56	1.40
650.0	0.00	0.00	2.82	0.00	0.35	0.70	1.06	0.00	0.00	18.31	1.76
665.0	0.00	0.00	2.93	0.00	0.33	0.00	0.33	0.00	0.65	23.78	0.98
670.0	0.68	0.00	2.05	0.00	0.00	0.00	0.00	0.00	0.00	18.49	1.71
675.0	0.36	0.00	2.50	0.36	0.00	0.00	0.00	0.36	0.00	23.93	2.14
680.0	0.27	0.00	3.51	0.00	0.81	0.27	1.08	0.27	0.27	17.84	1.62
685.0	0.31	0.00	6.75	0.61	1.23	0.00	1.23	0.61	0.31	15.95	1.53

Appendix A1. continued.

DEPTH (cm)	*O. universa*	*G. conglobatus*	*G. ruber*	*G. tenellus*	*G. sacculifer* w/o sac	*G. sacculifer* w/sac	*G. sacculifer* total	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*
690.0	0.91	0.00	4.53	0.00	0.91	0.00	0.91	1.21	0.91	21.75	1.21
695.0	2.01	0.00	0.80	0.00	0.40	0.00	0.40	0.40	1.20	25.30	1.20
700.0	0.70	0.00	1.40	0.70	0.70	0.70	0.00	0.00	0.00	15.79	2.11
705.0	0.32	0.00	0.97	0.00	0.00	0.00	0.00	0.00	0.32	28.71	0.97
710.0	1.37	0.00	2.05	0.00	0.68	0.00	0.68	0.34	0.34	22.95	1.37
715.0	0.00	0.00	1.00	0.00	0.33	0.00	0.33	0.00	1.33	24.58	2.66
720.0	0.00	0.00	1.54	0.00	0.00	0.00	0.00	0.00	0.00	26.46	0.62
725.0	0.36	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	25.36	1.09
730.0	0.30	0.00	1.20	0.00	0.00	0.00	0.00	0.00	0.00	16.52	1.50
732.5	0.66	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00	17.22	1.99
737.5	1.00	0.00	2.33	0.00	0.67	0.00	0.67	0.00	1.00	21.67	1.67
740.0	0.86	0.29	1.72	0.57	0.00	0.00	0.00	0.00	0.00	14.90	0.57
745.0	0.66	0.00	2.30	0.00	0.66	0.00	0.66	0.00	0.66	20.72	1.97
750.0	0.26	0.00	1.80	0.00	1.03	0.00	1.03	0.26	0.51	17.74	1.03
755.0	1.03	0.00	1.54	0.00	2.06	0.00	2.06	0.00	0.00	24.16	1.03
760.0	0.00	0.00	0.83	0.00	0.83	0.00	0.83	0.00	0.83	14.96	1.11
765.0	0.33	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	20.86	0.33
770.0	0.27	0.00	1.64	0.00	0.00	0.00	0.00	0.27	0.00	23.22	0.82
775.0	0.00	0.00	2.05	0.00	0.00	0.34	0.34	0.00	0.34	21.92	2.40
780.0	0.00	0.00	1.82	0.30	1.52	0.91	2.42	0.00	0.30	16.97	0.91
785.0	0.00	0.00	2.35	0.00	0.59	0.29	0.88	0.00	0.00	25.29	2.65
790.0	0.00	0.00	2.16	0.00	0.00	0.00	0.00	0.00	0.36	18.71	1.44
795.0	0.72	0.00	3.23	0.00	0.72	0.00	0.72	0.00	0.36	19.35	1.08
800.0	0.00	0.00	3.54	0.00	0.96	0.00	0.96	0.32	0.00	19.61	0.96
805.0	0.00	0.00	0.98	0.00	0.98	0.00	0.98	0.33	0.00	15.31	1.63
810.0	0.30	0.00	0.60	0.00	0.60	0.00	0.60	0.00	0.30	21.75	1.51
815.0	1.37	0.00	0.82	0.00	1.92	0.00	1.92	0.00	0.27	18.96	1.10
820.0	0.00	0.00	2.49	0.00	1.11	0.00	1.11	0.28	0.28	19.67	2.49
825.0	0.33	0.00	3.01	0.00	0.00	0.00	0.00	0.33	0.00	17.06	2.01
830.0	0.32	0.00	1.93	0.00	0.32	0.00	0.32	0.00	0.32	16.08	1.61
835.0	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	18.39	3.34
840.0	0.32	0.00	0.95	0.00	0.63	0.00	0.63	0.32	0.63	13.88	2.52

Appendix A1. continued.

DEPTH (cm)	*O. universa*	*G. conglobatus*	*G. ruber*	*G. tenellus*	*G. sacculifer* w/o sac	*G. sacculifer* w/sac	*G. sacculifer* total	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*
845.0	0.64	0.00	0.32	0.00	0.64	0.00	0.64	0.00	0.32	11.90	0.96
850.0	0.94	0.00	0.94	0.00	0.31	0.00	0.31	0.00	0.00	13.17	0.00
855.0	0.28	0.00	1.68	0.00	1.12	0.28	1.40	0.00	0.00	15.69	1.96
860.0	1.16	0.00	4.62	0.00	1.16	0.00	1.16	0.29	0.58	17.05	1.45
865.0	0.89	0.00	5.95	0.00	0.60	0.00	0.60	0.30	0.89	18.15	0.89
870.0	0.00	0.00	5.32	0.00	1.00	0.00	1.00	0.33	0.00	17.28	3.65
875.0	0.00	0.00	1.28	0.00	0.00	0.00	0.00	0.32	0.00	20.13	3.51
880.0	0.24	0.00	1.92	0.00	0.00	0.00	0.00	0.00	0.00	23.02	1.44
885.0	0.00	0.00	1.45	0.00	0.58	0.00	0.58	0.00	0.29	19.36	1.73
890.0	0.34	0.00	1.68	0.34	0.00	0.00	0.00	0.00	0.34	16.16	1.68
895.0	0.00	0.00	4.27	0.00	0.28	0.00	0.28	0.00	0.00	17.09	1.71
900.0	0.32	0.00	5.14	0.00	3.22	1.29	4.50	0.00	0.32	12.86	1.61
905.0	0.91	0.30	5.49	0.00	0.91	0.00	0.91	0.00	0.00	16.77	0.91
910.0	0.95	0.00	2.21	0.32	1.58	0.00	1.58	0.00	0.63	14.51	1.26
915.0	0.86	0.00	2.57	0.00	0.57	0.00	0.57	0.57	0.00	20.86	1.43
920.0	0.00	0.00	1.76	0.00	0.00	0.00	0.00	0.00	0.00	29.58	1.06
925.0	0.68	0.00	2.39	0.00	0.00	0.00	0.00	0.34	0.68	21.16	2.73
930.0	0.33	0.00	3.61	0.00	0.66	0.00	0.66	0.00	0.00	13.44	0.98
935.0	0.60	0.00	4.52	0.00	0.90	0.00	0.90	0.30	1.20	18.98	3.01
940.0	0.00	0.00	4.00	0.00	2.15	0.00	2.15	0.31	0.31	15.08	2.77
945.0	0.37	0.00	1.47	0.00	0.37	0.00	0.37	0.00	0.00	16.48	1.10
950.0	0.00	0.00	3.19	0.00	0.71	0.00	0.71	0.35	0.00	15.96	1.06
952.5	0.72	0.00	4.69	0.00	1.44	0.00	1.44	0.36	0.00	16.97	0.72

Appendix A1. continued.

DEPTH (cm)	*G. digitata*	*G. rubescens*	*G. humilis*	*G. quincq.*	*N. pachyderma* (sinistral)	*N. pachyderma* (dextral)	*N. dutertrei*	*G. hexagona*	*P. obliquiloc.*	*G. inflata*	*G truncatulinoides* (sinistral)
3.0	0.00	0.19	0.00	0.38	0.94	10.55	18.83	0.00	0.94	19.59	3.58
10.0	0.00	0.00	0.00	0.18	0.54	13.87	15.68	0.36	0.18	21.44	2.16
15.0	0.00	0.00	0.00	0.00	0.30	9.88	15.57	0.00	0.30	27.25	2.40
20.0	0.00	0.00	0.00	0.00	0.69	19.76	12.48	0.00	1.04	21.49	4.51
25.0	0.00	0.00	0.00	0.26	0.00	19.48	16.10	0.00	0.52	25.19	1.82
30.0	0.00	0.00	0.00	0.21	2.08	33.75	16.46	0.00	0.00	13.54	1.46
35.0	0.00	0.00	0.00	0.88	2.64	23.17	21.70	0.00	0.00	10.26	1.17
40.0	0.00	0.19	0.00	0.38	1.69	27.31	26.37	0.00	0.00	10.36	2.07
45.0	0.00	0.51	0.00	0.00	1.52	26.58	16.71	0.00	0.00	22.53	0.76
51.0	0.00	0.00	0.00	0.30	1.49	31.55	16.67	0.00	0.00	14.58	1.49
55.0	0.00	0.28	0.00	0.28	1.42	28.33	20.11	0.00	0.00	17.00	3.40
60.0	0.00	0.00	0.00	0.23	2.07	27.42	20.28	0.00	0.00	20.74	2.07
65.0	0.00	0.00	0.23	0.23	1.85	21.06	17.36	0.23	0.23	23.15	3.70
70.0	0.00	0.00	0.00	0.00	1.54	27.08	15.69	0.00	0.00	20.62	3.08
74.5	0.00	0.43	0.00	0.43	1.09	24.13	21.52	0.00	0.00	17.39	2.83
80.0	0.00	0.00	0.00	0.52	1.57	30.29	14.36	0.00	0.00	19.58	1.83
84.5	0.00	0.00	0.00	0.00	1.36	27.37	17.89	0.00	0.00	20.33	2.17
90.0	0.00	0.00	0.00	0.94	1.18	25.94	16.98	0.00	0.00	17.69	1.89
95.0	0.00	0.31	0.00	0.31	0.94	20.31	17.81	0.00	0.00	21.56	3.13
100.0	0.00	0.00	0.00	0.00	0.77	31.70	13.66	0.00	0.00	18.30	2.06
105.0	0.00	0.00	0.00	0.00	0.68	26.37	21.23	0.00	0.00	16.44	2.40
110.0	0.00	0.00	0.00	0.00	1.45	25.12	20.29	0.00	0.24	18.60	3.86
115.0	0.00	0.00	0.00	0.94	0.94	27.90	14.42	0.00	0.00	19.12	4.39
120.0	0.00	0.00	0.00	0.45	1.35	25.06	13.09	0.00	0.68	17.83	1.81
125.0	0.00	0.00	0.00	0.29	1.44	25.57	13.51	0.00	0.00	17.24	4.89
130.0	0.00	0.26	0.00	1.53	0.77	22.45	13.01	0.00	0.51	23.21	2.55
135.0	0.00	0.00	0.00	0.77	0.51	18.37	16.58	0.00	0.26	27.30	2.55
140.0	0.00	0.00	0.00	0.00	1.95	16.23	16.23	0.00	0.97	31.17	2.92
145.0	0.00	0.00	0.00	0.00	1.43	22.54	12.54	0.00	0.32	25.87	1.90
150.0	0.30	0.30	0.00	0.00	1.22	15.81	16.41	0.00	0.30	29.18	2.13
155.0	0.00	0.00	0.00	0.00	0.56	17.46	12.39	0.00	0.00	33.80	3.66
160.0	0.00	0.24	0.00	0.00	1.21	14.25	2.56	0.24	0.24	37.92	5.31

Appendix A1. continued.

DEPTH (cm)	*G. digitata*	*G. rubescens*	*G. humilis*	*G. quincq.*	*N. pachyderma* (sinistral)	*N. pachyderma* (dextral)	*N. dutertrei*	*G. hexagona*	*P. obliquiloc.*	*G. inflata*	*G truncatulinoides* (sinistral)
165.0	0.00	0.00	0.00	0.56	1.40	17.37	16.81	0.00	0.00	29.13	3.36
170.0	0.00	0.00	0.00	0.00	0.60	19.52	20.42	0.00	0.00	26.13	4.20
175.0	0.00	0.27	0.00	0.00	0.27	14.82	15.90	0.00	0.00	35.31	2.96
180.0	0.00	0.00	0.00	0.96	0.32	17.68	19.61	0.00	0.96	25.40	3.54
185.0	0.00	0.00	0.00	0.00	0.28	20.56	17.78	0.00	0.00	20.83	3.61
190.0	0.00	0.00	0.00	0.00	1.22	28.44	19.88	0.31	0.00	23.85	1.53
195.0	0.33	0.00	0.00	0.00	1.00	25.91	17.94	0.00	0.00	18.60	1.99
200.0	0.00	0.00	0.00	0.00	1.45	22.65	15.18	0.00	1.45	20.00	2.17
205.0	0.00	0.00	0.00	0.00	0.63	25.63	16.46	0.00	0.00	14.87	0.63
210.0	0.00	0.00	0.00	0.29	1.46	14.04	10.23	0.00	0.58	27.49	4.68
215.0	0.00	0.00	0.00	0.24	0.24	20.71	13.57	0.24	0.00	20.71	3.33
220.0	0.00	0.31	0.00	0.00	0.00	8.81	8.18	0.00	0.31	40.25	4.72
222.5	0.00	0.34	0.00	0.34	0.68	13.22	8.47	0.00	0.34	37.63	6.10
227.5	0.00	0.00	0.00	0.34	0.34	11.49	11.15	0.00	0.00	35.47	5.41
230.0	0.00	0.25	0.00	0.00	0.74	10.17	12.16	0.25	0.50	36.23	3.47
235.0	0.00	0.00	0.00	0.00	0.99	13.20	9.24	0.00	0.00	29.70	4.29
240.0	0.00	0.00	0.00	0.00	0.27	14.97	13.37	0.00	0.27	28.07	4.28
242.5	0.00	0.28	0.00	0.00	0.84	13.41	8.10	0.00	0.00	29.89	6.15
247.5	0.00	0.00	0.00	0.00	0.89	15.43	7.72	0.00	0.00	27.89	2.97
250.0	0.00	0.00	0.00	0.30	0.59	7.10	7.69	0.00	1.18	36.39	5.33
252.0	0.00	0.00	0.00	0.22	0.89	9.33	14.44	0.00	0.44	21.11	2.89
254.0	0.00	0.00	0.00	0.00	0.94	14.99	9.37	0.00	0.70	27.87	3.51
256.0	0.00	0.00	0.00	0.57	0.57	12.86	10.00	0.00	1.43	28.86	2.57
258.0	0.00	0.00	0.00	0.00	0.97	10.63	11.35	0.00	0.72	25.36	4.11
260.0	0.00	0.00	0.00	0.29	0.57	14.08	10.92	0.00	0.57	25.29	4.31
262.0	0.00	0.00	0.00	0.70	0.70	10.30	11.48	0.00	0.70	29.74	3.28
264.0	0.00	0.00	0.00	0.26	0.26	7.63	10.79	0.00	0.00	30.00	3.42
266.0	0.29	0.00	0.00	0.00	0.88	11.47	14.41	0.00	0.00	27.94	6.47
268.0	0.00	0.00	0.00	0.22	0.22	12.11	12.11	0.00	0.67	28.03	5.38
270.0	0.00	0.00	0.00	0.00	0.86	5.46	10.92	0.29	0.57	32.76	3.16
272.0	0.00	0.00	0.00	0.00	0.29	12.29	9.43	0.00	0.86	24.29	4.00
274.0	0.00	0.00	0.00	0.00	0.53	3.16	7.37	0.00	0.79	35.53	5.00

Appendix A1. continued.

DEPTH (cm)	*G. digitata*	*G. rubescens*	*G. humilis*	*G. quincq.*	*N. pachyderma* (sinistral)	*N. pachyderma* (dextral)	*N. dutertrei*	*G. hexagona*	*P. obliquiloc.*	*G. inflata*	*G truncatulinoides* (sinistral)
276.0	0.00	0.00	0.00	0.00	0.31	5.54	11.69	0.00	1.54	31.69	4.31
278.0	0.00	0.27	0.00	0.00	2.17	4.88	10.84	0.00	0.27	24.39	3.52
280.0	0.00	0.27	0.00	0.00	1.09	8.72	9.54	0.00	0.00	26.70	2.18
282.0	0.00	0.00	0.00	0.00	1.55	5.75	9.73	0.00	0.22	29.20	2.88
284.0	0.00	0.23	0.00	0.00	2.08	4.16	9.01	0.00	0.00	30.95	3.46
286.0	0.00	0.00	0.00	0.00	1.72	6.59	8.31	0.00	0.00	27.79	2.87
288.0	0.00	0.00	0.00	0.00	0.81	8.55	9.57	0.20	0.20	21.38	2.44
290.0	0.00	0.00	0.00	0.00	0.00	9.02	9.84	0.00	0.00	32.51	3.55
292.0	0.00	0.53	0.00	0.26	0.79	10.29	9.76	0.26	0.00	25.59	1.32
294.0	0.00	0.00	0.00	0.00	0.45	13.17	9.15	0.00	0.22	26.79	2.90
296.0	0.00	0.00	0.00	0.00	0.21	10.23	7.89	0.00	0.21	31.77	1.92
298.0	0.00	0.26	0.00	0.00	0.00	16.40	4.76	0.00	0.00	31.48	2.65
300.0	0.00	0.24	0.00	0.24	0.47	21.04	8.75	0.00	0.00	31.91	2.13
302.0	0.00	0.00	0.00	0.28	0.00	22.56	7.52	0.00	0.00	32.31	2.51
304.0	0.00	0.00	0.00	0.00	0.85	17.56	8.50	0.00	0.00	30.59	2.83
306.0	0.00	0.23	0.00	0.70	0.46	18.10	7.19	0.00	0.00	34.80	1.16
308.0	0.00	0.23	0.00	0.23	0.23	15.79	9.15	0.00	0.00	31.12	3.20
310.0	0.00	0.00	0.00	0.00	1.54	16.71	7.71	0.00	0.00	31.88	4.63
312.0	0.00	0.00	0.00	0.00	1.25	16.04	7.52	0.00	0.50	33.58	1.75
314.0	0.00	0.00	0.00	0.34	1.71	19.45	4.44	0.00	0.00	29.35	2.73
316.0	0.00	0.00	0.00	0.00	1.97	19.15	5.35	0.00	0.28	30.70	2.54
318.0	0.00	0.00	0.00	0.25	0.76	13.35	5.54	0.00	0.25	32.24	3.27
320.0	0.00	0.00	0.00	0.00	2.30	14.25	7.59	0.00	0.00	36.78	1.61
325.0	0.00	0.00	0.00	0.30	0.89	19.88	9.79	0.00	0.00	29.38	2.97
330.0	0.00	0.00	0.00	0.31	1.56	15.63	9.69	0.00	0.31	34.38	4.06
335.0	0.00	0.00	0.00	0.31	1.54	16.92	8.92	0.00	0.62	31.69	4.62
340.0	0.00	0.00	0.00	0.26	0.79	10.82	10.55	0.00	0.26	48.55	1.06
345.0	0.00	0.00	0.00	0.00	1.22	11.25	13.07	0.00	0.00	41.64	1.22
350.0	0.00	0.00	0.00	0.30	1.20	14.37	7.78	0.00	0.30	43.41	1.50
355.0	0.00	0.00	0.00	0.00	1.43	21.07	8.57	0.00	0.00	32.14	0.36
360.0	0.00	0.00	0.00	0.85	0.85	17.33	10.51	0.00	0.28	34.09	2.27
365.0	0.00	0.26	0.00	0.00	0.26	23.28	10.05	0.00	0.26	29.10	2.38

Appendix A1. continued.

DEPTH (cm)	*G. digitata*	*G. rubescens*	*G. humilis*	*G. quincq.*	*N. pachyderma* (sinistral)	*N. pachyderma* (dextral)	*N. dutertrei*	*G. hexagona*	*P. obliquiloc.*	*G. inflata*	*G truncatulinoides* (sinistral)
370.0	0.00	0.00	0.00	0.00	0.29	16.18	11.56	0.00	0.00	35.55	1.73
375.0	0.00	0.00	0.00	0.67	0.67	20.81	7.72	0.00	0.00	37.58	2.35
380.0	0.00	0.00	0.00	0.28	0.84	21.79	9.22	0.00	0.28	37.99	3.63
385.0	0.00	0.00	0.00	0.00	0.66	18.03	9.84	0.00	0.33	38.69	2.62
390.0	0.00	0.00	0.00	0.53	2.11	26.91	9.23	0.00	0.00	20.32	1.32
395.0	0.00	0.31	0.00	0.31	0.93	24.46	12.38	0.00	0.00	22.91	2.17
400.0	0.00	0.00	0.00	0.28	1.12	22.47	8.15	0.00	0.00	32.87	3.09
405.0	0.00	0.00	0.00	0.00	0.30	20.41	11.24	0.00	0.00	28.11	1.48
410.0	0.00	0.24	0.97	0.00	1.21	17.92	8.47	0.24	0.00	25.42	2.42
415.0	0.00	0.00	0.00	0.32	1.27	21.90	9.21	0.00	0.00	30.79	1.59
420.0	0.00	0.00	0.00	0.00	1.80	21.65	6.96	0.00	0.26	26.80	1.55
425.0	0.00	0.00	0.00	0.32	0.63	14.51	8.52	0.00	0.00	28.08	1.89
430.0	0.00	0.00	0.00	0.32	0.00	17.46	9.52	0.00	0.00	35.56	2.86
435.0	0.00	0.00	0.32	0.32	1.29	20.26	7.40	0.00	0.32	36.98	0.64
440.0	0.00	0.00	0.00	0.32	1.26	20.82	9.78	0.00	0.32	33.12	1.89
445.0	0.00	0.00	0.00	0.32	0.97	20.06	6.47	0.00	0.32	40.78	1.29
450.0	0.00	0.00	0.00	0.33	2.63	13.16	9.54	0.00	0.33	32.57	4.28
455.0	0.00	0.00	0.00	0.00	1.10	14.29	7.42	0.00	0.00	37.09	3.57
460.0	0.00	0.00	0.00	0.00	0.80	9.65	5.63	0.00	0.27	35.39	2.68
465.0	0.00	0.32	0.00	0.00	1.29	9.00	9.97	0.00	0.00	18.33	2.57
470.0	0.00	0.35	0.00	0.00	1.41	13.43	7.42	0.00	0.00	40.99	3.53
475.0	0.00	0.25	0.00	0.25	0.50	11.84	6.55	0.00	0.25	42.82	2.77
480.0	0.00	0.00	0.00	0.00	3.24	14.71	7.65	0.00	0.59	35.00	2.06
485.0	0.00	0.33	0.00	0.00	0.99	24.67	11.18	0.00	0.00	23.68	2.96
490.0	0.00	0.00	0.00	0.00	0.82	19.29	7.61	0.00	0.27	29.08	3.53
495.0	0.00	0.00	0.00	0.75	1.49	23.88	7.84	0.00	0.00	19.03	1.87
500.0	0.00	0.00	0.00	1.70	0.73	26.52	7.30	0.00	0.24	25.30	3.41
505.0	0.00	0.00	0.00	0.00	1.17	26.69	11.14	0.00	0.00	19.06	1.47
510.0	0.00	0.00	0.00	1.00	2.75	20.50	9.25	0.00	0.50	27.25	2.25
515.0	0.00	0.00	0.00	0.30	3.02	31.12	9.37	0.00	0.00	22.05	2.72
520.0	0.00	0.00	0.00	0.29	2.89	21.68	11.85	0.00	0.00	23.99	0.87
525.0	0.00	0.00	0.00	0.31	0.92	23.31	7.36	0.00	0.31	23.01	3.07

Appendix A1. continued.

DEPTH (cm)	*G. digitata*	*G. rubescens*	*G. humilis*	*G. quincq.*	*N. pachyderma* (sinistral)	*N. pachyderma* (dextral)	*N. dutertrei*	*G. hexagona*	*P. obliquiloc.*	*G. inflata*	*G truncatulinoides* (sinistral)
530.0	0.00	0.00	0.00	0.00	1.68	20.39	4.75	0.00	0.28	37.43	1.40
535.0	0.00	0.00	0.00	0.00	1.32	19.21	6.84	0.00	0.26	38.42	1.05
540.0	0.00	0.00	0.00	0.23	2.11	22.95	7.49	0.00	0.00	34.89	2.11
545.0	0.00	0.00	0.00	0.66	0.33	21.59	7.97	0.00	0.00	32.56	1.00
550.0	0.00	0.00	0.00	0.59	0.88	22.42	10.32	0.00	0.00	28.32	1.18
555.0	0.00	0.00	0.00	0.00	1.67	17.67	7.33	0.00	0.00	23.33	2.33
560.0	0.00	0.00	0.00	0.00	0.33	19.87	9.27	0.00	0.00	40.07	1.32
565.0	0.00	0.00	0.00	0.00	1.12	17.70	6.74	0.00	0.00	39.33	1.97
570.0	0.00	0.00	0.00	0.00	1.43	15.00	10.36	0.00	0.00	35.36	3.57
575.0	0.00	0.00	0.00	0.31	2.77	19.69	7.08	0.00	0.00	28.00	1.54
580.0	0.00	0.31	0.00	0.00	1.84	16.56	7.36	0.00	0.31	25.77	1.23
585.0	0.00	0.00	0.00	0.33	2.29	16.67	10.13	0.00	0.00	34.97	0.33
590.0	0.00	0.35	0.00	0.00	3.90	14.18	12.06	0.00	0.00	27.66	1.42
595.0	0.00	0.00	0.00	0.00	1.94	10.85	11.63	0.00	0.00	31.01	0.78
600.0	0.00	0.00	0.00	0.75	2.01	27.82	9.77	0.00	0.00	23.81	0.50
605.0	0.00	0.00	0.00	0.00	1.29	18.65	13.50	0.00	0.00	27.01	0.96
610.0	0.00	0.00	0.00	1.14	2.56	13.35	11.36	0.00	0.00	25.57	0.85
615.0	0.00	0.00	0.00	0.32	1.29	17.80	11.33	0.00	0.00	29.13	0.32
620.0	0.00	0.37	0.00	0.00	1.12	22.30	12.27	0.00	0.00	21.93	1.49
625.0	0.00	0.00	0.00	0.00	1.40	24.48	14.34	0.00	0.00	19.93	1.40
630.0	0.00	0.30	0.00	0.30	1.82	17.93	14.29	0.00	0.00	22.80	1.52
635.0	0.00	0.00	0.00	0.34	1.36	15.25	15.59	0.00	0.00	20.00	0.68
640.0	0.00	0.00	0.00	0.30	0.90	18.21	19.10	0.00	0.30	26.87	0.60
645.0	0.00	0.00	0.00	0.00	1.06	17.73	17.38	0.00	0.00	23.05	2.13
650.0	0.00	0.00	0.00	0.57	1.44	18.39	18.68	0.00	0.00	22.13	0.86
655.0	0.00	0.00	0.00	0.00	0.84	17.98	11.80	0.00	0.00	18.54	1.40
650.0	0.00	0.00	0.00	0.70	0.70	15.49	13.38	0.00	0.00	30.99	1.76
665.0	0.00	0.33	0.00	0.33	0.98	14.66	12.05	0.00	0.33	30.29	2.61
670.0	0.00	0.00	0.00	0.00	1.37	16.10	14.04	0.00	0.68	28.77	1.37
675.0	0.00	0.00	0.00	0.00	2.86	15.00	15.71	0.00	0.00	20.71	0.00
680.0	0.00	0.00	0.00	0.00	0.81	15.14	17.03	0.00	0.27	23.51	3.78
685.0	0.00	0.00	0.00	0.31	0.31	11.35	18.40	0.00	0.92	19.02	1.84

Appendix A1. continued.

DEPTH (cm)	*G. digitata*	*G. rubescens*	*G. humilis*	*G. quincq.*	*N. pachyderma* (sinistral)	*N. pachyderma* (dextral)	*N. dutertrei*	*G. hexagona*	*P. obliquiloc.*	*G. inflata*	*G truncatulinoides* (sinistral)
690.0	0.00	0.00	0.00	0.30	0.91	17.52	12.99	0.00	0.00	22.05	1.21
695.0	0.00	0.00	0.00	0.00	2.01	18.88	16.06	0.00	0.00	14.86	0.00
700.0	0.00	0.00	0.00	1.05	4.21	18.25	15.44	0.00	0.35	22.11	0.35
705.0	0.00	0.00	0.00	0.00	1.94	20.32	17.42	0.00	0.00	17.42	0.97
710.0	0.00	0.00	0.00	0.34	0.68	10.62	12.67	0.00	0.00	35.27	0.68
715.0	0.00	0.00	0.00	0.00	0.00	13.29	17.61	0.00	0.00	28.24	1.00
720.0	0.00	0.00	0.00	0.00	1.23	13.23	14.15	0.00	0.00	32.31	0.00
725.0	0.00	0.00	0.00	0.36	1.45	20.29	11.96	0.00	0.00	28.26	0.36
730.0	0.00	0.00	0.00	0.00	1.20	17.12	11.11	0.00	0.00	39.04	1.20
732.5	0.00	0.00	0.00	0.00	0.00	12.25	11.59	0.00	0.00	49.01	0.66
737.5	0.00	0.00	0.00	0.00	2.33	13.33	8.33	0.00	0.33	39.00	0.67
740.0	0.00	0.00	0.00	0.29	0.86	12.32	14.04	0.00	0.00	43.84	0.00
745.0	0.00	0.00	0.00	0.33	1.64	16.78	13.49	0.00	0.33	27.96	0.99
750.0	0.00	0.00	0.00	0.77	1.54	12.08	11.57	0.26	0.00	38.05	1.03
755.0	0.00	0.00	0.00	0.00	0.77	12.85	9.25	0.00	0.00	37.79	0.26
760.0	0.00	0.28	0.00	0.00	4.16	16.90	14.40	0.28	0.00	31.02	2.22
765.0	0.00	0.00	0.00	0.00	1.66	16.23	13.91	0.00	0.00	38.74	0.66
770.0	0.00	0.00	0.00	0.00	2.19	13.39	16.94	0.00	0.00	25.96	1.37
775.0	0.00	0.00	0.00	0.34	0.68	16.44	15.75	0.00	0.00	25.00	2.05
780.0	0.30	0.30	0.00	0.00	2.12	18.48	13.64	0.61	0.30	18.18	1.21
785.0	0.00	0.00	0.00	0.00	0.88	16.47	15.59	0.00	0.00	25.00	2.35
790.0	0.00	0.00	0.00	0.00	0.36	21.22	16.91	0.00	0.36	28.78	1.80
795.0	0.00	0.00	0.00	0.36	1.43	21.15	20.43	0.00	0.00	19.00	2.15
800.0	0.00	0.32	0.00	0.00	3.22	20.58	15.76	0.00	0.00	16.40	1.61
805.0	0.00	0.00	0.00	0.65	1.30	23.45	20.52	0.00	0.33	20.52	1.30
810.0	0.00	0.00	0.00	0.00	1.21	22.66	19.34	0.00	0.00	17.22	0.91
815.0	0.00	0.00	0.00	0.00	1.92	14.01	10.71	0.00	0.00	35.44	0.27
820.0	0.00	0.00	0.00	0.28	2.49	22.71	21.88	0.00	0.00	13.57	1.11
825.0	0.00	0.00	0.00	0.33	1.67	25.42	22.41	0.00	0.33	14.05	0.67
830.0	0.00	0.00	0.00	0.32	2.89	26.69	15.11	0.00	0.00	16.72	0.64
835.0	0.00	0.00	0.00	0.00	3.01	31.10	14.72	0.00	0.00	16.72	0.00
840.0	0.00	0.00	0.00	0.00	2.84	28.71	13.25	0.00	0.32	19.87	0.63

Appendix A1. continued.

DEPTH (cm)	*G. digitata*	*G. rubescens*	*G. humilis*	*G. quincq.*	*N. pachyderma* (sinistral)	*N. pachyderma* (dextral)	*N. dutertrei*	*G. hexagona*	*P. obliquiloc.*	*G. inflata*	*G truncatulinoides* (sinistral)
845.0	0.00	0.00	0.00	0.00	3.22	31.51	17.36	0.00	0.00	18.01	0.96
850.0	0.00	0.00	0.00	0.00	1.25	16.61	11.29	0.00	0.00	42.95	2.19
855.0	0.00	0.00	0.00	0.28	1.40	28.57	15.13	0.00	0.00	21.29	0.56
860.0	0.00	0.00	0.00	0.29	1.73	17.92	14.16	0.00	0.58	25.43	0.00
865.0	0.00	0.00	0.00	0.00	3.27	22.32	6.85	0.00	0.00	24.11	0.60
870.0	0.00	0.00	0.00	0.00	1.99	16.28	10.96	0.00	0.00	29.57	0.33
875.0	0.00	0.00	0.00	0.00	4.15	22.36	12.46	0.00	0.00	22.04	0.00
880.0	0.00	0.24	0.00	0.00	4.56	15.83	11.99	0.00	0.00	25.66	0.24
885.0	0.00	0.00	0.00	0.29	2.89	13.29	14.74	0.00	0.29	29.77	0.00
890.0	0.00	0.00	0.67	0.34	2.36	13.47	8.08	0.00	0.34	42.76	1.01
895.0	0.00	0.00	0.00	0.28	0.85	14.25	6.55	0.00	0.00	42.17	0.28
900.0	0.00	0.00	0.00	0.00	0.64	13.18	9.65	0.00	0.64	30.55	0.32
905.0	0.00	0.00	0.00	0.00	0.91	7.01	6.40	0.00	0.61	44.21	0.30
910.0	0.00	0.00	0.00	0.00	2.84	11.67	5.36	0.00	0.00	44.79	0.00
915.0	0.00	0.00	0.00	0.00	3.14	8.57	4.86	0.00	0.00	44.57	0.57
920.0	0.00	0.00	0.00	0.70	3.52	10.21	9.86	0.00	0.00	35.21	0.00
925.0	0.00	0.00	0.00	0.68	6.48	7.51	6.14	0.00	0.00	37.88	0.34
930.0	0.00	0.00	0.00	0.66	2.30	19.34	9.51	0.00	0.00	32.13	0.33
935.0	0.00	0.30	0.00	0.30	1.20	12.65	6.63	0.00	0.00	37.35	0.00
940.0	0.00	0.00	0.00	0.00	1.54	20.92	9.54	0.00	0.31	25.85	0.31
945.0	0.00	0.00	0.00	0.00	2.56	23.44	12.82	0.00	0.73	24.18	0.00
950.0	0.00	0.00	0.00	0.35	3.55	27.30	14.18	0.00	0.35	15.96	0.00
952.5	0.00	0.00	0.00	0.36	1.44	9.60	16.25	0.00	0.00	14.44	0.00

Appendix A1. continued.

DEPTH (cm)	*G. truncatulinoides* (dextral)	*G. crassaform.*	*P/D*	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. iota*	*G. bradyi*	*other*
3.0	0.00	0.19	4.33	0.56	0.94	0.00	3.95	0.00	0.00	1.51
10.0	0.36	0.36	5.05	0.72	0.90	0.18	5.23	0.00	0.00	1.80
15.0	0.00	0.30	2.69	0.60	0.60	0.00	5.69	0.00	0.00	3.59
20.0	0.00	0.52	4.16	0.69	0.52	0.17	5.37	0.00	0.00	1.04
25.0	0.52	0.26	2.86	0.26	0.00	0.00	7.27	0.00	0.00	1.04
30.0	0.21	0.21	5.63	0.00	0.42	0.21	3.96	0.00	0.00	1.67
35.0	0.29	0.29	5.57	0.29	0.88	0.29	9.09	0.00	0.00	0.88
40.0	0.00	0.75	8.85	0.00	0.38	0.00	2.45	0.00	0.00	0.56
45.0	0.25	0.51	8.86	0.51	0.25	0.00	1.52	0.00	0.00	2.28
51.0	0.00	0.00	7.74	0.30	0.00	0.00	3.57	0.00	0.00	1.79
55.0	0.00	0.28	7.08	1.13	0.57	0.00	3.40	0.00	0.00	0.57
60.0	0.00	0.46	3.23	0.23	0.00	0.00	1.61	0.00	0.00	1.61
65.0	0.46	0.00	4.86	0.46	0.93	0.00	2.78	0.00	0.00	0.23
70.0	0.00	0.31	6.77	0.62	0.00	0.00	1.85	0.00	0.00	2.15
74.5	0.00	0.43	7.17	0.00	0.00	0.00	3.91	0.00	0.00	1.30
80.0	0.00	0.00	6.27	0.00	0.52	0.00	0.52	0.00	0.00	1.57
84.5	0.27	0.54	7.59	0.81	0.54	0.00	2.44	0.00	0.00	1.36
90.0	0.00	0.00	6.84	0.00	0.00	0.00	0.00	0.00	0.00	1.42
95.0	0.00	0.31	3.75	0.63	0.00	0.31	2.81	0.00	0.00	1.56
100.0	0.00	0.00	3.61	0.26	0.52	0.26	4.64	0.00	0.00	3.09
105.0	0.34	0.00	5.48	0.00	0.00	0.34	5.48	0.00	0.00	1.71
110.0	0.00	0.00	7.00	0.48	0.24	0.00	2.42	0.00	0.00	2.17
115.0	0.00	0.00	5.96	0.00	0.00	0.00	4.39	0.00	0.00	0.94
120.0	0.45	0.23	3.84	0.68	0.68	0.00	5.19	0.00	0.00	2.03
125.0	0.57	0.57	3.74	0.29	0.29	0.29	6.03	0.00	0.00	1.15
130.0	0.26	0.00	6.12	0.77	0.26	0.00	6.63	0.00	0.00	1.02
135.0	0.26	0.00	6.12	0.77	0.00	0.51	4.34	0.00	0.00	1.79
140.0	0.65	0.32	3.90	0.32	0.00	0.65	4.55	0.00	0.00	2.92
145.0	0.63	0.00	6.51	1.11	0.00	0.00	4.76	0.00	0.00	1.59
150.0	0.30	0.91	5.17	0.30	0.00	0.30	3.95	0.30	0.30	0.91
155.0	0.28	0.28	5.35	0.00	0.56	0.00	4.51	0.00	0.00	1.13
160.0	0.00	0.24	3.62	0.24	0.48	0.00	1.69	0.00	0.00	1.69

Appendix A1. continued.

DEPTH (cm)	*G. truncatulinoides* (dextral)	*G. crassaform.*	*P/D*	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. iota*	*G. bradyi*	*other*
165.0	0.56	0.56	2.52	0.84	0.28	0.00	2.24	0.00	0.00	1.12
170.0	0.00	0.00	3.90	0.60	0.30	0.00	3.60	0.00	0.00	1.50
175.0	0.54	0.27	7.55	1.08	0.27	0.54	2.96	0.00	0.00	0.27
180.0	0.00	0.64	5.47	0.32	0.00	0.32	3.86	0.00	0.00	0.96
185.0	0.83	0.28	7.78	0.83	0.28	0.56	3.61	0.00	0.00	0.56
190.0	0.00	0.00	4.28	0.00	0.31	0.61	3.06	0.00	0.00	2.14
195.0	0.00	0.00	3.65	0.00	1.00	0.00	5.65	0.00	0.00	1.00
200.0	0.00	0.48	6.75	0.00	0.72	0.00	5.06	0.00	0.00	1.93
205.0	0.00	0.63	6.65	0.32	0.63	0.00	4.11	0.00	0.00	0.32
210.0	0.00	0.88	3.22	0.29	0.29	0.58	6.14	0.00	0.00	3.51
215.0	0.00	0.24	5.00	0.24	0.95	0.24	5.95	0.00	0.00	1.19
220.0	0.63	0.94	2.83	1.26	1.26	0.31	5.35	0.00	0.00	1.89
222.5	0.34	0.68	3.39	0.00	0.34	0.34	2.37	0.00	0.00	0.68
227.5	0.34	1.01	2.03	1.01	1.35	0.00	2.70	0.00	0.00	0.68
230.0	0.50	0.74	2.48	0.50	0.00	0.50	2.98	0.00	0.00	2.48
235.0	0.33	0.99	2.31	0.99	0.33	1.32	5.94	0.00	0.00	1.65
240.0	0.00	0.00	5.35	0.27	0.27	0.27	5.61	0.00	0.00	3.48
242.5	0.28	1.12	2.51	0.00	0.84	0.00	5.59	0.00	0.00	0.56
247.5	0.30	0.30	4.45	1.19	0.30	0.30	8.01	0.00	0.00	1.19
250.0	0.00	0.30	2.96	0.00	0.89	0.59	3.25	0.00	0.00	3.25
252.0	1.11	0.44	4.89	0.44	0.89	0.00	5.33	0.00	0.00	2.00
254.0	0.70	0.47	5.15	0.94	0.23	0.00	5.85	0.00	0.00	0.94
256.0	0.29	0.29	3.14	0.57	0.29	0.29	8.00	0.00	0.00	0.86
258.0	0.48	0.48	4.35	0.00	0.72	0.72	5.07	0.00	0.00	1.69
260.0	0.29	0.57	4.02	0.29	1.44	0.00	6.03	0.00	0.00	1.44
262.0	0.00	0.23	2.11	1.17	0.47	0.00	6.32	0.00	0.00	1.64
264.0	0.00	1.32	5.26	0.53	0.26	0.26	5.53	0.00	0.00	1.84
266.0	0.00	0.29	2.65	1.47	1.47	0.29	4.71	0.00	0.00	1.47
268.0	0.45	1.35	2.69	0.67	0.22	0.22	2.91	0.00	0.00	2.02
270.0	0.86	0.29	1.72	0.00	0.00	0.00	4.60	0.00	0.00	2.01
272.0	0.29	0.86	0.86	0.29	0.57	0.57	6.29	0.29	0.00	2.29
274.0	0.79	1.32	0.79	1.05	0.00	0.26	3.68	0.00	0.00	1.05

Appendix A1. continued.

DEPTH (cm)	*G. truncatulinoides* (dextral)	*G. crassaform.*	P/D	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. iota*	*G. bradyi*	*other*
276.0	0.92	0.92	1.85	0.31	0.31	0.31	5.54	0.00	0.00	0.92
278.0	1.36	0.54	1.36	0.81	0.00	0.00	6.23	0.00	0.00	2.98
280.0	0.82	0.27	2.72	0.00	0.82	0.27	7.36	0.00	0.00	1.63
282.0	0.44	0.44	1.55	0.00	1.11	0.22	8.19	0.00	0.00	1.77
284.0	0.92	0.46	5.31	0.00	0.46	0.00	6.70	0.00	0.00	1.85
286.0	0.86	0.86	1.72	0.29	0.00	0.00	8.31	0.00	0.00	3.15
288.0	1.02	0.41	1.22	0.20	1.02	0.00	8.76	0.00	0.00	2.44
290.0	0.00	0.55	1.09	0.55	0.27	0.27	5.74	0.00	0.00	1.37
292.0	0.00	0.00	2.11	0.26	0.53	0.00	9.76	0.00	0.00	2.64
294.0	0.22	0.22	2.46	0.00	1.12	0.67	8.26	0.00	0.00	1.34
296.0	0.43	0.00	2.56	0.00	0.64	0.43	10.02	0.00	0.00	1.07
298.0	0.53	0.79	2.91	0.00	0.00	0.26	7.94	0.00	0.00	3.44
300.0	0.00	0.00	4.73	0.24	0.47	0.24	1.89	0.24	0.00	2.13
302.0	0.28	0.00	3.90	0.00	0.28	0.28	2.79	0.00	0.00	3.90
304.0	0.00	0.00	3.68	0.00	0.85	0.57	4.25	0.00	0.00	1.13
306.0	0.23	0.70	3.48	0.00	0.46	0.00	2.55	0.00	0.00	1.86
308.0	0.23	0.00	3.43	0.00	0.46	0.46	2.97	0.00	0.00	2.52
310.0	0.51	0.26	3.60	0.00	0.00	0.00	4.11	0.00	0.00	2.57
312.0	0.25	0.25	4.76	0.00	0.75	0.00	6.27	0.00	0.00	1.00
314.0	0.34	0.34	2.73	0.00	0.34	0.00	4.78	0.00	0.00	0.34
316.0	0.56	0.28	4.79	0.00	1.41	0.56	3.94	0.00	0.00	2.25
318.0	0.00	0.00	9.82	0.00	0.76	0.25	2.02	0.00	0.00	2.02
320.0	0.23	0.00	2.30	0.00	0.23	0.00	2.30	0.00	0.00	2.30
325.0	0.30	0.59	4.75	0.30	0.89	0.30	3.56	0.00	0.00	1.48
330.0	0.31	0.94	5.31	0.31	0.31	0.31	5.94	0.00	0.00	0.94
335.0	0.62	1.54	4.92	0.62	0.31	0.00	4.92	0.00	0.00	0.92
340.0	0.26	0.00	4.22	0.00	0.26	0.00	1.85	0.00	0.00	2.64
345.0	0.00	0.61	5.78	0.30	1.22	0.00	4.86	0.00	0.00	0.61
350.0	0.60	0.30	4.49	0.30	0.60	0.90	2.40	0.00	0.00	2.69
355.0	0.00	0.36	5.71	0.00	0.71	0.00	1.79	0.00	0.00	0.36
360.0	0.28	0.00	9.38	0.00	0.00	0.00	2.84	0.00	0.00	1.70
365.0	0.00	0.00	4.50	0.53	0.26	0.79	2.65	0.00	0.00	0.79

Appendix A1. continued.

DEPTH (cm)	*G. truncatulinoides* (dextral)	*G. crassaform.*	*P/D*	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. iota*	*G. bradyi*	*other*
370.0	0.00	1.16	7.80	0.29	0.58	0.29	1.45	0.00	0.00	3.18
375.0	0.67	0.67	3.02	0.00	0.00	0.00	3.02	0.00	0.00	0.34
380.0	0.00	0.00	6.15	0.00	0.84	0.00	1.40	0.00	0.00	0.00
385.0	0.98	0.00	6.56	0.00	0.33	0.33	2.62	0.00	0.00	0.33
390.0	0.79	0.00	8.18	0.00	0.53	0.00	2.64	0.00	0.00	2.90
395.0	0.00	0.31	6.81	0.31	0.31	0.31	2.48	0.00	0.00	0.00
400.0	0.00	0.28	5.34	0.00	0.56	0.56	2.81	0.00	0.00	0.28
405.0	0.30	0.00	7.10	0.30	0.89	0.59	3.55	0.00	0.00	0.30
410.0	0.24	0.00	5.81	0.00	0.48	0.24	5.33	0.00	0.00	1.45
415.0	0.32	0.63	6.35	0.32	0.32	0.00	6.35	0.00	0.00	0.32
420.0	0.52	0.00	7.22	0.26	1.55	0.26	3.35	0.00	0.00	1.80
425.0	0.00	1.26	5.68	0.63	1.89	0.32	7.26	0.00	0.00	3.15
430.0	0.32	0.00	5.71	0.63	0.32	0.63	4.13	0.00	0.00	2.22
435.0	0.32	0.32	6.43	0.00	0.32	0.00	4.18	0.32	0.00	0.96
440.0	0.00	0.95	5.36	0.00	0.00	0.32	4.42	0.00	0.00	3.15
445.0	0.00	0.32	7.12	0.00	0.00	0.00	5.18	0.00	0.00	0.97
450.0	0.33	0.33	7.57	0.00	0.66	0.00	4.61	0.00	0.00	4.28
455.0	0.00	1.37	3.85	0.55	1.65	0.55	6.04	0.00	0.00	1.37
460.0	0.54	0.00	4.83	0.27	1.61	0.00	7.24	0.00	0.00	4.29
465.0	0.32	1.61	3.86	0.96	2.57	0.00	9.65	0.00	0.00	3.86
470.0	0.35	0.00	5.65	0.35	0.35	0.35	4.59	0.00	0.00	1.41
475.0	0.00	1.01	4.53	0.00	0.76	0.50	3.02	0.00	0.00	2.02
480.0	0.29	0.59	5.59	0.00	0.29	0.29	2.94	0.00	0.00	2.65
485.0	0.66	0.33	9.21	0.00	0.33	0.33	4.28	0.00	0.00	1.97
490.0	0.00	0.54	7.61	0.82	0.54	0.00	3.53	0.00	0.00	3.53
495.0	0.75	0.37	7.09	0.00	0.00	0.00	10.07	0.00	0.00	2.24
500.0	0.00	0.24	6.57	0.00	0.24	0.00	4.87	0.00	0.00	2.92
505.0	0.00	0.29	7.04	0.00	0.00	0.00	3.52	0.00	0.00	1.76
510.0	0.00	0.00	8.75	0.25	0.25	0.25	5.00	0.00	0.00	2.00
515.0	0.30	0.60	6.04	0.00	0.00	0.00	6.04	0.00	0.00	1.51
520.0	0.00	0.58	6.94	0.00	0.00	0.58	3.76	0.00	0.00	2.60
525.0	0.00	0.31	6.75	0.00	0.92	0.31	10.12	0.00	0.00	2.15

Appendix A1. continued.

DEPTH (cm)	*G. truncatulinoides* (dextral)	*G. crassaform.*	*P/D*	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. iota*	*G. bradyi*	*other*
530.0	0.00	0.28	7.54	0.00	0.28	0.00	4.75	0.00	0.00	2.51
535.0	0.00	0.26	9.74	0.26	0.00	0.00	2.89	0.00	0.00	1.32
540.0	0.23	0.47	5.39	0.00	0.00	0.23	1.64	0.00	0.00	3.28
545.0	0.00	0.00	8.31	0.33	0.33	0.66	3.65	0.00	0.00	1.33
550.0	0.29	0.59	9.44	0.00	0.59	0.29	5.31	0.00	0.00	2.06
555.0	0.00	0.33	8.67	0.67	1.00	0.00	7.33	0.00	0.00	1.67
560.0	0.00	0.33	9.60	0.33	0.00	0.00	1.99	0.00	0.00	0.33
565.0	0.28	0.28	6.46	0.00	0.00	0.00	3.93	0.00	0.00	1.12
570.0	0.36	0.00	7.14	0.36	0.00	0.00	1.79	0.00	0.00	0.00
575.0	0.00	0.00	8.31	0.62	0.92	0.31	5.54	0.00	0.00	2.77
580.0	0.00	0.61	9.20	0.61	0.92	0.92	3.99	0.00	0.00	1.53
585.0	0.00	0.65	5.23	0.00	0.33	0.00	3.92	0.00	0.00	1.31
590.0	0.35	1.06	5.67	1.77	0.71	0.71	5.67	0.00	0.00	2.13
595.0	0.00	0.39	5.81	0.39	0.00	0.00	6.20	0.00	0.00	1.16
600.0	0.00	0.00	4.01	0.25	0.00	0.25	5.01	0.00	0.00	3.51
605.0	0.00	0.32	6.43	0.64	0.32	0.00	2.57	0.00	0.00	1.61
610.0	0.28	0.28	7.67	0.57	0.28	0.00	5.11	0.00	0.00	2.84
615.0	0.32	0.32	8.09	0.00	0.00	0.00	6.80	0.00	0.00	1.29
620.0	0.00	0.37	7.43	0.74	0.74	0.00	4.09	0.00	0.00	0.74
625.0	0.00	0.00	10.14	0.70	0.00	0.35	4.55	0.00	0.00	0.70
630.0	0.00	0.30	10.33	0.61	0.30	0.30	3.65	0.00	0.00	1.22
635.0	0.00	0.68	5.42	1.36	0.34	0.34	6.10	0.00	0.00	1.02
640.0	0.00	0.00	8.36	0.00	0.00	0.30	5.37	0.00	0.00	0.30
645.0	0.00	0.71	7.45	1.06	0.00	0.00	4.96	0.00	0.00	0.71
650.0	0.00	0.00	7.76	0.57	0.86	0.00	4.89	0.00	0.00	0.29
655.0	0.28	0.28	8.43	0.28	0.56	0.00	7.30	0.00	0.00	1.12
650.0	0.70	0.70	4.23	0.35	0.70	0.00	4.93	0.00	0.00	0.35
665.0	0.33	0.00	5.21	2.28	0.33	0.33	0.65	0.00	0.00	0.33
670.0	0.34	0.68	6.85	0.34	0.68	0.00	4.45	0.00	0.00	1.37
675.0	1.07	0.36	4.29	0.00	0.36	0.36	8.21	0.00	0.00	1.43
680.0	0.27	0.27	5.41	1.35	0.27	0.27	4.32	0.00	0.00	1.35
685.0	0.00	0.00	6.13	1.23	0.31	0.31	10.12	0.00	0.00	1.23

Appendix A1. continued.

DEPTH (cm)	*G. truncatulinoides* (dextral)	*G. crassaform.*	*P/D*	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. iota*	*G. bradyi*	*other*
690.0	0.91	0.30	5.44	0.00	0.91	0.00	4.53	0.00	0.00	0.60
695.0	0.40	0.80	4.82	1.61	0.80	0.40	5.62	0.00	0.00	2.01
700.0	0.00	1.05	9.12	0.00	0.35	0.70	2.11	0.00	0.00	2.81
705.0	0.00	0.00	9.35	0.00	0.00	0.00	1.29	0.00	0.00	0.00
710.0	0.34	0.68	5.14	1.37	0.00	0.34	1.37	0.00	0.00	0.68
715.0	0.00	0.33	5.32	0.66	0.00	0.00	2.99	0.00	0.00	0.33
720.0	0.00	0.00	5.85	0.31	0.62	0.31	3.08	0.00	0.00	0.31
725.0	0.00	0.72	3.99	0.36	0.36	0.36	4.35	0.00	0.00	0.00
730.0	0.30	0.30	4.50	0.90	0.00	1.50	2.70	0.00	0.00	0.60
732.5	0.33	0.33	2.98	0.66	0.00	0.00	0.99	0.00	0.00	0.66
737.5	0.00	0.00	3.33	0.67	0.33	0.00	2.33	0.00	0.00	0.33
740.0	0.00	0.00	3.44	0.57	0.00	0.57	2.87	0.00	0.00	2.29
745.0	1.32	0.66	2.96	0.66	0.00	0.66	3.62	0.00	0.00	0.99
750.0	1.80	1.29	3.34	0.51	0.26	0.51	1.80	0.00	0.00	1.54
755.0	0.51	1.29	1.54	1.54	0.00	0.00	1.03	0.00	0.00	1.29
760.0	0.00	1.11	3.88	0.28	0.00	0.28	1.39	0.00	0.00	4.43
765.0	0.00	0.00	2.32	1.66	0.00	0.33	1.66	0.00	0.00	0.99
770.0	0.00	0.00	4.92	2.19	0.00	0.00	4.64	0.00	0.00	2.19
775.0	0.00	0.00	4.45	1.71	1.03	0.00	3.42	0.00	0.00	1.71
780.0	0.91	0.30	6.36	1.21	0.61	0.61	4.85	0.00	0.00	4.85
785.0	0.29	0.00	3.24	0.59	0.00	0.00	1.76	0.00	0.00	1.76
790.0	0.72	0.00	2.52	0.36	0.36	0.36	2.16	0.00	0.00	1.44
795.0	0.00	0.72	3.94	0.00	0.72	0.72	2.51	0.00	0.00	0.72
800.0	0.00	0.64	5.47	0.96	0.32	0.00	5.79	0.00	0.00	2.57
805.0	0.33	0.00	5.21	0.65	0.65	0.00	2.93	0.00	0.00	1.95
810.0	0.00	0.30	6.34	0.91	0.30	0.00	4.23	0.00	0.00	0.91
815.0	0.55	0.27	0.82	1.65	0.27	0.55	3.30	0.00	0.00	3.85
820.0	0.00	0.55	2.77	0.28	0.55	0.00	4.16	0.00	0.00	2.22
825.0	0.00	0.33	4.68	0.67	0.33	0.00	4.01	0.00	0.00	2.34
830.0	0.00	0.96	7.72	0.64	0.00	0.00	4.18	0.00	0.00	3.22
835.0	0.00	0.67	6.35	0.33	0.00	0.33	1.00	0.00	0.00	2.01
840.0	0.32	1.58	6.62	0.95	0.00	0.00	2.21	0.00	0.00	2.84

Appendix A1. continued.

DEPTH (cm)	*G. truncatulinoides* (dextral)	*G. crassaform.*	*P/D*	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. iota*	*G. bradyi*	*other*
845.0	0.32	1.29	6.11	0.64	0.00	0.00	3.54	0.00	0.00	1.61
850.0	0.00	0.63	3.45	0.31	0.00	0.31	4.08	0.00	0.00	1.25
855.0	0.00	0.28	5.60	0.00	0.00	0.00	2.80	0.00	0.00	1.68
860.0	0.58	0.58	3.47	0.00	0.00	0.58	4.62	0.00	0.00	2.60
865.0	2.68	0.89	3.27	0.00	0.30	0.00	4.46	0.00	0.00	2.98
870.0	1.00	2.66	2.66	0.33	0.66	0.00	3.32	0.00	0.00	1.66
875.0	0.00	1.92	6.39	0.64	0.32	0.00	2.88	0.00	0.00	1.60
880.0	0.96	2.16	2.64	0.24	0.72	0.24	6.71	0.00	0.00	1.20
885.0	0.58	1.73	2.60	1.73	0.00	0.00	6.07	0.00	0.00	2.02
890.0	1.01	1.68	3.37	0.67	0.67	0.34	1.01	0.00	0.34	1.35
895.0	0.00	1.14	3.13	0.85	0.00	0.00	3.42	0.00	0.00	3.42
900.0	0.32	2.57	2.57	1.93	0.32	0.00	6.11	0.00	0.00	1.93
905.0	0.61	2.44	2.13	1.22	0.30	0.30	3.96	0.00	0.00	3.35
910.0	0.63	2.21	0.32	2.21	0.00	0.00	3.47	0.00	0.00	3.47
915.0	0.00	4.86	2.00	0.86	0.86	0.00	1.14	0.00	0.00	1.14
920.0	0.00	1.76	2.46	0.00	0.00	0.00	3.52	0.00	0.00	0.35
925.0	0.00	1.71	2.39	0.68	0.00	0.00	6.14	0.00	0.00	2.05
930.0	0.00	4.26	1.97	0.66	0.98	0.33	6.23	0.00	0.00	1.64
935.0	0.00	3.61	2.41	0.30	0.30	0.00	2.11	0.00	0.00	2.41
940.0	0.00	1.54	5.23	2.15	0.00	0.00	3.38	0.00	0.00	2.46
945.0	0.37	4.03	3.66	1.10	0.00	0.00	4.76	0.00	0.00	2.20
950.0	0.00	3.19	4.61	2.13	1.42	0.00	3.55	0.00	0.00	1.42
952.5	0.00	1.81	3.25	0.36	0.00	0.00	5.05	0.00	0.00	1.08

Appendix A2. Depth and percent abundance of planktic foraminifera in V34-157.

DEPTH (cm)	*O. universa*	*G. ruber*	*G. tenellus*	*G. sacculifer*	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*	*G. digitata*	*G. rubescens*
0.0	0.00	0.64	0.00	0.00	0.00	0.32	26.43	3.82	0.00	0.00
10.0	0.65	0.00	0.00	0.00	0.00	0.65	26.13	2.26	0.00	0.00
15.0	0.60	0.30	0.00	0.30	0.00	0.00	25.98	2.72	0.00	0.00
20.0	1.40	1.40	0.00	0.00	0.00	0.56	26.97	2.53	0.28	0.00
25.0	0.00	1.66	0.00	0.00	0.00	0.00	29.09	1.66	0.00	0.00
30.0	0.00	1.60	0.00	0.32	0.00	0.96	34.29	1.60	0.00	0.00
35.0	0.34	1.36	0.00	0.00	0.00	0.00	27.12	1.02	0.00	0.00
40.0	0.00	0.51	0.00	0.00	0.00	0.00	29.85	1.79	0.00	0.26
45.0	0.32	0.64	0.00	0.00	0.00	0.96	23.25	1.59	0.00	0.32
50.0	0.31	0.00	0.00	0.00	0.00	0.00	26.15	2.15	0.00	0.00
55.0	0.32	0.97	0.32	0.00	0.00	0.00	30.97	1.61	0.00	0.00
60.0	0.33	0.98	0.00	0.00	0.00	0.00	30.62	2.61	0.00	0.00
65.0	0.00	0.00	0.00	0.00	0.00	0.00	24.62	2.77	0.00	0.00
70.0	0.32	0.00	0.00	0.00	0.00	0.00	27.71	2.23	0.00	0.00
75.0	0.00	0.36	0.00	0.00	0.00	0.00	25.72	1.09	0.00	0.00
80.0	0.60	0.00	0.00	0.00	0.00	0.00	30.12	1.51	0.00	0.00
85.0	0.29	0.58	0.00	0.00	0.00	0.29	30.99	2.34	0.00	0.00
90.0	0.30	0.30	0.00	0.00	0.00	0.00	28.05	2.13	0.00	0.00
95.0	0.00	0.00	0.00	0.00	0.00	0.00	24.60	0.65	0.00	0.00
100.0	0.00	0.00	0.00	0.00	0.00	0.36	24.46	1.08	0.00	0.00
105.0	0.00	0.36	0.00	0.00	0.00	0.72	29.75	0.72	0.00	0.00
110.0	0.32	0.00	0.00	0.00	0.32	0.32	22.98	0.00	0.00	0.00
115.0	0.00	0.28	0.00	0.00	0.00	0.00	25.77	0.56	0.00	0.00
120.0	0.00	0.00	0.00	0.00	0.00	0.00	34.56	1.01	0.00	0.00
125.0	0.49	0.24	0.00	0.00	0.00	0.00	29.93	0.73	0.00	0.00
130.0	0.00	0.30	0.00	0.00	0.00	0.00	29.85	0.90	0.00	0.00
135.0	0.00	0.29	0.00	0.00	0.00	0.00	34.58	0.29	0.00	0.00
140.0	0.00	0.00	0.00	0.00	0.00	0.00	30.13	0.33	0.00	0.00
145.0	0.00	0.31	0.00	0.00	0.00	0.00	32.21	0.61	0.00	0.00
150.0	0.00	0.00	0.00	0.00	0.00	1.04	27.68	0.35	0.00	0.00
155.0	0.00	0.89	0.00	0.00	0.00	0.00	28.57	0.00	0.00	0.00
160.0	0.37	0.00	0.00	0.00	0.00	0.74	30.11	1.12	0.00	0.00

Appendix A2. continued.

DEPTH (cm)	*O. universa*	*G. ruber*	*G. tenellus*	*G. sacculifer*	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*	*G. digitata*	*G. rubescens*
165.0	0.00	0.80	0.00	0.00	0.00	0.00	22.00	1.20	0.00	0.00
170.0	0.00	0.62	0.00	0.00	0.00	0.00	24.15	0.93	0.00	0.00
175.0	0.00	0.00	0.00	0.00	0.00	0.00	19.58	0.89	0.00	0.00
180.0	0.00	0.34	0.00	0.00	0.00	0.00	24.24	2.02	0.00	0.00
185.0	0.00	0.00	0.00	0.00	0.00	0.00	25.96	1.40	0.00	0.00
190.0	0.28	0.28	0.00	0.00	0.00	0.00	22.63	0.56	0.00	0.00
195.0	0.25	0.76	0.00	0.00	0.00	0.00	16.46	0.51	0.00	0.00
200.0	0.00	0.35	0.00	0.00	0.00	0.35	19.79	1.04	0.00	0.00
205.0	0.34	0.34	0.00	0.00	0.00	0.00	23.05	0.68	0.00	0.00
210.0	0.00	1.70	0.00	0.00	0.00	0.00	21.70	0.43	0.00	0.00
215.0	0.00	0.33	0.00	0.00	0.00	0.00	22.26	0.66	0.00	0.00
220.0	0.00	0.00	0.00	0.00	0.00	0.00	27.76	0.76	0.00	0.00
225.0	0.00	0.00	0.00	0.00	0.33	0.33	27.57	1.33	0.00	0.00
230.0	0.00	0.00	0.00	0.00	0.00	0.00	30.95	0.68	0.00	0.00
235.0	0.00	0.63	0.00	0.00	0.00	0.63	27.90	0.94	0.00	0.00
240.0	0.00	0.00	0.00	0.00	0.00	0.00	27.25	1.50	0.00	0.30
245.0	0.00	0.33	0.00	0.00	0.00	0.98	29.97	0.65	0.00	0.00
250.0	0.00	0.31	0.00	0.00	0.00	0.00	31.66	0.00	0.00	0.00
255.0	0.00	0.00	0.00	0.00	0.00	0.32	38.41	0.00	0.00	0.00
260.0	0.00	0.00	0.00	0.00	0.00	0.26	39.42	1.32	0.00	0.00
265.0	0.66	0.00	0.00	0.00	0.00	0.66	36.72	1.31	0.00	0.00
270.0	0.00	0.31	0.00	0.00	0.00	0.31	26.93	0.62	0.00	0.00
275.0	0.00	0.52	0.00	0.00	0.00	0.00	30.41	1.29	0.00	0.00
280.0	0.00	0.00	0.00	0.00	0.00	0.00	32.72	0.74	0.00	0.00
285.0	0.00	0.31	0.00	0.00	0.00	0.00	31.45	0.63	0.00	0.00
290.0	0.00	0.93	0.00	0.00	0.00	0.31	33.64	0.00	0.00	0.00
295.0	0.46	0.00	0.00	0.00	0.00	0.46	36.99	0.91	0.00	0.00
300.0	0.38	0.00	0.00	0.00	0.00	0.00	30.19	1.89	0.00	0.00
305.0	0.32	0.32	0.00	0.00	0.00	0.63	33.75	0.95	0.00	0.00
310.0	0.32	0.00	0.00	0.00	0.32	0.00	31.94	1.61	0.00	0.00
315.0	0.32	0.63	0.00	0.00	0.00	0.00	35.02	0.32	0.00	0.00
320.0	0.29	1.17	0.00	0.00	0.00	0.00	33.43	0.00	0.00	0.29

Appendix A2. continued.

DEPTH (cm)	*O. universa*	*G. ruber*	*G. tenellus*	*G. sacculifer*	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*	*G. digitata*	*G. rubescens*
325.0	0.00	0.33	0.00	0.33	0.00	0.33	33.33	0.33	0.00	0.00
330.0	0.32	0.96	0.00	0.00	0.00	0.32	30.23	0.96	0.00	0.32
335.0	0.54	0.81	0.00	0.00	0.00	0.27	29.73	0.00	0.00	0.00
340.0	0.30	1.49	0.00	0.00	0.00	0.30	35.22	0.60	0.00	0.00
345.0	1.20	0.00	0.00	0.00	0.00	0.60	30.84	0.60	0.00	0.30
350.0	0.30	1.20	0.30	0.00	0.30	0.90	27.93	1.80	0.00	0.00
355.0	0.38	0.76	0.00	0.00	0.00	0.38	28.14	1.52	0.00	0.00
360.0	0.60	1.50	0.00	0.00	0.00	0.30	29.43	1.80	0.00	0.00
365.0	0.68	1.71	0.00	0.00	0.34	0.00	23.63	0.68	0.00	0.00
370.0	0.31	0.61	0.00	0.31	0.00	0.61	27.52	0.31	0.00	0.00
375.0	0.99	0.33	0.00	0.99	0.00	0.66	29.61	1.32	0.00	0.00
380.0	0.64	0.64	0.00	0.00	0.64	1.61	34.73	1.61	0.00	0.00
385.0	0.32	1.62	0.00	0.32	0.00	0.32	31.82	0.65	0.00	0.00
390.0	1.58	0.79	0.00	0.26	0.00	0.26	27.37	1.58	0.00	0.00
395.0	1.00	0.67	0.00	0.00	0.00	1.00	36.33	1.00	0.00	0.00
400.0	0.38	0.00	0.00	0.00	0.38	0.76	22.90	1.53	0.00	0.00
405.0	1.18	1.18	0.79	0.00	0.39	0.39	28.74	1.57	0.00	0.00
410.0	0.82	1.37	0.00	0.27	0.00	0.00	30.22	0.27	0.00	0.00
415.0	0.88	0.88	0.00	0.29	0.00	0.59	27.57	0.29	0.00	0.00
420.0	1.94	0.65	0.00	0.32	0.32	0.32	22.65	0.97	0.00	0.00
425.0	1.20	0.60	0.00	0.00	0.00	0.00	27.71	0.00	0.00	0.00
430.0	1.48	0.74	0.00	0.00	0.00	0.00	24.81	1.11	0.00	0.00
435.0	0.85	0.28	0.00	0.00	0.00	0.00	25.42	0.56	0.00	0.00
440.0	0.62	0.31	0.00	0.00	0.00	0.62	27.73	0.93	0.00	0.00
445.0	0.32	0.00	0.00	0.00	0.32	0.00	16.40	0.63	0.00	0.00
450.0	0.57	0.00	0.00	0.00	0.00	0.29	15.76	0.57	0.00	0.00
455.0	0.00	0.00	0.00	0.00	0.00	0.00	14.13	0.83	0.00	0.00
460.0	0.37	1.10	0.00	0.00	0.00	0.00	15.81	1.10	0.00	0.00
465.0	0.00	0.00	0.00	0.00	0.00	0.00	20.29	0.36	0.00	0.00
470.0	0.54	0.27	0.00	0.00	0.00	0.27	28.11	1.08	0.00	0.00
475.0	0.35	0.35	0.00	0.00	0.00	0.00	20.42	0.69	0.00	0.00
480.0	0.00	0.00	0.00	0.00	0.00	0.00	25.41	0.65	0.00	0.00

Appendix A2. continued.

DEPTH (cm)	*O. universa*	*G. ruber*	*G. tenellus*	*G. sacculifer*	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*	*G. digitata*	*G. rubescens*
485.0	0.96	0.00	0.00	0.00	0.00	0.00	28.94	0.64	0.00	0.00
490.0	0.73	0.73	0.00	0.00	0.00	0.00	32.36	0.00	0.00	0.00
495.0	0.00	0.42	0.00	0.00	0.00	0.00	26.27	0.00	0.00	0.00
500.0	0.32	0.64	0.00	0.00	0.00	0.00	19.49	0.96	0.00	0.00
505.0	1.05	0.00	0.00	0.00	0.00	0.00	23.16	0.00	0.00	0.00
510.0	0.00	0.33	0.00	0.00	0.00	0.00	17.11	0.33	0.00	0.00
515.0	0.00	0.00	0.00	0.00	0.00	0.00	18.26	0.60	0.00	0.00
520.0	0.00	0.30	0.00	0.00	0.00	0.00	17.16	0.59	0.00	0.00
525.0	0.92	0.00	0.00	0.00	0.00	0.31	22.77	0.00	0.00	0.00
530.0	0.59	0.00	0.00	0.30	0.00	0.00	24.63	0.89	0.00	0.00
535.0	0.00	0.00	0.00	0.00	0.00	0.00	23.48	0.79	0.00	0.00
540.0	0.00	0.61	0.00	0.00	0.00	0.00	24.85	0.61	0.00	0.00
545.0	0.26	0.00	0.00	0.00	0.00	0.26	18.02	0.26	0.00	0.00
550.0	0.00	0.27	0.00	0.00	0.00	0.00	20.48	0.00	0.00	0.00
555.0	1.01	1.01	0.00	0.00	0.00	0.00	22.82	0.34	0.00	0.00
560.0	0.00	1.06	0.00	0.00	0.00	0.00	20.07	0.35	0.00	0.00
565.0	0.00	0.56	0.00	0.00	0.00	0.28	19.15	0.00	0.00	0.00
570.0	0.30	0.00	0.30	0.00	0.00	0.30	22.09	0.30	0.00	0.00
575.0	0.00	0.35	0.00	0.00	0.00	0.00	22.71	0.35	0.00	0.00
580.0	0.00	0.00	0.00	0.00	0.00	0.00	20.71	0.30	0.00	0.00
585.0	0.00	0.54	0.00	0.00	0.00	0.00	21.68	1.08	0.00	0.00
590.0	0.00	0.38	0.00	0.00	0.00	0.00	25.00	0.38	0.00	0.00
595.0	0.00	0.00	0.00	0.00	0.00	0.00	19.67	0.00	0.00	0.00
600.0	0.42	0.42	0.00	0.00	0.42	0.42	24.05	0.42	0.00	0.00
605.0	0.00	1.18	0.00	0.00	0.29	0.00	20.00	0.29	0.00	0.00
610.0	0.00	0.27	0.00	0.00	0.00	0.00	15.59	0.00	0.00	0.00
615.0	0.00	0.29	0.00	0.00	0.00	0.00	20.70	0.87	0.00	0.00
620.0	0.00	0.92	0.00	0.31	0.31	0.00	20.62	0.92	0.00	0.00
625.0	0.00	0.92	0.00	0.00	0.00	0.31	18.35	0.31	0.00	0.00
630.0	0.00	0.59	0.30	0.00	0.00	0.00	23.15	1.19	0.00	0.00
635.0	0.00	0.65	0.00	0.00	0.00	0.00	23.30	0.32	0.00	0.00
640.0	0.00	0.74	0.00	0.00	0.00	0.00	19.70	1.86	0.00	0.37

Appendix A2. continued.

DEPTH (cm)	*O. universa*	*G. ruber*	*G. tenellus*	*G. sacculifer*	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*	*G. digitata*	*G. rubescens*
645.0	0.00	1.32	0.00	0.00	0.00	0.00	21.19	0.33	0.00	0.00
650.0	0.00	0.90	0.00	0.00	0.00	0.00	22.89	0.00	0.00	0.00
660.0	0.00	0.84	0.00	0.00	0.00	0.28	23.18	0.28	0.00	0.00
665.0	0.00	0.59	0.00	0.00	0.00	0.00	21.18	0.00	0.00	0.00
670.0	0.33	0.65	0.00	0.33	0.00	0.98	20.85	0.00	0.00	0.00
675.0	0.30	0.00	0.00	0.00	0.00	0.00	23.49	0.30	0.00	0.00
680.0	0.00	0.34	0.00	0.00	0.00	0.00	21.62	1.01	0.00	0.00
685.0	0.35	0.71	0.00	0.00	0.00	0.00	22.34	0.00	0.00	0.00
690.0	0.34	0.67	0.00	0.00	0.34	0.00	23.15	0.34	0.00	0.00
695.0	0.00	1.12	0.00	0.00	0.00	0.00	20.82	0.37	0.00	0.00
700.0	0.00	0.72	0.00	0.36	0.00	0.72	20.86	0.36	0.00	0.00
705.0	1.04	1.04	0.00	0.00	0.00	0.35	19.72	0.69	0.00	0.00
710.0	0.64	0.32	0.00	0.00	0.00	0.00	22.29	0.96	0.00	0.00
715.0	0.00	0.62	0.00	0.00	0.00	0.00	26.09	0.93	0.00	0.00
720.0	0.84	0.00	0.00	0.00	0.00	0.00	19.50	2.23	0.00	0.00
725.0	0.33	1.00	0.00	0.00	0.00	0.00	16.39	0.33	0.00	0.00
730.0	0.27	0.27	0.00	0.00	0.00	0.00	25.00	0.54	0.00	0.00
735.0	0.00	0.66	0.33	0.00	0.33	0.33	25.58	0.00	0.00	0.00
740.0	0.00	0.00	0.00	0.00	0.00	0.00	26.79	0.30	0.00	0.00
745.0	0.00	0.78	0.00	0.00	0.00	0.00	27.13	0.52	0.00	0.00
750.0	0.00	0.00	0.00	0.00	0.00	0.30	22.16	0.60	0.00	0.00
755.0	0.00	0.00	0.00	0.00	0.00	0.58	19.13	0.00	0.00	0.00
760.0	0.00	0.32	0.32	0.00	0.00	0.00	20.19	0.32	0.00	0.00
765.0	0.00	0.28	0.00	0.28	0.00	0.00	18.18	0.83	0.00	0.00
770.0	0.29	0.29	0.00	0.00	0.00	0.00	22.19	0.00	0.00	0.00
775.0	0.00	0.30	0.00	0.00	0.00	0.00	15.45	0.00	0.00	0.00
780.0	0.00	0.00	0.00	0.00	0.00	0.00	20.63	0.00	0.00	0.00
785.0	0.00	1.14	0.00	0.00	0.00	0.00	17.61	0.00	0.00	0.00
790.0	0.93	0.62	0.00	0.00	0.00	0.31	19.20	0.00	0.00	0.00
795.0	0.00	0.63	0.00	0.00	0.00	0.00	21.07	0.00	0.00	0.00
800.0	0.00	0.69	0.00	0.00	0.00	0.35	19.03	0.00	0.00	0.00
805.0	0.34	0.68	0.00	0.00	0.00	0.68	19.11	0.34	0.00	0.00

Appendix A2. continued.

DEPTH (cm)	*O. universa*	*G. ruber*	*G. tenellus*	*G. sacculifer*	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*	*G. digitata*	*G. rubescens*
810.0	0.94	0.63	0.00	0.00	0.00	0.31	23.58	0.00	0.31	0.00
815.0	0.43	0.85	0.00	0.00	0.00	0.21	33.40	0.43	0.00	0.00
820.0	0.00	0.00	0.00	0.00	0.00	1.06	23.67	0.00	0.00	0.00
825.0	0.35	0.00	0.00	0.00	0.00	0.35	21.83	0.70	0.00	0.00
830.0	0.33	0.66	0.00	0.00	0.00	0.33	27.81	0.33	0.00	0.00
835.0	0.70	0.35	0.00	0.00	0.00	0.00	23.43	0.00	0.00	0.70
840.0	0.00	0.33	0.00	0.00	0.00	0.00	26.14	0.33	0.00	0.00
845.0	0.00	0.00	0.00	0.00	0.00	0.00	17.94	0.00	0.00	0.00
850.0	0.00	0.30	0.00	0.00	0.00	0.00	15.45	0.00	0.00	0.00
855.0	0.32	0.00	0.00	0.00	0.00	0.00	18.45	0.32	0.00	0.00
860.0	0.32	0.64	0.00	0.00	0.00	0.00	20.45	0.00	0.00	0.32
865.0	0.97	0.00	0.00	0.00	0.00	0.00	20.06	0.00	0.00	0.00
870.0	0.00	0.34	0.00	0.00	0.00	0.00	20.20	0.34	0.00	0.00
875.0	0.30	0.00	0.00	0.00	0.00	0.00	20.67	0.30	0.00	0.00
880.0	0.31	0.61	0.00	0.00	0.00	0.31	19.27	0.00	0.00	0.00
885.0	0.00	0.00	0.00	0.00	0.00	0.34	17.12	0.34	0.00	0.00
890.0	0.64	0.64	0.00	0.00	0.00	0.32	19.17	0.00	0.00	0.00
895.0	0.62	0.31	0.00	0.00	0.00	0.00	18.77	0.00	0.31	0.00
900.0	0.27	0.00	0.00	0.00	0.00	0.00	23.90	0.27	0.00	0.00
905.0	0.27	0.00	0.00	0.00	0.00	0.00	20.05	0.00	0.00	0.00
910.0	0.00	0.00	0.00	0.00	0.00	0.30	16.01	0.00	0.00	0.00
915.0	0.00	0.00	0.00	0.00	0.00	0.00	23.10	0.00	0.00	0.00
920.0	0.30	0.00	0.00	0.00	0.00	0.00	19.03	0.00	0.00	0.00
925.0	0.00	0.63	0.00	0.00	0.00	0.00	25.16	0.63	0.00	0.00
930.0	0.30	0.30	0.00	0.00	0.00	0.00	30.36	0.00	0.00	0.00
935.0	0.96	0.96	0.00	0.00	0.00	0.64	30.45	0.00	0.00	0.00
940.0	0.72	0.00	0.00	0.00	0.00	0.00	35.48	0.00	0.00	0.00
945.0	0.30	0.30	0.00	0.00	0.00	0.00	21.92	0.30	0.00	0.00
950.0	0.29	0.29	0.00	0.00	0.00	0.00	21.49	0.00	0.00	0.00
955.0	0.00	0.00	0.00	0.00	0.00	0.00	20.28	0.00	0.00	0.00
960.0	0.30	0.30	0.00	0.00	0.00	0.30	23.40	0.30	0.00	0.00
965.0	0.00	0.00	0.00	0.00	0.00	0.00	20.54	0.00	0.00	0.00

Appendix A2. continued.

DEPTH (cm)	*O. universa*	*G. ruber*	*G. tenellus*	*G. sacculifer*	*G. aequilatera*	*G. calida*	*G. bulloides*	*G. falconensis*	*G. digitata*	*G. rubescens*
970.0	0.00	0.32	0.00	0.00	0.00	0.64	21.79	0.00	0.00	0.00
975.0	0.31	0.00	0.00	0.00	0.00	0.62	22.15	0.00	0.00	0.00
980.0	0.00	0.26	0.00	0.00	0.00	0.52	20.63	0.26	0.00	0.00
985.0	0.91	0.00	0.00	0.00	0.00	0.91	23.17	0.91	0.00	0.00
990.0	0.56	0.00	0.00	0.00	0.00	0.28	19.44	0.28	0.00	0.00
995.0	0.00	0.52	0.00	0.00	0.00	0.00	15.97	0.00	0.26	0.00
1000.0	0.00	0.32	0.00	0.00	0.00	0.00	13.96	0.00	0.00	0.00
1005.0	0.57	0.29	0.00	0.00	0.00	0.00	21.55	0.00	0.00	0.00
1010.0	0.63	0.00	0.00	0.00	0.32	0.32	24.76	0.63	0.00	0.00
1015.0	0.35	0.00	0.00	0.00	0.00	0.70	19.16	1.05	0.00	0.00
1020.0	1.24	0.50	0.00	0.00	0.00	0.00	25.81	0.50	0.00	0.00
1025.0	0.55	0.28	0.00	0.00	0.28	0.28	23.42	0.00	0.00	0.00
1030.0	0.00	0.00	0.00	0.00	0.00	0.00	25.26	0.68	0.00	0.00
1035.0	0.85	0.00	0.00	0.00	0.00	0.28	23.01	0.00	0.00	0.00
1040.0	0.35	1.04	0.00	0.00	0.00	0.00	21.53	0.00	0.00	0.00
1045.0	0.69	0.00	0.00	0.00	0.00	0.00	30.24	0.34	0.00	0.00
1050.0	0.00	0.64	0.00	0.00	0.00	0.32	36.31	0.00	0.00	0.00
1055.0	0.28	0.00	0.00	0.00	0.00	0.00	35.04	0.28	0.00	0.00
1060.0	0.26	0.00	0.00	0.00	0.00	0.00	27.82	0.00	0.00	0.00
1065.0	0.00	0.33	0.00	0.00	0.00	0.00	28.62	0.00	0.00	0.00
1070.0	0.27	0.00	0.00	0.27	0.00	0.00	40.75	0.00	0.00	0.00
1075.0	0.67	0.00	0.00	0.00	0.00	0.00	25.50	0.00	0.00	0.00
1080.0	0.28	0.00	0.00	0.28	0.00	0.00	21.05	0.28	0.00	0.00
1085.0	0.31	0.00	0.00	0.00	0.00	0.00	24.77	0.00	0.00	0.00
1090.0	0.33	0.33	0.00	0.00	0.33	0.00	21.71	0.33	0.00	0.00
1095.0	0.00	0.33	0.00	0.00	0.00	0.33	18.36	0.00	0.00	0.00
1100.0	0.53	0.53	0.00	0.00	0.00	0.00	21.37	0.26	0.00	0.00
1105.0	0.00	0.63	0.00	0.31	0.00	0.00	20.94	0.31	0.00	0.00
1110.0	0.00	1.61	0.00	0.00	0.00	0.27	30.65	0.00	0.00	0.00
1115.0	0.00	0.61	0.00	0.00	0.00	0.00	33.13	0.00	0.00	0.00
1120.0	0.00	2.96	0.00	0.00	0.00	0.00	26.64	0.33	0.33	0.00
1125.0	0.60	1.51	0.00	0.30	0.00	0.00	20.48	0.90	0.00	0.00

Appendix A2. continued.

DEPTH (cm)	*O. universa*	*G. ruber*	*G. tenellus*	*G. sacculifer*	*G. aequilatera.*	*G. calida*	*G. bulloides*	*G. falconensis*	*G. digitata*	*G. rubescens*
1130.0	0.31	1.55	0.31	0.00	0.00	0.00	20.74	0.62	0.00	0.00
1135.0	0.00	1.86	0.31	0.00	0.00	0.00	16.72	0.31	0.00	0.00
1138.0	0.32	0.95	0.00	0.32	0.00	0.00	22.78	0.00	0.00	0.32

Appendix A2. continued.

DEPTH (cm)	*G. humilus*	*G. quinq.*	*G. pachyderma* (sinistral)	*G. pachyderma* (dextral)	*N. dutertrei*	*N. conglo.*	*N. obliquiloc.*	*G. inflata*	*P. truncatulin.* (sinistral)	*G. truncatulin.* (dextral)
0.0	0.00	3.82	4.78	13.06	9.87	0.00	0.00	19.11	4.14	0.32
10.0	0.00	3.23	3.87	20.97	5.16	0.00	0.00	18.06	3.87	0.32
15.0	0.00	3.32	3.32	19.64	2.42	0.00	0.00	22.05	3.32	0.00
20.0	0.00	3.37	3.09	16.57	5.34	0.00	0.00	17.13	3.09	0.00
25.0	0.28	6.65	6.93	19.94	1.66	0.00	0.00	12.74	3.88	0.00
30.0	0.00	3.21	3.85	22.12	2.56	0.00	0.00	14.10	1.92	0.32
35.0	0.00	4.41	5.08	21.36	3.73	0.00	0.00	14.92	1.36	0.00
40.0	0.00	6.38	4.34	20.92	4.59	0.00	0.00	17.60	1.28	0.00
45.0	0.00	2.55	7.01	22.93	4.14	0.00	0.00	18.47	4.46	0.64
50.0	0.00	5.23	4.92	22.77	1.54	0.00	0.00	19.38	4.31	0.00
55.0	0.00	2.26	4.52	32.58	0.97	0.00	0.00	11.94	1.29	0.00
60.0	0.00	4.56	6.84	34.20	1.63	0.00	0.00	9.12	0.98	0.00
65.0	0.00	4.62	8.00	40.00	2.46	0.00	0.00	6.77	0.92	0.00
70.0	0.00	2.87	11.46	36.31	2.55	0.00	0.00	5.73	0.32	0.00
75.0	0.00	3.26	7.97	39.86	0.36	0.00	0.00	10.51	0.00	0.00
80.0	0.00	3.31	12.35	32.53	2.11	0.00	0.00	7.23	0.60	0.00
85.0	0.00	2.92	6.73	34.50	0.88	0.00	0.00	8.48	0.88	0.00
90.0	0.00	2.44	5.79	36.59	0.00	0.00	0.00	11.28	1.52	0.00
95.0	0.00	5.18	7.44	37.86	2.27	0.00	0.00	9.39	0.65	0.00
100.0	0.00	7.19	7.55	38.13	0.36	0.00	0.00	8.99	0.72	0.00
105.0	0.00	4.66	8.60	33.69	1.08	0.00	0.00	7.53	0.72	0.72
110.0	0.00	6.15	5.83	42.39	0.32	0.32	0.00	10.36	0.97	0.00
115.0	0.00	3.92	10.08	37.82	1.12	0.00	0.00	10.92	0.84	0.00
120.0	0.00	3.02	8.39	31.21	1.01	0.00	0.00	9.40	1.01	0.00
125.0	0.00	5.11	7.06	34.31	1.22	0.00	0.00	9.73	0.73	0.00
130.0	0.00	4.78	13.43	32.54	0.30	0.00	0.30	7.46	1.49	0.60
135.0	0.00	3.75	8.36	27.95	0.29	0.00	0.00	11.24	1.73	0.29
140.0	0.00	3.31	9.60	31.13	0.99	0.00	0.00	13.25	1.66	0.00
145.0	0.00	4.60	8.90	28.53	0.92	0.00	0.00	11.96	1.23	0.00
150.0	0.00	6.23	6.23	38.06	1.04	0.00	0.00	9.34	0.69	0.00
155.0	0.00	3.27	8.93	31.25	1.19	0.00	0.00	12.80	1.19	0.00
160.0	0.00	3.72	11.52	30.86	0.37	0.00	0.00	11.15	1.12	0.00

Appendix A2. continued.

DEPTH (cm)	*G. humilus*	*G. quinq.*	*G. pachyderma* (sinistral)	*G. pachyderma* (dextral)	*N. dutertrei*	*N. conglo.*	*N. obliquiloc.*	*G. inflata*	*P. truncatulin.* (sinistral)	*G. truncatulin.* (dextral)
165.0	0.00	4.80	12.40	26.80	1.20	0.00	0.00	18.00	1.60	0.00
170.0	0.00	5.57	8.98	34.06	0.31	0.00	0.00	14.55	1.24	0.00
175.0	0.00	4.45	13.65	40.95	0.30	0.00	0.00	8.01	1.19	0.30
180.0	0.00	5.05	10.77	35.02	0.34	0.00	0.00	10.44	2.02	0.00
185.0	0.00	1.75	10.18	38.95	1.05	0.00	0.00	9.12	1.40	0.35
190.0	0.00	1.68	13.97	41.90	0.56	0.00	0.00	9.78	1.12	0.00
195.0	0.00	1.77	12.91	47.59	0.76	0.00	0.00	10.13	1.01	0.00
200.0	0.00	3.47	7.64	44.79	0.69	0.00	0.00	9.03	2.43	0.00
205.0	0.00	2.71	7.80	46.44	1.36	0.00	0.00	6.44	1.02	0.00
210.0	0.00	2.55	10.21	42.98	0.00	0.00	0.00	11.91	0.43	0.00
215.0	0.00	4.65	2.99	46.51	1.00	0.00	0.00	5.32	1.99	0.00
220.0	0.00	4.18	4.94	39.54	0.38	0.00	0.00	7.22	1.52	0.38
225.0	0.00	2.33	3.99	41.86	0.66	0.00	0.00	9.63	1.00	0.00
230.0	0.00	2.72	6.80	38.10	0.68	0.00	0.00	8.16	2.72	0.00
235.0	0.00	5.33	6.27	38.24	0.63	0.00	0.00	10.66	2.19	0.00
240.0	0.00	3.89	3.29	42.22	0.60	0.00	0.00	10.18	0.90	0.00
245.0	0.00	2.93	4.89	34.53	0.33	0.00	0.00	10.42	1.63	0.00
250.0	0.00	3.76	5.96	34.80	0.63	0.00	0.00	9.72	1.25	0.00
255.0	0.00	3.81	4.44	29.21	0.95	0.00	0.00	9.52	1.59	0.00
260.0	0.00	2.91	2.38	26.72	0.53	0.00	0.00	11.11	0.26	0.00
265.0	0.00	2.62	3.93	29.51	0.98	0.00	0.00	12.46	2.30	0.33
270.0	0.00	1.55	7.74	34.98	0.31	0.00	0.00	15.48	1.55	0.00
275.0	0.00	1.80	10.57	28.09	0.77	0.00	0.00	13.92	2.06	0.00
280.0	0.00	2.57	9.93	27.57	0.37	0.00	0.00	9.93	5.51	0.37
285.0	0.00	3.14	7.23	30.82	1.57	0.00	0.00	9.43	2.52	0.31
290.0	0.00	3.70	7.72	29.32	0.31	0.00	0.00	9.26	3.09	0.00
295.0	0.00	3.20	5.48	30.14	0.00	0.00	0.00	9.59	0.91	0.00
300.0	0.00	1.51	6.04	36.98	1.89	0.00	0.00	9.43	3.40	0.00
305.0	0.00	5.05	6.94	25.55	0.63	0.00	0.00	10.41	4.73	0.00
310.0	0.00	4.19	6.13	24.52	0.32	0.00	0.00	16.45	1.94	0.00
315.0	0.00	4.42	4.10	27.76	0.00	0.00	0.00	12.30	1.89	0.00
320.0	0.00	4.40	2.93	29.33	0.00	0.00	0.00	12.61	1.76	0.00

Appendix A2. continued.

DEPTH (cm)	G. humilus	G. quinq.	G. pachyderma (sinistral)	G. pachyderma (dextral)	N. dutertrei	N. conglo.	N. obliquiloc.	G. inflata	P. truncatulin. (sinistral)	G. truncatulin. (dextral)
325.0	0.00	3.92	6.54	29.08	0.33	0.00	0.00	13.73	1.96	0.00
330.0	0.00	5.47	5.79	29.26	0.32	0.00	0.00	12.22	3.86	0.00
335.0	0.00	4.05	5.95	31.62	0.54	0.00	0.00	13.24	2.70	0.00
340.0	0.00	1.19	9.25	31.94	1.19	0.00	0.00	9.85	1.79	0.00
345.0	0.00	2.10	8.68	38.02	0.30	0.00	0.00	7.49	1.20	0.00
350.0	0.00	4.20	8.41	34.23	1.20	0.00	0.00	8.41	2.40	0.00
355.0	0.00	0.76	6.46	37.26	0.76	0.00	0.00	11.03	2.66	0.38
360.0	0.00	2.10	7.81	37.54	0.60	0.00	0.00	10.81	2.10	0.00
365.0	0.00	2.74	9.93	32.19	1.37	0.00	0.00	14.73	2.74	0.00
370.0	0.00	2.75	6.42	31.50	0.92	0.00	0.00	13.15	3.67	0.31
375.0	0.00	2.30	6.58	30.92	0.00	0.00	0.00	9.87	4.28	0.33
380.0	0.00	2.57	5.79	27.01	0.00	0.00	0.00	8.04	4.18	0.32
385.0	0.00	2.92	3.90	28.25	0.97	0.00	0.00	15.26	2.92	0.00
390.0	0.00	2.37	4.21	30.00	0.53	0.00	0.00	16.05	1.32	0.00
395.0	0.00	1.67	3.33	28.33	0.33	0.00	0.00	15.67	1.67	0.00
400.0	0.00	3.82	3.05	33.59	0.76	0.00	0.00	17.56	2.67	0.00
405.0	0.00	2.36	5.51	33.07	0.00	0.00	0.00	13.78	1.57	0.39
410.0	0.00	1.65	5.77	30.22	0.82	0.00	0.00	15.66	2.75	0.27
415.0	0.00	1.17	3.52	30.50	1.17	0.00	0.00	19.06	5.57	0.88
420.0	0.00	2.27	5.83	29.13	0.00	0.00	0.00	21.04	7.44	0.00
425.0	0.00	1.81	7.83	26.20	0.30	0.00	0.00	19.88	5.42	0.00
430.0	0.00	2.22	11.48	27.04	0.00	0.00	0.00	18.52	4.44	0.00
435.0	0.00	4.24	15.25	32.49	0.00	0.00	0.00	13.84	1.98	0.00
440.0	0.00	4.36	16.20	28.66	0.00	0.00	0.00	10.28	1.87	0.00
445.0	0.00	2.84	23.34	36.59	0.00	0.00	0.00	8.83	2.21	0.00
450.0	0.00	5.73	25.79	31.23	0.00	0.00	0.00	11.17	0.00	0.00
455.0	0.00	5.54	25.48	36.84	0.28	0.00	0.00	10.25	1.11	0.00
460.0	0.00	4.41	23.53	35.29	0.37	0.00	0.00	5.15	0.74	0.00
465.0	0.00	3.99	20.29	34.06	0.72	0.00	0.00	10.14	0.72	0.00
470.0	0.00	4.59	18.65	31.08	0.81	0.00	0.00	6.76	0.54	0.00
475.0	0.00	1.73	14.19	43.94	0.35	0.00	0.00	11.07	0.35	0.00
480.0	0.00	4.23	20.20	31.92	0.65	0.00	0.00	10.10	1.95	0.33

Appendix A2. continued.

DEPTH (cm)	*G. humilus*	*G. quinq.*	*G. pachyderma* (sinistral)	*G. pachyderma* (dextral)	*N. dutertrei*	*N. conglo.*	*N. obliquiloc.*	*G. inflata*	*P. truncatulin.* (sinistral)	*G. truncatulin.* (dextral)
485.0	0.00	1.93	12.86	34.73	0.00	0.00	0.00	15.11	0.96	0.00
490.0	0.00	1.45	13.09	33.82	0.00	0.00	0.00	14.91	0.73	0.00
495.0	0.00	1.27	17.37	38.14	0.42	0.00	0.00	11.86	0.00	0.00
500.0	0.00	2.88	16.61	41.85	0.00	0.00	0.00	12.78	0.64	0.00
505.0	0.00	4.74	17.37	37.89	0.26	0.00	0.00	8.16	0.26	0.00
510.0	0.00	2.30	19.41	46.38	0.66	0.00	0.00	5.59	1.32	0.00
515.0	0.00	5.09	20.06	36.53	1.20	0.00	0.00	11.08	0.00	0.00
520.0	0.00	2.07	17.16	41.72	0.59	0.00	0.00	11.24	0.59	0.00
525.0	0.00	2.77	14.46	41.23	0.31	0.00	0.00	9.85	0.62	0.00
530.0	0.00	2.67	15.13	37.69	0.30	0.00	0.00	8.01	1.48	0.00
535.0	0.00	2.37	11.35	43.80	1.06	0.00	0.00	10.29	0.53	0.00
540.0	0.00	4.29	11.96	42.94	1.23	0.00	0.00	7.67	1.53	0.00
545.0	0.00	4.96	22.19	35.77	1.04	0.00	0.00	9.40	0.78	0.00
550.0	0.00	3.46	10.37	42.82	0.53	0.00	0.00	11.70	1.06	0.00
555.0	0.00	3.02	10.74	40.27	0.00	0.00	0.00	12.75	1.01	0.00
560.0	0.00	1.76	18.66	29.93	0.00	0.00	0.00	17.96	2.11	0.00
565.0	0.00	4.51	11.27	40.28	0.56	0.00	0.00	13.80	0.85	0.00
570.0	0.00	1.49	12.84	39.10	0.30	0.00	0.00	17.31	0.30	0.00
575.0	0.00	1.41	16.37	40.49	0.53	0.00	0.00	9.15	0.70	0.00
580.0	0.00	4.73	14.50	38.17	0.00	0.00	0.00	11.54	0.00	0.00
585.0	0.00	2.71	15.45	38.75	0.00	0.00	0.00	9.76	1.63	0.00
590.0	0.00	4.55	10.98	39.39	0.00	0.00	0.00	10.61	0.76	0.00
595.0	0.00	3.00	10.00	44.00	0.00	0.00	0.00	16.33	0.33	0.33
600.0	0.00	3.80	12.66	37.97	1.27	0.00	0.00	10.97	0.42	0.00
605.0	0.00	0.59	14.71	41.18	0.29	0.00	0.00	14.41	0.59	0.00
610.0	0.00	1.34	7.80	45.16	0.27	0.00	0.00	22.04	1.34	0.00
615.0	0.00	3.79	9.04	45.77	1.17	0.00	0.00	14.87	1.46	0.00
620.0	0.00	1.23	9.23	46.15	1.85	0.00	0.00	12.92	0.62	0.00
625.0	0.00	2.14	8.87	45.57	0.92	0.00	0.00	14.68	1.83	0.00
630.0	0.00	3.56	9.50	42.14	1.48	0.00	0.00	11.28	1.19	0.00
635.0	0.00	2.59	8.09	44.98	0.32	0.00	0.00	12.94	0.00	0.00
640.0	0.00	2.60	2.60	50.56	0.74	0.00	0.00	14.13	1.49	0.00

Appendix A2. continued.

DEPTH (cm)	*G. humilus*	*G. quinq.*	*G. pachyderma* (sinistral)	*G. pachyderma* (dextral)	*N. dutertrei*	*N. conglo.*	*N. obliquiloc.*	*G. inflata*	*P. truncatulin.* (sinistral)	*G. truncatulin.* (dextral)
645.0	0.00	2.32	6.29	45.70	0.66	0.00	0.00	14.90	1.32	0.00
650.0	0.00	0.90	4.22	49.70	0.00	0.00	0.00	13.55	0.60	0.00
660.0	0.00	1.68	6.70	44.41	0.28	0.00	0.00	14.25	2.51	0.28
665.0	0.00	2.06	8.82	45.88	0.29	0.00	0.00	13.82	0.88	0.00
670.0	0.00	1.63	7.49	45.93	0.33	0.00	0.00	12.05	1.63	0.00
675.0	0.00	1.51	9.94	43.37	0.30	0.00	0.00	9.94	2.71	0.00
680.0	0.00	0.34	5.74	44.59	1.01	0.00	0.00	15.20	2.03	0.00
685.0	0.00	1.42	7.80	39.36	0.71	0.00	0.00	11.70	3.90	0.00
690.0	0.00	2.01	10.07	42.62	0.34	0.00	0.00	10.07	1.68	0.00
695.0	0.00	2.60	10.04	35.69	0.74	0.00	0.00	11.52	3.35	0.00
700.0	0.00	5.04	7.19	37.05	0.00	0.00	0.00	12.95	1.80	0.00
705.0	0.00	2.77	4.50	37.02	0.00	0.00	0.00	14.88	3.81	0.00
710.0	0.00	1.59	7.32	35.35	0.00	0.00	0.00	18.47	2.87	0.00
715.0	0.00	1.86	5.90	33.23	0.93	0.00	0.00	18.63	1.86	0.00
720.0	0.00	4.46	5.01	32.87	1.39	0.00	0.00	21.17	3.06	0.28
725.0	0.00	3.01	12.37	36.12	1.00	0.00	0.00	20.07	2.01	0.00
730.0	0.00	3.80	5.43	25.27	0.82	0.00	0.00	21.74	2.99	0.54
735.0	0.00	3.65	5.32	29.24	0.33	0.00	0.00	21.93	2.66	0.00
740.0	0.00	4.17	10.42	28.57	0.00	0.00	0.00	21.73	2.38	0.00
745.0	0.00	2.58	12.66	27.39	0.00	0.00	0.00	18.86	3.10	0.00
750.0	0.00	2.10	11.38	43.71	0.30	0.00	0.00	11.38	2.40	0.60
755.0	0.00	1.16	9.57	45.22	0.29	0.00	0.00	13.33	2.03	0.00
760.0	0.00	2.88	8.65	42.95	0.00	0.00	0.00	13.46	0.96	0.00
765.0	0.00	2.75	9.09	42.70	0.00	0.00	0.00	14.33	0.83	0.00
770.0	0.00	1.73	8.93	41.21	0.29	0.00	0.00	14.70	3.17	0.00
775.0	0.00	4.24	7.88	48.18	0.61	0.00	0.00	12.42	1.52	0.00
780.0	0.00	2.10	7.34	48.95	0.35	0.00	0.00	8.74	2.10	0.00
785.0	0.00	3.98	6.25	43.18	0.00	0.00	0.00	16.48	1.70	0.00
790.0	0.00	3.10	6.50	40.56	0.00	0.00	0.00	16.10	1.86	0.00
795.0	0.00	5.66	7.86	32.70	0.31	0.00	0.00	14.15	3.14	0.00
800.0	0.00	2.77	5.54	38.06	0.00	0.00	0.00	16.26	4.15	0.00
805.0	0.00	3.75	10.58	35.49	0.00	0.00	0.00	11.95	3.75	0.00

Appendix A2. continued.

DEPTH (cm)	*G. humilus*	*G. quinq.*	*G. pachyderma* (sinistral)	*G. pachyderma* (dextral)	*N. dutertrei*	*N. conglo.*	*N. obliquiloc.*	*G. inflata*	*P. truncatulin.* (sinistral)	*G. truncatulin.* (dextral)
810.0	0.00	3.77	9.75	31.13	0.31	0.00	0.00	9.75	4.40	0.00
815.0	0.00	1.49	7.23	27.45	0.43	0.00	0.00	14.89	2.77	0.00
820.0	0.00	3.53	9.89	29.33	0.35	0.00	0.00	15.55	3.53	0.00
825.0	0.00	2.82	6.69	32.04	0.70	0.00	0.00	13.73	4.58	0.35
830.0	0.00	2.32	9.60	23.51	0.00	0.00	0.00	16.89	3.64	0.00
835.0	0.00	3.50	10.84	29.37	0.00	0.00	0.00	13.64	1.75	0.35
840.0	0.00	4.58	13.07	32.35	0.00	0.00	0.00	7.84	3.92	0.00
845.0	0.00	2.33	18.27	38.21	0.00	0.00	0.00	12.96	0.66	0.00
850.0	0.00	1.52	16.36	43.03	0.30	0.00	0.00	6.67	1.82	0.00
855.0	0.00	3.56	15.21	46.60	0.00	0.00	0.00	7.44	0.00	0.00
860.0	0.00	3.19	17.25	39.30	0.00	0.00	0.00	10.54	0.96	0.00
865.0	0.00	2.59	10.03	43.37	0.00	0.00	0.00	13.59	0.32	0.00
870.0	0.00	2.36	12.12	44.78	0.00	0.00	0.00	12.79	0.00	0.00
875.0	0.00	3.95	11.85	39.51	0.00	0.00	0.00	13.07	0.91	0.00
880.0	0.00	1.83	10.70	42.20	0.00	0.00	0.00	15.29	0.92	0.00
885.0	0.00	4.11	12.33	36.99	0.00	0.00	0.00	16.44	0.68	0.00
890.0	0.00	3.83	13.10	37.38	0.00	0.00	0.00	15.02	0.96	0.00
895.0	0.00	3.08	9.85	41.23	0.00	0.00	0.00	15.08	1.23	0.31
900.0	0.00	0.00	10.16	33.79	0.00	0.00	0.00	28.57	0.00	0.00
905.0	0.00	0.54	18.70	43.90	0.00	0.00	0.00	16.26	0.00	0.00
910.0	0.00	1.51	22.05	41.69	0.00	0.00	0.00	15.71	0.00	0.00
915.0	0.00	0.56	12.39	43.10	0.00	0.00	0.00	19.15	0.00	0.00
920.0	0.00	1.51	6.34	50.45	0.00	0.00	0.00	15.11	0.60	0.00
925.0	0.00	0.94	6.92	38.36	0.00	0.00	0.00	16.35	0.63	0.00
930.0	0.00	2.38	4.46	32.14	0.00	0.00	0.00	19.05	0.89	0.00
935.0	0.00	3.21	6.41	27.24	0.00	0.00	0.00	20.19	2.24	0.00
940.0	0.00	1.43	0.72	27.24	0.36	0.00	0.00	26.88	1.79	0.00
945.0	0.00	0.60	8.41	40.84	0.00	0.00	0.00	21.62	0.30	0.30
950.0	0.00	1.15	10.32	39.26	0.00	0.00	0.00	22.92	0.86	0.00
955.0	0.00	1.40	11.19	46.15	0.00	0.00	0.00	17.83	0.70	0.00
960.0	0.00	0.61	7.29	41.95	0.30	0.00	0.00	20.36	0.61	0.00
965.0	0.00	1.01	13.13	41.08	0.00	0.00	0.00	14.48	1.01	0.00

Appendix A2. continued.

DEPTH (cm)	*G. humilus*	*G. quinq.*	*G. pachyderma* (sinistral)	*G. pachyderma* (dextral)	*N. dutertrei*	*N. conglo.*	*N. obliquiloc.*	*G. inflata*	*P. truncatulin.* (sinistral)	*G. truncatulin.* (dextral)
970.0	0.00	0.64	9.29	34.62	0.00	0.00	0.00	22.44	1.60	0.32
975.0	0.00	0.62	6.77	41.23	0.00	0.00	0.00	17.85	0.62	0.00
980.0	0.00	0.78	7.83	39.69	0.52	0.00	0.00	20.89	1.57	0.00
985.0	0.00	0.00	6.10	35.98	0.61	0.00	0.00	23.48	0.61	0.00
990.0	0.00	0.28	8.89	33.61	0.00	0.00	0.00	26.39	0.83	0.00
995.0	0.00	0.26	4.97	43.72	0.00	0.00	0.00	27.75	0.52	0.00
1000.0	0.00	1.62	3.90	37.99	0.00	0.00	0.00	32.14	0.97	0.32
1005.0	0.00	0.57	9.48	30.46	0.00	0.00	0.00	27.87	2.59	0.29
1010.0	0.00	0.95	6.67	30.79	0.32	0.00	0.00	23.81	2.54	0.00
1015.0	0.00	0.35	13.94	26.48	0.35	0.00	0.00	25.78	4.18	0.00
1020.0	0.00	0.25	12.66	25.81	0.50	0.00	0.00	22.08	3.97	0.25
1025.0	0.00	1.93	22.87	21.49	0.28	0.00	0.00	23.42	0.83	0.00
1030.0	0.00	0.68	20.14	24.91	0.00	0.00	0.00	22.18	0.34	0.00
1035.0	0.00	2.56	29.83	24.15	0.00	0.00	0.00	11.08	0.57	0.00
1040.0	0.00	2.43	22.57	21.18	0.00	0.00	0.00	17.01	1.04	0.00
1045.0	0.00	1.03	17.87	18.21	0.00	0.00	0.00	19.59	0.69	0.00
1050.0	0.00	0.64	18.15	20.70	0.00	0.00	0.00	11.15	2.23	0.00
1055.0	0.00	0.85	19.37	21.37	0.00	0.00	0.00	11.97	1.71	0.00
1060.0	0.00	0.00	16.01	27.30	0.00	0.00	0.00	16.01	1.05	0.00
1065.0	0.00	0.33	21.71	26.32	0.00	0.00	0.00	15.46	0.66	0.33
1070.0	0.00	0.00	15.82	25.20	0.00	0.00	0.00	14.21	0.00	0.00
1075.0	0.00	0.34	23.49	29.53	0.00	0.00	0.00	12.08	1.34	0.00
1080.0	0.00	0.83	22.44	28.25	0.00	0.00	0.00	14.68	0.55	0.00
1085.0	0.00	1.22	24.16	24.46	0.00	0.00	0.00	12.54	0.00	0.00
1090.0	0.00	1.97	21.38	27.63	0.00	0.00	0.00	13.82	0.00	0.00
1095.0	0.00	2.30	26.56	26.23	0.00	0.00	0.00	13.11	0.00	0.00
1100.0	0.00	2.11	16.62	28.23	0.26	0.00	0.00	19.26	0.00	0.00
1105.0	0.00	0.94	12.50	35.94	0.00	0.00	0.00	23.13	0.31	0.63
1110.0	0.00	2.15	8.06	29.84	0.00	0.00	0.00	19.35	0.00	0.00
1115.0	0.00	0.00	12.27	27.91	0.31	0.00	0.00	12.88	1.23	0.31
1120.0	0.00	1.64	15.46	28.29	0.66	0.00	0.00	11.51	0.33	0.00
1125.0	0.00	0.90	15.96	31.63	0.30	0.00	0.00	15.06	0.00	0.00

Appendix A2. continued.

DEPTH (cm)	*G. humilus*	*G. quinq.*	*G. pachyderma* (sinistral)	*G. pachyderma* (dextral)	*N. dutertrei*	*N. conglo.*	*N. obliquiloc.*	*G. inflata*	*P. truncatulin.* (sinistral)	*G. truncatulin.* (dextral)
1130.0	0.00	0.31	20.43	28.17	2.17	0.00	0.31	11.46	0.00	0.00
1135.0	0.00	1.24	27.55	28.17	0.31	0.00	0.31	8.05	0.31	0.00
1138.0	0.32	1.27	28.80	21.84	0.32	0.00	0.00	9.81	0.32	0.00

Appendix A2. continued.

DEPTH (cm)	*G. crassaformis*	P/D	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinat a*	*G. bradyi*	*other*
0.0	0.96	0.96	0.64	0.96	0.00	6.69	0.00	3.50
10.0	0.97	2.26	0.97	0.65	0.00	8.06	0.00	1.94
15.0	1.21	1.51	1.21	0.00	0.00	10.88	0.00	1.21
20.0	0.00	2.25	2.53	0.28	0.00	12.08	0.00	1.12
25.0	0.83	3.60	1.94	0.00	0.00	8.31	0.00	0.83
30.0	0.32	1.28	2.24	0.32	0.00	7.37	0.00	1.60
35.0	1.69	2.37	2.03	1.69	0.00	10.85	0.00	0.68
40.0	0.26	1.28	0.51	0.26	0.00	10.20	0.00	0.00
45.0	0.00	0.32	1.27	0.96	0.00	9.55	0.00	0.64
50.0	1.23	0.92	0.62	0.00	0.00	8.92	0.00	1.54
55.0	0.00	4.19	0.97	0.00	0.00	6.45	0.00	0.65
60.0	0.65	1.95	0.33	0.00	0.00	4.23	0.00	0.98
65.0	0.00	3.08	0.31	0.00	0.00	4.92	0.00	1.54
70.0	0.00	4.14	0.00	0.00	0.00	5.41	0.00	0.96
75.0	0.00	3.26	0.36	0.00	0.00	6.52	0.00	0.72
80.0	0.60	0.60	0.60	0.00	0.00	7.23	0.00	0.60
85.0	0.00	0.58	0.00	0.00	0.00	7.89	0.00	2.63
90.0	0.91	2.13	0.91	0.00	0.00	7.01	0.00	0.61
95.0	0.32	2.27	0.32	0.00	0.00	7.77	0.00	1.29
100.0	0.00	1.08	0.72	0.00	0.00	8.27	0.00	1.08
105.0	0.00	0.00	0.00	0.36	0.00	10.39	0.00	0.72
110.0	0.00	0.00	0.32	0.00	0.00	8.74	0.00	0.65
115.0	0.56	0.00	0.56	0.00	0.00	6.72	0.00	0.84
120.0	0.00	0.00	0.00	0.34	0.00	9.73	0.00	0.34
125.0	0.00	0.97	0.00	0.24	0.00	8.27	0.00	0.97
130.0	0.00	0.60	0.60	0.60	0.00	5.67	0.00	0.60
135.0	0.00	1.73	1.15	0.00	0.00	7.78	0.00	0.58
140.0	0.00	0.33	1.32	0.33	0.00	6.95	0.00	0.66
145.0	0.00	0.00	0.61	1.23	0.00	7.36	0.00	1.53
150.0	0.00	0.69	0.00	0.00	0.00	7.96	0.00	0.69
155.0	0.00	0.60	0.60	0.00	0.00	9.23	0.00	1.49
160.0	0.00	0.37	0.74	0.74	0.00	5.95	0.00	1.12

Appendix A2. continued.

DEPTH (cm)	*G. crassaformis*	*P/D*	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinat a*	*G. bradyi*	*other*
165.0	0.00	0.80	0.80	0.00	0.00	8.40	0.00	1.20
170.0	0.31	0.62	0.31	0.93	0.00	6.81	0.00	0.62
175.0	0.00	0.89	0.30	0.59	0.00	8.61	0.00	0.30
180.0	0.00	0.00	0.34	1.01	0.00	7.07	0.00	1.35
185.0	0.00	0.00	0.35	0.00	0.00	8.42	0.00	1.05
190.0	0.00	0.28	0.00	0.00	0.00	6.98	0.00	0.00
195.0	0.25	0.25	0.25	0.00	0.00	6.84	0.00	0.25
200.0	0.00	0.69	0.00	0.35	0.00	7.99	0.00	1.39
205.0	0.34	0.00	0.34	0.00	0.00	8.14	0.00	1.02
210.0	0.00	2.13	0.43	0.00	0.00	5.11	0.00	0.43
215.0	0.66	0.66	0.00	0.66	0.00	11.96	0.00	0.33
220.0	1.52	0.76	0.76	0.38	0.00	9.51	0.00	0.38
225.0	0.00	0.33	0.66	0.00	0.00	9.30	0.00	0.66
230.0	0.00	0.34	0.34	0.68	0.00	6.80	0.00	1.02
235.0	0.00	0.00	0.00	0.94	0.00	5.33	0.00	0.31
240.0	0.00	0.00	0.90	0.90	0.00	8.08	0.00	0.00
245.0	0.00	0.00	0.65	0.00	0.00	11.40	0.00	1.30
250.0	0.00	0.31	0.31	0.31	0.00	10.03	0.00	0.94
255.0	0.00	0.63	0.32	0.63	0.00	9.84	0.00	0.32
260.0	0.00	0.26	0.26	1.06	0.00	12.17	0.00	1.32
265.0	0.00	0.00	0.66	0.66	0.00	7.21	0.00	0.00
270.0	0.00	0.31	0.62	0.62	0.00	8.67	0.00	0.00
275.0	0.00	0.26	0.26	0.00	0.00	9.28	0.00	0.77
280.0	0.00	0.37	0.37	0.00	0.00	9.19	0.00	0.37
285.0	0.31	0.00	0.63	0.94	0.00	10.06	0.00	0.63
290.0	0.00	0.31	0.00	0.62	0.00	10.80	0.00	0.00
295.0	0.00	0.00	0.00	0.00	0.00	11.42	0.00	0.46
300.0	0.00	1.13	1.89	0.00	0.00	3.77	0.00	1.51
305.0	0.00	0.63	0.95	0.00	0.00	8.83	0.00	0.32
310.0	0.00	0.65	1.61	0.00	0.00	9.35	0.00	0.65
315.0	0.00	0.95	0.63	0.63	0.00	10.09	0.00	0.95
320.0	0.00	0.88	0.88	0.29	0.00	10.85	0.00	0.88

Appendix A2. continued.

DEPTH (cm)	*G. crassaformis*	P/D	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. bradyi*	*other*
325.0	0.00	0.00	0.33	0.98	0.00	7.84	0.00	0.65
330.0	0.00	0.96	0.96	0.64	0.00	6.11	0.00	1.29
335.0	0.00	0.27	0.54	0.00	0.00	8.38	0.00	1.35
340.0	0.00	0.30	0.30	0.30	0.00	5.67	0.00	0.30
345.0	0.30	0.00	0.30	0.00	0.00	7.78	0.00	0.30
350.0	0.00	0.30	0.30	0.00	0.00	7.51	0.00	0.30
355.0	0.00	1.52	0.00	0.38	0.00	6.84	0.00	0.76
360.0	0.00	0.00	0.30	0.30	0.00	4.80	0.00	0.00
365.0	0.00	0.34	0.00	0.00	0.00	8.90	0.00	0.00
370.0	0.00	0.00	0.61	0.61	0.00	10.09	0.00	0.31
375.0	0.00	0.00	1.64	0.33	0.00	9.54	0.00	0.33
380.0	0.32	0.32	0.00	1.29	0.00	9.97	0.00	0.32
385.0	0.00	0.32	0.32	0.65	0.00	8.77	0.00	0.65
390.0	0.26	0.53	0.00	1.32	0.00	10.53	0.00	1.05
395.0	0.33	0.33	0.00	2.00	0.00	5.33	0.00	1.00
400.0	0.00	0.76	0.00	1.91	0.00	9.16	0.00	0.76
405.0	0.00	0.00	0.79	1.57	0.00	5.91	0.00	0.79
410.0	0.00	0.00	0.00	0.55	0.00	8.79	0.00	0.55
415.0	0.00	0.00	1.17	0.00	0.00	5.57	0.00	0.88
420.0	0.32	0.00	1.29	0.00	0.00	4.85	0.00	0.65
425.0	0.00	0.30	0.60	0.00	0.00	7.23	0.00	0.90
430.0	0.00	1.11	0.00	0.00	0.00	7.04	0.00	0.00
435.0	0.00	0.56	0.00	0.00	0.00	3.67	0.00	0.85
440.0	0.00	0.62	0.00	0.31	0.00	6.23	0.00	1.25
445.0	0.00	0.32	0.32	0.00	0.00	7.26	0.00	0.63
450.0	0.00	0.00	1.15	0.00	0.00	7.16	0.00	0.57
455.0	0.00	0.00	0.28	0.00	0.00	4.43	0.00	0.83
460.0	0.00	1.10	0.00	0.00	0.00	10.66	0.00	0.37
465.0	0.00	0.72	0.36	0.00	0.00	6.88	0.00	1.45
470.0	0.00	0.54	0.00	0.00	0.00	5.68	0.00	1.08
475.0	0.00	0.69	0.69	0.00	0.00	4.84	0.00	0.35
480.0	0.33	0.33	0.00	0.00	0.00	3.91	0.00	0.00

Appendix A2. continued.

DEPTH (cm)	*G. crassaformis*	P/D	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. bradyi*	*other*
485.0	0.00	0.32	0.00	0.00	0.00	3.22	0.00	0.32
490.0	0.00	0.00	0.36	0.00	0.00	1.82	0.00	0.00
495.0	0.00	0.00	0.00	0.00	0.00	3.39	0.00	0.85
500.0	0.00	0.32	0.00	0.00	0.00	3.51	0.00	0.00
505.0	0.00	0.00	0.00	0.00	0.00	6.32	0.00	0.79
510.0	0.00	0.66	0.00	0.33	0.00	4.93	0.00	0.66
515.0	0.00	0.00	0.00	0.00	0.00	5.99	0.00	1.20
520.0	0.00	0.00	0.30	0.59	0.00	7.40	0.00	0.30
525.0	0.00	0.00	0.31	0.00	0.00	6.15	0.00	0.31
530.0	0.00	1.19	1.19	0.00	0.00	5.34	0.00	0.59
535.0	0.00	0.79	0.26	0.53	0.00	4.49	0.00	0.26
540.0	0.00	0.92	0.31	0.00	0.00	2.15	0.00	0.92
545.0	0.00	0.78	0.00	0.00	0.00	5.48	0.00	0.78
550.0	0.27	0.53	0.27	1.06	0.00	6.38	0.00	0.80
555.0	0.00	0.00	0.34	0.00	0.00	6.38	0.00	0.34
560.0	0.00	0.00	0.00	0.35	0.00	7.39	0.00	0.35
565.0	0.00	0.00	0.00	1.13	0.00	7.32	0.00	0.28
570.0	0.00	0.00	0.00	0.60	0.00	4.18	0.00	0.60
575.0	0.18	0.00	0.00	0.18	0.00	7.39	0.00	0.18
580.0	0.30	2.07	0.30	0.00	0.00	6.21	0.00	1.18
585.0	0.00	0.27	0.00	0.54	0.00	6.50	0.00	1.08
590.0	0.38	0.00	0.38	0.38	0.00	6.82	0.00	0.00
595.0	0.00	0.00	0.67	0.00	0.00	5.33	0.00	0.33
600.0	0.84	0.84	0.00	1.27	0.00	2.95	0.00	0.84
605.0	0.29	0.00	0.88	0.00	0.00	5.00	0.00	0.29
610.0	0.27	0.54	0.27	0.27	0.00	4.57	0.00	0.27
615.0	0.00	0.58	0.58	0.00	0.00	0.87	0.00	0.00
620.0	0.00	0.00	0.00	1.23	0.00	3.08	0.00	0.62
625.0	0.31	0.92	0.00	0.00	0.00	4.28	0.00	0.61
630.0	0.00	0.30	0.30	0.30	0.30	4.45	0.00	0.00
635.0	0.00	0.32	0.32	0.65	0.00	5.18	0.00	0.32
640.0	0.00	0.37	0.00	0.00	0.00	4.83	0.00	0.00

Appendix A2. continued.

DEPTH (cm)	*G. crassaformis*	P/D	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. bradyi*	*other*
645.0	0.00	0.33	0.00	0.66	0.00	4.30	0.00	0.66
650.0	0.30	0.00	0.60	0.00	0.00	6.02	0.00	0.30
660.0	0.00	0.00	0.84	0.00	0.00	4.47	0.00	0.00
665.0	0.00	0.59	0.29	0.59	0.00	4.71	0.00	0.29
670.0	0.00	0.00	0.98	0.33	0.00	6.19	0.00	0.33
675.0	0.00	1.20	0.30	0.00	0.00	6.02	0.00	0.60
680.0	0.68	0.34	0.68	0.00	0.00	6.08	0.00	0.34
685.0	0.71	1.06	0.00	1.06	0.00	7.80	0.00	1.06
690.0	0.34	0.34	1.68	0.67	0.00	5.37	0.00	0.00
695.0	0.00	0.74	1.49	1.49	0.00	9.67	0.00	0.37
700.0	0.00	1.08	0.72	1.44	0.00	8.63	0.00	1.08
705.0	0.00	0.69	1.38	1.38	0.00	9.69	0.00	1.04
710.0	0.32	0.32	1.27	0.00	0.00	8.28	0.00	0.00
715.0	0.00	0.62	0.62	0.31	0.00	8.39	0.00	0.00
720.0	0.56	0.00	0.84	0.84	0.00	6.96	0.00	0.00
725.0	0.00	0.00	0.33	0.67	0.00	6.02	0.00	0.33
730.0	0.27	0.54	1.09	0.82	0.00	9.24	0.27	1.09
735.0	0.00	0.66	0.00	0.33	0.00	6.64	0.00	1.99
740.0	0.00	0.60	0.30	0.00	0.00	4.76	0.00	0.00
745.0	0.00	0.26	0.26	0.00	0.00	5.17	0.00	1.29
750.0	0.60	0.00	0.00	0.30	0.00	3.89	0.00	0.30
755.0	0.29	0.00	0.00	0.29	0.00	7.25	0.00	0.87
760.0	0.96	0.00	0.00	0.96	0.00	8.01	0.00	0.00
765.0	0.83	0.00	0.28	1.10	0.00	8.54	0.00	0.00
770.0	0.00	0.00	0.00	0.29	0.00	6.05	0.00	0.86
775.0	0.61	0.00	0.30	0.00	0.00	7.27	0.00	1.21
780.0	0.35	0.00	0.35	0.00	0.00	8.74	0.00	0.35
785.0	0.28	0.00	0.57	0.28	0.00	8.24	0.00	0.28
790.0	0.31	0.31	0.93	0.62	0.00	8.67	0.00	0.00
795.0	0.31	0.00	0.94	0.63	0.00	12.26	0.00	0.31
800.0	0.35	0.00	0.00	1.04	0.00	11.76	0.00	0.00
805.0	0.34	0.00	0.68	0.00	0.00	12.29	0.00	0.00

Appendix A2. continued.

DEPTH (cm)	*G. crassaformis*	P/D	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinata*	*G. bradyi*	*other*
810.0	0.94	0.00	1.26	0.94	0.00	11.64	0.00	0.31
815.0	0.43	0.00	0.00	0.43	0.00	9.15	0.00	0.43
820.0	0.00	0.00	0.35	0.00	0.00	11.66	0.35	0.71
825.0	0.00	0.00	0.00	0.00	0.00	15.14	0.00	0.70
830.0	0.00	0.00	0.99	0.00	0.00	12.91	0.00	0.66
835.0	0.00	0.00	0.70	0.00	0.00	13.64	0.00	1.05
840.0	0.00	0.00	0.65	0.33	0.00	10.13	0.00	0.33
845.0	0.00	0.00	0.33	0.33	0.00	7.97	0.00	1.00
850.0	0.00	0.30	0.30	0.30	0.00	13.03	0.00	0.61
855.0	0.00	0.00	0.32	0.97	0.00	6.80	0.00	0.00
860.0	0.00	0.00	0.64	0.00	0.32	6.07	0.00	0.00
865.0	0.00	0.00	0.32	0.00	0.00	8.09	0.00	0.65
870.0	0.00	0.00	0.67	0.34	0.00	6.06	0.00	0.00
875.0	0.00	0.00	0.00	0.00	0.00	8.81	0.00	0.61
880.0	0.00	0.00	0.31	0.61	0.00	7.65	0.00	0.00
885.0	0.00	0.68	0.34	1.37	0.00	8.56	0.00	0.68
890.0	0.00	0.00	0.32	0.96	0.00	7.67	0.00	0.00
895.0	0.00	0.00	0.31	0.00	0.00	8.92	0.00	0.00
900.0	0.00	0.00	0.00	0.00	0.00	3.02	0.00	0.00
905.0	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00
910.0	0.00	0.00	0.30	0.30	0.00	1.81	0.00	0.30
915.0	0.00	0.00	0.28	0.00	0.00	1.41	0.00	0.00
920.0	0.00	0.00	0.30	0.00	0.00	5.74	0.00	0.60
925.0	0.00	0.00	0.63	0.31	0.00	9.12	0.00	0.31
930.0	0.30	0.00	0.60	0.30	0.00	8.33	0.00	0.60
935.0	0.00	0.00	0.32	0.00	0.00	6.41	0.00	0.96
940.0	0.00	0.00	0.00	0.36	0.00	5.02	0.00	0.00
945.0	0.30	0.00	0.00	0.60	0.00	3.90	0.00	0.30
950.0	0.00	0.00	0.00	0.00	0.00	3.15	0.00	0.29
955.0	0.00	0.00	0.00	0.35	0.00	2.10	0.00	0.00
960.0	0.00	0.00	0.00	0.00	0.00	4.26	0.00	0.00
965.0	0.34	0.00	0.34	0.00	0.00	7.07	0.00	1.01

Appendix A2. continued.

DEPTH (cm)	*G. crassaformis*	P/D	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinat a*	*G. bradyi*	*other*
970.0	0.00	0.00	0.00	0.32	0.00	7.37	0.00	0.64
975.0	0.92	0.00	0.92	0.00	0.00	8.00	0.00	0.00
980.0	0.26	0.00	0.00	0.26	0.00	6.01	0.00	0.52
985.0	0.30	0.00	0.91	0.00	0.00	5.49	0.00	0.61
990.0	1.67	0.00	0.83	0.00	0.00	6.11	0.00	0.83
995.0	0.26	0.00	0.52	0.26	0.00	4.97	0.00	0.00
1000.0	0.65	0.32	0.00	0.65	0.00	7.14	0.00	0.00
1005.0	0.29	0.00	0.86	0.00	0.00	5.75	0.00	0.00
1010.0	0.00	0.00	0.63	0.00	0.00	7.94	0.00	0.32
1015.0	0.35	0.00	0.00	0.00	0.00	6.97	0.00	0.70
1020.0	0.50	0.00	0.25	0.00	0.00	6.70	0.00	0.25
1025.0	0.28	0.00	0.00	0.00	0.00	4.68	0.00	0.00
1030.0	0.00	0.00	0.00	0.00	0.00	5.80	0.00	0.00
1035.0	0.28	0.00	0.00	0.00	0.00	7.95	0.00	0.28
1040.0	0.00	0.00	0.00	0.69	0.00	11.81	0.00	0.69
1045.0	0.00	0.00	0.34	0.34	0.00	10.65	0.00	0.69
1050.0	0.96	0.00	0.32	0.00	0.00	8.28	0.00	0.32
1055.0	0.57	0.00	0.57	0.28	0.00	7.69	0.00	0.28
1060.0	0.26	0.00	0.52	0.26	0.00	10.76	0.00	0.00
1065.0	0.66	0.00	0.00	0.00	0.00	5.59	0.00	0.00
1070.0	0.00	0.00	0.00	0.00	0.00	3.75	0.00	0.00
1075.0	1.01	0.00	0.00	0.00	0.00	5.70	0.00	1.01
1080.0	0.55	0.00	0.28	0.55	0.55	9.14	0.00	0.55
1085.0	1.22	0.00	0.00	0.31	0.00	10.70	0.00	0.61
1090.0	1.32	0.00	0.99	0.00	0.00	9.87	0.00	0.33
1095.0	0.98	0.00	0.33	0.66	0.00	10.49	0.00	0.33
1100.0	2.37	0.00	0.26	0.00	0.00	7.92	0.00	0.79
1105.0	1.25	0.00	0.31	0.00	0.00	2.81	0.00	0.00
1110.0	1.08	0.00	0.00	0.81	0.00	5.38	0.00	0.81
1115.0	0.61	0.00	0.00	0.92	0.00	9.20	0.00	0.61
1120.0	0.66	0.00	0.66	0.33	0.00	8.22	0.00	1.97
1125.0	0.30	0.00	1.81	0.60	0.00	9.64	0.00	0.60

Appendix A2. continued.

DEPTH (cm)	*G. crassaformis*	*P/D*	*G. hirsuta*	*G. scitula*	*G. menardii*	*G. glutinat a*	*G. bradyi*	*other*
1130.0	0.31	0.00	0.31	0.00	0.00	12.38	0.00	0.93
1135.0	0.00	0.00	0.93	0.31	0.00	12.07	0.00	1.55
1138.0	1.27	0.00	0.32	0.00	0.00	10.76	0.00	0.63

APPENDIX B

DEPTH (cm), AGE (Ka) AND STABLE OXYGEN ($\delta^{18}O$, per mil vs PDB) ISOTOPES

Appendix B1. Depth, age and oxygen isotopes in RC11-86.

DEPTH (cm)	AGE (Ka)	$\delta^{18}O$ (‰)
15.0	8.0	0.52
25.0	12.3	0.94
35.0	16.6	1.36
46.0	20.3	0.98
55.0	22.0	1.38
65.0	24.9	1.21
75.0	29.2	1.38
85.0	33.5	1.07
95.0	37.8	0.83
105.0	42.1	0.78
115.0	46.4	0.78
125.0	50.7	0.68
135.0	55.8	0.83
145.0	60.9	0.77
155.0	66.0	1.05
165.0	69.3	0.87
175.0	72.7	0.59
185.0	76.0	0.56
195.0	79.3	0.45
205.0	84.3	0.78
215.0	89.3	0.67
223.0	93.4	0.65
228.0	95.9	0.50
235.0	99.4	0.44
243.0	103.3	0.45
248.0	105.7	0.58
252.0	107.7	0.26
254.0	108.7	0.46
256.0	109.7	0.95
258.0	110.6	0.60
260.0	111.6	0.69
262.0	112.6	0.81
266.0	114.5	0.96
268.0	115.5	0.54
270.0	116.5	0.42
282.0	122.4	0.55
286.0	124.5	0.54
292.0	128.8	0.80
298.0	133.0	1.17
300.0	134.4	0.66
302.0	135.8	0.98
306.0	138.6	1.42
308.0	140.0	1.48
310.0	141.4	1.59
312.0	142.8	1.15
316.0	145.7	1.33
318.0	147.1	1.09
325.0	152.0	1.50
335.0	175.0	1.03
345.0	178.6	1.19
355.0	182.1	1.33

Appendix B1. continued.

DEPTH (cm)	AGE (Ka)	$\delta^{18}O$ (‰)
365.0	185.7	1.18
375.0	189.3	1.01
385.0	192.9	0.98
395.0	196.4	0.89
405.0	200.0	0.65
415.0	215.0	0.79
425.0	230.0	1.46
435.0	233.3	0.96
445.0	236.7	0.59
455.0	240.0	0.16
465.0	245.5	0.33
475.0	251.0	1.11
485.0	258.0	0.65
495.0	264.0	0.74
505.0	270.0	1.12
515.0	290.0	0.64
525.0	300.0	1.05
535.0	305.6	0.78
545.0	311.2	0.62
550.0	314.0	0.46
555.0	322.0	0.95
560.0	326.0	0.73
565.0	330.0	0.50
575.0	333.0	0.65
585.0	336.0	0.63
595.0	339.0	0.76
605.0	342.0	1.31
615.0	345.6	1.13
630.0	351.0	1.18
640.0	369.0	0.99
645.0	377.0	1.07
655.0	393.0	0.80
665.0	409.0	0.74
675.0	417.3	1.02
685.0	425.7	1.08
695.0	434.0	1.87
705.0	463.8	1.40
715.0	471.9	1.32
725.0	480.0	1.10
738.0	501.0	1.09
745.0	512.0	1.48
755.0	514.2	1.44
765.0	516.5	0.98
775.0	518.8	0.52
785.0	521.0	0.49
795.0	530.5	0.77
805.0	540.0	1.15
810.0	550.5	0.57
815.0	561.0	1.03
820.0	567.0	0.72
825.0	573.0	0.63
835.0	578.5	0.84

Appendix B1. continued.

DEPTH (cm)	AGE (Ka)	$\delta^{18}O$ (‰)
845.0	584.0	0.96
855.0	596.0	0.61
875.0	607.0	0.79
885.0	612.5	0.82
895.0	618.0	0.52
905.0	624.0	0.92
915.0	630.0	1.01
925.0	649.5	0.80
935.0	669.0	0.64

Appendix B2. Depth, age and oxygen isotopes in V34-157.

DEPTH (cm)	AGE (Ka)	$\delta^{18}O$ (‰)
0.0	1.5	1.82
10.0	3.7	1.84
20.0	5.9	1.66
30.0	8.1	2.19
40.0	10.2	2.70
50.0	12.4	3.14
60.0	14.6	3.07
70.0	16.8	3.45
80.0	19.0	3.29
90.0	20.8	3.22
100.0	22.6	3.05
110.0	24.3	3.04
120.0	26.1	2.98
130.0	27.9	2.83
140.0	29.7	2.92
150.0	31.4	2.92
160.0	33.2	2.57
170.0	35.0	2.59
180.0	36.8	2.76
190.0	38.5	2.83
200.0	40.3	2.62
210.0	42.1	2.76
220.0	43.9	2.50
230.0	45.5	2.51
240.0	47.0	2.55
250.0	48.6	2.41
260.0	50.2	2.46
270.0	57.6	2.55
280.0	65.0	2.66
290.0	70.7	2.59
300.0	76.5	2.52
310.0	82.2	2.41
320.0	87.9	2.33
330.0	93.7	2.37
340.0	99.4	2.19
350.0	108.5	2.59
360.0	111.6	2.44
370.0	114.6	2.27
380.0	117.7	2.11
390.0	120.8	1.74
400.0	123.8	1.51
410.0	127.4	1.93
420.0	131.0	2.86
430.0	134.6	2.95
440.0	138.2	2.90
450.0	141.8	3.16
460.0	145.4	3.03
470.0	149.0	3.26
480.0	152.6	3.13
490.0	154.9	3.30
500.0	157.2	3.00

Appendix B2. continued.

DEPTH (cm)	AGE (Ka)	$\delta^{18}O$ (‰)
510.0	159.5	3.00
520.0	161.8	2.83
530.0	164.1	2.87
540.0	166.5	2.79
550.0	168.8	2.84
560.0	171.1	2.87
570.0	173.4	2.79
580.0	175.7	2.80
590.0	178.0	2.85
600.0	180.3	3.01
610.0	182.9	3.02
620.0	185.6	2.62
630.0	188.3	2.33
640.0	191.0	2.62
650.0	193.8	2.41
660.0	196.5	2.37
670.0	199.2	2.57
680.0	201.9	2.25
690.0	204.6	2.32
700.0	207.4	2.24
710.0	210.1	2.32
720.0	212.8	2.20
730.0	215.5	2.09
740.0	220.0	2.56
750.0	224.5	2.93
760.0	229.0	2.94
770.0	231.8	2.60
780.0	234.6	2.54
790.0	237.4	2.40
800.0	240.2	2.30
810.0	243.8	2.51
820.0	247.3	2.74
830.0	250.9	2.59
840.0	254.4	2.85
850.0	258.0	2.73
860.0	260.4	2.83
870.0	262.8	2.65
880.0	265.2	3.05
890.0	267.6	2.88
900.0	270.0	3.41
910.0	275.5	2.98
920.0	281.0	2.62
930.0	286.5	2.43
940.0	288.0	2.58
950.0	292.0	2.89
960.0	296.0	2.96
970.0	299.5	2.75
980.0	303.0	2.40
990.0	306.5	2.32
1000.0	310.0	2.07
1010.0	311.7	2.87
1020.0	313.3	2.95

Appendix B2. continued.

DEPTH (cm)	AGE (Ka)	$\delta^{18}O$ (‰)
1030.0	315.0	3.43
1040.0	316.7	3.04
1050.0	318.3	3.15
1060.0	320.0	3.18
1070.0	321.7	3.18
1080.0	323.3	3.02
1090.0	325.0	2.99
1100.0	326.7	2.66
1120.0	330.0	1.73
1130.0	331.7	2.21

APPENDIX C

DEPTH (cm), AND COMPARISON OF ABUNDANCES (%) OF *N. pachyderma*, *N. dutertrei*, the P/D intergrade and ESTIMATED SEA SURFACE TEMPERATURES (°C)

Appendix C. Comparison of abundances (%) of *N. pachyderma*, *N. dutertrei*, P/D, and estimated sea surface temperatures (°C) in RC11-86.

DEPTH (cm)	VERARDO *N. pachyderma* (R)	VERARDO *N. dutertrei*	VERARDO P/D	VERARDO SST (°C) Tc	VERARDO SST (°C) Tw	KIPP *N. pachyderma* (R)	KIPP *N. dutertrei*	KIPP P/D	KIPP SST (°C) Tc	KIPP SST (°C) Tw
3	10.6	18.8	4.3	16.6	25.7	10.7	11.5	12.9	16.1	24.0
10	13.9	15.7	5.0	16.5	24.0	14.5	7.3	15.0	16.0	23.0
20	19.8	12.5	4.2	15.8	23.9	18.3	5.5	14.1	15.4	22.4
30	33.8	16.5	5.6	13.8	22.7	30.6	3.4	25.1	12.9	18.9
40	27.3	26.4	8.8	13.9	23.9	33.0	4.0	25.4	12.1	18.2
45	26.6	16.7	8.9	14.0	23.3	29.8	5.6	21.8	12.4	19.8
60	27.4	20.3	3.2	14.3	24.0	27.2	2.6	21.8	13.4	19.9
70	27.1	15.7	6.8	14.4	23.5	27.2	3.5	26.8	13.8	20.8
80	30.3	14.4	6.3	13.9	22.8	23.2	4.6	24.5	13.4	20.6
90	25.9	17.0	6.8	14.4	23.6	22.8	3.4	25.0	13.5	20.1
100	31.7	13.7	3.6	14.9	22.7	23.3	4.0	22.8	14.4	20.6
110	25.1	20.3	7.0	14.2	24.1	22.0	5.8	26.3	13.2	20.5
120	25.1	13.1	3.8	13.9	22.5	15.9	4.7	22.7	13.4	20.7
130	22.4	13.0	6.1	15.3	23.4	18.2	5.5	18.7	15.0	22.0
140	16.2	16.2	3.9	15.1	23.8	9.6	6.3	21.8	14.9	22.5
150	15.8	16.4	5.2	15.0	23.6	9.0	9.9	20.6	14.9	22.9
160	14.2	12.6	3.6	14.7	22.1	10.2	7.7	13.7	14.4	21.7
170	19.5	20.4	3.9	15.3	24.2	12.6	10.5	22.5	14.7	23.0
180	17.7	19.6	5.5	15.4	24.5	9.2	12.2	22.4	14.9	23.6
190	28.4	19.9	4.3	15.0	24.0	18.9	13.5	21.7	14.6	23.3
200	22.6	15.2	6.8	14.0	23.4	10.4	6.5	29.3	13.7	21.8
210	14.0	10.2	3.2	15.1	23.0	10.4	3.4	14.7	14.8	21.8
220	8.8	8.2	2.8	15.6	21.9	7.2	3.6	9.8	15.4	21.6
230	10.2	12.2	2.5	15.3	22.2	9.7	5.1	11.7	14.9	21.5
240	15.0	13.4	5.3	16.1	23.5	12.8	6.2	15.0	15.8	22.4
250	7.1	7.7	3.0	15.3	22.1	6.2	4.2	6.8	15.4	21.8
252	9.3	14.4	4.9	16.2	24.5	7.6	5.6	16.4	15.5	23.1
254	15.0	9.4	5.2	15.5	22.7	12.5	4.6	13.0	15.4	21.8
256	12.9	10.0	3.1	15.6	22.7	7.3	4.6	12.0	15.5	22.4
258	10.6	11.3	4.3	16.0	23.5	8.0	8.5	10.7	15.9	23.0

Appendix C. continued.

DEPTH (cm)	VERARDO *N. pachyderma* (R)	VERARDO *N. dutertrei*	VERARDO P/D	VERARDO SST (°C) Tc	VERARDO SST (°C) Tw	KIPP *N. pachyderma* (R)	KIPP *N. dutertrei*	KIPP P/D	KIPP SST (°C) Tc	KIPP SST (°C) Tw
260	14.1	10.9	4.0	16.1	23.5	9.9	9.3	9.9	16.0	23.2
262	10.3	11.5	2.1	15.9	22.9	7.4	8.6	8.8	15.7	22.4
264	7.6	10.8	5.3	16.4	23.1	8.0	11.3	5.5	16.4	23.1
266	11.5	14.4	2.6	16.2	23.1	7.9	11.6	9.7	16.3	22.8
268	12.1	12.1	2.7	16.3	22.7	8.6	9.5	9.7	16.1	22.4
270	5.5	10.9	1.7	15.9	22.7	5.2	5.2	8.5	15.6	22.0
272	12.3	9.4	0.9	16.4	23.0	6.7	8.0	4.1	16.2	22.5
274	3.2	7.4	0.8	16.2	21.5	2.8	6.9	2.2	16.2	21.5
276	5.5	11.7	1.9	16.5	22.9	3.9	9.9	5.8	16.3	22.7
278	4.9	10.8	1.4	15.7	23.0	6.1	11.1	4.7	16.0	23.0
280	8.7	9.5	2.7	16.0	23.5	7.1	7.4	3.1	15.8	23.1
282	5.8	9.7	1.6	15.6	22.9	4.0	8.2	5.6	15.7	22.6
284	4.2	9.0	5.3	14.9	22.1	4.6	9.0	5.8	14.8	22.0
286	6.6	8.3	1.7	15.5	22.6	4.9	7.4	4.6	15.0	22.1
288	8.6	9.6	1.2	16.5	23.4	4.8	8.3	7.4	16.4	23.0
290	9.0	9.8	1.1	16.3	23.1	5.7	8.3	6.8	16.1	22.8
292	10.3	9.8	2.1	16.5	23.6	8.1	8.1	7.5	16.5	23.2
294	13.2	9.2	2.5	16.4	23.4	10.8	7.3	8.0	16.2	23.1
296	10.2	7.9	2.6	16.3	23.2	8.2	6.2	4.5	16.2	22.9
298	16.4	4.8	2.9	16.1	22.7	12.0	2.6	9.1	16.0	22.3
300	21.0	8.8	4.7	15.2	22.8	15.7	3.2	16.9	14.9	22.9
302	22.6	7.5	3.9	15.3	22.7	16.3	4.0	14.7	15.2	22.0
304	17.6	8.5	3.7	14.7	22.1	12.6	2.6	15.3	14.4	21.3
306	18.1	7.2	3.5	14.5	21.7	15.0	5.2	9.5	14.4	21.5
308	15.8	9.2	3.4	15.7	22.9	21.9	11.2	5.5	15.5	22.4
310	16.7	7.7	3.6	14.3	21.9	12.4	4.6	11.3	14.2	21.3
312	16.0	7.5	4.8	15.5	22.5	12.0	4.1	12.5	15.3	21.9
314	19.4	4.4	2.7	14.8	22.0	14.7	5.1	10.2	14.7	22.1
316	19.1	5.3	4.8	13.6	21.1	11.2	2.4	16.8	13.6	20.
318	13.3	5.5	9.8	15.3	22.2	15.6	2.7	10.3	15.1	21.7

Appendix C continued.

DEPTH (cm)	VERARDO *N. pachyderma* (R)	VERARDO *N. dutertrei*	VERARDO P/D	VERARDO SST (°C) Tc	VERARDO SST (°C) Tw	KIPP *N. pachyderma* (R)	KIPP *N. dutertrei*	KIPP P/D	KIPP SST (°C) Tc	KIPP SST (°C) Tw
320	14.2	7.6	2.3	14.2	21.8	11.8	5.8	7.5	14.0	21.5
330	15.6	9.7	5.3	14.4	22.3	11.2	3.1	18.9	14.2	21.5
340	10.8	10.6	4.2	14.6	21.1	9.9	2.2	14.3	14.2	20.5
350	14.4	7.8	4.5	14.5	21.6	17.2	2.4	16.9	14.3	21.3
360	17.3	10.5	9.4	14.7	22.7	15.7	1.2	21.6	14.1	21.1
370	16.2	11.6	7.8	14.7	22.6	13.3	2.7	21.7	14.1	21.5
380	21.8	9.2	6.2	14.7	22.1	14.9	2.6	19.3	14.4	21.3
390	26.9	9.2	8.2	12.5	21.3	17.6	1.1	27.6	12.1	19.4
400	22.5	8.2	5.3	14.2	22.1	14.7	0.9	22.2	13.9	21.8

APPENDIX D

DEPTH (cm), AGE (Ka), VARIMAX FACTOR MATRIX AND COMMUNALITY

Appendix D1. Depth, age, varimax factor matrix and communality in RC11-86.

DEPTH (cm)	AGE (Ka)	ASSEMBLAGES transitional	subpolar	subtropical	tropical	polar	upwelling	communality
3.0	2.8	0.713	0.348	0.314	0.183	0.050	0.074	0.770
10.0	5.8	0.734	0.439	0.244	0.191	0.041	0.028	0.830
15.0	8.0	0.814	0.289	0.254	0.161	0.030	0.046	0.840
20.0	10.1	0.715	0.498	0.191	0.154	0.043	-0.032	0.823
25.0	12.3	0.713	0.414	0.234	0.168	0.021	-0.105	0.774
30.0	14.4	0.452	0.593	0.175	0.074	0.066	-0.224	0.647
35.0	16.6	0.403	0.610	0.244	0.144	0.089	-0.070	0.627
40.0	19.2	0.404	0.544	0.274	0.038	0.056	-0.161	0.565
45.0	20.1	0.663	0.507	0.187	0.033	0.058	-0.204	0.778
51.0	21.3	0.476	0.636	0.187	0.053	0.059	-0.184	0.706
55.0	22.0	0.542	0.546	0.221	0.038	0.053	-0.179	0.677
60.0	23.0	0.601	0.466	0.214	0.065	0.072	-0.122	0.649
65.0	24.9	0.685	0.484	0.221	0.068	0.077	-0.051	0.766
70.0	27.0	0.639	0.517	0.186	0.065	0.060	-0.173	0.748
74.0	28.8	0.567	0.525	0.245	0.076	0.049	-0.129	0.681
80.0	31.3	0.593	0.557	0.162	0.058	0.064	-0.171	0.724
84.0	33.0	0.608	0.555	0.200	0.014	0.056	-0.146	0.742
90.0	35.6	0.585	0.557	0.200	0.083	0.060	-0.100	0.713
95.0	37.8	0.673	0.493	0.229	0.066	0.053	0.024	0.756
100.0	39.9	0.567	0.553	0.139	0.091	0.036	-0.166	0.684
105.0	42.1	0.540	0.544	0.238	0.045	0.034	-0.110	0.659
110.0	44.2	0.578	0.520	0.240	0.050	0.059	-0.152	0.692
115.0	46.4	0.603	0.598	0.161	0.035	0.049	-0.089	0.758
120.0	48.5	0.588	0.620	0.176	0.071	0.064	-0.010	0.770
125.0	50.7	0.565	0.626	0.185	0.048	0.065	-0.028	0.753
130.0	53.3	0.713	0.505	0.163	0.103	0.043	-0.144	0.823
135.0	55.8	0.766	0.450	0.219	0.028	0.040	-0.024	0.841
140.0	58.4	0.804	0.315	0.216	0.108	0.071	-0.094	0.818
145.0	60.9	0.722	0.523	0.170	0.076	0.064	-0.103	0.845
150.0	63.5	0.794	0.381	0.220	0.081	0.057	-0.029	0.835
155.0	66.0	0.822	0.414	0.168	0.026	0.043	-0.013	0.877
160.0	67.7	0.872	0.274	0.172	0.052	0.056	-0.012	0.872
165.0	69.3	0.762	0.385	0.237	0.060	0.068	-0.000	0.793
170.0	71.0	0.720	0.394	0.256	0.043	0.037	-0.060	0.746
175.0	72.7	0.837	0.353	0.209	0.015	0.035	-0.047	0.872
180.0	74.3	0.696	0.452	0.269	0.070	0.041	-0.033	0.769
185.0	76.0	0.661	0.520	0.254	0.087	0.033	-0.096	0.789
190.0	77.6	0.640	0.443	0.208	0.060	0.046	-0.185	0.689
195.0	79.3	0.559	0.582	0.220	0.058	0.051	-0.057	0.709
200.0	81.8	0.637	0.579	0.213	0.058	0.064	-0.083	0.801
205.0	84.3	0.479	0.691	0.218	0.060	0.051	0.008	0.762
210.0	86.8	0.774	0.457	0.170	0.144	0.075	0.084	0.870
215.0	89.3	0.614	0.628	0.206	0.079	0.044	0.048	0.823
220.0	91.9	0.895	0.239	0.138	0.093	0.029	0.050	0.888
222.0	92.9	0.863	0.321	0.133	0.101	0.052	0.055	0.882
227.0	95.4	0.848	0.297	0.156	0.140	0.044	0.079	0.859
230.0	96.9	0.886	0.241	0.179	0.094	0.046	0.056	0.889
235.0	99.4	0.799	0.413	0.163	0.167	0.062	0.097	0.877
240.0	101.8	0.824	0.378	0.177	0.136	0.029	-0.030	0.873
242.0	102.8	0.829	0.388	0.152	0.147	0.053	0.073	0.891
247.0	105.3	0.774	0.516	0.133	0.125	0.056	0.093	0.911

Appendix D1. continued.

DEPTH (cm)	AGE (Ka)	transitional	subpolar	subtropical	tropical	polar	upwelling	communality
		ASSEMBLAGES						
250.0	106.7	0.891	0.242	0.172	0.122	0.047	0.103	0.910
252.0	107.7	0.732	0.446	0.281	0.175	0.059	0.147	0.870
254.0	108.7	0.826	0.435	0.139	0.151	0.052	0.027	0.918
256.0	109.7	0.823	0.412	0.159	0.134	0.043	0.100	0.903
258.0	110.6	0.805	0.399	0.193	0.204	0.059	0.107	0.901
260.0	111.6	0.770	0.462	0.173	0.197	0.049	0.062	0.881
262.0	112.6	0.851	0.315	0.178	0.166	0.046	0.107	0.897
264.0	113.6	0.868	0.297	0.188	0.201	0.034	0.074	0.924
266.0	114.5	0.853	0.253	0.189	0.174	0.041	0.049	0.861
268.0	115.5	0.878	0.257	0.159	0.157	0.025	0.071	0.892
270.0	116.5	0.841	0.263	0.174	0.213	0.057	0.186	0.891
272.0	117.5	0.812	0.376	0.159	0.187	0.031	0.173	0.891
274.0	118.4	0.913	0.071	0.135	0.270	0.034	0.129	0.948
276.0	119.4	0.867	0.223	0.208	0.194	0.035	0.146	0.904
278.0	120.4	0.812	0.230	0.170	0.356	0.089	0.192	0.912
280.0	121.4	0.772	0.423	0.200	0.211	0.067	0.173	0.894
282.0	122.4	0.831	0.279	0.172	0.257	0.069	0.163	0.895
284.0	123.3	0.855	0.312	0.167	0.171	0.086	0.163	0.919
286.0	124.5	0.836	0.311	0.165	0.217	0.074	0.176	0.907
288.0	125.9	0.730	0.441	0.158	0.275	0.054	0.274	0.907
290.0	127.3	0.823	0.328	0.167	0.190	0.036	0.150	0.873
292.0	128.8	0.766	0.418	0.166	0.261	0.052	0.122	0.876
294.0	130.2	0.788	0.428	0.154	0.221	0.041	0.079	0.884
296.0	131.6	0.809	0.383	0.153	0.203	0.036	0.089	0.875
298.0	133.0	0.814	0.417	0.096	0.182	0.029	-0.018	0.880
300.0	134.4	0.795	0.435	0.134	0.098	0.045	-0.075	0.856
302.0	135.8	0.793	0.428	0.121	0.082	0.031	-0.108	0.845
304.0	137.2	0.808	0.456	0.142	0.078	0.054	0.054	0.893
306.0	138.6	0.826	0.414	0.120	0.052	0.048	0.011	0.873
308.0	140.0	0.813	0.409	0.149	0.144	0.043	0.037	0.875
310.0	141.4	0.814	0.429	0.123	0.089	0.073	0.025	0.875
312.0	142.8	0.842	0.371	0.104	0.168	0.058	-0.063	0.892
314.0	144.3	0.803	0.446	0.096	0.141	0.074	-0.014	0.879
316.0	145.7	0.821	0.464	0.102	0.049	0.079	-0.008	0.908
318.0	147.1	0.871	0.388	0.107	0.132	0.051	-0.070	0.946
320.0	148.5	0.844	0.339	0.139	0.100	0.089	0.041	0.866
325.0	152.0	0.767	0.500	0.145	0.064	0.058	0.007	0.866
330.0	163.5	0.847	0.379	0.155	0.066	0.065	-0.041	0.895
335.0	175.0	0.838	0.407	0.153	0.043	0.066	-0.036	0.899
340.0	176.8	0.903	0.176	0.154	0.004	0.042	-0.053	0.875
345.0	178.6	0.880	0.243	0.186	0.048	0.051	-0.062	0.877
350.0	180.4	0.895	0.244	0.143	0.031	0.052	-0.080	0.891
355.0	182.1	0.791	0.467	0.122	0.085	0.068	-0.035	0.872
360.0	183.9	0.836	0.413	0.155	0.058	0.052	-0.110	0.911
365.0	185.7	0.752	0.487	0.166	0.059	0.038	-0.074	0.841
370.0	187.5	0.843	0.379	0.178	0.020	0.039	-0.068	0.892
375.0	189.3	0.845	0.349	0.132	0.054	0.044	-0.087	0.865
380.0	191.1	0.853	0.340	0.126	0.034	0.044	-0.152	0.885
385.0	192.9	0.862	0.364	0.145	0.001	0.043	-0.064	0.903
390.0	194.6	0.606	0.655	0.140	0.031	0.087	-0.114	0.838
395.0	196.4	0.656	0.606	0.179	0.009	0.058	-0.029	0.835

Appendix D1. continued.

DEPTH (cm)	AGE (Ka)	ASSEMBLAGES transitional	subpolar	subtropical	tropical	polar	upwelling	communality
400.0	198.2	0.809	0.426	0.126	0.036	0.054	-0.117	0.870
405.0	200.0	0.737	0.550	0.167	0.042	0.044	0.002	0.877
410.0	207.5	0.735	0.570	0.152	0.058	0.070	0.036	0.898
415.0	215.0	0.758	0.524	0.134	0.034	0.061	-0.066	0.876
420.0	222.5	0.760	0.528	0.122	0.087	0.077	-0.104	0.896
425.0	230.0	0.778	0.519	0.169	0.053	0.051	0.063	0.912
430.0	231.7	0.838	0.398	0.143	0.070	0.032	-0.041	0.888
435.0	233.3	0.835	0.425	0.110	0.017	0.059	-0.070	0.898
440.0	235.0	0.816	0.400	0.152	0.045	0.055	-0.139	0.873
445.0	236.7	0.867	0.345	0.098	0.052	0.044	-0.149	0.906
450.0	238.3	0.876	0.353	0.159	0.047	0.092	-0.060	0.931
455.0	240.0	0.882	0.319	0.129	0.087	0.051	-0.011	0.906
460.0	242.8	0.889	0.320	0.108	0.134	0.047	0.049	0.926
465.0	245.5	0.649	0.546	0.176	0.304	0.076	0.200	0.888
470.0	248.3	0.900	0.266	0.115	0.108	0.056	-0.061	0.913
475.0	251.0	0.903	0.243	0.144	0.062	0.040	-0.026	0.902
480.0	254.5	0.868	0.355	0.146	0.055	0.108	-0.025	0.916
485.0	258.0	0.714	0.526	0.138	0.114	0.046	-0.201	0.861
490.0	261.0	0.834	0.448	0.102	0.088	0.045	-0.085	0.925
495.0	264.0	0.583	0.695	0.102	0.164	0.071	-0.074	0.870
500.0	267.0	0.712	0.549	0.094	0.092	0.047	-0.161	0.853
505.0	270.0	0.567	0.679	0.176	0.016	0.064	-0.049	0.821
510.0	280.0	0.775	0.526	0.133	0.058	0.099	-0.094	0.916
515.0	290.0	0.604	0.619	0.108	0.030	0.096	-0.160	0.796
520.0	295.0	0.703	0.529	0.191	0.115	0.107	-0.125	0.851
525.0	300.0	0.680	0.618	0.126	0.065	0.047	-0.106	0.877
530.0	302.8	0.841	0.420	0.087	0.041	0.065	-0.113	0.910
535.0	305.6	0.847	0.425	0.109	0.008	0.059	-0.092	0.922
540.0	308.4	0.827	0.387	0.116	0.053	0.075	-0.140	0.875
545.0	311.2	0.799	0.481	0.127	0.064	0.040	-0.110	0.904
550.0	314.0	0.743	0.543	0.134	0.076	0.052	-0.138	0.892
555.0	322.0	0.715	0.619	0.135	0.126	0.079	-0.008	0.935
560.0	326.0	0.859	0.378	0.125	0.020	0.035	-0.125	0.914
565.0	330.0	0.847	0.399	0.113	0.035	0.057	-0.039	0.895
570.0	331.5	0.860	0.367	0.135	0.104	0.066	-0.006	0.908
575.0	333.0	0.779	0.528	0.119	0.080	0.100	-0.087	0.924
580.0	334.5	0.733	0.583	0.151	0.115	0.089	0.011	0.921
585.0	336.0	0.845	0.384	0.137	0.073	0.083	-0.021	0.893
590.0	337.5	0.786	0.462	0.187	0.067	0.134	0.040	0.890
595.0	339.0	0.797	0.402	0.169	0.194	0.084	0.049	0.873
600.0	340.5	0.661	0.570	0.127	0.052	0.077	-0.102	0.797
605.0	342.0	0.745	0.504	0.195	0.043	0.067	-0.010	0.853
610.0	343.8	0.719	0.564	0.200	0.042	0.111	0.094	0.898
615.0	345.6	0.740	0.564	0.158	0.024	0.067	0.033	0.896
620.0	347.4	0.671	0.606	0.178	0.048	0.060	-0.030	0.856
625.0	349.2	0.628	0.629	0.183	0.046	0.062	-0.107	0.840
630.0	351.0	0.659	0.620	0.219	-0.001	0.080	0.015	0.874
635.0	360.0	0.563	0.646	0.227	0.007	0.079	0.207	0.835
640.0	369.0	0.697	0.524	0.245	-0.012	0.053	-0.005	0.823
645.0	377.0	0.665	0.570	0.235	0.002	0.061	0.052	0.829
650.0	385.0	0.637	0.577	0.238	0.042	0.072	0.031	0.803

Appendix D1. continued.

DEPTH (cm)	AGE (Ka)	ASSEMBLAGES transitional	subpolar	subtropical	tropical	polar	upwelling	communality
655.0	393.0	0.549	0.728	0.175	0.045	0.064	0.150	0.891
660.0	401.0	0.767	0.468	0.192	0.052	0.056	0.086	0.858
665.0	409.0	0.740	0.494	0.178	0.026	0.070	0.160	0.855
670.0	413.2	0.749	0.511	0.194	0.025	0.070	0.059	0.869
675.0	417.3	0.581	0.622	0.217	0.055	0.112	0.203	0.829
680.0	421.5	0.685	0.516	0.247	0.075	0.058	0.098	0.816
685.0	425.7	0.596	0.546	0.272	0.201	0.041	0.108	0.781
690.0	429.8	0.634	0.615	0.190	0.096	0.067	0.120	0.844
695.0	434.0	0.469	0.698	0.233	0.005	0.093	0.181	0.803
700.0	450.1	0.672	0.562	0.245	0.012	0.148	-0.029	0.850
705.0	463.8	0.496	0.691	0.218	-0.023	0.091	0.149	0.802
710.0	467.9	0.787	0.413	0.193	0.012	0.061	0.165	0.859
715.0	471.9	0.693	0.507	0.232	-0.006	0.043	0.196	0.831
720.0	476.0	0.717	0.505	0.197	-0.003	0.073	0.179	0.845
725.0	480.0	0.669	0.587	0.171	-0.020	0.076	0.134	0.845
730.0	488.1	0.838	0.377	0.167	-0.003	0.059	0.020	0.877
732.0	491.3	0.879	0.254	0.147	-0.019	0.034	0.063	0.864
737.0	499.4	0.819	0.392	0.137	0.020	0.090	0.126	0.868
740.0	504.1	0.856	0.276	0.181	0.007	0.051	0.030	0.846
745.0	512.0	0.719	0.506	0.203	0.033	0.081	0.129	0.839
750.0	513.1	0.835	0.342	0.182	0.014	0.074	0.090	0.861
755.0	514.2	0.787	0.397	0.167	0.005	0.062	0.175	0.839
760.0	515.4	0.782	0.401	0.210	-0.009	0.134	0.013	0.834
765.0	516.5	0.794	0.388	0.184	-0.029	0.073	0.095	0.829
770.0	517.6	0.668	0.530	0.229	0.014	0.095	0.178	0.820
775.0	518.8	0.679	0.545	0.211	0.024	0.059	0.154	0.830
780.0	519.9	0.603	0.634	0.247	0.050	0.096	0.022	0.838
785.0	521.0	0.652	0.545	0.212	0.023	0.067	0.210	0.816
790.0	525.8	0.708	0.480	0.209	0.015	0.045	0.056	0.780
795.0	530.5	0.558	0.567	0.267	0.048	0.073	0.066	0.715
800.0	535.2	0.529	0.661	0.218	0.079	0.120	0.063	0.788
805.0	540.0	0.594	0.547	0.257	0.002	0.062	-0.034	0.723
810.0	550.5	0.517	0.653	0.244	-0.008	0.065	0.066	0.761
815.0	561.0	0.799	0.383	0.190	0.005	0.082	0.115	0.842
820.0	567.0	0.446	0.607	0.269	0.044	0.095	0.087	0.659
825.0	573.0	0.458	0.605	0.250	0.046	0.070	-0.005	0.646
830.0	575.8	0.535	0.661	0.184	0.025	0.102	-0.085	0.775
835.0	578.5	0.515	0.648	0.163	-0.014	0.099	-0.059	0.726
840.0	581.3	0.600	0.599	0.164	-0.001	0.095	-0.125	0.771
845.0	584.0	0.529	0.586	0.196	-0.013	0.096	-0.179	0.703
850.0	590.0	0.856	0.313	0.154	-0.001	0.055	-0.027	0.859
855.0	596.0	0.597	0.595	0.189	0.016	0.063	0.089	0.759
860.0	598.8	0.698	0.514	0.215	0.100	0.082	0.049	0.816
865.0	601.5	0.669	0.584	0.098	0.128	0.121	0.017	0.829
870.0	604.3	0.776	0.445	0.157	0.110	0.087	0.091	0.854
875.0	607.0	0.641	0.616	0.164	0.002	0.138	0.045	0.838
880.0	609.7	0.664	0.562	0.177	0.032	0.152	0.175	0.844
885.0	612.5	0.740	0.456	0.213	0.023	0.107	0.138	0.832
890.0	615.3	0.873	0.301	0.126	0.003	0.086	0.048	0.878
895.0	618.0	0.857	0.338	0.103	0.061	0.055	0.054	0.869
900.0	621.0	0.802	0.388	0.206	0.150	0.050	0.027	0.861

Appendix D1. continued.

DEPTH (cm)	AGE (Ka)	ASSEMBLAGES transitional	subpolar	subtropical	tropical	polar	upwelling	communality
905.0	624.0	0.867	0.247	0.123	0.092	0.056	0.109	0.851
910.0	627.0	0.875	0.245	0.113	0.032	0.090	0.054	0.851
915.0	630.0	0.852	0.281	0.108	0.021	0.103	0.147	0.849
920.0	639.8	0.720	0.464	0.154	0.003	0.124	0.266	0.843
925.0	649.5	0.814	0.357	0.113	0.039	0.182	0.194	0.875
930.0	659.3	0.779	0.431	0.144	0.075	0.086	-0.020	0.828
935.0	669.0	0.835	0.363	0.118	0.074	0.068	0.120	0.867
940.0	678.7	0.736	0.530	0.157	0.090	0.073	-0.026	0.861
945.0	688.5	0.659	0.562	0.180	0.016	0.095	-0.019	0.793
950.0	698.5	0.513	0.638	0.180	0.057	0.121	-0.064	0.725
952.5	702.0	0.447	0.653	0.194	0.096	0.066	-0.058	0.681

Appendix D2 . Depth, age, varimax factor matrix and communality in V34-157.

DEPTH (cm)	AGE (Ka)	ASSEMBLAGES subpolar	transitional	polar	upwelling	subtropical	tropical	communality
0.0	1.5	0.628	0.565	0.181	0.351	0.155	0.012	0.894
10.0	3.7	0.728	0.523	0.147	0.218	0.091	-0.001	0.881
15.0	4.8	0.693	0.577	0.128	0.223	0.066	0.021	0.884
20.0	5.9	0.740	0.498	0.130	0.288	0.093	0.054	0.908
25.0	7.0	0.797	0.390	0.236	0.652	0.044	0.037	0.916
30.0	8.1	0.778	0.385	0.144	0.308	0.062	0.025	0.873
35.0	9.2	0.785	0.430	0.179	0.215	0.071	0.040	0.886
40.0	10.2	0.757	0.455	0.162	0.261	0.084	0.013	0.881
45.0	11.3	0.694	0.524	0.217	0.165	0.068	0.023	0.835
50.0	12.4	0.719	0.518	0.172	0.203	0.047	0.002	0.859
55.0	13.5	0.815	0.347	0.141	0.121	0.025	0.003	0.820
60.0	14.6	0.794	0.292	0.193	0.131	0.024	-0.005	0.770
65.0	15.7	0.780	0.258	0.203	-0.007	0.016	-0.018	0.716
70.0	16.8	0.799	0.235	0.276	0.047	0.026	-0.019	0.773
75.0	17.9	0.782	0.305	0.198	-0.014	0.006	-0.009	0.744
80.0	19.0	0.784	0.242	0.304	0.142	0.032	-0.013	0.787
85.0	19.9	0.804	0.268	0.182	0.142	0.017	0.003	0.772
90.0	20.8	0.789	0.331	0.159	0.068	0.008	-0.005	0.761
95.0	21.7	0.791	0.286	0.198	0.001	0.025	-0.010	0.747
100.0	22.6	0.787	0.271	0.203	0.014	0.004	-0.006	0.734
105.0	23.4	0.813	0.234	0.225	0.131	0.020	0.008	0.784
110.0	24.3	0.761	0.281	0.155	-0.040	0.002	-0.005	0.684
115.0	25.2	0.752	0.304	0.247	0.031	0.016	-0.010	0.720
120.0	26.1	0.809	0.262	0.217	0.210	0.030	-0.006	0.815
125.0	27.0	0.808	0.280	0.195	0.115	0.025	-0.005	0.784
130.0	27.9	0.773	0.243	0.331	0.137	0.014	-0.013	0.785
135.0	28.8	0.806	0.305	0.229	0.225	0.030	-0.008	0.847
140.0	29.7	0.764	0.350	0.252	0.148	0.030	-0.015	0.793
145.0	30.6	0.782	0.321	0.245	0.209	0.033	-0.008	0.819
150.0	31.4	0.798	0.268	0.173	0.053	0.017	-0.010	0.742
155.0	32.3	0.780	0.340	0.238	0.121	0.029	0.012	0.796
160.0	33.2	0.764	0.315	0.295	0.155	0.021	-0.018	0.794
165.0	34.1	0.688	0.477	0.338	0.074	0.028	0.014	0.821
170.0	35.0	0.740	0.386	0.241	0.040	0.012	-0.000	0.757
175.0	35.9	0.726	0.255	0.308	-0.080	-0.009	-0.003	0.693
180.0	36.8	0.749	0.315	0.275	0.054	0.003	-0.001	0.738
185.0	37.7	0.760	0.276	0.237	0.033	0.010	-0.006	0.712
190.0	38.5	0.715	0.280	0.301	-0.050	-0.000	-0.007	0.683
195.0	39.4	0.665	0.283	0.261	-0.166	-0.012	0.003	0.619
200.0	40.3	0.730	0.276	0.177	-0.096	-0.007	0.002	0.650
205.0	41.2	0.749	0.220	0.174	-0.064	0.001	-0.001	0.644
210.0	42.1	0.720	0.325	0.232	-0.089	-0.007	0.011	0.687
215.0	43.0	0.784	0.198	0.086	-0.068	-0.004	0.014	0.666
220.0	43.9	0.810	0.236	0.138	0.050	0.007	-0.002	0.733
225.0	44.7	0.786	0.277	0.111	0.029	0.008	-0.003	0.709
230.0	45.5	0.794	0.254	0.176	0.103	0.015	-0.015	0.736
235.0	46.2	0.769	0.302	0.173	0.067	0.011	-0.007	0.717
240.0	47.0	0.779	0.287	0.102	0.028	0.006	-0.008	0.700
245.0	47.8	0.810	0.288	0.142	0.124	0.016	0.011	0.775
250.0	48.6	0.816	0.267	0.166	0.134	0.021	0.001	0.782
255.0	49.4	0.830	0.252	0.142	0.264	0.039	-0.007	0.845

Appendix D2 . continued.

DEPTH (cm)	AGE (Ka)	ASSEMBLAGES subpolar	transitional	polar	upwelling	subtropical	tropical	communality
260.0	50.2	0.826	0.277	0.099	0.305	0.038	0.003	0.864
265.0	53.9	0.793	0.325	0.131	0.256	0.038	-0.014	0.818
270.0	57.6	0.748	0.390	0.198	0.066	0.016	-0.001	0.756
275.0	61.3	0.759	0.367	0.273	0.187	0.029	0.006	0.822
280.0	65.0	0.788	0.292	0.260	0.237	0.025	-0.002	0.831
285.0	67.9	0.808	0.277	0.200	0.186	0.032	0.006	0.806
290.0	70.7	0.818	0.260	0.211	0.219	0.023	0.018	0.831
295.0	73.6	0.827	0.254	0.158	0.246	0.026	0.000	0.834
300.0	76.5	0.771	0.302	0.163	0.107	0.025	-0.024	0.724
305.0	79.3	0.805	0.300	0.209	0.275	0.032	0.003	0.858
310.0	82.2	0.766	0.417	0.189	0.248	0.035	-0.002	0.860
315.0	85.1	0.819	0.316	0.141	0.242	0.029	0.009	0.850
320.0	87.9	0.822	0.321	0.115	0.206	0.025	0.022	0.835
325.0	90.8	0.783	0.347	0.190	0.212	0.034	0.004	0.816
330.0	93.7	0.787	0.349	0.184	0.185	0.021	0.005	0.809
335.0	96.5	0.785	0.348	0.176	0.142	0.025	0.007	0.789
340.0	99.4	0.781	0.279	0.232	0.202	0.029	0.006	0.783
345.0	103.9	0.792	0.235	0.209	0.097	0.012	-0.011	0.737
350.0	108.5	0.787	0.274	0.224	0.111	0.014	0.017	0.758
355.0	110.0	0.776	0.324	0.168	0.065	0.012	0.003	0.740
360.0	111.6	0.757	0.312	0.197	0.092	0.010	0.007	0.718
365.0	113.1	0.732	0.398	0.260	0.051	0.021	0.034	0.766
370.0	114.6	0.777	0.358	0.183	0.123	0.027	0.016	0.781
375.0	116.2	0.796	0.302	0.186	0.170	0.024	0.015	0.789
380.0	117.7	0.820	0.256	0.173	0.278	0.021	0.017	0.845
385.0	119.2	0.778	0.390	0.135	0.205	0.037	0.028	0.820
390.0	120.8	0.770	0.418	0.135	0.128	0.028	0.022	0.803
395.0	122.3	0.765	0.383	0.120	0.249	0.036	-0.009	0.809
400.0	123.8	0.737	0.455	0.107	0.035	0.019	0.002	0.764
405.0	125.6	0.757	0.376	0.162	0.124	0.012	0.010	0.757
410.0	127.4	0.763	0.395	0.168	0.159	0.033	0.022	0.793
415.0	129.2	0.708	0.482	0.120	0.128	0.036	0.004	0.766
420.0	131.0	0.650	0.548	0.174	0.081	0.022	0.003	0.760
425.0	132.8	0.699	0.496	0.221	0.163	0.033	0.002	0.810
430.0	134.6	0.690	0.487	0.305	0.111	0.020	0.007	0.819
435.0	136.4	0.698	0.368	0.372	0.062	0.012	-0.021	0.766
440.0	138.2	0.737	0.300	0.406	0.140	0.014	-0.009	0.818
445.0	140.0	0.624	0.266	0.508	-0.094	-0.013	-0.005	0.727
450.0	141.8	0.585	0.300	0.592	-0.065	-0.006	-0.007	0.788
455.0	143.6	0.569	0.285	0.550	-0.126	-0.013	-0.017	0.724
460.0	145.4	0.658	0.192	0.522	-0.093	-0.017	0.031	0.752
465.0	147.2	0.676	0.291	0.470	-0.028	0.005	-0.012	0.763
470.0	149.0	0.736	0.224	0.441	0.119	0.016	-0.013	0.801
475.0	150.8	0.683	0.305	0.299	-0.100	-0.005	-0.014	0.660
480.0	152.6	0.684	0.291	0.471	0.071	0.014	-0.025	0.780
485.0	153.7	0.710	0.377	0.302	0.083	0.018	-0.031	0.745
490.0	154.9	0.710	0.361	0.303	0.129	0.022	-0.025	0.743
495.0	156.1	0.689	0.309	0.375	0.015	0.010	-0.022	0.712
500.0	157.2	0.651	0.336	0.355	-0.095	-0.008	-0.013	0.672
505.0	58.4	0.715	0.243	0.391	-0.014	0.002	-0.016	0.724
510.0	159.5	0.652	0.205	0.381	-0.151	-0.015	-0.011	0.635

Appendix D2 . continued.

DEPTH (cm)	AGE (Ka)	ASSEMBLAGES subpolar	transitional	polar	upwelling	subtropical	tropical	communality
515.0	160.7	0.649	0.304	0.454	-0.071	0.006	-0.015	0.725
520.0	161.8	0.656	0.306	0.364	-0.122	-0.007	-0.003	0.671
525.0	163.0	0.712	0.277	0.317	0.046	0.001	-0.016	0.686
530.0	164.1	0.734	0.261	0.345	0.008	0.005	-0.016	0.726
535.0	165.3	0.718	0.292	0.249	-0.055	0.005	-0.022	0.667
540.0	166.5	0.726	0.250	0.269	-0.027	0.005	-0.020	0.662
545.0	167.6	0.643	0.274	0.500	-0.076	0.003	-0.016	0.744
550.0	168.8	0.711	0.316	0.237	-0.089	-0.000	-0.009	0.670
555.0	169.9	0.717	0.335	0.250	-0.035	0.001	0.004	0.691
560.0	171.1	0.621	0.448	0.445	0.005	0.007	0.013	0.784
565.0	172.2	0.695	0.354	0.264	-0.086	0.001	0.001	0.685
570.0	173.4	0.662	0.415	0.288	-0.047	0.009	-0.025	0.697
575.0	174.6	0.707	0.265	0.350	-0.039	0.000	-0.005	0.695
580.0	175.7	0.717	0.320	0.338	-0.069	-0.001	-0.016	0.736
585.0	176.9	0.705	0.290	0.348	-0.033	-0.007	-0.002	0.703
590.0	178.0	0.746	0.292	0.260	0.006	0.002	-0.007	0.710
595.0	179.2	0.670	0.386	0.222	-0.110	-0.002	-0.019	0.660
600.0	180.3	0.716	0.314	0.302	-0.007	0.016	0.020	0.704
605.0	181.5	0.656	0.365	0.317	-0.087	-0.003	0.002	0.671
610.0	182.9	0.605	0.480	0.170	-0.175	0.000	-0.015	0.657
615.0	184.2	0.662	0.371	0.204	-0.102	0.005	-0.029	0.630
620.0	185.6	0.673	0.339	0.201	-0.103	0.010	-0.008	0.619
625.0	186.9	0.668	0.370	0.197	-0.138	-0.001	-0.005	0.641
630.0	188.3	0.718	0.317	0.223	-0.037	0.012	-0.010	0.668
635.0	189.7	0.716	0.328	0.185	-0.067	0.000	-0.009	0.659
640.0	191.0	0.684	0.349	0.074	-0.130	-0.007	-0.004	0.612
645.0	192.4	0.690	0.366	0.150	-0.096	0.000	0.001	0.642
650.0	193.8	0.708	0.326	0.102	-0.099	-0.005	-0.002	0.628
660.0	196.5	0.702	0.359	0.159	-0.056	0.000	-0.006	0.650
665.0	197.8	0.693	0.344	0.195	-0.104	-0.002	-0.011	0.648
670.0	199.2	0.704	0.318	0.169	-0.099	-0.001	-0.001	0.636
675.0	200.6	0.734	0.290	0.221	-0.052	-0.001	-0.016	0.676
680.0	201.9	0.696	0.380	0.135	-0.077	0.006	-0.008	0.654
685.0	203.3	0.741	0.334	0.192	-0.034	0.006	0.007	0.699
690.0	204.6	0.724	0.294	0.229	-0.044	-0.002	-0.005	0.664
695.0	206.0	0.740	0.340	0.252	-0.016	0.003	0.027	0.727
700.0	207.4	0.748	0.357	0.194	-0.036	0.003	0.014	0.726
705.0	208.7	0.728	0.405	0.129	-0.041	-0.002	0.027	0.713
710.0	210.1	0.700	0.462	0.188	0.003	0.009	0.002	0.738
715.0	211.5	0.729	0.457	0.164	0.069	0.025	0.005	0.772
720.0	212.8	0.660	0.538	0.151	0.001	0.023	-0.005	0.748
725.0	214.2	0.614	0.489	0.295	-0.098	0.010	0.007	0.713
730.0	215.5	0.697	0.541	0.173	0.135	0.038	0.006	0.828
735.0	217.8	0.695	0.523	0.165	0.090	0.030	-0.000	0.793
740.0	220.0	0.673	0.511	0.274	0.109	0.028	-0.024	0.803
745.0	222.3	0.679	0.469	0.326	0.136	0.024	-0.005	0.806
750.0	224.5	0.694	0.314	0.250	-0.063	-0.002	-0.022	0.647
755.0	226.8	0.686	0.339	0.206	-0.118	-0.004	-0.010	0.642
760.0	229.0	0.709	0.343	0.200	-0.088	-0.004	-0.001	0.667
765.0	230.4	0.690	0.364	0.207	-0.111	-0.004	0.003	0.664
770.0	231.8	0.701	0.373	0.209	-0.048	0.004	-0.010	0.676

Appendix D2. continued.

DEPTH (cm)	AGE (Ka)	ASSEMBLAGES subpolar	transitional	polar	upwelling	subtropical	tropical	communality
775.0	233.2	0.670	0.317	0.173	-0.180	-0.009	-0.003	0.612
780.0	234.6	0.724	0.253	0.158	-0.113	0.009	-0.005	0.626
785.0	236.0	0.683	0.395	0.154	-0.123	-0.007	0.015	0.661
790.0	237.4	0.703	0.400	0.164	-0.087	-0.001	0.009	0.688
795.0	238.8	0.750	0.377	0.218	0.019	0.008	0.027	0.752
800.0	240.2	0.714	0.408	0.146	-0.058	-0.000	0.025	0.701
805.0	242.0	0.731	0.336	0.263	-0.033	-0.005	0.030	0.718
810.0	243.8	0.776	0.300	0.262	0.079	0.009	0.027	0.768
815.0	245.5	0.769	0.372	0.200	0.227	0.033	0.010	0.823
820.0	247.3	0.739	0.406	0.265	0.083	0.020	0.010	0.788
825.0	249.1	0.761	0.372	0.181	0.045	0.013	0.029	0.753
830.0	250.9	0.739	0.428	0.264	0.202	0.027	0.029	0.840
835.0	252.7	0.757	0.360	0.284	0.075	0.013	0.027	0.790
840.0	254.4	0.775	0.250	0.326	0.101	0.004	0.010	0.779
845.0	256.2	0.654	0.335	0.401	-0.093	-0.005	-0.007	0.709
850.0	258.0	0.689	0.217	0.336	-0.148	-0.018	0.021	0.657
855.0	259.2	0.686	0.230	0.309	-0.133	-0.016	-0.011	0.637
860.0	260.4	0.681	0.293	0.381	-0.063	-0.002	-0.003	0.698
865.0	261.6	0.702	0.339	0.223	-0.099	-0.003	-0.008	0.668
870.0	262.8	0.685	0.325	0.258	-0.104	-0.007	-0.010	0.653
875.0	264.0	0.714	0.338	0.275	-0.058	-0.001	-0.005	0.702
880.0	265.2	0.682	0.375	0.238	-0.102	-0.004	0.002	0.672
885.0	266.4	0.673	0.415	0.295	-0.098	-0.001	-0.003	0.721
890.0	267.6	0.682	0.382	0.310	-0.068	-0.000	0.005	0.712
895.0	268.8	0.693	0.373	0.227	-0.099	-0.003	0.003	0.681
900.0	270.0	0.585	0.592	0.233	0.004	0.026	-0.032	0.749
905.0	272.7	0.600	0.377	0.370	-0.113	-0.001	-0.038	0.653
910.0	275.5	0.565	0.372	0.444	-0.150	-0.007	-0.031	0.677
915.0	278.3	0.640	0.426	0.261	-0.068	0.007	-0.036	0.664
920.0	281.0	0.672	0.350	0.136	-0.152	-0.007	-0.017	0.616
925.0	283.8	0.732	0.395	0.171	0.011	0.008	0.006	0.722
930.0	286.5	0.746	0.436	0.137	0.128	0.028	-0.006	0.782
935.0	287.2	0.716	0.474	0.190	0.179	0.033	0.001	0.807
940.0	288.0	0.676	0.542	0.066	0.214	0.049	-0.026	0.804
945.0	290.0	0.645	0.479	0.193	-0.064	0.009	-0.020	0.687
950.0	292.0	0.623	0.502	0.233	-0.062	0.012	-0.024	0.699
955.0	294.0	0.637	0.403	0.233	-0.118	-0.001	-0.031	0.638
960.0	296.0	0.667	0.453	0.170	-0.050	0.012	-0.020	0.682
965.0	297.7	0.681	0.361	0.286	-0.078	-0.000	-0.012	0.682
970.0	299.5	0.652	0.514	0.225	-0.016	0.015	-0.005	0.740
975.0	301.3	0.698	0.416	0.161	-0.058	0.007	-0.009	0.689
980.0	303.0	0.654	0.478	0.185	-0.067	0.012	-0.011	0.696
985.0	304.7	0.649	0.532	0.155	-0.005	0.023	-0.018	0.729
990.0	306.5	0.593	0.587	0.214	-0.045	0.020	-0.015	0.745
995.0	308.2	0.572	0.559	0.115	-0.159	0.005	-0.010	0.678
1000.0	310.0	0.534	0.642	0.101	-0.150	0.013	-0.004	0.730
1005.0	310.8	0.584	0.615	0.232	0.012	0.025	-0.012	0.774
1010.0	311.7	0.665	0.548	0.178	0.067	0.028	-0.008	0.779
1015.0	312.5	0.555	0.614	0.341	0.027	0.025	-0.007	0.803
1020.0	313.3	0.638	0.534	0.318	0.129	0.033	-0.003	0.811
1025.0	314.2	0.528	0.526	0.536	0.107	0.034	-0.018	0.856

Appendix D2. continued.

DEPTH (cm)	AGE (Ka)	ASSEMBLAGES subpolar	transitional	polar	upwelling	subtropical	tropical	communality
1030.0	315.0	0.589	0.504	0.466	0.108	0.028	-0.020	0.830
1035.0	315.8	0.584	0.278	0.667	0.088	0.012	-0.008	0.870
1040.0	316.7	0.606	0.414	0.556	0.104	0.018	0.033	0.860
1045.0	317.5	0.647	0.447	0.435	0.251	0.040	-0.000	0.872
1050.0	318.3	0.716	0.280	0.426	0.313	0.035	0.001	0.872
1055.0	319.2	0.702	0.299	0.451	0.289	0.034	-0.014	0.870
1060.0	320.0	0.707	0.390	0.379	0.136	0.024	0.000	0.814
1065.0	320.8	0.647	0.372	0.494	0.144	0.024	-0.016	0.823
1070.0	321.7	0.712	0.319	0.350	0.292	0.040	-0.034	0.819
1075.0	322.5	0.645	0.316	0.525	0.078	0.014	-0.019	0.798
1080.0	323.3	0.627	0.372	0.522	0.030	0.021	-0.000	0.806
1085.0	324.2	0.649	0.314	0.561	0.115	0.019	0.002	0.848
1090.0	325.0	0.651	0.357	0.509	0.048	0.012	0.008	0.814
1095.0	325.8	0.587	0.330	0.615	0.006	0.005	0.012	0.831
1100.0	326.7	0.636	0.471	0.409	0.031	0.022	0.002	0.795
1105.0	327.5	0.602	0.522	0.286	-0.045	0.017	-0.016	0.720
1110.0	328.3	0.715	0.448	0.217	0.146	0.028	0.007	0.781
1115.0	329.2	0.759	0.327	0.298	0.207	0.029	0.004	0.815
1120.0	330.0	0.727	0.322	0.388	0.124	0.015	0.054	0.801
1125.0	330.8	0.673	0.398	0.383	0.000	0.008	0.035	0.761
1130.0	331.7	0.671	0.317	0.487	0.035	0.025	0.046	0.792
1135.0	332.5	0.597	0.234	0.624	-0.025	-0.008	0.053	0.804
1138.0	333.1	0.598	0.254	0.664	0.112	0.018	0.027	0.876

APPENDIX E

DEPTH (cm), AGE (Ka) AND ESTIMATED SEA SURFACE TEMPERATURES (°C)

Appendix E1. Depth, age, Tc, Tw, and seasonality in RC11-86.

DEPTH (cm)	AGE (Ka)	TEMERATURE (°C) warm	cold	SEASONALITY (°C)
3.0	2.8	25.45	16.53	8.92
10.0	5.8	24.78	16.41	8.37
15.0	8.0	24.36	16.80	7.56
20.0	10.1	24.02	15.71	8.31
25.0	12.3	24.82	16.73	8.09
30.0	14.4	22.96	13.55	9.41
35.0	16.6	25.01	13.93	11.08
40.0	19.2	24.27	13.44	10.83
45.0	20.1	23.73	13.78	9.95
51.0	21.3	22.64	13.20	9.44
55.0	22.0	23.82	13.65	10.17
60.0	23.0	24.62	14.10	10.52
65.0	24.9	24.35	13.98	10.37
70.0	27.0	23.81	14.12	9.69
74.0	28.8	24.59	14.53	10.06
80.0	31.3	23.06	13.68	9.38
84.0	33.0	23.33	13.27	10.06
90.0	35.6	23.87	14.19	9.68
95.0	37.8	24.06	14.69	9.37
100.0	39.9	22.90	14.83	8.07
105.0	42.1	23.82	14.45	9.37
110.0	44.2	24.30	14.23	10.07
115.0	46.4	22.41	13.54	8.87
120.0	48.5	22.60	13.66	8.94
125.0	50.7	22.39	13.19	9.20
130.0	53.3	23.73	15.12	8.61
135.0	55.8	23.62	14.85	8.77
140.0	58.4	24.44	15.02	9.42
145.0	60.9	23.42	14.21	9.21
150.0	63.5	24.19	14.99	9.20
155.0	66.0	22.75	14.56	8.19
160.0	67.7	22.61	14.77	7.84
165.0	69.3	24.17	14.49	9.68
170.0	71.0	24.51	15.18	9.33
175.0	72.7	23.03	14.84	8.19
180.0	74.3	24.70	15.12	9.58
185.0	76.0	24.38	15.11	9.27
190.0	77.6	24.46	14.85	9.61
195.0	79.3	23.50	13.96	9.54
200.0	81.8	23.63	13.67	9.96
205.0	84.3	22.16	13.27	8.89
210.0	86.8	23.45	15.09	8.36
215.0	89.3	22.83	14.37	8.46
220.0	91.9	22.26	15.83	6.43
222.0	92.9	22.30	15.14	7.16
227.0	95.4	23.06	15.85	7.21
230.0	96.9	22.75	15.58	7.17
235.0	99.4	23.37	15.62	7.75
240.0	101.8	23.90	16.22	7.68
242.0	102.8	22.93	15.53	7.40

Appendix E1. continued.

DEPTH (cm)	AGE (Ka)	TEMERATURE (°C) warm	cold	SEASONALITY (°C)
247.0	105.3	22.57	15.23	7.34
250.0	106.7	22.29	15.58	6.71
252.0	107.7	24.63	16.05	8.58
254.0	108.7	23.09	15.54	7.55
256.0	109.7	23.03	15.74	7.29
258.0	110.6	23.93	16.10	7.83
260.0	111.6	23.86	16.09	7.77
262.0	112.6	23.30	16.12	7.18
264.0	113.6	23.49	16.59	6.90
266.0	114.5	23.69	16.47	7.22
268.0	115.5	23.16	16.65	6.51
270.0	116.5	23.20	16.21	6.99
272.0	117.5	23.23	16.55	6.68
274.0	118.4	21.82	16.56	5.26
276.0	119.4	23.35	16.79	6.56
278.0	120.4	23.64	16.30	7.34
280.0	121.4	23.75	15.99	7.76
282.0	122.4	23.39	16.11	7.28
284.0	123.3	22.59	15.10	7.49
286.0	124.5	22.92	15.71	7.21
288.0	125.9	23.70	16.76	6.94
290.0	127.3	23.42	16.51	6.91
292.0	128.8	23.92	16.55	7.37
294.0	130.2	23.84	16.37	7.47
296.0	131.6	23.42	16.39	7.03
298.0	133.0	22.86	16.12	6.74
300.0	134.4	22.96	15.10	7.86
302.0	135.8	22.64	15.38	7.26
304.0	137.2	22.29	14.65	7.64
306.0	138.6	21.98	14.51	7.47
308.0	140.0	23.22	15.74	7.48
310.0	141.4	22.24	14.38	7.86
312.0	142.8	22.90	15.55	7.35
314.0	144.3	22.76	14.86	7.90
316.0	145.7	21.19	13.58	7.61
318.0	147.1	22.42	15.30	7.12
320.0	148.5	22.08	14.19	7.89
325.0	152.0	22.46	14.30	8.16
330.0	163.5	22.68	14.42	8.26
335.0	175.0	22.39	14.06	8.33
340.0	176.8	21.57	14.79	6.78
345.0	178.6	22.82	14.96	7.86
350.0	180.4	21.81	14.53	7.28
355.0	182.1	22.60	14.90	7.70
360.0	183.9	23.01	14.59	8.42
365.0	185.7	22.97	14.70	8.27
370.0	187.5	22.82	14.61	8.21
375.0	189.3	22.31	14.79	7.52
380.0	191.1	22.44	14.72	7.72
385.0	192.9	22.15	14.27	7.88
390.0	194.6	21.42	12.27	9.15

Appendix E1. continued.

DEPTH (cm)	AGE (Ka)	TEMERATURE (°C) warm	cold	SEASONALITY (°C)
395.0	196.4	22.13	12.86	9.27
400.0	198.2	22.52	14.26	8.26
405.0	200.0	22.56	14.23	8.33
410.0	207.5	22.16	13.84	8.32
415.0	215.0	22.20	13.70	8.50
420.0	222.5	22.29	14.02	8.27
425.0	230.0	22.37	14.44	7.93
430.0	231.7	22.87	15.27	7.60
435.0	233.3	21.62	13.78	7.84
440.0	235.0	22.95	14.40	8.55
445.0	236.7	22.01	14.76	7.25
450.0	238.3	22.04	13.47	8.57
455.0	240.0	22.18	15.00	7.18
460.0	242.8	21.95	15.35	6.60
465.0	245.5	24.47	16.59	7.88
470.0	248.3	21.98	14.97	7.01
475.0	251.0	21.83	15.11	6.72
480.0	254.5	21.65	13.19	8.46
485.0	258.0	23.37	15.07	8.30
490.0	261.0	22.41	14.91	7.50
495.0	264.0	21.93	14.43	7.50
500.0	267.0	22.23	14.58	7.65
505.0	270.0	21.35	12.35	9.00
510.0	280.0	22.37	13.26	9.11
515.0	290.0	21.25	12.25	9.00
520.0	295.0	24.12	13.71	10.41
525.0	300.0	21.88	13.91	7.97
530.0	302.8	21.41	13.88	7.53
535.0	305.6	21.50	13.63	7.87
540.0	308.4	22.08	13.95	8.13
545.0	311.2	22.58	14.70	7.88
550.0	314.0	22.91	14.42	8.49
555.0	322.0	22.36	14.31	8.05
560.0	326.0	22.30	14.60	7.70
565.0	330.0	21.67	14.08	7.59
570.0	331.5	22.63	14.81	7.82
575.0	333.0	22.13	13.53	8.60
580.0	334.5	22.54	11.66	10.88
585.0	336.0	22.40	14.05	8.35
590.0	337.5	23.13	12.88	10.25
595.0	339.0	23.90	15.35	8.55
600.0	340.5	22.09	13.31	8.78
605.0	342.0	23.22	13.88	9.34
610.0	343.8	22.60	12.89	9.71
615.0	345.6	22.08	13.47	8.61
620.0	347.4	22.56	13.61	8.95
625.0	349.2	22.78	13.29	9.49
630.0	351.0	22.57	12.34	10.23
635.0	360.0	21.82	12.86	8.96
640.0	369.0	23.41	13.46	9.95
645.0	377.0	23.02	13.34	9.68

Appendix E1. continued.

DEPTH (cm)	AGE Ka)	TEMERATURE (°C) warm	cold	SEASONALITY (°C)
650.0	385.0	23.70	13.51	10.19
655.0	393.0	20.90	13.00	7.90
660.0	401.0	22.91	14.52	8.39
665.0	409.0	22.26	14.19	8.07
670.0	413.2	22.88	14.14	8.74
675.0	417.3	22.81	13.00	9.81
680.0	421.5	23.90	14.94	8.96
685.0	425.7	24.92	16.44	8.48
690.0	429.8	22.92	14.35	8.57
695.0	434.0	21.32	11.83	9.49
700.0	450.1	23.86	11.11	12.75
705.0	463.8	20.97	11.37	9.60
710.0	467.9	22.12	14.19	7.93
715.0	471.9	22.47	14.42	8.05
720.0	476.0	21.91	13.43	8.48
725.0	480.0	21.03	12.51	8.52
730.0	488.1	22.02	13.83	8.19
732.0	491.3	21.28	14.59	6.69
737.0	499.4	20.93	13.20	7.73
740.0	504.1	22.32	14.53	7.79
745.0	512.0	22.70	13.65	9.05
750.0	513.1	22.01	13.80	8.21
755.0	514.2	21.31	13.86	7.45
760.0	515.4	22.73	11.70	11.03
765.0	516.5	21.72	13.19	8.53
770.0	517.6	22.84	13.12	9.72
775.0	518.8	22.61	14.05	8.56
780.0	519.9	23.35	12.67	10.68
785.0	521.0	22.31	13.89	8.42
790.0	525.8	23.08	14.33	8.75
795.0	530.5	24.05	13.59	10.46
800.0	535.2	23.47	12.50	10.97
805.0	540.0	23.69	13.08	10.61
810.0	550.5	22.19	12.35	9.84
815.0	561.0	21.83	13.39	8.44
820.0	567.0	23.86	12.64	11.22
825.0	573.0	23.69	13.15	10.54
830.0	575.8	22.39	11.72	10.67
835.0	578.5	21.19	11.09	10.10
840.0	581.3	22.11	11.80	10.31
845.0	584.0	22.75	11.44	11.31
850.0	590.0	21.99	14.06	7.93
855.0	596.0	22.59	12.91	9.68
860.0	598.8	24.01	14.32	9.69
865.0	601.5	21.92	13.64	8.28
870.0	604.3	22.92	14.47	8.45
875.0	607.0	21.53	11.28	10.25
880.0	609.7	21.85	11.95	9.90
885.0	612.5	21.41	12.81	8.60
890.0	615.3	20.64	13.16	7.48
895.0	618.0	21.46	14.49	6.97

Appendix E1. continued.

DEPTH (cm)	AGE Ka)	TEMERATURE (°C) warm	cold	SEASONALITY (°C)
900.0	621.0	23.78	15.74	8.04
905.0	624.0	21.60	14.95	6.65
910.0	627.0	20.21	13.27	6.94
915.0	630.0	9.56	12.75	6.81
920.0	639.8	20.27	12.29	7.98
925.0	649.5	19.07	11.42	7.65
930.0	659.3	22.72	13.95	8.77
935.0	669.0	21.49	14.35	7.14
940.0	678.7	22.88	14.19	8.69
945.0	688.5	22.61	12.50	10.11

Appendix E2. Depth, age, Tc, Tw, and seasonality in V34-157.

DEPTH (cm)	AGE (Ka)	TEMERATURE (°C) warm	cold	SEASONALITY (°C)
0.0	1.5	18.44	7.85	10.59
10.0	3.7	17.31	10.36	6.96
15.0	4.8	17.36	11.13	6.23
20.0	5.9	18.21	11.67	6.54
25.0	7.0	14.68	9.38	5.30
30.0	8.1	15.44	9.80	5.64
35.0	9.2	16.70	10.17	6.53
40.0	10.2	16.60	10.03	6.57
45.0	11.3	17.16	10.01	7.15
50.0	12.4	15.70	9.79	5.92
55.0	13.5	14.03	8.62	5.41
60.0	14.6	12.93	7.26	5.67
65.0	15.7	13.13	7.16	5.97
70.0	16.8	12.63	6.36	6.27
75.0	17.9	13.27	7.70	5.57
80.0	19.0	12.53	6.56	5.97
85.0	19.9	12.92	7.69	5.23
90.0	20.8	13.41	8.14	5.28
95.0	21.7	13.78	7.60	6.18
100.0	22.6	12.87	7.46	5.41
105.0	23.4	12.69	7.33	5.36
110.0	24.3	13.60	8.12	5.48
115.0	25.2	13.42	7.42	6.00
120.0	26.1	12.51	7.25	5.26
125.0	27.0	13.11	7.54	5.56
130.0	27.9	11.51	6.47	5.04
135.0	28.8	12.50	7.45	5.04
140.0	29.7	13.23	7.51	5.73
145.0	30.6	12.94	7.53	5.41
150.0	31.4	13.09	7.53	5.56
155.0	32.3	14.11	8.25	5.86
160.0	33.2	12.17	6.96	5.21
165.0	34.1	14.76	8.84	5.92
170.0	35.0	13.95	8.24	5.71
175.0	35.9	12.68	7.22	5.46
180.0	36.8	12.80	7.52	5.28
185.0	37.7	13.07	7.35	5.72
190.0	38.5	13.04	7.21	5.84
195.0	39.4	14.06	8.11	5.95
200.0	40.3	13.82	8.29	5.53
205.0	41.2	13.37	7.80	5.57
210.0	42.1	14.06	8.41	5.65
215.0	43.0	13.47	8.81	4.66
220.0	43.9	12.79	7.72	5.07
225.0	44.7	13.65	8.39	5.26
230.0	45.5	12.56	7.24	5.32
235.0	46.2	13.42	7.88	5.54
240.0	47.0	13.73	8.48	5.26
245.0	47.8	13.52	8.34	5.19
250.0	48.6	13.07	7.79	5.28

Appendix E2. continued.

DEPTH (cm)	AGE (Ka)	TEMERATURE (°C) warm	cold	SEASONALITY (°C)
255.0	49.4	12.70	7.71	4.98
260.0	50.2	13.33	8.59	4.74
265.0	53.9	13.52	8.30	5.22
270.0	57.6	14.27	8.50	5.77
275.0	61.3	13.52	8.12	5.39
280.0	65.0	12.22	7.33	4.89
285.0	67.9	13.32	7.81	5.51
290.0	70.7	12.85	7.86	4.99
295.0	73.6	12.47	7.66	4.80
300.0	76.5	13.39	7.61	5.78
305.0	79.3	12.75	7.84	4.92
310.0	82.2	13.95	8.76	5.19
315.0	85.1	13.48	8.52	4.96
320.0	87.9	14.13	9.09	5.04
325.0	90.8	13.51	8.13	5.38
330.0	93.7	13.58	8.37	5.21
335.0	96.5	14.08	8.53	5.55
340.0	99.4	13.21	7.65	5.56
345.0	103.9	12.24	6.94	5.29
350.0	108.5	13.39	7.92	5.47
355.0	110.0	13.72	8.21	5.51
360.0	111.6	13.67	8.13	5.54
365.0	113.1	14.98	9.13	5.84
370.0	114.6	14.54	8.79	5.75
375.0	116.2	13.41	8.21	5.20
380.0	117.7	12.62	7.98	4.64
385.0	119.2	15.36	9.77	5.58
390.0	120.8	15.43	9.72	5.70
395.0	122.3	14.37	9.00	5.37
400.0	123.8	15.87	9.90	5.97
405.0	125.6	14.31	8.87	5.44
410.0	127.4	15.16	9.34	5.82
415.0	129.2	16.28	10.09	6.20
420.0	131.0	15.89	9.81	6.08
425.0	132.8	14.92	9.14	5.78
430.0	134.6	14.05	8.76	5.29
435.0	136.4	12.33	7.05	5.28
440.0	138.2	11.61	7.01	4.60
445.0	140.0	12.10	7.16	4.94
450.0	141.8	12.11	7.58	4.53
455.0	143.6	11.89	6.83	5.06
460.0	145.4	14.75	9.04	5.71
465.0	147.2	12.45	6.93	5.53
470.0	149.0	11.46	6.32	5.14
475.0	150.8	13.26	7.34	5.91
480.0	152.6	11.55	6.38	5.17
485.0	153.7	12.62	7.00	5.63
490.0	154.9	12.63	7.02	5.61
495.0	156.1	12.46	6.61	5.85
500.0	157.2	12.98	7.30	5.68
505.0	158.4	12.02	6.46	5.56

Appendix E2. continued.

DEPTH (cm)	AGE (Ka)	TEMERATURE (°C) warm	cold	SEASONALITY (°C)
510.0	159.5	12.47	6.67	5.80
515.0	160.7	13.04	6.87	6.17
520.0	161.8	13.45	7.49	5.96
525.0	163.0	12.69	6.86	5.83
530.0	164.1	12.06	6.56	5.50
535.0	165.3	13.21	7.13	6.08
540.0	166.5	12.74	6.73	6.01
545.0	167.6	12.67	6.74	5.94
550.0	168.8	13.77	7.80	5.97
555.0	169.9	13.83	8.08	5.75
560.0	171.1	13.54	8.47	5.07
565.0	172.2	14.27	8.16	6.11
570.0	173.4	13.84	7.61	6.23
575.0	174.6	12.94	7.13	5.81
580.0	175.7	12.78	7.15	5.62
585.0	176.9	12.59	7.29	5.30
590.0	178.0	12.85	7.34	5.52
595.0	179.2	14.27	8.18	6.09
600.0	180.3	13.33	6.98	6.36
605.0	181.5	14.09	8.03	6.05
610.0	182.9	16.04	9.60	6.44
615.0	184.2	14.41	8.02	6.39
620.0	185.6	14.96	8.43	6.54
625.0	186.9	15.04	8.79	6.25
630.0	188.3	14.07	7.80	6.28
635.0	189.7	14.08	8.23	5.85
640.0	191.0	15.57	10.12	5.46
645.0	192.4	15.22	9.23	5.99
650.0	193.8	14.91	9.43	5.48
660.0	196.5	14.64	8.76	5.88
665.0	197.8	14.30	8.33	5.97
670.0	199.2	14.47	8.66	5.82
675.0	200.6	13.13	7.44	5.69
680.0	201.9	15.29	9.20	6.09
685.0	203.3	14.40	8.51	5.89
690.0	204.6	13.46	7.73	5.73
695.0	206.0	14.43	8.67	5.76
700.0	207.4	14.44	8.77	5.67
705.0	208.7	15.63	9.96	5.67
710.0	210.1	14.49	8.66	5.83
715.0	211.5	15.54	9.41	6.12
720.0	212.8	16.49	9.94	6.55
725.0	214.2	15.52	8.89	6.63
730.0	215.5	16.03	9.92	6.11
735.0	217.8	15.89	9.72	6.17
740.0	220.0	13.91	8.18	5.73
745.0	222.3	13.47	8.20	5.27
750.0	224.5	13.18	7.31	5.88
755.0	226.8	14.25	8.29	5.97
760.0	229.0	14.26	8.45	5.80
765.0	230.4	14.60	8.71	5.89

Appendix E2. continued.

DEPTH (cm)	AGE (Ka)	TEMERATURE (°C) warm	cold	SEASONALITY (°C)
770.0	231.8	14.30	8.27	6.03
775.0	233.2	14.81	8.57	6.24
780.0	234.6	13.63	8.26	5.37
785.0	236.0	15.61	9.74	5.87
790.0	237.4	15.29	9.36	5.93
795.0	238.8	14.77	9.04	5.73
800.0	240.2	15.70	9.88	5.83
805.0	242.0	14.23	8.73	5.50
810.0	243.8	13.64	8.26	5.39
815.0	245.5	14.06	8.65	5.41
820.0	247.3	14.25	8.55	5.70
825.0	249.1	15.02	9.25	5.77
830.0	250.9	14.38	9.18	5.21
835.0	252.7	14.04	8.62	5.42
840.0	254.4	12.10	7.24	4.87
845.0	256.2	13.06	7.42	5.64
850.0	258.0	13.39	7.86	5.53
855.0	259.2	12.49	6.98	5.51
860.0	260.4	12.91	7.26	5.65
865.0	261.6	14.01	8.11	5.90
870.0	262.8	13.60	7.77	5.83
875.0	264.0	13.54	7.78	5.75
880.0	265.2	14.50	8.52	5.98
885.0	266.4	14.22	8.29	5.93
890.0	267.6	14.05	8.20	5.84
895.0	268.8	14.52	8.58	5.94
900.0	270.0	15.25	8.72	6.53
905.0	272.7	12.77	6.65	6.12
910.0	275.5	12.54	6.71	5.83
915.0	278.3	13.90	7.57	6.33
920.0	281.0	14.81	9.07	5.74
925.0	283.8	14.80	8.98	5.82
930.0	286.5	15.04	9.23	5.81
935.0	287.2	14.96	9.22	5.74
940.0	288.0	15.03	9.04	5.99
945.0	290.0	15.28	8.89	6.39
950.0	292.0	15.00	8.54	6.46
955.0	294.0	14.17	7.92	6.26
960.0	296.0	15.33	8.95	6.38
965.0	297.7	13.68	7.70	5.98
970.0	299.5	15.38	9.09	6.29
975.0	301.3	15.15	9.02	6.12
980.0	303.0	15.69	9.18	6.50
985.0	304.7	16.15	9.57	6.58
990.0	306.5	15.98	9.35	6.64
995.0	308.2	17.35	10.85	6.50
1000.0	310.0	18.25	11.60	6.66
1005.0	310.8	15.71	9.31	6.40
1010.0	311.7	15.87	9.58	6.28
1015.0	312.5	14.39	8.55	5.84
1020.0	313.3	14.36	8.60	5.76

Appendix E2. continued.

DEPTH (cm)	AGE (Ka)	TEMERATURE (°C) warm	cold	SEASONALITY (°C)
1025.0	314.2	11.98	7.29	4.68
1030.0	315.0	12.23	7.46	4.78
1035.0	315.8	11.27	7.45	3.82
1040.0	316.7	13.35	9.15	4.20
1045.0	317.5	12.54	7.97	4.57
1050.0	318.3	11.51	7.06	4.45
1055.0	319.2	11.01	6.72	4.29
1060.0	320.0	13.04	7.85	5.20
1065.0	320.8	11.77	7.11	4.66
1070.0	321.7	11.40	6.32	5.08
1075.0	322.5	11.55	6.77	4.78
1080.0	323.3	13.05	7.75	5.29
1085.0	324.2	12.19	7.72	4.48
1090.0	325.0	12.88	8.07	4.82
1095.0	325.8	12.72	8.34	4.38
1100.0	326.7	14.06	8.24	5.82
1105.0	327.5	14.82	8.38	6.44
1110.0	328.3	14.81	8.96	5.85
1115.0	329.2	13.00	7.66	5.34
1120.0	330.0	14.42	9.04	5.37
1125.0	330.8	14.55	8.94	5.61
1130.0	331.7	15.62	8.91	6.71
1135.0	332.5	14.14	9.50	4.64

APPENDIX F

DEPTH (cm), AGE (Ka) AND CALCIUM CARBONATE CONCENTRATION(%)

Appendix F1. Depth, age and percent carbonate in RC11-86.

DEPTH (cm)	AGE (Ka)	$CaCO_3$ (%)
12.0	6.7	74.3
22.0	1.0	73.2
32.0	15.3	78.2
42.0	19.6	77.2
51.5	21.4	83.7
62.0	23.6	77.9
72.0	27.9	75.5
82.0	32.2	80.2
92.0	36.5	71.9
102.0	40.8	81.8
122.0	49.4	67.6
132.0	54.3	77.9
142.0	59.4	80.7
152.0	64.5	78.3
162.0	68.3	77.6
172.0	71.7	75.2
182.0	75.0	64.9
192.0	78.3	65.4
202.0	82.8	75.9
212.0	87.8	75.5
222.0	92.9	71.8
232.5	98.1	68.2
242.0	102.8	68.8
252.0	107.7	75.7
262.0	112.6	75.9
272.0	117.5	64.6
282.0	122.4	73.6
292.0	128.8	74.6
302.0	135.8	76.0
312.0	142.8	75.1
322.0	149.9	78.7
332.0	168.1	77.9
342.0	177.5	78.9
352.0	181.1	80.8
362.0	184.6	80.6
372.0	188.2	79.4
382.0	191.8	80.8
392.0	195.4	78.9
402.0	198.9	78.5
412.0	210.5	74.1
422.0	225.5	77.7
432.0	232.3	71.4
442.0	235.7	67.1
452.0	239.0	73.3
462.0	243.9	91.2
472.0	249.4	72.8
482.0	255.9	72.7
492.0	262.2	71.5
502.0	268.2	79.1
512.0	284.0	75.5
522.0	297.0	75.9

Appendix F1. continued.

DEPTH (cm)	AGE (Ka)	$CaCO_3$ (%)
532.0	303.9	64.1
542.0	309.5	79.7
552.0	317.2	74.7
562.0	327.6	72.7
572.0	332.1	73.8
582.0	335.1	75.1
592.0	338.1	75.7
602.0	341.1	74.5
612.0	344.5	73.3
622.0	348.1	72.1
632.0	354.6	69.6
642.0	372.2	73.7
652.0	388.2	69.8
662.0	404.2	67.5
672.0	414.8	75.4
682.0	423.2	78.4
692.0	431.5	76.7
702.0	456.6	78.2
712.0	469.5	79.5
722.0	477.6	78.6
732.0	491.3	78.6
742.0	507.3	64.0
752.0	513.6	75.4
762.0	515.8	52.6
772.0	518.1	67.2
782.0	520.3	72.3
792.0	527.7	71.3
802.0	537.2	46.5
812.0	554.7	74.0
822.0	569.4	76.2
832.0	576.8	71.5
842.0	582.3	67.3
852.0	592.4	69.7
862.0	599.8	76.9
872.0	605.3	74.8
882.0	610.8	63.4
892.0	616.3	60.6
902.0	622.2	75.5
912.0	628.2	69.6
922.0	643.7	69.0
932.0	663.2	69.0
942.0	682.7	73.8

Appendix F2. Depth, age and percent carbonate in V34-157.

DEPTH (cm)	AGE (Ka)	$CaCO_3$ (%)
0.0	1.5	79.0
10.0	3.7	79.1
20.0	5.9	84.8
30.0	8.1	83.2
40.0	10.2	82.3
50.0	12.4	77.7
60.0	14.6	77.7
70.0	16.8	75.4
80.0	19.0	76.0
90.0	20.8	80.0
100.0	22.6	78.9
110.0	24.3	80.1
120.0	26.1	75.8
130.0	27.9	78.6
140.0	29.7	85.4
150.0	31.4	83.9
160.0	33.2	78.9
170.0	35.0	84.2
180.0	36.8	80.8
190.0	38.5	72.3
200.0	40.3	82.0
210.0	42.1	81.4
220.0	43.9	84.7
230.0	45.5	84.5
240.0	47.0	85.2
250.0	48.6	82.8
260.0	50.2	86.3
270.0	57.6	70.5
280.0	65.0	79.6
290.0	70.7	83.2
300.0	76.5	79.2
310.0	82.2	81.8
320.0	87.9	81.7
330.0	93.7	84.4
340.0	99.4	85.6
350.0	108.5	83.9
360.0	111.6	82.7
370.0	114.6	85.4
380.0	117.7	85.8
390.0	120.8	85.7
400.0	123.8	76.8
410.0	127.4	74.8
420.0	131.0	76.8
430.0	134.6	83.0
440.0	138.2	83.7
450.0	141.8	84.1
460.0	145.4	84.1
470.0	149.0	77.8
480.0	152.6	78.7
490.0	154.9	77.0
500.0	157.2	74.6

Appendix F2. continued.

DEPTH (cm)	AGE (Ka)	$CaCO_3$ (%)
510.0	159.5	80.5
520.0	161.8	84.4
530.0	164.1	75.4
540.0	166.5	71.8
550.0	168.8	79.5
560.0	171.1	80.1
570.0	173.4	77.2
580.0	175.7	82.1
590.0	178.0	82.6
600.0	180.3	75.3
610.0	182.9	82.4
620.0	185.6	84.5
630.0	188.3	86.5
640.0	191.0	82.3
650.0	193.8	83.2
660.0	196.5	84.2
670.0	199.2	86.8
680.0	201.9	81.1
690.0	204.6	81.5
700.0	207.4	80.8
710.0	210.1	84.1
720.0	212.8	83.1
730.0	215.5	82.7
740.0	220.0	82.0
750.0	224.5	78.6
760.0	229.0	86.1
770.0	231.8	78.5
780.0	234.6	72.8
790.0	237.4	86.3
800.0	240.2	86.0
810.0	243.8	83.3
820.0	247.3	84.0
830.0	250.9	83.7
840.0	254.4	83.2
850.0	258.0	83.4
860.0	260.4	83.0
870.0	262.8	80.2
880.0	265.2	85.3
890.0	267.6	83.7
900.0	270.0	64.7
910.0	275.5	67.9
920.0	281.0	82.1
930.0	286.5	85.2
940.0	288.0	76.1
950.0	292.0	76.0
960.0	296.0	79.1
970.0	299.5	82.5
980.0	303.0	78.7
990.0	306.5	82.4
1000.0	310.0	79.6
1010.0	311.7	79.7
1020.0	313.3	82.7

Appendix F2. continued.

DEPTH (cm)	AGE (Ka)	$CaCO_3$ (%)
1030.0	315.0	79.5
1040.0	316.7	80.1
1050.0	318.3	81.7
1060.0	320.0	79.2
1070.0	321.7	72.6
1080.0	323.3	80.9
1090.0	325.0	78.5
1110.0	328.3	79.5
1120.0	330.0	85.1

APPENDIX G

DEPTH (cm), AGE (Ka), AND RATIOS OF PLANKTIC FORAM FRAGMENTS AND WHOLE BENTHIC FORAMS

Appendix G1. Depth, age, and ratios of planktic foram fragments and whole benthic forams in RC11-86.

DEPTH (cm)	AGE (Ka)	PLANKTIC FRAGMENTS	BENTHIC RATIO
3.0	2.8	0.22	0.004
10.0	5.8	0.21	0.006
20.0	10.1	0.15	0.002
25.0	12.3	0.18	0.003
30.0	14.4	0.13	0.006
35.0	16.6	0.11	0.010
40.0	19.2	0.10	0.002
45.0	20.1	0.23	0.000
51.0	21.3	0.37	0.000
55.0	22.0	0.23	0.011
60.0	23.0	0.19	0.002
65.0	24.9	0.32	0.005
70.0	27.0	0.20	0.003
74.0	28.8	0.28	0.002
80.0	31.3	0.25	0.000
84.0	33.0	0.29	0.008
90.0	35.6	0.21	0.002
95.0	37.8	0.13	0.000
100.0	39.9	0.22	0.003
105.0	42.1	0.23	0.000
110.0	44.2	0.17	0.007
115.0	46.4	0.26	0.009
120.0	48.5	0.19	0.007
125.0	50.7	0.22	0.000
130.0	53.3	0.23	0.003
135.0	55.8	0.48	0.008
140.0	58.4	0.21	0.010
145.0	60.9	0.27	0.005
150.0	63.5	0.23	0.003
155.0	66.0	0.37	0.006
160.0	67.7	0.21	0.017
165.0	69.3	0.33	0.006
170.0	71.0	0.24	0.006
175.0	72.7	0.23	0.003
180.0	74.3	0.26	0.013
185.0	76.0	0.33	0.006
190.0	77.6	0.24	0.006
195.0	79.3	0.23	0.013
200.0	81.8	0.23	0.002
205.0	84.3	0.23	0.010
210.0	86.8	0.26	0.003
215.0	89.3	0.64	0.017
220.0	91.9	0.27	0.006
222.0	92.9	0.30	0.003
227.0	95.4	0.35	0.010
230.0	96.9	0.26	0.019
235.0	99.4	0.35	0.023
240.0	101.8	0.29	0.013
242.0	102.8	0.29	0.003
247.0	105.3	0.36	0.000
250.0	106.7	0.31	0.009

Appendix G1. continued

DEPTH (cm)	AGE (Ka)	PLANKTIC FRAGMENTS	BENTHIC RATIO
252.0	107.7	0.29	0.007
254.0	108.7	0.29	0.007
256.0	109.7	0.26	0.003
258.0	110.6	0.28	0.010
260.0	111.6	0.27	0.009
262.0	112.6	0.29	0.005
264.0	113.6	0.26	0.013
266.0	114.5	0.30	0.003
268.0	115.5	0.27	0.018
270.0	116.5	0.25	0.018
272.0	117.5	0.28	0.006
274.0	118.4	0.26	0.008
276.0	119.4	0.24	0.003
278.0	120.4	0.18	0.003
280.0	121.4	0.18	0.003
282.0	122.4	0.17	0.005
284.0	123.3	0.12	0.007
286.0	124.5	0.18	0.012
288.0	125.9	0.17	0.008
290.0	127.3	0.16	0.003
292.0	128.8	0.15	0.000
294.0	130.2	0.16	0.002
296.0	131.6	0.15	0.002
298.0	133.0	0.20	0.008
300.0	134.4	0.15	0.000
302.0	135.8	0.17	0.011
304.0	137.2	0.19	0.009
306.0	138.6	0.21	0.009
308.0	140.0	0.17	0.002
310.0	141.4	0.21	0.003
312.0	142.8	0.20	0.012
314.0	144.3	0.15	0.003
316.0	145.7	0.20	0.003
318.0	147.1	0.21	0.008
320.0	148.5	0.18	0.000
325.0	152.0	0.40	0.012
330.0	163.5	0.40	0.003
335.0	175.0	0.38	0.000
340.0	176.8	0.23	0.013
345.0	178.6	0.36	0.006
350.0	180.4	0.18	0.000
355.0	182.1	0.46	0.011
360.0	183.9	0.17	0.003
365.0	185.7	0.42	0.018
370.0	187.5	0.21	0.006
375.0	189.3	0.34	0.003
380.0	191.1	0.34	0.011
385.0	192.9	0.38	0.000
390.0	194.6	0.38	0.003
395.0	196.4	0.30	0.010
400.0	198.2	0.30	0.008
405.0	200.0	0.29	0.003

Appendix G1. continued

DEPTH (cm)	AGE (Ka)	PLANKTIC FRAGMENTS	BENTHIC RATIO
410.0	207.5	0.08	0.002
415.0	215.0	0.32	0.003
420.0	222.5	0.13	0.008
425.0	230.0	0.66	0.025
430.0	231.7	0.22	0.006
435.0	233.3	0.42	0.018
440.0	235.0	0.35	0.012
445.0	236.7	0.35	0.016
450.0	238.3	0.47	0.013
455.0	240.0	0.44	0.014
460.0	242.8	0.45	0.024
465.0	245.5	0.68	0.013
470.0	248.3	0.41	0.042
475.0	251.0	0.46	0.021
480.0	254.5	0.39	0.010
485.0	258.0	0.42	0.013
490.0	261.0	0.31	0.013
495.0	264.0	0.31	0.008
500.0	267.0	0.22	0.010
505.0	270.0	0.40	0.009
510.0	280.0	0.32	0.005
515.0	290.0	0.36	0.006
520.0	295.0	0.36	0.020
525.0	300.0	0.56	0.021
530.0	302.8	0.51	0.037
535.0	305.6	0.53	0.021
540.0	308.4	0.50	0.054
545.0	311.2	0.46	0.017
550.0	314.0	0.51	0.006
555.0	322.0	0.65	0.074
560.0	326.0	0.49	0.032
565.0	330.0	0.48	0.017
570.0	331.5	0.44	0.024
575.0	333.0	0.48	0.021
580.0	334.5	0.51	0.018
585.0	336.0	0.52	0.016
590.0	337.5	0.43	0.017
595.0	339.0	0.45	0.008
600.0	340.5	0.44	0.010
605.0	342.0	0.40	0.013
610.0	343.8	0.40	0.015
615.0	345.6	0.49	0.013
620.0	347.4	0.40	0.017
625.0	349.2	0.45	0.018
630.0	351.0	0.50	0.013
635.0	360.0	0.85	0.162
640.0	369.0	0.50	0.020
645.0	377.0	0.52	0.027
650.0	385.0	0.53	0.017
655.0	393.0	0.61	0.019
660.0	401.0	0.65	0.062
665.0	409.0	0.62	0.048

Appendix G1. continued

DEPTH (cm)	AGE (Ka)	PLANKTIC FRAGMENTS	BENTHIC RATIO
670.0	413.2	0.57	0.029
675.0	417.3	0.66	0.028
680.0	421.5	0.42	0.016
685.0	425.7	0.31	0.006
690.0	429.8	0.40	0.009
695.0	434.0	0.74	0.035
700.0	450.1	0.41	0.028
705.0	463.8	0.44	0.013
710.0	467.9	0.43	0.011
715.0	471.9	0.43	0.003
720.0	476.0	0.40	0.012
725.0	480.0	0.63	0.039
730.0	488.1	0.40	0.020
732.0	491.3	0.38	0.023
737.0	499.4	0.42	0.013
740.0	504.1	0.36	0.003
745.0	512.0	0.40	0.047
750.0	513.1	0.48	0.015
755.0	514.2	0.68	0.105
760.0	515.4	0.49	0.046
765.0	516.5	0.47	0.016
770.0	517.6	0.56	0.047
775.0	518.8	0.62	0.052
780.0	519.9	0.55	0.062
785.0	521.0	0.58	0.038
790.0	525.8	0.48	0.014
795.0	530.5	0.48	0.028
800.0	535.2	0.44	0.042
805.0	540.0	0.57	0.023
810.0	550.5	0.49	0.009
815.0	561.0	0.74	0.073
820.0	567.0	0.44	0.008
825.0	573.0	0.52	0.020
830.0	575.8	0.48	0.025
835.0	578.5	0.48	0.045
840.0	581.3	0.49	0.040
845.0	584.0	0.53	0.046
850.0	590.0	0.46	0.028
855.0	596.0	0.58	0.041
860.0	598.8	0.27	0.003
865.0	601.5	0.34	0.006
870.0	604.3	0.37	0.013
875.0	607.0	0.54	0.013
880.0	609.7	0.56	0.029
885.0	612.5	0.65	0.047
890.0	615.3	0.54	0.017
895.0	618.0	0.67	0.046
900.0	621.0	0.60	0.020
905.0	624.0	0.55	0.033
910.0	627.0	0.53	0.025
915.0	630.0	0.36	0.020
920.0	639.8	0.46	0.027

Appendix G1. continued

DEPTH (cm)	AGE (Ka)	PLANKTIC FRAGMENTS	BENTHIC RATIO
925.0	649.5	0.51	0.036
930.0	659.3	0.56	0.032
935.0	669.0	0.52	0.026
940.0	678.7	0.55	0.037
945.0	688.5	0.56	0.011

Appendix G2 Depth, age, and ratios of planktic foram fragments and whole benthic forams in V34-157.

DEPTH (cm)	AGE (Ka)	PLANKTIC FRAGMENTS	BENTHIC RATIO
10.0	3.7	0.22	0.000
15.0	4.8	0.22	0.000
20.0	5.9	0.17	0.000
25.0	7.0	0.15	0.006
30.0	8.1	0.17	0.006
35.0	9.2	0.16	0.000
40.0	10.2	0.18	0.007
45.0	11.3	0.19	0.000
50.0	12.4	0.15	0.003
55.0	13.5	0.20	0.009
60.0	14.6	0.33	0.000
65.0	15.7	0.23	0.008
70.0	16.8	0.24	0.009
75.0	17.9	0.25	0.003
80.0	19.0	0.35	0.004
85.0	19.9	0.23	0.003
90.0	20.8	0.25	0.003
95.0	21.7	0.23	0.000
100.0	22.6	0.16	0.007
105.0	23.4	0.17	0.000
110.0	24.3	0.19	0.000
115.0	25.2	0.23	0.006
120.0	26.1	0.30	0.000
125.0	27.0	0.22	0.007
130.0	27.9	0.21	0.005
135.0	28.8	0.19	0.012
140.0	29.7	0.14	0.000
145.0	30.6	0.19	0.007
150.0	31.4	0.12	0.006
155.0	32.3	0.07	0.000
160.0	33.2	0.15	0.023
165.0	34.1	0.12	0.007
170.0	35.0	0.13	0.004
175.0	35.9	0.10	0.009
180.0	36.8	0.13	0.003
185.0	37.7	0.16	0.003
190.0	38.5	0.21	0.003
195.0	39.4	0.14	0.003
200.0	40.3	0.19	0.013
205.0	41.2	0.24	0.003
210.0	42.1	0.14	0.003
215.0	43.0	0.22	0.000
220.0	43.9	0.18	0.007
225.0	44.7	0.18	0.000
230.0	45.5	0.17	0.000
235.0	46.2	0.11	0.003
240.0	47.0	0.07	0.000
245.0	47.8	0.10	0.003
250.0	48.6	0.09	0.010
255.0	49.4	0.12	0.000
260.0	50.2	0.12	0.003

Appendix G2. continued

DEPTH (cm)	AGE (Ka)	PLANKTIC FRAGMENTS	BENTHIC RATIO
265.0	53.9	0.15	0.008
270.0	57.6	0.15	0.000
275.0	61.3	0.21	0.000
280.0	65.0	0.21	0.008
285.0	67.9	0.20	0.007
290.0	70.7	0.18	0.006
295.0	73.6	0.16	0.000
300.0	76.5	0.18	0.000
305.0	79.3	0.30	0.007
310.0	82.2	0.17	0.003
315.0	85.1	0.16	0.000
320.0	87.9	0.16	0.000
325.0	90.8	0.12	0.006
330.0	93.7	0.19	0.003
335.0	96.5	0.15	0.003
340.0	99.4	0.18	0.003
345.0	103.9	0.16	0.000
350.0	108.5	0.18	0.012
355.0	110.0	0.16	0.000
360.0	111.6	0.20	0.004
365.0	113.1	0.13	0.006
370.0	114.6	0.16	0.010
375.0	116.2	0.16	0.003
380.0	117.7	0.16	0.000
385.0	119.2	0.10	0.003
390.0	120.8	0.11	0.003
395.0	122.3	0.08	0.010
400.0	123.8	0.09	0.000
405.0	125.6	0.20	0.000
410.0	127.4	0.10	0.000
415.0	129.2	0.11	0.000
420.0	131.0	0.13	0.000
425.0	132.8	0.10	0.003
430.0	134.6	0.12	0.000
435.0	136.4	0.11	0.000
440.0	138.2	0.09	0.006
445.0	140.0	0.10	0.015
450.0	141.8	0.11	0.006
455.0	143.6	0.09	0.006
460.0	145.4	0.14	0.011
465.0	147.2	0.12	0.004
470.0	149.0	0.17	0.011
475.0	150.8	0.14	0.016
480.0	152.6	0.09	0.007
485.0	153.7	0.09	0.000
490.0	154.9	0.15	0.003
495.0	156.1	0.30	0.004
500.0	157.2	0.20	0.000
505.0	158.4	0.20	0.003
510.0	159.5	0.10	0.000
515.0	160.7	0.07	0.003
520.0	161.8	0.13	0.000

Appendix G2 . continued

DEPTH (cm)	AGE (Ka)	PLANKTIC FRAGMENTS	BENTHIC RATIO
525.0	163.0	0.11	0.003
530.0	164.1	0.15	0.006
535.0	165.3	0.11	0.000
540.0	166.5	0.13	0.000
545.0	167.6	0.11	0.003
550.0	168.8	0.10	0.003
555.0	169.9	0.09	0.011
560.0	171.1	0.07	0.000
565.0	172.2	0.10	0.000
570.0	173.4	0.11	0.000
575.0	174.6	0.13	0.000
580.0	175.7	0.13	0.002
585.0	176.9	0.14	0.006
590.0	178.0	0.16	0.003
595.0	179.2	0.17	0.004
600.0	180.3	0.20	0.000
605.0	181.5	0.34	0.004
610.0	182.9	0.22	0.003
615.0	184.2	0.22	0.003
620.0	185.6	0.28	0.009
625.0	186.9	0.28	0.015
630.0	188.3	0.27	0.000
635.0	189.7	0.23	0.000
640.0	191.0	0.27	0.003
645.0	192.4	0.23	0.004
650.0	193.8	0.27	0.003
660.0	196.5	0.27	0.012
665.0	197.8	0.27	0.000
670.0	199.2	0.23	0.009
675.0	200.6	0.29	0.010
680.0	201.9	0.25	0.000
685.0	203.3	0.20	0.000
690.0	204.6	0.17	0.007
695.0	206.0	0.22	0.013
700.0	207.4	0.22	0.011
705.0	208.7	0.30	0.011
710.0	210.1	0.26	0.000
715.0	211.5	0.21	0.003
720.0	212.8	0.23	0.013
725.0	214.2	0.18	0.003
730.0	215.5	0.20	0.003
735.0	217.8	0.15	0.000
740.0	220.0	0.19	0.010
745.0	222.3	0.17	0.012
750.0	224.5	0.21	0.008
755.0	226.8	0.18	0.009
760.0	229.0	0.22	0.011
765.0	230.4	0.17	0.000
770.0	231.8	0.23	0.010
775.0	233.2	0.25	0.000
780.0	234.6	0.19	0.003
785.0	236.0	0.19	0.000

Appendix G2. continued

DEPTH (cm)	AGE (Ka)	PLANKTIC FRAGMENTS	BENTHIC RATIO
790.0	237.4	0.17	0.011
795.0	238.8	0.17	0.009
800.0	240.2	0.15	0.006
805.0	242.0	0.22	0.014
810.0	243.8	0.17	0.010
815.0	245.5	0.15	0.006
820.0	247.3	0.17	0.009
825.0	249.1	0.12	0.004
830.0	250.9	0.18	0.010
835.0	252.7	0.10	0.003
840.0	254.4	0.11	0.003
845.0	256.2	0.13	0.000
850.0	258.0	0.12	0.007
855.0	259.2	0.13	0.006
860.0	260.4	0.10	0.003
865.0	261.6	0.13	0.000
870.0	262.8	0.13	0.003
875.0	264.0	0.13	0.023
880.0	265.2	0.18	0.003
885.0	266.4	0.11	0.006
890.0	267.6	0.18	0.000
895.0	268.8	0.15	0.006
900.0	270.0	0.17	0.015
905.0	272.7	0.47	0.005
910.0	275.5	0.29	0.016
915.0	278.3	0.12	0.015
920.0	281.0	0.33	0.014
925.0	283.8	0.24	0.015
930.0	286.5	0.29	0.003
935.0	287.2	0.22	0.015
940.0	288.0	0.21	0.013
945.0	290.0	0.[illegible]1	0.000
950.0	292.0	0.24	0.015
955.0	294.0	0.28	0.020
960.0	296.0	0.29	0.031
965.0	297.7	0.31	0.018
970.0	299.5	0.33	0.013
975.0	301.3	0.33	0.006
980.0	303.0	0.30	0.015
985.0	304.7	0.66	0.013
990.0	306.5	0.78	0.009
995.0	308.2	0.34	0.014
1000.0	310.0	0.38	0.015
1005.0	310.8	0.39	0.000
1010.0	311.7	0.23	0.017
1015.0	312.5	0.22	0.003
1020.0	313.3	0.26	0.007
1025.0	314.2	0.27	0.007
1030.0	315.0	0.27	0.005
1035.0	315.8	0.29	0.020
1040.0	316.7	0.17	0.006
1045.0	317.5	0.19	0.020

Appendix G2. continued.

DEPTH (cm)	AGE (Ka)	PLANKTIC FRAGMENTS	BENTHIC RATIO
1050.0	318.3	0.23	0.020
1055.0	319.2	0.20	0.000
1060.0	320.0	0.15	0.014
1065.0	320.8	0.17	0.010
1070.0	321.7	0.22	0.010
1075.0	322.5	0.33	0.018
1080.0	323.3	0.27	0.024
1085.0	324.2	0.31	0.016
1090.0	325.0	0.23	0.000
1095.0	325.8	0.23	0.019
1100.0	326.7	0.15	0.009
1105.0	327.5	0.16	0.003
1110.0	328.3	0.48	0.048
1115.0	329.2	0.61	0.024
1120.0	330.0	0.46	0.032
1125.0	330.8	0.42	0.035
1130.0	331.7	0.42	0.009
1135.0	332.5	0.37	0.021

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